

Leaders of our communities say they want resilient buildings and resilient cities that can bounce back from major earthquakes.

Engineers can deliver resilient buildings, **but only if other stakeholders want them and can see their value.** 



If ever there was a demonstration of the importance of resilience in buildings, then the 22 February Earthquake's impact on Christchurch CBD is it.

The time has come to design and retrofit buildings so that they survive well and can resume their functions quickly after a major shake.

To achieve safety, low damage and quick repair times and so minimise the impact of earthquakes on the community overall.

A concerted effort by all stakeholders is required if we are to learn from the Canterbury Earthquakes and leave a fitting legacy to future generations.



Christchurch Women's Hospital on its lead-rubber base isolators showed us the way, riding out all the major shakes and aftershocks with minimal damage, while retaining its functionality – and the peace of mind of occupants.

Base isolation reduces damage to the building fabric, fittings and contents and enables buildings to function throughout strong earthquake shaking.

Ratings summary									
(3 separate ratings)									
	Safety	Damage Repair Time							
(R	(Risk of personal harm)								
****	Extremely low	Minimal	Days						
****	Very low	Moderate	Weeks						
***	Low	Significant	Months						
**	Moderate	Substantial	> 6 months						
*	High	Severe	> 1 year						
Ratings based on effects of 500-year shaking intensity The matrix of ratings is intended to align with the EPRS ratings developed by the Structural Engineers Association of Northern California (SEAONC) www.seaonc.org and as further developed and applied by the United States Resiliency Council (USRC). www.usrc.org.									

The Royal Commission on the Canterbury Earthquakes recommended that an earthquake grading scheme be developed for buildings.

A five-star grading scheme was being developed in the US [USRC 2019] and efforts were made here in NZ to do the same – especially in view of the Royal Commission's recommendation.

Over the last few years QuakeStar Worksheets have been developed which rate buildings for Safety, Damage and Repair Time. In addition, they identify any issues with adjacent buildings and sites that could affect the subject building. (See <u>www.quakestar.org.nz</u>)

As such the Worksheets provide a means for stakeholders to see specifically what greater resilience means for any building.

They can help engineers, owners and other stakeholders to *start thinking* beyond just safety – another vital step towards resilience.

Comparison of %NBS and QuakeStar Safety Scores								
Building Importance Level (IL)	Typical example	Seismic Factor for New Building Standard	%NBS for building to New Building Standard	QuakeStar Safety Score	QuakeStar Safety Rating			
IL2	Office Building	1.0	100%NBS	100 - 130	***			
IL3	School	1.3	100%NBS	130 - 170	****			
IL4	Hospital	1.8	100%NBS	180 - 230	****			

By looking beyond Safety the QuakeStar approach encourages thinking on overall building resilience – by architects, engineers, owners, insurers and funders.

The QuakeStar concept has great potential to bring about a much wider appreciation of earthquake risk across all sections of the community.

It needs pro-active support from all stakeholders so that, in time, earthquake issues become an integral part of property market transactions.

That way, owners and users of buildings will always want to know about the earthquake situation and factor this into their valuations.

A property market influenced in this way is the best way to ensure rational decisions on earthquake strengthening and priorities.



Some stakeholders have already got there!

This office building in Christchurch is base-isolated and designed to Importance Level 4, well above the minimum requirements for commercial buildings.

On the face of it, it would score 5-stars for Safety, Damage and Repair Time.

As such it is a fine example of a resilient building.

There should be more like it.

We need leadership and concerted action from all stakeholders to help achieve greater resilience in our building stock across New Zealand.

### So who are the stakeholders responsible for delivering resilient buildings?

### Main stakeholders

- Government authorities
- Property owners and developers
- Funders and Insurers
- Architects
- Structural Engineers
- Tenants and users
- Other building professionals

# Resilient Buildings – Who cares?

**Central Government** – from Prime Minister down.

Local Government – Mayors, Councillors, Managers, Building officials plus LGNZ

Property owners and developers - NZ Property Council, its members and others

Funders – NZ Bankers Association and its members

Insurers – Insurance Council and its members

Architects – NZIA and its members

Structural Engineers – Members of NZSEE, SESOC, NZGS, Engineering New Zealand

Tenants and users – Tenants Protection Association and the like.

Other building professionals - Services Engineers, Project Managers,

Quantity Surveyors, Builders, Real Estate Agents

And what should each stakeholder do in response to recent earthquakes to help bring about resilient buildings?



