Team Develops Seismic Upgrade for Istanbul’s Ataturk Airport Terminal

MCEER researcher Michael Constantinou was part of a team charged with the seismic upgrade of Istanbul’s Ataturk International Airport. The upgrade of the structure, which was under construction at the time of the August 17, 1999 Marmara earthquake and scheduled to open in January 2000, was recommended by TEPE-AKFEN-VIE (TAV), the local build-operate-transfer consortium of the 190,000 square meter terminal and parking garage; and its advisor on construction management, New York-based Turner International. The upgrade had to be accomplished prior to the opening of the airport, and although the earthquake did not damage the structure, TAV wanted to strengthen it beyond the local code’s requirement for life safety.

The design and implementation of the upgrade, led by LZA Technology, a division of Thornton-Tomasetti Group, New York City, took less than four months. Other team members were Michael Constantinou, professor and chair of UB’s Department of Civil, Structural and Environmental Engineering and an MCEER researcher, Andrew S. Whittaker, Associate Director of PEER, University of California at Berkeley, and Tuncel Engineering and Fondsiyuen Muhendislik Insaatvetic Ltd., both of Istanbul.

The modernization scheme consisted of three steps: 1.) increasing the strength of the second- and third-story columns by steel jacketing the columns, 2.) seismically isolating the roof to reduce seismic demand on third-story columns, and 3.) installing lock-up devices (shock absorbers) at roof expansion joints.

Professor Constantinou and his colleagues were involved in the development of the upgrade conceptual design, evaluating alternate solutions, performing nonlinear static and dynamic analysis of the structure, and assessing the displacement demand in the isolation bearings. The roof isolation scheme involved slicing the columns horizontally at the top and installing friction pendulum bearings, manufactured by Earthquake Protection Systems of Earthquake Protection Systems of...
Richmond, California. These devices, which were tested extensively at MCEER/UB, are designed to allow structures or structural components to swing gently from side to side, like a pendulum. According to Professor Constantinou, the segments of this 250-meter long roof were tied together as they sit on top of the isolation devices. This gives the roof the ability to “swing” as much as 300 mm with respect to the columns during an earthquake, thus protecting the columns.

However, the roof’s direct exposure to the sun necessitated the use of expansion joints that could accommodate thermal movement. Lock-up devices, which are like shock absorbers, manufactured by Taylor Devices, were installed. They allow the roof sections to respond individually to thermal stresses under normal circumstances, yet during a seismic event, the devices engage in position, forcing the entire roof to behave as one element. This hardware was also tested extensively at MCEER/UB.

MCEER Participates in Project Impact

FEMA hosted its annual Project Impact Summit this past December in Washington, DC. Project Impact is a national FEMA initiative which supports selected community-based activities to promote disaster mitigation and containment of disaster losses. Its objective is to build disaster resilient communities across the U.S. The meeting offered community representatives opportunities to listen, network, share and learn to improve their own activities to develop community partnerships and mitigation strategies. Access to extensive informational resources complimented the program; keynote addresses by FEMA Director James Lee Witt and ESRI CEO Jack Dangermond were notable highlights.

MCEER investigator and Research Committee member Professor Joanne M. Nigg (UDEL/DRC) is a Principal Investigator on a FEMA project to conduct an assessment of seven U.S. communities initially selected to participate in the disaster-resistant community initiative. Dr. Nigg addressed an Executive Session of FEMA program officials to review her findings.

MCEER is a partner and informational resource for the newly-established Project Impact community of Buffalo, New York. Andrea Dargush attended the Summit on the Center’s behalf with the Buffalo team. More information about Project Impact can be found at http://www.fema.gov.

Resources and Model Mitigation Plans Available

In an effort to reach out to those involved in planning for disaster resistant communities, the MCEER Information Service recently completed two projects: a web guide to resources for Project Impact participants and the acquisition of model mitigation plans. The guide lists web sites that provide information on disaster mitigation and management and is accessible at http://mceer.buffalo.edu/infoService/bibs/PIlinks.html.

