BUILDING PERFORMANCE

B1

B1 Structure

Verification Method B1/VM1

Structural design of buildings

SECOND EDITION | EFFECTIVE 28 JULY 2025

MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
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Te Kāwanatanga o Aotearoa
New Zealand Government

Preface

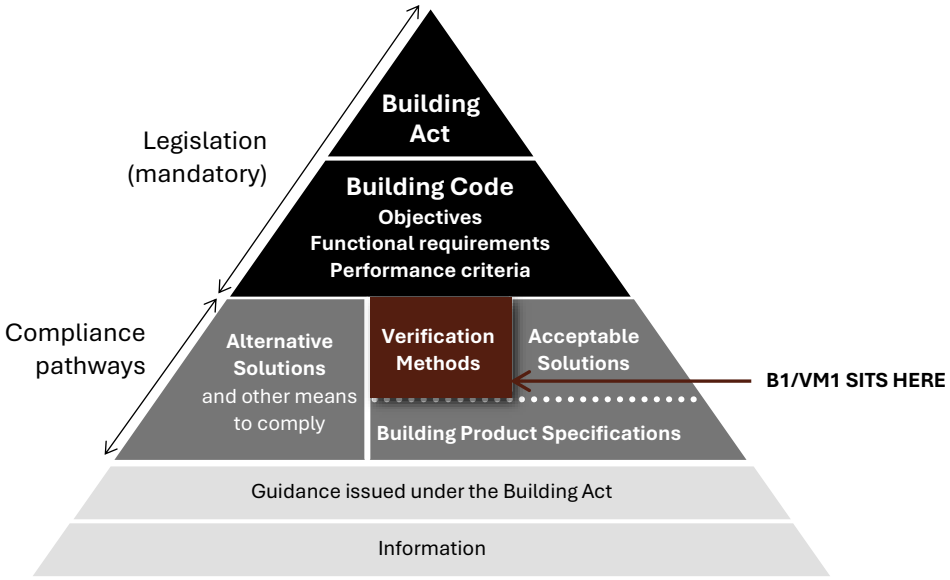
Document status

This document (B1/VM1) is a verification method issued under section 22 (1) of the Building Act 2004 and is effective on 28 July 2025. It does not apply to building consent applications submitted before 28 July 2025. The previous Verification Method B1/VM1 First Edition, as amended, can be used to show compliance until 31 July 2026 and can be used for building consent applications submitted before 1 August 2026.

Building Code regulatory system

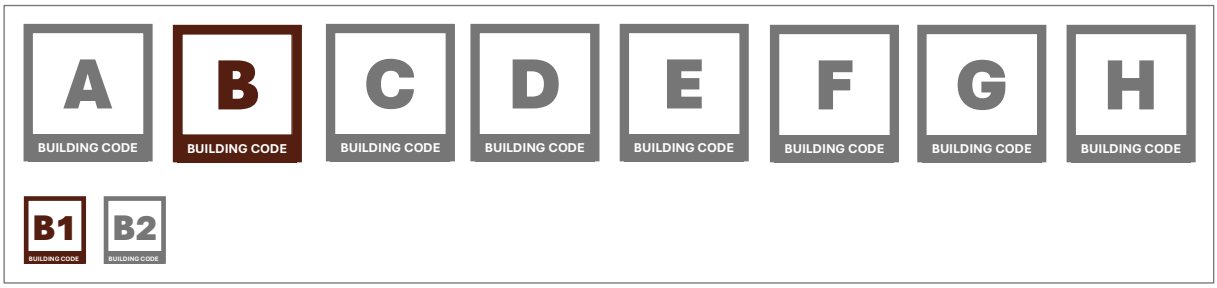
Each verification method outlines the provisions of the Building Code that it relates to. Complying with an acceptable solution or verification method are ways of complying with that part of the Building Code. Other options for establishing compliance are listed in section 19 of the Building Act.

Schematic of the Building Code system



A building design must take into account all parts of the Building Code. The Building Code is located in Schedule 1 of the Building Regulations 1992 and available online at www.legislation.govt.nz.

The part of the Building Code that this verification method relates to is clause B1 Structure. Information on the scope of this document is provided in Part 1. General.



Further information about the Building Code, including objectives, functional requirements, performance criteria, acceptable solutions, and verification methods, is available at www.building.govt.nz.

Main changes in this version and features of this document

Main changes in this version

This verification method is the second edition of B1/VM1. The main changes from the previous version are:

- The document has been published in a standalone format and the layout has been revised to improve clarity. This includes using a common structure for headings and text throughout the verification method.
- Minor amendments have been made to correct typos, grammar, cross-references, punctuation, wording, and formatting of the document. This includes changes to headings, paragraphs, tables and figures, table and figure notes, and definitions. These amendments do not affect the level of performance required in the document but may assist in the interpretation of the requirements.
- The title of the document has been revised from "General" to "Structural design of buildings" to reflect the scope of the verification method and the standards referenced within it. Additional information on the document and its scope is provided in Part 1. General.
- The verification method now refers to the Building Product Specifications for structural steel and steel fasteners in Paragraph 3.2.2.1, windows in Paragraph 4.2.1.1, and compaction testing in Paragraph 5.1.1.2. More information on the Building Product Specifications is provided in Subsection 1.2.2.
- References have been revised to reflect the documents cited in this verification method in Appendix A.
- Definitions have been revised to reflect the terms used in this verification method in Appendix B.

