

The history of the Great Lakes is one of people who underestimate their destructive power, often with tragic results. From two massive waves that smashed into Chicago's harbors in 1954 to a rip current that drowned a young swimmer in Port Washington, Wisconsin, in 2012, Lake Michigan and its neighbors have a track record of catching people off guard with dangerous currents.

People still commonly refer to such events with terms like "sneaky waves," as if these incidents were aberrations that couldn't have been helped or anticipated.

Professor Chin Wu isn't having it, because such incidents are, in fact, a long-established part of the lakes' behavior. "I say, 'sneaky waves?' These sneakier waves appear without warning, often surging high up on the beach with deadly force and creating rip currents," says Wu.

Between 2002 and 2013, rip currents—essentially strong channels of water that flow out from the shore—were involved in 85 deaths and 256 rescues in the Great Lakes. But this still hasn't changed the common misperception that rip currents are only a threat in the ocean. Currently, the lakes' only safety measures against rip currents rely on observation of factors like wave heights and water levels, leaving a dangerous gap in the region's defenses. Wu says it's possible to anticipate them based on possible causes in weather, the current's interaction with structures along the shore, and formations in the sea floor and sandbars.

Wu's research team—PhD students Yuli Liu, Adam Bechle and Josh Anderson—is developing a real-time warning system for dangerous rip currents on Great Lakes beaches. Supported by a



Professor Chin Wu

System alerts Great Lakes swimmers of dangerous currents

\$200,000 grant from the National Oceanic & Atmospheric Administration Great Lakes Coastal Storms Program, Wu recently began testing and implementing pilot systems at beaches in Milwaukee and Port Washington, Wisconsin, as well as in Duluth, Minnesota.

Staying ahead of danger—His system will alert safety officials when conditions become conducive to rip currents, or when alarming wave patterns are poised to radiate along the shoreline. Dubbed the Integrated Nowcast/Forecast Operation System (INFOS), the pilot program offers a mix of data on current conditions in an area. Ideally, it will catch the first stirrings of dangerous currents before they endanger people near the shore.

"There are only risk level warnings for beachgoers, but that's kind of a reactionary approach, and Chin's is more of a proactive approach," says

Julia Noordyk, a coastal storms specialist with the Wisconsin Sea Grant Institute. "Right now, there's no way to do real-time observation of dangerous currents forming. Hopefully, this project will change that."

INFOS builds on the principles of the wave imaging and modeling systems Wu's research group has pioneered. Once INFOS is refined at the test sites, Wu hopes the system can be deployed throughout the region, protecting swimmers and the economies of communities that depend on beach tourism.

"Part of the process is science, but an equally big part is outreach and education, bringing it to local communities," Wu says.

In addition to his project's partners at the Wisconsin and Minnesota Sea Grant Institutes, Wisconsin Coastal Management Program, and the National Weather Service, Wu has spent a lot of time coordinating with partners and local officials at each pilot site.

(Continued on page 7)



Pete Trelenberg (BSCEE '80) received the Distinguished Achievement Award during the 2014 ENGINEERS' DAY celebration October 24 on the UW-Madison campus.

Pete Trelenberg has experience in the world's largest publicly traded energy company, Exxon Mobil, through assignments in Texas, New Jersey, California and Hong Kong. Today, he advises Exxon Mobil leaders on the company's response to environmental issues, sustainability and regulatory reform.



Trelenberg honored at ENGINEERS' DAY 2014

His long tenure at Exxon has included roles in managing plants, building up the company's presence in China, and taking part in the company's mergers and business strategy.

In 2011, Trelenberg became Exxon Mobil Corporation's manager for environmental policy and planning. He advises senior management and the board of directors on climate change, and manages greenhouse gas, sustainability and regulatory reform.

His many fond memories of his time at UW-Madison include the Badger men's hockey team winning the 1977 NCAA championship; Friday afternoons on the Terrace; Saturday football games; canoeing on Lake Mendota; and running along the lakeshore.

He has maintained his UW-Madison connections through Exxon's recruiting efforts, and through his participation on the civil and environmental engineering

visiting committee.

Trelenberg lives in Dallas with his wife, Susan. The two frequently visit their children, Leigh Anna, Peter Jr., and Erik, who reside in southern California, and Trelenberg enjoys cycling, fishing, upland bird hunting, and hiking. He enjoyed coaching youth sports when his children were younger, and remains an avid Badger sports fan.

