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NEW ZEALAND SOCIETY FOR EARTHQUAKE ENGINEERING

Earthquake Ratings and Seismic Retrofit of Existing Buildings Following the Release of TS 1170.5

Advice for Engineers

Prepared In collaboration with SESOC, NZGS and MBIE

Endorsed by the Joint Committee for Seismic Assessment of Existing Buildings (NZSEE, NZGS, SESOC, MBIE, NHC)

August 2024

ENDORSED BY THE JOINT COMMITTEE FOR SEISMIC ASSESSMENT AND RETROFIT

The Joint Committee for Seismic Assessment and Retrofit (JC-SAR) comprises representatives from the five organisations originally partner to the development of the 2017 seismic assessment guidelines; the Ministry of Business, Innovation and Employment (MBIE), the New Zealand Geotechnical Society (NZGS) the New Zealand Society for Earthquake Engineering (NZSEE), the Structural Engineering Society of New Zealand (SESOC) and the Natural Hazards Commission Toka Tū Ake (formerly EQC).

Its purpose is the joint oversight of the system used to assess, communicate, manage and mitigate seismic risk in existing buildings. The Joint Committee reviews how the guidelines are functioning in practice, identifies areas that require further input and development, and either advises on or assists in the development of proposals for work programmes that contribute towards these objectives.

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Please send any comments or questions on this document to the NZSEE Executive Officer at exec@nzsee.org.nz .

Contents

Summary and Key Messages

During February 2024, Standards NZ released a public consultation draft of a new Technical Specification TS 1170.5 for determining earthquake actions for new building design, summarised in this TS 1170.5 Release Advisory. A finalised version of TS 1170.5 is anticipated to be published once changes resulting from the public consultation phase are incorporated.

This document contains more background on the earthquake rating system for existing buildings, and specific guidance on the design of retrofit work in this context. **A companion advisory, *Earthquake Ratings and Seismic Retrofit | Advice for Owners and Building Users* has been prepared, which summarises the key messages and can be shared with clients and stakeholders to help facilitate discussions**.

KEY MESSAGES FOR EXISTING BUILDINGS

- **The release of a future Earthquake Actions Standard (including TS 1170.5 once finalised and published) does not change *Earthquake Ratings* (%NBS) or *Seismic Grades*.**
- *Earthquake Ratings* (%NBS) and *Seismic Grades* should continue to use NZS 1170.5:2004. This is important to ensure that the existing building assessment system continues to function as it has been designed—and to allow fair and comparative assessment between buildings.
- Engineers should actively encourage use of *Seismic Grades* and their corresponding risk descriptions, alongside clear layperson consequence statements in all final communications (rather than solely %NBS scores and ratings). These can apply to vulnerabilities individually—as well as a building's overall rating. Seismic grades, consequence statements and concise engineering commentary are a better overall descriptor of the issues and are more reflective of our ability as engineers to estimate seismic risk.
- Over the next few years, MBIE and stakeholders will be working on proposals to update Building Code documents for new design work. This is a separate decision process to the framework used to manage and communicate risk in existing buildings and it will not affect the ratings and *Seismic Grades* that apply to existing or retrofitted buildings.
- Figure 1 places our existing building assessment system and *Seismic Grades* in the context of new building design approaches.

