Civil & Environmental Engineering

Spring 2009

The Bridge

COLLEGE OF ENGINEERING
UNIVERSITY of WASHINGTON
A Community of Innovators

Ribbons of Black Are Going Green

For most communities, roads are essential to sustainability. They are huge economic drivers and allow the mobility and freedom central to our way of life. If miles are one measure of economic impact, it is huge: the U.S. has more than four million miles of roads, and worldwide the total exceeds 40 million.

On the downside, roads require significant amounts of material, equipment, and space and have a substantial ecological impact. Constructing and maintaining one lane-mile of freeway pavement can use 7,000 to 12,000 tons of raw materials, consume 3 to 8 TJ (terra Joules) of energy, emit 500 to 1,200 tons of CO_2 equivalent expressed as Global Warming Potential (GWP), and generate 2,500 tons of waste. While we are beginning to move aggressively toward sustainability in building construction, the energy sector, and even the automobile industry, we have largely ignored transportation infrastructure.

Civil & Environmental Engineering's research efforts can help "green" America's roads. One effort, led by Assistant Professor Steve Muench, is developing Greenroads, a rating system that assesses the sustainability of new, reconstructed, and rehabilitated roads. Like several prior rating systems, including the LEED system for buildings, Greenroads awards credits for approved sustainable choices and can be used to certify projects.

Greenroads provides three benefits: (1) a holistic way to consider roadway sustainability, (2) a defined and quantitative means to assess sustainability, and (3) a tool that allows decision-makers, agencies, consultants, and contractors to make informed design and construction decisions. The ultimate goal is to create the nationwide rating system of choice.

"Interest in this system is growing quickly," Muench said. "We are in early negotiations to test the system on about 15 potential projects to help answer some key questions, such as: How much does it cost to use the rating system? What needs to be improved or changed? How can it be changed?"

The Greenroads project evolved from master's thesis work by Martina Soderlund (MS 2007, now at Stantec). The current research team includes CEE and UW students Jeralee Anderson, Yen Yu Lin, Chris Croft, Mac McCarthy, Jared Koester, Josh Hatfield, Paul Prigge, Rosslyn Luke, and Nick Jones. Sponsors include TransNow, the State Pavement Technology Consortium (DOT representatives from Washington, California, Minnesota, and Texas), and the Western Federal Lands Highway Division in Vancouver, Wash.

You can download the Greenroads manual at: www.greenroads.us. For more information, please contact Steven Muench, stmuench@u.washington.edu.

In this issue

CEE Alums Win Diamond Awards

See page 6

Message from the Chair

Welcome to the spring issue of *The Bridge*

As the end of the academic year approaches, we have a lot to be excited about in Civil & Environmental Engineering despite the challenging news about the economy. Although most of us are going through major budget cutting exercises (the UW is no exception), and all of us are coming up with new ways to do more with less, CEE still plans to grow. We believe that growth is imperative despite the poor economic situation. The stimulus package includes major infrastructure projects that will require civil and environmental engineers to get the jobs done. Once we get past these bad times, growth is inevitable and will require a pipeline of new CEEs. We will be ready to provide graduates to industries and agencies involved in creating our new infrastructure as the nation recovers.

We are searching for three new professors in structural/geotechnical engineering, water resources and hydrology, and transportation. We are expecting a larger than usual class of new graduate students and high demand for undergraduate enrollment. These CEEs of the future will fill roles that are anticipated in initiatives put forth by the Obama administration, which has made climate, energy, infrastructure, and education strategic priorities. This emphasis has many benefits for the nation, as investments in these areas are long overdue. These initiatives should benefit CEEs everywhere, including those the UW will be educating.

Other highlights of the last six months include new faculty appointments and honors for faculty and alumni. Professor Mark Benjamin has been selected as the forthcoming AEESP Distinguished Lecturer, which is an enormous honor. We welcomed two new faculty members — James Thomson in environmental fluid mechanics and Andrey Shcherbina in water resources. We are excited to have these bright, young faculty join our department and enhance our academic and research programs. In addition, congratulations to CEE alumni Tom Gibbs and Ray Clough, who have been selected to receive prestigious CoE Diamond Awards this May (story on page 6).

Please let us know about the exciting things going on in your world, and stop by for a visit if you are in Seattle.

