CIVIL

ENGINEERING IMPACT

PURDUE UNIVERSITY | SPRING 2016

ENGINEERING PURE WATER

Undergraduate researchers gain insights, career experience

As I make my way across campus, I see students preparing for the spring semester's final sprint. Lugging backpacks. Talking in clusters. Perusing notes before class. They seem to understand that their learning experience is as important as the degree itself. Indeed, the brightest students at the Lyles School seek to make the most of their undergraduate years.

An especially valuable opportunity for high-achieving Engineering undergraduates is the Summer Undergraduate Research Fellowship (SURF) Program, which hopes to attract bright young engineers to graduate school and perhaps academia. It's a chance for undergraduates to spend a summer in a paid research internship.

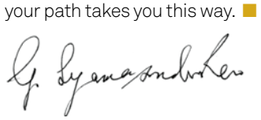
In this issue, we meet six SURF students preparing to change the world. Read about a young woman improving filtration membranes for clean drinking water, and about a student-driven project to reclaim and reuse the nutrients in human urine. Meet a student testing ways to produce PXCMs, super-strong materials more resistant to damage. Two students spent their SURF summer learning ways to secure our transportation infrastructure, improving soils under roads and culvert-bridges. Still another student had the rare opportunity to perform reconnaissance of concrete structures in post-earthquake Nepal.

In our alumni profile, we feature a fine example of a "renaissance" engineer: West Virginia Congressman David McKinley, one of only two engineers serving in Congress.

As Purdue University rallies support for its historic 2012-19 "Ever True" campaign, here in the Lyles School we seek to build on our successes in supporting educational programs, our faculty and our students. Among our campaign initiatives, we wish to provide even more opportunities for undergraduates and grad students — such as endowed scholarships and fellowships.

If you have questions about our funding priorities, or if you wish to help us create a future generation of "Next Big Things," I invite you to reach out to me directly.

Thank you for your continued interest in our school. As always, you are welcome to visit us, and I hope you will stop by whenever your path takes you this way. ■



RAO S. GOVINDARAJU
Bowen Engineering Head of Civil Engineering and Christopher B. and Susan S. Burke Professor of Civil Engineering

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On the cover: Enabling clean and plentiful water supplies is a priority for civil engineers around the globe.

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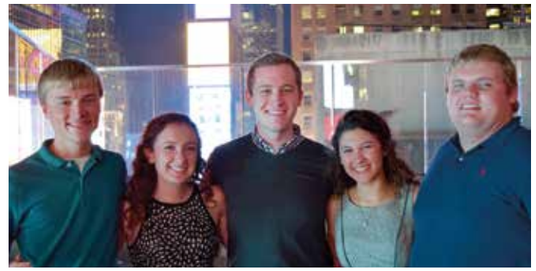
BOILERMAKERS IN NEW YORK

Over the October 2015 fall break, five officers from Purdue's student chapter of the American Society of Civil Engineers (ASCE) learned about the past, present and future of civil engineering at ASCE's annual convention in New York City.

History lessons included a New York City bridges by boat tour and an inside look at World's Fair construction throughout the years. Case studies and technical sessions on updated codes and on the responsibilities of an "engineer of record" provided practical knowledge. Students got detailed views into the future of civil engineering from a panel featuring representatives from Google's driverless car project and another from Walt Disney Imagineering.



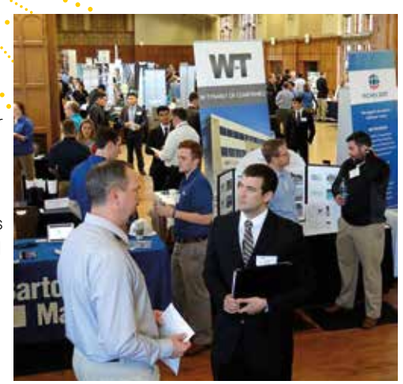
Purdue ASCE student officers, from left: Nathan Shellhamer, vice president; Kat Schmotzer, treasurer; Mike Kelly, president; Shannon Gunn, secretary; Austin Zitelli, events coordinator. (Photo: Kathy Heath)

Michael Kelly, a senior in civil engineering and Purdue's ASCE president, took it all in eagerly with his classmates. "The conference gave us a reference frame for what's out there after graduation," he says. "And I think everyone left with a couple of business cards from employers." ■

CE FOCUSED CAREER FAIR

The civil engineering field offers a wide range of career opportunities, and each October the Civil Engineering Student Advisory Council (CESAC) provides a unique job fair tailored to connect civil engineering students with prospective employers. On Oct. 1, 2015, job seekers and recruiters gathered in record numbers. About 400 students mingled with reps from 82 companies, up 17 from 2014.

