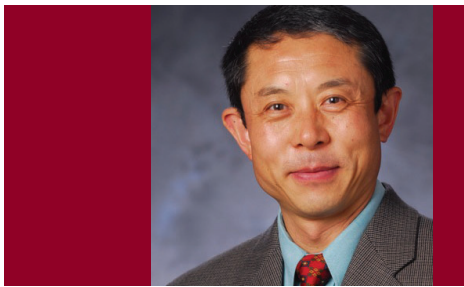


Civil and Environmental Engineering

Robert R. McCormick School of
Engineering and Applied Science
Northwestern University

SPRING 2012

Message from the Chair



The most recent economic crisis has taught us many things. It has made people more reflective and more conscientious about making financial decisions. As a result, the cost of higher education is again under the spotlight. Last week I attended a talk given by NU President Morton Schapiro, who is a professor of economics and one of the country's leading experts in the economics of higher education. One of the topics he discussed was the value return of higher education. It turns out that if the value of a college education is expressed on the same basis as the return on a financial investment, the net return is in the

order of 12 percent per year, over and above inflation. This compares favorably with annual returns on stocks that historically have averaged less than 7 percent.

While many aspects of higher education and the decisions made by students and their parents are driven by quantifiable costs, the outcomes of higher education are much more difficult to measure. At NU, one of the measures we use is the success and recognition of our students by their peers. In this issue of the NU CEE newsletter, we show you a glimpse of how successful our students are by highlighting some of the awards and recognitions they have received.

As you read on, you will find that our students received these awards not because of their GPAs or other test scores. Instead they are recognized by extracurricular activities, such as conducting water research in the Atacama Desert in northern Chile, lending a hand to the water management efforts in more than 80 villages in India's Thar Desert, and building a health center in El Canton, Honduras. It is through these extracurriculars that students

gain an appreciation for the world, learn organization, communication, and leadership skills, and sharpen their visions of the future. Very often these skills cannot be measured by dollars, and yet they are the differentiators between a good education and a great education. At NU, we strive for greatness by providing such opportunities so our students will become not only technical experts in their own fields, but also leaders across different fields. I bet the economists have yet to come up with a dollar amount for the high level of satisfaction of the professional career and personal life that many of our graduates enjoy.

Once again, thank you for your support of the department and on behalf our students, faculty, and staff, I wish you a very enjoyable summer.

Jianmin Qu
Walter P. Murphy Professor

Jan Achenbach Receives Rare Honorary Degree from China's Zhejiang University

Jan D. Achenbach, Walter P. Murphy and Distinguished McCormick School Professor Emeritus of Civil and Environmental Engineering and professor of engineering sciences and applied mathematics and mechanical engineering, has been awarded an honorary doctorate degree from China's Zhejiang University.

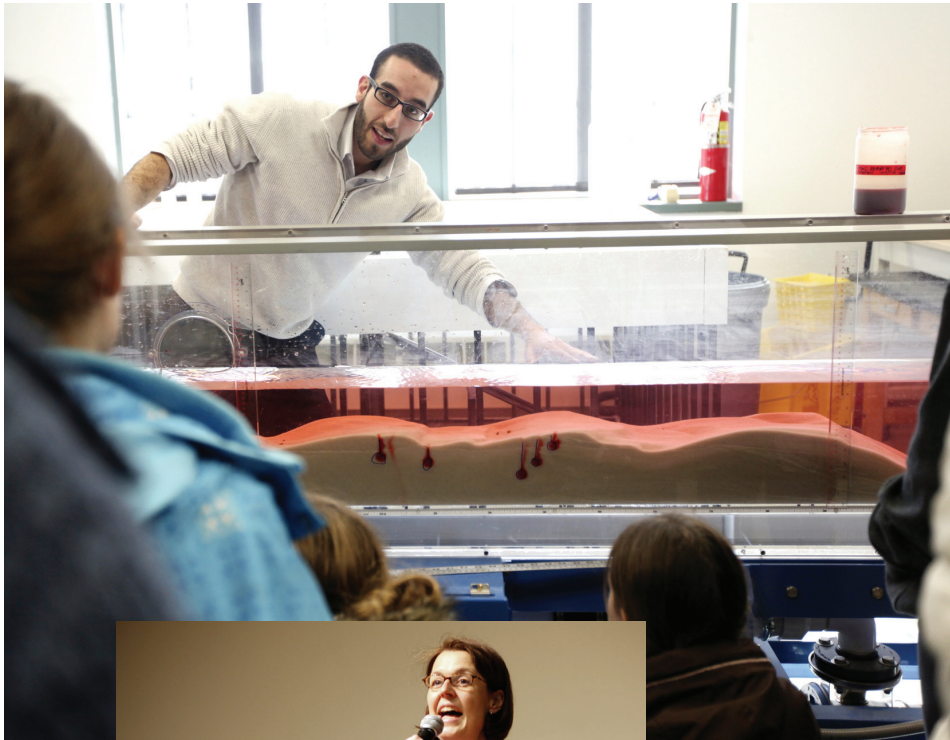
The award is a rare honor, as Chinese universities bestow honorary degrees only once every five years or so, and their selections must be approved by state officials. Previous recipients of

