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SEISMIC *shift*

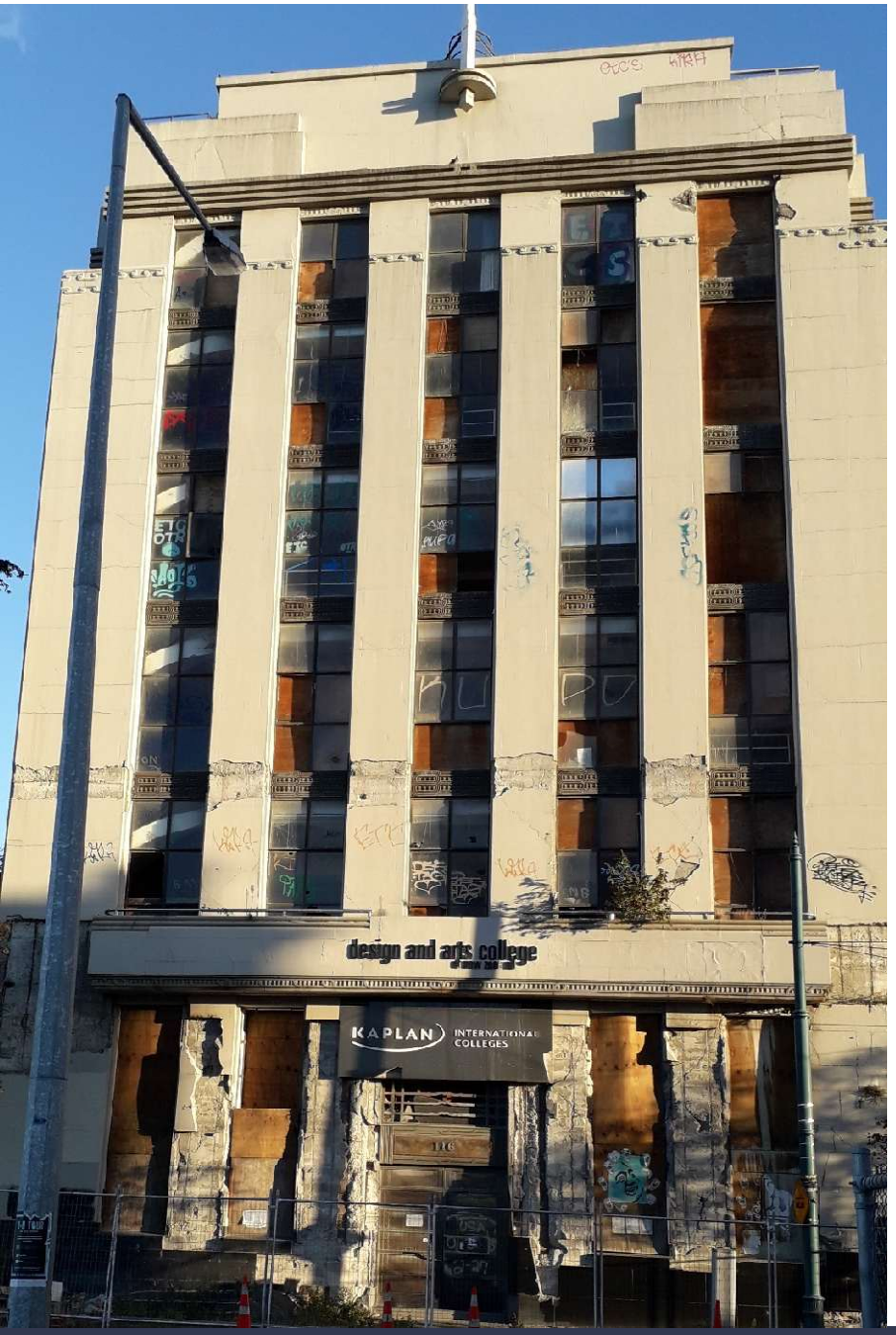
ASSESSING THE EARTHQUAKE RESISTANCE OF NEW ZEALAND'S BUILDINGS



INTRODUCTION

The earthquake events of recent years provided residential, commercial, public and historic property owners a rather abrupt reminder of the importance of seeking professional assistance with complex tasks involving damage assessment, insurance claims and quantifying the value of repairing or rebuilding

This publication aims to provide you with an insight into the seismic assessment process.



SEISMIC *Assessments*

IEPs, ISAs, DSAs – WHAT DOES IT ALL MEAN?

Today, building owners and investors could be left bewildered by the array of earthquake assessments and reporting available to them and it may be difficult to determine what is appropriate. Suddenly “IEP“, “DSA” and “%NBS” have become part of everyday vocabulary for those in the construction industry and property investors. The impact of these assessments can be significant and extensive. The risk has been transformed from that of harm or death, to a premium that will be paid in insurance and difficulties in leasing earthquake prone buildings.

