The U.S.-Japan Panel on

Wind & Seismic Effects

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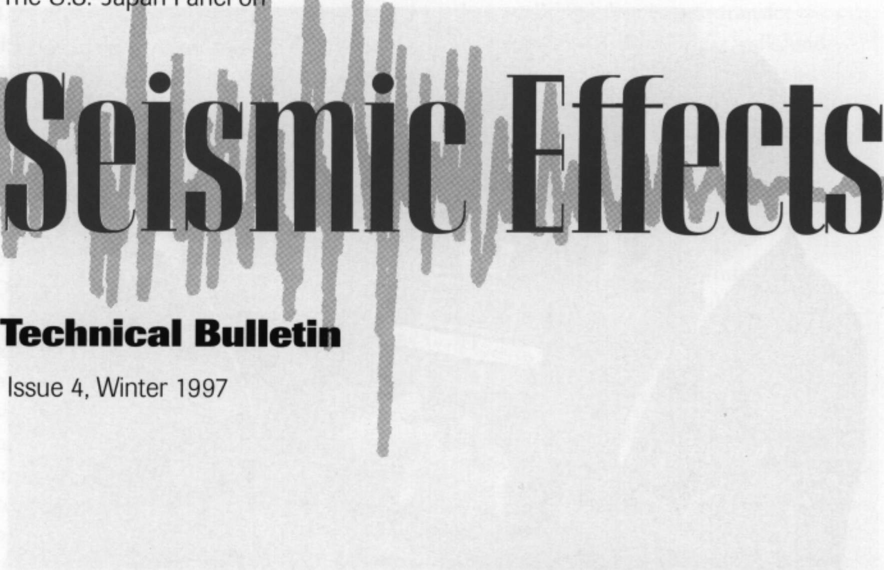


Eleventh World Conference on Earthquake Engineering

Amidst a small earthquake, a hurricane, and flooding, delegates to the Eleventh World Conference on Earthquake Engineering (11WCEE) in Acapulco, Mexico, were physically reminded that natural hazards are an inevitable reality. Two thousand delegates representing more than 100 countries attended the 11WCEE, convened under the auspices of the International Association of Earthquake Engineering (IAEE) from 23-28 June 1996. The Conference presented two keynote lectures, 18 state-of-the-art reports, and more than 1,200 oral and poster presentations in the main technical program. In addition four special seminars and 23 special theme sessions, including the Sixth International Forum on Seismic Zonation were presented in the complementary technical program. Delegates contributed research findings and lessons learned on ten broad themes:

- engineering and seismology;
- soils and foundations;
- structural materials, elements, and systems;
- structural response;
- active and passive control of structural response;
- special structures and systems;
- extended systems;
- structural design criteria and methods;
- seismic evaluation and rehabilitation of structures; and
- experiences derived from recent earthquakes.

11WCEE, an activity of the International Decade for Natural Disaster Reduction (IDNDR) acknowledged the inevitability of natural hazards, but focused on mitigating the effects of natural disasters through the effective working together of engineers, architects, earth scientists, planners, and politicians. The world conference is of particular interest to the U.S.-Japan Panel on Wind and Seismic Effects because it is a snapshot of the state-of-the-art of the world's earthquake science, engineering, and applications.

The host of the 11WCEE, the Mexican Society for Earthquake Engineering, successfully introduced two successful conference procedures. The first was Poster Sessions where 90 percent of the accepted papers were presented and displayed for about six hours. The Poster Sessions helped to broaden interactive participation and to stimulate dialog and follow on communication among the delegates. For the second, conference proceedings were published as a set of four CD-ROMs, instead of traditional hard copy. Delegates could print individual panel discussions on special theme sessions, keynote lectures, state-of-the-art reports, oral and Poster presentations, and perform keyword searches and other research activities with great flexibility. An abstract volume was made available in hard copy.

The CD-ROM's are compatible with Macintosh or Windows computer systems. Customers in the Americas can order the set from Elsevier Science, Regional Sales Office, Customer Support Department, 655 Avenue of the Americas, New York, NY 10010. Customers outside the Americas should order from Elsevier Science, Regional Sales Office, Customer Support Department, P. O. Box 211, 1000 AE Amsterdam, The Netherlands.

