



Determination 2015/081

Regarding the authority’s exercise of powers in issuing an earthquake-prone building notice for a multi-storey reinforced concrete building at 124 Wakefield Street, Wellington.

Summary

This determination considers whether the authority correctly issued an earthquake-prone building notice. The determination also discusses the relationship between the legal test under section 122 of the Building Act 2004, the authority’s earthquake-prone building policy and the engineering methodology used at the time the earthquake-prone building notice was issued.



Index

1. The matter to be determined	2
2. The building and site	4
3. Background	5
4. The initial submissions.....	7
4.1 <i>The applicant</i>	7
4.2 <i>The authority.....</i>	11
5. The first draft determination and further submissions.....	11
5.2 <i>The authority.....</i>	11
5.3 <i>The applicant</i>	14
6. The hearing.....	20
6.3 <i>Matter One: The application of the legal test (technical matters).....</i>	20
6.4 <i>Matter Two: The legal test.....</i>	21
6.5 <i>Matters Three and Four: The decision-making process and the subject building.....</i>	21

7. Post-hearing correspondence and submissions	23
7.1 The authority.....	23
7.2 The applicant	23
8. The second draft determination and further submissions	24
8.2 The authority.....	24
8.3 The applicant	24
9. The determination process.....	27
10. Discussion Part One: the Act, the legal test and the authority’s EQPB policy	31
10.1 Overview of the relevant sections of the Act	31
10.2 An earthquake-prone building under the Act.....	32
10.3 The authority’s approach to section 122 of the Act	34
10.4 The applicant’s approach to section 122 of the Act	34
10.5 Conclusion on the legal test under section 122 of the Act	35
10.6 The authority’s EQPB policy for determining whether a building is earthquake prone	35
11. Discussion Part Two: The challenge to the NZSEE guidelines and their incorporation in the authority’s EQPB policy.....	37
11.1 Overview.....	37
11.2 Observations on the NZSEE guidelines, EQPB policies and the Act.....	37
12. Upcoming changes	41
13. Discussion Part Three: the authority’s assessment of the building.....	42
13.1 The authority’s EQPB policy.....	42
13.2 The authority’s EQPB policy in relation to the current building	43
13.3 Evidence of previous building performance and probabilistic analysis	45
14. Next steps.....	46
15. The decision	47

1. The matter to be determined

1.1 This is a determination under Part 3 Subpart 1 of the Building Act 2004¹ (“the Act”) made under due authorisation by me, John Gardiner, Manager Determinations and Assurance, Ministry of Business, Innovation and Employment (“the Ministry”), for and on behalf of the Chief Executive of the Ministry.

1.2 The parties to the determination are:

- the body corporate of 124 Wakefield Street, acting through an agent (“the applicant”)
- Wellington City Council (“the authority”), carrying out its duties as a territorial authority or building consent authority, acting through a lawyer (“the authority’s lawyer”).

¹ The Building Act, Building Code, Acceptable Solutions and Verification Methods, past determinations and guidance documents issued by the Ministry are all available at www.building.govt.nz or by contacting the Ministry on 0800 242 243

- 1.3 This determination arises from the decision of the authority to issue an earthquake-prone building notice under section 124(1)(c)² (“the section 124 notice”) as the authority considered the building to be earthquake prone as defined in section 122 of the Act. The applicant considers the authority’s earthquake-prone building policy (“EQPB policy”) is not consistent with section 122 of the Act, that it did not correctly apply its policy in the case of this building, and that the authority failed to consider all the relevant information available at the time.
- 1.4 The matter to be determined³ is therefore whether the authority exercised its powers correctly in issuing the section 124 notice for the building, and the discussion of this matter and my conclusions are set out in sections 10 and 13 of the determination.
- 1.5 The applicant has also challenged the authority’s incorporation of the New Zealand Society for Earthquake Engineering’s (“NZSEE”) *Assessment and Improvement of the Structural Performance of Buildings in an Earthquake* June 2006⁴ (“the NZSEE guidelines”) in its EQPB policy and I have included a discussion of these issues in section 11 of the determination.
- 1.6 It is important to remember that the matter for determination in this case is concerns the requirement of section 124 of the Act and the determination may only confirm, reverse or modify that decision. The determination is required to consider the information relied on by the authority when making its decision, for example the authority relied on engineering assessments that used the Initial Evaluation Procedure (“IEP”) ⁵ screening methodology in the NZSEE guidelines. However, I emphasise I have no jurisdiction either to endorse or overturn the NZSEE guidelines, whether in relation to the IEP screening process or to the more substantive Detailed Seismic Assessment (“DSA”) methodology, both of which are used in those guidelines to determine whether a building is earthquake prone.
- 1.7 The applicant’s submissions raise a wide range of other matters and he has made a number of serious allegations about the determination process and my role as the Determinations Manager. The applicant has also demanded that various parts of his submissions are included verbatim. I have responded to these matters where they arise in the determination in section 9.
- 1.8 In making my decision on the matter to be determined, I have considered the submissions of the parties, the evidence presented at the hearing and the other evidence in this matter.
- 1.9 The determination application was sought for two buildings in one application. In acknowledging the differences in the buildings, I have separated the application into two stand-alone determination decisions.
- 1.10 All relevant legislation, including sections of the Act and clauses of the Building (Specified Systems, Change the Use, and Earthquake-prone Buildings) Regulations 2005 (“the Regulations”) can be found at Appendix A.

² I note this section has now been amended by the Building Amendment Act 2013 and the current section is referenced as section 124(2)(c) of the Act.

³ Under sections 177(1)(b) and 177(3)(f) of the Act

⁴ Including Corrigendum No.1 dated 04 August 2008. Corrigenda No.s 2-4 post-date the adoption of the NZSEE guidelines in the authority’s EQPB policy and so are not considered in this determination.

⁵ An Initial Evaluation Procedure (“IEP”) is an evaluation of a building’s seismic resistance carried out using standard methodology prescribed by the NZSEE. I note the terminology altered in 2014 and an Initial Seismic Assessment (“ISA”) is the process where an IEP is carried out, whereas a Detailed Seismic Assessment (“DSA”) is the process where Detailed Seismic Evaluation (“DSE”) is carried out. Please note that the terms may be used inconsistently in this determination where quoting from submissions.

2. The building and site

- 2.1 The building, also known as the Plumbers Building, is located on Wakefield Street across from the Wellington Town Hall. It is seven storeys high, with a café on the ground floor and offices or residential apartments on the remaining floors. The building is of pre-1935 design and has a reinforced concrete frame with unreinforced brick masonry (or similar) infill.
- 2.2 The seven level building is understood from design documentation to have been built in three stages. The bottom three levels were built c. 1923. In c. 1933 two additional levels were added, and in c. 1995 two lightweight levels were built and broader alterations to strengthen the building as a whole were carried out (refer paragraph 2.6).⁶ A partial basement exists at the rear (Bond Street frontage) of the building that provides car parking space. A shared ramp structure, also at the rear of the building, provides car park access to the ground floor level and an adjacent building. The typical floor area is c. 410 square metres.
- 2.3 The structural system of the lower five levels features reinforced concrete slabs supported on reinforced concrete beams and columns. The foundations for the columns are concrete footings. The upper two levels are of lightweight timber construction with lateral bracing provided by proprietary sheet-lined walls.
- 2.4 The design documents indicate the buildings share an unreinforced masonry party wall with the building on the west side along part of the length. A more recent building has been built on the east side with minimal gap between the two buildings. It is assumed that original window openings to the east façade of the building have been infilled.
- 2.5 Seismic resistance in the north-south direction is provided by a combination of frame action provided by the reinforced concrete frames and the walls on the east and west facades. In the east-west direction seismic resistance is provided primarily by frame action. Resistance is also expected to be provided by shear walls added at the lower levels as part of the c. 1995 alterations.
- 2.6 Design documents for the c. 1995 alterations indicate that the following earthquake strengthening work was performed.
- Strengthening the unreinforced masonry party wall by the installation of steel framing, viz beams and gravity prop columns, was to provide security against loss of gravity load support to adjoining suspended concrete floors should the party wall fail.
 - To facilitate the creation of car parking to the lower levels and apartments for the upper levels the 1995 alterations also included the following:
 - demolition of part of the south east corner of the building
 - the construction of a new reinforced concrete floor slab and new reinforced masonry shear walls on the lower levels of the south side of the building.
- 2.7 I note the 1995 alterations included a verification of the building structure in compliance with the (then current bylaw) standard, being two-thirds of NZS 1900 Chapter 8: 1965.

⁶ I note that the strengthening works undertaken around 1995 was to the then applicable local authority standard being two-thirds of NZS 1900 Loading Standard Chapter 8: 1965 within the Model Bylaw.

3. Background

- 3.1 On 27 March 2007, structural engineers engaged by the authority (“the authority’s engineers”) completed an IEP for the building, which concluded that the building’s %NBS⁷ was 3%, it was potentially earthquake-prone, and it had a provisional grading for seismic risk of E⁸ based on the IEP. Comments on the completed IEP included:
- vertical irregularity was a ‘significant’ critical structural weakness for the longitudinal direction (“change in stiffness due to storey height difference”) and ‘severe’ for the transverse direction (“soft storey 3.6m vs 3.0m at front, stiffness varies > 150%”)
 - short columns were a ‘significant’ critical structural weakness (“short cols [columns] at front, end columns part of infill wall so could fail in short col effect”).
- 3.2 On 31 May 2007 the authority wrote to the building owners⁹ enclosing a copy of the IEP, advising that the building had been identified as potentially earthquake prone, and saying that under its EQPB policy the building owners had six months to provide “any additional information about factors that may affect the strength of the building or a detailed assessment of the structure”. It said it would consider any information provided in this timeframe before finally deciding whether or not the building was earthquake prone.
- 3.3 The authority noted that under its EQPB policy all buildings to which the provisions of the Act applied, and that had been built or strengthened to pre-1976 structural design codes, were being assessed using the IEP methodology as set out in the NZSEE guidelines. It said the IEP had assessed the building with a score of less than a 34% NBS rating and therefore it had been identified as potentially earthquake prone on the basis of these findings.
- 3.4 On 5 November 2007 the building owners wrote to the authority requesting an extension of time until mid-February 2008 to respond in order to allow their engineers to complete a detailed building assessment. The authority replied on 9 November 2007 granting an extension to 25 February 2008 to provide further technical information for the authority to consider in reaching its decision as to whether or not the building was earthquake prone.
- 3.5 On 3 April 2008 the authority wrote to the building owners saying it had not received any information and suggesting a further extension be applied for. The authority said if it did not receive any communication within ten working days it would assume that they agreed with the authority’s building assessment and it would proceed to prepare the section 124 notice.
- 3.6 On 14 April 2009 the authority wrote to the building owners noting its previous correspondence and saying it had yet to receive any information. It said if no information was received before 11 May 2009 it would assume they agreed with the assessment and it would formally issue the section 124 notice.

⁷ New building standard for earthquake strength design. It is acknowledged that some inconsistency arises in relation to whether the standard is 33% NBS or less than 34% NBS. The authority’s EQPB policy refers to ‘less than 34% NBS’ and as this is the more commonly used phrase will be referred to throughout this determination.

⁸ Refer Table 2.1 of the NZSEE Guidelines: Grading system for earthquake risk, June 2006

⁹ The applicant for this determination was not the recipient of all correspondence from the authority. For the purposes of this determination I will refer to the ‘building owners’ being the various owners and the body corporate where appropriate.

- 3.7 The authority enclosed a reply form with one of three options for the building owners to check and return, thereby confirming that either:
- we have engaged an engineer to provide advice and respond to your letter, awaiting information (name of engineer, date information expected), or
 - we agree with the assessment showing the building is earthquake prone, or
 - our engineer has not completed the work to provide additional information (name of engineer, date information expected).
- 3.8 On 28 April 2009 the authority received a note advising the matter was being handled by the building's body corporate and providing contact details. The authority emailed this contact the same day with a copy of the 14 April 2009 letter and reply form.
- 3.9 The form was returned to the authority dated 5 May 2009 with the option checked: "we agree with the assessment showing the building is earthquake prone".
- 3.10 On 29 September 2009 the authority completed a one-page form headed "Checksheet when deciding whether a building is earthquake prone". This concluded that the building was earthquake prone, recorded the IEP result from the authority's engineer as 3%, confirmed the IEP and concluded the building was earthquake prone.
- 3.11 The checksheet also identified the following key issues which appear to have been carried forward from the original IEP assessment:
- Pre 1935 RC [reinforced concrete] frame in transverse direction/ RC walls or RC frame with masonry infill in longitudinal direction – assume infill frame
 - 7 levels in total but top two are lightweight and smaller in plan
 - 1st floor open at front
 - Short columns at front level 2 and above
 - Significant vertical irregularity
 - Soft storey 3.6m vs 3.0 m at front; stiffness varies >150%
 - Severe pounding effect. No separation, 4 storey height difference.
- 3.12 The checksheet noted that no information had been received from the building owners, the information had been reviewed by comparison with the authority's records, and there had been no further dialogue with the owners (apart from the completed reply form).
- 3.13 On 26 April 2010 the authority wrote to the building owners to advise it had issued the section 124 notice in respect of the building which it considered to be earthquake-prone. The enclosed notice advised them that they were required by 26 April 2025 (being 15 years from the then current date) to either:
- a) strengthen the building to a sufficient degree so that it is not earthquake prone; or
 - b) demolish the building.
- 3.14 On 25 February 2014, an engineering firm ("the engineering firm") prepared a DSA of the building on behalf of the building owners' construction firm. The uncompleted DSA¹⁰ and calculations were supplied to me by the applicant (refer paragraph 5.3.2) during the processing period for determination. I note the applicant has stated he

¹⁰ I note the DSA supplied to me, which is identified as Revision 0. 25 February 2014, is unsigned and I have treated the DSA as an uncompleted draft document.

disagrees with the findings in the DSA and that he only supplied it to me to illustrate some fundamental differences with the IEP (refer paragraph 8.3.8). Therefore, this determination places no reliance on the uncompleted document, but it is noted here for the applicant's purposes of comparing it with the authority's IEP.

The summary states:

- The [DSA] found the existing [building] to have a 10% NBS rating governed by the flexural capacity of the external columns at the internal frames.
- In the traverse direction, mixed sidesway mechanism with potential plastic hinges form at columns and beams are expected to occur subjected to lateral seismic demand.
- In the longitudinal direction, beam sidesway mechanism is expected to occur for the internal reinforced concrete frame.
- The performance of the perimeter concrete wall and unreinforced brick wall at the eastern and western elevations are expected to be governed by their shear capacity.

3.15 A letter from the engineering firm to the building owners' construction firm dated 17 November 2014 refers to the DSA which was supplied to me (the letter says Revision 0 was issued on 28 May 2014 but it was still incomplete at that date in my view). This letter made the following points:

- The engineering firm said its DSA report provided the %NBS for each seismic resisting element in each principal direction (transverse and longitudinal). Based on the structural analysis conducted for this DSA, it provided an overall %NBS of 15-25%.¹¹ This corresponded to a NZSEE rating grade of E/D.
- Therefore it said the building fell within the category of being earthquake prone (ie a %NBS of less than 34%) under the authority's EQPB policy.
- From the NZSEE guidelines, the relative risk of the strength of the building being exceeded due to an earthquake was 10-25 times that of a new building.

