KASHIWAZAKI, JAPAN EARTHQUAKE OF JULY 16, 2007

LIFELINE PERFORMANCE

Edited by Alex K. Tang, P.E. and Anshel J. Schiff



Technical Council on Lifeline Earthquake Engineering Monograph No. 31 October 2007





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Published by The American Society of Civil Engineers 1801 Alexander Bell Drive Reston, Virginia 20191–4400

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Cataloging-in-Publication Data on file with the Library of Congress.

American Society of Civil Engineers 1801 Alexander Bell Drive Reston, Virginia, 20191-4400

www.pubs.asce.org

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Preface

The Earthquake Investigation Committee of the Technical Council of Lifeline Earthquake Engineering (TCLEE), American Society of Civil Engineers (ASCE), was established to initiate, organize, train for, co-ordinate and evaluate the performance of lifelines following earthquakes. Members of the committee are employees of lifeline industries, consulting engineers, and academics from the United States and Canada. Committee members provide services on a voluntary basis. For some earthquake investigations, participant's companies do not require an individual to take vacation time for the investigation and may provide some support for expenses. ASCE also provides support to reimburse expenses. In addition to the time associated with the reconnaissance trip, the substantial effort by each individual to prepare a short report for the TCLEE Web page, and the full report for the monograph series is all done on a voluntary basis. The cost of this effort is substantially more than the support provided by ASCE.

Individuals participating in the investigation need not be members of the committee or members of ASCE, but they are expected to follow the committee's earthquake investigation practices as described in the ASCE publication, TCLEE Monograph 11, "Guide to Post-earthquake Investigation of Lifelines." Members of the investigation team coordinate with other groups and may participate in groups organized by other organizations. They gather both good and poor performance data from domestic and foreign earthquakes to provide information for practitioners to improve the performance of the lifeline systems. The foreign earthquakes that have been investigated include the 1985 Chile, 1988 Soviet Armenia, 1990 Philippines, 1991 Costa Rica, 1992 Kocaeli (Turkey), 1994 Kobe (Japan), 1999 Kocaeli (Turkey), 1999 Chi-Chi (Taiwan), 2001 Gujarat (India), 2002 Atico (Peru), and 2004 Zemmouri (Algeria) earthquakes.

The Kobe earthquake report is the first foreign earthquake investigation report published by ASCE as a TCLEE monograph, number 14. The first domestic earthquake investigation report published by ASCE as a TCLEE monograph, number 8, was for the Northridge earthquake. Prior to this time, TCLEE prepared a lifeline report that was published by the Earthquake Engineering Research Institute (EERI). The Earthquake Investigation Committee continues to cooperate with EERI to provide an abbreviated version of lifeline performance in Earthquake Spectra (EERI publication). TCLEE publishes brief preliminary reports on the ASCE/TCLEE Web page.

To provide information on the tectonic and ground motion data, experts in these fields are often asked to contribute to the reconnaissance report. This information is of value in providing a perspective to the lifeline damage report.

Alex K. Tang and Anshel J. Schiff October 2007

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TCLEE Monograph Series

These publications may be purchased from ASCE, telephone 1-800-548-ASCE (2723), World Wide Web http://www.asce.org.

The TCLEE web site is www.asce.org/community/disasterreduction/tclee_home.cfm and click on publications.

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ASCE Manual

Schiff, Anshel J., Editor, Guide to Improved Earthquake Performance of Electric Power Systems, ASCE Manual 96.

