Greetings alumni and friends,

As I pen these words to share this latest edition of our civil and environmental newsletter, I am struck by the profound impact our program continues to have on the lives of people locally, statewide, and around the world. We are continuing to make tremendous strides in research, education, and outreach activities.

Our world-class faculty are involved in significant research activity with expenditures exceeding $8 million this past fiscal year and an associated strong graduate program with more than 140 students and post-doctoral associates. Their research contributions continue to have real-world impacts, whether in developing better materials for Washington bridges, making advances in building new environmentally-friendly wood building materials for earthquake performance, or in improving the understanding of climate change effects on indoor air quality.

Our undergraduate program remains vibrant with more than 550 students. We have modernized our curriculum to meet changing societal needs and the challenges of tomorrow. Our students are best known for their hands-on, real-world work, so it’s exciting to see their participation in a real-world effort to develop sites for a future aviation biofuels industry. We are excited about the establishment of the new bachelor’s degree in construction engineering program slated to begin in fall 2016. This degree program is unique and combines the best of civil engineering and construction management. It will be the first of its kind in the Pacific Northwest.

Our faculty continue to be recognized nationally and internationally for their research, education, and professional and outreach services, and as leaders in their respective fields. The exciting new faces joining our journey will further strengthen our programs and make transformative contributions in research and education to meet the grand challenges facing society. We are particularly excited about the addition of professors Jan Boll and Timothy Ginn to our water resources program and look forward to their contribution in greatly enhancing its reputation.

This year, we are celebrating the 125th anniversary of Washington State University. Our civil engineering program has been an integral part of WSU from its earliest days, helping to meet our important land-grant mission and providing a prepared workforce to meet societal and industry needs. The strength of our program has benefited from the generosity and support of our alumni and friends. Our alums and donors have gone on to have a large impact in Washington state and around the world, and they understand the importance of the work we do here. We are so appreciative of our alumni and donors who provide important research support for our professors, support our student clubs, or provide needed equipment and upgrades for our laboratories. Given state funding trends, your support will be even more important in the future, whether through gifts and legacies or through engaging with and promoting the department in whatever way you find fulfilling.

Our department is in very good shape, and alumni should take great pride in that, not least because the department’s reputation is dependent on your success in life; and reciprocally, the reputation of the department in the future will redound to your credit. Looking to the future, we will continue to build on the successes and strengths of our department and programs.

I welcome you to visit us, especially if you have not been in the Palouse region for a while, as a lot has changed for the better on the campus and the community over the past decade. In the meantime, please stay in touch by visiting our webpage or reach us via email. I look forward to hearing from you.

All the best and Go Cougs!,
Balasingam Muhunthan
From the Chair’s Desk

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Researchers test a better concrete for Washington bridges

A group of Washington State University and University of Washington researchers are collaborating to develop and test a new high-performance concrete for Washington bridges using locally available materials.

Led by WSU Professor Pizhong Qiao and UW Professor John Stanton, in collaboration with Bijan Khaleghi, a Washington State Department of Transportation (WSDOT) bridge engineer, the researchers recently received WSDOT support for a two-year project to create and test the concrete, which is more durable and more than four times as strong as traditional concrete.

Qiao will lead materials development for the concrete mix, while Stanton will lead the structural tests. As part of the project, the researchers will also carefully evaluate the material and design.

“We have benchmarks and expectations to dramatically improve conventional concrete materials. We need to make sure our bridge joint design will meet these expectations,” he says.

Much of Washington’s concrete bridge infrastructure is more than 50 years old. With heavy traffic and continual abuse from Northwest weather, many bridges are in poor condition, says Qiao, professor in the Department of Civil and Environmental Engineering.

Qiao and Stanton, a professor of structural engineering and mechanics at UW, will be testing the ultra-high performance concrete (UHPC) for use in connection joints between bridge decks.

The researchers will be using locally available and inexpensive materials, including sand, to create the material. Made of ground quartz, super plasticizers, and steel fibers, UHPC is less porous and more homogeneous and can be in thinner sections than traditional concrete. It also allows for pre-cast construction.

Using the UHPC will allow them to reduce the joint width, compared to much larger traditional concrete joints, and significantly improve durability and performance, says Qiao. Because of its durability, the bridges will require less care and maintenance than those using traditional concrete.

“Once this material is developed, it can be used in other critical infrastructure components that are easily damaged,” Qiao says. “It can really improve a city’s civil infrastructure.”

WSU research leads to recycled concrete legislation

Every year, more than a million tons of concrete, asphalt, and other similar inert materials are disposed of in landfills in Washington state. After Haifang Wen, Colf Distinguished professor in the Department of Civil and Environmental Engineering, discovered concrete that is recycled performs just as well as newly manufactured concrete, the Washington State Legislature passed a bill calling for the use of recycled concrete in future building projects.

Wen researches sustainable concrete and asphalt production. Recycling concrete involves breaking down older concrete and remixing it into new concrete rather than mining and transporting new materials from mountainside quarries, a process that is both environmentally and fiscally costly.

“We save money and protect the environment,” Wen said. “It’s a no-brainer, really.”

Wen and his colleagues went to extensive lengths to measure the strength of the recycled concrete in order to prove its safety for use, and found it to perform just as well as concrete made with new materials.

