Civil and Environmental Engineering

Summer 2013

WASHINGTON STATE UNIVERSITY

From the Chair's Desk

Greetings alumni and friends,

I hope you enjoy this edition of our civil and environmental engineering newsletter. I have been a faculty member for more than 20 years here, and I'm now pleased to have the opportunity to serve in a leadership role as department chair.

This is a time of significant growth and exciting changes in our programs. In the past ten years, we have increased the number of bachelor degrees awarded from about 90 to 120 each year, and we have almost tripled the number of graduate students in our programs. We are now the 13th largest civil engineering program in the U.S.

Such growth has, however, put enormous stress on our faculty, facility, and staff resources.

A $3.8 million allocation from the state legislature this past year aims to help grow the number of engineering and computer science graduates in the state. As you know, our graduates are critical to growing a vital economy. With this allocation, we have had the opportunity to hire new faculty members in our focus research areas of water resources and atmospheric research. We have put forward plans to hire more faculty into our signature research programs and additional staff to ease the stress on our existing resources.

With support from industry, we are also starting a new construction engineering emphasis area within the department (p. 11). I look forward to helping this new program grow and to meet the significant industry need for graduates with a multidisciplinary engineering and construction background.

Our research programs have grown as well, from about $3 million to $7 million in the past 10 years. In this issue of our newsletter, you can read about some of our important research, such as projects to measure methane emissions coming from natural gas pipelines (p. 2), to develop bioasphalt (p. 5), and to assess construction and demolition debris in the region for eventual use in aviation biofuels (p. 3). In working to address critical problems related to energy and the environment, our research has a direct impact on the economy of the region and nation.

I want to thank you, our alumni and donors, for your valuable support. You make a tremendous difference in helping our programs succeed and grow during difficult economic times.

I also want to thank Dave McLean for his valuable service as department chair for the past 10 years. We are grateful for his hard work in helping to oversee much of the department's dramatic growth. He has accepted a position as the Dean of the College of Engineering at Colorado State University. We wish him our very best in his new leadership position.

I look forward to working together with you to continue to move our program forward. Please feel free to visit when you're on the WSU campus to find out more about what we're doing. I look forward to hearing from you soon.

Sincerely,
Balasingam Muhunthan

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The *Civil and Environmental Engineering Newsletter* is also available in electronic format. If you would like to receive e-publications from us, please send a note to Tina Hilding at thilding@wsu.edu.

Department Advisory Board

Natural Gas Methane Emissions Focus of New Study

Washington State University's Laboratory for Atmospheric Research is leading a nationwide field study to better understand methane emissions associated with the distribution of natural gas.

A WSU research team led by Regents Professor Brian Lamb is working to quantify methane emissions throughout local gas systems (from city border to customer meter) and use the data to estimate a national methane emissions rate for U.S. natural gas distribution systems.

"This work is important and the study is unique," said Lamb. "It is critical to do these careful measurements along the entire natural gas industry supply chain, so that we have a clear understanding of the impact of the industry's greenhouse gas emissions. These are critical questions as our nation faces the challenges of energy, sustainability, and climate change."

The work will be conducted with coordination and support from major natural gas utilities, the Environmental Defense Fund (EDF), and Conestoga-Rovers and Associates, an engineering and environmental consulting firm.

Potent Greenhouse Gas

Large amounts of natural gas are domestically available because of dramatic advancements in technology, creating significant economic and energy security benefits for the nation. Composed mostly of methane, natural gas is a cleaner fossil fuel that, when burned, produces less carbon dioxide and fewer greenhouse gas emissions than any other fossil fuel.

However, uncombusted natural gas is a potent greenhouse gas. When it is released into the atmosphere at various points along the supply chain, it has a higher warming potential than carbon dioxide, the principal contributor of manmade climate change. Greenhouse gas emissions from human activity are believed to be impacting the earth's climate.

Obtaining direct, carefully measured data under real-world conditions is essential to determine the scope of methane emissions from natural gas operations, including local distribution systems. The U.S. Environmental Protection Agency's (EPA) most recent assessment indicates methane emissions from natural gas operations are lower than previous reports, with data based on emissions estimates. A greater understanding of the total methane loss throughout natural gas operations can play a key role in development of sound energy policies and management practices.

Detailed, Accurate Measurements

The researchers are making direct emission measurements, component by component, at company gas facilities and for individual underground pipeline leaks.

The American Gas Association (AGA), EDF, National Grid, Pacific Gas and Electric Company (PG&E), and Southern California Gas Company (SoCalGas) commissioned this study to measure methane emissions when gas is routed through local service and distribution main pipelines, as well as gas metering and regulating stations.

The WSU study is part of a two-year research series in which EDF is collaborating with the natural gas industry and universities to more accurately characterize and understand methane emissions across the value chain. National Grid, PG&E, and SoCalGas are providing access to their gas facilities and equipment for tests in different regions throughout the country. Several companies are participating through AGA and are also providing access to their gas facilities for testing, including CenterPoint Energy, Citizens Energy Group, NW Natural, Piedmont Natural Gas, Questar Gas, and Xcel Energy.

"Brian Lamb and WSU's Laboratory for Atmospheric Research were instrumental in the first national natural gas emissions study issued by the EPA in the early 1990s," said Mark Brownstein, associate vice president and chief counsel of EDF's U.S. Energy and Climate Program. "His expertise is valuable in both designing the right scientific approach to gather data and then extrapolating those results nationally.

Charlotte Beall, a Research Experience for Undergraduates (REU) student in LAR, works to survey methane emissions from the local natural gas distribution system.

"We expect this study to continue to advance the discussion around methane leakage and, to the extent necessary, provide a business case for public utility commissions to better monitor and reduce leaks that lead to methane emissions," he said.

Field work began in April in multiple U.S. cities in coordination with local utilities and distribution service companies. The research team is carefully selecting numerous sites in various regions around the country that meet specific criteria in order to ensure that the dataset will be as comprehensive and representative for national scaling as possible. Results are expected to be released in a peer-reviewed journal in early 2014.

