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The Value of Seismic Risk Mitigation in Canterbury, New Zealand

Institute for Geological and Nuclear Sciences

Massey University

New Zealand

David Johnston

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As the case of the 2010-2011 Canterbury earthquakes in New Zealand illustrates, seismic risk mitigation programs can have a significant impact on reducing future losses from earthquake events, both in terms of reduced losses and of facilitating a faster response and recovery. The local electricity distribution company, for example, had been undertaking detailed seismic risk assessment and mitigation over the decade before the earthquake, spending over $NZ6 million on seismic strengthening of their network. It is estimated that this work saved them in excess of $60 million in direct asset replacement costs and repairs. This and other positive examples contrast with that of Christchurch's history of land-use decisions, which allowed residential development on land that had been identified as susceptible to liquefaction, lateral-spreading and subsidence in the event of earthquakes.

Expanded text The M_W 6.3 Christchurch earthquake struck at 12:51pm local time on 22 February 2012, causing 185 deaths, over 7000 injuries and in excess of US$12 billion in damage (Bannister & Gledhill 2012). The Christchurch earthquake occurred approximately six months after the 4 September 2010 M_W 7.1 Darfield earthquake, whose epicenter was 20km west of the city. There were no deaths and few major injuries from the September 2010 event, but property losses were in excess of $US 4 billion. Further damaging aftershocks continued through the remainder of 2011.

A community's infrastructure provides services, utilities and linkages which allow society to function. The term 'lifelines' is commonly used for this infrastructure. Lifelines are the means whereby a community supports its day to day activities and include mechanisms used to respond to and recovery emergencies. These systems are often large, complex and interdependent. Failure of one system (or part of it) causes repercussions in other systems and therefore increases a community's vulnerability further. Over last two decades several New Zealand projects have been initiated to address the issue of the vulnerability of 'lifelines' to natural hazards. The Wellington Earthquake Lifelines Study examines the impacts of a major earthquake on the engineering lifeline services (water, drainage, electricity, transportation etc.) in the Wellington region. The Christchurch Engineering Lifelines Study (Christchurch Engineering Lifelines Group 1997) extended the range of hazards considered to include earthquakes, snow and wind storms, flooding and tsunamis. A key feature of both projects was the wide involvement of engineers and managers from utility organisations, including local authorities, and private and public companies.

Since the release of the 1997 report (Christchurch Engineering Lifelines Group 1997), Christchurch's utilities companies built seismic mitigation and other resilience activities into their daily business practices. Inter-organisational collaboration was facilitated and formalized through the Canterbury Lifeline Utilities Group. The outcomes of these efforts were seen following 2010-2011 earthquakes in numerous ways, including (from Fenwick 2012):

- The resumption of operations within days of the earthquake at the Port of Lyttelton, despite significant damage, due in large measure to the strengthening work that had been done in previous years.

- Savings in excess of $65 million in direct asset replacement costs and repairs by Orion, the local began electricity distribution company, and a comparatively rapid restoration of supply to the majority of the city, due to $6 million of seismic strengthening work that had begun in

1996, and progressed systematically each year. From this time onwards, new facilities were designed to withstand a 500-year seismic event with little or no service disruption. Seismic restraint work undertaken by Transpower (the national electricity grid operator), which had been ongoing since the 1987 Edgecumbe Earthquake, also contributed to this outcome.

- The ability of telecommunication buildings to continue to operate throughout the earthquake series, due to seismically braced equipment in telecommunication buildings in Christchurch did not fail after the earthquake.

- The continuation of the national emergency 111 service in which Christchurch had a major role, due to Telecommunications backhaul duplication arrangements that had ensured backup in other parts of New Zealand.

- The viability of most bridges in the city due to risk screening and retrofitting of bridges by the Christchurch City Council and the New Zealand Transport Agency (although lateral spreading did cause the temporary closure of a few bridges).

- Continuation of petroleum supplies, due to cooperation between utilities. Mobil, the operator of the city's (main) Woolston Terminal, for example, received support from Orion and from Council water authorities, facilitating continued petroleum supplies. In turn, some petrol retailers made special arrangements to help keep emergency and repair vehicles filled.

- Rapid re-opening of viable bridges and key buildings due to firm arrangements with contractors and engineers in sectors, such as roading and electricity enabled quick inspections of bridges and key buildings.

The positive examples above contrast with Christchurch's history of land-use decisions, which allowed residential development on land that had been identified as susceptible to liquefaction, lateral-spreading and subsidence in the event of earthquakes (St Clair & McMahon 2011).

Reference

Bannister S., Gledhill K. (2012): Evolution of the 2010–2012 Canterbury earthquake sequence, New Zealand Journal of Geology and Geophysics, 55:3, 295-304

Christchurch Engineering Lifelines Group. (1997). Risks and Realities: A Multi-Disciplinary Approach to the Vulnerability of Lifelines to Natural Hazards. Christchurch: New Zealand Centre for Advanced Engineering.

Fenwick, T. (2012). The Value of Lifeline Seismic Risk Mitigation in Christchurch. Report by New Zealand Earthquake Commission, June 2012, 34p.

St Clair, M., McMahon, D. 2011.Canterbury Fact Finding Project - Consideration of liquefaction and lateral spreading hazards in the zoning and development of: Part A: The eastern suburbs of Christchurch from 1977 to 22 Feb. 2011; Part B: Brooklands, Kaiapoi and Kairaki/The Pines from 1977 to 4 Sept 2010. Hill Young Cooper Ltd and Resource Management Group Ltd, August 2011.