

UCLA Civil & Environmental Engineering

HENRY SAMUELI SCHOOL OF ENGINEERING AND APPLIED SCIENCE | UCLA | FALL 2013/WINTER 2013

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Photo courtesy of Kerry Sieh

Reflections on Northridge Earthquake after 20 years

Southern California is a great place to study ground motions and earthquake engineering, as was proven by the disastrous Northridge Earthquake of Jan. 17, 1994. The magnitude 6.7 quake caused an estimated 60 deaths, 7,000 injuries and \$41 billion in damage. At the time, it was the largest natural disaster in the nation's history.

Northridge was to become among the best documented earthquakes world-wide, with Los Angeles and surrounding communities serving as a "field laboratory" from which major insights were gained on topics as diverse as earthquake ground motions and their relationship to the regional geology, seismic ground failure and its effects on the built environment, and the vulnerabilities of buildings, bridges and earthen structures. Jonathan P. Stewart, the chair of the Civil and Environmental Engineering Department at UCLA, was the lead author of a comprehensive reconnaissance report published by the UC Berkeley Earthquake Engineering Research Center in June of 1994. This landmark document presented field observations from

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Message from the Chair

PROF. JONATHAN P. STEWART



Dear friends and colleagues,

I am pleased to present to you the Fall 2013 edition of the C&EE Department newsletter, which highlights some of the many exciting developments and accomplishments since our last edition. I hope you will take a moment to read the newsletter and learn more about

some of the great things happening in our department.

We begin academic year 2013-14 with our largest-ever graduate enrollment of approximately 180 students, roughly equally divided between our Masters and Doctoral students. These numbers point to a reality that is not well appreciated outside the department – on a per faculty basis, we have one of the highest levels of graduate enrollment and degrees awarded among Civil Engineering graduate programs nationwide. Our Ph.D. student productivity, at about 0.7 graduated students per faculty member per year, is second highest in the nation. This is a reflection of the extraordinary research occurring within the department by our faculty, students, post-doctoral scholars and research staff.

Once again, competition was fierce for admission into our undergraduate program, with 1,456 applicants vying for 73 spots in the freshman class. In related news, the department earned a positive review from the Accreditation Board for Engineering and Technology (ABET), the only nationally recognized U.S. accreditor of college and university programs in applied science, computing, engineering and technology. We are grateful to Professor Scott Brandenburg for leading the effort to prepare for the ABET review. Our accreditation is valid for five more years.

We are pleased to announce the addition of Dr. Mekonnen Gebremichael as a new member of the faculty. Professor Gebremichael joins us from the University of Connecticut, where he received a NASA New Investigator Program grant (2008) and the American Geophysics Union Early Career Hydrologic Sciences Award (2010). His research expertise and publications are in hydro-meteorology, remote sensing, stochastic analysis and nonlinear dynamics. His studies address the security of water resources, which is of critical importance, given

that one-fourth of the world's population resides in water-scarce regions. Professor Gebremichael is also Director of the U.S.-Ethiopia Partnership in Sustainable Water Resource Capacity Building.

We also have added two truly outstanding adjunct faculty. Robert E. Kayen, Ph.D., P.E., Research Civil Engineer at the USGS in Menlo Park, has authored more than 300 journal articles, professional papers, conference papers and reports in the fields of earthquake engineering, geomatics and marine geotechnics. He teaches two courses for us each year — Engineering Geomatics and Engineering Geology. George Mylonakis, Ph.D., Professor of Civil Engineering at the University of Bristol and University of Patras, specializes in geotechnical earthquake engineering and computational geomechanics and has authored approximately 200 scientific publications (more than 60 in professional journals). At UCLA, he teaches a graduate course on foundation engineering each year and is active in advising graduate students.

On Sept. 14, the department celebrated the 30th anniversary of its formation, with a gala event called “A Civil Gathering” at the UCLA Faculty Center. C&EE faculty, alumni and industry partners enjoyed dinner, an outstanding jazz trio from the UCLA Herb Alpert School of music, and a silent auction featuring sports memorabilia signed by UCLA greats such as Kareem Abdul-Jabbar, Troy Aikman, Bill Walton, John Wooden and the College World Series-winning 2013 UCLA Bruins baseball team. We were delighted to honor two of our extraordinary alumni, Robert E. Englekirk, MS '65, Ph.D. '70, S.E. and Soroosh Sorooshian, MS '73, ENG '77, Ph.D. '78, with the inaugural presentations of the Distinguished Alumnus/a Awards. We also recognized Geosyntec Consultants as our Outstanding Industry Partner at the event. We are grateful to Shannon & Wilson, Englekirk Institutional and KPFF Consulting Engineers for their sponsorship of the event.