A scientific advisory panel comprised of professors and experts in the fields relevant to the study will serve as independent advisors, charged with reviewing the appropriateness of the methodologies, results, and statistical methods. ▮

Aviation Biofuels *By Alyssa Patrick, CEA Communications*

Tracking Wood in Landfills for Future Energy Source

Karl Englund's research would be easier if all homes were built of Legos.

"If we designed for disassembly like that, you could just build your house, take it apart when you're done with it, and then sell all the parts," said Englund, an assistant professor in the Department of Civil and Environmental Engineering at Washington State University.

Accessible Wood Waste

As part of the five-year, $40 million Northwest Advanced Renewables Alliance grant that is developing regional biofuel solutions, Englund is trying to find communities that produce the most accessible, usable wood waste.

His research is an important part of NARA's mission to develop an environmentally and economically efficient supply chain that will allow for an aviation biofuel industry in the Pacific Northwest.

Extraction and Energy Potential

If homes were built with Lego pieces, they could more easily be disassembled and reused to build something else. Since that is not the case, and most things are built with materials that mix products like wood with resins and other chemicals, tracking usable wood waste is a complicated process.

It is important to know how much actual wood is in those composites in order to determine how much energy it will take to extract the wood for use in biofuel production.

Wood waste can come from mills, forest waste, material recycling facilities (MRFs), and municipal solid waste sites (MSWs). The MSWs are day-to-day trash streams, or how our garbage gets from the curb to a landfill. Many communities also have MSWs that are specifically for construction and demolition (C and D) waste, which is where Englund is focusing his research.

Composites to Biofuels

"Forest waste is mostly bark and sticks. And a lot of furniture that we buy, like this desk for instance," he said, tapping on his light-brown desk, "are made of wood composites, wood materials mixed with resins and other chemicals that can be converted to biofuel."

The C and D sites in the NARA region (Idaho, Montana, Oregon, and Washington) hold more than 2.5 million tons of wood waste per year. Finding out how much useable wood waste is at each landfill might be manageable if they were structured the same, but they aren't.

> "We know there is wood in the solid waste stream, but there is no mainstream structure followed, not even within each state."

Mapping Landfills

"We know there is wood in the solid waste stream, but there is no mainstream structure followed, not even within each state," Englund said.

So he is trying to grasp the bigger picture by mapping out the Pacific Northwest based on landfills and MRFs. Since he does not have time to go from landfill to landfill documenting how much wood waste each has and how the wood is collected, he plans to develop a model that will predict answers to those questions based on factors that surround the landfills.

He is using a geographic information system (GIS) to do this mapping. A GIS combines software, hardware, and data on factors such as population density, industry, and other frameworks of a community that will help Englund predict the type and amount of wood waste produced there.

For example, if he can predict about how much housing material will be made from composites in 30 years, he then can compare that percentage with the amount of housing wood waste a specific landfill brings in each year to set up a model of predicting how much wood waste is usable in that landfill.

Englund is in the second year of this research; by the end of the NARA grant, he hopes to have models set up that tell researchers demographically what type of wood is where. This could help a future biofuel company find the most economically and environmentally viable locations for transportation depots and refineries. ▮

WSU Receives $1.5M for Columbia Basin Water Modeling

By Kathy Barnard, reprinted from WSU News

Finding ways to involve primary water users in the research process to develop scientifically sound and economically feasible public policy for water usage in the Columbia River Basin is the focus of a new, $1.5 million grant at Washington State University.

Scientists from WSU's School of the Environment and the WSU Center for Environmental Research, Education, and Outreach have received a USDA National Institute of Food and Agriculture grant to build a collaborative water modeling project in the Columbia River Basin. Assistant Professor Cailin Huyck Orr, an expert in inland waters, will lead an interdisciplinary, multicampus team of social scientists, earth scientists, economists, civil and environmental engineers, agricultural scientists, and policy experts in the Watershed Integrated Systems Dynamics Modeling (WISDM) project.

Orr said the timing of the project aligns with what is happening with the regional climate.

"The intent of this program is to learn how water systems and associated stakeholders will adapt to changes in climate and water availability," said Orr. Precipitation is already falling more in the form of rain and less in the form of snow than in previous years, releasing water more quickly into the watershed and reducing the more steady availability that snow provides as it gradually melts in spring and summer.

The WISDM project will use collaborative simulations informed by people who live and work in the region. The model will demonstrate how the needs and perspectives of both agricultural and urban users can promote or detract from established and sometimes conflicting goals for water management in the region. Hydrological models will take crop systems into account; producers will be able to see how switching from one crop to another can affect water availability and quality, and stakeholders can plan for future water availability under different scenarios. Additionally, the system will calculate how regional economic changes influence the decision-making of individuals and then forecast the combined effects on water use.

To evaluate the trade-offs between in-stream and out-of-stream water use, WISDM also will integrate information from a Columbia River Basin reservoir management model that generates suggestions for optimal reservoir releases under various scenarios.

Jennifer Adam of WSU's Department of Civil and Environmental Engineering is the technical lead of the WISDM project. As the lead principal investigator of WSU's BioEarth Land Modeling System, she will coordinate the application of BioEarth modeling to WISDM. She also will contribute large-scale hydrologic modeling to the system.

Michael Barber, also with the Department of Civil and Environmental Engineering, will apply smaller scale hydrologic modeling, including climate forecasts, reservoir management modeling, and small-scale biogeochemical modeling. The WISDM team includes 10 other WSU faculty members and two regional experts. ▮

