

Four Centers Develop Cooperative Research Program

Research Focuses on Lessons Learned Following the Chi-Chi, Taiwan Earthquake

A new cooperative research program was recently initiated between MCEER, the National Center for Research in Earthquake Engineering (NCREE) at National Taiwan University, the Pacific Earthquake Engineering Research (PEER) Center at the University of California, Berkeley, and the Office of National Science and Technology Hazard Mitigation in Taiwan to focus research on lessons learned following the recent Chi-Chi, Taiwan earthquake.



■ *Figure 1. Surface faulting caused major damage to Shih-kang Dam*

The proposed three-year effort aims to take advantage of areas of overlapping interest and strengths of the four Centers, and to capitalize on the extensive results collected by the research team in Taiwan's reconnaissance efforts. By joining forces and collaborating on these projects, the Centers can leverage additional funding, talent, use of equipment and facilities, and data/information. Two major areas of emphasis were identified:

- Analysis of new information to enhance model validation, and



■ *Figure 2. Newly constructed buildings suffered severe damage*

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Research Programs (cont'd)

development of a better understanding that will lead to a new, more accurate knowledge base; and

- Code improvements and implementation specific to Taiwan developed by earthquake hazard mitigation professionals.

The research program will apply new reconnaissance information to projects already in progress. Proposed focus areas include the following:

- Ground motion attenuation, site effects, spatial variation and validation.
- Development of retrofit strategies for buildings shown to be vulnerable by the Chi-Chi earthquake. This includes two parts: development of specific retrofit ideas for 1-3 story and 8-12 story buildings; and development of evaluation and retrofit strategies for hospitals and selected manufacturing facilities, including contents.
- Development of evaluation and retrofit strategies, and system analysis of electric power and water systems.
- Using earthquake reconnaissance data collected following the 921 event, develop new system-related loss estimation methods for HAZ-Taiwan.
- Social and economic issues.

The Directors of the four Centers plan to meet this September in Taiwan, together with other researchers, to discuss and develop the specific details of the research program. ❖



Strategic Partnerships Network Seeks Structural Control Partners

Development of a structural control technologies “network” is the initial focus of MCEER’s Strategic Partnerships Network, a new business, industry and government partners program launched earlier this year by the Center. The program aims to unite a technology “application chain” of researchers, manufacturers, consultants, software developers and technology users, to further research, development and use of technologies to reduce earthquake damage and losses.

The Strategic Partnerships Network includes Specialty Interest Groups (SIGs) or “communities of interest,” centered around various technologies being studied by MCEER researchers. While current MCEER recruitment efforts focus on the development of a SIG on structural control (to protect buildings and bridges from damaging earthquake vibrations), others will follow. These include:

- Site Remediation – to stabilize soils and foundations;
- Advanced Systems Analysis and High-Performance Materials – to improve performance of lifelines;
- Condition Assessment – to better estimate real and potential earthquake losses; and
- Decision Support Systems – to enhance emergency response and post-earthquake recovery.

MCEER’s Strategic Partnerships Network features three levels of membership: Flagship Partner, Premier Partner, and Partner, each with its own array of Network benefits. Some of these include:

- Access to MCEER researchers and students;
- Preferred enrollment in the center’s Professional and Continuing Education (PACE) short courses;
- Early access to research results and new state-of-the-art ideas, concepts and methodologies;
- Preferred access to MCEER experimental facilities and equipment; and
- Opportunities for members to advance their company’s product development needs through collaborative research with MCEER researchers, fellow partners, and government agencies.

Annual membership fees are: \$10,000 for Flagship Partners; \$3,500 for Premier Partners; and \$1,000 for Partners. First-year memberships are effective through August 2001.

For information on the MCEER Strategic Partnerships Network, contact Donald J. Goralski at MCEER, phone: (716) 645-3391 ext. 108; fax: (716) 645-3399; email: goralski@acsu.buffalo.edu, or visit the “Partnerships” section of our web site at <http://mceer.buffalo.edu/partnerships/default.asp>. ❖

National Science Foundation Site Team Visits MCEER

On June 8-9, 2000, MCEER hosted its third annual site visit organized by the National Science Foundation's Division of Engineering Education and Centers. Dr. Joy Pauschke, NSF Program Officer, coordinated the site team to review MCEER's third year activities and plans for Year 4.

