

# Section 1: Summary and recommendations – Volume 4

In this Volume we discuss the question of how to define and treat existing buildings in New Zealand that are likely to perform poorly in earthquakes. We have outlined the development of building standards, legislation and policies in New Zealand since the major development of urban centres commenced. We have reviewed the particular characteristics of unreinforced masonry (URM) buildings, which form a significant proportion of New Zealand's earlier buildings and lack the capacity to resist seismic actions when compared to more recent structures using steel and reinforced concrete.

Failure of such buildings resulted in the deaths of 39 people in the 22 February 2011 earthquake. We have examined these building failures, along with two other building failures of a different construction and one domestic fireplace collapse, and report our findings on these. We also have considered how existing buildings may be assessed for their seismic resistance, and looked particularly at how unreinforced masonry buildings may be retrofitted to increase their seismic resistance.

We recommend a number of changes to the legislation, policies and practices underpinning how New Zealand addresses the issue of earthquake-prone buildings. The numbering of these recommendations continues from the recommendations made in Volumes 1 to 3 of our Report.

## Free-standing masonry walls

The collapse of a free-standing masonry wall of unknown structural strength in the February 2011 earthquake resulted in a death (see section 4.7 of this Volume of our Report). We consider such walls should either be adequately restrained or demolished.

## Recommendation

We recommend that:

71. Free-standing masonry walls of unknown structural strength should be adequately restrained or demolished.

## Assessing existing buildings

The Royal Commission considers that improving New Zealanders' understanding of the nature of a building they may be purchasing, using or passing by, is important. We consider that developing a grading system for existing buildings that is more easily understood by territorial authorities, building owners, tenants and the general public would be highly beneficial. Such a grading system could be based on or similar to that already set out in the New Zealand Society for Earthquake Engineering Initial Evaluation Process (IEP) Recommendations entitled *Assessment and Improvement of the Structural Performance of Buildings in Earthquakes*, dated June 2006 and referred to in this Volume of our Report as the NZSEE Recommendations<sup>1</sup>, using letter grades A to E. The advantage of this form of grading system is that the general public are familiar with such grades and could more easily understand that a D or E grade would indicate a building that poses a clear earthquake risk.

Conversely, buildings receiving higher grades may be able to attract higher rental returns and/or lower insurance premiums.

Assessing existing buildings is a complex task. The Royal Commission considers the NZSEE Recommendations are generally sound. However, the Initial Evaluation Process (IEP) and Detailed Assessment processes should be reviewed to take into account the risk that plans may not accurately record actual construction decisions and materials, especially for older buildings. The resulting new practice standards or methods for evaluating existing buildings should also be given regulatory standing and monitored, to ensure consistency in application and use, given the potential resulting classification as an “earthquake-prone building” under the Building Act 2004. There is a discussion in section 6.2.5 of this Volume that should be taken into account in assessing the potential seismic performance of buildings designed under Standards earlier than those that currently apply. Those assessing such buildings should be familiar with these matters.

## Recommendations

We recommend that:

72. The Ministry of Business, Innovation and Employment should work with territorial authorities, building owners, the New Zealand Society of Earthquake Engineering and other interested parties to develop a grading system for existing buildings that is able to be understood by the general public and adequately describes the seismic performance of a building.
73. The Ministry of Business, Innovation and Employment should review the New Zealand Society of Earthquake Engineering Recommendations entitled *Assessment and Improvement of the Structural Performance of Buildings in Earthquakes* and, in conjunction with engineering practitioners, establish appropriate practice standards or methods for evaluating existing buildings.

These practice standards or methods should have regulatory standing, and be monitored by the Ministry of Business, Innovation and Employment for consistency of application.

74. Structural engineers assessing non-URM buildings should be familiar with the practical assessment considerations discussed in section 6.2.5 of this Volume. Those considerations should also be referred to in the practice standards or methods developed in accordance with Recommendation 73.

The Royal Commission has reservations about the use of 15% damping, and the assumption of a structural ductility factor of 2 and an  $S_p$  factor of 0.7 for use with unreinforced masonry elements.