Creating a Sustainable Infrastructure

By Alyssa Patrick, CEA Communications

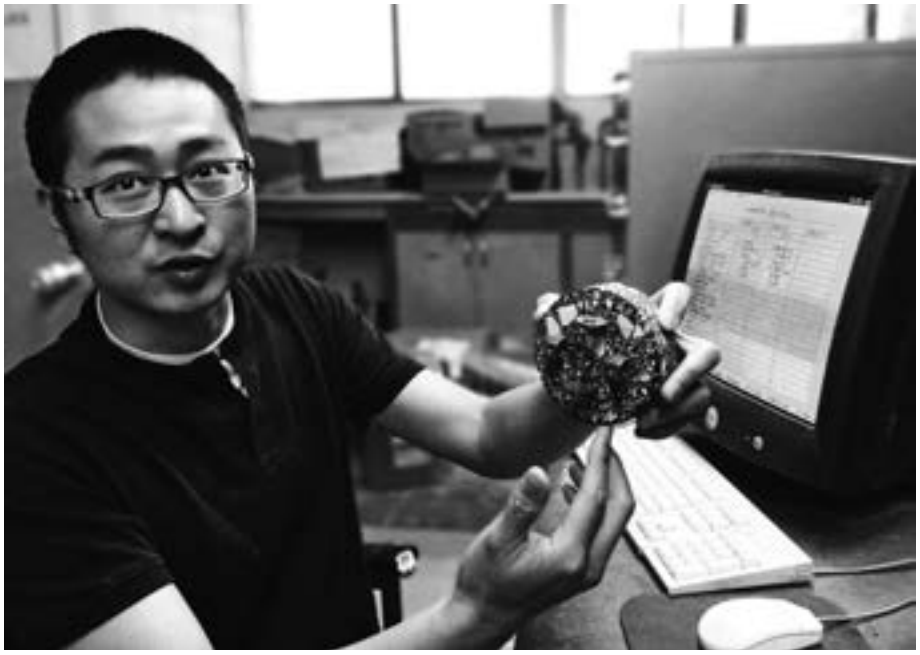
Future Roads of Cooking Oil and Old Shingles

Most people don't think a lot about roads or other asphalt surfaces they use. They're just thinking about getting to work, school, or home or parking their car.

When Haifang Wen looks at a road, however, he sees a whole life cycle.

"My research group is working toward sustainable infrastructure. Recycled roadway, sidewalk, shingles, buildings, cooking oil, and steel slag can all work together in a system to build renewable roadways," said Wen, who is a professor in the Department of Civil and Environmental Engineering.

Wen is the director of the Washington Center for Asphalt Technology, a partnership between the Washington State Department of Transportation, the Washington Asphalt Paving Association, and WSU.



Graduate student Shenghua Wu with sample.

> "Traditional asphalt is made from crude oil, which is expensive and environmentally harmful. Cooking oil is one-third the price of crude oil."

Two major projects Wen is leading evaluate the effectiveness of recycled asphalt taken from old roadways and shingles. Currently, about 100 million tons of roadway and 11 million tons of shingles are sent to landfills every year. With Wen's research, the asphalt in those materials is extracted and mixed with traditional asphalt. Using this method can reduce waste and the use of crude oil that currently makes up asphalt.

While the asphalt from those shingles and roads would be mixed with traditional asphalt, Wen is also doing research on the development of bioasphalt, a material made of cooking oil left over in McDonald's and other restaurants' deep fat fryers.

"Traditional asphalt is made from crude oil, which is expensive and environmentally harmful. Cooking oil is one-third the price of crude oil," Wen said. Plus, cooking oil is a harmful waste product, so finding a use for it also benefits the environment.

Asphalt is not the only material that makes up a roadway, however. The thick substance must be heated and mixed with aggregate in order to harden into the material we drive and walk over.

"Asphalt now has to be heated to 300 degrees Fahrenheit in order to combine with the aggregate. At that temperature the asphalt produces a toxic blue smoke," Wen said.

So he is working with a team on new technology to develop a warm mix asphalt, one that only has to be heated to 200 or 230 degrees. The warm mix gives off fewer fumes, meaning it saves energy and the health of the people who work with it.

Wen's team is also testing alternative aggregate materials, such as recycled sidewalks and steel slag from mills and recycled buildings. Using those materials would reduce the environmental impacts of resource extraction from mountains and quarries.

In a lab in the basement of Sloan, Wen and his research team test the different forms of asphalt and aggregate, comparing them to traditional roadways.

"So far, most of our samples perform as well as samples of traditional road," Wen said.

As his research moves forward, he will begin testing the materials on actual roadways, and eventually create samples that are made entirely of recycled materials.

These research projects are funded by and in collaboration with a variety of organizations, including the National Cooperative Highway Research Program, National Science Foundation, King County, Washington State Department of Transportation, Idaho Transportation Department, University Transportation Center, and U.S. Department of Transportation. ∎

Protecting Bridges from Deterioration and Damage

Emily Smudde, reprinted from WSU News

When a truck collided with the Skagit River bridge this spring, the bridge disastrously collapsed, disrupting a major transportation artery in the Northwest. About one third of the 600,000 bridges in the United States are in need of repair or replacement due to deterioration and damage, including that caused by vehicle collisions.

A Washington State University civil engineer is applying his expertise in aerospace techniques to create an inexpensive solution to this growing problem.

Pizhong Qiao, professor of civil and environmental engineering, sandwiched aluminum and layers of honeycomb material to create impact-laminate (I-Lam) panels. The system protects bridges by absorbing the energy from collisions. In addition, data collected from attached sensors can help prevent future collisions.

If successful, the panels could be a major breakthrough in bridge protection and could be implemented nationwide, Qiao said.

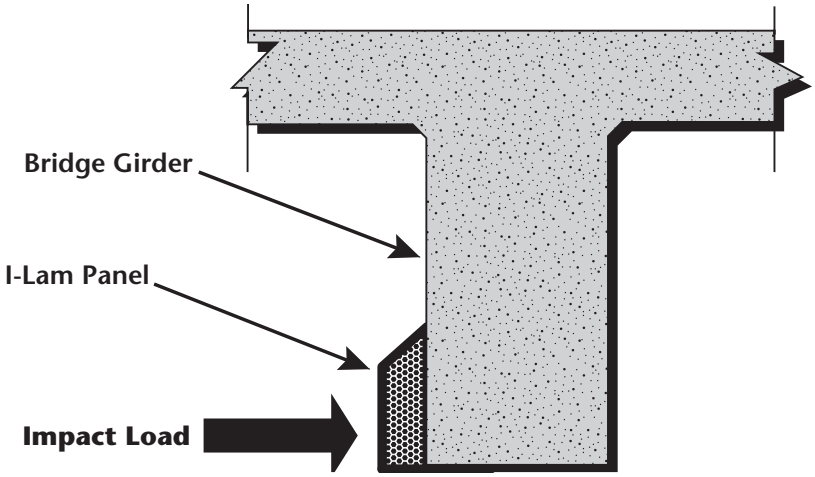
Energy Absorption

The panels—filled with layers of honeycombed compartments—cover the underside girders and sides of a bridge, he said. In a collision, the compartments are crushed, destroying the panel but saving the bridge.

