Joint Committee for Seismic Assessment and Retrofit of Existing Buildings

Statement of Research Needs

Report JC 25-03

April 2025

New Zealand Geotechnical Society

nzsee NEW ZEALAND SOCIETY FOR EARTHQUAKE ENGINEERING

SESOC

MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT HĪKINA WHAKATUTUKI

Natural Hazards Commission Toka Tū Ake

Foreword

The Joint Committee for Seismic Assessment and Retrofit of Existing Buildings is responsible for the joint oversight of the system used to assess, communicate, manage and mitigate seismic risk in existing buildings. It reviews how the guidelines are functioning in practice, identifies areas that require further input and development, and either advises on or assists in the development of proposals for work programmes that contribute towards these objectives. The Joint Committee includes representatives from The Natural Hazards Commission Toka Tū Ake, the Ministry of Business, Innovation & Employment, and the technical societies (NZGS, NZSEE, SESOC).

The Joint Committee's Vision is that:

- Seismic retrofits are being undertaken when necessary to reduce our seismic risk over time while limiting unnecessary disruption, demolitions and carbon impacts, promoting continued use or re-use of buildings.
- Decisions on retrofitting are informed by an appropriate understanding of seismic risk and are aligned with longer term asset planning.
- Seismic assessment and retrofit guidelines help engineers focus on the most critical vulnerabilities in a building, serve the needs of the market and regulation, and evolve through a stable ongoing cycle allowing new knowledge and improvements to be included in a predictable manner, including the consideration of objectives beyond life safety.
- Engineers are supported in the implementation of Seismic Assessment and Retrofit Guidelines through a range of training and information sharing strategies, including tools for risk communication to manage unnecessary vacating of buildings.
- Society is informed about the level of risk posed by existing buildings.

Acknowledgements

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Version	Date	Purpose/ Summary of changes
1	April 2025	For industry feedback

This document is managed by the Joint Committee for Seismic Assessment and Retrofit of Existing Buildings.

Please submit any feedback via design.resilience.nz.

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Abbreviations

EPB	Earthquake-prone building
Joint Committee	Joint Committee for the Seismic Assessment and Retrofit of Existing Buildings
MBIE	Ministry of Business, Innovation, and Employment (Building System Performance branch)
NHC	Natural Hazards Commission Toka Tū Ake
NZGS	New Zealand Geotechnical Society
NZSEE	New Zealand Society for Earthquake Engineering
SESOC	Structural Engineering Society New Zealand

Note that "Seismic Assessment Guidelines" is used generically throughout this document. It does not specifically refer to those used for regulatory earthquake-prone building assessments, nor to voluntary seismic assessments, except as noted in context.

1. Statement Purpose

The Joint Committee sees a need for specific research and investigations that support important upcoming work to improve the seismic resilience of existing buildings. This Statement of Research Needs articulates those needs.

As a leader in the building sector on seismic risk of existing buildings, the Joint Committee intends for this to signal to other stakeholders and partners—and especially to funding agencies—that the topics described herein are of immediate interest and importance in assessing, evaluating, and ultimately managing seismic risk in Aotearoa New Zealand.

2. The Joint Committee

The Joint Committee on the Seismic Assessment and Retrofit of Existing Buildings (Joint Committee) is a leadership group providing direction on the improvement of seismic resilience of existing buildings in Aotearoa New Zealand. It includes representatives from:

- Ministry of Business, Innovation, and Employment (MBIE),
- Natural Hazards Commission Toka Tū Ake (NHC)
- New Zealand Geotechnical Society (NZGS),
- New Zealand Society for Earthquake Engineering (NZSEE), and
- Structural Engineering Society (SESOC).

The Joint Committee advises MBIE—and other agencies—on the management of seismic risk from existing buildings in New Zealand, including through the Earthquake-prone building (EPB) system. It is a forum for technical practitioners and regulators to regularly engage on how and whether existing buildings are being adequately managed over time, including how the Seismic Assessment Guidelines are functioning in practice and flagging areas that require additional input or development.

