

Tragic Events Underscore Need for Preparedness

MCEER offers its sincerest condolences to all who have been victimized by the terrorist attacks of September 11th, 2001. Like our family, friends, colleagues, and fellow citizens, we search for answers in the aftermath of these tragic and unspeakable events. Given the special mission of MCEER as an earthquake engineering research center responsible to the citizens of New York State and this country, we are especially motivated to learn from these events. We must apply lessons learned and focus our research expertise to create ever safer structures and emergency response systems to mitigate against future disasters.



■ *George C. Lee*

From this tragedy, we should find renewed purpose in our work as members of the disaster mitigation community. We have been leaders in advocating stringent seismic codes and specifications in vulnerable regions of New York State. While many eastern states have only a low to moderate probability of a damaging earthquake, the consequences, should one occur, would be very high. The recent events are a graphic demonstration of the terrible structural, economic, social, and emotional damage that disasters can inflict upon our citizens.

We now see more clearly than ever that the public infrastructure must remain functional after major disasters. Our efforts focus on earthquakes, but clearly our work to strengthen the disaster resistance of critical facilities such as hospitals, as well as lifeline and transportation networks, has essential usefulness in any type of disaster, natural or otherwise, as does our work in emergency response and recovery. We must continue to contribute our expertise in each of these areas to improve disaster readiness at the local, state, and national levels. Further, we must redouble our outreach efforts to build an educated population. People must be made aware of how they themselves should respond, and how relief agencies will respond when a disaster occurs. Citizens should be empowered to make informed decisions when limited resources of a community must be allocated for many competing purposes.

The events of September 11th, 2001 underscore new threats to public safety, and our efforts take on an even greater dimension. We must identify the relevant lessons from this horrific event, learn from them, and refine our goals. Our multidisciplinary work should strive to make communities not simply more earthquake-resistant, but more disaster-resistant. MCEER researchers must

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MCEER Researchers Investigate Structural Damage and Emergency Response in Wake of World Trade Center Attacks

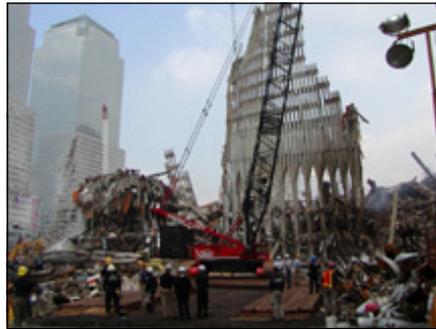
MCEER has received a National Science Foundation (NSF) award to investigate damage to engineered structures and response of medical and emergency operations following the September 11 attack on the World Trade Centers. The award is one of eight announced by NSF. Studies involve:

- On-site inspections of the collapsed World Trade Center towers and surrounding buildings,
- Field investigations with hospital and emergency response personnel, and
- The collection of airborne and satellite information and imagery from before and after the attacks.

Researchers are seeking to gain a better understanding of damage that occurred and demands that were placed on hospital and government emergency response systems immediately following the disaster.

Data will be used to help improve the strength and performance of buildings and other structures during natural and other disasters, and to improve the nation's response to such threats.

Four researchers, Michel Bruneau, Andrei Reinhorn and Andrew Whittaker, all of the Department of Civil, Structural and Environmental Engineering at the University at Buffalo, and Kathleen Tierney, Disaster Research Center, University of Delaware, visited the World Trade Center site on September 21 and 23 to inspect the damage and collect perishable data. The UB group has since presented several seminars at the University at Buffalo, including one to students who will be involved in research related to the disaster and to members of the Buffalo Chapter of ASCE (see review on page 7).



—photo by M. Bruneau

- *MCEER researchers visited the site of the World Trade Center disaster to inspect the damage and collect perishable data.*

Researchers from MCEER are participating in the upcoming NSF-sponsored workshop for grantees, organized by Dr. Rae Zimmerman of New York University on December 12-13, 2001 in New York City. MCEER is also planning to organize two back-to-back workshops next spring that will concentrate on progress made on World Trade Center-related studies. The MCEER workshops will focus on post-disaster emergency management and terrorism resistant civil engineering design.

The NSF's Directorate for Engineering has set up a website for information regarding the World Trade Center disaster. The site includes a list of awards, press releases, notes, and quotes, and can be accessed at <http://www.eng.nsf.gov/wtc/default.htm>. ❖

Director's Message

(Continued from page 1)

continue to pursue our refined aspirations with even greater resolve, for what we learn from the disasters and earthquakes of today can truly mean the difference between life and death for people tomorrow. ❖

George C. Lee, Director

Strategic Partnerships Network



MCEER's Strategic Partnerships Network links world-renowned researchers with practitioners in business,

industry, and government, to serve common goals. The program seeks to unite the entire technology "application chain" – researchers, manufacturers, consultants, software developers, and users of advancing technologies – in an effort to collectively advance technology application. The program's hope is to develop greater opportunities for all, through increased networking and cooperative initiatives.