The concrete industry was very interested in Wen’s research, and took that research to the legislature this past year. In April 2015, the legislature passed a bill that will require a 25 percent increase in the use of recycled concrete in the upcoming year, with usage steadily increasing for the following years.

“I’ve never seen that before. I never knew this project would become a bill,” Wen said. “I’m very honored.”

Mandatory concrete recycling opens up new avenues for Wen and his colleagues, as they will have more opportunities to work with the Washington State Department of Transportation and other government sectors to continue to improve sustainability in our transportation and building infrastructure.
Finding new uses for old wind turbine blades

Hauling an old or broken wind turbine blade to your local landfill can be challenging. They weigh 22,000 pounds, are over 170 feet long, and are generally located in the middle of nowhere. Finding a solution for what to do with the huge and cumbersome garbage is not just an academic exercise as the wind energy industry grows and a rapidly increasing number of wind turbines dot the landscape. More companies are facing the spendy proposition of disposing of the blades, which have an average lifespan of 18 years. Each wind turbine uses three of the monstrous blades.

“Talk about clean energy—that’s enough garbage to really fill a landfill,” says Karl Englund, a research associate professor in the Department of Civil and Environmental Engineering, who has spent more than a decade finding innovative solutions for waste materials in the Composite Materials Engineering Center (CMEC).

WSU researchers are working with Seattle-based Global Fiberglass Solutions Inc. (GFS) to recycle and manufacture composite fiberglass material from the decommissioned blades.

The trick to creating a successful recycling effort is to keep the process economical and simple, says Englund. Fancy thermal treatments, for instance, will raise the cost of recycled material. Stay away from the nasty chemicals and a lot of labor, too.

“If you’re going to use a bunch of chemicals or energy to make a product, it’s not going to be worth it,” he says. “Any added energy, labor, and chemicals will significantly add costs to a material that is already considered a waste product.”

For the wind blade project, the WSU researchers received the wind blades after they had been cut into palm-sized pieces by GFS, and then the researchers broke them down further and refined the materials by grinding and milling. A finished product from the blade materials could have a variety of applications, from floor tiles to plastic road barriers.

Earlier this year, the researchers began processing and testing the recycled wind blade materials and found that they held up well compared to many wood composites. GFS has recently begun working with Janicki Industries to move forward with the project.

The WSU researchers have also recently completed a project with Triumph Composites Inc. to explore recycling the carbon fiber composite materials that are used in many airplane parts, such as for flooring and ventilation pieces. Supported by a grant through the Joint Center for Aerospace Technology and Innovation, Englund used low energy methods to re-process the composite material to create potential new parts.
Researchers test new environmentally friendly wood building material for earthquake performance

Washington State University researchers recently put a new, environmentally friendly wood building material, which they hope might replace steel and concrete in buildings, to the test, shaking it to mimic a Pacific Northwest earthquake. The researchers hope the work will lead to the design and construction of tall buildings made of wood in the United States in the next five years.

Cross-laminated timber (CLT) has been called “plywood on steroids.” The material is created by stacking layers of lumber, with the grain facing in different directions, and binding them together using a urethane-based glue. The timber can be as strong as steel and has a good fire rating. It’s more sustainable and less energy intensive to make than steel or concrete. CLT can be used to create panels for ceilings, floors, decks, or walls, and because it is modular, allows for rapid construction of multi-story buildings.

The wood material has been used to build tall buildings in Canada, Europe, and Australia, but it hasn’t been used in regions with high seismic risk. The researchers are working to enable design and construction of CLT buildings in the United States by 2020, including in areas that are prone to earthquakes. U.S. building codes began including standards for the material in 2015.

Over the past decade, WSU has been conducting leading research on CLT product development and on developing customizable methods of creating the material that are similar to 3-D printing. Two buildings on the WSU campus use CLT, including the new WSU visitor’s center and the PACCAR Environmental Technology Building, currently under construction.

Led by Professor Dan Dolan, the researchers are investigating three potential structural systems to make tall CLT buildings safe from earthquakes. Their tests featured a two-story massive timber wall that was subjected to lateral forces, or the sideways shaking of an earthquake. The researchers are prototyping the system in full-scale and the results will be used to model buildings. The system has been shown to work, and the results are influencing the committee that is working on the design method for this system in smaller buildings. The researchers aim to incorporate this type of wall panel within the next few years, along with other earthquake-resistant systems throughout a tall wood building.

The team includes researchers from the Colorado School of Mines, Colorado State University, Lehigh University, the University of Washington, and the U.S. Forest Service, as well as industry partners from FP Innovations and ARUP, an engineering consulting firm. The work is funded by the National Science Foundation.

Green highway snow and ice control cuts the chemicals

By Becky Phillips, WSU News Service

Ice-free pavement. “Smart snowplows.” Vegetable juice ice-melt. Cold-climate researchers at Washington State University are clearing the road with green alternatives to the salt, sand, and chemicals typically used for highway snow and ice control.

As a nation, “we are kind of salt addicted, like with petroleum, as it’s been so cheap and convenient for the last 50 years,” said Xianming Shi, WSU associate professor in civil and environmental engineering.

But this winter, road salt was in short supply across the northern states. In some regions prices increased 10-30 percent since last year, said Shi. Also, there are public concerns about salt’s impact on the environment and how this might affect future generations.

