QuakeCoRE
NZ Centre for Earthquake Resilience
Te Hiranga Rū

Pathways to practice:

Can we improve the transition of earthquake science into regulatory practice by tracing the pathways science takes?

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Outline

1. Why transfer science to practice?
2. New earthquake science
3. Methods of transfer and challenges
4. Pathways to practice
5. Lessons from the pathways
6. Other opportunities

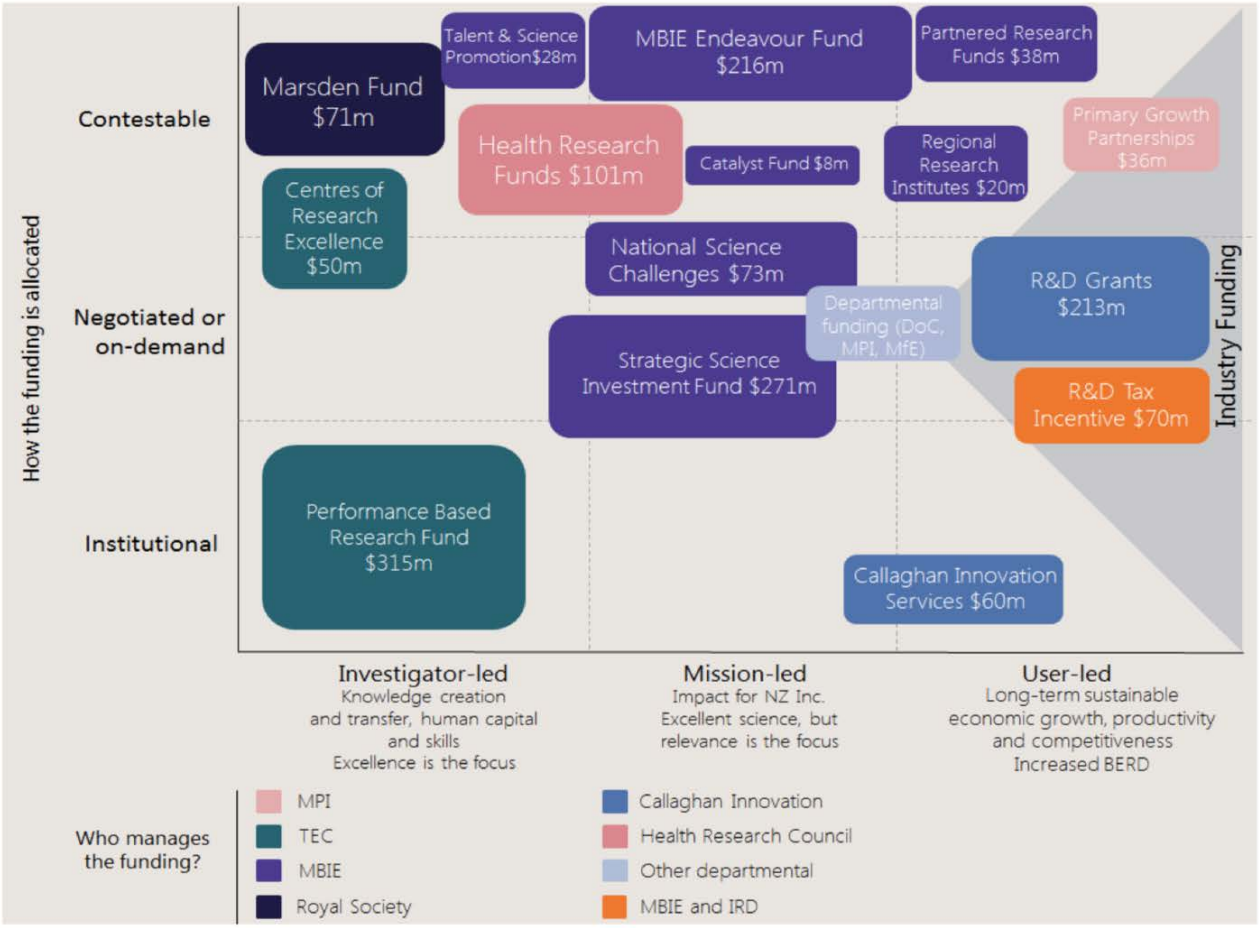
We need to be making better decisions about where we build and how we build

The emphasis needs to move to 'managing the risk rather than managing the disaster' – 'the hazard only turns into a disaster due the decisions we have made – where to locate and how to build'

(Elizabeth Longworth, Former Director, United Nations Office for Disaster Risk Reduction, Motu Speech 2017)