Advanced Research on Earthquake Engineering for Dams

Task Committee D held its first U.S.-Japan Workshop on Advanced Research on Earthquake Engineering for Dams, 12-14 November 1996, Vicksburg, Mississippi. It was held under the sponsorship of the U.S. Army Corps of Engineers Waterways Experiment Station (WES) and the Public Works Research Institute of Japan (PWRI). Dr. William Roper (USACE) and Mr. Hitoshi Yoshida (PWRI), the U.S.-side and Japan-side chairs of Task Committee D, convened the workshop and introduced the participants. Dr. Robert Whalin, director of WES, and Mr. Tadahiko Sakamoto, immediate past director general of PWRI, encouraged all the workshop participants to maintain a high level of communication and excellence. Drs. Mary Ellen Hynes, WES, and Yoshikazu Yamaguchi, PWRI, were the U.S.-side and Japan-side workshop organizers.

Three keynote addresses were presented:

- Professor Choshiro Tamura, Nippon University, provided new insights about ground motions observed in Japan;
- Professor Yoshio Ohne, Aichi Institute of Technology, related the results of many large-scale shaking table experiments on earthfill and rockfill embankments providing new insights about mechanisms of failure for these structures; and
- Dr. Ellis Krinitzsky, WES, delivered a thought-provoking talk on deterministic and probabilistic methods for selecting design-level earthquake ground motions.

Twenty-one technical papers were presented. They provided details about the types

Dr. Robert Whalin presents a commemorative plaque to Mr. Tadahiko Sakamoto for the first U.S.-Japan Workshop on Advanced Research on Earthquake Engineering for Dams.

of field conditions and design problems that engineers face in the U.S. and Japan and the wide range of approaches for solving these problems. The presentations triggered lively discussions on material properties and methods of analysis. Speakers addressed earthfill, rockfill, concrete, and roller-compacted concrete dam structures. In the U.S., dam engineers primarily deal with the seismic performance of existing dams since most were built when earthquake engineering was in its infancy and seismic hazards were neither recognized nor understood. Consequently, U.S. dam engineers are concerned with high levels of ground motions, potential liquefaction, large deformations in embankment dams, and potential cracking and damage to concrete dams and outlet works. The seismic design focus in Japan is primarily on new dams. The seismic hazard appears to result in levels of ground motions for designs that are less than in the U.S. The dams are well built, primarily on rock foundations, and liquefaction and deformation for embankment dams and cracking of concrete dams are not issues. The presentations by the Japanese delegates also provided a wealth of empirical data, observations of response, information about the performance of their dams during large earthquakes, and insightful analyses of measured response compared with computed response.

Workshop participants identified three topics for future work: 1. methods of analysis for seismic design of dams including the outlet works; 2. dynamic characteristics of dam construction materials and site conditions; and 3. analysis of observed behavior of dams and outlet works during earthquakes. A second workshop on earthquake engineering for dams will be held in Japan in two years. Proceedings from this workshop are expected to be available in the summer of 1997.

Following the workshop, the Corps' Vicksburg District Office arranged a field trip to the Sardis and Enid Dams in northwestern Mississippi. Both Sardis and Enid Dams have potentially liquefiable fine-grained materials in their foundation deposits. Sardis Dam, a hydraulic fill dam, was recently upgraded to improve its seismic performance. Sardis Dam was remediated with an innovative approach: nailing the dam in place with 0.19 m^2 reinforced concrete piles. The seismic performance of Enid Dam, a well-compacted rolled-fill embankment dam, is still under study. The field trip itinerary traversed most of the Mississippi Delta.

The workshop was attended by 11 Japanese and 26 U.S. participants and a visiting engineer from the United Kingdom. Three agencies and two universities were represented in the Japanese delegation: PWRI; Japan Institute for Construction Engineering; Water Resources Development Public Corporation; Nippon University; and Aichi Institute of Technology. U.S. participants came from the U.S. Army Corps of Engineers (Headquarters, Waterways Experiment Station, Vicksburg District, Kansas City District, and Sacramento District) and the U.S. Bureau of Reclamation.