The review began Thursday morning, with introductions and an overview of MCEER's program by George Lee, Director, and Michel Bruneau, Deputy Director. Stephanie Chang presented a highlight of MCEER's research program, by describing an integrated approach to earthquake loss estimation for mitigation, response and recovery. This was followed by descriptions of each of MCEER's research programs. Presenters were:

- Masanobu Shinozuka, University of Southern California, seismic evaluation and retrofit of lifeline networks
- Thomas O'Rourke, Cornell University, water supply networks
- Michel Bruneau, MCEER, seismic retrofit of hospitals
- Kathleen Tierney, Disaster Research Center, University of Delaware, earthquake response and recovery



■ MCEER participants and invited guests enjoyed a barbecue the evening before the site visit

- Ron Eguchi, ImageCat, Inc., using advanced technology to conduct earthquake reconnaissance following the Marmara earthquake
- Andrei Reinhorn, University at Buffalo, user networks for seismic assessment and retrofit of critical facilities
- Andrea Dargush, MCEER, education and educational outreach

Seven of the Center's industry partners also participated in the site review. They included:

- Anna Day, representing Ellis Stanley, director of the City of Los Angeles Emergency Management
- Mohammed Ettouney, Weidlinger Associates, Inc., consulting engineers
- Ali Karakaplan, LARSA, Inc., structural analysis software developer
- Mary Kerns, Enidine, Inc., seismic damping systems manufacturer
- LeVal Lund, lifelines consultant
- Anoop Mokha, Earthquake Protection Systems, Inc., seismic isolation systems manufacturer
- Douglas Taylor, Taylor Devices, Inc., seismic damping systems manufacturer

Following an overview of MCEER's partners program by Michel Bruneau and Donald Goralski, Senior Program Officer, Industry/User Partnerships, LeVal Lund and Anoop Mokha gave brief presentations on their involvement with MCEER research. LeVal Lund discussed the need to improve performance of pipeline slip joints during earthquakes. He provides assistance to a project involving fiber reinforced com-

posite wrappings for water pipelines headed by Thomas O'Rourke, Cornell University

Anoop Mokha discussed his long-time involvement with MCEER research and the value of the Center's seismic isolation studies that helped to validate the use of the friction pendulum system (FPS). Dr. Mokha initially worked with the technology as a graduate student under Michael Constantinou at the University at Buffalo. Later, he championed the use of FPS, as a consultant for Skidmore Owings and Merrill's San



■ Yingjuan Wang of Rensselaer Polytechnic Institute explains her research to NSF's Clifford Astill during the student poster session

Francisco, California office. Today he serves as vice president of marketing for Earthquake Protection Systems, Inc., manufacturer of the FPS.

Many of MCEER's students contributed posters for discussion and display, which featured current research work. They were on hand to discuss their projects with the site team members. Students also participated in the first formal meeting of the Student Leadership Council (SLC), held the evening before the site visit ([see article on page 4](#)). Finally, MCEER staff members Jane Stoye and Laura Taddeo hosted a display of the Center's Information Service and Publications capabilities and products. ❖

Student Leadership Council Activities

The first activity of MCEER's newly formed Student Leadership Council was a seminar by Guy Nordenson, Structural Engineer and Associate Professor, School of Architecture, Princeton University, titled "Seismic Codes in Moderate Seismic Regions - the New York City Experience" on April 19, 2000. The seminar was the first in a series to be sponsored by MCEER on behalf of the newly formed Council and took place in Ketter Hall, Dept. of Civil, Structural and Environmental Engineering, University at Buffalo. Mr. Nordenson concentrated on the development of seismic codes in regions of moderate seismicity, including the seismic code developed for New York City that has been in effect since 1995.

The Council held its first formal meeting on June 7, 2000 prior to the annual NSF site review. Fifteen students from various MCEER-affiliated institutions participated in the meeting, including representatives from the University at Buffalo, University of Delaware, University of Washington, Rensselaer Polytechnic Institute, Cornell University, New Jersey Institute of Technology and Virginia Tech. One participant was an undergraduate student who is participating in MCEER's REU (Research Experiences for Undergraduates) program (see related article). The objectives and responsibilities of the SLC were summarized by Ms. Andrea Dargush (Education Coordinator) and Dr. Andrei Reinhorn (Faculty Advisor). The meeting then concentrated on ways to



■ *Members of the Student Leadership Council attended the annual NSF site visit. Shown from left are Natali Sigaher, Gauri Guha, Jerry Shen, Gyuhae Park, Yingjuan Wang, Dyah Kusumastuti and Walter Svekla*

develop/improve interaction among members of the SLC and the next day's meeting with the NSF site review team.

On June 2, the MCEER-SLC participated in the *Tri-Lateral SLC Workshop* that took place within the context of the EERI Annual Meeting in St. Louis, Missouri. This was the first formal gathering of the three earthquake centers' (MAE, MCEER and PEER) council members. After introduction of the councils by each representative, presentations were made on issues regarding the REU program, mini-shake table project, web-based course modules, NSF SLC annual retreat (by Dr. Priscilla Nelson of NSF), and SLC participation in Centers. Future activities involving the three Centers' councils were discussed. Among these are a tri-lateral poster and e-mail list serve, a journal as part of the REU program for which reviewers will consist of graduate students, and communication via video-conferencing. The councils discussed way to involve undergraduates, such including them in the tri-lateral e-mail list serve and the proposed journal.

