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LYLES SCHOOL OF CIVIL ENGINEERING

PAGE 8

ON THE LINE

MIXED-REALITY STUDY ANALYZES IMPACT OF AT-RISK BEHAVIOR ON WORKER SAFETY

PURDUE UNIVERSITY

Lyles School of Civil Engineering

BEETLE'S SUPER STRENGTH MAY HOLD SECRETS TO IMPROVING MATERIALS | PAGE 2

MESSAGE FROM THE HEAD

It is a new semester and a new year — both of which, I think, most of us were all very much looking forward to seeing.

It is a bit of an odd feeling when I look outside my window. The warmer days are coming, Purdue University's beautiful campus is turning green again and scattered, masked students are making their way to their socially-distanced classrooms.

It is both a show of progress and a reminder that we still have a long way to go before life fully returns to normal. However, unlike in 2020 — where it seemed like the mindset was "just make it through the year" — 2021 has a far more hopeful light shining upon it.

Thanks to the incredible work of researchers around the world, an end to this pandemic is finally in sight. And it is just another reminder how vital our role here at the Lyles School of Civil Engineering really is.

The students we educate today could very well be among those who make a similar, world-changing impact tomorrow. The ongoing research our students, faculty and staff are engaged in has the potential to affect our lives for the better.

That is what it means to be an engineer and an educator — to strive to improve the world around us and ensure the next generation of students have the knowledge, skills and opportunity to do the same.

Simply put: we endeavor to create a better future.

In this edition of *IMPACT*, you will see what our students, faculty and staff are researching to secure that better future. These stories include developing a database to aid in flood response, creating better-performing concrete that will leave a greatly-reduced carbon footprint and advances in how we teach and train our students using 3D technology.

While it is still relatively early in the year and many aspects of it remain uncertain, the one thing I can confidently say is that the Lyles School of Civil Engineering is, and continues to be, a source of progress that will ensure the lives of our students — and everyone else — will improve as times goes on.

All the best,

Rao S. Govindaraju
Bowen Engineering Head of Civil Engineering
and Christopher B. and Susan S. Burke Professor of Civil Engineering

IN THIS ISSUE:

ON THE COVER

To assess how unsafe behavior compromises the benefits of safety interventions among line workers, Sogand Hasanzadeh, assistant professor of civil engineering and construction engineering and management, and her team collaborated with the Purdue Envision Center to create a mixed reality environment that simulates a job site. Participants stand in a utility bucket holding a hot stick used to move power lines while outfitted in their climbing gear and wearing a virtual reality (VR) headset.

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NEWS & EVENTS

The Lyles School of Civil Engineering has — once again — been recognized as a top five civil engineering undergraduate program in the United States.

U.S. News & World Report has released its national rankings of undergraduate programs for 2021 with Purdue Civil Engineering ranked No. 3 in the nation. The rankings are computed from the responses to a survey sent to deans, heads and selected senior faculty.

Purdue Civil Engineering has been consistently ranked in the top 10 by *U.S. News & World Report* for over a decade. This is also the third year in a row the school has been ranked in the top five.

Overall, Purdue University's College of Engineering undergraduate program was ranked ninth in the nation.

→*READ MORE* about Purdue Engineering's 2021 undergraduate rankings.

→*VIEW A FULL LIST* of the Purdue Engineering national rankings.

WINTER GRADS

Congratulations to the 80-plus graduate and undergraduate students who earned their civil engineering degrees in December!

Unfortunately, the campus shutdown prevented us from having our traditional post-commencement celebration but we could not be prouder of your achievements and what you overcame in the final months of the semester.

We cannot wait to see you all again when you come back to visit.

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IRONCLAD INSIGHTS

DIABOLICAL BEETLE'S SUPER STRENGTH MAY HOLD SECRETS TO IMPROVING MACHINERY, MATERIALS

Getting run over by a car is not a near-death experience for the diabolical ironclad beetle.

How the beetle survives could inspire the development of new material joints with the same herculean toughness, said Pablo Zavattieri, the Jerry M. and Lynda T. Engelhardt Professor in Civil Engineering. These joints or connections would be strong but ductile like a paper clip, making structures that employ dissimilar materials safer and longer-lasting.

