The U.S.-Japan Panel on

Wind & Seismic Effects

Technical Bulletin

Issue 6, Winter 1999

30th Joint Panel Meeting

The 30th Joint Meeting of the U.S.-Japan Panel on Wind and Seismic Effects was held at the National Institute of Standards and Technology, Gaithersburg, MD, from 12-15 May 1998. Forty-five papers were written, 22 by U.S. members and 23 by Japanese members. Thirty-eight papers were presented orally. The papers were organized into five themes: wind engineering, earthquake engineering, storm surge and tsunamis, summary of joint cooperative research programs, and real time information acquisition and dissemination. The published papers are found in *Wind and Seismic Effects, Proceedings of the 30th Joint Meeting,* NIST SP 931. The delegation visited 10 technical sites at three locations during 11 and 16-21 May.

■ Washington, D.C.

U.S. Army's Topographic Engineering Center (TEC) hosted the delegation; discussions centered on enhanced environmental and terrain capabilities for distributed interactive simulations and TEC's 3-D visualization capabilities to demonstrate virtual reality environments. Of particular interest to the panel is TEC DrawLand software that permits the visualization of terrain data much like a flight simulator—what is seen on the monitor changes in response to how one manipulates the controls of a virtual vehicle. The Panel will benefit by having access to these capabilities for activities such as its new Task Committee on Seismic Information Systems.

A visit to the **National Building Museum,** located in the historical 1887 Pension Building provided the delegation an opportunity to learn about the design and construction of this unique brick structure and of government programs to educate the public about building technologies. They visited one exhibit, *Breaking Through the Creative Engineer,* which is designed to explore how creativity is expressed through the work of modern engineers.

■ Greater Denver, Colorado Area

The Fluid Dynamics and Diffusion Laboratory, Colorado State University, Fort Collins, CO, hosted the delegation with discussions on fluid mechanics and a tour of several of its wind tunnels. The Meteorological Wind Tunnel which independently heats and cools air to generate thermally stratified flows is used to study flow characteristics of the atmospheric surface layer and to measure wind pressures on buildings and structures. The Industrial Aerodynamic Wind Tunnel has an adjustable ceiling height that can be heated to 93.3 °C. The Open Circuit Gust Wind Tunnel has a 3.7 m long test section and is 0.9 m wide and 0.9 m high.

Staff at the **U.S. Geological Survey, Golden, CO** provided a review of their mapping and research capabilities in developing ground motion maps and national seismic hazard maps. A mini-symposium was held with Dr. Arthur Tarr, USGS, and Dr. Michio Okahara, Director, Bridge and

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Highlights of Recent T/C Workshops

T/C J, 14th U.S.-Japan Bridge Engineering Workshop

At the confluence of the Allegheny, Monongahela, and Ohio rivers in Pittsburgh, PA, the 14th U.S.-Japan Bridge Engineering Workshop was held during 2-8 November 1998. The Bridge Engineering Workshop, initiated in 1984, was established to foster closer ties between U.S. and Japanese bridge engineers. The original focus of the workshops centered on exchanging information related to seismic and wind effects on bridges. Over time, the Japan Public Works Research Institute (PWRI) of the Ministry of Construction, the U.S. National Science Foundation (NSF), and the Federal Highway Administration (FHWA) realized that broader areas of topics in bridge engineering impacted the overall seismic or aerodynamic performance of bridges.

In this year's workshop, a Japanese delegation of 22 engineers and scientists joined 32 U.S. participants representing a mix of bridge owners, designers, researchers, material suppliers, and other industry representatives. The main theme of the workshop