The model plans can assist local planners with post-disaster recovery and reconstruction efforts and are available for loan from the University at Buffalo Libraries. Contact Laura Taddeo for additional information by email: ltaddeo@acsu.buffalo.edu or phone: (716) 645-3377.
Report from the Twelfth World Conference on Earthquake Engineering

On January 30-February 4, 2000 over 2,000 members of the international earthquake engineering community assembled for the Twelfth World Conference on Earthquake Engineering (12WCEE) in Auckland, New Zealand. Many members of the MCEER community were featured participants in this world forum, which is held every four years. Ian Buckle and T.T. Soong were among the eleven specialists of international standing who were selected to present keynote speeches. In their joint session, Buckle and Soong addressed the history and state-of-the art in structural control.

MCEER Information Service’s Dorothy Tao hosted the MCEER exhibit, which attracted many visitors, including old friends and colleagues. She also participated in UB Night, where a number of UB graduates, now researchers and professionals throughout the world, ferried to Devenport Island for an evening of dinner and socializing.

Proceedings from the 12WCEE, containing 1,520 papers, are available on CD-ROM (NZ $225) or as a 15 volume hard-bound set (NZ $1,015). To order, contact Richard Buchanan, 12WCEE Conference Manager, email: richardb@cmsl.co.nz.

About 15 current and former UB/MCEER affiliates gathered for dinner during the 12WCEE. Shown (from left) are G. Chen, A. Reinhorn, S. Nikolaou, K. Skliros, S. and M. Symans, and G. Mylonakis.

The 13WCEE will be held in Vancouver, Canada in August 2004. For information, contact Donald Anderson, 13WCEE, email: wcee13@civil.ubc.ca.

K eith Kesner is a Ph.D. candidate at Cornell University, and is currently involved in a project entitled “Development of Engineered Cementitious Composite Materials for Seismic Strengthening and Retrofit.” Dr. Sarah Billington is his advisor, and his expected graduation date is May 2002. The project is directed towards the development of cementitious composite materials that exhibit a “pseudo strain hardening” response in tension. It is believed that these materials have excellent potential for seismic strengthening and rehabilitation applications. Development of these materials will require laboratory testing to establish fundamental behavior characteristics, and additional testing to verify the performance of components made with the composite materials. Concurrent with the laboratory testing, material models will be developed to allow for finite element based simulations of the material performance in structural models.

According to Keith, “This research represents a transition in the field of structural engineering from the use of traditional materials such as reinforced concrete and steel to materials with engineered performance characteristics. This is one of the many facets of the project that is exciting to me.”

This project fits well into MCEER’s mission to develop new and emerging materials that have potential for use in seismic rehabilitation of structures. These newer materials may possess significant advantages over conventional civil engineering materials such as reinforced concrete and steel.

In the future, Keith plans to continue research in the areas of material development with specific applications towards strengthening and rehabilitation of structures. Additionally, he would like the opportunity to teach at the university level.

The Student Spotlight is a new column developed to introduce our many student researchers and to highlight their current research work. We plan to feature brief profiles on one or two students in each issue.

Keith Kesner works on part of an exhibit on earthquake engineering that will be displayed in the Ithaca Science Center.
Highway Seismic Research Council Meeting Review:
TEA-21 Highway Project

MCEER started work on the first year of a new 6-year, $10.8 million program sponsored by the Federal Highway Administration in August 1999. This contract, which was authorized under the 1998 Transportation Equity Act for the 21st Century (TEA-21), will focus on several special issues considered critical to the future of the nation’s highway transportation infrastructure (see MCEER Bulletin, Volume 13, No. 3, Summer 1999, page 3 for TEA-21 research objectives).

The first meeting of the TEA-21 Highway Seismic Research Council (HSRC) was held on December 2-3, 1999 in Buffalo. The meeting was attended by more than 15 members of the HSRC, the project Research Committee members, and project researchers. The HSRC was established to provide advice and guidance on technical and administrative project issues. The meeting provided an opportunity for the HSRC to meet with the project researchers and to receive an overview of the Year 1 research plans.