28th Joint Panel Meeting

The 28th Joint Meeting of the U.S.-Japan Panel on Wind and Seismic Effects was held at the National Institute of Standards and Technology, Gaithersburg, Maryland, from 14-17 May 1996. Forty-six papers were written, 21 by U.S. members and 25 by Japanese members. Thirty-four papers were presented orally; 16 by the U.S.-side and 18 by the Japan-side. The papers were organized into five themes: wind engineering; earthquake engineering; storm surge and tsunamis; summary of joint cooperative research programs; and report of task committee workshops conducted during the past year. Also, eight papers were presented at two mini-symposia during the technical site visit segment of the Joint Panel Meeting, four from each side. These papers were presented at the University of Minnesota, Minneapolis and at the Oregon Department of Geology and Mineral Industries, Portland. Eight technical sites were visited at four U.S. locations.

1. Washington, D.C. The Panel members visited the 298,000 m^2 Ronald Reagan Federal Triangle Building where more than 191,000 m^3 of concrete were used for this cast-in-place trade center. The members also visited the Smithsonian's 34,000 m^2 Quadrangle Museums that house the vast art collection from Japan and Africa. To satisfy the Washington, D.C., Commission on Fine Art's concerns about constructing a new museum on this site, 95 percent of the two buildings are constructed below ground.

2. Southern Florida. In Miami, the panel members visited the National Hurricane Center of the National Oceanic and Atmospheric Administration. The Center maintains a continuous watch for tropical storms over the Atlantic Ocean, Caribbean

Sea, and the Gulf of Mexico. It prepares and distributes hurricane watches and warnings for the public and marine and military advisories for other users. The Center produces real-time surface wind analyses for major storms giving forecasters better data. In Homestead, Florida, the members visited Habitat for Humanity, a 18-hectare site of self-help, sweat-equity Housing and Urban Development (HUD) housing project of 187 dwelling units being built to replace housing destroyed by Hurricane Andrew. Forty units will be constructed using all steel frames. HUD teamed with the National Association of Home Builders Research Center (NAHBRC) to provide the technical assistance in construction code approval and builder education. The American Iron and Steel Institute (AISI) donated the steel for framing and produced a training manual for the owners and contractors building the houses. Since the use of cold-formed steel for frame construction is not explicit in the building code, prototype housing will be evaluated for performance and cost. NAHBRC developed performance criteria for the steel framing and recommended lateral bracing to meet local building codes.

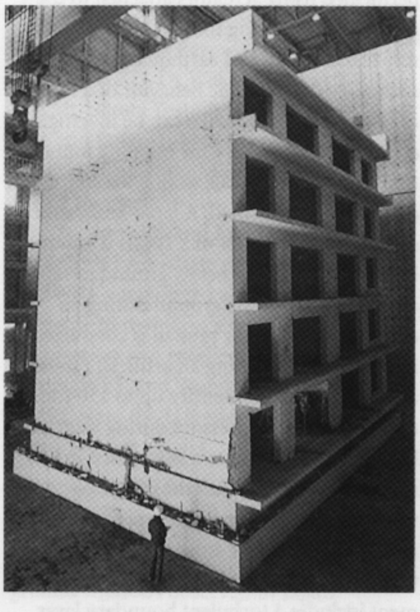
3. Minneapolis, Minnesota. The delegation visited St. Anthony Falls Hydraulic Laboratory, University of Minnesota. Its focus is on fluid mechanics, waters resources engineering, aerodynamics, and wind engineering. Recent wind tunnel studies include the flow of wind around buildings and the determination of the peak and fluctuation pressures on buildings. During the visit, the delegation conducted a mini-symposium featuring two papers by wind tunnel graduate students and two papers from the Japan-side. In Eden Prairie, the members visited MTS Systems Corporation, developer of Japan's Public Works Research Institute's shake table that replicates the loading from the Hyogo-ken Nanbu (Kobe) Earthquake. MTS also provided the major components for Japan's Science and Technology Agency's National Research Institute for Earth Science and Disaster Prevention large shake table. MTS representatives said that the future is in producing modular multispan portable shake tables such as the 2-45 ton 14 m by 14 m tables being designed for the University of Nevada under sponsorship of the U.S. Federal Emergency Management Agency (FEMA). MTS, in collaboration with MIT, is studying a large-scale seismic simulator for the Idaho National Engineering Laboratory.

