

Royal Commission of Inquiry into Building Failure Caused by the Canterbury Earthquakes

Standards Council – Submission (B): Issue 3 of the Notice of Issues

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For the purpose of this submission, the glossary terms given in **Appendix A** have been used.

1. Executive summary

This part of the Standards Council's submissions provides information specifically on Issue 3 of the Notice of Issues.

New Zealand Standards are the agreed requirements set by a committee of expert stakeholder representatives drawing on the knowledge, evidence and research available to them.

New Zealand Standards are voluntary documents, so to ensure adequacy for their function as part of the building controls framework they need to be maintained, regularly reviewed, and kept up to date.

Standards are an important part of the building controls framework.

The Standards Council is confident that the development process for Standards is robust and transparent, given the resources and policy settings under which it operates.

However, our stakeholders have expressed concern about some limitations the current operating model creates. These concerns include the ability for all technical experts to make a direct contribution to the development process of New Zealand Standards and the timely initiation of projects.

This questions:

- Whether the current operating environment is sufficient for the Standard's Council to give effect to requirements of the Standards Act 1988.
- The fitness for purpose of the Standards Act 1988 for consistency with international best practice for Standards development
- The fitness for the purpose of setting Standards for the current building controls system.

The mechanisms of the wider building controls system are critical to supporting the adequacy of legal and best-practice requirements. The Standards Council supports opportunities to ensure the currency and maintenance of New Zealand Standards provides ongoing value to the stakeholders and wider New Zealand interests.

The Standards Council's stakeholders indicate that changes to the policy settings for the Standards Council would address these concerns and limitations.

The Standards Council supports opportunities to ensure the currency and maintenance of New Zealand Standards provides ongoing value to the stakeholders and wider New Zealand interests. As the interim report of the Royal Commission has indicated, there are several New Zealand Standards that need to be reviewed and either updated or reconfirmed.

Standards are part of the fabric of the building controls system; however, a lack of adequate funding prevents them being frequently reviewed, maintained, and kept up to date. In addition, clarity is needed on where and when Standards should and are being used as part of the building controls framework.

The Standards Council believes the New Zealand Building Code should be supported by an updated suite of national Standards which represents an appropriate mix of international and national Standards, together with joint Australian/New Zealand Standards that:

- provide greater detail in compliance documents at the next level (in conformance with the Government's preferred "stepped-approach" from regulation down to supporting documents at the next level)
- are, as at present, a mix of acceptable solutions, verification methods and alternative solutions, but with greater scope for the last of these
- are suitable for regulatory incorporation, drawing on best international practice for Standards development
- are cited by the regulator in a timely and accessible manner.

2. Scope and purpose of this submission

The Royal Commission has indicated in its interim report that it will conduct a public hearing in the weeks of 7 and 14 November 2011 in which it will consider evidence and submissions on Issue 3 of its Notice of Issues.

Issue 3 relates to the adequacy of the current legal and best-practice requirements for the design, construction, and maintenance of buildings in central business districts in New Zealand to address the known risk of earthquakes.

There is also some overlap between Issue 3 and Issue 4, and we wish to reserve the right to submit further information on Issue 3 and Issue 4 through further submissions.

The Standards Council's submission addresses the following matters arising under Issue 3:

- What are the 'legal and best practice requirements for the design, construction, and maintenance of buildings in central business districts in New Zealand to address the known risk of earthquakes'?
- How has knowledge and measurement of seismic events been used in setting standards for the design, construction, and maintenance of buildings to address the known risk of earthquakes (Issue 3(a))?
- How are those standards reflected in and applied within the legal framework – including in respect of section 122 of the Building Act (Issue 3(b) and (c))?
- What is the role of the Standards Council, in particular, in relation to central government, local government, the building and construction industry, and other elements of the private sector in developing and enforcing legal and best-practice requirements (Issue 3(d))?

The Standards Council makes this submission in accordance with the intentions set out in its expression of interest, namely to ensure that the Royal Commission and the parties that appear before it are fully informed about:

- (a) the nature and function of Standards within the system of legal and best-practice requirements concerning the design, construction, and maintenance of buildings, and
- (b) how Standards are made and incorporated into legal and best-practice requirements (both within New Zealand and internationally).

This submission should be read together with the Council's general submission about its role, and the role of Standards generally in the regulatory system.

For the purpose of this submission, the terms given in **Appendix A** have been used.

