EERI

EARTHQUAKE ENGINEERING RESEARCH INSTITUTE

NEWSLETTER

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NEWS OF THE INSTITUTE

Summary of the Minutes of the October 19, 1987, Board of Directors Meeting

Directors present: C. Allen, R. Borcherdt, W. Clough, F. McClure, R. Olson, D. Ward, R. Whitman, and L. Wyllie. Present during portions of the meeting were R. Hanson, C. Poland, A. Kiremidjian, Association Director Newman, Administrative Secretary Strom, and Consultant Treseder.

Minutes of July 19, 1987 Board of Directors Meeting were approved.

The Directors met in Executive Session to interview applicants for the newly created position of Executive Director.

Secretary/Treasurer Lagorio's income and expense statement as

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THE TOKYO EARTHQUAKE OF DECEMBER 17, 1987

This report is provided by Makoto Watabe, Professor of the University of Tokyo Metropolitan and Visiting Professor at Stanford University, as a contribution to the EERI Learning from Earthquakes Program. This program is sponsored by the National Science Foundation.

At 11:08 a.m. on the 17th of December, 1987, severe ground shaking terrified people in the Tokyo metropolitan area. The reported information of this earthquake is shown in Table 1 and Figure 1.

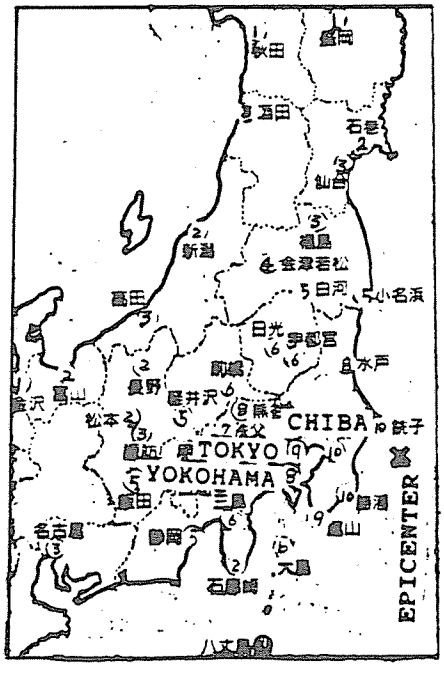

Fig. 1 Epicenter and intensity map.

1) Source and Intensity of the Earthquake

The hypocentral area of this earthquake is the so called triple junction of three plates, the Continental plate from the northwest, Pacific plate from the southeast, and Philippines plate from the south as is shown in Figure 2. This source area has also been a seismic gap and for 37 years no earthquake greater than magnitude 5.5 has been reported. The intensity distribution from this earthquake is

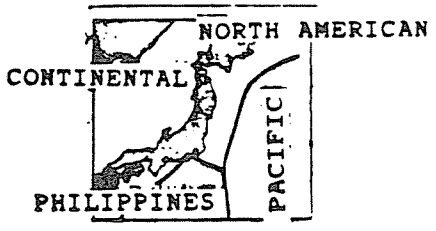

Fig. 2 Triple junction of plates.

shown in Figure 1. The approximate intensities are converted from the Japanese scale. As is well known, Japan is a seismically prone country and sixteen earthquakes greater than magnitude 6 have been recorded in 1987. It is clear that earthquakes of this size occur frequently in Japan. However, this particular earthquake was reported internationally as a major earthquake because it had shaken Tokyo metropolis with some severity.

Figure 3 shows free field accelerograms recorded in the City Park in Kotoh-ku (an eastern district in Tokyo, closer to the epicenter). The time difference between P and S arrivals is about 11 seconds, and the focal distance from this site is estimated to be about 90 kilometers. The peak acceleration of the east-west component is 101 cm/sec^2. According to the attenuation equation based on past earthquake records on rock sites in Japan, the average peak acceleration on rock sites due to an earthquake of magnitude 6.6 and hypocentral distance of 90 km is estimated to be approximately 25 cm/sec^2.
As can be observed in Figure 3, the duration of ground motion is about 70 seconds, which is quite long compared with the average duration for an earthquake with magnitude 6.6, and suggests successive multiple events.

