

A man with glasses and a blue shirt is shown in a thoughtful pose, with his hand on his chin. He is in an industrial or laboratory setting with large pipes and machinery. The lighting is dramatic, with a strong blue tint on the left side of the image.

ANNUAL REPORT 2023-24



Northeastern University
Civil and Environmental Engineering



With over 240 tenured/tenure-track faculty and 20 multidisciplinary research centers and institutes with funding by eight federal agencies, the College of Engineering is a leader in experiential education and interdisciplinary research focused on discovering solutions to global challenges to benefit society. Northeastern's global university system—with engineering programs on campuses across the U.S. and in multiple countries—provides flexible academic offerings, innovative partnerships, and the ability to scale ideas, talent, and solutions.

About Northeastern

Founded in 1898, Northeastern is a global research university and the recognized leader in experiential lifelong learning. Our approach of integrating real-world experience with education, research, and innovation empowers our students, faculty, alumni, and partners to create worldwide impact.

Northeastern's personalized, experiential undergraduate and graduate programs lead to degrees through the doctorate in 10 colleges and schools across our 13 campuses worldwide. Learning emphasizes the intersection of data, technology, and human literacies, uniquely preparing graduates for careers of the future and lives of fulfillment and accomplishment.

Our research enterprise, with an R1 Carnegie classification, is solutions oriented and spans the world. Our faculty scholars and students work in teams that cross not just disciplines, but also sectors—aligned around solving today's highly interconnected global challenges and focused on transformative impact for humankind.

We are a leader in experiential education and interdisciplinary use-inspired research, focused on innovating for global impact.

DEAR COLLEAGUES, FRIENDS, AND STUDENTS,

Global events continue to stress the need for more sustainable and resilient societies, and the Department of Civil and Environmental Engineering at Northeastern University is expanding its scope of impact and leadership to meet the needs of this exciting moment.

Beginning fall 2024, we welcomed our first class of MS in climate science and engineering students. Through the interdisciplinary nature of this degree, offered in tandem with the Department of Marine and Environmental Sciences, students will learn the skills and techniques needed to solve challenges posed by climate change to engineered and natural systems.

I am also pleased to announce the expansion of our construction management faculty cohort with two new hires for the 2024-2025 academic year. Tiffany Nichols joins the department as an assistant professor with a joint appointment in the Department of History. Her scholarship focuses on siting and design of large-scale infrastructure as well as environmental management informed by law, policy, engineering, science, and technology studies. In the spring, we will welcome assistant professor Gilbert Yang Ye, whose expertise lies in human-AI/robot teaming, automation and AI in engineering, and training and assistive technology.

This annual report details the academic and professional accomplishments of our faculty and students for the 2023-2024 academic year. It is a critical time for civil and environmental engineering, as society looks to our profession for leadership on today's greatest challenges. Let's meet them together.

Sincerely,

Jerome F. Hajjar, PhD, PE, NAE, F.ASCE, F.SEI

University Distinguished Professor,
CDM Smith Professor, and Department Chair
Civil and Environmental Engineering
jf.hajjar@northeastern.edu

For more details, visit our website at [CEE.NORTHEASTERN.EDU](https://cee.northeastern.edu).



Quick Facts **CIVIL AND ENVIRONMENTAL ENGINEERING**

39 **TENURED/
TENURE-TRACK**
Faculty

15 **Young
Investigator
Awards**

13 **Professional
Society
Fellowships**

611 Students enrolled,
47% are women
(Fall 2023)

22 **Distinguished
Research and
Service Awards**

\$39M **External
Research
Awards**
(2022-2024)

4 Research Centers
and Institutes

ARROW

Academic Center for Reliability
and Resilience of Offshore Wind
funded by DOE

ECHO

Environmental Influences
on Child Health Outcomes,
funded by NIH

Global Resilience Institute

Northeastern University
interdisciplinary research institute

PROTECT

Superfund Research Center
funded by NIEHS

Degree Programs

UNDERGRADUATE:

- BS Civil Engineering
- BS Civil Engineering and Architectural Studies
- BS Civil Engineering and Computer Science
- BS Environmental Engineering
- BS Environmental Engineering and Chemical Engineering
- BS Environmental Engineering and Data Science
- BS Environmental Engineering and Health Science
- BS Environmental Engineering and Landscape Architecture

