



IMPACT

LYLES SCHOOL OF CIVIL ENGINEERING

TRANSFORMING TRANSPORTATION

Undergraduate student researcher Ben O'Brien envisions a future with more equitable transit systems

PAGE 6



**PURDUE
UNIVERSITY**

Lyles School of Civil Engineering



As the first signs of the spring season start to hit our lovely campus here at Purdue, I find myself looking forward to what is to come and I am filled with a great sense of pride.

With spring comes the reminder that the semester — and the college careers for many of our students — is just a handful of weeks away from coming to a close. Fitting, as both the season and graduation mark the start of great new beginnings.

At the Lyles School of Civil Engineering, our primary focus has always been educating and preparing our students to be leaders and innovators — and a good number of these graduating students I have personally taught, advised and conducted research alongside. To see their growth over the years has been such a pleasure. I have every confidence they will continue the Boilermaker tradition of becoming future influential leaders.

This semester has also been extra special for me as I find myself in the midst of my six-month term serving as the acting school head while Rao Govindaraju is on sabbatical. It has been an eye-opening experience for me to see just how many breakthrough technologies are developed by Purdue faculty, students and staff. The impact they continue to make in our nation or around the worldwide is tremendous.

In this edition of *IMPACT* magazine, we share just a few of our latest educational and research efforts involving our undergraduate students. Stories this season include research into infant dust inhalation, roadway electrification and indoor air quality. We also provide highlights of experiential learning opportunities through the lens of undergraduate research programs, study abroad opportunities and a capstone course.

These, of course, are just a few examples of the outstanding work conducted at the Lyles School of Civil Engineering. Whether it is re-inventing the roads we drive across or researching how we can establish habitats in space, our faculty, students and staff continually find themselves at the forefront of their fields, and I look forward to seeing — and sharing — their future successes.

Boiler Up!

Luna Lu
Acting Head and Reilly Professor
Lyles School of Civil Engineering

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ON THE COVER

Sophomore Ben O'Brien is an undergraduate research assistant in the Advancing Sustainability through Powered Infrastructure for Roadway Electrification (ASPIRE) Center. He researches the intersection of engineering and social issues, studying how to make transportation systems more equitable and sustainable.

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NEWS & EVENTS



CONGRATULATIONS GRADUATES!

Congratulations to our nearly 100 Lyles School of Civil Engineering students who just earned either their graduate or undergraduate degrees in December!

We are all so very proud of you and we're already looking forward to your next visit on campus!

SABBATICAL

Dr. Rao Govindaraju, Bowen Engineering Head of Civil Engineering and The Christopher B. and Susan S. Burke Professor of Civil Engineering is on a six-month sabbatical and will return to his position in the summer. We wish him the best and are overjoyed to be working with Dr. Na (Luna) Lu, Reilly Professor of Civil Engineering, as acting school head.



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Junior David Kopp (front, center) with fellow students during the two-week 21st Century European Transportation study abroad course.



ACCESSING TRANSPORTATION

VISUALLY IMPAIRED STUDENT EXPERIENCES EUROPEAN TRANSIT SYSTEMS THROUGH STUDY ABROAD

Study abroad opportunities offer students a unique opportunity to not only experience differences in culture, but how those differences affect engineering and design.

One of the most popular study abroad opportunities offered at the Lyles School of Civil Engineering is the two-week 21st Century European Transportation course led by Darcy Bullock, the Lyles Family Professor of Civil Engineering. Each May, students travel throughout Europe, where they learn about the construction and operational activities involved in integrating the region's airports, trains, ports, subway, pedestrian and bicycle infrastructure. Supply chain logistics are also addressed during site visits to automotive and aircraft assembly plants.

Major cities visited in the past include London, Berlin, Hamburg, Munich, Prague and Paris. While there, students experience the various transportation systems such as railways, airports and bicycle paths. They also visit cultural landmarks as well as major transportation industries such as the Volkswagen assembly lines, Berlin Brandenburg Airport construction site and the Hamburg Airbus aircraft assembly plant.

"It's active learning; it's something you cannot get in class — or even in our country," Bullock said. "The cultural aspect, along with gaining an up-close understanding of how public transportation operates in other countries, opens you up to new ideas and you gain a great appreciation of the different challenges other countries and industries outside of the U.S. face."