“In 2013, the U.S. Environmental Protection Agency reported alarming levels of sodium and chloride in groundwater along the East Coast,” Shi said. “Once salt exceeds the legal threshold, there are increased health risks and you can’t use it for drinking water.”
In 2013, the U.S. Environmental Protection Agency reported alarming levels of sodium and chloride in groundwater along the East Coast. Once salt exceeds the legal threshold, there are increased health risks and you can’t use it for drinking water.” —Xianming Shi

Shi is assistant director of the recently established Center for Environmentally Sustainable Transportation in Cold Climates. It is the only center in the United States studying cold climate “road ecology,” which includes green snow and ice control plus issues with wildlife crossings, fish passages, dust, and the use of recycled materials in pavement.

Funded by the U.S. Department of Transportation with $2.8 million for two years, the center is a collaborative effort between the University of Alaska Fairbanks, Montana State University and WSU. Liv Haselbach is the WSU site director.

Shi recently presented his findings on environmental stewardship practices for winter roadway operations at the American Public Works Association Western Snow and Ice Conference.

A spendy enterprise
The United States spends $2.3 billion each year to remove highway snow and ice plus another $5 billion to mitigate the hidden costs associated with the process. That’s not counting the costs for city and rural road maintenance, said Shi.

The hidden costs include long-term impacts of salt, sand, and chemical deicers on the natural environment and road infrastructure as well as short-term impacts on semi-trailer trucks and other vehicles from rust and corrosion.

In Washington state, for example, road crews apply roughly four tons of salt per lane mile per winter season, said Shi.

“When a four-lane highway, you have 16 tons of salt per year in that one mile segment,” he said. “In 50 years, that’s about 800 tons of salt in that one mile – and 99 percent of it stays in the environment. It doesn’t degrade. It’s a scary picture.”

Indeed, and one that pales in comparison to the nine tons of salt per lane mile Shi said is used in Minnesota.

“To their credit, state and county agencies are doing a very difficult balancing act,” he added. “They have to look at safety first and sustainability second. On top of that, they have budget constraints. So I think research is crucial to help them out.”

Sensors and software
Though snow and ice control can appear quite simple—just plow the road and put on some salt or sand—Shi said getting it right is highly technical and involves detailed science and engineering.

His research has led to the advances and evaluation of sensitive new technologies like the smart snowplow, which comes loaded with sensors and is already being integrated into winter fleets, he said.

“Ordinary snowplows have at least one sensor to measure pavement temperature,” he said. “Smart snowplows not only read temperature but also residual salt from previous applications, the presence of ice and the amount of friction on the road. All of these readings help operators apply less salt.

“In the past, it was all done visually,” he said. “By the time you can see salt on the road, it’s way too much and is going into the vegetation and groundwater.”

Another innovation Shi helped evaluate is the open source software called Maintenance Decision Support System, funded by the Federal Highway Administration. The program can be installed at city maintenance shops or on snowplows.

“It can tell you current road and weather conditions, give weather forecasts, inventory salt supplies, and suggest application rates based on those variables. It also allows you to model alternative types of salts to see what will happen,” he said.

Green chemistry
At WSU, Shi’s passion is cooking up green deicers and ice-free pavement. In his laboratory, a brand-new, industrial size mixer awaits his “culinary” genius.

“There is a lot of talk about beet and tomato juice deicers that are meant to be less corrosive to vehicles, guard rails, steel bridges, and concrete pavement,” he said.

“They help, but there is still plenty of room for improvement.”

Besides tweaking the recipes for beet deicer, Shi has successfully developed an ice-melt composed of leftover barley residue from vodka distilleries.

He is also mixing up several new types of concrete that can streamline snow and ice removal while protecting the infrastructure. Deicer-resistant concrete, for one, doesn’t break down as quickly in the presence of salt and chemicals, thereby extending the life of roads and sidewalks, he said.

For ice-free concrete, Shi adds nano- and micro-sized particles that make the pavement less prone to icing over. By producing a surface barrier, the mixture prevents bonding with snow and ice. This, in turn, makes plowing easier and decreases the need for salt, he said.

Shi hopes to see ice-free pavement also used for sidewalks and parking lots.

“Our ultimate goal is to apply the best amount of salt, sand or deicers at the right location at the right time,” he said.
Voiland College of Engineering and Architecture researchers will soon be measuring air quality in a dozen local homes as part of a national study on climate change’s effects on future indoor air quality.

While people spend 80 percent of their time inside, little research has looked at how the changing climate will affect the indoor environment, says Brian Lamb, Regents Professor in the Department of Civil and Environmental Engineering who is leading the project. The three-year, multidisciplinary project is funded by the U.S. Environmental Protection Agency and includes researchers from civil engineering, computer science, and construction management.

Outdoor air pollution infiltrates into homes, but the problem is made worse when people keep their houses closed up during really hot weather—especially if the house lacks proper ventilation.

“One of the reasons we are interested in climate change is because what happens inside a home is, in part, driven by what is going on outside the home,” says Lamb.

The issue is also important because trying to reduce carbon dioxide emissions and save energy in homes requires sealing them up, which can decrease incoming fresh air and worsen indoor air quality.

