

AS/NZS 1170.0 Supplement 1:2002

Structural design actions—General principles—Commentary (Supplement to AS/NZS 1170.0:2002)



Standards Australia



AS/NZS 1170.0 Supp 1:2002

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STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

RECONFIRMATION

OF

AS/NZS 1170.0 SUPP 1:2002

**Structural design actions—General principles—Commentary (Supplement to
AS/NZS 1170.0:2002)**

RECONFIRMATION NOTICE

Technical Committee BD-006 has reviewed the content of this publication and in accordance with Standards Australia procedures for reconfirmation, it has been determined that the publication is still valid and does not require change.

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NOTES

AS/NZS 1170.0 Supplement 1:2002

Structural design actions—General principles—Commentary (Supplement to AS/NZS 1170.0:2002)

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PREFACE

This Commentary was prepared by the Joint Standards Australia/Standards New Zealand Committee BD-006, General Design Requirements and Loading on Structures, as a Supplement to AS/NZS 1170.0, *Structural design actions*, Part 0: *General principles*. This Commentary supersedes in part AS 1170.1—1989, *Minimum design loads on structures*, Part 1: *Dead and live loads and load combinations* and in part NZS 4203:1992, *Code of practice for general structural design and design loadings for buildings* (Vol. 2).

This Commentary incorporates Amendment No. 1 (November 2003). The changes required by the Amendment are indicated in the text by a marginal bar and amendment number against the clause, note, table, figure or part thereof affected.

The Commentary provides background material for and guidance to the requirements of the Standard.

The clause numbers of this Commentary are prefixed by the letter ‘C’ to distinguish them from references to the Standard clauses to which they directly relate. Where a Commentary to certain clauses is non-existent, it is because no explanation of the Clause is necessary.

The intention is that the AS/NZS 1170 series of Standards will be applied by a suitably qualified professional.

The AS/NZS 1170 series sets out the basic procedure for the structural design of structures. Other Standards that provide engineered solutions for particular situations (e.g., house framing) may be based on the methods given in these Standards. The AS/NZS 1170 series includes clauses that contain an element of engineering judgement. This reflects the fact that engineering is a creative activity based on science applied with art and skill.

ACKNOWLEDGEMENT

Standards Australia wishes to acknowledge and thank the following members who have contributed significantly to this Commentary:

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STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

Australian/New Zealand Standard**Structural design actions—General principles—Commentary
(Supplement to AS/NZS 1170.0:2002)**

SECTION C 1 SCOPE AND GENERAL

C1.1 SCOPE

This Commentary is intended to be read in conjunction with AS/NZS 1170.0:2002. It explains the provisions of and, in some cases, suggests approaches that may satisfy the intent of the Standard. Commentary Clauses are not mandatory. Lists of references are also given for further reading.

The Standard (AS/NZS 1170.0) has been revised as a joint Australian/New Zealand Standard. It specifies the basic procedure for the structural design of structures including buildings. Other documents may be relevant for the details of building design (e.g., design of fire escapes) that are not needed for the design of the structure.

The Standard incorporates the fundamentals of the limit states method and enables the designer to confirm the design of a structure. The intention is that confirmation establishes the ability of the proposed structure to resist known or foreseeable types of action appropriate to the intended use and design working life of the structure.

The determination of structural resistance is covered by the Standards for design of materials.

Much of the philosophy and some of the text (for example, most of the definitions and notation) are drawn from ISO Standards, including ISO 2394, ISO 3898, ISO 4356 and ISO 8930.

The general principles given in the Standard are relevant to the design of any structure. However, the information may not be sufficient for some structure types because their design is more complex (due to the inherent behaviour of the structure) or involves loadings that are not covered (type of action or load case), or other Standards give design criteria.

Structures and structural elements should be designed so that they are suited for their intended use during the design working life.

ISO 2394 states the following:

‘In particular, they shall fulfil, with appropriate degrees of reliability, the following objectives:

- (a) They shall perform adequately under all expected actions.
- (b) They shall withstand both extreme actions and frequently repeated actions occurring during their construction and anticipated use.
- (c) They shall have structural robustness.’

These three objectives enunciate the serviceability, ultimate and fatigue, and progressive collapse (structural robustness) aspects of design.

SPECIAL STUDIES

Where methods or information used in a design are outside the scope of the Standard justification would normally be required for approval under building regulations. This would require a 'special study'. A special study is a means of establishing information for use in design that is not specifically stated in the Standard. This may include information varied from or not included in the Standard (see Appendix A and its Commentary). The results of such special studies are outside the scope of the Standard.

Special studies may be carried out at the initiative of the designer for any building, subject to satisfying the requirements of the appropriate authority. Appendix B covers testing as part of a special study.

Appendix CA gives additional information on actions not covered, including—

- (i) movement effects;
- (ii) construction loads; and
- (iii) accidental actions.

OTHER STRUCTURE TYPES

The following publications give information useful or necessary for the design of the structures indicated:

- (A) HB77 for bridges.
- (B) AS 4678 for earth-retaining structures.
- (C) AS 3995 for lattice towers and masts, including electrical transmission structures.
- (D) AS 3962 for marinas.
- (E) AS 3826, ISO 2394 and ISO 13822 for assessment of existing structures.
- (F) AS 2159 for piling.
- (G) AS/NZS 4676 for utility services poles.
- (H) AS 1418 for cranes.
- (I) AS/NZS 1576 for scaffolding.
- (J) AS 3610 for formwork.
- (K) AS 2156.2 for walking track structures.

The design of chimneys may require the use of specialist publications.

Off shore structures require additional information on winds, waves, currents and earthquake.

High-risk structures that require special reliability consideration (such as dams) are generally covered by the special requirements of the regulatory authorities responsible for them.