The Network encourages interaction between industry colleagues and MCEER researchers. It offers preferred enrollment in the center's Professional and Continuing Education (PACE) short courses; early access to research results; preferred access to MCEER experimental facilities and equipment; and opportunities for collaborative studies with MCEER researchers, fellow partners, and government agencies.

The Strategic Partnerships Network features three levels of membership: Flagship Partner, Premier Partner, and Partner, each with its own array of Network benefits. Annual membership fees are: \$10,000 for Flagship Partners; \$3,500 for Premier Partners; and \$1,000 for Partners.

Profiles of our Flagship and Premier Partner companies are included as a special insert to this issue of the **MCEER Bulletin**. Additional information on the Strategic Partnerships Network, and links to the web sites of the companies profiled in this issue, can be found at <http://mceer.buffalo.edu/partnerships>. For more information, contact Donald J. Goralski at MCEER, email: goralski@acsu.buffalo.edu. ❖

NYCEM Researchers Assist Engineering Efforts in Aftermath of World Trade Center Disaster

Researchers participating in the New York City-area Consortium for Earthquake Loss Mitigation (NYCEM) are continuing to complete HAZUS-based scenario studies for a broad region encompassing metropolitan New York and New Jersey. This is being accomplished through a systematic integration of building inventory data and a more accurate characterization of soil type and distribution. The intended outcome of the project will be a regional loss estimation model that can project economic losses for the area in the event of a damaging earthquake. The modeling capability of HAZUS as refined by the NYCEM study is meant to assist public officials, emergency managers and others in earthquake-related planning and decision-making. NYCEM is sponsored by the Federal Emergency Management Agency, New Jersey Office of Emergency Services and New York State Emergency Management Office, and coordinated by MCEER. For details, visit <http://www.nycem.org>.

NYCEM researchers were well-positioned to assist engineering efforts in the aftermath of the September 11th disaster at the World Trade Center complex. A structural damage assessment survey of 406 buildings was conducted to determine their safety. The survey was conducted by approximately 60 engineers from the Structural Engineers Association of New York (SEAoNY) at the request of New York Mayor Rudolph W. Giuliani (R).

NYCEM researcher and SEAoNY member Guy Nordenson was able to draw upon the NYCEM building inventory database which was originally provided to NYCEM by the city's Department of Finance. Aided by Princeton Professor



■ Princeton researchers developed a 3-D representation of the inspected areas in lower Manhattan.

George Deodatis and Michael Tantala, Ph.D. student, packets were prepared for the engineers containing maps, checklists for each building including the address, block and lot numbers, size and other pertinent data. Using this information, the engineers conducted rapid visual inspections followed by detailed evaluation of the damaged buildings. Data collected was then transferred to a general map defining areas of damage. Mr. Nordenson, Professor of Engineering and Architecture at Princeton University, indicated that a repeat of the rapid visual screening would be conducted and refinements made to the GIS-based damage inventory. A 3-D representation of the survey area was also developed by the Princeton team to help illustrate inspection areas.

SEAoNY was established in 1996 to provide a forum to address the unique interests of structural engineers, and other professionals outside the engineering community. Membership includes individuals from most major structural engineering design firms in the New York Tri-State Area. For more information, check their web site at <http://www.seaony.org>. ❖

Highway Project Activities

Work on MCEER Highway Project 094 research is progressing as planned. The Year 1 annual report was prepared and submitted to the Federal Highway Administration (FHWA) in mid-summer 2001, and can be viewed on our web site at http://mceer.buffalo.edu/research/HighwayPrj/TEA_21/proj094.

Meetings with the FHWA, Missouri Department of Transportation (MoDOT), and US Geological Survey were held in the early fall to review plans and procedures for the project task which is designing and acquiring a structural response seismic instrumentation system for the cable-stayed bridge currently under construction across the Mississippi River near Cape Girardeau, Missouri. For more information on this project, see the Summer 1999 issue of the **Bulletin** via the publications section of our web site at <http://mceer.buffalo.edu/publications/bulletin/99/03/sum99.asp>.

With respect to Year 3 research plans, the Research Committee (RC) met in Las Vegas, Nevada, on August 25-26, 2001. During the meeting, the RC identified a number of specific research needs, and developed a preliminary task plan for the project. Funding will be allocated for several new tasks in Year 3, along with continued support for multiyear tasks which were initiated in Years 1 and 2. The Year 3 task plan and research budget will be finalized in the late fall, and it is anticipated that authorizations to initiate Year 3 research will occur in early 2002.