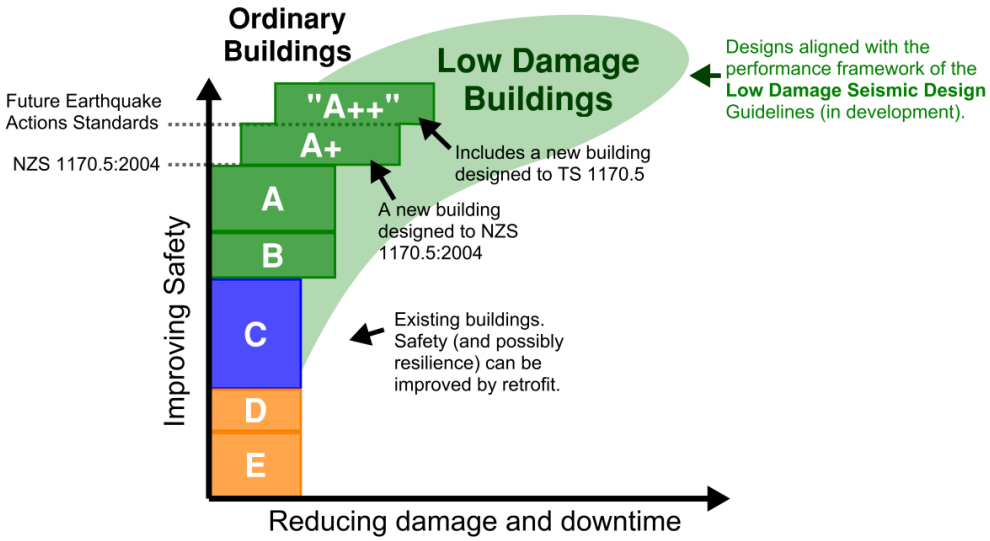

Figure 1: A graphic of the NZSEE grading framework outlined in Table 1 that should be used for all assessments. It shows how future Earthquake Actions Standards relate to the way Seismic Grades should continue to be assigned. It shows the benefits of Low Damage Design—one of the key focus areas of standards development for new buildings that can also be relevant for some high performing retrofits.

Purpose of this Advisory

During February 2024, Standards NZ released a public consultation draft of a new Technical Specification TS 1170.5 for determining earthquake actions for new building design. This advice addresses assessment of existing buildings following the release of a final version of TS 1170.5. The purpose of this advisory (and the companion advisory *Earthquake Ratings and Seismic Retrofit | Advice for Owners and Building Users*) is to:

- Give confidence to the market that publication of TS 1170.5 (currently in draft) will not affect *%NBS Earthquake Ratings* for buildings,
- Help engineers understand what earthquake design actions Standard to use when designing seismic upgrades (retrofits) for existing buildings,
- Provide specific advice regarding seismic assessment and upgrade required as part of alterations (Building Act Section 112) or changes of use (Building Act Section 115).

Initial advice on the TS 1170.5 draft release and limitations is available in this TS 1170.5 Release Advisory. The draft gives a preview as to what Building Code changes in coming years could require for earthquake loading in new building design. A finalised version of TS 1170.5 is anticipated to be published once changes resulting from the public consultation phase are incorporated. Standards NZ received ~600 submissions on the draft, and so changes are likely.

This advice does not relate to the EPB review announced by the Minister for Building and Construction in April 2024. This document reiterates the current regulatory requirements for EPB Buildings, but its primary purpose is to advise owners who have been undertaking (and can continue to undertake) voluntary (non-regulated) assessment and seismic retrofit work outside of the EPB system.

Advice on existing buildings following release of TS 1170.5

HOW TO ASSIGN EARTHQUAKE RATINGS AND GRADES IN ASSESSMENT

The way Earthquake Ratings and Grades are calculated and assigned is not changing.

Earthquake Ratings (*%NBS*) and *Seismic Grades* should continue to be determined using NZS 1170.5:2004, and Earthquake Geotechnical Practice Module 1 (2016) for geotechnical assessment. This applies even when the finalised TS 1170.5 is published in the future. It also continues to apply if/when Building Code documents are updated to reference a new Technical Specification or Earthquake Actions Standard—which is a separate decision process to existing building benchmarks).

The NZSEE Grading Scheme adopted by the seismic assessment system is summarised in Table 1. All assessments (including those that are completed voluntarily outside of the EPB Methodology) should calculate and report *Earthquake Scores/Ratings* and *Seismic Grades* in accordance with Table 1.

This is important for three reasons:

- To ensure the existing building assessment system continues to function as it has been designed,
- To ensure consistent and comparable assessments between buildings,
- To more appropriately reflect the uncertainties associated with seismic assessment generally.

It is best to use *Seismic Grades* and associated life-safety risk descriptions in communications instead of *%NBS* scores. These can apply to vulnerabilities individually—as well as a building's overall rating. Percentage-based *Earthquake Ratings* are the technical mechanism that determines *Seismic Grades*—but

they are not an effective communication tool. The risks they imply are generally not comprehended well by end users, with wide and often biased interpretations. There are also many uncertainties involved in determining an earthquake rating that are not well reflected in a single rating number. *Seismic Grades* and their risk descriptions, presented alongside layperson descriptions of consequence are considered a better descriptor of the issues.

Table 1: The NZSEE grading system that should continue to be used after TS 1170.5 is published (and after any subsequent Building Code update). Grades A+ through E should continue to use NZS 1170.5:2004.