People using this document should check for amendments on a regular basis. The Ministry of Business, Innovation and Employment may amend any part of any acceptable solution or verification method at any time. Up-to-date versions of acceptable solutions or verification methods are available from www.building.govt.nz.

Features of this document

- For the purposes of Building Code compliance, the standards and documents referenced in this verification method must be the editions, along with their specific amendments listed in Appendix A.
- Words in *italic* are defined at the end of this document in Appendix B.
- Hyperlinks are provided to cross-references within this document and to external websites and appear with a blue underline.
- Appendices to this verification method are part of, and have equal status to, the verification method. Figures are informative only and the wording of the paragraphs takes precedence. Text boxes headed 'COMMENT' occur throughout this document and are for guidance purposes only.
- A consistent number system has been used throughout this document. The first number indicates the Part of the document, the second indicates the Section in the Part, the third is the Subsection, and the fourth is the Paragraph. This structure is illustrated as follows:

2	Part
2.5	Section
2.5.3	Subsection
2.5.3.1	Paragraph
2.5.3.1(a)	Paragraph (as a portion of the relevant paragraph)
2.5.3.1(a)(i)	Paragraph (as a portion of the relevant paragraph)

Contents

Part 1. General

1.1 Introduction

1.1.1 Scope of this document

1.1.1.1 This verification method can be used for the design of *buildings* and structures.

1.1.1.2 Limitations on the scope of this verification method are specified in each of the cited standards along with the modifications and additional requirements stated in this document.

1.1.2 Items outside the scope of this document

1.1.2.1 This verification method does not contain provisions for foundations. For foundations, refer to Verification Method B1/VM2 or use an alternative means to demonstrate compliance.

1.1.2.2 The citation of standards covers only the scope stated or implicit in each standard. Aspects outside the scope, when applied to a particular *building*, are not part of the verification method.

1.1.3 Compliance pathway

1.1.3.1 This verification method is one option that provides a means of establishing compliance with the functional requirements and performance criteria in Building Code clause B1 Structure. It can be used to demonstrate compliance with clauses B1.2, B1.3.1, B1.3.2, B1.3.3, B1.3.4, B1.3.5, B1.3.6, and B1.3.7.

1.1.3.2 If this verification method cannot be followed in full, use an alternative means to demonstrate compliance.

1.2 Using this verification method

1.2.1 Modification and citation of standards

1.2.1.1 This verification method contains modifications of cited standards in order to achieve compliance with the Building Code. The modifications are given for the relevant provisions in each standard.

1.2.1.2 Citation of Standards in this verification method is subject to the following conditions:

a) provisions in the cited standards that are in non-specific or unquantified terms do not form part of the verification method. This includes, but are not limited to:

   i) special studies, and

   ii) manufacturer's advice, and

   iii) references to methods that are appropriate, *adequate*, suitable, relevant, satisfactory, acceptable, applicable, or the like; and

b) where AS/NZS 1170 is used in combination with other standards cited in this verification method and there are incompatibilities with these other standards, then the underlying philosophy, general approach, currency of information, and methods of AS/NZS 1170 take precedence; and

c) an engineer with relevant experience and skills in structural engineering shall be responsible for interpretation of the requirements of the standards cited when used for *building* structure design. A structural engineer who is chartered under the Chartered Professional Engineers of New Zealand Act 2002 would satisfy this requirement.

1.2.2 Building Product Specifications

1.2.2.1 This verification method refers to the Building Product Specifications for *building* product standards and specifications in relation to their manufacture, fabrication, testing, quality control, physical properties, performance, installation, and/or maintenance

General

1.2.2.2 The Building Product Specifications cannot be used in isolation to demonstrate compliance with any requirements of the Building Code. To comply with B1/VM1, *building* products conforming to the Building Product Specifications must be used with the scope, limitations, and other applicable requirements set out in this verification method.

Part 2. Structural design actions

2.1 AS/NZS 1170 suite of standards

2.1.1 Overview

2.1.1.1 Structural design actions shall comply with the AS/NZS 1170 suite of standards comprising of:

a) for general principles, AS/NZS 1170.0:2002 including Amendments 1, 2, 3, 4, and 5 as modified in Section 2.1.1.2; and

b) for permanent, imposed, and other actions, AS/NZS 1170.1:2002 including Amendments 1 and 2 as modified in Section 2.3; and

c) for wind actions, AS/NZS 1170.2:2011 including Amendments 1, 2, 3, 4, and 5 as modified in Section 2.4; and

d) for snow and ice actions, AS/NZS 1170.3:2003 including Amendment 1 as modified in Section 2.5; and

e) for earthquake actions, NZS 1170.5:2004 as modified in Section 2.6.

> COMMENT: This suite of standards, together with their amendments and modifications, are referred to collectively in this verification method as "AS/NZS 1170".

2.1.1.2 Where AS/NZS 1170 calls for the use of appropriate material standards, only those material standards and Building Product Specifications referenced in this verification method are included. Use of other standards must be treated as an alternative solution.

2.1.1.3 "Notes" that relate to clauses, tables, or figures of AS/NZS 1170 are part of the verification method.

> COMMENT: AS/NZS 1170 makes a general statement that notes are not an integral part of the standard. However, in many cases the content of the notes makes them an integral part of the interpretation of the standard. In these cases, the notes have been specifically cited as being part of this verification method.