Another major focus has been on planning for the *3rd National Seismic Conference and Workshop on Bridges and Highways*, which MCEER is organizing on behalf of the FHWA. Progress on this effort is discussed on page 9. ❖

Update on the MCEER Consortium NEES Experimental Facilities

This is the first in a regular series of columns that will report on the progress of the MCEER-related George E. Brown, Jr. Network for Earthquake Engineering Simulation (NEES) program equipment sites. These sites are engineering laboratories that will be fully functional by 2004, and operate for at least the next decade. For more information on the NEES program, see <http://www.eng.nsf.gov/nees>.

University at Buffalo

The NEES project team negotiated the scope of work and subcontract document to purchase a large earthquake engineering equipment package from MTS Systems Corporation of Eden Prairie, Minnesota. The package includes two high-performance moveable shake tables, numerous static and dynamic actuators, a high-capacity hydraulic system, and extensive control systems. The subcontract is valued at \$8.4M, and is funded by the National Science Foundation. The equipment is scheduled for installation in a newly constructed portion of Ketter Hall's Structural Engineering and Earthquake Simulation Laboratory (SEESL) in late 2003.

The conceptual design phase of the SEESL construction project, which includes a 10,000 square foot expansion, enlarged strong floor, reaction wall, and a trench for the moveable shake tables, has just been completed. The project, which is valued at \$9M and is funded by the State of New York, will now move into the design development phase. It is expected that the project will be put out for bid in early 2002, and that construction will begin by mid-2002. Completion of the expansion is scheduled for late 2003. The improved SEESL facility is scheduled to be fully operational by late 2004.



■ *Profs. Bruneau and Reinhorn discuss progress with engineers at the construction site of the National Institute for Earth Science and Disaster Prevention (NIED) Jumbo Shaking Table at Miki City, outside Kobe.*

The University at Buffalo also took the lead in organizing a tour of Japanese earthquake engineering laboratories featuring shake tables and large scale testing facilities. Researchers visited the following laboratories: National Institute for Earth Science and Disaster Prevention (NIED) (Tsukuba), Mitsubishi, Kajima, Miki City, BRI, Takenaka, PWRI, Obayashi, Oiles, Taipei, Takenaka, Shimizu, Kyoto (Nadashima) and Kyoto-Underwater Table. For each facility visited, the team noted the specific facilities, how they are currently used, and how they could be applied to research in progress, and collected materials including bibliographies, data and other related information. The team included Andrei Reinhorn, Andrew Whittaker, Michel Bruneau, Sabanayagam Thevanayagam, and Mark Pitman, all from the University at Buffalo, Ian Buckle, University of Nevada, Reno, Don Clyde and Bozidar Stojadinovic, University of California, Berkeley, and Benson Shing, University of Colorado, Boulder.

University of Nevada, Reno

The NEES project at the Large-Scale Structures Laboratory at the University

of Nevada, Reno has entered its construction phase as of early July 2001. The project involves a major upgrade of and expansion to the earthquake engineering simulation facilities. Funding is provided in part by the National Science Foundation, the Department of Energy and the Department of Housing and Urban Development. These funds will enable the upgrade of the two existing tables from uniaxial to biaxial motion, and the purchase, installation and commissioning of a third biaxial table. Each of these identical tables is manufactured by MTS and is 4.25 m square, have 445 kN payload capacity and 600 mm peak-to-peak stroke in the horizontal plane. Moreover, overall project design includes new hydraulic distribution lines along with upgraded hydraulic power supply. The tables are relocatable and each table can be operated independently of the other two tables, or in-phase with the other two tables, thus forming a single large table, or differentially with the other two tables for the simulation of spatial variation effects in earthquake ground motions.

It is intended that this upgrade and expansion will be completed, and the facility online, by September 30, 2004. For more information see <http://bric.ce.unr.edu/nees/nees.htm>.



■ *Schematic realization of the multiple shake table facility at the University of Nevada, Reno.*

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Student Spotlight

Ali Rejaie is a Ph.D. student in the Department of Civil and Environmental Engineering at the University of Southern California. His advisor is Professor Masanobu Shinozuka, Fred Champion Chair

in Civil Engineering and Director of the International Institute of Innovative Risk Reduction Research on Civil Infrastructure Systems. Ali's research focuses on extracting information about major structural damage by comparing images acquired from the same area but before and after a strong earthquake. The main emphasis is to report structural damage in an unsupervised and near real-time fashion. He defended his thesis in September 2001 and is currently working to finalize his dissertation, which is titled "Unsupervised Change Detection in Remotely Sensed Images." He anticipates graduating at the end of this year.