3.16 The Ministry received an application for determination on 13 January 2015.

4. The initial submissions

4.1 The applicant

4.1.1 The applicant provided a detailed written submission with the application for determination for this and another Wellington building. He noted that this building had been assessed as 15-25% NBS by engineers for the building owners¹² and designated an earthquake-prone building by the authority, and that his application sought to reverse that designation on the basis that the authority's EQPB policy did not correctly apply section 122 of the Act. The applicant contended that the authority inappropriately relied on the NZSEE guidelines to interpret section 122 of the Act and the Regulations, because the NZSEE's guidelines do not correctly implement the requirements of the Act but effectively attempts to "re-write" the Act.

4.1.2 The applicant's submission falls into three parts. The first two parts directly challenge the use of the NZSEE guidelines and submit that as the NZSEE guidelines are not consistent with section 122 of the Act they cannot be used to determine

¹¹ I note the DSA summary referred to in paragraph 3.14 stated the building had a %NBS of 10%; however the seismic range in the calculations provides for 10% to 33%. For the purposes of this determination I consider the summary in the 17 November 2014 letter, noting the %NBS to be between 15-25% NBS, to be an appropriate calculation.

¹² In its letter of 17 November 2014 referred to in paragraph 3.15.

whether a building is earthquake prone. No new factual information or engineering analysis was provided about why the building is not earthquake prone in these two parts. However, the third part of the submission provides evidence of the past performance of the building and other buildings in a range of earthquake events as supporting the conclusion that the building is not earthquake prone. I will summarise each part of the submission for the purposes of this determination.

Part one of the applicant's submission: What is an earthquake-prone building?

- 4.1.3 In relation to section 122(1)(a) of the Act the applicant agreed with the description of 'ultimate capacity' in Determination 2012/043¹³, that the natural and ordinary meaning is a reference to the point at which the building fails in a structural sense and could collapse. A moderate earthquake is defined in Clause 7 of the Regulations and the applicant understands a moderate earthquake for Wellington (being one third as strong as the design earthquake of 0.4 g) would have a force (defined by acceleration¹⁴) of 0.133 g but the same duration as that which would be used to design a new building at the site. The applicant considered the word 'likely' did not need to be further defined as a likelihood of collapse forms part of the definition for 'ultimate capacity'.
- 4.1.4 The applicant said the word 'will' in the context of section 122(1)(a) did not require absolute certainty of the predicted event occurring; however it could not be equivalent to 'likely'. The applicant submitted the appropriate interpretation would imply a very high degree of probability.
- 4.1.5 He said the phrase 'collapse' was commonly understood to mean a complete structural failure; however it would frustrate the intent of the Act if some form of partial collapse were not considered to be a collapsed state under section 122. He noted that GNS Science uses a damage ratio of 60%-100% and "a similar interpretation would be appropriate."

Part two of the applicant's submission: How did the authority apply the law?

- 4.1.6 The applicant contended that in assessing the NZSEE guidelines adopted by the authority in its EQPB policy to identify and assess earthquake-prone buildings:
- 'Ultimate capacity' does not mean 'ultimate limit state' which is an engineering term. The applicant stated at the point a building's ultimate limit state is reached there is a very low risk of structural collapse or other failure that may be life threatening. This is a lower threshold than ultimate capacity, at which point there is a real prospect of collapse or other failure causing death.
 - The applicant contended there is a much smaller gap between the ultimate limit state and ultimate capacity point for non-ductile existing buildings such as those constructed in unreinforced brick masonry, so the two terms can reasonably be used interchangeably in such instances. The applicant stated how the use of an ultimate limit state affects the definition of an earthquake-prone building depends on what ultimate limit state strength parameter is used – that is 'ultimate limit state' or 'ultimate capacity'. He said if ultimate capacity was at the design level, a building could not be earthquake prone, as the earthquake demand could not exceed its ultimate limit state in a moderate earthquake, which is one third as strong. If ultimate limit state was assessed with reference to the moderate

¹³ Determination 2012/043 Whether the special provisions for dangerous, earthquake-prone, and insanitary buildings in Subpart 6 of the Building Act that refer to a building can also be applied to part of a building (*Department of Building and Housing*) 7 June 2012

¹⁴ A seismic event is in part described by the resulting peak ground acceleration (PGA). This is a measure of earthquake acceleration on the ground and is described in terms of the gravitational constant, "g". For example, a PGA of 2 g is acceleration twice that of gravity.

earthquake demand this opened up a gap (or ‘margin in excess’) between the referenced ‘ultimate capacity’ and ‘ultimate limit state’ points.

- The interpretation of ultimate capacity as ultimate limit state means the test to determine whether a building is earthquake prone in the NZSEE guidelines is very different to that in the Act. The applicant stated:

The NZSEE [guidelines] determine whether a building will have its ultimate limit state exceeded in a moderate earthquake. The Act requires the building’s ultimate capacity to be exceeded.

- The applicant contended it is highly likely that buildings assessed at under 34% NBS, applying NZSEE guidelines, will not have their ultimate capacity exceeded in a moderate earthquake and are therefore not earthquake prone.
- In relation to section 122(1)(b) he noted that this is a two stage test: that is a building must reach its ultimate limit state and be likely to collapse. He contended that the interpretation of the legal definition of earthquake-prone buildings under the NZSEE guidelines was not consistent with the definition in the Act, and therefore an earthquake-prone building could not be defined solely as one having less than 34% NBS.

Part three of the applicant’s submission: Evidence the building is unlikely to collapse in a moderate earthquake

4.1.7 The applicant also contended that the building was not earthquake prone due to evidence (provided by way of example) it would not collapse in a moderate earthquake. Examples relevant to this determination included:

- The Hawkes Bay earthquake 1931: a study the performance of (and damage to) some 100 reinforced concrete buildings demonstrated not a single building collapsed. He said these buildings would have been of a similar construction to the applicant’s building.
- Wairarapa Earthquakes 1942: he said the forces generated in central Wellington would “almost certainly” have been above 0.13 g but he had not uncovered any evidence that the building incurred material damage in these earthquakes.
- Darfield Earthquake September 2010: No reinforced concrete buildings collapsed, and for many no apparent structural damage was observed. The applicant said most such buildings in Christchurch would have been subject to forces well in excess of 0.13 g.
- Lyttleton Earthquake February 2011: He said that reinforced concrete buildings were subject to forces up to 10 times higher than a horizontal force of 0.13 g. It was reported that few cases of severe damage of infill frames were observed in Christchurch after the February 22 earthquake.
- Cook Strait Earthquake 2014: The applicant’s building sustained ‘light interior damage’ and ‘cosmetic damage’ when subjected to forces which were likely below but near 0.13 g. The applicant submitted that if reinforced concrete buildings were likely to collapse in a moderate earthquake there would have been evidence of widespread structural damage in Wellington.

4.1.8 The applicant considered the empirical background to Modified Mercalli (“MM”) intensity scale¹⁵ which he said linked a 0.13 g earthquake with expected damage to

¹⁵ The Modified Mercalli (MM) intensity scale measures earthquake intensity, whereas the more commonly reported moment magnitude measures the energy released. In general terms, the lower numbers of the MM scale deal with the manner in which an earthquake is felt by

buildings. He said he had examined two links between earthquake strength and the MM scale:

- the US Geological Survey's link, which he said had a similar intensity scale to that of the MM scale – using this scale, a 0.13 g earthquake sits in the middle of the 'V1' category for instrumental intensity, perceived shaking is described as 'strong' and potential damage as 'light', and
- another link presented on the NZSEE website¹⁶ which he said described a 0.13 g quake as very strong and linked to a 7 in the MM scale (although he also noted it was not clear what authority this interpretation of the link between earthquake force and damage had). He concluded the difference between the two assessments was not considered to be significant for the purposes of his submission:

Either relationship will demonstrate conclusively that building collapse or life threatening damage is very unlikely with a 0.13g quake.

4.1.9 The applicant said the subject building was a type 3 building¹⁷ and that in either a MM 6 or MM 7 earthquake it would be a long way from generating collapsing or structural damage.

4.1.10 He also noted that GNS Science had produced a 'quantification of the likelihood' that different building types would receive 60% to 100% damage in earthquakes of different magnitudes for the Ministry's¹⁸ 2012 cost-benefit analysis of seismic strengthening rules. From this information, and assuming that the relevant MM rating for generating collapse was 7 ('very strong') and that the subject building being equivalent to a medium rise 'defective' reinforced concrete building in the scale descriptions (which he said was a very conservative assumption to account for the building's early construction). From his calculations¹⁹ he concluded that there was a 1:40,000²⁰ chance that the subject building would receive 60% to 100% damage in an MM 7 earthquake event.

4.1.11 In summary, the applicant submitted that the authority's exercise of powers under section 124 of the Act must be reversed as its adopted EQPB policy did not correctly apply the section 122 definition of an earthquake-prone building and therefore the authority could not be satisfied the building was earthquake prone. In addition he said there was evidence that buildings, including this one, classified as earthquake prone had survived collapse under conditions similar to, or exceeding, the moderate earthquake threshold as defined in the legislation.

Additional material supplied by the applicant

4.1.12 The applicant provided the following documentation with his application:

- A letter from the engineering firm to the building owners' construction firm dated 17 November 2014 (and referred to in paragraph 3.15) with more information relating to the DSA issued by this firm on 28 May 2014.
- An appendix with details of the 'New Zealand MM Intensity Index'.

people and the higher numbers are based on observed structural damage. A particular earthquake may have many different Mercalli intensity values measured for it, as the measure is 'field observations-based' and its effects can vary greatly from place to place.

¹⁶ Available at www.nzsee.org.nz/projects/past-earthquakes/2013-cook-strait-earthquake-sequence/intensity

¹⁷ The appendix referred to in paragraph 4.1.12 described type 3 buildings as 'reinforced masonry or concrete buildings of good workmanship and with sound mortar, but not formally designed to resist earthquake forces'

¹⁸ The report was prepared for the Department of Building and Housing, the Ministry's predecessor

¹⁹ I note I do not have information on how these calculations were conducted or what information these are based on.

²⁰ The applicant later revised the figure supplied in this submission from 1:15,000 to 1:40,000 and asked for this to be amended.

4.1.13 On 13 April 2015 the applicant provided a supplementary submission on the recent Supreme Court decision, *University of Canterbury v The Insurance Council of New Zealand Incorporated*.²¹ The question under appeal was whether an authority was entitled to require a building to be strengthened to greater than 34% of NBS (the point at which a building would no longer be earthquake prone); however the Supreme Court had also considered the meaning of an earthquake-prone building as defined under the Act and Regulations in its decision. With regard to this, the applicant submitted:

- The decision did not consider the issue of whether 34% NBS was the equivalent of the standard referred to in section 122(1). The use of ‘the 34% shorthand’ did not mean that the Court had considered and agreed with the NZSEE interpretation of that section. However, the Court recognised the definition of an earthquake-prone building has two limbs and both limbs must be satisfied before a building can be deemed earthquake prone.
- The Court agreed that section 122(1) should be read as one sentence, with components split to improve readability.
- The judgement settled the issue of whether the ‘likely to collapse’ limb was not just a ‘general expectation’ as the NZSEE guidelines had argued but a fundamental part of a test to determine whether a building was earthquake-prone or not.

4.2 The authority

4.2.1 On 16 April 2015 the authority’s lawyer noted a submission would be made following the release of the first draft determination. It provided the following documentation:

- the IEP assessment for the building
- notification to the applicant that the building was potentially earthquake prone
- correspondence between the building owners and the authority dated between 31 May 2007 and 3 May 2010
- a copy of the section 124 notice for the building issued 23 April 2010 and a photograph of the notice attached to the building.

5. The first draft determination and further submissions

5.1 On 30 April 2015 I issued a first draft determination (“the first draft”) to the parties. The first draft determined the authority was correct in issuing an earthquake-prone building notice under section 124 of the Act. The parties’ responses to this draft are included within paragraphs 5.2 and 5.3 which follow.

5.2 The authority

5.2.1 On 18 May 2015 the authority’s lawyer provided a written submission accepting the first draft in general terms, relating to upholding the authority’s decision to issue the section 124 building notice. In summary, the submission noted:

²¹ *University of Canterbury v The Insurance Council of New Zealand Incorporated* [2014] NZSC 193 [22 December 2014]

The building and the authority's actions

- 5.2.2 The building was assessed by the authority's engineers using the NZSEE guidelines' IEP procedure and the building was identified as being below 34% NBS (3% NBS or Grade E).
- 5.2.3 The authority's reliance on the NZSEE guidelines is a 'standard feature' of authorities' policies in relation to earthquake-prone buildings, adopted in accordance with section 131 of the Act.
- 5.2.4 The owners of the building agreed that the buildings were appropriately classified as earthquake prone. The DSA result provided by the applicant was subsequently made available during the determination process and confirmed the building was, in the authority's opinion, below the 34% NBS threshold.

Statutory interpretation and recent court decisions

- 5.2.5 The authority's lawyer acknowledged the Supreme Court decision in *University of Canterbury v Insurance Council of New Zealand Incorporated* confirms that both limbs of section 122(1) (paragraphs a and b) must apply to a building in order for it to be classified as earthquake prone.
- 5.2.6 A consequence of this analysis is that the definition must be taken to refer to the likelihood of collapse in a moderate earthquake. The authority agreed the NZSEE guidelines will need to be adjusted to reflect this.
- 5.2.7 The authority's lawyer acknowledged the Supreme Court was considering section 122(1) of the Act in the context of a challenge to the scope of the strengthening work that an authority can legitimately require through section 124 notices. The authority noted the 'precise nature' of the relationship between the two limbs of section 122(1) was not the primary issue in the proceeding.
- 5.2.8 Step 1 of the authority's EQPB policy recognises the Court's proposition, in stating that 'a desk top review of [authority] files will be undertaken by [the authority] to assess which buildings could be earthquake-prone. Buildings that will *not* require further assessment include those...isolated structures unlikely to collapse causing injury, death or damage to other property (refer section 122(1)(b) of the Act)'.
- 5.2.9 In relation to ultimate capacity, the first draft appeared to endorse the NZSEE's view that it is appropriate to equate 'ultimate capacity' with 'ultimate limit state' for the purposes of section 121(1)(a) of the Act. The authority considered this is logically consistent with the link between the 'moderate earthquake' definition in the Regulations and NZS 1170.5:2004²² as the reference point for new buildings designed with ultimate limit state philosophy. The authority considered the first draft could express approval for the NZSEE approach more clearly.

Likely to collapse

- 5.2.10 The authority's lawyer considered it necessary to give 'likely' an independent meaning as it is a distinct part of the second limb of section 122(1). The authority considered the most appropriate meaning for 'likely' is that applied to the dangerous building definition under the former Act²³ given the similarity of language, statutory purpose, and the enforcement powers that both definitions trigger. The NZSEE guidelines adopt a 'could well occur' formulation which is consistent with the case law.