The 2022 study abroad trip included a civil engineering student who experienced it unlike others had in the past. Junior David Kopp has a genetic eye disorder called aniridia. In Kopp's case, it has led to total blindness in both of his eyes. Due to his condition, Kopp said, he has always had a special interest in both civil engineering and public transportation since they greatly impact his ability to travel.

"Public transportation has a huge impact on my life," Kopp said. "It's how I get around and it's what I depend on. That's why I wanted to study transportation engineering so I can both learn more about a great interest of mine and help improve the future of public transportation in America."

To further his understanding of transportation engineering, Kopp said he was eager to participate in Bullock's study abroad course.

"Everything that I've learned about public transportation in Europe is that it's far more robust than what we have here, so I was very interested in experiencing it all for myself," Kopp said. "Also, just the chance to travel outside of the country and experience other cultures was very appealing to me."

The trip, Kopp said, did not disappoint. In particular, Kopp said he was blown away by London's bus and tube systems as well as Germany's high-speed rail network.

"Those cities definitely resonated with me the most," he said. "To experience how advanced and efficient their public transportation networks were — and how easy it was for me to use them even though I never had before — was incredible. The ease of use and access of public transportation that some cities and countries in Europe have was something I had never experienced before."

Bullock said it was also an amazing experience to travel with Kopp and share in his discoveries.

"Honestly, I was a little nervous at first given that we would be in a completely different environment, but it was never an issue," Bullock said. "He integrated himself seamlessly with the rest of group and was a tremendous addition. And to see for myself how well the cities' transportation systems accommodated people with disabilities was also impressive."

Overall, Kopp said, the lessons learned from the two-week course will stick with him forever and has only deepened his love and interest for both civil engineering and Purdue.

"To have opportunities like this and to learn from some of the best civil engineers in the world is why I chose to come to Purdue in the first place," Kopp said. "The environment, the people, the doors a Purdue education provides are invaluable to me and it makes me proud to be both a civil engineer and a Boilermaker."



BABIES KICK UP CLOUD OF DUST

INFANTS MAY INGEST HARMFUL CONTAMINANTS AS THEY CRAWL

The dust particles infants kick up while crawling across the floor could be more harmful to them than we realize, Purdue University researchers say.

Brandon Boor, associate professor of civil engineering, leads a multidisciplinary research team for the United States Environmental Protection Agency (EPA) that is looking into the physical and chemical characteristics of dust and other particulates found in indoor environments. Once analyzed, researchers can use the data to determine infant ingestion rates and surface transfer behaviors of dust particles.

“For this project, we wanted to evaluate exactly how much dust infants ingest,” Boor said. “The EPA is interested because there are many contaminants in dust, ranging anywhere from antimicrobials to lead — some of which can be harmful to early-childhood health.”

The experimental procedure is divided into four key processes: sample collection, sample packaging, characteristic analysis and surface transfer analysis. A standardized vacuuming method has been used to collect dust samples from infant-occupied urban and suburban homes around the U.S. Dust samples have been sifted for fibers and analyzed to determine characteristics such as mass, density, particulate size and chemical composition.

To test and measure the amount of particles kicked up, Boor and Brian Magnuson, an undergraduate student researcher, designed and built a full-scale environmental chamber to conduct their dust transfer experiments. Magnuson also designed and built dust sampling equipment and is co-designing a new robotic platform to simulate dust transfer to an infant’s hands.

“There wasn’t any equipment out there that could be used to conduct the experiments we wanted to conduct, so we had to make our own,” Magnuson said. “Using what we designed and created, we can now replicate organic movements with our robotic model and with our chamber we can adjust the weight and velocity in which it moves across the floor to evaluate different hand contact impulses.”

Additionally, Boor’s team is working with both a psychologist and a chemist from Purdue to assist with their research.

“We are looking into determining just how often infants are touching the floor, how often they are putting their hands in their mouths and how often the things they touch are touching the floor,” Boor said. “We can use that data to better determine how much dust an infant has ingested during the day.”

Boor said the team is continuing to test and collect data which they will share with NYU’s Infant Action Lab to develop a comprehensive report.



Brian Magnuson, an undergraduate student researcher, helped design and build a full-scale environmental chamber to conduct dust transfer experiments.

SENIOR DESIGN

CAPSTONE COURSE PUTS PROFESSIONAL SCENARIOS INTO PRACTICE

Through their involvement with real-world projects, Purdue civil engineering seniors take their education beyond the classroom and into a professional setting.