Many seismic assessments start with an IEP. The Initial Evaluation Procedure (IEP) was developed in 2006 by the New Zealand Society for Earthquake Engineering (NZSEE) and updated in 2017 to reflect experience from the Canterbury earthquakes of 2010/11.

The IEP is a tool to assign a percentage of New Building Standard (%NBS) rating and associated grade to a building, and enables building owners and managers to review their building stock as part of an overall risk management process.

Specialist Structural Engineers incorporate the IEP into their Initial Seismic Assessment (ISA) reports, which explains how the %NBS rating was derived for a property and provides recommendations for how it could be improved.

The ISA follows the guidelines from the NZSEE “*The Seismic Assessment of Existing Buildings – Technical Guidelines for Engineering Assessments*” together with the codes and standards applicable to New Zealand.

What is a %NBS rating?

When we calculate a %NBS rating, we are basically assessing the capability of a building to resist earthquake shaking. We do this by determining its probable capacity to resist shaking and comparing this against the loading requirements for new buildings defined in the New Zealand Earthquake Loadings Standard issued on 1 July 2017 (NZS 1170.5).

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. 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.

How risky are earthquake-prone buildings?

Buildings are determined to be earthquake prone by the Territorial Authority (TA) 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.

Generally, the TA will then determine if the building is earthquake prone if it's rated under 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.

Responsibilities in Law

The Building Act 2004, and the later Building (Earthquake-prone Buildings) Amendment Act 2016, set out the framework for identifying and managing earthquake-prone buildings. Under law:

- Territorial Authorities (TAs) must identify potentially earthquake-prone buildings
- Building owners of potentially earthquake-prone buildings must commission an engineering assessment (this could use the Initial Evaluation Procedure or IEP)
- TAs must use this information to determine whether or not a building or part is earthquake prone.

The Building Act also states that the owner is responsible for ensuring compliance with any notices to fix.

However, even when there is no 'legal' requirement for building owners or purchasers to procure an IEP, buyers and property owners are often asked by the bank or insurance company to procure an IEP when borrowing money against a property, or obtaining insurance for it.

Meaning of earthquake-prone building

A building or a part of a building is earthquake prone if, having regard to the condition of the building or part and to the ground on which the building is built, and because of the construction of the building or part,—

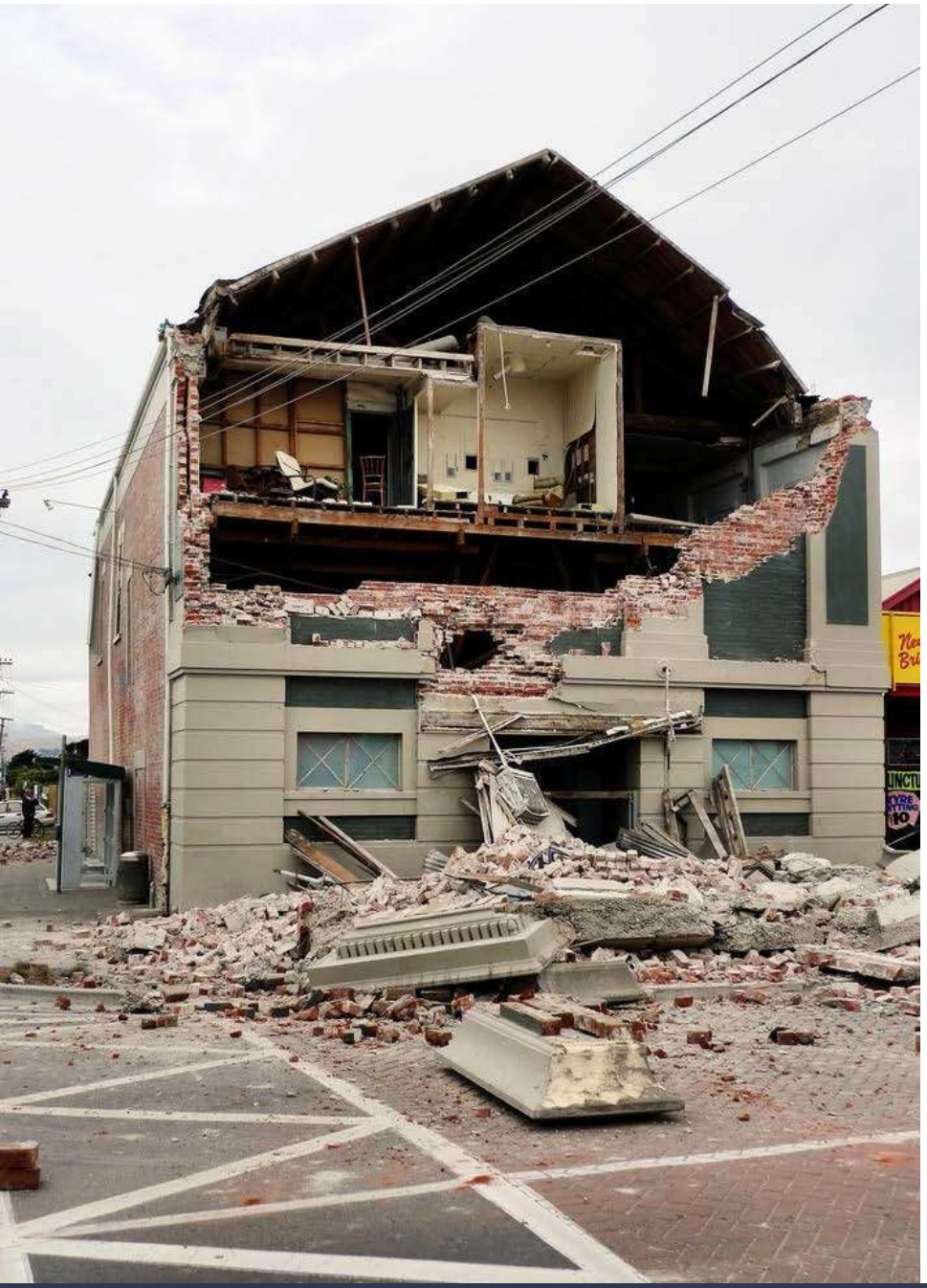
(a) the building or part will have its ultimate capacity exceeded in a moderate earthquake; and