2.1. How research supports the Joint Committee

The Joint Committee is a "boundary organisation"; it allows for engagement and collaboration across political, scientific, and practitioner partners to address a systemic challenge. This position affords it the perspective and mana to set long-term work programmes and identify current needs to overcome future challenges. It also has the opportunity to review and revise past decisions and work programmes based on ongoing review and monitoring. This extends to identifying gaps and barriers that would inhibit future work programmes, including those that can be addressed through research.

Research is undertaken to answer specific questions that contribute to a wider or larger societal need. Science, broadly, is "expected to make contributions to the attainment of explicit societal goals and advance development. An inability to demonstrate impact can jeopardise support for public investments in science over the long term"[1]. Further, MBIE defines research impact as "a change to the economy, society, or environment, beyond contribution to knowledge and skills in research organisations."[2]

[1] MBIE 2017 *Science Impact Discussion Paper*
[2] MBIE 2019 *The Impact of Research Position Paper*

Figure 1 - How research serves society

In overseeing the implementation of the Guidelines for both regulatory EPB assessments and voluntary seismic assessments, the Joint Committee works to improve the efficacy and availability of existing system levers and practitioner tools. Much of the work necessarily focuses on the ongoing relevance of the Seismic Assessment Guidelines and other aligned projects to improve seismic risk management in existing buildings. This leads to a natural work structure following projected revision cycles and the various modules or chapters of the guidelines.

The Joint Committee has identified what it believes are the desired impacts regarding seismic risk management and worked backwards to understand the initial research questions that will help to successfully deliver on these impacts. This *Statement* articulates those questions. Maintaining this line of sight from research to implementation and impact is critical to the eventual success of the Joint Committee in managing seismic risk of existing buildings in Aotearoa New Zealand.

3. Research needs

The Joint Committee has identified research needs across five main themes:

Figure 2 - Research themes

3.1. Ground performance

How does the behaviour of the ground impact the superstructure, and how can it be improved?

- Reconciling the 2022 National Seismic Hazard Model with ground motion models for cumulative average velocity
- Settlement of shallow foundations on liquefiable soils and the impact on buildings.
- Lateral spreading and flow failure risk
- Cyclic degradation (of foundation systems and of soils)
- Better information on performance of unique soils (for example, pumiceous soils)
- What combinations of ground conditions and building types require geotechnical assessment.
- Validation of a simplified means to account for soil structure interaction in seismic assessments.

3.2. Building performance and assessment

What are the most vulnerable parts of a building that affect its behaviour and damageability?

- Better understanding of diaphragm performance and how it correlates with significant life safety hazard.
- Assessment methodologies for existing diaphragms
- Performance of masonry gable walls beyond what is covered by Section C8 (2025)
- Validation of assessment outcomes for masonry infill construction
- Contribution of cladding and other parts to overall building performance and ratings
- Precast flooring performance (especially expected performance of rib and infill and double T, including heritage forms)

- Improved assessment of gravity load collapse potential
- Consideration of consequence in building ratings
- Performance of shallow embedded anchors
- Common limitations in assessments of steel buildings
- Improve or explore new building performance metrics
- The impact of soil structure interaction on the demands on the superstructure
- Validation of current approaches for use of NLTHA for existing structures
- Field testing of structures to demonstrate their performance and resilience.

3.3. Retrofit and repair

Which retrofit or repair approaches are most appropriate?

- Explore the feasibility of incremental retrofit, particularly of reinforced concrete.
- Develop and promote case studies to help guide and streamline future practice
- Understanding the effect of specific elements on the performance on the building as a whole (holistic performance)
- Practical risk reduction solutions (e.g. for precast floor rating NMF/PMF/support loss)
- Explore simple, economical repair strategies to avoid unnecessary demolition.
- Identify levels of damage requiring repair, including in an insurance context.

3.4. Risk-informed decision-making

How are we considering risk in our decision-making?

