

AS 1684.2:2021



STANDARDS
Australia



Residential timber-framed construction

Part 2: Non-cyclonic areas



AS 1684.2:2021

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- Australian Forest Products Association
- Australian Institute of Building Surveyors
- Australian Timber Flooring Association
- Engineers Australia
- Forest and Wood Products Australia
- Forest Industries Federation, WA
- Frame & Truss Manufacturers Association of Australia
- Glued Laminated Timber Association of Australia
- Griffith University
- Housing Industry Association
- Housing SA
- Institution of Fire Engineers
- James Cook University
- Master Builders Australia
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Part 2: Non-cyclonic areas

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Preface

This Standard was prepared by the Australian members of the Joint Standards Australia/Standards New Zealand Committee TM-010, Timber Structuring and Framing, to supersede AS 1684.2—2010.

The objective of this Standard is to provide the building industry with procedures that can be used to determine building practice, to design or check construction details, and to determine member sizes, and bracing and fixing requirements, for timber-framed constructions in non-cyclonic areas.

The objectives of this revision are to —

- (a) make editorial revisions and some technical changes to correct mistakes and clarify the application of the document;
- (b) amend [Section 5: Flooring and Decking](#) to remove ambiguities and to reflect current research and experience which is able to provide for a quieter and more robust floor;
- (c) amend Table 9.25 of AS1684.2 to include suitable nail and screw fixings for 45mm thick roof battens;
- (d) reversing the values in Table 8.18 to represent JD5 capacities, while continuing to recognise JD4 capacities (an increase the values by 12.5%) where this is known;
- (e) amend AS 1684.2 and AS 1684.3 to provide a suitable deemed-to-satisfy detail for metal tie down to timber connection that is compatible with AS 4773; and
- (f) relaxing the notching requirements for non-loadbearing walls.

This is Part 2 of a series of Standards for residential timber-framed construction. The Standards in the series are as follows:

AS 1684.1, *Residential timber-framed construction, Part 1: Design criteria*

AS 1684.2, *Residential timber-framed construction, Part 2: Non-cyclonic areas*

AS 1684.3, *Residential timber-framed construction, Part 3: Cyclonic areas*

AS 1684.4, *Residential timber-framed construction, Part 4: Simplified — Non-cyclonic areas*

While AS 1720.3-2016 Design Criteria for timber-framed residential building supersedes AS 1684.1:1999, notwithstanding this, AS 1684.1:1999 is not withdrawn as a standard, and remains relevant as the basis for Parts 2-4. AS 1684.4:2010 (derived from AS 1684.2:2010) remains current.

This Standard refers to Supplements that are an integral part of this Standard. Statements expressed in mandatory terms in Notes to the Span Tables in the Supplements are deemed to be requirements of this Standard.

Notes to the text contain information and guidance. They are not an integral part of the Standard.

The terms “normative” and “informative” are used in Standards to define the application of the appendices to which they apply. A “normative” appendix is an integral part of a Standard, whereas an “informative” appendix is only for information and guidance.

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Australian Standard®

Residential timber-framed construction

Part 2: Non-cyclonic areas

Section 1 Scope and general

1.1 Scope and application

1.1.1 Scope

This Standard specifies requirements for building practice and the selection, placement and fixing of the various structural elements used in the construction of timber-framed Class 1 and Class 10 buildings as defined by the National Construction Code and within the limitations given in [Clause 1.4](#). The provisions of this Standard also apply to alterations and additions to such buildings.

This Standard also provides building practice and procedures that assist in the correct specification and determination of timber members, bracing and connections, thereby minimizing the risk of creating an environment that may adversely affect the ultimate performance of the structure.

This Standard may also be applicable to the design and construction of other classes of buildings where the design criteria, loadings and other parameters applicable to those classes of building are within the limitations of this Standard.

NOTE 1 Refer to AS 1684.1 for details of design criteria, loadings and other parameters.

NOTE 2 While this Standard may be used to design Class 10 buildings, less conservative levels of design for this building class may be permitted by building regulations and other Australian Standards.

NOTE 3 Advisory information for the construction and specifications of timber stairs, handrails and balustrades is provided in FWPA's Design Guide 8, see Bibliography.

1.1.2 Application

Throughout this Standard, reference is made to the Span Tables in the Supplements. The Supplements are an integral part of, and shall be used in conjunction with, this Standard.

The Supplements are as follows:

Supplement 0, *General introduction and index*

N1/N2 Supp. 1, *Wind classification N1/N2 — Seasoned softwood — Stress grade F5*

N1/N2 Supp. 2, *Wind classification N1/N2 — Seasoned softwood — Stress grade F7*

N1/N2 Supp. 3, *Wind classification N1/N2 — Seasoned softwood — Stress grade F8*

N1/N2 Supp. 4, *Wind classification N1/N2 — Seasoned softwood — Stress grade MGP 10*

N1/N2 Supp. 5, *Wind classification N1/N2 — Seasoned softwood — Stress grade MGP 12*

N1/N2 Supp. 6, *Wind classification N1/N2 — Seasoned softwood — Stress grade MGP 15*

N1/N2 Supp. 7, *Wind classification N1/N2 — WA seasoned hardwood — Stress grade F14*

N1/N2 Supp. 8, *Wind classification N1/N2 — Seasoned hardwood — Stress grade F17*

N1/N2 Supp. 9, *Wind classification N1/N2 — Seasoned hardwood — Stress grade F27*

N1/N2 Supp. 10, *Wind classification N1/N2 — Unseasoned softwood — Stress grade F5*

N1/N2 Supp. 11, *Wind classification N1/N2 — Unseasoned softwood — Stress grade F7*

N1/N2 Supp. 12, *Wind classification N1/N2 — Unseasoned hardwood — Stress grade F8*

N1/N2 Supp. 13, *Wind classification N1/N2 — Unseasoned hardwood — Stress grade F11*