Craig H. Benson, PhD, PE
Professor and Chair

The Henry Roy Berg Endowed Lecture

Joe P. Mahoney

Established in 1989 by a generous gift from the estate of Henry R. Berg, the annual Henry Roy Berg Endowed Lectureship in Civil & Environmental Engineering provides a CEE faculty member with the opportunity to address colleagues and industry peers on the research topic of his or her choice. This year, Professor Joe P. Mahoney will deliver a lecture entitled "Transportation Infrastructure — A Look Back, A Look Ahead"

Professor Mahoney's research focuses on transportation and construction. His primary areas of expertise are highway and airfield pavements, pavement materials, pavement management systems, and industry-related environmental regulations and compliance.

The lecture, which is free and open to the public, is Monday, May 11, 2009 at 4:30 pm in the Guggenheim Auditorium, Room 220. A Texas barbeque reception will follow. If you would like to join us, please RSVP to Heather Wilson at (206) 543-8883 or hwilson@u.washington.edu.

The Daniel L. and Irma Evans Lecture

The Daniel L. and Irma Evans Lectureship in Civil & Environmental Engineering exposes students and practitioners to the concepts, concerns, and methods of other disciplines they will encounter in their professional careers. The three Evans sons — Dan, Robert, and Roger — established the endowment in 1982 to honor their parents for the human values and broad societal outlook demonstrated throughout their lives.

Peter Head

This year's Evan's Lecturer is Peter Head, director of Arup, a global firm of designers, engineers, planners, and business consultants. He will speak on the topic "Entering the Ecological Age: The Engineer's Role." Head is a commissioner on the newly formed London Sustainable Development Commission and a past chair of the London First Sustainability Unit.

The lecture is Thursday, April 30, 2009 at 4:30 pm in the Kane Hall Auditorium, Room 220, and is free and open to the public, with a reception to follow. If you would like to join us, please RSVP to Heather Wilson at (206) 543-8883 or hwilson@u.washington.edu.

Welcome to New Faculty

Two new faculty members joined the department this spring quarter — James M. Thomson and Andrey Shcherbina. Both are oceanographers whose expertise will strengthen our water resources program. Two other new faculty members will arrive in the fall — Michael C. Dodd and Linda Ng Boyle.

JAMES M. THOMSON accepted an appointment as assistant professor with Civil & Environmental Engineering while he will continue his Oceanographer 4 appointment with the Applied Physics Laboratory (APL). Thomson received his PhD (2006) in physical oceanography from MIT and BA (2000) from Middlebury College. He then became a postdoctoral investigator for numerical modeling of surface-gravity waves at Woods Hole Oceanographic Institution.

ANDREY SHCHERBINA joins CEE as an acting assistant professor. He earned his PhD (2004) at Scripps Institution of Oceanography, University of California, San Diego, and MS (1998) from the Moscow Institute of Physics and Technology. Shcherbina was a postdoctoral scholar at Woods Hole Oceanographic Institution working on wintertime coastal current dynamics from 2004 to 2007, when he joined the UW faculty as a research associate with the Applied Physics Laboratory.

MICHAEL C. DODD begins his appointment as an assistant professor in autumn quarter. Dodd received his PhD (2008) from the Swiss Federal Institute of Technology in Zurich and MS (2003) from the Georgia Institute of Technology. He is currently a postdoctoral fellow at Yale University. His research interests broadly encompass oxidation reactions in engineered and natural aquatic systems, in particular, their application to pollutant and pathogen elimination during water and wastewater treatment.

LINDA NG BOYLE returns to the UW in autumn quarter to begin a joint appointment as associate professor with CEE and Industrial Engineering. A CEE alumna, she received her PhD in 1998 and MS in 1994. She joins us from the University of Iowa, where she has been a faculty member in mechanical and industrial engineering since 2002. Boyle will bring a wealth of information and experience to our transportation engineering program.

Farewell to Retired Faculty

Water, air, and soil – three of the most important elements on Earth. Just like these elements, three recently retired professors helped nourish our department throughout their storied careers.

Professor John Ferguson

The pursuit of clean water was a driving force in John Ferguson's career. His research focused on the chemical and biological processes in water and wastewater treatment, and in natural water systems, and he was active nationally in the American Water Works Association and the Water Environment Federation. WEF honored him three times with the Eddy Medal. Professor Ferguson joined the Civil Engineering faculty in 1974, and served three stints as acting chair, in 1986, 1992–1997, and in 2007, earning respect for his diplomatic approach to administration and enthusiasm for academic discovery. Over his career he advised more than 100 masters and PhD students and oversaw interdisciplinary projects that lead to practical solutions to water issues. Professor Ferguson officially retired in 2007, but continues an active research program, working with faculty collaborators and graduate and undergraduate students.