IN THE FIELD

CEE undergrads share their recent internship experiences



"Over the summer I worked for Mortenson Construction as a field engineer intern. I worked on a wide variety of tasks throughout the summer, including formatting a site utilization plan, various integrated work plans and an emergency response plan, as well as writing the occasional request for information, and working with our BIM (building information modeling) specialist to review lift drawings. In addition, I worked one on one with the foremen, and made frequent calls to the architect and engineer with regards to discrepancies found in the contract document drawings. I also drafted quality inspection checklists and uploaded them to BIM 360 Field—an iPad app we used on site, as well as performed quality and safety inspections on the field. This experience was incredibly valuable in my development as an engineer, as it gave me a taste for what it would be like to become a field engineer, and I had the opportunity to become acquainted with the culture and value system of an awesome construction company."—**Elisa Shapson**



"This summer I worked as an engineering intern for Mortenson Construction at the Mall of America phase 1C project. This project consists of building a 342-room hotel, adding retail of more than 50 new stores, and constructing another parking ramp for the mall. My primary task for the summer was inspecting post-tension concrete decks prior to the pours. This involved me getting out in the field with plans and shop drawings to ensure that everything was in the right place and ready for the pours. I further expanded my construction knowledge and working on a big project allowed me to see how certain components fit together in the process. I enjoyed my time with Mortenson so much that I recently accepted an offer to work full time with them starting next summer."—**Aaron Blazich**

CHAIR'S MESSAGE



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Greetings, UW-Madison friends and alumni, and welcome to the fall 2014 *Conduit!* We are eager to share exciting news from your CEE department.

We have an excellent new cohort of undergraduate and graduate students in the department. In July, a new professor, Brock Hedegaard, joined us after completing his PhD at the University of Minnesota.

In this issue, you'll learn about how our faculty are working on solving society's challenges in areas such as managing hazards on the Great Lakes; creating sustainable roadway infrastructure for northern climates; and innovation in barrier materials to protect the environment from industry's most challenging waste streams. We also highlight how industry is supporting new labs for our faculty and students, and providing internships that provide hands-on experiential learning experiences for students.

We also highlight one of our outstanding alumni, Pete Trelenberg of Exxon Mobil, who has received a 2014 College of Engineering Distinguished Achievement Award. He manages the climate change and sustainability initiatives for one of the world's largest corporations.

I hope you enjoy this issue of *The Conduit*. If you have material to share for the next issue, send it to me. And if you get to Madison, please stop by for a visit.

Craig H. Benson 
PhD, PE, NAE
Wisconsin Distinguished Professor



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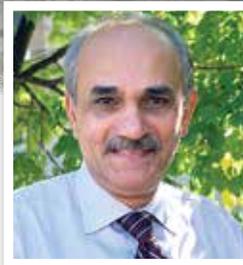
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Collaboration aims at longer-lasting roads for northern states



More than 80 percent of major roads in the United States are still surfaced with asphaltic mixtures—and the liquid asphalt, a byproduct of oil refining, remains a bit of a chemical mess, an inconsistent, complex mix of hydrocarbons. So to understand how different kinds of asphalt will hold up under the weight of vehicles and the punishment of the elements, road engineers must use physical methods, from ovens to hydraulic testing devices, to inflict stress and extreme temperatures upon the stuff.

Vilas Distinguished Professor Hussain Bahia and his team in the UW-Madison Modified Asphalt Research Center (MARC) have more of that kind of gear than almost anyone in the country, and they are partnering with the Wisconsin Department of Transportation and four other states to revise the durability standards that asphalt has to meet before it goes on our roads.



Hussain Bahia



Department welcomes Brock Hedegaard

UW-Madison has made an exciting addition to its structural engineering faculty in fall 2014 with the hiring of Assistant Professor Brock Hedegaard.

A native of Sydney, Montana, Hedegaard attended Montana State University as an undergraduate and completed his doctorate in June 2014 at the University of Minnesota. His dissertation focused on monitoring and modeling the long-term time-dependent behavior of the I-35W post-tensioned concrete bridge in Minneapolis, and particularly on the interactions between seasonal temperature changes and time-dependent deformation rates. His current research interests include multiscale modeling of viscoelastic materials, pre-stressed and post-tensioned concrete, and structural monitoring.