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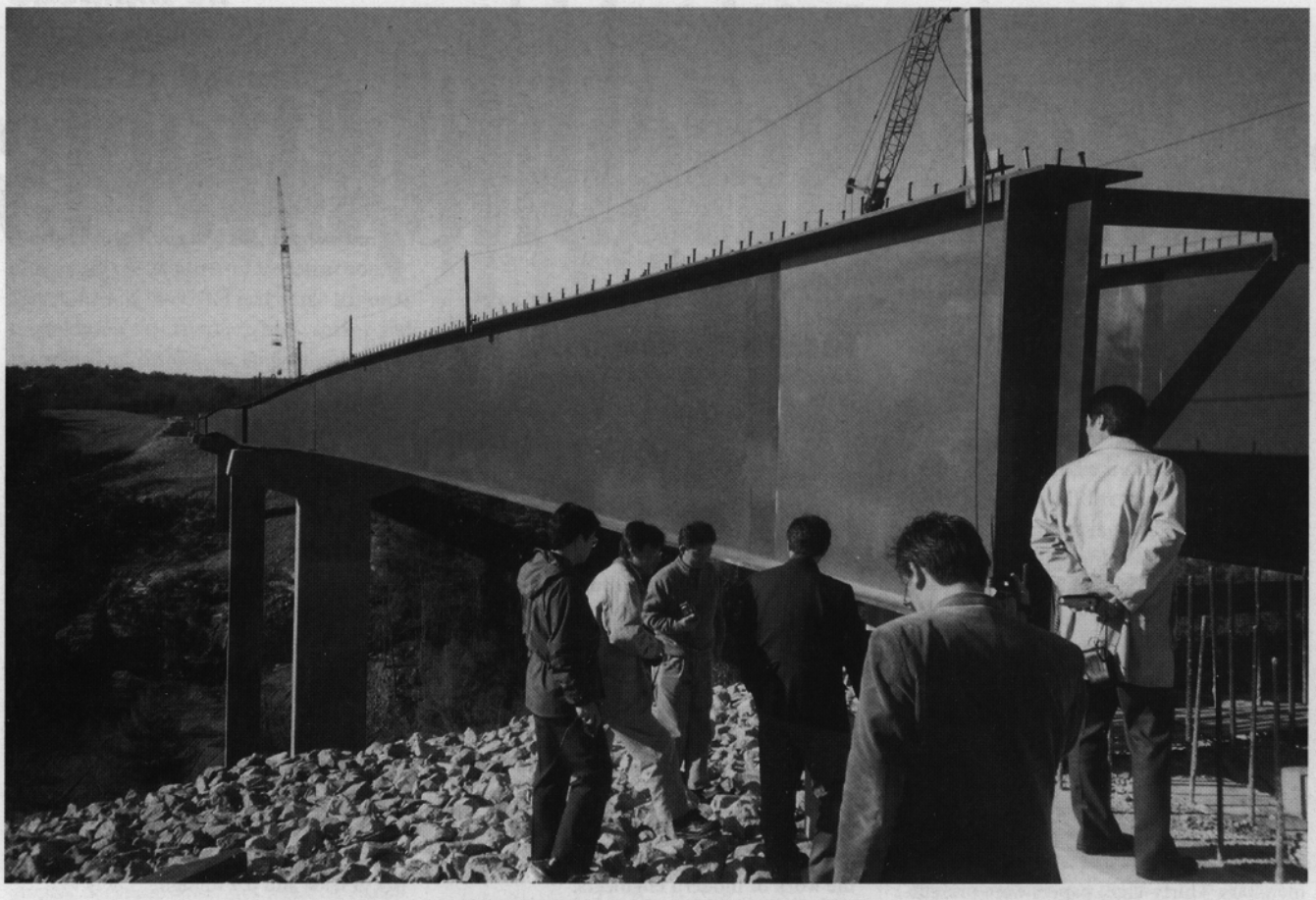

Workshop participants in the field are discussing a high-performance steel (HPS) bridge under construction near Rugby, TN. HPS offers lighter weight superstructures that can improve seismic performance and durability and reduce maintenance and overall project costs.

Highlights of Recent T/C Workshops

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focused on improved earthquake response of bridges and the advancement and use of high-performance steels to improve bridge durability. Thirty-seven technical papers were presented in eight sessions:

- Protective Systems and Bridge Response;
- Seismic Design;
- High Performance Steel Design;
- Seismic Retrofit and Repair;
- Design and Behavior of Steel;
- Design and Behavior of Concrete (2 sessions); and
- General Design.

The workshop proceedings are being developed by FHWA. An outgrowth of the UJNR program has been an establishment of a bilateral agreement between FHWA and the Ministry of Construction for Advanced Highway Technologies.