We consider that the use of the undefined term “new building standard” or “NBS” conveys an incorrect expectation of how a building will perform in an earthquake and that the term “ultimate limit state” or “ULS” is more accurate. We consider that the Ministry of Business, Innovation and Employment should clearly describe to territorial authorities and the public the difference between the expected behaviour of an existing building prior to collapse and the behaviour of a building that complies with the current Building Code.

## Recommendation

We recommend that:

75. Further research should be carried out into the suitability of assuming 15 per cent damping, and a structural ductility factor of 2 and an  $S_p$  factor of 0.7, in assessing unreinforced masonry elements.
76. The Ministry of Business, Innovation and Employment should clearly describe to territorial authorities and the public the difference between the expected behaviour of an existing building prior to collapse, and the behaviour of a building that complies with the current Building Code.

## Improving existing buildings

We consider that there is a demonstrated need in the interests of public safety for the hazardous elements of unreinforced masonry (URM) buildings to be strengthened throughout New Zealand. We consider that falling hazards such as chimneys, parapets and ornaments should be secured or removed. In addition, we consider that the external walls of all URM buildings should be supported by retrofit, even in areas of low seismicity. We also consider that the design actions for the elements and connections to be strengthened should be based on the provisions in NZS 1170.5:2004: *Section 8 – Requirements for Parts and Components*<sup>2</sup>.

## Recommendations

We recommend that:

77. For unreinforced masonry buildings, falling hazards such as chimneys, parapets and ornaments should be made secure or removed.
78. The design actions for the elements and connections to be strengthened should be based on the provisions in NZS 1170.5:2004: *Section 8 – Requirements for Parts and Components*.
79. The external walls of all unreinforced masonry buildings should be supported by retrofit, including in areas of low seismicity.
80. The detailed assessment of unreinforced masonry buildings that are earthquake-prone should take into account the potential need to:
  - a ensure adequate connection between all structural elements of the building so that it responds as a cohesive unit;
  - b increase the in-plane shear strength of masonry walls; or
  - c introduce high-level interventions (such as the insertion of steel and/or reinforced concrete frames) to supplement or take over the seismic resisting role from the original unreinforced masonry structure.

Such buildings should be strengthened in accordance with the findings of that detailed assessment.

81. Recommendations 75 to 80 should be undertaken within the same timeframes as recommended in Recommendations 82 to 86 for unreinforced masonry buildings.

## Earthquake-prone buildings policy and legislation

It is important that territorial authorities are able to address appropriately buildings that pose a danger in an event such as an earthquake. The Royal Commission recommends a number of changes that should be made to the legislation governing how territorial authorities address earthquake-prone buildings in their districts. These include recommendations to enable territorial authorities to ensure that timely improvements are made to URM buildings. The Royal Commission considers that, to protect life safety, there is no justification to set the shaking level to be resisted for earthquake-prone structures at greater than one third of the requirements for a new building. However, because some elements of URM buildings pose a particular source of danger, we consider that a higher level of protection should be given to them: in particular, chimneys, parapets, ornaments and external walls.

We are also of the opinion that the maximum time permitted to complete the evaluation and strengthening of existing buildings should be set nationally.

However, territorial authorities should also be empowered to adopt earthquake-prone building policies that are stricter than the minimum statutory requirements (as to the level of strengthening or the time allowed for implementation) where they consider that is appropriate, taking into account particular economic considerations, building characteristics, and/or seismic circumstances that are relevant to their districts. Adoption of a policy that exceeded the minimum statutory requirements would require the territorial authority to follow the special consultative procedures of the Local Government Act 2002.

There are some buildings that are very seldom used and are so located that their failure in an earthquake is most unlikely to cause loss of life, or serious injury to passers-by. An example is rural churches. We consider that there is a good case for such buildings to be exempt from the general legislative requirements for earthquake-prone buildings. If that policy position is adopted, we consider it should be set out in legislation so that one rule applies nationally.

