

CEE NEWS

GLOBAL REACH

CEE FACULTY, STUDENTS AND ALUMNI
ENGINEER AROUND THE GLOBE





CEE Department Head - Dave Dzombak

Dear Alumni and Friends,

This issue of CEE News provides views of the global reach of our department, from the spectrum of nationalities represented in our student body, to our formal international programs, to the diverse educational, research, and professional activities of our faculty, students, and alumni. I think you will find the breadth and diversity of activities interesting and reflective of trends in global connections and commerce.

Our CEE graduate program has always attracted students from around the world. There is no better evidence of this than our famous alum Dr. **Yisheng Mao** (1896-1989), who was the first PhD graduate from our department and from the Carnegie Institute of Technology, in 1919. In January I visited Southeast University in Nanjing, China, where Dr. Mao served as director of the engineering program and then as president of the university. We have had a number of graduate students from Southeast University over the years, and in 2013 we initiated a formal program that will bring students from SEU into both our undergraduate and graduate programs. This issue describes our new 3+1+1 program.

Our alumni are engaged in projects all over the world. In this issue we feature the activities of several alums associated with Paul C. Rizzo Associates, Inc., founded by CEE alum Dr. **Paul Rizzo**. With offices in Pittsburgh, the Czech Republic, three countries in South America, and elsewhere, Rizzo Associates does most of its work internationally. The firm employs a diverse international work force, including many CEE alums, which facilitates extension of its expertise on high-end engineering projects around the globe.

During the Spring semester break, we had students and faculty travelling far and wide in education and research pursuits. For example, as described in this issue, Professor **Burcu Akinci** led a group of undergraduate and graduate students participating in her International Collaborative Construction Management class to Turkey and Israel. They met with the student groups and professors with whom they are collaborating at Middle East Technical University and the Technion-Israel Institute of Technology. Also, a group of undergraduate students from CEE and Mechanical Engineering, along with Director of Undergraduate Programs **Andrea Francioni Rooney**, travelled to Beijing, China. We'll have a summary of their experiences in the next issue. Student observations and photos are available on our CEE website and Facebook page.

A big upcoming event for CEE is the retirement celebration for Professor Emeritus **Larry Cartwright**, who retired in June, 2013, but who continues to teach part-time for us, through Spring 2015. The celebration will be Friday evening, April 11, 2014. In honor of Larry, the Lawrence Cartwright Support Fund for Teaching Professors has been established. Please consider contributing. The fund will help us to carry on the legacy of Larry's commitment to undergraduate education far into the future.

Another priority for department development is the Dr. **Elio D'Appolonia** Graduate Fellowship Fund, established in 2012 with some initial gifts from former students and professional colleagues of Dr. D'Appolonia. The fund will provide an endowment to help support CEE PhD students. More information about this important initiative will be given in the Summer 2014 issue of CEE News.

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
Walter J. Blenko, Sr. University Professor and Department Head

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CEE Launches Exchange with China's Southeast University

Nearly a century ago, the Carnegie Institute of Technology awarded its first PhD degree to a Civil Engineering student named **Yisheng Mao** (known as Thomas Eason Mao while a student in the U.S.), who would later become known as the founder of modern bridge engineering in China. Dr. Mao returned to his native China after completing his doctoral education and, among other significant contributions to higher education in China, founded the engineering program at Southeast University (SEU), a top-five engineering university in Nanjing, Jiangsu Province. Today, SEU undergraduate student **Xuan Li** is completing his senior year in the very hall where Mao earned his PhD through a special Civil & Environmental Engineering and SEU program called 3+1+1.

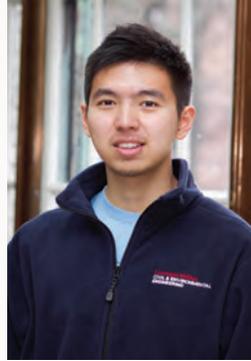
A number of current and former CEE graduate students are alumni of SEU. The idea of the 3+1+1 program arose in 2010, when SEU Civil Engineering professor **Dafang Fu** visited the CEE department and met with then-department head **Jim Garrett** and current head **Dave Dzombak** to discuss ways to establish a closer relationship between the two universities. Their conversation led to the establishment of 3+1+1.

In the 3+1+1 program, up to three high-achieving SEU students who have completed their first three years of undergraduate studies in civil engineering are recommended to Carnegie Mellon's CEE department, whose faculty then select the students to participate. The enrolled students complete the final year of their undergraduate studies in the CEE department following a hybrid of the junior and senior year curricula, and have the option to apply for a one-year professional master's degree from the program ("3+1+1" refers to the stages of the program in years). Li is the first to participate in the program, which was launched in the summer of 2013.

"The students in this program take several group-project-based classes to give them opportunities to become integrated into the CEE community," explained **Andrea Francioni Rooney**, Director of Undergraduate Programs. "They can also supplement their schedule with elective courses that interest them and subjects they need to complete their B.S. degree at SEU."

Li, whose studies in China focused on water supply engineering, was encouraged to apply to the program by Dr. Fu, his professor at SEU. "I like that the professors here at CMU prefer to guide students to choose their own professional focus area, and the teamwork here is awesome," Li said. "I am teaming up with other students on group projects and presentations. The CEE community is very friendly." In addition to completing his senior year coursework and taking part in CEE extracurricular activities, Li is in the process of applying to the CEE master's program. "I would like to explore more topics within environmental engineering, particularly air quality," he explained.

"The students who have come here from Southeast University have all been successful and are an important part of the CEE community," said Dzombak, who visited the university in January. "We're proud to be collaborating with the engineering program at SEU which our famous alumnus, Dr. Mao, established."



Xuan Li



Professors Dafang Fu and
Dave Dzombak

Where in the world are you?

Our favorite alumni submission comes from Mageba USA project manager, **Amit Kutumbale** (MS '12) who sent us a photo of himself inspecting structural bearings at Kimbell Art Museum in Forth Worth, TX.

Show us where you are in the field! Please send photos to Mireille Mobley at mmobley@andrew.cmu.edu with a couple of sentences telling us about your latest project.



CEE Graduates Tackle International Projects at Paul C. Rizzo Associates, Inc.

Name a country, and Pittsburgh-based engineering consulting firm Paul C. Rizzo Associates, Inc. has probably worked there. But the firm also has close ties to Pittsburgh, and attracts many graduates of the Carnegie Mellon Civil & Environmental Engineering department.



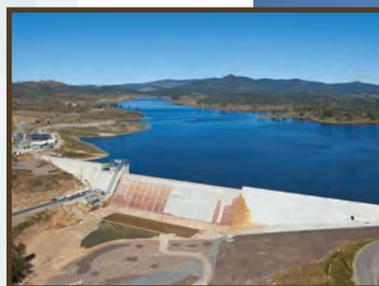
Michael Edwards

When **Michael Edwards** began his engineering education in Carnegie Mellon's Civil & Environmental Engineering Department, he would never have guessed that within a few years, he would find himself paddling furiously up a river in Madagascar, scanning the surrounding land to select the ideal site for a hydroelectric project. "It was my first time rafting, it was my first time out of the country, it was the first time I ever got food poisoning, and it was the first time I ever wondered whether I was going to die," he recalls, chuckling. "But it was also a memorable experience."

Edwards (BS '02, MS '11) is the Vice President of Projects at Pittsburgh-based engineering consulting firm Paul C. Rizzo Associates, Inc. ("Rizzo Associates"). He is also one of many graduates of CEE working at the firm, whose founder and CEO, **Paul C. Rizzo**, is a CEE graduate himself (BS '63, MS '64, PhD '66). Since the firm was founded in 1984, it has become a well-respected name in engineering consulting around the world, particularly in the fields of nuclear power, seismic design, dams, mining, and tunneling. And the firm's namesake is enthusiastic about drawing both more international projects and more CEE graduates.

Lessons from CEE

A number of the approximately 300 employees at Rizzo Associates earned degrees from the Civil & Environmental Engineering Department, but their paths to the firm were all slightly different. The CEE graduates at the firm say they constantly draw on their experiences at Carnegie Mellon in their work, and in discussing their experiences, they all



Wyaralong dam located in south-east Queensland, Australia, near the township of Beaudesert





Subsurface investigations in the UAE

come back to a central lesson: “Carnegie Mellon teaches you how to think,” says Edwards. “I’m not sure that I could have gone to another university and accomplished the same things.” Edwards, who has also worked as a recruiter for the company, says that Carnegie Mellon students tend to excel over students whose educations have emphasized calculation methodologies rather than macro-level thinking. “The CMU students understand how to apply a technique, when to apply it, and how it fits into the bigger scheme.”

Edwards learned about the company during his junior year in CEE, when Deborah Lange, Executive Director of Carnegie Mellon’s Brownfields Center, recommended that he apply for a summer internship at Rizzo Associates. “Consulting exposes you to structural engineering, geotech, water resources—all kinds of things,” he says. “It really helps you figure out where you want to go with a master’s or with your career.”

