



Addressing Earthquake-vulnerable Buildings

Addressing buildings at risk of collapse after earthquakes, and finding socially and economically viable solutions to strengthen them

Aotearoa New Zealand has a significant stock of earthquake vulnerable buildings. Many of them are legislated to be retrofitted or demolished before 2030.

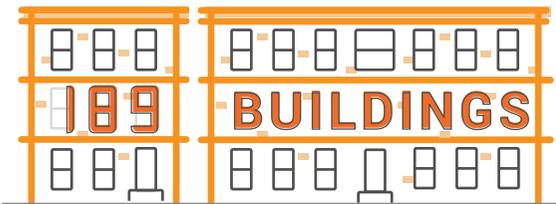


Te Hiranga Rū QuakeCoRE: New Zealand Centre for Earthquake Resilience. It is a Centre of Research Excellence funded by the New Zealand Government.



Making Aotearoa New Zealand's urban environment more seismically resilient.

Reducing the likelihood and severity of future disasters by making Aotearoa's urban environments **less vulnerable to earthquakes.**



Four affected councils - Wellington, Hurunui, Lower Hutt and Marlborough - issued 189 s124 notices to owners of street-facing Unreinforced Masonry (URM) buildings. A workshop, organised by Flagship 3 shortly after the Kaikōura earthquakes, recommended securing of parapets and facades, which eventually became central theme of the government order. As a result of the Order, 118 buildings were secured, 70 were proven to be secured prior to earthquakes and one is yet to be secured. The success of the Order was in part due to the URM Fund that was set up to assist with securing costs. Consequently, owners spent ~\$9.8m with the Fund contributing ~\$3m.

DIFFERENT PHASES OF CHRISTCHURCH CORDONS

Post-quake cordons protect lives and enable rapid building assessments to occur. Post-2011, Christchurch CBD had a cordon for over 2 years.



1. Feb 22, 2011 (Entire CBD) 2. Apr 11, 2011
3. Dec 21, 2011 4. Oct 15, 2012

THE NEW ZEALAND CON(CRETE) TEXT

When Statistics House partially collapsed in the 2016 Kaikōura Earthquake (built in 2006 with precast concrete floors) engineers reviewed damage and developed

guidelines to assess similar buildings with precast floors. Precast floors are commonly used in Aotearoa New Zealand but not in the rest of the world. Making this a key focus for QuakeCoRE.



LEADING THE WORLD!

These precast floor assessment guidelines are the first of their kind in the world.

MULTIDISCIPLINARY FOCUS POINTS

1 Developing **holistic criteria** to determine which buildings should be prioritised for strengthening.

2 Determining **economically viable seismic retrofit solutions** to help retain existing building stock and sharing these methods with the engineering community for implementation.

3 Developing **best practice legal frameworks** that encourage and require seismic resilience.



MAKING WELLINGTON AN EARTHQUAKE RESILIENT CITY

Created a building inventory dataset for seismic risk assessment and management.



- Building Use Category**
- Residential
 - Commercial
 - Other
 - Not assigned
- Geology**
- Greywacke
 - Reclamation
 - Swamp
 - Colluvium
 - Old Alluvium
 - Hydraulic Fill
 - Young Alluvium
 - Marginal Marine

400 buildings surveyed

- Occupancy
- Building use
- Vulnerability of concrete components
- Modelling the collapse risk
- Cordoning prioritisation
- Prioritisation of strengthening/demolition
- What lies beneath - soil class
- Cultural / public use assets
- Regulatory solutions

MULTIPLE WEIGHTED CRITERIA

SOIL CHARACTERISTICS AND BUILDINGS IN WELLINGTON CBD

Reference 1