However, because MCEER's affiliated institutions are so geographically diverse, it is challenging to convene students from all universities. Members of the MCEER SLC will be meeting next at a conference jointly organized by MCEER and the EERI student chapters at Cornell University and University at Buffalo. The meeting will be held on August 7-8, 2000, at Cornell University. This event is meant to expose students to other campuses, provide an opportunity to know each other better – and to be only one of many more joint activities in the future. ❖

MCEER Begins New Undergraduate Program

Following the framework of NSF's initiative *Research Experiences for Undergraduates*, MCEER began a summer internship program for undergraduates. Students participate in an eight-week session under faculty advisement, gaining greater insights into organized center research and the scientific method employed to solve earthquake hazard mitigation problems. The first year is being funded jointly by NSF and MCEER.



■ *Students involved in EERI, SLC and/or REU programs held a barbeque at UB in July*

Tony Yang, Jason Hanley, both of the University at Buffalo (UB) and Jason McCormick of Catholic University have been recruited into the program at UB. Jason "H" and Jason "M" are working with Prof. Andrei Reinhorn to develop user networks which can be used by researchers studying the performance of critical facilities and potential retrofitting approaches. Tony Yang is working with MCEER Director George Lee to explore innovative new applications of active and passive control technologies. The students will present their work at a joint UB/Cornell SLC/EERI workshop in early August. They will also participate in a workshop on effective engineering communication on August 2. The internship will culminate in a 2 1/2 day REU Symposium, held in collaboration with the PEER and the MAE Centers. ❖

Student Spotlight

The Student Spotlight column introduces our many student researchers and highlights their current research work. We plan to feature brief profiles on one or two students in each issue.

Gauri-Shankar Guha is a Ph.D. candidate in the Department of Energy, Environmental & Mineral Economics (EeEM) at The Pennsylvania State University. He expects to graduate in the summer of 2001. Estimating economic losses from earthquakes is one of the three essays of his dissertation, which relates to the economic dimensions of man-environment interactions. He is currently involved in an MCEER-funded project entitled "Loss Estimation Methodologies and Indirect Losses." His advisor, Professor Adam Rose, the Principal Investigator of the project, is one of the leading experts in the world on impact assessment and regional economic analysis, using Input-Output (I-O) and Computable General Equilibrium (CGE) techniques.

Before joining the doctoral program at Penn State, Gauri headed the ACRP, a countrywide environmental research project of the Government of India. He was fascinated by the challenge of studying the impacts of extreme natural events

(like earthquakes and hurricanes) and climate change on human systems. The EeEM program provided the ideal niche, and Gauri feels fortunate at being "able to examine, formalize and test some of the intuitive hypotheses on the subject, as well as to obtain great credentials."

Being part of MCEER is "also a lucky break...since MCEER is an excellent research fraternity providing access to a very high quality expert knowledge-base, and peer review." His research with Dr. Rose represents a methodological breakthrough in estimating economy-wide indirect impacts (for example, a business may suffer losses even when it is not directly damaged, but its suppliers or customers are) in the wake of an earthquake, using CGE models. Indirect losses are difficult to estimate and tend to be ignored, but they are significant and can be very different across sectors and sub-areas of the economy. The new methodology will make it possible to estimate indirect impacts, when direct impacts are known from a survey.

Ideally, Gauri would like to work in an international organization, consulting on disaster/environmental impact economics and management. This field is very challenging, since "even though disasters may not increase per se, their impacts are increasing, due to the rising density of human settlements and investments on the ground." ❖



■ *Gauri Guha talks with Stephanie Chang and Walter Svekla prior to the NSF site visit*

George C. Lee Receives Nathan Newmark Medal



The American Society of Civil Engineers (ASCE) has chosen George C. Lee, Director of MCEER and Samuel P. Capen Professor of Engineering at the University at Buffalo (UB), to receive the prestigious Nathan M. Newmark Medal for 2000. The national medal is given to an ASCE member who, through contributions in structural mechanics, has helped to substantially strengthen the scientific base of structural engineering. Dr. Lee received the award at the 14th Engineering Mechanics Conference in Austin, Texas. Previous recipients include George Housner, Joseph Penzien, Masanobu Shinozuka, Emilio Rosenblueth, Alfredo H.S. Ang, Vitelmo Bertero, Anil Chopra, Jose Roesset and William Iwan.