Professor Mike Pilat

An expert on air quality, Mike Pilat joined the Civil Engineering faculty in 1967, attained full professor rank in 1978, and also became an adjunct professor of chemical engineering in 1983. A UW alumnus, he earned his CE doctorate in 1967 and held an engineering position at Boeing prior to joining the faculty. His teaching and research focused on air resources engineering and air pollution control equipment design. At the time, this new field demanded much research and public education. Fond memories of students and faculty include his Wilcox hallway bulletin board featuring many student photos, and his maze of an office—piled high with papers, books, and always a surprise or two.

Professor Bob Holtz

A geotechnical engineer, Bob Holtz joined the Civil Engineering faculty in 1988 after 15 years on the faculty at Purdue University. His diverse early career included positions at California State University, Sacramento, the California Department of Water Resources, Swedish Geotechnical Institute, NRC-Canada, and consulting engineering in Chicago, France, and Italy. His research focused on soil improvement and geosynthetics. The American Society for Civil Engineers (ASCE) named him a Distinguished Member in 2007, and his colleagues of the Geotechnical Group of the ASCE Seattle Section honored him by establishing the Robert D. Holtz Endowed Fellowship in Civil Engineering at the UW. To the delight of his colleagues, Professor Holtz remains active in CEE and is a great resource for all things geotechnical.

Mitigating Earthquake Damage

Team Studies Design Options for Port Structures

Ports contribute significantly to local, national, and global economies. In the U.S. alone, more than $5.5 billion in goods passes through port facilities each day.

As with any component of vital infrastructure, resilience to damage and longevity are critical to maximizing societal benefits. Ports are highly susceptible to damage caused by seismic events because many port structures, such as wharves, are built on poor, often highly liquefiable soils, in corrosive, high-impact environments. In addition, the structures are usually heavily loaded.

Over the past two decades, earthquakes damaged port structures in California (1989 Loma Prieta), Japan (1995 Great Hanshin), and Turkey (1999 Kocaeli). Earthquake reconnaissance efforts suggest that damage results from liquefaction of surrounding soil, which induces large deformation demands that may result in structural failure or inadequate structural performance. Structural damage is largely due to inadequate connection performance. It is important to understand how these structures perform under certain loading situations to determine the measures needed to minimize the impact of a significant seismic event.

Despite the importance of highly resilient pile-to-deck connections, only minimal research has investigated their performance. Furthermore, engineers lack a unified design procedure and criteria. To develop these important engineering tools, the University of Washington is collaborating with six other institutions to investigate the structural and economic performance of wharf systems and components and propose new design options to help mitigate seismic losses. This project, titled Seismic Risk Management Systems for Ports, is housed at the Georgia Institute of Technology and is funded through the Network for Earthquake Engineering Simulation (NEESR), National Science Foundation (NSF) Grand Challenge (http://www.neesgc.gatech.edu/).

Placing a full-scale pile-to-wharf connection for structural testing.

The UW research component is evaluating the seismic performance, including response and damage, of pile-to-wharf connections meeting state-of-practice design methods. Professors Dawn Lehman and Charles Roeder have worked with their graduate students, Amanda Jellin, Emily Brackmann, and Stuart Stringer, to develop a robust, damage-resistant connection.

Photo courtesy of the Port of Tacoma's website photo gallery

The CEE team is evaluating the structural performance of wharf pile connections.

To date, the team has tested ten piles to study different types of connections and scale effects. Of central interest are the tests simulating the state-of-practice (SP) design and the damage-resistant (controlled-rotation or CR) connection. For the NEES-NSF tests, the specimens were full-scale simulations of pile connections for berths found in West Coast construction. The SP specimen consisted of a 24-inch octagonal precast, prestressed concrete pile embedded 3 inches into a reinforced concrete deck section. T-headed reinforcing bars anchored the pile to the deck and were grouted 59 inches into the precast pile and 20 inches into the deck section. The CR connection modified this specimen by adding a cotton-duck bearing pad to sustain the rotation demands, a 15-inch unbonded length, and a flexible material to prevent shearing of the deck cover. A comparison of the damage states and 2.5% and 5% drift show that the damage to the pile and the deck is quite extensive in the SP connection but is controlled in the CR connection. The

results indicate that the modest modifications to the CR connection resulted in increased drift capacity and reduced damage and strength degradation.