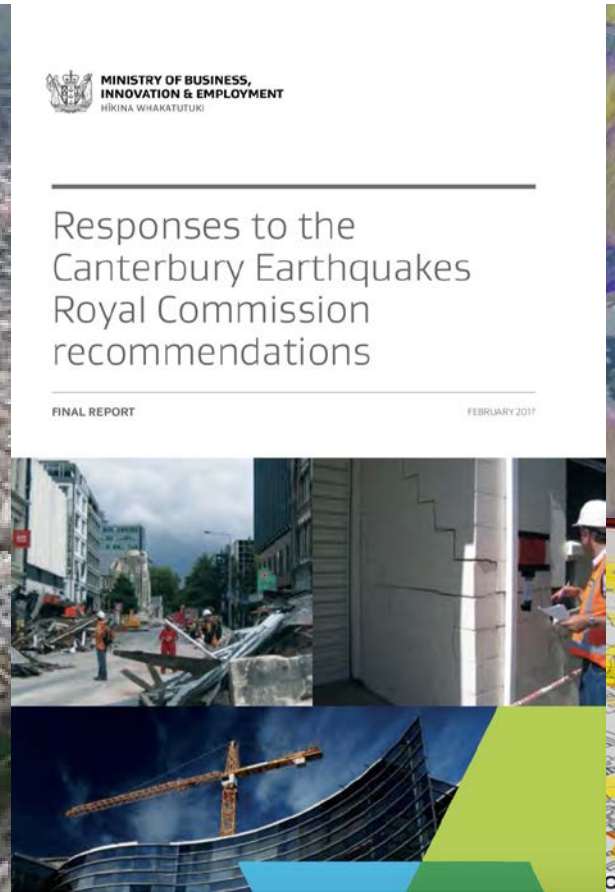

We spend a lot on public science – is it getting into practice?

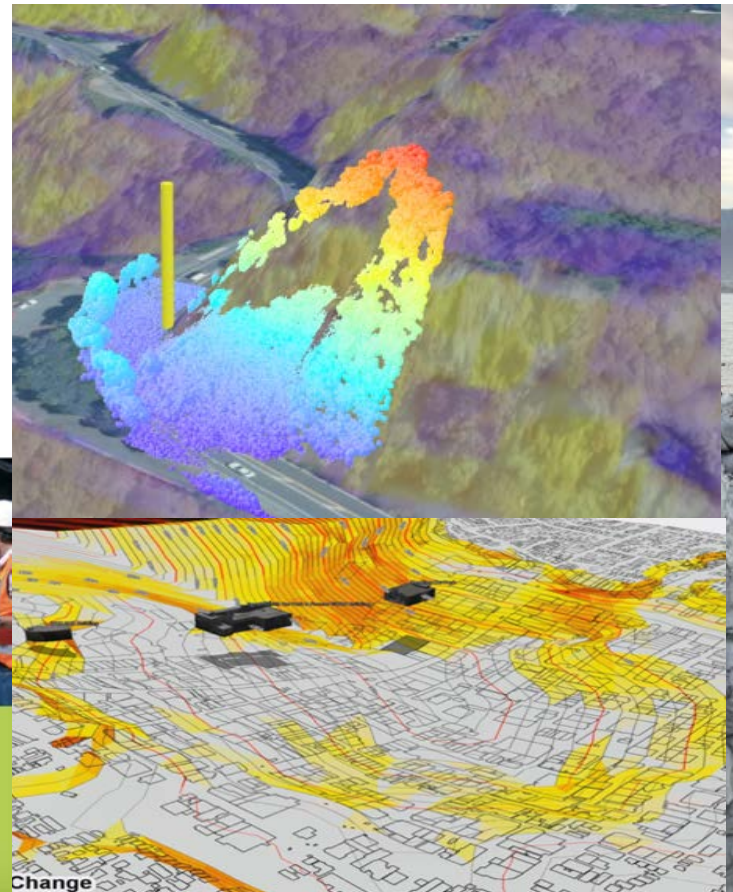


Public support for science and innovation per 2018/19 estimates of appropriations

Source: MBIE

We have new knowledge from Canterbury and Kaikoura earthquakes and further research is underway

