FALL 25

IMPACT

LYLES SCHOOL OF CIVIL AND CONSTRUCTION ENGINEERING

INNOVATION SCIENCE

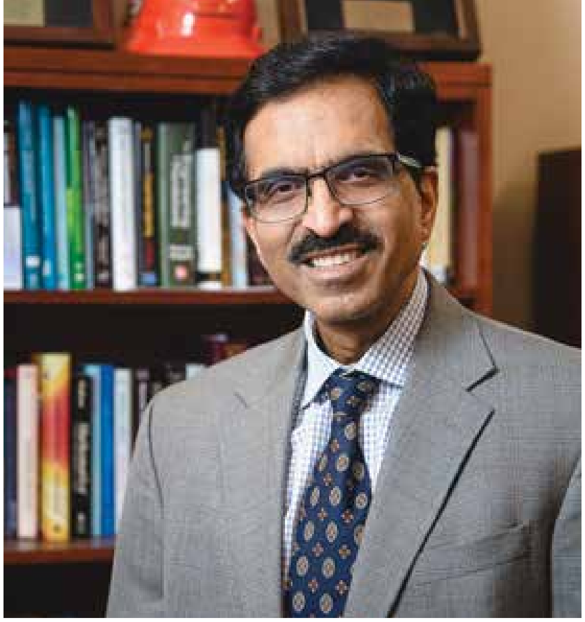
Institute takes strategic approach to advance process of transforming ideas into impact PAGE 6

PURDUE UNIVERSITY

Lyles School of Civil and Construction Engineering

FIELD-SCALE STEEL BRIDGE FIRE EXPERIMENT CONDUCTED AT S-BRITE | PAGE 4

MESSAGE FROM THE HEAD



While I was walking to my classroom and saw the many eager students, I was reminded why we continually strive to improve the educational experience: to ensure our next generation of engineers will be prepared to lead and take us to new heights.

For the Lyles School of Civil and Construction Engineering to be seen and recognized as one of the premiere programs is truly a tremendous honor. And it is something our faculty and staff persistently pursue to make every school year a better experience than the next.

Last year, civil engineering officially merged with construction engineering and management where we saw 116 new undergrads join us, making us one of the largest programs in the country with 763 undergrads and 381 graduate students. The transition went a lot smoother than I could have hoped for — and it is thanks to students, alumni, faculty, staff and partners who came together to ensure it would be a success.

Now, thanks to everyone's efforts, we can start looking beyond the merger and integration and once again set our sights fully on greater efforts and achievements. Together — as one, unified school.

In this edition, we will share several of these continuing endeavors through our innovative research as well as how we are providing resources to our students to pursue their own goals so that all our small steps will cumulatively lead to more giant leaps forward.

These stories include an exploration into the Institute for Innovation Science where graduate students pursue an array of research interests with support of faculty and staff. We also have stories on world-impacting research into seismic design, travel, and improvements to one of the Seven Wonders of the Modern World — the Panama Canal.

These are just a few of the many incredible efforts taking place as we continue to innovate and improve the way we educate and prepare our students and positively impact the world through research. I look forward to sharing even more of these stories soon.

All the best,

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

IN THIS ISSUE:

ON THE COVER

Akash Patil (MSME '18) is a graduate student researcher and PhD candidate in the Institute for Innovation Science, which studies the methods, mindsets and behaviors of innovative organizations and individuals to advance the success rate of innovative activity.

CCE Impact is published biannually for alumni and friends of the Lyles School of Civil and Construction Engineering. We welcome your comments, opinions and questions.

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NEWS & EVENTS

MAY COMMENCEMENT

Congratulations to the Lyles School of Civil and Construction Engineering class of 2025! This spring, we saw 160 undergraduates and 75 graduate students earn their degrees. Boiler up!

WORLD BUILDING CONGRESS

In May, Purdue University hosted the 23rd World Building Congress. The title of the conference was "Sustainable Built Environment — The Role of the Construction Community in Meeting the UN SDGs" and saw experts from around the world sharing their research and findings.

This was the first time the conference has been held at Purdue and only the third time in the U.S.

KLEMENCIC RECEIVES HONORARY DOCTORATE

During the May commencement ceremonies, Purdue University awarded an honorary doctorate to Ron Klemencic (BSCE '85), chairman and CEO of Magnusson Klemencic Associates.