Pulling together a career fair is a tall order. Marisol Tsui, a senior in civil engineering and the 2015 CESAC president, says efforts began last March by asking nearly 1,000 companies to participate. "Employers registered over a five-month period, filling out detailed questionnaires that we turned into walking checklists for students," she says. "We also created a booklet with company information."



Approximately 400 students attended the fall career fair. (Photo: Mariah Schroeder)

Tsui, who plans on attending graduate school, says career fair logistics make for a crazy day behind the scenes. But based on feedback from employers and many of their future employees, students made connections smoothly. ■

POST-EARTHQUAKE RECONNAISSANCE IN KATHMANDU

The catastrophic April 2015 earthquake in Kathmandu, Nepal, offered Prateek Shah a rare opportunity as an engineering student — a research experience related to his interest field that would also help his hometown.

During the summer of 2015, Shah, then a junior in civil engineering, participated in the Summer Undergraduate Research Fellowship (SURF) Program under the guidance of Santiago Pujol, associate professor of civil engineering. The primary goal of their research project was to carry out damage assessment surveys of reinforced concrete buildings in Kathmandu, considered to be one of the most seismically vulnerable cities in the world, following the magnitude 7.8 earthquake.

> "... what we do as engineers has a very pronounced effect on society."

It caused more than 8,500 deaths and left more than 22,000 people injured. Another major earthquake of magnitude 7.3 occurred in Nepal on May 12, 2015. Thousands of buildings were destroyed and many more rendered unsafe.

"We wanted to gather data on building performance," Pujol says. "Every earthquake causes tragic losses, but they also generate opportunities to learn to avoid such losses."

Shah, who plans to specialize in earthquake engineering, says, "This research gave me a once-in-a-lifetime opportunity to study and analyze the extent and nature of damage caused by major earthquakes. This invaluable experience enabled me to connect theory to practice."

In seismically active cities like Kathmandu, there often exists a need to assess the seismic vulnerability of a large number of poorly designed buildings within a short period of time. Traditional analysis techniques are ineffective because they require building data that are either inaccurate or unavailable.

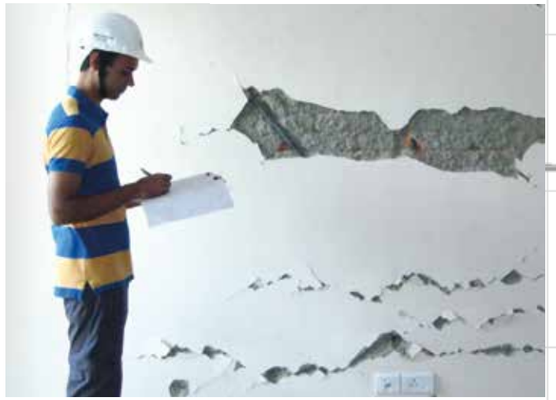
Shah and Pujol tested an alternate analysis technique, the Priority Index, which uses simple correlations involving basic building information to estimate the seismic vulnerability of a building. Their research results showed a good correlation between vulnerability estimates and observed damage, which suggests the Priority Index can be used as a rapid and cost-effective analysis tool for earthquake-prone cities.

"This project exposed several young engineers to an experience that cannot be replicated in the classroom or the laboratory," Pujol says. "Eagerness to learn does not always manifest itself in such a clear way as it did in Kathmandu."

According to Shah, "Apart from gaining technical knowledge, perhaps what I enjoyed the most about the survey was the opportunity to witness firsthand the human facet of engineering as I interacted with a lot of people who had been directly affected by the earthquake. I learned that what we do as engineers has a very pronounced effect on society." ■

— Chris Adam

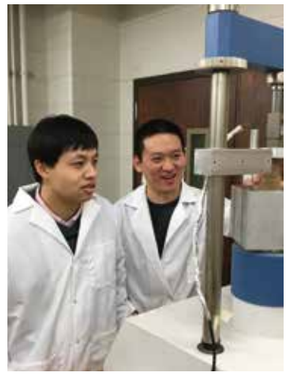
The Purdue team documented damage such as this case of combined shear and axial (compressive) failure of a column.