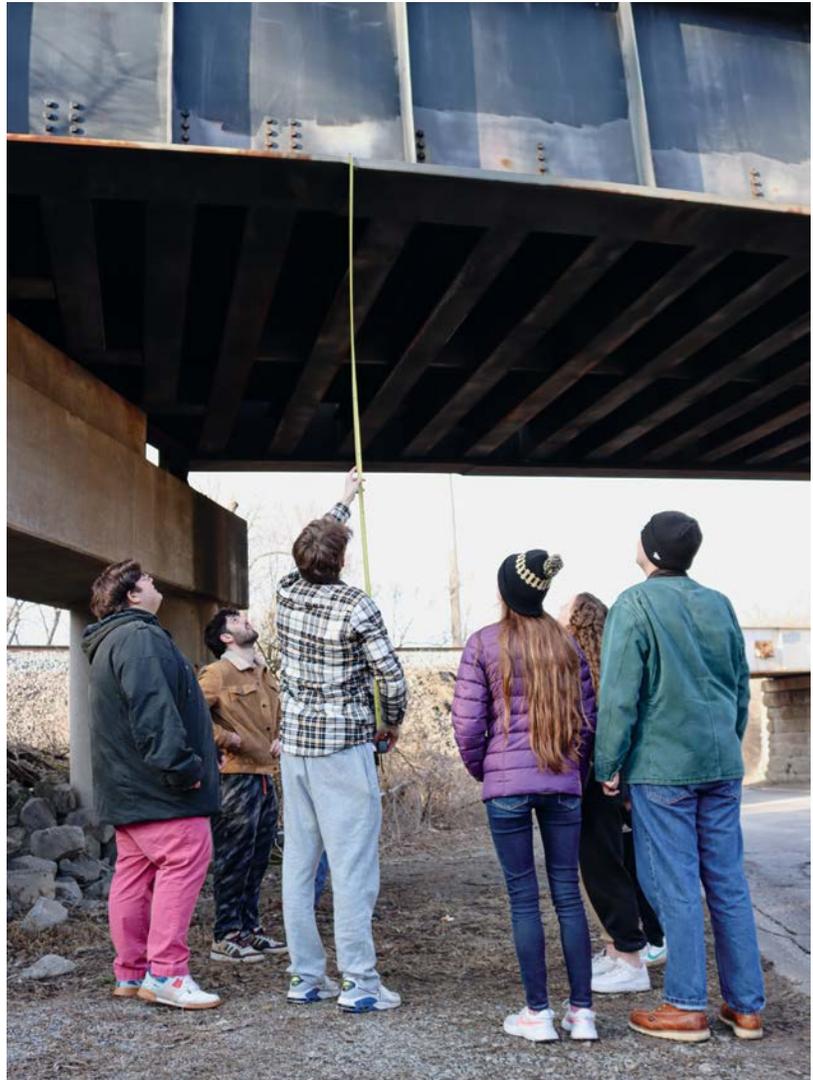
Signifying the near-completion of their undergraduate careers in the Lyles School of Civil Engineering — and serving as a rite of passage — all students must complete the senior design capstone course in their final year. The class employs all the knowledge they have accumulated at Purdue and emphasizes the importance of collaboration in a team environment.

“Senior design prepares our students for the professional world and deepens their understanding of what we have been teaching them over the years,” said Bob Jacko, professor of civil engineering and senior design instructor. “You can really see the difference it makes by the end of the semester. Not only do our students come out of this class with a greater understanding of civil engineering, but they gain an additional level of maturity as they learn what it’s like to be part of a planning and design team.”

Each semester, the project changes depending on the needs of partner organizations such as the Greater Lafayette and Tippecanoe County government offices, as well as several engineering firms and alumni. Past projects have included sample design work for historic theater renovations, roadway expansions and stadium construction.

This spring, students are working with Butler, Fairman & Seufert Inc. of Indianapolis on the Big 4 Trail project within Tippecanoe County. The Big 4 Trail stretches from Indianapolis to Delphi, Indiana, following closely along the abandoned Big 4 Railroad. The Tippecanoe County portion is a 27-mile-long pedestrian/bike trail that runs from the southeast corner of the county through Lafayette, West Lafayette and Battle Ground up to the county line toward Delphi. Railroad bridge redesign, shelter buildings, potable and sanitary water and property line delineation are only some of the civil engineering challenges facing the students this semester.

The students work in teams and act as their own civil engineering companies. Each team member takes on a specific role in the company as they plan out the entire project from the concept phase to final development. The teams then present their plans at the end of the semester and provide full reports that include a budget and schedule for the development of their project.