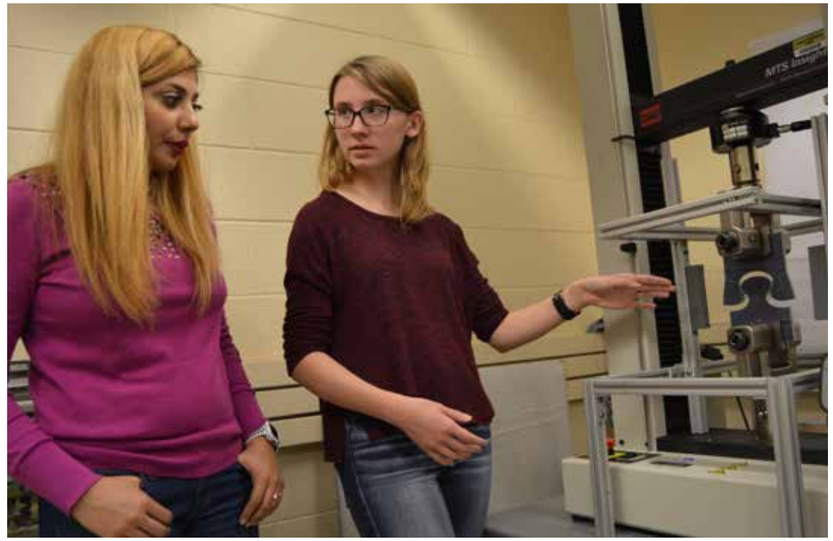
The study, led by engineers at Purdue University and the University of California, Irvine (UCI), found that the diabolical ironclad beetle's super-toughness lies in its two armor-like "elytron" that meet at a line, called a suture, running the length of the abdomen. In flying beetles, the elytra protect wings and facilitate flight.

But the diabolical ironclad beetle, a terrestrial beetle, doesn't have wings. Instead, the elytra and connective suture help to distribute an applied force more evenly throughout its body.

"The suture acts like a jigsaw puzzle," Zavattieri said. "It connects various exoskeletal blades — puzzle pieces — in the abdomen under the elytra."

Zavattieri has been putting this puzzle together for more than four years now and has teamed up with graduate and undergraduate students in the Lyles School of Civil Engineering to assist him in his research. One such undergrad was Molly Cooper (BSCE '19).

"These are beetles that can be run over by cars and come out alive," Cooper said. "It seemed like a great sample to study and see if we could recreate that strength. And when we recreated the pattern with 3D printing, the material was many times stronger than it had been before."



Post-doctoral researcher Maryam Hosseini and undergraduate Molly Cooper test the strength of the beetle-inspired material.

To uncover these strategies, a team led by UCI professor David Kisailus first tested the limits of the beetle's exoskeleton and characterized the various structural components involved by looking at CT scans.

Using compressive steel plates, UCI researchers found that the diabolical ironclad beetle can take on an applied force of about 150 newtons — a load of at least 39,000 times its body weight — before the exoskeleton begins to fracture.

That's more impressive than it sounds. A car tire would apply a force of about 100 newtons if running over the beetle on a dirt surface, the researchers estimate. Other terrestrial beetles the team tested couldn't handle even half the force that a diabolical ironclad beetle can withstand.

Zavattieri's lab followed up these experiments with extensive computer simulations and 3D-printed models that isolated certain architectural features of the suture to better understand their role in saving the beetle's life.

All of these studies revealed that when under a compressive load such as a car tire, the diabolical ironclad beetle's jigsaw-like suture offers two lines of defense.

First, the interconnecting blades lock to prevent themselves from pulling out of the suture like puzzle pieces. Second, the suture and blades delaminate, which leads to a more graceful deformation that mitigates catastrophic failure of the exoskeleton. Each strategy dissipates energy to circumvent a fatal impact at the neck, where the beetle's exoskeleton is most likely to fracture.

Even if a maximum force is applied to the beetle's exoskeleton, delamination allows the interconnecting blades to pull out from the suture more gently. If the blades were to interlock too much or too little, the sudden release of energy would cause the beetle's neck to snap.

It's not yet known if the diabolical ironclad beetle has a way to heal itself after surviving a car "accident." But knowing about these strategies could already solve fatigue problems in various kinds of materials and structures.

"An active engineering challenge is joining together different materials without limiting their ability to support loads. The diabolical ironclad beetle has strategies to circumvent these limitations," said David Restrepo, an assistant professor at the University of Texas at San Antonio who worked on this project as a postdoctoral researcher in Zavattieri's group.

In gas turbines or body panels of lightweight vehicles like cars or aircrafts, for example, metals and composite materials are joined together with a mechanical fastener. This fastener adds weight and introduces stress that could lead to fractures and corrosion.

"These fasteners ultimately decrease the performance of the system and need to be replaced every so often. But the interfacial sutures of the diabolical ironclad beetle provide a robust and more predictable failure that could help solve these problems," said Maryam Hosseini, who worked on this project as a PhD student and postdoctoral researcher in Zavattieri's group. Hosseini is now an engineering manager at Procter & Gamble.