"This is a sacrificing type of system," he said. "The I-Lam sacrifices itself to protect the bridge girders underneath."

After the collision, the panel can easily be replaced, which saves the hassle and expense of repairing the bridge, Qiao said.

"Here at WSU, we are the first to apply an I-Lam system like this," he said. The honeycomb is used in aerospace technology as an energy-absorption system, but it hasn't been applied much like this, he said.



"The proposed detection system is capable of triggering a camera to catch the collision," he said. "Knowing what types of vehicles collide with bridges may help develop future collision prevention strategies."

Detection System Too

The panels also help detect and monitor collisions, Qiao said. Attached smart piezoelectric sensors trigger remote data collection when panels are hit. Damage is reported early and data is collected to make improvements.

"The proposed detection system is capable of triggering a camera to catch the collision," he said. "Knowing what types of vehicles collide with bridges may help develop future collision prevention strategies."

In collaboration with Professor J. Leroy Hulsey of the University of Alaska Fairbanks, Qiao received a $200,941 grant from the Alaska University Transportation Center to test and implement the I-Lam system in cold-weather regions. After conducting analytical modeling and lab testing, the researchers hope to conduct future field tests in the Northwest. The Washington State Department of Transportation has also shown interest in the proposed system, as many bridges in the state have been hit by overheight trucks.

The Challenges of Cold Weather

Although the panels can be used in other climates, cold-weather regions pose particular challenges to monitoring and repairing bridges after collisions, Qiao said. Bridges often are in remote areas and the weather makes detection and repair difficult. Without repair, bridges can deteriorate.

"After a collision, the concrete girder will peel off, exposing the steel reinforcement inside," Qiao said. "Exposing these reinforcements to the moist climate of these regions can cause permanent damage to the bridge."

By preventing damage and alerting local authorities that repairs are needed, the I-Lam system will help extend the life of these structures. ∎

Researchers Assess Outlook for Water Resources and Farming in 2030

Yields for dryland crops like winter and spring wheat look good, while irrigated corn and potatoes will be down.

That's the forecast through the year 2030 from a group of WSU researchers, who are working to assess future growing conditions under climate change for 40 types of crops in the Columbia River Basin.

As part of a project funded through the Washington State Department of Ecology and the United States Department of Agriculture, the researchers developed a forecast for water supply and demand in 2030 and assessed how future economic and environmental conditions, including water scarcity, will affect agricultural productivity.

While future precipitation projections are uncertain, more robust warming projections will mean that more precipitation will occur as rain and snow will melt earlier in the season, so that less water will be available for crop irrigation in the late summer months.

To better understand how crop yields will be affected by climate change, Jennifer Adam, a civil and environmental engineering assistant professor, worked closely with her colleagues, including Claudio Stöckle in the Department of Biological Systems Engineering, Chad Kruger with the Center for Sustaining Agriculture and Natural Resources, and Michael Brady in the School of Economics. Kirti Rajagopalan, a graduate student in the Department of Civil and Environmental Engineering, also worked on the project. 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.

Photo by Chad Kruger. The Sunshine Farm in Chelan, Washington.

"There are several competing factors that have positive and negative impacts," Adam says. "Our science is teasing out the effects."

The researchers found that dryland crops, like winter wheat and spring wheat, will be positively affected, at least in the next 20 years, as atmospheric carbon dioxide levels rise due to anthropogenic activities, such as burning fossil fuels. The increased carbon dioxide allows the plants to use water and sunshine more efficiently.

"The direct impact of more carbon dioxide benefits some types of plants," says Adam.

Other crops that will also grow better in a warmer Northwest are alfalfa, hay, and timothy grass. Warmer temperatures will affect all of the crops negatively, but warmer temperatures can be outweighed by higher carbon dioxide levels.

As temperatures continue to rise, however, the negative effects of warmer temperatures may eventually have a larger negative impact, says Adam.

"It's non-linear," she says. "Crop productivity impacts are positive at first, but at some point, warming results in negative impacts."

At the same time, irrigated crops in Washington, such as potatoes and corn, should see lower yields by 2030, says Adam. While increased carbon dioxide levels might help the crops grow better, warmer temperatures and insufficient water supplies will outweigh any possible positive effects.

For their models, the researchers use "mechanistic" models, which are based on simple physics and computer programming to predict future climate impacts. The models use fundamental scientific principles, like the conservation of mass and energy, to predict what will happen as the climate drives change.

The model is complicated because it has to include all the physical factors, such as evaporation, transpiration, snow pack, and soil moisture just to get a predicted number for stream flow, for example.

"It is a very compelling computing challenge," she said. "But the whole point is to integrate and to get a better understanding of land use and our natural ecosystems." ▮

Gage Pepin: From Really Big Slacker to Really…Really…Really…Outstanding

With approximately 4,000 undergraduate students in the College of Engineering and Architecture at WSU, it is pretty amazing to be named the outstanding sophomore. To repeat the accomplishment as a junior is also amazing.

But for Gage Pepin to be named outstanding sophomore, junior, and senior for the college is thought to be unprecedented.

And also ironic, since he was not a stellar student in high school.

Originally from Camano Island, Washington, Pepin always liked his math and science classes, but he received only average grades in high school. Coming to WSU was an opportunity to prove himself.

"I was a really, really big slacker and didn't take school seriously," he said.

At the same time, he is the first in his family to go to a university for a four-year degree. His father, who has worked at Kimberly Clark in Everett as an instrument technician, and his mother, who is a nurse, have been tremendously supportive of his efforts to go to school.

"I owed it to them to do well in school," he said. "I kind of wanted to earn it more than just showing up."

Undecided when he arrived, he was grateful for support he received from his advisor, Kasey Schertenleib, who guided him toward civil engineering. And when he arrived at WSU, he decided to do as much as he possibly could.