2.2 General principles

2.2.1 Combinations of actions

2.2.1.1 In AS/NZS 1170.0, add the following to the end of the Clause 4.1 General:

a) "The combination factors for permanent actions (dead loads) are based on the assumption that they have a coefficient of variation of approximately 10%. Situations where this assumption is not valid are outside the scope of this verification method."

2.2.1.2 In AS/NZS 1170.0, replace Clause 4.2.4 with the following:

a) "The combination of actions for checking strength and stability for the ultimate limit state for *fire* shall be as follows:

(a) During the *fire*:

(i) [G, thermal actions arising from fire, $\psi_l Q$] together with:

(ii) a lateral force of 2.5% of ($G + \psi_c Q$) applied as per Clause 6.2.2.

(b) After the *fire* until the *building* is either repaired or demolished:

(i) [G, thermal actions arising from *fire*, $\psi_l Q$] together with the more critical of either:

(ii) a lateral force of 2.5% of ($G + \psi_c Q$) applied as per Clause 6.2.2. or

(iii) a uniformly distributed horizontal face load of 0.5 kPa in any direction.

Account shall be taken of the effects of the *fire* on material properties and the geometry of the structure."

2.3 Permanent, imposed, and other actions

2.3.1 Imposed actions

2.3.1.1 In AS/NZS 1170.1 Table 3.2:

a) replace the entry for "R2, Other roofs (i) Structural elements" with: "R2 Other roofs (i) Structural elements 0.25 1.1"; and

b) remove Note 2; and

c) remove Note 3

2.3.1.2 In AS/NZS 1170.1 Clause 3.6 Barriers:

a) in the first paragraph, second sentence, replace "... top edge or handrail..." with:

i) "... top edge and rail..."; and

b) replace the second paragraph with:

i) "Apply as detailed below the uniformly distributed line loads (kN/m), uniformly distributed loads (kPa) and concentrated loads (kN) given in Table 3.3.

For the purposes of applying loads, a rail shall be any handrail or any top rail having a width in plan of greater than 30 mm.

The following are separate load cases, and one load at a time, either vertical or horizontal, is to be applied.

(a) Line loads (kN/m). Regardless of barrier height, line loads need not be applied more than 1200 mm above the floor (or stair pitch line):

(i) For domestic and residential activities, other residential (Row 2 of Table 3.3)

For barriers with a rail or rails:

– apply the horizontal load to the top rail

– where the top of the barrier is not a rail and where it is less than 200 mm above the top rail, the horizontal load to the top of the barrier may be reduced by 50%, otherwise apply the full horizontal load

– apply the vertical load to the top of the barrier.

For barriers without a rail, apply:

– the horizontal load at 900 mm above the floor (or stair pitch line)

– 50% of the horizontal load to the top of the barrier

– the vertical load to the top of the barrier

(ii) For all types of occupancy other than Row 2 of Table 3.3:

– apply the loads to the top edge of the barrier and to the top rail

– where the top of the barrier is not a rail and where it is less than 200 mm above the top rail, the horizontal load to the top of the barrier may be reduced by 50%, otherwise apply the full horizontal load.

(b) Distributed loads (kPa):

(i) For all types of occupancy:

– consider the load as acting over the whole area bounded by the top of the barrier and the floor line for the full length of the barrier

– distribute this load to the appropriate solid portions of the barrier.

(c) Concentrated loads (kN):

(i) For all types of occupancy:

– consider each concentrated load to be distributed over a circular or square area of 2000 mm^2

– apply concentrated loads so as to produce the most severe effect on the structural element being considered

– concentrated loads applied more than 1200 mm above the floor (or stair pitch line) may be reduced by 50%

– where the barrier infill or balustrade consists of parallel vertical members, less than 100 mm wide and with spaces between them of less than 100 mm, 50% of the concentrated load may be applied to each vertical member."

COMMENT: In Table 3.3, "external balconies" for domestic and residential activities applies to decks, balconies, verandahs, and the like of individual houses as well as multi-unit dwellings. Such barriers may be required by clause F4 Safety from falling of the Building Code.

2.3.2 Car parks

2.3.2.1 For car parks in AS/NZS 1170.1, add to the last paragraph of Clause 3.8:

a) "The basis for determining the horizontal impact actions on barriers quoted in the Clause, including the assumed deceleration distances, is given in Clause C 3.8 of the Commentary to AS/NZS 1170 Part 1. Different design actions may be derived using Equation C3.8, provided that:

(i) The deceleration length applied is based on analysis or tests.

(ii) The vehicle mass and associated velocity are not reduced from those quoted in Commentary Clause C3.8."

2.3.3 Track and outdoor visitor structures

2.3.3.1 For track and outdoor visitor structures in AS/NZS 1170.1 Appendix B, replace the last paragraph with the following:

a) "For the design of outdoor visitor structures as defined in SNZ HB 8630:2004, the imposed actions must be as given by that publication with references to NZS 4203 replaced by equivalent references to AS/NZS 1170."

2.4 Wind

2.4.1 Local wind design information

2.4.1.1 In AS/NZS 1170.2, add the following at the end of Clauses 3.2 and 4.4.3:

a) "Where local wind design information is more onerous than determined by this standard and is published and required to be used by any *territorial authority* for its area, this local wind design information shall take precedence over the equivalent information in this standard for the determination of wind actions on buildings.

Where such local wind design information is less onerous than that of this standard, the use of such information is not part of this verification method."