SURF student Prateek Shah, who plans to specialize in earthquake engineering, had a remarkable opportunity to collect post-quake data in Kathmandu, Nepal. (Photos: Team led by S. Pujol)

THE ROAD TAKEN

SUMMER UNDERGRADUATE RESEARCH PROGRAM PROVIDES TWO-FOLD OPPORTUNITIES



SURF student Xuanchi Li (left) gets assistance from his graduate student mentor, Fei Tao. (Photo: Alain El Howayek)

Specimen cylinder under loading. (Photo:Kuanchi Li)

As the son of a Beijing man who worked in China's energy industry, Xuanchi Li, perhaps not surprisingly, chose Purdue for its international engineering reputation. Now, the junior in civil engineering is gaining research experience that could literally pay off down the road. For both the pavement and himself.

As part of Purdue's Summer Undergraduate Research Fellowship (SURF) Program, Li worked with Antonio Bobet, professor of civil engineering, on an investigation into soils that could improve Indiana roadways. The path could also lead him to graduate school and a research career.

Through a collaboration between the Indiana Department of Transportation (INDOT) and Purdue's Joint Transportation Research Program, Bobet examines problem soils. "Specifically we're looking at clays that have either low plasticity or high plasticity, along with uniform sands," he says. "These are soils found in Indiana, and particularly around the Midwest, which are part of the pavement subgrade."

The soils become problematic, however, when they fail to support the pavement and trucking loads. Rather than swapping out the bad soil for either nonnative materials or cement-treated soils, the research team is looking at how to achieve the desired strength and stiffness of the pavement foundation through less costly treatments. Working with INDOT engineers, Bobet blends the theoretical with the practical to ascertain the best ways of improving various clays and sands from around the state.

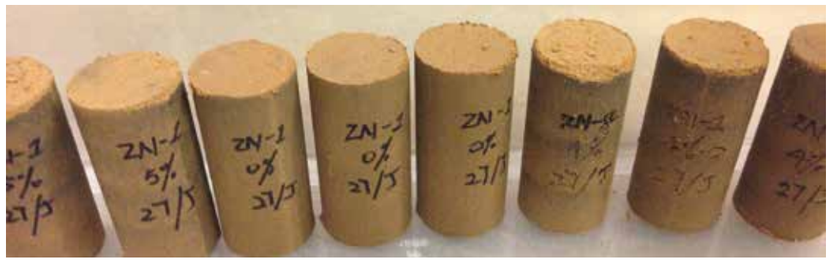
"In the School's Bechtel Laboratory, we're exploring the possibilities of treating existing soil with lime or a combination of lime and cement," Bobet says. "Lime is a byproduct that's cheaper than cement alone."

Li's hands-on work, which includes running experiments and supporting the work of Fei Tao, a graduate student, provides something greater than a course's weekly lab section. He's even earned co-author credit on reports and publications. "This project allows me to get to know the properties of the soil very well," says Li, whose emphasis is in geotechnical engineering. "The most exciting thing, however, is the experience I've gained over time."

Indeed the SURF program is proving beneficial across two-way streets. "The undergrad research is a wonderful experience for the students, complementing the concepts they learn in class," Bobet says. "For us, it's a great way to recruit students to graduate school."

With options ahead of him, Li says he's considering both his future in geotechnical engineering and graduate school. And with a growing familiarity of the School's Bechtel Lab, a Purdue advanced degree is definitely on that list of possibilities. ■

— William Meiners



Sample soil specimens. (Photo: Kuanchi Li)

FLUSH IN NUTRIENTS

STUDENT PROJECT TRANSFORMS URINE INTO FERTILIZER

Presenting a simulation of his project's goal, SURF student Nathaniel Kallmyer (center) stands with his faculty mentors, Professor Ernest "Chip" Blatchley (left), and Professor Zhi "George" Zhou. (Photo: Charles Jischke)

Processing human waste is a circular affair. We fill toilets with potable water, only to contaminate it with nutrient-rich urine. We flush the fouled water to treatment plants, where it's stripped of nutrients, cleaned — and pumped back into toilets.