Seismic Grade	Rounded[1] Earthquake Rating (calculated using the EAG and NZS 1170.5:2004)	Reported %NBS	Life-safety risk description (Note 3)
A+	>100 (Note 2)	"> 100% NBS (IL_)"	Low Risk
A	80-100	"__% NBS (IL_)" *(insert rounded score)*	
B	67-79		Low to Medium Risk
C	34-66		Medium Risk
D	20 to 33		High Risk
E	15 to <20		Very High Risk
	<15%	"15% NBS (IL_)"	

Note 1: Refer to the Engineering Assessment Guidelines (Part A) for more information on rounding NBS scores.

*Note 2: An "A++" zone has been indicated in Figure 1 to differentiate (diagrammatically) a Grade A+ building that **also** has sufficient capacity to meet the current Earthquake Actions Standard of the day (such as the finalised TS 1170.5 and corresponding 2024 revision of the Earthquake Geotechnical Practice Module 1).*

Note 3: This describes life safety risk relative to a similar new building on the same site. It can also be interpreted more generally as the risk of failure if a significant (and low probability) earthquake were to occur. It does not consider the consequences of a potential failure, which is why the 'consequence statements' given by assessing engineers are very helpful and important.

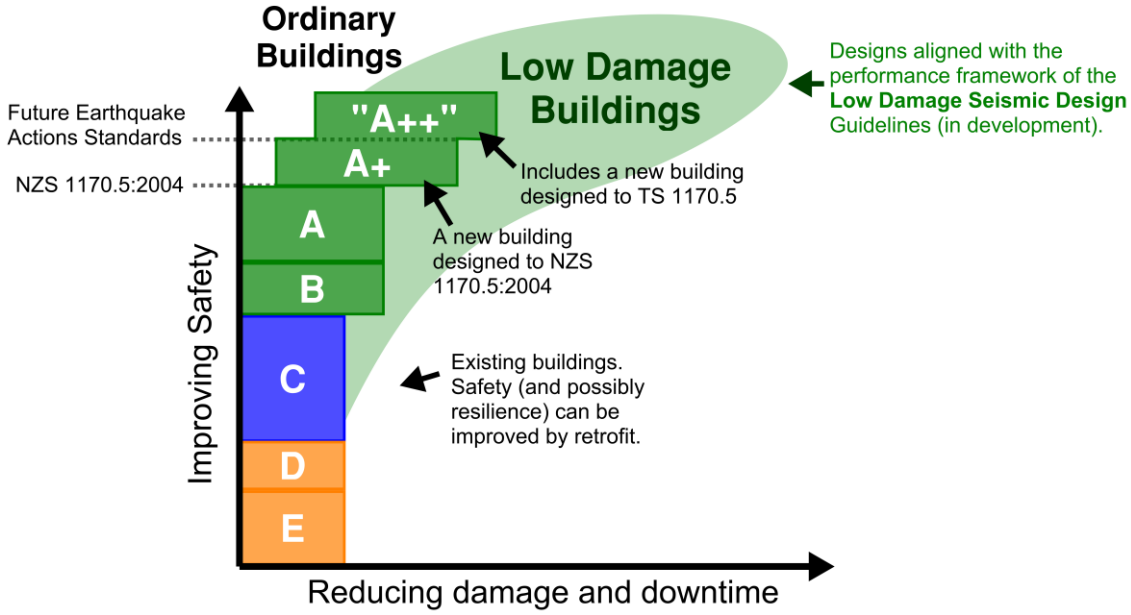

Figure 1: A graphic of the NZSEE grading framework outlined in Table 1 that should be used for all assessments. It shows how future Earthquake Actions Standards relate to the way Seismic Grades should continue to be assigned. It shows the benefits of Low Damage Design—one of the key focus areas of standards development for new buildings that can also be relevant for some high performing retrofits.

In the future, if it was desired to show that the *Ultimate Capacity* (seismic) of an existing grade A+ building *also* exceeded the design actions specified by the current Earthquake Actions Standard of the day (the finalised TS 1170.5) this could be done using the "A++" zone indicated in Figure 1. As Table 1 shows, the *Earthquake Rating* in this case would remain written as ">100% NBS (IL_)". However, the use of the *Seismic Grade* and risk description is preferred for all buildings—not the percentage scores.