You should take pride in your alma mater, which is the most selective public university in the world, and the C&EE Department from which many of you graduated. We are enjoying considerable success and are truly grateful for the tremendous support we receive from alumni like you and industry sponsors. Go Bruins!

Mekonnen Gebremichael Joins the C&EE Faculty



The UCLA Civil and Environmental Engineering Department welcomes Associate Professor Mekonnen Gebremichael this fall. His research centers on water governance, understanding and predicting hydrological fluxes on a range of space and time scales and advancing the use of satellite datasets for water resource applications. Gebremichael grew up in Ethiopia, and his first engineering job involved design of a water project there. At that time he realized that developing substantial, reliable scientific information on hydrologic variability was the key to making a positive impact. Since then, he's become a recognized scholar in hydrology and water resources. He notes that water resources are critical to areas including food and energy security, economic development and public health, particularly with the advent of climate change. Gebremichael also leads capacity-building activities in Africa, establishing a water resource institute and academic programs in Ethiopia. Gebremichael has received the Early Career Hydrologic Sciences Award from the American Geophysical Union; the New Investigator Award from NASA; is the co-editor of two textbooks; and is a member of national and international working groups including the NASA Precipitation Measurement Mission Science Team.

He received his Ph.D. from the University of Iowa and was previously on the engineering faculty at the University of Connecticut.

Department adds Kayen, Mylonakis as Adjuncts

The Civil and Environmental Engineering Department welcomes two distinguished engineers and researchers as adjunct faculty in 2013-14: Robert E. Kayen and George Mylonakis.

Kayen's work focuses on geotechnical engineering, seismic soil liquefaction and the impact of ground failure on structures on bridges, ports and harbor facilities. Since 1982 he has worked with the U.S. Geological Survey's Pacific Science Center, where he is now a senior research engineer.

Kayen has been a lecturer at UCLA since 2007. He earned a bachelor's degree in civil engineering from Tufts University, a master's degree in geology from California State University, East Bay and a master's degree and Ph.D. in civil engineering from UC Berkeley. His honors include the American Society of Civil Engineering's Thomas A. Middlebrooks Award and the Ames Honor Award from the NASA-Ames Research Center.

Mylonakis' areas of research include geomechanics, engineering mathematics, soil-structure interaction and the seismic response of extended structures, with an emphasis on pile foundations. Mylonakis is professor at the University of Bristol and the University of Patras in Greece.

A member of the editorial board at the Journal of Environmental Geotechnics and the Journal of Earthquake and Structures, Mylonakis earned a diploma in civil and structural engineering from the National Technical University in Athens and a Ph.D. in civil and geotechnical engineering from the State University of New York at Buffalo. He received the Shamsheer Prakash International Research Award in 2002.

"Professors Mylonakis and Kayen bring great expertise in geotechnical engineering and exceptional teaching skills to UCLA," said Jonathan P. Stewart, chair of the department. "We are proud to add them to our adjunct faculty."

CEE Faculty Awards and Honors

Mahendra wins Dupont award

Assistant Professor Shaily Mahendra was selected in May as a 2013 DuPont Young Professor. The recognition from the global science and technology company is designed to help promising young and untenured faculty as they launch their research careers.



Mahendra has developed microbes and fungi that show promise in remediating the effects of chemical contaminants in groundwater at industrial sites. Her research has broad applications in the cost-effective detection, containment and remediation of toxins on site, without the need to remove contaminated soil or pump groundwater.

Since 1968, DuPont has provided nearly \$50 million in grants to more than 680 young professors.

In April, Mahendra, who joined the department in 2009, received the National Science Foundation's Faculty Early Career Development Award (CAREER). In November, Mahendra will receive the Northrop Grumman Excellence in Teaching Award.

Brandenberg wins research award



Professor Scott Brandenburg in September was awarded the Shamsheer Prakash Research Award for young engineers. The award goes to geotechnical engineering experts from around the world who are under 40 and who have made significant contributions to the field.

Brandenberg's research focuses on analysis of bridge performance and design of bridge foundations for use in soft and unstable soils.

In 2010 he received the American Society of Civil Engineers' Arthur Casagrande Professional Development Award. Brandenburg, who serves as the department's vice chair for undergraduate studies, joined the UCLA faculty in 2005.

