



Significant changes in structural design

New Loadings Standards have been cited with substantial modifications

NZS 1170 referenced in Verification Method

Amendment 8 to the Compliance Document for the New Zealand Building Code Clause B1 Structure was published in June 2008. The amendment references the suite of Standards known as NZS 1170, together with changes in references to material Standards. Subject to modifications, they may be used in Verification Method B1/VM1 to verify that a building meets the performance requirements of Clause B1 Structure of the Building Code.

The citation amends the list of structural design Standards for some materials.

Verification Method, B1/VM4 Foundations is also amended.

This practice advisory highlights the changes to these two Verification Methods (VMs) and notes significant implications. You should consult the amended VMs for details of the changes.

The amended Compliance Document may be downloaded from www.dbh.govt.nz

B1/VM1: Structure

Citation of AS/NZS 1170

The citation of AS/NZS 1170 covers the following suite of Standards which is referred to as NZS 1170.

AS/NZS 1170: Structural design actions –

- Part 0: 2002 General principles (including Amendments 1, 2 and 4)
- Part 1: 2002 Permanent imposed and other actions (including Amendment 1)
- Part 2: 2002 Wind actions (including Amendment 1)
- Part 3: 2003 Snow and ice actions (including Amendment 1)

NZS 1170: Structural design actions –

- Part 5: 2004 Earthquake actions – New Zealand

Deletion of NZS 4203 effective on 1 December 2008

Several out-of-date Standards will be deleted from B1/VM1. These include NZS 4203:1992, and material standards that have not yet been brought into line with NZS 1170.

These changes take effect at the end of the transition period, 1 December 2008. Both NZS 1170 and NZS 4203 (as amended in the current Compliance Document) may be used until then.

During the transition period NZS 1170 may be used as part of an alternative method of verification and NZS 4203 remains part of the VM.

Limited judgement endorsed – but by a CPEng

The proper use of NZS 1170 and its related material standards depends on the designer applying engineering judgement. The Department recognises that decisions based on experience and specialist knowledge are part of the structural design process. However, NZS 1170 and its related material standards sometimes allow open-ended judgements. Examples include statements allowing 'other approved methods'. The citation of NZS 1170 specifically excludes these open-ended judgements from the VM. Those judgements that remain are regarded as being bounded by imposed limitations and/or by generally accepted engineering principles.

The citation is made on the condition that people responsible for interpreting the requirements of the Standards have appropriate experience and skills in structural engineering. The Compliance Document notes that a structural engineer who is a chartered professional engineer (CPEng) would satisfy this requirement.

Where many designs depend on, for example, design tables or software, the Department would expect that documentation accompanying such a design aid would name the CPEng who is 'responsible for interpretation of the requirements of the Standards cited'. It would not be practicable for this engineer to sign off every use of that design aid. This would apply, for instance, to design aids for proprietary trusses or floor beams. Where these design aids are used, building consent documentation should include, as a minimum, relevant input assumptions such as soil type, the factors affecting wind loads, occupancy type and material specifications.

Building consent authorities (BCAs) may still accept, for example, non-complex designs prepared without the involvement of a CPEng. In such a case, the BCA will need to be satisfied, based on the complexity of the design and their previous knowledge of the designer's work, that the designer is competent to use the VM on a particular project.

Whether or not a CPEng is involved, a BCA will still need to be satisfied on reasonable grounds that the building will meet the relevant performance requirements of the Building Code.

VM amends some NZS 1170 requirements

Amendment 8 to the Compliance Document includes some important changes and limitations to the requirements of NZS 1170. These must be applied when NZS 1170 is used as part of a VM (as distinct from an alternative solution). Designers and BCAs must be aware of these changes and limitations when NZS 1170 is used as part of a VM. Consult the amended Compliance Document for full details.

Scope limitations

Some citation conditions clarify limits on the scope of the Standards. This highlights the need for BCAs to examine building consent applications to see that the VM covers all aspects of a design. It may be that part of the consent application will be an alternative solution proposal. The BCA should not just rely on a reference to a cited Standard for assurance that a consent application meets all the requirements.