UCI researchers built a carbon fiber composite fastener mimicking a diabolical ironclad beetle's suture. Purdue researchers found through loading tests that this fastener is just as strong as a standard aerospace fastener, but significantly tougher.

"This work shows that we may be able to shift from using strong, brittle materials to ones that can be both strong and tough by dissipating energy as they break. That's what nature has enabled the diabolical ironclad beetle to do," Zavattieri said.

This research is financially supported by the Air Force Office of Scientific Research and the Army Research Office through the Multi-University Research Initiative (award number FA9550-15-1-0009). The study used resources at the Advanced Light Source, a U.S. Department of Energy Office of Science User Facility.

A video explaining these findings is available on →*YOUTUBE.*

RIVER STUDIES

MASSIVE DATA PROJECT WILL MAP INDIANA'S CHANGING WATERWAYS

Indiana's rivers are being mapped out like never before.

Venkatesh Merwade, professor of civil engineering, is leading a research effort to compile flood models for the state of Indiana. The goal of this work is to create a platform for mining information from these models for constructing river geometry and support river morphology studies.

"It's not easy to find river geometry or bathymetry information and it is very expensive to obtain," Merwade said. "This is something I have been working on for about 15 years now, but we've really been pushing forward with it this past year."

Merwade added that he believes this new platform will lead to even greater research efforts in the future and serve as an invaluable tool for river studies.

"Once this is complete, there will a platform for river morphology data for all 92 counties in Indiana available online," Merwade said. "We hope this will serve as a resource for future river studies and allow others to better learn about Indiana's rivers, how they are changing over time, and how that influences water and sediment delivery."

Merwade's team began work by downloading flood models from Indiana Department of Natural Resources' Indiana Hydrology and Hydraulics Model Library. Tasked with downloading and testing the near 15,000 river flow and modeling files was civil engineering undergraduate Eli Weitzner.

"I know it sounds like a really intimidating job, but I actually thought it was a lot of fun," Weitzner said. "I really like patterns, so it was pretty enjoyable to see all the data come together into something like this."

Weitzner added that in addition to his enjoyment of the research, he also found the experience aided him tremendously in his studies.

"You get a greater sense of how to organize your time and you get to see what you've been studying applied in a real-world setting," he said. "And I'm happy that Purdue allows undergrads to participate in things like this. It's pretty great that you can approach a professor and ask to assist in research and there's actually a good chance they'll at least interview you for a spot."

Merwade's research is funded through the National Science Foundation. It began in August 2020 and is part of a three-year project.

EMBRACING COMPLEXITY TO FOSTER THE BLUE ECONOMY

CAPSTONE COURSE CHALLENGES STUDENTS TO EXPLORE A HOLISTIC VIEW OF INNOVATION

What does it take to make an impact? The term is frequently used, but few have attempted to define it and try to understand how it happens.

Work completed by the Purdue Innovation Science Team, led by Joe Sinfield, professor of civil engineering, indicates that impact can be framed as the achievement of shifts in the paradigms underpinning one's field; influence on the human condition along dimensions such as health, culture, the environment and economics; reach in the sharing or effects of ideas across individuals, groups or society as a whole; and change that has lasting effect. And, it turns out, there are patterns to the ways impact is achieved — patterns that are rooted in means to navigate the complexity of socio-technical systems.

The fall 2020 semester provided undergraduates with an opportunity to apply these patterns in the course "Breakthrough Thinking for Complex Challenges," which is the capstone to the University-wide Minor in Innovation and Transformational Change also led by Sinfield who serves as the director of the College of Engineering Innovation and Leadership Studies Program. Students in the course worked in close collaboration with representatives from the U.S. Department of Energy Water Power Technologies Office, the National Renewable Energy Laboratory and the Pacific Northwest National Lab to help define a comprehensive strategy to foster the Blue Economy — that is the socio-technical ecosystem enabled by Marine Renewable Energy (MRE).

"What we're trying to do with this capstone class is to get students to think about what it takes to manage the full pathway from an idea to impact," Sinfield said. "You can have a great idea, but if you cannot prioritize among potential solution paths, potential users won't adopt the solution, or you can't realize the concept in a sustainable manner, it won't scale; and many of the decisions made at the outset of an effort significantly alter its potential."

The theory and methods students learn throughout the minor's curriculum and apply in the capstone course are designed to equip them with the tools they need to assess this full suite of issues.