Dr. Lee is cited for his achievements in both research, where he has made major contributions to the study and practice of making steel buildings safer during earthquakes, and education, where he was an early player in the move to build a program, now highly acclaimed, in earthquake engineering at UB. Dr. Lee is being honored specifically for his work on plastic analysis of structures and his research and leadership in aseismic design of structural and mechanical systems.

A member of the UB faculty since 1961, Dr. Lee served as dean of the UB School of Engineering and Applied Sciences from 1977-95, and as Senior University Advisor for Technology since 1995. He has published over 150 papers in structural engineering, mechanics and earthquake engineering, and has co-authored four books. For more information about Dr. Lee's medal, check our web site at <http://mceer.buffalo.edu/outreach/pr/DrLeeAward.asp>. ❖

TEA-21 Highway Project Research Committee Meets

MCEER's TEA-21 Highway Project Research Committee meeting was held at the University of Nevada, Reno (UNR) on April 10-11, 2000. The meeting was attended by the Research Committee members: Dr. George C. Lee, Chair (MCEER); Dr. Ian G. Buckle, Co-Chair (UNR); Mr. Ronald T. Eguchi (ImageCat); Dr. John B. Mander (University of Canterbury, formerly University at Buffalo); Dr. Geoffrey R. Martin (USC); Mr. Charles Seim, P.E. (TY Lin); Dr. Michel Bruneau, P.Eng. (MCEER); Dr. Masanobu Shinozuka (USC); Mr. Ian M. Friedland, P.E. (ATC); Mr. Stuart Werner (SSEC); Mr. Michael Higgins, P.E., (MCEER); and Dr. Gokhan Pekcan (MCEER).

An overview of the Year 1 research task accomplishments was presented by the respective task coordinators. These included Task B — Loss Estimation Methods for Highway Systems (Eguchi and Werner), Task C — Seismic Design and Retrofit Manual for Specialty Bridges (Seim and Bruneau), Task D — Response Modification Systems (Lee and Buckle), Task E — Foundation and Geotechnical Studies (Martin), Task F — Special Studies (Shinozuka and Mander), and Task G — Technology Exchange and Transfer (Friedland and Higgins). The recommendations of the Highway Seismic Research Council (HSRC) (see *MCEER Bulletin* Spring 2000, Volume 14, Number 1) following the December 1999 meeting were discussed and evaluated for possible impact on future research directions. In light of these discussions, the entire six-year research plan was reviewed and the second year's research tasks were discussed and refined in keeping with immediate future needs. Accordingly, it was decided to put more emphasis on the development of the interim edition of the *Seismic Design and Retrofit Manual for Specialty Bridges* as well as the *Design and Retrofit Manual with Response Modification Systems*.

For more information on MCEER's TEA-21 Highway Project, check the "Research" section of our web site at <http://mceer.buffalo.edu/research/HighwayPrj/default.asp>. Complete Year 2 research task statements will be made available in late September, 2000. ❖

K-12 Educational Activities

When the earth science curriculum approaches earthquakes, teachers look to MCEER to highlight the usual classroom lessons. MCEER's Andrea Dargush has been addressing numerous groups of students aged 8 - 18 for the past few years, continuing an effort launched by former Educational Specialist Katharyn Ross. As many as 15 visits are made each year in the local area, for groups as large as 120 students. Geared for grade level, the talks feature earthquake basics and fundamental geology, the role of engineering in solving earthquake problems, the effects of earthquakes on society and the importance of preparedness. Smaller groups enjoy hands-on exercises as part of the experience. Classroom visits are just one part of MCEER's K-12 activities. Thanks to the web, many requests are also received from around the country.

Students can also obtain directed guidance on earthquake-related projects and can access materials in the "Education" section of our web site at <http://mceer.buffalo.edu/education/default.asp>. ❖

MEDAT-1 Workshop Review

A workshop on *Mitigation of Earthquake Disaster by Advanced Technologies (MEDAT)* was held, under sponsorship of MCEER and the National Science Foundation (NSF), in Los Angeles at the Radisson Hotel Midtown, across from the University of Southern California campus on March 2-3, 2000. This workshop consisted of all-plenary two day sessions and is the first of a new series of MCEER-sponsored workshops involving advanced technologies. Workshop participants explored the state-of-the-art field applications of non-destructive inspection and health



■ Almost 60 researchers participated in the MEDAT-1 workshop in Los Angeles, California

monitoring technology including remote sensing techniques for the purpose of mitigating urban earthquake disasters. Innovative applications of technology either actually implemented or with a high potential for implementation in civil infrastructure systems were emphasized.

Two discussion sessions of generous duration, led by Dr. Walter Hays, ASCE, provided a forum for critical review and exchange of ideas among all the participants for breakthrough applications of the technologies.