Government authorities, central and local, must:

- Recognize that **better buildings reduce economic and social impacts** of major earthquake events well beyond any benefits to owners.
- Set a regulatory environment that promotes resilient buildings
- **Provide financial incentives** for owners and developers to deliver them.
- Show leadership. Leadership from government authorities is a vital ingredient that helps motivate other stakeholders.



Owners and developers must

- Demand resilient buildings from architects and engineers.
- Challenge their architects and engineers to deliver them at reasonable cost.
- Create market conditions that reward better buildings.
- Put a premium on superior earthquake engineering and resilient design.
- Demand better terms from funders and insurers for resilient buildings.



#### Lenders and insurers must

- **Actively develop ways to** *reward greater resilience* based on recognized building attributes and *assessed* earthquake performance.
- **Provide financial incentives and disincentives.** Even small incentives can influence owner behaviours significantly.
- Make it worthwhile for owners to invest in greater resilience.



#### Architects must:

- Think about overall building resilience when conceiving a building
- Promote the concept of building resilience amongst their members
- Persuade clients of the long term value of resilient buildings
- Challenge engineers to devise ways to reduce earthquake damage and reduce repair times at reasonable cost.



Structural engineers must:

- Widen their focus beyond safety.
- Devise and deliver buildings with reduced damage and shorter repair times.
- Persuade their clients (owners, developers, architects) that resilient buildings represent better value all round.



Tenants and users must:

- Demand resilient buildings that will deliver:
  - Safety
  - Low damage
  - Faster re-occupancy,
  - Lower insurance premiums
  - Better mortgage terms
  - Greater peace of mind.



**Other Building Professionals** (Services Engineers, Project Managers, Quantity Surveyors, Builders, Real Estate Agents) must:

- Actively encourage members to **understand what delivers earthquake resilience** in buildings
- Actively encourage members to **promote the benefits of greater resilience** to owners and to the community



Would **all stakeholders** in the property market please recognise the value of building for better earthquake resilience.

Please **commit time, effort, money and resources to improve the resilience** of our buildings and, through that, our cities and communities.

This would do so much to drive day-to-day behaviours that will help reduce the impact of future events on the community.

Please can we not fall back to the indifference, ignorance and apathy that existed prior to the life-changing events of Canterbury and Kaikoura

We owe it to future generations to keep the horrendous impacts of recent earthquakes firmly in mind when designing, constructing, strengthening, buying, selling, renting, insuring, funding, consenting, certifying and using buildings.

And in so doing, deliver a fitting legacy from the experiences of the Canterbury and Kaikoura Earthquakes.

No stakeholder group can do this in isolation. It requires a team effort.



Resilient Buildings for New Zealand. Who cares?

May the answer be resounding

## "We do!"

From each and every stakeholder.....



It is my earnest hope (dream) that these stakeholders will join together and change the way New Zealand designs and constructs its buildings to achieve the resilience we all want.

The **next step** is for central government to **convene a meeting of stakeholders** to motivate them to commit to ongoing effective action.

The meeting would seek to get a commitment from each stakeholder group to the following resolution:



In the wake of the Canterbury and Kaikoura Earthquakes and in light of the overall need to improve city resilience to natural disasters, we encourage all stakeholders to consider overall building resilience when designing new buildings or retrofitting existing ones.

To this end, we endorse the QuakeStar concept that seeks to rate buildings according to Safety, Damage and Repair Time.

We encourage all stakeholders in building performance (owners, users, authorities, insurers, funders, engineers and architects) to use QuakeStar ratings as an informal non-binding measure of assessed earthquake performance – designed to supplement the current %NBS assessments.

The long-term aim is for the QuakeStar measures of Safety, Damage and Repair Time to develop over time and become embedded into property market considerations – to distinguish between buildings and to keep earthquake risk and building resilience in the minds of owners and users.

Such an outcome would be a fitting legacy from recent experiences in the Canterbury and Kaikoura Earthquakes.



*This picture is of a proposed base-isolated building in Taiwan about 2009.* 

The developer found that people were prepared to pay a premium for having the extra resilience and peace of mind.

This premium was more than the small extra cost to incorporate base-isolation.

Can we develop a market in New Zealand that recognises the value of resilient buildings in earthquake?

Javid Hopkins

David Hopkins Consulting Engineer Auckland April 2019