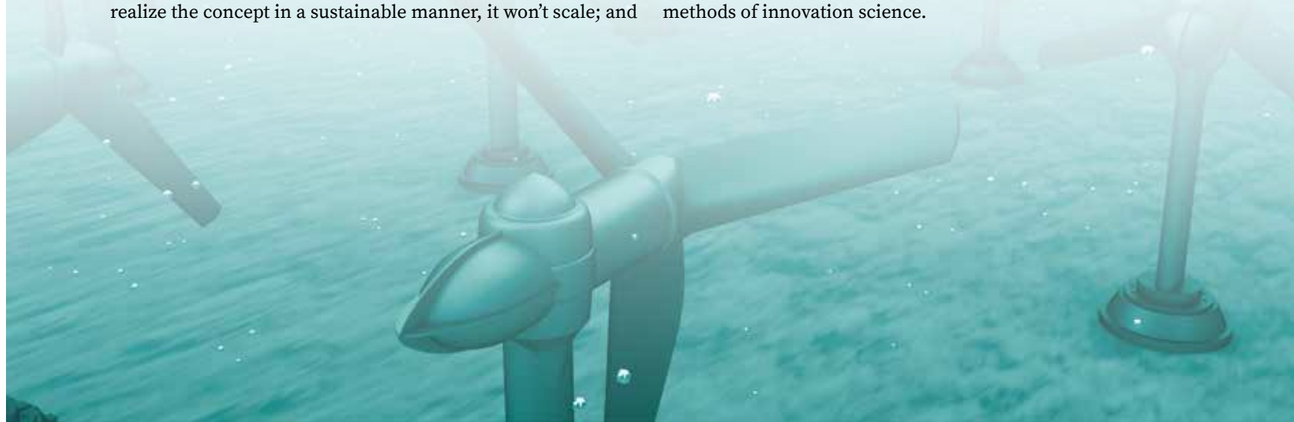
"A lot of ambitious and well-intentioned projects fail because we're not looking at the problem broadly enough," Sinfield said. "We often try to simplify problems to make them tractable, but this is actually where we can miss critical details that make all the difference in connecting a problem and a solution in a viable manner. The minor, and the 'Breakthrough' course in particular, encourages students to embrace this complexity and provides students with the experiential learning opportunity that can help them apply their knowledge of innovation science in their future careers."

Civil engineering undergraduate Sean Murphy said the lessons he learned through coursework in this minor greatly enhanced his understanding and approach to his other classes.

"When you first look at a complex problem it can seem overwhelming but when you break it down systematically, the pieces start to come together," he said. "And what I've taken away from this minor, I've used in my other engineering classes and projects. It's really helped me take my understanding and approach to problems to a higher level."

The work was supported by a grant from the DOE's Water Power Technologies Office and results of the effort are being incorporated in the WPTO's annual strategic planning process.

Sinfield is excited about the quality and comprehensiveness of the class's output and believes that the project showcases what students can achieve when equipped with the powerful methods of innovation science.



AN ECO-FRIENDLY

UPGRADE

ALTERNATIVE CEMENT PRODUCES STRONGER, MORE ENVIRONMENTALLY SUSTAINABLE CONCRETE

Purdue Civil Engineering researchers are testing a greener, more durable concrete.

Concrete is an essential material in the developed world, but its production is also one of the biggest emitters of carbon dioxide. Na (Luna) Lu, American Concrete Pavement Association professor of civil engineering, is testing a new cementitious material that appears to be more durable than standard concrete and has a significantly smaller carbon footprint.

The key component of this cementitious material is suspended liquid nano silica — more commonly called E5 LFA (liquid fly ash). In the testing thus far, the concrete mixed with E5 LFA has shown to produce a stronger, better-reacting concrete that requires 5-15 percent less cement to produce.

"Less cement used means less carbon dioxide created," Lu said. "This new use of liquid nano silica as a fly ash replacement has shown great potential to improve both future projects and the environment overall."

Lu's team began their large-scale research in early 2020 in partnership with Specification Products, an Indiana-based liquid nano silica manufacturer.

"We're excited about the future and what E5 LFA can bring to concrete," said Joe Shetterley, CEO of Specification Products. "The research being done at Purdue will grant us a greater understanding of the material's strength and potential."

Lu's team conducted a large-scale slab testing project to understand the in-situ concrete strength development using different approaches for obtaining samples, including conventional molded cylinder, cast-in-place sample and a core sample. The 8-by-12-foot slabs were prepared at Purdue's Center for Aging Infrastructure to simulate the practical construction of concrete pavement. The researchers tested various ages of concrete slabs including some recently poured and others left for one year for long-term monitoring.

