DISRUPTION OF CRITICAL INFRASTRUCTURE DURING PROLONGED NATURAL DISASTERS

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THE PROJECT AIMS TO QUALIFY AND QUANTIFY THE IMPACTS OF PROLONGED AND MULTI-HAZARD NATURAL HAZARD EVENTS ON UTILITY, TRANSPORT AND/OR COMMUNICATION NETWORKS; AND TO ALSO UNDERSTAND THE INTERCONNECTEDNESS OF THESE CRITICAL SERVICES.

BACKGROUND

- There is a growing reliance on infrastructure and technology that provides essential utility, transport and communication needs. These lifeline networks are often coupled with strong interdependencies; meaning one failure could potentially turn into a cascading disaster.
- Prolonged and multi-hazard natural disasters can impact surrounding areas for weeks to months after the initial event; causing vast and on-going disruption to lifeline networks; essential services that are vitally important for day to day living, the economy and emergency response groups.
- Whilst significant work has gone into understanding the direct impacts from natural hazards, less emphasis has been placed on understanding the vulnerability of critical infrastructure, including indirect and long-term disruption (Murray 2013; Moon and Lee 2012).

RECENT EVENTS

- Recent events throughout Australasia have highlighted the vulnerability of lifeline networks to disruption from a variety of natural hazard events (Figure 1 and 2).

Figure 1: May 2014 Flights cancelled at Darwin Airport due to volcanic ash from Sangeang Api volcano, Indonesia.

Figure 2: June 2014 Northland Storm, New Zealand. Widespread power outages due to downed lines and fallen trees.

PROLONGED AND MULTI-HAZARD EVENTS

- Prolonged events are events with a long duration or a series of events that occur in quick succession e.g. Sinabung volcano eruption Sept 2013 - ongoing or the Canterbury earthquake sequence, ~2 years.
- A multi-hazard event is where the initial hazard is associated with additional hazards, e.g. earthquakes are often associated with liquefaction, landslides, fires and tsunamis (Figure 3).

Figure 3: 2011 Tohoku earthquake, tsunami and nuclear disaster. Resulted in 4.4 million households without electricity. A long-term power solution is years away.

RESEARCH QUESTIONS

- How does the interconnectedness of critical services lead to a cascade of failures?
- What influences network recovery and how long can it take to rebuild?
- How long can impacts of a natural hazard event last and what is the cost of long term network disruption?
- What scenarios could generate a potential catastrophic disruption in the future?

FUTURE WORK

- Review key historical Australian natural disasters and the impact they had on essential infrastructure and critical services.
- Review existing network vulnerability models
- This project is linked with the BNHCRC 'Scenario and Loss Analysis' cluster and outputs of this project will contribute to the 'Using realistic disaster scenario analysis to understand natural hazard impacts and emergency management requirements' project.

COMMENTS FROM THE END USERS

- There is close alignment with the theme of this research with the BNHCRC Scenario and Loss Analysis cluster. The outcomes of this research will also be of interest to both Emergency Combat Agencies and to various functional areas and recovery coordinators (NSW SES).

REFERENCES

Moon, I. and Lee, L. (2013). Review on modelling and simulation of large-scale and complex disaster scenarios. SCS M&S Magazine.

Murray, A. T. (2013). An overview of network vulnerability modelling approaches. GeoJournal Vol 78: 209-221.

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