"When you think about it, it makes no sense," says Professor Ernest "Chip" Blatchley, who holds appointments in civil engineering and environmental and ecological engineering.

"Urine is loaded with nitrogen, phosphorus and potassium," Blatchley says. "It's a remarkably valuable commodity."

Pondering this during a 2014 "Maymester" class, Blatchley asked students: What would be the implications if 50 percent of the urine from the Purdue campus were diverted from the City of West Lafayette water treatment plant?

When he worked up the key, Blatchley was startled by the potential quantity of recoverable nutrients that could be reclaimed as fertilizer. Students, too, were amazed. Several were so intrigued that they petitioned Blatchley to let them build a urine recovery reactor in the civil engineering building. "How could I say no?" he smiles.

Today, top-notch engineering students tinker with test reactors in the Delon and Elizabeth Hampton Hall of Civil Engineering. Students hope to demonstrate the feasibility of a waste management system that could both lighten the load on the local water treatment plant and provide the university an income source: fertilizer. Also contributing to the project is Zhi "George" Zhou, assistant professor of civil engineering and environmental and ecological engineering.

The nutrient recovery experiments are based on work done by others, including the Swiss Federal Institute of Aquatic Science and Technology (EAWAG), which has already demonstrated the feasibility of reclaiming urine as fertilizer — in one of its buildings, which is roughly the size of Hampton Hall.

Nathaniel Kallmyer, a senior double-majoring in chemistry and chemical engineering, became involved with the project via the Summer Undergraduate Research Fellowship, or SURF, Program. He's interested in renewables and reaction engineering, and the biochemistry of the Hampton Hall reactor appealed to him. It employs bacteria used by water treatment plants to convert ammonia in urine to nitrate, a form of nitrogen that plants can use.

"The major issue now is that ammonia in urine is 50 to 100 times more concentrated than the wastewater these bacteria are used to," Kallmyer says. "To adapt this population to higher concentrations of ammonia, we're gradually increasing the concentration we feed the bacteria."

Blatchley is optimistic that, using Hampton Hall as a living lab, students will develop a workable reactor process that could be implemented in other buildings on campus. "It's a learning opportunity," he says. "And a business opportunity." ■

— Marti LaChance

BRIDGING THE UNKNOWN

When thinking about bridges, most people envision elevated arches spanning scenic waterways. But as Xiao Zhang learned from his work in the 2015 Summer Undergraduate Research Fellowship (SURF) Program, some bridges are actually underground drainage culverts; they often go unnoticed by drivers on the roads above them.

"If it spans more than 20 feet, the structure is classified as a bridge, which requires regular inspections and a load rating to ensure it won't fail," explains Mark Bowman, professor of civil engineering and director of the School's Bowen Laboratory.

Most bridges are inspected and load rated based on the design plans on file with the Indiana Department of Transportation (INDOT), which owns and maintains more than 5,600 bridges in the state. But what about the nearly 100 bridges in Indiana that don't have plans on file with INDOT?

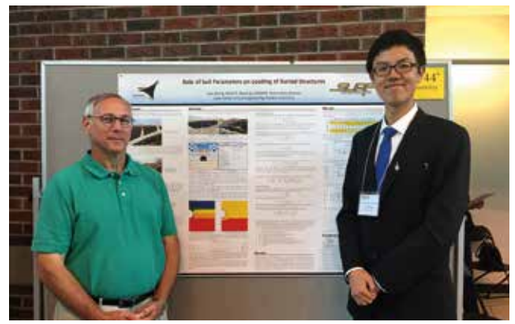
"The vast majority are in safe condition, but without a load rating there is some question about the level of safety," Bowman says. "They are potentially carrying loads above their correct rating, which is a real problem and potential safety issue."

One such problematic structure — which became the focal point of Zhang's summer research —is located about two miles north of Peru, Indiana, on U.S. 31, where three underground culverts placed side-by-side lay beneath the road.

Working with Bowman and his graduate assistant, Rafael Armendariz Briones, Zhang examined the role of soil parameters on the loading of buried structures as part of the team's overall goal to develop protocol for load rating bridges without plans, including those above ground.

"Knowing the contributions and interactions of different soil parameters can significantly reduce the amount of work when rating these structures," Zhang says. "For buried structures without plans, however, those parameters are unknown."