At the start of the meeting, Drs. George C. Lee and Ian G. Buckle welcomed all participants and introduced Dr. John M. Kulicki as the Chair of the HSRC. Dr. Buckle provided a technical overview of MCEER’s Highway Project, and Mr. Ian M. Friedland (formerly Assistant Director for Transportation Research) discussed administrative issues. Introductions were followed by general overviews and technical presentations by the research task coordinators and project researchers on the primary research task areas that will be pursued under this project.

Meeting participants provided critical and constructive comments on the overall research program and its objectives during the project discussions. An executive session was held by the HSRC during which the members of the Council developed consensus recommendations for the current research tasks and for longer-term research plans. It is anticipated that the HSRC will hold annual meetings over the six-year life of the project at which similar annual program reviews and accomplishments are discussed, as well as interim technical meetings with project researchers in selected technical areas.

Highway Seismic Research Council

Dr. John M. Kulicki, P.E., Chair
Modjeski & Masters, Inc.
Mr. Ralph E. Anderson, P.E.,
Illinois Department of Transportation
Dr. Donald G. Bathurst
Federal Emergency Management Agency
Mr. David B. Beal, P.E.,
Transportation Research Board
Dr. Roger D. Borchert
U.S. Geological Survey
Mr. Robert C. Holt
NYS Department of Transportation
Dr. Mary Ellen Hynes
Earthquake Engineering Seismology
Branch
USAE Waterways Experiment Station
Dr. Charles Kircher
Charles Kircher & Associates

Mr. Paul V. Liles, Jr., P.E.,
Georgia Department of Transportation
Mr. Joseph P. Nicoletti, P.E.,
URS Greiner Woodward Clyde
Mr. John O’Fallon, P.E.,
Federal Highway Administration
Dr. Joseph Penzien
International Civil Engineering
Consultants, Inc.
Mr. Thomas Post
California Dept. of Transportation
Mr. Christopher Rojahn
Applied Technology Council
Dr. Glenn R. Smith, Jr., P.E.,
Federal Highway Administration
Dr. Bojidar Yaney, P.E.,
NYC Department of Transportation
Dr. W. Phillip Yen
Federal Highway Administration

MCEER Welcomes New Program Officer

MCEER welcomes Mr. Michael Higgins, P.E. as Senior Program Officer. Mr. Higgins will assume responsibility for coordinating the center’s Highway Project, sponsored primarily by the Federal Highway Administration.

Mr. Higgins joins MCEER from ASCE’s Civil Engineering Research Foundation (CERF), where he served as Project Manager for the Highway Innovative Technology Evaluation Center (HITEC). He managed the independent product evaluations of over 30 innovative technologies for the bridge and highway industry, and was responsible for overseeing the work of expert panels, hiring consultants, and obtaining test and research facilities necessary to complete these evaluations. Prior to joining CERF, Mr. Higgins was a project manager and engineer at Watts Engineers, Buffalo, NY.

Mr. Higgins was selected as CERF’s 1998 Employee of the Year and was the recipient of the 1996 “Young Engineer of the Year” award by the Erie/Niagara Section of NYSSPE. He received his B.S. in Civil Engineering from the University at Buffalo in 1993.
Earthquake Centers Attend NSF-ERC Annual Meeting

For the first time as part of the NSF division of Engineering, Education and Centers (EEC), MCEER, MAE and PEER were invited to the Engineering Research Center (ERC) Annual Meeting. Chaired by NSF Program Leader Lynn Preston, the November 1999 meeting featured special sessions on strategic planning for research, ERC achievements and performance measurements, and highlighted accomplishments, industry partnerships and educational programs. A highlight of the meeting was the introduction of newly-designated ERC's.

Property Modification Factors for Seismic Isolation Bearings

by M.C. Constantinou, P. Tsopelas, A. Kasalanati and E. Wolff, 7/20/99, MCEER-99-0012, 204 pages, $35.00

This report deals with the problem of establishing upper and lower bound values of properties of seismic isolation bearings for use in the analysis and design of seismically isolated bridges. These bounding values of properties are determined by using system property modification factors or $\lambda$-factors. On the basis of experimental results and an understanding of the basic behavior of seismic isolation bearings, $\lambda$-factor values are presented for several of these properties, including the effects of aging, contamination, travel, temperature and scragging for selected sliding interfaces and elastomeric bearings. The concepts presented and the values of the $\lambda$-factors represent the basis on which bounding analysis is described in the new 1999 AASHTO Guide Specifications for Seismic Isolation Design.