3. What are the 'legal and best practice requirements'?

The Royal Commission's terms of reference and also Issues 3 and 4 use the term 'legal and best-practice requirements'.

The Standards Council notes that requirements could be set as minimum requirements or set as a best solution. The New Zealand Standards catalogue has documents that are designed to set requirements in each of these ways.

Where New Zealand Standards have been developed for the purpose of inclusion into the compliance documents of the New Zealand Building Code, they were designed to provide a minimum set of requirements.

Where New Zealand Standards have been developed as voluntary tools for the sector, these may have been developed to set requirements for achieving the best solution.

In all situations though, the best knowledge available has been drawn on from both the committee of experts that have put that have been put forward by their nominating organisations, and from the wider public through open comment process. Through a consensus-based process the best-practice is set for specifying requirements.

4. How has knowledge and measurement of seismic events been used?

Context: The use of Standards in the building controls system

The process for setting Standards

The Standards development process is described in Submission (A): Overview.

The use of New Zealand Standards and sector standardisation documents has and continues to form part of the fabric of the building control system. The purpose of the Building Act 2004 (section 3) includes the setting of performance standards for buildings. The principles to be applied in performing functions, and exercising powers, under the Act include the importance of standards of building design and construction in achieving compliance with the building code (section 4(2)(f)).

Standards themselves are developed and promulgated by the Standards Council under section 10 of the Standards Act 1988. While the methodology for developing

New Zealand Standards has continued to evolve and be refined since our founding in 1932, its basic premise and guiding principles have remained consistent.

The Standards Council is confident that the development process for Standards is robust and transparent, given the resources and context under which it operates. However, our stakeholders have expressed concern about some limitations the current operating model creates. These concerns include the ability for all technical experts to make a direct contribution to the development process of New Zealand Standards and the timely initiation of projects.

This questions:

- whether the current operating environment is sufficient for the Standard's Council to give effect to requirements of the Standards Act 1988.
- the fitness for purpose of the Standards Act 1988 for consistency with international best practice for Standards development, and
- the fitness for the purpose of setting Standards for the current building controls system.

The mechanisms of the wider building controls system are critical to supporting the adequacy of legal and best-practice requirements. **The Standards Council supports opportunities to ensure the currency and maintenance of New Zealand Standards provides ongoing value to the stakeholders and wider New Zealand interests.**

The concerns expressed by our stakeholders have indicated the need to review the Standards Council's operating model to enable better support of the maintenance of Standards, (see SESOC 2011), New Zealand Construction Industry Council 2009 submission on the Building Act review (see **Appendix B**), and a letter to the Editor of the Structural Engineering Society of New Zealand and their response (see **Appendix C**). The issue is not about the robustness of the operating model itself. Rather, it is about the context in which the model operates and the resourcing that is available to ensure the necessary range of expertise is contributed effectively. A review of these matters could also assist in the longer term support for developing new and emerging Standards where the sector considers more guidance is required to help building professionals to exercise their judgement.

The Standards Council's statutory role includes revising New Zealand Standards that have been previously promulgated. However, the Council's funding model is such that it has limited resources to maintain the currency of the Standards catalogue. Maintaining the currency of the catalogue is important for two reasons. It keeps Standards up to date as a basis for providing acceptable solutions and verification methods. It also assures the building control system because it draws on standardised methods and approaches that continue to evolve and develop.

Standards are part of the fabric of the building controls system; however, a lack of adequate funding prevents them being frequently reviewed, maintained, and kept up to date. In addition, clarity is needed on where and when Standards should and are being used as part of the building controls framework.

There is a need to maintain a balance between regulator-developed compliance documents, consensus-based Standards, and industry guidelines and practice notes. A risk-based framework for product and systems assurance should align the

Standards development methodology and level of specification with the level of risk associated with use of the product or process. In this context, **we believe the New Zealand Building Code should be supported by an updated suite of National Standards which represents an appropriate mix of international and national standards, together with joint Australian/New Zealand Standards that:**

- **provide greater detail in compliance documents at the next level (in conformance with the Government's preferred 'stepped-approach' from regulation down to supporting documents at the next level)**
- **are, as at present, a mix of acceptable solutions, verification methods and alternative solutions, but with greater scope for the last of these**
- **are suitable for regulatory incorporation, drawing on best international practice for Standards development**
- **are cited by the regulator in a timely and accessible manner.**

The Department of Building and Housing (DBH) notes on its [website](#) in relation to Standards that:

'The building control framework comprises mandatory and non-mandatory documents.