2.5 Snow and ice

2.5.1 Local snow and ice design information

2.5.1.1 In AS/NZS 1170.3, add the following at the end of Clause 2.1:

a) "Where local snow and ice design information is more onerous than determined by this standard and is published by any *territorial authority* for its area, this local snow and ice

design information shall take precedence over the equivalent information in this standard for the determination of snow and ice actions on buildings.

Where such local snow and ice design information is less onerous than that of this standard, the use of such information is not part of this verification method."

2.5.2 Ground snow loads

2.5.2.1 In AS/NZS 1170.3, add the following to end of Clause 5.4.3:

a) "For Regions N4 and N5 the minimum value of s_g for the ultimate limit state only must be taken as 0.9 kPa."

2.6 Earthquakes

2.6.1 Special studies

2.6.1.1 In NZS 1170.5, add the following to the end of the Clause 1.4:

a) "Where a special study yields a site-specific uniform risk design spectrum for 500 year return period equivalent to a hazard factor, Z, of less than 0.08, a design spectrum equivalent to at least Z = 0.10 may be adopted and the minimum magnitude 6.5 earthquake need not be considered."

COMMENT: In areas where the uniform risk hazard factor is less than 0.08, the use of a minimum hazard factor Z = 0.13 implies design for earthquakes with extremely low probabilities of occurrence. For some projects in these areas this may involve considerable cost consequences and a reduction in requirements is acceptable when site-specific hazard studies are undertaken.

2.6.2 Consequence changes due to the 2010/2011 Canterbury earthquakes

2.6.2.1 As a result of the 2010/11 sequence of earthquakes in Canterbury, NZS 1170.5 shall modified as follows:

a) add the following to the end of Clause 3.1.4:

   i) "The minimum hazard factor Z (defined in Table 3.3) for the *Canterbury earthquake region* shall be 0.3. Where factors within this region are greater than 0.3 as provided by NZS 1170.5, then the higher value shall apply."; and

b) in Table 3.3,

   i) replace row 102 Christchurch 0.22, with 102 Christchurch 0.3, and

   ii) replace row 101 Akaroa 0.16, with 101 Akaroa 0.3; and

c) modify Figure 3.4 Hazard factor Z for the South Island to show a minimum hazard factor Z of 0.3 for the *Canterbury earthquake region* and where factors within this region are greater than 0.3 as provided by NZS 1170.5, then the higher value shall apply.

COMMENT:

1. As a result of the 2010/11 sequence of earthquakes in Canterbury, there is a heightened risk of seismic activity over the next few decades above that currently factored into structural design requirements. B1/VM1 is amended to reflect an increased seismic hazard factor for the *Canterbury earthquake region*.
2. The seismic hazard factor Z defined in NZS 1170.5 (Table 3.3) has been raised for the *Canterbury earthquake region*. This is reflected in the modifications in this subsection in B1/VM1.

2.6.3 Seismic weight and seismic mass

2.6.3.1 In NZS 1170.5 Clause 4.2 Seismic weight and seismic mass, after: "0.3 is the earthquake imposed action (live load) combination factor for all other applications" add the following:

a) "except roofs.
ψ_E = 0.0 is the earthquake imposed action (live load) combination factor for roofs."

2.6.4 Time history analysis

2.6.4.1 Time history analysis in NZS 1170.5 Sections 5 and 6 is not part of this verification method.

> COMMENT: Time history analysis is a highly specialised method of assessing structural response to earthquakes. It requires many detailed and interdependent assumptions to be made in relation to the nature of earthquake shaking and its propagation from the source, the properties of the *building* site and the detailed characteristics of the *building* and its structural elements.
>
> AS/NZS 1170 outlines the steps for time history analysis in some detail, but the applicability of each step needs to be evaluated on a *building*-by-*building* basis. More importantly, the output of the analysis needs to be examined carefully in each particular context.
>
> Time history analysis can be an acceptable aid to verifying compliance with structural requirements provided that:
>
> - It is carried out by specialists with in-depth experience in applying the technique.
> - The output of the analysis and the viability of the resulting structural design are reviewed by an independent team experienced in both analysis and design.

2.6.5 Design earthquake actions and structural analysis

2.6.5.1 In NZS 1170.5 Clause 5.2.2.3, replace equation 5.2(4) with:

a) $C_d(T) = \frac{C(T)S_p}{k_\mu}$

2.6.5.2 In NZS 1170.5 Clause 6.1.4.1 Requirement for modelling,

a) replace the last sentence of the first paragraph with:
   i) "The model shall include representation of the diaphragm's flexibility."; and
b) remove the third (last) paragraph.

Part 3. Buildings and structures

3.1 Concrete

3.1.1 Concrete and masonry structures

3.1.1.1 Concrete and concrete masonry structures shall comply with the following standards to the extent relevant:

a) NZS 3101.1 for concrete structures subject to the modifications in Subsection 3.1.2; and/or

b) NZS 3106 for concrete structures for the storage of liquids; and/or

c) NZS 4230 for concrete masonry structures subject to the modification in Subsection 3.1.3; and/or

d) the additional requirements for welded steel mesh in Subsection 3.1.4.

3.1.2 Modifications to NZS 3101.1 for concrete structures

3.1.2.1 In NZS 3101.1, replace reference to AS/NZS 4671:2001 with AS/NZS 4671:2019.

3.1.2.2 In NZS 3101.1, for the detailing requirements for the support of hollow-core floors:

a) delete the existing Clause 18.7.4.4 and replace with 'Support of hollow-core floors is not part of this verification method'.