"I wanted to take advantage of everything I could and get the most out of the whole experience," he said. "Once you're done with college, you're not going to get those experiences again. I didn't want to pass up on the opportunity to learn from all of the great resources at this school."

And so he did.

Pepin was part of an interdisciplinary Boeing Scholars project to teach a robot to remove and replace a sharp milling insert.

"Once you're done with college, you're not going to get those experiences again. I didn't want to pass up on the opportunity to learn from all of the great resources at this school."

Pepin has maintained a 3.93 GPA. He's been active in the WSU community, where he has been a peer mentor for the Innovation in Design (Engineering 120) course, assisting students who are starting their engineering studies. He has served as president for the WSU chapter of Tau Beta Pi honor society. With more than 40 incoming members, the chapter this year processed its largest initiation to date. He was also recruitment and retention officer for the WSU student chapter of the American Society of Civil Engineers. He participated in and organized many volunteer activities for these groups, such as stream cleanups, food drives, and activities to introduce young people to engineering. In his spare time, he was a DJ for KZUU 90.7 FM and participated in recreational sports.

"He is a solid student and interested in what was going on around him," says Kirk Reinkins, for whom Gage worked as a peer mentor. "That goes a long ways. He does the work that is necessary."

He also participated in the Boeing Scholars program, which provides students with two-year scholarships as well as internship opportunities between their junior and senior years. During their senior year, students from engineering, science, and business participate in an interdisciplinary course, collaborating with Boeing scientists and engineers on a real-life aerospace industry project.

A large part of his success, says Pepin, has been the support he has received from WSU civil engineering faculty. College is a time with a lot of new experiences and challenges, and it can feel overwhelming, he says. From making his first decisions on a major to encouragement to join student clubs to advice on internships and careers, the faculty helped him every step of his college career, he said.

"The professors are so welcoming here to students and make themselves really available," he said. "It doesn't seem like they were ever bothered by me barging into their offices," he said.

In fact, his favorite thing about his college experience was the Department of Civil and Environmental Engineering.

"It was easy to decide to stick with engineering," he said. "They were so encouraging. Any civil engineering major would say the same thing."

Pepin decided, in fact, to try to grab just a little bit more out of his college education. He will graduate in December with a bachelor's degree in civil engineering. ▮

Grad Student Earns Prestigious Bullitt Fellowship

By Alyssa Patrick

Ricardi Duvil, a civil engineering doctoral student at Washington State University, has earned a prestigious Bullitt Foundation fellowship for research focused on water quality improvement.

"The Bullitt Foundation was looking for a unique individual who has promise to make a difference, and Ricardi hit all of those areas," said Marc Beutel, Duvil's advisor and an associate professor in the Department of Civil and Environmental Engineering.

Based in Seattle, the foundation is a leading environmental charitable organization established by prominent businesswoman and philanthropist Dorothy Bullitt in 1952. Led by Denis Hayes, who started Earth Day, it focuses on protecting and restoring the environment in the Pacific Northwest.

"The Bullitt Foundation was looking for a unique individual who has promise to make a difference, and Ricardi hit all of those areas"

In addition to supporting research and projects, the foundation each year grants a fellowship to a candidate pursuing a leadership position in the environmental field. The $100,000 award is split over two years and is available to graduate students in Washington, Oregon, Idaho, western Montana, southern Alaska, and British Columbia.

Duvil came to WSU in spring 2011 to work with Beutel on research about how nitrogen may affect mercury cycling in aquatic systems.

"His research is somewhat of a paradox," Beutel said. Nitrogen is a chemical that is most often considered a pollutant, especially in agriculture. Duvil, on the other hand, is exploring the ability of nitrate, a form of nitrogen, to improve water quality, specifically in its control of mercury cycling.

Duvil started this research with the help of a two-year Nitrogen Systems: Policy Integrated Research and Education (NSPIRE) fellowship that he received when he arrived at WSU. NSPIRE is an integrative research and graduate training program whose students include in their studies a policy component as well as scientific discovery.

Duvil's broad knowledge of environmental science and policy likely helped make him a standout candidate at the Bullitt Foundation, Beutel said.

Duvil's diverse background added to his qualifications. His mother is Haitian and his father is Cuban. He was born in Haiti, lived in France for part of high school, and then moved to Boston.

While growing up in Haiti, Duvil was very aware of a nearby industry that was dumping waste and polluting regional water bodies. No one spoke out against the industry for fear of violence and the government.

"By adding the knowledge and credibility he is gaining with education to his understanding of the culture and language in Haiti, Ricardi is empowering himself to make a difference in underdeveloped communities," Beutel said. ∎

7:23 to Build a Steel Bridge in Sloan Courtyard

Kevin Chang runs across the Sloan courtyard with a utility belt around his waist and a steel bridge section in his hand.

"Tony, top," he says, handing the piece to senior civil engineering student Chris Reynolds. Reynolds is standing in the middle of a half-constructed steel bridge that he holds with one hand as he uses the other to pass the beam to Tony Parris. Parris, a civil engineering graduate student, holds the end of the bridge while attaching the new piece.

WSU Steel Bridge Team spent hours practicing their bridge-building skills to prepare for the National Steel Bridge Competition that took place on June 1. The team placed second at the regional competition in mid-May, and joined 48 other teams from around the country and Canada to compete in Seattle. The competition is sponsored by the American Society of Civil Engineers (ASCE) and the American Institute of Steel Construction.

> "For us it kind of became a hobby, or an obsession."

ASCE released a problem statement in the fall with specifications for a bridge the teams had to build. At the competition they are scored based on construction, build time, appearance, and how much weight they can hold.

While there are about 12 other people on the WSU team, these three actually participated in the competition.

"For us it kind of became a hobby, or an obsession. We would think and talk about it even outside of group meetings and class," Chang said.

While practicing, the WSU team members set up their equipment as if for the competition. They laid out the steel beams and triangular braces next to red cups filled with bolts and screws.

Left to right: Tony Parris and Chris Reynolds.

"All of these pieces came to us either as whole pipes or sheets of steel. We did all the cutting and forming of the sections," said Chang, who will be the team captain next year.