Proceedings of the MCEER Workshop on Ground Motion Methodologies for the Eastern United States

edited by N. Abrahamson and A. Becker, 8/11/99, MCEER-99-0016, 113 pages, $25.00

In October 1997, MCEER and FHWA sponsored a two day workshop, *Ground Motion Methodologies for the Eastern United States*, to evaluate ground motion modeling methods applicable in the eastern U.S. The intent of the workshop was to evaluate the state-of-the-art for strong ground motion prediction and the variability of time histories from different modeling methods, and to introduce the participants to the concept of formal model validation and application to develop synthetic motions. The focus was on responding to the user community’s need to evaluate the credibility of synthetic time histories developed for specific projects and the lack of criteria on which to base these evaluations. Eight scientists contributed to this effort. The proceedings contain a description of the ground motion modeling methods, model validation and estimation of variability, scenario event ground motions, and a discussion of the results. The results from these studies can be downloaded in PDF format from the publications section of MCEER’s web site at [http://mceer.buffalo.edu/publications/reports/docs/99-0016/appendices.html](http://mceer.buffalo.edu/publications/reports/docs/99-0016/appendices.html). A summary of the workshop is provided at [http://mceer.buffalo.edu/publications/reports/docs/99-0016/default.html](http://mceer.buffalo.edu/publications/reports/docs/99-0016/default.html).
Quindío, Colombia Earthquake of January 25, 1999: Reconnaissance Report
At 13:19 local time (18:19 GMT), on Monday, January 25, 1999, an earthquake with magnitude 6.2 on the Richter scale occurred in the western part of Colombia. The earthquake caused approximately 1,200 deaths and 5,000 injuries, damaged or destroyed 50,000 structures, and displaced more than 200,000 people from their homes throughout an area extending some 50 kilometers from the epicenter. Economic losses are estimated to exceed $2 billion. This report describes the types and causes of damage resulting from the earthquake and the resulting social and economic impacts.

Hysteretic Models for Cyclic Behavior of Deteriorating Inelastic Structures
For several years now, MCEER has supported research associated with developing nonlinear time history modeling strategies for structural systems. An important element of these codes is for the user to have an appreciation of the strengths and weaknesses, pitfalls, advantages and disadvantages of the various types of hysteretic models employed. In the past, users of various nonlinear time history analysis programs have needed to be very adept in assigning values for the various parameters that control hysteretic rules, as little documentation was available. More recently, there has been an increased awareness in the use of nonlinear time history analysis programs in professional engineering practice. Instead of developing better programs, there is a need to use existing programs in a smarter fashion. Therefore, the purpose of this report is: (1) to provide a theoretical basis for a range of rule-based piecewise linear hysteretic models (in Section 2), as well as differential equation-based smooth hysteric models (in Section 3); and (2) to provide a sound and formal reasoning for the basis of the above-mentioned models that are founded on the fundamentals of mechanics and the interrelationship between these various types of models (in Section 4).

Proceedings of the 7th U.S.-Japan Workshop on Earthquake Resistant Design of Lifeline Facilities and Countermeasures Against Soil Liquefaction
edited by T.D. O’Rourke, J.P. Bardet and M. Hamada, 11/19/99, MCEER-99-0019, 674 pages, $40.00
Over 25 researchers from both the U.S. and Japan participated in the 7th U.S.-Japan Workshop on Earthquake Resistant Design of Lifeline Facilities and Countermeasures Against Soil Liquefaction, held in Seattle on August 15-17, 1999. The main themes of the workshop were liquefaction and large ground deformation, lifeline performance and mitigation, and waterfront facilities, buildings and deep foundation performance. U.S. and Japanese reporters for each of these themes summarized key findings, advances and future direction in each subject area. The proceedings contain approximately 50 papers, the agenda and list of participants, and the summaries of the workshop reporters. Summary information about this workshop is available from the publications section of MCEER’s web site at http://mceer.buffalo.edu/publications/reports/docs/99-0019/default.html.

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