Student Xiao Zhang (white hard hat) with fellow researchers inspecting culverts near Peru, Indiana. (Photo: Mark Bowman)



Xiao Zhang (right) with his professor and mentor, Mark Bowman. (Photo provided.)

Zhang's study examined three different types of soil from the most porous to the least porous — gravelly sand, sandy silt and silty clay — as well as the structure's physical characteristics. He then used existing computer software to model the buried culverts and simulate the theoretical structural responses using 2D finite element analysis.

"Thanks to Xiao's work and subsequent research by Rafael, we're confident that most underground culverts can be load rated without instrumentation and field load testing, which is much more time consuming and costly," Bowman says. "He gave us insight into the most critical locations to address and a good start on our next phase of research." ■

— Eric Nelson

ENGINEERING PURE WATER

For environmental and ecological engineering junior Holly Haflich, the Summer Undergraduate Research Fellowship (SURF) Program was a great way to get experience working on prevalent issues in her field. She joined Amisha Shah's lab last summer to investigate a current issue in water treatment. Professor Shah is an assistant professor of civil engineering and environmental and ecological engineering.

Because of a worldwide freshwater shortage, researchers are looking for ways to purify halide-impaired water — like seawater or brackish water. An inexpensive and effective way to do this is through reverse osmosis and nanofiltration using a membrane. However, a significant problem with this technique is membrane performance loss, called "biofouling." Shah's study looks to discover ways to treat the membrane with a chlorine-based disinfectant — without damaging the membrane.

"Chlorine can be used as a disinfectant in order to decrease biofouling, but the chlorine reacts with halides causing secondary oxidants to form, which can damage the membrane," Haflich says. "These secondary oxidants can potentially react with polymer functional groups on the membrane surface causing polymer degradation, which leads to rapid membrane integrity loss."

Haflich's contribution to the project was developing a method for detecting different model compounds representative of polyamide-based membrane monomers by the liquid chromatography/mass spectrometry instrument at a low sensitivity, to explore how such compounds react in the presence of chlorine.

"It took time to optimize each of the components of this process, but I was able to optimize each of the different organic compounds we were looking at that had similar structures to the polyamide membrane in reverse osmosis and nanofiltration," Haflich says.

"I got a good understanding of what other people are doing and seeing how much can be accomplished even just as an undergraduate student," she says. "This research has given me insight on what I'm interested in, in terms of environmental engineering, and what I want to do after graduation."

Holly Haflich puts nitrogen compound samples in the liquid chromatograph/mass spectrometry instrument, which separates and quantifies organic compounds.

Haflich says she enjoyed working with her fellow lab members, and that they became great role models.

"Holly worked very hard during the course of the summer, was a fast learner and was a valuable asset to this project," Shah says. "At the end of the summer, she gave a presentation to our lab members that was extremely clear and logical, and one of the best undergraduate presentations that I have experienced."

The impact of this research could change the way researchers look at water filtration, and it already has had a positive impact on Haflich's undergraduate career. ■

— Angela Petrie

Student Holly Haflich with her faculty mentor, Professor Amisha Shah. (Photos: John Underwood)

WHERE DID CIVIL ENGINEERING TAKE YOU?

AN ENGINEER GOES TO WASHINGTON

David McKinley (BS '70) is used to being the odd man out. As one of two professional engineers in Congress, McKinley often finds himself debating legislation and hotbutton topics with fellow lawmakers who do not necessarily understand his more scientific approach to solving problems.

"Many of the members of Congress are attorneys, so it makes for an interesting mix," McKinley says. "We are kind of like oil and water at times. They are not always comfortable that I use an engineering approach for identifying a problem and implementing solutions. It's not the typical way things are done in Washington."

McKinley says his time at Purdue gave him the confidence to confront difficult issues and take on new challenges.

"I was not the best student with the best grades," McKinley says. "It was not my focus to have the highest grades. I focused on obtaining the knowledge and experiences I needed to meet my professional goals."

McKinley took a risk as soon as he graduated by starting his own homebuilding business. Eventually, after years of working in the construction industry as a certified professional engineer, he founded McKinley and Associates — an architectural and engineering firm. McKinley and Associates is the largest A&E firm in West Virginia with offices in West Virginia and Pennsylvania. Over the four decades McKinley ran the business, he created hundreds of jobs.