The project is focused on adopting the emerging piezoelectric sensing technology developed by Lu's research team to monitor the material's hydration development and long-term performance.

"We're still in the early stages of testing, but it is exciting to see how well the concrete has held up," Lu said. "To date, liquid nano silica has never been used to replicate the positive effects of fly ash to my knowledge, so we're all learning a great deal."

Members of Lu's research team included civil engineering undergraduates Harrison Kuszmaul and Songhao Wu. Both students said the experience greatly expanded their theoretical and experimental skills.

"This was an incredible opportunity for me," Kuszmaul said. "To be part of large-scale research team and see how, exactly, what I've learned in class is applied was an eye-opening experience for me."

"Seeing what we've studied applied to research like this gave me some great experience that I couldn't have gotten anywhere else," Wu added. "Being part of the research team really helped me discover my passion."

Testing and research will continue through 2022, Lu said.

> "LESS CEMENT USED MEANS LESS CARBON DIOXIDE CREATED. THIS NEW USE OF LIQUID NANO SILICA AS A FLY ASH REPLACEMENT HAS SHOWN GREAT POTENTIAL TO IMPROVE BOTH FUTURE PROJECTS AND THE ENVIRONMENT OVERALL."
>
> ***Na (Luna) Lu***
> *ACPA professor of civil engineering*

IMPROVING WORKER SAFETY

RESEARCH AIMS TO UNCOVER HOW UNSAFE BEHAVIOR COMPROMISES BENEFITS OF SAFETY INTERVENTIONS AMONG LINE WORKERS

Transmission and distribution line workers face numerous on-the-job hazards every day.

The risk of falls, electrical shocks, burns and other injuries is inherent in their work. Add to that long hours, working in adverse weather conditions and the expectation to work quickly to restore power to communities, and it is no wonder the occupation is frequently cited as one of America's most dangerous jobs.

Despite numerous innovations in personal protective equipment (PPE) and improvements in safety technologies, injuries and fatalities persist. Could human behavior be a factor? Sogand Hasanzadeh, assistant professor of construction engineering in the Lyles School of Civil Engineering, is leading a study to determine to what degree an individual's perception of risk influences their decisions in high-risk situations.

"By replicating different experimental conditions that simulate the job site while exposing workers to time-pressure and productivity demands, we can measure how different factors influence worker behavioral changes," Hasanzadeh said.

Similar to how a thermostat activates the furnace or the air conditioner when the temperature deviates, risk compensation theorizes that humans adjust their behavior based on the perceived level of risk in a given situation. The amount of protective equipment a person is using could influence their assessment of risk.

To test whether risk compensation exists among electrical contractors, Hasanzadeh and her team collaborated with the Purdue Envision Center to create a mixed reality environment that simulates a job site. The subjects, actual line workers, would stand in a utility bucket holding a hot stick used to move power lines while outfitted in their climbing gear and wearing a virtual reality (VR) headset.

Participants physically use the real stick to complete simulated tasks in the VR environment, such as transferring live electrical wires from an old pole to a new pole in a suburban area. Various sensors measure psychophysiological and behavioral responses, such as eye movement, heart rate, emotional state, and brain activity. Should a subject get too close to a virtual power line during the experiment, they'd see and hear a loud electrical zapping noise, experiencing arc flash virtually.

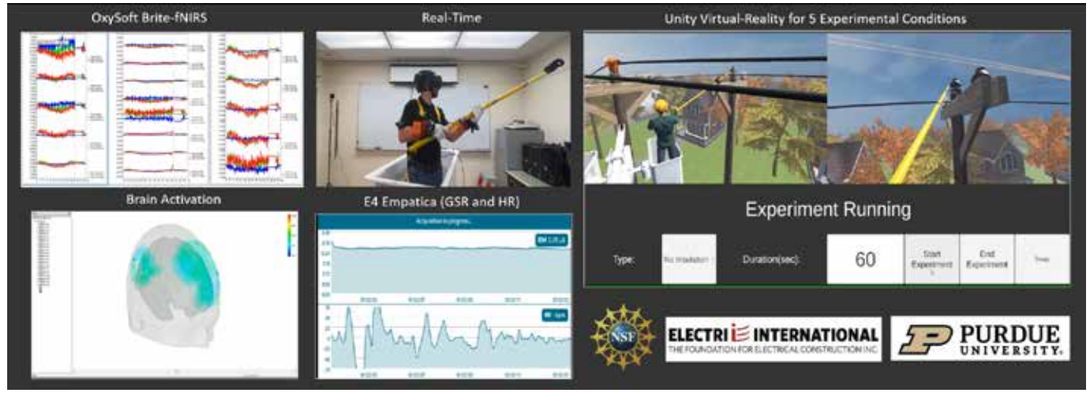
"Each subject completes a set of tasks under five different experimental conditions," Hasanzadeh said. "In each scenario, we manipulate different factors and monitor the changes in worker behavior. We're measuring how an individual might compromise the benefits of safety interventions when they feel pressured to complete the task quickly. For example, we will incentivize them by giving them $5 if they finish a task within a certain time limit. The same thing happens on a job site, the more quickly they finish a task and move on to the next one, the more compensation they stand to earn."

