College of Engineering
UNIVERSITY OF WISCONSIN–MADISON

SPRING 2025 NEWSLETTER

DEPARTMENT OF

CIVIL AND ENVIRONMENTAL ENGINEERING

Greetings from Madison!

Forward. Recognized by many of us as Wisconsin's state motto, the State Historical Society says it reflects our state's "continuous drive to be a national leader." Our CEE community has been thinking a lot about this during the current academic year, considering how we continue our leadership in research and workforce development with excellence in faculty and facilities during a time of rapid change. By the end of the academic year, we expect to capture our thinking in a five-year strategic plan for 2025-30. In the next newsletter, I expect to use this space to summarize the initiatives we will focus on.

The development of a new strategic plan gives us an opportunity to reflect on the strategic plan that shaped where we are today. In the last five years, we kicked off a new undergraduate degree program in environmental engineering, increasing our total undergraduate enrollment from 390 students to 530. We also launched a new undergraduate certificate in architecture, already the largest certificate program in the College of Engineering after 1.5 years of operation. We added new faculty members in environmental engineering and autonomous transportation systems, contributing new courses and research directions. Our faculty also grew their annual research expenditures from $12 million to $16 million over the last five years. As illustrated in this newsletter, their research is making our communities and our environment healthier, safer, more sustainable and more resilient.

Remarkably, we kicked off the implementation of our last strategic plan at a time of enormous uncertainty. As I write this, it is almost five years to the day on which we transitioned all of our educational programming from in person to online due to the onset of the Covid-19 pandemic. Except for essential experimental work, much of our research enterprise was relocated to home offices as well. That our 800-person community accomplished so much during the last five years is a powerful testament to the CEE community's commitment to living by our state's motto.

As we start the next five years, we face uncertainty in federal support for research and education at a time when artificial intelligence and machine learning will rapidly change our profession. We also know that a new engineering dean and a new engineering building are on the way. As always, the times present challenges and opportunities. I have no doubt that we will rise to the occasion in our continuing quest to look forward.

On, Wisconsin!

Gregory W Harrington

Gregory Harrington
Professor and Department Chair

Get ready to golf!

Register today for the 28th annual CEE Golf Outing on September 26. This year's event offers new booth sponsorship opportunities and on-the-course entertainment.

Register at: go.wisc.edu/cee-golf-outing or use the QR code below.

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UW-Madison civil and environmental engineering PhD student Wei Han demonstrates a virtual reality system his group, under Assistant Professor Zhenhua Zhu, is using to research how drones affect construction worker safety on work sites. Photo: Joel Hallberg.

Do eyes in the sky distract workers on the ground?

In virtual reality, new study explores safe drone use on construction sites

The buzz of drones on construction sites is becoming ever more common, enabling crews to scan or inspect their work from above. At the same time, those drones can distract workers and cause accidents or injuries.

Under M.A. Mortenson Company Construction Engineering & Management Assistant Professor Zhenhua Zhu, researchers are using an innovative virtual reality experiment to see how workers react to drones in a variety of simulated scenarios.

Construction engineering and management PhD student Wei Han, who is leading the project, says the research looks at if buzzing drones impair worker hazard recognition and reaction times.

"For this project, we know that different configurations will have different impacts on workers," Han says. "We hope these findings will help inform, for example, whether drones should be limited to a certain distance from workers. One of the most important outcomes of this study is to provide a foundational understanding of drone-related distractions, so drones can be used safely in the future."

In a set of experiments, 24 participants, using a virtual reality headset paired with handheld controllers and a special, circular treadmill, moved through a virtual construction site with and without drones present. The researchers measured the participants' attention around potentially hazardous areas like fences, openings and ledges. The results, Han says, show a general drop in workers' attention to their surroundings with drones present.

Han says the team plans to expand its virtual testing to explore how drones could affect tower crane operators. In that scenario, a crane operator moving materials through a site would need to keep the crane's load stable while a drone flies nearby.

The group is also collaborating with CEE Professor Fei Dai at West Virginia University to assess how drones affect construction worker stability. For that part of the study, workers will be painting—in virtual reality—while standing on simulated scaffolding with force plates that can measure their balance as drones fly by.

The research team is also collaborating with Statistics Professor Wei-Yin Loh at UW-Madison for assistance on experiment design insight and data analysis.

With UW-Madison leadership, autonomous vehicles could bridge transportation gaps for people living in rural areas

Civil and Environmental Engineering Professor Xiaopeng Li and collaborators nationwide from academia, government, nonprofits, industry and tribal nations are hoping to broaden access to AVs. Photo: Joel Hallberg.