Harini Venugopal, an Assistant Project Engineer at Rizzo Associates who works mostly on surface water quality modeling, earned her MS in Civil and Environmental Engineering from Carnegie Mellon in 2009. She says that the software skills she developed during her work as a research assistant to Professor **Jeanne VanBriesen** led to her position with the company. “When you graduate, you see that you’ve learned so much, and when you apply it, you have an edge over the others,” she remarks. At Carnegie Mellon, Venugopal was able to zero in on the topic that interested her most—numerical modeling—while also developing the flexibility needed to succeed in an interdisciplinary environment. “I took a lot of courses outside of my discipline at CEE, and that helped me to think outside of my work,” she says. “Here at Rizzo Associates, I work with at least four different groups, and I think that my ability to manage that variation, to quickly learn and make the transition from one group to the next, came from my CMU training.”



Sittipong Jarenprasert

Technical Director **Sittipong Jarenprasert** (MS '00, PhD '05) who as a student studied soil structure interaction, focuses on earthquake prediction and nuclear power in his work at Rizzo Associates. He says his degree from CMU, combined with his basic background in civil engineering, has helped him enormously, commenting, “My background helps me do and understand more of what’s



Founder, President, and CEO Paul Rizzo inspects soil and rock cores as part of a geolocial study at a nuclear power plant in Visaginas, Lithuania



going on in the company, whether it is structural work or learning something new about seismology and motion prediction.”

Engineering Associate **Mudasar Zahoor** (BS '06, PhD '11) credits his experience in the CEE department with helping him approach new projects with confidence. “When you do a PhD, you take a topic that is completely alien to you and, step by step, you make in-roads that eventually lead you to something. And in that process, you develop the confidence to handle any project.”



Mudasar Zahoor

These benefits are not lost on Paul Rizzo. “CEE graduates are highly qualified in what they do,” he says. “They have very good computer skills and good language skills. We like to see as many graduates apply here as possible.”

The advantages – and thrills – of international work

“Very few American firms will go outside of the U.S. for work, but we focus our business on international projects,” Rizzo explains. “Overseas, the American technology is welcome



San Pedro Dam project in Peru

everywhere.” He recites a list of some of the projects the firm is currently involved in: nuclear power plants in the United Arab Emirates, Uganda, and Russia; copper mines in Peru, Chile, and Argentina; earthquake damage repair in New Zealand; and dams in Australia. “Most of our employees travel freely.”

Edwards sees the focus on international work as one of the firm’s strengths. “For the size of company we are, we work in some pretty remote and interesting places,” he says, noting that most of the employees have been all over the world after a few years with the firm. “It’s a very diverse workplace and a very diverse industry, and when you branch out internationally, you realize that the world is really wonderful but small, and it isn’t intimidating to think about working on the other side of the planet.”

Depending on their particular discipline and group, an engineer at Rizzo Associates may work on a number of different projects around the world in a given year. Two years ago, Jarernprasert was working in a group tasked with assessing the damage from New Zealand’s Christchurch earthquake and proposing a solution; now, he is studying the ability of nuclear power plants in Japan to withstand earthquake damage. “It’s good to work in these different environments,” he says. “What I learn from the U.S. is going to be different from what I learn in another country: the culture, the government, and the building code will all be different.”

Much of Zahoor’s work at Rizzo Associates involves refining in-house programs and methodologies. He recalls a recent project which entailed deciphering an older in-house program. “They gave the program to me to see if I could bring it back to working

condition, and we were able to use it in a soil consolidation project in Lithuania,” he says. “That was one of the most satisfying projects I worked on.” As a member of the seismic group, he is constantly incorporating new nuclear regulations and methodologies into their work. “There usually isn’t much time to implement things, so that’s very challenging and exciting—actually, it’s similar to graduate school,” he explains, laughing.



Harini Venugopal

Drawing strength from diversity

also contributes to her personal growth. “I was doing fieldwork in the United Arab Emirates for three months, and it was a very different experience from sitting in the office,” she remembers. “It puts you out of your comfort zone, but I think that’s when you grow, because you’re pushing yourself.”

The employees of Rizzo Associates are just as diverse as the company’s list of projects, and Rizzo is quick to point out that the highly international workforce offers invaluable cultural insight and language skills for the company’s work abroad. Zahoor, who hails from Kashmir, notes that the firm’s diversity of disciplines and cultures leads to a greater wealth of ideas. “The more variety you have, the more ideas you get,” he explains. “The way your mind works might be very different from

Venugopal, a native of India, has worked on projects in several different countries. She explains that working abroad not only exposes her to a new country’s professional practices and regulations, but

the way someone else’s mind works. So when you mix all of these different mindsets together, you can isolate the best ideas and develop something extraordinary.” Adds Venugopal, “It’s nice to find these connections with people here. When you start talking to someone, you start finding similarities between your culture and theirs, and that helps you build strong friendships.”

The rewards of engineering consulting

Ask the CEE graduates of Rizzo about the most rewarding aspect of their work, and you’ll get a wide range of answers. Edwards enjoys connecting with CEE graduates who are completing their degrees and trying to settle on a post-graduation course of action. “It’s very rewarding to have a conversation with people who are in the exact same position that I was ten years ago about what the future could hold and what kinds of things are important to think about,” he says. Edwards is currently earning his PhD in CEE and is advised by Professor **H. Scott Matthews** and Duquesne Light Company University Professor **Chris Hendrickson**.

For Venugopal, working in the energy industry is meeting one of her personal goals. “I think that avoiding an energy crisis in an environmentally friendly way is the biggest challenge that we face right now, and I personally feel that nuclear energy is a good solution,” she explains. “This work is very interesting to me.”

Jarernprasert likes that his work keeps him learning and allows him to expand on the soil structure interaction research that he conducted in CEE. “Because the projects are diverse, I’m learning all the time,” he explains. Zahoor echoed that sentiment, noting that he is always absorbing new information about upcoming theories in the seismic field. “There is so much scope in a consulting company,” he says. “When we can implement new theories to fit real-life problems, this excites me.”

And what does Paul Rizzo enjoy the most about his work? The answer is simple. “When you see a project function as it’s intended to,” he says. “Seeing a dam spill water, or a power plant generate electricity—that’s a thrill.”

The Civil & Environmental Engineering department is currently compiling a list of companies founded by CEE alumni. Please contact Mireille Mobley at mmobley@andrew.cmu.edu to let us know about your company.



Professor Akinci and Universidade Federal do Rio Grande do Sul Professor Eduardo Isatto are two of the four faculty involved in the ICCM course.

One Project, Four Countries

Innovative CEE course gives engineering students a taste of international collaboration

CEE Professor **Burcu Akinci** knows a thing or two about the challenges of international collaboration. Akinci earned BS and MBA degrees in her native Turkey before moving to the U.S. to earn her MS and PhD at Stanford University, and in the process she took part in projects spanning multiple cultures and languages. Now, she's sharing her knowledge with CEE students via International Collaborative Construction Management (ICCM), a project-based course in which students form joint construction ventures with students from universities in Israel, Brazil, and Turkey and tackle the challenges of operating internationally.

The course was the brainchild of Akinci and CEE Adjunct Professor **Lucio Soibelman**, a native of Brazil who is now chair of the University of Southern California's CEE Department. "We wanted to recognize the industry need for more globally savvy engineers," Akinci said. "The course is focused on the cultural aspects of international construction: how do you build a positive team dynamic when you're working with people across the world whom you've never seen?" In 2006, Akinci and Soibelman reached out to professors at Middle East Technical University in Turkey, Technion Israel Institute of Technology in Israel, and Universidade Federal do Rio Grande do Sul in Brazil, and after extensive planning, the course became a reality.

The course is more reminiscent of a business than a lecture, just as its designers intended. The "client" (a faculty member who also serves as a mentor) presents students with a project that was designed with a specific country in mind: for instance, a two-story medical office building designed to be built in the U.S. The students form

small teams with their counterparts from the other three universities and, via video chat, identify the requirements for completing the project in the remaining three countries. Because each country has its own restrictions – building material and technology availability, construction regulations, even weather – the teams must modify the design and construction schedule to fit each scenario. After completing an estimate, schedule, and risk assessment of building the facility in each of the four countries, each team selects the "best" option and presents their proposal to the client.

Akinci notes that the projects encourage engineers to be aware of their construction environment. "The goal is not to develop a perfect design; the goal is to value-engineer the project to develop a good alternative for different countries," she said. "In the process, the students explore and make decisions about possible trade-offs between cost, schedule, and risk within each country and amongst different countries."

The course's lessons have stretched beyond the walls of Carnegie Mellon. Since it was first offered in 2006, more than one hundred CMU students have taken it. Alumni tell Akinci that they regularly apply lessons from the course to their jobs, and many have stayed in touch with their international teammates. "I see the students grow quite a bit during the course, not only professionally but personally," she said. "They leave with a better understanding of what it means to work in a global industry."

An ICCM Spring Break

During spring break 2014, Professor **Burcu Akinci** and three students, **Rachel Browne** (BS '14), **Silvana Flores** (BS '14) and **Jared Maurer** (MS '14), traveled to Israel and Turkey to visit historical architecture and engineering marvels. During their time in Israel they also met with students taking the ICCM course.

