

THE BRIDGE

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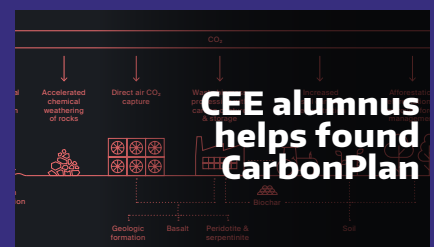
A mountain of learning

Students practice drone surveying techniques at Mount Baker

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CIVIL & ENVIRONMENTAL ENGINEERING
UNIVERSITY of WASHINGTON



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MESSAGE FROM THE CHAIR



Welcome to the Spring 2022 edition of *The Bridge*. With COVID restrictions lifting this spring on campus, it has been wonderful to see crowds enjoying the blossoming cherry trees in the UW quad, prospective students and their families touring campus, and members of the UW community filling campus paths, cafes, hallways, classrooms and, of course, More Hall. We were thrilled to be able to invite faculty, students, alumni and the Puget Sound engineering community to hear Professor Emeritus Steve Kramer present the Burges Endowed Lecture in-person in late May, as well as to enjoy lectures by two Visiting Burges Endowed Professors. I am particularly excited to celebrate three years' worth of graduations this June, as we invite students from the graduating classes of 2020-2022 and their families to attend a graduation ceremony at Hec Edmundson Pavilion.

From natural hazard events to climate change concerns, this edition of *The Bridge* highlights the work of CEE faculty, students and alumni to respond to critical challenges of the 21st century. In the coming years, our UW CEE graduates will be increasingly called on to design civil infrastructure that can meet the needs of urban environments and foster sustainable communities. To prepare the next generation of engineers, Assistant Professor David Shean is teaching students to use new drone surveying technology to track glacier change at Mount Baker. Several of our alumni are also working to mitigate the impacts of climate change through a new organization called CarbonPlan, which presents the best available science and data in unique ways to public and private stakeholders. To enable engineers to design more resilient infrastructure, the department also launched a new certificate program in earthquake engineering this spring. The work taking place across our CEE community gives me hope for the future.

In closing, I will take this opportunity to say farewell as department chair as my five-year term concludes at the end of the summer. I will return to being a regular faculty member and focus my efforts more directly on educating the next generation of engineers and advancing structural engineering research and practice. During my time as chair, I have been incredibly proud of the advances the department has made to integrate justice, equity, diversity and inclusion into our curriculum, research, department operations and infrastructure as well as our ability to come together as a community to overcome challenges, such as COVID. We have emerged with new knowledge, skills and practices that make us an even stronger department.

Laura Lowes
Chair & Professor

Faculty honors

Professor Dawn Lehman's contributions to the Miami Herald's investigative reporting led to the news team being honored with the 2022 Pulitzer Prize in Breaking News Reporting. The award honors the media team's investigation into the partial collapse of Champlain Towers South, for which Lehman provided expert commentary and technical insight following the June 2021 collapse of the 12-story beachfront condominium in Surfside, Florida.

Assistant Professor Brett Maurer has been awarded the 2022 Arthur Casagrande Professional Development Award from the American Society of Civil Engineers' Geo-Institute. The award recognizes Maurer's accomplishments in teaching and research in geotechnical earthquake engineering.

Professor Steve Muench has been selected to receive the 2022 College of Engineering Faculty Teaching Award. According to Dean Nancy Allbritton, Muench was selected for

his "exceptional work as a teacher and mentor, as well as curriculum development and departmental service."

Associate Professor Rebecca Neumann and **Professor Joe Wartman** have been selected by the American Geophysical Union to be ambassadors in the inaugural cohort of Local Science Partners. The Local Science Partners program is designed to facilitate partnerships between ambassadors and policymakers to help encourage science-based decision making. The program

includes travel to Washington, D.C., for a congressional visit day in the spring.

Assistant Professor Jessica Ray is the recipient of a National Science Foundation Faculty Early Career Development Program Award, which supports early career faculty who have the potential to lead notable advances in research and education. The award supports Ray's work to design novel, low-cost composite materials to selectively remove and/or degrade toxic contaminants in water sources.

A student-focused send-off

Newly established student support fund honors Professor Joe Mahoney

If you know Professor Joe Mahoney, you know he loves a good story. And the new student scholarship fund established in honor of his upcoming retirement is not only a good one — it's a story that will get better over time.

That's because the scholarship fund will support undergraduate students, with a focus on underrepresented students who are the first in their family to attend college and have experienced educational or economic disadvantage.

"It was quite a shock when I found out they were doing this," says Mahoney, who retires September 15. "I hope to see students from all over Washington, and particularly from Eastern Washington, apply. If we can help them financially along the path to earning a BSCE degree, that would be fabulous."

The Mahoney Endowed Student Support Fund was established by Mahoney's colleague Professor Steve Muench and Muench's wife Yvonne. The two faculty members first met in 1989 when Muench was an undergraduate student enrolled in one of Mahoney's classes. Several years later, when Muench returned to the department to earn master's and Ph.D. degrees, Mahoney served as his faculty adviser.

