New Zealand Lifelines Committee

NATIONAL LIFELINES FORUM 2013 – KEY POINTS

Prof Tom O'Rourke set the scene for the 2013 National Lifelines Forum (NLF) with a clarion call for improved resilience of critical infrastructure. A lesson from the Tohoku earthquake, Hurricane Sandy[1] and earlier events such as Hurricane Katrina is that some infrastructure, where outages could have the most disabling impacts on businesses and communities, is just "too big to fail". It was an attention-grabbing keynote presentation, setting the scene for the valuable presentations that followed.

The main points from Prof O'Rourke's presentation, *Earthquake Effects on Critical Lifelines and Infrastructure*, were:

- Reassessing the resilience of critical infrastructure: Recent disasters point compellingly to the need to identify and reassess the resilience of infrastructure that is critically important, including fully probing the "what if" questions to fully test design assumptions and standards.
- Christchurch's experiences are informing international research: Lifeline utility and geophysical data from Christchurch is recognised as most helpful in advancing world-wide understandings of infrastructure damage from earthquake-induced lateral and vertical ground deformation, e.g. relating to performance of different pipe materials. Prof O'Rourke particularly noted the remarkable performance of highly ductile HDPE and MDPE pipelines in Christchurch.
- The importance of getting simple things right: Basements are not good locations for sensitive equipment, emergency kit or fuel storage – access is often difficult and flooding from meteorological events or burst pipes is common.
- The importance of local application of global lessons: This is where Lifeline Groups play important roles.

Abstract:

The effects of the recent Tohoku earthquake and Canterbury Earthquake Sequence are examined with respect to their effects on critical infrastructure. The impact of the Canterbury Earthquake Sequence on the underground infrastructure in Christchurch, NZ is explored with the use of an extraordinary GIS data set covering the effects of both liquefaction-induced permanent ground deformation and transient ground motion for 3 different earthquakes. High resolution LiDAR and geospatial analyses of earthquake-affected utility systems are combined to develop relationships among lifeline damage and both lateral and vertical ground deformation. The earthquake relative performance of different types of pipelines is quantified, and the lessons learned are applied for the seismic protection of lifelines at other vulnerable locations, including Wellington, San Francisco, and Los Angeles.

[1] A compelling post-Sandy report on New York resilience issues is available at http://www.nyc.gov/html/sirr/html/report/report.shtml.

The Forum was attended by 75 persons from Lifeline Groups, ministries, utilities, scientists and other agencies with an interest in infrastructure resilience. A feature was the number of persons attending for the first time.

Other Points of Interest

Points of interest from other presentations are:

- In a session led by *Roger Fairclough* (leader of the infrastructure sub-theme in the Natural Hazards Research Platform), researchers presented snapshots of current work:
    - ***Economic Modelling***: Tony Fenwick, speaking on behalf of a collaboration involving GNS Science, Market Economics and Resilient Organisations, noted that work is progressing on development of a model known as "MERIT" (Measuring the Economics of Resilient Infrastructure Tool) to explore the economic consequences of infrastructure failures, initially in Christchurch and Auckland.
    - ***Resilience of Ports***: Liam Wotherspoon, University of Auckland, is working on understanding the resilience of ports, economically very important assets vulnerable to a range of hazards. CEOs are involved. A "virtual" approach has been adopted to protect data confidentiality.
    - ***Projecting Building Damage*** and ***Multi-Hazard Impacts***: Sonia Giovinazzi, University of Canterbury, outlined her work on projecting building damage and losses from the Canterbury earthquakes and on earthquake-flood multi-hazard impacts on lifelines.
    - ***Organisational Resilience***: Erica Seville, Resilient Organisations, advocated development of resilience as a corporate strategic opportunity and drew attention to the range of cultural and other elements needed.
    - Other recent and current research includes
        - development of a natural hazards risk-based toolbox (GNS Science)
        - understanding infrastructure interdependencies (GNS Science)
        - measuring transport resilience (AECOM)
        - seismic performance of underground services (Opus)

Rod Cameron from the Stronger Christchurch Infrastructure Rebuild Team (SCIRT) described the challenges faced in infrastructure recovery on a huge scale (damage unclear, urgency, need to ensure value for money, need for sound community engagement). Innovative governance arrangements involving owners and contractors have been established. SCIRT's work has been recognised internationally including, most recently, through the award of the British Institution of Civil Engineers' Brunel Medal.

Brian Park and *Chris Watson* from Watercare noted key risk factors in water management: asset failure (pipes comprise 65 per cent of assets), demand growth (which absorbs excess capacity and calls for very large investments over time), level of service and natural disasters / climate change. Watercare's capital works programme includes the very large Hunua 4 Watermain Project, to replace an aging asset, permit maintenance on other assets and meet growth requirements.

Rob Bell, NIWA, drew attention to likely increased prevalence of high-intensity rainfall, storms and wind, seal level rises leading to inundation and salinisation, and landslides as a result of climate change.

Hazard rankings need to adjust and climate change adaptation needs to be treated by utilities and others as a normal / ongoing activity.

Roger Fairclough and *Richard Ward* from the National Infrastructure Unit (NIU) noted that Government's *2015 National Infrastructure Plan* will be more evidence-based than earlier versions. The emphasis is on service delivery (i.e. "outputs"), not just assets and other "inputs". NIU noted that Lifeline Groups help by building information on infrastructure performance and resilience improvements. Resilient Organisations' work draws attention to the balance between planned and adaptive approaches – Roger and Richard noted the importance of the latter.

Dave Brunsdon, Kestrel Group, noted that the three NZLC infrastructure resilience themes, physical performance, inter-agency coordination and realistic user expectations, can apply also to the building sector. Other points:

- More work needs to be done to clarify the application of the building importance level framework to infrastructure, including an opportunity for the lifeline utilities to provide specific recommendations relating to their common building types.
- The 2006 NZSEE Guidelines for structural performance of buildings are being updated, with Section 3 covering Initial Seismic Assessments having just been released.
- Recent Cabinet decisions on earthquake-prone buildings were summarised and the possible link with Lifeline Group reports on priority access routes and priority utility sites for restoration were noted.

Mike Frew from the Ministry of Civil Defence & Emergency Management noted recent and current work on the National CDEM Plan (a formal / legal document), Director's Guidelines for Lifelines (emphasising business continuity planning) and utility capability assessment. MCDEM sees utilities as "partners" in the effort to improve national resilience.

James Goodchild from MBIE described current policy work to improve New Zealand's petroleum security including establishment of a new "Oil Security Group", a committee with wide membership to assist development of measures to improve oil security (NZLC is represented).

Richard Bentley drew attention to the Centre for Advanced Engineering's seminal and longstanding involvement in lifelines work. The revitalised Centre aims to facilitate discussion on complex issues in the interface between economics and engineering, and a focus on technology as an economic base is planned.

Natalia Deligne and *Sara Page* presented updates on activities of the Volcanic Impacts Study Group and Geonet.

Conclusion

Prof O'Rourke's presentation and other papers from the Forum will be posted on the website of the Ministry of Civil Defence & Emergency Management in due course (they are also temporarily available on https://www.dropbox.com/sh/lswei1x7tfdx75x/9YjO-jxnGc).

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