UNIVERSITY of HOUSTON | DEPARTMENT of CIVIL & ENVIRONMENTAL ENGINEERING

Blueprint

Cullen College Department
of Civil & Environmental Engineering Magazine | Issue No. 6

LOST CITY

DISCOVERED DEEP WITHIN HONDURAN RAINFORESTS

+ NEW GEOSENSING SYSTEMS PH.D. PROGRAM

+ RESEARCH BREAKTHROUGHS

+ STUDENT SUCCESS

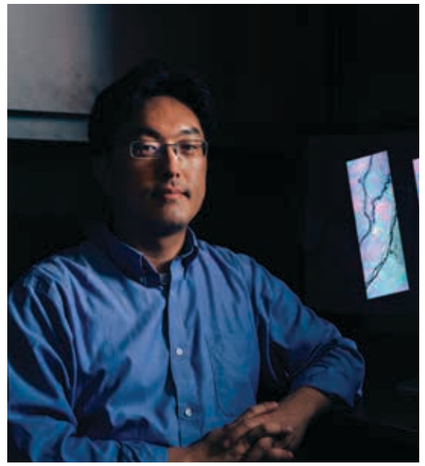
COLLEGE ANNOUNCES PH.D. PROGRAM IN GEOSENSING SYSTEMS ENGINEERING AND SCIENCES

The UH Cullen College of Engineering continues its tradition of providing innovative and industry-relevant academic programs by officially announcing the approval of a new Ph.D. program in geosensing systems engineering and sciences. The University of Houston is currently the only institution in the world offering a graduate program in geosensing systems engineering and sciences, a cross-disciplinary field focusing on the use of airborne mapping to meet the needs of private industry, government agencies and academic institutions.

Graduate students pursuing a degree in geosensing systems engineering have the benefit of working within the NSF-funded National Center for Airborne Laser Mapping (NCALM), the world's leading center for using Light Detection and Ranging, or LiDAR, to conduct cutting-edge research for a variety of disciplines. With LiDAR, researchers fly a plane over 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. In the past five years, NCALM has 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.

Ramesh Shrestha, NCALM director and Hugh Roy and Lillie Cranz Cullen Distinguished Professor of civil and environmental engineering, said as the geospatial technology sector continues to grow rapidly, so does the demand for scientists who are trained to use these technologies. "That's why we knew we had to develop a doctoral program," Shrestha said. "We developed the Ph.D. program in direct response to these industry trends."

To learn more about the Geosensing Systems Engineering and Sciences Ph.D. Program, please visit http://www.cive.uh.edu/programs/geosensing-systems-graduate/doctor-philosophy-phd.



CONTENTS

Blueprint

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Communications Director	Audrey Grayson
Art Direction & Design	Rachel Ward
Photography	Carlos Landa
Writer	Elena Watts
Contributing Writer	Jeannie Kever

Office of Communications
Cullen College of Engineering
University of Houston
E301 Engineering Bldg. 2
Houston, Texas 77204-4009
Phone: 713-743-4220 Fax: 713-743-8240

Contact CEE:
Phone 713.743.4250
Website www.cive.uh.edu

cullen college news
@uhengineering
uhengineering
UHCullenCollege
University of Houston Cullen College of Engineering

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CHAIR'S MESSAGE

Welcome to the fall 2015 issue of *Blueprint*, the magazine devoted to the academic and research achievements of the faculty and students within the Civil and Environmental Engineering (CEE) Department at the UH Cullen College of Engineering. I would like to express to all of our alumni and friends my sincere appreciation for their moral and financial support over the years, which has been instrumental to the continuous improvements of our vibrant teaching and research programs.

As a newcomer to the department, I am inspired by the entrepreneurial spirit of the city of Houston and the boundless energy and excellence of the faculty, staff and students at the Cullen College. The research and teaching performed in the CEE department are helping to restore our nation's ailing infrastructure, providing technical expertise that will facilitate underground energy resources, ensuring that our water sources are clean and safe for drinking, and protecting the Gulf Coast region from hurricanes and natural disasters, among many other contributions to society.

Recent job growth projections for civil engineers show that graduates of our academic and research programs will be in even higher demand in the years to come. In fact, civil engineering was ranked first in job growth out of all engineering occupations, with over 45,000 new jobs expected to come online through 2023. According to Kelly Engineering Services, civil engineering students, faculty and alumni will play an even greater role in the city of Houston, where demand for engineers will be higher than in any other U.S. city.

In preparation for the increased demand for UH civil and environmental engineering graduates, the CEE department will continue to grow its student enrollment, faculty members and research portfolios. In the meantime, I invite you to learn more about how the Civil and Environmental Engineering Department at UH is making a positive and lasting impact on the Greater Houston region and beyond in this issue of *Blueprint* magazine.

Roberto Ballarini
Thomas and Laura Hsu Professor and Department Chair
Civil and Environmental Engineering
Cullen College of Engineering
University of Houston

BY THE NUMBERS

CIVIL ENGINEERING IS

#1 in job growth out of all engineering occupations

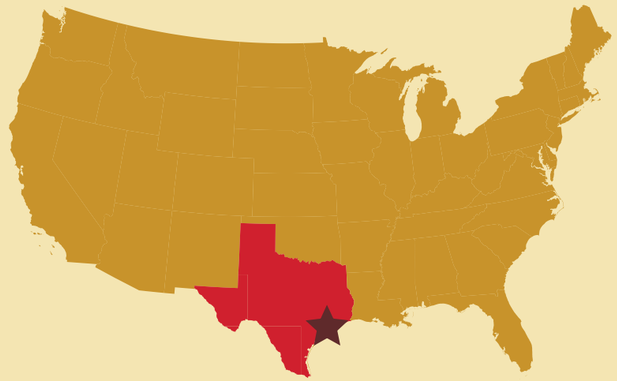
TOP 10 OCCUPATIONS

Growth forecast for engineering occupations:

CIVIL ENGINEERS	**+45,745**
Mechanical engineers	+25,485
Architectural and engineering managers	+19,650
Industrial engineers	+17,660
Electrical engineers	+16,561
Electronics engineers*	+12,139
Petroleum engineers	+11,469
Computer hardware engineers	+10,799
Biomedical engineers	+10,542
Environmental engineers	+10,129

*Excluding computer engineers [Source: Kelly Engineering Services, 2015]

The city of **HOUSTON** is the **#1** metropolitan area in the U.S. for demand for engineers



TOP 10 LOCATIONS

These U.S. metropolitan areas will have the greatest demand for engineers:

HOUSTON, TX	**+ 14,925**
Washington, D.C.	+ 9,864
Los Angeles, CA	+ 8,898
Dallas, TX	+ 8,163
San Francisco, CA	+ 7,312
New York, NY	+ 6,970
San Jose, CA	+ 6,820
Boston, MA	+ 6,773
Denver, CO	+ 6,385
Phoenix, AZ	+ 6,147

[Source: Kelly Engineering Services, 2015]

Civil engineering was one of the **TOP TEN** **highest paid majors in 2014,** with bachelor's degree graduates earning an average starting salary of **$60,018**

[Source: National Association of Colleges and Employers, 2015]

The median income for engineers is **$85,000 per year –** TWICE that of all other occupations

[Source: Kelly Engineering Services, 2015]

UH engineering majors are ranked 15th in the U.S. for earning potential.

UH engineers earn an average starting salary of **$69,800** per year in their early careers and about **$123,500** by their mid-careers

[Source: PayScale.com]

UH SELECTED TO LEAD OFFSHORE ENERGY RESEARCH CENTER

The University of Houston will lead a national research center for subsea engineering and development of safe and sustainable offshore energy resources. The work will focus on reducing risks of offshore accidents, oil spills and other deepwater disasters in the Gulf of Mexico.

The Subsea Systems Institute is funded by the federal Resources and Ecosystems Sustainability, Tourist Opportunities and Revived Economies of the Gulf Coast States (RESTORE) Act with penalties paid by British Petroleum (BP) for the devastation caused by the 2010 Deepwater Horizon oil spill.

Outgoing Texas Gov. Rick Perry earmarked $4 million already paid to Texas by BP for the UH-led center and another center led by Texas A&M University-Corpus Christi. Total funding is pending determination of penalties levied in civil court. UH President Renu Khator called the Subsea Systems Institute a "defining moment" in the University's growth in her annual address last fall.

"We are grateful for this grant, which is the culmination of years of work to establish the University of Houston as 'The Energy University' and a vibrant and comprehensive partner with the energy industry," Khator said. "We envision our Subsea Systems Institute as serving to ensure that technologies, policies, regulations and standards needed for safe and environmentally responsible operations in the energy industry are developed and shared."

The RESTORE Act requires that the five states along the Gulf Coast affected by the Deepwater Horizon oil spill create centers to conduct research. The Houston-area Congressional delegation offered strong bipartisan support for UH as the lead institution for the center focused on offshore energy.

UH will lead the collaboration with Rice University, the NASA Johnson Space Center, Texas Southern University, Houston Community College and Lone Star College to serve as a resource for industry and government regulators.

"A center focused on prevention is the right thing to do," said Ramanan Krishnamoorti, chief energy officer at UH. "A center in Houston is the right place to do it, and UH, Rice and NASA is the right team."