N1/N2 Supp. 14, *Wind classification N1/N2 — Unseasoned hardwood — Stress grade F14*

N1/N2 Supp. 15, *Wind classification N1/N2 — Unseasoned hardwood — Stress grade F17*

N3 Supp. 1, *Wind classification N3 — Seasoned softwood — Stress grade F5*

N3 Supp. 2, *Wind classification N3 — Seasoned softwood — Stress grade F7*

N3 Supp. 3, *Wind classification N3 — Seasoned softwood — Stress grade F8*

N3 Supp. 4, *Wind classification N3 — Seasoned softwood — Stress grade MGP 10*

N3 Supp. 5, *Wind classification N3 — Seasoned softwood — Stress grade MGP 12*

N3 Supp. 6, *Wind classification N3 — Seasoned softwood — Stress grade MGP 15*

N3 Supp. 7, *Wind classification N3 — WA seasoned hardwood — Stress grade F14*

N3 Supp. 8, *Wind classification N3 — Seasoned hardwood — Stress grade F17*

N3 Supp. 9, *Wind classification N3 — Seasoned hardwood — Stress grade F27*

N3 Supp. 10, *Wind classification N3 — Unseasoned softwood — Stress grade F5*

N3 Supp. 11, *Wind classification N3 — Unseasoned softwood — Stress grade F7*

N3 Supp. 12, *Wind classification N3 — Unseasoned hardwood — Stress grade F8*

N3 Supp. 13, *Wind classification N3 — Unseasoned hardwood — Stress grade F11*

N3 Supp. 14, *Wind classification N3 — Unseasoned hardwood — Stress grade F14*

N3 Supp. 15, *Wind classification N3 — Unseasoned hardwood — Stress grade F17*

N4 Supp. 1, *Wind classification N4 — Seasoned softwood — Stress grade F5*

N4 Supp. 2, *Wind classification N4 — Seasoned softwood — Stress grade F7*

N4 Supp. 3, *Wind classification N4 — Seasoned softwood — Stress grade F8*

N4 Supp. 4, *Wind classification N4 — Seasoned softwood — Stress grade MGP 10*

N4 Supp. 5, *Wind classification N4 — Seasoned softwood — Stress grade MGP 12*

N4 Supp. 6, *Wind classification N4 — Seasoned softwood — Stress grade MGP 15*

N4 Supp. 7, *Wind classification N4 — WA seasoned hardwood — Stress grade F14*

N4 Supp. 8, *Wind classification N4 — Seasoned hardwood — Stress grade F17*

N4 Supp. 9, *Wind classification N4 — Seasoned hardwood — Stress grade F27*

N4 Supp. 10, *Wind classification N4 — Unseasoned softwood — Stress grade F5*

N4 Supp. 11, *Wind classification N4 — Unseasoned softwood — Stress grade F7*

N4 Supp. 12, *Wind classification N4 — Unseasoned hardwood — Stress grade F8*

N4 Supp. 13, *Wind classification N4 — Unseasoned hardwood — Stress grade F11*

N4 Supp. 14, *Wind classification N4 — Unseasoned hardwood — Stress grade F14*

N4 Supp. 15, *Wind classification N4 — Unseasoned hardwood — Stress grade F17*

The Span Tables for unseasoned hardwood F8 and F11 may be used for unseasoned F8 and F11 softwood as well.

1.2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document:

NOTE Documents referenced for informative purposes are listed in the Bibliography.

AS 1170.4, *Structural design actions, Part 4: Earthquake actions in Australia*

AS 1214, *Hot-dip galvanized coatings on threaded fasteners (ISO metric coarse thread series) (ISO 10684:2004, MOD)*

AS 1397, *Continuous hot-dip metallic coated steel sheet and strip — Coatings of zinc and zinc alloyed with aluminium and magnesium*

AS 1684.1, *Residential timber-framed construction, Part 1: Design criteria*

AS 1691, *Domestic oil-fired appliances — Installation*

AS 1720.1, *Timber structures, Part 1: Design methods*

AS 1720.5, *Timber structures, Part 5: Nailplated timber roof trusses*

AS 1810, *Timber — Seasoned cypress pine — Milled products*

AS 1860.2, *Particleboard flooring, Part 2: Installation*

AS 2796.1, *Timber — Hardwood — Sawn and milled products, Part 1: Product specification*

AS 2870, *Residential slabs and footings*

AS 3700, *Masonry structures*

AS 4055, *Wind loads for housing*

AS 4440, *Installation of nailplated timber trusses*

AS 4773.1, *Masonry in small buildings, Part 1: Design*

AS 4785.1, *Timber — Softwood — Sawn and milled products, Part 1: Product specification*

AS 5604, *Timber — Natural durability ratings*

AS/NZS 1170.1, *Structural design actions, Part 1: Permanent, imposed and other actions*

AS/NZS 1170.2, *Structural design actions, Part 2: Wind actions*

AS/NZS 1604, *Specification for preservative treatment (all Parts)*

AS/NZS 1859.4, *Reconstituted wood-based panels — Specifications, Part 4: Wet-processed fibreboard*

AS/NZS 1860.1, *Particleboard flooring, Part 1: Specifications*

AS/NZS 2269.0, *Plywood — Structural, Part 0: Specifications*

AS/NZS 2918, *Domestic solid fuel burning appliances — Installation*

AS/NZS 4534, *Zinc and zinc/aluminium-alloy coatings on steel wire*

AS/NZS 4791, *Hot-dip galvanized (zinc) coatings on ferrous open sections, applied by an in-line process*

1.3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

1.3.1

loadbearing wall

wall that supports roof or floor loads, or both roof and floor loads

1.3.2

may

indicates the existence of an option

1.3.3

non-loadbearing walls

1.3.3.1

non-loadbearing wall, external

wall that supports neither roof nor floor loads but may support ceiling loads and act as a bracing wall, and may support lateral wind loads

Note 1 to entry: Examples include gable and skillion end walls.

