

**Fall 1997**  
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CUREe is a California nonprofit corporation dedicated to the advancement of earthquake engineering. CUREe's member institutions are:



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## THE PRESIDENT'S COLUMN

Helmut Krawinkler

On October 7 NSF made an official announcement that it has named three centers "to conduct and coordinate earthquake engineering research for the nation." The three centers are the Pacific Earthquake Engineering Research Center (PEER), the Mid-America Earthquake Center, and the Center for Advanced Technologies in Earthquake Loss Reduction. Each Center will receive \$2 million per year for five years from NSF, and has to provide matching funds. The article on pages 4 and 5 in this newsletter provides more details.

CUREe extends the best wishes for success to these new centers, especially to PEER, whose core university members are the eight institutions that belong to CUREe, along with the University of Washington.

The impact of the new centers on California's university research community is difficult to predict, but we hope it will be greatly positive. The presence of the PEER Center will change the mode in which much (but certainly not all) of our research will be conducted. Much of the research will be coordinated and multi-institutional. It will provide many new opportunities and it will take some others away. In one way or another, it will affect all of us.

As President of CUREe I want to especially extend my congratulations and best wishes to the PEER Director, Prof. Jack Moehle of UC Berkeley, and the other members of the PEER leadership. Most of all, I would like to urge you all to lend PEER your full support. Like CUREe, PEER was created for its member institutions and has no purpose in life without the support of its members. Moreover, the member institutions of CUREe and PEER

are the same with the exception of the University of Washington. CUREe and PEER have had a parent/child relationship in the past, and are expected to have a mutually supportive relationship in the future.

CUREe can take the credit for initiating the PEER effort, for appointing and sponsoring the committees that developed the proposal and the consensus behind a single, unified effort from California, and for much of the effort that went into helping the Center to obtain State matching funds (SB 1864). This was done with significant labor and expense, and it is fair to say that PEER would not have come about without CUREe. CUREe has been the life-giving spark and has nurtured the embryo from inception to birth. Now PEER has its own life and we all should do our best to contribute to its success.

I want to extend my sincere thanks to CUREe's Center Committee, chaired by Paul Jennings, which led the effort from the beginning; to our Executive Director, Bob Reitherman, who has devoted much of his energy to the Center effort and who proved valuable in obtaining political backing from the State; and to our former President, Steve Mahin, who made it a top CUREe priority at the inception of this national competition to put together a unified entry representing all of the CUREe universities. Sincere thanks go to the many CUREe researchers who have devoted much time to writing the proposal and who, under Jack Moehle's leadership, have brought this first stage to a successful completion.

With best wishes to PEER,

Helmut Krawinkler  
CUREe President

# The Northridge Earthquake Research Conference

SPONSORED BY THE NATIONAL EARTHQUAKE HAZARDS REDUCTION PROGRAM (NEHRP) AGENCIES



**NIST**

On August 20-22, 1997 in Los Angeles, the CUREe-organized Northridge Earthquake Research Conference and Workshop was held, an event funded by the four National Earthquake Hazards Reduction Program Agencies: the National Science Foundation, US Geological Survey, Federal Emergency Management Agency, and National Institute of Standards and Technology. Attended by over 300 researchers and members of the implementation community, the Conference featured plenary sessions where specially commissioned overview papers were presented, along with simultaneous sessions for the presentation of individual research projects.

The half-day Invitational Workshop on August 22 was attended by approximately 60 individuals, representing a wide variety of backgrounds and regions. The Workshop dealt with four theme questions:

1. What was learned

from the research that was important to (a) the technical community conducting the research, and (b) to the other members of the research community outside the particular discipline?

2. What gaps in knowledge exist regard-

ing the Northridge Earthquake because of the initial topical distribution of grants, or because new findings identified unanticipated needs?

3. What should be done to more effectively apply research?

4. Based on experience from the Northridge research effort, what could be done following future destructive earthquakes to improve post-earthquake research?