The asphalt standards different states use end up having a big impact on both road quality and the cost of maintaining and building roads. The project's end goal is to create a common set of standards that multiple states—for now, Wisconsin, Idaho, Ohio, Colorado and Kansas—can use for testing asphalt's durability.

Bahia says this will streamline the process of making asphalt right where it starts, at the petroleum refineries of which asphalt is a by-product. "If I own the refinery and terminal and I have six different specifications to meet, I have to have six storage tanks," he says. "It will cost me much more money to produce, and I will pass the costs on."

And for states whose roads face a lot of the same problems, especially from harsh weather, that just doesn't make sense.

The efficiencies could eventually spread beyond the four states currently participating in this project. "There are a lot of northern climate states, and whatever we come up with, it's important for us to be testing and thinking on the same page," says Barry Paye, the materials lab supervisor at WisDOT, who earned his bachelor's and master's degrees in civil and environmental engineering from UW-Madison.

Even when multiple states form a purchasing group to streamline the administrative side of buying asphalt, those member states often will have different standards, Paye says. So Paye's hope is that the states in the research project can attain consistent results and common specifications, then work as a group to save money and maintain more resilient roads.

Asphalt engineers still don't know everything about making roads hold up under the abuse of cold weather, ice and snow. So in northern states, road surfaces often don't last as long as they are intended to, which drives up states' costs still more.

"Our main problem is what's called thermal cracks," Bahia says. "If you drive around, you will see most of our roads in Madison have almost horizontal cracks from one edge of the road to the other, and spaced every 30 to 60 feet. This is an effect of the climate conditions we have. To create a specification to minimize that damage is really the starting point."

Judie Ryan, another WisDOT asphalt expert involved with the project, credits Bahia and MARC with using an unmatched wealth of asphalt expertise and testing equipment for the broader benefit of transportation agencies around the country. "MARC helps WisDOT think about the future," Ryan says.



Physical testing remains crucial to developing and proving new technologies in structural engineering.

Giving tomorrow's builders hands-on experience

As the College of Engineering prepares to revamp its lab for hands-on structures experimentation, one of Wisconsin's most prominent civil engineering firms sees a chance to help UW-Madison train students to keep up in an ever-evolving industry.

GRAEF, a Milwaukee-based firm with two CEE alums at the helm—CEO John Kissinger (MSCEE '83) and Chairman Richard Bub (BSCEE '75)—has donated \$50,000 to support the lab, slated to debut in 2016 with new features that enable physical testing of new building technologies.

"I'm glad that future students will have the opportunity to work in this lab and observe how actual results compare to what their simulations show," says Kissinger. "It is sometimes hard for younger engineers to have the feel for how things work, and participating in this type of research will definitely help."

Despite the advantages of computer modeling and simulation, Kissinger points out that the increasing need for better and less expensive building technologies has made physical testing more important. "There's a movement in our business to go to performance-based designs, and that really requires research to prove out ideas," he says.



John Kissinger

to the department's strong legacy of influential structural engineers. "I learned a great deal of what I know in grad school in Madison, in large part due to the faculty at the time.

Wisconsin Distinguished Professor and department chair Craig Benson says the gift from GRAEF is a key step in giving the structural engineering program a strong future. "This lab will provide hands-on experiential learning opportunities for undergraduate and graduate students, allow our faculty to conduct research on full-scale structural elements, and provide a state-of-the-art testing facility for structural and construction industries in the Midwest," Benson says.

Solid research also can speed up the pace of change, helping to assuage some of the skepticism with which industry and government sometimes view new technology. "The research that's done can give them the comfort that if they're trying something new they're not getting a pig in a poke," Kissinger points out.

That concern is amplified when it comes to the bigger societal problems that civil engineers deal with, especially the increasingly urgent need to rejuvenate America's infrastructure. Cost is the main obstacle, and structural engineering research has a part to play in tackling that. "One part of the solution is to come up with increased funding, but the other part is coming up with a better way of building infrastructure so that it costs less and lasts longer," Kissinger says.