COMMENT:

1. The detailing requirements for the support of hollow-core floors, including use of the proposed detail of NZS 3101.1 and C18.6.7 of NZS 3101.2: 2006, comprises an alternative solution.
2. It is expected that additional evidence (both testing and analysis) would be required to demonstrate the compliance of support design for the hollow-core floors. This would need to include demonstrating that the support is able to accommodate deformation of the structure taking into account three-dimensional boundary conditions and diaphragm inertial loads.
3. Welded wire fabric that is used in designs to NZS 3101.1 is subject to the requirements of Subsection 3.1.4 of this verification method.

3.1.3 Modifications to NZS 4230 for concrete masonry structures

3.1.3.1 In NZS 4230, replace reference to AS/NZS 4671:2001 with AS/NZS 4671:2019.

3.1.4 Welded steel mesh

3.1.4.1 Where Grade 500E welded steel mesh is specified, it shall meet the requirements of AS/NZS 4671.

3.2 Steel

3.2.1 Steel structures

3.2.1.1 Steel structures shall comply with:

a) NZS 3404.1 for steel structures subject to the modifications and additional requirements in Subsection 3.2.2; or

b) AS/NZS 4600 for cold-formed steel structures subject to the modifications in Subsection 3.2.3.

3.2.2 Modifications to NZS 3404.1 for steel structures

3.2.2.1 For materials and brittle fracture in NZS 3404.1:

a) in Clause 2.2.1, the specification of structural steel shall comply with Subsection 3.4.2 of the Building Product Specifications; and

b) in Clause 2.3.1, steel bolts, nuts, and washers shall comply with Subsection 3.4.3 of the Building Product Specifications.

3.2.2.2 For general design requirements in NZS 3404.1, add the following after Clause 3.9:

a) "Clause 3.10 Documentation
The requirements in AS/NZS 5131 Section 4.1.1 General shall be applied."

3.2.2.3 For bolts and bolting categories in NZS 3404.1, in Clause 9.3.1.2 replace: "and AS 1559" with:

a) ", AS 1559, BS EN 14399-1, BS EN 14399-2, BS EN 14399-3 and BS EN 14399-5"

3.2.2.4 For the design of composite members and structures in NZS 3404.1, replace Section 13 Design of composite members and structures with the following:

a) "13 Design of composite members and structures shall be in accordance with AS/NZS 2327."

3.2.2.5 For fabrication and erection in NZS 3404.1, make the following modifications:

a) replace Section 14 Fabrication with the following:

i) "14 Fabrication The fabrication of steel structures shall be in accordance with AS/NZS 5131. Construction categories for the purposes of this Standard shall be determined in accordance with Appendix C of
AS/NZS 5131."; and

b) replace Section 15 Erection with the following:

i) "15 Erection The erection of steel structures shall be in accordance with AS/NZS 5131. Construction categories for the purposes of this standard shall be determined in accordance with Appendix C of AS/NZS 5131."; and

c) replace Section 16 Modification of existing structures with the following:

i) "16 Site modifications during erection and modification and repair of existing structures Site modifications during erection and modification and repair of existing structures shall be in accordance with AS/NZS 5131 Section 14 Site modifications during erection and modification and repair of existing structures."; and

d) add the following after Section 17:

i) "18 Architecturally exposed structural steelwork
The requirements in AS/NZS 5131 Section 10 Architecturally exposed structural steelwork shall be applied."

3.2.2.6 In the appendices in NZS 3404.1, make the following modifications:

a) in Appendix A, replace references to AS/NZS 3678, AS/NZS 3679.1 and AS/NZS 3679.2 in NZS 3404 with AS/NZS 3678:2016, AS/NZS 3769.1:2016, and AS/NZS 3679.2:2016; and

b) replace Appendix C Corrosion Protection with the following:

i) "Appendix C Corrosion Protection Corrosion protection shall be in accordance with SNZ TS 3404."; and

c) replace Appendix D Inspection of Welding to AS/NZS 1554.1 with the following:

i) "Appendix D Inspection of Welding
The recommendations in AS/NZS 5131 Appendix I Inspection of Welding and Bolting. (Informative) should be used."; and

d) replace Appendix K Standard test for evaluation of slip factor (normative) with the following:
   i) "Appendix K Standard test for evaluation of slip factor (normative)
   The requirements in AS/NZS 5131 Appendix G Standard test for evaluation of slip factor shall be used."; and

e) replace Appendix L Inspection of bolt tension using a torque wrench (informative) with the following:
   i) "Appendix L Inspection of bolt tension using a torque wrench (informative)
   The recommendations in AS/NZS 5131 Appendix H Inspection of bolt tension using a torque wrench should be used."; and

f) add the following after Appendix Q:
   i) "Appendix R Selection of materials for the avoidance of lamellar tearing (informative)
   The guidance in AS/NZS 1554.1 Appendix H Selection of materials for the avoidance of lamellar tearing should be used."