1.3.3.2

non-loadbearing wall, internal

non-loadbearing internal wall supports neither roof nor floor loads but may support ceiling loads and act as a bracing wall

1.3.4

relevant authority

an agency authorized by legislation or regulation to issue determinations, orders, or other instructions in respect of any subject covered by this Standard

Note 1 to entry: In the context of this Standard, the relevant authority may include local council building surveyors, private building surveyors or other persons nominated by the relevant State or Territory building legislation as having the legal responsibility for approving the use of structural timber products.

1.3.5

rim board

member at right angles to and fixed to the end of deep joists (including I-joists) that provides restraint to the joists

1.3.6

roof

1.3.6.1

coupled roof

pitched roof construction system with a roof slope of not less than 10 degrees where horizontal members (ceiling joists and collar ties) combine with opposing rafter pairs to create a triangulation of the roof structure

Note 1 to entry: A coupled roof system includes collar ties fixed to all opposing rafter pairs as specified in [Clause 7.2.16](#), and rafters and ceiling joists securely fixed to the same top plate or to each other if they align, see [Table 9.4](#). It may also include some area where it is not possible to fix ceiling joists or collar ties to all rafters, e.g. hip ends or parts of a T- or L-shaped house.

Note 2 to entry: In a coupled roof both gravity and wind forces can be resisted by axial forces in rafters, collar ties and ceiling joists, see [Figure 7.1](#).

1.3.6.2**non-coupled roof**

pitched or flat roof that is not a coupled roof and does not incorporate triangulation

Note 1 to entry: This includes cathedral roofs and roofs constructed using ridge and intermediate beams.

Note 2 to entry: In a non-coupled roof both gravity and wind forces can only be resisted by bending in the rafters, see [Figure 2.5](#).

1.3.6.3**pitched roof**

roof where members are cut to suit, and which is erected on site

1.3.6.4**trussed roof**

engineered roof frame system designed to carry the roof or roof and ceiling, usually without the support of internal walls

1.3.7**shall**

indicates that a statement is mandatory

1.3.8**should**

indicates a recommendation

1.3.9**spacing and span****1.3.9.1****spacing**

centre-to-centre distance between structural members, unless otherwise indicated

Note 1 to entry: [Figure 1.1](#) illustrates the terms “spacing”, “span”, “single span” and “continuous span”.

1.3.9.2**span**

face-to-face distance between points capable of giving full support to structural members or assemblies

Note 1 to entry: In particular, rafter spans are measured as the distance between points of support along the length of the rafter and not as the horizontal projection of this distance.

1.3.9.3**single span**

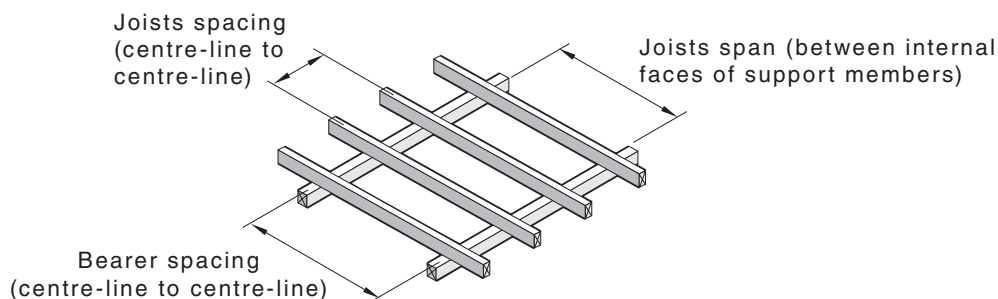
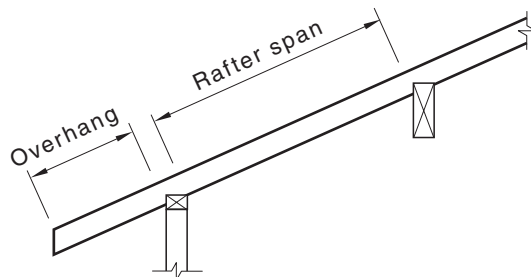
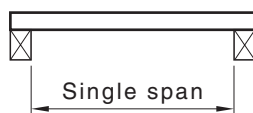
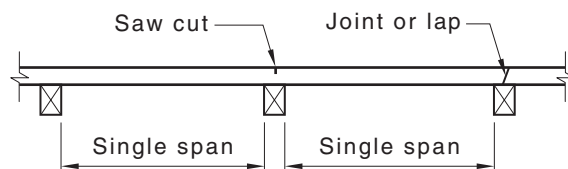
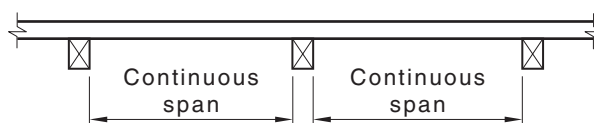
span of a member supported at or near both ends with no immediate supports

Note 1 to entry: This includes the case where members are partially cut through over intermediate supports to remove spring, see [Figures 1.1\(c\)](#) and [1.1\(d\)](#).

1.3.9.4**continuous span**

span of a member supported at or near both ends and at one or more intermediate points such that no span is greater than twice another

Note 1 to entry: See [Figure 1.1\(e\)](#) for an illustration.

**(a) Bearers and joists****(b) Rafter****(c) Two supports****(d) Joint or sawcut over supports****(e) Continuous span**

NOTE The design span is the average span unless one span is more than 10 % longer than another, in which case the design span is the longest span.

Figure 1.1 — Spacing and span**1.3.10****stress grade**

classification of timber to indicate, for the purposes of design, a set of structural design properties in accordance with AS 1720.1

1.3.11**stud height**

distance from top of bottom plate to underside of top plate or the distance between points of lateral restraint provided to both the breadth and depth of the stud

1.3.12

two storey

in any section through the house, construction that includes not more than two levels of timber-framed trafficable floor

Note 1 to entry: Trafficable floors in attics and lofts are included in the number of storeys.

