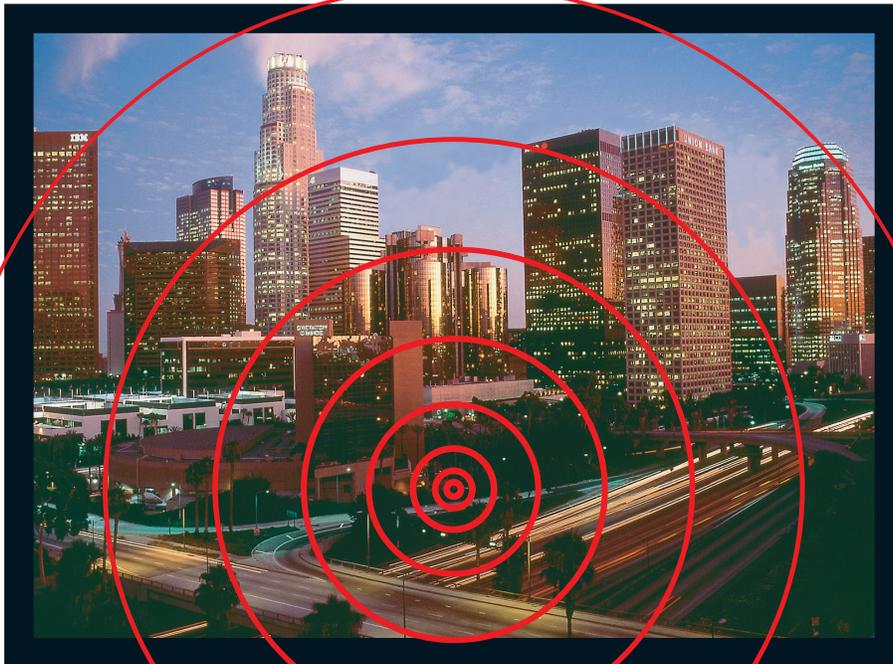


# MULTIDISCIPLINARY CENTER FOR EARTHQUAKE ENGINEERING RESEARCH



*A National Center of Excellence in Advanced Technology Applications*

**Engineering Solutions For Earthquake Loss Reduction**

# MULTIDISCIPLINARY CENTER FOR EARTHQUAKE ENGINEERING RESEARCH

The Multidisciplinary Center for Earthquake Engineering Research (MCEER) is a national center of excellence that develops and applies knowledge and advanced technologies to reduce earthquake losses. Headquartered at the University at Buffalo, the Center was established in 1986 by the National Science Foundation (NSF) as the country's first National Center for Earthquake Engineering Research (NCEER).

MCEER unites a group of leading researchers from numerous disciplines and institutions throughout the United States to integrate knowledge, expertise, and interdisciplinary perspective with state-of-the-art experimental and computational facilities in the fields of earthquake engineering and socioeconomic studies. The result is a systematic "engineered" program of basic and applied research that produces solutions and strategies to reduce the structural and socioeconomic impacts of earthquakes.

Sponsored principally by NSF, the State of New York and the Federal Highway Administration (FHWA), MCEER garners additional support from the Federal Emergency Management Agency (FEMA), other state governments, academic institutions, foreign governments and private industry.

MCEER's mission is to reduce earthquake losses through research, development and application of knowledge and advanced technologies that improve engineering, pre-earthquake planning, and post-earthquake response and recovery. In pursuit of this goal, MCEER coordinates a nationwide program of problem-focused, multidisciplinary team research, education and outreach activities that include collaboration with business, industry, consultants and government.

Since its inception, MCEER has coordinated more than \$120 million in projects to reduce our nation's vulnerability to earthquakes.