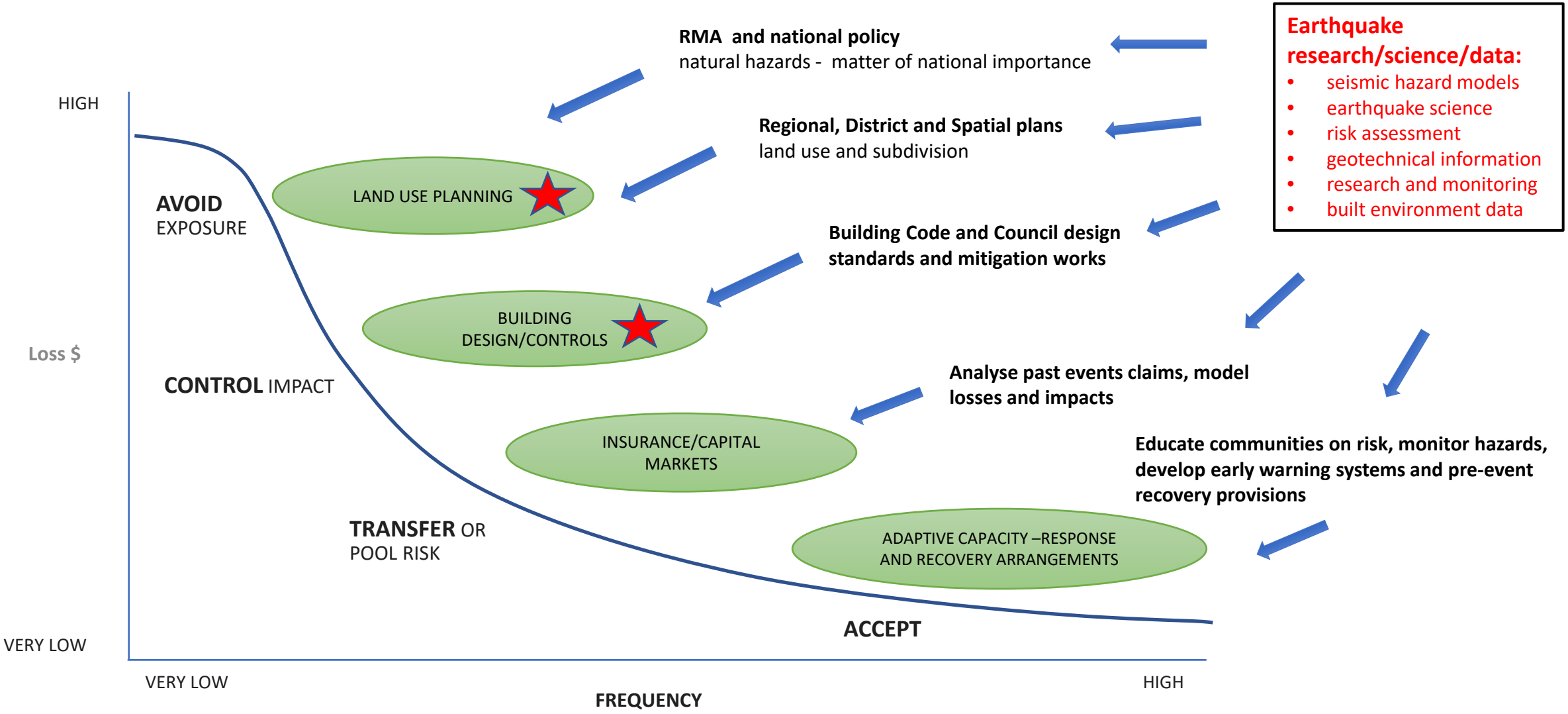




Summary of new knowledge

	Canterbury Earthquake Sequence	Kaikoura earthquake
Land issues	Building on liquefaction-prone land	Basin edge effects
	Performance of soils and foundations	Soft soils and reclaimed land
	Rockfall and cliff collapse	Rockfall
	Land damage – cascading impacts	Land damage – urban and rural
	Port Hills mass movement	Landslides, coastal uplift and seafloor displacement
Building issues	Structural performance of existing buildings – critical vulnerabilities	Precast concrete floor buildings
	Seismic assessment processes	New seismic hazard information – new faults, performance of faults
	Seismic performance of infrastructure	Performance of non-structural elements

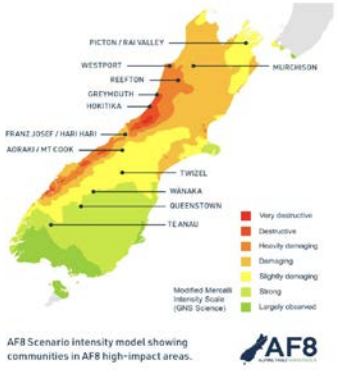
How can earthquake science feed into risk management policy?



And what are some of the challenges of science to practice?

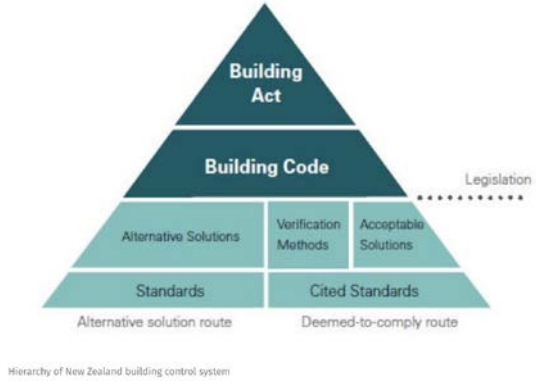
National SCIENCE Challenges

earthquake science



challenges

- timing
- scope
- values
- trust and certainty
- evidence
- nature of information
- translation



policy/practice

Summary of challenges

	Science/Research	Policy
Timeframes	• Slow moving	• Fast-paced, fixed time for input
Scope of work	• Often narrow in scope	• Systems-view and nationally focused
Role of societal values	• Scientific-method - aims to be value free	• Influenced by a political/societal values, beliefs, bias
Trust and certainty	• Earthquake science involves uncertainty • Risk is difficult to quantify • Inconsistent views between experts	• Tend to use management consultant advice • Economics and law often dominate
Evidence	• Formal assessment / research methodology	• Informal assessment of a range of information
Nature of information	• Science presented without interpretation	• Needs tailored information at the right time
Translation	• No active science advisory system • Many actors in knowledge exchange system	• Weak demand-pull • Limited policy capability on risk management

How can we improve the transfer of science to practice?