GRADUATE:

- PhD Civil and Environmental Engineering
- MS Civil Engineering
- MS Climate Science and Engineering
- MS Engineering and Public Policy
- MS Environmental Engineering
- MS Sustainable Building Systems



**Member of National
Academy of Engineering**

Jerome F. Hajjar
University Distinguished and CDM
Smith Professor and Department Chair

Quick Facts **COLLEGE OF ENGINEERING**

With **246** tenured/tenure-track
faculty and **20** multidisciplinary
research centers and institutes with
funding by eight federal agencies,
the college is a leader in experiential
education and interdisciplinary
research focused on discovering
solutions to global challenges to
benefit society.

5 **Engineering
Departments**

142 **YOUNG
INVESTIGATOR
Awards**

Including **73** NSF CAREER
Awards, and **24** DOD Young
Investigator Awards

110 **Professional
Society
Fellowships**

3,274 **Total Co-op Hires**
(AY2024)

2,420 **Co-op Employer
Partners** (AY2022-2024)

TOTAL ENROLLMENT (Fall 2023)

10,481 65% Graduate
35% Undergraduate

**Graduate
Enrollment
Growth**

up **63%**
vs. 2018

New Faculty



Tiffany Nichols *Assistant Professor*

Jointly appointed: History

PhD: Harvard University, 2022

JD: University of Virginia, 2008

Previously: Presidential Postdoctoral Research Fellow, Princeton University

Scholarship focus: Siting and design of large-scale infrastructure; environmental management informed by law, policy, engineering, and science and technology studies



Gilbert Yang Ye *Assistant Professor*

PhD: University of Florida, 2024

Previously: Postdoctoral Research Associate, University of Florida

Scholarship focus: Human-AI/robot teaming; automation and AI in engineering; training and assistive technology

Faculty by Research Area

Civil Infrastructure Security

Dionisio P. Bernal
Luca Caracoglia
Qin Jim Chen
Stephen Flynn
Peter Furth
Auroop R. Ganguly
Fatemeh Ghoreishi
Jerome F. Hajjar
Michael Kane
Haris Koutsopoulos
Nancy Larson Varney
Jack Lesko
Yiannis Levendis
Sinan Müftü
Andrew Myers
Mark Patterson
Nathan Post
Mehrdad Sasani
Thomas Sheahan
Craig Shillaber
Michael B. Silevitch
Ali Touran
Eleonora Tronci
Sara Wadia-Fascetti
Ming L. Wang
Qi “Ryan” Wang
Mishac Yegian
Adel Zadeh
Moira Zellner

Environmental Health

Akram Alshawabkeh
R. Edward Beighley
Qin Jim Chen
Peter “James” Dennedy-Frank
Matthew J. Eckelman
Loretta A. Fernandez
Auroop R. Ganguly
Khaled Ghannam
Tarik Gouhier
Jonathan Grabowski
Brian Helmuth
Randall Hughes
Philip Larese-Casanova
Shang Liu
Yu Miao
Amy Mueller
Samuel Munoz
Annalisa Onnis-Hayden
Mark Patterson
Kelsey Pieper
Cristina Schultz
Thomas Sheahan
Aron Stubbins
Geoffrey C. Trussell
Julia Varshavsky
Yang Zhang

Sustainable Resource Engineering

Serena Alexander
Luca Caracoglia
Peter “James” Dennedy-Frank
Matthew J. Eckelman
Demi Fang
David Fannon
Peter Furth
Auroop R. Ganguly
Khaled Ghannam
Tarik Gouhier
Jonathan Grabowski
Jerome F. Hajjar
Brian Helmuth
Randall Hughes
Michael Kane
Haris Koutsopoulos
Michelle Laboy
Nancy Larson Varney
Yu Miao
Tiffany Nichols
Mark Patterson
Nathan Post
Cristina Schultz
Craig Shillaber
Jennie C. Stephens
Ali Touran
Eleonora Tronci
Geoffrey C. Trussell
Ming L. Wang
Qi “Ryan” Wang
Moira Zellner
Yang Zhang

First DOE Research Center Dedicated to Offshore Wind Energy

Andrew Myers, professor of civil and environmental engineering (CEE); **Nathan Post**, associate research professor of CEE and mechanical and industrial engineering; and **Jerome F. Hajjar**, University Distinguished and CDM Smith Professor and Chair of the CEE department, in collaboration with the University of Massachusetts Amherst and a consortium of 40 partners, were selected to join a first-of-its-kind \$11.9 million Department of Energy research center, the Academic Center for Reliability and Resilience of Offshore Wind (ARROW).