TCLEE Earthquake Investigation Reports

TCLEE has also prepared numerous earthquake reports that have appeared in other publications. References to these reports and ten short reports associated with TCLEE monographs can be viewed on the ASCE/TCLEE web site address given below. The 10 short reports are each about 5 to 15 pages long, contain a summary of main observations and some pictures and can be downloaded at www.asce.org/community/disasterreduction/tclee_home.cfm

Acknowledgements

Most of the contributing authors of this report are members of the Earthquake Investigation Committee (EIC) of Technical Council on Lifeline Earthquake Engineering (TCLEE). Anshel Schiff, Curt Edwards, Yumei Wang, and Alex Tang were funded by ASCE. Stephen Dickenson was funded by NSF and GEER and joined the GEER Team two weeks before the ASCE Team. Mark Yashinsky was funded by EERI. Jorgen Johansson was funded by the University of Tokyo. Hiroyuki Yanagawa was funded by JSCE. The investigation team was grateful to the American Society of Civil Engineers (ASCE) International Group that set up the interface with Japan Society of Civil Engineers (JSCE). ASCE support was received at the direction of Pat Natale (executive director), with support from John Durrant, John Segna, Tenzing Barshee, Mike Sanio, and Meggan Farrell. Furuki Moriyasu, Hajime Inagaki, Kozo Katayama, and Yukiko Shibuya of JSCE provided the team with local logistics support. Translation of all the materials from Japanese to English by Yukiko Shibuya of JSCE helped to enrich the contents of this report. We deeply appreciate her extra effort to accommodate our requests.

In addition to all the individuals acknowledged in the chapters, the investigation team was also assisted by many groups and individuals in the field. The debriefing session set up by JSCE with presentations by Prof. Kazuo Konagai, Prof. Muneo Hori, and Prof. Jörgen Johansson (all of the University of Tokyo), Tomoharu Maeda of Tohoku Electric Power Co, and his team (Yuji Sato and Daisuke Aoki), and Toshio Iwasaki, Ph.D., of the Public Works Research Center (PWRC) proved to be extremely helpful for the days in the field.

Tohoku Electric Power Co., Inc. not only provided us with access to their facilities, they also shared with us the information collected soon after the earthquake. They also provided us with the damage information and fixes for the 1964 earthquake in this area.

Public Works Research Institute (PWRI) lead by Shigeki Unjoh, Tetsuya Sasaki, and Joji Nakano provided us with car and escort vehicles to visit damaged sites proved to be one of the success factors of this report. This event was the work of Toshio Iwasaki, Ph.D.

We were also greatly indebted to Chiharu Kinami and Masatoshi Yamaga of NTT for their assistance to provide us with access to the Central Office in Kashwazaki and a remote office between Kariwa and Kashiwazaki. Yamaga-san also provided us with data of damage and pictures. We are thankful for Peter Yanev, who introduced us to the two NTT gentlemen.

In the field we also have excellent support from Prof. Hirkazu Iemura of Kyoto University and Prof. Yozo Goto of Fuji Tokoha University, who set up meetings at City Hall, Gas, and Water Bureau for the team. They also accompany the team to these meetings and site visits.

We cannot leave this section without mentioning the support and the translation provided by Prof. Jörgen Johansson throughout the whole period in the field.

Alex Tang, F. ASCE, Investigation Team Leader Curt Edwards, F. ASCE, Chair of Earthquake Investigation Committee



ASCE/TCLEE Investigation Team at JSCE briefing session. The meeting was set up by JSCE to help our investigation effort. **Front row**: Yumei Wang (ASCE/TCLEE) **Middle row** (left to right): Yuji Sato (Tohoku Electric Power), Kazuo Konagai (The University of Tokyo), Alex Tang (ASCE/TCLEE), Tomoharu Maeda (Tohoku Electric Power), Toshio Iwasaki (PWRC) **Third row** (left to right): Daisuke Aoki (Tohoku Electric Power), Curt Edwards (ASCE/TCLEE)

Third row (left to right): Daisuke Aoki (Tohoku Electric Power), Curt Edwards (ASCE/TCLEE), Jörgen Johansson (The University of Tokyo), Anshel Schiff (ASCE/TCLEE), Mark Yashinsky (EERI), Kurt McMullin (San Jose State University)



Yukiko Shibuya of JSCE and Anshel Schiff are working the details of contacts for the investigation in Kashiwazaki.