Krishnamoorti said Houston's thriving energy industry makes the University's location ideal for the institute, which is also expected to explore the continued push by energy companies to move into deeper waters.

Researchers will test and validate equipment to establish neutral, third-party knowledge, standard policies and best practices. The institute will develop new materials and oversee workforce training, especially at depths and temperatures previously unexplored.

"As the home of the nation's only subsea engineering program, the University of Houston is uniquely positioned to lead not just the United States but the world in developing educational programs to ensure future leaders are able to safely and efficiently discover and develop future sources of energy in the Gulf of Mexico and other deepwater regions," said Paula Myrick Short, vice president for academic affairs and provost at UH.

UH ENGINEERING MAJORS RANKED 15TH IN U.S. FOR EARNING POTENTIAL

The University of Houston's Cullen College of Engineering was ranked among the top 20 schools in the country for graduating students with the highest salary potential by PayScale.com.

The 2013-2014 PayScale Potential Salary Report features the rankings of colleges by salary potential for graduates with degrees in nine specific major groupings, including humanities, engineering, social sciences and computer sciences. The University of Houston was ranked 15th for salary potential of engineering graduates. Other top 20 schools included Columbia University (#13) and MIT (#11).

PayScale.com is an online salary, benefits and compensation information company that provides surveys to estimate compensation for professions based on education levels, academic institutions, job titles, experience, companies and location, among other factors.

According to the PayScale report, UH engineering graduates earn an average of $69,800 annually early in their careers and an average of $123,500 annually by their mid-careers.

Read the full report at www.payscale.com/college-salary-report/best-schools-by-majors/engineering.

CULLEN COLLEGE WELCOMES ROBERTO BALLARINI AS CIVIL ENGINEERING DEPARTMENT CHAIR

The UH Cullen College of Engineering proudly welcomed **Roberto Ballarini** as the chair of the civil and environmental engineering department last fall.

Ballarini came to UH from the University of Minnesota, where he served as the James L. Record Professor of civil engineering for eight years in addition to heading the department from 2007 to 2012.

Although Ballarini earned his M.S. and Ph.D. degrees in civil engineering from Northwestern University, he said that his passion is applying his knowledge and skills to many fields and disciplines – even those beyond engineering. "My primary background is in the mechanics of materials and structures, but early on in my career I decided not to work on one specific topic," Ballarini said. "Instead, I decided to adopt a multidisciplinary approach and to pursue interesting problems in many different fields."

This cross-disciplinary outlook on the engineering field could help to explain why Ballarini's research has been published in civil engineering, mechanical engineering, biophysics, microengineering, and even dentistry journals; in fact, his research spans topics including advanced composites, microeletromechanical systems, natural and synthetic nanostructures, biological structures, aerostructures, applied mathematics and prosthetics.

But despite his many successes as a researcher, Ballarini said his proudest achievements came during his role as a teacher and mentor to engineering students.

"Teaching is what I enjoy the most. It is my number one priority," Ballarini said. "What I feel most happy about are the positive contributions I have made to the lives of the students I've taught. I very much enjoy receiving postcards at Christmas from undergraduate students who I taught almost 30 years ago. That's what I'm most proud of – the impact I have had as an engineering educator."

Ballarini added that his multidisciplinary mindset helps to inform his teaching style and classroom lectures. He often illustrates complicated engineering concepts by drawing on examples from industry and research from a variety of different fields.

"For example, a structural engineer can apply their knowledge of the laws of physics and chemistry to model the behavior of biological materials such as collagen, or electronic materials that comprise the guts of computers and cell phones," he said.

And since engineering students will be required to work in multidisciplinary teams once they enter industry or academia, Ballarini stressed the importance of introducing cross-disciplinary examples and concepts to engineers within their academic curriculum. Moreover, doing so increases the chances of students finding their niche within the many engineering fields by increasing students' exposure to a wide range of disciplines and career paths.

"Many new engineering students don't understand the versatility of a civil engineering degree," Ballarini said. "Our students graduate and go on to work at NASA, Boeing and in the oil industry – they are not just building bridges and roads, designing transportation systems, and helping to clean the environment. I think giving students this kind of mentoring on their possible career paths is so important."

In addition to adding a multidisciplinary flair to the civil and environmental engineering curriculum at the Cullen College, Ballarini said he hopes to increase undergraduate and graduate student enrollment within the department. He will also aggressively recruit new civil and environmental engineering faculty members, especially those who have expertise in geotechnical engineering and water resources.

Ballarini said he also plans to explore the potential benefits of starting a transportation program that will leverage the strengths of the Cullen College, other departments within the University of Houston, local industry and the Texas Department of Transportation.

Ultimately, Ballarini said the civil and environmental engineering department at the UH Cullen College of Engineering is destined for great things. This is due in no small part to UH's location in the city of Houston, the energy capital of the world.

"For a civil engineer, being in Houston is like being a kid in a candy store," Ballarini said. "There is a huge opportunity to connect with local industries, and Houston is an excellent place to try to solve many of the grand challenges faced by the civil engineering profession, such as transportation, infrastructure, carbon sequestration, clean water and even weather events such as hurricanes. Civil engineers have so much potential impact right here in Houston."

CIVIL ENGINEERING TOPS THE LIST OF FASTEST GROWING OCCUPATIONS IN THE U.S.

Engineering students across the country have a lot to look forward to according to workforce solution provider Kelly Services. The staffing agency published an engineering employment outlook last April with projections through 2023. In that time, they are predicting nearly 250,000 new engineering jobs will become available in the U.S.

Civil engineering tops the list of growing occupations, with Kelly Services estimating 45,000 jobs added through 2023. Following that is mechanical engineering (25,000 new jobs), architectural and engineering managers (19,000 new jobs), and industrial engineering (17,000 new jobs).

Even better news for Cullen College students: Houston was ranked as the top city for engineering demand. The overall demand for engineers in the U.S. is 60 percent higher than all other occupations, and the median income for engineers ($85,000) is over double that of general occupations.

To access the full outlook, please visit www.egr.uh.edu/engineering-job-growth.

RESEARCHERS HELP UNCOVER FURTHER EVIDENCE OF ANCIENT CULTURE IN HONDURAN JUNGLE

A scientist with the National Center for Airborne Laser Mapping (NCALM) at the University of Houston was part of the first expedition to a remote area of the Honduran rain forest, returning with more supporting evidence of an ancient civilization that has yet to be named.

Juan Carlos Fernandez Diaz said the group explored a small portion of the region the UH team mapped in 2012, when researchers completed the first light detection and ranging (LiDAR) survey of that country's Mosquitia region.

In addition to Fernandez, the group included American and Honduran archaeologists, an anthropologist, a documentary film crew, Honduran military forces and a British security crew. A reporter and photographer from National Geographic also accompanied the crew, which traveled to Honduras last month to gather additional evidence of the civilization.

Originally, the 2012 LiDAR mapping triggered talk that researchers had found the legendary White City, or Ciudad Blanca. But Fernandez said they identified evidence of two main cities and several smaller settlements, indicating not the mythological city but instead extensive traces of an ancient civilization that scientists have been aware of for decades but still have not been able to fully identify or name.

UH serves as the operational center for the National Center for Airborne Laser Mapping (NCALM), a collaboration between UH and the University of California at Berkeley funded by the National Science Foundation. LiDAR is used in a variety of applications – archaeology, charting land erosion, mapping the sea floor and identifying levees in danger of failing, among others.

It works by shooting thousands of laser bursts per second at the ground – the newest technology sends 900,000 bursts per second – using the information gathered as the light returns to the source to create detailed topographical maps.

Ramesh Shrestha, NCALM director and Hugh Roy and Lillie Cranz Cullen Distinguished Professor of civil and environmental engineering at UH, said the 2012 expedition returned with evidence of several distinct sites.

"Nobody knew what it was," he said. "How do we know what is down there? They haven't even named the civilization, but now they know it exists."

Researchers documented the artifacts discovered last month but left them in place. Fernandez said the Honduran military has agreed to secure the area – the exact location hasn't been named, to prevent looting.

It took more than two years for researchers to return after the initial discovery, in part because there was no way to reach the area. Shrestha noted that there were no roads to the area, which is located in the midst of an impenetrable jungle.

While the 2012 mapping was done with airborne LiDAR, Fernandez took a smaller, portable LiDAR unit on this trip to document the artifacts and more finely detail the 2012 findings. But he said he and the other team members left with more questions than answers.

"We don't know who they were, or how they lived, what foods they produced and consumed, or how they died," he said of the original inhabitants.

When the area was inhabited is still a matter of debate. Preliminary estimates from external researchers suggest the area was inhabited sometime between 500 A.D. and 1500 A.D. Fernandez said that is just one subject among many for future researchers to pursue.

"This is one of the nice things about being on the cutting edge of science and technology," he said. "More questions than answers."

PROFESSOR HELPS SOUTH ASIAN COUNTRIES MANAGE WATER RESOURCES WITH NASA GRANT

Hyongki Lee, assistant professor in the Cullen College's department of civil and environmental engineering, won a grant through NASA's Applied Sciences Program to help South Asian nations independently manage their water resources using software that interprets data collected from NASA satellites. The award to UH totals $220,000 distributed over four years.