Zhejiang University's honorary doctorate include former United Nations Secretary-General Kofi Annan and former International Olympic Committee President Juan Antonio Samaranch.

Achenbach is the seventh person — and the first engineer — to receive an honorary doctorate from Zhejiang University. He was presented the award in September in a ceremony with the university's president, Yang Wei, in the Zhejiang Province.



Engineering: The Sky's the Limit



The Department of Civil and Environmental Engineering opened its doors to a group of young visitors on February 25 for McCormick's 2012 Career Day for Girls. Now in its 41st year, Career Day for Girls seeks to get middle- and high school girls excited about research and careers in engineering and applied science.

This year more than 200 girls attended the event, taking part in lab tours, demonstrations, and discussions. In the CEE lab, the students made cement figurines, studied 3,000-year-old sediment recovered from a lake in Iceland, and saw demonstrations of how water rushes over a dam flowing along a river.

Career Day for Girls is organized by the Northwestern University Society of Women Engineers.

When the event began in 1970, only 4 percent of McCormick students were women. Today, roughly one-third of McCormick students are women.

Girls watch a demonstration in the CEE department at the 2012 Career Day for Girls.

*"It's important to reach out to girls and show them all that engineering has to offer. Career Day for Girls does exactly that."
—Ellen Worsdall, McCormick's assistant dean for student affairs (shown at left center)*

CEE Welcomes Two New Professors

Last fall, the Department of Civil and Environmental Engineering welcomed two new professors, both natives of Italy: Giuseppe Buscarnera, assistant professor in the geotechnical engineering area, and Gianluca Cusatis, associate professor in the structural engineering and infrastructure materials area and a member of the theoretical and applied mechanics (TAM) faculty.

Buscarnera received both his BS and MS degrees in civil engineering from the Politecnico di Milano in Milan, Italy, where his MS research project involved the numerical analysis of underground cavities exposed to chemical degradation. Buscarnera earned his doctoral degree from a program of the Politecnico di Torino, Milano and Bari (Scuola Interpolitecnica di Dottorato). His doctoral research addressed the activation of fast landslides induced by rainfall events. During his PhD, Buscarnera was awarded the Rocca Fellowship, which supported a period of research studies at MIT. His dissertation was recognized with the PhD Prize by the Alliance of Laboratories in Europe for Research and Technology (ALERT) Geomaterials association.

Buscarnera's research focused on the mechanical response of unsaturated geomaterials, the theory of material stability, and the stability analysis of slopes. It was published in several international journals, such as the *International Journal for Numerical and Analytical Methods*

"We are so pleased to welcome professors Cusatis and Buscarnera to our department. They make an excellent addition to our faculty."
– Prof. Jianmin Qu

in *Geomechanics*, *European Journal for Environmental and Civil Engineering*, *Géotechnique*, *Géotechnique Letters* and *International Journal of Solids and Structures*. Buscarnera has been involved in the educational activities of the MS program CERM (Civil Engineering for Environmental Risks Mitigation) at the Politecnico di Milano.

Cusatis, who also serves as the area coordinator of the Structural Engineering and Infrastructure Materials (SEIM) program, also graduated from the Politecnico di Milano. He obtained his *laurea* degree (a five-year degree roughly equivalent to Northwestern's BS/MS degree) with a thesis on the viscoelastic behavior of concrete subjected to variable temperature and humidity and his PhD with a dissertation dealing with mesoscale modeling of concrete.