C1.2 APPLICATION

C1.3 REFERENCED DOCUMENTS

The following documents are referred to in this Commentary:

AS	
1418	Cranes (including hoists and winches)
2156	Walking tracks
2156.2	Part 2: Infrastructure design

AS	
2159	Piling—Design and installation
2327	Composite structures
2327.1	Part 1: Simply supported beams
3610	Formwork for concrete
3826	Strengthening existing buildings for earthquake
3962	Guidelines for marinas
3995	Design of steel lattice towers and masts
4040	Methods of testing sheet roof and wall cladding
4040.3	Part 3: Resistance to wind pressures for cyclone regions
4678	Earth retaining structures
HB77	Australian bridge design code
AS/NZS	
1170	Structural design actions
1170.0	Part 0: General principles
1170.1	Part 1: Permanent, imposed and other actions
1170.2	Part 2: Wind actions
1576	Scaffolding
1576.1	Part 1: General requirements
4673	Cold-formed stainless steel structures
4676	Structural design requirements for utility services poles
ISO	
2394	General principles on reliability for structures
3898	Bases for design of structures—Notations—General symbols
4356	Bases for the design of structures—Deformations of buildings at the serviceability limit states
8930	General principles on reliability for structures—List of equivalent terms
10137	Bases for design of structures—Serviceability of buildings against vibration
13822	Bases for design of structures—Assessment of existing structures

Other documents are detailed in Clause C4.3 and Appendix CZ.

C1.4 DEFINITIONS

The definitions are drawn from or based on ISO 2394 and ISO 8930 except for those for design capacity, load, proof testing and prototype testing, which are not defined in those Standards.

C1.5 NOTATION

The notation used in AS/NZS 1170.0 follows the guidelines given in ISO 3898. The same notation is used in this Commentary together with the following:

$P-\Delta$ = load and deflection effects (second order analysis).

SECTION C2 STRUCTURAL DESIGN PROCEDURE

C2.1 GENERAL

The use of this Standard within the regulatory framework in Australia and New Zealand differs and the Standard includes clauses that are specific to these countries. Reference is made to the Building Code of Australia for Australia and to Section 3 for New Zealand.

The clauses include the determination of appropriate levels of environmental actions for a particular structure and the appropriate materials design Standards.

Materials design Standards include the following:

AS

1720	Timber structures
1720.1	Part 1: Design methods
2159	Piling—Design and installation
2327	Composite structures
2327.1	Part 1: Simply supported beams
3600	Concrete structures
3700	Masonry structures
4100	Steel structures
4678	Earth retaining structures

AS/NZS

1664	Aluminium structures
1664.1	Part 1: Limit state design
4065	Concrete utility services poles
4600	Cold-formed steel structures
4673	Cold-formed stainless steel structures
4676	Structural design requirements for utility services poles
4677	Steel utility services poles

NZS

3101	Concrete structures standard
3101.1	Part 1: The design of concrete structures
3404	Steel structures standard
3404.1	Part 1: Steel structures standard
3603	Timber structures standard
4223	Glazing in buildings
4230	The design of masonry structures
4297	Engineering design of earth buildings

C2.2 ULTIMATE LIMIT STATES

Where other actions than those given in the Standard are relevant to the design of the structure, the following additional steps should be added to the procedure given in Clause 2.2 before the structure is analysed:

- (a) Determine values for any other applicable actions.
- (b) Determine combinations for any other applicable actions.

This would be the subject of a special study.

C2.3 SERVICEABILITY LIMIT STATES

The selection of the serviceability criteria and their limits is outside the scope of the Standard. Some advice is given in Appendix C. Selection of criteria for serviceability may require a special study.

Where other actions than those given in the Standard are relevant to the design of the structure, the following additional steps should be added to the procedure given in Clause 2.3 before the structure is analysed:

- (a) Determine values for any other applicable actions.
- (b) Determine combinations for any other applicable actions.

SECTION C3 ANNUAL PROBABILITY OF EXCEEDANCE (FOR NEW ZEALAND USE ONLY)

C3.1 GENERAL

C3.2 IMPORTANCE LEVELS

The ‘importance level’ of a structure is related to the consequences of failure and is reflected in the acceptance (explicit or implicit) of the probability of exceeding a limit state.

C3.3 DESIGN WORKING LIFE

The ‘design working life’ is a reference time period expressed in years. It is a concept used to select the probability of exceedance of different actions. This does not mean that when the design working life is reached the structure will fail; nor does it mean that the design working life has to correspond exactly with the intended useful life the designer has in mind or with the durability of the construction materials.

C3.4 ANNUAL PROBABILITY OF EXCEEDANCE

The annual probability of exceedance depends on the chosen notional ‘importance level’ and on the ‘design working life’ of the structure. Once the ‘importance level’ and the ‘design working life’ are determined for a structure, the annual probability of exceedance of an action is obtained from the Clause.

For each probability, design values are given in the Standards for environmental actions (e.g., AS/NZS 1170.2). ISO 2394 suggests that specific material factors may also be specified by the material design Standards for varying importance levels.

Importance factors previously given in wind and earthquake loading Standards are now covered by the variation provided for in Tables 3.1 and 3.2.

Calibration of loading and materials design Standards is usually carried out for ‘normal structures’, for which a design working life of 50 years is assumed. A 10 percent probability of exceedance in the life of the structure is commonly accepted for calibration. Thus, for wind and earthquake applied to normal structures, an annual probability of exceedance of 1/500 is specified. Adjustment is provided for other design working lives to provide relatively constant levels of safety against failure of the structure within the respective working lives. This provides for the safety of the structure as a function of its importance to the community.

For design working lives of less than 25 years, an annual probability of exceedance equal to that for 25 years is required. This provides for a level of personal safety that may be expected by an individual using the structure.