Lee is an expert in utilizing data collected from remote imaging and sensing technologies, such as satellites, to create robust maps and data sets of regions of the world that are difficult to access by foot. Last year, Lee won NASA's New (Early Career) Investigator Award in Earth Science to use data collected from remote sensing technologies to better understand the hydrology and hydrodynamics of the waters in the Congo River Basin as well as the basin's connections with climate change, deforestation and carbon emissions from Congo waters.

With his latest NASA grant, Lee will travel to several South Asian countries to train government officials to use a novel software toolbox to better predict and prepare for floods and monsoons. Lee and his collaborators at the University of Washington and Ohio State University developed the software, which translates satellite altimetry data into easy-to-interpret maps and text descriptions of river water levels throughout South Asia.

The software toolkit, Lee said, is incredibly user-friendly, and the process of training government officials to use the toolkit is simple, inexpensive and relatively quick. Together, Lee and his team will visit Bangladesh, Pakistan, Bhutan and Nepal – all countries that depend on transboundary, or shared, river basins for their annual water supplies.

Many South Asian nations – including Pakistan, Thailand, Bangladesh, Myanmar, Laos, Vietnam, India, Cambodia, the Philippines and Malaysia – depend entirely on the monsoon season's heavy rains and flooding for their water supplies. In some of these places, up to 80 percent of the total annual rainfall comes during the monsoon season, which usually begins in mid-May and ends in late October or early November.

But floods and monsoons in these countries often originate in river basins that are located outside of their nations' boundaries.

"These countries often don't have enough time to prepare for flooding – for example, only about three days of lead time in the case of Bangladesh – because of a lack of communication between the nations," Lee said. "This is devastating for them."

The annual monsoon rains combined with increased glacial melt have made flooding more severe as well as more difficult to predict in these regions, Lee said. Last year, news reports cited that millions of people across South Asia were stranded in their flooded homes and hundreds of people died from waterborne diseases, electrocution, building collapses and drowning.

Lee and his collaborators developed their software toolkit for interpreting satellite data a few years ago. Since then, Lee has focused on creating a very simple and accessible graphic user interface, or GUI, for their software toolkit.

"The GUI is what takes all of the complicated data in the back end of the software – all of the calculations and algorithms – and translates it on the front end into a very user-friendly interface where the data appears as either a graphic map or a text output," Lee said.

Last year, Lee and his collaborators took their software toolbox to Bangladesh to train officials at the Bangladesh Flood Forecasting Warning Center to use the software to predict floods. With the new software, officials at the center were able to accurately predict floods up to eight days before they occurred.

"This was a huge success," Lee said. "We were able to increase their time to prepare by five days."

Lee and his collaborators traveled to Pakistan last March to train officials on how to use the software.

"Part of the purpose of this visit is to talk with decision-makers there about their specific needs," Lee said. "Then, we will take their feedback back to our labs and incorporate it into a modified version of the software toolkit, which will allow us to provide them with a product that is tailored specifically to their needs."

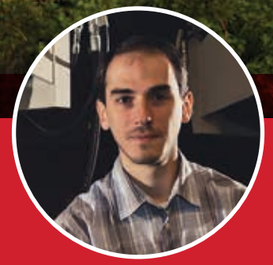
The ultimate goal is for these countries to use this software without the help of the researchers so that they can independently manage their own water supplies and better predict major floods and monsoons, Lee said.

This research falls under NASA's Applied Sciences Program, which encourages more researchers to use satellite altimetry data to solve real-world problems.

"There has been a lot of great basic research making use of satellite data, but NASA also wants to encourage researchers and academics to find novel ways of using satellite data for operational usage that has a real impact here on Earth," Lee said. "That's my specialty: using satellite data to solve real problems we are facing today."

Photo by Neil Palmer/CIAT for Center for International Forestry Research (CIFOR).

PROFESSOR WINS NSF CAREER AWARD TO STUDY NOVEL MATERIALS FOR BRIDGE COLUMNS



Bora Gencturk, assistant professor of civil and environmental engineering at the UH Cullen College of Engineering, earned a National Science Foundation (NSF) CAREER Award to explore novel materials to increase the resiliency of reinforced concrete bridge columns. The award totals $500,000 over five years.

The foundation awards 600 grants each year to support the development of academic careers that are dedicated to the stimulation of the discovery process through inspired teaching and enthusiastic learning, according to the NSF website.

Nationwide, the average age of bridges, which are generally designed for 50-year lifespans, is 42, according to data provided by the American Society of Civil Engineers. On a scale from A to F, the average grade for more than 600,000 bridges in the United States was a C-plus in 2013, and one-quarter of them were rated structurally deficient or functionally obsolete. The Federal Highway Administration estimates the cost to eliminate the backlog of bridge deficiencies at $20.5 billion annually until 2028. Currently, only $12.8 billion is spent each year.

Gencturk is working to improve durability and to lengthen lifespans of new and existing bridges. His research focuses on the combined effects of environmental aging and earthquakes on bridge infrastructure in the United States as well as the effects of using new materials for bridge construction. In the lab, Gencturk and his collaborators plan to produce representative columns with corrosion-induced damage to simulate environmental aging. Their objective is to study the load-carrying capacity of the bridges in aged conditions during regular operation and simulated seismic activity.

"The novel aspects of this study are the consideration of multiple hazards and the use of new, advanced materials to address those hazards," Gencturk said.

Deterioration is caused primarily by rusting of steel reinforcement bars inside concrete bridge columns and by reduced capacity and resistance of bridges located in seismic regions. Concrete's main flaw is that it cracks over time, and the cracks allow external environmental agents to penetrate the structures and rust the steel reinforcement.

Earthquakes, which cause large horizontal drifts, can cause significant damage to bridge columns and can render entire structures dysfunctional in their aftermath.

"We want to understand how reinforced concrete behaves and propose a new design approach to improve durability and seismic performance of the bridges," Gencturk said.

Gencturk and his team are studying conventional reinforced concrete structures to enlighten their understanding of applications for prefabricated ductile fiber-reinforced cementitious composite, DFRCC, counterparts. DFRCC provides increased crack resistance, higher tensile ductility and lower permeability. Another of Gencturk's goals is to examine designs of existing bridge columns for comparison to new design and construction approaches.

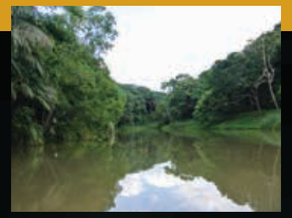
"We're not abandoning concrete and coming up with something totally new," Gencturk said. "We want to use advanced materials in an optimal sense in bridges in order to reduce repair and maintenance costs, and to extend their lifetimes."

Significant reductions in maintenance costs are expected because the materials are more resistant to environmental attacks and earthquakes. However, initial construction costs are expected to increase because DFRCC is more expensive than conventional reinforced concrete.

"Fortunately, the new bridges are expected to last at least twice as long – 100 years – which offsets initial increases in the long-term," Gencturk said.

Gencturk hopes to see his research implemented in bridge construction in the next decade. He also envisions application of the innovative design technology to marine architecture including offshore structures, piles and ports as well as parking garages and other construction exposed to environmental conditions.

NASA AWARD BOOSTS RESEARCH LINKING CONGO BASIN WATERS TO CLIMATE CHANGE



Hyongki Lee, assistant professor of civil and environmental engineering, won NASA's New Investigator Award to study the hydrology and hydrodynamics of the waters in the Congo River Basin, and their connections to climate change, deforestation and carbon emissions.

With a surface area of approximately 3.7 million square kilometers, the Congo River Basin is the second largest river basin in the world, surpassed only by the Amazon. Compared to the Amazon, though, the Congo Basin is a mystery. Its remote location combined with political instability in the region have prevented researchers from gathering even the most basic information about the basin: How much water exists in its wetlands? Is most of this water from direct precipitation, river flooding or upland runoff? How does deforestation impact downstream discharge? Is the Congo Basin a carbon sink? All of these are unknowns.

But there's still plenty of data being collected on the Congo River Basin. Satellites orbiting the Earth are constantly imaging the region, but these bird's eye views of the wetlands provide only the crudest details of a vast and highly complex ecosystem.

Luckily, Lee is an expert at taking the various forms of satellite remote sensing data and combining them to answer complex earth science questions. In this particular project, Lee will integrate satellite radar images, satellite radar altimetry data and multi-spectral satellite images to create two-dimensional, high-resolution maps of water balances in the Congo wetlands.

The maps of the region will help to answer the most pressing questions about water flow, sources, and patterns and contributions to global methane emissions. The project should give researchers a better understanding of everything from regional climate change to greenhouse gas emissions, Lee said.

PROFESSOR CREATES "DEFINITIVE GUIDE" ON NUCLEAR POWER INFRASTRUCTURE

Worldwide, dozens of nuclear power plants are scheduled for construction during the next decade, while hundreds more will be reviewed and examined by regulators. Thanks to the efforts of a University of Houston Cullen College of Engineering professor, the designers and operators of these facilities will have the most up-to-date guidelines on nuclear plant infrastructure available in one book.

"Infrastructure Systems for Nuclear Energy," published by John Wiley and Sons in 2014, was edited by **Thomas Hsu,** John and Rebecca Moores Professor with the department of civil and environmental engineering, along with Chiun-Lin Wu and Jui-Liang Lin, both with the National Center for Research on Earthquake Engineering in Taiwan.