CMU students had the opportunity to interact face-to-face with their on-going project group members who they, until now, have only connected with via email and video conferencing. "Meeting face to face was more personal and efficient," says Rachel Browne. "I was really looking forward to that interaction because it made the project easier."

CIT and the Vice Provost of Undergraduate Education funded this trip to support the growing relationship between CMU and Technion-The Israel Institute of Technology and to give the students a unique global educational opportunity.

CMU students gained firsthand experiences of differences in construction methods, decision-making processes, cultural differences, and differences in priorities. Students also gained a unique perspective into how civil engineering works in other parts of the world and had the opportunity to immerse themselves in the culture of the cities they were visiting.

Weathering Drought: An International Effort to Improve Water Management in Costa Rica

Lately, there have been a lot of clear skies in Costa Rica. Unfortunately, while vacationers are thrilled, the lack of rain is causing droughts in many parts of the country. In response to this stress, Costa Ricans have teamed up with scientists and engineers from Carnegie Mellon University, Canada, and France on project FuturAqua. The project aims to use a combination of physical and social science research to help Costa Rica better manage its increasingly limited water supply.

The physical science component involves improving weather and climate forecasting. CEE/EPP H. John Heinz Professor and CMU Principal Investigator **Mitchell Small** explains that this would allow more accurate modeling of the amount of water available in the environment. Better models would help Costa Rican government officials, water managers, and heads of local communities to make more effective decisions about how water is allocated and conserved. EPP research scientist **Iris Grossmann** is an integral part of the team focused on climatology.

But better forecasting is only half of the solution. “Costa Rica is an example of an ecological social system—the information people have interacts with the ecosystem in a very intimate way,” says Small. That means that improved estimates are only useful if decision-makers can access and

easily understand them. To address these needs, EPP research scientist **Gabrielle Wong-Parodi** will help investigate what information Costa Ricans need to make informed water decisions and the best ways to present that information to them.

This interdisciplinary collaboration will also be an international endeavor. Carnegie Mellon researchers will be working alongside experts from the University of British Columbia, the French Center for Agriculture Research for Development, and The Costa Rican Tropical Agricultural Research and Higher Education Center. The project is funded by a Belmont Forum G8 grant, with Carnegie Mellon’s support provided through the USA National Science Foundation.

With the project initiated in Fall 2013, team members met in Costa Rica this past December to begin implementing their proposal. Though FuturAqua is still in its early stages, Small is enthusiastic about its potential to positively impact scientific knowledge and Costa Ricans’ quality of life. “It’s an opportunity to address real problems and learn generalizable lessons in a country with both a highly involved citizenry and a stunningly beautiful environment,” Small says.



CEE/EPP H. John Heinz Professor Mitchell Small at Ricon de la Vieja National Park in the Guanacaste Province in northwestern Costa Rica



CEE Students Help Bring Green Energy to Classrooms in India

Can you imagine spending several hours in a 100-degree classroom? The children and staff at Symbiosis public school in Rampur, India did this often until CMU's chapter of Engineers Without Borders (EWB) devised a solution. To produce energy for fans, a team of Carnegie Mellon students—including several from CEE—helped to design and install a solar panel system for the school's roof.

EWB is an international organization that works to develop sustainable engineering solutions for communities across the world. The Carnegie Mellon chapter currently consists of about 50 active members from many CIT disciplines and is almost entirely student-run. This allows “students to feel a sense of ownership of the projects and of the organization itself,” says faculty advisor and CEE Associate Professor **Kelvin Gregory**. The CMU chapter's projects include some local work, like finding ways to recycle electronics safely on CMU's campus, as well as work overseas. A team has been working on project Symbiosis in India for about 3.5 years.

According to CMU EWB chapter co-president **Michelle Krynock** (BS '15), the problem in Rampur was unreliable electricity. Homes and schools only get a few hours each day, meaning that residents have to use generators to get power for lights and fans. Aside from being expensive, generators pose a particular problem for schools like Symbiosis because they are also extremely noisy. Krynock explains, “When their generator was on, the kids could really not hear the teachers at all. So they had to choose between using the loud generators and being distracted, or not running the fans and being so hot that they were distracted.”

In the first stage of the project, Krynock and a team of several other students evaluated potential alternative energy sources to determine which would be the most economically, socially, and environmentally sustainable for the community. Based on these criteria, they chose solar panels as the best match for Rampur and then designed the system with the help of an electrical engineer from the EWB Pittsburgh professional chapter.

“The projects we tackle require an interdisciplinary approach,” says Gregory. “Our engineering solutions must consider locally available resources, the knowledge base and skills in the community, and how a final implementation may integrate into the established culture. As a result, our members bring their skills in applied physics, chemistry and biology and then acquire skills in anthropology, sociology, psychology, and what I call distance empathy.”

After finishing the design, the Symbiosis team got the exciting opportunity to travel to India for one week to oversee local contractors as they installed the panels. “I had never traveled overseas before and this trip helped me develop a larger view of the world,” Krynock says. She adds that it was also gratifying to see the final result of the team's months of planning and preparation.

Even more gratifying was that the technology was a huge improvement. “The students and staff were thrilled,” says Krynock. “We would hold meetings in one of the rooms in the school, and the kids would run out of class and try to hand us thank you cards.” In fact, because the solar panels store extra energy in a battery bank, the school hasn't needed to use their generators at all in the two years since the installation. The project at Symbiosis was so successful that EWB is now planning to install similar solar panel systems for other schools in India.



Michelle Krynock (BS '15) and members of the travel team bolt the final panel onto the frame.



Craig Bowman (BS '15) and a member of the REIC team demonstrate to third grade students the basics of wiring small solar panels to make small fans run.



Mark Barlow, from Research Environmental & Industrial Consultants (REIC), inspects the combiner box located underneath a row of solar panels on the roof of Symbiosis Public School. The results of the inspection were the key results of the monitoring trip. The inspection includes all components of the solar energy system: panels, wiring, combiner box, charge controller, battery bank, and breaker box.



Akinci Awarded \$2 Million NSF Grant to Develop Aerial Robot for Infrastructure Monitoring

Flying robots may be just around the corner... or underneath the bridges you drive over. CEE Professor **Burcu Akinci** and three collaborators have received a \$2 million grant from the National Science Foundation's National Robotics Initiative (NRI) to develop an autonomous robotic assistant for use in infrastructure modeling and inspection. The grant, which spans three years, was awarded to an interdisciplinary team of CMU researchers led by Research Professor **Sanjiv Singh** (Robotics Institute) and featuring Akinci, Senior Systems Scientist **Daniel Huber** (Robotics Institute), and Systems Scientist **Sebastian Scherer** (Robotics Institute) as co-principal investigators. The project will also include researchers from Northeastern University's Civil & Environmental Engineering department, who bring expertise in structural analysis and finite element modeling.

The aerial robot project was initially funded by a Pennsylvania Infrastructure Technology Alliance (PITA) seed grant awarded to Akinci, Scherer, and Huber for 2012-2013. The PITA-funded project focused on developing the first robotic prototype for bridge inspection and was conducted in collaboration with the Pennsylvania Department of Transportation. PITA, a Pennsylvania Department of Community and Economic Development (DCED) sponsored program, is designed to provide economic benefit to Pennsylvania through knowledge transfer, technological discovery, and the retention of highly educated students. PITA's programs have led to the creation and implementation of numerous cutting-edge technologies in Pennsylvania companies and have also led to the formation of several start-up companies.

The NRI-funded aerial robot project, entitled "Fast and Accurate Infrastructure Modeling and Inspection with

Low-Flying Robots," proposes combining small aerial robots with 3D imaging techniques and state-of-the-art planning, modeling, and analysis to evaluate the health of bridges, buildings, and other infrastructure. The researchers will also study the potential roles of humans in the assessment process, such as robot deployment or data registering, and will develop a curriculum to involve robotics and civil engineering students in the research.



Akinci's role in the project will focus on supporting a virtual environment that infrastructure inspectors can use to perform inspections and interact with data gathered by aerial robots and other methods. This virtual environment will include both an immersive 3D environment and a desktop environment to support inspector decision-making and increase situation awareness. "We're hoping that with this environment, the inspector will be able to conduct an initial inspection and then communicate requirements for the next stage of data collection to the aerial robot," Akinci explained.

Akinci is renowned for her research on smart infrastructure technologies and has demonstrated a continued interest in promoting sustainable solutions to civil infrastructure issues in Pennsylvania and worldwide. "What is interesting about this project is that it's a multi-institution, multi-disciplinary initiative that draws on a number of perspectives," Akinci said. "I'm already receiving calls from researchers around the country who are interested in the work we're doing. I think this project is going to put CMU in the forefront of this type of research for large-scale infrastructure system inspection."

Faculty Awards



Costa Samaras – DOE American Energy Data Challenge

Assistant Professor Samaras was awarded third place in the Department of Energy's American Energy Data Challenge. Samaras' entry outlined several ideas to use and improve the data contained in the DOE's Transparent Cost Database, a tool that collects and standardizes historical and projected cost estimates for a variety of energy technologies.



Hae Young Noh – Berkman Faculty Development Award

Assistant Professor Noh's proposal entitled *Smart Train for Efficient Monitoring of Bridges* focuses on light rail systems where sensors are placed in and around a rail car. These sensors will deliver data about the structural health of existing railway bridges.