Civil engineering student Camille Hamilton said her experience has been truly eye-opening.

“What was so great about this class was that I felt like it really gave me a good glimpse of what it would be like to work with fellow civil engineers,” Hamilton said. “We had to learn how to work together and effectively communicate what we expected of each other.”

Classmate Harrison Kuszmaul echoed Hamilton, adding that the class gave him a greater appreciation of established professionals.

“To take what we’ve learned and put it into practice has been invaluable to me,” Kuszmaul said. This class, I feel, has been a great lead-up to what I aspire to do as a professional. I want to be part of a company and team that can come together and do something incredible.”

A student team takes measurements for the Big 4 Trail project as part of the senior design capstone course.



From left: Ben O'Brien, undergraduate research assistant; Konstantinos Flaris, graduate research assistant; and Nadia Gkritza, professor of civil engineering and agricultural and biological engineering

Toward the end of his second semester in first-year engineering, Ben O'Brien read a book that would change the course of his life. O'Brien came to Purdue from Nebraska with the intent to study aerospace engineering. In high school, he'd excelled in STEM but he also developed a passion for social justice. He was searching for a way to incorporate social issues into his engineering coursework when he read "Right of Way: Race, Class and the Silent Epidemic of Pedestrian Deaths in America" by Angie Schmitt.

"The book is a study in how transportation engineering has historically been very hostile toward pedestrians and pedestrian rights and how that intersects with race and class," O'Brien said. "It made me realize that civil engineering, specifically transportation, was a way to study the technical and scientific aspects of engineering while taking into account the people side of engineering as well."

Now a sophomore in civil engineering double majoring in political science, O'Brien works as an undergraduate research assistant under Nadia Gkritza, professor of civil engineering and agricultural and biological engineering, in the ASPIRE (Advancing Sustainability through Powered Infrastructure for Roadway Electrification) Center. A National Science Foundation-funded Engineering Research Center, ASPIRE's mission is to improve health and quality of life for everyone by catalyzing sustainable and equitable electrification across the transportation industries.

"Mass transit is viewed differently in the United States than other countries," O'Brien said. "Unless you live in a large city with a substantial transit system, there's a perception in the states that transit is only for the poor. The transportation infrastructure, or lack thereof, across the Midwest contributes to a lot of social

injustices. I want to understand why many Midwestern communities don't have this kind of progressive infrastructure and work to implement solutions while addressing the related social justice issues surrounding transit."

Konstantinos Flaris, a graduate research assistant, serves as O'Brien's mentor in the ASPIRE Center. The two are working with Gkritza to assess community engagement for a pilot roadway electrification project planned near Purdue's campus.

"The goal is to design pavement that charges electric vehicles as they drive over it," O'Brien says. "Part of that project involves how an electric roadway could potentially affect the community. We are in the early stages of identifying the communities in Greater Lafayette that could be impacted by environmental justice issues related to the project and determining the methodologies available to gauge community perception."

The pilot project, planned for installation along U.S. Route 231, involves placing slabs of magnetizable concrete with embedded coils that produce electromagnetic fields that transmit to an electric vehicle's receiver. The technology operates similarly to wireless phone chargers built-in to counters and nightstands. Sales of electric vehicles accounted for about 5% of the U.S. market in 2022, so widespread adoption of electrified roadway could be decades away. For O'Brien, that means engineers have time to make sure they get it right.

"We tend to focus on the technical aspects of how the science works but the most important factor is how does the technology impact people's everyday lives? How does it affect the environment in which it is built?" O'Brien said. "Being able to answer those questions is what's interesting to me and aligns with my passions in the field."

WORKING TOWARD MORE EQUITABLE TRANSIT

**ASPIRE CENTER TEAM
SUPPORTS UNDERGRADUATE
RESEARCH ASSISTANT'S
FOCUS ON SOCIAL JUSTICE**



Laura Ajala (right) from Campinas, Brazil, was one of the students selected to participate in the 2022 PONTES program. She joined a research team led by Nusrat Jung (left), assistant professor of civil engineering.

UNDERGRADUATE RESEARCH

SURF AND PONTES PROGRAMS OFFER IMMERSIVE OPPORTUNITIES

The Lyles School of Civil Engineering's commitment to educate and prepare undergraduates — both on campus and around the world — helps to extend giant leaps far beyond what is taught in the classroom.