Building owners or tenants interested in higher earthquake performance in new and existing buildings are encouraged to consider tolerance for property loss and operational disruption alongside life safety risks. For buildings which already meet high earthquake safety standards, more value is likely to be obtained from performance enhancements that provide resilience benefits (designing or retrofitting to minimise damage and downtime). This is indicated graphically in Figure 1, and refers to voluntary grades that will be defined by *Low Damage Seismic Design* guidelines in preparation (anticipated in 2024). The *Low Damage Seismic Design* framework has been developed for new building design. However, comparable performance could be achieved by well performing existing buildings, or through well-conceived, high performing retrofits.

EARTHQUAKE RATING TARGETS FOR RETROFIT WORK

The same rating system applies to buildings that have been seismically upgraded.

Whether or not an existing building has been seismically upgraded, the same earthquake rating and grading system applies. There is no difference between an as-designed existing building, and a seismically upgraded one, in terms of how its safety and performance should be assessed once the upgrade is in place.

Once committing to retrofit, the highest practicable performance should be targeted.

This means exploring options to achieve a *Low-Risk* grade as an aspirational starting point for any vulnerabilities that the retrofit work seeks to address (grade B to A+, or A++ if practical). However, what ultimately determines a retrofitted building's *Seismic Grade*, is the rating it would achieve if re-assessed in accordance with the Assessment Guidelines, including the proposed upgrade work once it is complete. Achieving any "Low Risk" grade for the vulnerabilities being upgraded is a significant and valuable improvement, and practical realities will determine what is reasonably achievable.

It is also important to be clear that to *minimally* comply with the *Building (Earthquake-prone Buildings) Amendment Act 2016*, buildings with Earthquake-prone notices only need to be seismically upgraded so that they are not Earthquake-prone within the specified timeframes (or if triggered by 'substantial' alteration work as defined by Section 133AT). This means they need to score ≥ 34% NBS or ≥ Grade C, *Medium Risk* as assessed in accordance with the *Engineering Assessment Guidelines*. This does not change with the release of TS 1170.5 nor with any future change to B1/VM1.

Seismic upgrade work design still needs to be detailed to the Building Code, using the target XX% ULS shaking demand. The section "Design of Seismic Upgrade Work" later in this advisory gives more commentary on setting overall performance objectives for retrofit, and design loads for retrofit components.

BACKGROUND TO THE EARTHQUAKE RATING RECOMMENDATIONS, AND FREQUENTLY ASKED QUESTIONS

Why wouldn't the rating system change to "keep pace" with the new earthquake loading specification?

To understand this, it is necessary to recall and consider the overall outcome objectives of the *Existing Building Assessment System*. The system has been designed to enable the identification of detailing and configurational vulnerabilities that we know can be a safety hazard in earthquakes based on experiences in past earthquakes here and around the world—and incentivise retrofit or other risk mitigation.

This intent is well summarised by the following words from Section 2.8 of the 2006 edition of the NZSEE Assessment Guidelines, which also feature in the current edition:

The elimination of non-ductile failure mechanisms and critical structural weaknesses is in itself of greater importance than the actual assessment and strengthening level…

… Building failures during earthquakes rarely occur solely because the design forces have been underestimated. More often than not, poor performance results from some obvious configurational or detailing deficiency.

The system targets tangible risk reductions that can be implemented over time. It focuses effort toward our highest risk buildings in our highest risk geographical areas. *High Risk* Earthquake-prone buildings are the priority of this system, but the system also supports gradual market driven safety improvements to other *Medium Risk* buildings. *Medium Risk* buildings aren't Earthquake-prone, and their detailing or configurational vulnerabilities are less likely to fail or collapse in an earthquake—but they could still be a risk. The earthquake assessment and rating framework (specifically, the *%NBS Rating* and *NZSEE Grading Scheme*) is the key engineering tool used by the system to help achieve the above objectives. The rating framework has achieved wide market recognition.

The EPB Methodology's *Profile Categories* target older buildings built in the early-mid 20th century due to poorer or generally lacking seismic design considerations. However, assessments can also identify hazards in those built from the mid-1970s to the 2000s in the "modern era" of seismic design.