UW-Madison engineers are leading a first-of-its-kind research center devoted to advancing autonomous vehicle (AV) availability in rural and tribal communities.

The Tribal & Rural Autonomous Vehicles for Efficiency, Livability, and Safety (TRAVELS) Center at UW-Madison is supported by a $15 million grant from the U.S. Department of Transportation, with an additional $15 million available through matching funds and services from state entities, industry partners and participating universities.

"TRAVELS is the first national large-scale program focusing on rural and tribal autonomous passenger vehicles. It will help accelerate the deployment of state-of-the-art AV technologies in vast rural and tribal areas in the United States that have often lagged behind in access to these technologies," says Harvey D. Spangler Professor Xiaopeng "Shaw" Li, who is heading the initiative. "It includes both fundamental research and real-world outreach and deployment. It will be a unique opportunity to utilize our cutting-edge research on real-world problems and see how university research can truly benefit communities in Wisconsin and across the nation."

There are many barriers to transportation services in rural communities, including a lack of or limited availability of services like public transit, as well as physical infrastructure limitations and workforce shortages.

The researchers hope to develop solutions that could ultimately help, for example, fill gaps in healthcare access or enable people without personal vehicles to commute to work. That could be through services like autonomous busses or robotaxis. "We can directly dispatch autonomous vehicles if we get a call from someone who has a need," Li says. "That can improve response speed and, if they're deployed at scale, they could provide more frequent access to services across large geographic areas, connect people to job opportunities, and bolster access to necessities."

Moving autonomous vehicles from cities, where they're most frequently used, to rural communities comes with its own set of challenges. Andrea Bill, traffic safety engineer research program manager in the Traffic Operations and Safety Laboratory, says rural roads can have different types of pavement marking and lane striping, or no striping at all. That means it will be important to make sure autonomous vehicles can "see" and "understand" their surroundings well enough for safe navigation, regardless of the lack of common roadway infrastructure.

Professor and Wisconsin Transportation Center/TOPS Lab Executive Director David Noyce says the center's researchers will rely on input from many partners—especially rural and tribal communities—to understand how autonomous vehicles can suit their unique needs.

"Even though there's a lot of collaborative efforts in these current programs, development of rural AV systems can't be a one-way street," Noyce says. "This is really a case where partnerships are critical. We need to work with the local communities so we can understand their needs and how AV solutions can be developed to meet these needs."

UW-Madison is leading the center in partnership with Oklahoma State University, the University of Washington, Morgan State University, Northern Oklahoma College, the University of Wisconsin-Milwaukee and the University of Georgia. The institutions will work with 34 state-level partners: eight state agencies, nine local governments, 12 tribal nations and five nonprofit organizations. The TRAVELS Center also brings in several industrial partners with experience in multi-modal autonomous vehicles and associated technologies.

The center will begin a six-year project in 2025 that will unfold in three phases: research, demonstration and deployment. The research institutions will carry out the bulk of the first phase, and Li says industry partners should become more actively involved as the project moves to development and active deployment.

Learning from the light: In class and in the field, civil engineers study long-standing Lake Superior sentinel

A group of 10 CEE graduate students is monitoring the structural health of a 150-year-old Lake Superior lighthouse.

With Assistant Professor Jesse Hampton, the students are studying the Au Sable Lighthouse located in the Pictured Rocks National Lakeshore in Michigan's Upper Peninsula. The lighthouse, first constructed in 1874 at Au Sable Point, is part of a complex of structures comprising the Au Sable Light Station.

Using fiber-optic cables wound helically around the lighthouse's central stairway, Hampton's students instrumented the lighthouse in coordination with the U.S. Army Engineer Research and Development Center's Construction Engineering Research Laboratory and the National Park Service.

"With fiber-optic sensing, we can monitor high-frequency and low-frequency deformations," Hampton says. "Low frequency could be, for example, if there's any cantilever beam action from the wind or a big storm pushing against the structure. High frequency could be any sort of vibration from the ground or people moving through the building."

Nathan Opperman and Gowshikan Arulananthan are two geological engineering PhD students in Hampton's research group. Opperman says the monitoring system yielded gigabytes' worth of data in the weeks since the researchers installed the fiber optic cables.

The data shows a cyclical pattern that coincides with the daily rise and fall in temperature (a type of low-frequency change as the structure expands and contracts). By looking at high-frequency acoustic data, Arulananthan says, the team could monitor foot traffic through the site.