Klemencic is a globally recognized innovator and leading expert in high-rise structural engineering, sought after for his creativity, big-picture approach and ability to consistently produce cost-effective and inventive designs.

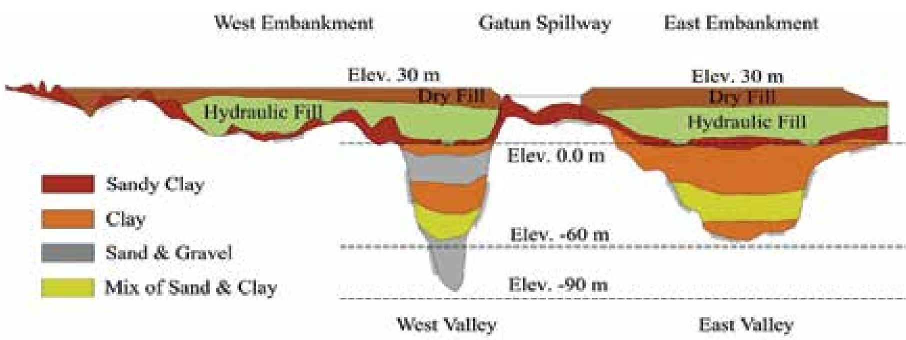
SEISMIC RISK

Advanced earthquake simulations reveal vulnerabilities in Panama's century-old Gatun Dam

As one of the critical infrastructures of Panama, the Gatun Dam plays a vital role in the functioning of the Panama Canal and the surrounding environment. Constructed between 1907 and 1913 by the U.S. Army Corps of Engineers, our estimates of seismic risks to the structure have undergone significant revisions. Today, research led by Antonio Bobet, the Edgar B. and Hedwig M. Olson Professor in Civil Engineering, and PhD student Daniel Muschett sheds light on the potential vulnerabilities of the dam and emphasizes the urgent need for proactive measures in engineering and safety.

One of the primary concerns in seismic safety is the phenomenon of liquefaction. During an earthquake, certain soil types can lose their strength and behave like a liquid, a process that poses a grave risk to structures built with such materials. For the Gatun Dam, liquefaction could lead to severe deformations, settlements and even catastrophic failure. The dam's original design did not account for earthquake loads, largely due to a historical belief that Panama was a seismically inactive area.

However, modern seismological studies have revealed that Gatun Dam is situated within an active seismic zone, exposing it to moderate to strong earthquakes. The implications of potential liquefaction and subsequent dam failure cannot be overstated. Besides the threat to the dam itself, a catastrophic failure could lead to the loss of the Panama Canal, extensive flooding and damage to the surrounding environment and infrastructure.



In response to these challenges, Bobet and Muschett are employing advanced 3D computer models to simulate earthquake conditions and predict the dam's behavior under stress. These models recreate the dam's complex geometry — given that it sits on top of two very deep paleochannels carved by the Chagres river — and the seismic response of the surrounding soil, providing crucial insights into potential failure modes. By estimating how the dam might deform during an earthquake, researchers can develop effective mitigation strategies aimed at protecting this vital infrastructure.

Muschett, a Panamanian graduate student researcher in geotechnical engineering, outlines two primary paths for future research: analyzing the 3D effects on seismic response in various dams and continuing work on Gatun Dam with new mitigation strategies.

"This analysis is crucial for helping engineers determine when a simpler and less costly 2D analysis is sufficient, and when full 3D seismic models are necessary," Muschett said. "This research combines aspects of geotechnical engineering, earthquake engineering and advanced computational modeling."

In an era of increasing natural disasters related to climate variability and tectonic activity, the need for proactive infrastructure assessments has never been more pressing. The research conducted by Bobet and his team is a crucial step toward ensuring the safety and longevity of the Gatun Dam.

"As we continue to learn more about the seismic dangers it faces, it is imperative that we act decisively to address these vulnerabilities," Bobet said. "By investing in modern engineering techniques and comprehensive risk assessments, we can safeguard this important structure for future generations."

COOL FACTOR

NOVEL FIRE TESTS COULD CHANGE HOW CREWS SAVE BURNING BRIDGES.