Ali became interested in earthquake engineering because of its multidisciplinary nature. According to Ali, "In order to have a broad vision in earthquake engineering, some knowledge of geotechnical engineering, structural mechanics, stochastic analysis, etc. is required and depending on the interest of a researcher, he can focus on any of these aspects. Earthquake engineering is mathematically appealing and also any practical contribution potentially serves a large number of people living in high-risk zones, which is another beauty of this field." He added, "I have been interested in earthquake engineering since I was a college junior."

When asked about his future plans, Ali said, "My main interest is to get involved in research activities in major consulting firms after graduation. Some of the existing R&D centers affiliated with either universities or private firms would be a nice fit with my interests, I believe. I am also interested in improving my skills in object-oriented programming (software engineering) and would like to prepare commercial software as an extension to what I have implemented for my Ph.D. dissertation. I think this software can serve as a practical and advanced tool for near real-time monitoring and earthquake hazard mitigation."

In his spare time, Ali enjoys indoor and outdoor sports. He has been playing volleyball for his school team throughout his undergraduate and graduate studies. He also enjoys snow skiing, water skiing, tennis and racquetball. In addition to sports, Ali enjoys going to museums, movies and hanging out with friends. ❖



■ Ali Rejaie explains his research to a fellow student at the EERI annual meeting earlier this year.

NEES Project Update

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Rensselaer Polytechnic Institute

The NEES team for this geotechnical centrifuge earthquake engineering project is currently focusing on the acquisition of two major pieces of equipment: a 2D electrohydraulic in-flight shaker (two prototype horizontal directions) and a four-degree-of-freedom in-flight robot. Requests for proposals for the design and construction of these two equipments were answered by several companies and reviewed by two panels of experts, with meetings taking place with the prospective vendors. Decisions and

contracts are expected in the next few months. Manufacturing of these two equipments is scheduled to be finalized in 2003.

Other activities currently progressing along the original schedule of this four-year project include: a new networked data acquisition with Internet telecapability; high speed cameras, image processing software and development of a new generation of advanced and improved sensors for better resolution of the centrifuge model response (development done in

cooperation with the University of California, Davis); and other equipment aimed at increasing the capability of the centrifuge to test a greater number and wider variety of earthquake engineering models. The Internet telecapability will be used in teleobservation/teleoperation exercises as part of a pilot project involving RPI faculty and students together with faculty and students at the University of California, San Diego.

The improved centrifuge earthquake engineering facility is scheduled to be fully operational by late 2004. ❖

Student Leadership Council Activities

The MCEER Student Leadership Council (SLC) is pleased to report the success of its second annual SLC retreat. The retreat was held at the Nittany Lion Inn at Pennsylvania State University from August 10-12, 2001. The concept of a student retreat was refined during the SLC sessions at the Principal Investigator's Meeting in November 2000 to provide members with a chance to present research to their peers in a casual environment. The presentations were concluded by a guest lecture from Dr. Adam Z. Rose, head of Penn State's Energy, Environmental, and Mineral Economics Department and an MCEER researcher. In addition to the presentations, the retreat featured an SLC meeting and various social activities.



■ *Tony Yang (center) and Gordon Warn (right) were among the students to present current research work at the retreat.*

The student presentations were divided into four sessions: materials and structures; innovative technologies in earthquake engineering; geotechnical earthquake engineering; and socioeconomic issues. The following SLC members presented their work: Jeffrey Berman (University of Buffalo), Rory Connell (University of Delaware), Keith Kesner (Cornell University), Michael Kiley-Zufelt (University of Delaware), Alyssa Koch (Drexel University), Wei Liu (University of Buffalo), Jessica Moeller (Cornell University), Natali Sigaher (University of Buffalo), Gordon Warn (University of Buffalo), and Tony Yang (University of Buffalo).



■ *Participants at the SLC retreat pose for a group photograph.*

The SLC retreat also marked the departure of two active members: Gauri-Shankar Guha and Michael Kiley-Zufelt. Gauri-Shankar Guha is currently an Assistant Professor in the Department of Economics and Decision Sciences at Arkansas State University. Michael Kiley-Zufelt has completed his course work at the University of Delaware and is currently residing in Philadelphia, PA. The presence of these two important members of the SLC will be missed at future meetings.

Many issues were discussed, including future plans for SLC activities and organization. The meeting served as a brainstorming session for a collaborative future SLC project that will incorporate the various disciplines in the MCEER research community.

