

Chair's Memo: Interdisciplinary Research at UC Berkeley



Gregory
Fenves

One of the strengths of Civil and Environmental Engineering at UC Berkeley is that our faculty and students are passionate about solving pressing problems in California, the United States, and the world.

What are these problems? We read about them every day in the newspaper: the deteriorating infrastructure, transportation congestion, devastation caused by natural hazards, water shortages and poor water quality, the enormous issues related to energy and the need for alternative energy resources, and the growing awareness of how important sustainable systems and policies will be to the future of the planet.

One characteristic is shared among these issues: the solutions require knowledge from many disciplines. At UC Berkeley, interdisciplinary research is very important, and CEE has an excellent track record in leading such efforts.

This issue of the newsletter highlights several of the centers in Civil and Environmental Engineering that are conducting interdisciplinary research, educating students to be future leaders, and providing valuable service to society by involving diverse stakeholders. I encourage you to support these centers by providing advice, expertise, and even financial support. Your assistance will be greatly appreciated.

Go Bears!



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Chair,
Civil & Environmental Engineering



Raymond Seed and Robert Bea (center)
inspect New Orleans' levees

CEE Team Reports on New Orleans' Levees Failure

A national team of 38 engineers and investigators led by Professor Raymond Seed conducted an independent investigation of the failure of New Orleans' levees during Hurricane Katrina. The investigation was sponsored by the National Science Foundation and UC Berkeley's Center for

Information Technology Research in the Interest of Society (CITRIS).

The team made a thorough study of the New Orleans regional levee system, including urgent post-hurricane forensic ground investigations, field borings and laboratory testing, and extensive computer modeling and analyses. In its final report published July 31, 2006, the team concluded that the failures occurred for a number of reasons, including the choice of materials used in the levee construction, the challenging geology and unstable soils upon which they were built, efforts to achieve economic savings at the expense of safety, and engineering lapses associated with failure to anticipate critical failure modes and mechanisms specific to some of the failure sites.

Professor Robert Bea, co-author of the report, added that the levees were deficient as a result of organizational problems within the U.S. Army Corps of Engineers, which oversees the design and construction of the levee system, and organizational problems endemic to the overall system within which the U.S. Congress, the Corps, and local government and oversight agencies must coordinate their efforts to design and construct complex regional systems.

The team recommended changes from national to local district levels. Their recommendation was to re-establish the necessary organizational strength and funding levels for the Corps of Engineers and to refocus a larger fraction of the Corps' efforts on engineering rather than on project management.

CEE participants in this study include Professors Jonathan Bray, Juan Pestana and Michael Riemer, and graduate students Rune Storesund, Adda Athanasopoulos, Diego Cobos-Roa, Xavier Vera-Grunauer, Carmen Cheung, Kofi Inkabi, and Julien Cohen-Waerber.

The final report can be found at http://www.ce.berkeley.edu/~new_orleans



The CEE Team: Xavier Vera-Grunauer, Rune Storesund, Adda Athanasopoulos, Raymond Seed, Robert Bea, J. David Rogers (University of Missouri, Rolla), Kofi Inkabi, Diego Cobos-Roa

Project Production Systems Laboratory Revolutionizes Lean Production

CEE Professors Iris Tommelein and Glenn Ballard are directing the new Project Production Systems Laboratory. P²SL is developing knowledge and tools to manage project production systems and organizations that produce and deliver goods and services through such systems.

The range of project production systems is large, including: construction, product development, software engineering, ship building, work-order systems, job shops, performing-arts productions, oil field development, and health care delivery.

P²SL is inspired by the Toyota Production System known as 'lean production'. P²SL focuses on lean delivery of custom products (goods or services) that are designed, made, and delivered through projects. A project is the most fundamental form of production system. Even products intended for mass production are initially designed and made through projects. However, production theory was developed for repetitive manufacturing, where projects are peripheral forms of production. Project management developed in isolation from production theory altogether. P²SL aims to bridge production and project management.

