

Seismic performance of the New Zealand Bridge Stock: Inangahua-present

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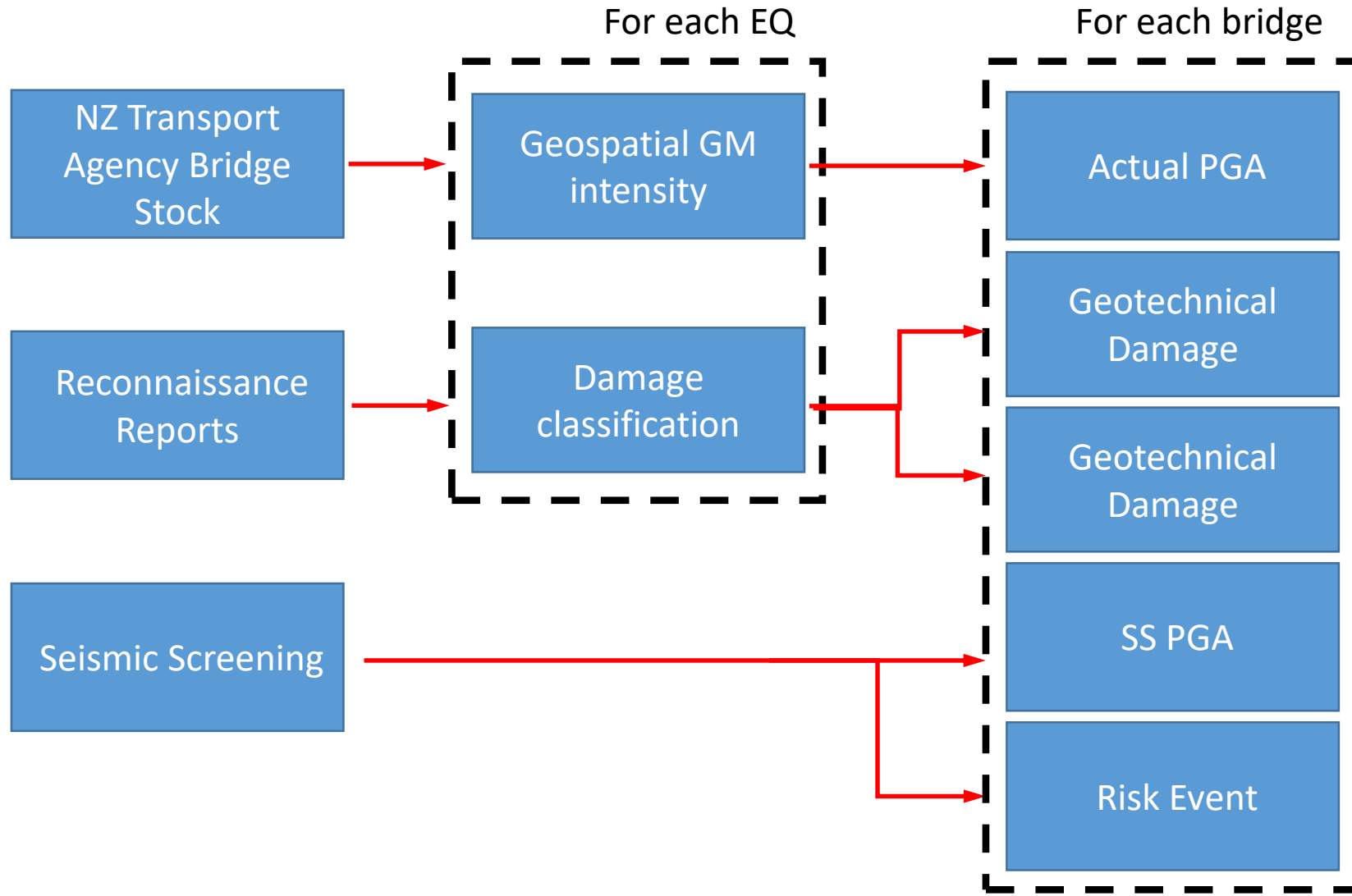
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Overview