Since its inception, Purdue civil engineering faculty and staff have participated in the College of Engineering's Summer Undergraduate Research Fellowship (SURF) program. The program provides an action-oriented research experience for undergraduate students to stimulate their interest in advanced education and research careers.

Selected students engage in research projects over the summer. SURF matches undergraduate fellows with a faculty member and graduate student mentor who work together to solve problems in science, engineering and technology. This competitive fellowship is a paid, 10-week, immersive summer research experience guided by the faculty and graduate student mentors.

In addition to research activities, students also participate in weekly professional development workshops. The program culminates with a student research symposium where all fellows present a technical poster or an oral talk.

As a SURF program participant, civil engineering undergraduate Brian Magnuson assisted

Brandon Boor, associate professor, with his indoor air quality research. Magnuson said the experience and knowledge he gained over the summer increased his understanding far more than anything else he had experienced before the program.

“To actually see what I’ve studied put into action and see how researchers conduct their work is something that will stick with me forever,” Magnuson said. “My experience with the SURF program was incredible.”

Magnuson continued to assist Boor’s research into the 2022-23 academic year.

PONTES PROGRAM

In addition to seeking undergraduates on campus to assist in research, Purdue University — and the Lyles School of Civil Engineering — participate in the PONTES program. This program invites qualified undergraduate-level students from Brazil who have been preselected by their respective universities to compete for a research opportunity on Purdue’s campus.

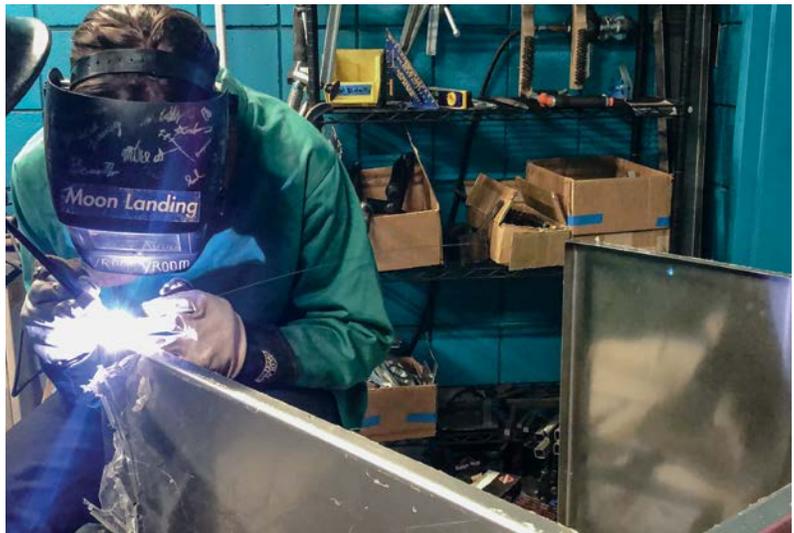
Those selected for the PONTES program receive up to \$6,000 to aid in housing and travel expenses. Interested students went through a selection process after they submitted a transcript, an abstract of their proposed research project/idea and a letter of recommendation.

Laura Ajala from Campinas, Brazil, was one of the selected students in 2022. She joined a research team led by Nusrat Jung, assistant professor of civil engineering, to study experimental evaluations of changes in HVAC filter performance in buildings.

“It was a very challenging experience for me, but I am so glad I did it,” Ajala said. “To come overseas and take part in new research and even develop new equipment to run tests were things I never had done before. Until I came here, everything I learned was in class and was theoretical. So, to see what civil engineers really do and what their work means was an amazing experience.”

Jung said Ajala was an invaluable member of the team and encourages more faculty to participate in programs like SURF and PONTES.

“One of the best things about Purdue is just how many opportunities it offers to undergraduate students,” Jung said. “Not only is it a great opportunity for students, but it is a tremendous resource for faculty researchers. These students are knowledgeable and capable and can become invaluable assets to any team. I strongly encourage faculty to participate.”



As a SURF program participant, Brian Magnuson worked with Brandon Boor, associate professor of civil engineering, to design and build a full-scale environmental chamber to conduct dust transfer experiments.