²² NZS 1170.5: 2004 Structural design actions - Part 5: Earthquake actions

²³ Building Act 1991 ("the former Act")

- 5.2.11 The authority's lawyer agreed with the conclusions reached in the first draft in relation to 'collapse'; however, considered that the approach taken under the NZSEE guidelines could be explored and explained further in the discussion around the decision.
- 5.2.12 Referring to the dictionary definition and the approach adopted in Determination 2012/043 the authority's lawyer agreed that a 'collapse' can refer to a part of a building. Section 122(1)(b) addresses collapse that has particular outcomes (injury or death to persons in the building or to persons on any other property, or damage to any other property).
- 5.2.13 The NZSEE guidelines state it is almost impossible to predict collapse; however the word 'likely' establishes a lower threshold than indicated by the words 'will' and 'predict'. The authority noted the following points:
- In the case of a new building at ultimate limit state, the possibility that loss of life will occur in a design earthquake is not entirely excluded; however it is an acceptable risk.
 - Therefore the lesser impacts of injury to people or damage to property also cannot be excluded.
 - A building at 34% NBS will present the same acceptable risk of loss of life in a moderate earthquake as a new building during a full scale design earthquake.
 - The NZSEE guidelines indicate that high risk buildings (those with D or E ratings) would lose integrity at 34% NBS or less and the ultimate limit state would be obtained, or that injury would be likely.
 - The NZSEE guidelines noted 'it is recognised that collapse may occur at or above the level at which [ultimate limit state] is attained'.
- 5.2.14 The ultimate limit state assessment does not amount to a prediction of a definite collapse state for the building; however the authority considered it is sufficient to establish a reasonable possibility that some part of the building will give way causing death, injury or damage to property in terms of section 122(1)(b)(i) and (ii) or alternatively that such a failure is something that could well occur. This is sufficient to satisfy the second limb of section 122(1).

Empirical evidence

- 5.2.15 The authority's lawyer agreed with the conclusions reached in the first draft. The authority emphasised the uncertainty and variation associated with earthquake events and the forces they impose on individual buildings.
- 5.2.16 The peak ground acceleration reflects the focus of earthquake design on responsiveness to ground shaking, not just peak force. In terms of historic earthquakes it may be possible to evaluate data relating to peak force or the Modified Mercalli intensity of an event but these may not have been recorded with any precision.
- 5.2.17 The authority's lawyer provided the equation given in NZS 1170.5 for calculating the 'design' peak ground acceleration which includes the 'Z factor' he said correlated to the 0.4 g figure cited by the applicant. He noted this was not the only element to consider; others being a ground condition coefficient and a risk factor. As well as peak force, other variables driving a building's response to individual earthquakes included:

- the distance (from the site) and depth of epicentre
- the direction of the primary force wave
- the frequency of the forces
- the particular combination of horizontal and vertical forces/accelerations, and
- the length of time over which the forces are applied (i.e. duration).

5.2.18 Individual buildings will be affected by each of these factors in different ways, and the fact that a building survived one or a series of moderate earthquake events does not establish with any certainty that it will survive others or that it is not earthquake-prone under the Act.

5.2.19 On 15 June 2015 the authority's lawyer provided the full property file for the building. I note that these documents should have been provided earlier in the determination process, in particular with regard to the hearing that occurred on the 19 June 2015, refer paragraph 6.1.

5.3 The applicant

5.3.1 On 15 May 2015 the applicant advised the draft determination was not accepted and a substantive submission would be provided.

5.3.2 On 10 June 2015 the applicant provided a written submission, which is summarised below, and the following documentation:

- The Hastings District Council's Agenda for a Council Meeting dated 25 September 2014. Item 11 relates to the Review of the Hawkes Bay Opera House redevelopment Project 2004-2008 and subsequent assurance reviews commissioned by Hastings District Council.
- A DSA from the engineering firm dated 25 February 2014 and associated calculations (the applicant said the DSA was presented to illustrate his points with respect to the IEP's accuracy. He said he did not agree with the accuracy of the DSA).

The applicant's arguments

5.3.3 The applicant said it was incumbent on the authority to prove the building would have its ultimate capacity exceeded in a moderate earthquake and was likely to collapse (in a moderate earthquake). The authority had not proven this as its policy substituted ultimate limit state for ultimate capacity, which imposed a much lower trigger point, and it had not considered the likelihood of collapse. The IEP assessments did not establish an accurate %NBS, let alone determine whether a building would have its ultimate capacity exceeded and was likely to collapse, and the absence of contradictory evidence from a building owner did not constitute proof of this.

5.3.4 The authority's assessment in its submission of 'likely' as some variation of 'could well occur' was incorrect in law as it was too vague and could not reasonably be applied to a building with a 1 in 40,000 chance of collapse in a moderate earthquake. The applicant's evidence of the building's past performance, the performance of similar buildings in far stronger earthquakes and the available GNS Science data proved the building was not likely to have its ultimate capacity exceeded in a moderate earthquake and was not likely to collapse.

The burden of proof

- 5.3.5 The first draft confirmed the onus remains with the authority to prove a building is earthquake prone. The authority in this case has not proven the building will have its ultimate capacity exceeded in a moderate earthquake and will be likely to collapse. Following the IEP, the authority's EQPB policy is to advise owners of buildings assessed at under 34% NBS as being 'potentially earthquake prone' and invites an owner to provide additional information. If no information is forthcoming, the EQPB policy states that the authority will issue the section 124 notice.
- 5.3.6 The applicant considered the authority had not proven the building is earthquake prone. The absence of evidence to the contrary within a specified time period does not change the burden of proof, and neither does an owner's agreement to the authority's assessment.

Statutory interpretation

- 5.3.7 The applicant considered the authority's approach to interpretation has glossed over other important purposes in the Act, noting that public safety was not the only purpose and there were important reasons for a different approach to the dangerous building and earthquake-prone building provisions.

Cost-benefit analysis

- 5.3.8 In relation to cost-benefit studies, the applicant said an intention of the Act is that seismic strengthening standards should reflect a balance of the costs and benefits of strengthening. The applicant in this case had conducted a cost-benefit analysis for the subject building that showed the present value of the life safety benefits of strengthening to 34% NBS is \$22,000. The cost of strengthening based on estimates would be 'at least \$4,000,000'. The applicant provided the key inputs and assumptions made for this assessment.
- 5.3.9 The applicant submitted the primary purpose of seismic life safety regulation is to improve the welfare of building occupants. The apartment occupants in the building were now aware of the risk they are running with the current strength of the building and the risk is 'trivial'. The chance of a regular customer in the restaurant one hour a week being killed in an earthquake is over 10 million to one per year.

The meaning of 'likely' to collapse

- 5.3.10 The applicant agreed that the likelihood of collapse is conditional on the test that the building will have exceeded its ultimate capacity in a moderate earthquake. The applicant is of the view a building that has exceeded its ultimate capacity will be at the point of collapse, thus this must be a high likelihood.
- 5.3.11 Determination 2012/043 interpreted 'ultimate capacity' according to the ordinary and natural meaning as the point at which the building fails in a structural sense and could collapse causing injury or death to persons. The applicant agreed with this interpretation, and noted if Parliament intended 'ultimate capacity' to mean 'ultimate limit state' it would have used those words.
- 5.3.12 The authority's argument that 'likely' must be given an independent meaning is not consistent with the authority's agreement that the likelihood of collapse is a presumed consequence of exceedance of ultimate capacity; it is a conditional probability. The applicant disagreed that the interpretation of 'likely' in the context of dangerous buildings can be used for earthquake-prone buildings. The applicant

provided information on three court decisions relating to dangerous buildings²⁴ including an extract from *Wanaka Gym Ltd v Queenstown Lakes District Council* as follows:

In *Weldon Properties Ltd v Auckland City Council* this Court upheld an District Court judgment in which it was stated that “likely” for the purposes of the predecessor section to s 121 does not mean “probable”, as that puts the test too high. On the other hand, a mere possibility is not enough, so it has to be a reasonable consequence or something that could well happen.

- 5.3.13 The applicant said the tests applied in these cases reflected the breadth of issues that could be addressed by section 121 of the Act. The definition of ‘likely’ had to be flexible to meet the array of circumstances section 121 may address. In contrast, for earthquake risk there is a well-documented understanding of risk and its quantification, and this should be applied when assessing the meaning of ‘likely’ to provide consistent and authoritative outcomes in terms of life safety risk.
- 5.3.14 He said the interpretation of ‘likely’ being ‘could well occur’ was too vague to produce consistent results between buildings in terms of life safety risk. In addition, the dangerous building cases are distinguishable from the earthquake-prone building cases as the balance of the costs and benefits are required to be evaluated and the cost can have a significant impact on an owner to remediate an earthquake-prone building.
- 5.3.15 The applicant did not consider the first draft addressed the issue of whether the guidelines identify buildings that are ‘likely to collapse’ in a moderate earthquake.
- The NZSEE guidelines***
- 5.3.16 The authority’s submission did not address the issue of what portion of the building must collapse (nor do the NZSEE guidelines). The authority appeared to indicate if any part of the building could collapse in a moderate earthquake then the whole building is earthquake prone. The applicant disagreed with Determination 2012/043, on this point although he noted that this aspect is not an issue in this case.
- 5.3.17 The applicant said it was not true the GNS Science categories only addressed a ‘significant probability’ of death but there was no harm in excluding ‘insignificant probabilities’ of death if the test is whether the collapse is ‘likely to cause death’. The GNS Science methodology divided collapse outcomes into five damage states. He concluded the probability of deaths in ‘damage state 3’ for reinforced concrete buildings combined with the probability a building would be in this damage state in a moderate earthquake led to an extremely small probability of death.
- 5.3.18 The NZSEE guidelines are calibrated to a very low probability standard that a building will collapse. The ultimate limit state has been calibrated in the new building standard (NZS 1170.5 Commentary) to ensure that at the ultimate limit state there is a very low probability of collapse.²⁵ The commentary sets a target life safety risk for new buildings of 1 in 1,000,000 which is extremely high.
- 5.3.19 The applicant agreed with the authority’s assessment that the probability of collapse under the NZSEE ultimate limit state framework is extremely low.

²⁴ *Wanaka Gym Ltd v Queenstown Lakes District Council* [2014] NZSC 198 [23 December 2014], *Weldon Properties Ltd v Auckland City Council* HC Auckland HC26/97, 21 August 1997, *Rotorua District Council v Rua Developments Limited* DC Rotorua NP1327/97, 17 December 1999.

²⁵ The applicant refers to the report on the Hastings Opera House (paragraph 5.3.2) at page 69.

- 5.3.20 The applicant considered the NZSEE had given no regard to the costs of meeting a target which is well in excess of the risks prudent people knowingly take in their day to day activities.
- 5.3.21 In relation to the NZSEE guidelines the applicant questioned some aspects of the authority's interpretation of these and said the conclusion could not be drawn that injury would be likely in a moderate earthquake in Wellington. He considered ground conditions are captured by the NZSEE model, with the effect that a building with worse ground conditions will receive a lower %NBS than a building with more secure ground conditions. He said suggestions good building performance in stronger earthquakes could have been due to favourable ground conditions did not match the facts for the Hawkes Bay and Canterbury earthquakes. He considered the relevant test was not the worst case scenario at a given magnitude but an earthquake with the design strength duration at that magnitude. He also said the new building standards, which underpin the NZSEE guidelines, had been developed (in part) on the basis of building performance in past earthquakes. The evidence that large numbers of similar buildings have survived earthquakes equivalent to or much stronger than a moderate earthquake provided overwhelming evidence that the probability the building in this case will collapse in a moderate earthquake is very small.
- 5.3.22 The applicant did not agree with the first draft that the NZSEE guidelines provide an appropriate methodology for determining whether a building is likely to collapse in a moderate earthquake.

The authority's EQPB policy and the IEP

- 5.3.23 In relation to the authority's EQPB policy, had the owners not agreed to the IEP assessment the applicant does not consider the authority would have produced a DSA at its own expense (which it did not). The IEP is a coarse screening device, unlikely to provide an accurate estimate of %NBS, and which does not provide a basis for the authority to satisfy itself that a building is earthquake prone.
- 5.3.24 The applicant contended the authority's process by which 'agreement' is obtained is problematic. The owners are not informed of the limitations of the IEP and that it is not a robust assessment of %NBS. The owners are not informed it is the authority's obligation to determine the status of the building and the onus of proof has not been reversed.
- 5.3.25 He said the DSA for the building raises issues with the quality of the IEP that was generated at 2.8% NBS²⁶; for example, vertical building irregularity was a potential critical structural weakness on the IEP but was not identified as a concern on the DSA. In addition the IEP assessed the building as standalone, whereas it is between two larger buildings that are not earthquake prone and is understood to share a common wall with one of them. Another mitigating factor referred to was that the building was within a row of generally similar buildings.

The authority's EQPB policy

- 5.3.26 The applicant did not consider the authority 'turned its mind' to the legal test of whether buildings would exceed their ultimate capacity and be likely to collapse in a moderate earthquake.
- 5.3.27 He criticised the authority's process for adopting its EQPB policy and said it did not have an open mind on adopting the NZSEE guidelines. In relying purely on these guidelines it should have satisfied itself that they provided an equivalent test to a

²⁶ I note as per paragraph 3.1 of the determination the stated %NBS from the IEP was 3%

direct consideration of whether the buildings will reach their ultimate capacity in a moderate earthquake and be likely to collapse. This could have involved asking the NZSEE to confirm that buildings under the 34% trigger point were likely to collapse in a moderate earthquake, satisfying itself that an IEP provided a robust estimate of %NBS, and obtaining a cost–benefit analysis. He said the authority had a cost–benefit analysis on file but criticised the authority’s apparent inability to assess this.

Ultimate limit state and ultimate capacity

- 5.3.28 The applicant considered a key issue was whether ultimate limit state and ultimate capacity were equivalent or closely equivalent terms for the subject building. He considered the %NBS that an engineer determines is based on the ultimate limit state that a new building is designed to, which is required to have a low probability of failure at the design load, therefore the 34% NBS that defines earthquake prone is also based on a low probability of failure. As the NZSEE framework set a ‘very low risk of collapse’ test it could not be used for the test under the Act.
- 5.3.29 He also considered the determination omitted a key section on determining the %NBS with respect to non-ductile buildings as the commentary to NZS 1170.5 states this compensates for the relatively poor performance of ‘brittle’ buildings by adding an additional strength requirement. This is intended to ensure that new non-ductile and ductile buildings have the same very low probability of collapse at the ultimate limit state.
- 5.3.30 The first draft noted the NZSEE considered the differences between the references in section 122 of the Act and the engineering term ‘ultimate limit state’ and for practical reasons, having regard to current engineering tools and practices, equates ultimate capacity with ultimate limit state as defined in the current building standards. The applicant does not agree these terms can be changed for ‘practical reasons’.
- 5.3.31 He said this should not have been a consideration for the authority as using the NZSEE guidelines was not its only option. The NZSEE could have been asked to set the %NBS building trigger point lower, while other appropriate models included the US government’s mandate of cost–benefit analyses when strengthening federal buildings and the GNS Science models. The NZSEE guidelines noted that the adoption of the ultimate limit state to measure acceptable performance ‘has the advantage of familiarity and simplicity’ but he said this did not provide a justification.