The second half of the workshop consisted of technical site visits to bridges in Pittsburgh, in WV, and in Nashville, TN. Plans for rehabilitating the Fort Pitt Bridge and tunnel rehabilitation were discussed. The 1995 rehabilitation of Gustave Lindenthal's Smithfield Street lenticular truss bridge was reviewed. The American Society of Civil Engineers recognized the project for its value in the restoration of one of Americas historic structures. The rehabilitation of the Monongahela Connecting Railroad Bridge was discussed. An abandoned railroad bridge is being converted to highway use to open commercial development in an area that housed the Jones and Laughlin steel mills. The group reviewed the South Tenth Street Bridge, which required splicing and re-anchoring of the main suspension cables. The new Veterans Memorial Bridge (a cable-stayed bridge) over the Ohio River at Weirton, WV, provided a review of its construction and discussions on abnormal vibrations of the cable stays when wind interacts with water laden cables during rain storms. In Morgantown, WV, the delegation visited the facilities and laboratories of West Virginia University to discuss research on use of fiber-reinforced polymer composites (FRP). One of the concepts for a glass bridge deck was investigated at the university. The group visited the Wickwire Bridge, a 9 m span, pultruded FRP bridge deck where design and constructability issues were discussed. Two bridges designed using high performance steel (HPS) were visited in Tennessee. The first all HPS bridge at Martins Creek near Nashville was examined. The use of HPS resulted in a 24 percent weight reduction of steel, an overall 11 percent cost savings for structural steel, and an overall project cost reduction of 6.5 percent.

The Japanese and U.S. delegations were led by Messrs. Kazuhiro Nishikawa and Masahiko Yasuda of PWRI and James Cooper of FHWA. The strong participation of Parsons Binkerhoff, the Bayer Corporation, Michael Baker Engineering, West Virginia University and the Tennessee Department of Transportation were instrumental in the success of the workshops and site visits.

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30th Joint Panel Meeting

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Structures Department, Public Works Research Institute. Dr. Tarr discussed his work in developing dynamic mapping of earthquake and landslide resources for distribution on the Internet. This work will be a valuable contribution to the panel's new Task Committee on Seismic Information Systems. Dr. Okahara discussed PWRI's research, following the January 1995 Kobe earthquake, on seismic retrofit of bridge substructures involving the redesign of reinforced concrete columns. The delegation learned of USGS National Earthquake Information Center's (NEIC) responsibility in providing earthquake information through printed and electronic media.

Natural Hazards Information Center, University of Colorado, Boulder, is increasing its communication activities between hazard/disaster researchers and individuals, agencies, and organizations actively working to reduce disaster damage and suffering. The Natural Hazards Information Center has a variety of resources available from the Internet.

■ Greater San Francisco, CA Area

Pacific Gas and Electric Corporation staff reviewed their work on assessing earthquake hazards and vulnerability of PG&E's facilities. For example, following the 1989 Loma Prieta Earthquake, PG&E restored and strengthened its 70-year-old, four-building headquarters complex by using a massive structural shear-wall design. The building's interiors were gutted, strengthened and repaired, and the infrastructure modernized. The cost for this work was $180 million. The state of California provided a $21 million tax incentive because PG&E maintained the architectural integrity of the building. PG&E also develops earthquake engineering technologies to strengthen existing buildings and to improve the design of new facilities. PG&E funds earthquake engineering research with USGS in Menlo Park and at the Pacific Earthquake Engineering Research Center at the University of California, Berkeley.

The Pacific Earthquake Engineering Research (PEER) Center performs research on performance-based earthquake engineering, response of unsafe concrete bridges, bridge response to ground motions, and safety and reliability of utility systems and lifelines. PEER developed an interactive Web site on research results from Internet searches of experimental results and data. Three PEER papers were discussed: "Repair of Moderately and Severely Damaged Bridge Columns," "Numerical Modeling and Simulation of Seismic Soil-Pile-Structure Interaction Experiments," and "A Database of Experimental Results on Earthquake Protective Systems Hardware." PEER staff highlighted research in their Earthquake Simulator Laboratory at the Richmond Field Station. The 6 m by 6 m simulator is configured to produce three co-translational components of motion. During a visit to the Hayward Fault (the Berkeley Campus sits atop the Hayward fault) the delegation was informed of a recently developed uniform rating system to evaluate the seismic vulnerability of over 150 Berkeley campus buildings. Findings from the rating system suggest that it is cost-effective to strengthen buildings rather than demolish them.