3.2.3 Modifications to AS/NZS 4600 for cold-formed steel structures

3.2.3.1 In AS/NZS 4600,

a) actions must be determined in accordance with AS/NZS 1170 as modified in Part 2. Structural design actions. All references to NZS 4203 are replaced by equivalent references to AS/NZS 1170 as modified by this verification method; and

b) the term "normative" identifies a mandatory requirement for compliance with this standard; and

c) the term "informative" identifies information provided for guidance or background which may be of interest to the standard's users. Informative provisions do not form part of the mandatory requirements of the standard; and

d) where this standard has provisions that are in non-specific or unquantified terms, these do not form part of the verification method. The proposed details must be submitted to the *building consent authority* for approval as part of the *building consent* application. This includes, but is not limited to, special studies and manufacturer's advice; and

e) all stages of *construction* of a structure or part of a structure to which this standard is applied shall be *adequately* reviewed by a person who, on the basis of experience or qualifications, is competent to undertake the review; and

f) the extent of the review to be undertaken shall be nominated by the design engineer, taking into account those materials and workmanship factors which are likely to influence the ability of the finished construction to perform in the predicted manner; and

g) at the end of the first paragraph of Appendix A add the words "Unless noted otherwise a document referred to below shall be the version of that document current at the date of issue of this standard or if amendments are cited to this standard in the "References" pages of this document at the latest date of those amendments."; and

h) Appendix B shall be read as normative with "shoulds" changed to "shalls".

3.3 Timber

3.3.1 Timber structures

3.3.1.1 Timber structures shall comply with NZS 3603 subject to the following modifications:

a) actions must be determined in accordance with AS/NZS 1170 as modified in Part 2. Structural design actions. All references to NZS 4203 are replaced by equivalent references to AS/NZS 1170 as modified by this verification method; and

b) replace Clause 2.2.1.2 with:

i) "Machine stress-grading shall be in accordance with AS/NZS 1748 as modified by NZS 3622. Machine stress-graded timber shall have its properties verified, and be identified, in accordance with the requirements of NZS 3622."

3.4 Aluminium

3.4.1 Aluminium structures

3.4.1.1 Aluminium structures shall comply with AS/NZS 1664.1 subject to the following modifications:

a) actions must be determined in accordance with AS/NZS 1170 as modified in Part 2. Structural design actions. All references to NZS 4203 are replaced by equivalent references to AS/NZS 1170 as modified by this verification method; and

b) the terms "capacity factor" and "strength limit state" are to be read as "*strength reduction factor*" and "ultimate limit state" respectively; and

c) where this standard has provisions that are in non-specific or unquantified terms then these do not form part of the verification method and the proposed details must be submitted to the *building consent authority* for approval as part of the *building consent* application. This includes, but is not limited to, special studies and manufacturer's advice; and

d) all stages of *construction* of a structure or part of a structure to which this standard is applied shall be adequately reviewed by a person who, on the basis of experience or qualifications, is competent to undertake the review; and

e) the extent of the review to be undertaken shall be nominated by the design engineer, taking into account those materials and workmanship factors which are likely to influence the ability of the finished *construction* to perform in the predicted manner; and

f) modify clause 1.2 to read "MATERIALS This Standard applies to aluminium alloys listed in Table 3.3(A) that comply with AS 1734, AS 1865, AS 1866, AS 1867 and AS 2748.1."; and

g) at the end of the first paragraph of Clause 1.4, add the words:

i) "Unless noted otherwise a document referred to below shall be the version of that document current at the date of issue of this standard or if amendments are cited to this standard in the "References" pages of the acceptable solutions and verification methods at the latest date of those amendments."

3.5 Earth buildings

3.5.1 Earth walled buildings

3.5.1.1 Earth *buildings* shall comply with NZS 4297 subject to the following modification:

a) actions must be determined in accordance with AS/NZS 1170 as modified in Part 2. Structural design actions. All references to NZS 4203 are replaced by equivalent references to AS/NZS 1170 as modified by this verification method.

Part 4. Individual building elements

4.1 Drains

4.1.1 Buried concrete pipes

4.1.1.1 Buried concrete pipes shall comply with AS/NZS 3725 subject to the modifications for:

a) referenced documents, definitions, and notation in Subsection 4.1.2; and

b) vertical loads, internal waters, and test loads in Subsection 4.1.3.

4.1.2 Referenced documents, definitions, and notation

4.1.2.1 In AS/NZS 3725, make the following modifications:

a) in Clause 3, add to the list of reference documents:

i) “NZS 3101 The design of concrete structures. NZS 4402 Methods of testing soils for civil engineering purposes: Tests 2.4, 2.8, 4.1.1, 4.2.1, 4.2.2, 4.2.3 and 5.1.1. New Zealand Geotechnical Society, Field Description of Soil and Rock – Guidelines for the field description of soils and rocks in engineering purposes.”; and

b) in Clause 4, in the paragraph headed "(c) Select fill", after the words "given in Table 1" add "or the New Zealand Geotechnical Society Guidelines”; and

c) in Clause 5, in the definition of Pt, replace “AS 4058” with “AS/NZS 4058”.