The book includes 31 peer-reviewed chapters that cover the design and analysis of everything in a nuclear power plant save the reactor and its piping. These chapters fall into four main sections:

- An overview of nuclear plant infrastructure,
- Containment structures,
- Computer software for containment structures, and
- Nuclear waste storage facilities.

The book grew out of a conference organized and chaired by Hsu in 2010. The International Workshop on Infrastructure Systems for Nuclear Energy was held in Taipei, Taiwan in December of that year. The conference was truly international in nature, with invited speakers from China, France, Italy, Japan, Korea, the Netherlands, Switzerland, Taiwan and the United States.

From the outset, Hsu and his collaborators planned to use the conference presentations as the basis for a book on nuclear infrastructure. Initially, he said, they expected to have the book published by the spring of 2012, a little more than a year after the conference.

But on March 11, 2011, less than three months after the gathering, a magnitude 9.0 earthquake struck off the coast of Japan, causing a five-meter tsunami. These combined to cause massive damage and large radiation leaks at the Fukushima Nuclear Power Plant.

"Fukushima had a huge impact on this book," said Hsu. "The disaster revealed a lot about how to design a nuclear power plant. Almost every chapter in this book had to be changed. In some cases, there were just a few small adjustments. In others, the changes were quite extensive."

To complete the book, in fact, Hsu spent fifteen months as a visiting professor in Taiwan, where, in addition to teaching classes and recruiting graduate students to the University of Houston, he spent many long hours working with his co-editors on the book. The end product, he said, should serve as a central resource for students learning how to design and analyze these plants; as a comprehensive reference for the plant designers; as a resource that will help existing operators to improve their facilities; and as a guiding document for academics to recognize the direction of future research.

"Obviously, everyone wants nuclear power plants to be designed and built in the absolutely safest way possible," said Hsu. "With this book, we believe we have created the definitive guide on how to build and to operate these facilities."

RESEARCHERS TEST SMARTPHONES FOR EARTHQUAKE WARNING

Smartphones and other personal electronic devices could, in regions where they are in widespread use, function as early warning systems for large earthquakes, according to newly reported research. This technology could serve regions of the world that cannot afford higher quality but more expensive conventional earthquake early warning systems.

The study, published April 10 in the inaugural volume of the AAAS journal *Science Advances*, found that the sensors in smartphones and similar devices could be used to build earthquake warning systems. Despite being less accurate than scientific-grade equipment, the GPS (Global Positioning System) receivers in a smartphone can detect the permanent ground movement caused by fault motion in a large earthquake.

University of Houston researchers **Craig Glennie** and **Darren Hauser** are among those participating in the study.

Using crowd-sourced observations from participating users' smartphones, earthquakes could be detected and analyzed, and customized earthquake warnings could be transmitted back to users.

"The speed of an electronic warning travels faster than the earthquake shaking does," said Glennie, assistant professor of civil and environmental engineering at UH.

Sarah Minson, U.S. Geological Survey geophysicist and lead author of the study, said the crowd-sourced alerting "means that the community will benefit by data generated by the community." Minson was a post-doctoral researcher at Caltech while working on this study.

While much of the world's population is susceptible to damaging earthquakes, earthquake early warning (EEW) systems are currently operating in only a few regions around the globe, including Japan and Mexico.

"Most of the world does not receive earthquake warnings, mainly due to the cost of building the necessary scientific monitoring networks," said USGS geophysicist Benjamin Brooks.

Researchers tested the feasibility of crowd-sourced EEW with a simulation of a hypothetical magnitude 7 earthquake, and with real data from the 2011 magnitude 9 Tohoku-oki, Japan earthquake. The results show that crowd-sourced EEW could be achieved with only a tiny percentage of people in a given area contributing information from their smartphones. For example, if phones from fewer than 5,000 people in a large metropolitan area responded, the earthquake could be detected and analyzed fast enough to issue a warning to areas farther away before the onset of strong shaking.

The authors found that the sensors in smartphones and similar devices could be used to issue earthquake warnings for earthquakes of approximately magnitude 7 or larger, but not for smaller, yet potentially damaging earthquakes.

Comprehensive EEW requires a dense network of scientific instruments. Scientific-grade EEW, such as the USGS's ShakeAlert system currently being implemented on the west coast of the United States, will be able to help minimize the impact of earthquakes over a wide range of magnitudes. However, crowd-sourced EEW has significant potential in parts of the world where consumer electronics are increasingly common but there aren't sufficient resources to build and maintain scientific networks.

The U.S. Agency for International Development has already agreed to fund a pilot project, in collaboration with the Chilean Centro Sismologico Nacional, to test a pilot hybrid earthquake warning system comprising stand-alone smartphone sensors and scientific-grade sensors along the Chilean coast.

"The use of mobile phone fleets as a distributed sensor network — and the statistical insight that many imprecise instruments can contribute to the creation of more precise measurements — has broad applicability including great potential to benefit communities where there isn't an existing network of scientific instruments," said Bob Iannucci of Carnegie Mellon University, Silicon Valley.

"Thirty years ago it took months to assemble a crude picture of the deformations from an earthquake. This new technology promises to provide a near-instantaneous picture with much greater resolution," said Thomas Heaton, a coauthor of the study and professor of Engineering Seismology at Caltech.

"The U.S. earthquake early warning system is being built on our high-quality scientific earthquake networks, but crowd-sourced approaches can augment our system and have real potential to make warnings possible in places that don't have high-quality networks," said Douglas Given, USGS coordinator of the ShakeAlert Earthquake Early Warning System.

"Crowd-sourced data are less precise, but for larger earthquakes that cause large shifts in the ground surface, they contain enough information to detect that an earthquake has occurred, information necessary for early warning," said study co-author Susan Owen of NASA's Jet Propulsion Laboratory, Pasadena, California.

The research was a collaboration among scientists from the USGS, California Institute of Technology (Caltech), the University of Houston, NASA's Jet Propulsion Laboratory, and Carnegie Mellon University-Silicon Valley, and included support from the Gordon and Betty Moore Foundation.

ENGINEERS EARN GRANT TO EXPAND BASE PLATE CONNECTION RESEARCH IN LOW-RISE METAL BUILDINGS

Metal buildings comprise almost 50 percent of all non-residential, low-rise construction in the United States. The most common configuration is the gabled frame with sets of exterior columns supporting rafters that form house-shaped peaks, and base plates serve as the load-resisting mechanisms that withstand horizontal forces, such as high winds.

Bora Gencturk and **Mina Dawood,** assistant professors of civil and environmental engineering at the UH Cullen College of Engineering, explored base plate connections in low-rise metal buildings in a preliminary study sponsored by NCI Building Systems. The results earned them a subsequent one-year $50,000 grant from the Metal Building Manufacturers Association, MBMA, with additional in-kind support to expand their research.

"The assumption was that the base acts like a hinge that freely rotates," Dawood said. "For the purposes of design, engineers had neglected stiffness in connections because they could not really quantify it."

Funded by MBMA, Gencturk and Dawood are conducting a systematic follow-up study in terms of isolating individual parameters of base plate connections to quantify their effects. The goal is to generate a realistic set of rules so that engineers can account for rotational stiffness of base connections in their designs.

"We are taking the first step in the process, which is research, so the association can take the information to code committees and develop design guidelines," Dawood said.

The initial year-long study funded by NCI Building Systems quickly and economically tested and proved the premise that base connections provide some level of rigidity. In the lab, Gencturk and Dawood used steel columns and bases to avoid replacement of concrete foundations after each test. To simulate gravity loads, they applied thousands of pounds of force to the columns, cycling them back and forth horizontally, after which they measured displacements and rotations.

With numerical analysis techniques, they quantified the stiffness for a certain subset of gabled frames using the experimental data. They determined that they could curtail costs of manufacturing metal buildings by as much as 12 percent by reducing the amount of steel in other parts of the frames for which the rigidity of base plate connections compensated. For an average building, this translated to several tons of steel, which costs approximately 50 cents per pound.

"Understanding the metal building industry is important because just looking at the funding level of the study belies the impact of the research," Dawood said. "Metal buildings are used in every sector of infrastructure including hospitals, churches, schools, shopping centers and industrial buildings."

Low-rise metal buildings are typically selected on the basis of cost, so the industry is extremely cost competitive. Even minor savings can make a significant difference.

"You can think about how much enclosed space you see in warehouses and how little steel is used in their structures," Gencturk said. "That gives you some sense of how much the manufacturers try to economize their construction by removing unnecessary weight."

RESEARCHERS WIN $700K GRANT TO DEVELOP PIPELINE SAFETY SYSTEM

Damage to natural gas pipelines is both dangerous and expensive to repair. Much of it is also entirely avoidable.

Excavators cause about 30 percent of pipeline damage incidents. In most of these events, the teams working the excavators began digging before they consulted a 24/7 national hotline that provides locations for natural gas pipelines.

In response, two researchers with the UH Cullen College of Engineering are developing a low-cost GPS-based system that can provide real-time alerts for pipeline owners and excavator operators when digging takes place near the pipelines. The research is supported by a $700,000 grant from the U.S. Department of Transportation and the Gas Technology Institute.

Assistant professor **Craig Glennie** and professor **Hanadi Rifai**, both with the civil and environmental engineering department, are leading the project.