- Bridges key components of the transport network
- NZ Bridge stock experienced a number of earthquakes
- Performance of bridge stock in recent events better than may have been expected
- **AIM: Compare the estimated and actual performance of the NZ Transport Agency Bridge Stock in historic EQs**
- **Inform and improve future assessment methods and design**

Process

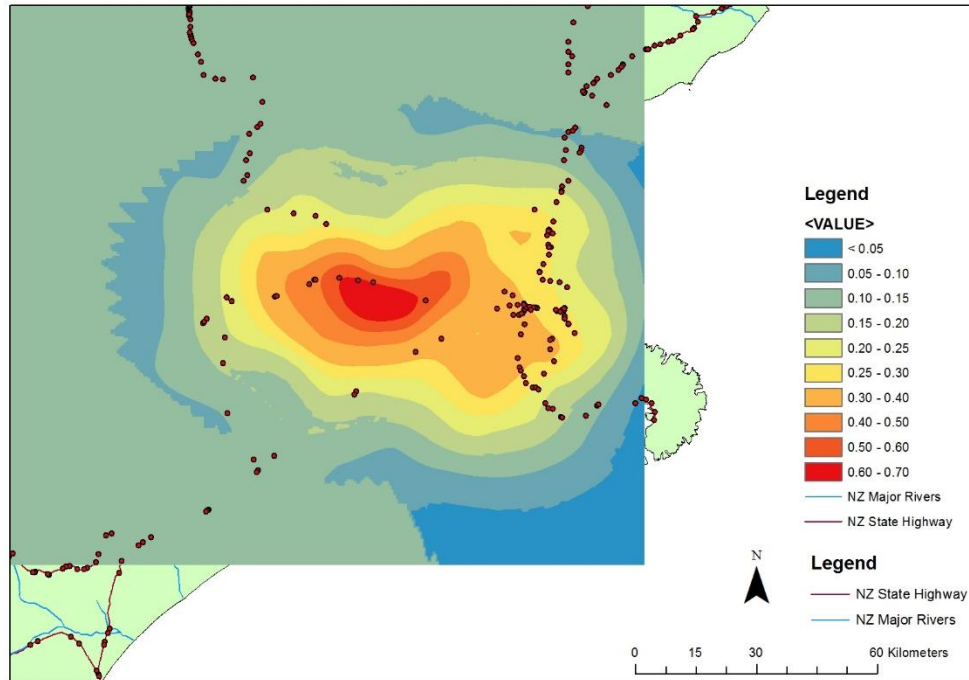


Historic earthquakes

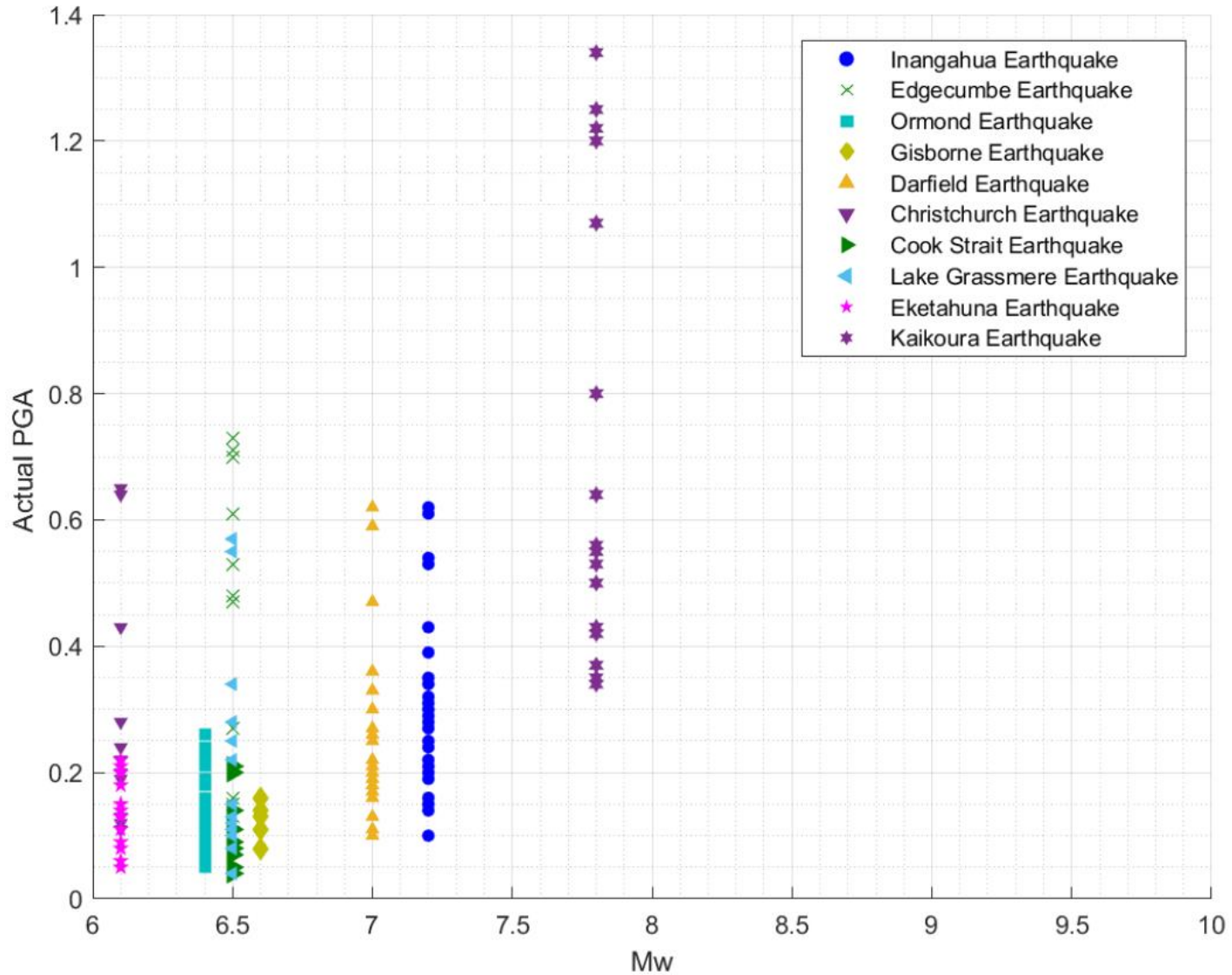
Earthquake	Date	Magnitude
Inangahua Earthquake	24 May 1968	M _w 7.2
Edgecumbe Earthquake	2 Mar 1987	M _w 6.5
Ormond Earthquake	10 Aug 1993	M _w 6.4
Gisborne Earthquake	20 Dec 2007	M _w 6,6
Darfield Earthquake	4 Sept 2010	M _w 7.0
Christchurch Earthquake	22 Feb 2011	M _w 6.1
Cook Strait Earthquake	21 July 2013	M _w 6.5
Lake Grassmere Earthquake	16 Aug 2013	M _w 6.5
Eketahuna Earthquake	20 Jan 2014	M _w 6.1
Kaikoura Earthquake	14 Nov 2016	M _w 7.8

Ground Motion Intensity

- GNS or USGS geospatial datasets
- Kriging based estimates of PGA at each bridge location
- Ignore all bridges with $PGA < 0.05g$