Despite the Earthquake Design Actions Standard having been updated several times since 1976, "modern era" buildings have generally been designed for levels of earthquake shaking that are broadly comparable to today's Building Code (NZS 1170.5:2004). However, some still have detailing and configuration vulnerabilities, or lack features that we now know are important for good performance. In this case, **the intent of the assessment process is to identify any of these features that might limit the capacity of the building to perform to its full intended capacity** (as benchmarked by NZS 1170.5:2004). If it can perform to its full intended capacity, we would expect the risk to be low—and that outcome is important to the assessment system's design. The assessment process should only heavily penalise a modern building's overall design strength if there are certain specific reasons that far too little lateral strength had been provided (or too little stiffness relative to the drift capacity of its component parts).

This historical context is why NZS 1170.5:2004 remains an appropriate benchmark to use in this system design at this time. Using a different earthquake actions standard may adversely affect the way the seismic assessment and earthquake rating system helps us identify, communicate and proportionately manage earthquake risk in existing buildings.

The new Technical Specification for Earthquake Actions TS 1170.5 is intended to ensure new buildings continue to be designed to a high safety standard—so that as time goes on, progressively lower proportions of our buildings require us to tolerate higher levels of risk. These high safety standards are appropriate for new building construction where the marginal costs to achieve good earthquake performance are lower. It is important to understand that the increases in demands come predominantly from very low probability events that produce extremely high levels of shaking—and which are unlikely to occur.

The associated A++ zone depicted in Figure 1 is an important clarification that puts new and existing buildings in context. It allows building owners and their engineers to recognise comparably high levels of performance in existing buildings, should they wish. However, for existing buildings, it is important to recognise that the life-safety benefits of seeking like-for-like performance with new buildings designed to future versions of Building Code documents are less significant than the benefits of retrofitting *Medium* or *High-Risk* buildings (Grades C to E) so that they are a *Low Risk* (Grades A and B).

Using Seismic Grades for communication (instead of %NBS Ratings)

Although calculating *%NBS Scores* and *Ratings* are a fundamental engineering tool in assessment, the risks implied by percentage scores themselves are generally not comprehended well by end users. There are wide and often biased interpretations. This is why it is better to use the *Seismic Grade* and risk descriptions in all final communications, and consequence statements. Grades apply to the building's overall rating (and the *critical structural weakness*), and they can also apply to individual vulnerabilities. Alongside consequence statements and good engineering commentary, these are a better general descriptor of the issues—and they are more reflective of the precision involved in the process, particularly when articulating the risks.

It can be important to remind end users that the basic risk descriptions are not absolute, but relative to a similar new building. They can also be taken to represent the risk of failure if a significant earthquake were to occur. However, they do not consider the consequences of failure, only whether a 'significant life safety hazard' is present. This is why the consequence statements are so important to reporting and communication.

End users will form their own individual or collective views on tolerance to risks, but it is important that the upfront perception of risk against which people measure their tolerance is as clear as it can be. **Using *Seismic Grades* and their risk descriptions, supported by layperson consequence statements and concise engineering commentary, should result in better decision outcomes**. As much as possible, this should apply to individual vulnerabilities, as well as the building's overall grade (which is based on the lowest score). The presentation of the overall grade is a requirement, but clarity in the risk grade and consequence of each weakness makes the overall risk profile much clearer.

This is also the reason that using grade A+ is preferable to awarding final *%NBS Ratings* greater than 100%. It is hard for the public to know how to value such high scores and fixation on the percentages has the potential to introduce bias. Although such scoring may be used as part of technical discussions, the emphasis of communication beyond the basic *Seismic Grades* should focus on the identified earthquake risks and their potential consequences—rather than %NBS.

I'm really interested in achieving the best seismic performance I can, what should I do?

NZSEE, and the Joint Committee support and celebrate all efforts to improve seismic safety and resilience—in context.

Therefore, first and foremost, if targeting high *Seismic Grades* it is important to consider earthquake safety in the context of other important building performance measures and risks. This includes many aspects, such as:

- Operational energy efficiency and thermal efficiency,
- Air quality and comfort,
- Fire safety,
- Accessibility,
- Embodied carbon benefits of continued building use or reuse,
- Other earthquake risks (damage, property losses and downtime) and secondary/external earthquake hazards such as tsunami, rockfall or land damage.