Likely to collapse and critical structural weaknesses

- 5.3.32 The applicant said the determination’s observation regarding the NZSEE guidelines (at paragraph 11.2.17) did not address the issue of whether these guidelines identified buildings likely to collapse in a moderate earthquake, and he questioned the conclusion that they provided an appropriate methodology to determine this.
- 5.3.33 Further, he said the first draft implied the mere identification of what might be a ‘critical structural weakness’ in the IEP provided sufficient evidence to prove that the building was likely to collapse in a moderate earthquake. The applicant did not agree with this approach, as a DSA gives a more complete picture of the building’s possible seismic performance. For the building the DSA produced a 15-25% NBS rating compared to a 3% NBS rating from the IEP assessment. He said different engineers (for the IEP and for the DSA) also came to different conclusions with respect to the building’s critical structural weaknesses.

5.3.34 The applicant considered the NZSEE guidelines adjust for the effect of critical structural weaknesses in design-level earthquakes, not moderate earthquakes. The applicant provided pounding as an example which he said was a critical structural weakness under the NZSEE guidelines but only a factor in building collapse in exceptional cases. This approach does not provide a reliable way of assessing building performance in a moderate earthquake.

Empirical evidence

5.3.35 The first draft determination and the authority discounted the empirical and analytical evidence presented by the applicant in his initial submission, but the applicant considered this evidence was overwhelming. In relation to ‘duration’ the first draft suggested that stronger earthquakes have a longer duration than weaker ones; however, his data indicated that the duration of what he defined as moderate earthquakes²⁷ is longer than design strength earthquakes, which do not have a stated duration.²⁸ The applicant considered this theory is wrong as ‘generally, weaker earthquakes are more distant from the source and last longer’.

5.3.36 The applicant provided a summary of data on the relationship between peak ground acceleration and duration. The applicant considered the first draft determination suggested that stronger earthquakes have a longer duration than weaker ones;

5.3.37 For example he considered the 2013 Wellington earthquakes had lasted longer than a design strength earthquake and subjected a large number of ‘earthquake-prone buildings’ to stresses close to or above that of a moderate earthquake. However, it appeared they had not suffered material damage or collapsed. In response to the determination’s conclusion that the evidence supplied did not establish the building was not earthquake prone, he said ‘likely’ was not quantified, this reversed the burden of proof, and that he had proved the building was not likely to collapse in a moderate earthquake beyond any reasonable doubt.

5.3.38 The applicant submitted the historical evidence became more compelling when it related to the same class of building. The Hawkes Bay, Darfield and Christchurch evidence relates to reinforced concrete buildings, and the fact these buildings did not collapse provides compelling evidence that the current building will not collapse in a moderate earthquake. He also considered the Wairarapa earthquake was directly relevant.

5.3.39 The first draft does not mention the GNS Science evidence, which the applicant considered an authoritative source. The applicant provided a table of evidence showing the probabilities that the building(s) will collapse or be severely damaged in a design strength earthquake, being more severe than a moderate earthquake. For an applicable building type (‘reinforced concrete frame sound medium height pre-1980’) he gave the probability of collapse as 0.20% for an MM 8.3 and 0.32% for an MM 8.5 design-level earthquakes.

5.3.40 The applicant submitted that if the NZSEE framework provided a sound basis for identifying earthquake-prone buildings then this should be applied uniformly throughout the country. In Auckland and other areas with low seismicity he said the design strength earthquake was 0.13 g and the moderate earthquake 0.043 g, which barely equated to a MM 5 earthquake, and he disagreed with the contention that

²⁷ The applicant presented data from Raghunandan and Liel *Effect of Ground Motion Duration on Earthquake-Induced Structural Collapse* Appendix A. ‘Moderate earthquakes’ were classified as 0.08-0.18 g, and design strength earthquakes variously between 0.30-0.50 g and 0.35-0.45 g, all with varying durations.

²⁸ I consider the applicant refers to the time history analysis methods enabled by the NZS 1170 Seismic Actions Standard requiring some 15 seconds of strong ground motion recorded for each of several referenced earthquakes to be considered to achieve a compliant design.

earthquake-prone buildings in Auckland will exceed their ultimate capacity in such an earthquake and be likely to collapse.

Summary

5.3.41 The applicant summarised his position on various issues already noted above and concluded that:

- There was no dispute section 122 should be read as one continuous sentence with two limbs and both limbs must be met.
- Ultimate capacity meant the point at which the building fails in a structural sense and could collapse, not something closer to the ultimate limit state which he said could only mean what NZS 1170.5 says it means.
- As ‘likely to collapse’ is conditional on a building exceeding its ultimate capacity it must refer to a high probability of collapse, not to ‘could well occur’.
- The authority’s designations applied to the building as a whole, not some undefined part of the building.

5.3.42 I have taken account of the submissions where appropriate and corrected minor errors in the first draft determination. I note here that the applicant also raised procedural matters relating to time delay of the determination process and an allegation of apparent bias: refer section 9 for further comments on the determination process.

6. The hearing

6.1 On 19 June 2015 I held a hearing in Wellington. The hearing was attended by the following people:

- one officer of the authority accompanied by two structural engineers²⁹
- the authority’s lawyer
- three representatives for the applicant and the applicant’s legal advisor
- I was accompanied by a Referee engaged by the Chief Executive under section 187(2) of the Act, together with two officers of the Ministry, and two lawyers.

6.2 All the attendees spoke at the hearing to clarify various matters of law and fact and were of assistance to me preparing this determination. The views put forward at the hearing and evidential submissions provided at the hearing are summarised below.

6.3 Matter One: The application of the legal test (technical matters)

6.3.1 The issue of the term ‘duration’ of a moderate earthquake was discussed. The applicant asked what the duration of a design earthquake was in the standard³⁰ (noting there is some reference to 15 seconds). He also referred to the examples of earthquakes provided in his submission and said he thought one should be able to rely on the force as the relevant criterion and ignore the duration.

6.3.2 The authority’s engineer said duration is an important parameter in terms of damage and there is an important correlation between duration and earthquake shaking. He noted that duration varies around the country but is not well defined. He produced an article from the a book entitled “New Zealand Disasters”³¹ adding that the duration

²⁹ The engineers were representing firms contracted to provide seismic engineering services to the authority

³⁰ The earthquake actions standard NZS 1170.5: 2004

³¹ Eugene C. Grayland, “New Zealand Disasters” at Chapter 22 ‘Earthquake in Wellington’.

of a Wellington fault event of magnitude 7.5 was typically considered to be around 20-30 seconds. However, there are other variables involved; for example, ground conditions and location of the epicentre.

- 6.3.3 The issue of critical structural weaknesses was discussed. The applicant considered the authority had made a statement that meant the building could collapse at relatively low ground movement. The authority's engineer stated critical structural weaknesses come out of observations and behaviours of actual, small scale earthquakes. Pounding is still an issue at more distant, major earthquakes and will depend on contact. The applicant used the building as an example noting the starting point for the IEP was 17% NBS, but the critical structural weaknesses identified took it down to 3% NBS. However, from his review of the analysis, the DSA did not identify any critical structural weaknesses.
- 6.3.4 The parties discussed the empirical evidence from various earthquakes. It was noted by the authority's engineer that the recent Wellington earthquake was 'nowhere near' a moderate earthquake and there was only 2-3 seconds of strong shaking. The applicant stated the most compelling evidence was the GNS Science data and he referred to the table provided in his submission of 10 June 2015 which he said described the relationship between g forces and the Modified Mercalli index (refer paragraph 4.1.8). He also discussed the cost-benefit analysis provided in response to the first draft determination, noting this related to the life safety of building occupants and did not cover the life safety of pedestrians. The applicant agreed to clarify this and provide further details relating to data about the probabilities of collapse or severe damage in a design-level earthquake in Wellington.

6.4 Matter Two: The legal test

- 6.4.1 The applicant stressed that the NZSEE guidelines are an advisory document only and the 'very low probability of collapse' adopted into the authority's EQPB policy is not consistent with the law. The applicant considered the authority did not have to use the NZSEE guidelines approach. The authority's engineer stated the NZSEE has had to make assumptions for guidance for engineers but the overall intent of the NZSEE guidelines is that the %NBS considers how an existing building will perform in a moderate earthquake compared with a new building in a design-level earthquake.
- 6.4.2 The applicant's lawyer stated the concept of exceeding ultimate capacity is an extremely high threshold; however, there is a separate requirement for the likelihood of collapse which is very difficult to predict. The applicant restated the threshold for 'likely' cannot be compared to that used for dangerous buildings.
- 6.4.3 The parties discussed the public consultation of the various regulations and policies set by Parliament and the authority. The applicant considered it has been difficult for the public to contribute and understand highly technical issues. The authority considered there has been various opportunities for consultation over the years.

6.5 Matters Three and Four: The decision-making process and the subject building

- 6.5.1 Relating to the subject building, the applicant referred to the property file provided by the authority four days prior to the hearing, that 'significant strengthening' took place in 1995 and the building shares a common wall with the neighbouring building which was strengthened. He said these were not mentioned on the IEP document and he also objected to this assessment being publicised. The authority stated all relevant information is sent to the authority's engineers to complete an IEP assessment. The

authority was unable to ascertain what information was sent to the engineers for the current building and said it would provide further information post-hearing. I note the IEP template sheet prepared by the authority's engineers listed a limited number of documents, and makes no reference to drawings on that list.

6.5.2 Relating to the authority seeking agreement from the building owners regarding the earthquake-prone status of the building, the applicant contended it is irrelevant if an owner is satisfied a building is earthquake prone. It was established it was standard practice at the time (around 2009-2010) for a small brochure to accompany the IEP assessment to inform the owners.

6.5.3 The authority's lawyer provided a summary document dated 19 June 2015 at the hearing. In summary:

- It is common ground that both limbs of section 122(1) need to be satisfied and relate to the occurrence of a moderate earthquake.
- Limb one requires an assessment of the capacity of a building against the forces imposed by a moderate earthquake. A relatively high degree of certainty is required.
- Limb two addresses the consequences of a moderate earthquake; that is, the likelihood of collapse causing injury, death, or damage in the manner described. A lower degree of certainty is required.
- The applicant submitted the language of limb one controls the interpretation of limb two. However, the authority is of the view the assessment of the likelihood of collapse is addressed independently in limb two and is not controlled by the assessment of ultimate capacity under limb one.
- It is appropriate to equate ultimate capacity with ultimate limit state design. It is noted 'ultimate capacity' is not defined in the Act. It is not currently possible to identify the point at which a building will definitely fail in a design-level event and to then design to ensure that the capacity of a building exceeds that threshold.
- It is possible to identify a capacity limit at a lower level where structural performance can be reliably predicted. This is the ultimate limit state design approach. The ultimate limit state evaluation of existing buildings is about trying to compare a theoretical capacity beyond which a building could collapse against the theoretical forces of a moderate earthquake.
- The phrase 'likely' has a range of meanings as a matter of ordinary natural usage. The authority considers the appropriate meaning of 'likely' is 'could well occur'. This is the expression used in the NZSEE guidelines.
- The authority acknowledges the imminence of harm posed by an earthquake-prone building and the range of circumstances that could lead to that harm are different from that of a dangerous building; however 'likely' should still be attributed the same meaning applied in the context of dangerous buildings. This is consistent with the NZSEE guidelines.
- The authority's EQPB policy considers the application of the likelihood of collapse at the desk-top review stage. The EQPB policy was adopted using the special consultative procedure provided in the Local Government Act 2002. The Ministry guidance and the NZSEE guidelines are utilised. The authority submitted the legitimacy of the EQPB policy is beyond the jurisdiction of the determinations process.

- The authority did not issue the section 124 notices on the strength of IEP assessments alone, but also took into account any further information provided by the owners at the time. In relation to the burden of proof, it is agreed this broadly lies with the authority. However, the agreement from the owners that the building was earthquake prone is ‘relevant evidential material’.

7. Post-hearing correspondence and submissions

7.1 The authority

7.1.1 On 7 July 2015 the authority’s lawyer provided copies of the information provided to the authority’s engineers prior to their IEP assessment of the building (refer paragraph 6.5.1). These documents included:

- a single page information sheet that provided basic details about the building (including date of construction, construction type, heritage status, building use, stability hazard of land, permits and building consents)
- a list of ‘service requests’³² for the building
- a diagram showing the intranet viewer map identifying the lot number
- a short summary from the city scope online data view listing basic information about the building.

7.2 The applicant

7.2.1 On 24 June 2015 the applicant advised further information would be sent in relation to the following (refer paragraph 6.3.4):

- an assessment of the article on earthquake duration presented by the authority at the hearing (refer paragraph 6.3.2)
- a reformatted appendix from the applicant’s earlier submission
- an assessment of the relevance of two determination decisions on IEPs that were cited by the authority at the hearing
- a figure of the relationship between risk and %NBS
- an assessment on the risk presented to people on the footpaths adjoining the buildings.

7.2.2 The applicant commented in relation to whether the building is ‘likely’ to collapse in a moderate earthquake, stating there are risks around the GNS Science based modelling, and building collapse in moderate earthquakes are an ‘extremely rare and a remote possibility’. The applicant questioned how uncertainty impacts on a more complex decision-making process such as a cost–benefit analysis.

7.2.3 On 13 August 2015 the applicant provided further information, in summary:

- In respect of duration, he said the authority has provided evidence that stronger earthquakes have a longer duration (refer paragraph 6.3.2). The evidence presents some of the ‘regressions’ calculated for magnitude-duration relationship. The applicant considered the information has limited value in addressing the question of whether there is a positive relationship between magnitude and duration as:

³² A ‘service request’ search document is a report from the authority’s database system. The list is intended to capture all building consents/permits relevant to the particular address. The authority’s engineers typically use this list to request any of the building consents/permits identified (for example a strengthening building consent) listed on the service request search from authority’s archives.

- the sources of regression are not cited and likely to be dated
- there is no information on the definition of duration and the estimates are imprecise
- the relationships presented are between Modified Mercalli values, not g force and duration. The information the applicant cited, in contrast, has a defined measure of duration from authoritative and updated sources.
- The applicant considered the severity of a moderate earthquake can be defined by g force alone without reference to duration. There is no definitive measure of duration in NZS 1170.5 (other than the guidance on duration for dynamic modelling), and he said a regulatory standard should be verifiable and not rely on the opinion of individual engineers. Even if the information provided by the authority on duration was correct it would make little difference to the applicant's assessment of empirical and analytical information provided.
- In relation to risks to pedestrians, the applicant conducted a small test on the pedestrian count on the pavement outside the building, stating that 159 pedestrians passed the building in the half hour between 11.04 to 11.34 am on 7 July 2015. The applicant stated the average transition time was 8 seconds, and therefore the average pedestrian occupancy of the pavement was 0.7. He said this was low compared to the average occupancy of the building and concluded the risk to pedestrians in a moderate earthquake was 'very, very small'.
- The applicant is progressing with the risk model. I note I have not been provided with further information in relation to this.

8. The second draft determination and further submissions

8.1 On 4 September 2015 I issued another draft determination ("the second draft") to the parties, taking account of the points raised in the hearing and further submissions where appropriate. This draft determined the authority was correct in issuing an earthquake-prone building notice under section 124 of the Act.