During spring semester they spent hours in Bill's Welding Shop in downtown Pullman. The shop has supported the Steel Bridge Team for several years.

"I don't know what we'd do without him," Reynolds said. Funding for the team's materials mostly comes from civil engineering alumni donations.

Chang stays with the equipment, and Reynolds and Parris walk about 30 feet away and stand at the ready like football players. One of them starts a timer, and Chang begins running pieces over one at a time. They call to each other occasionally, indicating who the piece is for or where it should go.

"7:23, that's our best time yet," Reynolds said once they finished the practice run. What began as around 30 pieces of metal is now a steel bridge a little over 16 feet long. ▮

New Emphasis in Construction Engineering Gets Underway

Because of significant changes in technology, global markets, and economics over the past 10 to 15 years, successful construction companies increasingly need both managerial and engineering expertise.

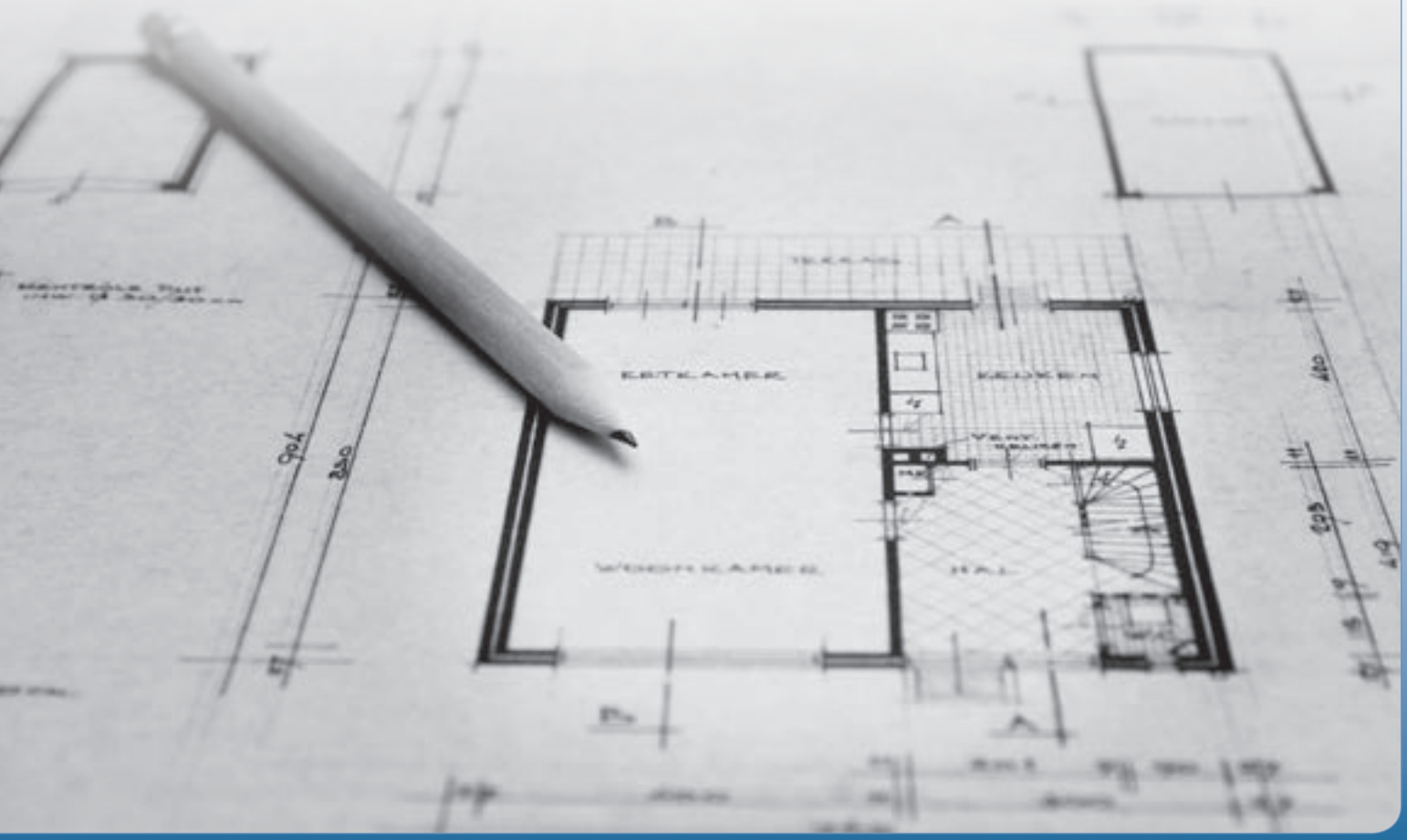
In response to this need, the Department of Civil and Environmental Engineering and the School of Design and Construction have established a new construction engineering track within the civil engineering program. With this new track the ABET accredited BSCE program will have five tracks: environmental engineering, water resources; structural engineering; infrastructure engineering, and construction engineering. The program will get underway this fall with 20 students.

The design-build method of doing business is creating a need for construction engineers in addition to construction managers within the construction industry, says Balasingam Muhunthan, chair of the Department of Civil and Environmental Engineering. The new track will allow the department to graduate civil engineering students who have expertise in "heavy' infrastructure design, building design, and construction technology.

"There has been increased interest among students and industry to have a construction engineering program, and industry fully supports this,'' he said. "We hope that it will continue to grow.''

A student who chooses the construction engineering option will be required to fulfill the requirements for an accredited degree in civil engineering while at the same time completing several construction management courses. Students will take courses in planning and scheduling, heavy/civil estimating, and sub-structures. They will also take additional civil engineering courses in areas such as reinforced concrete design, civil engineering materials, soil and site improvement, or structural steel design.

The new courses will be offered through a cooperative agreement between the Department of Civil and Environmental Engineering and the School of Design and Construction. The program also allows for enhancement of the construction management program, fostering a synergistic partnership between the two disciplines and allowing construction management students to interact with engineering students, Muhunthan said. ∎



WSU Exhibit Featured at Paris Air Show

By Rob Strenge, WSU News

Michael Wolcott, WSU Regents Professor of civil and environmental engineering, was one of three faculty members who represented Washington State University at the International Paris Air Show, held in June.