The system employs two GPS units, one in the cab of the excavator and one at the end of the digging arm. The units will not only reveal where exactly the excavator is, but by comparing the readings from each one, the researchers will be able to tell whether the arm is actually below ground level, indicating that it is digging.

That information will be sent over a cellular network to a central server loaded with a geographic information system, or GIS, that will provide an accurate map of pipeline locations and their buffer zones. The GPS data and the GIS are then matched up to look for potential problems.

"The software will look at the signals coming from the excavator in real time, determine if it's within any pipeline boundaries and actively digging, and if it is, will alert the owner of the pipeline and the person operating the excavator," Glennie said.

While there are other systems that warn operators about pipelines, they cost tens of thousands of dollars. Glennie and Rifai are aiming for a system that costs between $500 and $750.

PROFESSOR HONORED FOR WORK IN NANOMATERIALS

Debora Rodrigues, assistant professor of civil and environmental engineering at the University of Houston, received the Emerging Investigator award from the Sustainable Nanotechnology Organization (SNO).

Rodrigues has worked with nanomaterials since arriving at UH in 2010, using the technology to develop new methods for water purification and treatment. In addition to her research, she was recognized for her work with students and her outreach to other educators.

This was the first year the award was given. Vicki Grassian, editor-in-chief of the journal *Environmental Science*, said Rodrigues was selected for her pioneering and outstanding contributions to the field of sustainable nanotechnology, including nanotoxicology and applications of nanotechnology in water remediation.

The award was announced at the conclusion of a SNO conference in Boston last November.

Rodrigues said she wasn't expecting the honor, but it wasn't her first. She received a National Science Foundation (NSF) CAREER Award in 2011. That award, worth up to $450,000 over a five-year period, is given to promising junior faculty to help launch successful careers in research and education.

By then, Rodrigues was serving as co-principal investigator on another NSF grant aimed at offering middle and high school teachers an opportunity to spend their summers assisting in nanotechnology-related research projects conducted by faculty in UH's Cullen College of Engineering. This project received the U.S. President's Community Service Award in 2013. She also has mentored high school students to encourage them to enter engineering or other science fields.

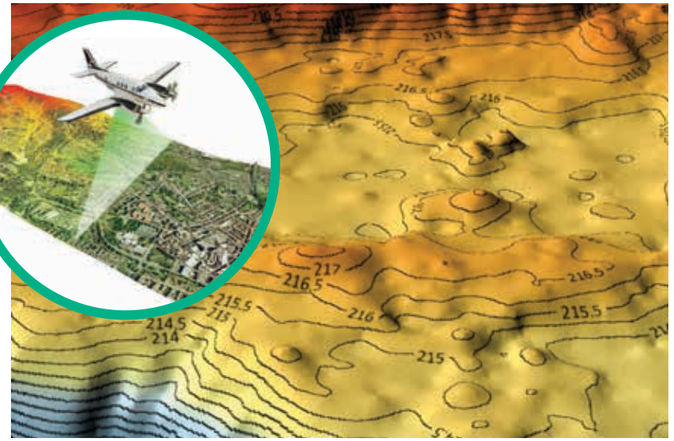
Her twin passions for education and research also came together this spring when a team of UH entrepreneurship students developed a business plan based on Rodrigues' technology – nanocomposite coating used for water purification that is capable of removing heavy metals, radioactive materials and micro-organisms. The students took their plan to competitions around the country and won several honors before they decided to form a startup business.

Rodrigues now serves as an advisor to the company, WAVVE, while continuing her research.

She said the Emerging Investigator award, which included a cash award and a plaque, isn't just about her.

"It is for my whole research group," she said. "It means we are making a difference. We are getting recognized."

NCALM RESEARCHER AWARDED $200K TO DEVELOP OPEN-SOURCE LIDAR SOFTWARE



Craig Glennie, assistant professor of civil and environmental engineering and researcher at the National Center for Airborne Laser Mapping (NCALM), was awarded a two-year grant for more than $200,000 by the National Science Foundation to develop an open-source software suite tailored specifically to the users of LiDAR (light detection and ranging) data. The hope, Glennie said, is that this new software will allow for a much greater range of data analysis than is possible through current LiDAR software.

LiDAR technology allows unprecedented data collection in areas of the world that are extremely difficult to enter on foot, such as the interiors of rainforests. NCALM researchers are using the data generated by LiDAR to create detailed maps of previously uncharted areas, such as the Tahoe National Forest and the Honduran Rainforest.

The basics of LiDAR are simple: an airplane flies over the area to be mapped with a system that shoots thousands of laser pulses per second at the ground. The speed at which those pulses hit the ground and bounce back to their source can be used to calculate the exact distance between the plane and the ground.

However, the process of turning this data into a map is complicated. Users of LiDAR who want to analyze the data they've collected must rely on the limited software that comes directly from the manufacturer of LiDAR equipment.

In fact, NCALM researchers had to develop their own algorithms and add-ons for the standard software suite provided by the LiDAR equipment manufacturer to generate their highly detailed maps.

"The best case scenario would be if we released this software to the open source and a community of developers began actively participating and improving upon the software, uploading their own changes and algorithms to it as well, so it becomes kind of its own living, breathing organism," Glennie said.

INTERNATIONAL TEAM USING SHAPE MEMORY ALLOYS TO REHAB CONCRETE STRUCTURES

A team of researchers from the UH Cullen College of Engineering and Qatar University has won a $779,000 grant to develop a new way to rehabilitate deteriorating reinforced concrete structures.

The three-year grant, from the Qatar National Research Fund, goes to a team led on the UH end by civil and environmental engineering assistant professor **Mina Dawood.** His UH collaborators are professor **Abdeldjelil Belarbi** and assistant professor **Bora Gencturk,** both from the same department. They are teaming up with Mohammed Al-Ansari, a civil engineering professor at Qatar University in Doha, Qatar.

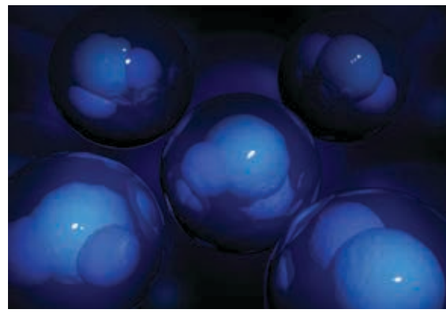
There's nothing new about attempts to extend the life of old concrete structures. It's often far cheaper to extend the life of an existing bridge or building by several years (or decades) through rehabilitation than to replace it completely.

One well-established technique in this field is the use of fiber-reinforced polymers (FRPs), which are essentially super-strong fabrics that can be wrapped around columns. This, said Dawood, is an example of passive confinement. FRPs wrapped around a column confine the structure and limit outward expansion. The repair materials are engaged when – and only when – the column deforms or experiences damage.

But Dawood and his colleagues are proposing an active confinement system that confines the column at all times. At the heart of this research are shape memory alloys (SMAs), which are materials that can take on specific shapes when exposed to specific conditions. This research uses commercially available SMAs that are long pre-stretched wires or rods that contract to their original lengths when heated.

While their initial efforts will focus on the type of deterioration caused by Qatar's harsh environment, the research team plans to develop a fundamental model of the behavior of SMA-reinforced concrete. Such a model would allow this reinforcement technique to be translated to different structural members with varying degrees of deterioration.

FILTRATION RESEARCH RAMPS UP AS SOURCES FOR QUALITY WATER WORSEN



Few Houstonians wake each morning concerned that the clean water that pours from their faucets could run dry, but this is a reality that could affect future generations. In fact, the United States Bureau of Reclamation, USBR, is proactively researching more efficient, cost effective ways to desalinate brackish groundwater and surface water sources.

"You have no choice but to move to worse and worse source waters," said **Shankar Chellam,** professor of civil and environmental engineering at the UH Cullen College of Engineering. "So maybe we don't think very much about our water in Houston, but you go to other areas of Texas and Central Oklahoma, and it's already a crisis."

Chellam received $150,000 from the USBR to research ways to remove contaminants and salt from brackish surface water in Foss Reservoir in Foss, Okla., located several hours north of Houston. The City of Houston, Foss Reservoir Master Conservancy District and the University of Houston supported the project with in-kind contributions.

Growing population pressures and symptoms of drought, which include overutilization of groundwater, increased concentrations of existing pollutants and addition of new pollutants, have taken their tolls on water supplies around the world. Consequently, the relatively clean surface water and groundwater supplies available 50 years ago are essentially nonexistent today, Chellam said.

"So the qualities of the water supplies are decreasing as we are forced to expand production," Chellam said. "Old technologies are incapable of dealing with these issues."

The extended drought has caused high evaporative losses in Foss Reservoir, and the remaining water has higher-than-usual salt content without the diluting effects of rain. The water district has relied on electrodialysis reversal, an expensive desalination method, in the face of the drought, which is expected to continue for several more years. It is a scenario that has become more common among water districts in arid areas across the country.

The most common method for salt filtration in the U.S. is reverse osmosis, which is also the gold standard for removing high levels of salt from seawater and ocean water. However, the salt content is so high in ocean water that the energy required for desalination is prohibitively expensive for public water utilities in all but a few areas of the world where limited freshwater supplies make it necessary, Chellam said.

"We want to implement less expensive processes so the induction into an actual technology can happen faster," Chellam said. "We don't always want to use the most expensive method even though we know it does a very good job."