## MCEER RESEARCH

MCEER research aims to improve seismic assessment and performance of buildings, highways and other infrastructure, as well as emergency response and recovery systems. Basic and applied studies are carried out by integrated multidisciplinary teams with expertise in:

- Seismology
- Geotechnical Engineering
- Structural Engineering
- Risk Engineering
- Architecture & Urban Planning
- Structural Control & Technologies
- Materials Science
- Sociology
- Economics
- Public Policy

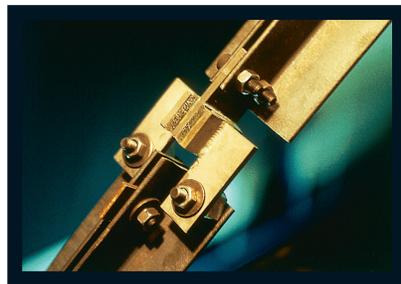
Through this time-tested, systems-integrated approach, MCEER works to develop solutions that are scientifically sound, economically feasible and socially acceptable.

### A NATIONWIDE PROGRAM TO ADDRESS NATIONWIDE RISK

According to the National Earthquake Hazards Reduction Program (NEHRP), no state is immune from the hazards of earthquakes and at least 44 are at risk to moderate or major seismic activity. With large concentrations of population, structures and infrastructure located in vulnerable urban centers across the U.S., the consequences from a damaging earthquake could be devastating. MCEER, with more than 65 researchers throughout the country, addresses vulnerabilities to the built environment that are present from east to west.

### THE URGENT NEED FOR NEW STRATEGIES

Economic losses from urban earthquakes in the last decade have risen dramatically. Recent damaging U.S. quakes (Loma Prieta, 1989 and Northridge, 1994) recorded losses in tens of billions of dollars. Japan's 1995, Kobe earthquake, magnitude 6.9, resulted in losses exceeding \$120 billion. A similar moderate-size earthquake striking a major U.S. metropolitan area, or a repeat of historic large-scale events that hit San Francisco (1906) and Memphis (1811, 1812) could cause extensive injury and loss of life, and widespread damage with direct economic losses (damage to the built environment, building contents, inventory and ensuing business disruption) and indirect losses (supply shortages and other ripple effects to economic sectors not sustaining direct damage) comparable to those of Kobe.



*Seismic energy-absorbing dampers and materials are tested, developed and adapted by MCEER researchers for use in new construction and retrofit of existing structures.*

New strategies and technologies to reduce escalating losses are the thrust of MCEER's program. Center research seeks to define innovative approaches to improve performance assessment of engineered structures and infrastructure systems, and to develop cost-effective advanced techniques for the design of new construction and the rehabilitation of existing critical facilities — those that must remain operational after an earthquake — like hospitals, schools, police, fire and emergency command centers, utilities and highway systems.

### THE PROMISE OF NEW TECHNOLOGIES

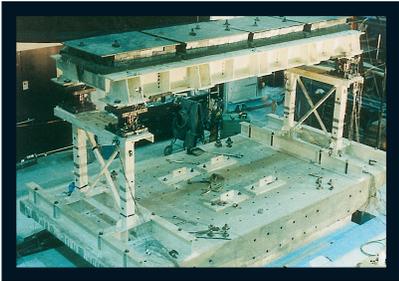
MCEER's research program is grounded in the belief that the future of earthquake engineering and loss reduction lies in advanced and emerging technologies. Throughout the years, Center studies have demonstrated technology's ability to make great strides in reducing earthquake hazards while providing a higher level of performance than is possible with conventional techniques.

Consequently, MCEER contributions to advancements in seismic isolation and damper technologies, and developments in computer modeling and simulation, have helped pave the way for increased application of a variety of protective systems in new construction and retrofit of buildings, bridges and lifelines around the world.

MCEER continues to examine these and other technologies to advance the state-of-the-art in structural control, condition assessment and site remediation. It also explores the potential of high-performance materials, advanced computer environments, and decision support systems to improve seismic behavior of engineered structures, as well as the efficiency of emergency preparedness, emergency management, and decision-making in critical moments immediately following earthquakes.

### REAL-WORLD DEMONSTRATION PROJECTS

MCEER demonstration projects enable researchers and partners in industry and government to examine the promise of advanced technologies in real-world situations. For example, projects involving water supply and electrical power systems in California, infrastructure networks in Memphis, hospital facilities in New York, and bridge sites in Utah, provide opportunities to evaluate engineering and socioeconomic strategies for urban risk assessment and rehabilitation of critical facilities in a systematic integrated fashion.