## Recommendations

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We recommend that:

82. The Building Act 2004 should be amended to require and authorise territorial authorities to ensure completed assessments of all unreinforced masonry buildings within their districts within two years from enactment of the Amendment, and of all other potentially earthquake-prone buildings within five years from enactment.
83. The legislation should be further amended to require unreinforced masonry buildings to be strengthened to 34% ULS within seven years from enactment of the Amendment and, in the case of all other buildings that are earthquake-prone, within 15 years of enactment.
84. The legislation should be further amended to require that, in the case of unreinforced masonry buildings, the out-of-plane resistance of chimneys, parapets, ornaments and external walls to lateral forces shall be strengthened to be equal to or greater than 50% ULS within seven years of enactment.
85. The legislation should provide for the enforcement of the upgrading requirements by territorial authorities, with demolition (at owner's cost) being the consequence of failure to comply.
86. The legislation should allow territorial authorities to adopt and enforce a policy that requires a shortened timeframe for some or all buildings in the district to achieve the minimum standard required by the legislation, after following the special consultative procedures in the Local Government Act 2002.
87. The legislation should allow territorial authorities to adopt and enforce a policy that requires a higher standard than the minimum ULS required by the legislation for some or all buildings in the district, after following the special consultative procedures in the Local Government Act 2002.
88. The legislation should allow territorial authorities to adopt and enforce a policy that requires a higher standard of strengthening for buildings of high importance or high occupancy, where public funding is to be contributed to the strengthening of the building or where the hazard to public safety is such that a higher standard is justified, after following the special consultative procedures in the Local Government Act 2002.
89. Guidance should be provided by the Ministry of Business, Innovation and Employment to territorial authorities on the factors to be considered in setting discretionary policies under the amended legislation. These factors should include the nature of a community's building stock, economic impact, numbers of passers-by for some buildings, levels of occupancy, and potential impact on key infrastructure in a time of disaster (e.g. fallen masonry blocking key access roads).
90. The legislation should exempt buildings that are very seldom used and are so located that their failure in an earthquake is most unlikely to cause loss of life, or serious injury to passers-by.

## Issues with defining a building as dangerous and/or earthquake-prone

The Royal Commission notes that there are questions about the proper interpretation of sections of the Building Act 2004, including the interrelationship of the earthquake-prone buildings provisions and other sections of the Act. There is some uncertainty about whether a part, or parts, of a building (for example, parapets) fall within the definition of “earthquake-prone” as set out in section 122 of the Building Act 2004. We also consider it important that territorial authorities are able to immediately repair or demolish a building that was not considered earthquake-prone before an earthquake, but poses a danger after being damaged in a recent earthquake.

## Recommendations

We recommend that:

91. The Building Act 2004 should be amended to make it clear that sections 122 and 124 of the Act apply to parts of a building.
92. The Building Act 2004 should be amended to empower territorial authorities to take action where a building is not deemed dangerous under section 121 or earthquake-prone under section 122, but requires immediate repair or demolition due to damage caused by an event such as an earthquake.

## Adjacent and adjoining buildings

The Canterbury earthquakes showed there can be a significant risk to buildings that are next to damaged or dangerous buildings. The Building Amendment Bill (No. 4), currently before Parliament, would go some way towards addressing this issue, if enacted in the form in which it was introduced. The proposed amendment alters sections 124 and 125 of the Building Act 2004 to give territorial authorities the ability to restrict entry to affected buildings for particular purposes or to particular persons. We do not think it is necessary to go further, in the context of our recommendation that there should be set statutory timeframes for the strengthening of earthquake-prone buildings generally.

We heard evidence about lack of communication of knowledge about the state of buildings between people making decisions about the building, building owners, tenants and neighbours. Sharing of knowledge and information can reduce the level of risk that dangerous structures create. As examples, tenants were not advised of risk; neighbours did not appreciate the possibility of an adjacent collapse; and the Earthquake Commission (EQC) assessors felt constrained by privacy obligations.