The awarding agency, the Shamsheer Prakash Foundation, was launched by former president of the Indian Society of Earthquake Technology and professor emeritus of the Missouri University of Science and Technology Shamsheer Prakash.

Hoek's new technology wins award

A groundbreaking membrane material developed by Professor Eric Hoek and a UCLA colleague received an international award for innovation at one of the water industry's largest global conferences.

The new technology holds promise for cleaning wastewater, in particular the water co-produced during oil and gas extraction. It earned a Distinction Award for Technology Innovation of the Year at the Global Water Awards, held in Seville, Spain, in April.

To contain pollutants, many oil and gas producers use ceramic-based membranes, which are high performing but are also expensive and bulky. A new polymeric-ceramic membrane developed by Hoek and Richard Kaner, UCLA professor of chemistry, biochemistry, materials science and engineering, exhibits ceramic-like performance at much lower cost.

The new membrane can be made with openings from a few nanometers up to a few hundred nanometers, suggesting it can be engineered for use in a range of water and wastewater treatment applications.

Hoek, who won the 2011 American Society of Civil Engineers' Walter L. Huber Award for Achievements in Civil Engineering Research, joined the UCLA faculty in 2004.



Sant named a Hellman Fellow

In June, Assistant Professor Gaurav Sant was named a UCLA Hellman Fellow for 2013-2014. The UCLA Hellman Fellows program supports assistant professors who perform research of distinction.

Sant was recognized for his work on the formulation of new, low-CO₂-footprint building materials that could dramatically reduce the amount of greenhouse gases produced in the construction process. Sant investigates the use of natural and waste materials in concrete, development of organic and inorganic chemicals to improve performance of cementitious materials, and development of low-CO₂ concretes for carbon capture.

Sant, who joined the UCLA faculty in 2010 and holds the Rice Endowed Chair in Materials Science, also received the National Science Foundation's Faculty Early Career Development Award (CAREER) in April.



materials and ceramic and polymer composites.

Ju joined the UCLA faculty in 1993. He is a fellow of the American Society of Mechanical Engineers and the American Society of Civil Engineers, and is a distinguished chair holder at Tongji University in Shanghai and Guangxi University.

The award ceremony was held in December, at the Asian-Pacific Association for Computational Mechanics symposium in Singapore.

AISC taps Sabol for seminar

Adjunct Professor Thomas Sabol has been awarded the 2013 Louis F. Geschwindner Seminar by the American Institute of Steel Construction. Each year the institute selects an engineer and educator with structural steel design and research expertise to be the presenter of the annual Geschwindner Seminar. The seminar is presented as part of the 2013 North American Steel Construction Conference and subsequent presentations in 2013 and 2014.

Sabol's seminar focuses on applications of the AISC Seismic Provisions for Structural Steel Buildings, of which he was one of the co-authors.

Sabol, '82 MS and '85 PhD, is a principal at Los Angeles-based Englekirk International Inc. At UCLA he teaches graduate and undergraduate courses focusing on tall building design and structural steel.

AISC is a not-for-profit technical institute and trade association established in 1921 to serve the structural steel design community and construction industry. The presenter of the Geschwindner Seminar receives a \$15,000 stipend.



Ju honored by ICACM



Professor Jiann-wen "Woody" Ju has been selected to receive the International Center for Applied Computational Mechanics Award for 2013. The award recognizes outstanding and sustained contributions to computational mechanics.

Ju's research focuses on microstructural damage mechanics in construction and other materials. He studies and tests materials including reinforced concrete, ceramics, nanomaterials, cementitious

17 Full-time faculty

5 ASCE Walter L. Huber Civil Engineering Prize winners

7 NSF CAREER Award winners

4 ASCE Fellows

Students go to Fiji to help islanders upgrade water systems



Professor Eric Hoek (center, in plaid shirt), accompanied by several students, talks to Fijian villagers about ways to improve the safety of their water supply.

Living among farm animals and fields of root crops and sugar cane, the rural residents of Fiji get their water unfiltered and untreated from creeks, wells and springs. Access to clean, drinkable water is a pipe dream.

To bring 8,000 residents closer to achieving that dream, a team of UCLA graduate students led by Professor Eric Hoek trekked through July's 100-degree heat on the islands of Vanua Levu and Taveuni to reach 16 villages to assess the quality of their drinking water. The team included project leader Catalina Marambio-Jones, Michelle Thompson, James Temple, Rachel Druffel-Rodriguez and Ryan Kristensen. The effort also was supported by the Rotary Pacific Water Association, Fiji's Ministry of Health and Lori Hall, founder of the nonprofit Global Classrooms for Peace.