The *Engineering Assessment Guidelines* set out an approach based on minimum standards. Greater earthquake safety is desirable, and this document demarcates "A++" as the highest standard on this grading scale—recognising building capacities and seismic upgrades aligned with the future Earthquake Actions Standard of the day. However, the benefits of seismically upgrading to such high safety standards, relative to other performance measures and other non-earthquake risks may start to diminish—especially if the cost (and opportunity cost) of achieving this through retrofit becomes disproportionately high.

It is important to continually evolve and improve our design standards for new buildings to ensure that over time, we are building the resilient building stock that New Zealander's want. In new construction, the costs involved in doing so are a fraction of those that might be needed to apply a similar standard to an existing building retrofit. Establishing minimum seismic requirements for existing buildings needs to be approached more cautiously.

Considering other earthquake risks—damage and downtime and secondary hazards

As alluded to above, it is important to recognise that the *%NBS Earthquake Rating* only considers life safety risk. Other earthquake risks exist—such as disruption to business continuity, the ability to stay in your home or apartment after a large earthquake, and the possibility of significant damage and losses. The *Low Damage Buildings* zone indicated in Figure 1 relates to the voluntary *Low Damage Seismic Design Guidelines* (in preparation, Volume 1 release anticipated in 2024). This document defines Low Damage Grades. They express how high performing new buildings (and possibly also high performing retrofitted buildings) can achieve not only safe outcomes, but also resilient outcomes if certain aspects are considered in scheme optioneering and design—including both structural and non-structural aspects.

The Ministry of Building, Innovation and Employment's *Seismic Risk Resource for Commercial Building Tenants* may also help to facilitate these discussions with commercial property owners and tenants.

Don't forget other factors which are *crucial* for a seismically upgraded building to perform well.

Retrofit design and construction in existing buildings is typically more complex than new building design work. For any given *Seismic Grade*, it is important—especially when retrofitting—to consider holistically all parts of the system that are crucial for a seismically upgraded building to perform to its stated *Seismic Grade*. These include:

- Designer competence in the appropriate practice area (designers and those supervising the design work),
- Design review,
- Availability of information that reflects an existing building's actual constructed condition,
- Quality of construction and monitoring of construction in the execution of retrofit work, and the validation of assumptions that underpinned the retrofit design.

Why would we use the term New Building Standard (%NBS) if we're not using TS 1170.5? I'm confused…

The term New Building Standard (NBS) refers to the safety standard set by the Building Code Clause B1 for a similar new building on the same site. It is currently determined as the ratio of a building's capacity, evaluated in accordance with the *Engineering Assessment Guidelines* (which is different from B1/VM1), and the demand as determined from NZS 1170.5:2004. This is the same earthquake actions standard currently used for the design of new buildings in accordance with Building Code Verification Method B1/VM1—consistent with the natural meaning of NBS. However, this may not be the case in the future if a different earthquake actions standard replaces NZS 1170.5:2004 in B1/VM1.

It has been recognised that the choice of words has created misconceptions about the intended extent of equivalence between a Grade A+ existing building and a new building designed to B1/VM1 (where there is no need for the designer to explicitly consider the seismic risks associated with the design).

There is a possibility that the label and its acronym could be changed to use different words in the future that better reflect what %NBS is intended to convey and how it is to be evaluated. However, although procedural in principle, because the term is defined in the EPB Methodology there is reasonable effort in doing so. Although discussions have been had, there are no Joint Committee project plans in place which would progress this at this stage.

It is important to treat %NBS scores and ratings (calculated using NZS 1170.5:2004) as an index tool to determine the *Seismic Grade* in accordance with Table 1. The *Seismic Grade* and risk description should be used in all communications.

Design of Seismic Upgrade Work

General principles for seismic upgrade work are discussed in sections A5.5.2 and A10 of the Assessment Guidelines. As stated in those sections, retrofit work should be detailed to the requirements of the Building Code (using a factored XX% ULS shaking demand if the retrofit improvement target is <100% NBS).

This section further clarifies the meaning of this statement, especially in the context of TS 1170.5 (which could become the Earthquake Actions standard referenced by B1/VM1 in the future). However, this has little material effect to the overall approach, beyond reference to Table 1 and Figure 1 when discussing and agreeing performance objectives.

