SCIRT Rebuilding Infrastructure

LEARNING LEGACY

Lessons learned from one of New Zealand's most challenging civil engineering projects: rebuilding the earthquake damaged pipes, roads, bridges and retaining walls in the city of Christchurch 2011 - 2016.

Seismically Induced Shear of a Concrete Reservoir in the February 2011 Christchurch Earthquake: Investigations and Response

Story: Huntsbury Reservoir

Theme: Design

A PowerPoint presentation prepared for the Australia New Zealand Geotechnical Engineering Conference.

This document has been provided as an example of a tool that might be useful for other organisations undertaking complex disaster recovery or infrastructure rebuild programmes.

For more information about this document, visit www.scirtlearninglegacy.org.nz

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Seismically Induced Shear of a Concrete Reservoir in the February 2011 Christchurch Earthquake: Investigations and Response

ANZ 2015 // 22-25 February 2015

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Huntsbury No. 1 Reservoir

- Circa 1954
- 36,000 m^3 capacity
- Reinforced concrete
- M_w6.2 EQ 22 February 2011
- Damage ➡ complete functional failure

Canterbury Earthquake Sequence

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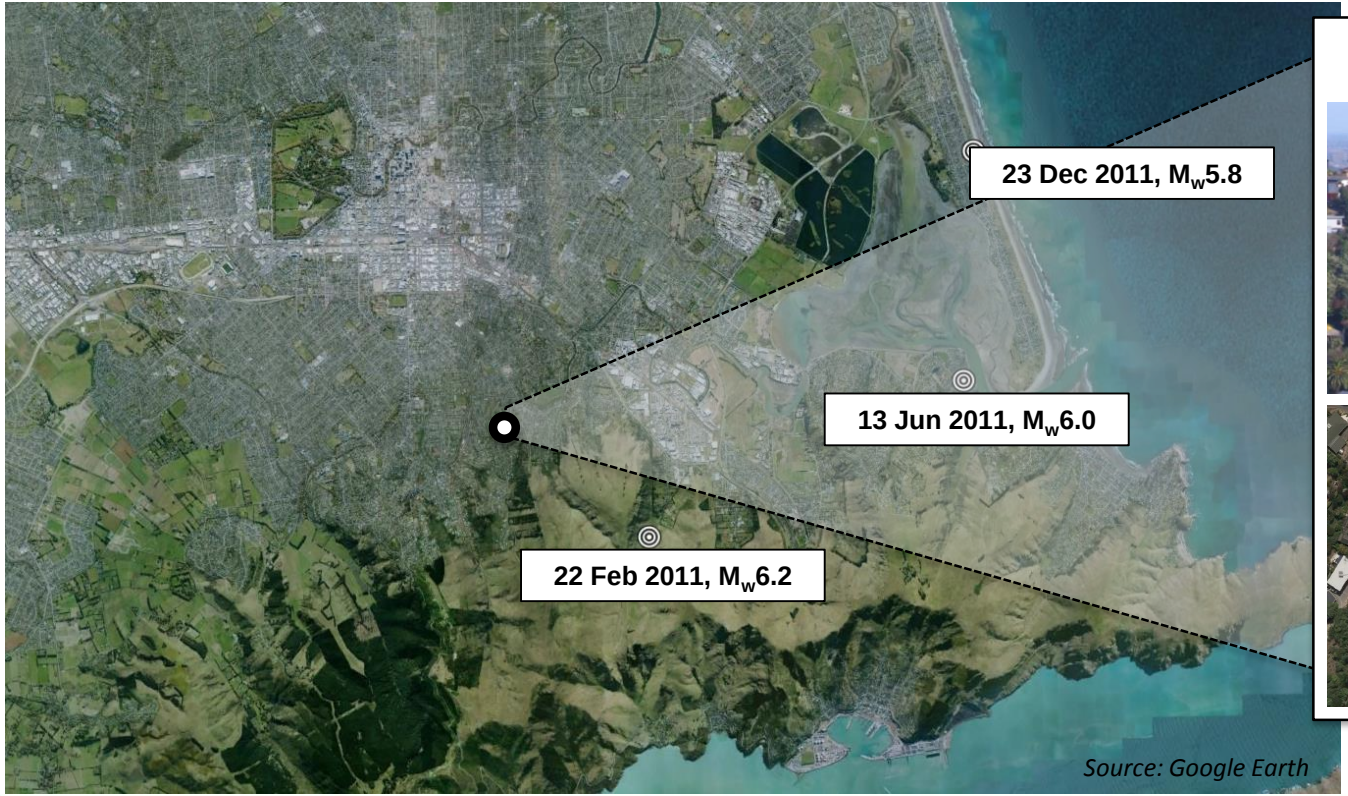