Standards, which are created by the organisation Standards New Zealand, come into the non-mandatory category. Many Compliance Documents refer to them in Acceptable Solutions or Verification Methods.

When a Standard is published or revised, the Department reviews it to determine whether it is suitable to be used in the Compliance Documents. Depending on the outcome of the review, the Department may cite the entire Standard or parts of it in a Compliance Document. It may also cite the Standard subject to certain modifications'

Clearly articulated "intervention logic" should specify when, how and why the regulator would use a particular approach, and at what level of the building control framework: for example, to define those circumstances where a compliance document written by the department should be used as opposed to a consensus-based national Standard or industry developed Code of Practice/guideline.

Similarly, creating greater transparency in decision making for partial citation of Standards or modification of clauses within those Standards (for regulatory purposes) would help to remove uncertainty about status of information contained in those documents, and the evidence base for that information.

The development of Standards for the design, construction and maintenance of CBD buildings to address the known risk of earthquakes

As the Technical Report to the Royal Commission on Unreinforced Masonry (URM) by the University of Auckland and University of Adelaide advises, successive New Zealand Standards development committees have considered the need to design for seismic forces since 1935. The attached diagram (**Appendix D**) shows the evolution of New Zealand loading Standards since 1935.

As this overview diagram shows, the Standards Council has been using the Standards development process to codify knowledge in the area of seismic loadings and design for many years. Its role has been and continues to be one of process owner and facilitator to ensure knowledge presented is considered and consensus has been reached on requirements being set.

The Standards development process has developed seismic loading New Zealand Standards by bringing together engineers and stakeholder expert representatives from universities, local authorities, science and research organisations, as well as providing an opportunity for the wider public to offer comments and additional information for consideration.

In addition to this, the Standards Council has drawn on its membership role in the International Standards community for Standards development. Where New Zealand participates in relevant committees of the International Organization of Standardization (ISO), review groups are established to ensure New Zealand expertise is provided to this committee and knowledge is disseminated back from the international community to New Zealand through the participating delegates.

A particularly relevant example of this is the use of ISO 2394:1998 *General principles on reliability of structures* to guide the underlying philosophies, principles, and preparation of the current suite of loading Standards for Australia and New Zealand (AS/NZS 1170 *Structural design actions*).

New Zealand Standards and standardisation documents are voluntary. As the [Technical Report developed by the Department of Building and Housing](#) for the Royal Commission advises, between 1935 and 1976 the role of New Zealand Standards was to codify knowledge into New Zealand Standards as model bylaws. During this period, the use of unreinforced masonry for buildings, recognised as having limited seismic performance, was discouraged and subsequently disallowed through the New Zealand Standards. These voluntary New Zealand Standards were adopted as bylaws by some local authorities and enforced.

In 1976, the loading values and model bylaw were separated into two New Zealand Standards. However, the Standards development process for reviewing the loading Standard has continued in the same process and on the same premise of drawing on stakeholder experts to agree by consensus on requirements having considered the best research and information available to them.

From 1991 and the advent of the Building Act 1991, the role of New Zealand Standards setting loading requirements has changed.

Until 1991, the New Zealand Standard provided a means for a local authority to set requirements for loadings, and to determine the applicable loads.

After 1991, under the performance-based building controls system, the functional requirement and the criteria are expected to be defined by the New Zealand Building Code, and the New Zealand Standard for loadings provides a method for verifying compliance with these requirements. Performance-based building systems are prevalent in many developed countries, and member countries of the Inter-Jurisdictional Regulatory Collaboration Committee (IRCC) have evolved the best-practice design of these systems.

The IRCC was formed in 1997 following discussions between four countries working on performance-based building regulatory systems. This group provides a number of documents that can be considered international good practice for regulatory design when using performance based building control systems.

This IRCC group has since grown to now involve thirteen countries.

The IRCC meets twice a year with a fundamental objective of discussing and developing knowledge about performance-based regulatory building systems

Knowledge transfer into the current loading Standard

NZS 1170 Part 5:2004 *Structural design actions - Earthquake actions - New Zealand* is the current loading Standard. As the overview diagram in **Appendix D** shows, this Standard was published in 2004, and incorporated by reference by the regulator into the Verification Method to clause B1 *Structure* of the New Zealand Building Code in 2008.