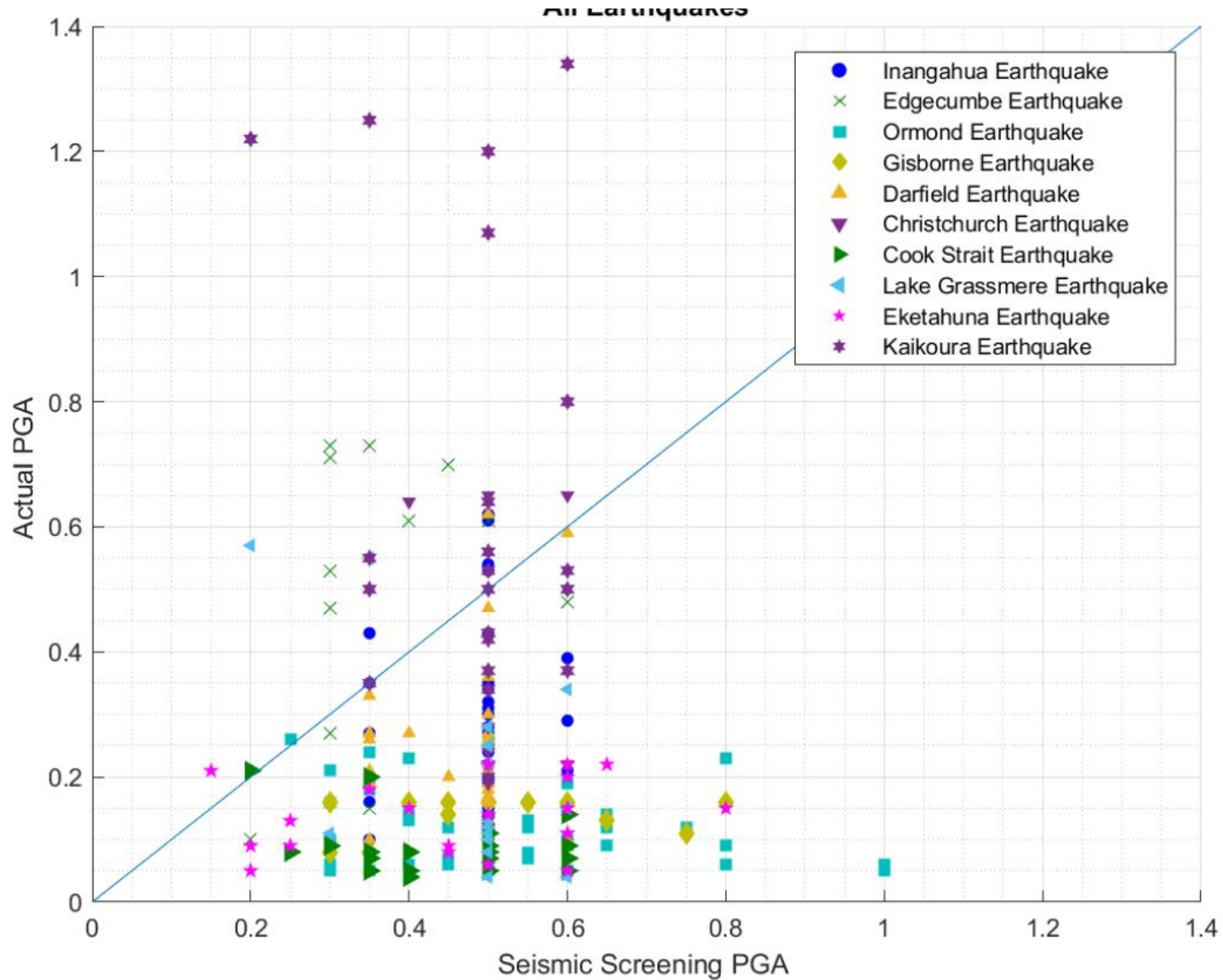
Overall Bridge Dataset



Seismic Screening

- Desktop approach to screen the NZ Transport Agency Bridge Stock (completed 2002)
- Ranking of bridge stock for further detailed assessment
- Risk event and PGA defined
 - Component vulnerability and associated PGA
 - Multiple risk events possible