Professor Stephen A. Mahin of UC Berkeley, CUREe's Principal Investigator for

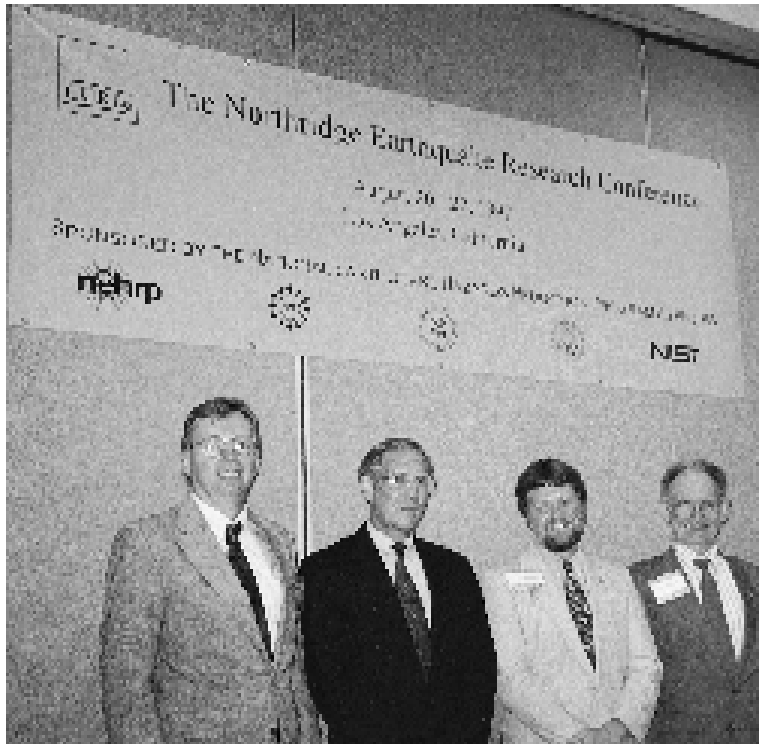
the project, commented that "The schedule at the Conference was intense, but most people found it very successful. The Overview presentations managed to accomplish their difficult tasks of covering technical material in a variety of disciplinary areas while still holding the attention of a large audience with various backgrounds. The discussion at the Workshop was lively, and it was the first time that I have seen such an organic form of discussion pull together a variety of research and implementation issues at a technical meeting."

A full set of indexed Proceedings will be produced soon, containing the Overview papers, over 150 papers on individual research projects or implementation experiences, and the Workshop proceedings. Contact CUREe for ordering information.

This 1997 Conference completed the process begun in 1994 when CUREe, with funding from FEMA, organized the Northridge Earthquake Research Coordination Conference as

researchers were just beginning their work on this earthquake, the most destructive (\$40 billion) natural disaster in U.S. history.

A listing of the Conference Moderators and Overviewers is on page 6.



### NEHRP Agency Representatives

Left to right: James Whitcomb (NSF), John Filson (USGS), Michael Mahoney (FEMA), Richard Wright (NIST)

## Northridge Conference Opening Remarks

by George W. Housner, Carl F Braun Professor of Engineering, Emeritus, California Institute of Technology

The Northridge Earthquake was a significant milestone in the progress of developing earthquake safety. This was the first time that all individuals and organizations that are concerned about earthquake safety have taken a positive attitude toward solving the earthquake problem. Federal government agencies, state government agencies, city government agencies, technical and scientific societies, political leaders, engineers, earth scientists, social scientists and other key groups all reached basic agreement following the earthquake that positive actions should be undertaken. In previous U.S. earthquakes, one or more of these key groups was missing.

In this century, for example, after the 1906 San Francisco Earthquake disaster most of the foregoing groups were missing. Charles Derleth, Professor of Civil Engineering at the University of California at Berkeley studied the earthquake and wrote a paper on the engineering aspects which was published in the Transactions of the American Society of Civil Engineers. In this paper he said it would be futile to try to calculate earthquake stresses for nothing of practical value would be obtained. At that point in history, he was correct. There were no accelerograph records of strong ground shaking available, in fact, no accelerographs were available to record strong ground motions; in addition, practically nothing was known about dynamic performance of structures, dynamic properties of materials, etc. With such almost complete ignorance of the problem, it was not the time to try to compute earthquake stresses. Similarly, in the political arena no actions were taken following the earthquake. The building code was not changed to incorporate the consideration of earthquakes; and, in fact, no building code in the world contained seismic design provisions. The first country which did include seismic design requirements in the building code was Italy which introduced the % g method of design following the Messina Earthquake. In the United

States the next earthquake disaster was the 1925 Santa Barbara Earthquake.

Despite the fact that a number of people were killed and quite a few buildings were badly damaged, the code still did not change; and there were still no recordings of how the ground actually moved during the earthquake. This earthquake did spur John R. Freeman into action. He convinced the Department of Commerce to establish the Seismological Field Survey and to install accelerographs. The first accelerographs were installed in Southern California in 1932.



In the 1933 Long Beach Earthquake recordings of earthquakes were finally obtained in the region of strong shaking. However, no one knew what to do with these accelerograms or how to relate them to the percent g seismic requirements that were then put into the building code. In following earthquakes more records were obtained of the response of structures and of strong ground motions and this increased our understanding of the problem. However, there

was no general consensus on what to do about the earthquake problem.