The California Department of Transportation (CALTRANS) hosted the delegation with discussions on and visits to the San Francisco-Oakland Bay Bridge. Under way is a $125 million retrofit program to reduce seismic risks to the west section of the bridge. A new east section is to be constructed in 2003. The new bridge will be a single-tower suspension bridge designed to withstand a magnitude 8 earthquake. Its design will complement other suspension bridges around the Bay. When the new bridge is open for traffic, the old bridge will be dismantled and sold in sections for use by other countries.

San Francisco City Hall provided the setting to learn about the retrofitting of this 1915-beau Arts structure. Turner Construction is the general manager of the seismic retrofit project; Forell/Elsesser Engineers Inc. is the prime architect/engineer firm performing the seismic retrofit of the 47,983 m^2 building. The building opened on New Year's Eve 1998. The structural work is designed to withstand a magnitude 8 earthquake. The repair work involved installing a new base isolation system for the entire City Hall—530 1-m diameter rubber-lead core base isolators (designed to 0.5 m displacement) and 66 slider isolators under the ground floor. Following the discussions on the renovation work, Dr. Hsi-Ping Liu, Structural Engineer from USGS, presented USGS' work in instrumenting selected San Francisco facilities near four deep bore holes. Data records from these bore holes were used in developing ground shaking amplification mapping.

The National Weather Service hosted the delegation at its Monterey office. Discussions centered on storm field experiments to improve numerical weather forecast models to better simulate the present and future states of the atmosphere; development of numerical model studies of typhoon flows over the Japan islands that are approximating real-time weather during the approach and landfall of typhoons; and a review on new NOAA technologies for forecasting weather using Doppler weather radar.

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Highlights of Recent T/C Workshops

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T/C H, Workshop on Soil Dynamics Studies by Centrifuge

On 28-29 September 1998 at the Public Works Research Institute, Tsukuba, Japan, T/C H conducted a workshop on Soil Dynamics Studies by Centrifuge. Mr. Michael Sharp led the U.S. delegation on behalf of Dr. Mary-Ellen Hynes, U.S.-side T/C Chair, both are from the CORPS' Waterways Engineering Station, and Mr. Sharp served as co-chair with Mr. Osamu Matsuo of the Public Works Research Institute (PWRI). Dr. Koichi Yamamoto, Deputy Director-General, PWRI, gave the opening remarks welcoming participants to the workshop. Forty-nine researchers attended the workshop; 39 from Japan, six from the United States, two from Canada, one from England, and one from India. Eighteen technical papers were presented.

The two-day workshop was divided into seven sessions:

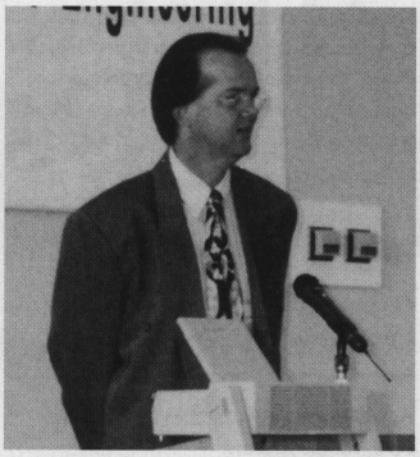
1) liquefaction and liquefaction induced failures;

2) liquefaction and its effects on foundations, structures, and embankments;

3) seismic effects on retaining walls and philosophies behind centrifuge modeling;

4) remediation modeling by centrifuge models and comparison with large scale tests;

5) composite breakwaters under earthquake shaking;



Michael Sharp U.S.-side acting Task Committee chair is delivering opening remarks at the workshop.

6) aging effects and behavior of liquefying soils; and

7) U.S. Army Centrifuge Research Center.

The participants gave presentations and raised several key points in centrifugal investigations such as: use of sinusoidal motions versus actual field recorded motions for research purposes; variations and applications of different containers; need for more numerical modeling and field validation; need to extract more from recorded data than presently employed; and need to share and cooperate more with other researchers. The delegation visited PWRI's centrifuge and large-scale 3D shaking table facility. The Workshop proceedings is under development by PWRI.