As part of a performance-based building controls system, the functional requirements and criteria should be set out in the New Zealand Building Code. When revising the New Zealand Standard for loading, the focus of the experts should be on the robustness of the methods and requirements for verifying compliance with the New Zealand Building Code.

The Australian Building Controls Board (ABCB) cited the AS/NZS 1170 suite of Standards in Amendment 11 to the Building Code of Australia (BCA). However, unlike New Zealand, the ABCB updated the BCA structural provisions to define the functional requirements and criteria for structural performance in their Building Code, and the loading Standard suite then formed part of their deemed to satisfy provisions. As the ABCB describes them:

‘The BCA structural provisions have been revised and expanded to include matters of public policy. The public policy statements are expressed in revised Performance Requirements and Deemed-to-Satisfy Provisions. These provisions contain minimum acceptable risk and safety levels that assign an annual probability of design event for safety for all buildings and structures covered by the BCA.....’

‘Policies need to be set with due consideration for the technical, economic, social and political aspects of the issue being considered after consultation with all relevant stakeholders. The new BCA Performance Requirements for structural sufficiency contain public policy statements that reflect community expectations about the structural performance of buildings.’

‘These changes to the BCA are expected to increase general understanding of the setting of minimum acceptable risk levels. The Deemed-to-Satisfy Provisions are also more detailed and now contain quantifiable risk and safety levels and state that the action or load must be less than the resistance of the building or structure to those actions.’ ABCB 2002.

In the absence of structural provisions in the New Zealand Building Code clause B1 *Structure*, the structural provisions are given in Section 3 *Annual probability of exceedance for design limits* of AS/NZS 1170.0 which applies to New Zealand only. This creates confusion for users on where to access information and illustrates an inconsistent and confusing approach within the building controls framework.

It is appropriate for this content to be included in a New Zealand Standard that is incorporated by reference into a verification method. It provides a means, but not the only means, of compliance for the New Zealand Building Code clause B1 has been raised by our stakeholders.

The process used for revising and developing the current New Zealand Standard for seismic loading requirements, NZS 1170.5:2004 *Structural design actions* –

Earthquake actions – New Zealand has been extensive and thorough (see **Appendix C**). It has involved a wide range of organisations, and many technical experts, and provided a means for aspects including learnings from other seismic events to be discussed and considered robustly before requirements were set.

Comment on the process

The AS/NZS 1170 *Structural design actions* suite of loading Standards are joint Standards between Australia and New Zealand, and developed through the Standards development process by Standards Australia. NZS 1170.5:2004 is a New Zealand part of this suite of Standards, and the only part of the loading Standard suite developed and led by New Zealand.

The development of NZS 1170.5:2004 involved extensive consultation, peer review, and review by a wide range of sector interests, which was extensive, robust, and considered many substantial issues thoroughly (see **Appendix E**).

Where possible, international expertise and experience was drawn on.

New Zealand does have unique and specific seismic conditions, and as the Royal Commission [Technical Report](#) developed by GNS advises, the NZS 1170.5:2004 committee has had to develop a detailed map showing zones of seismicity. This map has been developed based on the National Seismic Hazard Model (NSHM).

All New Zealand building Standards (which includes AS/NZS) draw on evidence-based knowledge. For building design Standards this may include direct input from technical experts supported by the Earthquake Commission in reconnaissance teams to countries affected by earthquakes, through to drawing on well documented research models such as the NSHM.

Standards are a snapshot of collective knowledge at a particular point in time. As new research becomes available and able to be codified, Standards need be reviewed to ensure their currency is maintained and the information provided is up to date and relevant.

5. How are those Standards reflected in and applied within the legal framework?

Issue 3(b) and (c), as we understand them, invite comment on the approach of regulating buildings which meet a legislated test for ‘earthquake prone’, irrespective of whether they meet the ‘current legal and best practice requirements’.

Section 122 of the Building Act 2004 refers to a requirement of a proportion of the ‘New Building Standard’. Currently, this would be NZS 1170.5:2004. The Standards Council does not offer any views on the appropriateness of this as a mechanism for setting legal requirements.

6. What is the role of the Standards Council?

The Royal Commission has sought submissions on the roles of central government, local government, the building and construction industry, and other elements of the private sector.