With the modern development of the digital computer and the increase in number of accelerographs installed in the free-field and in structures, we are now learning much more about earthquakes and the response of structures. The Northridge Earthquake, at the same time, provided some surprises about ground motions and structural responses and made it clear that although we were learning many new things about earthquakes we were also finding out that there were many more things of importance that we did not yet know. This can be paraphrased by "The more we learn, the less we know." This conference on the Northridge Earthquake will clarify what we have learned and also will explain what we don't know.



### CUREe-Sponsored Student Attendees

**Left to right:** Karthik Narayanan (UC Davis), Ali AlAli (Stanford), Xiaojing Duan (USC), Qisong Yu (UC San Diego), Laura Lowes (UC Berkeley), Anders Carlson (Caltech), Professor Stephen Mahin. **Not pictured:** Anil Agrawal (UC Irvine)

## NSF Funds Pacific Earthquake Engineering Research (PEER) Center, One of Three NSF-Funded Earthquake Engineering Research Centers

On October 7, 1997, the National Science Foundation named the three winners (see insets next page) of the national competition to establish NSF-funded earthquake engineering research centers. This culminated the process NSF began on May 2, 1996 with the issuance of a program announcement, which required proposals to be submitted approximately a year ago (October 15, 1996). NSF funding for each center is set at \$2 million per year for five years, and each center must provide at least as much in matching funds.

As noted in the comments of CUREe President, Professor Helmut Krawinkler of Stanford (See page 1), CUREe helped to form the coalition of universities that created the successful Pacific Earthquake Engineering Center (PEER) proposal, and wishes it well as it begins a life of its own. CUREe also extends its congratulations to the other two winners and their Directors, Professors Daniel Abrams and George Lee, whose centers are described on the next page.

Prof. Stephen A. Mahin, who initiated the effort to develop a unified California entry in the NSF competition in 1995 while president of CUREe, commented: "CUREe was formed a decade ago to bring together the premiere research universities in the state to reduce the threat posed by earthquakes. When the competition for an NSF earthquake center was announced, CUREe took the leadership in formulating a plan for the center, in developing a consensus among the research community, and in developing the required political and financial support. I am proud of how CUREe-affiliated researchers, staff and students worked together to win this Center. I am sure all CUREe members join me in wishing the new PEER Center the greatest success in its efforts to conduct the world class research needed to improve seismic safety and reduce the social and economic impacts of earthquake disasters. We also extend our congratulations to our colleagues at the new centers headquartered at the University of Illinois and at SUNY Buffalo."

### PEER Research Plan

The PEER research plan features performance-based engineering and a focus on the problems faced by highly seismic urban regions. PEER Director Jack Moehle noted at the press conference held October 7, 1997, "The potential payoff for the activities of the PEER Center are immense. The research funding base of the center is significant, yet only one ten thousandth of the \$40 billion price tag of the 1994 Northridge Earthquake. Published estimates of potential earthquake losses from a major

cated: engineers who deal with high-seismic requirements on every design project, building officials whose toughest quality control tasks relate to seismic construction features, dozens of cities with hazardous building ordinances, California legislators who debate front-page earthquake bills every session, a half dozen state agencies and a seismic safety commission which have 25 to 65 years of earthquake program experience, utility and building owners who have suffered millions of dollars in losses in the past decade, an insurance

industry whose number one issue is coverage for earthquakes. These practitioners, as well as the academic researchers, constitute the audience PEER will perform for—an audience as big as it is demanding. It will keep PEER on its toes."

The significance of locating a center in California was highlighted by the award of \$2.4 million dollars from Pacific Gas and Electric Co. to augment PEER's budget. Lloyd Cluff, Manager of the Geoscience Department of PG & E, and the former Chair of the

California Seismic Safety Commission, which helped shepherd the matching funds bill for PEER through the California Legislature, said, "The Seismic Safety Commission is pleased to have played a significant role in securing the Governor's and Legislature's support toward the state matching funds for PEER. For the future, the Commission will play an important role in it's annual report to the Governor and the Legislature with regard to PEER's role in implementing some of the critical initiatives in the California Earthquake Loss Reduction Plan that was recently adopted by the Governor. PG&E is also pleased to have provided vital support in securing the NSF-supported award. PG&E is enthusiastic about the newly formed Utility Partnership that will focus practical user-driven research on the safety and reliability of utilities during future earthquakes. We have high expectations that other utilities will choose to join in the Utility Partnership."

