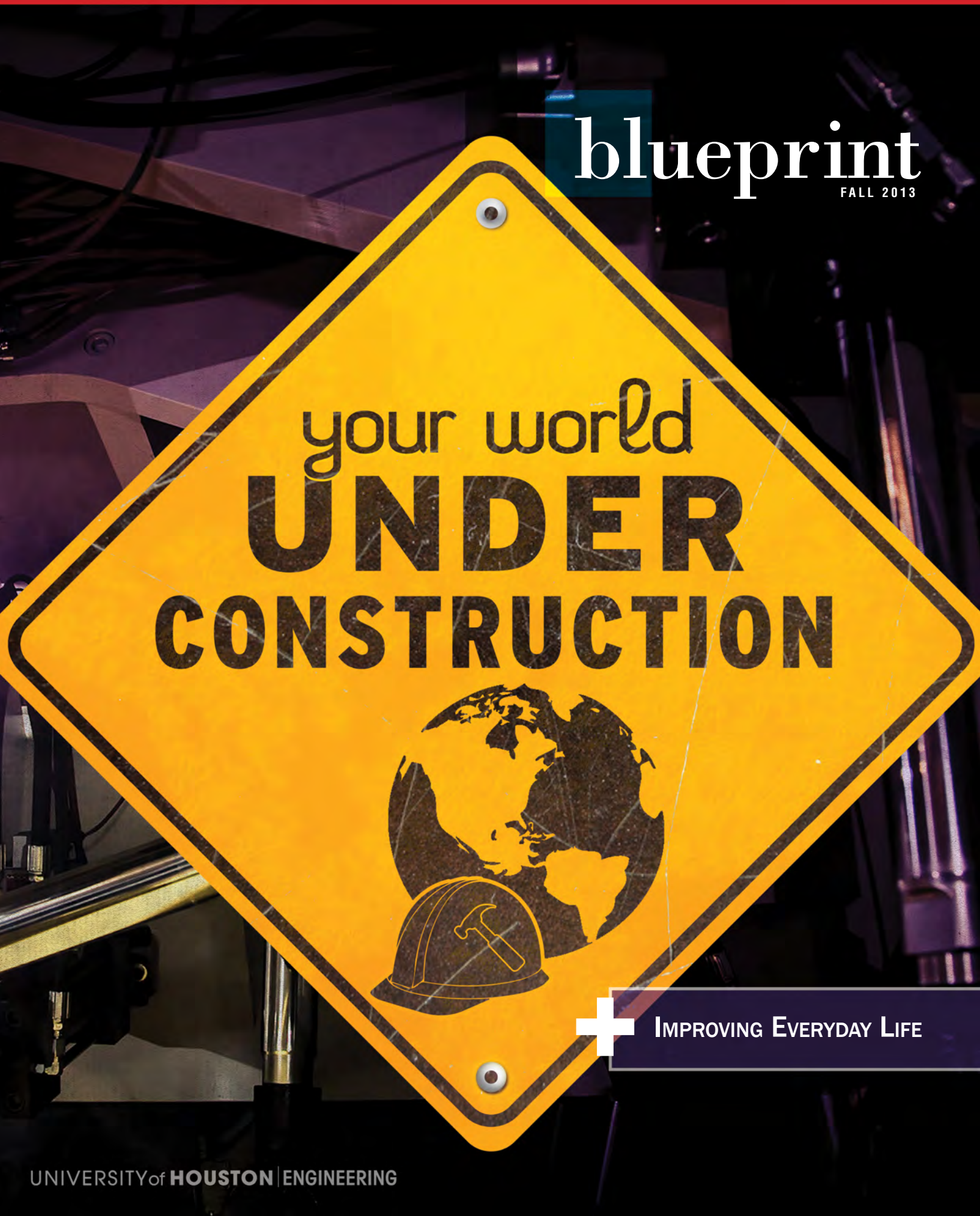
blueprint

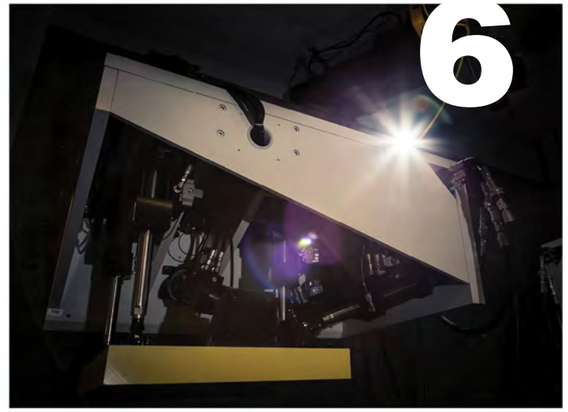
FALL 2013



+ Improving Everyday Life

blueprint
MEDIA spotlight

Each summer and fall, clouds of dust from the Sahara Desert in Africa blow across the Atlantic Ocean and settle in and around the city of Houston, lowering the air quality. Professor **Shankar Chellam** is unraveling the mystery of why and how the Saharan dust comes to Houston each year and – perhaps more importantly – just how much the dust pollutes Houston's air. Chellam's work has been featured in Science Daily, Science 2.0, The Environmental Monitor and on local Houston TV and radio news stations, including News 92 FM with Mike Barajas.



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Rogers Retires After 43 Years of Service

Jerry Rogers, one of the longest-serving faculty members in the history of the department of civil and environmental engineering, officially retired at the end of the 2012/2013 academic year.

Rogers joined the department in 1970 and went on to lead a highly distinguished career in the practice and teaching of civil engineering, particularly environmental and water resources engineering.

Over the decades, he amassed a long list of designations and awards that underscore a high level of professional contribution. These include the 1974 Texas Young Engineer of the Year Award from the Texas Society of Professional Engineers San Jacinto Chapter; the 1996 Engineer of the Year Award from the Texas Society of Professional Engineers and Engineers Council of Houston; and the 2011 Lifetime Achievement Award from the Environmental and Water Resources Institute of the American Society of Civil Engineers (ASCE).

Rogers has served as president of the ASCE Houston Branch, president of the ASCE Texas Section, and national president of the American Water Resources Association (AWRA).

Rogers has participated in funded UH research contracts from NASA, Harris County Flood Control District, City of Houston, City of Conroe, City of Pearland, and U.S. Community Service. From 1971 to 2001, Rogers authored or co-authored 60 papers and publications and has given dozens of research and invited seminar presentations.

