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Sarah Sinclair
Auckland Council Building Control
Private Bag 92300
Auckland 1142

Murray Burt
Auckland Transport (AT)
20 Viaduct Harbour Avenue
Auckland 1010

Subject: Downtown Carpark Seismic Risk

Dear Sarah/Murray

The following clarifies the position of Compusoft Engineering Limited regarding the level of seismic risk associated with the Downtown Carparking building. In forming our opinion, we have considered the knowledge we have obtained through undertaking a Detailed Seismic Assessment (DSA) of the structure along with a general understanding of seismic design and analysis philosophy.

Our DSA showed that the capacity of the limiting seismic elements in the building is less than 34%NBS (for an Importance Level 2 building) and as such should be considered as being potentially Earthquake Prone. The limiting elements in the building are the diaphragms with a rating in the order of 20%NBS, which is principally due to the unreliability of the mesh reinforcement used to resist seismic demands.

Whilst we believe that the carpark does not currently meet the minimum requirements for seismic capacity, in our opinion we do not believe that it poses an immediate risk to life safety either for those in or around the building. Design level seismic events are rare events and only have a small probability of occurrence during the lifetime of a structure (a 1 in 500-year event). New Zealand Society for Earthquake Engineering (NZSEE) guidelines[1] lists the life safety earthquake risk of the building as being approximately 25 times that of a new building, however it's capacity should still be viewed in the context of the risk of occurrence. A guidance document clarifying %NBS[2] states the following with regard to the limitations of a %NBS rating;

> *'…a %NBS rating does not represent an absolute assessment of risk or safety. For example, a rating of less than 34%NBS does not mean a building poses an imminent risk nor is that building expected to collapse in moderate levels of earthquake shaking. However, that building is expected to present a greater risk to life during earthquake shaking than a building with a significantly higher rating'.*

A seismic event equivalent to 20%NBS is still a rare event and the probability of injury or death resulting from this is still less than the risk that we accept daily in other facets of life. This guidance document also states;

> *'A rating of less than 34%NBS indicates a risk to occupants of approximately 10 to 25 times that of an equivalent new building that just meets the minimum life safety requirements in the New Zealand Building Code.*
>
> *However, you need to put that in context of the seismic risk we expect of new buildings. The target for new buildings is around 1 in 1,000,000 chance of fatality – a very low level of risk. This is similar to the risk of death by lightning strike, for example.*
>
> *… We tolerate similar or greater levels of risk in other contexts. For example, your chance of dying in a plane crash is 1 in 100,000. In 2016, 1 in 15,000 New Zealanders died on our roads'.*

Thus, the chance of dying in a car crash is greater than dying in an earthquake prone building and is similar to that associated with dying in a plane crash.

The low level of risk associated with earthquake prone buildings, and the level of seismicity where the building is located is reflected in the time periods provided in which to remediate an earthquake-prone building. Auckland is considered to be '*an area of low seismic risk*' under section 133AD of the 2004 Building Act[3] and under section 133AM of the Act the building owner has 35 years within which to strengthen an earthquake prone building. This contrasts with 7.5 to 15 years in a high seismic risk area such as Wellington.

Furthermore, WorkSafe have released information[4] pertaining to PCBU's and building owners intended to clarify the requirements of dealing with earthquake related health and safety risks. This document is attached for clarity however a key point raised by this document is

> *'If a building is found to be earthquake-prone, this doesn't necessarily mean it shouldn't be occupied. The Building Act provides a period of several years for strengthening or demolition work to be undertaken. While the risk of harm to people in or around an earthquake-prone building is greater than an equivalent new building, this doesn't*

typically require short term action. WorkSafe expects that you will fulfil your duties under the Building Act when you are addressing seismic risk.'

Worksafe's position is also reflective of the relatively low risk that earthquake-prone buildings pose to those in and/or around it.

We have no reason to suspect that the building is not capable of supporting gravity actions or is in any level of distress. As such the carpark would NOT be classified as a Dangerous Building under the Building Act.

We trust this letter provides the information you require. Please do not hesitate to contact us should you need additional information.