8.2 The authority

8.2.1 On 14 September 2015 the authority's lawyer replied accepting the second draft subject to a few minor typographic errors and the like, which I have corrected.

8.3 The applicant

8.3.1 On 21 September 2015 the applicant requested an extension until 16 October 2015 to respond, which I granted. He also asked if a report of any sort was produced by the expert referee that this be released to parties (refer sections 9.1.2 and 9.1.3).

8.3.2 On 21 October 2015 the applicant replied that the second draft was not accepted and he was not requesting a further hearing. He asked that the determination acknowledge and take account of his comments, which were provided in an attachment: a summary of these is below.

8.3.3 I have considered the points raised and amended the draft as appropriate. The applicant's concerns regarding the determination process are dealt with in the following section 9, and issues relating to the matter for determination are dealt with in sections 10 or 11, with any issues relating to the NZSEE guidelines in section 12.

Authority's presentation of new information at hearing

8.3.4 The applicant objected to the authority's provision at the hearing of what he considered substantial new information in its written aide memoire and regarding earthquake duration, meaning he was unable to contest this at the time.

Alleged omission of applicant's submissions from determination intended to deceive

8.3.5 The applicant considered the second draft to be 'deceptive' in that it omitted a number of what he considers critical arguments and other evidence, and that this 'deception was intentional'. The omissions were alleged to include:

- all arguments relating to inadequacies in the way the authority reviewed its EQPB policy
- a key argument relating to the difference between ultimate capacity and ultimate limit state (the adjustment for non-ductile buildings) and the necessity of equating the two
- the applicant's arguments with respect to the 'necessity' of using the ultimate limit state approach
- key analytical arguments derived from the GNS Science analysis that the buildings' probability of collapse is 1:40,000
- important elements of the applicant's submission on the Supreme Court ruling³³
- 'most arguments, evidence and discussions in the meeting [hearing] that did not suit [my] conclusions'
- all arguments (made in submissions) that rebutted points I made in the first draft.

Onus of proof

8.3.6 The applicant submitted that while the applicant, the authority and I agree that the onus of proof lies with the authority, in practice, I had reversed that onus in the determination.

Report of the hearing

8.3.7 The applicant listed what he viewed as important omissions from the summary of the hearing on 19 June 2015. These included points relating to:

- the GNS Science evidence on the building's likelihood of collapse
- the IEP assessment of the building and the use of IEP ratings for a final assessment, plus other evidence regarding the number of IEP assessments by the authority on other buildings subsequently overturned by a DSA
- the late receipt of the authority's building file and a lack of confirmation (at the hearing and subsequently) of whether information in this file about strengthening work had been reviewed before the IEP assessment
- the authority's response to the Supreme Court decision
- the building's likelihood of collapse in a moderate earthquake and the authority's engineers' lack of response on this

³³ Refer paragraphs 10.2.5 to 10.2.7 for further description of this ruling

- the application of NZSEE guidelines to Auckland buildings given the Auckland moderate earthquake force of 0.04 g.

The uncompleted DSA for the building

8.3.8 The applicant said he strongly objected to my use of an unsigned DSA for the building, which he said I had done to ‘rescue [my] position that the building has a percentage NBS of less than 34 when it became clear the IEP was fatally flawed’. He said I was informed this report was only provided to make the point there were fundamental differences in the critical structural weaknesses identified in the IEP and that there were significant issues with the report, including that the building was assessed:

- on the basis that its common wall with an adjoining building was unreinforced masonry, but this wall was reinforced in 1995 and additionally when the adjoining building was strengthened (he understood to 90% NBS)
- on a standalone basis, when the joint behaviour of both buildings should have been considered.

Further amendments requested by applicant

8.3.9 The applicant identified various paragraphs in the second draft he wished deleted or amended. These related to the authority’s provision of a brochure to the building owners, as he said there was no evidence for this; comments by the authority’s engineer relating to the recent Wellington earthquake, which he said were ‘only reported to give the appearance of “scientific authority” to the contention that a moderate earthquake is somehow very severe’; and comments regarding the relationship between MM and earthquake duration.

The reasoning in the second draft determination

8.3.10 The applicant criticised the presentation of arguments in the discussion section of the second draft and also asked for a number of amendments. His concerns included:

- the issue of earthquake duration and how this was presented
- the authority’s formulation of its EQPB policy, which the applicant does not believe was acceptable at the time or that the authority’s subsequent actions were validated because this policy had been consulted on
- the authority’s application of its EQPB policy, which he does not believe was done correctly in this case as it did not review its property files for this building or the adjoining one
- the NZSEE guidelines, which he does not accept were best practice for its time, saying there should have been a cost–benefit analysis of different cut-off points (for earthquake-prone buildings), and that they did not provide a robust methodology in the hands of experienced engineers as in this case they had ‘got it hopelessly wrong’
- the interpretation of the meaning of ultimate capacity compared with that in determination 2012/043 (he considered the latter correct) and implications arising from use of the term ‘fail in a structural sense’; the interpretation of ‘likely’ as something akin to ‘could well occur’, as in the context of a dangerous building (he said this was used as another way of expressing reasonable probability or possibility and did not change or weaken this test); and the representation of some of the applicant’s arguments relating to this

- the representation of his evidence and analysis on the probability of collapse, which he said omitted the GNS Science-based analysis and the probabilities he presented for a design-level earthquake, which were still very low and clearly much lower again for a moderate earthquake

8.3.11 The applicant further said it was agreed that the GNS Science methodology generated a probability of a building collapsing in a year as 1:40,000, which was not a reasonable probability or possibility even if this was accepted as the meaning of ‘likely’, and that the Supreme Court decision noted that building safety was not the only consideration in interpretation of the Building Act.

9. The determination process

9.1.1 The applicant’s submissions relating to the determination process are responded to in this section. Both parties’ submissions relating to the matter for determination, including the earthquake-proneness of the building, and the role of the NZSEE guidelines are responded to in sections 10 to 12.

Material from the referee

9.1.2 On 21 September 2015 the applicant asked that, if a report of any sort had been produced by the determinations referee, and if so that this be released to the parties. I treated this request as a request for information under the Official Information Act 1982 and wrote to the applicant on 23 October 2015 advising that the determinations referee had prepared a memorandum for me dated 30 March 2015 considering the way in which the NZSEE guidelines were applied in relation to the definition of an earthquake-prone building in section 122. I noted that this memorandum was not requested by me and was not a report I had relied on, nor did I intend to rely on it, when making this determination (as any such report would, of course, have been disclosed to parties).

9.1.3 I also advised the applicant that, while this memorandum, which was simply prepared as a contribution to my own understanding and internal consideration of the application for determination, would not normally be released³⁴, I was prepared in this case to make it available to the parties given the important issues and complex technical matters being considered.

Breach of statutory timeframe

9.1.4 The applicant alleged that the Ministry “deliberately breached” the statutory time limit for completing the determination, saying the essential phase of the process – asking the authority for documents – did not start until the time limit was up. The applicant states he intends to “ask the Chief Executive to conduct an investigation as to why the breach occurred” and that he will also make a complaint to the Ombudsman.

9.1.5 While acknowledging there have been delays in the process, I reject the applicant’s assertion that these delays were deliberate. The applicant has produced no evidence for his claim that I have deliberately delayed the determination process and the allegation is inappropriate.

9.1.6 This application for a determination and the wide ranging matters raised by the applicant address some significant and technically complex issues. The determination process has endeavoured to provide both parties with sufficient

³⁴ Refer to Official Information Act 1982 sections 9(2)(ba) and (g)(i) for grounds for withholding confidential information and information necessary to maintain the effective conduct of public affairs through the free and frank expression of opinions between officials

opportunity to fully respond to each other's submissions and the various drafts of the determination that have been prepared. The time taken to complete the determination process is regretted, but this is an extreme example of a disputed matter for resolution and most determinations are completed within the statutory timeframe. The breadth of the issues raised by the applicant, the lack of engineering evidence produced by the applicant about the earthquake-proneness or otherwise of the building, and the wide-ranging allegations levelled by the applicant at the determination process and myself have not assisted in the timely disposal of this determination.

Onus of proof

- 9.1.7 The applicant stated that while the parties and I agree the onus of proof lies with the authority, in practice the determination has reversed that onus. The applicant has provided no particulars as to why he considers the determination has reversed the onus of proof. However, I presume he feels he is being required to prove the building is not earthquake prone, when it is the authority that is required to prove the building is earthquake prone. The matter is complicated by the range of issues being considered and it is important to understand that the earthquake-proneness of the building is being considered separately from the issues the applicant has raised concerning the appropriateness of the NZSEE guidelines.
- The authority's decision to issue a section 124 notice for the applicant's building is the matter for determination. The section 124 notice is based on an IEP carried out by the authority's engineers in conjunction with the lack of a DSA provided by the owners indicating contrary findings. The applicant has raised concerns about that process (which are considered in sections 10 and 11), but has not produced any engineering evidence about the strength of the building and why it should not be considered earthquake prone.
 - The applicant's challenge to the NZSEE guidelines is an issue over which I have no jurisdiction, because a determination cannot endorse or overturn these guidelines. If the applicant had provided engineering evidence that concerned the way the NZSEE guidelines were applied in the IEP process relied on by the authority, the determination could consider whether the application of the NZSEE guidelines in that particular case was consistent with the requirements of section 122 of the Act. Similarly, if the owners had obtained a DSA and the authority had used that DSA as the basis for its section 124 decision the owners could have sought to challenge the authority's reliance on that DSA if they considered the way that DSA had been undertaken was inconsistent with the requirements of sections 122 and 124 of the Act. However, as the owners have not provided any such evidence related to the way the IEP relied on by the authority has been carried out, the determination is unable to consider whether the way the NZSEE guidelines have been applied to this building are consistent with section 122 of the Act. There is no issue of a reversal of the onus of proof in respect of this matter.
- 9.1.8 In the first instance, the onus of proof is on the authority and I refer to my subsequent discussion on this in section 11. In the second instance, there is no onus of proof at issue because the applicant has not provided engineering evidence that is specific to this building that challenges the way the authority has carried out the IEP process for this building.

Authority's presentation of new information at hearing

- 9.1.9 The applicant questioned the authority's provision of what he considered new written and oral material at the hearing, saying he was unable to contest this at the time. The applicant has been given the opportunity to respond to this material if he wishes, as evidenced by the applicant's further submission on 21 October 2015 that was submitted well after the date of the hearing. The rules of procedure and evidence for a determination in section 186 of the Act are more flexible than for a court and I consider it was quite appropriate for this information and evidence to be provided by the authority at the hearing.

Evidence about what the authority's engineers said

- 9.1.10 Regarding the hearing, the applicant reported that the authority's engineer had said the authority had not amended its approach to take into account the Supreme Court's ruling that an earthquake-prone building must be likely to collapse and that the authority's current approach did not take the likelihood of collapse into account. The applicant objected to the fact that the summary of the hearing did not report this comment. However, I note that the summary of the hearing is not a transcript and not all material presented at the hearing can be summarised. I further note this was a report of what someone else said and I consider it more appropriate for the authority to provide direct evidence on its approach than for the determination to rely on second-hand reports of what authority employees or contractors might have said.
- 9.1.11 The applicant considers statements he made at the hearing concerning conversations by engineers about whether the building was likely to collapse in a moderate earthquake should have been summarised in the determination. An engineer was reported to have refused to answer the question: 'Will the building collapse in a moderate earthquake?' The applicant considers this points to a "conspiracy of silence in the earthquake engineering community." Again, I note that not all reports made at the hearing of what other people have said can be summarised in the determination. It is for the parties to provide direct evidence of the strength or otherwise of the building, which the determination can consider, rather than just referring to comments that other people are reported to have made.

Accuracy of IEPs v DSAs

- 9.1.12 The applicant referred to evidence that he presented at the hearing on the number of authority IEP assessments subsequently overturned by a DSA, and to statements made by the authority's engineer at the hearing that IEPs were broadly accurate. The applicant considered this should have been reported. The relationship between IEPs and DSAs is discussed in more detail in section 11 below, but it is accepted that IEPs are a screening tool and will not necessarily accurately match the outcome of DSAs. This is the reason why owners are strongly encouraged to obtain DSAs rather than relying on IEPs.

Relevance of GNS Science methodology

- 9.1.13 The applicant considered the hearing summary omitted that I and the authority's engineer agreed the GNS Science methodology was sound and the GNS Science evidence was authoritative. He also considered that the representation of his evidence and analysis was misleading, as it omitted the GNS Science-based analysis. To clarify, I have not questioned the GNS Science data, which the applicant has subsequently drawn on to develop a probability of damage for his building (refer paragraph 4.1.10). The relevance of this data is discussed more fully at section 11.2.

Information brochure provided by authority to building owners

- 9.1.14 The applicant challenged the statement in paragraph 6.5.2 that it was established a brochure accompanied the authority's IEP assessment to inform the building owners. The applicant considered it had not been established that such a brochure had been provided to owners, because the authority had not provided any evidence of what was provided to owners. To clarify, the brochure was listed as an enclosure in the authority's letter to the owners of 31 May 2007 (notifying them their building was potentially earthquake prone). The letter stated:

The Earthquake Prone Building Policy may be viewed in full at [the authority's website] or you can refer to the copy of the [authority's] earthquake prone buildings brochure which is enclosed.

Comparison with earthquake-prone buildings in Auckland

- 9.1.15 The applicant objected to the fact that his comments at the hearing relating to the likelihood of collapse of Auckland buildings had been omitted. I note this is not in issue in the determination. However, the methodology outlined in the NZSEE guidelines for IEPs and DSAs requires the assessor to take a number of variables into account when assessing the building (e.g. age, construction materials, building importance level) and these include the seismic hazard (Z) factor for the building's location, as specified in NZS 1170.5: 2004.

Allegations of substantive bias

- 9.1.16 The applicant's submission in response to the second draft determination again made allegations of substantive bias in respect of my role as Determinations Manager. A number of allegations were made including:
- that having taken a lead role in the current legislation review, and having 'made substantive errors in doing so', I should have highlighted those errors and as a result this determination has meant I have 'acted as judge in [my] own case'
 - that because the Ministry has actively promoted the NZSEE guidelines 'any admission now that they were flawed would undermine their credibility' and means I have 'protected the Ministry's interests' in this determination
 - that because the Ministry and the earthquake engineering profession have worked together to develop and implement the current framework 'the Ministry has become wedded to that arrangement' and I have 'protected the economic interests and credibility of the earthquake engineering profession' in this determination.
- 9.1.17 In respect of the first allegation, the applicant has not provided details of why he considers this determination makes me a judge of my own case when the determination concerns a section 124 notice issued by the authority in respect of the building at 124 Wakefield Street and does not concern the contents of the Building (Earthquake-prone Buildings) Amendment Bill 2013. However, it is possible the applicant considers the methodology for determining an earthquake-prone building under the proposed amendments will simply be a carry-over of the approach under the current Act. That is not the case. The proposed earthquake-prone building methodology will not be a recitation of the current NZSEE guidelines and I reject any suggestion that my participation in the current legislation review somehow makes my role in this determination a judge of my own case.
- 9.1.18 I also reject the second and third allegations of bias. I have not acted to protect the Ministry's interests in the NZSEE guidelines; nor have I acted to protect the interests of the earthquake engineering profession. As will be observed in section 12, It is

accepted that the NZSEE guidelines require revision in light of the lessons that have been learnt from the Canterbury earthquakes, and that the NZSEE guidelines require particularly careful application to ensure they are applied consistently with the requirements of section 122 of the Act, notwithstanding proposed changes to this legislation.