Future MEDATs will address additional applications of these and other advanced technologies. Workshop proceedings will be available this fall. ❖

William R Johnson: MCEER Business Manager

It is with great sadness that we report the death of our colleague, friend, and long-time Business Manager William (Bill) Johnson. Bill passed away on Saturday, June 17, 2000 at age 62 after suffering a heart attack earlier in the week. All of us at MCEER will miss Bill's enthusiasm for the Center and its goals, his knowledge of the university and its history, and perhaps most of all, his irrepressible spirit and cheerful good will.

Bill was a key member of MCEER's management team from its inception in 1986. He was recruited by our first director, Dr. Robert Ketter, to develop the physical facilities used by MCEER. These facilities consist of over 9,200 square feet of office/library space in Red Jacket Quad and Capen Hall, and over 12,000 square feet of laboratory space in Ketter Hall. His responsibilities included developing and managing the Center's budget, establishing subcontracts with participating research institutions, handling of personnel matters, purchasing materials and supplies, and maintaining equipment inventories and the facilities.

Bill had a long and prosperous career with the University at Buffalo. He joined



*William R Johnson
1938-2000*

the university in 1961 as an assistant purchasing agent, and quickly worked his way up the ladder. He was appointed Special Assistant to the Vice President for Business Affairs in 1963. He became the Director of the Equipment Division, Office of Facilities Planning, in 1968, where he was responsible for managing the \$70 million overall capital equipment budget. In 1972, he was appointed Secretary to the New York State Task Force appointed by then-Governor Nelson Rockefeller to establish the value of assets owned by SUNY statewide. He was responsible for planning and coordinating much of the activity that took place when the new University of Buffalo campus was constructed in Amherst. This included acquiring new laboratory equipment, coordinating the moving of many departments, and the acquisition of temporary space. It was during this time that Bill was instrumental in acquiring the then state-of-the-art \$1.5 million seismic simulator for the civil engineering department's laboratory.

In 1974, he was asked to join the Town of Lockport's Cable Television Planning Committee as Secretary to assist in evaluating the Town's cable television requirements and coordinating merger efforts with the City of Lockport. The net result of these efforts was a single non-profit local Commission responsible for administering a cable television franchise for two separate municipalities, a first for New York State. This public access television station now has an annual operating budget in excess of \$250,000, operates two TV studios (one of which is named in Bill's honor), including a mobile van, and has produced local programming which has received national recognition. Bill continued to serve as secretary of the Cable Commission until the time of his death.

Survivors include his wife of 19 years, the former Gail Provenzano, four sons, Timothy and Christopher Johnson and Marc and Michael Marotta; one daughter Patti Bednarz; a sister, Janet Long of Watertown; and three grandchildren. ❖



Kudos

★ Several MCEER staffers and researchers were honored at a recognition ceremony for their years of service at the University at Buffalo. **Andrei Reinhorn**, professor of civil, structural and environmental engineering, MCEER Research committee member and longtime researcher, was honored for 20 years of service. MCEER staff members **Dorothy Tao**, Manager, Information Service, and **Connie Beroza**, Assistant to the Director, were honored for 10 years of service.



■ *Bill Johnson, George Lee, Robert Ketter, all of UB, and Joe Hubbard, MTS Corp. complete negotiations for UB's \$1.5 million seismic simulator laboratory*



NYCEM Activities

The Executive Committee of the New York City-area Consortium for Earthquake-loss Mitigation (NYCEM) met May 18 at Princeton University to discuss ongoing progress and plans for the next year of the program. Activities to date in Year 2 of this FEMA-supported effort have focused on completing a HAZUS-loss estimation scenario for Manhattan below 59th Street. With the acquisition of expanded sets of building and soil borehole data, it has become possible to accelerate and expand the effort throughout Manhattan.

Building inventory data being used by NYCEM researchers at Princeton to supplant default data within HAZUS has been field validated by a group of students from the City College of New York, with support from MCEER. Using new borehole data generously supplied by the Metropolitan Transportation Authority and an improved census track outline map, NYCEM researchers at Lamont have recently generated a new census track soil map for all of Manhattan.

These collective efforts will be directed at producing a HAZUS scenario for the entire borough by fall 2000. Activities projected to begin in Year 3 will extrapolate the loss estimation study to the greater New York-New Jersey area, with incorporation of parallel studies presently being carried out in northern New Jersey and Westchester County, NY. Coming this fall, reports of Year 2 activities will be posted on the NYCEM web site at <http://www.nycem.org>. ❖



Research Progress and Accomplishments: 1999-2000

The second annual *Research Progress and Accomplishments* report highlights our achievements on research and education during the past year. This time period was marked by two devastating earthquakes in Turkey and Taiwan. MCEER reconnaissance teams visited both these areas, and several of the papers in this

report describe their efforts to learn from these tragic events. A few papers describe research that has been completed, most notably the Federal Highway Administration-sponsored project on the seismic vulnerability of new highway construction, while others describe work in progress. The authors identify the sponsors of the research, collaborative partners, related research tasks within MCEER's various programs, links to research and implementation efforts outside MCEER's program, and web site addresses for additional information. Papers are:

- **Modeling Earthquake Impact on Urban Lifeline Systems: Advances and Integration** by *Stephanie E. Chang (Coordinating Author), Adam Rose, Masanobu Shinozuka, Walter D. Svekla and Kathleen J. Tierney*
- **Development of Fragility Information for Structures and Nonstructural Components** by *Masanobu Shinozuka, Mircea Grigoriu (Coordinating Author), Anthony R. Ingraffea, Sarah L. Billington, Peter Feenstra, Tsu T. Soong, Andrei M. Reinhorn and Emmanuel Maragakis*
- **Damage to Critical Facilities Following the 921 Chi-Chi, Taiwan Earthquake** by *Tsu T. Soong (Coordinating Author), George C. Yao and Chi-Chang Lin*
- **Highway Bridge Seismic Design: Summary of FHWA/MCEER Project on Seismic Vulnerability of New Highway Construction** by *Ian M. Friedland*
- **Ground Motion Prediction Methodologies for Eastern North America** by *Apostolos S. Papageorgiou*
- **Fiber Reinforced Composites for Advanced Seismic Performance of Water Supplies** by *Thomas D. O'Rourke (Principal Author), James A. Mason, Ilker Tutuncu and Timothy Bond*
- **The Marmara, Turkey Earthquake: Using Advanced Technology to Conduct Earthquake Reconnaissance** by *Ronald T. Eguchi (Coordinating Author), Charles K. Huyck, Bijan Houshmand, Babak Mansouri, Masanobu Shinozuka, Fumio Yamazaki, Masashi Matsuoka and Suha Ülgen*
- **Restoration Activities Following the Marmara, Turkey Earthquake of August 17, 1999** by *Gary R. Webb*
- **Human and Institutional Perspectives of the 921 Chi-Chi, Taiwan Earthquake** by *George C. Lee and Chin-Hsiung Loh*
- **Education and Educational Outreach: Using the Center Approach for Effective Knowledge Transfer** by *Andrea S. Dargush and George C. Lee*
- **Graduate Professional Education in Earthquake Engineering: An Integrated Approach** by *Andrei M. Reinhorn, Shahid Ahmad and Ernest Sternberg*

The full color report is available on our web site in PDF format at <http://mceer.buffalo.edu/publications/resaccom/9900/default.asp>. A limited number of black and white copies are available by contacting MCEER publications. ❖

The QUAKELINE® Database: Much More Than Earthquake Engineering!

Many readers know that MCEER's QUAKELINE® database provides access to the literature of earthquake engineering. What readers may not realize, however, is that QUAKELINE also provides access to literature for multihazards — both natural and man-made — including high winds, floods, tsunamis, volcanoes, landslides, hazardous material spills, and blast/bombing.

In addition, QUAKELINE covers the social and economic effects of earthquakes, the psychological effects of disasters, legislative and policy issues, as well as emergency/disaster management.

Users can easily search the QUAKELINE database from our web site at <http://mceer.buffalo.edu/utilities/quakeline.asp>. In addition, QUAKELINE can be searched on the Earthquakes and the Built Environment Index (EBEI), a CD-ROM that also contains the National Information Service for Earthquake Engineering (NISEE) Earthquake Engineering Abstracts database, as well as the Newcastle Region (Australia) Public Library Earth-

quake Project database. All three databases can be searched simultaneously with one command language which removes duplicate records.

While the majority of QUAKELINE records are for highly technical publications, an effort has been made to include material suitable for students in middle school and high school and/or the general public. It is hoped that broadening the collection in this way will encourage students' interest in earthquake engineering and hazards mitigation; help earth science teachers to quickly locate materials suitable for classroom use; and assist in educating the general public about natural hazards and the steps they can take to protect themselves and their property from damaging earthquakes.

QUAKELINE records contain bibliographic information for each publication (author(s), title, publisher, and year of publication), as well as a list of keywords and a brief abstract. The database presently contains over 34,000 records. Approximately 57% of these records are

for conference papers, since research in earthquake engineering is published primarily in conference proceedings. Other document types in QUAKELINE include journal articles, technical reports, monographs, maps, standards, newspaper clippings, and audiovisual materials (videos, slides, CD-ROMs). QUAKELINE includes records for materials that have been published in many languages other than English, such as Chinese, Japanese, Spanish, and Italian. The records for foreign language publications include an abstract and keywords in English.