The Standards Council is and continues to be an essential part of the New Zealand building control system.

The Standards Council is not easily classified into these role descriptions. That is, the Standards Council is a Crown entity and therefore owned by the Crown. However, it operates autonomously from the Crown. It has a function of codifying knowledge from different industries and sectors, but is not owned by those parties or by private interests. This reflects the Standards Council's origins and the ongoing high levels of industry and community support for the Standards Council.

The [technical report](#) prepared for the Royal Commission by the Department of Building and Housing describes the building controls system. The Standards Council agrees with this description of the building controls system. However, while this report describes the various roles in the sector, it does not describe the functions and mandate of the Standards Council in their entirety.

New Zealand Standards are statements of 'agreed requirements having considered the best information' at the time they are promulgated. A Standard is not legally binding. To make it binding, it could be incorporated directly or by reference into legislation (including statutory regulations) on the advice of a regulator such as the Department of Building and Housing; into a bylaw promulgated by a local authority; or adopted or referred to for other purposes such as by a professional body under its rules of professional practice.

Role of the Standards Council in the building controls system

In the building context, a Standard may be cited as an acceptable solution or a verification method through regulations made under section 401(1) of the Building Act 2004, or may be adopted by the Chief Executive as a compliance document under section 23.

Through the 246 directly referenced New Zealand Standards (which include NZS and joint AS/NZS) in the New Zealand building controls system, there are a further 12,000 references to Standards and standardisation documents.

The primary function of the Standards Council and Standards in the system is to support or provide means of compliance within the compliance documents (formerly approved documents) as acceptable solutions or verification methods. The Standards Council is not responsible for determining whether Standard is to have a status beyond that of being voluntary, or by what means that might occur. Nor does the Council regulate or have any responsibility for the enforcement of building controls. However, The Council has a proactive role in ensuring they are fit for purpose and contribute value to New Zealand.

Through our engagement with different New Zealand sectors we identify the necessary changes to Standards and needs for further standardisation.

Good practice for the design of performance-based regulatory systems includes the provision of appropriate information on where and when to use Standards and Standardisation documents.

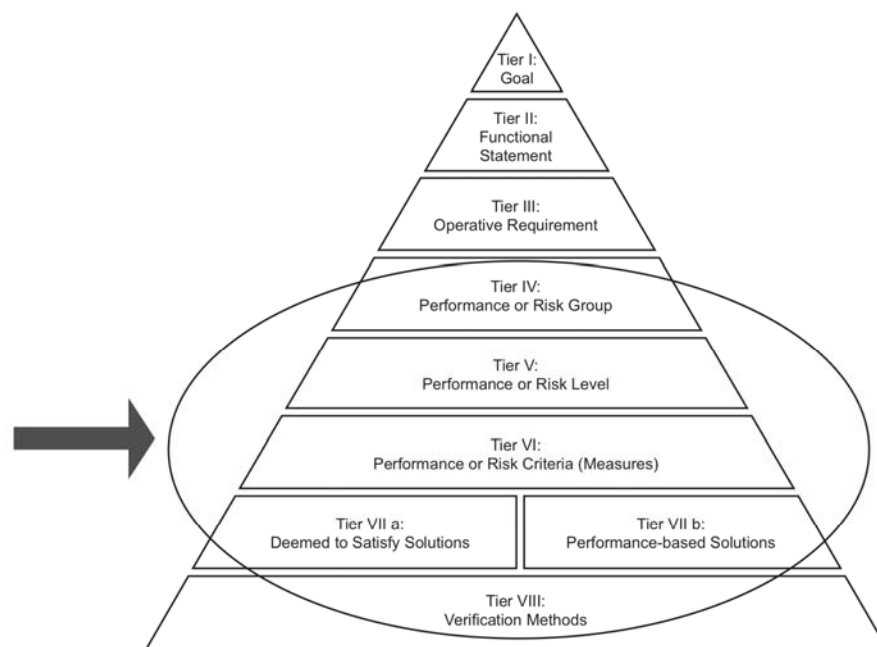
The IRCC reports that experience with functional, objective-based and performance-based building regulations has indicated that although the approach provides increased flexibility and innovation in the market, more detail can be helpful in the regulatory system, particularly in describing the level(s) of performance (or risk) that buildings are intended to achieve over a wide range of conditions, and to better describe the criteria or measures against which successful performance will be evaluated.