Note 2 to entry: In the subfloor of a two storey construction, the maximum distance from the ground to the underside of the lower floor bearer is 1 800 mm.

Note 3 to entry: This terminology does not preclude the application of this Standard to up to a two storey timber-framed construction supported —

- (a) by a bearer and joist substructure designed in accordance with this Standard; or
- (b) by lower levels of timber wall framing or other support systems designed in accordance with engineering principles and approved by a relevant authority.

1.4 Limitations

1.4.1 General

The criteria specified in this Standard are specifically for conventional timber-framed buildings and applicable to single and two storey constructions built within the limits or parameters given in [Clauses 1.4.2 to 1.4.10](#) and [Figure 1.2](#).

1.4.2 Wind classification

For wind loads, the simplified wind classifications for non-cyclonic areas N1 to N4, as described by AS 4055, shall be used with the corresponding maximum design gust wind speeds given in [Table 1.1](#).

Either AS 4055 or AS/NZS 1170.2 shall be used to determine the wind classification necessary for the use of this Standard.

The wind classifications covered by this Standard shall be determined as follows:

- (a) Where the wind classification is determined from AS 4055, the maximum building height limitation of 8.5 m, as given in AS 4055, shall apply to this Standard. The maximum building width is specified in [Clause 1.4.5](#).
- (b) Where AS/NZS 1170.2 is used to determine the maximum design gust wind speed, a wind classification shall be adopted in accordance with [Table 1.1](#). The ultimate limit state design gust wind speed determined from AS/NZS 1170.2 shall be not more than 5 % greater than the ultimate limit state wind speed given in [Table 1.1](#) for the corresponding wind classification adopted.

NOTE 1 The determination of the design gust wind speed and wind classification should take into account the building height, terrain category, topographic classification and shielding classification given in AS/NZS 1170.2 or AS 4055.

NOTE 2 Some relevant authorities provide wind classification maps or wind classifications for designated sites within their jurisdiction.

Table 1.1 — Maximum design gust wind speed

Wind classification regions A and B	Maximum design gust wind speed, ms		
	Permissible stress method, V_p	Serviceability limit state, V_s	Ultimate limit state, V_u
N1	28 (W28N)	26	34
N2	33 (W33N)	26	40
N3	41 (W41N)	32	50
N4	50 (W50N)	39	61

1.4.3 Plan

Building shapes shall be essentially rectangular, square, L-shaped or a combination of rectangular elements including splayed-end and boomerang-shaped buildings.

1.4.4 Number of storeys of timber framing

The maximum number of storeys of timber framing shall not exceed two, see [Section 2](#).

1.4.5 Width

The maximum width of a building shall be 16 000 mm, excluding eaves, see [Figure 1.2](#).

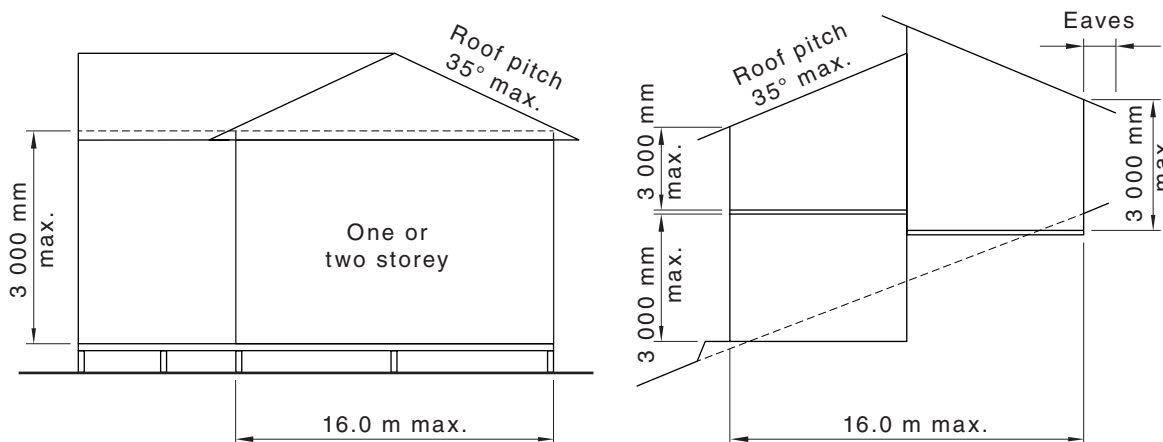
1.4.6 Wall height

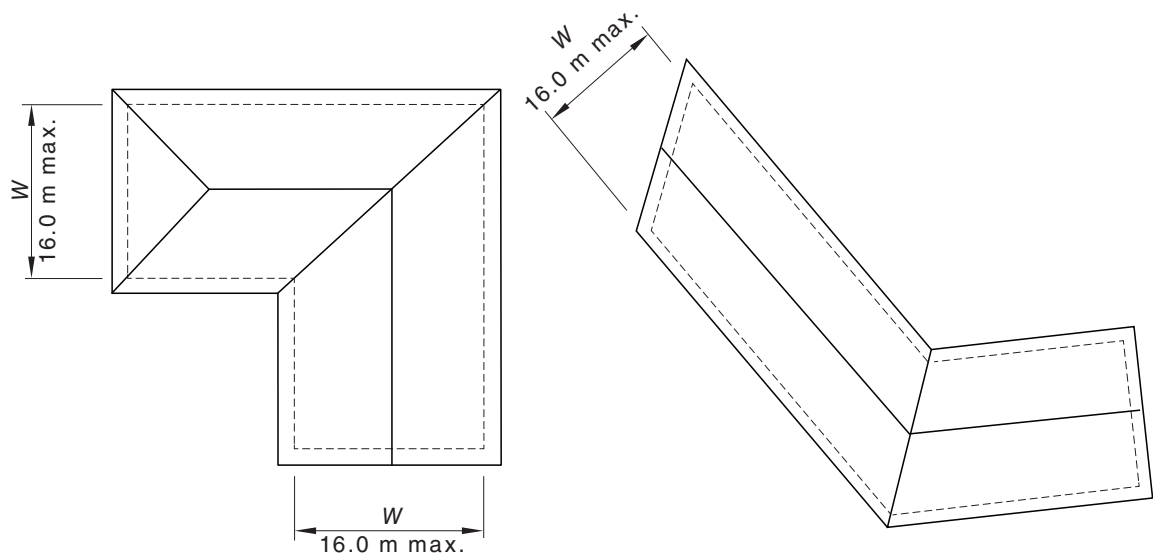
The maximum wall height shall be 3 000 mm (floor to ceiling, as measured at common external walls, i.e. not gable or skillion ends), see [Figure 1.2](#).