4.1.3 Vertical loads, internal water loads, and test loads

4.1.3.1 In AS/NZS 3725, make the following modifications:

a) in Clause 6.4, replace the word “may” with “shall” and remove the words “Superimposed concentrated dead loads should be avoided.”; and

b) in Clause 6.5.3.1, remove the words “The appropriate road vehicle loading shall be specified by the relevant highway authority or owner.”; and

c) in Clause 6.5.3.2.2.2, replace the word “may” with “shall”; and

d) in Clause 6.5.4.3, remove the words “unless otherwise specified by the Relevant Authority”; and

e) in Clause 6.5.5:

i) remove the first words “For”, and

ii) after the words “for aircraft types”, add the words “is outside the scope of this Standard but…”; and

f) in Clause 7, replace the word “should” with “shall”; and

g) in Clause 10.3, after the words “the test load”, add “or proof load”; and

h) in Appendix A, replace “Normative” with “Informative”; and

i) in Appendix B, replace “Normative” with “Informative”

4.2 Windows

4.2.1 Structural specification of windows

4.2.1.1 Windows shall comply with Subsection 4.4.1 of the Building Product Specifications.

4.3 Engineering systems in buildings

4.3.1 Seismic performance

4.3.1.1 Seismic performance of engineering systems shall comply with NZS 4219 subject to the following modification to the *Canterbury earthquake region*:

a) the zone factor shall be determined from the standard but shall not be less than 0.3.

Part 5. Siteworks

5.1 Engineered fill

5.1.1 Residential developments

5.1.1.1 Engineered fill for lightweight structures shall comply with NZS 4431.

5.1.1.2 Minimum compaction acceptance testing for engineered fill shall be carried in accordance with methods specified in Subsection 2.1.1 of the Building Product Specifications.

Appendix A. References

For the purposes of Building Code compliance, the standards and documents referenced in this verification method must be the editions, along with their specific amendments, listed below.

Standards New Zealand		Where quoted
AS/NZS 1170	Structural design actions	1.2.1.2, 2.1.1.1, 2.1.1.2, 2.1.1.3, 3.2.3.1, 3.3.1.1, 3.4.1.1, 3.5.1.1
AS/NZS 1170.0:2002	Structural design actions – Part 0: General principles Amendments 1, 2, 3, 4, 5	2.1.1.1, 2.2.1.1, 2.2.1.2
AS/NZS 1170.1:2002	Structural design actions – Part 1: Permanent imposed and other actions, Amendments 1, 2	2.1.1.1, 2.3.1.1, 2.3.1.2, 2.3.2.1, 2.3.3.1
AS/NZS 1170.2:2011	Structural design actions – Part 2: Wind actions Amendments 1, 2, 3, 4, 5	2.1.1.1, 2.4.1.1
AS/NZS 1170.3:2003	Structural design actions – Part 3: Snow and ice actions Amendment 1	2.1.1.1, 2.5.1.1, 2.5.2.1
NZS 1170.5:2004	Structural design actions – Part 5: Earthquake actions – New Zealand	2.1.1.1, 2.6.1.1, 2.6.2.1, 2.6.3.1, 2.6.4.1, 2.6.5.1, 2.6.5.2
AS/NZS 1554.1:2014	Structural steel welding – Part 1: Welding of steel structures, Amendments 1, 2	3.2.2.6
AS/NZS 1664.1:1997	Aluminium structures – Part 1: Limit state design Amendment 1	3.4.1.1
AS/NZS 1748.1:2011	Timber – Stress graded for structural purposes – Part 1: General requirements, Amendment 1	3.3.1.1
AS/NZS 1748.2:2011	Timber – Stress graded for structural purposes – Part 2: Qualification of grading method, Amendment 1	3.3.1.1
AS/NZS 2327:2017	Composite structures – Composite steel-concrete construction in buildings Amendment 1	3.2.2.4
NZS 3101.1:2006	Concrete structures standard – Part 1: The design of concrete structures, Amendment 1, 2, 3	3.1.1.1, 3.1.2.1, 3.1.2.2, 4.1.2.1
NZS 3106:2009	Design of concrete structures for the storage of liquids	3.1.1.1
NZS 3404.1:1997	Steel structures standard, Amendment 1, 2	3.2.1.1, 3.2.2.1, 3.2.2.2, 3.2.2.3, 3.2.2.4, 3.2.2.5, 3.2.2.6
SNZ TS 3404:2018	Durability requirements for steel structures and components	3.2.2.6
NZS 3603:1993	Timber structures standard Amendments 1, 2, 4	3.3.1.1
NZS 3622:2004	Verification of timber properties Amendment 1	3.3.1.1

References

Standards New Zealand		Where quoted
AS/NZS 3678:2016	Structural steel – Hot-rolled plates, floorplates and slabs	3.2.2.6
AS/NZS 3679.1:2016	Structural steel – Part 1: Hot-rolled bars and sections	3.2.2.6
AS/NZS 3679.2:2016	Structural steel – Part 2: Welded I sections	3.2.2.6
AS/NZS 3725:2007	Design for installation of buried concrete pipes	4.1.1.1, 4.1.2.1, 4.1.3.1
AS/NZS 4058:2007	Precast concrete pipes (pressure and non-pressure)	4.1.2.1
NZS 4219:2009	Seismic performance of engineering systems in buildings	4.3.1.1
NZS 4230:2004	Design of reinforced concrete masonry structures Amendment 1	3.1.1.1, 3.1.3.1
NZS 4297:1998	Engineering design of earth buildings	3.5.1.1
NZS 4402.2.4:1986	Methods of testing soils for civil engineering purposes – Test 2.4: Soil classification tests – Determination of liquid limit	4.1.2.1
NZS 4402.2.8.1:1986	Methods of testing soils for civil engineering purposes – Test 2.8.1: Soil classification tests – Standard method by wet sieving	4.1.2.1
NZS 4402.2.8.2:1986	Methods of testing soils for civil engineering purposes – Test 2.8.2: Soil classification tests – Standard method by dry sieving	4.1.2.1
NZS 4402.2.8.3:1986	Methods of testing soils for civil engineering purposes – Test 2.8.3: Soil classification tests – Standard method for fine soils (pipette method)	4.1.2.1
NZS 4402.4.1.1:1986	Methods of testing soils for civil engineering purposes – Test 4.1.1: Soil compaction tests – Determination of the dry density/water content relationship – New Zealand standard compaction test	4.1.2.1
NZS 4402.4.2.1:1986	Methods of testing soils for civil engineering purposes – Test 4.2.1: Soil compaction tests – Determination of the minimum and maximum dry densities and relative density of a cohesionless soil – Minimum dry density	4.1.2.1
NZS 4402.4.2.2:1988	Methods of testing soils for civil engineering purposes – Test 4.2.2: Soil compaction tests – Determination of the minimum and maximum dry densities and relative density of a cohesionless soil – Maximum dry density	4.1.2.1
NZS 4402.4.2.3:1988	Methods of testing soils for civil engineering purposes – Test 4.2.3: Soil compaction tests – Determination of the minimum and maximum dry densities and relative density of a cohesionless soil – Relative density	4.1.2.1
NZS 4402.5.1.1:1986	Methods of testing soils for civil engineering purposes – Test 5.1.1: Soil density tests – Determination of the	4.1.2.1