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T/C A, Workshop on Strong Motion Data and Applications

Twenty-eight earthquake engineers and scientists from the U.S. and Japan participated in T/C A Workshop on Soil-Structure Interaction held at USGS, Menlo Park, CA, 22-23 September 1998. The workshop was funded by NSF and USGS and several Japanese organizations. It was organized by Dr. Mehmet Celebi, USGS, and Dr. Izuru Okawa, Building Research Institute. The participants presented 28 technical papers on topics such as: current SSI methods used in design/analyses processes in Japan and the United States; existing experimental SSI research arrays and/or facilities and those in development; and methods to improve cooperation on future SSI research. The participants discussed the issue of funding not being increased in recent years and the number of SSI publications remaining steady (why hasn't there been growth?). The participants recommended organizing an International Association for Soil-Structure Interaction (IASSI) aimed at improving funding for SSI research and communication between researchers and practicing engineers. A pre-proceedings volume of the workshop was made available. The official Workshop proceedings, including the papers and recommendations, will be published before the 31st Joint Panel meeting.

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Members from the Task Committee Workshop on Soil-Structure Interaction.

Spotlight on US Member Agencies

Agency for International Development

The Agency for International Development (AID) is represented on the Panel by its Office of Foreign Disaster Assistance (OFDA). OFDA manages the U.S. government's humanitarian assistance in response to natural and manmade disasters that occur overseas. OFDA also oversees a portfolio of projects designed to prevent or reduce the impact of disasters on the people and economic infrastructure in foreign countries; provides technical and logistical support to its programs and personnel overseas; and administers the financial and accounting systems for disbursement of funds to respond quickly to disasters. OFDA maintains field personnel in countries to monitor disaster response and support activities.

Increasingly, OFDA deploys short- or long-term field personnel to countries where disasters are occurring or threaten to occur. The largest percentage of OFDA's assistance goes to relief and rehabilitation project grants managed by qualified local relief organizations. Relief projects include airlifting supplies to affected populations in remote locations, providing funds to support primary health care and supplementary feeding centers, and providing shelter materials to disaster evacuees and displaced persons. The first principle in disaster response accountability is to ensure that appropriate assistance gets to the neediest victims in time to minimize death and suffering.

Not all of OFDA's assistance goes to providing aid in response to disasters. OFDA also oversees a portfolio of projects designed to reduce the impact of disasters on victims and economic assets in disaster-prone countries. Over the last several years, OFDA invested in various programs in partnership with the USGS, Pan American Health Organization, the Asian Disaster Preparedness Center, the World Environment Center, and other offices within AID. These programs enhance a country's capacity to manage its own disasters and hazards and they promote the transfer of technology, goods, and services between the United States and the host country. OFDA publications are available on the Internet and by request.

For additional information:
see AID's Web Page
http://www.info.usaid.gov
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Base of main scarp of the Pajarito fault looking up the trench from the toe of the main scarp.

The U.S. Department of Energy Natural Phenomena Hazards Programs

The U.S. Department of Energy (DOE) is responsible for ensuring energy security, maintaining the safety and reliability of nuclear stockpiles, cleaning up the environment from the legacy of the Cold War, and developing innovations in science and technology. DOE's work takes place in a wide range of facilities throughout the country, and they are exposed to a wide spectrum of natural phenomena hazards. The work involves operations with hazardous radioactive and chemical materials. A high level of attention is given to assuring that the buildings and equipment provide

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Spotlight on Japan-side Member Agencies

Geographical Survey Institute

The Geographical Survey Institute (GSI) is the national survey and mapping organization under the Ministry of Construction. Established in 1869, GSI is the sole national organization that conducts basic survey and mapping and defines the land conditions in Japan. GSI's four major tasks are:

1) survey administration based on the Survey Act;

2) implementation of survey works mainly composed of basic surveys;

3) research and development in survey and mapping; and

4) international cooperation for survey and mapping.

The GSI Headquarter is in Tsukuba; 10 regional survey departments and two Geodetic Observatories are located throughout Japan. GSI has eight departments/centers: geodetic, topographic, geographic, cartographic, geodetic observation, and geographic & crustal dynamics research. Panel-related research is mainly carried out at the geographic department and geographic and crustal Dynamic Research Center.