The goal of the 20-day trip was determine the condition of the villages' water and wastewater systems in order to submit official Rural Water and Sanitation Plans so the villages can qualify for Fijian government funding to make improvements. The team identified several sources of concern. Creeks and springs are contaminated with feces, and unlined wells are exposed to contaminants from animal waste as well as pit latrines lined with corroded 55-gallon drums. With fewer immunities than adults, children get sick after rainstorms hit and conditions deteriorate.

Plans are at an early stage for a return visit by another group of UCLA students to oversee improvements, such as installation of filters and tanks, if the islanders get the funding. Ideas also are percolating about starting a program to engage village women as teachers of clean water and sanitation practices.

Hoek said the trip was invaluable for his students, but that it also is vital to show the farmers that the traditional way is not the only way. "We realized that while we can put in a pipe or a water tank, it's likely to be unsustainable unless you can provide people with an explanation of why they should maintain it," Hoek said.

- Cynthia Lee

ITE students place second with Santa Monica parking project



From left, ITE Advisor Walter Okitsu, Tiffany Huang, Monica Shei, and Paul Lee at the So-Cal ITE Annual Student Night Presentation.

Civil and Environmental Engineering students representing the UCLA student chapter of the Institute of Transportation Engineers took second place at ITE's annual Presentation Night event in May. The group presented on the operational impacts of inbound queueing at one of the busy City of Santa Monica public parking structures, collecting data on existing conditions, analyzing the impacts of the city's proposed circulation plans and making practical and economical proposals to improve conditions. Members of the team included Tiffany Huang, Paul Lee and Monica Shei. Seven clubs competed in the event. Presentation Night included representatives of both ITE SoCal and the Orange County Traffic Engineering Council.

The team thanks faculty advisors Patrick Gibson and Walter Okitsu and the City of Santa Monica.

CalGeo chapter wins Rising Star Award

A group of UCLA Civil and Environmental Engineering students won the Rising Star Award at the California Geotechnical Engineers Association 2013 Conference in May. The award is given each year to the CalGeo chapter showing the most initiative in encouraging student involvement in the professional geotechnical community.

Students who attended the conference at Tenaya Lodge outside Yosemite included then UCLA CalGeo chapter President Sean Ahdi, incoming chapter President Sean Munter, Treasurer Yi Tyan Tsai, and Graduate Student Advisor Dennis Nguyen. The group made a poster presentation during the awards luncheon at the conference.

Members of the club thank supporters including faculty advisor Scott Brandenburg; the CalGeo Professional Chapter and especially industry liaison Veronica Tolnay; the Geo-Institute of ASCE, the UCLA Engineering Alumni Association and the many companies and industry professionals who gave their time to interact with students.



From left, Sean Ahdi, Yi Tyan Tsai, Dennis Nguyen, and Sean Munter accept the 2013 Rising Star Award at the CalGeo Conference.

Watts Towers work draws national attention



NBC News, The *Los Angeles Times* and numerous other media outlets sent journalists to follow in the footsteps of Professor Ertugrul Taciroglu and Research Engineer Robert Nigbor this spring, as the two performed research at the Watts Towers. Nigbor and Taciroglu placed a series of sensors on the famous construction of steel, colored glass, sea shells and ceramic tiles – erected by iconoclastic, self-trained artist Simon Rodia between 1920 and 1954 – which has suffered from falling pieces, water damage and other strains. Among the causes: Temperature swings, rain, earthquakes and patchwork repairs done over the years.

The National Science Foundation funded the UCLA study, conducted under the auspices of the Los Angeles County Museum of Art, which oversees conservation of the towers. The professors are still gathering data, which they believe will be of use at other cultural heritage sites around the world.

Coverage appeared on the front page of The *Los Angeles Times*; the national program CBS This Morning, KTLA Channel 5 and KABC Channel 7 in Los Angeles; National Public Radio affiliates KPCC and KCRW in L.A. and KQED in San Francisco; and elsewhere.

A Civil Affair: Department Celebrates 30th, Honors Two Distinguished Alumni

Nearly 120 alumni, faculty, students and friends of the UCLA Civil and Environmental Engineering Department came out to celebrate the 30th anniversary of the department on Sept. 14 at the UCLA Faculty Center.

The event featured dinner, music, a silent auction, a student poster session, lab tours, recognition of distinguished alumni and talks about the state of UCLA Engineering from Dean Vijay K. Dhir and the history of the C&EE Department by Chair Jonathan P. Stewart.