“If there are new regulations related to addressing climate change through energy conservation, how will that affect the way the buildings are constructed, and how will that affect indoor air quality levels?” asks Lamb.

The researchers are using a sophisticated computer code developed by the National Institute of Standards and Technology (NIST), called Contam, to measure the air quality for more than 200 different housing types. These housing types represent the bulk of U.S. housing, and cover every form of building design from basic one-story houses to apartment complexes and three-story houses with a garage. They will look at both current and future indoor climate conditions in the homes.

“When we say future climate conditions, we’re talking generally about climate conditions in the 2050s,” says Lamb. “If the weather changes, then how will that affect people’s behavior, and in turn, how will that affect indoor air quality levels?”

The team will run tests on 12 local homes, measuring indoor and outdoor pollution, weather conditions, ventilation, and even the frequency of doors and windows being opened. They will then compare their real measurements to the computer model’s predictions.

“We use our measurements to understand how Contam works and how to best apply it,” explains Lamb. “Then we will turn around and use Contam to test the 209 housing types across the United States.”

The multidisciplinary team of researchers, including Professors Diane Cook, Tom Jobson, Max Kirk, Shelley Pressley, and Von Walden, will look at future climate scenarios at the regional level, track occupant behaviors in homes, and assess building structures and building codes.

“We are looking at the linkages between occupant behavior, indoor air quality, and climate change,” said Lamb. “We have people with the right expertise to cover all the different bases.”
A team led by Washington State University researchers have found that methane emissions from local natural gas distribution systems in cities and towns throughout the United States have decreased in the past 20 years, with significant variation by region.

The researchers found that upgrades in metering and regulating stations, changes in pipeline materials, better instruments for detecting pipeline leaks, and regulatory changes have led to methane emissions that are from 36 percent to 70 percent lower than previous Environmental Protection Agency estimates when the data gathered for this study are combined with pipeline miles and number of facilities. The study showed significant variation by region, with some areas showing higher than average emissions because of large differences in the age and type of pipe in different parts of the United States.

The study, published earlier this year in Environmental Science & Technology, provides the most comprehensive direct measurements yet of emissions from the distribution system. With a series of partner studies, it is helping to determine the natural gas industry’s contribution to U.S. greenhouse gas emissions and global warming. The distribution system includes underground natural gas pipelines as well as metering and regulating facilities and customer meters in cities and towns.

The research was led by Regents Professor Brian Lamb in WSU’s Laboratory for Atmospheric Research with assistance from Conestoga-Rovers and Associates, an engineering and environmental consulting firm. The study was done in coordination with major natural gas utilities and the Environmental Defense Fund (EDF) and was sponsored by the American Gas Association, Con Edison, EDF, National Grid, Pacific Gas & Electric, and Southern California Gas.
Earlier this year, Washington Governor Jay Inslee declared a statewide drought emergency. A woefully inadequate snowpack melted away by early April. Record warm temperatures and an unusually dry summer added to the challenges and meant less water was available throughout the state.

Welcome to the types of conditions one may expect in a warmer and changing climate later this century.

With its land-grant institutional history of providing practical solutions for the state, WSU's water program in the Department of Civil and Environmental Engineering is at the forefront of addressing management and availability of water, which promises to be one of the region's biggest future challenges.

“The only thing we can count on is there is no normal—there is so much variability in the system,” says Jennifer Adam, associate professor in the department and associate director of the State of Washington Water Research Center.

The WSU researchers are focused on human implications and real-world impacts. Whether dealing with drought, wildfires, or nitrogen pollution, many 21st century water challenges are related to management issues. WSU’s program aims to embed human decision-making into its modeling efforts, says Adam.

So, for example, WSU researchers were involved in a 2011 Washington State Department of Ecology study to look at predicted changes in surface water supplies in eastern Washington during the next 20 years. The comprehensive report was meant as a guide for developing new water supplies in eastern Washington. Led by Adam, the researchers developed a forecast for water supply and demand and assessed how future economic and environmental conditions, including water scarcity, will affect agricultural productivity. The researchers integrated three computer modeling programs, bringing together climate predictions, water management scenarios, and economics to better understand water supplies, demand for irrigation, unmet demand, and future crop yields.

To better understand how crop yields will be affected by climate change, the researchers worked as part of an interdisciplinary team that included Claudio Stöckle in the Department of Biological Systems Engineering and Michael Brady in the School of Economics. Kirti Rajagopalan, a graduate student in the Department of Civil and Environmental Engineering, and Georgine Yorgey and Chad Kruger with the Center for Sustaining Agriculture and Natural Resources also worked on the project.

The researchers are continuing their work and will soon publish the 2016 report. With sophisticated computer models, the researchers are taking a closer look at water supplies and the impact on specific crops, including dryland and irrigated crops. The 2016 forecast aims to provide scientific information to help state leaders make better decisions about where and how to fund water supply projects.

The water program has grown this year with the addition of two faculty members, Timothy Ginn and Jan Boll (see sidebar). Both researchers have strong leadership capabilities and a history of working as part of an interdisciplinary team on complex water issues, says Adam.

With their addition, the program will be able to conduct computer modeling of water issues at all scales, from 10 meters to 100 kilometer water basins, building better understanding of the interplay between water resources, the hydrological
The Department of Civil and Environmental Engineering continues to grow with the recent addition of professors Jan Boll and Timothy Ginn.