*continued on page 5*



### PEER Center Press Conference

**Left to right:** Roger Gray - Vice President of General Services/PG&E, Jack Moehle - PEER Director, Robert Berdahl - UCB Chancellor, Robert Shelton - Vice Provost for Research/UC Office of the President, James van Loben Sels - Director of Transportation/State of California

urban earthquake exceed \$220 billion, or almost four times the annual budget of the State of California." Theme research areas of PEER include performance-based engineering, hazard assessment of existing construction, design for near-source ground motion, improving the reliability and safety of utility systems, and innovative technologies.

### "Location, Location, Location"

CUREe Executive Director Bob Reitherman noted that "establishing an earthquake engineering research center in California is as natural as setting up a French cuisine institute in Paris. In starting a retail store they say it's 'location, location, location.' In the case of an earthquake engineering research center like PEER, its future will be strongly affected by its location in the West and particularly in California where the biggest earthquake problems are. This is also where most of the country's active 'earthquake problem-solvers' are lo-

from page 4

### Development of PEER Team and Proposal

The PEER proposal originated with a strategy developed by CUREe aimed at achieving a single, unified proposal representing California. The California Seismic Safety Commission, under the leadership of then-chair Lloyd Cluff, drafted legislation that was introduced in February, 1996 by former State Senator Alfred Alquist, which provided the necessary state matching funds (one-to-one non-federal match for NSF dollars is required) and designated CUREe as the organization to either carry the standard as California's entry in the contest or develop a coalition around a single university as the center's headquarters. As the CUREe universities agreed on a plan to centralize the administration of the new center at UC Berkeley under the direction of UC Berkeley professor of civil engineering Jack Moehle, the bill was amended to substitute the University of California for CUREe. In September of 1996, Governor Wilson signed SB 1864 to provide \$1.5 million in matching funds, in time for the October 15, 1996 proposal submittal deadline. The University of California and State of Washington will also provide at least \$1/2 million per year in matching funds. As noted above, Pacific Gas and Electric Co. has made a major investment, and other Industrial Partners of PEER, such as leading engineering firms, have contributed significant amounts as well.

### PEER Structure

Leading the key components of PEER will be the Deputy Director for Research, Prof. Frieder Seible of UC San Diego, and Assistant Directors Prof. Gregory Fenves of UC Berkeley (Business and Industry Programs) and Prof. Gerard Pardo of UC Irvine (Education). Along with University of Washington representatives Prof. Steve Kramer and Prof. J. R. Kiely, this group will form Director Moehle's Executive Committee. A Research Committee represents a balance of disciplines and topical research areas, and an Institutional Board represents each university.

### Pacific Earthquake Engineering Research Center (PEER)

**Headquarters:** University of California at Berkeley  
**Director:** Professor Jack Moehle  
**Consortia members:** Caltech, Stanford, UC Berkeley, UC Davis, UC Irvine, UCLA, UC San Diego, University of Southern California, University of Washington; also affiliated universities in nine western states.

"Leading academic scientists will work side by side with economists and policy experts to build our base of knowledge, helping minimize future economic damage and investing in public safety. California is the rightful place to lead the charge and meet the challenge."

*Governor Pete Wilson, California*

"As the fault rupture spreads beneath an urban center, how will the impulsive ground motions spread across the urban landscape, and how will our built environment respond? To understand these issues requires an integration of research in earth sciences, engineering, and public policy and planning."

*Professor Jack Moehle, PEER Center Director*

Joining the nine "core universities" are nine Affiliates in the Western US: California Polytechnic State University - San Luis Obispo, Oregon State University, San Jose State University, University of Alaska - Fairbanks, University of Hawai'i, University of Nevada - Las Vegas, University of Nevada - Reno, University of Utah, and Washington State University.

The Western States Seismic Policy Council (WSSPC), through a Memorandum of Understanding with PEER, is to be involved in outreach activities throughout the Western US. The cities of Long Beach, Los Angeles, Oakland, San Francisco, San Diego, San Jose, and Seattle officially supported the PEER proposal and have expressed formal interest in being pilot urban region project sites for loss reduction techniques to be developed by PEER.

### Mid-America Earthquake Center (MAE)

**Headquarters:** University of Illinois at Urbana-Champaign  
**Director:** Professor Daniel Abrams  
**Consortia members:** Georgia Institute of Technology, Massachusetts Institute of Technology, Saint Louis University, Texas A & M University, University of Illinois, University of Memphis, Washington University

"The center is particularly important to Illinois because its research endeavors will be directed toward reducing the disastrous effects of earthquakes on the people and the economy of our region. Not only will the center advance the national agenda of hazard mitigation, but the nature of the research activity will greatly enrich the quality of the education provided by the participating institutions."