The citation conditions amend the Standards so that their requirements that are expressed in non-mandatory terms, but are necessary for Building Code compliance, become part of the VM's requirements. This is done by making mandatory some material from the commentaries to the Standards. Similarly, some notes within the Standards are made mandatory, even though the Preface to the Standard indicates they are for guidance only.

Removal of older Standards

The following Standards will no longer be cited by B1/VM1 as they are out of date, are superseded by new editions or relate to working stress design that is no longer supported by Loadings Standards.

NZS 1900: Model building bylaw Ch 11: 1985 Special structures. Division 11.2 Farm buildings.	Withdrawn and not replaced. Out of date.
AS/NZS 1664:- Aluminium structures – Part 2: 1997 Allowable stress design	Withdrawn and not replaced. Not supported by NZS 1170. (Part 1, Limit state design, remains cited.)
NZS 3106: 1986 Code of practice for concrete structures for the storage of liquids	Withdrawn and not replaced. Out of date. New Standard being developed.
NZS 4203: 1984 Code of practice for general structural design and design loadings for buildings	Withdrawn, out of date. Replaced by NZS 1170.
NZS 4203: 1992 Code of practice for general structural design and design loadings for buildings	Withdrawn, out of date. Replaced by NZS 1170.
NZS 4219: 1983 Specification for seismic resistance of engineering systems in buildings	Withdrawn and not replaced. Out of date. New Standard being developed.
NZS 4230: Part 1: 1990: Code of practice for the design of masonry structures NZS 4230: Part 2: 1990 Commentary on the design of masonry structures.	Withdrawn and replaced by NZS 4230: 2004 with Amendment 1.

Masonry design

The 2004 edition of NZS 4230, Design of reinforced concrete masonry structures, including Amendment 1, will be cited in place of NZS 4230: 1990.

Loads for outdoor visitor structures

The Standards New Zealand Handbook, SNZ HB 8630: 2004, Tracks and outdoor visitor structures, will be cited to provide design loads for such structures.

Important changes

Roof loads

AS/NZS 1170 Part 1 specifies roof uniformly distributed actions (live loads) that become larger as the tributary area for a structural member becomes smaller. This results, for instance, in a live load of 0.5 kPa (twice the load required by NZS 4203) for a purlin that supports a roof area of 5 m². A purlin supporting 2 m² would have a live load of more than 1 kPa. The new B1/VM1 reinstates the NZS 4203 requirements so that trusses, rafters and purlins can be designed for similar loads as previously and an iterative design process does not become necessary.

Barrier loads

- **Barrier loads**

The loads for some barriers in AS/NZS 1170 Part 1 are greater than those in NZS 4203.

There is also a new point load requirement for all barriers. The citation clarifies where and how barrier loads are to be applied.

- **Barrier loads taken by handrail**

The citation reduces the effect of loads for exterior residential barriers. Where a barrier has a handrail that is below the top of the infill, the full load is applied to the handrail, but the load applied to the top of the infill is, in some circumstances, reduced to 50% of those required by NZS 1170.

- **Application height of barrier loads**

The Standard defines the height of action of barrier line loads as the top of any balustrade with no maximum specified. This is unreasonable and it is unlikely that loads will be applied at the top of barriers that are very high. The VM specifies a height of application as the top of the barrier or at a height of 1.2 m, whichever is the least. This is in line with overseas national standards.

- **Loads on vehicle barriers**

AS/NZS 1170 Part 1 increases by factors of 3 and more the design loads given in NZS 4203 for vehicle barriers of car parking decks and garages. The change made by the VM allows the use of energy-based methods to derive forces other than those set by the Standard.

Stability of buildings following fire

The Verification Method clarifies the application of structural loads during and after a fire, and reinstates the 0.5 kPa face load applied to the residual structure following a fire. This was in NZS 4203, but not in AS/NZS 1170.1.

Wind and snow loads – local effects

The maps for wind and snow load regions are small scale and fine detail is difficult to determine. In some cases, these maps are not based on robust data. Local authorities can provide design levels for use in their areas. This local wind or snow design information can take precedence over the equivalent information in NZS 1170 for determining actions on buildings.