The SLC would like to thank Dr. Adam Rose for taking the time to speak at the meeting, and the assistance of the members of Penn State's Department of Energy, Environmental, and Mineral Economics. The retreat was also made possible by the coordinating efforts of SLC members Diego Lopez-Garcia, Gauri-Shankar Guha, and Michael Kiley-Zufelt. Finally, thank you to Natali Sigaher for providing the opening remarks and for her organizational assistance. The next SLC meeting will be held during the forthcoming annual Principal Investigator's meeting. ❖

—Submitted by Rory P. Connell, University of Delaware

MCEER Hosts Earth Science Day Exhibit

MCEER participated in the 4th Annual Earth Science Day at the Penn Dixie Paleontological and Outdoor Education Center in Western New York on October 13, 2001. Well over 1400 children and adults attended the event, which features numerous exhibits and demonstrations to illustrate the role of the earth sciences in research, industry and policy.

Andrea Dargush hosted an exhibit on behalf of MCEER, featuring hands-on activities and informational materials which describe the interaction between earth science and engineering in the study of earthquakes and earthquake-resistant design.

Earth Science Day is held at the culmination of National Earth Science Week, a nationwide initiative to educate the public about the role of earth science in daily life and its contributions to the advancement of science. During Earth Science Week, celebrations including field trips, exhibits, school visits and open houses took place in all 50 states, Australia, Canada and at least 20 other countries. To publicly recognize the importance of earth science, many state governors signed Earth Science Week proclamations. More than 150 museums, science centers, libraries and book stores participated in this year's events, with many national parks hosting special activities. ❖



ASCE-MCEER-UB Seminar:

Structural Engineering Reconnaissance at Ground Zero

Presented by Michel Bruneau, Andrei Reinhorn and Andrew Whittaker, Department of Civil, Structural and Environmental Engineering, University at Buffalo

Three MCEER researchers, Michel Bruneau, Andrei Reinhorn and Andrew Whittaker, all from the Department of Civil, Structural and Environmental Engineering (CSEE) at the University at Buffalo (UB), gave a joint seminar on *Structural Engineering Reconnaissance at Ground Zero* at UB on October 11, 2001. The three visited the area surrounding the World Trade Center (WTC) in lower Manhattan to survey building damage as part of a National Science Foundation-sponsored research effort (see related article on page 2). About 70 to 80 people attended the seminar, which was co-organized by ASCE, MCEER and UB.

Mr. Dean Gustavson, president elect of the ASCE Buffalo Section (BS 1992, CSEE graduate, UB), opened the seminar. He led the audience in a brief moment of silence to commemorate the victims of the attacks on the WTC and the Pentagon. Dr. Gary Dargush, CSEE, UB, and vice president of the ASCE Buffalo Section, then introduced the speakers.

Dr. Michel Bruneau began the presentation by describing how earthquake engineering evolved from blast engineering around the middle of last century. Now, in light of the collapse of the WTC towers, blast engineering could possibly benefit from new developments in earthquake engineering. He gave an overview of the damage at the World Trade Center site, which was very localized, unlike the widespread damage that typically occurs after a major earthquake. The buildings around the WTC experienced heavy impact loads from falling, and sometimes flaming, debris in the aftermath of the crash. He pointed out the challenging work facing the recovery teams, such as removing debris from the site and stability concerns for the foundation retaining walls. An important

challenge is to safely remove debris from surrounding buildings, some of which came to rest at considerable heights in the buildings. He emphasized that the data that the site team collected will be primarily shared with graduate students who will assist faculty members in the forensic analysis of the structural aspects of the WTC collapse and damage to adjacent buildings.

Dr. Bruneau then handed the podium to Dr. Andrei Reinhorn, who provided an introduction and background overview of the WTC structures, which arguably were among the tallest structures in the world and state-of-the-art engineering landmarks. He described the collapse of the towers, followed by a detailed presentation of their structural characteristics, explaining the lateral and gravity structural systems and their extremely light and efficient construction. He emphasized the inclusion of viscoelastic dampers in their construction



—photo by M. Bruneau

■ *A large portion of the facade from World Trade Center Tower 2 fell on the facade of the 130 Liberty Plaza building, removing 17 stories of the perimeter column from the structural system.*

to reduce wind-induced vibrations. He mentioned, in particular, the type of floor system used in the towers and its connection to the structural system.

Next, Dr. Andrew Whittaker presented the observations of the visiting team at 130 Liberty Plaza, Bankers Trust, a 42-story building to the north of the WTC towers. This building was hit by falling debris, including life vests and seats from American Airlines flight 767 upon impact to WTC tower 1. During the collapse of WTC tower 2, the building was showered with heavy debris. The most severe impact was from a very large portion of the facade of tower 2, which fell on the facade of the Liberty Plaza building, effectively removing a perimeter column from the structural system from the 23rd story of the building down to the 6th story, where it came to rest. Prof. Whittaker presented the structural aspects of this damaged part of the building, both of the lateral and gravity



—photo by M. Bruneau

■ *Many buildings around the World Trade Center, such as 3 Financial Center (above), experienced heavy impact loads from falling debris.*

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MCEER REU Students Participate in Annual Symposium



Undergraduates from across the nation converged upon Salt Lake City, Utah for the National Science Foundation (NSF) *Earthquake Engineering Research Centers' 2001 Student Symposium*. Twenty-four student research interns attended the event; seven of which were sponsored by MCEER.