Gianluca Cusatis and Giuseppe Buscarnera

Prior to joining Northwestern, Cusatis spent six years at Rensselaer Polytechnic Institute, where he taught undergraduate and graduate civil engineering courses and performed research in the field of computational and applied mechanics with emphasis on heterogeneous and quasi-brittle materials, concrete and reinforced concrete modeling, and infrastructure materials. His research interests include micro- and meso-mechanics, linear and nonlinear fracture mechanics, nonlinear constitutive modeling, concrete creep, rate effect on material strength, moisture and heat transfer, and concrete-steel interface behavior.

Cusatis has authored seminal articles on discrete modeling of concrete, and he has been an invited speaker at several national and international conferences. He serves as principal investigator for several projects sponsored by federal agencies, such as the National Science Foundation, Defense Threat Reduction Agency, Department of Homeland Security, and Engineer Research and Development Center. He is member of several professional associations, including the American Society of Civil Engineers, American Concrete Institute, and the United States Association for Computational Mechanics, and he serves as chair of the ACI 446 committee on fracture mechanics of concrete.

ALUMNI NEWS

Civil engineering alumna **Mehri Paydar** was named among the "2012 New Faces of Civil Engineering" by the American Society of Civil Engineers (ASCE). Once a professional ballet dancer, Paydar received her BSCE in June 2011. She is currently with the RISE Group in Chicago.

Catherine Aimone-Martin received the International Society of Explosives Engineers' Distinguished Service Award on February 14 at ISEE's Annual Conference on Explosives and Blasting Technique in Nashville. The Distinguished Service Award is the society's highest award of merit given to an individual who has made an outstanding contribution to the field of explosives engineering. Since earning her PhD in civil engineering from McCormick in 1981, Aimone-Martin has become a leader in the explosives industry through work in the ISEE, government, university, and private sectors.

Isabelle Ji, BSEE '2011, is among eight McCormick students named on the Illinois Technology Foundation's 2011 Fifty for the Future list. Now in its fifth year, Fifty for the Future is designed to recognize students with the interest and potential to use technology in innovative ways and to connect them with business leaders.

Engineers for a Sustainable World Students Conduct Water Research in Chile

Last summer, two environmental engineering students – Brooke Jarrett, a first-year PhD candidate, and Kimberly Huynh, a sophomore – traveled to the Atacama Desert in northern Chile to learn about its water problems.

The students went to Chile as part of the Thirst Project, a program that since 2010 has brought together students from McCormick and the Pontific Catholic University of Chile to pursue clean water solutions and education for the people of the Lluta Valley. The Thirst Project is a segment of Engineers for a Sustainable World (ESW), a student group that works to promote sustainable living in developed and developing countries.

Jarrett and Huynh visited Los Molinos, a village with 140 residents near the Lluta River, a waterway contaminated by boron and arsenic. Over the course of 10 days in July, Jarrett and Huynh collected water samples from people's homes, met with experts, and interviewed community members about their water practices. Their goal: to design and implement an affordable, low-maintenance strategy that will improve water quality for people in the region.

Improving water quality requires more than just technology, the students learned, but also behavioral changes. "Water is something that you can fix with a device," Jarrett said. "But behavior around water is not something that just snaps into place. You definitely need something that is ongoing to inform, to educate, to learn more about how people live and then see what kind of intervention you can have."

This year, the group decided on solar distillation as their preferred method to treat the polluted water. With a donation of a parabolic solar distiller from a local mechanical engineer, the students are updating the device. They plan to visit Chile again for six weeks this summer, where they will collect additional data and test the distiller on site.

Members of Engineers for a Sustainable World collect measurements in Chile's Lluta River, a waterway polluted by boron and arsenic.



"Behavior around water is not something that just snaps into place. You definitely need something that is ongoing to inform, to educate, to learn more about how people live and then see what kind of intervention you can have." – PhD candidate Brooke Jarrett

Seven Graduates from Class of 2011 Receive Departmental Awards

During the Department Commencement Reception in June 2011, the department presented awards and prizes to seven graduating seniors.

Rebecca (Penskar) Gherini received the Outstanding Civil and Environmental Engineering Award; **Thomas Koeger** and **Constance Mihalache** received the Wallis S. Hamilton Outstanding Civil Engineering Award; **Erik Herberg** and **Anjolie Cheema** received the Outstanding Environmental Engineering Award; **Isabelle Yuxi Ji** received the Jimmie Quon Outstanding Environmental Engineering Award; and **Francesca Ferrero** received the Edwin C. Rossow Outstanding Structural Engineering Prize.