The need to better understand how performance targets can be established on the levels of risk, safety, and performance the public expects, and why quantified performance criteria can be useful in assessing how different attributes of the building perform in relation to one another, resulted in an evolution of the original regulatory model into the eight-tier IRCC Model.

The IRCC model reflects additional levels for performance or risk group, performance or risk level, and performance or risk criteria (measures).

These tiers were added to the Nordic performance-based model to illustrate how factors such as levels of tolerable building performance or risks, and importance of a building category to the community, are reflected in goals, functional requirements, and operative (performance) requirements. With these added tiers, the IRCC hierarchy is also better able to illustrate how test methods and standards, evaluation methods, design guides, and other verification methods can be used to demonstrate compliance.

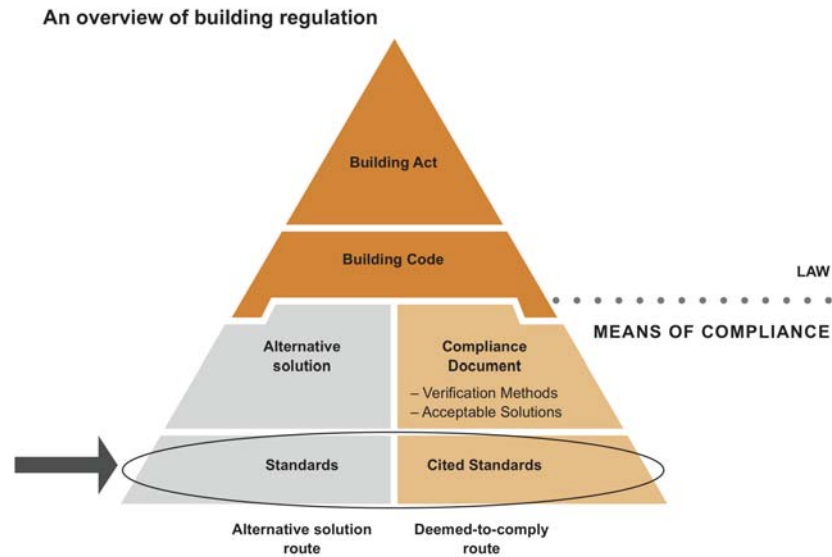
Figure 1, below, shows how a performance-based building control model might be applied using the following tiers. As the 2003 [IRCC report](#) comments however, Standards take on a more integrated role within a performance-based model.



(IRCC, 2010)