Estimated vs SS PGA



Bridge Damage Classification

- Informed by reconnaissance reports
- Structural Damage
 - Link to seismic screening
- Geotechnical Damage

- Damage severity classification
 - Link to level of service

Bridge Damage Classification

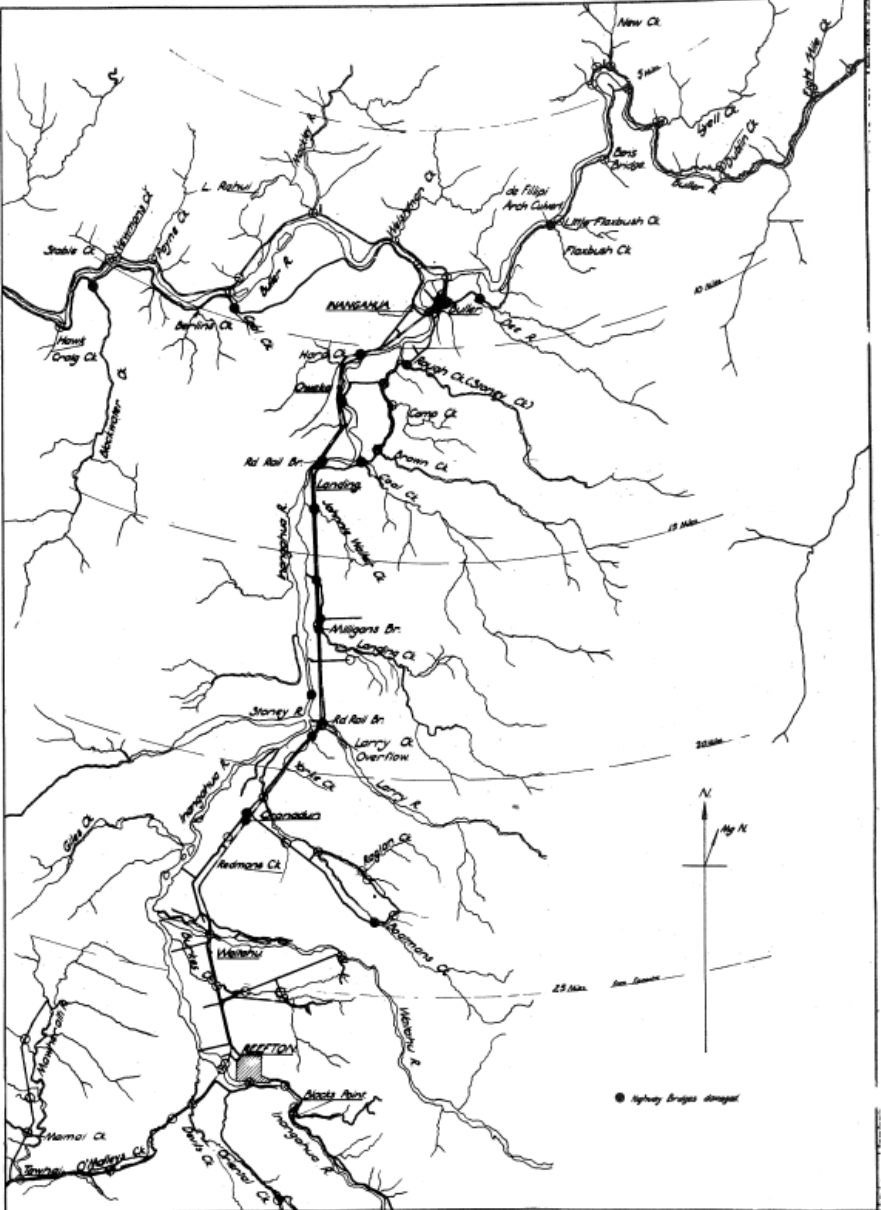


FIG 1 MAP SHOWING HIGHWAY BRIDGES IN INANGAHUA COUNTY

Bridge Damage Classification

February 22nd 2011 Earthquake

State Highway Bridges Preliminary Condition Report



QuakeCoRE
NZ Centre for Earthquake Resilience