Better facilities will help the department continue to attract distinguished structural engineering faculty, and that, too, is an important part of the experience Kissinger wants to ensure for future undergraduate and grad students. "The faculty when Rich Bub and I went to school included Chuck Salmon, C.K. Wang, and other giants of our industry," Kissinger says, referring

IN THE FIELD

CEE undergraduate internship experiences



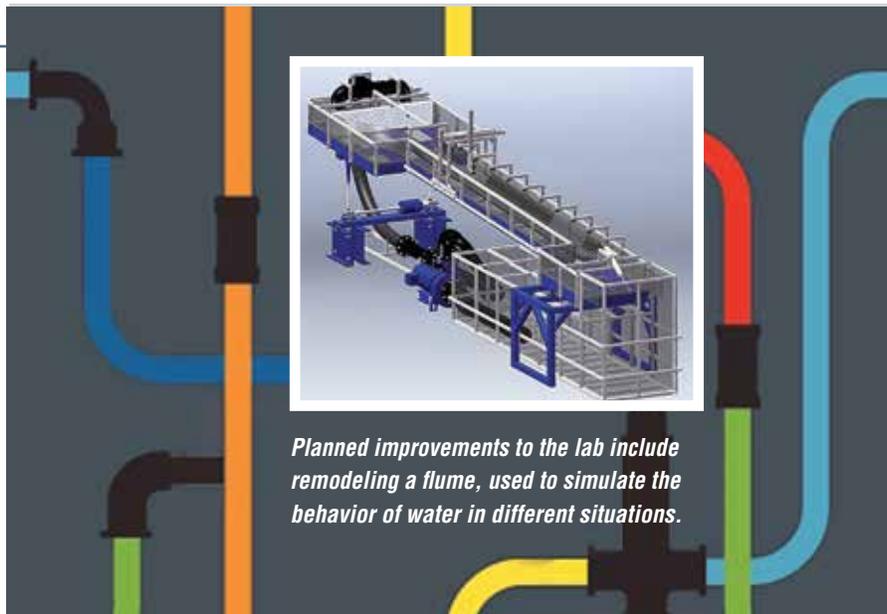
"This summer for my internship with IEA (formerly RMT), I had the opportunity to lead a geotechnical investigation of a 50-megawatt, 39-turbine wind project located about 50 miles southeast of Laredo, Texas (just north of the U.S.-Mexico border). The investigation included borings of the turbine, substation and electrical tower locations, as well as electrical and thermal resistivity tests. I was leading two drill crews as well as another subcontracted geologist, so it provided great project management experience in addition to the technical experience."—**Michael Krause**



"This past summer I relocated to Anchorage, Alaska, to work as a transportation intern for a private consulting company named Kittelson & Associates Inc. (KAI). As an intern, I was treated with the same respect as a full time entry-level employee. KAI is a transportation consulting company that works with general civil firms and offers expertise on transportation and traffic engineering/planning. My summer left me with valuable technical skills and project examples I can use while searching for a full-time position. Beyond the technical side of my job, I learned

As the Department of Civil and Environmental Engineering looks toward the future, it's building on two of the areas in which UW-Madison has a long history of influential research. The biggest projects the department is currently pursuing involve renovations to a structures testing lab and a water engineering research lab.

Structural engineering and water engineering have long been strong areas for UW-Madison. Over the decades, the department has been home to some of the most innovative and influential researchers in the structural engineering field, including C.K. Wang, Charles Salmon, William Saul,



Planned improvements to the lab include remodeling a flume, used to simulate the behavior of water in different situations.

Mead & Hunt honors strengths of UW-Madison civil engineering

Alain Peyrot and John E. Johnson. The department has an equally proud and diverse history in water-engineering research, building on the work of professors including John Hoopes, Peter Monkmeyer, Theodore Green III, Erhard Joeres, David Armstrong, James Villemonite, and Ken Potter.



Raj Sheth

These professors also made an impact on generations of students who went on to shape Wisconsin's watersheds and the built environment in government and industry. That impact is certainly felt at Wisconsin's largest engineering firm, Mead and Hunt, a strong supporter of UW-Madison, which is honoring the UW-Madison traditions of structural and water engineering with a \$50,000 gift to support renovations in both labs.

"We have kind of a sentimental attachment to the water lab," says Mead & Hunt CEO Raj Sheth, a structural engineer who earned his master's degree in civil and environmental engineering from UW-Madison in 1972. "Our founder, Daniel Mead, was one of the early professors in water engineering at UW-Madison, around 1900."