Science, research, data

new information post-event

Research:

land and building performance

engineering and planning solutions

understanding hazards

social and economic impacts

insurance market behaviour

USEFUL

Translation and integration

quantitative modelling and impact estimation

qualitative advice

data sharing, correlation of data sets, GIS and data viewers

risk communication

USEABLE

Risk management decisions

Risk reduction:

building and land use policy

planning and engineering practice

Risk transfer:

insurance pricing

also recovery, readiness and response decisions

USED

Implementation

The pathways

Example pathway – Orion Energy

Case studies:

1. MBIE Earthquake-prone buildings policy
2. MBIE/MfE/EQC Planning and engineering guidance for potentially liquefaction-prone land
3. MBIE Guidance on securing parapets and facades of URM buildings
4. WCC Spatial Plan and District Plan Review

What's a pathway? Orion Energy example:

EQC invest in earthquake hazard research in Chch, including potential for liquefaction – 1990s

Chch Lifelines Group - Risk & Realities report, published by CAE, 1997

New knowledge shared with local infrastructure providers and other stakeholders

Local electricity network provider (Orion) applies information

$6 million invested in seismic strengthening programme for electricity assets

Canterbury Earthquake Sequence 2010-2011

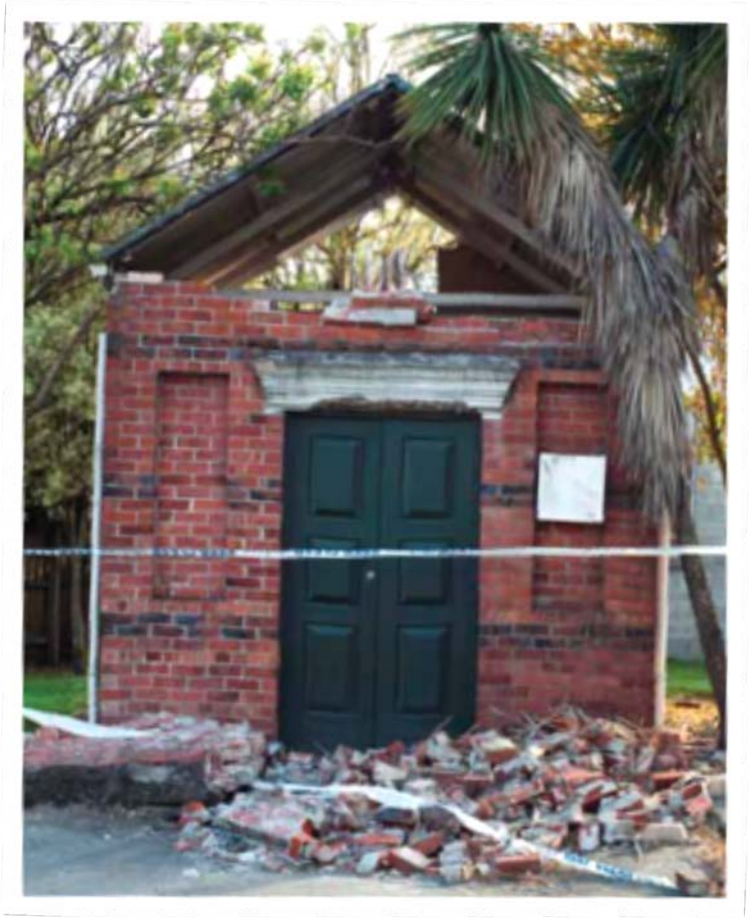
Orion network performs well with continued functionality

Less damage and quicker recovery for electricity network

Reduced economic and social impact for community

Estimated savings of $60 to $65 million in direct asset replacement costs and repairs

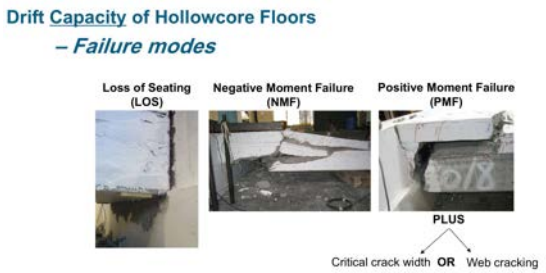
Seismic risk reduction – pays off



Substation - **decommissioned**
prior to earthquakes

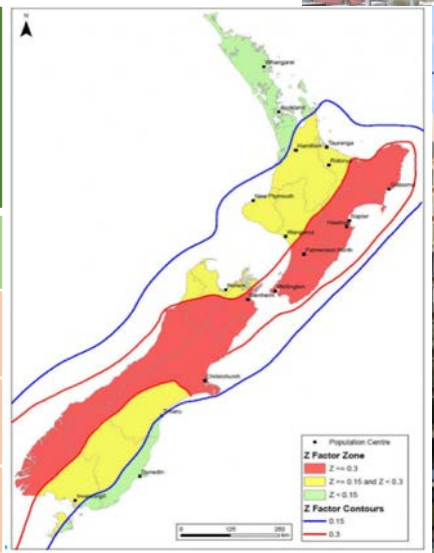
Substation - **strengthened**
prior to earthquakes