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Shake table tests enable MCEER researchers to examine and develop structural control and other advanced technologies to improve seismic performance of bridges, buildings and civil infrastructure.

### EARTHQUAKE RECONNAISSANCE INVESTIGATIONS

Post-earthquake reconnaissance investigations offer additional real-world insight to MCEER's research. Though tragic in nature, the devastation of earthquakes in the U.S. and abroad serves as a real-life learning laboratory for Center investigators of all disciplines. Quickly dispatched to stricken regions, MCEER researchers learn valuable lessons from field investigations and on-site interviews which often bring new perspectives to the nation's and the Center's research agendas. Post-investigation technical briefings and reports contribute immeasurably to the worldwide body of knowledge in earthquake engineering and hazards mitigation.

### MCEER OUTREACH

MCEER outreach efforts include broad-based dissemination of information and technology through research reports, national and international conferences and workshops, industry partnerships, and a national Information Service that provides convenient access to published, recorded and on-line materials on engineering, geological, social, political, and economic aspects of earthquakes. MCEER also engages in cooperative research programs with institutions outside the U.S., including Japan, the People's Republic of China, Mexico, Taiwan, and others. The

international alliances promote global cooperation, collaborative experimental research, and information exchange that advance earthquake engineering and loss mitigation principles in the U.S. and abroad.

### PARTNERSHIPS

MCEER's partnerships program forges strategic alliances with manufacturers, consultants, end-users and other public- and private-sector stakeholders to develop, adapt, test and help implement the use of new and emerging technologies to mitigate earthquake losses. The program creates opportunities for cross-participation in collaborative research and demonstration projects enabling partners to widely examine and assess the reliability of new and emerging technologies. It also provides partners with access to a variety of research, education and technology transfer opportunities including state-of-the-art knowledge, experimental facilities, information resources, publications, meetings, seminars, short courses and distance learning.

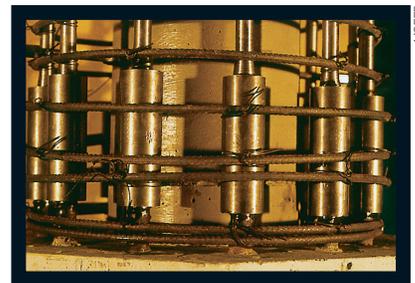
### PUBLICATIONS

MCEER publications foster knowledge and technology transfer by communicating the latest developments in earthquake engineering research and loss reduction practices to academic researchers, consultants, practitioners and policymakers in government and the private sector. Since its inception, the Center has published more than 300 technical reports, workshop and conference proceedings, special publications and monographs to address the needs of these important audiences.

### INFORMATION SERVICES

MCEER's national Information Service is a comprehensive source for earthquake engineering and loss reduction information. Housed in the University at Buffalo Science

and Engineering Library, the Information Service provides reference services including literature searches and document delivery to academics, practitioners, policymakers and at-large publics worldwide. Information professionals on staff fulfill an average of 200 requests per week, and the Center's World Wide Web site, offering additional online information and resources, receives more than 56,000 distinct visits annually. MCEER's Quakeline database, updated monthly and also available online, provides easy access to tens of thousands of records on books, journals, technical reports and other earthquake engineering and natural hazards mitigation literature.



MCEER

Innovative MCEER concepts such as "replaceable hinges," limit earthquake damage to reinforced concrete bridge columns, allowing for speedier, more cost-effective repair.

### MCEER EDUCATION

MCEER's education initiatives provide learning opportunities for students and educators at the K-12 and university undergraduate and graduate levels, as well as practitioners seeking specialized training through continuing education. Consistent with the Center's goals, educational activities aim to stimulate interest in engineering and sciences at the earliest levels, develop future leaders in earthquake engineering and hazards mitigation at the undergraduate and graduate levels, and help today's engineering and emergency management practitioners keep pace with changes in their respective fields.