Dedicated to accelerating reliable and equitable offshore wind energy deployment across the nation, ARROW will focus on workforce development, targeted research, and partnerships and strategies to embed equity in offshore wind development. Three main programs have been established. ARROW-Empower is aimed at educating over 1,000 postsecondary students on the offshore wind field. ARROW-Innovate focuses on the interdisciplinary technical research needed to grow the industry. ARROW-Engage focuses on ensuring community input, equitable distribution of benefits, and the growth of the industry's workforce.

As industry exchange program lead for ARROW, Myers leverages his expertise in structural engineering of offshore structures and experience working with the industry. "We focus heavily on industry partnerships here at Northeastern," said Myers, pointing to the university's co-op program and use-inspired research focus. "Often in academia, we are siloed into our specific areas of study, but the industry must pull together all these fields, from structural and mechanical engineering to policy, logistics, and atmospheric sciences, to be successful. I look forward

to helping coordinate that as part of ARROW's mission."

Myers also serves as the lead of the infrastructure thrust within the Innovate Initiative. "We are taking a full-cycle view of infrastructure: manufacturing, installation, operation, decommissioning. My specific research focuses on making sure the turbine support structures and foundations are reliable and resilient to stressors." In addition to Myers, Post and Hajjar provide expertise on design specifications, blade materials, large-scale testing, composite materials, and advanced manufacturing and AI.

The nascent U.S. offshore wind industry has great potential, a bright future, and a lot of catching up to do, says Myers. "The U.S. has set an ambitious 30GW goal of installed offshore wind capacity by 2030. There is a huge variety of technical expertise even within engineering and the sciences needed to succeed here; this industry is coming and there is a need for a professional workforce that understands the interdisciplinarity of the engineering, atmospheric science, policy, and community engagement challenges." The center aims to push growth in all these dimensions.

Myers has focused much of his career on helping the U.S. jumpstart offshore wind. In addition to his academic research, he has developed a national research agenda for offshore wind energy infrastructure with the Massachusetts Clean Energy Center and led and hosted conferences and workshops on the topic, such as Offshore Wind Tech Week in 2022 and the International Offshore Wind Technical Conference in 2023. He has worked closely with the industry on a number of projects, including supporting the design and large-scale testing of a project recently named to Time Magazine's Best Inventions of 2023 list.



“

We focus heavily on industry partnerships here at Northeastern. Often in academia, we are siloed into our specific areas of study, but the industry must pull together all these fields, from structural and mechanical engineering to policy, logistics, and atmospheric sciences, to be successful.”

Andrew Myers
Professor, Civil and Environmental Engineering

\$3M DOD Study To Fend Off Cyberthreats in the Wake of Natural Disasters

Auroop Ganguly, Distinguished Professor of civil and environmental engineering, and his interdisciplinary team, are conducting a \$3 million, five-year Department of Defense study on recovery from disruptions to military and civilian critical infrastructure. The focus is on mapping failure and recovery pathways and adapting to changing conditions, including extreme weather events due to climate change and evolving security challenges such as terrorism and cyberattacks. The study will pay particular attention to compounded threats.



Photo by Alyssa Stone

AISC Special Achievement Award

Jerome F. Hajjar, University Distinguished and CDM Smith Professor and Chair of the Department of Civil and Environmental Engineering, is one of five individuals who received a 2024 Special Achievement Award from the American Institute of Steel Construction (AISC) for innovative research through the Steel Diaphragm Innovation Initiative.