Semiha Ergan – Berkman Faculty Development Award

Assistant Research Professor Ergan's proposal entitled *A Visualization Based, Integrated Information Repository for Troubleshooting HVAC Related Problems*. This project takes raw data from various data sources available for Facilities Management and utilizes an integrated data model to identify applicable data to troubleshoot an HVAC related problem. This model then provides information to HVAC mechanics in a user-friendly format.



Kaushik Dayal – Eshelby-UH Mechanics Award for Young Faculty

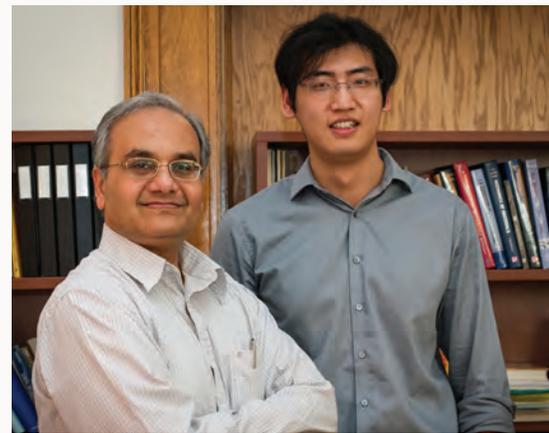
Assistant Professor Dayal accepted this newly established award given annually to rapidly emerging junior faculty who exemplify the creative use and development of mechanics.

International collaborations in Professor Acharya's work on Field Dislocation Mechanics

Professor **Amit Acharya** published work in 2001, developing a theory of Field Dislocation Mechanics. This theory enables description of the plasticity properties and behavior of crystalline materials. The atomic structure of crystalline materials is characterized by regular periodic patterns in space; under loads, the atoms of such materials can be moved around to replicate the same pattern. Since the total energy of a material is governed by atomic positions and interatomic forces, the existence of atomic configurations of exactly the same energy does not hinder atomic movements under loads that are permanent in the sense of being unrecoverable when the loads are removed. Such atomic movements produce defects in the atomic structure, whose motion enhances the production of permanent deformation. This permanent deformation is referred to as plastic deformation. The subject of plasticity is an intensely studied field of solid mechanics which, despite more than one hundred years of study, still has not yielded a definitive theory capable of predicting the effects of intrinsic microstructure on macroscopic material properties. Professor Acharya characterizes the challenge in developing a microstructure-sensitive mathematical theory of plasticity as "immense." In crystalline materials, motion of crystal defects called dislocations is responsible for plasticity. Being a problem arising from motion of defects, plasticity is necessarily a time-dependent, nonlinear phenomenon (i.e. a situation where physical response to an 'addition' of causes is not simply an addition of the individual responses to the causes involved).

Building on apparently disconnected theoretical and empirical advances in modeling the role of defects in plastic material behavior from the 1950s to 2000, Professor Acharya and his collaborators have developed a far-reaching theoretical generalization of, and connection between, those models, and new computational

techniques that render the new theory practical. This advance eluded the solid mechanics research community for more than 30 years. The developed theory shows demonstrated promise for the prediction of the dynamics of dislocation microstructure evolution in the plastic response of solids through the work of independent research groups in the US and Europe.



L-R: Professor Amit Acharya and PhD Student Xioahan Zhang

Professor Acharya's collaborators in development of the theory of Field Dislocation Mechanics include his former students and CEE alumni Dr. **Anish Roy** (Senior Lecturer, Loughborough University, UK), Dr. **Saurabh Puri** (Software Development Manager, R&D, Dassault Systemes Simulia Corp), and Dr. **Amit Das** (Asst. Professor, Indian Institute of Technology, Mumbai, India); current student Mr. **Xioahan Zhang**; Carnegie Mellon mathematicians Professors **Luc Tartar** and **Noel Walkington**; Professor **Armand J. Beaudoin** of the University of Illinois at Urbana-Champaign; Professor **Claude Fressengeas** of the University of Lorraine and CNRS, Metz, France; Professor **Jonathan Zimmer** and Dr. **Karsten Matthies** of the University of Bath, UK; Dr. **Pierre Suquet**, Directeur de Recherche at the CNRS Laboratoire de Mécanique et d'Acoustique, Marseille, France; Dr. **Renald Brenner**, CNRS and University Pierre et Marie Curie, Paris, France; Professor **Robin J. Knops** of Heriot-Watt University, Edinburgh, Scotland; and Professor **S. Jonathan Chapman** and Dr. **Y. Zhu** of the University of Oxford, UK.

STAFF NEWS

CEE Staff Promotions and New Hires



Nathan Kotecki was promoted as the department's Research Administrator in November. In his new role Nathan manages the pre- and post-awards and contract management for department research grants.

Nathan joined CEE in November 2012 and has a degree in Managerial Economics from Allegheny College and is currently pursuing a masters in Public Policy and Management at the Heinz School.



In February we welcomed new staff member, **Daniel Joyner** as the department Financial Assistant. Daniel previously was at the University of Pittsburgh - Dietrich School of Arts and Sciences - Office of the Dean, where he was the payroll and personnel data assistant.

Daniel earned his Bachelor of Arts in Business Administration and Japanese Studies, as well as a Master of Business Administration from the University of Pittsburgh.

Melissa Brown Wins CIT Staff Award



Melissa Brown, Assistant Graduate Program Coordinator for CEE, received the 2013 CIT Staff Rookie Award at the CIT Staff Awards Luncheon. The Rookie Award recognizes an outstanding CIT staff member who has been a part of CIT for a period of at least six months and no more than two years at the time of the nomination deadline.

Melissa joined CEE in August 2012 as our Assistant Graduate Program Administrator to help with the graduate student admissions process in CEE. Melissa holds a BS in Business Administration from the University of Pittsburgh, with a concentration in Human Resources and Accounting. She also holds a certificate of International Business.

In the time that she has been a member of CEE, she has demonstrated a high level of dedication and commitment to the educational and research missions of the department and has brought creativity, skill, and a strong work ethic to her work in graduate admissions.

Scanning for Silver: Investigating Nanoparticle Absorption in Plants



PhD Student John Stegemeier and Dr. Clement Levard at CERGE in Aix en Provence



PhD Student John Stegemeier collects samples at the CEINT facility

There might be metal in your gym socks. That's because nanosilver—silver particles that are a million times smaller than a centimeter on a standard ruler—are being increasingly added to a variety of household products. While its antibacterial properties may be great for keeping sweat socks odor-free, researchers are still working to understand nanosilver's effects on the environment. As part of this effort, CEE professor **Greg Lowry** and his PhD student **John Stegemeier** are studying nanosilver uptake in aquatic plants.

“Nanoparticles in the environment are going to end up in aquatic systems and soil, so one of the key questions right now is: ‘Do aquatic or terrestrial plants take up these nanoparticles?’ If so, they might enter the food web this way,” Lowry explains. Stegemeier has already collected some data suggesting that aquatic plants do absorb nanosilver particles. Now, with the help of a National Science Foundation funded NEEP-IGERT (Integrative Graduate Education and Research Traineeship) travel grant, he is working in France to investigate exactly where within the plants those nanoparticles end up.

In collaborator **Clement Levard's** lab, Stegemeier has been growing duckweed, a fairly common breed of aquatic plant. To some batches, he adds a solution that includes silver nanoparticles. He then takes tiny slivers of the duckweed and inserts them into the Nano CT, a machine that uses X-rays to develop a three dimensional picture of each piece. Because silver is about ten times more dense than water—the primary component of duckweed—Lowry says that some high-density

areas should be visible in slivers of the plant that contain nanoparticles.

At least, that's what he and Stegemeier are hoping—no one has ever used the Nano



Greg Lowry

CT for this purpose before. “We're pushing the capabilities of this instrument. If it works, it will be the first time anyone has ever done this and more importantly, it will tell us where in the plant root these nanomaterials reside,” he says.

This work is just a small part of a long-standing working relationship and friendship between Lowry and Levard. Both are members of the Center for Environmental Implications of Nanotechnology (CEINT), a National Science Foundation funded center that combines the expertise of researchers from all over the world. Lowry says that the partnership between CEINT and France's Centre de Recherche et d'Enseignement de Géosciences de l' Environnement (CEREGE), where Levard is also a full-time research scientist, has been “particularly fruitful” because the two centers often conduct complementary research projects.

The information from this particular project will help researchers and eventually government policy makers to evaluate the risks associated with using nanosilver. Lowry says, “Nanotechnology is one of the first technologies where we're really considering the potential effects as it's rolled out. We have not yet realized the potential of nanoparticles and we're trying to provide feedback for safe design.”

#CITCHINA14: Over spring break, a group of CEE and MechE students traveled to Beijing, China to attend lectures about air quality, fuel cells and water treatment plants at Beijing University of Technology and Peking University. They also had the opportunity to visit a solar energy lab, visit a water treatment plant, and learn first hand about engineering in China. The group also took time to see the Forbidden City, the Great Wall and the Summer Palace.