NOTE 1 The Span Tables provide for stud heights in excess of 3 000 mm to cater for gable, skillion and some other design situations where wall heights, other than those of common external walls, may exceed 3 000 mm.

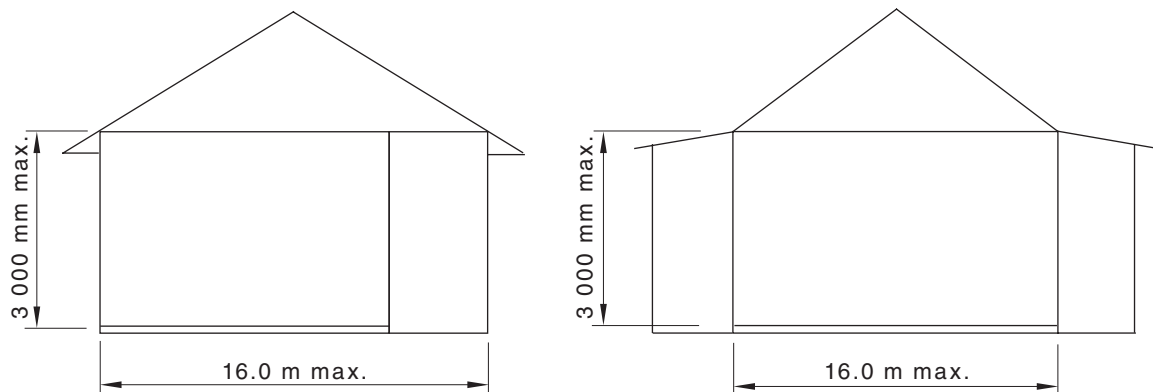
NOTE 2 Building height limitations apply where wind classification is determined using AS 4055, see [Clause 1.4.2](#).

NOTE 3 The provisions contained in this Standard may also be applicable to houses with external wall heights up to 3 600 mm where appropriate consideration is given to the effect of the increased wall height on racking forces, reduction to bracing wall capacities, overturning and uplift forces, shear forces and member sizes.

**(a) Sections**



(b) Plan



(c) Verandahs

NOTE 1 Building height limitations apply where wind classification is determined using AS 4055, see [Clause 1.4.2](#). See also [Clause 1.4.4](#).

NOTE 2 Member sizes may be limited by the maximum roof load widths (*RLW*) given in the Span Tables in the Supplements.

Figure 1.2 — Geometric building parameters

1.4.7 Roof pitch

The maximum roof pitch shall be 35° (70:100).

1.4.8 Spacing of bracing

For single or upper storey construction, the spacing of bracing elements, measured at right angles to elements, shall not exceed 9 000 mm, see [Section 8](#).

For the lower storey of two storey or subfloor of single or two storey construction, bracing walls shall be spaced in accordance with [Clause 8.3.5.9](#).

NOTE Bracing walls may be spaced greater than the prescribed limits where the building is designed and approved in accordance with engineering principles.

1.4.9 Roof types

Roof construction shall be hip, gable, skillion, cathedral, trussed or pitched, or in any combination of these, see [Figures 2.2](#) to [2.7](#).

1.4.10 Building masses

Building masses appropriate for the member being designed shall be determined prior to selecting and designing from the Span Tables in the Supplements. Where appropriate, the maximum building masses relevant to the use of each member Span Table are noted under the Table.

The roof mass shall be determined for the various types of roof construction for input to the Span Tables in the Supplements for rafters or purlins, intermediate beams, ridge beams and underpurlins.

For rafters or purlins, mass of roof shall include all supported materials. For underpurlins, mass of roof shall include all supported materials except the rafters that are accounted for in the design. For counter beams, strutting beams, combined hanging strutting beams, and similar members, the mass of roof framing (rafters, underpurlins) is also accounted for in the Span Tables in the Supplements.

The mass of a member being considered has been accounted for in the design of that member.

NOTE [Appendix A](#) provides guidance and examples on the determination of masses.

1.5 Design criteria

The design criteria that have been used in the preparation of this Standard are the following:

- (a) The bases of the design used in the preparation of this Standard are AS 1684.1 and AS 1720.1.
- (b) The design dead, live, and wind loadings specified in AS/NZS 1170.1, AS/NZS 1170.2 and AS 4055 were taken into account in the member computations, with appropriate allowances for the distribution of concentrated or localized loads over a number of members where relevant, see also [Clause 1.4.2](#).

NOTE 1 Construction supporting vehicle loads is outside the scope of this Standard.

- (c) All pressures, loads, forces and capacities given in this Standard are based on limit state design.
- (d) The member sizes, bracing and connection details are suitable for construction (including timber-framed brick veneer) of design category H1 and H2 domestic structures in accordance with AS 1170.4.

NOTE 2 This Standard does not provide specifications for unreinforced masonry construction subject to earthquake loads.