The National Park Service preserves and maintains historically significant structures and cultural landscapes such as the Au Sable Light Station. There's a chance the UW-Madison monitoring equipment may remain in place for up to 15 years, which would yield an unprecedented period of data collection.

"That would be one of the only data sets in existence that really monitors climate impacts on a historic structure over a long period, especially with distributed fiber optic sensing," says Hampton.

While on-site, the researchers used LIDAR to take 3D scans of the lighthouse, then used those scans to create exceptionally detailed point cloud images of the structure. These images are being used to develop augmented and virtual reality site visits and inspections, allowing anyone to access scanned structures regardless of location. They can also be used to monitor the structure's health.

Though the work is part of an ongoing research project, Hampton also saw an opportunity to add a new dimension to his class, CEE/GLE 534: *Nondestructive Evaluation*. For the Spring 2025 semester, Hampton took the class on a three-day field trip to set up nondestructive equipment at the site, and later in the semester, asked the students to analyze the data they collected.

"Jesse's taking a really bold and admirable approach of having the class built into the structure of the research project itself," Opperman says. "It's a lot of the class members' first exposure to the type of data we're using, so kind of like throwing people into the deep end and expecting them to flourish in that. And I think that's a good way to teach, and leads to a lot of growth and development of people's research ability, project management and communication skills, because we're working in groups."

The Au Sable Lighthouse instrumentation is part of a larger project with Alain H. Peyrot Associate Professor Hannah Blum. They're monitoring historic structures with support from the U.S. Army Engineer Research and Development Center's Construction Engineering Research Laboratory.

A team of CEE graduate students gathering data—potentially for up to 15 years—to determine climate impacts on a historic lighthouse. Submitted photo.

Meet grad student Savannah Finley: Committed to contaminant-free drinking water for all

Savannah Finley is a civil and environmental engineering PhD student and a Graduate Engineering Research Scholar. She is advised by Assistant Professor Athena Nghiem in the Department of Geoscience.

Finley's research broadly looks at environmental challenges through industrial waste management and water quality, with a focus on understanding the source of—and ultimately reducing—molybdenum concentrations in drinking water in southeastern Wisconsin.

How did you get interested in your research area?

Growing up in and surrounding a predominately low-income and minority neighborhood, I witnessed environmental challenges and the struggle for access to clean drinking water. Encountering these issues ignited my passion for environmental justice and ensuring that communities have access to clean and safe drinking water. My research on water quality merges my scientific and personal motivation to advocate for a cleaner environment for our communities.

What do you like best about being part of the GERS community?

GERS helps me find a place where I can truly be myself. It's a space where we can empathize with each other and share our experiences, which makes the challenges of graduate school feel more manageable. Through GERS, I've also met people who have become incredibly important in both my personal and professional life.

Anything else you'd like to tell us about yourself or about your experiences here?

One of the things I've enjoyed most about UW-Madison is how easy it is to find community here, both in and outside of my research. Whether it's discussing ideas with peers or enjoying the beauty of campus and the city, there are countless ways to feel at home. My experience here has shown me that meaningful research doesn't happen in isolation—it's built through collaboration, curiosity, and community.

Savannah Finley in the field. Submitted photo.

The College of Engineering's Graduate Engineering Research Scholars (GERS) is celebrating its 25th anniversary in the 2024/2025 academic year. The program was established to recognize excellence in research and/or scholarship and to enhance the experiences and opportunities of graduate students in the College of Engineering.

Learning through a different lens: New course offers diverse perspectives and networking for students

A new course, *Construction by Women*, is bringing diverse perspectives and a new community to undergraduate students in a way that's not for–but by–women.

Led by Melanie Taylor (BS '04), vice president of manufacturing at Bildt, in collaboration with Professor Awad Hanna and graduate student Alexa Rademacher, the course combines classroom learning with real-life experiences to help future leaders develop skills for success in construction-related industries.

"The course creates space for professionals to share their experience through the lens of women and provide guidance for students interested in the construction industry," Taylor says.

For students, community-building and networking were important takeaways from the course, and Taylor drew from her own experiences to emphasize their importance. "When I was a student, I didn't realize how important it is to build a network," she says. "It's just not your mindset at the time. You're thinking about other things, like getting through classes and finals. So, if we can expose students to women in the industry and start building a network for them, that'll give them a head start in their career."

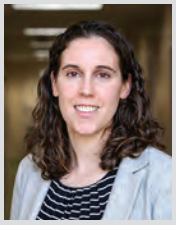
Taylor expanded the course's focus beyond the construction industry to include adjacent fields to give students a deeper understanding of how different roles influence real-world construction projects. The course hosted more than 30 professional presenters, including alumni, with guest and student interactions ranging from panel discussions to in-person job site tours.