Collaboration with Colombian University Leads to First Velocity Model of Aburrá Valley

Paul Christiano University Professor **Jacobo Bielak**, a renowned researcher in engineering seismology and earthquake engineering, believes strongly in the benefits of cross-cultural collaboration and is involved in a number of international projects related to earthquake simulation. Several years ago, Bielak and **Jim Garrett**, then-CEE department head, initiated an agreement between the Carnegie Mellon University Civil & Environmental Engineering Department and Colombia's EAFIT University to promote joint educational and research initiatives that would benefit both institutions. The agreement, which was signed during a visit to EAFIT by Bielak and Garrett in 2010, established a dual PhD program between EAFIT and CMU.

The first EAFIT student to participate in the program, **Doriam Restrepo**, received joint funding from EAFIT, the Fulbright Program, the CEE Department, and Colombia's CNSC (Comisión Nacional del Servicio Civil) to develop a model of the Aburrá Valley, the hilly, highly seismic region where EAFIT is located. "Researchers in Colombia wanted to be able to conduct earthquake simulations of the Valley, like the ones we are conducting in California," Bielak explained. "But to do that, you need a model of the region's geological properties, and that didn't exist. So Doriam, working with geologists in EAFIT, created a large model of this region. It was a project that was of interest to us in CEE, but also one that will benefit Colombia."

In creating the model, Restrepo and Bielak developed a new method that more accurately represents hills and mountains in a landscape. Previously, sloped sections of the land were modeled in Hercules, the wave propagation finite element code developed by the Quake group at CMU, using small cubes as units. This resulted in an artificial, jagged edge, much like a staircase, which introduced errors in the model. The challenge was to find a way to better define the contours of the surface. "This involved 'cheating' the existing methodology, which only understands cubes, to create arbitrary shapes while preserving the structure of the code – not an easy task," Bielak explained. After developing the methodology, they then applied it to the Aburrá Valley model.

"With the help of local researchers, Doriam has constructed the first model ever created of a seismic region in Colombia," Bielak said. "We have already conducted some initial tests in which we simulate an earthquake in a particular area and explore how the waves travel. It is quite an accomplishment."

Restrepo completed his PhD studies in October 2013 and is now an assistant professor in EAFIT. He is in the process of publishing several papers that detail the modeling methodology that he developed and discusses potential applications of his approach. Other students are expected to take part in the joint program in the future, and Bielak hopes to see the program expand to include additional departments within Carnegie Mellon.

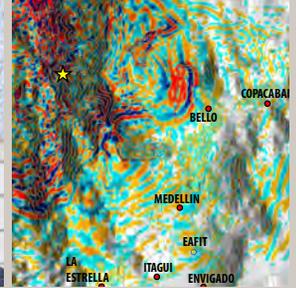
"The advantages of international projects like the CEE-EAFIT agreement are numerous," said Bielak. "In the case of EAFIT, they sent a student here, he has been trained, and he is now returning as a representative of CMU and will have an influence there," he explained. "And at the same time, we in CEE were able to contribute to knowledge. That type of win-win situation is when these collaborations work." Bielak also noted that international exchanges benefit CEE students academically and personally. "I see that when our students have the opportunity to live abroad – even for as little as a month – it not only expands their understanding of engineering; it also gives them a better understanding of the U.S. and of the world."



Jacobo Bielak



Doriam Restrepo



Top left: a view of the Aburra Valley from the city Medellín, the second largest city in Colombia.

Bottom right figure: (detail) Vertical component of the velocity wave field at $t=7.5s$ due to a $M_w=4.0$ point-source earthquake along the Romeral fault. The yellow star represents the earthquake epicenter. Results were obtained using the Initial Velocity Model of the Aburra Valley region developed in partnership by the Quake Group at CMU and the Applied Mechanics Group at Universidad EAFIT.

Honoring a Colleague in Mexico

Jacobo Bielak's international projects span many cultures, but one upcoming event has particular significance for him. In June 2014, he will return to his native country of Mexico for a conference organized by the International Union of Geodesy and Geophysics (IUGG). Bielak has a special link to the event: it is being held to honor his past colleague Dr. Ismael Herrera, a renowned applied mathematician who is retiring after a long career at the National University of Mexico. "I collaborated with Dr. Herrera when I was living in Mexico after I earned my PhD," he explained. "At the conference, he will be giving the keynote speech in a session that I am organizing on computational seismology. For me, this is very meaningful."

Bielak has a long history of collaborations in Mexico, and is a corresponding member of the Mexican Academy of Engineering and of the Mexican Academy of Sciences, in addition to being a member of the U.S. National Academy of Engineering.

ASCE Awards Two Juniors for Student Leadership



Madelyn Gioffre (BS '15)

Madelyn Gioffre (BS '15) and **Michelle Krynock** (BS '15) have been awarded the American Bridge Leadership Award through the Student Award Foundation (SAF) of Pittsburgh. The award honors outstanding achievement of students and was created to enhance the civil engineering profession by attracting the highest quality of people to the field.

Gioffre is the leader for an Engineers Without Borders project producing plastic roof thatch from recycled bottles. She is also the treasurer for the CMU student chapter of the American Society of Civil Engineers (ASCE) and is a mentor for CMU's Emerging Leaders Program.



Michelle Krynock (BS '15)

Krynock is a member of many organizations on campus, including the student sustainability group, Sustainable Earth, and is part of the ASCE Steel Bridge Competition team. She has also served the CMU chapter of Engineers Without Borders as chapter president and as the leader for an international project in Rampur, India.

In 1988, ASCE Pittsburgh Section members founded SAF. Since then, the foundation has recognized emerging student leaders. In 2007, the American Bridge Company provided a donation of \$75,000 and since, the primary award has been dubbed the American Bridge Leadership Award.



l-r: Adefolahan Odunlade (14) Christopher Ejifor (14)



Irving Oppenheim, Carolyn Menard, Lisa Oppenheim



Michelle Krynock, Ralph Gilbert - President of ASCE - PA



Dave Dzombak

Chi Epsilon Inducts Nine New Members

The Chi Epsilon Carnegie Mellon Chapter inducted nine new members this spring: CEE undergraduate students **Remy Behl** ('14), **Yang You** ('15), **Jacqueline Guevel** ('14), **Stacie Lackler**, ('14) and **Andrew Bakert** ('15) and CEE graduate students: **Miguel Mora**, **Tessa Roscoe**, and **Manayer Al-Mujalhem**.

Chi Epsilon is the National Civil Engineering honor society in the United States. The organization honors engineering students who have exemplified the principles of "Scholarship, Character, Practicality, and Sociability" in the civil engineering profession.



Pictured Left to Right: Stacie Lackler, Manayer Al-Mujalhem, Miguel Mora, Margo Johnson, Remy Behl, Negin Ashoori, Tessa Roscoe, Yang You, Varun Kasireddy

CEE Junior Selected As MLK Day Celebration Speaker



Millard McElwee (CE '15) was selected as one of two student speakers for CMU's Dr. Martin Luther King, Jr. celebration. Millard was selected among many of the applicants for this unique and highly competitive honor.

"I wholeheartedly believe that we have a moral obligation to do our part to uplift others and ensure that Dr. King's dream is actualized," said Millard. His speech reflected on the legacy of Dr. King and how that legacy has personally impacted both Millard's life and his educational career.

Millard preceded former U.S. Assistant Secretary of State for African Affairs Dr. Jendayi Frazer's keynote address titled "Leading with Courage and Conviction."

Student Awards

Andrew Carnegie Society Scholars



Jeffie Chang (BS '13, MS '14)

Jeffie has entered her third year of involvement with the American Society of Civil Engineers CMU Steel Bridge team. Jeffie completed an internship at Halvorson and Partners Structural Engineers in Chicago and has conducted undergraduate research with Professor Cartwright.



Christopher Ejiofor - CEE/EPP (BS '14)

Christopher has been a guiding force for the CMU student chapter of the American Society of Civil Engineers and has formed a strong relationship between the chapter and the Pittsburgh Young Members Forum (YMF) of ASCE. Chris completed a competitive internship at Gannett Fleming and has conducted undergraduate research with Professor Akinci in CEE and Dr. Lange of the Steinbrenner Institute.



William Elmore - CEE/EPP (BS '13)

William is a leader in the Student Senate and completed an internship at Alcoa as a Corporate Strategy Analyst where he will continue working after graduation. William spent a summer in Denmark examining the role of publicly owned wind power generation and was awarded a SURF (Summer Undergraduate Research Fellowship) to research the willingness to pay for carbon offsets by commuters.

ARL 2013 Summer Student Symposium



Jason Marshall - MMC PhD Student

Jason was awarded third place in the 2013 U.S. Army Research Laboratory Summer Student Symposium with his presentation entitled *Analysis of Atomistic Defects in Materials with Complex Lattices using Non-Local Quasicontinuum Method*. He discussed a newly developed method for the multiscale analysis of materials that enables the atomistic simulation of new classes of materials subject to various loads, including lightweight alloys used in advanced turbine blades and solid electrolytes used in next generation solid oxide fuel cells.