The MCEER-coordinated symposium was the culmination of an eight-week program in which each student interned with a faculty advisor belonging to one of the three earthquake centers: the Mid-America Earthquake Center, the Pacific Earthquake Engineering Research Center, or MCEER (see the Summer 2001 issue of the **Bulletin**, or visit <http://mceer.buffalo.edu/publications/bulletin/01/02/reu.asp> for a list of MCEER interns and mentoring faculty). The program itself was sponsored as part of NSF's Research Experiences for Undergraduates Program.



■ *Twenty-four student research interns attended NSF's Research Experiences for Undergraduates Symposium in Salt Lake City.*

Primarily, the symposium served to provide a forum for the interns to present their work and get to know their peers. Over two days, each participant gave a ten-minute talk regarding their project. The topics covered many different facets of earthquake engineering, thus providing a stimulating atmosphere for



■ *Dr. T. Leslie Youd led a field trip to several seismically designed or retrofitted buildings in the Salt Lake City area. Shown above is the historic city and county building, which was retrofitted with base isolators.*

the interns to expand their knowledge of the field. Proceedings will be available on the MCEER website. Contact Andrea Dargush at dargush@mceermail.buffalo.edu for details.

The presentations were complimented by numerous additional educational and social activities. First, Professor Ed Harris of Texas A & M University gave a talk on engineering ethics and the issues that face those in the field. To apply the methods for decision-making presented by Professor Harris, the session closed with the research interns breaking into groups to examine ethical case studies. An evening reception and banquet served to give the interns the opportunity to get to know one another, as well as the professors who were attending the symposium. Further, the banquet was followed by a talk by Mr. A. Parry Brown, Vice President of Reaveley Engineers & Associates, Inc. His presentation, "Designing for Earthquakes in Salt Lake City," discussed the efforts that the city is devoting to retrofitting certain buildings to mitigate the seismic hazard associated with the area. Finally, Professor T. Leslie Youd of Brigham Young University led a field trip to several seismically designed or retrofitted buildings in the Salt Lake City area. The tour included the historic Salt Lake City and

County building, which had been retrofitted with base isolators, and the new Church of Latter Day Saints Conference Center, which seats about 21,000 people and is built to survive UBC Seismic Zone 4 forces.



—photo by A. Dargush

Through the course of these internships and the symposium, the undergraduate interns learned a great deal about the discipline of earthquake engineering, while also getting

a head start on meeting peers in their field from across the nation - an opportunity for which they otherwise may have had to wait for years. Given the quality of the presentations, and the fulfilling weekend of activities, the program was a great success for all those who participated. ❖

—Submitted by Michal Orlikowski, REU Intern, Princeton University

ASCE Seminar

(continued from page 7)

structural systems as well as the floor systems. He emphasized that despite considerable localized damage and loss of structural components, the building did not collapse, apparently due to significant reserve capacity for overloading - a positive note on which he ended the presentation.

After the presentations, Dr. Dargush opened the floor to questions from the audience. Discussions regarding the prospects of salvaging the Liberty Square Building; the plan for recovery regarding the stability of the landfill and adjacent buildings; the ability of structures such as the WTC towers to withstand large lateral loads from colliding airplanes; and the role of fireproofing capabilities of construction materials followed. ❖

—Submitted by Benedikt Halldorsson, UB-EERI Secretary, University at Buffalo

7th U.S. National Conference on Earthquake Engineering Adds Session on World Trade Center Disaster



Preparations continue for the 7th U.S. National Conference on Earthquake Engineering, to be held July 21-25, 2002 at the Boston Park Plaza Hotel & Towers, Boston, Massachusetts. Several hundred abstracts were submitted for consideration, with over 600 authors subsequently invited to submit papers. The deadline for submission of full papers to the EERI conference website was October 22.

Organizers for the conference have decided to include a special additional session on the September 11 disaster, focusing on the potential contributions of earthquake engineering knowledge to

better understanding of structural vulnerability and damage. More details on this special session will be provided in the next announcement for the conference, which is due out in early January.

Among other activities being planned for the event are technical tours of local area engineering projects, including the Boston Central Artery/Tunnel project, a dinner cruise of Boston Harbor and visits to other sites and attractions of interest to conference participants and guests.