NOTE 3 Typical unreinforced masonry may include masonry bases for timber-framed houses.

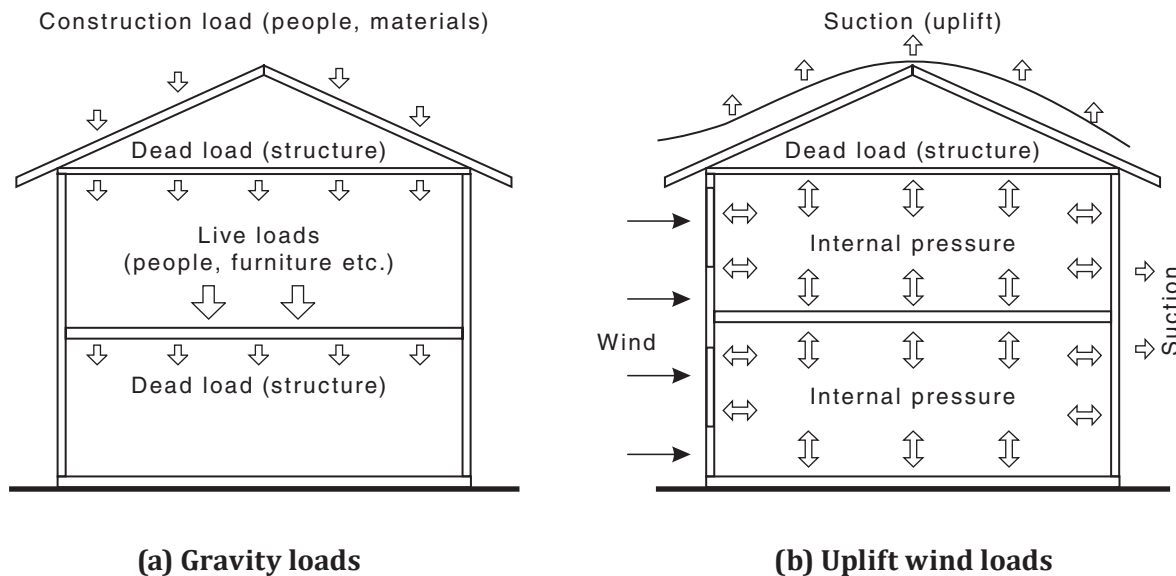
- (e) The effects of snow loads up to 0.2 kPa on member sizes, bracing and connection details have been accommodated in the design.

1.6 Forces on buildings

The design of framing members may be influenced by the wind forces that act on the specific members. When using the Span Tables in the Supplements, the appropriate wind classification (e.g. N2), together with the stress grade, shall be established prior to selecting the appropriate supplement to obtain timber member sizes.

All framing members shall be adequately designed and joined to ensure suitable performance under the worst combinations of dead, live, wind and earthquake loads. Members shall also meet serviceability requirements for their application.

Assumptions used for forces, load combinations and serviceability requirements of framing members are given in AS 1684.1. Forces applied to timber-framed buildings, which shall be considered in the design of framing members, are indicated in [Figure 1.3](#).



NOTE For clarity, earthquake and snow loads are not shown, see [Clause 1.5](#).

Figure 1.3 — Loads on buildings

Forces on buildings produce different effects on a structure. Each effect shall be considered individually and be resisted. [Figure 1.4](#) summarizes some of these effects. This Standard takes account of these.