"I couldn't think of a better person to work with than Joe," Muench says. "He is by far the most influential person in my professional life. I learned how to be a professor from Joe and I can't imagine doing what I'm doing now without his contributions."

Honoring Mahoney's upcoming retirement by helping students is fitting, says Muench, who not only benefitted from Mahoney's advice and encouragement during his own schooling, but says that Mahoney regularly goes out of his way to support students. He helps them secure internships, jobs and scholarships through the large network of contacts he's built over the years.

"Generations of students have called upon him for life advice. His door is always open," Muench says. "I've seen him go out of his way to help students who he didn't even know a few months ago. To Joe, that is part of his job — and a very enjoyable part of his job, if you ask me. Those kinds of efforts often go unrecognized."

Both faculty are excited that the timing of the scholarship fund may potentially dovetail with an initiative currently underway in the department, which is to offer an online BSCE degree program in the near future. The online option could greatly reduce barriers for students with financial limitations who may not be able to afford moving to the city, says Mahoney. And coupled with the scholarship program, students could not only live at home, but have some of their tuition costs offset.

"My assumption is that if you can educate young people where they now live, they'll get their degree and probably practice there or nearby. And if that's the way it turns out, that's fantastic and would be the ideal outcome for the graduate and the state," Mahoney says.



Support students

To donate to the fund, visit ce.uw.edu/campaign/joe-mahoney

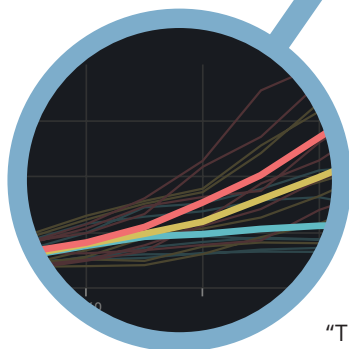
Photo: Professor Joe Mahoney, center, discusses pavement issues with two graduate students in 1992.

Countering

CLIMATE CHANGE



Alumnus co-founds CarbonPlan to inform and evaluate climate solutions



The concept of climate change may not be new, but the team at the nonprofit research organization CarbonPlan has a new approach to help inform both carbon removal and climate solutions.

Founded by UW CEE alumnus Joe Hamman (Ph.D. '16), together with two colleagues, the team at CarbonPlan is presenting the best available science and data in unique ways to public and private stakeholders.

“Over the next decade, we need to go from a carbon-intensive economy to a carbon-free economy,” Hamman says. “There are a lot of new ideas coming into the space, but not a lot of outside perspective that puts some bounds of realism around what will work and what won’t. That’s why we stepped in.”

After securing donations and grant funding, the organization launched in 2020. The remote-only team has grown to 12 employees, including CEE alumna Oriana Chegwiddden (Ph.D. '20), a research scientist and the organization’s first official hire.

One of CarbonPlan’s hallmarks is utilizing “open science” to help move conversations forward in the climate solutions arena. The term open science refers to a collaborative approach to science that entails creating reusable and shareable tools, such as interactive models, visualizations and datasets. The merging of both open science and climate policy in one place is unique, says Hamman.

“There are not many organizations doing these things in tandem,” says Hamman, whose current role is technology director. “My motivation was thinking about how open science could be used to accelerate actual action we can take to stave off the worst of climate change.”

High-profile projects

In addition to informing the development of future climate-related programs, CarbonPlan also uncovers how some climate solutions simply aren’t working. One high-profile project shined a light on the shortcomings of the forest carbon offsets program in California, which is the largest program of its kind and is valued at more than \$2 billion. In order to meet emission-reduction actions, governments and companies can buy carbon credits, which essentially fund the preservation of forests. The CarbonPlan team identified a large-scale and systematic over-crediting of forest offsets — by 29%. This means that a large portion of credits do not reflect real climate benefits and are, in fact, contributing to carbon dioxide in the atmosphere by allowing the entities that are buying credits to pollute. As part of their analysis, the CarbonPlan team used a new approach to estimate carbon credits across forests, based on tree species, since some sequester more carbon. The team shared their findings with journalists, resulting in a two-part story in ProPublica last April.

Photo above: Alumnus Joe Hamman (Ph.D. '16). Photo above right: Alumna Oriana Chegwiddden (Ph.D. '20)

“Early on in the project, we realized we were onto something significant. This led to a collaboration with two investigative journalists that resulted in two in-depth stories that leveraged our analysis. Our work helped tell the story of how and why offsets are failing to achieve their stated goals,” Hamman says.

Another notable project that the CarbonPlan team worked on uncovered how a variety of situations, from wildfires to insect outbreaks to droughts, may impact forests throughout the United States. Forests are an important part of the global carbon cycle, as carbon is stored in the biomass of trees. However, when trees die the carbon is released back into the atmosphere. Using the latest generation of climate change models, together with satellite and ecological data, the CarbonPlan team created spatial maps that project future forest risks through the end of the 21st century.