Hundreds of steel bridge fires occur in the U.S. each year. When the fire department arrives on the scene, its first priority is safely evacuating the area while putting out the fire. But after the flames have been doused, what's the best method of cooling the steel with limited damage to the structure?

A research team led by Amit Varma, the Karl H. Kettelhut Professor of Civil Engineering and director of the Bowen Laboratory of Large-Scale Civil Engineering Research, is testing cooling methods to determine the best process to preserve the integrity of a steel bridge following a fire.

The project, titled Steel Bridge Inspection, Assessment, Repair and Management under FIRE, is funded by the Indiana Department of Transportation under the Joint Transportation Research Program. Engineers from INDOT were on hand to observe an experiment at the Steel Bridge Research Inspection Training and Engineering Center (S-BRITE) in April. Michael Ubelhor, secretary of transportation and infrastructure for the state of Indiana, was also present.

Tom Bradt, lead research engineer at Bowen and a volunteer firefighter, led the collaboration with Ron Huffman, an outside consultant, to design custom fire testing equipment that could ignite six propane burners to simulate the intensity of a fire caused by the collision of a gasoline fuel tanker.

"Gasoline tankers have thousands of gallons of fuel aboard," said Shivam Sharma (MSCE '22), a graduate research assistant in civil engineering and lead researcher on the project. "When there's a lot of fuel, the fire will burn very hot, rapidly increasing the temperature of the steel. Overheating changes the mechanical properties of the metal, causing it to soften and become more ductile. Then, if heated steel is cooled too quickly, it can become harder and more brittle."

This was the second steel bridge fire test executed during the spring semester with each using different firefighting techniques. In February, the steel was allowed to cool naturally through air exposure, after the base fire was extinguished. In April, a crew from the Purdue Fire Department was on hand to blast the bridge with water hoses.

"We're still in the nascent stages of evaluation, but once we've analyzed the measurements and data, that information will be used to establish guidelines for fire departments responding to steel bridge fires."

Sharma led the team in designing the test setup, instrumenting the girders, fabricating the assembly, conducting the test, developing safety protocols and performing numerical studies and material testing. He also spearheaded the microscopic analysis of the steel's microstructure to identify changes that affect its mechanical properties before and after testing.

For both tests, the fire burned for 30 minutes before it was turned off. Early results indicated that the steel reached temperatures high enough to cause degradation in properties within 10 minutes. Microstructure examinations showed that cooling the bridge with water versus air resulted in slightly different post-fire microstructure of the steel. Another significant finding was the large deflections observed during the tests, which exceeded the predictions of the team's numerical models.

Amit Varma, the Karl H. Kettlehut Professor of Civil Engineering and director of the Bowen Laboratory of Large-Scale Civil Engineering Research, is the primary investigator of the Steel Bridge Inspection, Assessment, Repair and Management under FIRE project.

"Estimating structural response under fire is very complex," Varma said. "Physical studies of this magnitude have not been completed before because it's a dangerous experiment that requires a comprehensive safety plan, extensive planning and coordination, and the right set of circumstances. It's the type of experiment that could only be conducted at Purdue."

Although Varma has previously conducted reconnaissance on steel bridge fires, the opportunity to stage a controlled experiment to obtain active measurements is invaluable. The potential impact of the research will inform not only fire crews' responses, but also bridge inspectors' decisions on whether the bridge can be reopened, and how soon after the fire.

"When a bridge is closed to traffic for any reason, every minute matters," Varma said. "A closed bridge can disrupt supply chains, affect traffic patterns, alter access to health care and have a ripple effect through the economy. As inconvenient as bridge closure can be, the priority is always safety."

For Varma, this experiment is the culmination of decades of research on fire behavior, analysis and design of structures. The opportunity to mentor Sharma — someone who is just embarking on a career — on a project of this caliber is equally rewarding.

"Working on a project of this magnitude sets the tone for the rest of his career," Varma said. "I expect him to go on and design even more complex experiments and complete them successfully. I expect great things from him."

ILLUMINATING INNOVATION

Akash Patil (MSME '18) and Waire Olawolu (MSCE '22) are two of the graduate student researchers leading projects in the Institute for Innovation Science.

Institute for Innovation Science uncovers methods, mindsets and behaviors behind innovative activity

Formally established in 2022, the Institute for Innovation Science studies the methods, mindsets and behaviors of innovative organizations and individuals to advance the success rate of innovative activity. The institute defines innovation as the strategic pursuit of novel ideas that impact society.