Kaylee Dillard and Aditya Mane place the VR headset on a research subject.

ELECTRI International, the foundation for electrical contractors, and the National Science Foundation funded the research. Hasanzadeh worked closely with industry advisors from Duke Energy and American Line Builders Chapter to build realistic scenarios that addressed the complex safety challenges related to electrical work. The researchers also assessed the level of risk aversion in each individual participant through a questionnaire that estimated propensity for risk based on personality traits and past behavior. The level of risk aversion was then correlated with the subject's behavioral responses during the experiment.

Kaylee Dillard, a senior from Grand Rapids Michigan, assisted with the study. After learning about Hasanzadeh's research focus, Dillard applied for a spot on the research team. As a construction management major, Dillard was particularly interested in learning more about how human behavior contributes to a safe environment.

"You have to be a people person in construction management," Dillard said. "To be an effective project engineer or project manager, you have to be able to communicate with others. To under-



Above: Graduate student Aditya Mane assists a research subject with safety gloves worn by line workers. Below: While conducting the mixed-reality experiment, researchers reference a dashboard that displays various data.

stand the different hazards your crew faces, it's important to look beyond technology and construction. Psychology plays a role in safety, too."

Dillard knew she wanted to pursue engineering and chose to attend Purdue because it offered a Big Ten experience in a collegial, close-knit environment. The opportunity to assist with a major research project as an undergraduate enhanced her academic education, and gaining experience working with VR technology boosted her career prospects. For the experiment, Dillard facilitated orientation for subjects to help them understand the purpose of the research before applying fNIRS, sensors placed on the head to measure brain activity.

"Undergraduate research opportunities in my major are rare," Dillard said. "Learning how to conduct experiments through VR and how data is collected with fNIRS is really going to help me in the future. The construction industry changes very fast and the integration of technology is increasing. This experience will definitely help me with future employers."

Graduate researcher Aditya Mane (MS CE'20) mentored the team of three undergraduates on the research project. Along with Hasanzadeh, he was present for every experiment and monitored the computer systems collecting data from the subjects.

"Undergraduates have less exposure to research and may not understand how to enforce the parameters of an experiment," Mane said. "My main responsibility was to introduce the undergraduates to research and help them understand the protocols. This project was a good start that they will build upon."

In addition to ensuring the sensors were functioning properly and collecting data, Mane also monitored the subjects' heartbeats, temperature and respiratory reactions to ensure they were not over-exerting themselves during the experiment.

The research team. From left: Kaylee Dillard, Aditya Mane, Sogand Hasanzadeh, Beyza Kiper, Makayla Simpson and Doug Hermo.

"We gave them breaks between scenarios so the participants could relax and calm down," Mane said. "We didn't want elevated body responses to interfere with the data collection during the next phase of the experiment."

Like Dillard, Mane was excited to assist with cutting-edge research.

"Focusing on human subjects is relatively new in the construction industry," Mane said. "The design of this experiment involved physical activity coupled with virtual reality — that's very different from the types of research projects that have been conducted before. The most interesting part for me is that you can refine processes and reduce errors to increase safety, but you cannot change the individual's behavior. You must analyze and understand how people react in order to mitigate safety hazards."

The influence of human behavior on safety conditions was something Mane witnessed firsthand on construction sites in his native India.

"While working on construction sites, I personally observed how human error can put others in danger," Mane said. "A job site can quickly become unsafe because of one person's state of mind. Transmission line workers are subject to the same life stressors and external pressures as any other occupation. The difference is, their job requires them to work under already dangerous conditions and someone who is distracted or carrying a large mental load might behave in an unsafe manner. In this case, that can have fatal consequences."

The researchers used a few different techniques to simulate increased mental loads, such as a fan blowing on the subject to add an environmental stimulant or giving subjects a secondary task to complete while setting a time limit on correctly performing a task and offering a monetary incentive to complete the task on time.

"All three things going on at the same time, the pressure of a time limit, the opportunity to earn more money and the need to memorize a sequence of numbers, simulates the stress of normal life," Mane said. "The experiment was designed to replicate the same conditions line workers encounter performing their jobs every day."