“Forests sequester carbon, but they also release it via mechanisms like fire, drought and insect outbreaks. Here in the western U.S., we’re witnessing increasingly devastating fires, and our study found that climate change will almost certainly make them worse,” Chegwiddden says. “This could turn into a large source of carbon emissions.”

Sharing work quickly

Getting their research into the hands of decision-makers, journalists and the public is a priority for the CarbonPlan team. Due to the urgency of their work and the need to inform policy decisions, they share their research in preprint form following internal quality control, while waiting to be published in peer-reviewed journals. They also make all of their datasets and software publicly available.



“I wrote a paper in grad school that took three years to get published. It’s not to say there isn’t a place for peer review, but it runs counter to the urgency of the problems we’re working on,” Hamman says.

Their work at CarbonPlan builds upon skills honed during their graduate studies, say Hamman and Chegwiddden, who both worked with Professor Bart Nijssen. For Hamman, that includes climate modeling expertise as well as interdisciplinary research experience he gained while working on the Regional Arctic System Model, which simulates how the Arctic region will change using climate modeling tools.

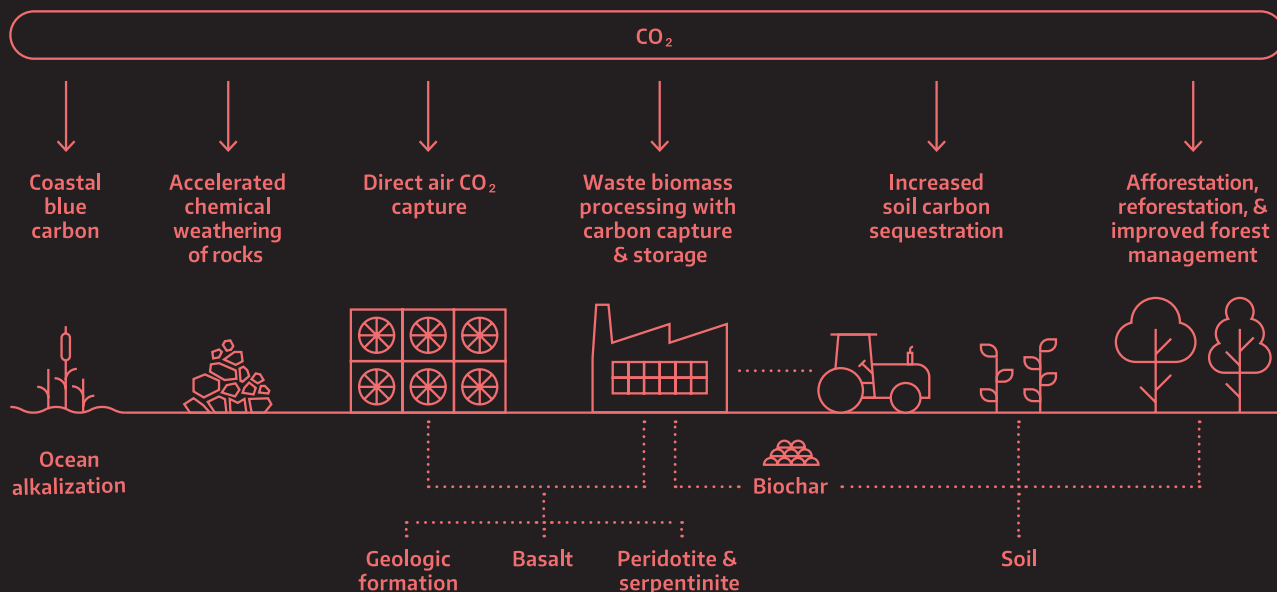
In addition to working with big data during her graduate studies, Chegwiddden is grateful for the policy experience she gained. While investigating the Columbia River snowpack, she worked with a variety of stakeholders, from ecosystem scientists to meteorologists to hydropower specialists, to discuss how to prepare for climate change.

“I learned two big things — one was how interdisciplinary collaborations can strengthen the impact of science,” says Chegwiddden. “I also learned the importance of getting information in the hands of people who need it. It’s very meaningful.”

 **Learn more about CarbonPlan’s work at carbonplan.org**

Below: A diagram of different carbon dioxide removal (CDR) approaches from the CDR Primer, the first textbook on the topic. The CarbonPlan team helped write, edit and produce the resource as an open source web book, with a print version coming soon. Image courtesy of CarbonPlan.

Carbon removal

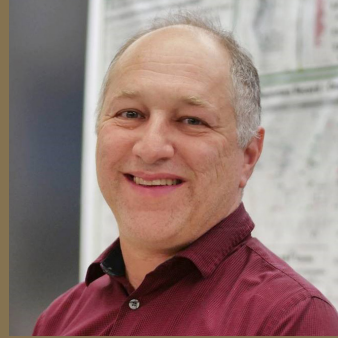


DEPARTMENT NEWS

Twice the expertise Visiting Burges Professors joined the department for spring quarter

Two visiting professors means twice the expertise. During spring quarter, faculty from Germany and Colorado shared their knowledge and outside perspectives with the department by teaching classes, meeting with researchers and giving lectures.