1. *Reducing earthquake risk from existing buildings*



- **Canterbury earthquakes 2010-2011** – 1240 buildings demolished
- **Kaikoura earthquake 2016** – 80 mid-rise buildings affected

Seismic risk area	TAs must identify potentially EPBs by:		Owners of EPBs must carry out seismic work within (time from issue of EPB Notice)	
	PRIORITY	OTHER	PRIORITY	OTHER
High	1 Jan 2020	1 July 2022	7.5 years	15 years
Medium	1 July 2022	1 July 2027	12.5 years	25 years
Low	n/a	1 July 2032	n/a	35 years



Pathway #1 – MBIE Earthquake-prone Buildings Policy

Canterbury earthquakes

185 deaths & over 1240 buildings demolished

Royal Commission

MBIE - Existing Buildings Resilience Project

Earthquake-prone buildings legislation (2016)

Risk-based – strengthening timeframes

Central register - 2000 buildings

National consistency - not 68 council approaches

Government and councils subsidies

Councils facilitate implementation

Fines issued for work not done

EQC funds training and guidance

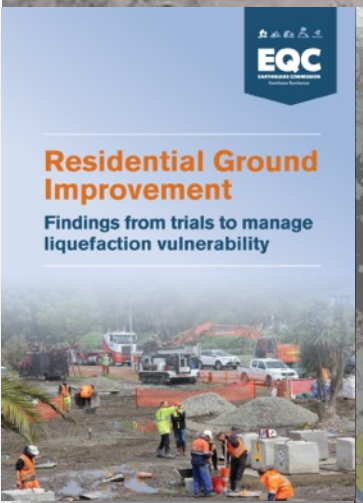
Safer buildings?

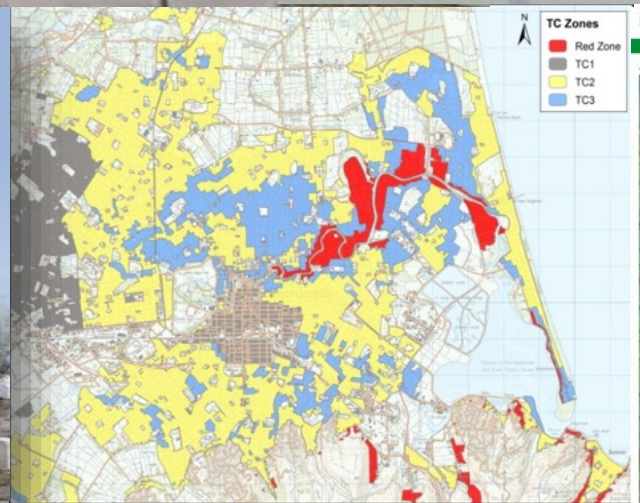
BUT:

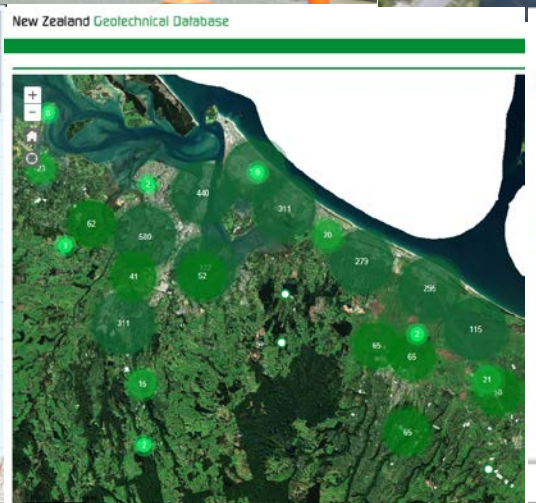
Cost is a barrier

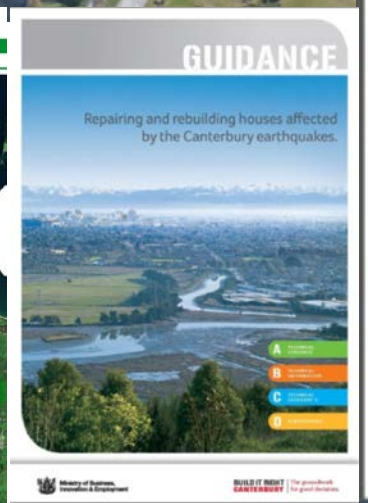
Kaikoura quake – precast floor buildings not regulated as EPBs