- 9.1.19 The applicant said he wrote to the Ministry’s Chief Executive to object to my role but was not satisfied with the response, which was that under section 187 of the Act an independent technical expert (a structural engineer) had been appointed as a referee to assist with the determination. The applicant said he did not consider the referee as appointed had the appropriate legal or risk engineering skills for the current determination.
- 9.1.20 It is inevitable, given the breadth of the Chief Executive’s powers and functions under the Act, which include the determinations function, that at times, matters on which the Chief Executive has had some prior involvement will come before the Chief Executive for a determination. While in this case I had no prior involvement in the development of the current framework for earthquake-prone buildings, as the applicant has identified, I have been involved in the current policy review relating to earthquake-prone buildings. However, I do not consider that has improperly influenced me in respect of this determination, which will be made on the facts and law presented to me by the parties.

10. Discussion Part One: the Act, the legal test and the authority’s EQPB policy

10.1 Overview of the relevant sections of the Act

- 10.1.1 Subpart 6 of Part 2 of the Act contains provisions relating to dangerous, affected, earthquake-prone and insanitary buildings. This determination only concerns the provisions that relate to earthquake-prone buildings. Section 122 defines when a building will be earthquake prone and provides:

122 Meaning of earthquake-prone building

- (1) A building is earthquake prone for the purposes of this Act if, having regard to its condition and to the ground on which it is built, and because of its construction, the building—
- (a) will have its ultimate capacity exceeded in a moderate earthquake (as defined in the regulations); and
 - (b) would be likely to collapse causing—
 - (i) injury or death to persons in the building or to persons on any other property; or
 - (ii) damage to any other property.
- (2) Subsection (1) does not apply to a building that is used wholly or mainly for residential purposes unless the building—
- (a) comprises 2 or more storeys; and
 - (b) contains 3 or more household units.

- 10.1.2 The definition of a “moderate earthquake” is contained in clause 7 of the Regulations and provides:

Earthquake-prone buildings: moderate earthquake defined

For the purposes of section 122 (meaning of earthquake-prone building) of the Act, **moderate earthquake** means, in relation to a building, an earthquake that would generate shaking at the site of the building that is of the same duration as, but that is

one-third as strong as, the earthquake shaking (determined by normal measures of acceleration, velocity, and displacement) that would be used to design a new building at that site.

- 10.1.3 A moderate earthquake is one that is of the same duration as the earthquake used to design a new building at a site, but only one-third as strong (in terms of acceleration, velocity and displacement). I note the submissions from the applicant (refer paragraphs 5.3.35, 5.3.36, 6.3.1, 7.2.3) in relation to duration and that the relationship between duration and earthquake shaking has a level of uncertainty. However, I note that in broad terms a larger magnitude earthquake has a longer duration than a smaller magnitude earthquake.
- 10.1.4 A building will therefore be earthquake-prone if the building will have its ultimate capacity exceeded in a moderate earthquake (the forces of which are calculated in accordance with NZS 1170.5, using the duration of shaking that would be required for a new building at the site but that are one-third as strong as that required for a new building), and would be likely to collapse causing injury or death to persons in the building or on any other property or causing damage to any other property.
- 10.1.5 Section 124 confers various powers on a territorial authority in respect of an earthquake-prone building, including putting up a hoarding or fence to prevent people from approaching the building nearer than is safe; attaching a notice to the building warning people not to approach the building; issuing a notice requiring work to be carried out on the building to reduce or remove the danger; and issuing a notice restricting entry to the building for particular purposes or to particular persons or groups of persons.
- 10.1.6 Sections 125 to 130 contain various administrative and enforcement provisions concerning the notice requirements for an earthquake-prone building notice; powers for a territorial authority to carry out work on an earthquake-prone building when an earthquake-prone building notice has not been complied with or there is an immediate danger to the safety of people; and various offences for contravening an earthquake-prone building notice. Sections 131 to 132A require a territorial authority to prepare, consult and adopt a policy for performing its functions in respect of buildings under subpart 6.

10.2 An earthquake-prone building under the Act

- 10.2.1 As noted above in paragraph 10.1.1, the two essential requirements for a building to be earthquake-prone under section 122(1) of the Act are: (a) “the building will have its ultimate capacity exceeded in a moderate earthquake” and (b) the building “would be likely to collapse causing injury or death to persons in the building or to persons on any other property or damage to any other property”. The applicant disagrees with the way the NZSEE guidelines interpret and apply these requirements of the Act. The following section of the determination notes the aspects of the definition of an earthquake-prone building the authority and applicant agree on, and also the areas of disagreement.
- 10.2.2 In its submissions, the authority referred to section 5(1) of the Interpretation Act 1999, which states “the meaning of an enactment must be ascertained from its text and in light of its purpose”, and to the purposes of the Building Act 2004, which include the need to ensure that “people who use buildings can do so safely”. The authority cited *Hyslop v Dunedin City Council* HC Dunedin, AP35/93, 21 June 1993, which concluded that because the earthquake-prone building provisions in the Act

are for the protection of building users and the public they should be interpreted in a “fair, large and liberal way”.

- 10.2.3 The applicant disagreed with the reference to the *Hyslop* case, noting that it concerned a dangerous building, and earthquake-prone buildings presented very different issues. The applicant considered the earthquake-prone building provisions reflect a balancing of the costs and benefits of strengthening, and that it was for this reason the Department of Building and Housing³⁵ had advised territorial authorities to conduct a cost–benefit study when developing their earthquake-prone building policies.
- 10.2.4 I consider while the earthquake-prone building provisions are undoubtedly intended to protect building users and the public, and this should be kept clearly in mind when interpreting and applying the provisions, a conclusion that a building is earthquake-prone can also have a significant impact on the value, saleability, mortgage and insurance of a building. The earthquake-prone building provisions will also impact differently on different types of building: for example, industrial, commercial, multi-unit residential buildings, and buildings owned by not-for profit organisations will all be affected in different ways.
- 10.2.5 The requirements for a building to be considered earthquake prone under section 122(1) of the Act have been the subject of the recent Supreme Court decision in *University of Canterbury v Insurance Council of New Zealand Incorporated* [2014] NZSC 193, which confirmed that the definition of an ‘earthquake-prone building’ in section 122(1) has two limbs and that a building will not be earthquake prone in terms of the section unless both limbs apply to it. In light of this recent decision, I consider authorities must consider the second limb of the legal test when assessing buildings to be earthquake prone under the current legislation.
- 10.2.6 The Supreme Court commented that there was no dispute about the meaning of the ‘first limb’; that if a building is below the 34% NBS benchmark (using this term as a shorthand to describe the requirement in the Regulations), this element of the definition is met. The Court also took the view that it was implicit within section 122 that not all buildings whose ultimate limit capacity is exceeded will collapse. Both the applicant and the authority recognised this and agreed that it was not possible to predict when a particular building will collapse. As the commentary in NZS 1170.5:2004 states:
- Given the current state of knowledge of the variables and the inherent uncertainties involved in reliably predicting when a structure will collapse, it is not currently considered practical to either analyse a building to determine the probability of collapse or base a code verification method around a collapse limit state.
- 10.2.7 The Supreme Court also considered the second limb refers to the likelihood of collapse specifically in a moderate earthquake³⁶, and I agree with this interpretation. The Court took the view that this second limb operates as a further filter to exclude those buildings that are unlikely to collapse even though they fail to meet the 34% NBS benchmark, as well as those buildings that if they collapsed would not cause injury, death or damage to other property, for example, because the building is unoccupied and there is no other property in the vicinity. The Supreme Court stated at [44]:

The interpretation favoured by the Courts below treats the second component as a consequence of the first: the building is likely to collapse because it does not meet the

³⁵ The predecessor to the Ministry

³⁶ *University of Canterbury v Insurance Council of New Zealand Incorporated* [2014] NZSC 193 at [44] and [57].

34 per cent of NBS benchmark. The purpose of the provision is to limit the ambit of the definition, by excluding buildings that, despite failing to meet the 34 per cent of NBS threshold, are not likely to collapse. This recognises the possibility that not every building that fails to meet the 34 per cent of NBS benchmark will be likely to collapse. That interpretation necessarily treats the likelihood of collapse as arising in a moderate earthquake, because it builds on the first limb of the definition.

- 10.2.8 The applicant and the authority do not disagree with any of the above statements regarding section 122 of the Act, but have different views about the way these requirements in section 122 of the Act are applied.

10.3 The authority's approach to section 122 of the Act

- 10.3.1 The authority agreed with the approach set out in the draft determination that the term 'ultimate capacity' in section 122(1)(a) of the Act could be equated with 'ultimate limit state' as recommended in the NZSEE guidelines, particularly given the link between the definition of moderate earthquake in regulation 7 of the Regulations and NZS 1170.5:2004 as the reference point for new buildings, which are designed in accordance with ultimate limit state philosophy.
- 10.3.2 The authority's approach to assessing whether a building was likely to collapse cited the Supreme Court's comments at paragraph 10.2.7, and treated collapse as a consequence of a finding under the first limb that the ultimate capacity of the building would be exceeded, unless there was some particular reason for concluding that the building was unlikely to collapse causing injury, death or damage to other property. The authority noted that, under Step 1 of its EQPB policy, buildings that will not require further assessment included those "isolated structures unlikely to collapse causing injury, death or damage to other property (refer Sections 122(1)(b) of the Building Act 2004)".
- 10.3.3 In the authority's view, the term "likely" in section 122(1)(b) means "a reasonable probability or possibility" or "that having regard to the circumstances of the case it could well happen". It cited Judge McGuire's conclusions in *Rotorua District Council v Rua Developments Limited* DC Rotorua, NP1327/97 regarding the meaning of the term "likely" as used in the definition of a dangerous building.
- 10.3.4 The authority considered it was important to give different meanings to the probabilities in section 122(1)(a) as to whether a building "will have its ultimate capacity exceeded" and in section 122(1)(b) as to whether a building would be "likely to collapse".

10.4 The applicant's approach to section 122 of the Act

- 10.4.1 The applicant did not agree that the term 'ultimate capacity' in section 122(1)(a) of the Act could be equated with 'ultimate limit state' in the NZSEE guidelines. The applicant preferred the meaning given to 'ultimate capacity' in Determination 2012/043, and submitted that the requirement in section 122(1)(a) that a building "will have its ultimate capacity exceeded" required a very high degree of probability.
- 10.4.2 The applicant noted that 'ultimate limit state' as advocated by the authority is explained in NZS 1170.5:2004 as the level when "there will be a very low risk at the ULS [ultimate limit state] of structural collapse [or] failure of parts and elements which would be life threatening". The commentary to NZS 1170.5:2004 goes on to explain that the ultimate limit state sets a target life safety risk of 1 in 1,000,000 and the implied probabilities of a building collapse to achieve that target range from 1 in 10,000 to 1 in 1,000,000. Using the midpoint of these numbers of 1 in 505,000 and

the probability of a moderate earthquake in Wellington being a 1 in 50 year event gives a probability of collapse in a moderate earthquake for a building at 34% NBS of around 1 in 10,000.

- 10.4.3 The applicant stated this very low level of probability of collapse is not consistent with the requirement in section 122(1)(a) that a building “will have its ultimate capacity exceeded”. The applicant considered the probability of collapse at 34% NBS using the NZSEE guidelines is probably even lower than this and closer to 1 in 40,000 if the more precise GNS Science data on probability of collapse is used.
- 10.4.4 The applicant did not specify the probability of collapse required by section 122(1)(a) but considered that whatever the appropriate figure was it was certainly a much higher probability than the 1 in 40,000 referred to above.
- 10.4.5 The applicant noted that if there is a high degree of probability that a building will have its ultimate capacity exceeded, there will be little need to specifically consider whether the building will be “likely to collapse”. However, the second limb in section 122(1)(b) was still relevant, as it provides a further filter for those buildings that even though they might collapse will not cause injury, death or damage to other property.
- 10.4.6 The applicant considered the authority’s interpretation of “likely” in section 122(1)(b) of a “reasonable possibility” or something that “could well happen” was too low, and that while appropriate for a dangerous building because of the wide range of circumstances when a building might be dangerous and the difficulty of conducting a probabilistic assessment of the risk of the building causing injury or death, the context for earthquake-prone buildings under section 122 of the Act was different. The applicant stated “there is a well-documented understanding of [earthquake] risk and its quantification ... and this should be applied when assessing the meaning of ‘likely’ to produce consistent and authoritative outcomes in terms of life safety risk”.

10.5 Conclusion on the legal test under section 122 of the Act

- 10.5.1 In conclusion, the interpretation of the legal test that was undertaken at the time the authority created its EQPB Policy has now advanced in particular in relation to the recent Supreme Court decision. There have also been advances in engineering assessments. Further discussion on next steps for the authority and an overview of new policy developments can be found in section 12. However, it is important to stress (and as noted in paragraph 1.4) the matter to be determined is whether the authority exercised its powers correctly in issuing the section 124 notice for the building based on the IEP process carried out on that building.

10.6 The authority’s EQPB policy for determining whether a building is earthquake prone

- 10.6.1 Section 131 of the Act requires the authority to adopt a policy setting out the approach the authority would take to exercising its powers in respect of earthquake-prone buildings, the authority’s priorities for performing those functions, and how the policy would apply to heritage buildings.
- 10.6.2 The authority adopted its policy on earthquake-prone buildings under this section of the Act in May 2006. Section 132(1) required that the authority adopt its policy in accordance with the special consultative procedure in section 83 of the Local

Government Act 2002. Section 132(4) requires the authority to review its policy after five years and at five yearly intervals thereafter.

- 10.6.3 To assist territorial authorities with their decision-making in relation to whether a building is earthquake prone, the Ministry prepared guidance for the authorities in June 2005: 'Earthquake-prone Building Provisions of the Building Act 2004: Policy Guidance for Territorial Authorities' in June 2005. The guidance stated the NZSEE procedures would, if followed, "become the principal means of assessment used by owners' structural engineers and authorities". The NZSEE guidelines were subsequently published in June 2006. The NZSEE guidelines contain the methodology to be used by structural engineers to assess the structural performance of an existing building in a moderate earthquake. They set out the two types of evaluation: the IEP and the DSA described below.
- 10.6.4 The NZSEE guidelines (at pages 2-6 and 3-1) detail the IEP procedure, which is "intended to be a coarse screening involving as few resources as reasonably possible" to identify potentially earthquake-prone buildings. The results from the IEP are used to identify buildings that warrant a DSA on their structural performance. The results also highlight structural issues that may warrant further investigation (in a DSA), and provide a preliminary score for a comparative risk grading of buildings.
- 10.6.5 Where an IEP indicates that a building is likely to be high risk, or 'potentially earthquake prone' the NZSEE guidelines stated a DSA should be carried out to provide a more specific and convincing evaluation on which a final decision can be made by an authority. The DSA allows an engineer to look in more detail at "characteristics of the building, its response to earthquake shaking, the demands it places on structural elements, and the capacity of such elements to meet those demands by maintaining structural integrity under imposed actions and displacements" (at page 4-1).
- 10.6.6 The authority's current EQPB policy (from 2009) incorporates the approach in the NZSEE guidelines and has four main steps, which can be summarised as follows.
- Step 1: A desk-top review to assess which buildings could be earthquake prone.
 - Step 2: An initial assessment where the authority uses an IEP in accordance with the NZSEE guidelines.
 - Step 3: Advising the owners in writing of the IEP if it is less than 34% NBS and/or where there is other evidence to suggest the building is potentially earthquake prone. The owners have a six month time period to either provide additional information of relevant factors or supply a DSA, to be carried out in accordance with the NZSEE guidelines.
 - Step 4: Issuing a section 124 notice if the authority is satisfied the building is earthquake prone based on the IEP if no further response is provided, or based on further information.
- 10.6.7 I further note Step 5 'Updates' states that as building consents for structural strengthening are received and the strengthening work is completed, the database will be updated to reflect the status of buildings no longer classed as earthquake prone.