Chellam's earlier work with nanofiltration membranes focused on improved methods for eliminating contaminants such as bacteria, viruses, organic matter and inorganic chemicals from surface waters that serve as municipal water supplies. This project aims also to remove salt from the mix.

Nanofiltration membranes, which are less expensive than reverse osmosis membranes, could potentially fill a niche for waters that fall somewhere on the salt spectrum between relatively unsalted lakes, such as Lake Conroe, and briny oceans.

Polymer nanofiltration membranes have irregular-shaped, nano-sized pores that filter salt and contaminates by size exclusion and charge repulsion. The filters mimic most natural systems with negative charges that repel negatively charged contaminants.

The challenge is to understand the mechanisms by which contaminants pass through filters to determine ways to improve their removal, to optimize flow of water without irreversibly clogging the filters and to determine ways to regenerate the filters when they clog. Chellam plans to evaluate electrocoagulation and electroflotation, novel pretreatment methods, to prevent clogging.

"Nanofilters are useless if they clog rapidly," Chellam said. "They need to last five or 10 years, or they become unreasonably expensive."

Water conservation is another benefit of nanofiltration. Desalination with reverse osmosis membranes typically recovers 75 to 80 percent of the feed water, which means 20 to 25 percent of the water is lost, said Kevin McCalla, special counsel for the Texas Commission on Environmental Quality's Office of Water, in an email.

"It basically improves treatment technologies so they're not wasting as much water," Chellam said. "It strengthens water supplies, especially in times of drought."

In Texas, 13 water treatment plants desalinate surface water, and three more, including one in Galveston County, are approved for construction, McCalla said. All the facilities use reverse osmosis membranes with the exception of one, which uses electrodialysis reversal.

The total combined maximum amount of water desalinated at the 13 plants ranges from 15 to 22 million gallons per day, which means three to six million gallons are lost each day in Texas from these plants, based on 2010 data.

In the next couple of years, Chellam, his graduate student, Mutiara Ayu Sari, and his collaborators from Austin's USBR office, Collins Balcombe and Anna Hoag, expect to lay the theoretical and experimental framework for meaningful implementation of this technology.

"Every environmental engineer is working to protect the environment we all interact with, whether it's clean air, clean soil or clean water, and they're all important for our quality of life," Chellam said. "Safe, clean drinking water is an important environmental issue that affects every single human."

UH HOSTS CENTER FOR INNOVATIVE GROUTING MATERIALS & TECHNOLOGY ANNUAL CONFERENCE

The Center for Innovative Grouting Materials & Technology (CIGMAT) held its annual conference on March 6 at the UH Hilton. The theme of this year's conference was "Infrastructures, Energy, Geotechnical, Flooding and Sustainability Issues in Houston & Other Major Cities."

Hundreds of leading industry professionals, researchers and government policymakers from across the country came together at the conference to discuss the most pressing current challenges facing the construction, maintenance and sustainability of various civil infrastructures in the Houston region and beyond. Energy production and related issues were also discussed.

The one-day conference also included presentations on current projects and proposed projects that specifically address challenges for the region's infrastructure and energy production needs.

Bill Brudnick, director of planning at TxDOT, was the conference's keynote speaker. Other speakers included Dale Rudick, director of the City of Houston's Public Works and Engineering Department; Jeffrey Haby, director of sewer system improvement for the San Antonio Water System (SAWS); Ivan Langford, director of the Gulf Coast Water Authority; Mike Talbott, director of the Harris County Flood Control District; Diane Lowery-Binnie, assistant director of the Street & Drainage Division of the City of Houston; and Mark Loethen, deputy director of the Planning & Development Services Division of the City of Houston.

Cumaraswamy "Vipu" Vipulanandan, professor of civil engineering at the Cullen College, is the director of CIGMAT and a leading expert in the field of smart materials. Over the past three years, Vipu and his colleagues at CIGMAT have received more than $3 million in funding from the non-profit Research Partnership to Secure Energy for America, (RPSEA), the U.S. Department of Energy (DOE), and oil field services firm Baker Hughes to develop new types of cementing and drilling materials for use in oil rig operations. Such materials could also be used to increase the resilience and sustainability of aging infrastructures.

CRAIG GLENNIE APPOINTED ASSOCIATE EDITOR OF ASCE JOURNAL OF SURVEYING

The newest associate editor of the *Journal of Surveying* is **Craig Glennie,** assistant professor of civil and environmental engineering at the Cullen College.

Glennie was appointed as associate editor of the American Society of Civil Engineer (ASCE) journal last August. In this position, he will manage the peer review process of assigned papers submitted to the journal for review and possible publication.

The *Journal of Surveying* covers surveying and mapping activities encountered in modern practice, including areas like construction surveys, control surveys, photogrammetric mapping, engineering layout, deformation measurements, precise alignment and boundary surveying.

THOMAS HSU NAMED ASCE DISTINGUISHED MEMBER

Thomas Hsu is a Moores Professor of civil and environmental engineering, an author of multiple civil engineering textbooks and a world-renowned researcher. Now, Hsu will add another title to his resume: Distinguished Member of the American Society of Civil Engineers (ASCE).

Distinguished Membership is the highest honor ASCE bestows its members; it is reserved for civil engineers who are either ASCE Members or Fellows. According to the ASCE website, "a Distinguished Member is a person who has attained eminence in some branch of engineering or in the arts and sciences related thereto, including the fields of engineering education and construction." Only one out of every 7,500 ASCE members is granted Distinguished Membership. Hsu is one of only 13 inducted in the 2015 class.

Hsu earned is B.S. in architectural engineering from the Harbin Institute of Technology in China. He earned both is M.S. and Ph.D. in structural engineering from Cornell University. Hsu spent six years in industry as a development engineer for the Portland Cement Association before entering academia in 1968 as an associate professor of civil engineering at the University of Miami. He joined the Cullen College of Engineering in 1980 as department chair, and he has taught classes at UH for 35 years. He was named John and Rebecca Moores Professor in 1998, only one year after the establishment of the professorship. Hsu also earned the Fluor-Daniel Faculty Excellence Award and Abraham E. Dukler Distinguished Engineering Faculty Award from the University of Houston.

Learn more about the ASCE Distinguished Membership, please visit http://www.asce.org/membership/distinguished.

JOSEPH TEDESCO, DEAN OF CULLEN COLLEGE, ELECTED AS ASCE FELLOW

Joseph W. Tedesco, Elizabeth D. Rockwell Dean of the UH Cullen College of Engineering, has been elected as a Fellow of the American Society of Civil Engineers (ASCE). This prestigious honor is held by less than 4 percent of ASCE members.

Tedesco's primary research interests are in modeling of load-bearing and stress on concrete and other structural materials. An outstanding educator and researcher in the field of civil engineering, Tedesco authored two textbooks on structural dynamics and served as an author, coauthor, or editor of over 170 books, book chapters, presentations and conferences. He has also been the principal investigator on several dozen granted research projects.

Tedesco earned his doctorate degree in civil engineering from Lehigh University. Prior to his role as Dean of the Cullen College, he taught civil engineering at the University of Florida (Gainesville), Auburn University and Oregon State University. He received the Loyd M. Carter Award at Oregon State University and the Outstanding Professor Award at Auburn University for his excellence in teaching.

As an active member of ASCE, Tedesco has served on numerous ASCE technical committees and on the editorial board of ASCE's *Journal of Structural Engineering* for 12 years. He also served as faculty advisor to the ASCE Student Chapter at Auburn University from 1986 to 1992.

UH HOSTS NSF WORKSHOP AIMED AT INSPIRING STEM STUDENTS TO PURSUE ACADEMIA

Debora Rodrigues, an assistant professor in the department of civil and environmental engineering, said many of her female students approach her not just for course help, but for life advice. They ask about things like balancing work and home life, childcare, and prejudices in STEM careers.

"Students wish they had more faculty who are like them, faculty they can relate to," she said. Part of the problem, according to Rodrigues, is the dwindling number of women and minority faculty members in STEM (science, technology, engineering and math) fields.

The 2013 National Science Foundation (NSF) report "Women, Minorities, and Persons with Disabilities in Science and Engineering" states that women's participation in engineering and computer sciences remains below 30 percent, and since 2000, underrepresented minorities' shares in engineering and the physical sciences have been flat while participation in mathematics has dropped. "Despite the attention given to the STEM disciplines over the last several years, the number of minorities and females pursuing STEM careers are still far from ideal," Rodrigues said.

But instead of bemoaning the lack of representation in her field, Rodrigues teamed up with researchers from the University of Ohio and Mississippi State University to fix the problem. With funding from the NSF, they're putting on a series of workshops meant to encourage women and minorities to pursue research and careers in academia.

The workshop, "Career Development: From Senior Undergraduates to Navigating Assistant Professorship," took place at the University of Houston from June 4-5. It was open to STEM students from the undergraduate level all the way through recently hired junior STEM faculty looking for career advice, mentoring and networking opportunities.