Following his success in small business, McKinley decided to turn his attention to government. From 1981 through 1994, he represented the Third Delegate District in the West Virginia Legislature and in 1990 was elected as chairman of the West Virginia Republican Party Executive Committee. McKinley was elected into office in 2010, and currently represents the First District of West Virginia, which includes the northern part of the state and the cities of Wheeling and Morgantown. He is currently serving his third term.

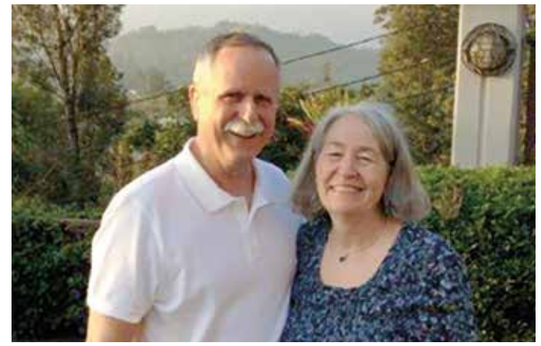
McKinley is a seventh-generation resident of Wheeling, West Virginia. He is married with four children and six grandchildren.

As an individual with significant hearing impairment and a grandfather to a child with special needs, McKinley is no stranger to overcoming the obstacles of disabilities. He has used his role on the Energy and Commerce Committee, which oversees health policy, Medicare and Medicaid to push for better coverage for families and the elderly.

"You can use a disability as an excuse, or you can push on through it," McKinley says. "I often say a person's own doubts are their only limiting factor." ■

— Chris Adam

U.S. Rep. McKinley (left) with constituent Phillip Carl, vice president of a local manufacturing plant. (Photo: Ian Hicks, The Intelligencer/Wheeling News-Register)



U.S. Rep. McKinley with his wife, Mary. (Photo provided.)

UNDERGRADUATE STUDENT

DISCOVERS HER ROLE AS RESEARCHER

Nadia Aljabi is not your typical undergraduate civil engineering student.

The daughter of a Syrian father and Costa Rican mother, Aljabi has already traveled much of the world, seeing firsthand how many countries lack the basic infrastructure to live comfortably and productively. Her response: Work to mitigate the impact of natural disasters that cost lives and untold property damage.

"As a civil engineering student at Purdue, I am learning the necessary skills and technical knowledge to be an active contributor to society in a way that's beneficial and long-lasting," says Aljabi, who hopes to pursue a doctoral degree in engineering or education.

To that end, Aljabi worked with associate professor Pablo Zavattieri and David Restrepo Arango, a graduate research assistant and doctoral student, exploring the development of special materials — called phase-transforming cellular materials (PXCMs) — that can absorb energy and help mitigate damage in the structural components of buildings, bridges and other large structures. The plastic-like materials also are reusable and are less expensive than existing energy absorption/damage mitigating materials.

Zavattieri is collaborating with General Motors Corp. to develop a new type of energy-absorbing material that might be 3D printed and that could have an impact in areas ranging from earthquake engineering to safer football helmets.

The research experience changed her understanding of the ways civil engineers can make a difference. "Now I realize this contribution can either be done as a direct field engineer or as an active participant in the advancement of science and technology through research," says Aljabi, who is studying in Colombia this spring.

Her summer 2015 project, part of Purdue Engineering's Summer Undergraduate Research Fellowship (SURF) Program, focused on the fabrication method for PXCMs based on different approaches using 3D printing. CAD models were first designed following analytical tools. Those models then were 3D printed and assembled together so researchers could explore the fabrication of PXCMs in different materials without relying on 3D printing.

Student Nadia Aljabi with her PhD graduate student mentor, David Restrepo Arango, at the 3D printer. (Photo: Pablo Zavattieri)

Aljabi then examined the geometric design space of the PXCMs that exhibits phase transformation in two or more preferential directions. For this, the team developed 2D and 3D geometric designs, performing a parametric study by using 3D-printed models to explore the behavior of each cell.

The results: They observed that most of the 3D geometric models revealed the expected PXCM behavior under the same conditions — bi-stability and meta-stability, energy absorption and phase transformation capabilities. These experimental results are important for the development of new theories and computational models that will be employed for the design of PXCMs for specific applications.