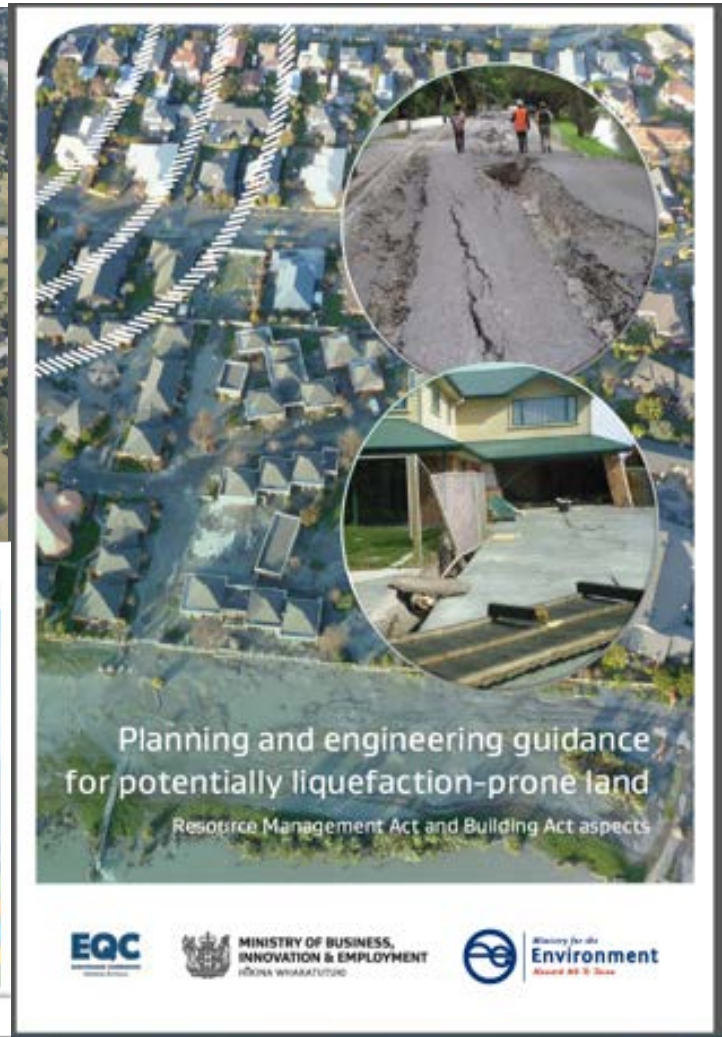
2. Development on potentially liquefaction-prone land











Pathway #2 – Planning and engineering guidance for potentially liquefaction-prone land

Canterbury earthquakes - 7000 houses red-zoned

CERC Recs – councils to better manage liquefaction risk

EQC/MBIE/HNZ/ NSF – ground improvement trials

CGD and technical categories

MBIE house repair and rebuild guidance with EAG

National guidance on assessing potential for liquefaction-risk for land and building development

Risk-based approach

Collaborative Technical Advisory Group

Training by experts in 2018 (T+T)

2019 EQC fund further training

>200 planners and engineers trained

Councils still need to assess liquefaction risk then imbed policies/rules in plans

Data costs & planning capability challenges

Liquefaction vulnerability understood

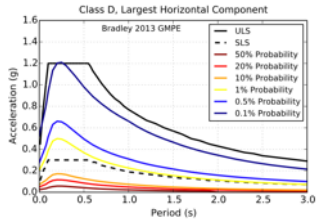
Appropriate level of site investigations and foundations

More resilient homes

3. Securing parapets and facades of URM buildings

Aftershock Hazard Forecasts
Next 30 Days – Wellington Site Class D

- 15x higher than before the earthquake

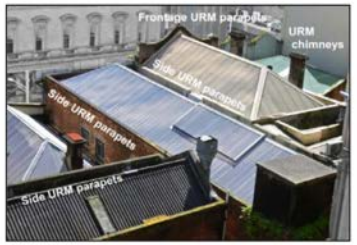


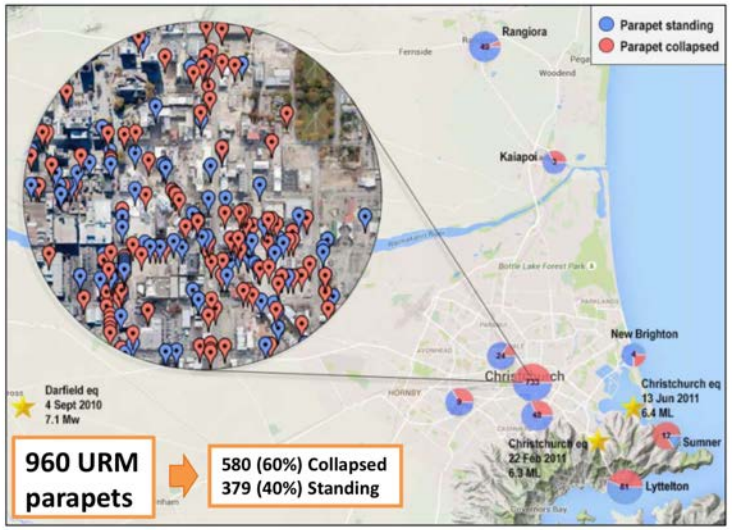
Aftershock Risk

- Turn shaking into impact forecasts

	Probability of Experiencing Ground Shaking That Could Cause Masonry to Fall into the Streets from Unreinforced Masonry Buildings			
Forecast Time Period	Unretrofitted URM	Braced Parapet URM	Partial Retrofit URM	Full Retrofit URM
Within 1 month from 5 December 2016	4% (14 x higher than before the earthquake)	2% (13 x higher)	1% (13 x higher)	1% (14 x higher)
Within 3 months from 5 December 2016	6% (4 x higher)	3% (4 x higher)	2% (3 x higher)	1% (4 x higher)