From the University of Colorado Boulder, Karl Linden is a professor of environmental engineering and the Mortenson Professor in Sustainable Development. His expertise involves novel water and wastewater treatment systems, including advanced and innovative ultraviolet systems for inactivation of pathogens and degradation of organic and other emerging contaminants. Linden also researches sustainable implementation of water and sanitation technologies globally. While at the UW, he collaborated on ultraviolet-related research for contaminant degradation, as well as sanitation solutions for marginalized communities. He also taught a series of classes on water reuse, gave a research seminar and met with various research groups and students.



From the Technical University of Berlin, Timo Hartmann is a professor of systems engineering. He oversees the teaching program of the Civil Systems Engineering department and conducts research on complex infrastructure system management and circular economy for the built environment, which is a model of production and consumption that involves reusing materials. While at the UW, Hartmann conducted research on how the increased use of digital technologies affects minorities within the engineering workforce. He also taught a class on integrated collaborative engineering practice as well as a Ph.D. seminar titled “The Role and Future of Civil Engineering as a Profession.”

The visiting professors were made possible thanks to financial support from the Burges Endowed Visiting Professorship program.

Karl Linden from University of Colorado Boulder, left, and Timo Hartmann from the Technical University of Berlin, right.

New faculty, new appointment

DEOHS faculty member to work closely with environmental engineering group



It must be her engineering mindset, but incoming Department of Environmental and Occupational Health Sciences (DEOHS) Assistant Professor Erica Fuhrmeister saw an opportunity to create a new type of interdisciplinary appointment — one that will enable her to work closely with the CEE department.

Fuhrmeister comes to the UW following postdoctoral work at the University of California, Berkeley,

where she also received her Ph.D. in environmental engineering. With DEOHS as her home department, she will work at the intersection of public health and environmental engineering.

Joining the UW in June 2022, Fuhrmeister will also assume a 0% tenure track appointment in CEE. This type of appointment will make her more prominent within the department and will facilitate a closer working relationship than most adjunct faculty.

In addition to engaging and collaborating with environmental engineering faculty members, Fuhrmeister is also interested in advising CEE master’s and Ph.D. students.

“The connection to engineering was really important to me. I didn’t want to just have an affiliation, I wanted to be involved in the engineering community,” Fuhrmeister says. “It’s important to me to be visible to engineering students — my background is in engineering, and it’s what I’m familiar with.”

On the recent research front, Fuhrmeister is working to understand the environmental transmission pathways of pathogens, particularly in low- and middle-income countries where lack of adequate sanitation often leads to the transfer of infectious diseases between animals and humans. A related topic that she is investigating is antimicrobial resistance, as the increased use of antibiotics in the past century has made it more difficult to treat infections. During her postdoctoral work, she researched the transmission of antibiotic resistance genes between humans, animals and the environment in Nairobi, Kenya.

“I am trying to understand the transmission of pathogens in the environment in order to take more of a preventative approach and prevent illnesses,” Fuhrmeister says. “The focus on pathogen infection is the clinical side, but what I care about is preventing infections from ever happening. This means stopping pathogens from being transmitted in the first place.”

New earthquake engineering certificate program

It's groundbreaking news, or perhaps ground shaking is more accurate: This spring, Civil & Environmental Engineering launched a new certificate program in earthquake engineering.

"We are excited — this is something we've been wanting to do for a long time," says Associate Professor Mike Motley. "We have a very strong program in earthquake engineering and want to offer people that additional background for structural design."

With the goal of enabling engineers to design more resilient infrastructure, the certificate program is intended for practicing engineers, or those who are planning to work, in regions with an increased risk of seismic activity, which includes Washington, Oregon and California.

"There are some pockets around the rest of the country, but the majority of seismic activity is along the West Coast," Motley says. "The 'big one' is also a West Coast phenomenon, which is an urgent concern."

The Pacific Northwest is overdue for a Cascadia Subduction Zone earthquake, which makes the certificate program even more timely. The Cascadia Subduction Zone extends from Vancouver Island, B.C., in the north to Cape Mendocino, Calif. in the south. All structures located in a seismically active region must be designed following specific building codes, in order to meet a desired performance.

"There is a great demand for engineers with this skillset," says Associate Professor Paolo Calvi. "The majority of design and consulting firms located on the West Coast of the U.S. and Canada predominantly hire engineers who can manage seismic-related issues. This is also becoming common for firms located in non-seismic regions too, because they want to successfully bid on projects located in seismic areas."

Comprised of three courses, the certificate program can be completed in nine months. Classes cover a broad range of topics, from fundamentals to design to advanced topics. Students will gain a skillset beyond what is covered in traditional undergraduate earthquake design classes and will practice applying real-world seismic design concepts using structural analysis software and industry-standard approaches.