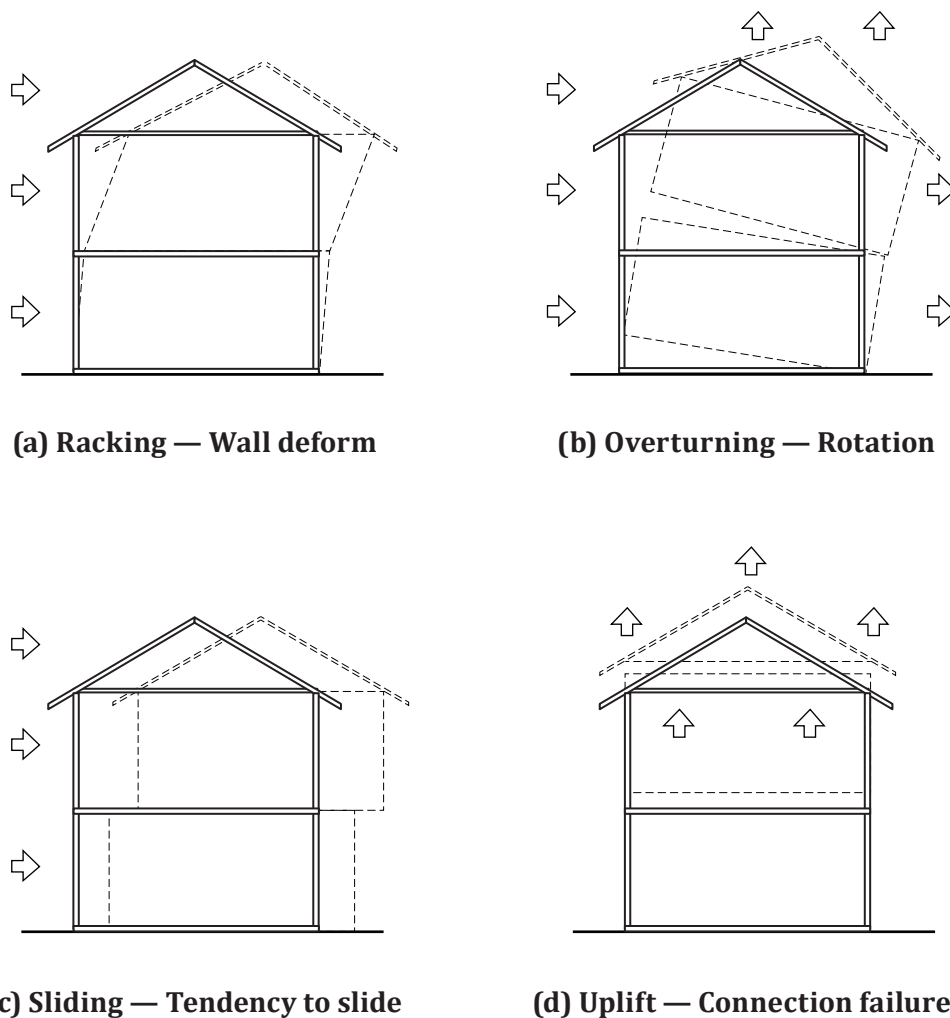


Figure 1.4 — Effects of forces on buildings

1.7 Load paths — Offsets and cantilevers

Where applicable, roof loads shall be transferred through the timber frame to the footings by the most direct route. For floor framing, the limitations imposed regarding the support of point loads and the use of offsets and cantilevers are specified in [Section 4](#).

NOTE 1 This load path in many cases cannot be maintained in a completely vertical way, relying on structural members that transfer loads horizontally. Offset or cantilevered floor framing supporting loadbearing walls may also be used, see [Figures 1.5](#) and [1.6](#).

NOTE 2 Floor members designed as “supporting floor load only” may support a loadbearing wall (walls supporting roof loads) where the loadbearing wall occurs directly over a support or is within 1.5 times the depth of the floor member from the support, see also [Clause 4.3.1.2](#) and [Clause 4.3.2.3](#).

NOTE 3 Other members supporting roof or floor loads, where the load occurs directly over the support or is within 1.5 times the depth of the member from the support, do not require to be designed for that load.

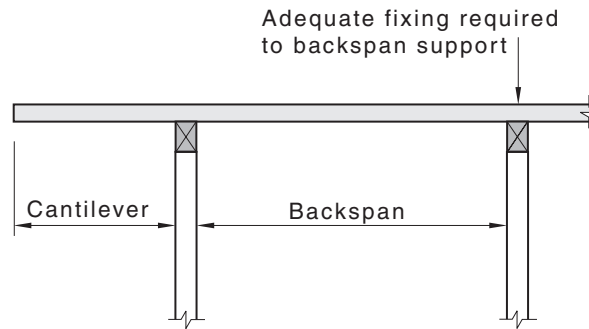


Figure 1.5 — Cantilever

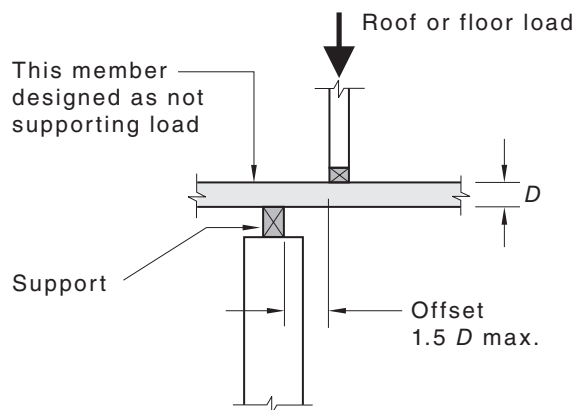


Figure 1.6 — Offset

1.8 Durability

Structural timber used in accordance with this Standard shall have the level of durability appropriate for the relevant climate and expected service life and conditions, including exposure to insect attack or to moisture, which could cause decay.

Structural timber members that are in-ground contact or that are not protected from weather exposure and associated moisture ingress shall be of in-ground durability Class 1 or 2 as appropriate (refer to AS 5604), or shall be adequately treated with preservative in accordance with the AS/NZS 1604 series, unless the ground contact or exposure is of a temporary nature.

NOTE For guidance on durability design, see [Appendix B](#).

1.9 Dimensions

Timber dimensions throughout this Standard are stated by nominating the depth of the member first, followed by its breadth (see [Figure 1.7](#)), e.g. 90 mm × 35 mm (studs, joists, etc.), 45 mm × 70 mm (wall plates, battens, etc.).

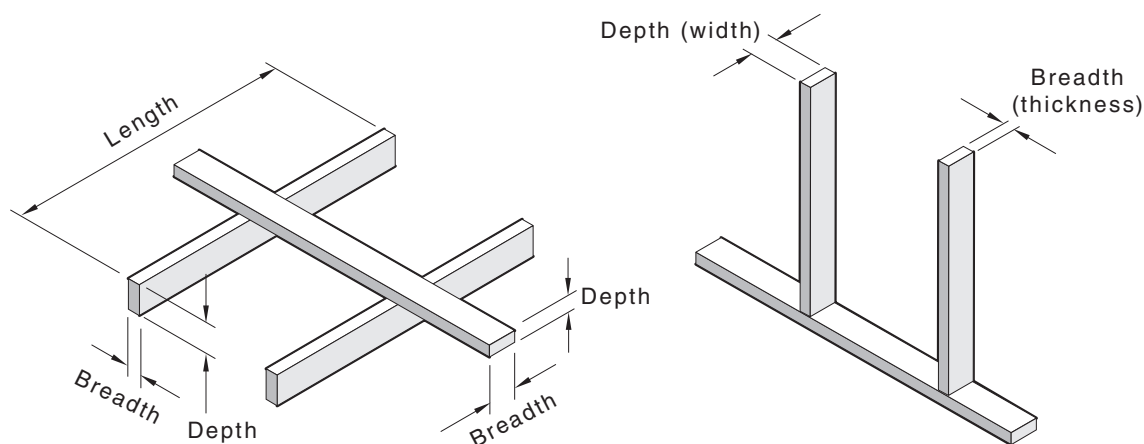


Figure 1.7 — Dimensions

1.10 Bearing

The minimum bearing for specific framing members (bearers, lintels, hanging beams, strutting beams, combined strutting/hanging beams, counter beams, combined counter/strutting beams and verandah beams) shall be as given in the Notes to the Span Tables of the Supplements, as appropriate.