Huntsbury No. 1 Reservoir

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Structural Damage

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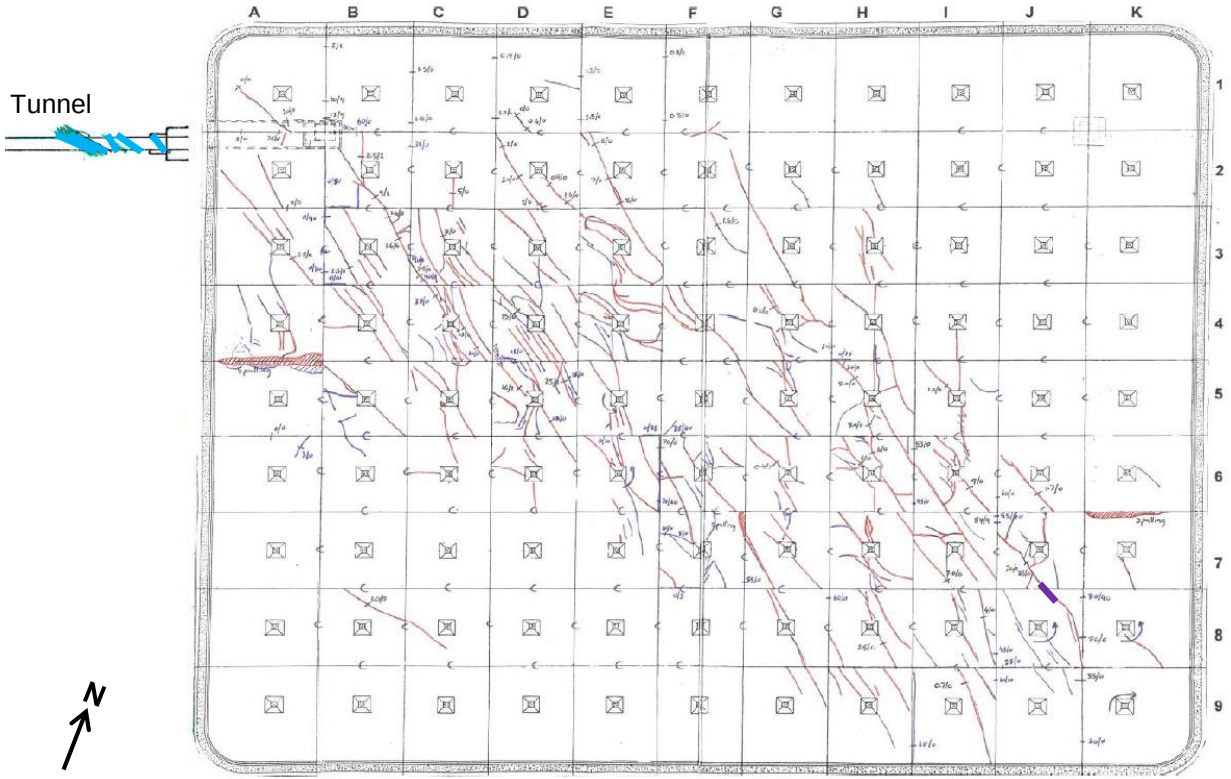
Crack Mapping