We have noted that the privacy provisions of the Earthquake Commission Act 1993 inhibit the sharing of information and we recommend an amendment to these provisions. We also consider that engineers, other professionals and building owners should all have a duty to share information with each other when they become aware of a building in a potentially dangerous condition.

## Recommendations

We recommend that:

93. The proposed amendments to sections 124 and 125 of the Building Act 2004 in the Building Amendment Bill (No. 4) should be enacted.
94. Section 32(4) of the Earthquake Commission Act 1993 should be amended to allow for disclosure of information that may affect personal safety. A suggested wording is set out in section 4.25.4.3 of this Volume.
95. Legislation should provide for:
  - a a duty to disclose information that a building is in a dangerous or potentially dangerous condition to the relevant territorial authority and any affected neighbouring occupier;
  - b the above duty to be applied to statutory bodies, engineers and other professional persons who have become aware of the information;
  - c a similar duty on building owners in respect of their own tenants and neighbouring occupiers; and
  - d the protection of those carrying out these duties in good faith from civil or other liability or allegations of professional misconduct.

## Buildings divided into separately owned parts

The Royal Commission has considered whether there should be a requirement on all owners of parts of a building that will behave in an earthquake as a single structure to strengthen their part of the building at the same time. If this matter is not addressed, owners of different parts of a building may not take collective action at the same time, which would be more efficient, provident and effective.

A similar issue arises when walls become end walls as a result of the removal of walls on a neighbouring property, which have previously provided support to the adjoining building.

The objective of earthquake strengthening to a nationally-set standard within definite timeframes recommended above is unlikely to be achieved if owners of individual titles in what is effectively one building cannot be compelled to strengthen at a similar time. Providing through legislation an appropriate process by which the relevant issues could be resolved between owners is likely to result in more efficient, effective and timely implementation of the strengthening objectives.

## Recommendations

We recommend that:

96. Legislation should ensure that all portions of a structure are included in the requirement to strengthen buildings to achieve the minimum level required by the legislation by the due date. In drafting the legislation, consideration should be given to providing for a fair process in which all owners of a building divided into separate titles may be required to strengthen the building at the same time.
97. Territorial authorities should be authorised and required to ensure the acceptable strength of remaining walls, particularly end walls, when issuing building consents for the removal of adjoining walls.

## Altering an existing building

Section 112(1) of the Building Act 2004 prevents building consent authorities from issuing building consents for alterations unless satisfied that, after the alteration, the building will comply as nearly as is reasonably practicable with the provisions of the Building Code that relate to means of escape from fire and access and facilities for persons with disabilities. The Royal Commission heard evidence that section 112(1)(a)(ii) can operate as an impediment to building owners strengthening their buildings.

While it is important that egress from a building at a time of fire or earthquake (section 112(a)(i)) remains subject to this rule, we consider it would be preferable if building consents could be issued for strengthening works without the need to comply with the disabled access rule. We say that having regard to the need to strike an acceptable balance between cost and strengthening work, and the desirability of the latter actually being carried out.

## Recommendation

We recommend that:

98. Section 112(1) of the Building Act 2004 should be amended to enable building consent authorities to issue building consents for strengthening works without requiring compliance with section 112(1)(a)(ii). The existing provision would continue to apply to building consents for other purposes.



## Inclusion of residential buildings

Section 122 of the Building Act 2004 excludes buildings that are used wholly or mainly for residential purposes from classification as earthquake-prone, unless they are of two or more storeys, or contain three or more household units. This means the vast majority of dwellings are not covered by the legislation.

We consider there are clearly some elements of residential buildings that pose hazards in earthquakes, for example, URM chimneys, and it is desirable that these should be made more resilient. We also consider that the significance of this issue is one that will vary across New Zealand, depending on the seismic risk of the region and the nature of the housing stock. We therefore consider that this should be addressed by territorial authorities in consultation with their communities.

## Recommendation

We recommend that:

99. The Building Act 2004 should be amended to authorise territorial authorities to adopt and enforce policies to address hazardous elements in or on residential buildings (such as URM chimneys), within a specified completion timeframe consistent with that applied to non-URM earthquake-prone buildings in their district.