11. Discussion Part Two: The challenge to the NZSEE guidelines and their incorporation in the authority's EQPB policy

11.1 Overview

- 11.1.1 This part of the determination considers the applicant's challenge to the authority's incorporation of the NZSEE guidelines in its EQPB policy on the basis that they are not consistent with the requirements of section 122(1) of the Act for determining when a building is earthquake prone.
- 11.1.2 As I noted in paragraph 1.6, I have no jurisdiction either to generally endorse or overturn the NZSEE guidelines in relation to the IEP process or the more substantive DSA methodology used for determining whether a building is earthquake prone. However, the issues the applicant has raised are important and deserve careful consideration. The discussion below is intended to assist the building owners and applicant in the event they wish to commission an engineer to undertake a DSA of their building and wish to ensure that this will be carried out consistently with the requirements of the definition of an earthquake-prone building in section 122(1) of the Act.
- 11.1.3 A further discussion on how the authority assessed the subject building in this case can be found at section 13.

11.2 Observations on the NZSEE guidelines, EQPB policies and the Act

- 11.2.1 The applicant has raised two main points regarding the relationship between the legal test under section 122 of the Act and the NZSEE guidelines which inform the authority's current EQPB policy:
- Issue One: the difference between 'ultimate limit state' under the NZSEE guidelines and the authority's EQPB policy and the phrase 'ultimate capacity' in the Act
 - Issue Two: what he considers to be flaws in the NZSEE interpretation of 'likely to collapse'.
- 11.2.2 Before discussing these issues in turn, it is important to note that the NZSEE guidelines are not a substitute for the legal test in section 122 of the Act. I consider the legal test requires the application of the wording of section 122 using evidence provided by a skilled, professional engineer to inform the decision-making process an authority must make. An authority is still required to consider whether on all the evidence before it, including the results of the application of the NZSEE methodology, it is satisfied a building is earthquake prone.

Issue One – Ultimate limit state and ultimate capacity

- 11.2.3 In Determination 2012/043 I considered whether the special provisions of subpart 6 of the Act relating to dangerous, earthquake-prone and insanitary buildings that simply refer to a 'building' could also be applied to part of a building, and concluded that they could. The determination was initiated by the Chief Executive³⁷ following some uncertainty amongst territorial authorities as to whether they could apply these special provisions to parts of buildings that may be falling hazards (e.g. parapets, chimneys or gable ends). In other words, the issue was whether just these parts could be defined as earthquake prone in cases where the whole building would not

³⁷ Under section 181 of the Act

- otherwise meet the test for an earthquake-prone condition under section 122 of the Act.
- 11.2.4 In that determination I noted the term ‘ultimate capacity’ was not a specific engineering term and I was therefore of the view that the natural and ordinary technical meaning of these words needed to be considered. I stated that ‘in my view, the reference to the ultimate capacity of a building is therefore a reference to the point at which the building fails in a structural sense and could collapse’.
- 11.2.5 I note that these comments regarding ultimate capacity were made in the context of considering parts of a building (in particular components of a type that might not have the capacity or form to redistribute seismic overloads), whereas the context for the ultimate limit state comments from the NZSEE guidelines are as it applies to whole buildings. While I consider the definition of ultimate capacity in Determination 2012/043 to be appropriate in this broader context, it is useful to clarify what is meant by the phrase ‘fails in a structural sense’. In my view ultimate capacity can be defined as the point beyond which you can no longer reliably predict the way the structure will perform and the building and/or part of a building could start to collapse.
- 11.2.6 I note the applicant’s view that the natural and ordinary meaning of these words does not change if the context is part of a building or a whole building. He said the outcome of Determination of 2013/043 was that part of a building could be earthquake prone, i.e. that part of a building was equivalent to the whole building, and the relationship between ultimate limit state and ultimate capacity was the same for part of a building or a whole building.
- 11.2.7 He also disagreed with the additional interpretation of ultimate capacity I have provided in this determination, saying this implied the ultimate limit state point somehow distinguished cases where a building could collapse from those that could not. In his view, this was wrong and at odds with my and the authority’s arguments that it was not possible to ascertain when a building will collapse.
- 11.2.8 I disagree with the applicant on this point. It is my view that the context for considering ultimate capacity is significant and this clarification is appropriate. For example, the parts of buildings that provided the context for Determination 2012/043 were those that could be falling hazards, such as chimneys and parapets. Such building parts are generally brittle (non-ductile) and it was appropriate to refer to their failing in a structural sense when considering their performance. In contrast, the performance of a whole building is significantly more complex because of redundancies in its lateral force resisting system.
- 11.2.9 In considering the relationship between the ultimate limit state and ultimate capacity (i.e. the point beyond which a building or part of a building could collapse), it may be useful to set out the considerations required for designing new buildings against those for assessing existing buildings.
- 11.2.10 The earthquake actions standard NZS 1170.5:2004 and the general loading standard AS/NZS 1170.0:2002³⁸ provide the basis for structural engineers to prepare new building designs based on dependable material strengths. In Determination 2012/043 I referred to the ultimate limit state under these standards as:

³⁸ NZS 1170.5:2004 New Zealand Standard Structural Design Actions Part 5 Earthquake Actions and NZS 1170.0:2002 Australia/New Zealand Standard Structural Design

the state at which the strength or ductility capacity of the structure is exceeded, when it cannot maintain equilibrium and becomes unstable, and is the limit beyond which the structural integrity of the building cannot be maintained.

- 11.2.11 These standards, when applied to new buildings, allow structural engineers to include appropriately conservative factors to provide for reliable building performance. Design for the ultimate limit state represents a process that is aimed at ensuring the probability of collapse of a building (and therefore risk to human life) is at an acceptably low level.
- 11.2.12 This contrasts with the assessment of existing buildings; particularly those designed before 1976 when modern seismic loading standards were introduced, and which are therefore the focus of most authorities' EQPB policies. For example, instead of the dependable strengths used for new building design, engineers assessing existing buildings use probable strengths, as provided in the NZSEE guidelines, to reflect the likely actual strengths, taking into account the materials used and the building's date of construction. They then make a judgement around the building's overall robustness in terms of likely earthquake resistance.
- 11.2.13 Accordingly, I note that the term 'ultimate limit state' when applied to the building as a whole is less well defined in engineering terms for an older existing building than it is for a new building. This is because new buildings are designed to be able to maintain an ultimate limit state condition under design loadings, by meeting a set of specific engineering criteria from current structural standards to ensure the post-yield condition is reliable and practicable. While some of these individual criteria may be met by existing buildings, it is very rare that they will all be achieved.
- 11.2.14 In Determination 2012/043 I also noted that the NZSEE considered the differences between the reference in section 122 to 'ultimate capacity' and the engineering term 'ultimate limit state' and, for practical reasons, having due regard to current engineering tools and practice, equates ultimate capacity with ultimate limit state as defined in current design standards. I consider this was a reasonable interpretation for buildings under consideration at the time. I confirm it is agreed by all the parties it is not possible to predict collapse. However, I consider that 'ultimate capacity' and 'ultimate limit state' have a closer alignment in practice for being able to predict collapse for brittle existing buildings (for example, unreinforced masonry) and to some lesser extent for older buildings like the one subject to this determination, which is a pre-1935 reinforced concrete building with infill masonry. It is for this reason that DSAs are recommended as a means of estimating the inter-relationship between 'ultimate capacity' and 'ultimate limit state'.
- 11.2.15 I note that in relation to the Building (Earthquake-prone Buildings) Amendment Bill 2013 (refer paragraph 12.1.1) the definition for ultimate capacity will be set in new regulations.

Issue Two – Likely to collapse

- 11.2.16 I accept the applicant's submission that the reference to likelihood of collapse in section 122(1)(b) relates to collapse in a moderate earthquake, as opposed to an 'overall expectation' as currently stated in the NZSEE guidelines, and that the NZSEE guidelines should be updated, particularly in light of the recent decision of the Supreme Court noted in paragraph 10.2.5.
- 11.2.17 Notwithstanding the need to update that particular point in the NZSEE guidelines, I consider that the NZSEE guidelines when used by a suitably qualified and experienced structural engineer will identify the 'likely' response behaviour of a

building as a whole and the various recognisable features of the building (essentially, the ‘critical structural weaknesses’) that have the potential to cause a collapse of the building at relatively low levels of ground shaking.

- 11.2.18 In relation to the interpretation of ‘likely’ as used in section 122, I agree with the submission from the authority that this is akin to something that could well occur, as per the well-established definition of ‘likely’ in the context of a dangerous building as defined in section 121 of the Act. In addition, I note this is the interpretation adopted in the NZSEE guidelines. I acknowledge the comments from the applicant that the context of the use of the word ‘likely’ is different between an earthquake-prone building notice and a dangerous building notice and I consider it important to consider the purposes of applying the ‘likely’ test in different contexts.
- 11.2.19 I also note the applicant’s comments in his most recent submission; namely that the Court³⁹ has said likely means a ‘reasonable probability or possibility’ or ‘that having regard to the circumstances of the case it could well happen’, and accordingly being akin to something that could well occur did not change or weaken the ‘reasonable probability or possibility’ test. The applicant has also provided probability analyses relating to the likelihood of collapse for his building in a moderate earthquake and, as referred to earlier, concluded that this is very low.
- 11.2.20 In relation to collapse, the difficulties of predicting this point for a building are acknowledged in the NZSEE guidelines. I acknowledge that this provides some challenges for authorities whose EQPB policies are informed by these guidelines in applying the legal test (i.e. to determine whether or not a building is earthquake prone by virtue of the second limb of the section 122 test) but, as noted earlier, engineering knowledge and judgement needs to be brought to bear in the assessment of a particular building.
- 11.2.21 I note that, as referred to earlier in the determination, the need to consider whether a building is likely to collapse (in a moderate earthquake) acts as a further filter to the consideration of its ultimate capacity so that the cohort of buildings being considered at this point will already be a group that is inherently more ‘likely to collapse’ than the wider set of buildings generally. There is a further filter again which authorities must consider, and that is the likelihood of whether the building will collapse causing injury to people or damage to other properties. This allows the authority to take into account risk factors relating to location and occupancy (as also referred to in paragraph 10.3.2): for example, in considering whether and how to assess an isolated and seldom-used building in a rural location, as opposed to a central city apartment block.
- 11.2.22 I also note that the risk table in the NZSEE guidelines⁴⁰, while considering %NBS thresholds rather than likelihood of collapse, notes that a building assessed at 20-33% NBS (i.e. below the current threshold) is at approximately 10 to 25 times greater risk of their strength being exceeded due to earthquake actions than a new building and a building at less than 20% NBS is likely to be at least 25 times greater risk (of having their strength being exceeded due to earthquake actions). In contrast, buildings assessed at between 34% and 66% NBS are considered to have approximately 5 to 10 times greater risk than a new building.

³⁹ In *Weldon Properties Ltd v Auckland City Council* HC Auckland HC26/97, 21 August 1997

⁴⁰ Table 2.2 Page 2-14

12. Upcoming changes

- 12.1.1 I note for the benefit of the applicant and other interested parties that there is current policy work underway to further clarify the legislation (see the Building (Earthquake-prone Buildings) Amendment Bill 2013) (“the EPB Bill”). The changes proposed in the EPB Bill will see a national approach to dealing with earthquake-prone buildings with different timeframes to identify and remediate buildings. The EPB Bill aims to ‘strike a balance between protecting people from harm in an earthquake and managing the costs of strengthening or removing buildings’; and the amendments include clarifying the current threshold for defining an earthquake-prone building, including a clarification that it applies to parts of buildings as well as whole buildings. As noted earlier, the definition for ‘ultimate capacity’ will be set in regulations.
- 12.1.2 I acknowledge this is a complex field and that the applicant has highlighted some of the challenges faced by authorities in interpreting and applying the legal test. There have been recent developments in the form of the Supreme Court decision that have clarified how the legal test should be applied. I consider that, for territorial authorities making assessments as to the earthquake-proneness of a building, the following broad principles might be considered in the future, in particular when assessing the ‘likely to collapse’ limb. I note this is not an extensive or exhaustive list but can be used in conjunction with a DSA provided by an owner (which is strongly recommended).
- Considering the structural form of a building and identifying the likely collapse mode, having due regard to any potential critical structural weaknesses identified in the IEP.
 - Considering selected parts of a building that might contribute to partial collapse.
 - Considering benefits of previous strengthening (if any).
 - Placing reliance on statements by suitably experienced CPEng engineers if, in their professional opinion, the building is not likely to collapse despite being less than 34% NBS.
- 12.1.3 I acknowledge that further guidance is required in this area, and confirm that the Ministry will issue guidance on how to apply the legal test under the new legislation, during the legislation’s transition period.
- 12.1.4 In addition, the NZSEE guidelines are currently undergoing a review with input from the Ministry, and will acknowledge changes in current engineering practice and interpretation so that they will align with the proposed new legislation.
- 12.1.5 When these guidelines were developed in 2006 the focus was on brittle (non-ductile) buildings. In my view, and in general terms, these guidelines have provided a reasonable proxy for older and heavier brittle buildings for consideration of both limbs of the legal test. However, there have been significant improvements in engineering knowledge and understanding in recent years; in particular, considerable experience from the performance of New Zealand’s building stock following the Canterbury earthquake sequence of 2010-2011. There has also been a greater appreciation of the additional judgement required for other building types when considering the second limb of the legal test.

- 12.1.6 The revised guidelines⁴¹ are intended to reflect these advances in knowledge and understanding. In addition to technical updates, they will address aspects such as:
- placing increased emphasis on determining how the building as a whole behaves, including quantifying the contributions from all building elements
 - identifying critical features that lead more directly to brittle (non-resilient) failure with significant consequences
 - considering the impacts of different ground conditions on the building as a whole.