T-SET UTC Student of the Year



George Lederman - AIS PhD Student

George was recognized for his accomplishments, scholarship and contributions to transportation technologies and research on the indirect health monitoring of bridges.

Jared and Maureen Cohon Graduate Fellowship



Marguerite Marks - EESS PhD Student

Marguerite's studies focus on air quality models to investigate the effects of atmospheric particulate matter on global climate. Marguerite uses satellite and ground-level measurements to improve the representation of cloud condensation nuclei (CCN) in a global climate model and to understand natural sources of CCN.

SCE's T&DI Green Streets, Highways and Development Conference



Yeganeh Mashayekh - CEE/EPP PhD Graduate

Yeganeh won Best Paper for her paper titled, *Benefits of Proactive Monitoring of Traffic Signal Timing Performance Measures - Case Study of a Rapidly Developing Network*. The paper outlines her research in studying the environmental and cost savings associated with monitoring traffic signals within a high traffic area.

Bradford and Diane Smith Fellowship

Aniela Burant - EESS PhD Student



Aniela is working in the area of carbon storage and enhanced oil recovery. Her research focuses on assessing the risk for organic compounds found in depleted oil reservoirs to migrate to aquifers and explores the use of those compounds as naturally occurring tracers for the detection of CO₂ and brine leaks from storage formations.

John and Claire Bertucci Fellowship

Suman Giri - AIS PhD student



Suman studies energy consumption data from various home appliances and uses this information to allow the consumer or power supplier to make informed decisions about power usage and/or distribution. His research focuses on creating models for appliance behavior based on data collected from the aggregate circuit-level; this, consequently, can be used in calculating energy consumption of such appliances.



Jason Marshall - MMC PhD Student

Jason works on developing a faster method with less restrictive assumptions than currently available to simulate atomistic defects in electronic materials. An initial method was recently published and work is ongoing to improve the method.



Sheryl (Xue) Yang - AIS PhD Student

Sheryl studies how to use digital building information models (BIMs) to help heating, ventilation, and air conditioning (HVAC) mechanics rapidly diagnose and fix problems. Yang's goal is to extract specific pieces of information from a building's BIM and present that information to facilities managers in an intuitive way to help them quickly resolve occupant complaints.

Bushnell Fellowship in Engineering



Akanksha Garg - MMC PhD Student

Akanksha creates simulations to study mechanical instabilities in thin films of metals and alloys driven by nano-indentation loading. One of the applications is in semiconductor thin films used for communication and solid state lighting purposes.



Students in CEE Design – Fall 2013 were tasked by the Black Knight to attack King Arthor’s Castle, Camelot, and steal the Holy Quail (a wooden icon of great national pride). One pound water balloons were to be launched at the king and his court, Queen Ginanbeer, Sir Prancelot, and the Queen’s handmaiden, Lady Inweighting, at a distance of 50 feet across an open field to breach the battlements and seize the Holy Quail.



The ten teams designed various siege weaponry within a budget of \$200 and were given five shots to reach their target. Additional restrictions were that only inanimate counterweights could be used and all energy storage technology must be appropriate to the era.



IGERT Grant Helps Students Make International Connections



Lauren visiting the ancient Roman city Caesarea

Second year CEE PhD student **Lauren Strahs** knows how to find water in the middle of the desert. That's because she spent six weeks in Israel last June working with engineers who can turn ocean brine into drinking water. Strahs took the trip with the help of the Integrative Graduate Research Fellowship (IGERT) program, 'Educating at the Interface:

Nanotechnology-Environmental Effects and Policy (NEEP)', housed in ICES, and funding students in several CIT departments including CEE. This interdisciplinary program, funded by the National Science Foundation, has resources specifically allocated for students' international travel.

Strahs' advisor and IGERT principal investigator **Jeanne VanBriesen** explains that in addition to completing research and coursework combining engineering and environmental policy, all IGERT students are encouraged to pursue an overseas research experience. This is unique because many traditional PhD candidates do not have the means to travel, even if their advisors have international collaborators. The IGERT program, however, provides each student with funding for airfare, housing, and other living expenses for one to two months abroad. This gives students the chance to learn skills that they can share with their research groups at Carnegie Mellon and use to enhance their own work.

For instance, Strahs' current project in Pittsburgh is focused on cleaning water through use of membranes. Her collaborators at Ben Gurion University use this same technology to remove the salt from seawater and create drinking water for Israel's residents. Strahs says it was an "added bonus" to visit a place with such different



Ben Gurion University PhD student Jenia Gutman trains Lauren how to operate the QCM-D which is used to characterize thin film formation in an effort to mimic organic adsorption on a membrane surface.

water challenges from Pittsburgh because it broadened her understanding of global water issues.

The Israeli research group, led by Dr. **Moshe Herzberg**, taught Strahs to use a technique that will give her a closer look at the layer of material that builds up on membranes as they filter water. Strahs plans to use this technique to help find ways to reduce this build-up and make the membranes filtering industrial wastewaters more efficient. She also plans to hold a small workshop to teach this technology to other interested students, using a similar piece of equipment recently acquired in the laboratory of her co-advisor, **Meagan Mauter**, Assistant Professor of Chemical Engineering and Engineering and Public Policy.

"We're very lucky that IGERT gives us this opportunity," says Strahs, because she feels she learned a lot from the experience. "I got some excellent training and it was great expanding my personal and professional network." She also feels that the experience benefitted her personally, especially since her future career may take her outside of the United States. "Every country works a bit differently and understanding that will make it easier every time I meet new people," she says.



The Carnegie Mellon Chi Epsilon chapter sponsored a CEE Love a Donor event in conjunction with the University's Love a Donor Week in February. Over 30 CEE undergraduates and graduate students gathered to write personalized thank you notes to supporters of the CEE department. More than 100 notes were written during the event.



Students Visit Steel Fabrication Plant



The student ASCE chapter sponsored a visit to Sippel Steel Fabrication Plant in Ambridge, PA which gave students the opportunity to visit a commercial scale facility and learn about the steel fabrication process first hand.



CEE/BME senior

Corinne Clinch

(BS '14) spent her summer developing inexpensive water treatment technologies in the Limpopo Province of South Africa.

Senior Travels to South Africa to Develop Water Treatment Technologies

CEE: What did you do in South Africa over the summer?

Corinne: I went to rural South Africa on a Research Experience for Undergraduates from the NSF. The University of Virginia sponsored work with the local University of Venda to do field and lab research on technologies for improving water quality in developing countries. Five other college students around the U.S., our graduate mentors, and I lived and worked together. We regularly collected local water samples and tested them before and after the effects of our water treatment technologies.

CEE: Tell us more about the water treatment technologies you investigated.

Corinne: I personally researched paper imbibed with silver and copper nanoparticles. The silver papers were made simply by soaking them in a silver and glucose solution and then microwaving until dry. These papers can be used like coffee filters to remove unwanted particles from dirty water, but the nanoparticles also kill bacteria living in the water. Thus the filters have physical and biological cleaning properties. Dirty, contaminated water goes through the filter and becomes cleaner and safer drinking water. This was proven by my mentor's (Teri Dankovich) doctoral thesis, and our work was expanding on this information to find more applied answers. How much water can this filter clean? How clean does it make the water? What could interfere with this cleaning process?

CEE: How did you get involved in this research project?

Corinne: I saw an e-mail from Professor **Kelvin Gregory** about a paid research opportunity in South Africa. I applied in December and was accepted early in the spring semester. We had almost weekly preparation meetings to get us informed and ready to travel.

CEE: How has this experience influenced your career goals?

Corinne: I have been interested in humanitarian aid

and international development since high school, but I feel like I learned so much more about how aid is implemented from the most basic research to delivery. I also see a lot of room for improvement in this process, so I've been convinced to further my education in the field of global health. I hope to continue graduate studies at the University of Pittsburgh's Graduate School of Public Health, especially in the Behavioral and Community Health Sciences department. I'm interested in possibly becoming a Fulbright Scholar and continuing to engineer health solutions from the States.

CEE: What CEE classes or faculty helped prepare you for this research?

Corinne: **Greg Lowry's** Environmental Engineering course helped me understand the applied chemistry before I went. Having lab experience from Professor **Dave Dzombak's** Environmental Engineering Lab was also essential. My CEE advisor **Mario Bergés** wrote me a recommendation, and the selection committee at UVA said this was a very high priority in their judgement of applications.

CEE: What skills did you pick up or develop in this experience?

Corinne: I developed a more mature perspective on the inherent potential of developing countries. I learned repeatedly how one's own ideas and initial approach to solving a problem can easily be misguided and sometimes even counterproductive. Patiently understanding the larger picture and its context is the only way to start finding the right answers.

My main personal accomplishment was learning how to drive in a developing country and on the left side of the road! It was both scarier and easier than I expected. I certainly developed a better understanding of lab and field research techniques such as membrane filtration, field sample collection, data management, and sterile lab procedures.