The course now will be offered every fall semester.

Faculty receive named professorships, promotions

Five CEE faculty were honored with named professorships and three were promoted, with two gaining tenure during the process, during the 2024-25 academic year. These achievements are the result of these faculty members' outstanding accomplishments and dedication to research and teaching. The named professorships and promoted/ tenured faculty include:

Zhenhua Zhu received the M.A. Mortenson Company Construction Engineering & Management Assistant Professorship. Zhu's research focuses on advancing information and robotic technologies to drive automation and innovation in construction project delivery. His work has been supported by various federal and industrial funding agencies and recognized with numerous awards.



Hannah Blum received the Alain H. Peyrot Associate Professorship. Blum's research is geared toward next-generation steel structure design and improved structural resilience for changing climates. Blum has implemented innovative teaching methods using augmented and virtual reality for her students and has drawn upon industry partnerships to enhance research opportunities and establish the new Consortium for Holistic Steel Systems. She's won numerous awards for her work, including the McGuire and Terry Peshi awards. In addition to the named professorship, Blum was promoted from assistant to associate professor with tenure.

Daniel Wright received the Arno Lenz Memorial Associate Professorship of Water Resources Engineering. Wright's research, teaching and outreach focus on extreme rainfall and floods, and how both are influenced by meteorology, urbanization and climate change. His work has been supported through numerous research grants including a NASA Postdoctoral Program fellowship at Goddard Space Flight Center and a National Science Foundation CAREER Award.

Andrea Hicks received the Keith and Jane Nosbusch Associate Professorship in Engineering Education. Hicks is a leading expert in using life-cycle assessments to determine the overall environmental impacts of products or processes. She also holds the Hanson Family Fellowship in Sustainability and is the Director of Sustainability Education and Research through the UW-Madison Office of Sustainability.

Xiaopeng Li received the Harvey D. Spangler Professorship. Li researches emerging transportation technologies, including autonomous, connected and electric vehicles. He leads the Connected and Automated Transportation Systems Lab (CATS) Lab. The CATS Lab developed a multi-scale connected and automated vehicle testbed, including multiple full-scale and reduced-scale connected and automated vehicles and associated units.

Steven Loheide received the Distinguished Professorship of Water Resources Engineering. Loheide's research focuses on the interactions between ecological and hydrological processes in natural and built systems. His approaches use a combination of field data, remote sensing and numerical modeling to promote water security and sustainability. He co-founded Water@UW, which fosters connection, communication and collaboration among members of the diverse UW-Madison water community.

Matthew Ginder-Vogel was promoted from associate professor to professor. He researches the movement of nutrients and contaminants through the environment and how those processes interact with crucial resources such as clean groundwater. Among other recognition for his work, Ginder-Vogel has won a National Science Foundation CAREER Award.

Bu Wang was promoted from assistant professor to associate professor with tenure. Wang leads the Sustainable Materials Innovation Lab, which focuses on ways to develop sustainable materials needed for civil engineering. Some of Wang's work includes researching ways to reduce or even reverse the carbon footprint of cement production, which is one of the largest single sources of human-produced carbon emissions.

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Meet the college's next dean

Devesh Ranjan, a mechanical engineer and a leader at one of the country's largest and highest-ranked engineering programs, will be the college's 10th dean. He will begin on June 16.

Ranjan, the Eugene C. Gwaltney Jr. School Chair and Professor of Mechanical Engineering at the Georgia Institute of Technology, remembers the promise he felt when he first arrived at UW-Madison in 2003 to begin graduate school in the college he will now lead.

"I've been blessed from that day onward," Ranjan says. "The thing I say about UW-Madison is if you dream about doing something here, it will happen. It will happen because of the opportunity and the support here for you at UW-Madison."

After earning a doctorate at UW–Madison in 2007 in the lab of Professor Riccardo Bonazza, Ranjan was a Director's Postdoctoral Fellow at Los Alamos National Laboratory before joining the faculty at Texas A&M University in 2009. He moved to Georgia Tech in 2014, where his own work has focused on the dynamics of fluids at very high speeds—air across the surface of supersonic jets, the plume of a volcanic eruption, shock waves that fragment kidney stones—and designing next-generation power cycles optimized for solar energy sources or incorporating the efficiency of supercritical carbon dioxide as in heat pumps.

Read more about incoming Dean Ranjan.