*Governor Jim Edgar, Illinois*

"The eastern United States is particularly susceptible to earthquake damage because population densities are high and the attenuation of seismic waves occurs over much longer distances than in the west. Many of the buildings, bridges and port facilities lack the seismic strength and ductility necessary to survive moderate or intense ground shaking."

*Professor Daniel Abrams, MAE Center Director*

### Center for Advanced Technologies in Earthquake Loss Reduction

**Headquarters:** State University of New York at Buffalo  
**Director:** Professor George Lee  
**Consortia members:** Cornell University, Disaster Research Center at University of Delaware, EQE Center for Advanced Planning and Research, Rensselaer Polytechnic Institute, State University of New York at Buffalo, University of Nevada at Reno, University of Southern California, Virginia Polytechnic Institute, Wharton Risk and Decision Process Center at the University of Pennsylvania

"This money will go toward making all forms of surface transportation safer from seismic activity. There is no better place for this research than the University at Buffalo. It is the premier earthquake research center in the East."

*Senator Daniel P. Moynihan, New York*

"NSF is sending a strong signal that the concept of center-funded earthquake engineering research has proven to be an effective way to develop methods of mitigating the damage wrought by earthquakes."

*Professor George Lee, NCEER Director*

## Northridge Conference Moderators & Overviews

Continued from page 2

### Moderator, Earth Sciences

Research Overview: Seismological Aspects  
 Research Overview, Strong Ground Motion  
 Implementation Overview, Strong Ground Motion and Seismology  
 Research Overview, Ground Failures and Geotechnical Aspects  
 Implementation Overview, Ground Motion and Ground Failures

Roger Borchardt  
 James Mori  
 Paul Sommerville  
 William Joyner  
 Geoffrey Martin  
 James Davis

### Moderator, Engineering

Research Overview, Steel Buildings  
 Research Overview, Concrete and Masonry Buildings  
 Research Overview, Seismic Response of Structures  
 Implementation Overview, Buildings  
 Research Overview, Highway Bridges and Transportation Systems  
 Implementation Overview, Highway Bridges and Transportation Systems  
 Research Overview, Utility Systems  
 Implementation Overview, Utility Systems

Gary Hart  
 Charles Roeder  
 Sharon Wood  
 Farzad Naeim  
 William Holmes, R.J. Phillips  
 Frieder Seible  
 James Roberts  
 Riley Chung  
 Ronald Eguchi, H.A. Seligson

### Moderator, Social Sciences

Research Overview, Emergency Response  
 Implementation Overview, Emergency Response  
 Research Overview, Economic Aspects and Recovery  
 Implementation Overview, Economic Aspects and Recovery  
 Research Overview, Public Policy  
 Implementation Overview, Public Policy

Joanne Nigg  
 Kathleen Tierney  
 Shirley Mattingly  
 Peter Gordon  
 Mary Comerio  
 Steven French  
 Robert Olson

## Publications

The **1998 CUREe Calendar** can be ordered for \$11.50.

The *Proceedings* of the Northridge Earthquake Research Conference will be available soon. For ordering information, please contact CUREe.

## Seismic Events

### CUREe Board of Directors

November 7, 1997 - UCLA

## New CUREe Members

The following individuals were approved as new members of CUREe at the July 25, 1997 Board of Directors' meeting:

Rachel Davidson	Stanford
Ahmed Elgamal	UCSD
Anju Gupta	Stanford
Khalid Mosalam	UCB

## CUREe Board of Directors

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#### CALIFORNIA INSTITUTE OF TECHNOLOGY

Professor Wilfred D. Iwan

#### STANFORD UNIVERSITY

Professor Haresh C. Shah

#### UNIVERSITY OF CALIFORNIA AT BERKELEY

Professor Stephen A. Mahin

#### UNIVERSITY OF CALIFORNIA AT DAVIS

Professor Bruce L. Kutter

#### UNIVERSITY OF CALIFORNIA AT IRVINE

Professor Gerard C. Pardo

#### UNIVERSITY OF CALIFORNIA AT LOS ANGELES

Professor Mladen Vucetic

#### UNIVERSITY OF CALIFORNIA AT SAN DIEGO

Professor Chia-Ming Uang

#### UNIVERSITY OF SOUTHERN CALIFORNIA

Professor Geoffrey R. Martin

### MEMBERS ELECTED AT-LARGE

Professor James C. Anderson

Professor James L. Beck

Professor Gregory L. Fenves

Professor Helmut Krawinkler

### MEMBERS REPRESENTING SEAOC

Gregg E. Brandow

Donald R. Libby

### MEMBERS FROM PROFESSIONAL PRACTICE

K. Lee Benuska

William T. Holmes

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OCTOBER 27, 1997

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