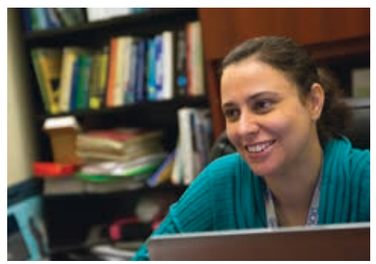
"As a professor, you see so many kids with a lot of potential who end their education after [earning] their bachelor's [degree]. It's not that that's a bad thing – it's okay to stop at undergrad. But some of them have the potential to go further and they don't, simply because they don't think they can, or they don't understand how it works," Rodrigues said. She hopes the workshop will reach students at all the university levels and encourage them to keep pushing their research and academic pursuits. The workshop also aims to create a community of underrepresented groups that can support each other.

"I want them to think academia can be a possibility, can be a career path. That's the thought I want them to leave with," she said.

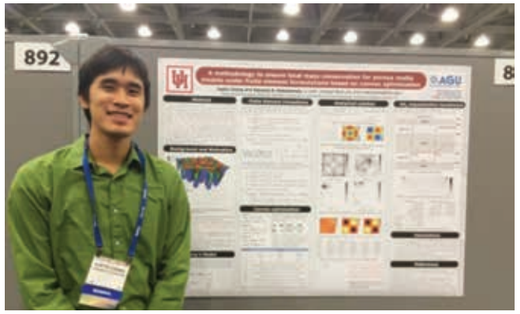
The workshop topics spanned subjects including assistant professorship careers, time management, applying for grants and NSF CAREER awards, college-level STEM teaching and culturally responsive STEM teaching. It also included specific information for undergraduates looking at graduate school as well as a roundtable discussion for the entire group.

For Rodrigues, the push for more talent in academia is just as important as in industry. "There are so many good people in engineering going to industry – much more than academia. It's sad because we need good professors, we need people with good research backgrounds, and I see all this great talent going away," she said. "And who wouldn't like to have their student as a colleague? I would feel so proud of one of my students becoming a faculty member."

For more information on the engineering career development workshops at UH, please visit www.egr.uh.edu/workshops/NSF.



PH.D. STUDENT EARNS DOE RESEARCH AWARDS



This summer, civil engineering Ph.D. student **Justin Chang's** educational career will receive a boost in the form of funding from the U.S. Department of Energy's Office of Science Graduate Student Research (SCGSR) Award. The SCGSR program provides supplemental awards to support part of a graduate student's thesis research to be conducted at a DOE laboratory.

The SCGSR award term is from mid-August through next January, and the award is intended to cover incremental costs associated with living and travel expenses for Chang's proposed SCGSR research project, "Enhancing predictive capability of flow and transport in the subsurface," to be conducted at Los Alamos National Laboratory (LANL) during the award term period. Chang's advisor is Kalyana Nakshratala, civil and environmental engineering assistant professor.

"It is a pleasure working with Justin. He is quite methodical in attacking research problems," Nakshratala said. "The award has two criteria: potential and academic preparation of the student and the merit of the research proposal. Justin has obtained a good foundation in mechanics, numerical methods, applied mathematics and parallel computing," he said.

During the award period, Chang will use the travel stipend for living and travel costs associated with his work at the LANL in New Mexico, where he will write scientific code and study the computational efficiency of these numerical methods on state-of-the-art high performance computing (HPC) systems.

"When I first heard about my acceptance, I was thrilled. Working alongside world-class researchers at the Department of Energy national laboratories is such a rare opportunity," Chang said. "All of the research I conduct in those five months will go directly into my doctoral dissertation. It is my hope that the hands-on experience and scientific skills acquired will help our Computational and Applied Mechanics Laboratory (CAML) research group as well as the civil engineering department become significant contributors to the computational Earth and environmental science and HPC communities."

STUDENT ATTENDS SIAM CONFERENCE IN COMPUTATIONAL SCIENCE AND ENGINEERING

Civil engineering doctoral student **Saeid Karimi** received a travel award from the Society of Industrial and Applied Mathematics (SIAM) to attend the 2015 SIAM Conference in Computational Science and Engineering (CSE15) held in Salt Lake City, Utah last March. The award included a registration fee waiver and cash award.

Karimi's advisor is civil engineering assistant professor Kalyana Babu Nakshatrala. Karimi delivered a talk and presented a poster for the student competition at the conference. The title of his talk was "Monolithic multi-time-step coupling methods for transient systems."

Under this research, funded by the National Science Foundation, robust numerical frameworks have been developed for problems involving multiple mathematical scales, which has been a subject of great interest in computational mathematics and engineering. A systematic theoretical study has also been performed on the proposed numerical formulations. The research work provides the much-needed accurate simulation tools for solving multi-scale and multi-physics problems like fluid-structure interaction (for example, blood flow in deformable arteries) and soil-structure interaction.

The research on a multi-time-step method for elastodynamics has been published in the *Journal of Computational Physics*, and the research on multi-time-step methods for advective-diffusive-reactive systems has appeared in *Computer Methods in Applied Mechanics and Engineering*.

"I was quite excited to receive the award," Karimi said. "Some of the past winners have become faculty members or scientists in national laboratories. It's one of the most important gatherings in my research area."

Learn more about CSE15 at http://www.siam.org/meetings/cse15/.

STUDENT DELIVERS AWARD-WINNING ELEVATOR PITCH

Jingjing Fan, a graduate student in the Cullen College's civil and environmental engineering department, delivered an award-winning elevator pitch at the Sustainable Nanotechnology Organization's (SNO) first ever Nano Pitch Contest.

The contest, which was held last February in Boston as part of the SNO's annual conference, challenged 16 graduate students hailing from universities across the country to deliver a 100-second pitch about their nano-related research. The contestants could only rely on a single slide to back-up their pitch.

Typical research pitches, also known as elevator talks, last about 2-3 minutes. For the Nano Pitch Contest, participants were limited to only 100 seconds because, as the SNO notes, "nothing is nano beyond 100nm."

Fan received a cash prize for her elevator pitch, which explained her research on antimicrobial activity of nanostructured molybdenum disulphide. Her advisor on this work is Debora Rodrigues, assistant professor of civil and environmental engineering at the the Cullen College and the winner of last year's Emerging Investigator award from the SNO.

CIVIL ENGINEERING STUDENT NAMED 2015 OUTSTANDING JUNIOR

With over 3,000 undergraduate students enrolled at the UH Cullen College of Engineering, standing out from the crowd is no small feat. Each year, college faculty are charged with the difficult task of combing through throngs of bright, talented and motivated students and picking just a handful of front runners.

This year, college administrators named an outstanding junior and senior in each Cullen College department as well as one outstanding junior and senior overall. The 2014-2015 outstanding junior is civil engineering student **Seth Pedersen.**

Although still a junior, Pedersen has completed more undergraduate research than the majority of his senior peers, and his primary research interest is one that impacts every corner of the globe: clean water.

Pedersen currently works in the laboratory of civil and environmental engineering professor Shankar Chellam. Under Chellam's guidance, Pederson is studying water purification processes in east Houston. He started his research endeavors with the Summer Undergraduate Research Fellowship (SURF) in 2013.

In addition to the hands-on experience he gained in Chellam's lab, Pedersen also worked at an engineering consulting firm last summer. Although Pedersen said he enjoyed his experience in private industry, he preferred his time in the laboratory more because it allowed him to delve "deeper into how things actually work," he said.

After working with water and sanitation research for a few years, Pedersen said the field has become a passion. "I see it as a big need in the world," he said. "It's also pretty cool to take disgusting water and turn it into something you can drink." He said he hopes to continue his research in graduate school and is considering a research career.

As for being named Outstanding Junior, Pedersen said the honor was unexpected. "I have classes with really great students, I was really surprised because there are so many great students in the college," he added.

He attributes his success to the balancing act of work and play. "Keeping the right balance between focusing on your studies and building the right relationships with people is important," he said. "You can be too social and not focus on your studies, but you can also be really isolated and miss out on another side of life." In his spare time, Pedersen said he loves music and plays bluegrass with his siblings.

TEXAS PUBLIC WORKS ASSOCIATION HONORS CULLEN COLLEGE ALUMNUS

Every year, the Texas Public Works Association honors a select few public works employees with the prestigious Top Public Works Leader of the Year Award. This year, Cullen College alumnus **Doug Haude** (BSCE '02) received the award for his work with the San Jacinto River Authority (SJRA).

Haude, SJRA senior project manager, oversees the implementation of the groundwater reduction plan program in Montgomery County. Several years ago, the Lone Star Groundwater Conservation District determined that area aquifers were being depleted faster than they could refill. The district mandated that large volume groundwater users in Montgomery County find an alternative source of water to reduce the pumpage rate on the aquifer over a 40-year period. Haude has led the SJRA's efforts, including the construction of a multi-million dollar treatment plant, to use treated surface water in Lake Conroe rather than ground water.

The groundwater reduction plan includes more than 50 miles of large-diameter water lines to transfer the treated Lake Conroe surface water to areas throughout Montgomery County including The Woodlands, Conroe, Oak Ridge and other municipal utility districts. The plan is intended to reduce the strain on underground aquifers by allowing large volume groundwater users to tap into an alternate water source.

For Haude, tackling public works projects in North Houston is more than a job – it's in his blood. He can trace his family lineage back to the original Spring/Klein area settlers, and he believes his Texas work ethic helped him earn the award.

"It made me proud that hard work does get recognized," he said. "I do know deep down inside that I am a hard worker and I give it all I've got. So [this award] was kind of a validation of that."