Sincerely,

Derek Bradley
BE, CPEng, FEngNZ

Dr Barry Davidson
PhD, FEngNZ

References

[1] NZSEE The Seismic Assessment of Existing Buildings -Technical Guidelines for Engineering Assessments: Assessment Objectives and Principles. Part A. . Jul-(2017)

[2] Engineering New Zealand Revised Version of C5 - Talking about %NBS. . 10-Oct-(2019)

[3] Department of Building & Housing Licensed Building Practitioners (LBPs). . [Online]. Available: http://www.dbh.govt.nz/lbp

[4] Worksafe Dealing With earthquake-related health and safety risks. . New Zealand Government,

Incl. Reference [2] & [4]

WORKSAFE

June 2018

INFORMATION FOR PCBUs AND BUILDING OWNERS

Dealing with earthquake-related health and safety risks

The primary piece of legislation governing work health and safety in New Zealand is the Health and Safety at Work Act 2015 (HSWA).

Key points

- If you're a PCBU who owns or occupies an earthquake-prone building and you're meeting the earthquake performance requirements of the Building Act 2004, we are not going to enforce to a higher standard under HSWA.
- If you're not doing what you should be doing under the Building Act, the best agency to intervene will be the local council.
- If you're not doing what you're supposed to be doing under the Building Act and someone is harmed, WorkSafe New Zealand may intervene under HSWA.
- We expect you to proactively manage risks arising from objects in and around workplace buildings on a regular and ongoing basis.
- You need to keep on top of new or emerging information and ensure that your workplace is prepared to deal with an earthquake.

Policy clarifications set out WorkSafe's view of HSWA in relation to a clearly defined sector, a particular set of circumstances, or a specific function.

This policy clarification explains when WorkSafe may intervene with regard to earthquake-related health and safety risks.

This policy clarification should be read by:

- persons conducting a business or undertaking (PCBU)s, including owners and occupiers of buildings that are or contain workplaces
- advisers to PCBUs on building-related matters (such as engineers)
- directors, chief executives, health and safety managers.

What does the law say?

Under HSWA, PCBUs, including owners of workplace buildings, must identify and manage risks in the place of work so far as is reasonably practicable. This requirement to manage risk includes risks related to the building.

What is worksafe's approach to earthquake related risks?

The most appropriate agency to deal with any matters concerning earthquake resilience is the council.

The structural integrity of your building to withstand an earthquake is covered by requirements including those outlined in the Building Act. The Building Act defines what an earthquake-prone building is, and any related enforcement action will come from your council.

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If you're a PCBU who owns or occupies a building, and you're meeting the requirements of the Building Act, we are not going to enforce to a higher standard under HSWA.

If a building is found to be earthquake-prone, this doesn't necessarily mean it shouldn't be occupied. The Building Act provides a period of several years for strengthening or demolition work to be undertaken. While the risk of harm to people in or around an earthquake-prone building is greater than an equivalent new building, this doesn't typically require short-term action. WorkSafe expects that you will fulfil your duties under the Building Act when you're addressing the seismic risk.

Are building parts covered by HSWA?

Building parts are individual building elements that would pose a significant life safety hazard.[1] These include parts such as parapets, heavy ceilings, masonry walls and other features.[2]

WorkSafe expects PCBUs to take steps to identify and eliminate or minimise the risks from these parts, where reasonably practicable (as you would any other work-related risk). Minimisation could include steps such as securing the relevant parts or isolating people from them.

Objects within workplaces such as bookcases, fridges or other heavy furniture remain the responsibility of tenants and occupants. Anchoring such objects to sturdy building elements to ensure they cannot move or fall on people during an earthquake is a common way of addressing these risks. Failure to identify and properly manage these types of risks is a breach of HSWA.

If you're a tenant and you have a concern about a building part which you cannot deal with, you will need to involve the building owner.

If you're a building owner and a problem has been raised by your tenant about a building part, then you will need to do what is reasonably practicable to manage the risk.

We expect you to proactively manage these types of work-related risks, particularly for buildings that a council has defined as earthquake-prone. If building owners and occupants can't agree on the risks and what should be done about them, they need to work through the dispute resolution steps in their occupancy agreements.

Should a failure to manage these matters expose people to an immediate and severe risk to their health and safety or result in people being harmed, WorkSafe may intervene.

You must be aware of potential risks

If you're complying with the Building Act and you're properly managing work-related risks then you will not generally receive attention from WorkSafe in this regard.