"The ability of a structure to dissipate energy without considerable structural damage will significantly improve seismic performance, and reduce repair, downtime, and non-structural damage and loss after a seismic event," Lehman said. "Minimal investment in modifying the design has the potential to yield considerable returns when the structure is fully functional after a seismic event."

Damage at the end of pile testing of the CR connection.

Support for the UW research included the NEES funding, prior Pacific Earthquake Engineering Center research funding, and material donations from Concrete Technology Corportation, PCMac, Headed Reinforcement Corp., and the generous graduate student support of PCI and Moffat and Nichol.

All the data is available on the NEES data repository (https://central.nees.org). This material is based upon work supported by the National Science Foundation under grant Nos. CMS-0530478 and CMS-0402490.

The UW Structural Engineering Laboratory conducts structural testing for industry and research institutions including, but not limited to, seismic resisting systems, bridge bearings, hydraulic ram calibration, and system verification.

For more information, contact Dawn Lehman at (206) 715-2108 or delehman@u.washington.edu.

Awards and Accolades

Benjamin Named AEESP Distinguished Lecturer

Professor Mark Benjamin has been named the Distinguished Lecturer for 2009 by the Association of Environmental Engineering and Science Professors. Typically, the lecturer spends two weeks in the winter and two in spring giving lectures in environmental engineering to programs throughout North America. This honor is awarded to an individual who is distinguished as both a researcher and educator, with his or her demonstrated ability to give engaging presentations."

Lundquist Receives AGU Cryosphere Award

Assistant Professor Jessica Lundquist was recently selected by the American Geophysical Union (AGU) Cryospheric Focus Group for the 2008 Cryosphere Young Investigator Award based on her innovative contributions to cryospheric research and ability to link the results within and beyond the broader cryosphere community.

Stanton and Lehman Win 2008 Munro Prize

Professor John Stanton and Assistant Professor Dawn Lehman have won the 2008 Munro Prize, the *Engineering Structures* award for the best paper of the year, for their article "A cyclic shear stress–strain model for joints without transverse reinforcement" (Vol. 30:4, 941–954). They share the prize with co-author Meredith Anderson of Read Jones Christoffersen, Ltd., Vancouver, Canada.

Graduate Student Wins Oral Presentation Award

Nathalie Voisin, CEE graduate student in hydrology, water resources, and environmental fluid mechanics, received the American Meteorological Society's student award for best oral presentation at the AMS 89th Annual Meeting in Phoenix in January. She delivered a talk on "Verification of a Downscaling Approach for Large Area Flood Prediction Over the Ohio River Basin."

Team Wins Environmental Design Contest

Professor Mark Benjamin led his team of undergraduates Zoe See and Adam Price, graduate student Zhenxiao Cai, and Chinese exchange student Peiran Zhou to first place over eight other teams in the Brackish Water Pretreatment category of the Waste Management and Environmental Research design contest held at New Mexico State University in early April. The annual WERC contest brings together industry, government, and academia in the search for improved environmental solutions and draws hundreds of college students who compete in six design categories.

CEE Junior Receives Mary Gates Scholarship

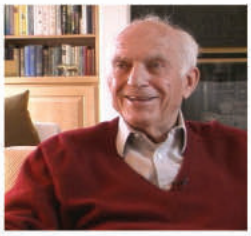
Melyssa Nagamine has been awarded a Mary Gates Research Scholarship for a project she is working on with Assistant Professor Alex Horner-Devine. This competitive scholarship enhances the educational experiences of students across campus by offering opportunities to engaged in research with faculty.

Civil & Environmental Engineering's Alumni Diamonds

The College of Engineering is honoring Ray Clough and Tom Gibbs with 2009 Diamond Awards, to be presented at the fourth annual Diamond Awards Dinner on May 8. Their many-faceted careers offer dazzling examples of exemplary service to society and to the profession. Congratulations to both!

Ray Clough — Legend of Earthquake Engineering & Finite Element Analysis

Diamond Award for Distinguished Achievement in Academia



Ray Clough

From Chile to Morocco, Ray Clough traveled the world to survey earthquake damage with the goal to improve the seismic performance of structures. Last fall he returned from the World Conference of Earthquake Engineering in China with an award and title befitting his pioneering work in the field — "Legend of Earthquake Engineering."