2) Social Effects

Statistics and damage features are summarized in Table 2. The

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TOKYO EARTHQUAKE

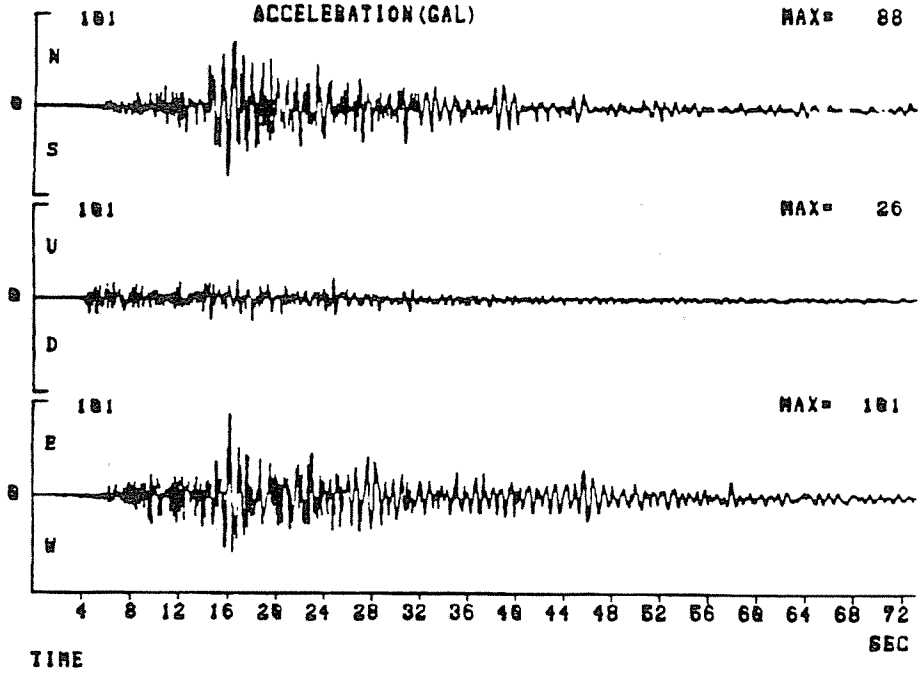

Fig. 3 Free-field accelerograms, approximately 90 km from the hypocenter.

case of the death caused by the overturned concrete block fence provides us with an agonizing lesson. This concrete block wall, consisting of a one foot high concrete foundation and seven layers of 8 in. high concrete blocks, had no re-bars in the upper three layers of blocks and is obviously added construction without any official approval.

It should be noted also that housewives and small children have been the victims of this kind of tragedy in the past. The June 14, 1978 Miyagiken-oki Earthquake with magnitude of 7.4 overturned many concrete block fences in the area of Sendai City (about 100 km from the epicenter) and killed fourteen small school boys and elderly women. Since then, earthquake resistant details for foundation and re-bars of masonry walls have been more strict than ever. Most local governments have made the public aware of the danger posed by these masonry walls and have encouraged the reinforcement.

However, again it happened. This kind of tragedy cannot be prevented by laws but only through education that makes the public aware of the potential danger of these materials if not properly used.

No fires broke out. According to a poll of Tokyo citizens, conducted immediately after the earthquake by the Tokyo Fire Prevention Agency, 81% of the respondents felt fear. Nearly 50% were using some fire sources and 95% of these extinguished the fire sources during the earthquake. 12% of those who failed to extinguish the fire sources became stricken with panic and unable to move. 25% of the respondents reported overturning of furniture or falling objects such as kitchen boards, dishes, glass cases, heavy pressing irons, and audio speakers.

Department stores and high-rise buildings are usually equipped with automatic announcing systems to provide information to occupants, such as "the intensity of the earthquake was ..., this building will never collapse, so please stay calm and follow the instructions by our staff ..." A young lady doctor in a rehabilitation hospital protected an aged man from falling objects by covering him.

Base isolation systems worked perfectly, reducing response motions to one fifth.

TABLE 1 EARTHQUAKE INFORMATION

*TIME: 11:08 a.m. local time (0208 GMT), December 17, 1987

*MAGNITUDE: M=6.6

*EPICENTER: 20 km east offshore of Chiba Pref. (neighbor district of Tokyo Met.)