"We determined these unit cells can be linked together to form a product that can be included in structural members to improve structural resistance," she says. "Further testing, however, is needed to determine the ratio that would allow the 1D and 2D models to demonstrate snap-through behavior, meaning the structures can flex back and forth and remain in either position indefinitely, not unlike a flexing playing card."

This YouTube video illustrates the PXCM concept: https://www.youtube.com/watch?v=OCDkI2fLVyg.

Adds Zavattieri: "Nadia is very professional, a brilliant student, and a straightforward and open-minded person. She critically thought and questioned the material for the PXCM project. It's rewarding to work with a student who is such a dedicated team member, and who has the talent to advance this research." ■

— Phillip Fiorini

Professor Darcy Bullock (far right) with a 2014 study abroad contingent, near London Bridge. (Photo: Darcy Bullock)

STUDY ABROAD

In May 2016, faculty from the Lyles School are leading two study-abroad adventures.

Europe. Darcy Bullock, professor of civil engineering and director of Purdue's Joint Transportation Research Program, has developed an experience-based learning itinerary for students to study building and operation procedures in some of the world's busiest business districts. Pedaling bikes, taking planes and riding trains, Bullock and 20 civil engineering students will spend two weeks exploring mega-transportation systems in London, Paris and Berlin.

"In London, we'll compare and contrast early subway systems built 100 years ago with the Crossrail project, the most modern rail system in the world that's currently under construction," Bullock says. "They'll see the complex civil engineering associated with building a tunnel through the city."

Turkey. Ayhan Irfanoglu and Santiago Pujol, both associate professors of civil engineering, will lead a two-week course on structural form using old and new structures as illustrations. The group will stay in Istanbul, at the Istanbul Technical University campus, and then in the 400-year-old historic village of Eski Doğanbey in a national park on the Aegean coast of Turkey.

Students will visit structures as old as 2,500 years — in places like Ephesus, Priene, and Miletus — and visit others currently under construction — such as high-rise residentials and a third Bosphorus bridge connecting Asia and Europe — as well as many others in between. ■

— William Meiners

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EVER TRUE
150 YEARS
THE CAMPAIGN FOR PURDUE UNIVERSITY

HOW YOU CAN HELP

Through *Ever True: The Campaign for Purdue University*, we will meet the call for highly qualified civil engineers by concentrating on the following components, aligning with strategic growth initiatives.

Students

- *Endowed scholarships* enable Civil Engineering to continue its commitment to quality and diversity by recruiting and retaining the best, most creative students.
- *Endowed fellowships* attract outstanding graduate students, bolstering the reputation of Purdue Engineering and drawing high-quality faculty and increased research funding. To be competitive, we must be able to offer our graduate students tuition and living stipends.

Faculty

- *Endowed professorships* attract and help retain top faculty. Our goal is to have a total of 15 named professorships.
- *"Rising Star" faculty endowments* recognize and retain accomplished early-career professors.
- *Faculty of engineering practice* teach, mentor, and engage students in the application of knowledge and putting research into practice.

Programs

- *New/enhanced curricula* for experiential learning, including global experiences, design projects, internships, practica, service learning, and undergraduate research.
- *A hybrid undergraduate distance-learning/on-campus* program.
- A program enabling students to *earn an MS degree after their BS* + 1 year of graduate study.
- *A professional MS degree* program.

Facilities:

- *Repair, renovation, and repurposing (R3)* of teaching, laboratory, and research space. This is critical to support student growth and to attract and retain superb faculty. We anticipate investing as much as $10 million in R3 projects over the course of our strategic growth. Investments will enhance learning and research experiences for undergrad and grad students.

We invite you to join us in supporting these initiatives. Help us shape the Lyles School of Civil Engineering to ensure the education and leadership we provide our students and our profession remains the very best in the world. Together, we build.

For information, contact:
Don Fry, Senior Managing Director of Development
(Ph: 765-494-2236; email: drfry@prf.org)

LYLES SCHOOL OF CIVIL ENGINEERING –
130 YEARS
IN 2017

MARTHA DICKS STEVENS, PURDUE'S FIRST WOMAN ENGINEERING GRADUATE –
120 YEARS
IN 2017

DAVID ROBERT LEWIS, PURDUE'S FIRST AFRICAN-AMERICAN ENGINEERING GRADUATE –
125 YEARS
IN 2019