4. Portland Oregon. Visits here included the U.S. Army Corps of Engineers (CORPS) Portland Earthquake Engineering District and the CORPS' Bonneville Dam, located about 60 km east of Portland. The Portland district office manages 21 multipurpose hydroelectric power dams, provides dam safety and evaluation, emergency action plans, and dam safety training programs. During the early 1990s, seismic risk for northern Oregon was changed from Zone 2 to Zone 3. The district is re-evaluating the maximum credible earthquake values considering new earthquake sources. It is evaluating critical structures to assure that they meet project safety requirements and is considering using GPS to monitor dams' performance. Based on recent data, the district office has revised its dam safety evaluation guidelines for liquefaction potential and embankment deformations. The members visited the Bonneville Dam with its original 1933-1937 constructed dam, powerhouse, and lock and the second powerhouse constructed between 1974 and 1981. Results from the district's latest dam safety assurance evaluation shows that the dam is adequate for current stability requirements. Also in Portland, the members were hosted by the Oregon Department of Geology and Mineral Industries (DGMI) that provides for a cost-effective source of geological information. DGMI creates partnerships for reducing life loss and property damage from geologic hazard; serves as experts on the state's geologic processes, and serves as the state's entry point for recommending geologic hazard's safety legislation. Recent studies revealed that a large earthquake could result in more than $125 billion of damages to buildings in Portland. DGMI has identified the highest risk unreinforced masonry buildings and has recommended that the state develop a seismic standard, create an inventory of buildings, increase state seismic engineering expertise, identify financial incentives that will speed seismic retrofit, and stress education to achieve public support for raising the needed money to realize seismic retrofit. A mini-symposium was held featuring four papers, two from the Japan-side and two from DGMI. Three buildings were visited: an historic building to be retrofitted with base isolation; a partially reinforced 1912 library building undergoing conventional seismic retrofit including work on the foundation using pin piles to tie it to the earth; and an abandoned hotel undergoing retrofitting for seismic safety that includes pin piles to tie the foundation to the ground, installing shear walls and drag bars to transfer the tension loads to the shear walls, and installing struts between the wings and shear walls for structural stability.

BRI, What We Do

The Building Research Institute (BRI) founded in 1946 and located in Tsukuba, Japan conducts research in eight primary departments: 1. Housing and Building Economy; 2. Materials; 3. Structural Engineering; 4. Building Production; 5. Environment, Design, and Fire; 6. Urban Planning; 7. Seismology and Earthquake Engineering; and 8. Codes and Evaluation Research.

Current research related to the Panel's mission includes undertaking post-earthquake investigations of the behavior of buildings 17 January 1995 Hyogo-ken Nanbu (Kobe) earthquake that caused the largest damage to buildings in Japan since World War II. BRI dispatched several reconnaissance teams to Kobe to investigate building damage. It has published many reports on the behavior of buildings during the earthquake. The investigation's findings



Photograph: courtesy of BRI

BRI's structural laboratory is equipped to conduct strength tests of structural elements and joints of buildings and vibration tests to insure aseismicity and safety performance in buildings. The equipment includes a 1000 ton capacity testing machine, a shaking table, a compression/bending testing machine, and a short column testing machine.

provide valuable information to improve seismic design practices for future buildings in Japan. BRI has under way a three-year national research project to develop performance-based structural design schemes. This research was brought about increased activities in globalization of building construction. In new technologies, BRI is investigating new systems such as base isolation and structural response control systems for reducing earthquake forces. It is involved with the application of new materials for structural members and systems.

BRI's unique research facilities include: a large-scale structural laboratory equipped to conduct strength tests of structural elements and joints and vibration tests to improve seismic safety performance of buildings. The laboratory equipment includes a 1000-ton capacity testing machine, a shake table, a compression/bending testing machine, and a short-column testing machine. The laboratory includes two reaction slabs, one 20 m wide x 25 m long, and a reaction wall that is 25 m high. A seven-story, full-scale building was tested in the laboratory. Each of the building's floors may be instrumented. The floors were constrained to a maximum area of 400 m^2 (20 m x 20 m). The horizontal loading of the test building is performed using actuators attached to the reaction wall causing the test building to respond as if in a real earthquake. Through such tests, the dynamic behavior of a building during an earthquake can be investigated. In BRI's laboratory for building foundation and soils, full-scale testing for soil dynamics is performed. A large-scale, shear soil layer box (5 m x 4 m x 10 m) is equipped in five large pits 6 m below ground to reproduce vibration of the ground during an earthquake. A test for rainfall is conducted in this laboratory using an artificial rainfall apparatus with an intensity up to 150 mm/h that addresses soil pressure during rainfall. In the wind and rain test laboratory, experiments are conducted on the effects of wind on buildings, the waterproof performance of finishes, and the air-flow characteristics in and around buildings. The equipment includes a turbulent boundary layer wind tunnel, a storm generator and other apparatuses.