Study Lounge



VIEW



Hydraulic and Hydrologic Engineering



Materials Engineering



Geomatics Engineering



Geomatics Engineering



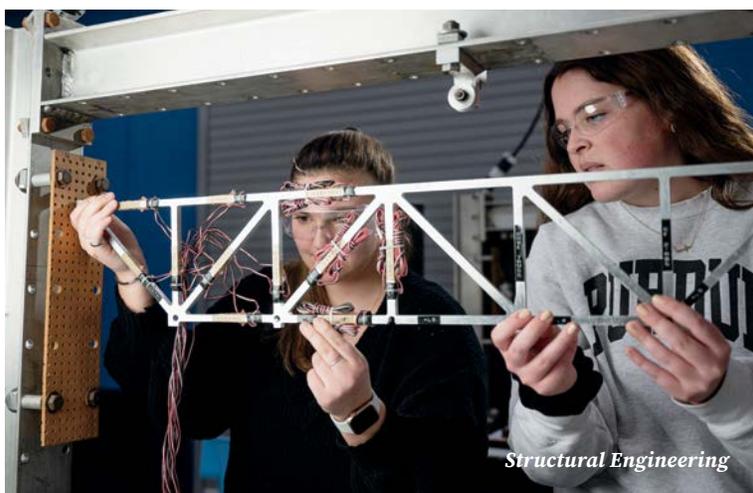
Study Lounge



Computer Lab

FROM THE LAB

Undergraduate students in the Lyles School of Civil Engineering have the opportunity to focus their studies in one of nine academic engineering specialties: architectural, construction, environmental, geomatics, geotechnical, hydraulic and hydrologic, materials, structural and transportation. State-of-the-art lab facilities and engaging study lounges enhance both education and the discovery process.



Structural Engineering



Olson Senior Design Lab



BUILDING A CAREER ABROAD

BECHTEL ENGINEER VALUES PROFESSIONAL EXPERIENCE IN AUSTRALIA

Wanting to make a difference in the world, Emily Foote (BSCE '10, MSBCM '18) took a chance on engineering. That chance landed her in Queensland, Australia.

Born and raised in Akron, Ohio, Foote had big plans growing up — none of which included becoming a civil engineer. The idea was introduced to her by her uncle, an engineer, who encouraged her to give Purdue University a chance.

“At first, my mind was dead set on going to law school,” Foote said. “But, after learning more and more about both engineering and Purdue, my interests began to shift. Among the colleges that accepted me, Purdue was the first. My mom immediately saw the twinkle in my eye when we entered West Lafayette for our visit. We both knew it was where I was supposed to be.”

Foote said the reason civil engineering was so appealing was because of steel bridges. After her introduction to the Purdue student bridge team while a senior in high school, engineering became the only option.

As a senior, Foote coordinated the National Student Steel Bridge Competition. Coordinating the event was a full-time job but the lessons and skills she developed through it, benefited her greatly in her current career as a construction superintendent for Bechtel.

“Event planning and managing a budget definitely helped me grow in my career” Foote said.

But, as she approached the final months before she earned her bachelor’s degree in civil engineering, Foote said she “wouldn’t have changed anything about my time at Purdue, but I still hadn’t been abroad.” With that in mind — and wanting to make the most of the time she had left — Foote sought study

abroad opportunities and decided to enroll in the Olympic Gold study abroad program in London.

While in London, Foote said the “most interesting experience on this trip was meeting with Bechtel and witnessing their projects firsthand.”

Foote said she was immediately impressed with Bechtel and the company’s work, and it gave her a definite idea of what she wanted to do and who she wanted to work for. Shortly after graduation, she moved to Houston to work for Bechtel in the subcontracts department where she was soon given her first on-site job in Queensland, Australia, on Curtis Island.

“It was a roller coaster of emotions moving to Australia out of college” Foote said. “Things really changed for the better for me, it felt good to live in a college-like environment again.”

While working in Australia, Foote was contacted by Bechtel CEO Bill Dudley to help coordinate and plan the upcoming Purdue study abroad to Australia that following year. Foote said she used her personal and professional experience to balance the student curriculum with seeing Bechtel’s latest projects.

“The stars aligned for me to help assist in planning this trip” Foote said. “It was all about balancing the curriculum with cool stuff in all honesty. Discovering everything you could do in construction truly fulfilled me and helped me realize this is what I was born to do.”

To this day, Foote said she remains heavily connected to Purdue through sports and events — and her co-workers are all very well aware that being a Boilermaker is a part of who she is.

“I couldn’t be happier with the way things in my career have gone and I couldn’t have a better employer,” Foote said. “It amazes me how interconnected my career has been with Purdue. Witnessing how full circle everything has come in my career through Purdue has been incredible.”



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