"We have a very high-quality program, as the classes offered are also part of our master's and Ph.D. curriculum," Calvi says. "Students will be exposed to the exact same material and held to the same exact standards as our UW graduate students."

Held online with live lectures, the classes are taught by CEE faculty, several of whom have conducted research on the Cascadia Subduction Zone earthquake through the M9 Project. Instructors include faculty Jeffrey Berman, Paolo Calvi, Marc Eberhard and Travis Thonstad.





A mountain of LEARNING

Students practice drone surveying techniques at Mount Baker

There's an ideal way to learn about retreating glaciers: visit them for the day.

That's exactly what a group of UW students did in September 2021, when they hiked up to one of Mount Baker's most prominent glaciers, Easton Glacier, and learned how to gather highly precise data that can be used to track glacier change.

"It's a great educational opportunity — students just need a pair of hiking boots," says CEE Assistant Professor David Shean. "There are things you experience when you are standing next to a glacier that you just can't learn in a classroom. Students feel the wind and hear the roar of the waterfall as the glacier melts. They realize there are daily variations in these things, and you don't get that from a textbook or PowerPoint slides."

Photo above: CEE Ph.D. student Hannah Besso's sunglasses reflect an image of the glacier. Photos by Mark Stone/University of Washington

About twice per year, Shean takes students out to the glacier. Many have already taken or are planning to take Shean's Advanced Surveying class, which covers modern surveying techniques for scientific and engineering applications.

"To go through the calculations and match up the elevation models and see clearly where the glacier has thinned was interesting," says CEE Ph.D. student Seth Vanderwilt. "Just from standing on the hiking trail, if you took a picture every year, you would struggle to put a number on how much ice has melted away."

The outings are a mix of teaching opportunity and research for Shean, who has been studying the glacier, located in the North Cascades, since 2014. During his Ph.D. studies, Shean started using satellite data to track glaciers in Washington and continues to monitor glacial change. In the past seven years, he has observed hundreds of meters of retreat and up to 20 meters of thinning in places.

"It's important to monitor sites like Easton to understand the impacts of regional climate change, but coupled with that are changes in the snowpack, vegetation and surrounding landscape, such as bedrock that was covered with ice for thousands of years," Shean says. "We are building a record that can be used to study this interconnected system in detail."

Gathering glacier data

After crossing glacial streams and hiking three miles through an old-growth forest, an alpine meadow and up a 180-foot tall moraine ridge created by the shifting glacier, the group set up their home base directly above the glacier. They surveyed the lower part, called the terminus, as well as the rocky area below the glacier. For many of the students, this was the first time they used drones to conduct an outdoor field survey.

“Since I’d never flown drones before, doing this fieldwork gave me more confidence and background,” says CEE Ph.D. student Hannah Besso. “Talking about techniques is great, but actually going out and doing it yourself helps the most.”

A few students ventured into the valley below to place ground control point targets that would help lock in the precise locations of the drones and surface of the glacier, while other students helped launch the two drones: a quadcopter and a small fixed-wing drone with a 3-foot wingspan, for mapping larger areas.



Equipped with high-resolution cameras, the drones captured a variety of photos from different locations and angles. The students also gained valuable experience with satellite navigation and positioning, which would be important for their later modeling efforts. Survey-grade Global Navigation Satellite System receivers on board the drones communicated with multiple satellite networks to pinpoint the precise location where images were captured.

“Even with the best-available satellite images, the resolution and geolocation accuracy of our measurements is around a few feet. Using the drones, we can get down to a few centimeters, which enables all sorts of new science questions to be answered,” Shean says. “We can measure subtle changes as well as capture the rate of change, which shows how the glaciers are evolving over time.”

Photo above left: CEE Assistant Professor David Shean, center, explains how to perform a Global Navigation Satellite System survey, where receivers on board the drones communicate with multiple satellite networks to pinpoint the precise location where images are captured.

Above right: The Easton Glacier.



Creating 3D models

Gathering highly precise data is just the first step. In Shean’s Advanced Surveying course, students learn to use software to stitch the drone images together and create 3D models and topographic maps.

For the final class deliverable, students apply what they’ve learned to a project of their choice. Teaming up with classmates, Vanderwilt processed the images gathered at Easton Glacier in September, along with all of the data going back to 2014. The students created a time series analysis with a combined 6,500 drone images, which revealed approximately 3-4 meters of thinning over the lower glacier each year.

For Besso’s final project, she worked with classmates to collect new drone imagery at the site of the 2014 Oso landslide, which they used to create data visualizations. Comparing their 3D models to post-landslide data gathered by the United States Geological Survey, the students found that in the aftermath of the landslide, the banks of the North Fork of the Stillaguamish River were eroding and the channel was widening.

“We took the project from the idea phase to going out to the field site to fly drones on a weekend,” Besso says. “It was something that was within our ability level after taking the class, but it took some training and planning because there were tall trees and challenging terrain and we didn’t want to crash the drones.”