In the field of earthquake engineering, several major research activities are being performed such as continuous monitoring of crustal deformation and geographical surveys of predicting earthquakes. GSI has been operating its GPS array nationwide since October 1994. This network is designed for two purposes: crustal deformation monitoring and a highly precise new geodetic network. The Institute is precisely monitoring crustal deformation with almost automatic processing, and its accuracy is within several millimeters in horizontal direction and within several centimeters in vertical. GSI is producing "Active Fault Map in Urban Area" which shows the location of active faults around major urban areas. Fifty-six map sheets had been prepared by 1998 at a scale of 1:25,000. Traces of active faults are detected by aerial photo interpretation and geomorphological research.

Additional information is available at:
http://www.gsi-mc.go.jp/

Meteorlogical Research Institute

The Meteorological Research Institute (MRI) was established in 1947 as a branch of the Japan Meteorological Agency (JMA) under the Ministry of Transport. MRI is organized with an Office of Planning, Administration Department, and nine research departments where research is performed as well as development of technology for operational work. Its primary research subjects correspond to its research departments:

1) weather forecasting techniques;

2) global climate changes and variability;

3) tropical meteorology and typhoons;

4) precipitation mechanisms, boundary layer, atmospheric ozone, and radiation;

5) environmental and applied meteorology;

6) meteorological satellites and weather observation systems;

7) prediction of earthquakes, tsunamis, and volcanic eruptions;

8) general ocean circulation and predictability; and

9) atmospheric, oceanic, and crust chemistry.

Recently, global environmental anthropogenic issues, such as global warming due to the increase of carbon dioxide or other greenhouse gases and the depletion of stratospheric ozone due to CFCs, have been given attention. The Intergovernmental Panel on Climate Change (IPCC) has requested contributions of climate research to be integrated in its scientific assessment. Ongoing research has been making a contribution through a national priority project to the IPCC based on a coupled atmosphere-ocean modeling. Research efforts also are being made on ozone depletion based on monitoring observations.

Research in typhoons, severe storms, earthquakes, and tsunamis are contributing to the Panel's mission. In September 1998, Typhoon 9807 hit the central Japanese Islands and brought strong winds, which caused severe damage. A research program was initiated to survey the damages and to find ways of reducing future threats from severe winds. In 1996, a tornado and a downburst occurred in the detection range of the Doppler radar installed by JMA at Narita Airport. MRI researchers investigated the structures using such techniques as radar and wind profilers. MRI performed the survey and observation of related phenomena in situ and revealed the generation mechanism of earthquakes and tsunamis by using numerical simulations. After the disaster in Kobe in 1995, MRI started a research project to study crustal activity in and around the intraplate seismic gap where a strong earthquake may occur in the near future.

Additional information is available at:
http://www.mri-jma.go.jp/

Spotlight on US Member Agencies

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adequate protection to the worker from potentially damaging effects of natural phenomena hazards.

A set of DOE natural phenomena hazard (NPH) technical standards has been developed over the past 10 years based on the objective of reducing risks from earthquakes, wind, and floods. These standards establish a process for investigating the site hazard characteristics; developing a hazard function that depicts hazard severity as a function of frequency; and selecting the hazard load and design rules based on the importance of the structure, system, or component has in preventing unacceptable consequences. National consensus design codes and standards are used where possible and are selectively modified or supplemented to achieve a balanced design for protection against the identified natural hazards.

The Department has been using their NPH standards in upgrading the safety analysis of existing and new facilities. This activity has been going on in parallel with the development of the NPH technical standards. The feedback from the application experience is being used to refine the NPH standards and keep them current with developments outside the Department. As a part of its NPH Program, DOE also conducts geological field investigations. The photograph on page 5 shows the geologic field investigation being performed on the Pajarito Fault to determine the frequency of earthquakes. The trench exposes soils of the different ages that can be used to measure the rate of slip for this fault. In addition, DOE is contributing to an effort by the American Nuclear Society and the American Society of Civil Engineers to develop a set of national consensus seismic design standards to address the same broad scope of nuclear facilities covered by the Department's NPH technical standards.

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