The research is ongoing, so no hard conclusions can be drawn yet. But Hasanzadeh is excited about the possibility of positively impacting industry safety.

"I'm very passionate about people," she said. "I don't like viewing workers as passive recipients of safety interventions or technological advances. I want to engage workers as proactive agents who will inform the design and implementation of more effective interventions. It's not an issue of more training. It's about how the worker thinks, perceives risk and makes decisions at job sites."

IN THE FIELD

CIVIL ENGINEERING STUDENTS TEAM UP FOR FIELD RESEARCH

Picture courtesy of Jose Capa Salinas and Jack Green

In summer 2020, a team of graduate and undergraduate students assisted in the construction of two testing strips at the Purdue Center for Aging Infrastructure (CAI) Steel Bridge Research, Inspection, Training and Engineering (S-BRITE) Center. The project, aimed at developing guidelines for control of the properties of aggregate drainage layers used in pavement structures, is funded by the Indiana Department of Transportation (INDOT).

"This was a major operation with significant large equipment brought to the site," said Marika Santagata, professor of civil engineering, who led the research team. "We relied on INDOT and on specialty contractors to replicate the construction methods employed in practice, including those for cement stabilization of the subgrade and for placement and compaction of the aggregate."

Following construction, the strips were utilized as test beds for an extensive experimental program to measure the compaction and permeability properties of the aggregate layers. The team was in the field almost daily between August and November under the strict guidelines resulting from the COVID-19 pandemic. Philippe Bourdeau, professor emeritus of civil engineering, and Peter Becker, a soil foundation engineer at INDOT's Division of Research and Development, served as co-principal investigators, with two geotech graduate students, Kike Garzon Sabogal and Amy Getchell, taking responsibility for field operations and data analysis.

"This was a fantastic opportunity for students, with exposure to the challenges associated with conducting testing on a large scale under the constraints of operating within a schedule defined by contractors and weather," Santagata said. "Away from the lab, things get complicated and our ingenuity was continuously tested. We had to setup temporary experimental stations out of the backs of our cars and use small mobile carts to move around the strip. Despite this, after weeks of working from home, being together as a team and making progress on the project was exactly what we all needed."

Undergraduate researcher Matthew Halverson, who assisted in performing in-situ density tests under the guidance of Vince Drnevich, professor emeritus, said his experience out in the field greatly expanded his understanding and appreciation for civil engineering.

"What I've been able to take away from my experience I'm confident I'll be able to put to good use toward my career," Halverson said. "It was a great project to be a part of."

Fellow undergraduate researcher Alexander Landyshev said that he was both surprised and appreciative that he was treated like a member of the team and not just a student on the project.

"Looking back on it, I feel really fortunate to have been part of the team," Landyshev said. "I was given a lot of responsibility and autonomy to perform our tests. It really offered me a greater perspective of what civil engineering researchers do."

Santagata said that including undergraduate researchers is one of the reasons why the University is known for producing graduates who are able to hit the ground running when they become professionals.

"Research like this greatly expands students' experience and gives them a real sense of what is in store for them as professionals," she said. "These research opportunities also propel their understanding and grasp of civil engineering in the classroom."

As for what is next for the project, Santagata plans to conduct additional testing at INDOT construction sites this coming summer. In the meantime, her team will be focusing on data analysis and comparison of field results with laboratory test data.

BE THE CHANGE

JARVIS JOINTER FINDS PURPOSE IN MAKING POSITIVE IMPACT FOR OTHERS

With a focus on improving the quality of life for everyone, Jarvis Jointer (BSCE '04) says he sees it as his responsibility to be an active participant in his community, his profession and his alma mater.

"Everything civil engineering touches affects the quality of life of everyone on a daily basis," Jointer said. "I knew I wanted to be part of something that has a positive impact and I found that through my degree and my career."

Jointer is the owner of JQOL — a civil engineering firm with offices in Indiana and Kentucky. Since its formation in January 2019, Jointer's certified Minority Business Enterprise has grown from a staff of two to 16. In its two years of operation, the firm has been involved in a number of large development projects, including the Indianapolis Toll Road, Washington Township Schools, Johnson County Public Library and the Center for Leadership Development in Indianapolis.

MAKING A DIFFERENCE AT PURDUE

Jointer is also a co-chair of the Purdue College of Engineering's Admissions Task Force, which aims to address the challenge of providing a Purdue Engineering education to a larger number of African Americans and other underrepresented groups, better understand why it has been so difficult for the college to offer the opportunity to earn a degree to some populations and will identify new approaches to address this persistent problem.