Undergraduates Receive Scholarships from Professional Organizations

Galen Reed, a senior civil engineering student, received a 2011-12 scholarship from the American Institute of Steel Construction Education Foundation. Galen was the first Northwestern student to receive a scholarship from AISC.

Kelsey Watterworth, a senior in civil engineering, was awarded the Institute of Transportation Engineering (ITE) Illinois Section Scholarship.

Kimberly Huynh, a sophomore in environmental engineering, was awarded the Illinois Section American Water Works Association (ISAWWA) Scholarship and the IL Section ASCE Environmental Engineering and Water Resources Scholarship.

Maya Stuhlbarg, a junior in civil engineering, was awarded the Illinois Section ASCE Structural Engineering Institute Scholarship.

Civil Engineering Senior Finalist for Prestigious Award

Elif Koru, a senior in civil engineering, was one of five finalists for the Skidmore, Owings & Merrill Foundation 2012 Structural Engineering Travel Fellowship, a prestigious award that aims to foster an appreciation of the aesthetic potential in the structural design of buildings and bridges.

Civil Engineering PhD Students Receives GEM Fellowship

Jovanca Smith, a PhD student in structural engineering and infrastructure materials, has been awarded the prestigious GEM Fellowship. The GEM Consortium is dedicated to enhancing the value of the nation's human capital by increasing the participation of underrepresented groups at the master's and doctoral levels in engineering and science. Jovanca's research focuses on the

mechanics of cementitious materials using numerical modeling techniques. She will spend this summer doing internship at Sandia National Lab, sponsor of the GEM Fellowship. Gianluca Cusatis is her faculty adviser.

Environmental Engineering Graduate Student Wins ACS Award

Tiezheng Tong, a second-year graduate student in the environmental engineering and science program, was awarded a 2012 Graduate Student Award in Environmental Chemistry from the Division of Environmental Chemistry of the American Chemical Society. Tiezheng's research is in cytotoxicity and ecotoxicity of nanomaterials, particularly nanostructured titania, using high throughput analysis in the labs of professors Kimberly Gray and Jean-François Gaillard.

Graduate Student Wins Conference Travel Award

Madison Fitzpatrick, a graduate student studying transportation, received the Dwight David Eisenhower Transportation Travel Allowance to attend the transportation conference in Washington, D.C.

GAB Students Take Top 5 in National Competition

The Northwestern Chapter of Global Architecture Brigades (GAB) placed in the top five in a national design contest for a health center to be built in a rural Honduras village.

The Global Brigades umbrella organization is the world's largest student-led global health and sustainable development organization. The organization provides an opportunity for students to improve the quality of life in under-resourced communities. Northwestern's GAB chapter got its start in 2009, when it was founded by two civil engineering students, Mehri Paydar and Elif Koru. The following year, the group hosted its first trip to Honduras, where they built a school in the village of Zurzular. Students had the chance to mix and pour concrete, cut re-bar, and nail concrete formwork on site, all while helping people in need.

A new addition to the National GAB this year is that each participating GAB chapter submits a design proposal for the project the chapter plans to work on. The final design is voted by the local community among all submissions. Northwestern submitted a design for a health

center that focused on sustainability, ease of construction, and passive lighting and ventilation systems. Among 15 submissions from the nation's top architecture schools, Northwestern's design became a top five finalist.

During spring break of 2012, 10 Northwestern GAB members took a second trip to Honduras to construct the winning design of the El Canton Health Center.

Students in Northwestern's GAB chapter help construct a health center in Honduras



Success and Failure in Engineering: A Paradoxical Relationship



Professor Jianmin Qu and Henry Petroski

It may seem strange to think of catastrophic failure as the means to success. But when it comes to engineering innovations, being wrong is not only inevitable — it's vital.

That is the argument of Henry Petroski, Aleksandar S. Vesic Professor at Duke University and the author of dozens of books, including his most recent, *To Forgive Design: Understanding Failure*.

On April 26, Petroski presented a lecture, "Success and Failure in Engineering: A Paradoxical Relationship," as part of the Distinguished Lecture Series of McCormick's Department of Civil and Environmental Engineering.

To illustrate his point that failure breeds success, Petroski pointed to a classic century-old engineering disaster: the sinking of the Titanic on April 15, 1912.

