



Key Points from the US Technical Council for Lifeline Earthquake Engineering Conference

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Overview

- **TCLEE acts as a focal point for the production of high quality technical guidelines, reconnaissance reports and monographs**
- **TCLEE Conf held every 4 to 6 years**
- **NZ represented since 1991**
- **~250 delegates, mainly from North America**

- **American Lifelines Alliance – seismic resilience of buried pipelines**
 - Relevance to WSL and application to Hunua No 4 project
 - Number of presenters discussed how they were applying ALA
 - Targeted to known risk/vulnerability – for Hn4 increased level of geotechnical investigation
 - Harden design accordingly

- **Application of ALA**
 - 1 in 475 yr initial assessment
 - 1 in 1000, 2000 assessment
 - Level of risk reduction targeted to criticality of facilities
 - E.g. from CH2MHill Utah Project c.f. open channel v welded steel pipeline \$20m premium paid for improved resilience
- **System fragility**
 - LADWP fragility studies cf with Northridge actual damage reports
 - LADWP damage assessment of aqueducts huge – 2 years to repair
 - Research into performance of pipeline fittings

- **QA**

- Research papers
- Reassurance that we are on the right track
e.g. Welded lap joints
- Can achieve high level of resilience through
QA and targeted design to known hazards

- **ALA –cont.**

- Visit with SFW witnessed application
- Haywards Fault Crossing of Bay Division pipelines 3&4
- 2 x Cross-over valve arrangements; seismically triggered isolation valves; remote actuation
- Slip joints at fault crossing designed to accommodate
- 21 mile BDPL 5 project incl. 5mile tunnel under SF Bay
- Rehabilitation of No 1 & 2 when complete





- **SF Water Drivers – multi-hazard approach**
 - Water Quality
 - Seismic Reliability
 - Delivery Reliability – LOS
 - Water Supply - drought

- **OTHER SFW INITIATIVES**
 - Calaveras dam replacement – controlled at 70%; Hayward's fault
 - WTP's upgrade seismic & processes

- **Bay Bridges Field trip**

- Bay Bridge Replacement of Oakland section
- Golden Gate – Sth Abutment reconstructed; upgrade of approach bridge spans; towers upgrade next
- Richmond Br – seismic dampers