For further information, check the conference web site at <http://mceer.buffalo.edu/meetings> or <http://www.eeri.org>. ❖

ATC-17-2 Seminar on Response Modification Technologies for Performance-Based Seismic Engineering

First Announcement and Call for Abstracts

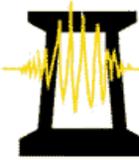
The Applied Technology Council (ATC) and MCEER are organizing the ATC-17-2 Seminar on Response Modification Technologies for Performance-Based Design, the third in a series of seminars first held in San Francisco in 1986. The seminar will focus on seismic isolation, energy dissipation, active and semi-active control systems, and the use of new materials in structural response modification. It will be held May 30-31, 2002 in Los Angeles. The purpose of the two-day seminar is to present a comprehensive picture of the state of practice and current research on response modification technologies for performance-based seismic design, including future directions. Themes and topics to be addressed include:

- Case studies of current and future applications summarizing project information and important issues,
- Summaries of recent research,

- Future directions in the development and application of devices and systems, and
- Emerging technical and policy issues, including barriers to implementation.

The Seminar Steering Committee is seeking papers pertaining to the above themes and topics. Verbal presentations are planned but poster papers may also be included. Abstracts should be one page, typewritten (single spaced) and not more than 250 words. Please indicate in the upper right corner of the abstract the format of presentation preferred (verbal or poster). Abstracts should be submitted to: ATC-17-2 Project, Applied Technology Council, 555 Twin Dolphin Drive, Suite 550, Redwood City, CA 94065; fax: (650) 593-2320; email, atc@atcouncil.org. The deadline is January 15, 2002. For more information on the seminar, see <http://www.atcouncil.org/index.html> or <http://mceer.buffalo.edu/meetings>. ❖

Third National Seismic Conference & Workshop on Bridges and Highways Attracts More Than 120 Abstracts



More than 120 abstracts from throughout the United States and around the world, have been submitted for *The Third National Seismic Conference and Workshop on Bridges and Highways*. The conference, scheduled for April 28 through May 1, 2002, in Portland, Oregon, is expected to attract worldwide participation from hundreds of bridge and highway engineers, design consultants, researchers, and federal, state and local transportation agency owners.

It will feature 50 to 60 formal presentations, and another 25 poster presentations. The Conference Technical Committee is currently reviewing the submissions and planning sessions for the conference; authors of papers that will be accepted for presentation at the conference will be notified in late fall.

For more information or to be placed on a mailing list for registration and exhibitor information, contact: Michael S. Higgins, P.E., Regional Manager, Eastern Region, Pure Technologies US Inc., 10015 Old Columbia Road, Suite B-215, Columbia, MD 21046; phone: (410) 309-7050; fax: (410) 309-7051; email: mike.higgins@soundprint.com, or visit the conference web site via the MCEER home page at <http://mceer.buffalo.edu>. ❖

News from the Information Service Fee Schedule Changes

The Information Service has revamped its fee schedule for nonprofit organizations. Effective October 1, 2001, instead of different fees for photocopying for non-profit and for-profit organizations, all customers will be charged a standard \$.25 per page, with a minimum charge of \$5. Similarly, all customers will be charged for postage and handling. Domestic customers will be charged a minimum of \$5 for postage and handling. International customers will be charged at cost for Global Priority or Air Parcel Post.

Effective January 1, 2002, non-profit subscriptions for the *MCEER Information Service News* will no longer be free of charge except when downloaded from the web. For all non-profit subscribers, the charge will be \$20 (U.S.). Subscription prices applicable to for-profit subscribers will remain the same: \$45 for North America, including Canada & Mexico; \$75 for international surface mail; \$117 for international airmail.

We would like to remind readers that the *MCEER Information Service News*, including the popular tables of contents from selected journals, can be fully downloaded and printed out from the MCEER web site at <http://mceer.buffalo.edu/infoService/eneews>. ❖

Staff News

We are pleased to announce that Shari Salisbury has been named MCEER Information Specialist. Shari joined the Information Service over a year ago as a graduate assistant assigned to assist with the **MCEER Information Service News**. She recently completed her Master of Library Science degree at the University at Buffalo, from which she graduated summa cum laude in 2000, with a triple major in linguistics, art history, and women's studies. Her program also included coursework in geology. Shari was a recipient of The Dean's Medal for Outstanding Senior in the Humanities, among other honors.

MCEER said goodbye to **Claudia Samulski**, who accepted a position in the Foreign National Tax Unit, Human Resource Services, at the University at Buffalo. Claudia worked in both the Information Service and Red Jacket offices of MCEER as an accounting clerk for over six years, and we wish her the best in her new position. ❖

International Research Opportunities *Office of International Science and Engineering, National Science Foundation*

The National Science Foundation (NSF) is seeking applicants for its summer programs in Japan, Korea, and Taiwan for U.S. graduate students in science and engineering. The application deadline is December 1, 2001

For eligibility and other information, consult the Program Announcement NSF02-007, at <http://www.nsf.gov/cgi-bin/getpub?nsf02007>.