Recent PhD Theses

AMIN AGHAEI - Symmetry-Adapted Molecular Modeling of Nanostructures and Biomembranes - Advisor: Dayal

DERRICK CARLSON - Analyzing Residential End-Use Energy Consumption Data to Inform Residential Consumer Decisions and Enable Energy Efficiency Improvements - Advisor: Matthews

TE GAO - Constructing a Complete and Accurate As-Built BIM Based on an As-Designed BIM and Progressive Laser Scans - Advisors: Akinci, Ergan, and Garrett

LINCHEN HAN - Evaluation of Nanoporous Electrode Materials for Ion Removal and Energy Recovery in Water Treatment by Capacitive Deionization - Advisors: Gregory and Karthikeyan

YIGIT ISBILIROGLU - Coupled Soil-Structure Interaction Effects of Symmetric and Asymmetric Buildings in Urban Regions - Advisor: Bielak

MOHAN JIANG - Integrating Water Use and Water Quality into Environmental Life Cycle Assessment: Limitations and Advancements Derived from Applications - Advisors: Hendrickson and VanBriesen

KAMRAN KARIMI - Quenched Stresses and Linear Elastic Response of Random Packings of Frictionless Particles Near Jamming - Advisor: Maloney

CHANG-TSAN LU - Atomistic Study of Motion of Twin Boundaries: Nucleation, Initiation of Motion, and Steady Kinetics - Advisor: Dayal

DORIAM RESTREPO - Effects of Topography on 3D Seismic Ground Motion Simulation with An Application to the Valley of Aburrá in Antioquia, Colombia - Advisor: Bielak

DANIEL TKACIK - Secondary Organic Aerosol Formation from Combustion Emissions: Molecular Studies to Highway Tunnels - Advisors: Adams and Robinson

Isbilioğlu Models Buildings' Behavior During Earthquakes



When **Yigit Isbilioğlu** (CEE PhD '13) looks at buildings, he sees details others might not notice. Isbilioğlu, who belongs to an inter-departmental team of CMU researchers known as the Quake Group, studies the way buildings behave during earthquakes. He recently published a paper that presents his latest accomplishments in earthquake modeling. His latest paper, *Coupled Soil-Structure Interaction Effects*

of Building Clusters During Earthquakes, presents his latest accomplishments in earthquake modeling and was recently accepted for publication in *Earthquake Spectra*. The paper is co-authored with **Ricardo Taborda** (CEE PhD '12), Assistant Professor at the University of Memphis' Center for Earthquake Research & Information, and **Jacobo Bielak**, Isbilioğlu's advisor and the Paul Christiano University Professor of Civil & Environmental Engineering.

When an earthquake occurs, each building feels the impact differently depending on the structural rigidity of the building, its foundation, and the surrounding soil. The motion of the ground between and around buildings may also vary widely. Isbilioğlu wants to know how the arrangement of a group of buildings could affect the severity of the earthquake's effects on buildings. "The basic approach until now has been to study buildings in isolation," he explained. "That gives you some idea of how a particular building will behave in an earthquake, but as cities evolve and closely spaced, high-rise buildings are constructed in city centers, we also need to understand the interactions between buildings through the ground."

With funding from the National Science Foundation, Isbilioğlu's team simulated the ground motion of the 1994 Northridge earthquake, whose close proximity to densely populated Los Angeles metropolitan area made it the costliest earthquake in U.S. history. They then created simplified models of buildings in a section of the San Fernando Valley and compared the behavior of a group of buildings during the earthquake to that of a single building. "Because we put everything into a single simulation, every part talks with each other: the earthquake source, the ground, and the buildings," he said. "It is a more complete representation of reality."

One might think that clusters of buildings are beneficial during an earthquake because the motion is distributed among the buildings, lessening the severity of the overall

effect. However, Isbilioğlu's team is exploring several factors that might determine how a building will fare during an earthquake. The number of buildings, their dynamic properties (or ability to "bend"), and the distance between them all dictate the maximum ground motion underneath them. The team has found that in some cases, the ground motion between buildings may actually be stronger because of variation in these factors, which in turn can affect the demand on some of the buildings themselves.

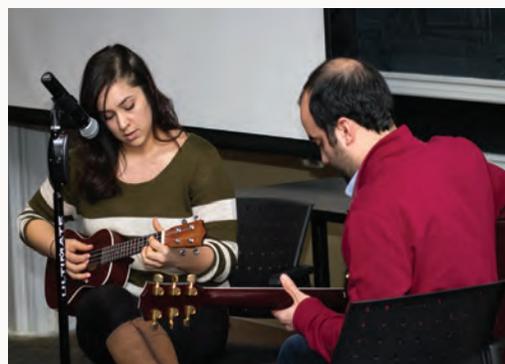
Their study will be key in expanding engineers' and city planners' understanding of the way earthquakes affect cities. "Ours is the first truly three-dimensional study done using a realistic seismological background model for studying how multiple interactions between buildings can affect the ground motion and the structural response of buildings," Isbilioğlu said.

The simulations of the earthquake and the building cluster response were conducted using Kraken, an aptly named supercomputer located at the National Institute for Computational Sciences at the University of Tennessee, Knoxville. It took 15,000 processors running for fifteen hours to simulate the regional response of the ground during the Northridge earthquake and the dynamic behavior of a family of different building clusters, an achievement whose magnitude is not lost on Isbilioğlu. "Prior to coming here, I never imagined this was possible," he said. "We can take a volume of 100 kilometers cubed, model it, and use supercomputers to simulate a real earthquake, and then compare it with the observations with good results. To have such a tool amazes me."

There is a special reason for Isbilioğlu's interest in earthquakes: Turkey, his native country, is prone to them. He noted that earthquake engineering is a popular research topic among civil engineers in Turkey, adding, "I always planned to get an advanced degree in earthquake engineering, with the idea that in the future I may be able to help Turkey construct more sound buildings."

Isbilioğlu completed his PhD in September and joined Paul C. Rizzo Associates in Pittsburgh as an Engineering Associate. He hopes that city planners can use his research as a resource when developing building codes, saying, "Often, you see two buildings that are identical in dimensions, yet in an earthquake, one collapses and the neighboring one stays intact. We are helping to explain such things."

2014 CEE Talent Show: (l-r) Samuel Kim (BS '15); Pierce Sinclair (BS '16); PhD student Rachel Hoesly (BS '10, MS '11) and CEE Assistant Professor Mario Berges; Melissa Daly (BS '13, MS '14)



CEE Alumnus Seth Pearlman receives ASCE Henry L. Michel Award



Seth Pearlman (BS '78 MS '79) was recently selected as the 2014 winner of the Henry L. Michel Award for Industry Advancement of Research. The American Society of Civil Engineers (ASCE) gives this prestigious award annually to someone in the design, construction, or environmental community who has had a significant impact on

research and innovation. Pearlman has spent the greater part of his career helping to design, test, and market cost-effective and sustainable ways to reinforce soil so that it can better support buildings, highway embankments, and other large structures.

He was surprised and deeply honored upon learning he was chosen, "When you work really hard, you know that someday you may be recognized. But it's not something you campaign for, so when it comes it's very gratifying," he says. He is also quick to thank those who contributed to his success, "This award is also for the people who support

me. You can't get where we've gotten without building a really good team."

Pearlman, who is President and CEO of Menard USA, earned both his bachelors and masters degrees in Civil and Environmental Engineering at CMU, believes that his time here helped to foster the creative problem solving skills that have shaped his career. He says that many of his professors were particularly inspiring—so much so that he made sure to include them in his upcoming award acceptance speech. "Success is a combination of the school and the person, but having a good foundation really helps," he says. He has stayed connected to the university and department by serving on the CEE Advisory Council and through his son **Julian Pearlman** (BS '14), who is also a civil engineer.



Seth and Julian Pearlman (BS '14)

Pearlman received the award in Washington, D.C. at the American Society of Civil Engineers' Outstanding Projects and Leaders (OPAL) award ceremony on March 20th.

Coffelt (PhD '08) Named Associate Vice President & Director of FMS



Don Coffelt (PhD '08) has recently assumed the role of Associate Vice President and Director of Facilities Management Services. Vice President for Campus Affairs Michael Murphy said of Coffelt, "Don has been the driving force in optimally managing our constrained physical resources

to maintain and enhance our growing campus in ways that facilitate our core vision while ensuring our commitment to efficiency, environmental practices and a safe and productive campus."

Coffelt and the FMS team of nearly 300 are responsible for campus-wide utility services, asset and infrastructure management, facility operations and facility services through a \$60+M annual budget. Coffelt is also an adjunct CEE faculty member. He teaches both graduate and undergraduate courses and serves on PhD committees for students within the area of Advanced Infrastructure Systems. Said Coffelt, "My whole experience at CMU has been amazing – even so, my opportunity to serve as a member of the CEE faculty has been absolutely transformational."

Alumni Gathering in D.C.



Several alumni who are involved with the NAE Transportation Research Board recently gathered in Washington, DC for an informal gathering after the TRB meeting.

📍 Mikhail Chester (CE '02, CEE '03), Rachel Nealer (CEE '09, '12), Kristen Sanford Bernhardt (CE '94, CEE '97), David Martinelli (CEE '85, '87), Darcy Bullock (CEE '88, '92), Eric Gonzales (CEE '06). Joined with Professor Chris Hendrickson, Professor Emeritus Steve Fennes and current PhD candidate Gwen DiPietro and her friend Patricia Overmeyer.