Figure 1 – The IRCC 8-tier performance based model

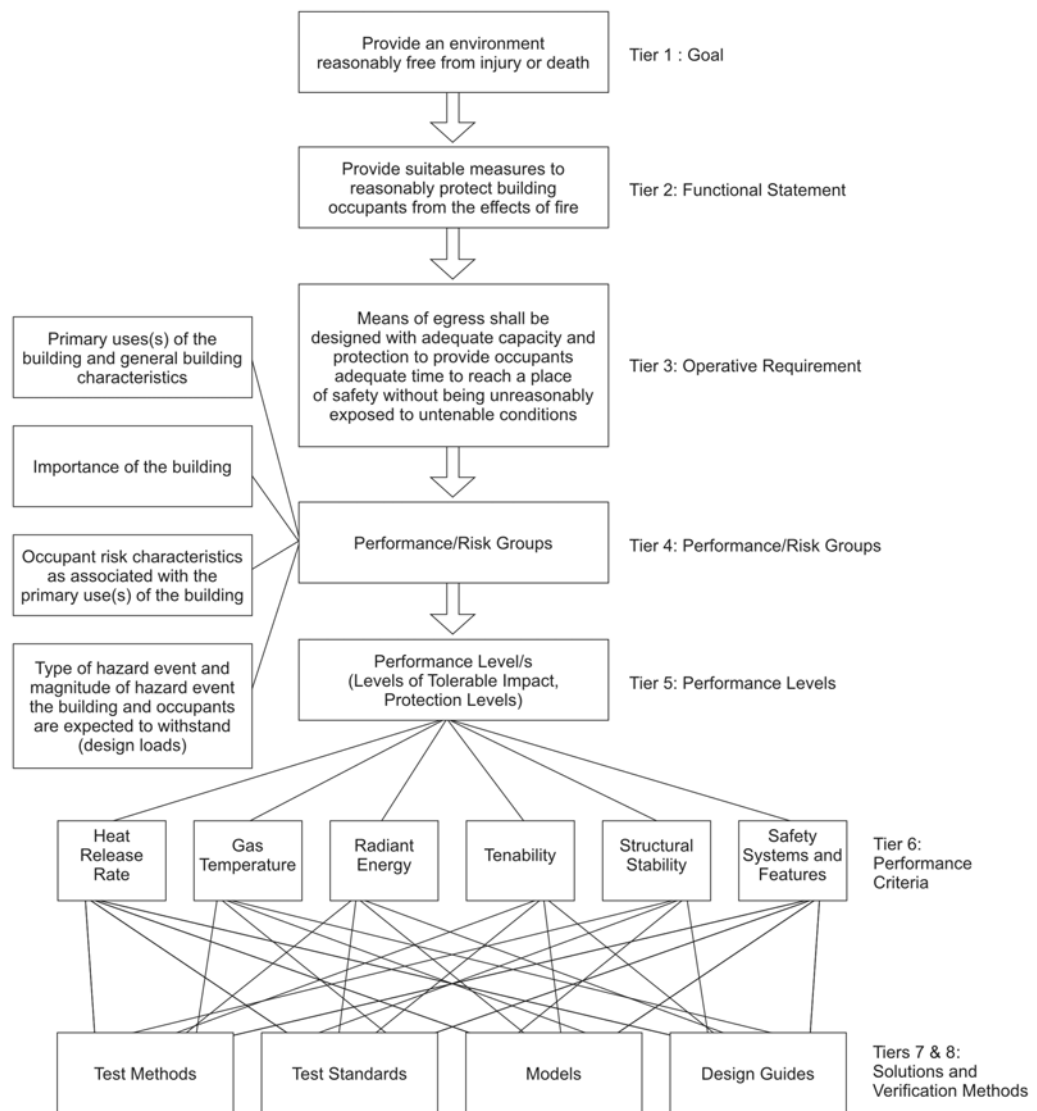
Through the Building Act 1991 and subsequently 2004, New Zealand has established a performance-based building controls system model, and this is represented in Figure 2.



(DBH website)

Figure 2 – New Zealand building controls system

With these added tiers the IRCC hierarchy is also better able to illustrate how test methods and Standards, evaluation methods, design guides, and other verification methods can be used to demonstrate compliance. This is illustrated in the representation of the IRCC model in Figure 3, which is based on linkages of a safety objective related to safe egress in the event of fire (IRCC, 2010).



(IRCC, 2010)

Figure 3 – Example of a performance based building controls model

As Figure 3 shows, Standards can be used to support tier 4 through to tier 8. However, clarity is needed on the function of the Standard and the tier which it is intended to support.

In addition to direct referencing of Standards into the building controls system as compliance documents, Standards also support the wider system in a variety of ways.

This includes:

- providing guidance for preparing performance requirements – As the IRCC comments on the development of the New Zealand building controls system, Standards have assisted in the preparation of performance-based requirements such as ISO 6240:1980 *Performance standards in buildings* by providing best practice guidance for those writing performance requirements for building components and assemblies
- providing test methods or requirements for materials and designs considered as alternative solutions to the NZBC. That is, the demonstration of compliance to a New Zealand or overseas Standard might be used as supporting evidence to building consent authorities where the alternative solution pathway is pursued
- providing confidence in the conformance structure such as the accreditation of laboratories. The Joint Accreditation System of Australia and New Zealand (JAS ANZ) and the International Accreditation New Zealand (IANZ) may require management and system compliance with a Standard such as ISO/IEC 10725:2005 *General requirements for the competence of testing and calibration laboratories* to ensure testing is conducted in an adequately robust way
- providing additional guidance material over and above the minimum requirements set out in the building controls system.

REFERENCES

Australian Building Controls Board (ABCB) June 2002 Australian Building Regulation bulletin – Technical support for building code users Issue 21

Inter-jurisdictional Regulatory Collaboration Committee (IRCC) February 2010 Performance-based building regulatory systems – Principles and experiences: A report of the Inter-jurisdictional Regulatory Collaboration Committee. Brian J. Meacham, Editor.

Structural Engineering Society of New Zealand (SESOC) 2011 Preliminary observations from Christchurch earthquakes. Technical report prepared for the Royal commission of inquiry.