Sought-after skillset

Hands-on experience gathering, processing and analyzing high-resolution topographic data gives students an advantage when applying for jobs, says Shean. Environmental consulting firms now rely on drones for inspections and mapping, but drone surveying is not taught in traditional college courses.

“It gives our students a leg up,” Shean says. “They understand the data acquisition, software and how to deliver a final product. I get emails from students who took this class in previous years saying they did a drone survey at their new job and it worked beautifully. It’s one of the most rewarding aspects of teaching courses like this at UW.”

PacTrans offers new summer program for middle schoolers

A new transportation course for middle school-aged students will be offered this summer, thanks to a partnership between the Pacific Northwest Transportation Consortium (PacTrans) and UW Continuum College's Youth & Teen Programs. The course, Introduction to Autonomous Cars, will enable sixth to eighth grade students to learn about important topics related to autonomous vehicles (AVs) and their supporting infrastructure. Students will also work with a team to build their own AV using LEGO Education SPIKE Prime Kits, which combine building blocks and other elements with hardware and software.

During the course, students will hear from expert guest speakers on topics such as traffic safety, traffic control, sensing/computer vision, autonomous vehicles, human factors, advanced robotics



and more. They will also get hands-on practice automating vehicle movements by integrating sensors, algorithms and a computing unit. Students will also have the opportunity to take field trips to on-campus labs and hear from UW researchers and scientists.

The objective of the course is to stimulate more interest in transportation-related education and careers among middle school students, as well as general STEM learning topics. PacTrans leaders hope to make this course an annual offering and to work with the UW Youth & Teen Programs team to add more transportation focused courses in the future.

SCTL celebrates five years of success

In celebration of its fifth anniversary, the Supply Chain Transportation and Logistics Center (SCTL) is looking in the rearview mirror. In five years, the Center has made progress defining urban freight management problems, measuring and quantifying the urban freight system, and designing and pilot testing novel solutions to make urban freight more efficient and sustainable.

The Center is home to the Urban Freight Lab, founded in October 2016 as an innovative partnership that brings together academic researchers, private industry and governmental agencies. The Lab's work is focused on a problem area they identified as the "Final 50 Feet," now a widely used term that describes when delivery drivers must locate both parking and customers. The Lab recently completed a three-year project to reduce energy consumption in urban delivery, funded by a \$1.5 million U.S. Department of Energy grant with additional contributions.

The Lab has undertaken numerous innovative projects, including piloting a common-carrier parcel pick-up locker system at the 62-floor Seattle Municipal Tower, which enabled drivers to deliver to numerous recipients with just one stop. Three other locker systems were installed in Seattle's Belltown neighborhood along with in-ground sensors to gather data about delivery patterns and loading zones. Researchers also developed OpenPark, a first-of-a-kind app providing real-time and predicted parking availability, and piloted one of the nation's first zero operating emissions delivery hubs that utilized electric-assist cargo bikes, delivery routing software, and electric pallets to move parcels from a transportation hub to customers.

The Lab looks forward to continuing their work and seeing the transformation of the urban freight system into a safe, sustainable and accessible system for all.

SCTL Director and Professor Anne Goodchild cuts a cake.



RAPID Graduate Scholars Program

The Natural Hazards Reconnaissance Facility (RAPID) has established a Graduate Student Scholars program to help expand the pool of natural hazards and disaster researchers. The new program aims to train graduate students on using state-of-the-art field instrumentation and data collection tools, as well as post-processing and analysis techniques. Students will also learn archiving practices that will enable data reuse by the broader research community. To support their proposed work, graduate scholars selected to participate in the program receive a \$3,250 grant in addition to waived equipment use fees and other support services.

Three graduate students have been selected to participate in the inaugural program: Amber Spears from Jackson State University, in Mississippi, will be conducting field reconnaissance on five small dam failures following torrential rain and flooding; Tyler McCormack from Northeastern University will be combining optical and acoustic methods to enhance wave observations in nearshore environments during storm events to help protect vulnerable coastal communities; and Julia Loshelder from University of Arkansas will be investigating soil strength changes at the site of a significant landslide in Norway to assess the risk of a future landslide and possible threat to nearby residents. The graduate students are expected to begin their research projects in summer 2022. The data they collect will be archived and shared in the DesignSafe data repository.



TRAC works to expand transportation equity

Nearly every journey in a city depends at some point on a crucial, yet often overlooked bit of urban infrastructure: the sidewalk. Yet the digital maps and transportation apps that have revolutionized urban navigation over the past two decades contain little information about sidewalks or other pedestrian infrastructure. That poses a particular problem for people with mobility-limiting disabilities, for whom a cracked or uneven sidewalk or a missing curb ramp can be an insurmountable barrier.

A growing group of UW engineering and computer science researchers are making digital wayfinding more equitable and accessible to a broader segment of the population via a series of projects focused on sidewalks. One project, which aims to link sidewalk accessibility data

to the broader transportation network, is the Transportation Data Equity Initiative (TDEI), supported by an \$11.45-million, multiyear award from the U.S. Department of Transportation. The initiative is co-led by Mark Hallenbeck, director of the Washington State Transportation Center (TRAC), which acts as a link among government agencies, university researchers and the private sector, working to coordinate transportation research efforts.