However, you need to pay attention to current events and be aware of what others are saying or doing. If you're having discussions with other PCBUs, staying in contact with your council, undertaking regular checks of the building and building parts and responding to any issues or concerns that are raised then you're probably staying on top of the issue.

You must also consider any new information that might be relevant to your building's earthquake performance. If you are concerned about your building's earthquake structural integrity or safety then you should get relevant professional advice such as an engineer's assessment to help determine if you've got an issue.

You need to keep on top of new or emerging information. When in doubt get professional advice.

You should prepare for an earthquake

If you're a PCBU that occupies a building, you need to prepare for emergencies. You need to ensure that the people working in or near your building know what to do in the event of an earthquake, whatever the seismic rating of the building. You can practice earthquake drills, prepare survival kits and keep up to date contact information. Your council and civil defence can help you prepare your workplace to survive an earthquake emergency. You should also work with your building owner to ensure that any critical systems in the building will function during an emergency.

If an earthquake occurs, PCBUs should use their judgement to assess any health and safety concerns. Where necessary you should engage a professional to see if the building has been structurally compromised. By following a relevant professional's advice, you will be taking reasonably practicable steps to minimise harm.

If you're a building owner, you should make it your business to understand and support your occupants' emergency plans and procedures. Ensure the building's emergency systems are capable of effectively supporting those plans and procedures where appropriate.

Preparing your workplace to deal with an earthquake is not a new or additional requirement. PCBUs need to prepare for emergencies. Building owners and occupants need to work together to ensure emergency plans work and people are safe during emergencies.

[1] Ministry of Business, Innovation and Employment (2017). *Considering parts of buildings. EPB methodology*. (p. 17).

[2] Ministry of Business, Innovation and Employment (2017). *The seismic assessment of existing buildings. Technical guidelines for Engineering Assessments.* (p. A4-8). Retrieved from: www.eq-assess.org.nz/assets/2017-07/Part_A-Assessment_Objectives_and_Principles.pdf

REVISED VERSION OF C5
TALKING ABOUT %NBS

October 2019

This information for engineers should be read alongside **our factsheet** introducing the revised (yellow) version of C5, and **this information** released by MBIE.

We've developed this factsheet to provide guidance about how you should use the revised (yellow) version of C5 when giving a *%NBS* rating, and to help you advise owners of buildings with low ratings.

If a building has a rating of less than 34*%NBS*, this points to a definite need to address its vulnerable structural features within a reasonable period of time. However, a rating of less than 34%NBS does not mean the building is dangerous or poses an imminent risk. In most cases, from an engineering risk perspective, it can continue to be occupied. Decisions around the continued occupancy of a low-rating building are the responsibility of the owner and tenants.

FREQUENTLY ASKED QUESTIONS

What is a *%NBS* rating?

A *%NBS* rating indicates the percentage of the New Building Standard that a building achieves in terms of protecting life in earthquakes.

When you calculate a *%NBS* rating, you are basically assessing the capability of a building to resist earthquake shaking. You do this by determining its probable capacity to resist shaking and comparing this against the ultimate limit state loading requirements for new buildings defined in the New Zealand Earthquake Loadings Standard issued on 1 July 2017 (NZS1170.5).

What's the purpose of *%NBS* ratings?

The *%NBS* rating provides an indication of how well the building protects life when compared with a hypothetical similar new building on that same site that just complies with the minimum standard required by the Building Code.

A *%NBS* rating allows comparison between buildings as well as against the earthquake-prone building requirements.

It's worth pointing out that correctly designed and constructed new buildings can be expected to have equivalent ratings well in excess of 100*%NBS*.

What are the limitations of *%NBS* ratings?

A *%NBS* rating doesn't predict how the building will perform in a particular earthquake. Earthquakes have a range of different ground-shaking effects. How a certain earthquake affects a specific building at a particular site depends on many factors. These include the earthquake itself, local geological and geotechnical features, the characteristics of that specific building and how all of these factors interact.

This means a *%NBS* rating does not represent an absolute assessment of risk or safety. For example, a rating of less than 34*%NBS* does not mean a building poses an imminent risk nor is that building expected to collapse in moderate levels of earthquake shaking. However, that building is expected to present a greater risk to life during earthquake shaking than a building with a significantly higher rating.