Department Chair Jonathan Stewart awarded the school's inaugural Distinguished Alumnus Award to Robert E. Englekirk, MS '65 and PhD '70, and Soroosh Sorooshian, MS '73 and PhD '78.

Englekirk is an expert in structural engineering who is recognized internationally for his innovative and constructible design of reinforced concrete. He is chairman emeritus of Englekirk Institutional, the company he founded in 1969, which has offices in California, Hawaii, Guam and China.

Some of Englekirk's most notable projects include the Getty Center and the Hollywood/Highland Project in Los Angeles and The Paramount residential building in San Francisco, which at 40 stories is the tallest concrete building in California.

Englekirk has taught graduate courses in concrete and steel design at UCLA, USC and UC San Diego. He sits on the Industrial Advisory Board of the Robert and Natalie Englekirk Structural Engineering Research Center at UC San Diego and is on the Institutional



Board of the Pacific Earthquake Engineering Center at UC Berkeley.

A fellow of the American Concrete Institute and the Prestressed Concrete Institute and a member of the Earthquake Engineering Research Institute, the Structural Engineers Association of California and the Los Angeles Tall Building Structural Design Council, he is the author of several leading textbooks, including "Seismic Design of Reinforced and Precast Concrete Buildings" and "Steel Structures: Controlling Behavior through Design."

Englekirk has received industry several honors, including the PCI Medal of Honor and ACI Alfred E. Lindau and Henry C. Turner awards.

Sorooshian is an internationally renowned expert in water resource engineering who is a distinguished professor of Civil and Environmental Engineering at UC Irvine.



Sorooshian has made significant impacts in areas including watershed modeling, hydro-climatic modeling and application of remote sensing to hydrology. He developed optimization methods for parameter estimation for physically-based watershed models, including the Sacramento model, and did pioneering work in combining global optimization with maximum likelihood estimation. His methodology in this area was adopted by the U.S. Weather Service for its river forecast system.

Sorooshian is a former editor of Water Resources Research and former president of the Hydrology Section of the American Geophysical Union. From 1989 to 1996 he chaired the University of Arizona Department of Hydrology and Water Resources.

Among his many honors include membership in the National Academy of Engineering, the International Academy of Astronautics and the World Academy of Sciences. He is a recipient of the NASA Distinguished Public Service Medal and in 2013 was selected to receive the highest honor in the field of hydrology, the AGU Robert E. Horton Medal.



Clockwise from top left: Undergraduate students take part in the Civil and Environmental Engineering Department 30th anniversary celebration; Professor Mladen Vucetic with Ronald Eguchi; Professor Mekonnen Gebremichael with Dean Vijay K. Dhir; Recent C&EE alumni; Professor William W-G. Yeh, Jennie Yeh, Natalie and Robert Englekirk; Dennis Lundquist of Battelle Memorial Institute, Professor Shaily Mahendra, her husband Lakshman Rao and Thierry Sanglerat of Geosyntec Consultants.



The people behind the celebration

The Civil and Environmental Engineering Department would like to thank our guests and everyone who offered or bid on silent auction items. A special thank you to the members of our Anniversary Celebration Committee: Jan Douglas '87 MS '88; Ron Eguchi '74 MS '75; Christine Goulet MS '04 PhD '08; Patrick Ho '05 MS '06; Peter Jonna '08; Marshall Lew '72 PhD '76; Dennis Lundquist '70 MS '71; Parand Maliki '08 MS '11; Tom Sabol MS '82 PhD '85; Richard Shimano '89 MS '90. Thanks also to sponsors Shannon & Wilson, Englekirk Institutional and KPFF Consulting Engineers. Finally, thanks to Monti Beach, Bill Goodin and Brad Vartan from the UCLA Engineering Office of External Affairs.

Thank You



Help Build the Future of UCLA Engineering!

UCLA Engineering alumni have an exclusive opportunity to make a lasting contribution to the future of the school. The *Alumni Legacy Campaign* to build Engineering VI is playing a vital role in creating a new, 150,000-square-foot Anchor for Engineering Innovation that will be home to three centers of excellence, state-of-the-art labs, an alumni center, faculty offices and a 250-seat learning facility.

Donors who give \$1,000 or more to the *Alumni Legacy Campaign* will see their names placed on a wall of honor in Engineering VI. Gifts may be paid over a three-year period. Alumni also may seek matching gifts from their employers.

Only 5,000 spots are available, and they are reserved exclusively for UCLA Engineering alumni.