## Impediments to the rebuild, repair, or demolition of dangerous buildings – the Resource Management Act 1991 and the Historic Places Act 1993

District plans made under the Resource Management Act 1991 contain provisions that require resource consent applications to be made where buildings are scheduled for protection. The interaction between these provisions and the Building Act 2004 can act as an impediment to the rebuild, repair or demolition of dangerous buildings. In some cases, the consent of the New Zealand Historic Places Trust may be required for demolition of some buildings.

The Royal Commission considers that the immediate securing of dangerous buildings should not be impeded by the consent process and that life safety should be a paramount consideration for all buildings, regardless of heritage status. We consider that it would be appropriate for legislation to make it plain that, where a building is in a state that makes demolition or the carrying out of other works desirable to protect persons from injury or death, no consent for those works is required, regardless of whether the building is protected by a district plan or registered under the Historic Places Act.

## Recommendation

We recommend that:

100. Legislation should provide that, where a building is in a state that makes demolition or protective works necessary to protect persons from injury or death, no consent is required, regardless of whether the building is protected by a district plan, or registered or otherwise protected under the Historic Places Act 1993.

## Knowledge, information and education

The Royal Commission considers there is considerable confusion and misunderstanding among building owners, tenants and territorial authorities about the risk buildings pose in earthquakes, what an assessment of building strength means, the likelihood of an earthquake, and the legal obligations under the Building Act 2004 for earthquake-prone buildings. This contributes to inaction and delay in addressing earthquake-prone buildings.

It is desirable in particular that building owners have a better understanding of their rights and obligations. We believe that raising awareness about these matters would be of significant assistance in supporting action to address earthquake-prone buildings. We also consider that territorial authorities should be required to maintain and publish a schedule of earthquake-prone buildings, as the resulting awareness would be an effective means of encouraging the strengthening of existing buildings.

We have also concluded that there is a lack of knowledge amongst industry participants, such as insurers, valuers and property managers, about the risks involved with earthquake-prone buildings and the legal obligations under the Building Act 2004. This lack of knowledge has potentially prevented building owners and tenants making informed decisions about the risk from, and requirements for, earthquake-prone buildings. Parties who are in an advisory position to building owners and tenants need to ensure that they understand, to an appropriate level, the issues relating to earthquake-prone buildings, and that this information is communicated to those they are advising in an understandable way.

We have noted in this Volume that assessing and strengthening existing buildings is a task requiring specialist knowledge and expertise. We consider that territorial authorities and subject matter experts (such as academics and specialist practising structural engineers) would benefit from sharing information and research among themselves on assessing, and seismic retrofit techniques for, particular kinds of buildings.

## Recommendations

We recommend that:

101. Territorial authorities should be required to maintain and publish a schedule of earthquake-prone buildings in their districts.
102. The Ministry of Business, Innovation and Employment should review the best ways to make information about the risk buildings pose in earthquakes available to the public and should undertake appropriate educational activities to develop public understanding about such buildings.
103. The engineering and scientific communities should do more to communicate to the public the risk buildings pose in earthquakes, what an assessment of building strength means, and the likelihood of an earthquake.
104. Industry participants, such as insurers, valuers, and property managers, should ensure that they are aware of earthquake risks and the requirements for earthquake-prone buildings in undertaking their roles, and in their advice to building owners.
105. The Ministry of Business, Innovation and Employment should support industry participants' awareness of earthquake risks and the requirements for earthquake-prone buildings through provision of information and education.
106. Territorial authorities and subject matter experts should share information and research on the assessment of, and seismic retrofit techniques for, different building types.



## References

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1. New Zealand Society for Earthquake Engineering (2006). *Assessment and Improvement of the Structural Performance of Buildings in Earthquakes; including Corregendum No.1*. Wellington, New Zealand: Author.
2. NZS 1170.5:2004. *Structural Design Actions, Part 5: Earthquake Actions – New Zealand*, Standards New Zealand.