Working out of an exhibition booth at the show's Alternative Aviation Fuels Pavilion, Ralph Cavalieri, WSU associate vice president for alternative energy, Wolcott, and James Petersen, director and professor of the Gene and Linda Voiland School of Chemical Engineering and Bioengineering, were promoting the university's expertise in developing viable alternative jet fuels before more than 150,000 representatives of the aviation industry from across the globe. The researchers were spreading the word that the university is in the vanguard of U.S. efforts to use alternative biofuel technologies in the development of economically viable advanced aviation fuels.

"WSU was invited to come to Paris as a result of our growing international reputation as a leader in the development of biofuel technologies," said Cavalieri. "Aviation is obviously a global activity, and Paris is the place where the international aviation community meets every two years. It gives us a tremendous opportunity to demonstrate our research leadership and interact with all manner of aircraft and engine manufacturers, airline operators and others in the aviation industry."

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Cavalieri said WSU's message to the aviation industry is that the university's long land-grant tradition in agricultural research and basic plant science, together with its expertise in technologies to chemically and biologically convert plant materials to drop-in fuels and wood engineering, provide a natural framework for the development of biofuels from a wide range of plant-based sources.

In fact, overcoming obstacles to develop economically viable wood-based jet fuel and petrochemical substitutes is the focus of a consortium led by WSU that has already brought together scientists from universities, government laboratories, and private industry, he said.

Called the Northwest Advanced Renewables Alliance (NARA) and funded through a $40 million grant from the U.S. Depart-

ment of Agriculture National Institute of Food and Agriculture, the consortium aims to address the need for a domestic biofuel alternative for U.S. commercial and military air fleets. NARA researchers envision developing a new, viable aviation fuel industry using wood wastes in the Pacific Northwest, which has established oil refining and distribution assets as well as a significant aviation industry. ▮

Professor Michael Wolcott, director of WSU's Institute for Sustainable Design, was named a fellow of the International Academy of Wood Science. The award recognizes Wolcott's outstanding contributions in wood research. He was recognized for his leadership in the field of natural fiber composites and biopolymers.

Wolcott has led development of advanced materials to improve durability and reduce manufacturing costs and pollution. He holds five patents for innovative materials and structures from wood and natural fibers. He has been actively engaged with industry to commercialize his research and has participated in projects for more than 50 companies.

He serves as co-project director for the Northwest Advanced Renewables Alliance (NARA) project, which aims to develop a supply chain for aviation biofuels. NARA received a $40 million grant from the U.S. Department of Agriculture to develop alternatives to petroleum-based fuels and chemicals.

Briefs

Vikram Yadama, assistant professor and extension specialist in the Department of Civil and Environmental Engineering, recently received a National Science Foundation CAREER award for his work to develop unique, sustainable building materials from wood strands. According to the NSF website, the Faculty Early Career Development (CAREER) Program offers the agency's most prestigious awards for junior faculty for outstanding research and integrated education and research efforts.

With the five-year, $400,000 grant, Yadama and his colleagues aim to develop better sustainable building materials made from lignocellulosic fibers, or wood-based material. In particular, they are working to expand knowledge on the design and manufacturing of wood-based composite products for use in net zero energy construction, particularly for the outer shell of buildings, which is called a building's envelope. Buildings account for approximately 40 percent of U.S. energy use; of that, homes use 54 percent and commercial buildings use 46 percent. The U.S. government aims to increase development of net-zero energy commercial buildings by 2015 and residential buildings by 2030, said Yadama.

Brooke Whiting is a recipient of a top national advising award from the National Academic Advising Association (NACADA). She was also selected as a mentee in the association's emerging leaders program. Whiting works with 600 undergraduates, helping them find connections to succeed. In her advising role, she is working with a growing number of female students to connect them with female faculty mentors, to encourage involvement in the Society of Women Engineers, and to inform them about women-only scholarships and research opportunities.

New Faculty

The Department of Civil and Environmental Engineering welcomes the following new faculty members:

John Petrie holds a doctorate in civil and environmental engineering from Virginia Tech. His research interests include river morphology, field measurements of river velocity, and computational hydraulics. His dissertation work focused on the relationship between variations in discharge patterns due to hydropower operations and downstream riverbank erosion and stability. He has published his research in *Water Resources Research* and *Environmental Science and Technology* and has reviewed manuscripts for *Earth Surface Processes and Landforms*. Petrie was an assistant professor of physics and mathematics at the Virginia Commonwealth University in Qatar (VCUQ) for three years. In addition to his work in engineering, he holds a bachelor of music degree in jazz performance from the New England Conservatory and has performed internationally on string bass. He is the recipient of several fellowships and awards, including a Hydro Research Foundation fellowship for his work in modifying hydropower releases to reduce riverbank erosion.

Photo courtesy of University of Idaho

Von P. Walden comes to WSU from the University of Idaho, where he has been a professor since 2001. His research interests include polar meteorology and remote sensing of the polar atmosphere, as well as understanding climate change in the western United States. He has conducted seven field experiments in the Antarctic and Arctic regions and is currently conducting an experiment at Summit Station, Greenland, as part of the National Science Foundation's Arctic Observing Network. Walden served on NASA's Validation Team for the Atmospheric Infrared Sounder (AIRS) from 2001 to 2008. He has acquired funding for a wide variety of research projects, including modeling hydrology of snowmelt-dominated basins, downscaling climate model output, and measuring properties of polar atmospheres. He holds master's and doctoral degrees in geophysics from the University of Washington and a bachelor's degree in physics from Utah State University.

In Memoriam

We're sad to report the passing in the last year of two longtime civil engineering professors, Bertel O. "Bert" Olson and Roger Nelson.

Bert Olson taught engineering from 1957 to 1982 and was a member of the WSU Quarter Century Club. He was a member of the American Society of Civil Engineers, American Society for Engineering Education, International Society of Geotechnical Engineers, Phi Kappa Phi Honor Society, Professional Ski Instructors Association, the American Legion, U.S. Hang Gliding Association, and Trinity Lutheran Church. In addition to teaching civil engineering, he taught alpine and Nordic skiing for 25 years, was president of the Pullman Men's Golf Club, and participated in marathon Nordic ski races in the United States, Norway, Sweden, and Australia.