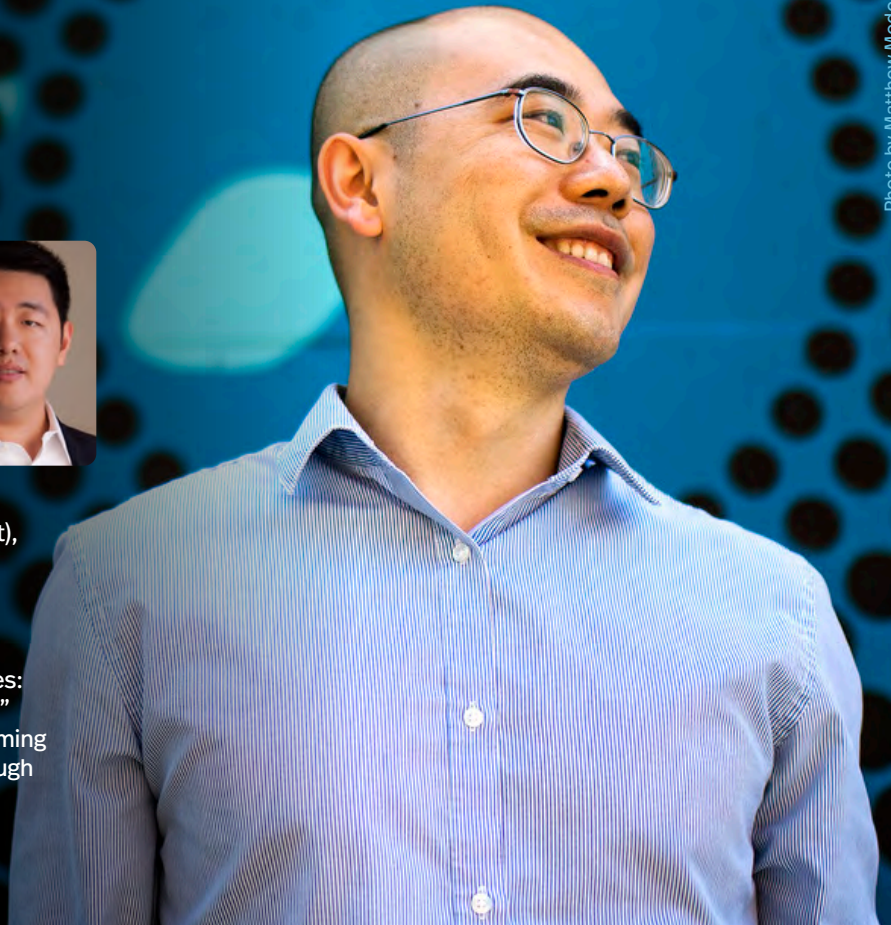
New Model for Wind Turbine Blade Design

Luca Caracoglia, professor of civil and environmental engineering, in collaboration with the University of Massachusetts Amherst, was awarded a \$704,942 National Science Foundation grant for “Modeling the Influence of Turbulence on Flow-Induced Instabilities of Large Flexible Structures With Innovative Applications in Wind Turbine Blades.” Caracoglia will focus on the stochastic modeling side, while the UMass team will focus on experimental validation at various scales.

\$1.6M NSF Grant To Create Inclusive Cities Through Technology



Qi “Ryan” Wang, associate professor of civil and environmental engineering, and **Yanzhi Wang** (inset), associate professor of electrical and computer engineering, in collaboration with the University of Florida and the University of Virginia, received a \$1.6 million National Science Foundation award for “Strengthening Elderly Mobility in Urban Landscapes: Towards Age-Inclusive and Equitable Communities.” The team will use a novel methodology for transforming infrastructure planning, design, and operation through advanced technologies with an emphasis on social equity and user experience.



Chemicals in Household Products Cause Long-Term Health Issues

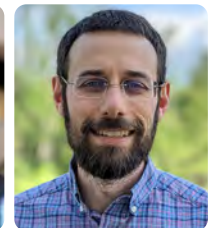
Julia Varshavsky, assistant professor in the Bouvé College of Health Sciences, jointly appointed in civil and environmental engineering, published research in the journal *Environmental Health Perspectives*, on findings from a study she led in Puerto Rico in affiliation with the PROTECT Center that shows chemicals, like phenols and parabens in products such as sunscreen and makeup, can result in long-term health problems for both the woman and fetus.

Phase II of Steel Plate Flooring System Grant

Jerome F. Hajjar, University Distinguished and CDM Smith Professor and Chair of the Department of Civil and Environmental Engineering, received a \$415,000 grant constituting Phase II of a multiyear grant from the Charles Pankow Foundation, which totals \$835,000 to date. The research is creating a design for steel floors that allows them to be built without concrete, fabricated offsite, and installed in buildings in a modular fashion.