All the items listed in the QUAKELINE database are located in the University at Buffalo libraries or the MCEER Information Service. For more information, contact Marsha Flett, e-mail: flett@acsu.buffalo.edu. For reference/document delivery requests or information about fees, contact Laura Taddeo, e-mail: ltaddeo@acsu.buffalo.edu. Both can also be reached by phone: (716) 645-3377 or fax: (716) 645-3379. ❖

Upcoming Events

September 5-8, 2000

Postearthquake Highway Response and Recovery Seminar ■ St. Louis, Missouri

Sponsors:

■ Federal Highway Administration ■ Missouri and Illinois Departments of Transportation ■ Missouri and Illinois State Emergency Management Agencies ■ Mid-America Earthquake Center ■ Central U.S. Earthquake Consortium ■ University of Missouri ■ Consulting Engineers Council of Missouri ■ MCEER ■ Missouri Society of Professional Engineers

Contact:

Don Neumann, Federal Highway Administration ■ Phone: (573) 636-7104

Web Site:

<http://www.fhwa.dot.gov/modiv/quake.htm>

June 17-22, 2001

ICOSSAR '01 - 8th International Conference on Structural Safety and Reliability ■ Newport Beach, California

Co-Chairmen:

G. Schueller, University of Innsbruck, Innsbruck, Austria ■ M. Shinozuka, University of Southern California

Organized by:

International Association for Structural Safety and Reliability and sponsored by a number of organizations, including MCEER

Contact:

Secretariat, University of Colorado, College of Engineering and Applied Science, Campus Box 422, Boulder, Colorado 80309-0422 ■ Phone: (303) 492-7006 ■ Fax: (303) 492-0353 ■ Email: corotis@colorado.edu

Web Site:

<http://www.colorado.edu/engineering/ICOSSAR>

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

Contact:

Andrea Dargush, MCEER ■ Phone: (716) 645-3391 ext. 106 ■ Fax: (716) 645-3399 ■ Email: dargush@acsu.buffalo.edu

Web Site:

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

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 order a report reviewed in this issue, fill out the order form and return it to MCEER. 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/default.asp>.

Development of Measurement Capability for Micro-Vibration Evaluations with Application to Chip Fabrication Facilities

by G.C. Lee, Z. Liang, J.W. Song, J.D. Shen and W.C. Liu, 12/1/99, MCEER-99-0020, 129 pages, \$25.00

In this project, MCEER researchers conducted vibration tests at a site in West Seneca, New York to determine its suitability for attracting and supporting a ChipFab facility. ChipFab, a short name for a semiconductor chip fabrication facility, is a high-tech manufacturing facility where the electronic chips for items ranging from computers to cellular phones to automobiles are manufactured. The industrial park site (North American Park) is located near a railroad, a major expressway and an active mining operation. The level of micro-vibrations of ground motion is critical for this type of facility.

Several locations were instrumented within the industrial park. Three direction

acceleration components were measured at each location, during the period between November 1 and December 1, 1998. These acceleration data were subsequently converted into RMS velocity (one-third-octave band) through specially derived analytical relationships. It was found that the proposed ChipFab site in the northern section of the industrial park was suitable for the manufacturing facility.

The measurement system used to conduct this testing was developed specifically for this project. This report describes the measurement system in detail, including its sensory system, data acquisition and recording, sensor installation and distribution of the measurement locations. The procedure to obtain measurements, data evaluation, and results and analyses related to the West Seneca site are also described in the report.

Design and Retrofit Methodology for Building Structures with Supplemental Energy Dissipation Systems

by G. Pekcan, J.B. Mander and S.S. Chen, 12/31/99, MCEER-99-0021, 196 pages, \$30.00

The study described in this report focuses on fundamental issues related to the design and use of supplemental damping devices in building structures. The principle objective is to develop a generic/practical analysis and design methodology for structures that considers structural velocities and equivalent viscous damping of the devices. These two issues are explored in depth. Tools to transform the spectral velocity to an actual relative structural velocity are provided, and a simple design procedure which incorporates power equivalent linear damping based on actual structural velocities is presented. The effectiveness of the design methodology is demonstrated with a retrofit design example using a supplemental load balancing tendon configuration.

Proceedings of the MCEER Workshop for Seismic Hazard Mitigation of Health Care Facilities

Edited by G.C. Lee, M. Ettouney, M. Grigoriu, J. Hauer and J. Nigg, 3/29/00, MCEER-00-0002, 134 pages, \$25.00



The purpose of the MCEER Workshop for Seismic Hazard Mitigation of Health Care Facilities was to develop and consider the possible scope and emphases for MCEER's hospital project. The workshop brought representatives from academia, industry, government and emergency management together to discuss issues and identify barriers to seismic rehabilitation. The major observations and recommendations are:

- Establish unified guidelines for mitigation of seismic hazards for health care facilities in the eastern U.S.,
- Emphasize the protection of buildings as well as contents by using advanced technologies,
- Integrate mitigation and emergency response consistent with MCEER's overall vision, and
- Coordinate with the current FEMA project carried out at the University of Southern California that concentrates only on nonstructural hospital elements.