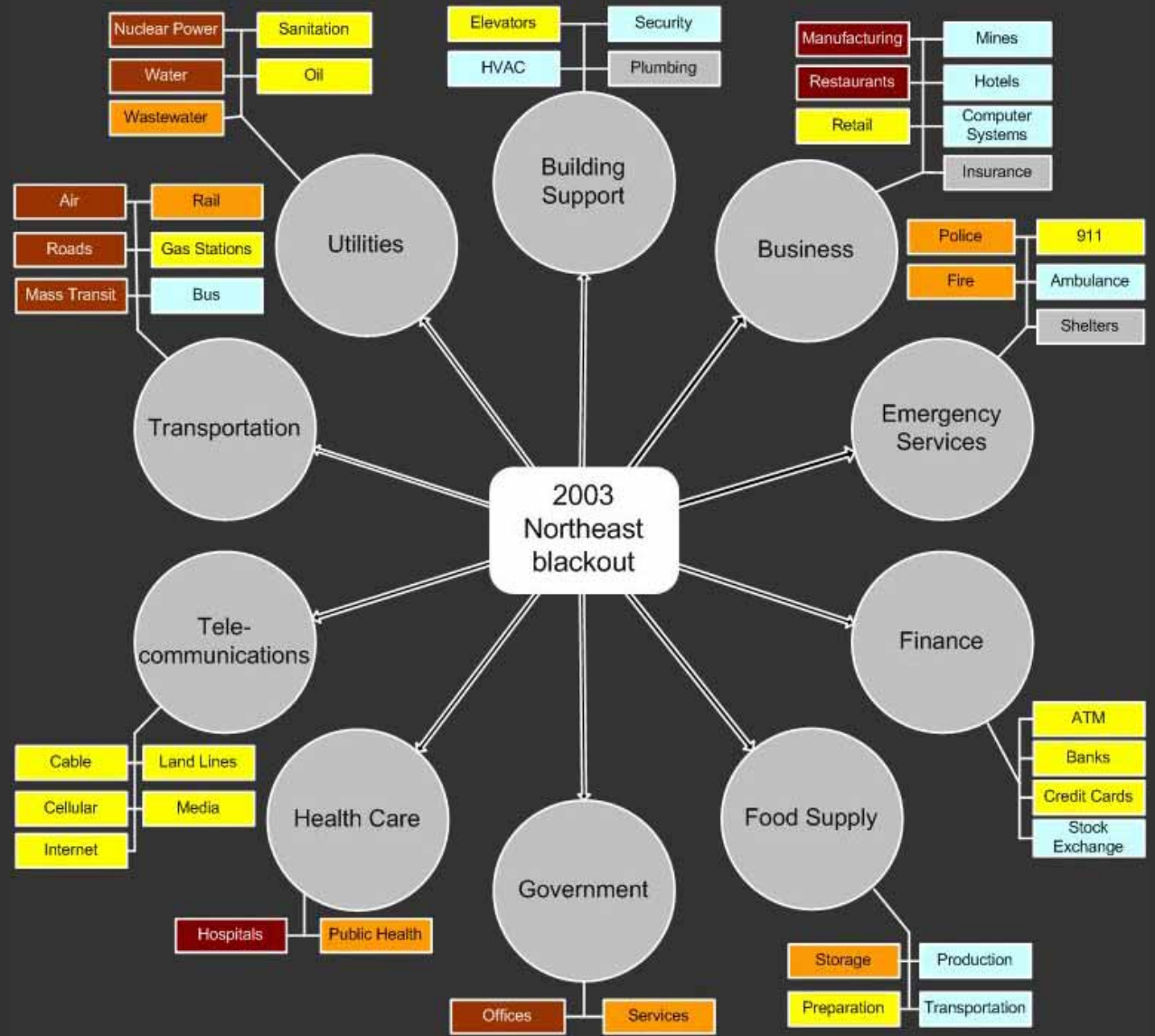
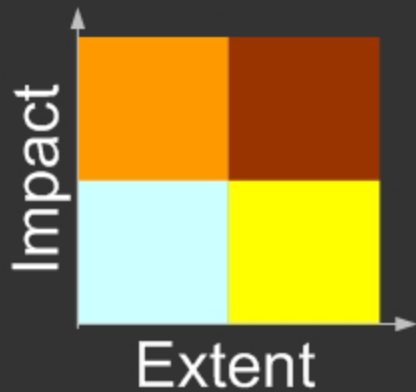




Key Points

- 1. The many risk reduction issues highlighted by Hurricane Katrina appear to have many people thinking more about multi-hazards**
- 2. The concept of core Lifeline Utilities as 'Enabling Infrastructure' that underpins other infrastructure categories**
- 3. No significant new work or breakthroughs around interdependency analysis**

Consequences



(Source: McDaniels et al. 2007. In *J. Infra. Systems*)

Key Points (2)

- 4. Several papers highlighted that the restoration of water supplies to public hospitals is critical to community recovery**
 - this was under-estimated in Katrina, as it is in NZ (particularly in Wellington and Auckland).