*FOCAL DEPTH: 70 km (may be the subduction zone at the triple junction)

TABLE 2 EARTHQUAKE DAMAGE FEATURES

*DEATHS: 2 (crushed by overturned concrete block fence, and by big stone lantern at a temple)

*INJURED: 65 (3 serious)

*STRUCTURES: Some minor damage, no collapse

*NON-STRUCTURAL MEMBERS: Many glass panes broken; at Narita Airport 120 panes damaged

*HIGHWAY: Some cracks in pavements. Drivers were requested to reduce car speed to 35 mph for about 2 hours

*ELECTRICITY: 2 power stations were automatically shut down, and resumed in one hour

*RAILWAY: Trains were stopped to check possible damage and resumed in 2 hours; 650,000 riders affected. All bullet trains stopped; 91,000 riders affected

*WATER LINES: 2 submain pipes were fractures

*GAS LINES: No damage

*TELEPHONE: Saturated for one hour (Tokyo has 10 million lines)

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methods for the actual repair process. Temporary and permanent repair procedures are reviewed for river coastal and erosion control facilities, roads, bridges, tunnels, and waste water pipelines. Specific examples from the U.S. and Japan are provided for each of these types of structures. Emphasis is also given to emergency response in the event of damage and the importance of information collection and dissemination of this information to the public.
The original Japanese document is 539 pages. For further information on cost and availability, please contact William R. Johnson, National Center for Earthquake Engineering Research, SUNY Buffalo, 118 Red Jacket Quadrangle, Buffalo, NY 14261, (716) 636-3391.

NEWS OF THE PROFESSION

Stanford Linear Collider Has EQ Safety System

Key pieces of highly sensitive equipment at Stanford University's new Linear Collider are now better prepared to withstand earthquakes.

Seismic isolators from Dynamic Isolation Systems Inc. (DIS) have been installed beneath the collider's Mark II Detector Unit and additional isolators are being placed under the Liquid Argon Calorimeter.

DIS, a Berkeley-based developer of engineered systems for earthquake safety of buildings, heavy equipment, bridges and other structures, specializes in designing seismic isolators -- lead-rubber bearings -- that act as shock absorbers during an earthquake. The seismic isolators can be installed in new or existing structures.

More information can be obtained from Donald K. Hansen, Dynamic Isolation Systems Inc., (415) 843-7233.

ASFE Name Change

The Association of Soil and Foundation Engineers has changed its name to its acronym ASFE, in response to significant changes in its membership and the services provided by member firms. In print, the ASFE acronym will be modified by "The Association of Engineering Firms Practicing in the Geosciences." More information from John P. Bachner, Executive Vice President (301) 565-2733.

SRC to Address Computer Technology

Computer Technology Applied to Structural Stability will be a feature of the 1988 Annual Technical Session of the Structural Stability Research Council (SSRC) when it meets at the Radisson University Hotel in Minneapolis, Minnesota on April 25-27, 1988.

The Technical Sessions scheduled for 26-27 April will cover reports of current research activities germane to the various Council task groups and task reporters. An opportunity is provided for practicing engineers and research workers to describe their latest findings and to exchange information with others working in similar fields. Open task group meetings on 25 April precede the Technical Session.

In addition to the papers on a wide range of subjects related to stability of metal structures, a special Theme Session chaired by Theodore Galambos (EERI, 1977) of the University of Minnesota will be held Tuesday afternoon. Speakers will include William McGuire (EERI, 1984) of Cornell University, Peter Birkemoe of the University of Toronto, Wai-Fah Chen (EERI, 1979) of Purdue University, Howard Harrison of the University of Sydney, Richard Gallagher of Worcester Polytech Institute, and Steven Fenves of Carnegie-Mellon University.

This will be followed by a Tuesday evening Panel Discussion on "Computer Technology Applied to Structural Stability" moderated by Gerard F. Fox of Howard Needles Tammen & Bergendoff. Panelists will be Charles H. Thornton of Thornton-Tomasetti, P.C., Michael H. Ackroyd of Visual Edge Softward Limited and William J. LeMessurier of LeMessurier Consultants, Inc..

For further information concerning the conference and the program, please contact SSRC Headquarters, Fritz Engineering Laboratory #13, Lehigh University, Bethlehem, PA 18015 (215)758-3522/3519. In the Minneapolis area, contact Prof. Theodore V. Galambos (612) 625-0545.

NEWS OF THE MEMBERSHIP

Big Bear Dam Notes from Schaefer Dixon

A well-done flyer from SDA (Schaefer Dixon, EERI 1975) describes briefly their work on the Big Bear Municipal Water District's Big Bear Dam, as a result of investigations showing the dam to be unsafe in the event of a major earthquake.

THE TOKYO EARTHQUAKE OF DECEMBER 17, 1987

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*ELEVATORS: 1 lady was kept in an elevator for one hour

*HOSPITALS: No effect on surgery operations

*OTHERS: Unidentified number of bottles and ceramics were overturned or fell in many shops. On-line computer systems in banks were unaffected except in 2 cases, in which normal operations were resumed the same day.