The expected outcome of this workshop is the development of a guideline to identify requirements of seismic mitigation efforts for health care facilities in the eastern U.S.

Summary information about this workshop is available from the "Publications" section of our web site at <http://mceer.buffalo.edu/publications/default.asp#spubs>.

The Marmara, Turkey Earthquake of August 17, 1999: Reconnaissance Report

Edited by C. Scawthorn with major contributions by M. Bruneau, R. Eguchi, T. Holzer, G. Johnson, J. Mander, J. Mitchell, W. Mitchell, A. Papageorgiou, C. Scawthorn and G. Webb, 3/23/00, MCEER-00-0001, 202 pages, \$35.00



Early in the morning of Tuesday, August 17, 1999, a magnitude 7.4 earthquake struck along the Anatolian fault in the northwestern region of Turkey. Within days, MCEER dispatched several researchers to the region - three of them simultaneously serving as part of the Earthquake Engineering Research Center (EERI) reconnaissance team - to examine the earthquake's impact. Their initial observations and impressions are reported in two publications, *MCEER Response* by M. Bruneau, J. Mander, W. Mitchell, A. Papageorgiou, C. Scawthorn and N. Sigaher, and in a

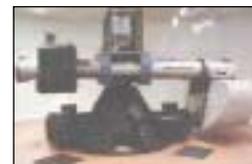
Preliminary Report by C. Scawthorn. Both reports can be accessed from the "Research" section of our web site at <http://mceer.buffalo.edu/research/turkeyeq/default.asp>.

MCEER sponsored a second reconnaissance trip to Turkey together with the Earthquake Disaster Mitigation (EDM) Research Center in Miki, Japan. Team members visited Turkey from September 28 to October 4 to conduct high level reconnaissance using satellite imagery, differential global positioning systems and in-field GPS-GIS interfaces. In addition, restoration activities already underway were observed and documented.

This report includes observations from both these reconnaissance trips. It is the product of many authors representing several disciplines and, while not a final assessment of the topics addressed, represents an interim earthquake engineering evaluation of the natural, built and social environments. As noted by several of the authors, the analogies between the North Anatolian Fault Zone in Turkey and the San Andreas Fault in the United States are strikingly similar. The observations and conclusions herein form a springboard for future collaborative research efforts, which will advance society's ability to better withstand the destruction caused by earthquakes throughout the world.

RPI Upgrades Centrifuge Web Site

The web site for the Rensselaer Polytechnic Institute's (RPI)



centrifuge facility at <http://www.rpi.edu/~dobryr/centrifuge/> or <http://www.ce.rpi.edu/centrifuge/> has been recently upgraded. This site provides information and photos on the 100 g-ton centrifuge and its equipment, which has been used mainly for geo-earthquake and geo-environmental modeling. Also featured are examples of research and publications and several visualizations of earthquake response and liquefaction of soil in the free field and near a quay wall. The visualizations are based directly on the measurements obtained from centrifuge models subjected to in-flight base shaking.

■ RPI's centrifuge facility

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Recent Events...

March 1, 2000 - July 31, 2000

March 1-3, 2000

First Workshop on Mitigation of Disaster by Advanced Technologies (MEDAT-1)
Los Angeles, California

March 4, 2000

Implementation Advisory Committee Meeting
Los Angeles, California

March 11, 2000

Research Committee Meeting
Buffalo, New York

March 12-15, 2000

US-PRC Researcher Exchange Program:
MCEER Hosts Visitors from the Dalian Institute of Technology
Buffalo, New York

April 10-11, 2000

TEA-21 Highway Project Research Committee Meeting
Reno, Nevada

April 14-15, 2000

Research Committee Meeting
Buffalo, New York

May 12, 2000

Scientific Advisory Committee Meeting
Chicago, Illinois

May 18, 2000

NYCEM Executive Committee Meeting
Princeton University
Princeton, New Jersey
<http://www.nycem.org>

June 2, 2000

Tri-Lateral Student Leadership Council Meeting
St. Louis, Missouri

June 7, 2000

Student Leadership Council Meeting
Buffalo, New York

June 8-9, 2000

NSF Annual Site Visit
Buffalo, New York

June 27-29, 2000

National Cooperative Highway Research Program (NCHRP) 12-49 Meeting
Las Vegas, Nevada

July 25-26, 2000

MCEER Workshop on NCHRP 12-49 Proposed Seismic Provisions for Steel Bridges
Las Vegas, Nevada