- Zone 20-25 m wide
- Oriented 280° - 300°
- Full depth of slab
- S moved ~50 mm NW



Tunnel Observations

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Observations Beyond the Reservoir

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Geotechnical Investigation

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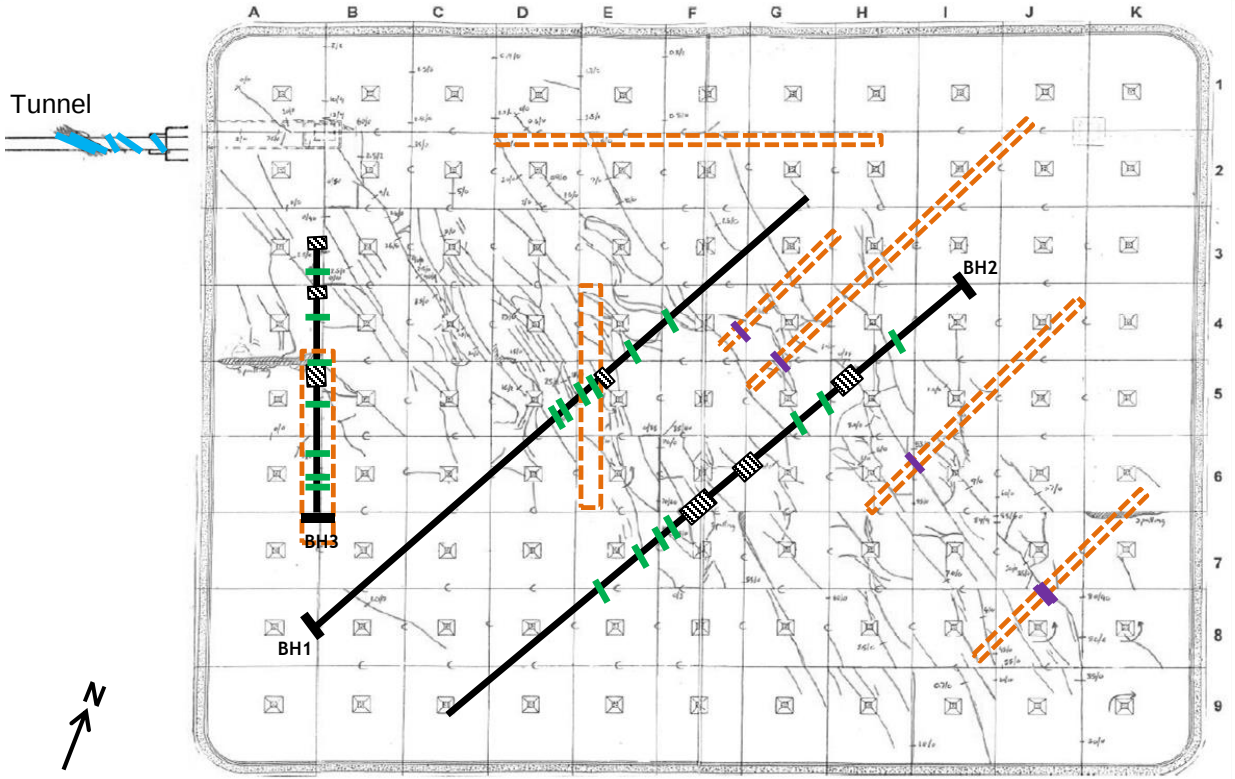
Legend

- Floor Cracks
- Borehole
- Trench
- Evidence of shear zone within core
- Evidence of shear zone within trenches
- Evidence of shear zone within Tunnel
- Significant core loss