**Jan Boll** comes to WSU from the University of Idaho, where he was the director of Environmental Science, Water Resources, and Professional Science Masters programs and a professor in the College of Agricultural and Life Sciences, teaching in the area of biological and agricultural engineering.

His research areas include water resource systems, conservation practice effectiveness, watershed modeling and water quality, and eco-hydrology; he examines how the natural environment shapes the availability and quality of water for drinking and use in the natural environment. He teaches courses in hydrology, environmental water quality, and integrated water management.

At the University of Idaho, Boll also led the Waters of the West program, which allowed him to collaborate with scientists in a range of fields to perform integrated water resource analyses. This program, which is unique in the U.S., provides an educational component by bringing students and faculty from all relevant disciplines together in teams to perform comprehensive water basin analysis, and to study the issue holistically.

In 2010, he won a university-wide award for his interdisciplinary and collaborative effort in the program.

He is also a recipient of UI’s College of Engineering outstanding research faculty award, an outstanding faculty award from the Environmental Science Program, and the College of Agriculture’s outstanding teaching award. In 2013, Boll and colleagues were awarded the prestigious IGERT (Integrated Graduate Education and Research Traineeship) grant from the National Science Foundation on Adaptation to change in water resources: science to inform decision-making across disciplines, cultures, and scales.

**Timothy Ginn** will join WSU in January from the University of California, Davis, where he was a full professor in civil and environmental engineering.

Ginn brings with him expertise in hydrogeology and mathematical modeling of biogeochemical processes, with research interests including colloid filtration theory, bioremediation, microbial-induced calcite precipitation in porous media, horizontal gene transfer, acid-mine drainage, and groundwater age and sustainability. He teaches courses in quantitative biogeochemistry, hydrogeology, inverse problems, and probability and statistics, and does research with both graduate and undergraduate students.

He has published over 115 papers in journals such as Langmuir, The Geotechnical Testing Journal and Water Resources Research.

Ginn has been an invited lecturer at dozens of events and conferences in many countries. He was also awarded the Outstanding Engineering Mid-Career Award from the University of California, Davis, in 2010.

Before becoming a professor for the University of California, Davis, Ginn worked close to home—he was a research scientist at Batelle Pacific Northwest Laboratory in Richland, Washington.
Researcher wins Fulbright chair to study Arctic change

Von P. Walden is expanding international collaboration on research into thinning sea ice as the 2015 U.S. Fulbright Arctic Chair in Norway. Walden, a professor in Voiland College’s Department of Civil and Environmental Engineering, is spending four months at the Norwegian Polar Institute (NPI) in Tromsø, a small city north of the Arctic Circle, and is collaborating with colleagues throughout the country.

The Arctic has experienced some of the greatest effects of a changing climate, including dramatic reductions in sea ice. Walden has collaborated with NPI for a year to understand sea ice formation in the Arctic Ocean. Institute scientists have been conducting experiments aboard a ship frozen in the ice since January.

Walden is a member of WSU’s Laboratory for Atmospheric Research and joined the Arctic ship in May to make measurements of the atmosphere. The award, among the most prestigious Fulbright appointments, allows him to analyze data and improve atmospheric modeling in the Arctic as part of the ongoing collaboration.

Adam named among top 100 inspiring women in STEM

For excellence in mentoring and motivating students, WSU Associate Professor Jennifer Adam received a “100 Inspiring Women in STEM” award from INSIGHT into Diversity magazine.

This annual award celebrates women in science, technology, engineering, and mathematics who encourage the involvement of women in STEM fields. Adam was honored in the magazine’s September edition. Adam, who works in the Department of Civil and Environmental Engineering, is also the associate director for the State of Washington Water Research Center.

“Jennifer Adam is an amazing example of a faculty member who leads by example while guiding her students with kindness, compassion, and understanding,” said Sarah Anderson, a student who supported Adam’s nomination. “She encourages the female students under her tutelage but also minority and international students as exemplified by her diverse research group.”

Adam conducts research in hydrologic modeling, the hydrologic impacts of global change, Earth systems modeling, and land and atmosphere interactions. She is currently leading a multidisciplinary team of approximately 40 faculty and student researchers in the development of a computer modeling platform called “BioEarth.”

Adam is passionate about interdisciplinary research, and actively collaborates with faculty in biological systems engineering, chemical engineering, earth and environmental sciences, geology, atmospheric sciences, economics, political science, computer science, and biology, Anderson said, and she always strives to put students first.

Adam has won several departmental and college teaching awards, including the Voiland College of Engineering and Architecture’s Reid Miller Teaching Excellence Award and the Leon Luck Faculty Award as the Most Effective Professor in the Department of Civil and Environmental Engineering in 2014.

“Adam mentors and leads by setting the example,” Anderson said. “She shows her students how to obtain the mentoring and training they need by doing so herself and sharing that process with her students.”

Adam holds three degrees in civil engineering, including a bachelor’s degree from the University of Colorado, Boulder, and a master’s degree and doctorate from the University of Washington.