"Imagine that the Titanic had not struck that iceberg," Petroski said to a standing-room-only crowd in McCormick's Ford Motor Company Engineering Design Center. "That would have just reinforced the misconception that it was unsinkable. And every time it went across the Atlantic, it would further confirm that hypothesis."

If that had occurred, competing shipbuilders would have integrated the ship's design, building larger and faster ships with the same faulty bulkhead design, fewer rivets, and — since the design was considered indestructible — fewer lifeboats: in short, a fleet of ultimately deadly ships.

"Eventually however, odds are a descendant of the Titanic ... would hit an iceberg, and all the thinking that was developed over the years would have to be rethought," Petroski said. "A century of lessons learned can be effectively erased by decades or even just years of successful experience."

The relationship between engineering failure and success is also evident in the progression of the suspension bridge from 1854 to 1931, Petroski showed. When American engineer John Roebling built the successful Niagara Bridge in the 1850s, he relied on four engineering feats: weight, stiffness, stays, and trusses.

But as time passed, pioneering and cost-cutting engineers parsed down Roebling's design until they were constructing unstable and dangerous suspension bridges, such as Washington's Tacoma Narrows, a bridge that twisted violently and finally, in 1940, collapsed — again, a failure that spawned new safety measures and engineering knowledge.

Global & Ecological Health Engineering: First Student Project in the Thar Desert, India

Three Global and Ecological Health Engineering students — the first from the environmental engineering program — traveled to Jodhpur, India last July to tackle water scarcity issues in the world's most densely populated desert.

Roshni Brahmhatt, Susan Vescovi, and Tracy Yang spent a month at the Jal Bhagirathi Foundation (JBF), where they learned about the organization's water management efforts in more than 80 villages in the Thar Desert.

The indigenous Marwarian people in this area live remotely with limited access to goods, services, and life-sustaining water. Women, particularly young girls, are tasked with retrieving water for their families, walking as much as five kilometers away to fetch five or ten liters at a time. (According to locals, an average family requires 50 to 70 liters per day.) The chore consumes the girls' entire day, leaving them uneducated and with few opportunities to improve their lives.

By bringing back the traditional use of rainwater catchment ponds (*talabs*), JBF has eliminated much of this burden, ensuring that women and girls have time to work and go to school. With the issue of water quantity largely addressed, JBF turned to Northwestern for help



Susan Vescovi, Tracy Yang, and Roshni Brahmhatt

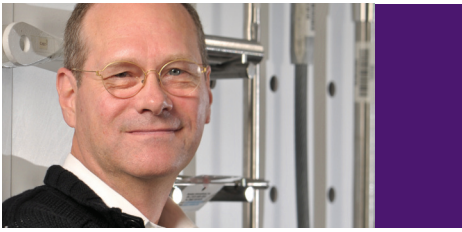
in establishing a water quality program. Currently, Marwarians use salinity as their only index of quality control: "sweet" water is considered safe to drink, while "salty" is not. This faulty test has caused health issues that further threaten the villagers' quality of life.

Brahmhatt, Vescovi, and Yang visited JBF's project villages to conduct a feasibility study for a project that would relate seasonal changes in water quality with health fluctuations. The team visited several catchment ponds, spoke to local

villagers, and collected basic health data in hopes of selecting a range of project villages for future study. They were well received, and in four weeks, the project team identified two suitable work sites for future research.

Northwestern is currently researching the potential for creating a mobile laboratory, with which JBF staff could take basic measurements onsite in the future.

FACULTY NEWS



William Baker, a member of the CEE External Advisory Committee, adjunct faculty, and principal of Skidmore, Owings, and Merrill, was named a member of the National Academy of Construction (NAC) in March.



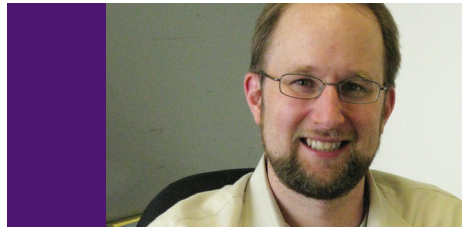
The Czech Society for Mechanics has named an engineering prize after Czech-born **Zdeněk P. Bažant**. The Z.P. Bažant Prize for Engineering Mechanics will be awarded annually to the author of an article or series of articles on an original topic, a book, monograph, or PhD thesis.