TDEI aims to refine and help gain adoption of international data standards for three elements of the transportation system: sidewalks (the next iteration of an existing effort to develop data standards for sidewalks, called OpenSidewalks); navigating transit centers; and paratransit, which includes on-demand shuttles and community transit on Native American reservations. The initiative will develop procedures to collect, store, update and publish these data as a feed.



THE INEQUITY OF AIR

Two new studies highlight air pollution disparities

In recent months, two new air pollution studies have been published, both of which highlight how people of color are exposed to higher air pollution levels. The research was conducted by CEE Professor Julian Marshall and collaborators from the department and other universities.

Pollution disparities for people of color

People of color are more likely to be exposed to six major air pollutants, regardless of income level, across the continental United States. UW CEE researchers investigated disparities in exposure to six major air pollutants in 1990, 2000 and 2010 by comparing models of air pollution levels to census data — including where people live, their racial/ethnic background and their income status. Previously, the researchers showed that Americans of color were exposed to higher concentrations of nitrogen dioxide (NO₂), an outdoor pollutant from cars and trucks, in two census years: 2000 and 2010. Now, the team has expanded that research to look at five additional harmful pollutants: carbon monoxide (CO), ozone (O₃), sulfur dioxide (SO₂) and particulate matter — both larger particles, such as dust or pollen (PM₁₀), and smaller particles, such as molecules from vehicle exhaust (PM_{2.5}). For all pollutants except for PM_{2.5}, the researchers expanded the census years studied to include 1990, when the Clean Air Act was revised to address air pollution and emissions. They published their results in *Environmental Health Perspectives* in December 2021. The research team included CEE Ph.D. student Jiawen Liu, Lara Clark, who completed this research as a postdoctoral researcher, and Matthew Bechle, a postdoctoral researcher.

Housing discrimination and air pollution

Housing discrimination practices dating from the 1930s still drive air pollution disparities in hundreds of American cities today, according to a study from a UW and UC Berkeley research team. The team examined more than 200 cities and found a strong correlation between present-day air pollution levels and historical patterns of redlining. The term “redlining” describes a widespread federally backed discriminatory mortgage appraisal practice in the 1930s, which color-coded city areas red if they included high concentrations of Black, Asian, immigrant or working-class residents. The practice essentially blocked access to favorable lending, and historically redlined areas have been cumulatively affected by a low prevalence of home ownership, uneven economic development and lack of access to education and economic opportunities. The researchers compared year-2010 levels of two regulated air pollutants — nitrogen dioxide (NO₂) and fine particulate matter (PM_{2.5}) — to redlining maps in 202 U.S. cities. In these cities, redlined areas consistently had higher levels of pollution today than areas that received favorable treatment. The long-lasting implications of historical segregation on present-day disparities are striking, according to the researchers, who published their findings in *Environmental Science & Technology Letters* in March 2022.

UW researchers investigated disparities in exposure to six major air pollutants in 1990, 2000 and 2010 by comparing models of air pollution levels to census data. Joel Muniz/Unsplash



Researchers have found that housing discrimination practices dating from the 1930s still drive air pollution disparities. Sarah McQuate/University of Washington

A life and a legacy

Frank Miles family supports Concrete Canoe Team and student scholarships

Alumnus Frank Miles (BSCE '60, MSCE '61) was clearly ahead of his time. More than a decade before the Concrete Canoe Team was founded in 1975, he was already experimenting with making concrete buoyant.

"He built a concrete boat and waterskied behind it for his master's thesis," says Lisa Kittilsby about her father. "His thesis was regarding lightweight concrete and he built the boat to show just how light-weight it could be."

At the age of 81, Miles passed away in December 2019. To honor his legacy — and his successful career building one of the largest construction materials businesses in the Pacific Northwest — his family established the Frank Miles Endowed Memorial Student Support Fund. They also gifted \$30,000 to the Concrete Canoe Team for workspace improvements.

"When he passed away, we were thinking of ways to remember him and decided to support civil engineering. My dad earned a bachelor's and master's degree and was always proud of that," says Kittilsby.

After graduating, Miles took over the family business. Although he had hoped to teach engineering at the UW, due to the sudden passing of his father he decided to help his mother run the business, which he grew from six employees to 900. Headquartered in Puyallup, the Miles Sand & Gravel Company is still family owned and operated, now by the fourth generation of family. The business specializes in supplying construction materials such as sand, gravel, concrete and asphalt.

"In his retirement years, my dad loved to see the projects we got to pour concrete on, such as the new Amazon buildings," Kittilsby says.

After retiring, Miles relocated with his wife, Jeanie, to Sitka, Alaska. Entertaining and hosting family and friends brought him much joy. In addition to his two children, Lisa and Walt, he had nine grandchildren and two great-grandchildren. Miles also spent much of his retirement fishing and boating in Costa Rica and Alaska — a lifelong love that can be traced back to his time at the UW.