Researchers make atmospheric measurements as part of the Norwegian Young sea ICE experiment (N-ICE2015).
Coming soon: Construction engineering program planned for fall 2016

According to the American Society of Civil Engineers, America’s aging infrastructure needs $3.6 trillion in investment by 2020. To meet the employment needs of heavy/civil industries, the Department of Civil and Environmental Engineering (CEE) plans to offer the first accredited Bachelor of Science degree in construction engineering in the Pacific Northwest beginning in fall of 2016.

The initial intake will be limited to 25 students. The current specialization track for this high-demand program in CEE has proven popular, easily meeting its 25-student limit. This program is in collaboration with WSU’s construction management program. It is unique in higher education in the United States, offering crossover courses that meet industry needs, says Balasingam Muhunthan, chair of the Department of Civil and Environmental Engineering. The WSU civil engineering program has a reputation for providing job-ready graduates and provides a comprehensive design curriculum. Meanwhile, WSU’s construction management program is a leader in the commercial building industry.

The construction engineering program has been designed with support from more than 150 construction and engineering contractors. Graduates from the program will be able to enter the contracting industry with the ability to obtain a Professional Engineer license. Students in construction engineering will take core engineering courses as well as courses in heavy/civil construction administration, heavy/civil estimating, earthwork and equipment, human factors/management, delivery systems, and planning and scheduling.

In addition to the new anticipated construction engineering degree, the department is making additional curriculum changes to modernize programs and better meet student needs. Among the changes:
- Students will be required to take three sub-discipline courses instead of four. “This will allow students to take an extra course in their area of specialization,” says Professor Bill Cofer, who led a committee to assess changes.
- The curriculum committee is working with the Edward R. Murrow College of Communication to create a new technical communications course to improve student writing skills. The course was offered for the first time last spring as a pilot course.
- Additional or revised senior elective courses will be offered in traffic operation, traffic logistics, pavement maintenance, hydraulic engineering design, and sustainable pavements and bridges.

Students design pulp mill retrofits for a future biofuels industry

WSU civil engineering students worked on a unique, interdisciplinary project to design a retrofit for a pulp mill, so it might someday produce the sugars that are needed to make aviation biofuels.

The project is part of a large WSU-led research effort to identify a supply chain for production of aviation biofuels from forest and wood waste. One of the big challenges in turning slash piles into commercial products is processing and transportation costs as well as the cost of building new facilities, such as sugar depots. Sugar depots turn wood debris into simple sugars for use in biofuels. Pulp mills are ideal candidates to accommodate sugar processing because they use the same infrastructure, resulting in lower capital investment and greater economic sustainability for the mill.

As part of the year-long project, the students identified existing wood processing facilities throughout Idaho, Montana, Oregon, and Washington, and worked to rank facilities that could best be retrofitted to be a part of a potential supply chain. Students then designed a retrofit for a selected facility.

This project was part of the Integrated Design Experience, which brings together industry professionals with faculty mentors who guide groups of students as they tackle design projects focused on sustainability. Students came from a variety of disciplines, including civil engineering, architecture, and construction management. The work was supported by the Northwest Advanced Renewables Alliance (NARA), a WSU-led coalition of government groups, private industry, and universities centered on evaluating the feasibility of making bio-jet fuel and co-products from forest residuals.

“These students perform critical data gathering and analyses for the NARA project,” said Karl Olsen, clinical associate professor in the Department of Civil and Environmental Engineering. “At the same time, they’re getting invaluable hands-on and real-world experience that will help them become better engineers and designers.”
Sarah Waldo receives STARS Award

Sarah Waldo, a doctoral student in civil and environmental engineering, was among 105 students nationwide to receive Science to Achieve Results (STAR) fellowships from the U.S. Environmental Protection Agency. Waldo will receive up to $42,000 per year for two years to support research into factors influencing greenhouse gas emission and absorption in agricultural fields.

Because crops and soils can take up carbon dioxide, agriculture is a potential reservoir for removing and storing carbon dioxide from the atmosphere and mitigating climate change. However, farms also emit nitrous oxide, also known as laughing gas. Nitrous oxide emissions are small compared to human sources of carbon dioxide, but they are important because the gas is 300 times better at trapping heat than carbon dioxide over 100 years. It also destroys the “good” ozone in the stratosphere that protects life on earth from harmful ultraviolet radiation.

“To look at science and policy together appeals to me,” said Waldo. “I like learning about the world through science and research but I was also motivated by wanting to make a difference and by science that has impact. Keeping in mind how research can inform policies to protect the environment or human health is important.”

Student’s asphalt research gains national recognition

By Ethan Nash, Voiland College intern

A Washington State University student is helping the state transportation department investigate the use of steel in asphalt road paving to reduce tire wear. Shenghua Wu also is helping the agency evaluate the use of recycled asphalt shingles in pavement used across the state.

For this and more work in asphalt research, the graduate student in civil engineering is one of two nationwide recipients of the David R. Jones Scholarship from the Association of Modified Asphalt Producers. The award is presented yearly to young engineers and chemists doing research in asphalt paving technology.

Over the last three years, under the guidance of advisor Haifang Wen, Wu has been investigating and evaluating the long-term performance of warm-mix asphalts in 34 field studies across the United States with the aim of recommending best practices for their use. His research includes developing asphalt binders that perform well in low temperatures, studying the effects of engine oil on asphalt binders, assessing asphalt surface treatments, and testing fibers used in asphalt.