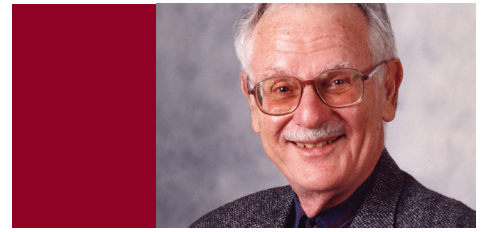
Professor **Ted Belytschko** has been elected a member of the prestigious U.S. National Academy of Sciences (NAS), one of the highest honors given to a scientist or engineer in the United States. In October, Belytschko was also presented with the prestigious William Prager Medal from the Society of Engineering Science. The Prager Medal is awarded for outstanding research contributions in theoretical or experimental solid mechanics.



A group of Northwestern Engineers for a Sustainable World (ESW) students have created a tiny, zero net-energy house — with a toilet in the shower — that produces its own electricity using solar panels and collects all of its water. During the design and construction phases of the project, **Karen Chou**, assistant chair and clinical professor of civil and environmental engineering, served as the team's civil engineering adviser. The house was displayed in front of the Ford Motor Company Engineering Design Center for a week in March, and tours were given to the public.



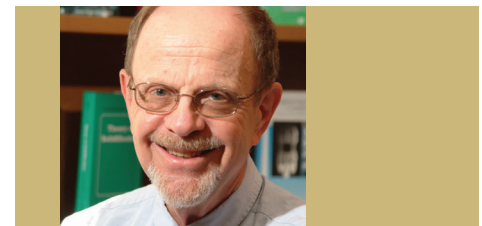
Clinical associate professor **David Corr** was nominated by his colleagues and students for the 2010-11 McCormick Teacher of the Year award. As a clinical professor, a non-tenure-track position, Corr was ineligible for the award. However, with the overwhelming support from his students and colleagues, the Dean's Office decided to recognize him with the special award: Recognition for Teaching Excellence.



Leon Keer, Walter P. Murphy Professor of Civil and Environmental Engineering and Mechanical Engineering, received the 2011 Raymond D. Mindlin Medal from the American Society of Civil Engineers. The award recognizes outstanding research contributions to applied solid mechanics.



John Rudnicki received the 2011 Daniel C. Drucker Medal from the American Society of Mechanical Engineers (ASME). The medal recognizes distinguished contributions to the field of applied mechanics and mechanical engineering through research, teaching, and service to the community over a substantial period of time.



McCormick's **Joseph L. Schofer** has been designated as a national associate by the National Research Council of the National Academies. The honorary title is bestowed upon people with an "extraordinary dedication" to the National Academies, which include the National Academy of Sciences, National Academy of Engineering, Institute of Medicine, and National Research Council.

In January, Schofer also received the 2011 Roy W. Crum Distinguished Service Award from the Transportation Research Board of the National Academies. The award recognizes outstanding achievement in the performance of distinguished service; the production of fundamental or developmental research; or the administration, promotion, or fostering of outstanding research.

CEE Hosts 48th Society of Engineering Science Technical Conference

The Department of Civil and Environmental Engineering and the Department of Mechanical Engineering hosted the 48th Society of Engineering Science Technical Conference at the Norris Center on Oct. 12 through 14, 2011. This annual meeting fosters and promotes the exchange of ideas and information among the various disciplines of

engineering and the fields of physics, chemistry, mathematics, bioengineering, and related scientific and engineering fields. Over 500 people from around the world attended the conference, and a number of CEE faculty and graduate students presented their research work.

Northwestern, Stanford Students Team Up for Virtual Collaboration

Students from McCormick and Stanford University came together — in a virtual sense — to work on a joint studio sketch project in February.

Working from their respective schools, students from McCormick's Architectural Engineering and Design course and Stanford's Architecture Studio course used electronic tools to collaborate across distance toward a single goal: designing a hypothetical new building to be built on a historic street in downtown Palo Alto, California. The project took place in February, and a final presentation was held simultaneously and broadcast live at both schools.

The McCormick course was taught by Larry Booth, principal at Booth Hansen and McCormick's Richard C. Halpern/Rise International Distinguished Architect in Residence, Scott Cyphers, associate principal at Booth Hansen, and Mark Sexton.



We are always interested in how our alumni are doing. Let us know about you! Keep in touch by e-mailing us at civil-info@northwestern.edu with an update and your current contact information.

McCormick

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Editors: Sarah Ostman and Karen Chou
Designer: Amy Charlson Design

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