The P²SL research agenda involves among others, CEE Professors Iris Tommelein, Glenn Ballard, Bozidar Stojadinovic, and Jack Moehle, who are developing a methodology for set-based design of rebar. Other P²SL initiatives focus on managing tolerances (dimensional variation), built-in quality, supply-chain management (with Industrial Engineering and Operations Research), target costing for hospitals, and health care delivery (with the School of Public Health).

Industry contributors to P²SL include DPR, Pankow, Boldt, Skanska, Southland, FM Booth, Rosendin, SPS, CPM, Sutter Health, and UC San Francisco.

To learn more about P²SL and explore participation, visit <http://p2sl.berkeley.edu>

Earthquake Engineering Research Center Begins New Phase in Davis Hall

The Pacific Earthquake Engineering Research Center (PEER) has moved its primary headquarters from the Richmond Field Station to 325 Davis Hall on the UC Berkeley campus.

"PEER's research and education programs are an integral part of excellence in research and teaching at Berkeley," says CEE Professor Jack Moehle, PEER's director, "PEER's research on performance-based earthquake engineering establishes Berkeley as a leader in this next-generation approach to engineering, attracts the best students to study here, and enhances teaching, which incorporates the latest thinking and tools for performance-based earthquake engineering."



*UC Berkeley Student Seismic Design Team:
Kyle Chatman, Daniel Castaneda, Eric Nguyen,
Kristin Tso, Lorraine Young, Alfred Twu*

PEER supports a wide range of research at Berkeley, including: earthquake ground motion and ground failure (which includes CEE Professors Norman Abrahamson, Jonathan Bray, and Michael Riemer); advanced simulation for engineered structures (with CEE Professors Armen der Kiureghian, Gregory Fences, Filip Filippou, Khalid Mosalam, and Nicholas Sitar); performance assessment of structural and nonstructural components and systems (with CEE Professors Stephen Mahin, Jack Moehle, and Bozidar Stojadinovic); and risk decision-making. Overall, including research at other institutions, 170 faculty, graduate student researchers, and post-doctoral researchers are funded by PEER.

PEER manages initiatives to attract and educate undergraduate and graduate students. The Undergraduate Seismic Design Competition challenges students to design multi-story balsa wood structures that are tested in a national competition on educational shake tables. The Earthquake Engineering Scholars Course invites upper-division undergraduates to an intensive four-weekend course held on PEER campuses. Other initiatives include the Tri-Center Doctoral Candidate Exchange, PEER Summer Internship Program, Tri-Center Earthquake Field Study Program for Students, PEER Student Leadership Council, and PEER Student Association.

Since it was established in 1997 under National Science Foundation sponsorship, PEER has established a strong reputation in earthquake engineering. With federal, state, and private funding, PEER has developed data and design procedures that are now used widely in bridge, building, and lifelines engineering. As anticipated under NSF's 10-year funding plan, PEER will graduate from NSF funding in 2007, but PEER will continue under federal, state, and private funding programs.

For information on PEER and how to participate in its programs, see <http://peer.berkeley.edu>

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Berkeley Water Center Takes Comprehensive Approach to Water Management



BWC examines agricultural irrigation and impact on bodies of water such as the San Francisco Bay

The Berkeley Water Center (BWC), established in 2005, brings together more than 70 UC Berkeley faculty and 200 scientists from the Lawrence Berkeley National Laboratory.

BWC's mission is to take a comprehensive approach to water resources management that reflects conditions in the 21st century: variable and uncertain supply, increasing demand, and inadequate infrastructure.

CEE Professor Yoram Rubin and Professor David Sunding from the College of Natural Resources are the center's co-directors.

BWC will use the state of California as a test bed for studying water resources in highly managed regions. Advanced instrumentation and models will measure and predict future conditions. BWC's initial focus is on agricultural regions, which use approximately 80 percent of the managed water in the state, so small improvements in efficiency have dramatic results. Findings from California will help other expanding regions that face similar conditions but without the same resources.