%NBS is only about performance in terms of protecting people's lives. A *%NBS* rating says nothing about likely damage to the building. If a building has a high *%NBS* rating, this doesn't mean it won't be damaged by an earthquake; it means people are more likely to be able to escape unharmed. If a building has a high *%NBS* rating, it isn't necessarily less likely to be damaged during an earthquake than a building with a low *%NBS* rating.

How does a building's occupancy or use affect *%NBS*?

If a building has a higher occupancy than defined for typical use, it's measured against a higher seismic standard. Remember that *%NBS* rating is relative to the standard required of a similar new building.

For example, if you assess a building that features crowd loadings, it will be characterised as Importance Level 3 (IL3). If you assess that building as 50%NBS, it will be against the higher IL3 standard. It therefore achieves a higher seismic standard than an office building that's rated at 50%NBS but against the lower IL2 standard. This is why it is important to include the Importance Level with the assessment rating – for example, 50*%NBS* (IL3).

Are all buildings rated at less than 34*%NBS* considered to be earthquake prone?

Buildings are determined by the Territorial Authority (TA) to be earthquake prone if they fall below the threshold set out under the Building Act 2004.

If a TA suspects that a building is earthquake prone, they will advise the owner that the building is potentially earthquake prone and will request an engineering assessment to confirm its status. When you carry out this assessment, you can only use the 2017 Red Book version of C5, because this version is the one formally recognised under MBIE's EPB methodology. The TA will then determine if the building is earthquake prone if it's rated under 34*%NBS*.

If you assess a building using the Yellow version of C5, and this results in a rating of less than 34*%NBS*, in the current regulatory environment this assessment will not lead to the building being earthquake prone.

How risky are earthquake-prone buildings (or buildings rated at less than 34*%NBS*)?

A rating of less than 34*%NBS* indicates a risk to occupants of approximately 10 to 25 times that of an equivalent new building that just meets the minimum life safety requirements in the New Zealand Building Code.

However, you need to put that in the context of the seismic risk we expect of new buildings. The target for new buildings is around 1 in 1,000,000 chance of a fatality – a very low level of risk. This is similar to the risk of death by lightning strike, for example.

To provide another perspective, if a building is rated at 34*%NBS*, it has the same likelihood of collapse in moderate levels of earthquake shaking as a new building has under full design-level shaking.

We tolerate similar or greater levels of risks in other contexts. For example, your chance of dying in a plane crash is about 1 in 100,000. In 2016, 1 in 15,000 New Zealanders died on our roads.

Who should make the decision on continuing to occupy a building rated less than 34*%NBS*?

Decisions around continued occupancy of a building that has a rating of less than 34*%NBS* should be made by owners and occupants. These decisions need to reflect a range of risk considerations – including the low likelihood of a major earthquake occurring in the short term prior to strengthening – and are not engineering decisions.

How long does an owner have to deal with an earthquake-prone building?

The Government has put legislation in place requiring earthquake-prone buildings to be upgraded or removed, over time. For earthquake-prone buildings in Wellington, which is a high seismic-risk area, the new legislation sets a maximum time frame of 15 years for non-priority buildings. This legislated period represents the time over which Parliament considers the heightened risk can be tolerated and addressed without affecting occupancy.

Do earthquake-prone buildings present a health and safety risk?

WorkSafe New Zealand issued a policy clarification in 2018 that says if you're a Person Conducting a Business or Undertaking that owns or occupies an earthquake-prone building and you're meeting the earthquake performance requirements of the Building Act 2004, WorkSafe will not enforce to a higher standard under the Health and Safety at Work Act. It also says:

> *If a building is found to be earthquake-prone, this doesn't necessarily mean it shouldn't be occupied. The Building Act provides a period of several years for strengthening or demolition work to be undertaken. While the risk of harm to people in or around an earthquake-prone building is greater than an equivalent new building, this doesn't typically require short-term action.*

You should always encourage owners of earthquake-prone buildings to begin preparing strengthening plans to remove the earthquake-prone status within much shorter timeframes than the minimum mandated in the legislation.

What about buildings assessed at less than 34*%NBS* but not defined as earthquake prone?

Essentially the same risk considerations apply as in the answer above.

As for earthquake-prone buildings, the focus should be on addressing the issues that lead to the building's low rating within as short a time frame as is practicable.