As a professor at UC Berkeley in the early 1960s, he cofounded the university's Earthquake Engineering Research Center, and with colleagues developed cutting-edge methods for testing models of buildings, bridges, and dams for seismic strength. His work has helped protect millions of people during devastating earthquakes

Clough is especially famed worldwide for developing the finite element method, which revolutionized numerical modeling of the physical world and enables analysis of stress fields in complex structures. The legacy of his pioneering work is visible in such architectural amazements as the Bird's Nest Olympic Stadium in Beijing, the Experience Music Project in Seattle, and a 2300-foot tall skyscraper in Dubai. Far beyond civil engineering, finite element methods enabled the groundbreaking design of the new Boeing 787, the production of stronger, lighter, more fuel-efficient cars, and high-performance sports equipment such as bikes and skis. Clough's definitive text, *Dynamic Structures*, is still in use today, three decades after its publication.

Clough earned his BSCE at the UW in 1946 and his ScD at MIT in 1949. During his almost 40 years at Berkeley he taught, advised, and mentored numerous students, inspiring their own significant contributions. His many honors include the Prince Philip Medal from the Royal Academy of Engineering in London, the National Medal of Science bestowed by President Clinton in 1994, and the 2006 Franklin Medal in Civil Engineering. He is a member of the National Academy of Sciences, the National Academy of Engineering, and the Chinese Academy of Engineering.

Charles V. "Tom" Gibbs — Champion of Clean Water & the Puget Sound Region

Diamond Award for Distinguished Achievement in Industry

Tom Gibbs

Using his skills in engineering, management, and team building, Tom Gibbs (BSCE '54 and MSCE '66) created innovative and lasting environmental legacies. His work for a sustainable environment nationally and in two major cities was of historic importance to the clean water movement. As executive director of Metro from 1967–1974, he led the acclaimed cleanup of Lake Washington and Puget Sound, earning commendation from the White House in 1971 and national awards from ASCE and the American Public Works Association.

After he joined CH2M HILL in 1974, he supervised the firm's work on Milwaukee's massive water pollution abatement program and then sparked the transformation of the city's downtown riverfront from a polluted eyesore to a dynamic urban destination. He then became executive vice president and director of water practice with responsibility for CH2M HILL's domestic water engineering projects until retiring in 1997.

On the national level, Gibbs rallied colleagues across the country to spearhead the 1969 creation of the National Association of Clean Water Agencies, a highly respected contributor to national environmental issues. He also played a significant role in the development of the original Clean Water Act in 1972. Both the Washington Society of Professional Engineers and the Consulting Engineers Council of Washington have honored him as Engineer of the Year.

Gibbs has long been a strong community service advocate. His leadership has touched many organizations, including the Seattle-King County Economic Development Council, the Greater Seattle Chamber of Commerce, the Mountains to Sound Greenway Trust, and the Board of Coastal Environmental Systems. As a board member of the Washington State Major League Baseball Stadium Public Facilities District, he was instrumental in the design and construction of SAFECO Field, a complex engineering challenge.

CH2M HILL Executive to Give 2009 Commencement Address

Bill Dehn

Bill Dehn (BS '68, MS '71), president of CH2M HILL's North American operations, will welcome our 2009 graduating class to the profession at the June 13 commencement ceremony.

Dehn manages the operating platform of 130 offices for the company's water, transportation, environment, communications, and information solutions businesses. He has more than 40 years of experience managing large, multidisciplinary programs and is an expert in global and operational project management.

He previously was executive vice president and chief operating officer of CH2M HILL Hanford Group, with responsibility for safely managing 53 million gallons of radioactive residuals to protect public health and avoid environmental contamination. Prior to his assignment at Hanford, Dehn was global operations director for the company's Energy, Environment & Systems business group, which manages projects for private industry and the federal government.

Dehn started his career at CH2M HILL by developing the Seattle/King County Solid Waste Management Plan. He later developed the wastewater management plan for South Kitsap County, which led to construction of the Bremerton secondary treatment plant. During the Reagan Administration, he was the company's program manager for the EPA in Washington, D.C., overseeing the government's program for uncontrolled hazardous waste sites in the 29 western states. From 1990–1994, he managed the San Francisco office.