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Geotechnical Investigation

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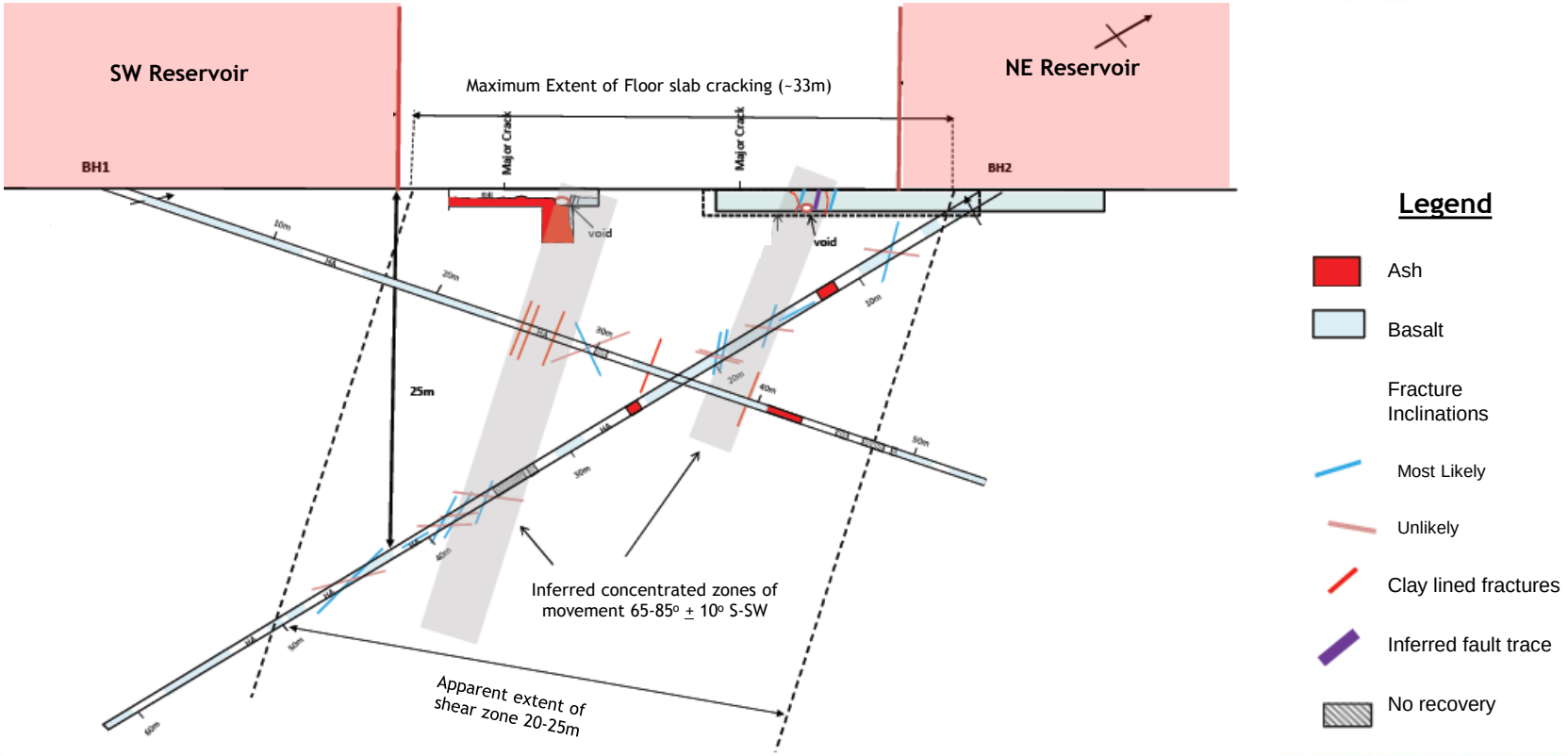
Interpreted cross-section of shear zone



Assessment of Geological Risk

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- Expect further displacement during seismic events
- Not possible to forecast seismic events or movement.
- Potential 50-150mm of movement along shear zone over next 50 years
- Extent and width of shear zone 20-25m
- Principles of MfE ‘Planning for Development of Land on or Close to Active Faults’

Remedial Options

- Alternative site – not viable
- Reinstatement solutions:

  Option A: Reinstate existing

  Option B: Single new reservoir

  Option C: Multiple new reservoirs

- Considered a range of technical solutions
- Materials: Reinforced Concrete Steel, HDPE liner

Selected Repair Solution

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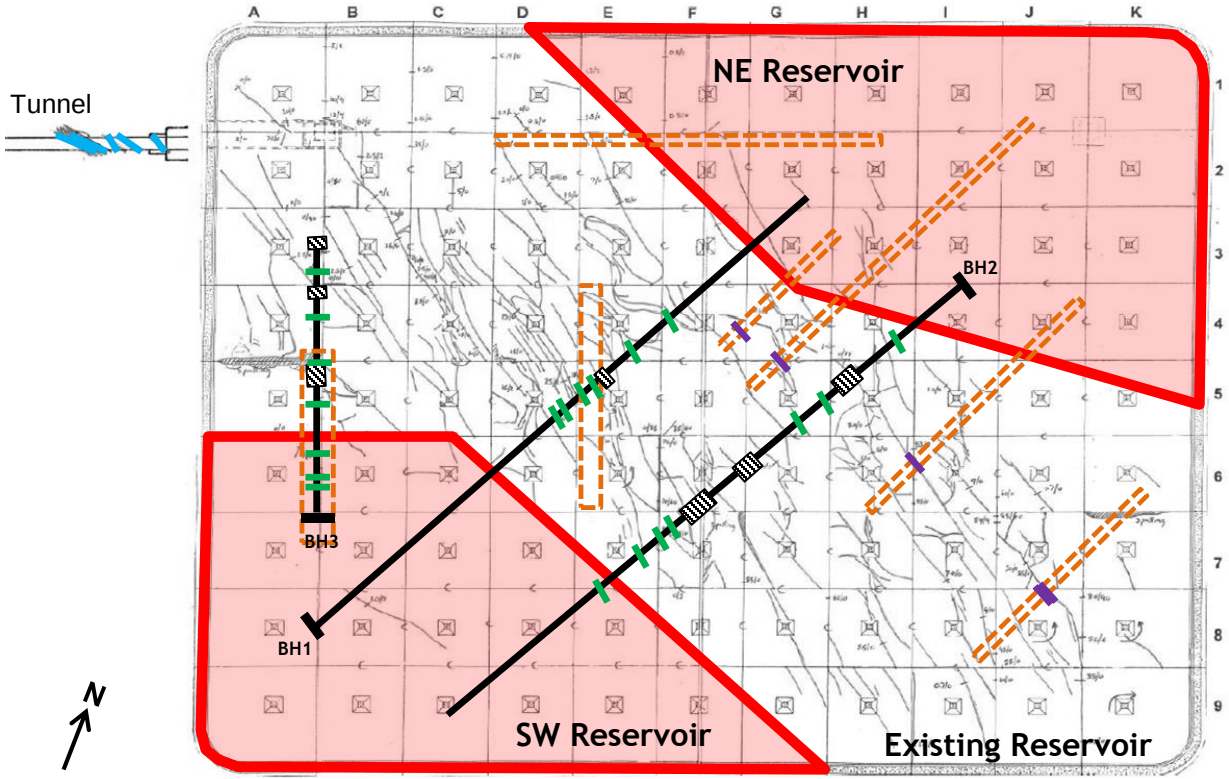
Legend

- Floor Cracks
- Borehole
- Trench
- Evidence of shear zone within core
- Evidence of shear zone within trenches
- Evidence of shear zone within Tunnel
- Significant core loss
- New Structures



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Construction

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Completed Repair

Conclusions

- Observations and investigation confirmed presence of 20-25m wide previously unknown shear zone
- Geotechnical design criteria - based on recorded evidence and judgement
- Assessment of risk, site viability and technical solutions
- Solution: modification of existing structure providing setback
- Highlights importance of integrated engineering, geological and geotechnical assessments when designing critical infrastructure.


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