ESTABLISHING OVERALL PERFORMANCE OBJECTIVES FOR STRENGTHENING

The first step in retrofit is establishing the clients/stakeholders' overall performance objectives and reviewing these against the risks that have been identified in the building's assessment. Building owners will often have a desired *Seismic Grade* in mind (from Table 1 and Figure 1). However, understanding the consequence of different weaknesses (should they fail or collapse), and the costs and practicalities of various strengthening options is a very important part of agreeing the retrofit objectives and how they'll be achieved. **Considering consequence is the key here, as this is not well captured in the grades alone**.

The lowest earthquake score of any weakness still remaining after the retrofit will determine the *Seismic Grade* for the building. This is important for applying the EPB methodology and Section 133AM or 133AT of the Building Act (strengthening to achieve ≥34% NBS). It will also be important for clients undertaking voluntary strengthening who have a desired *Seismic Grade* foremost in their mind. However, from an engineering and risk outcome perspective, it is more important to understand the underlying risk profile and how each of the various risks that have been highlighted can be improved or eliminated through retrofit or other risk mitigation. The Ministry of Building, Innovation and Employment's *Seismic Risk Resource for Commercial Building Tenants* can help facilitate these discussions with commercial property owners and tenants.

EARTHQUAKE LOADING FOR DESIGN OF RETROFIT COMPONENTS

Once committed to retrofitting a deficiency, the best aspirational starting objective is usually to target the strengthening of that component so that either:

- The vulnerability and the risk associated with it no longer exists at all, or
- Its capacity aligns with Building Code or B1/VM1 levels (by using 100% ULS demands). In other words, reducing the risk so that the score associated with its assessment achieves an A+ *Low-Risk* grade, (or A++ if practical, with reference to Figure 1).

This is a better long-term and enduring approach to risk management, and often makes sense for discrete components, such as precast panel securing, and improvement of stair separations. In these cases, achieving Grade A+ (or A++) performance may be only nominally more difficult than achieving a lower performance level.

However, this approach is unlikely to be practical in all situations, especially for aspects related to global building strength and stability. Here, the more pragmatic approach is to follow the general requirement described in Part A, where retrofit work is detailed to the Building Code but using the target XX% ULS shaking demand. Often, it is useful to adjust the target demand (in consultation with the client) to find the optimum points where the improvement in performance and risk reduction is most commensurate with the additional cost to achieve it.

Disproportionate cost uplift to achieve the highest *Seismic Grades* may be better invested elsewhere—including towards simpler retrofits in other earthquake risk buildings.

VALIDATION OF RETROFIT DESIGN

What ultimately determines the *Seismic Grade* of any retrofitted building, is the rating it would achieve if assessed in accordance with the Assessment Guidelines, including the upgrade work in its completed state. This does not imply such re-assessment would actually need to take place—this is usually achieved through the normal course of retrofit design validation.

However, this is an important philosophical exercise to apply as part of retrofit design. That is, assessing the existing and new work together—to ensure that any strengthening work that compliments the existing lateral load resisting system is compatible with that system, and with the overall building's displacement and behaviour. As with any assessment, this may not mean that you are reliant on the lateral strength contribution of all elements of the existing structure. But all parts of the structure *must* be checked for their ability to deform with the primary system and maintain gravity support.

Considering Seismic Compliance When Undertaking Alterations or Changes in Use

CARRYING OUT ASSESSMENT AND RETROFIT DESIGN WORK FOR REGULATORY PURPOSES FOR SECTION 115 "CHANGE THE USE"

When buildings are undergoing a Change in Use (as defined by Section 115 of the Building Act), the building is required to comply *as near as is reasonably practicable* with the Building Code. For seismic compliance, the Assessment Guidelines are usually used to establish what the level of seismic compliance is for regulatory purposes.

Until it is no longer referenced as part of B1/VM1, NZS 1170.5:2004 remains the standard which defines earthquake loading that complies with the Building Code. Therefore, it is some time before TS 1170.5 could have a regulatory impact for Section 115.

However, in the future, if the Building Code Verification Method B1/VM1 is amended to reference only the new Technical Specification TS 1170.5 (and once the version referencing NZS 1170.5:2004 becomes ineffective), that earthquake actions standard would define "Building Code" compliance. In other words, the A++ zone indicated in Figure 1 would represent compliance with the Building Code from that point onwards. However, full compliance may not be necessary if consent applicants can demonstrate that a lesser level of compliance can be considered to be *as near as is reasonably practicable* under the circumstances.