As a student, Dehn loved lab work, especially water and materials labs that enabled students to see how concrete, steel, water, and soils performed according to the theories learned in the classroom. He recalls that classes taught by professors Brian Mar and Dick Bogan were difficult, but helped stretch his thinking so he ultimately became a better engineer. As he moved into his career after the UW, he was most surprised at how important non-technical skills such as written and verbal communication and emotional intelligence affected his ability to be successful in industry. As a Husky, Dehn is grateful for having had such wonderful colleagues and professors at a great university, and he is proud of his UW education.

The commencement ceremony is Saturday, June 13, at 10 am in Kane Hall 120, followed by a reception in the Walker Ames Room.

Benson Conducts Regional Industry Roundtables

Our graduates work in a variety of capacities in the Northwest and around the world. To ensure that we are preparing the next generation of engineers for today's diverse work environment, we went straight to the source. This winter, department chair Craig Benson conducted three regional industry roundtable luncheons where he met with CEE alumni and industry representatives at Magnusson Klemencic Associates in Seattle, Golder Associates in Redmond, and The Boeing Company in Everett.

Pulling from a diverse group of active alumni and industry partners, Benson asked for participant feedback to help inform the department regarding curriculum, work-place readiness of our students, and other industry issues that could guide faculty and staff in their interactions with students. Spirited discussions focused on characteristics industry desires in new graduate hires, changes to the industry in the last 10–20 years, both locally and globally, and the type of relationship industry would like to build with the department. Information from these sessions has been shared with faculty and staff and will help shape our direction for the coming years.

Words of Wisdom for the Women of WiSE

Amy Haugerud (BS '77) gave the keynote address at the 2009 Women in Science and Engineering (WiSE) conference on February 7. Speaking to over 200 young women studying science and engineering, Amy dispensed words of wisdom regarding professional practice, running your own company, and work-life balance. Owner of Seattle-based Rosewater Engineering for over 25 years, Amy recently joined forces with leading international professional services company GHD.

The goal of the WiSE program is to recruit and support women of all ethnic backgrounds in science and engineering (S&E) and to create an academic and social climate at the UW that is conducive to men and women in S&E at the undergraduate and graduate levels.

Amy Haugerud (center) with student members of the WISE Advisory Board.

UNIVERSITY of WASHINGTON
CIVIL & ENVIRONMENTAL ENGINEERING
More Hall 201, Box 352700 Seattle, Washington 98195-2700

The Bridge

Craig H. Benson, PhD, PE
Professor and Chair

Sandy Marvinney
Heather Wilson
Editing

Contributors
Megan Kagel, Evan Lakin
Dawn Lehman, Steve Muench
Jason Perkizas

Masthead photo: WSDOT

Send address corrections, questions, and comments by email to comments@ce.washington.edu or to the return address above.

Civil & Environmental Engineering

Spring 2009

The Bridge

http://www.ce.washington.edu • Tel: 206.543.2390 • Fax: 206.543.1543

Super-Light Bridge Almost Goes the Distance

Weighing about 145 pounds, the super-light, super-efficient bridge withstood more than 2400 pounds of loading with only 1.55 inches of deflection. Had a weld not failed with less than 100 pounds to be added, the UW entry might have emerged a winner at the Pacific Northwest Division of the 2009 Student Steel Bridge Competition (SSBC).

Presented by AISC and ASCE and hosted in early April by Carroll College and Montana State University, the competition offered undergraduate students a great opportunity to see a project through from conceptual design to construction. With the help of faculty advisor Jeff Berman, the UW team of 15 juniors and seniors, including captains Jason Perkizas and Evan Lakin, tackled this year's challenge to design and construct a one-fifth scale, 20-foot "deck" bridge using a minimum amount of steel and without supporting members crossing the plane of the load-bearing surface.

The team fabricated the pieces in the CEE Structural Engineering Laboratory. At the competition, teams constructed their bridges in a simulated environment with realistic constraints such as minimal staging space, riverbank instability, and additional waterway complications. A panel of judges evaluated designs based on display, construction speed and economy, lightness, stiffness, and structural efficiency.

"A director of the competition said our bridge was among the lightest entries from all the regional events to date," Berman said. "The performance prior to the weld failure showed the students they had designed and engineered a super-efficient system. They felt a sense of accomplishment, and now an experienced group of juniors is poised to lead the team to success in the 2010 competition."

For their help and support, the Steel Bridge Team thanks AHBL Inc., Degenkolb Engineers, HDR Engineering Inc., KBA Incorporated, Magnusson Klemencic Associates, PCL Construction Services, and T.Y. Lin International.

For additional information, visit: http://nssbc.info/