Parapets performance





REF. Giaretton M., Dizhur D., da Porto F., & Ingham J. (2016). "Post-earthquake reconnaissance of unreinforced and retrofitted masonry parapets" *Earthquake Spectra*, 32(4) 2377-2397

URM in Wellington

- Mainly CBD, Cuba St, Newtown (also Jackson St, Petone)
- Red = unretrofitted, Orange=Retrofitted, Grey=unknown

Pathway #3 – Guidance on Securing parapets and facades of URM buildings

Canterbury earthquakes

580 URM parapets collapse

39 people killed and 100 people injured by URM building failures

EPB legislation enacted

Kaikoura earthquake Nov 2016

GNS Science - heightened aftershock risk

NZSEE & SESOC paper to Minister Smith to address risk to public safety of URM building collapses

OIC to amend the Building Act and RMA – in areas of heightened seismic risk

MBIE guidance issued for owners, councils, and engineers

Owners given 12 months to secure parapets and facades

Government and councils subsidise costs

Councils implement guidance

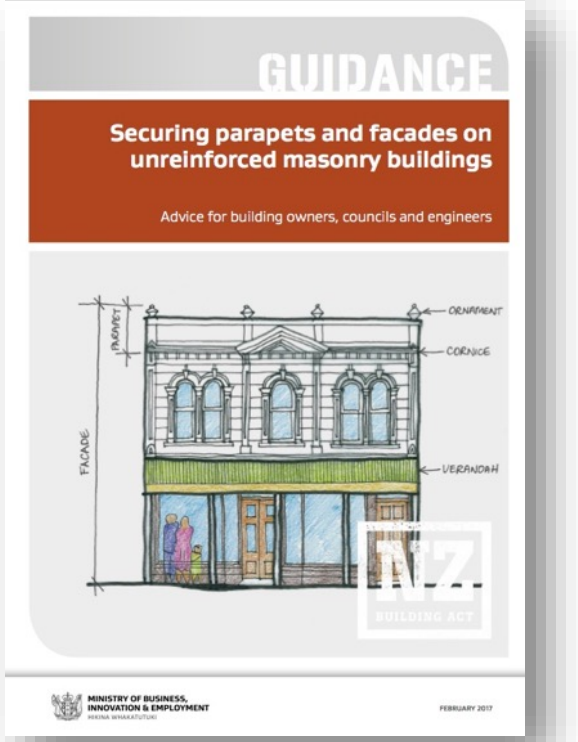
WCC uses a case management approach with owners and links them to contractors

Safer pedestrian and traffic environments around URM buildings

BUT

URM building may still be earthquake-prone

Successful outcomes



Wellington's unreinforced masonry buildings secured

1 October 2018

Of the 113 Wellington buildings with dangerous facades, all but one has completed their reinforcing work within their deadline.

Building owners have had 18 months to secure their Unreinforced Masonry (URM) elements.

"It's a real achievement that the city has reached this milestone," says Wellington Mayor Justin Lester.

"Having the URM elements secured means Wellington is a safer, more resilient place for all of us.

"Three months ago 54 building owners were still to complete their work. There's been a concerted effort by these owners to meet this tight deadline and on behalf of the city I'd like to congratulate them for their efforts."

One building owner has failed to meet their deadline. However, this work is due to be completed today, Monday 1 October 2018.

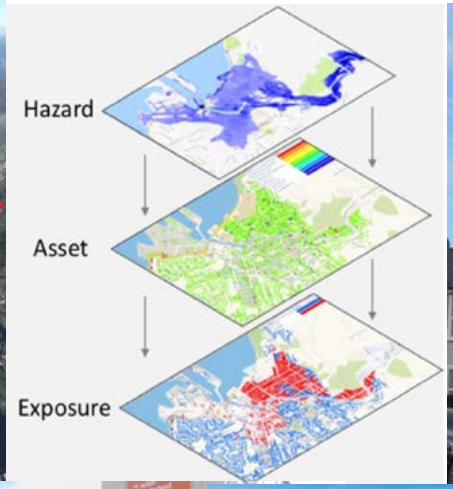
Lower Hutt safer after quake-risk buildings brought up to spec

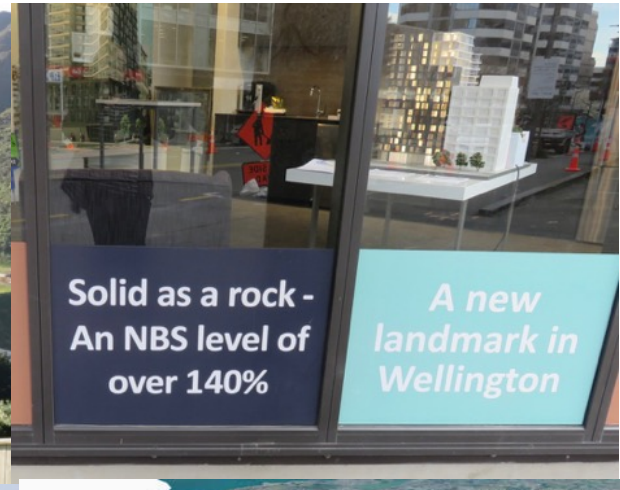
All buildings in Lower Hutt with unreinforced masonry parapets and façades, deemed an earthquake risk to public safety, have been brought up to a safe standard.

