

MCEER HOSPITAL RESEARCH

MCEER PROJECT FOCUSES ON STRUCTURAL AND OPERATIONAL ISSUES FOLLOWING EARTHQUAKES

Hospitals are the most critical of facilities. Needed for urgent emergency care following damaging earthquakes, hospitals must not only remain standing, they must remain fully operational.

MCEER's Hospital Project seeks to develop technologies and strategies to help hospitals deliver important services at a time when they're needed most. Program goals are to identify, explore and develop advanced technologies for seismic evaluation and rehabilitation of hospital facilities, helping them meet or exceed high levels of performance expected by society, following earthquakes.

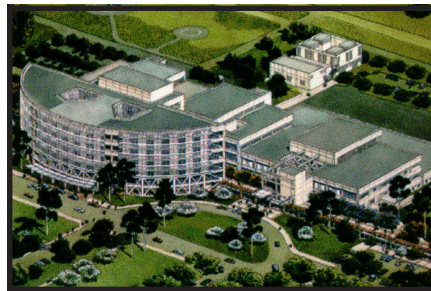
Teams of engineering and social science researchers from throughout the U.S., identify seismic vulnerabilities in hospitals, develop retrofit strategies, pinpoint challenges and impediments to rehabilitation, and examine incentives for adoption of measures to improve seismic performance. It is believed that this process will lead to increased use of technology-based retrofit methods that will cost less than conventional retrofitting.

CALIFORNIA LEGISLATION SERVES AS PROJECT CATALYST

While the project addresses hospitals nationwide, it is very timely for California where law requires health care facilities to evaluate seismic adequacy of buildings by January 2001 -- and to upgrade facilities to ensure life safety by 2008. By 2030, hospitals must remain fully operational following earthquakes.

Because hospitals house complex interconnected structural and non-

structural systems, MCEER researchers believe that advanced technologies may offer the best solution to meeting these most stringent requirements.



Structural control technologies will likely play a role in the design and retrofit of hospitals for earthquake loads, as they did in the case of the San Bernardino County (California) Medical Center.

HOSPITAL CHALLENGES TO SPUR SOLUTIONS FOR OTHER CRITICAL FACILITIES/BUILDINGS

Designing or retrofitting hospitals to be fully operational after earthquakes may require retrofit for the building, its foundation, underlying soil, and its non-structural contents and components.

Few structures pose such demanding challenges, and thus, seismic solutions addressing the complex nature and needs of hospitals should easily yield strategies for other, less complicated critical facilities.

STRUCTURAL EVALUATION AND RETROFIT

Advanced structural control technologies are among remedies being considered for hospital design and retrofit. In countering vibrations damaging to the hospital structure, such systems also provide a degree of protection for building contents.

MCEER RESEARCH

The Multidisciplinary Center for Earthquake Engineering Research (MCEER) seeks solutions to reduce earthquake losses, thus helping communities stand better prepared and increasingly resilient when faced with earthquakes. The center seeks to discover, nurture, develop, promote, help implement, and in some cases pilot-test innovative measures and advanced and emerging technologies to reduce losses in future earthquakes in a cost-effective manner.

MCEER believes that the future of earthquake engineering and loss reduction lies in advanced and emerging technologies. Research includes innovative applications of engineered systems and materials, scientific methodologies, and concepts and analytical approaches not previously used in earthquake engineering and loss reduction.

Projects focus on use of technologies to strengthen the most critical of facilities—hospitals, highways, and utilities—that communities become increasingly dependent upon in times of crisis, and to improve post-earthquake emergency response, crisis management, recovery and reconstruction efforts.

MCEER's nationwide program of problem-focused, multidisciplinary team research, education and outreach, includes collaboration with business, industry, and government.