"We study both high impact innovators, those who have introduced widely adopted products or solutions into the world, as well as high impact organizations that repeatedly change the way society operates," said Joe Sinfield, professor of civil engineering and director of the institute. "Innovations such as the laser, the transistor, the concept of insurance and the notion of microfinancing have introduced significant societal change through their development and are indicative of our focus."

The institute's educational arm supports an undergraduate minor in innovation and transformational change and offers core coursework in the strategic innovation concentration of the professional masters in engineering management as well as the interdisciplinary graduate concentration in transformational innovation and design. Students in the doctoral program complete their theses using a cross-disciplinary approach that examines innovation science from a systems lens, drawing from concepts in anthropology, social sciences, economics, business, industrial design and engineering, among others.

The types of problems addressed by the institute are wicked problems, meaning they are difficult or seemingly impossible to solve due to their complex, interconnected and often contradictory nature. These problems lack clear definitions, have no single right or wrong solution and often involve numerous stakeholders with conflicting interests and values.

"The process will never be perfect," Sinfield said. "But we can dramatically increase the success rate, and as a result, improve the efficiency of all resources deployed for innovation."

Here's a glimpse at some of the student-led projects emerging from the Institute for Innovation Science.

Could a new approach to creating affordable manufactured housing at scale alleviate the housing crisis?

Abhi Ajmani (BSME '19, MSCE '21) collaborated with a cross-disciplinary team of professors and industry professionals on an National Science Foundation proposal aimed at transforming the housing construction industry to address the housing affordability crisis. Through factory-built, mass-produced housing, they aim to significantly reduce construction costs, accelerate timelines and increase access to affordable homes. The work links to Ajmani's PhD research which is focused on means to develop innovation ecosystems and agglomerate related capabilities to spur the economy.

When faced with large-scale societal problems, how do you determine which resources to prioritize?

Romika Kotian (MSCE '18) led the development of a new complex problem framing approach termed Comprehensive Success Factor Analysis, which yields insight into hundreds of factors that shape the potential to address society's most vexing problems. Her work has been applied in multiple countries as part of a deep collaboration with USAID and has spanned challenges ranging from maternal and child health to food security of a nation to water rights management and migration crises.

How can the agri-food sector harness digital technologies to improve access to resources while enhancing system efficiencies?

Waire Olawolu (MSCE '22) partnered with Purdue's Digital Innovation in Agriculture Lab (DIAL) to develop a risk-mitigated strategy to improve agriculture and food systems across the Americas. The digital transformation of agri-food has vast consequences from supply and resource management to matching produce, livestock and fiber materials generated for textiles with market opportunities. Driven by an overall assessment of high impact innovation, Olawolu's research helped DIAL understand how to leverage startups to implement large scale system change.

Can understanding the journey from inspiration to impact help design ecosystems to facilitate innovation?

Akash Patil (MSME '18) is using natural language processing to analyze hundreds of episodes of the popular NPR podcast How I Built This, hosted by Guy Raz, to identify patterns in innovation journeys. By dissecting the innovation process into smaller components of resources, actors and innovator activities to understand the cause-effect relationships among these variables, Patil can shape an environment that fosters specific forms of innovative activity.

Is it possible to use AI to design sustainable industrial facilities for any location around the world?

In partnership with Google, Jenna Palka (BSCE '21) is leveraging AI to facilitate the design of sustainable data centers around the globe. Certain materials and construction processes available in one area may not be available in another, leading to a reevaluation of the process in each new location. AI-augmented approaches to design are making it possible to achieve a more holistic, context-aware assessment that takes environmental, social, financial and other variables into consideration.

SMART SIGNALS, SMALL TOWNS

Low-cost Data Diode could bring life-saving traffic tech to rural America

When one envisions smart and connected communities, a metropolis-like scene typically comes to mind. Purdue University researchers, however, are working to ensure that no small town gets technologically left behind.

Lyles School of Civil and Construction Engineering Professor Sam Labi leads a research team that is investigating cost-effective collection and distribution of intersection signal data. Fully termed the Low-Cost Unidirectional Connected Intersection Data box (LUCID) or simply, the Data Diode, the prototype device rapidly and securely shares real-time signal data with traffic centers, service and emergency workers, and other end users.