"He used to tell us a story, which we thought was hysterical, about how he lived across Lake Union from the UW and rowed a boat to campus every day from a houseboat he rented," Kittilsby says.



On his boat, Alumnus Frank Miles leads a fishing expedition in Alaska.

"When he passed away, we were thinking of ways to remember him and decided to support civil engineering. My dad earned a bachelor's and master's degree and was always proud of that," says Kittilsby.



Help support students: Consider donating to the Frank Miles Endowed Memorial Student Support Fund: <https://bit.ly/3KMuy1Y>



INVESTING IN students

CEE alumni step forward to help fund two building initiatives

CEE alumni are skilled at solving infrastructure problems. So perhaps it's no surprise that several have generously stepped forward to help fund two building initiatives currently underway at both the college and department levels.

Reliant on philanthropic support, both projects are intended to greatly enhance the student experience and better meet today's engineering education requirements by modernizing existing space as well as creating new space for students to learn and collaborate across departments.

Here, CEE alumni share what inspired them to get involved in paying it forward to the next generation of engineers.

Modernizing More Hall

At the department level, an initiative is currently underway to modernize and update More Hall, which was built in the 1940s and houses the CEE Department. Preliminary plans include creating a welcoming entrance to the building, a lobby to serve as a central gathering space, equitable restrooms and enhancements to the computer and teaching labs.

Renderings of the IEB's exterior and interior spaces courtesy of KieranTimberlake.

When recent alumnus Alex Ratcliff (BSENV '19) learned about the effort, he immediately decided to become involved. Passionate about creating a more inviting space for future students, Ratcliff will help fund the creation of a lobby through a five-year pledge.

"It would be great to have More Hall feel more welcoming and comfortable for students," says Ratcliff, who works as a sustainability engineer at PAE Consulting Engineers. "That psychological shift will go a long way toward inspiring students to consider CEE as a potential major."

As part of the inaugural class to graduate from the BSENV program, Ratcliff knows how important it is to encourage students to consider environmental engineering as a career field. He also knows first-hand the rewarding nature of the work and hopes more students will have the opportunity to make a difference in the world.

"UW brought me so much — I want to give others the same opportunity in the department that I call home," Ratcliff says. "I feel strongly that the work that CEE can do with the right students will benefit the community more in the long-run than what the money would do for me."

New interdisciplinary building

At the college level, planning is underway to create the Interdisciplinary Engineering Building (IEB), an academic home for students from all 10 engineering departments. The new building will allow the college to accommodate a growing student body and will be particularly beneficial for departments with space constraints, such as CEE. The state has approved design and construction funding of \$50 million, which the college seeks to match with private philanthropic investments to meet the estimated project cost of \$90 million.

When alumnus Mark D'Amato (BSCE '78) and his wife Linda (BA Architecture '78) learned about the vision for the IEB, they quickly stepped up to support the new building, which will offer additional classroom and lab space for the various engineering departments.

"The IEB is the first building to come along that we can call an extension of the civil engineering department. It also gives us an opportunity to not only expand the civil engineering department, but combine several disciplines with it," says D'Amato.

The interdisciplinary nature of the IEB, which will include space for cross-disciplinary courses and interaction across departments, will bring a broader perspective to students, says D'Amato. Recently retired from DCI Engineers, which he co-founded, D'Amato says his company encouraged employees to learn about the various engineering disciplines to become stronger team members.

The design of the new building also appeals to the couple, as incoming students and visitors will learn about the range and variety of engineering disciplines through displays and interactive features.

"It will certainly be a dynamic building. Hopefully it will entice students to pursue civil engineering, as we have a shortage of civil engineers," says D'Amato.



In addition to the modern building features and design, the couple was also inspired to help fund the IEB as a way to give back to their alma mater, which they say set them up for success. DCI Engineers started in the basement of their home and grew to become a national company with nearly 400 employees.

"We think that everything we've achieved in our lives is due to our education at the UW," D'Amato says. "We are very grateful."

Below left: Linda and Mark D'Amato (BSCE '78) Right: Alex Ratcliff (BSENVE '19)

JOIN THE EFFORT!

If you are interested in making an investment in More Hall upgrades or the new Interdisciplinary Engineering Building, please reach out to Kaitlin Colleary at kaitcoll@uw.edu or Janeka Rector at janekar@uw.edu.



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ENJOY THE VIDEO: 2022 BURGESS LECTURE

In May, Professor Emeritus Steve Kramer presented a talk titled “Big, Small, Fast, Slow: Geohazards I Have Known.” An expert in geotechnical engineering, Kramer examined a variety of geohazards and discussed examples from his 44-year career. He has been involved with the investigation of a number of geotechnical features — from landslides that traveled 100 feet to one that traveled 1,000 miles, and from residential homes that moved an inch to a 650-foot high-rise that settled and tilted sufficiently enough to be featured on “60 Minutes.”

Enjoy the video at ce.washington.edu/news/lecture/burgess