Structural,
Nonstructural,
Internal Lifelines

External Lifelines

Hospital Functionality

Revised

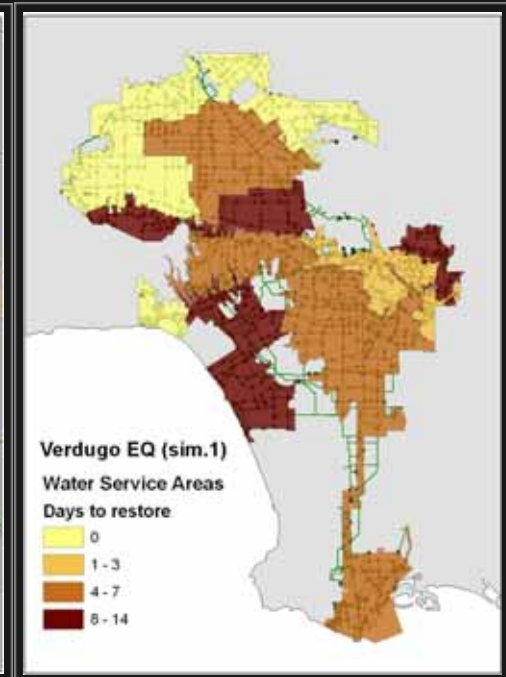
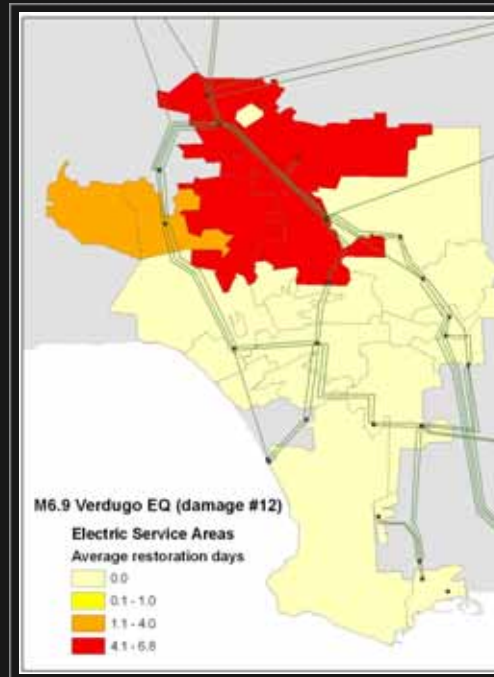
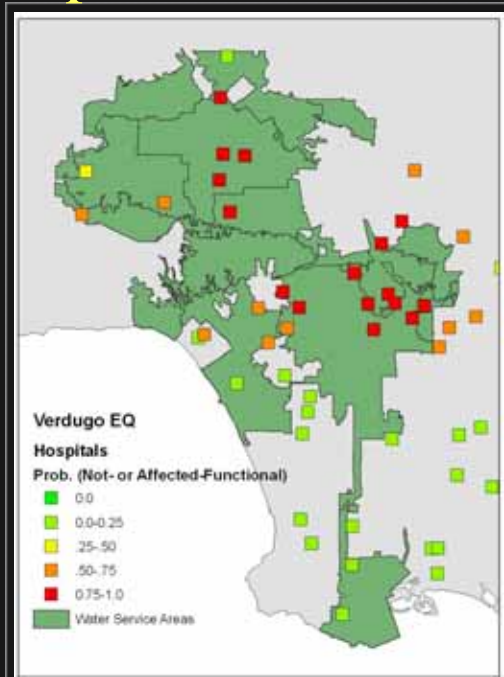
Hospital Functionality

ASSUMPTION

Loss of external lifeline(s) deteriorates hospital functionality by one functionality class

Electric Power

Water



Key Points (3)

5. **Greater willingness to indicate to the public the likely duration of water system outages**
 - e.g. San Francisco Public Utilities Commission and the California Seismic Safety Commission acknowledging 60 day outages currently anticipated with a rupture of the San Andreas/ Hayward's fault
 - hence the need for US\$4.6billion upgrade of that network

Key Points (4)

- **A corresponding increase in effort to articulate post-earthquake service levels for restoration**
 - e.g. the bulk water outcome objective is
 - winter demand within 24 hours at 70% of bulk network turnout points equally across the three service regions, and
 - average demand restored across the network within 30 days

Key Points (5)

6. Encouragement to

- keep thinking and acting at a systems level (incl. system of systems) rather than just at an elemental level
- focus on understanding and addressing the primary dependencies – the 'de-stabilisers' that would cause significant disruptions
 - rather than seeking to understand and quantify all dependencies
- act on the weaknesses that we already know exist

US TCLEE Conference: Some Actions



- **Fire Following Earthquake**
 - What is our capability to use water from the harbour to fight post-earthquake fires in central Wellington following a major earthquake?
 - WeLG is to re-instigate a project planned with the Fire Service in 2006/07
- **Articulating likely post-earthquake utility restoration times**
 - Of fundamental importance in order to progress mitigation work
 - Lifelines Groups should facilitate linkages more actively with critical facilities such as DHBs

Acknowledgements

- TO EQC for funding the attendance at this conference