"I'm at a point now in my life that I have to accept the role of responsibility and to be a voice," Jointer said. "A lot of times people don't know what they don't know. And now I have the ability and responsibility to change that. There's no better time than now to make a change."

The task force was formed in the summer of 2020 and is currently in the process of submitting their findings to the College of Engineering for further review and consideration.

BECOMING A BOILERMAKER

Jointer, a second-generation Boilermaker from Indianapolis, said that he knew early on that he wanted to attend Purdue like his mother, Kimberly, because a Purdue education would open a number of opportunities for him to make a difference.

"A lot of friends went to Purdue and eventually my younger brother, Jason, went as well, so I've always known how great of a university it was," he said. "I knew I'd go there eventually."

At first, Jointer attended Earlham College in Richmond, Indiana, where he played for the school's basketball and football teams. After one year there, Jointer said, he knew he wanted to fully commit to his education and applied to Purdue.

Jointer was an active student. He served as a student ambassador, joined the National Society of Black Engineers and worked at the Black Cultural Center. He credits his career preparedness to what he learned on campus.

"One of the truly great things about Purdue is that it prepares you for the outside world," he said. "I am especially recognizing just how well Purdue prepares its students now as an employer. The graduates from Purdue often seem far more prepared to jump into their careers than other candidates."

IMPROVING THE QUALITY OF LIFE FOR ALL

Through his education, his career and community involvement, Jointer said he is extremely proud of what he has accomplished — but he certainly plans to do even more in the future.

"I want to keep working to improve my community and have my company pursue projects that will be a great benefit for everyone," he said. "I also want to ensure those that work for me are also taken care of and have their lives positively impacted."

Jointer said that he long felt a desire to make an impact, but the urge grew exponentially after he became a civil engineer.

"I guess you could say I hit my mid-life crisis a bit earlier than expected," he said. "I was just hit with this overwhelming desire to help others and make a difference."

And it was through his career and service, Jointer said, that he felt like he could do just that.

"I think it's especially important now that leaders step up," he said. "America is at a crazy point and it's important that those of us who can make a difference, do what they can to help others. It's up to us to make the change we want become reality."

ONLINE MASTER'S DEGREE

PROGRAM OFFERS WORLD-CLASS GRADUATE DEGREE GEARED TOWARD WORKING PROFESSIONALS

To meet the needs of professional civil engineers who aspire to earn their graduate degree, the Lyles School of Civil Engineering has developed an online master's degree program.

"This is a tremendous opportunity for working professionals who wish to earn a graduate degree from one of the most respected universities in the world while also maintaining their career," said Rao S. Govindaraju, the Bowen Engineering Head of Civil Engineering and Christopher B. and Susan S. Burke Professor of Civil Engineering. "Our courses are designed by our faculty to ensure our learners will amplify their understanding and make giant leaps in their chosen fields."

The program offers a world-class graduate degree in engineering with the flexibility of an entirely online program. In just 30 credit hours, learners will dive deep into their chosen discipline and learn from the same world-renowned faculty who teach students on campus.

"Building on long-standing strengths in research and teaching, our highly ranked Lyles School of Civil Engineering is launching a bold and innovative interdisciplinary online master's program in three tracks to meet the needs of a wide range of professional engineers and lifelong learners," said Mung Chiang, the John A. Edwardson Dean of Engineering and the Roscoe H. George Distinguished Professor of Electrical and Computer Engineering. "This will further amplify our civil engineering faculty's impact on society."

The available interdisciplinary tracks offered are sustainable water; infrastructure, resiliency and sustainability; and smart mobility.

The sustainable water track will provide coursework related to water quantity and quality. The water quantity aspects of the program will be taught through coursework in hydrology and hydraulics, whereas water quality will be taught through coursework related to water treatment and related topics.

The infrastructure, resiliency and sustainability track focuses on the latest advancements in the analysis, design and construction of civil infrastructure including buildings, bridges, roadways, industrial facilities and power plants. These advancements include sustainable materials and non-destructive evaluation, digital twinning for planning and construction and design for natural hazards and resilience.

The smart mobility track focuses on emerging technologies in transportation engineering. This includes autonomous, connected, electrified and shared micro-mobility transportation systems. The topics covered will be of interest to learners who want to plan, design, operate or manage smart mobility systems. Techniques for assessing the safety, efficiency, sustainability and societal impacts of these systems will be useful to a broad cross section of professionals, including engineers and policy makers.

The admission consideration priority deadlines are April 1 and May 15 for summer and fall 2021, respectively. → *LEARN MORE*