The firm also employs UW-Madison CEE graduates from both water and structural backgrounds, and understands the importance of keeping up with new developments in both fields. Renovating the structures lab will provide up-to-date facilities for the crucial physical testing required to prove out new concepts and materials in building. Renovations in the water lab will reflect the diverse and constantly evolving context in which water research and education takes place, which means everything from computer upgrades to a new multipurpose flume.

Professor Greg Harrington says that in fields including hydroelectric power and urban drinking-water distribution, water engineers are increasingly required to think about the ways in which water relates to energy. Drinking water and wastewater systems, Harrington points out, are among the largest consumers of energy in the United States, and engineers need to be able to make them more efficient. Water utilities aren't just thinking about water quality and the hydroelectric power industry isn't just thinking about the best ways to generate electricity. These industries are also paying more attention to energy conservation.

The world of water is also increasingly a world driven by data. "We all hear about smart cities, and all of those require data being amassed in an automated fashion," Harrington says. "The future engineer for water systems is going to have to be familiar with how those things are set up and how to interpret that massive amount of data."

In addition to their research functions, both labs will also provide new hands-on experiences for undergraduates and even for mid-career engineers taking UW-Madison Engineering Professional Development courses. "The thing we're hearing from industry is a need to have students better prepared to deal with energy issues in practice," Harrington adds.

From Sheth's point of view, it's important for alums who have benefitted from their education to make sure that young engineers have the same opportunities to build skills and a professional network. And giving students access to the best facilities possible sends a strong message: "Be open to ideas and take on any challenges that come your way," Sheth says. "Besides being an engineer, you're a citizen of the world."

what it means to be a consultant and was involved in project budgeting, client meetings, proposal writing and business development meetings. Interns also participate in the intern jamboree, office exchanges and lunch time "tech sessions," where we are exposed to new and interesting transportation topics. I would highly encourage people interested in transportation to intern with KAI. You will gain valuable technical and business skills, travel between multiple offices, and leave your internship with a great understanding of what you value in a future employer."—**Tyler Rausch**

Containing the worst industrial waste

Storing industrial waste has never been a pretty job, and it's getting harder. New techniques for refining such metals as aluminum and vanadium, for example, also yield new by-products that have to be sealed away from human and environmental contact. And the practice of "scrubbing" the exhaust of coal-fired power plants keeps chemicals like sulfur dioxide from entering the air, but produces a more concentrated residue.

Now, many of these wastes are proving too acidic, basic or concentrated for commonly used storage materials.

That's why UW-Madison researchers, partnering with scientists from CETCO of Hoffman Estates, Illinois, through the National Science Foundation's Grant Opportunities for Academic Liaison with Industry program, set out to reinforce those materials by fusing them with polymers.

Their starting point is sodium bentonite clay, which has proven reliable in a variety of environmental applications, essentially swelling up and forming a seal when exposed to water or other liquids. But the clay sometimes fails to swell up adequately when subjected to harsh conditions, such as the extreme pH levels of "red mud," the alkaline residue produced by aluminum extraction.

"You have to be able to store the waste into perpetuity—hundreds of acres of this liquid," says Wisconsin Distinguished Professor Craig Benson. "Effective containment is part of the social contract these companies have with their community."

Benson, colleagues Tuncer Edil and William Likos, and former PhD student Joe Scalia have spent the past seven years working with CETCO scientists exploring how combining polymers with bentonite clay creates effective barriers. They eventually found that the best method was to let polymer molecules move around on the bentonite's surface, essentially finding their way into the flow paths of the liquid as the clay absorbs the leachate. The polymers then interact to form a blockage in the flow path, like a logjam in a river. The resulting material can withstand pH levels

as low as 1 (highly acidic) and as high as 14 (highly basic), depending on the concentration of the substances involved.

UW-Madison and CETCO researchers are working on how to adapt these materials to commercial uses. Chris Athanassopoulos, former technical services manager in CETCO's suburban Chicago office and now a professor at Harper College, says the involvement of UW-Madison engineers made it much easier to get people in industry interested in the new product. "When you're talking with a design engineer or a regulator, unfortunately they have lots of experience talking to salespeople, or people who promise the world to them without backing it up with good technical information," he says. "The fact that we were able to have data from Craig's lab over the long term, with some of these materials, was probably the biggest benefit in terms of getting acceptance."