"As America continues to move forward and becomes faster in sharing data, smaller markets should not be forgotten," Labi said. "Regardless of where you live, we want to ensure that the end users are able to receive relevant intersection signal information in a timely manner just as quickly as in a larger city."

Funded through the United States Department of Transportation and Purdue's Center for Connected and Automated Transportation, Labi said the Data Diode will use the cellular network to deliver information with emphasis on cyber-security and low implementation cost. This new device costs less than $200 per intersection, a sharp reduction from the $5,000 to $10,000 data collection equipment cost per intersection, Labi said. The low cost of the device makes it attractive for deployment in areas with limited budgets.

Labi added that when its potential benefits become more widely recognized, the Data Diode will be made to scale up, thus reducing the unit cost of deployment even further and facilitating rapid delivery of intersection data in small towns and communities. "That, in turn, is expected to help promote the realization of widespread connected and intelligent transportation ecosystems," Labi said.

Graduate student researcher Richard Ajagu said the team has been working with researchers at Virginia Tech, Purdue's Elmore Family School of Electrical and Computer Engineering, the USDOT Volpe Center, the Michigan DOT, the City of Owosso, and T-Mobile. The current phase of the research is refining the system architecture using a novel programming language, to facilitate deployment.

"We're at an exciting phase in our research as we prepare to deploy the Data Diode," Ajagu said. "This will be the first step for small communities to gain greater access to traffic information so that we can all take the next giant leap forward together as a country. The Diode is an integral part of a larger novel systems approach that is utilizing IoT technology to promote affordable, connected and cyber-secure engineering for smart signals."

Labi said his team will prepare a report by the end of 2025 and explore patent application for the system upon concluding the research.

ABOVE: Lyles School of Civil and Construction Engineering Professor Sam Labi (right) and graduate student researcher Richard Ajagu perform maintenance on the Data Diode.

BELOW: Labi and Ajagu lead a research team that has installed the device in rural areas to gather traffic information.

DRIVEN BY DATA

MODERNIZING INDIANA'S TRAFFIC MODELS WITH INSIGHTS FROM VEHICULAR DATA

As travel and vacation plans through the state evolve, so must their analysis.

Lyles School of Civil and Construction Engineering Professor and director of Purdue's Sustainable Transportation Systems Research Group (STSRG) Nadia Gkritza is leading a research team that aims to refine Indiana's trip generation procedures by incorporating local data for emerging and rapidly changing land uses such as warehouses, gas stations and fast-food restaurants.

"This research seeks to enhance the accuracy of travel demand models and traffic impact studies by integrating updated variables and context-specific insights tailored to Indiana," Gkritza said. "This includes paying attention to the statistical and analytical components, managing data collection and processing, and developing models that better reflect current travel behavior trends."

Since research began in the fall of 2024, the team's data has already shown that previous surveys are greatly underestimating the amount of travelers Indiana sees daily.

"Traffic numbers definitely appear to have been underrepresented in the past," Gkritza said. "We're hoping that once we complete our research, the state will be able to better identify sections of roadway that need to be expanded to alleviate existing traffic congestion and allow them to prepare for areas showing signs of traffic growth."

Graduate student researcher Rishika Tumula oversees both the technical and operational aspects of the work. She also leads the student research team, which includes 11 undergraduates from Purdue's CCE and mechanical engineering schools.

Together, the student team is advancing research that not only improves planning tools for the state but also fosters meaningful hands-on learning experiences for future engineers. So far, they have made 15 site visits across five locations throughout Indiana, and plan to study at least 20 other locations.

"We're putting together user data to better understand the evolving travel and resting habits of drivers along the state's busiest highways and rest stops," Tumula said. "We collect data at multiple points throughout the day and document everything we can from average traffic flow to detailed site characteristics such as business type, building and parking area, and service capacity."

Undergraduate researcher Carmen Caserio added that in addition to this data being beneficial to current traffic management efforts, it will also paint a better picture for local governments and the transportation agencies to plan future infrastructure improvements.

"By studying not just how many vehicles, but which types of vehicles use the roads, we can better predict which roads will more frequently need maintenance as well as which areas are best suited to serve travelers," Caserio said.

Supporting the STSRG in their research are the Indiana Department of Transportation and Joint Transportation Research Program. Gkritza said she expects to release a report of her team's findings in 2026.