Rogers is also an accomplished historian of civil and environmental engineering and has published and/or edited several books and publications on the subject. These efforts will continue well into his retirement. Next year, he will co-edit the ASCE Panama Canal Centennial (1914-2014) History and the AWRA 50th Anniversary (1964-2014) History. He is also completing a history of the UH department of civil and environmental engineering.

1: Kaspar Willam reads Jerry Rogers a speech at his retirement party. 2: Awards presented to Jerry Rogers throughout the years. 3: Jerry Rogers at the 2013 Civil Alumni Luncheon. 4: Jerry Rogers receives gifts from colleagues at his farewell party.

Two Alumns Honored by Department

C. Rick Coneway (BSCE '73, MSEE '76) and Kenneth E. Tand (BSCE '72, MCE '76) were officially inducted into the department's Academy of Distinguished Civil and Environmental Engineers last May.

Coneway is the executive vice president of development and operations at Doucet & Associates, Inc., a civil engineering design, consulting, land planning and surveying firm. He is a Fellow member of both the American Society of Civil Engineers and the Society of American Military Engineers, and a Lifetime Member of the Water Environment Federation. In 2000 he was named Engineer of the Year by the Texas Society of Professional Engineers and in 2010 the Civil Engineer of the Year by the ASCE Austin Branch. He has volunteered with Leadership Austin, Greater Austin Chamber of Commerce, Lake Travis Advisory Panel, and Wild Basin Wilderness Preserve.

Tand is the founder, president and principal engineer of Kenneth E. Tand & Associates, Inc., whose projects include geotechnical engineering studies for multi-story office buildings, office/warehouse complexes, and petrochemical units. Tand has published numerous technical papers and articles, and has taught courses at the University of Houston on case histories in civil engineering. He is a member of several professional societies, including American Society of Civil Engineers, Texas Society of Professional Engineers, National Society of Professional Engineers, American Council of Independent Laboratories, American Society for Testing and Materials, and the Chi Epsilon Honor Society.