📍 Professor Emeritus Steve Fennes with Alum David Martinelli.

Photos courtesy of Darcy Bullock

Kaplan (BS '07) Named ASCE Young Civil Engineer of the Year

Linda Kaplan (BS '07) came to Carnegie Mellon University to combine her love for engineering with her passion for the arts. Seven years later, she continues to pursue those interests as a bridge engineer for Gannett Fleming in Pittsburgh.

Kaplan received the American Society of Civil Engineers (ASCE) Pittsburgh Section Civil Engineer of the Year Award on February 22nd. The ASCE Award is given to an outstanding young engineer under age 35 who has demonstrated exceptional and innovative work in the field of engineering, is working to advance the profession, and is active in the Pittsburgh chapter of ASCE.

"I am truly honored to receive this award," Kaplan says. "I really was not expecting it and it is always nice to be recognized, especially by this group."

Kaplan has been an active member of ASCE since her sophomore year of college, serving as secretary her junior year and vice president her senior year. It was an important and active way for her to stay involved in the CEE department and a great networking opportunity.

Dave Dzombak, head of the CEE department praised Kaplan for her success in her career and for her work within the Pittsburgh community. "She has given many hours of her time to engage students and young engineers in the activities of the ASCE Pittsburgh Section," Dzombak explains. "We are very proud of our accomplished and hard working alumna." Currently Kaplan is the practitioner advisor for the student chapter



Kaplan (CE MS '07) accepting her award at the ASCE Pittsburgh awards banquet

of ASCE, serving as a liaison and providing a familiar connection for students. She is especially active in helping students become more familiar with resources in the Pittsburgh area and helps them get to conferences and regional events.

Earlier this month, Kaplan also received the Eastern Regional Younger Members Council (ERYMC) Outstanding Practitioner Advisor Award for outstanding work with a student chapter. The award also acknowledges her overall involvement level, showcasing her dedication to CMU students. She received the award at the ERYMC leadership conference in Indianapolis.

Kaplan continues to remain involved in the Pittsburgh region as well, with her work to improve the Squirrel Hill tunnels and the Hulton Bridge in Oakmont. "Engineering is fun and I hope more people will understand and appreciate that," Kaplan says.

Gannett Fleming Awarded ASCE Superior Employer Recognition Award



Senior Vice President John Kovacs (BS '93, MS '96) accepting the 2014 ASCE Superior Employer Recognition Award

Gannett Fleming was awarded for its outstanding work with younger employees on February 22nd at the ASCE Pittsburgh Section Annual Awards Banquet. The company received the Superior Employer Recognition Award for its exemplary support of younger member involvement in ASCE. Employers are judged on multiple criteria, including the involvement of employees age 35

and younger in local, regional and national ASCE levels.

John Kovacs (BS '93, MS '96), Senior Vice President of Gannett Fleming and director of the Midwest region, accepted the award on behalf of Gannett Fleming. The company has maintained a strong link with Carnegie Mellon University students, primarily in the CEE department. "Gannett Fleming regularly participates in the CEE Department's Career Fair," says John Kovacs. "Through this involvement we are able to have regular interaction with CEE students and have hired several great interns, some of whom have become full time employees."

Gannett Fleming actively encourages and supports employees to

be active in the community and to become thought leaders in the profession. "We promote the development of our firm's next set of leaders by the formation of a Future Generations group," says Kovacs. The award Gannett Fleming received also aims to highlight how the company has worked with younger members to help them prepare their professional work for publication. Gannett Fleming supports younger members through tuition reimbursement for employees pursuing higher education.

In keeping with their culture for innovation, Gannett Fleming recently collaborated with CEE professor **Burcu Akinci** and the Smart Infrastructure Incubator (Sii) to invest in Building Information Modeling and Geographic Information System Integration. The collaboration has enabled Akinci to further her research and allowed Gannett Fleming to become a stronger industry presence in the area.

Gannett Fleming will continue to maintain its long standing relationship with the CEE department through involvement in the Alumni Advisory Council on the part of John Kovacs and **Linda Kaplan** (BS '07). Kovacs is also a member of the University's Alumni Association Board of Directors, which strives to develop and enhance relationships between the University and alumni.

Alumni Honored at 2013 CEE Alumni Awards Luncheon



The CEE department recognized the achievements of a number of its alumni at the 2013 CEE Annual Alumni Awards Luncheon, which was held at the Pittsburgh Athletic Club in October. Alumni, students, current faculty, and staff attended the event.



RECENT ALUMNI ACHIEVEMENT AWARD



Aurora Sharrard (MS '04, PhD '07) and **Pingbo Tang** (PhD '09) each received the Alumni Achievement Award, which recognizes CEE alumni who have made noteworthy achievements within ten years of earning their highest degree from CEE. The recipient of this award must be a role model for students and demonstrate exemplary leadership in the public or private sector.

In addition to being the Vice President of Innovation of the Green Building Alliance (GBA) in Pittsburgh, Sharrard co-leads two GBA initiatives: the Database for Analyzing Sustainable and High Performance Buildings (DAHS) and the Pittsburgh 2030 District, which works toward 50% reductions in energy, water, and transportation emissions by the year 2030.



Tang, who is currently an Assistant Professor at Arizona State University, has published more than 40 peer-reviewed conference and journal articles, and his work on 3D data quality, spatial data processing workflows, and bridge management has been cited over 250 times by civil engineering, geoscience, and computer science researchers.

OUTSTANDING ALUMNUS SERVICE AWARD



John Kenny (BS '82) and **Kevin O'Brien** (BS, MS '00) were honored with the Outstanding Alumnus Service Award. This award recognizes CEE alumni who have provided sustained and outstanding service to the engineering profession. Kenny is Senior Vice President of Gannett Fleming, Inc. and has been a member of the CEE Alumni Advisory Council since 2008; Kenny has taken a special interest in internship and employment opportunities for CEE students.



O'Brien, a Project Engineer at Hatch Mott MacDonald in New York, joined the Carnegie Mellon Alumni Association Board in 2012 after service in a number of leadership roles in the New York Metro Chapter, including president. In addition to being a regular participant in Carnegie Mellon's Volunteer Forum, he has planned many events for New York alumni and has been an active member of the Carnegie Mellon Admissions Council since graduation.



DISTINGUISHED ALUMNUS AWARD

Alumna **Linda McNair Perry** (BS '80) received the department's Distinguished Alumnus Award, which is given to an alumnus whose work has positively affected the engineering profession and improved people's lives. Perry, a Senior Structural Engineer at SFC Engineering in Auburn, New Hampshire, has more than 30 years of experience in the design and construction administration of a wide range of projects. In 2012, she was named New Hampshire Engineer of the Year by a jury of peers from engineering societies across New Hampshire after being nominated by the Structural Engineers of New Hampshire, where she had served as president.



LT. COL. CHRISTOPHER K. RAIBLE DISTINGUISHED PUBLIC SERVICE AWARD

The awards ceremony was also the first time that the department presented the Lt. Col. Christopher K. Raible Distinguished Public Service Award. The CEE faculty unanimously agreed to create the award to honor the memory of Lt. Col. Raible, a husband, father, and CEE alumnus who was killed in action in Afghanistan in September 2012. Raible had a lasting impact on the CEE department during his time as a student, and was known for his strong leadership skills and good nature. He went on to a distinguished military career and received many honors, including a Meritorious Service Medal, ten Strike Flight Awards, a Navy and Marine Corps Commendation Medal, and a posthumously awarded Purple Heart and Bronze Star. The first award was given posthumously to **Lt. Col. Christopher Raible** (BS '95), and is intended to honor individuals who have provided exceptional public service. Raible's sister **Lona Bosley** accepted the award on her brother's behalf, saying, "I am honored to accept this award on behalf of my brother Chris."

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2014 CARNIVAL
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Dr. **Elio D'Appolonia** helped to shape the multidisciplinary, creative, problem-solving nature of civil engineering at Carnegie Mellon University that remains the hallmark of CEE. He brought excitement to the classroom and to field work. The Dr. Elio D'Appolonia Graduate Fellowship Fund was created to recognize his impact on the department. The fund focuses on innovation at CMU and was established to support doctoral students in Civil and Environmental Engineering.

Photo: CMU Archives

A Message to Our Alumni

Our CEE students learn engineering skills in our classrooms and in our labs, and they learn professional skills from you, our alumni. Alumni help us to connect students to internships, to research opportunities and to full-time positions. We value the time you give to our students, whether you meet in person, write email, or talk by phone.

We welcome alumni to be a part of professional growth for our current students and for your fellow alumni. If you are interested in visiting students on campus, being a recruiter at our fall CEE Career Fair, or participating in career path discussions with students and alumni, please contact Andrea Francioni Rooney at francioni@cmu.edu or 412-268-9723.

Help us to keep you informed. Stay connected to CEE in the following ways:

Update your contact information in the online alumni database at alumni.cmu.edu.

Join the Carnegie Mellon University Civil & Environmental Engineering Group on LinkedIn

Like us on Facebook and follow us on Twitter to learn about current CEE projects and events.

Facebook: www.facebook.com/CarnegieMellonUniversityCEE
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