Phase II of NOWRDC Offshore Wind Hurricane Risk Assessment

Andrew Myers, professor of civil and environmental engineering (CEE), **Jerome F. Hajjar**, University Distinguished and CDM Smith Professor and CEE Department Chair, and **Nathan Post**, CEE research associate professor are leading a team of five universities for Phase II of the National Offshore Wind Research and Development Consortium administered project, “Long-Term Availability and Bankability of Offshore Wind Through Hurricane Risk Assessment and Mitigation.”



Testing Life-Size Buildings Against Simulated Tornadoes

Luca Caracoglia, professor of civil and environmental engineering, is part of a team of researchers across universities, and led by Iowa State University, awarded a four-year \$14 million National Science Foundation grant to design a facility that can test tornado effects on building models of real-life scale. The project's official name is the National Testing Facility for Enhancing Wind Resiliency of Infrastructure in Tornado-Downburst-Gust Front Events, or NEWRITE.

Effective Strategies for Deploying Roadway Maintenance Machines

Haris Koutsopoulos, professor of civil and environmental engineering (pictured below), and CEE PhD student **John Moody**, published a paper, "Strategies To Optimize the Deployment of Roadway Maintenance Machines for Overnight Maintenance in Urban Rail Systems," in the *Transportation Research Record: Journal of the Transportation Research Board*. They developed multiple models to optimize the maintenance window of urban transit systems without disrupting passenger service.



Northeastern and SEI Host 'Towards Zero Carbon' Workshop

The Department of Civil and Environmental Engineering co-hosted the Structural Engineering Institute (SEI) three-day conference on decarbonization and new design objectives for the structural engineering industry. The workshop, which emphasized concepts of sustainability, equity, and resilience, was held at Northeastern and led by **Jerome F. Hajjar**, University Distinguished and CDM Smith Professor and Department Chair of Civil and Environmental Engineering, who is also SEI president.

Learn more about our accomplished faculty



Student Successes

SELECTED HIGHLIGHTS



Women Who Empower Innovator Award

Photo courtesy of Kaitlin McCarthy

Kaitlin McCarthy, E'09, civil engineering, won first place in the Experienced Alumnae category in the 2024 Women Who Empower Innovator Awards from Northeastern University for her company, Ionic Development, Co., a real estate development and consulting firm that affects positive change through development in the greater Boston area, and promotes women in real estate development and ownership.



Using AI To Save Lives on the Battlefield

Liam McEaney, MS'25, engineering and public policy, is working with Sarah Ostadabbas, associate professor of electrical and computer engineering, and Beverly Kris Jaeger-Helton, teaching professor of mechanical and industrial engineering, and in collaboration with MIT Lincoln Laboratory, to develop an AI-powered computer program that will accurately and quickly fill out tactical combat casualty care cards for injured soldiers on its own on the battlefield by processing video and audio from medics in real time, and quickly sending the digital card to hospital staff.



Predicting Rainfall With Artificial Intelligence

Puja Das, PhD'27, interdisciplinary engineering, who is supervised by **Auroop Ganguly**, Distinguished Professor of civil and environmental engineering, created a research model that the Tennessee Valley Authority is testing to forecast extreme rainfall. The model uses artificial intelligence to predict weather forecasts quickly and accurately.

Outstanding ASCE Student Chapter

The **Northeastern University chapter of the American Society of Civil Engineers (ASCE)**, was nationally recognized on multiple fronts, including being named the 2024 ASCE Distinguished Chapter for Region 1, and a recipient of a 2024 Certificate of Commendation. It also had strong showings in both the Concrete Canoe and Steel Bridge competitions.

Creating Change Through Research and Community Engagement

While at Northeastern, **Benjamin Lanava**, E'24, environmental engineering, worked for nearly four years as a research assistant to **Annalisa Onnis-Hayden**, teaching professor of civil and environmental engineering, completed two co-ops, took three trips abroad, including two Dialogue of Civilizations and one service trip, held leadership positions for engineering student groups, and volunteered with Boston-area children.

As testimony to his hard work, Lanava received a Northeastern Undergraduate Research and Fellowships' Project-based Exploration for the Advancement of Knowledge (PEAK) Experiences Award for his research on plant-based solutions to remove highly toxic "forever chemicals" from water supplies. The PEAK Experiences Awards are categorized in a progressively structured sequence to acknowledge heights of achievement. Lanava received a top-level, or Summit, award.