Energy, Water Researcher Joins Faculty

The department of Civil and Environmental Engineering welcomed its newest faculty member this fall, **Yandi Hu**. Hu earned her Ph.D. in May 2013 from Washington University in St. Louis' Department of Energy, Environmental and Chemical Engineering. Her main research interests focus on relieving emergency energy and water shortages and their associated environmental problems. These efforts include research into geologic carbon dioxide sequestration, preventing scale formation during oil production, and water pollution remediation using natural and engineered nanoparticles.

Cullen College of Engineering
Department of Civil and Environmental Engineering:

In the MEDIA

Professor Cumaraswamy "Vipu" Vipulanandan, director of the Texas Hurricane Center for Innovative Technology, was featured on Houston ABC affiliate Channel 13 news in August. The report focused on the fifth annual Texas Hurricane Center Conference held at UH and covered power grid restoration following hurricanes and other strong storms.

Researchers with the department's National Center for Airborne Laser Mapping made international news for their discovery of previously unknown ruins in the Honduran rainforest. Coverage of the finding included a multi-page feature in The New Yorker magazine.

Shankar Chellam's finding that dust from the Saharan Desert regularly makes its way to Houston air was covered extensively in local news reports and online. For more on this research, see front inside cover.

DISASTER RECOVERY

Gets Boost From NSF Grant

By Toby Weber

One of the biggest challenges following a natural disaster is simply getting help to where it's needed.

After an event like a hurricane or earthquake, debris and standing water can block roadways, making it nearly impossible for rescue crews to know which paths will lead them to people in need.

First responders often rely on aerial reconnaissance to learn which roads are passable. There are a lot of drawbacks to these flights, though, said **Craig Glennie,** assistant professor of civil and environmental engineering with the University of Houston Cullen College of Engineering. "When they bring mapping data collected in the air back, they have to land and they have to process that data. It takes a couple of hours to get it into the hands of the first responders."

The National Science Foundation has awarded Glennie a two-year, $300,000 grant to eliminate this lag time and put information into the hands of first responders in a matter of seconds. His technology: LiDAR, or Light Detection and Ranging.

Through LiDAR, hundreds of thousands of laser bursts per second are shot at the ground from an airplane. By analyzing how quickly that light returns to its source, researchers can create detailed topographical maps.

The basics of LiDAR technology itself are well developed. In most situations, however, LiDAR maps don't have to be created instantly. The real work of this project, Glennie said, will be developing algorithms that can create maps in a matter of seconds and identify landscape changes that actually matter.

"Telling first responders something has changed is important, but it doesn't matter if a tree fell down in a middle of a field. What matters is if you have a tree that fell down on a major roadway," Glennie said.

Glennie's collaborators on this project include Ioannis Kakadiaris, Hugh Roy and Lillie Cranz Cullen University Professor of Computer Science at UH; Shishir Shah, associate professor of computer science at UH; and Cumaraswamy Vipulanandan, professor of civil and environmental engineering in UH's Cullen College of Engineering.

HIGH Performance in Small Doses

New, stronger concrete that can better withstand an earthquake isn't much good if it's too expensive to use.

That's the idea behind a research project being conducted by **Bora Gencturk,** assistant professor of civil and environmental engineering. Gencturk recently won a two-year, $175,000 BRIGE award from the National Science Foundation to study ways to selectively use high-performance fiber-reinforced concrete (HPFRC) in buildings.

These types of concrete are made with fibers of polymer or steel, which give the material extra strength and ductility, making it more likely to survive an earthquake without suffering major damage. While that's clearly desirable, the fibers also drive up the price of concrete substantially, limiting the materials' practical uses.

"In most cases, it would be too costly to use high-performance concrete for an entire building," said Gencturk. "On average, the material is about three to five times more expensive than normal concrete. It's difficult to convince people to invest that much more money."

His alternative: use high-performance concrete only at those spots where a structure is likely to fail, specifically at the joint regions of horizontal beams and vertical columns. This approach, he said, would help limit construction costs while reaping the benefits of advanced materials.

To conduct this work, Gencturk is relying on two pieces of equipment to which few groups have access. The first is a multi-axial testing system. The heart of this system is a loading platform where a concrete column or beam can be attached. The platform itself is connected to a series of pistons that allow it to shift the beam or column in practically any direction. With this tool, Gencturk can very accurately simulate the types of loads beam-column joints are exposed to during an earthquake.