For other international opportunities for scientists and engineers, see program announcement NSF00-138 at <http://www.nsf.gov/cgi-bin/getpub?nsf00138>.

Information about NSF's East Asia and Pacific Program is available at <http://www.nsf.gov/sbe/int/eap/start.htm>. ❖

Recent Events...

August 1, 2001 - October 31, 2001

August 10 - 12, 2001

MCEER Student Leadership Council Retreat
State College, Pennsylvania

August 10-12, 2001

Research Experience for Undergraduates Symposium
Salt Lake City, Utah

August 20-21, 2001

NSF Research Centers: Partners in Science, Mathematics, Engineering and Technology Education
Ithaca, New York

August 24-25, 2001

Highway Project Research Committee Meeting
Las Vegas, Nevada

October 1 and 11, 2001

Seminar by Michel Bruneau, Andrei Reinhorn and Andrew Whittaker
Structural Engineering Reconnaissance at Ground Zero
Buffalo, New York

October 13, 2001

Earth Science Day
Buffalo, New York

October 26, 2001

Seminar by Norman Abrahamson
Incorporating Effects of Near Fault Tectonic Deformation into Design
Ground Motions
Buffalo, New York
Webcast address:
<http://civil.eng.buffalo.edu/webcast>

New MCEER Technical Reports

MCEER technical reports are published to communicate specific research data and project results. Reports are written by MCEER-funded researchers, and provide information on a variety of fields of interest in earthquake engineering. The proceedings from conferences and workshops sponsored by MCEER are also published in this series. To request a complete list of titles and prices, contact MCEER publications.

MCEER's web site offers a complete list of technical reports and their abstracts. The publications section allows users to search the report list by subject, title and author, and to place orders for these reports. Visit the site at <http://mceer.buffalo.edu/publications>.

Sensitivity Analysis of Dynamic Systems Subjected to Seismic Loads

by C. Roth and M. Grigoriu, 9/18/01, MCEER-01-0003, 240 pages, \$35.00

This research provides analytical and numerical methods directed to the development of optimal strategies for improving the seismic performance of hospitals and other critical facilities. The sensitivity factors developed in this research provide the basis for a cost effective implementation of advanced technologies.

This report investigates the parameters of both a seismic input and its effect on a dynamic system, such as a building. A quantitative measure of the sensitivity of the response to the seismic input or system parameter was developed, called the sensitivity factor. This factor is defined as the derivative of the response with respect to the parameter value. It can be used to identify critical parameters, estimate the effect of a small change in the parameter value, and select optimum values for the parameter. The direct differentiation method is pro-

posed to calculate the sensitivity factors. By differentiating the governing equation of the system, the governing equation of the sensitivity factor is obtained. This equation can be solved numerically by a similar method to that used to calculate the system response. The errors in the numerical method were investigated and not found to be significant. The method was implemented in two computer programs:

1. An entire program to calculate both displacement and sensitivity factors was written using the MATLAB code, for a relatively simple, beam-element level of analysis; and
2. New subroutines were added to an existing finite element analysis program, DIANA, for more detailed analysis.

An example is given illustrating applications of the sensitivity factors to a hospital in Buffalo, New York. Both the primary structural and a secondary piping system are considered. The sensitivity factors are used in identification of critical parameters, selection of retrofit strategies, and calculation of fragility curves. ♦

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University at Buffalo *The State University of New York*

Upcoming Events

April 28 – May 1, 2002

Third National Seismic Conference and Workshop on Bridges and Highways: *Advances in Engineering Technology for the Seismic Safety of Bridges in the New Millennium* ■ Portland, Oregon

Sponsored by:

Federal Highway Administration ■ Oregon Department of Transportation
■ Washington State Department of Transportation

Organized by:

MCEER, Federal Highway Administration's Western Resource Center

Co-Sponsors:

Caltrans, Mid-America Earthquake Center, MCEER, Pacific Earthquake Engineering Research Center, Transportation Research Board

Contact:

Michael S. Higgins, P.E., Pure Technologies U.S. Inc., 10015 Old Columbia Road, Suite B-215, Columbia, MD 21046 ■ Phone: (800) 537-2806
■ Fax: (410) 309-7051 ■ E-mail: mike.higgins@soundprint.com

Web Site:

<http://mceer.buffalo.edu/meetings>

July 21 – 25, 2002

7th U.S. National Conference on Earthquake Engineering: *Urban Earthquake Hazard* ■ Park Plaza Hotel ■ Boston, Massachusetts

Sponsor:

Earthquake Engineering Research Institute

Organizing Committee:

MCEER

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