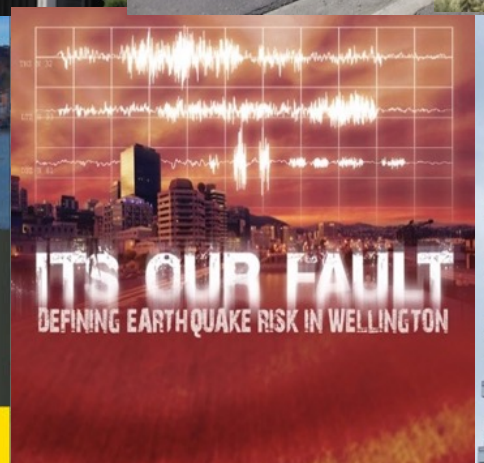
Owners of 25 buildings met the 10 September deadline to secure street-facing unreinforced masonry (URM) that would pose a serious risk of injury or death to the public in the event of an earthquake.

Hutt City Council originally identified 72 buildings as potentially having URM. This number was reduced to 25 as more information on buildings came to light or as building owners quickly got on with the job of securing parapets and façades.

4. A future opportunity – incorporating new science into Wellington City Spatial Plan & District Plan Review







Pathway #4 – WCC Spatial Plan and District Plan Review

New science from:

Canterbury & Kaikoura earthquakes

'It's Our Fault', MBIE Endeavour landslides project, Science Challenges, QuakeCoRE

It's Our Fault project – WCC in governance group

Council GIS data and expertise

NZ Geotech Database

Needs risk experts to apply science to growth scenarios

And

to formulate hazards chapter for district plan

Draft spatial plan for Wellington

(30 -50,000 houses over 30 years)

Full District Plan Review 2021 – new natural hazards chapter

Risk-based approach to future development and density

Development appropriately located for site conditions

More resilient homes and communities

Less damage and impact in earthquakes

Reviewing the pathways – what worked well:

- **EQC's active facilitation of science to practice** – funding science, research, overseas knowledge exchange, GeoNet, and training
- **A trusted evidence base** – professional societies (NZSEE and SESOC), GNS Science, Lifelines reports
- **Active lobbying of politicians** – if policy makers 'won't listen'
- **Involving end users in project governance**
- **Cross-discipline collaboration** for guidance development
- **Councils actively managing policy implementation**
- **Using risk experts** in guidance development and training – T+T, GNS, EAG
- **Financial incentives**

EQC
EARTHQUAKE COMMISSION
Kōmihana Rūwhenua

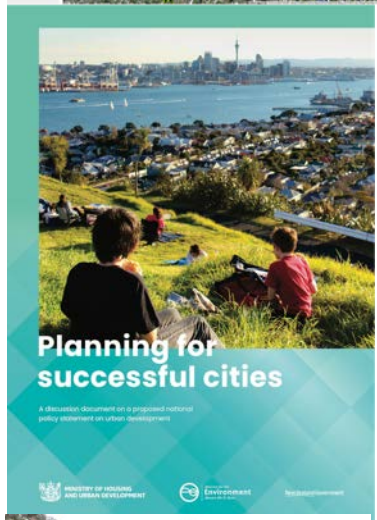
nzsee
NEW ZEALAND SOCIETY FOR EARTHQUAKE ENGINEERING

Other levers to get science into practice

- Create specific ‘knowledge broker’ roles to ‘sell’ science
- Actively facilitate connection of scientists and policy makers
- Focus effort where science/research will have greatest impact
- Participate in regulatory consultation processes
- Engage with the community to demand change
- Upskill technical capability in policy programmes
- Use non-regulatory guidance, training and education

“Land use planning is perhaps the most potent policy lever for influencing the level of future natural disaster risk”

(Australian Productivity Commission 2014)



My reflections:

- Research needs to talk louder for policy to listen AND policy also needs to better connect with science
- Science to practice/policy needs active facilitation and dedicated resourcing
- Policy still needs implementation to achieve risk reduction/mitigation
- Greater focus should be put on getting earthquake science into land use planning – this could achieve significant risk reduction benefits
- Identifying pathways to practice can help identify research impacts, give value to science, and ‘sell science’ for risk reduction
- The pathways examined show some success of getting earthquake science into practice, highlight many of the challenges, and show there is a lot of new science still to be incorporated into policy

Thank you

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