The second tool is a non-contact digital image correlation system. With this system, researchers coat the concrete with a spray-on peckle pattern. They then test how the material holds up to different loads while filming it with two separate cameras. By using individual speckles as reference points, they can then match up images from the two cameras to answer questions about material failure, such as where cracks occur and how they grow.

Combined, these two systems will allow Gencturk to study exactly how beam-column joints made with HPFRCs withstand different loads during earthquakes. Though this grant is his first in what will hopefully be a series of awards on this topic, Gencturk believes this work could lead to design specifications for the use of high-performance concrete at beam-column joints.

Faculty Writing Composite Materials

DESIGN Specs

While concrete and steel remain the backbones of modern infrastructure, civil engineers are exploring ways to add advanced composite materials to the mix. These materials could increase the service life of existing structures in need of repair and new structures alike by decades.

Before structural engineers can include these materials in roads and bridges, though, they must know exactly how to use them. “If you just tell the engineering community that there is a very nice new material they should use, it’s not going to happen,” said **Abdeldjelil “DJ” Belarbi**, professor of civil and environmental engineering with the University of Houston Cullen College of Engineering.

“You need to test these materials and create a set of design specifications that explain how they should be used.”

That’s exactly the task Belarbi and his colleagues Mina Dawood and Bora Gencturk, both assistant professors in civil and environmental engineering, have undertaken. The team is developing design guidelines and specifications for the use of prestressed carbon fiber reinforced polymers (CFRPs) in the construction of new bridges. To conduct this work, they recently won a three-year, $500,000 grant from the National Cooperative Highway Research Program, a group administered by the National Academy of Sciences and voluntarily funded by state transportation boards.

Depending on their particular makeup, CFRPs are not only stronger than steel, but they may also eliminate corrosion problems associated with prestressed steel – widely viewed as the biggest contributor to premature infrastructure deterioration.

CFRP systems can offer additional advantages by being prestressed. This, Belarbi said, helps limit superstructure deformations as well as the formation of cracks. The greater durability generated by CFRP prestressing systems allows for the construction of longer span bridges and the more efficient use of materials.

While this process is well understood, exactly how much strength different CFRPs confer on concrete bridge elements and how they should be used in new construction must be determined.

Belarbi and his team will conduct extensive testing on CFPR systems and use their findings to write design specifications for bridges using CFRP-reinforced concrete. These specifications almost certainly will be adopted as part of the official design code published by the American Association of State Highway and Transportation Officials (AASHTO). This code, Belarbi stated, is used by all state Departments of Transportation (DOTs) across the country to create binding rules for bridge design.

LASER MAPPING CENTER Gets Renewed NSF Funding

The University of Houston's National Center for Airborne Laser Mapping (NCALM) has, in the past few years, located ancient ruins, identified levees in danger of failing, charted land erosion following hurricanes, created flood maps for urban areas, found near-drought conditions in seemingly healthy plants, mapped the sea floor, charted areas prone to landslides, and helped identify how the presence of life impacts geographical features.

And that's just scratching the surface.

Given all that NCALM makes possible, the National Science Foundation has funded the center's operations for the past decade. This summer the NSF (through the Division of Earth Sciences, Instrumentation & Facilities, EAR 1043051) renewed its support for NCALM, granting it approximately $3.18 million to continue its work for the next five years.

"This is a big vote of confidence," said **Ramesh Shrestha**, NCALM director and Hugh Roy and Lilly Cranz Cullen Distinguished Professor of Civil and Environmental Engineering at UH's Cullen College of Engineering. "This funding is a signal that the technology and imaging techniques we develop have great value to researchers across the sciences."

NCALM's core technology is LiDAR, or Light Detection and Ranging. With LiDAR, researchers fly above an area they want to map, shooting hundreds of thousand of laser bursts per second at the ground. How that light returns to its source can be used to create extremely detailed topographical maps, even through dense vegetation and murky water.

Over the years, such maps have proven valuable to researchers in a number of disciplines. NCALM, in response, has dedicated itself to being a resource for outside investigators as well as a home to basic and applied research. Roughly 40 NSF-funded principle investigators have conducted research with data delivered by the center, and hundreds of peer reviewed articles that utilized NCALM observations have been published, including featured articles in Nature, Physics Today and Science.