Snow loads

After the damaging Canterbury snow storm of June 2006, the Department asked NIWA to review existing snow load data. As a result, the minimum snow load for the Canterbury, Otago and Southland regions is set at 0.9 kPa. Ongoing data collection may result in amendments to the snow provisions in the future.

Seismic loading

- **Changes to seismic hazard factors from NZS 4203: 1992**

In some areas, the NZS 1170 hazard factors are much higher than those in NZS 4203.

- **Horizontal design response spectrum correction**

The formula in NZS 1170 Part 5 for the serviceability limit state horizontal design response spectrum is corrected by the VM.

- **Special studies for seismic hazard in low risk areas**

When a special study gives a site specific hazard factor, Z , that is less than 0.08, the implicit requirement to consider a minimum magnitude 6.5 earthquake is relaxed by an amendment to the Standard by the VM. This has been done because, if the minimum hazard factor of 0.13 is applied in low seismic areas, unreasonably high return periods for the design earthquake can result. The minimum hazard factor of 0.13 may involve considerable cost consequences, and a reduction in requirements is acceptable where a project is large enough to justify a special study to determine seismic risk.

- **Time history analysis**

Numerical integration time history analysis is not included as part of the Verification Method.

This is because it requires a high degree of specialist experience for applying it safely.

This does not forbid its use, but any design that depends on time history analysis will be a proposed alternative solution to the Building Code.

B1/VM4: Foundations

The maximum sensitivity of cohesive soils the VM applies to has been reduced from 10 to 4 after a review of designs based on the higher value.

Amendment 8 corrects the formula in Figure 2 of VM4, which is for the effective foundation area for a circular foundation subject to vertical load and moment. It was too conservative before, so designs done to the previous version are not at risk.

Transitional arrangements

Effective date

The effective date of the B1 Structure Compliance Document (Amendment 8) is 1 December 2008.

How these transitional arrangements would relate to building consents and code compliance certificates is explained below.

Building consents issued before 31 March 2005

Where a building consent was issued before 31 March 2005 and a code compliance certificate has not been issued, the building consent authority has to issue the code compliance certificate if it is satisfied on reasonable grounds that the completed building work complies with the Building Code in place at the time the consent was issued.

Building consents applied for from 31 March 2005 to 30 November 2008

Where a building consent is applied for between 31 March 2005 and 30 November 2008 and the applicant uses B1 Compliance Document, Amendment 7, (including NZS 4203) as the Verification Method, the BCA has to issue the consent if it is satisfied that the performance criteria of the Building Code will be achieved. The applicant must apply for the consent before 1 December 2008. At the completion of the building work, the building consent authority must issue the code compliance certificate if the building work complies with the building consent.

Where a building consent is applied for between 31 March 2005 and 30 November 2008 and the applicant uses B1 Structure Compliance Document, Amendment 8, (including NZS 1170) as an alternative solution, or uses another alternative solution, the building consent authority must issue the consent if it is satisfied that the performance criteria of the Building Code will be achieved. If it refuses to issue the consent, the building consent authority must notify the applicant in writing giving reasons. When the building work is complete, the building consent authority must issue the code compliance certificate if the building work complies with the building consent.

Building consents applied for from 1 December 2008

Where a building consent is applied for on or after 1 December 2008 for Amendment 8, the applicant may use B1 Structure Compliance Document (Amendment 8) as the Verification Method for the building consent authority to issue the consent. When the building work is complete, the building consent authority must issue the code compliance certificate if the building work complies with the building consent.

B1 Structure Compliance Document (Amendment 7) may not be used as a Verification Method for a building consent from 1 December 2008.

Amended Compliance Document available

The Building Code Compliance Documents are available in the following formats.

- Hard copy
- CD-ROM (with a subscription for updates)
- PDFs of individual documents

Hard copies and CD-ROMs are available from the Victoria University Book Centre. You can download the PDF files free from our website, www.dbh.govt.nz