He also received a Udall Undergraduate Scholarship Honorable Mention, and was nominated for the Rhodes, Marshall, and Knight-Hennessey Scholarships. He was named to the Huntington 100, a universitywide annual honor to recognize students who embody the mission, ideals, and values of Northeastern. Additionally, he received the 2024 Compass Award, which recognizes exemplary students from the senior class who, during their time on campus, have demonstrated a true dedication to a core set of values of leadership, volunteerism, academic integrity, and commitment to Northeastern.

But what matters most to Lanava is getting clean water to people, especially those with the least access to it. Beginning in his first year, Lanava conducted research on improving water quality by eliminating toxic chemicals known as perfluoroalkyl and polyfluoroalkyl substances, or PFAS. Current solutions can be expensive because they involve other chemicals to counteract PFAS and can require the removal of the chemicals from the water and disposing of them elsewhere. Lanava's research departs from this strategy by introducing fungi into water that

can degrade and destroy the PFAS. This approach would be significantly less expensive because it involves no additional chemicals or chemical removal. A second research effort focused on the design and implementation of water delivery systems.

Lanava joined Northeastern's student chapter of Engineers Without Borders in his first year and ultimately served as its president. He co-led a group on a trip to Uganda in late August 2023 to support two villages with a combined population of about 4,000. During the nearly two-week stay, the group set up a solar powered pump, solar panels, a tank, and a tap stand.

Earlier in 2023, Lanava travelled to Sardinia, an island off the coast of Italy, as part of a Dialogue of Civilizations program with Onnis-Hayden. The group researched recycling and how to create new products from trash or convert it to energy. Lanava also completed a Dialogue of Civilizations in the Netherlands with Peter Furth, professor of civil and environmental engineering and a leading expert in sustainability in transportation. The experience reinforced his belief in the importance of community engagement as the group examined successful cycling and pedestrian traffic projects.

For his first co-op, which was at Dewberry, an engineering, construction, and consulting firm in Boston, Lanava worked with mapping software that provided data on issues like broken pipes that impacted environmental projects. His second co-op, also in Boston, was at Allonnia, a biotechnology and engineering company. Lanava assisted on lab work to develop mechanisms that can detect PFAS in water supplies. In fact, the experience inspired Lanava to pursue the plant-based research he continued to work on.

"At Northeastern, there was so much room for me to grow and take on all these different roles," Lanava says "I'm not sure if I would have had that opportunity at other colleges."