Wu earned bachelor’s and master’s degrees in civil engineering in China before coming to WSU in 2011 to pursue his doctorate with Wen, whom he thanked for guidance and for allowing him to work at WSU’s Washington Center for Asphalt Technology.

Dieckman and Marcy named top Voiland students

Civil engineering students Sydnee Dieckman and Devin Marcy were recently named outstanding students in the Voiland College of Engineering and Architecture.

Marcy, from Spokane, is a research mentor with the Office of Undergraduate Research and participated in undergraduate research with WSU’s Laboratory for Atmospheric Research. He is a member of the President’s Honor Roll. Outside of his civil engineering studies, Marcy is a member of the Concrete Canoe Club, where he helps design and build canoes made from concrete and aggregates.

Dieckman, from Olympia, participated in WSU’s Integrated Design Experience, where she helped to develop rubrics for siting analysis for a wood biomass to create a supply chain for jet biofuel. Upon graduation, she continued work that she started during her time at WSU in an engineering co-op at Puget Sound Naval Shipyard and Intermediate Maintenance Facility. There she works in the submarine nuclear reactor disposal division and in the nuclear propelled aircraft carrier repair division. She won multiple awards within the university, including being named Voiland College outstanding sophomore, outstanding Japanese student, and outstanding junior in civil engineering.
Students get real-world view of shaking quakes

Students in the Department of Civil and Environmental Engineering will gain improved understanding of how to design for earthquakes, thanks to a donation from employees of Coughlin Porter Lundeen (CPL), a Seattle engineering firm.

The donation supports an upgrade to the teaching earthquake table to help students better visualize how structures move in earthquakes. Students will use the table in the earthquake engineering and structural dynamics class as well as in the geotechnical earthquake engineering course.

“We thought this would be a perfect opportunity to enhance the classroom experience in regard to dynamic structures and earthquake design,” said Jim Coughlin, principal with CPL.

Every year the firm solicits donations from its employees, many of whom are WSU alumni. The company then matches the gift.

Especially in earthquake-prone Seattle, designing for earthquakes is what engineers do on a daily basis. Company engineers use computerized tools to model buildings in an iterative process, and it’s crucial that students not only understand the tools, but also understand what the numbers mean.

“When we hire a new graduate, especially a master’s graduate, we expect them to have the understanding of how to calculate for earthquake forces, how to distribute the forces to the various lateral elements, and how to design those elements for earthquake forces,” he said. “It goes hand in hand with designing a building.”

The earthquake table will allow students to model different structural elements and see how changes affect the behavior of the building. Often in the real-world workplace, there are competing demands that affect the geometry of a building and can complicate its design. The goal is for the structural engineer to collaborate with the design team to maximize the aesthetic and functional aspects of the building while maintaining an economical and safe structural design.

The earthquake table will allow students to see a structure as it shakes and will bring home the importance of what they’re doing, he said.

“When you have a visual tool, it really helps the students to understand it and generates their interest,” he said. “Rather than just reading about it in a book, watching it like that really sticks with you.”
Christopher McGann has been named the Colf Distinguished Professor in the Department of Civil and Environmental Engineering. This is the second professorship given to the department by alumnus Dick Colf. The professorship aims to advance excellence in civil engineering at WSU, providing annual funding for research and educational activities in civil engineering programs with an emphasis on geotechnical engineering and highway materials. The holder of the first Colf professorship is Haifang Wen.

Prior to joining the faculty at Washington State University, McGann conducted research at the University of Canterbury in Christchurch, New Zealand. There, he was on a team researching the role of 3-D nonlinear local site effects of the 2010-2011 Canterbury earthquake sequence.

McGann’s research interests include the analysis of structure-foundation-soil systems, constitutive modeling, and geotechnical site characterization. He holds a doctorate in civil engineering from the University of Washington, a master’s degree in structural engineering from the University of Washington, and a bachelor’s degree in civil engineering from Montana State University.

“We’re so grateful for support from this professorship, which makes a tremendous difference in being able to recruit and retain top faculty,” said Balasingam Muhunthan, chair of the Department of Civil and Environmental Engineering. “Especially in this important geotechnical research area that affects our nation’s infrastructure, the support helps us to start growing programs, compete with top schools in the country to bring the most productive faculty to WSU, and attract outstanding students.”

Colf, a 1966 alumnus, worked on and supervised many construction projects, including highways, levees, jetties, oil industry facilities, and dams during his extensive career. He was project manager on a $15 million, 450-person operation at Lewiston, Idaho, for the U.S. Corps of Engineers. He later spent two years managing work on the Trans-Alaska pipeline and the $126 million Terror Lake hydroelectric project on Kodiak Island.

Colf managed Kiewit’s Northwest district to an unprecedented 10 consecutive years as the company’s top performing district. He was named division manager in 1992 and at one point had executive management responsibility for six districts, covering much of the United States and all of Canada. He was selected to the board of directors in 1994 and the executive committee in 1998. Although he retired in 2009, he remained a member of the board until 2012.

In 2013, he was honored with the WSU Alumni Achievement Award, the highest honor bestowed by the WSU Alumni Association.