Civil engineering undergradate student Jiayu Zhu monitors and records street traffic data.

PhD student researcher Margaritis Tonidis prepares the two-story test structure for the next round of seismic testing at Bowen Laboratory.

RETROFIT *SOLUTION*

LOW-COST SEISMIC FIX STABILIZES OLD BUILDINGS AGAINST EARTHQUAKES

A research team led by Akanshu Sharma, the Jack and Kay Hockema Associate Professor in Civil Engineering, has taken the next step in its work that involves retrofitting structures to make them more resilient to seismic activity. The added resilience is created by using metal triangular haunches connected using adhesive anchors as braces.

The added haunches are both practical and cost-effective, Sharma said. And — most importantly — they will greatly increase the chance of saving lives in the event of a natural disaster.

"While a majority of developed nations' structures are being built for seismic resilience, for much of the rest of the world, that isn't the case," Sharma said. "Anywhere between 50 to 90 percent of existing concrete structures in developing countries are not designed appropriately against seismic activity."

The team's novel approach involves installing the haunches to reinforce beam-column joints. The haunches are attached with post-installed adhesive anchors secured with epoxy mortar, so material cost is relatively low. There is also an additional indirect cost savings by keeping the building's functionality intact during installation of the haunches.

PhD student Margaritis Tonidis said both the effectiveness of the haunches and their practicality are equally important.

"We need to ensure any solution we pursue is financially viable and relatively easy to apply in practice," Tonidis said.

In December 2024, Sharma's team began the first round of testing by building a life-size, two-story structure in the Bowen Laboratory for Large-Scale Civil Engineering Research. The test included generating loads similar to those that occur during an earthquake and recording where points of failure occurred.

"In the first test we took a structure with nonseismic detailing, and we identified weak joints and joint failures to better understand exactly where and when a nonseismically designed structure begins to fail," Tonidis said. "The results were extremely helpful as we prepared to create the retrofitted haunches for the next test."

In May 2025, the team tested the structure again — this time with the haunches attached.

In the second test, the joint shear failure was successfully eliminated due to the presence of the haunches, which demonstrated the efficacy of the retrofit solution and its potential in improving the seismic performance of existing structures.

"The preliminary results are promising," Tonidis said. "While further testing and research are necessary to refine the retrofitting procedure, we are confident that the current approach is heading in the right direction."

"Strengthening of joints in existing structures is one of the most challenging aspects due to the limited to no access to the joints of real-life buildings. This test has clearly demonstrated that using haunch elements with post-installed anchors offers a low-cost, highly effective and low-invasive solution," Sharma stated. Sharma says he and his team expect to publish a report on their findings before the end of 2025.

RETROFIT *REVOLUTION*

PIONEERING COMMUNITY-CENTERED SEISMIC RESEARCH TO PROTECT VULNERABLE BUILDINGS — AND THE PEOPLE WHO RELY ON THEM

As cities face the growing threat of earthquakes, researchers like Edwin Patiño (MSCE ’22) are at the forefront of innovative solutions aimed at building safer structures and retrofitting those that do not meet current building code standards.

Patiño, a graduate student researcher, studies the seismic performance of concrete columns in non-ductile buildings, analyzing historical data for structural weaknesses and testing reinforced concrete specimens. He creates detailed simulation models to understand the behavior of these columns in the context of entire building systems.

“It is critical to involve all stakeholders — government officials, insurance companies and residents — to improve earthquake preparedness,” Patiño said. “By integrating diverse perspectives, our project aims to identify buildings needing retrofitting and inform policies that enhance community safety.”

This research focuses on human-centric seismic risk management by engaging with community members to understand their perceptions of risk, particularly the importance of keeping hospitals and grocery stores operational during earthquakes. Through surveys, interviews and workshops, Patiño’s team collects insights that inform safety strategies, ultimately creating a dynamic tool that combines experimental findings with community input to guide policymakers in building safety enhancements.

This research examines retrofitting non-ductile reinforced concrete buildings in marginalized neighborhoods of Los Angeles. The structural studies are led by Patiño, and the team also collaborates with industrial engineering and economics partners to analyze community data on perceptions and vulnerabilities, and their management. The project aims to predict societal effects of retrofitting by considering structural, social, and economic factors such as community safety and access to services. It also addresses issues like temporary displacement. A Decision Support System (DSS) is being developed to help policymakers visualize retrofit trade-offs aligned with community priorities and budgets.