Athanassopoulos and former colleague Mike

Donovan, R&D director for CETCO, commercialized the product as Resistex GCL, and have developed an even more robust version, Resistex Plus.

So far, the products have been accepted by one of the world's largest producers of aluminum, which recently used the material to line one of its storage facilities for aluminum tailings.

To build on this success, Benson plans to focus on understanding the chemistry of how the material works, and eventually build off the material's design to create a suite of different materials tailored to contain different kinds of extreme chemistries.

Beyond industrial waste storage, Benson sees potential for this research in applications as diverse as plugging wells and building containment walls that seal off contaminated groundwater areas from the rest of the water supply. And as UW-Madison researchers and CETCO scientists learn more about the science of extremely resilient environmental materials, CETCO is exploring how to adapt its manufacturing processes to spread the benefit of these materials.

"Craig and his team are always asking questions and developing tests," Athanassopoulos says. "We've learned a lot from them."

"You have to be able to store the waste into perpetuity—hundreds of acres of this liquid."

—Wisconsin Distinguished Professor
Craig Benson



Currents *(Continued from front page)*

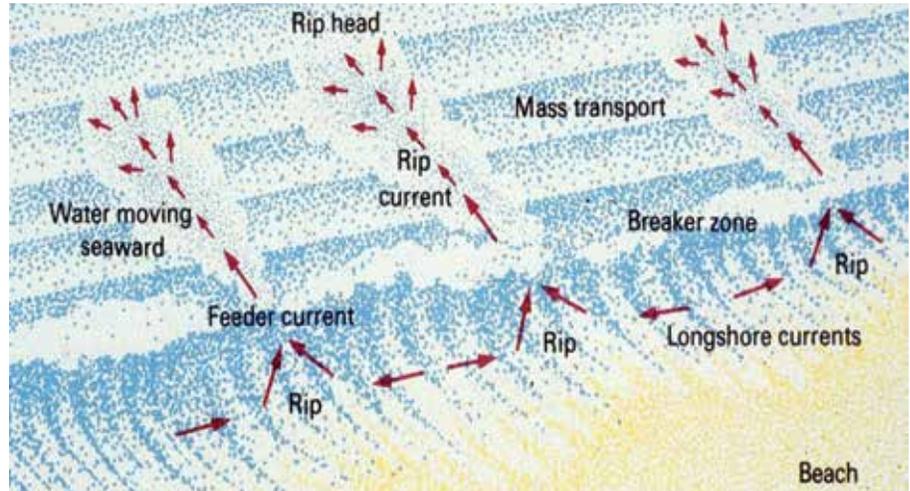
In the tradition of the Wisconsin Idea, he's determined to spread the benefits of science and engineering to people throughout the state and region.

Reading the lakes—Each pilot site is prone to a different kind of rip current, which creates an opportunity to flesh out some of the basic science of rip currents and to protect swimmers from a greater range of potentially dangerous conditions. Park Point Beach in Duluth sees a high occurrence of “bar gap” currents, which form in the gaps between sandbars. Milwaukee’s Bradford Beach often has “headland” currents, which sweep along the shoreline and then out, amplified by variations in the sea floor. Finally, North Beach in Port Washington faces “structure-induced” rip currents, which occur when currents deflect off a pier or breakwater.

The key thing is to understand the basic mechanisms that cause rip currents, Wu says. As inland seas, the lakes are subject to seiches—standing waves that essentially reverberate back and forth across a body of water—and to weather-generated tsunamis, known as meteotsunamis. Wu says that researchers will need to pay more attention to those factors if they ever hope to capture dangerous currents in the lakes.

Despite these gaps, INFOS will still draw on deep and nuanced knowledge of how the Great Lakes are different from—and in some respects, actually are more dangerous than—other bodies of water. Spreading that knowledge, too, is a key aspect of improving the region’s safety culture, and fighting the assumption that the lakes are inherently safer than the oceans. “In the Great Lakes, people underestimate the waves,” Noordyk says. “In the ocean, there’s a longer wave period, whereas in the Great Lakes, they just keep coming and coming.”