In recent years, the center has expanded into new technologies, including satellite data analysis, multi-sensor image processing that combines GPS with ground-based and airborne LiDAR, and hyperspectral imaging. NCALM researchers are currently developing smaller and cheaper LiDAR systems, systems that can scan the floor of lakes and the ocean through deeper and deeper water; and systems that use two or more different colored lasers, which may reveal properties of the materials they hit.

Former AEROSPACE Researcher Returns to School for CIVIL Degree

Non-traditional students often have incredible drive and passion for their education.

Scott Wallace is a perfect example.

Wallace is set to graduate with his Bachelor of Science degree in Civil Engineering in December with a truly impressive resume. He's taken at least 18 credit hours each semester and earned a spot on the dean's list every time. He's served as an officer in the UH chapter of the American Society of Civil Engineers and as captain of the concrete canoe team. He's also set to be one of the first students to earn a minor in the university's new Energy & Sustainability program.

"I don't work when I'm going to school. I played that game before and found I only had the bandwidth for one or the other. If I'm going to be in school, I'm going to treat it as a full-time job and get as much value out of it as I can," he said.

In truth, Wallace has always been a high achiever. Ironically, that probably stopped him from getting a degree during his first college go-around a decade ago. During his sophomore year, he took a job assembling components for an aerospace engineering start-up. As the company grew, so did his responsibilities. He soon left school to focus on project management and R&D with the firm.

Eventually, though, the lack of a degree caught up to him. "I was doing research initiatives with DARPA (Defense Advanced Research Projects Agency) and the Air Force Research Lab, and I needed to have that credential," he said.

So Wallace resolved to return to school. Having done enough work on components measured by millimeters (or less), he signed up for civil engineering and the bulk scale.

With graduation fast approaching, Wallace is now weighing his options. He's got a lot to consider. He's been accepted to multiple graduate programs and has received several job offers. Whatever route he chooses, Wallace will no doubt be well served by the drive he's shown during his career at the Cullen College.

"Going to school at this point in my life is on purpose. This is not the path of least resistance. When I was in school the first time, it was just what I was supposed to do. But to make this change now, this is the path of most resistance. It gives you a lot more purpose. I see it in other non-traditional students. We're here to accomplish something."

Chair's Message

Kaspar Willam

Interim Chair, Dept. of Civil and Environmental Engineering

"The higher UH is regarded, the more valuable and sought after an education at the University of Houston becomes."

Dear CEE Alumni and Friends,

Hello and welcome to the latest issue of Blueprint, which highlights the achievements of the Civil and Environmental Engineering Department at the University of Houston Cullen College of Engineering.

The past several months have been quite productive for our department. Last fall, primarily due to higher admission standards and programmatic changes, we saw a dip in our undergraduate enrollment. I am happy to report that enrollment in the spring of 2013 increased significantly, followed by another increase this fall. This upward trend in both enrollment and student caliber bode well for the future of the department.

Our graduate enrollment is also growing. In the fall of 2008, we had 85 graduate students in the department. Today, that number stands at 152. Roughly 90 of these students are pursuing a Ph.D. This is significant. Ph.D. graduates play a big role in building the reputation of the college and department, as well as the university as a whole. Not only do doctoral students go on to become professors and researchers whose work demonstrates the value of their time here, but the number of Ph.D.'s a university confers is factored into several important university rankings. And the higher UH is regarded, the more valuable and sought after an education at the University of Houston becomes.

Good news also came with the close of the fiscal year on July 31. Research expenditures in our department increased by nearly $1 million to more than $4.1 million. That translates to roughly $200,000 per faculty member. Those are very respectable figures representing our enterprising faculty and ones we should all be proud of. We are, of course, not satisfied and will continue our efforts to push these numbers even higher. In fact, many of the research projects featured in this publication will contribute to our research expenditures in the years ahead.

Finally, let me extend congratulations to two of our alumni, Rick Coneway (BSCE '73, MSEE '76) and Kenneth Tand (BSEE '72, MCE '76). In May, they were inducted into our Academy of Distinguished Civil and Environmental Engineers. The academy recognizes our most accomplished alumni, those who have made significant, sustained contributions to the engineering profession, discipline, the university, or society at large. You'll find a brief piece in this publication outlining some of their achievements. Once you read it, I'm sure you'll find them more than deserving of such an honor.

Kaspar Willam
Hugh Roy and Lillie Cranz Cullen Distinguished Professor
Interim Department Chair

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