13. Discussion Part Three: the authority's assessment of the building

13.1 The authority's EQPB policy

- 13.1.1 With respect to the authority's citation of the NZSEE guidelines in its EQPB policy, as stated above (paragraph 10.6.6), I consider that these guidelines reflected best practice at the time of issue and it was reasonable for the authority to use these guidelines to inform its decision-making in relation to the legal test to determine whether a building is earthquake prone.
- 13.1.2 With respect to the authority's adoption of its EQPB policy, I note that it followed the Ministry's guidance and that the policy was adopted following the special consultative process required under the Local Government Act (refer paragraph 10.6).
- 13.1.3 As noted in Determination 2014/032⁴², the main objective of the Act and associated policies set by authorities is to reduce the level of earthquake risk to the public over time and target the most vulnerable buildings as a priority.
- 13.1.4 One of the purposes of the Act's provisions is also to provide for local economic, social and other factors to be taken into account by the authority when implementing its EQPB policy. The consultative requirements noted in paragraph 10.6.2 are there to ensure that these policies are open, transparent and understood by the communities who will be affected by them.
- 13.1.5 I recognise that some of the considerations the policy addresses are complex and technical, and may have been difficult for the public to fully appreciate at the time it was consulted. However, the fact remains that it was open for public consultation, information was made available regarding its content, and members of the public had an opportunity to present their views to the authority before this EQPB policy was adopted.
- 13.1.6 In addition, I note I have previously considered a similar EQPB policy (in Determination 2010/133⁴³) and found it appropriate for the relevant authority to use its EQPB policy to inform its decision-making process in relation to the legal test in section 122 of the Act. I do not consider the authority's EQPB policy in this case to be materially different and I reach the same conclusion in this case.

⁴¹ The intended release date is 2016.

⁴² Determination 2014/032 Regarding the authority's exercise of powers in issuing a notice under section 124 of the Act for a building considered to be earthquake-prone (*Ministry of Business, Innovation and Employment*) 4 August 2014

⁴³ Determination 2010/133 The exercise of the powers of an authority to issue a notice under section 124 of the Act regarding a building considered to be earthquake-prone (*Department of Building and Housing*) 20 December 2010

13.2 The authority's EQPB policy in relation to the current building

- 13.2.1 From a review of the documents provided, I consider the authority correctly followed its EQPB policy in relation to the applicant's building. I acknowledge the authority made its decision based on the information available to it at the time the section 124 notice was issued, and that the submission provided by the applicant with this determination application (refer paragraph 4.1) was not part of the information the authority reviewed. In addition, the uncompleted DSA provided to the authority was provided after the section 124 notice was issued (refer paragraph 13.2.11).
- 13.2.2 The authority conducted an IEP that produced a %NBS rating of 3%, which is clearly less than the 34% threshold for being considered potentially earthquake prone.
- 13.2.3 The building owners were informed of this and given a period of time (six months) to produce any further information in response. The authority's EQPB policy was summarised in a brochure enclosed with this notification (a link was also provided to the full policy) that said:
- In providing this additional information, owners may wish to have an engineer carry out their own more comprehensive assessment of the structure.
- The IEP may frequently need to be supplemented by more in-depth investigations that take particular account of details of a specific building rather than generic assumptions based on its general attributes...
- 13.2.4 The owners subsequently wrote to the authority (refer paragraph 3.4) to advise that "The body corporate...(sic) are approving the engineers, [name], to provide a detailed assessment of the building" and they sought an extension of an additional three months for the engineers to have sufficient time to complete this assessment. However, they did not provide any further information within this period; nor did they ask for any further extension of time. The building owners did not dispute the authority's initial assessment that the building was earthquake prone. The matter was referred to the building's body corporate, and the authority subsequently received a form with the option checked: "We agree with the assessment showing the building is earthquake prone". The authority subsequently issued the section 124 notice on 26 April 2010.
- 13.2.5 At the hearing and subsequently the applicant has argued that the IEP for the building was flawed because it did not consider the common wall with the adjoining building or strengthening carried out in 1995 (refer paragraph 6.5.1). He also considers that the authority did not properly consider the full property file when making its IEP assessment (paragraph 7.1.1 describes the information provided to its engineers before the assessment), as this file showed there were strong elements in the building structure. I note again that the building owners were provided with an opportunity to provide a DSA before the issue of a section 124 notice but declined to do so.
- 13.2.6 I still consider the authority appropriately applied its EQPB policy given that the IEP is employed as a screening tool that is not designed to detect detailed aspects of the structure but to identify potential weaknesses to be explored further. It is the role of the DSA to consider such issues in more detail, and the fact that an IEP and DSA on the same building may differ in some aspects is not unexpected. As the NZSEE guidelines state at 3-1 to 3-3:
- Note that the objective of the initial evaluation is to identify, with an acceptable confidence level, all those buildings which will be potentially Earthquake Prone. At the same time the initial evaluation process must not catch an unacceptable number of buildings which on detailed evaluation, pass the test. ...

It is expected that those carrying out initial evaluations would be New Zealand Chartered Professional Engineers, or equivalent, who have:

- sufficient relevant experience in the design and evaluation of buildings for earthquake effects to exercise the degree of judgement required ...

The IEP is designed as a largely qualitative process involving considerable knowledge of earthquake behaviour of buildings and judgement as to key attributes and their effect on performance.

Due to the qualitative nature of the assessment it should not come as a surprise that in some circumstances assessments of the same building by two or more experienced engineers will differ. This is to be expected, as the evaluation of seismic performance is not an exact science. ...

For a typical multi-storey building, the process is envisaged as requiring limited effort and cost. It would be largely a visual assessment, but supplemented by information from previous assessments, readily available documentation and general knowledge of the building.

- 13.2.7 Accordingly, I consider the authority provided the building owners with sufficient information about, and opportunity for, providing a DSA or other relevant information prior to its issuing of the section 124 notice and that the applicant did not elect to provide any further information at the time. The owners were clearly aware of the importance of a DSA as they sought a three month extension on 5 November 2007 in order to allow engineers to complete a detailed assessment of the building. Further, as already noted, the earthquake-prone status of the building was accepted before the issue of this notice (refer paragraph 3.9). I also reiterate that the detailed submission from the applicant for this determination (refer paragraph 4.1) was not information the authority had seen prior to issuing a section 124 notice to the building owners.
- 13.2.8 It is apparent from information provided by the authority to its engineers that the full property file for the building was not provided by the authority prior to the IEP being carried out. The applicant has criticised this omission, however, there is a tension between the amount of information the authority can consider during the IEP process and the nature of the IEP process which is a 'coarse screening involving as few resources as reasonably possible'. The IEP process is simply not set up to consider detailed information about a building: such information can only be considered under the detailed assessment provisions of the NZSEE guidelines. Further, it is my view that even if some of the information had been able to be considered as part of the IEP process it would likely not have changed the outcome of the IEP in this case: additional details or features of a building (for example in this case the common wall) considered during an IEP are more likely to result in a lower score as assumptions cannot be made about the strength or performance of such features without proper investigation.
- 13.2.9 I further note that while a section 124 notice has ongoing status it can be reviewed by the authority if additional information is provided that challenges the building's earthquake-prone status (for example, if a DSA is commissioned and finds that or required strengthening work is completed, refer paragraph 10.6.7). There is no time limit on this process after a section 124 notice is first issued and the authority can remove the notice based on this additional information, if appropriate, at any time.

- 13.2.10 The applicant has also objected to what he considers an improper use of the unsigned DSA for the building he provided to me.⁴⁴ I noted in the draft determination that the applicant did not agree with the accuracy of this DSA. However, the determination has not relied on the DSA as supplied but has required me to consider whether the authority correctly issued the section 124 notice (which, under its EQPB policy, involved an IEP and the consideration of any other information supplied by the applicant at the time).
- 13.2.11 While the building owners engaged a structural engineer to prepare a DSA, the DSA was not issued until May 2014 and it was still uncompleted at that date, which is more than four years after the section 124 notice was issued. I note that, while the authority did not have this information at the time it exercised its powers of decision to issue the section 124 notice, the DSA does not dispute the building's assessment as earthquake prone, as it assesses the NBS rating at 15-25%. However, I have not taken this uncompleted DSA into account when considering whether the authority correctly applied section 124 when issuing the earthquake-prone building notice for this building, as it is disputed by the applicant.
- 13.2.12 In Determination 2014/032 I noted the onus of proof remains on the authority to determine the building is earthquake prone; however, the authority will consider any information provided by the applicant to suggest otherwise. In relation to the standard of proof required, I considered in Determination 2014/032 that:

the requirement to be 'satisfied' under section 124 of the Act is not purely a subjective requirement. A subjective analysis requires a person (with the necessary delegated authority to make the decision) to be satisfied that the building meets the test of being earthquake-prone under the Act. I conclude there must be an objective element to be satisfied in that there must be evidence to support the decision being made. The relevant evidence must then be weighted in order for a conclusion to be reached based on that evidence.

I therefore consider the standard of proof required is for the authority to have reasonable grounds in order to be satisfied a building is earthquake prone under the Act.

- 13.2.13 In this case no further information was presented to the authority within the required timeframe before the section 124 notice was issued; nor am I aware of any further information being presented following the issue of the section 124 notice that concludes the building is above 34% NBS.
- 13.2.14 The applicant's criticisms of the information referred to by the authority and its engineers when carrying out the IEP suggest that the authority could have provided additional information to its engineers for their review. As stated above at paragraph 13.2.8, in my view, even if this information had been considered it probably would not have changed the result of the IEP to an extent that the 'potentially earthquake prone' status would have been overturned.

13.3 Evidence of previous building performance and probabilistic analysis

- 13.3.1 In support of his contention that the building is not earthquake prone, the applicant has provided reviews of historical performance in a range of earthquake events whose effects exceeded the moderate earthquake event peak ground acceleration for Wellington central, being 0.13 g.

⁴⁴ The applicant's submission of 10 June 2015 said: "The owners of Wakefield Street presented the DSA with respect to that building to illustrate the points they make with respect to the accuracy of the IEP. The owners do not agree with the accuracy of the [engineering firm's] assessment. This is a matter between [the engineering firm] and the owners."

- 13.3.2 There may be situations when evidence of past performance can be a consideration to be taken into account when exercising a decision as to whether the building is earthquake prone. However, in this case, neither the Act nor the authority's EQPB policy make any provision for such an assessment to be taken into account when considering whether a building is earthquake prone.
- 13.3.3 Further, I note that this evidence relates to different buildings and different seismic events, and it can be very difficult to predict how one building will perform in a seismic event based on the evidence of how a similar building may have performed in another seismic event (which can greatly vary in duration, size and location), or to predict how a building will perform in a seismic event based on its past performance in a previous seismic event.
- 13.3.4 It is also important to note that the definition of 'moderate earthquake' in the Regulations requires the duration of shaking to be the same as for a design-level earthquake. This can also make it very difficult to correlate the performance of a building in a moderate earthquake (as defined in the Regulations) to the actual performance of a building in a previous seismic event. A comparison would have some validity only if it matched or exceeded a moderate earthquake event in relation to both the strength and duration of shaking.
- 13.3.5 I have considered the evidence submitted by the applicant relating to the performance of the building in previous seismic events and the performance of similar buildings in other seismic events, although I am not required to do so by either the Act or the authority's EQPB policy when considering whether the building is earthquake prone. The evidence is helpful and generally supports the applicant's concerns about the apparent incongruence between the requirements in section 122(1) that an earthquake-prone building would be likely to collapse and the way the NZSEE guidelines have been applied in the past. However, I am not satisfied that the evidence is sufficiently reliable or accurate when applied to this particular building to enable a conclusion to be drawn that the building is not earthquake prone. The relevance of this evidence was considered in section 11.
- 13.3.6 The applicant has also provided probability analyses relating to the likelihood of collapse for his building in a moderate earthquake and concluded the risk of this is very low. Again, I am not required to consider this evidence by either the Act or the authority's EQPB policy when considering whether the building is earthquake prone. However, I note that this evidence is not unhelpful and I discussed this in section 11.

14. Next steps

- 14.1 The applicant could request the engineering firm which completed the DSA for the building to revise this in light of the comments I have made in this determination. If the revised DSA finds the building is not earthquake prone I consider the authority should reconsider the status of the section 124 notice for the building in accordance with Step 5 of its EQPB policy (refer paragraph 10.6.7).
- 14.2 In a situation where the authority does not accept the revised DSA the applicant has the option for applying for a further determination.

15. The decision

- 15.1 In accordance with section 188 of the Building Act 2004, I hereby determine that the authority was correct in its exercise of powers in issuing an earthquake-prone building notice under section 124 of the Act and I hereby confirm that notice.

Signed for and on behalf of the Chief Executive of the Ministry of Business, Innovation and Employment on 7 December 2015.

John Gardiner
Manager Determinations and Assurance

Appendix A

A.1 Relevant sections of the Building Act 2004

122 Meaning of earthquake-prone building

(1) A building is earthquake prone for the purposes of this Act if, having regard to its condition and to the ground on which it is built, and because of its construction, the building—

(a) will have its ultimate capacity exceeded in a moderate earthquake (as defined in the regulations); and

(b) would be likely to collapse causing—

(i) injury or death to persons in the building or to persons on any other property; or

(ii) damage to any other property

...

124 Dangerous, affected, earthquake-prone, or insanitary buildings: powers of territorial authority

(1) This section applies if a territorial authority is satisfied that a building in its district is a dangerous, affected, earthquake-prone, or insanitary building.

(2) In a case to which this section applies, the territorial authority may do any or all of the following:

(a) put up a hoarding or fence to prevent people from approaching the building nearer than is safe:

(b) attach in a prominent place on, or adjacent to, the building a notice that warns people not to approach the building:

(c) except in the case of an affected building, issue a notice that complies with section 125(1) requiring work to be carried out on the building to—

(i) reduce or remove the danger; or

(ii) prevent the building from remaining insanitary:

(d) issue a notice that complies with section 125(1A) restricting entry to the building for particular purposes or restricting entry to particular persons or groups of persons.

...

131 Territorial authority must adopt policy on dangerous, earthquake-prone, and insanitary buildings

(1) A territorial authority must, within 18 months after the commencement of this section, adopt a policy on dangerous, earthquake-prone, and insanitary buildings within its district.

(2) The policy must state—

(a) the approach that the territorial authority will take in performing its functions under this Part; and

(b) the territorial authority's priorities in performing those functions; and

(c) how the policy will apply to heritage buildings.

132 Adoption and review of policy

- (1) A policy under section 131 must be adopted in accordance with the special consultative procedure in section 83 of the Local Government Act 2002.
- (2) A policy may be amended or replaced only in accordance with the special consultative procedure, and this section applies to that amendment or replacement.
- (3) A territorial authority must, as soon as practicable after adopting or amending a policy, provide a copy of the policy to the chief executive.
- (4) A territorial authority must complete a review of a policy within 5 years after the policy is adopted and then at intervals of not more than 5 years.
- (5) A policy does not cease to have effect because it is due for review or being reviewed.

A.2 Relevant clauses of the Building (Specified Systems, Change the Use, and Earthquake-prone Buildings) Regulations 2005**7 Earthquake-prone buildings: moderate earthquake defined**

For the purposes of section 122 (meaning of earthquake-prone building) of the Act, ***moderate earthquake*** means, in relation to a building, an earthquake that would generate shaking at the site of the building that is of the same duration as, but that is one-third as strong as, the earthquake shaking (determined by normal measures of acceleration, velocity, and displacement) that would be used to design a new building at that site.