“Edwin’s research requires that he advance the testing method known as hybrid simulation to control multiple actuators using mixed-mode control methods,” said Shirley Dyke, the Donald A. and Patricia A. Coates Professor of Innovation in Mechanical Engineering, professor of civil and construction engineering and director of Purdue’s Intelligent Infrastructure Systems Laboratory. “To accomplish this large-scale test, Edwin has developed new methods that extend the range of what is possible using such testing methods — thus enabling a new generation of experiments.”

Lyles School of Civil and Construction Engineering graduate students test and review the seismic performance of concrete columns at the Robert L. and Terry L. Bowen Laboratory for Large-Scale Civil Engineering Research.

ALUMNI SPOTLIGHT

MIND OVER MATERIALS

Reza Moini blends research, teaching and impact

In the constantly evolving field of engineering, the role of researchers and educators is pivotal in shaping the future of structural materials. One such individual making significant contributions is Reza Moini (PhD '20) whose commitment to training the next generation and advancing scientific understanding in structural materials is both inspiring and impactful.

Moini is a research scientist passionate about training future generations in structural materials — particularly concrete — through a scientific approach to engineering research. With a background in civil and structural engineering, his current work focuses on the intersection of advanced engineering materials and robotics. Originally from Iran, Moini grew up in a nurturing middle-class family that significantly influenced his intellectual development. Inspired by his mother's open and liberal discussions about human beings and society and his father's perspective on determination and perseverance, he developed a broad perspective about life. Learning from his highly educated siblings, who became professors, teachers, doctors and lawyers, Moini cultivated an early curiosity for knowledge and exploration.

With a primary interest in the sciences, particularly physics, Moini found civil engineering to be an area where he could apply his passion in applied physics. He was drawn to the vast potential for designing materials and structures at various scales. Purdue was a top choice for him due to its successful engineering materials program, which has produced many leading academics and professionals. During his time there, he was offered a

Photos of Moini Lab, CEE Department, Princeton University

PhD research position by Professors Jan Olek, Jeffrey Youngblood and Pablo Zavattieri, making him one of only two students at Purdue to have three advisors.

Moini says his experience at Purdue was transformative, thanks to dedicated faculty who provided exceptional mentoring. His time at Purdue, coupled with a focus on engineering cement-based materials through 3D printing, shaped his academic vision.

After graduating, he became an assistant professor in civil and environmental engineering at Princeton University where he established a laboratory for architected materials and robotics. His research addresses key questions regarding the design of heterogeneous materials and additively manufactured structures. At Princeton, he developed the course "CEE 374: Autonomous Fabrication and Robotics" to prepare students for modern concrete design using autonomous systems. With research funded by various agencies, he has received numerous grants and accolades.

Moini's journey in engineering began with internships during his undergraduate studies in Iran, leading to design and construction roles in the concrete industry. After earning a master's from the University of Wisconsin-Milwaukee and contributing to the development of more sustainable concrete for Wisconsin DOT, he worked at Collins Engineers focusing on structural design in the U.S. bridge and transportation infrastructure. This diverse background laid the foundation for a successful career in research and academia.

Moini is affiliated with several prominent initiatives in Princeton, including the Princeton Materials Institute, Princeton Robotics and the Princeton Institute for Computational Science and Engineering. In his role, Moini conducts fundamental research in mechanics and robotics, mentors students at various academic levels, teaches essential topics in structural and material engineering, and contributes to departmental and university committees.

"What endures beyond our careers are not just the papers, theses and dissertations contributions, but the people we train who can train others and advance our field further," Moini said.

He takes pride in the opportunity to instill scientific perspectives in PhD and undergraduate students, guiding them in objective inquiry and promoting critical and creative thinking. Furthermore, he emphasizes the importance of developing both hard and soft skills among his students, encouraging them to clearly communicate the significance of their work. Through his mentoring, he aims to cultivate a generation of researchers who are equipped to make meaningful contributions to their communities.

"It is important that we instill confidence in the next generation to change the world for better," Moini said. "Trust in your means and your goals is crucial; only then can you inspire confidence in your mentee."

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