

ASCE – Technical Council on Lifelines Earthquake Engineering  
Field Reconnaissance Team  
Niigata-ken Chuetsu-Oki Earthquake, Japan  
August 2007

Preliminary Report on July 16, 2007 Niigata-ken Chuetsu-Oki earthquake in Japan  
Submitted by the ASCE Technical Council on Lifeline Earthquake Engineering (TCLEE)  
reconnaissance team

The July 16, 2007 Niigata-ken Chuetsu-Oki earthquake, which was located just off the west coast of Honshu in the Niigata Prefecture, Japan, had a moment magnitude of 6.6. The reverse fault is oriented in the northeast direction, and is parallel to Japan's northern coastline. The maximum ground motion was  $6.67 \text{ m/s}^2$  and JMA intensities of 6 + (equivalent to MMI IX). Low-to-moderate damage was observed in Kashiwazaki located southwest of the earthquake (population 96,000), and smaller towns in the area such as Kariwa (south), and Nishiyama (south-southeast). Ground shaking levels and ground failures were intensified due to the proximity of river systems, flood plains of high ground water levels and the presence of soft and liquefiable soils. Damage of engineered structures was largely caused by soil failures from liquefaction, lateral spreading and subsidence.

In order to reduce travel time visiting damaged sites, the field reconnaissance team stayed in Kashiwazaki where there is no gas supply. The team members were very alert every morning after a cold shower!

On August 3, 2007 the Kashiwazaki disaster preparedness officials at the City Hall provided TCLEE Team with a brief summary of impact from this earthquake. Human casualty included 11 fatalities and 1,339 injured and 908 houses were destroyed in Kashiwazaki City. Immediately after the quake, 11,000 people required emergency shelter, since August 3, 10,000 people have returned to their homes. Temporary housing is being constructed for the remaining 1,000 people whose homes are not repairable. The military have been providing relief support, and in addition approximately 7,000 volunteers from outside the region were available to provide support to the people affected by the earthquake.

Although the human casualties are minimal, this earthquake had tremendous societal impacts, in particular there were concerns about safety of the country's largest nuclear power plant facility. As a consequence of the damage reported, Kashiwazaki-Kariwa nuclear power plant (7,965 MW) will be closed for a year.

Damage to buildings, and lifelines such as, bridges, highways, railways, ports, water, wastewater, gas, electric power, telecommunication and critical facilities were observed. Due to the poor soil in the region the damage was wide spread and mostly along the coastal area and flood plains. Landslide and ground deformation resulted in damage to highways, roads and railways in many locations. A parked rail car was tip on its side at the station. Differential movements between bridge abutments and roads were observed

and were repaired within two weeks. The wastewater treatment plant sustained damage that impacted normal service operations for a few days.

There were three fires reported, one of the fires was at the nuclear power plant. There was no observed physical damage to the telecommunication systems; however, the usual high volume of calls impaired the system reducing its performance. There were five locations of underground fiber optic cable conduit severed (5% of the fiber conductor in these cables were cut). Again due to poor soil, other underground facilities such as water pipelines, and gas pipelines sustained damage. The water system was fully restored by 31 July while the gas system is being repaired. However, the gas system was not fully restored as of Aug 08, 2007. Damage to power system was not as severe; however there were a few transmission towers with stressed structural members due to soil failure but none collapsed. Electric power was out for a maximum of three days in some areas. According to the Niigata Prefecture, the estimated loss due to damage to local infrastructure, including transportation, water, wastewater, gas and housing, is over \$13 billion (USD).

The degree of severity to lifeline damage varies from lifeline to lifeline, yet the interruption of lifeline services has a significant impact on economy. For example, the loss of revenue from the Kashiwazaki-Kariwa nuclear power plant could exceed \$1.66 billion (Associated Press, 7/26/2007). Slowed and/or stopped production of the auto industry resulted in loss of stock market prices and revenue for Toyota, Honda, Nissan, and Fuji.

The TCLEE reconnaissance team conducted its investigation from August 1 to 6, 2007. The team included: Stephen Dickenson (also on GEER team), Curt Edwards, Anshel Schiff, Alex Tang (leader), Yumei Wang, and Mark Yashinsky (also on EERI team). The team received support from Moriyasu Furuki (executive director) of the Japan Society of Civil Engineers (JSCE) in cooperation with ASCE. JSCE team members, Hiroyuki Yanagawa from JSCE, and Jorgen Johansson from the University of Tokyo, Professor Hirokazu Iemura from Kyoto University, and Professor Yozo Goto from Fuji Tokoha University. JSCE organized a briefing for ASCE/TCLEE Team with presentations by Professor Kazuo Konagai and Professor Muneo Hori, both at the University of Tokyo, Tomoharu Maeda of Tohoku Electric Power Co, and Toshio Iwasaki of the Public Works Research Center. Many organizations and individuals provided support including: Shigeki Unjoh of the Public Works Research Institute on transportation; Kashiwazaki city officials; Rob Kayen of the U.S. Geological Survey who led the GEER team, and others (who will be listed in the forthcoming TCLEE monograph).

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Photo taken after the briefing session at JSCE.

ASCE/TCLEE Team members, Dr. Iwasaki (PERI), Dr. McMullin, Professor Johansson (University of Tokyo), Professor Konagai (University of Tokyo), Mr. Maeda (Tohoku Electric Power Co.), Mr. Sato (Tohoku Electric Power Co.) and Mr. Aoki. (Tohoku Electric Power Co.)