ACADEMY OF DISTINGUISHED CIVIL AND ENVIRONMENTAL ENGINEERS INDUCTS TWO DISTINGUISHED ALUMNI

The UH Cullen College of Engineering's department of civil and environmental engineering inducted two new members into their prestigious Academy of Distinguished Civil and Environmental Engineers in May of 2014 at the Hess Club in Houston.

Joe Zimmerman (BSCE '83), vice president of Klotz & Associates, and **David Collins** (BSCE '71), senior civil engineer at FCM Engineers, were the latest inductees into the academy.

The goals of the academy are to help the University of Houston achieve national prominence in civil and environmental engineering education; to strengthen students' understanding of the engineering profession through personal and professional example; to provide organized assistance and advisory guidance to the department chair, faculty and students; and to improve the educational experience for all students.

BROWN & GAY ENGINEERS, INC. SUPPORTS CULLEN COLLEGE WITH SCHOLARSHIP ENDOWMENT

Brown & Gay Engineers, Inc. (www.browngay.com), an engineering consulting firm based in Houston, established an endowed scholarship in the UH Cullen College of Engineering's civil and environmental engineering department. The gift totals $52,000. Of that total, $50,000 will be used to establish the endowment and $2,000 will go towards current scholarships for fall 2015.

Alumni of the Cullen College of Engineering are employed in leadership positions throughout the city of Houston and around the world. Brown & Gay Engineers (BGE) is no exception: Cullen College alumnus Ronald L. Mullinax served as the chairman of the board at BGE until his retirement at the end of 2014.

Mullinax's plans for retirement first spurred on the decision to provide support to his beloved alma mater. Lee Lennard, president of BGE, also noted that the endowed scholarship will help to train world-class engineers like Mullinax who may one day be employed at BGE.

"BGE is in business to serve clients, to lead with excellence and to solve complex problems," said Lennard. "Creating an endowed scholarship at the University of Houston in honor of our retiring chairman of the board and UH alumnus, Ronald L. Mullinax, allows us to further partner in developing bright young professionals."

"These bright young civil engineering professionals will go into the world and make a profound difference by serving, leading and solving," he added.

The gift of an endowed scholarship represents a permanent asset at the Cullen College of Engineering from which engineering students can receive support toward their education. Endowments provide stability to scholarship programs because the principal gift is retained to produce income on an annual basis, in perpetuity, while a portion of the annual investment return is used for a scholarship award. The rest of the investment yield is returned to the principal and, over time, the fund grows.

To learn about other giving opportunities at the UH Cullen College of Engineering, please visit

http://www.egr.uh.edu/giving/opportunities

or contact Russell Dunlavy, chief advancement officer at the UH Cullen College of Engineering, at rtdunlavy@uh.edu.

UH CREATES MEHTA FAMILY ENGINEERING RESEARCH CENTER

The Mehta family has provided support to establish the Mehta Family Engineering Research Center on the ground floor of the University of Houston's new Multidisciplinary Research and Engineering Building (MREB).

The Mehta Family Engineering Research Center will house the University's new High Performance Computational Center, five state-of-the-art wet labs, the new Mass Spectrometry Lab, a large multipurpose room, conference room and student lounge.

The High Performance Computational Center will promote research and teaching on campus through integrating leading-edge high performance computing and visualization for UH faculty, staff and students.

The new wet labs are designed to allow researchers to work with chemicals, drugs or biological matter. The labs will handle liquid solutions or volatile phases requiring direct ventilation. The wet labs will be fitted with specialized piped utilities supplying water and various gases used during research.

The new Mass Spectrometry Lab will allow researchers access to the most current equipment designed for analytical chemistry.

Dean Joseph Tedesco said the Mehta family contribution is an example of the community support that allowed the Cullen College of Engineering and the University to move forward with the new building.

"This building will allow us to expand both our educational offerings and our research facilities," Tedesco said. "It will allow more students to participate in research opportunities. We appreciate the Mehta family for this generous gift."

The four Mehta siblings all attended the University of Houston.

"We have all benefited from the outstanding faculty and opportunities the engineering school provided us," said Rahul Mehta. "We are grateful for the dedication and excellence of the faculty."

Supporting the MREB is their way of showing appreciation for the opportunities afforded to them from the University, as well as to show their support for the faculty and other members of the UH community, the family said.

"It is educational investments like this that will keep the University of Houston at the forefront of research and education, and continue the tradition of excellence we all experienced during our time here," Jainesh Mehta said.

The MREB is scheduled to open in 2016.

SHELL OIL COMPANY COMMITS $3.5 MILLION TO UH

Shell Oil Company is contributing $3.5 million to the University of Houston in support of the new Multidisciplinary Research and Engineering Building (MREB) and other educational initiatives.

The collaboration between Shell and the University will ensure the continuation of research programs over the next three years, and through its social investment efforts, Shell will continue to support programs that develop talent for a future workforce.

"Energy is one of our main priorities at UH," said University of Houston President Renu Khator, "and this latest example of Shell's unrivaled generosity will allow us to considerably expand our efforts to become the Energy University. We deeply appreciate Shell's enlightened commitment to community improvement, social responsibility and innovative research."

"The University's programs increase energy education and engineering advancement for students, right here in our backyard, and that's something we value," said Marvin Odum, President of Shell Oil Company. "Energy leadership and innovation each have a long history in Houston, and it is imperative that we continue to provide support to the bright young minds of tomorrow."

When UH established its Energy Research Park (ERP) in 2009, Khator announced her vision for the facility as a collaborative endeavor, with the world's leading energy companies represented throughout the park's 75 acre campus.

Groundbreaking on the $51 million, four-story research and engineering building was Oct. 6, with occupancy set for 2016. The Shell contribution will ensure adequate teaching and physical resources are available to meet the industry demands for quality personnel.

CULLEN COLLEGE ALUMNUS GIVES BACK WITH $4.5M CHARITABLE GIFT ANNUITY

Over the course of his career as an engineer, Larry Snider (BSIE '55) lived and worked all around the world. Larry and his wife, Gerri, have called many places "home," from California and Iran, to Ohio and Pakistan. Yet no matter where his career took him, Larry said there was one place he always returned to: the University of Houston.

"My education at the University of Houston Cullen College of Engineering has helped me and my family in so many ways," Larry said. "That's why we feel it is so important to give back to the University that has given us so much."

Larry and Gerri decided to support the UH Cullen College of Engineering with a testamentary charitable gift annuity in the amount of $4.5 million. The gift is unique in that it allows the Sniders to provide an annual income to both of their adult daughters throughout their lifetimes. "This plan for supporting the University is really a win-win," Larry said.

A charitable gift annuity is a contract between a donor and UH wherein the donor agrees to make a gift to the University while also agreeing to pay a designated beneficiary a fixed amount each year for the rest of their life.

"You can give money to the University and at the same time use that money to fund a charitable gift annuity, which pays an income to your children all of their lifetimes," he said. "Your children get a current income every year during their lives, and when they pass, the residuum of the annuity goes to the University of Houston Cullen College of Engineering."

The Sniders have specified exactly how the residuum will be used once it is transferred to the Cullen College. The first funding priority is for an endowed department chair. The remainder of the funds will go towards funding professorships and full-time scholarships.

The Sniders said they felt it was particularly important to share the news about their gift to the Cullen College in order to raise awareness among alumni who may not have known such a gift agreement was a possibility.

"If God has blessed you with financial success as he has done us, we would like to invite you to consider investigating whether establishing a charitable gift annuity is a good fit for your portfolio, as the Cullen College would really benefit from having many more alumni establish these win-win gift agreements," Larry said.

In addition to their most recent gift, the Sniders have supported the University of Houston and its Cullen College of Engineering by funding scholarships.

The R. Larry and Gerri R. Snider Native American Scholarship, established by the Sniders in 2003, offers $10,000 per year to any engineering student entering their sophomore year or above who is a citizen of a federally recognized tribe. Larry is a citizen of the Cherokee Nation, and gives preference to Cherokee student applicants.

In 2009, the Sniders also established two other scholarships at the Cullen College. Named after their daughters, the Melody Kathryn and Becky Snider Women in Industrial Engineering scholarships are available to female engineering students.

"We've always felt that education is so important, and it has helped us in so many ways," Gerri said. "We hope that this gift will help a bunch of people."

The Sniders said they feel very passionate about supporting hard working students who have to put themselves through college, as they can personally relate to such a struggle. Larry worked 40 hours per week while attending the Cullen College full-time. Gerri also worked full-time and managed their household.

After five years at the Cullen College, Larry earned his bachelor's degree in process engineering, a combination of industrial and chemical engineering. From there, Larry's engineering career took him around the world, moving his family a total of 35 times. He has worked for Sheffield Steel Corp., Kaiser Steel, Booz Allen Hamilton, Peat Marwick & Mitchell, Sterling Electronics, RAPOCA Energy, Korn Ferry International, and Coopers and Lybrand. Upon his retirement in 1995, Larry established RLS Professional Services LLC.

Larry received the UH Engineering Alumni Association's Distinguished Engineering Alumni Award in 1991 and the Lifetime Achievement Award in 2013. He and Gerri are also members of Cullen College Bridge Builder Society.

CULLEN COLLEGE CELEBRATES FEMALE ENGINEERS WITH 2015 WOMEN IN ENGINEERING DAY

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