(b) if the building or part were to collapse, the collapse would be likely to cause—

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

(ii) damage to any other property.





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

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.

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.

Why would a Detailed Seismic Assessment (DSA) be required?

The Initial Seismic Assessment is a qualitative assessment based on a visual non-intrusive survey. Depending on outcome of the ISA, we may recommend that a Detailed Seismic Assessment (DSA) be carried out. This is a quantitative assessment based on intrusive investigation and testing.

The DSA would:

- Establish a more precise NBS% rating for the building,
- Identify weak structural elements, and
- Provide a strengthening concept to increase the building capacity

The minimum NBS% rating recommended by NZSEE is 34%, which would take the building from being potentially 'earthquake prone' to being 'earthquake risk'.

However, many clients seek strengthening solutions to take the building above 67%NBS and out of the 'earthquake risk' category. Indeed, NZSEE recommends 67%NBS as the minimum that should be considered for the improvement of structural performance, particularly when major alterations or refurbishments are contemplated.

The ISA is intended to be used as a broad brush approach to quickly identify earthquake prone buildings using minimal resources. Given the conservative nature of the IEP procedure used for the ISA, which relies heavily on engineering judgment, the results are far less definitive than a DSA.

The DSA requires calculations and analysis and also gauges the strength of structural elements and systems.

Sometimes, a building owner may already be aware of the limited seismic resisting capacity of their building and may rather direct resources from the outset towards a more detailed analysis, knowing that structural strengthening will be required.

The seismic capacity of a building must now become an important consideration for all building owners. We recommend an ISA is carried out when undertaking technical due diligence pre purchase.

Having comprehensive knowledge of your building puts you in a more powerful position. A building that has a high %NBS and grading is a highly marketable investment.

Conversely understanding a low %NBS and grading may be used for planning future improvements, from the outset.

Tenant demand is increasing for buildings with an earthquake rating of 67% NBS or better, with many tenants including earthquake resistance as one of their considerations when selecting a property to lease. Some Government and blue chip tenants even have policies in place which don't allow them to renew leases in buildings with an IEP score of less than 67% NBS – with many requiring 80% to 100% NBS.



SEISMIC STRENGTHENING

Building owners are responsible for ensuring that any work to their property complies with the building code. Strengthening buildings to improve their seismic resistance is a complex and risky business.

All building work must meet New Zealand Building Code requirements. Getting a building consent and code compliance certificate is the property owners' responsibility if you undertake to organize the works.

Licensed building practitioners must be employed complete certain restricted building works to the owner's premises.

To achieve safe, healthy, durable homes and buildings, all building work must meet strict requirements. The building regulatory system sets out a framework to promote good building practice. However, many in the building and construction industry don't fully understand this system which comprises:

- The Building Act 2004: the primary legislation governing the building and construction industry;
- The Building Code contained in schedule 1 of the Building Regulations 1992 sets the minimum performance standards buildings must meet; and
- Building Regulations which detail particular building controls (for example, prescribed forms, list of specified systems, definitions of 'change of use' and 'moderate earthquake', levies, fees and infringements).

These requirements determine how work can be done and who can do it, while ensuring that the system has checks and consumer protection in place.

The intention of the building regulatory system is to ensure that building work can be carried out more efficiently while maintaining quality. Our building performance based regulatory system requires consents, management and observation of the works and sign of to achieve code compliance.

Remediation of existing buildings requires a specific approach, and not that of the usual design and build process applied to new buildings.

Failure to take the necessary steps in diagnosing the failings and establishing correct remedial solutions increases future risk for all parties involved