- Align system risk settings with expectations (international, societal, scientific, etc)
- Explore the balance and interaction between sustainability and (seismic) retrofit
- Risk settings and definitions for the built environment
- Consideration of uncertainty in setting risk targets and communication
- Understand and quantify the costs and benefits associated with assessment and retrofit (and who bears them)
- Risk communication of the mechanism and impact rather than binary pass/fail ratings
- Investigation of what constitutes a significant life safety hazard (including experience from past earthquakes)
- Better understanding of risk posed by different New Zealand building typologies and knowledge of our building inventory.

3.5. Practice management

How effective are regulatory levers in managing seismic risk in existing buildings?

- Mechanism for the uptake of research into guidance
- Opportunities for international resources to be applied in New Zealand
- Capability (esp. younger practitioners) to deliver consistent high-quality outcomes
- Clarify the interaction between the building system and other legislation (especially the HSW Act 2015)
- Effective communication strategies through reporting tools, templates, etc.

4. A note on research funding

4.1. Funding agencies

This document signals the Joint Committee's interests in research outputs, not a capacity to fund said research. While organisations and representatives on the Joint Committee often have strong connections across the sector(s) or even affiliations with agencies that provide research funding, the Joint Committee is not itself responsible for any research funding. There are, however, several other organisations with strong research interests in the built environment that do provide funding mechanisms.

Natural Hazards Commission Toka Tū Ake

The Natural Hazards Commission[3] invests in natural hazard risk research that aligns with and support its strategic goals. It directs research funding towards research under several main themes, including "Resilient Buildings." The Natural Hazards Commission has various mechanisms and programmes that it distributes its research funding through, and it captures its investment priorities in its *Research Investment Priorities Statement*.

BRANZ

BRANZ Inc.[4] invests the Building Research Levy in industry good research and knowledge transfer. It directs the Levy funding to projects conducted by BRANZ research teams and with external agencies. The BRANZ Research Portfolio cover multiple key research areas that all focus on the building industry, and it also provides guidance on its research priorities through its *Investment Priorities Statement*.

Ministry of Business, Innovation, and Employment (MBIE)

MBIE oversees and distributes several investment funds[5]. Perhaps most notable for the building and natural hazard risk sectors are the Catalyst Fund—which supports the adaptation and incorporation of international resources for New Zealand's benefit—and the Endeavour Fund—which promotes research excellence and impact throughout the science system.

4.2. Aligned research programmes

Besides these established agencies, there are also several established, ongoing research programmes that contribute to the building sector. Funding arrangements and availability varies between these, but they often provide invaluable connection and collaboration opportunities for undertaking building-related research. Due to New Zealand's size and the relatively specialised focus of these topics, there is likely to be significant crossover and connections (in subject matter and in personnel) between these organisations as well.

[3] Natural Hazards Commission Toka Tū Ake Research
[4] BRANZ Research
[5] MBIE Science and Technology Investment Funds

Te Hiranga Rū QuakeCoRE

Funded by the New Zealand Tertiary Education Commission, QuakeCoRE[6] aims to establish and link multi-institutional national research programmes that advance the science of and resilience to earthquakes. It leverages system-level science and highly integrated collaboration networks across the physical, engineering, and social sciences. Currently QuakeCoRE is funded to 2028.

Building Innovation Partnership

The Building Innovation Partnership[7] is an industry-led research programme to improve the whole-of-life performance of infrastructure. It develops engineering solutions that improve the resilience and affordability of our built assets through engineering research. Currently, the Building Innovation Partnership is funded to 2026.

Natural Hazards and Resilience Platform

The Natural Hazards and Resilience Platform[8] is an evolution of the Resilience to Nature's Challenges National Science Challenge, which ended in 2024. The new Platform will seek to enhance New Zealand's resilience to natural hazards by delivering relevant science and supporting science capability important to resilience and emergency management. The Platform is funded to 2030.

[6] QuakeCoRE
[7] Building Innovation Partnership
[8] Natural Hazards and Resilience Platform