Roger Nelson taught civil engineering from 1955 until retiring in 1989. During his career, he taught structures and basic courses for civil engineering students. For almost 30 years he and his family spent summers at a WSU survey camp on White Pass (Washington). For many graduates who are old enough to have participated, Camp Welch is a treasured memory. Roger taught surveying and acted as camp manager from 1969 to 1978. He was also the first recipient of the Leon Luck faculty award, which honors the top teaching in civil engineering.

Two Alumni Receive WSU Alumni Achievement Award

Two civil engineering alumni are recipients of the WSU Alumni Achievement Award, the highest honor bestowed by the Washington State University Alumni Association (WSUAA). Since 1970, less than 510 WSU alumni have received this prestigious award.

Dick Colf is the retired executive vice president of Peter Kiewit Sons' Inc., one of the largest construction companies in North America. Colf received the award in April when he was on campus to give a lecture as part of the College of Engineering and Architecture's Lanning Lecture Series.

Colf began his career for Kiewit as a summer intern in 1965, working on a seven-mile stretch of I-90 east of Butte, Montana. That fall, he received a Kiewit scholarship that helped him finish his senior year at WSU. During his career, he worked on and supervised many construction projects, including highways, levees, jetties, oil industry facilities, and dams.

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 for 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.

Photo courtesy of U.S. Air Force

Retired Major General Paul J. Fletcher received the award at the Rotary Club of Spokane Valley. Fletcher, who served as Vice Commander, Third Air Force Base, Ramstein, Germany, at the time of his retirement, was honored for his distinguished military leadership, outstanding accomplishments in aviation, and significant community service.

Following his graduation from East Valley High School in Spokane Valley in 1968, Fletcher attended Washington State University on an Air Force Reserve Officer Training Corps (ROTC) scholarship, earning a degree in civil engineering in 1972.

Do you remember your first surveying class?

A group of students in CE 302 had their introduction to surveying outside Thompson Hall earlier this spring.

Alumni Notes

Adrienne Nikolic was named one of the 2012 New Faces of Engineering from the American Society of Civil Engineers. The award recognizes diverse, global, and talented engineering students and engineers age 30 or under who are making their mark on the world with achievements that represent the bold and humanitarian future of engineering.

Nikolic received her bachelor's degree in civil engineering in 2006 from Washington State University. She later went on to get a master's of science degree in engineering from Johns Hopkins University.

She started work in 2007 for Black & Veatch in Philadelphia, Pennsylvania, as a project engineer, where she analyzed and designed water treatment systems, water distribution systems, wastewater treatment systems, and collection systems. She was also involved in energy management and planning.

In 2011, she joined Ernst and Young LLP as a senior in their Advisory Services, Power and Utilities Practice in Philadelphia. There she works with power and utilities clients to improve their business performance and assists with executing enterprise-wide performance transformation initiatives.

Nikolic said when she was at WSU she learned that in life there are no substitutes for hard work and perseverance. "Always push yourself beyond your comfort zone—you're the only one truly capable of limiting yourself," she says.

James H. Clark ('75, '76 MS), senior vice president, Region Managing Director of Black & Veatch, received honorary membership in the Water Environment Federation. Clark is recognized for his commitment in the water environment profession, to the Water Environment Federation, and to his community. He served as the WEF President in 2001-2002 and is the recipient of the prestigious WEF Emerson Medal for outstanding service and the WEF Engelbrecht International Achievement Award for sustained and significant contributions in the international field. He received WSU's Alumni Achievement Award in 2004. His election to the honorary membership in the WEF is a recognition to his sustained contributions to advancing this field.

Mass Transit, a magazine dedicated to public transportation, added **Jeffrey Ensor**, a Washington State University alumnus, to the fourth annual *Mass Transit* Top 40 Under 40 list. The list honors those who have made significant contributions to the public transit industry. Ensor graduated from WSU in 2003 with a bachelor of science degree in civil engineering, and later went on to receive a master's degree in transportation from the Massachusetts Institute of Technology. He currently is a principal consultant in Parson Brinckerhoff's strategic consulting group.

Engineering is all about Making a Difference

As you know, the Department of Civil and Environmental Engineering brings together a creative community of faculty and students to create an excellent educational environment.

It's no secret that the strength and vitality of higher education depends on a mixture of public and private support. We're living in an era where higher education administration has to make critical decisions about resource allocation. In the Department of Civil and Environmental Engineering, we are working toward creating an environment to maintain excellence in education. Over the next several years we hope to attain the resources to create an endowed chair, renovate and update existing laboratory space, and create a comprehensive curriculum centered on sustainable solutions.

The support from alumni such as you will not only help us reach these goals but it creates engaged and motivated students who are challenged and inspired. Your continued response to the needs of this institution is especially gratifying to all of us.

We know you have many options when it comes to your philanthropy and we want to thank those of you that have continually answered our call to action. I hope to find an opportunity to meet with you to find a match between department priorities and your interests that will be worthy of your support.

If you want to find out more about how you can make a difference, please feel free to contact me at 509-335-0144 or pilcher@wsu.edu. Thank you again for your commitment to the future of the Department of Civil and Environmental Engineering at Washington State University.

B. Pilcher

Bridget Pilcher
Director of Development

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Congratulations to WSU's Steel Bridge Team!

A group of Washington State University students qualified and participated in the annual National Steel Bridge competition, held in June in Seattle.

A total of 48 teams from throughout the United States and Canada participated in the competition, which is sponsored by the American Society of Civil Engineers (ASCE) and the American Institute of Steel Construction (AISC). In order to qualify for the national competition, teams had to place in the top three in regional competitions held earlier this year.

The student-designed bridges are scored and ranked based on how well their bridge is built, including how light and stiff it is, as well as on its "economy"—or the speed in which it can be built with the fewest number of workers. The bridge must hold a load of 2,500 pounds with points earned for the least deflection under load.

Students who participated included Tony Parris, Chris Reynolds, and Kevin Chang. (See story, page 10.)

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