“One of the big challenges is that the near-shore system in the Great Lakes is very dynamic,” says Brent Schleck, a coastal storms



outreach coordinator with the Minnesota Sea Grant College Program. “It’s not apparent, with much forewarning, where these currents will be occurring. Where those rip channels in the sandbar are created is something that’s not necessarily known, and that leads us to the need for real-time observation on beaches.”

A community’s response to tragedy—

When these threats resulted in the death of a teenage swimmer, Port Washington residents and Mayor Tom Mlada vowed that it wouldn’t be in vain. Over Labor Day weekend 2012, Tyler Buczek, 15, drowned in a rip current off one of the city’s beaches. “When you see somebody’s life cut short, you’re reminded again of the power of Lake Michigan, and the need to respect that power,” Mlada says. “The indication of a community’s strength and character is not whether it suffers a tragedy, but how it responds.”

Wu had previously addressed safety issues on the Great Lakes, including freak waves that endanger kayakers in the Apostle Islands area in Lake Superior. Buczek’s death helped motivate Wu to start the INFOS project, well before he even received a grant, and Wu has spent the last couple of years meeting with the Port Washington beach safety committee, hashing out an approach that factors in the unpredictability of Lake Michigan.

“The lake is changing on a daily basis,” Mlada says. “Structurally, there certainly are areas that may be better to stay away from, but the reality is that to try to designate generically a place that folks should stay away from is pretty difficult to do.”

Like many communities along the lakes, Port Washington faces logistical barriers to safer beaches, including a lack of dependable cellphone service in some beach areas, which can make it hard to reach emergency responders. (The city may install some Wi-Fi networks in certain beach areas to at least aid in INFOS transmissions, Mlada says.) And unlike on the ocean coasts, it’s uncommon for Great Lakes beaches to have lifeguards.

Mlada says he has faced some criticism that the emphasis on safety will stir up fear among potential beachgoers, potentially damaging the \$6 to \$10 million economic impact the beaches annually draw into the local economy. But Mlada argues that INFOS will ultimately make beachgoers in Port Washington feel more confident by connecting them with a wealth of information.

“This is cutting-edge, but cutting-edge in all the right ways,” Mlada says. “It empowers people and keeps people informed.”



Swimmers at Park Point Beach in Duluth, one of three sites where UW-Madison researchers will test a pilot system for anticipating rip currents in the Great Lakes.



The CEE golf outing

The CEE department held its 18th annual golf outing September 25 at Pleasant View Golf Course in Middleton, Wisconsin. Fifty-eight companies sponsored the event and 170 golfers played in the scramble, raising almost \$60,000 to support our students and department.

Thanks to the strong support and hard work of our golf committee and all our volunteers, the event was a great success!



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UW-Madison launches online master of engineering in environmental engineering

The University of Wisconsin-Madison is now offering an online master of engineering degree in environmental engineering. Students may now apply for the program with classes beginning in September 2015.

The environmental engineering degree prepares engineers to tackle tomorrow's increasingly complex environmental challenges. Its courses are designed to provide the depth of skills needed for those engineers seeking to advance their career.

"We are very excited to launch the Master of Engineering in Environmental Engineering degree," says Lee DeBaillie, program director. "This degree program provides environmental engineers with the competencies needed to solve environmental challenges effectively across technical, organizational and social boundaries."

Environmental engineers are critical to solutions for some of society's biggest challenges. Leading teams toward successful solutions will require that environmental

engineers understand the viewpoint of members of interdisciplinary teams, social concerns including public health, environmental quality, government regulations and requirements, and sustainability concepts. This degree provides the foundation for graduates' success in consulting practice, government service, and industry.

UW-Madison's Department of Engineering Professional Development has worked closely with faculty from the Department of Civil and Environmental Engineering in designing this comprehensive program.

"We've carefully crafted a practical and applied program for environmental engineering practitioners," says Michael Doran, adjunct professor in the Department of Civil and Environmental Engineering. "Furthermore, the program was specifically designed to deliver the body of knowledge established by the American Academy of Environmental Engineers and Scientists as needed for professional practice."

The Environmental Engineering program builds on the strengths of UW-Madison's online graduate engineering programs, which are ranked #3 overall by *U.S. News & World Report*.

For more information on the new environmental engineering degree, visit environment.engr.wisc.edu, or contact Lee DeBaillie, program director, (608) 262-2329 or debaillie@wisc.edu.