BRI's unique instrumentation activities include its strong-motion earthquake observation project initiated in 1957. Fifty-two accelerometers were placed in key cities by 1964. Strong motion recordings were successfully collected from the 1964 Niigata, 1970 Hidaka Sankei, 1978 Miyagi-ken Oki, 1982 Urakawa Oki, 1993 Kushiro Oki, 1994 Hokkaido-toho Oki, and the 1994 Sanriku-haruka Oki earthquakes. Although, BRI has no accelerometers near Kobe, the Hyogo-ken Nanbu earthquake was recorded at Osaka by the BRI network. After the Kobe earthquake, BRI increased by 20 the number of its recording stations, especially around Tokyo. An array observation network was constructed in the Sendai area (located about 325 km northeast of Tokyo) to collect data on different properties for various soil conditions. The array consists of 11 stations with spacing of approximately 3 km to 4 km on the east-west axis passing through downtown Sendai. At each station, seismometers are installed in boreholes at three depths.

IIPLR Lists Key Areas for Mitigation Efforts

The Insurance Institute for Property Loss Reduction (IIPLR) identified six key areas on which it will focus its natural hazard mitigation efforts in the next several years. The six areas constitute a framework for a new strategic plan adopted by the IIPLR Board of Directors. "Excellence in these six areas will assure that IIPLR successfully fulfills its mission to reduce damage and suffering caused by natural disasters," said Harvey G. Ryland, who became IIPLR president on 1 October 1996 after serving as deputy director of the U.S. Federal Emergency Management Agency. Ryland explained that IIPLR is developing specific goals, strategies, and activities for each key area. The key areas complement the interests of the Panel on Wind and Seismic effects. The focus areas and the proposed goals and strategies for each are:

- **Public outreach.** Ensure that all stakeholders (policy- and decision-makers, insurance industry, businesses, emergency managers, community planners, lenders, builders, general public, for example) are aware of natural hazards, understand the associated risks, are knowledgeable about how to reduce these risks, and can take actions to reduce their level of risk. Potential strategy: Conduct information and education programs to institutionalize natural disaster mitigation as a public value.
- **Community land use.** Promote the location of structures out of high-risk areas that are subject to natural hazards. Potential strategy: Work with partners to develop incentives for not building in high-risk areas or for incorporating special mitigation measures.
- **Construction of new buildings.** Ensure that new structures are designed, engineered, and built using up-to-date techniques and materials that mitigate natural disaster risks. Potential strategy: Partner with stakeholders to develop a 'Seal of Approval' program to create demand for construction that is hazard-resistant.
- **Retrofitting of existing structures.** Promote the retrofitting of existing structures to incorporate features that mitigate natural disaster risks. Potential strategy: Work with partners to establish tailored incentives, e.g., reduced fees and taxes, reduced mortgage points, and interest rates.
- **Information management.** Provide for the collection, analysis, and dissemination of natural disaster loss and mitigation information. Potential strategy: Implement a comprehensive disaster loss data and mitigation information service.
- **Resources.** Provide all necessary resources, both human and economic, necessary to accomplish the mission of IIPLR. Potential strategy: Build and maintain a multi-skilled diverse work force and develop IIPLR code of ethics.

Editor: Noel J. Raufaste,
Secretary-General, U.S.-side Panel

Head, Cooperative Research Programs
Building and Fire Research Laboratory
National Institute of Standards
and Technology
Gaithersburg, Maryland 20899 USA
noel.raufaste@nist.gov
http://www.bfrl.nist.gov

Contributing writers:

Dr. Mary Ellen Hynes,
U.S. Army Corps of Engineers, WES

Dr. Walter Hays,
U.S. Geological Survey

Dr. Gregory Chiu,
Insurance Institute for
Property Loss Reduction

Dr. Izuru Okawa,
Building Research Institute, Japan