Advanced and emerging technologies being studied, include but are not limited to:

- Site Remediation Technologies
- Structural Control and Simulation
- High-Performance Materials
- Condition Assessment Technologies (including those for estimating potential and actual earthquake losses)
- Decision Support Systems

Because the design of hospital facilities differs throughout the United States, MCEER research involves the development of detailed structural analysis and design procedures for use of structural control technologies in a variety of construction types.

An initial challenge lies in establishing which technologies work best in each circumstance.

NON-STRUCTURAL EVALUATION AND RETROFIT

Seismic performance of non-structural components is equally important. The survival of a hospital is of no benefit if it has to be evacuated due to water damage, or if key emergency care and medical equipment is damaged.

Fundamentally, equipment must survive excessive vibrations and abuse. While this is more a design issue for equipment manufacturers, MCEER focuses on ensuring that expensive medical devices are not toppled, and that non-structural "lifeline" systems do not become dysfunctional, due to excessive structural response.

Testing examines equipment rocking and sliding, and performance of piping systems, large tanks, reservoirs, and other components such as elevators.

Researchers seek to identify and evaluate promising technologies for effective retrofit, taking into account complex interaction between structural and non-structural retrofit schemes. In some cases, retrofit of either structure or non-structural systems, may provide desired protection.

CALIFORNIA AND NEW YORK STATE MEDICAL BODIES TO AID PROJECT

MCEER's Hospital Project involves study of medical facilities in California, New York and other parts of the U.S., to allow for examination of varying construction types, earthquake hazards and socioeconomic

factors. Ties have been established with the New York and California Offices of State Health Planning & Development (OSHPD) to ensure the involvement, cooperation and input of critical stakeholders throughout the research process. The state offices provide invaluable contributions of data on the nature of hospital facilities and their operations. Their involvement also provides MCEER investigators with much-needed understanding of operational needs and expectations of hospital owners.

EVALUATION AND RETROFIT OF LIQUEFIABLE SOILS

Hospitals throughout the U.S. are built on soils that will likely liquefy in an earthquake. Behaving like quicksand, liquefied soils provide little support, causing structures to sink severely. While available soil remediation techniques counter liquefaction, all involve significant disturbance during installation.

Geotechnical research involves investigation of passive soil stabilization techniques that strengthen problem soils with little or no disturbance to hospital occupants and operational procedures during installation. Research also seeks to develop tools that reliably model and analyze behavior of hospital pile foundations in unstable soils.

SOCIAL AND ECONOMIC INCENTIVES AND IMPEDIMENTS

The best seismic retrofit technologies are useless if not implemented. While some hospital owners and administrators in severe seismic regions might embrace such remedies, others will not.

MCEER conducts sociological studies to identify barriers to implementation of earthquake loss reduction measures, and aids in development of incentives for retrofit. Researchers also develop tools for cost/benefit analyses that assist practicing engineers and hospital administrators in making informed retrofit decisions.

CURRENT RESEARCH PARTNERS

Cornell University
Rensselaer Polytechnic Institute
University at Buffalo
University of Delaware
University of Pennsylvania
University of Southern California
Virginia Polytechnic Institute & State University

USERS ADVISORY GROUP

Mohammed Ettouney
WEIDLINGER ASSOCIATES, INC.

Thomas H. Hale
STATE OF CALIFORNIA, OSHPD

Thomas Jung
STATE OF NEW YORK, DEPARTMENT OF HEALTH

Mahmoud Khater
EQE INTERNATIONAL, INC.

Robert Myrtle
UNIVERSITY OF SOUTHERN CALIFORNIA
SCHOOL OF POLICY, PLANNING AND DEVELOPMENT

Christopher Tokas
STATE OF CALIFORNIA, OSHPD

SPONSORS

National Science Foundation
New York State

CONTACT

MCEER Hospital Project
University at Buffalo
Red Jacket Quadrangle
Buffalo, New York 14261-0025
Tel: 716/645-3391
Fax: 716/645-3399
Email: mceer@acsu.buffalo.edu
WWW Site: <http://mceer.buffalo.edu>



Headquartered at the University at Buffalo