References

Standards New Zealand		Where quoted
	density of soil – Sand replacement test for the determination of in situ density	
NZS 4431:1989	Code of practice for earth fill for residential development Amendment 1	5.1.1.1
AS/NZS 4600:2005	Cold-formed steel structures Amendment 1	3.2.1.1, 3.2.3.1
AS/NZS 4671:2019	Steel for the reinforcement of concrete	3.1.2.1, 3.1.3.1, 3.1.4.1
AS/NZS 5131:2016	Structural steelwork – Fabrication and erection Amendment 1	3.2.2.2, 3.2.2.5, 3.2.2.6
SNZ HB 8630:2004	Tracks and outdoor visitor structures	2.3.3.1

These standards can be accessed from www.standards.govt.nz.

British Standards Institution		Where quoted
BS EN 14399-1:2015	High-strength structural bolting assemblies for preloading – Part 1: General requirements	3.2.2.3
BS EN 14399-2:2015	High-strength structural bolting assemblies for preloading – Part 2: Suitability for preloading	3.2.2.3
BS EN 14399-3:2105	High-strength structural bolting assemblies for preloading – Part 3: System HR. Hexagon bolt and nut assemblies	3.2.2.3
BS EN 14399-5:2015	High-strength structural bolting assemblies for preloading – Part 5: Plain washers	3.2.2.3

These standards can be accessed from www.standards.govt.nz.

New Zealand Geotechnical Society	Where quoted
Field Description of Soil and Rock – Guidelines for the field descriptions of soils and rocks for engineering purposes. December 2005	4.1.2.1

These standards can be accessed from http://www.nzgs.org.

New Zealand Legislation	Where quoted
Chartered Professional Engineers of New Zealand Act 2002	1.2.1.2

These standards can be accessed from http://www.legislation.govt.nz.

Appendix B. Definitions

These definitions are specific to this verification method. Other defined terms italicised within the definitions are provided in clause A2 of the Building Code.

Term	Definition
Adequate	Adequate to achieve the objectives of the Building Code.
Building	Has the meaning given to it by sections 8 and 9 of the Building Act 2004.
Building consent	Means a consent to carry out *building* work granted by a *building consent authority* under section 49 of the Building Act 2004.
Building consent authority	Has the meaning given to it by section 7 of the Building Act 2004.
Building element	Any structural and non-structural component or assembly incorporated into or associated with a *building*. Included are *fixtures*, services, *drains*, permanent mechanical installations for access, glazing, partitions, ceilings and temporary supports.
Canterbury earthquake region	Is the area contained within the boundaries of the Christchurch City Council, the Selwyn District Council, and the Waimakariri District Council.
Construct	In relation to a *building*, includes to design, build, erect, prefabricate, and relocate the *building*; and construction has a corresponding meaning.
Drain	A pipe normally laid below ground level including fittings and equipment and intended to convey *foul water* or *surface water* to an *outfall*.
Fire	The state of combustion during which flammable materials burn producing heat, toxic gases, or smoke or flame or any combination of these.
Fixture	An article intended to remain permanently attached to and form part of a *building*.
Sitework	means work on a *building* site, including earthworks, preparatory to or associated with the *construction*, *alteration*, demolition or removal of a *building*.
Strength reduction factor	The factor by which the ultimate strength is multiplied to obtain the design strength. COMMENT: NZS 4203:1992 uses the terms ideal strength in place of ultimate strength, and dependable strength in place of design strength.
Surface water	All naturally occurring water, other than sub-surface water, which results from rainfall on the site or water flowing onto the site, including that flowing from a *drain*, stream, river, lake or sea.
Territorial Authority (TA)	means a city council or district council named in Part 2 of Schedule 2 of the Local Government Act 2002; and – a) in relation to land within the district of a territorial authority, or a *building* on or proposed to be built on any such land, means that territorial authority; and b) in relation to any part of a coastal marine area (within the meaning of the Resource Management Act 1991) that is not within the district of a territorial authority, or a *building* on or proposed to be built on any such part, means the territorial authority whose district is adjacent to that part.

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