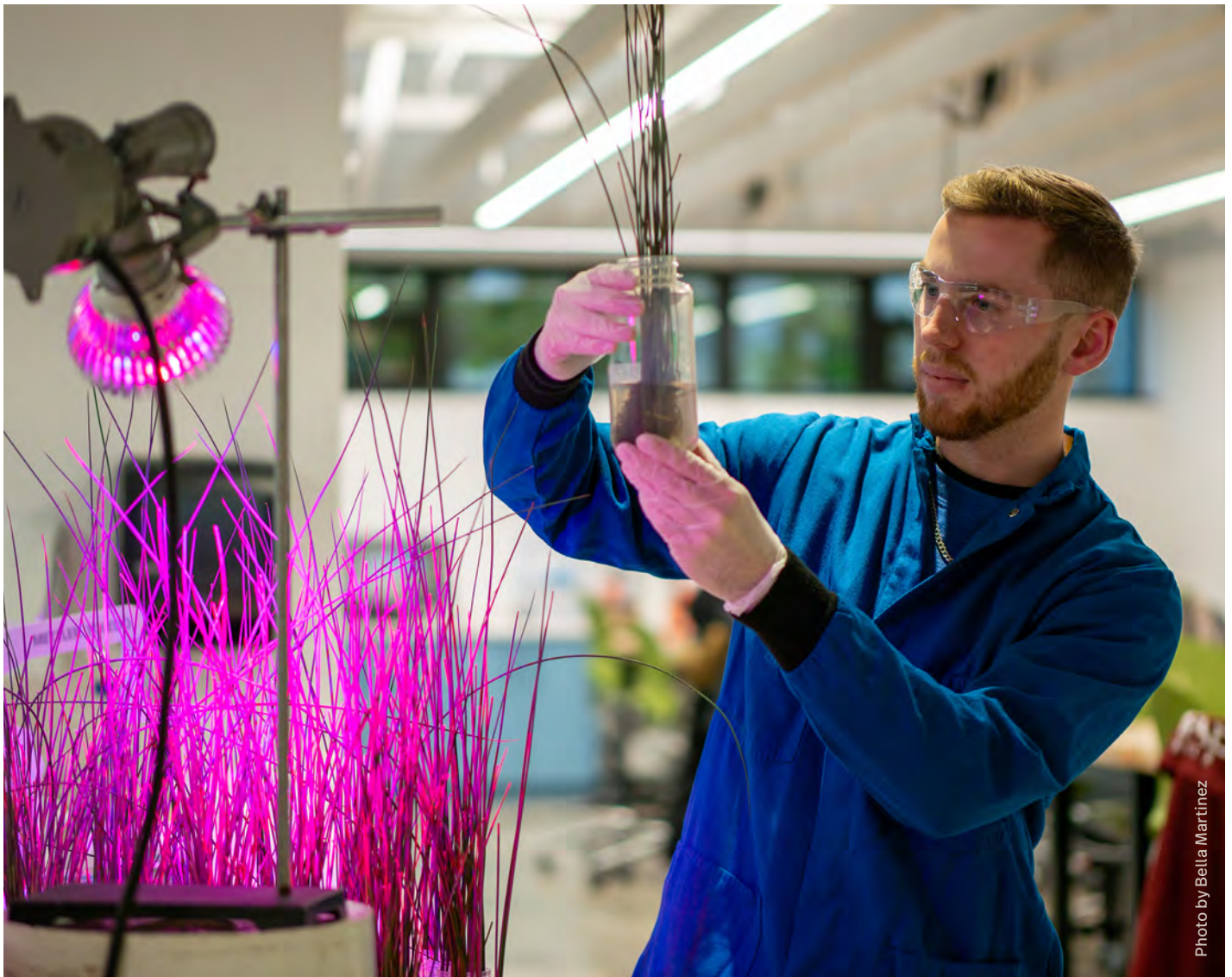


Photo by Bella Martinez

“

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Benjamin Lanava, E'24
Environmental Engineering



Benjamin Lanava co-led a trip to Uganda as part of the Engineers Without Borders student group.

R. Bailey Bond, PhD'24

CIVIL AND ENVIRONMENTAL ENGINEERING

Advised by Jerome F. Hajjar, University Distinguished and CDM Smith Professor and Chair of Civil and Environmental Engineering

R. Bailey Bond completed a bachelor's degree in architectural engineering at the University of Texas. Through a National Science Foundation-funded Research Experiences for Undergraduates program at Lehigh University, Bond conducted research on self-centering cross laminated timber, which laid foundational insights for his graduate studies. He began pursuing a PhD in civil and environmental engineering at Northeastern in 2019.

Bond initiated his doctoral research on steel diaphragms through the Steel Diaphragm Innovation Initiative, with a focus on building resilience. His work led to the development of a novel predictive model for headed shear stud strength in concrete-filled steel composite decks.

In his second year of studies, Bond integrated machine learning into his research under the additional mentorship of Hao Sun, an associate professor at Renmin University of China, and created data enhanced methods of modeling structural resilience against seismic hazards. His principal dissertation project focused on a physics-reinforced machine learning paradigm for probabilistic metamodeling of nonlinear structural systems with applications in seismic risk analysis.

Bond has published numerous articles and conference papers, including in *Journal: Earthquake Engineering & Structural Dynamics*. The publication focuses on advancing the field's understanding of machine learning in structures for structural resilience. He also gained industry experience as a structural engineering intern at DCI Engineers in Austin, Texas, where he honed his skills in structural analysis and design.



As a graduate teaching assistant, Bond excelled in mentoring, and received a College of Engineering Graduate Student Teaching Award in 2023. He served as president of Northeastern's Graduate Structural Engineering Association, ASCE Structural Engineering Institute NU Student Chapter. Additionally, he served as president of the Civil and Environmental Engineering Graduate Student Council. During his tenure, the student council received the Civil and Environmental Engineering Building Community and Belonging Award in 2023.

Bond is currently pursuing opportunities in industry that focus on the integration of machine learning and innovative technologies in civil engineering through hazard analysis and design.



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