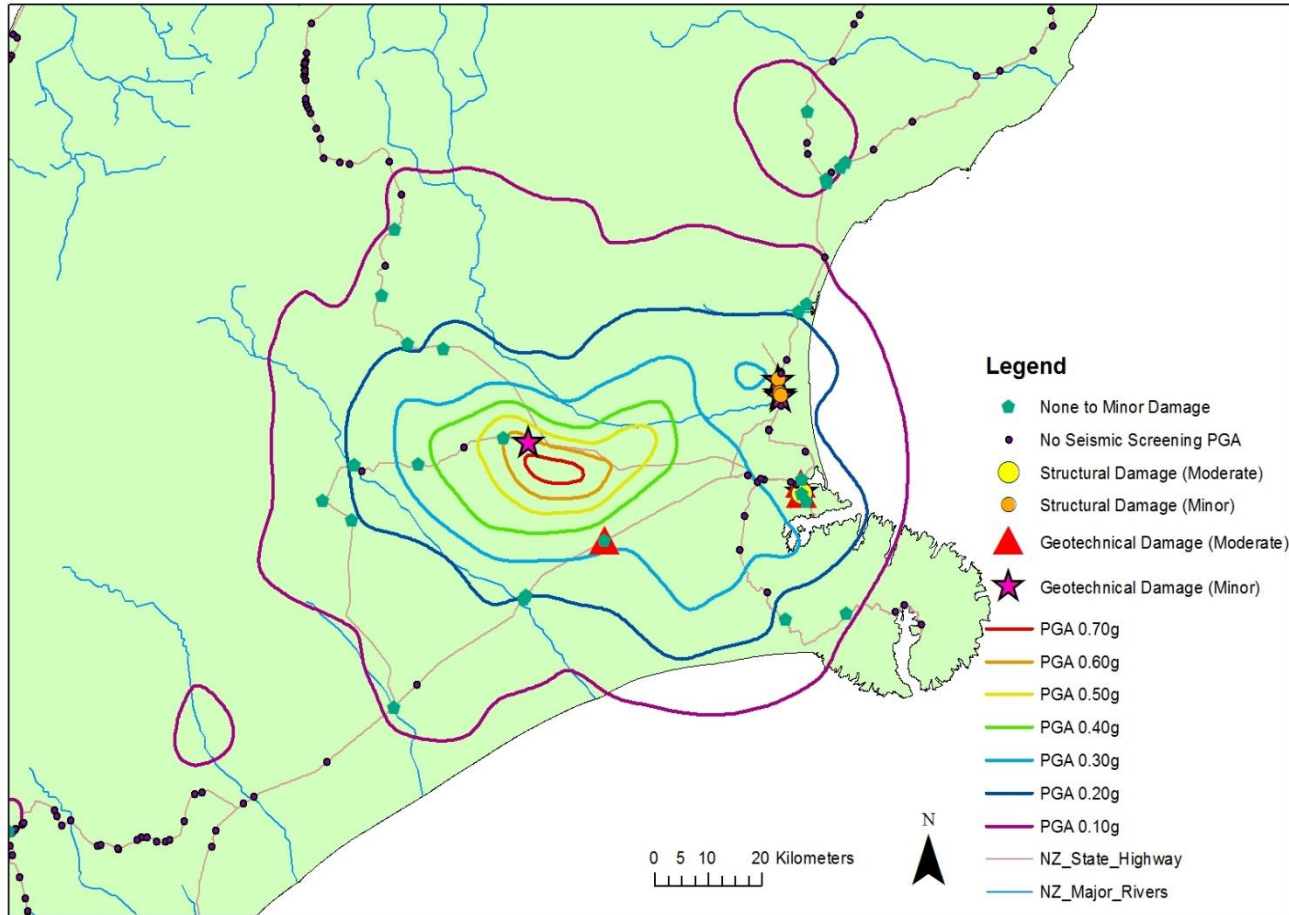


National
SCIENCE
Challenges

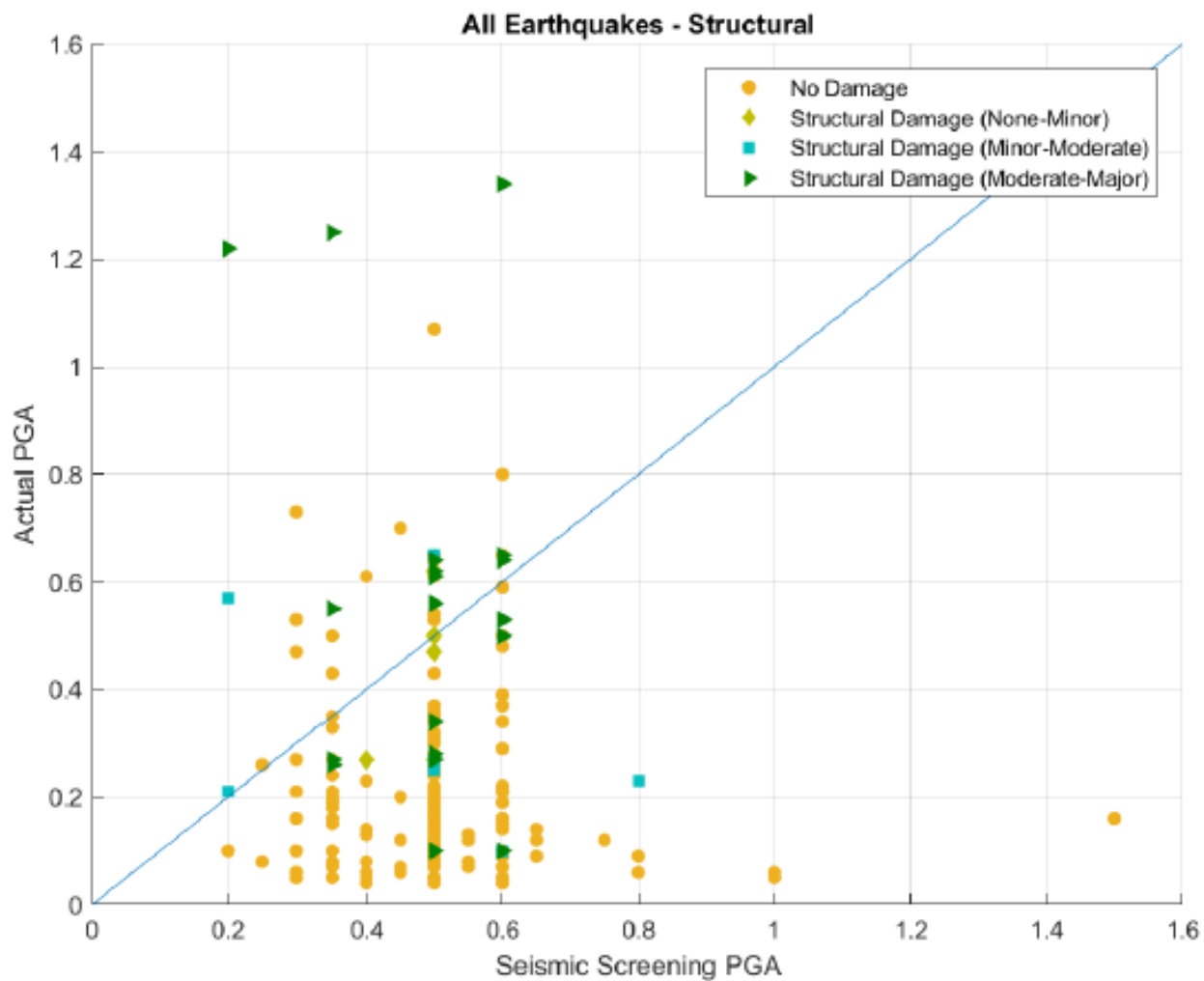
RESILIENCE
TO NATURE'S
CHALLENGES

Kia manawaroa
– Ngā Ākīna o
Te Ao Tūroa

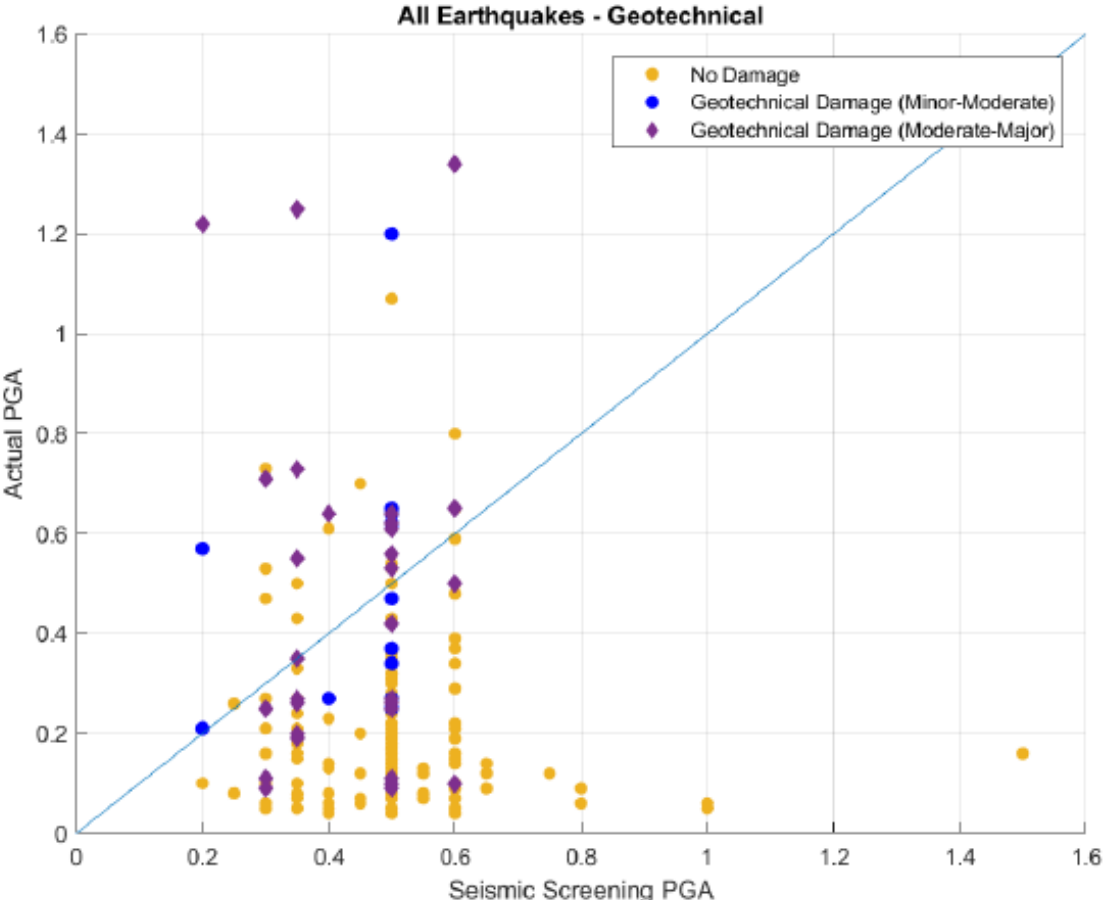
Bridge Damage Classification



Structural Damage



Geotechnical Damage



Summary

- National summary of bridge performance for historic EQs in NZ
- Next steps
 - Further screening of data
 - Assessment of bridge performance in more detail
 - No damage at high intensity
 - Damage at low intensity
 - Bridge characteristics