Kiewit Corporation, one of the largest construction companies in North America, provided support to renovate the construction management program’s primary teaching classroom and the Department of Civil and Environmental Engineering’s Laboratory for Asphalt Technology.

The construction studio project included aesthetic upgrades as well as technological improvements, such as new projection screens and a smart podium, which allows for a more interactive classroom. The improvements included remote access, allowing for easier interaction and connection between industry experts and students.

In the asphalt lab, the project entailed facilities renovations as well as upgrading testing equipment. The new equipment will allow research and testing of asphalt.
builds our civil engineering program

Donors ensure hands-on experiences for future students

They are annual and timeless Washington State University spring rituals that have changed the lives of generations of students.

There are the hours in the shop spent designing, soldering, and sanding. Bridge building practice with a stopwatch. Pouring concrete mixes. Road trips to competitions. Swamping, cracking, or paddling for a win. Presentations and timed races. And, finally, an awards ceremony and the long trip home.

WSU has long been known for its active chapter of the American Society of Civil Engineers (ASCE), where students get hands-on and real-world experience that they later bring into the workplace.

Thanks to support of alumni and donors, including from employees of Coughlin Porter Lundeen, and from Grant and Carol Buckingham, the student group has permanent endowment support that will provide funds for future generations.

“The employees and principals totally back this,” said Jim Coughlin, a principal with CPL. “We wanted to give back to the university because we felt we gained so much from going through the strong program that WSU has.”

As an undergraduate, Coughlin didn’t participate in a concrete canoe or steel bridge competition but fondly remembers being the only American club in a Canadian concrete toboggan competition. As he remembers, the WSU club was winning, but the Canadians changed the competition rules halfway through when they saw who was going to win.

More important than winning or losing the competition, though, was getting to work as a team on a project and learning the real work of designing and engineering.

“We were proud of the toboggan we made, had a lot of fun doing it, went on a trip, and had a great time,” he says.

As students, the Buckinghams were also active members of the ASCE student chapter, and Carol participated on the concrete canoe team.

For many alumni, the ASCE club activities were vital for their development as professional engineers, but the club also taught them valuable and fondly remembered life lessons.

“As a group, our alumni feel like we got a great education at WSU,” said Coughlin. “We want to give back and help make sure that the quality of education there is maintained.”

paving materials under specific environmental and engineering conditions.

“We so appreciate the support provided by Kiewit,” says Voiland College Dean Candis Claiborn. “The construction management and civil engineering programs at WSU have a long history of producing graduates who are work ready, day one. Support for this project will help us continue to turn out our top-quality graduates.”
CEE Program Data Highlights

Undergraduate Enrollment

Research Expenditures

OUTSTANDING FACULTY

4 Faculty Fellows of Professional Societies
- J. Daniel Dolan
- B. Muhunthan
- Pizhong Qiao
- Michael Wolcott

3 NSF CAREER Awardees
- Vikram Yadama
- Candis Claiborn
- Tim VanReken

2 WSU Regent Professors
- Brian Lamb
- Michael Wolcott

2 Fulbright Distinguished Chairs
- Liv Haselbach
- Von Walden

DONOR SUPPORT

$115 thousand undergraduate SCHOLARSHIPS

16 GRADUATE Scholarships
The Department of Civil and Environmental Engineering dates back to 1892, the very beginnings of WSU. The department, which was at first known as the Department of Mathematics and Civil Engineering, has graduated many distinguished alumni, starting with Carl Etsby and O.H. Stratton in 1897.

Civil engineering alumni went on to design the state and nation’s infrastructure, including floating bridges, transportation systems, airports, highways, and more. Lacey R. Murrow and Cecil Arnold are alumni who engineered the Murrow Floating Bridge in Seattle, the first of its kind. Alumnus William Bugge was best known for his design of San Francisco’s Bay Area Rapid Transit system. Alumnus Henry Heald was the president and director of the Ford Foundation, the largest philanthropic organization in the world.

Through its renowned research laboratories, the department’s faculty members have led groundbreaking research in many areas, including in hydropower dams, air and water quality, resilient building designs to withstand earthquakes and natural disasters, landslides and geotechnical earthquake engineering, climate change and water resources, composite and wood materials, biofuels, and asphalt green technology.

Fondly remembered by many alumni is Washington State College’s Survey Camp, which started in 1939 near White Pass. Each summer, students spent eight weeks at Camp Welch learning to survey, roughing it in the wilderness, being bitten by mosquitoes, and acquiring lifelong skills and friendships. The camp existed for nearly 40 years. Two professors, Harold “Hal” Sorensen and Roger Nelson, taught the summer survey class and worked at the camp. Nelson worked as a camp manager for about 30 years, and Sorensen was also a WSU alumnus.

Leon Luck was another well-loved professor and alumnus, who served the department for 40 years. As department chair, he was widely regarded as a guiding light, and credited for much of the department’s later success. He led the merging of the Departments of Civil and Environmental Engineering in 1973.

Today, the department includes nearly 50 faculty members and now graduates about 120 BSCE students per year, making it the 13th largest civil engineering program in the United States. Research totals more than $8 million a year, with four main areas of study: environmental engineering, geotechnical and transportation engineering, hydraulic and water resources, and structural engineering, materials, and sustainability.
Celebrating 125 Years