Several academic and research units at UC Berkeley sponsor the BWC: the College of Engineering, College of Natural Resources, Center for Information Technology Research in the Interest of Society, and Lawrence Berkeley National Laboratory.

BWC has also developed strong partnerships with government and the private sector. These partnerships foster interdisciplinary research and the transfer of water knowledge into applications and tools.

One such partnership is with Microsoft Corporation. Microsoft recently chose the BWC to host a Technical Computing Initiative focused on water cyberinfrastructure. The initiative will bring datasets and tools together to permit hypothesis testing and improved water management.

Opportunities to explore hydrological topics in an interdisciplinary environment can be found at <http://esd.lbl.gov/BWC>

Center for Future Urban Transport Explores Innovative Transport Solutions for International Cities



The Center for Future Urban Transport focuses on congestion in many cities, such as Beijing, China

The UC Berkeley Center for Future Urban Transport was established in 2004 after the Volvo Research and Educational Foundations designated it as a Volvo Center of Excellence in a large international competition. It is housed at the Institute of Transportation Studies (ITS) at Berkeley, and its director is CEE Professor Carlos Daganzo.

The center's theme is the interplay of policy and technology in solving urban transport problems. A significant part of its research agenda is drawn from problems specific to individual cities around the world. By work-

ing with partners in cities in China, Chile, Spain, Japan, France, and other countries in the future, the center's researchers develop solutions to problems of accessibility, mobility, sustainability, and safety that are tailored to these cities.

The center represents one of the largest international research collaborations ever attempted by ITS Berkeley. Because funding for the center comes through a grant, faculty and students can explore highly innovative ideas without the constraints of specific deadlines. Among its activities, the center holds a seminar series for all students in CEE and City and Regional Planning.

Projects that the center has undertaken include: shaping transportation, housing, and land use choices in China's rapidly growing cities; measuring the full environmental impact of alternative transportation modes such as battery-powered electric motorcycles; devising control systems for urban transportation networks to improve passenger and freight logistics in congested urban cores; adaptable scheduling for bus routes to make optimal use of transit systems; green logistics and devising easily replicated, high-performance, reliable, low-cost traffic signal control systems. Up to twelve doctoral students collaborate on these research projects.

Participating CEE faculty include Alexandre Bayen, Michael Cassidy, Arpad Horvath, Samer Madanat, Raja Sengupta, and Alexander Skabardonis. For more information visit <http://www.its.berkeley.edu/volvo-center>

Premier Center on Green Design and Engineering

UC Berkeley’s Consortium on Green Design and Manufacturing (CGDM) is an interdisciplinary research and educational center involving academia, industry, and government. CGDM has been the intellectual home for environmentally-conscious design, engineering and management research and education in the United States since 1993.

CGDM’s focus is design for environment, pollution prevention, and life-cycle engineering and management primarily for civil infrastructure systems, electronics and manufacturing industries, and also service industries. Example projects include: life-cycle environmental modeling of electricity generation technologies, machining and other manufacturing technologies, buildings and construction, computers, telework, water systems, and transportation.

Faculty and students come from the College of Engineering,

Energy and Resources Group, Haas School of Business, and the School of Public Health. Ongoing collaboration also exists with Lawrence Berkeley National Laboratory and Carnegie Mellon University.

A number of government agencies and companies have funded CGDM research and internships over its thirteen-year history, and CGDM researchers have taught courses on and off campus, such as in life-cycle engineering, to industrial partners. To date, 28 students affiliated with CGDM have graduated, 15 with Ph.D. and 13 with M.S. degrees.

CEE Professor Arpad Horvath is CGDM’s director. He is the point of contact for outside organizations to manage research and educational activities in green design, engineering, and management at UC Berkeley.

For more information visit <http://cgdm.berkeley.edu>

CEE Alumni—Stay in Touch!

Please give us your contact information and get the latest news for CEE’s alumni and supporters at <http://www.ce.berkeley.edu/alumni>

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