This is referred to as the ANARP test—and can be considered by applicants in consultation with Building Consent Authorities on a case-by-case basis. MBIE's Building Performance website provides some general guidance at Change of use and alterations and Demonstrating and assessing compliance for buildings undergoing alterations. The latter contains a useful diagram under "step 3" that illustrates some of the principles that can apply to weighing 'sacrifices' and 'benefits' in an ANARP test.

CLARIFYING SEISMIC COMPLIANCE REQUIREMENTS FOR ALTERATION WORK

Any alteration work to a building with an *Earthquake-prone Building* notice needs to comply with Section 133AT of the *Building (Earthquake-prone Buildings) Amendment Act 2016.* Specifically, if the alteration work meets the value-based definition of 'substantial alterations', this would trigger the requirement to complete *seismic work* as part of the alterations so that the building is no longer Earthquake-prone.

Otherwise, in structural alteration work where there is not a Section 115 Change in Use and, Section 112 of the Building Act applies. This requires the level of compliance be made no worse than before the alteration.

Engineers should be cautious not to misinterpret the purpose of the earthquake rating system when working with alterations (that is, alterations other than those which are purely seismic retrofit/improvement). If a building's overall assessed *Earthquake Rating* is 40% NBS (IL2), for example, then that rating does not represent a target rating for any alteration work. That is not the purpose of the earthquake rating system, and it would misrepresent the intent of Section 112. Low scoring parts of buildings may not bear any relation to the area affected by the alteration.

All weaknesses in a building contribute to an overall risk profile, and they may have different physical consequences. Alteration work should not lessen the level of compliance of any component part of a building, unless in doing so it would continue to comply with the Building Code.

In other words, **the key test is to ensure that no existing weaknesses are made worse, and no new weaknesses are introduced**.

The Future of our Existing Building Assessment System

Could the existing building Earthquake Rating and Grading system change in the future?

At any time, if there was likely to be benefit in doing so, a review could be carried out by government and the Joint Committee on the validity of NZS 1170.5:2004 benchmark loadings used in non-EPB assessments, and the form of grading system used (i.e. the way the risks are communicated). This would be a separate review and decision-making process to the one used when updating B1/VM1 for new buildings, as there are very different drivers and contexts. Any review would be independent of a decision to cite a new Earthquake Actions Standard in the Building Code Verification Methods (B1/VM1) for new building design.

For existing buildings, any review would need to consider the impacts of any system changes on the decision outcomes that result from the assessment process. The purpose of any system is not the *Earthquake Ratings* or *Seismic Grades* that result from an assessment, but the decision outcomes of that advice—such as:

- The quantity (collectively) of earthquake retrofit work or mitigation that is actually carried out,
- How any retrofit work that is being delivered would be expected to perform,
- Proportionality of the costs of the work,
- Where the costs of the work lie (who pays for the work, directly or indirectly),
- Who benefits from the work.

Like any grading system evolution, a review would also need to consider how recently assessed buildings or retrofitted buildings are to be considered (ensuring it continues to reward those who have invested in risk reduction measures even if the way in which risks are evaluated were to change). This is important to maintain confidence in the system—so that it continues to deliver good outcomes and so that owners are not discouraged from progressing seismic upgrade work.

Although these can be challenging concepts from a purely technical standpoint, they are the crucial to achieving goals of earthquake risk reduction over time, and to overarching goals of proportionality.

The government has announced a review of the Earthquake-prone Building System.

In April 2024, the Minister for Building and Construction Hon. Chris Penk announced that the government would bring forward a review of the Earthquake-prone Building (EPB) System. Originally scheduled for 2027 (around ten years after enactment), work on the review will now commence immediately. Deadlines for remediation work on Earthquake-prone Buildings will be extended by four years (for deadlines that had not already lapsed on the 2nd of April 2024). The intent of this extension is to allow time for the review to take place and to draft any legislative changes that might be needed subject to the outcome of the review.

The foremost focus of the review would be the EPB System and the requirements of the *Building (Earthquake-prone Buildings) Amendment Act 2016*. However, the way that seismic risk is managed outside the current EPB system is relevant to the review of settings applied in regulation.

This document reiterates the current regulatory requirements for EPB Buildings, but its primary purpose is to advise owners who have been undertaking (and can continue to undertake) voluntary (non-regulated) assessment and seismic retrofit work outside of the EPB system.