Programs include an undergraduate internship program, providing students with extensive involvement in ongoing research; a professional Master of Engineering program that offers focused and intensive graduate study in earthquake engineering and the current state-of-practice; and Professional and Continuing Education (PACE) short courses to help practitioners gain new knowledge of advancements in research and application of emerging technologies in earthquake engineering and hazards mitigation.

## RESEARCH FACILITIES

Through its consortium of institutions, MCEER brings together a network of state-of-the-art experimental and computational facilities located around the U.S. Remote access conveniently links multidisciplinary research teams, government and industry partners with laboratories for large-scale testing and computational needs. The combined facilities offer outstanding laboratory and computer capabilities for the study of seismic and geotechnical hazards, structural control and simulation, rehabilitation strategies for buildings and lifelines, and advanced technology and advanced materials testing.

### FACILITIES NETWORK IN EARTHQUAKE ENGINEERING (FNEE)

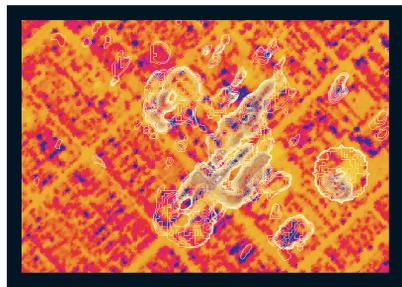
MCEER's Facilities Network in Earthquake Engineering creates an integrated experimental infrastructure for large-scale testing of structural models and components, soils, advanced materials and controls. Facilities include multi-axial seismic simulators, reaction frames and strong floor test beds for static and dynamic testing, geotechnical laboratories and centrifuge, and an advanced materials and controls laboratory.

### COMPUTATIONAL NETWORK IN EARTHQUAKE ENGINEERING (CNEE)

The Center's Computational Network in Earthquake Engineering links computing facilities and resources available at each of the MCEER member institutions, providing researchers and research partners with access to the most advanced computational tools for simulation and analysis of ground motion and structural behavior, loss and damage assessment, and emergency response.

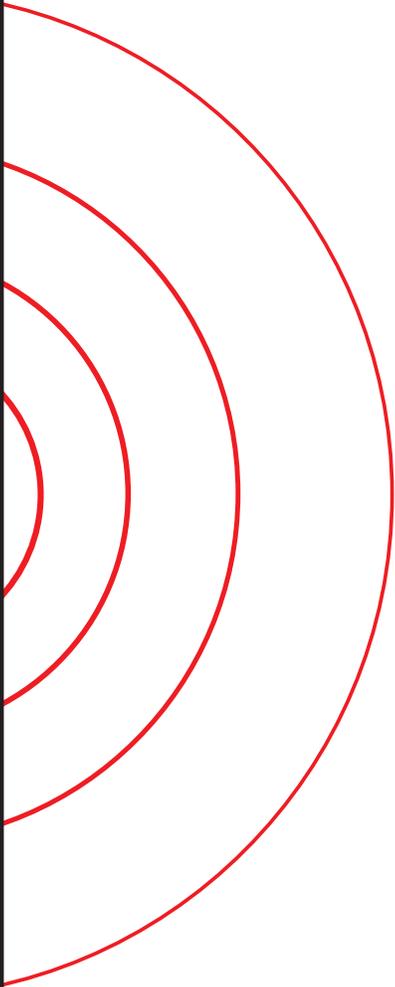
## ENGINEERING SOLUTIONS

The engineering of sound, cost-effective solutions to the problems posed by earthquakes, requires more than engineering alone. It requires a coordinated, unified effort of stakeholders from varied disciplines. Through a systematic integration of researchers, facilities and research partners in industry and government, MCEER engineers solutions to today's earthquake challenges, mobilizing expert multidisciplinary teams to investigate, test and develop strategies and technologies that lessen the impact of earthquakes on society.



ECE International

*MCEER researchers examine infrared, radar and other advanced remote sensing technologies to expedite and improve regional post-earthquake damage assessment and emergency response.*



## FOR MORE INFORMATION

For more information on MCEER or any of the Center's programs, contact:

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