To make a gift online, visit giving.ucla.edu/EngineeringAlumniLegacy

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Connecting research to industry with IAP

Through the Industrial Affiliates Program, the UCLA Civil and Environmental Engineering Department is dedicated to forging and maintaining partnerships with industry by aligning educational and research goals with the objectives of corporate partners in regard to student recruitment, increased partner visibility on the UCLA campus and the application of research results to practice.

Members of the program are able to present career opportunities to students through on-site interviews, seminars, industry-student dinners and participation in career fairs sponsored by the UCLA student chapter of the American Society of Civil Engineers, and may gain access to student resumes. Industrial Affiliates members can sponsor research programs, undergraduate and graduate course projects and summer internships.

CEE faculty members serve as panelists and lecturers at events and conferences sponsored by program members. The Industrial Affiliates Program welcomes members at the platinum, gold, silver and bronze (for firms of 20 or fewer employees) levels.

For more information contact:

- C&EE Department Chair Jonathan P. Stewart at jstewart@seas.ucla.edu
- UCLA Engineering Director of Corporate and Foundation Relations Kerri Bennett at 310.794.5130 or Kbennett@support.ucla.edu.
- Visit www.cee.ucla.edu/resources/industry/industrial-affiliates-program

Northridge continued from Page 1

a team of nearly three dozen researchers investigating the earthquake and its effects.

Then a Berkeley graduate student, Stewart and his colleagues used data from sensors around the region and found creative ways to gain other insights into the earthquake's impact. Stewart, for example, painstakingly studied maps at the offices of public utilities in the San Fernando Valley, Simi Valley, Santa Clarita and the Los Angeles basin to piece together information on pipelines disrupted by the quake. "There were no Google maps then," Stewart said, so the work was done by hand, yet yielded a comprehensive picture of where ground failure had occurred.

Susan Chang, now a geotechnical engineer for the Seattle Department of Planning and Development, was a member of the team.

"An important technical lesson to come out of Northridge was on the structural side—the widespread and unexpected damage in the welded steel beam-to-column connection," Chang said. "These connections were thought to be ductile, yet fractured in a brittle manner during Northridge."

Alan Kropp, a civil engineer and San Fernando Valley native now in private practice in Northern California, also participated in the study.

"We started to see this pattern with hillsides in Sherman Oaks, as well as in other areas, where lots of houses were damaged by the movement of fill," Kropp said. "They didn't collapse, but some had moved enough to need major repairs. At that time, the idea of a house being severely damaged just by moving a few inches was not really considered."

Kropp said that Northridge prompted more attention to performance-based engineering, or design that addresses relatively modest damage to infrastructure as well as catastrophic and life-threatening losses.

The Northridge quake also revealed some particular vulnerabilities of the region. Damage extended from the San Fernando Valley to Hollywood and Santa Monica. Supporting columns on an I-10 freeway bridge over La Cienega Boulevard, 20 miles from the fault, collapsed due to local amplification of the ground shaking from the soft soils near Ballona Creek.

The quake, Chang said, "provided a clear example of how the basin structure in the Los Angeles area amplifies



Collapse of the Interstate-10 overcrossing structure at Venice and La Cienega boulevards.

Photo from EERC report 94/08

earthquake motions in ways that can't be predicted by typical engineering site response techniques."

The 1994 study was to become the foundation of Stewart's career. His areas of research as the 20th anniversary of the quake nears include ground motions, seismic ground failure and soil-structure interaction.

Meanwhile, UCLA has become a leader in earthquake engineering research. Six full-time C&EE faculty members perform research in engineering seismology, geotechnical earthquake engineering, risk analysis and structural aspects of earthquake engineering. Many others contribute to the earthquake group, including adjunct faculty, researchers, post-doctoral scholars and graduate students.

Stewart, Professor Scott Brandenberg and Professor John Wallace have visited the sites of major quakes in Italy, Greece, Japan, Turkey and elsewhere, and have helped craft industry and government standards for earthquake engineering.

The late C. Martin Duke, a UCLA Professor of Engineering from 1947 to 1980 and one of the founders of earthquake engineering, led a pioneering study of the 1971 San Fernando Earthquake when he was at UCLA. Stewart and his colleagues are committed to continuing that legacy of leadership.

"Northridge advanced us in terms of technical knowledge and public policy," Stewart said. "We at UCLA are committed to playing a vital role in understanding seismic risk and the effects of earthquakes on civil infrastructure, with the goal of improving public safety and mitigating financial losses from earthquakes."

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