In all cases, except for battens, framing members shall bear on their supporting element a minimum of 30 mm at their ends or 60 mm at the continuous part of the member, by their full breadth (thickness). Reduced bearing area shall only be used where additional fixings are provided to give equivalent support to the members.

Where the bearing area is achieved using a non-rectangular area such as a splayed joint, the equivalent bearing area shall not be less than that required above.

1.11 Stress grades

All structural timber used in conjunction with this Standard shall be stress graded in accordance with the relevant Australian Standard.

All structural timber to be used in conjunction with this Standard shall be identified in respect of stress grade.

The timber stress grade is usually designated alphanumerically, e.g. F17, MGP12. Stress grades covered by the Span Tables in the Supplements to this Standard are given in [Table 1.2](#).

Table 1.2 — Stress grades

Species or species group	Most common stress grades available	Other stress grades available
Cypress (unseasoned)	F5	F7
Hardwood (unseasoned)	F8, F11, F14	F17
Hardwood (seasoned)	F17	F22, F27
Hardwood (seasoned Western Australia)	F14	—
Seasoned softwood (radiata, slash, hoop, Caribbean, pinaster pines, etc.)	F5, F7, F8, MGP10, MGP12	F4, F11, MGP15
Douglas fir (Oregon) (unseasoned)	F5, F7	F8a, F11a
Spruce pine fir (SPF) (seasoned)	F5	F8
Hemfir (seasoned)	F5	F8

Table 1.2 *(continued)*

Species or species group	Most common stress grades available	Other stress grades available
^a The Span Tables in the Supplements for unseasoned hardwood F8 and F11 may also be used for unseasoned F8 and F11 softwood. NOTE 1 Timber that has been visually, mechanically or proof stress graded may be used in accordance with this Standard at the stress grade branded thereon. NOTE 2 Check local timber suppliers regarding availability of timber stress grades.		

1.12 Engineered timber products and engineered wood products (EWPs)

Fabricated components (e.g. roof trusses, glued-laminated timber members, I-beams, laminated veneer lumber, laminated strand lumber and nailplate-joined timber) may be used where their design is in accordance with AS 1720.1 and their manufacture and use conforms to the relevant Australian Standards.

Glued-laminated timber, I-beams, laminated veneer lumber (LVL) and laminated strand lumber (LSL) are also commonly referred to as engineered wood products (EWPs).

NOTE 1 [Appendix J](#) provides guidance on building practices that are common to the use of EWPs from different manufacturers.

NOTE 2 In some situations, there are no relevant Australian Standards applicable to the design, manufacture or use of engineered timber products. In such cases, the use of these products in accordance with this Standard is subject to conformance to the manufacturer's specifications and the approval of the relevant authority, which may have additional requirements to those contained in this Standard. These may include, but are not restricted to, additional support, lateral restraint, blocking, and similar provisions.

1.13 Size tolerances

When using the Span Tables in the Supplements, the following maximum undersize tolerances on timber sizes shall apply:

- (a) Unseasoned timber:
 - (i) Up to and including F7 — 4 mm.
 - (ii) F8 and above — 3 mm.
- (b) Seasoned timber: All stress grades — 0 mm.

NOTE When checking unseasoned timber dimensions onsite, allowance should be made for shrinkage, which may have occurred since milling.

1.14 Alternative timber dimensions

The alternative timber dimensions given by this Clause shall not apply to the Span Tables in the Supplements.

Where a timber dimension is stated in the clauses of this Standard, it refers to the usual minimum dimensions of seasoned timber. Alternative dimensions for seasoned timber, unseasoned timber and seasoned Western Australian hardwood shall be in accordance with [Table 1.3](#).

The size tolerances given in [Clause 1.13](#) are also applicable to these dimensions.

Table 1.3 — Alternative timber dimensions

Min. seasoned timber dimensions, mm	Nominal unseasoned timber dimensions, mm	Min. seasoned W.A. hardwood dimensions, mm
19	25	19
32	38	30
35	38	30
42	50	40
45	50	40
70	75	60
90	100	80
120	125	125
140	150	125
170	175	175
190	200	175
240	250	220
290	300	260

1.15 Steel grade and corrosion protection

All metal used in structural timber connections shall be provided with corrosion protection appropriate for the particular conditions of use.

Where corrosion protection of steel is required, it shall be in accordance with AS/NZS 4791, AS/NZS 4534, AS 1397 and AS 1214. The level of corrosion protection provided shall take into consideration weather exposure, timber treatment, moisture and presence of salt.

The minimum corrosion protection that shall be applied to metal straps, framing anchors and similar structural connections shall be Z 275. The minimum thickness of metal strap shall be 0.8 mm and the minimum net cross-section area shall be 21 mm², unless noted otherwise.

NOTE Where other types of corrosion protection are provided, refer to the relevant authority for any requirements.

The min. steel grade for metal strap, framing anchors and similar structural connection shall be G 300. The grade of all other metal components shall be in accordance with the relevant Australian Standards.

1.16 Requirements for design using this Standard

Prior to using this Standard, the design gust wind speed and corresponding wind classification shall be determined. It shall include consideration of terrain category building height and topographic and shielding effects, see [Clause 1.4.2](#). The wind classification is the primary reference used throughout this Standard.

NOTE The recommended procedure for designing the structural timber framework is to determine first the preliminary location and extent of bracing and tie-down and then the basic frame layout in relation to the floor plan and the proposed method of frame construction. Individual member sizes are determined by selecting the roof framing timbers and then systematically working through the remainder of the framework to the footings, or by considering the floor framing through to the roof framing. Bracing and tie-down requirements should also be considered when determining the basic frame layout to ensure any necessary or additional framing members are correctly positioned. The flow chart shown in [Figure 1.8](#) provides guidance.

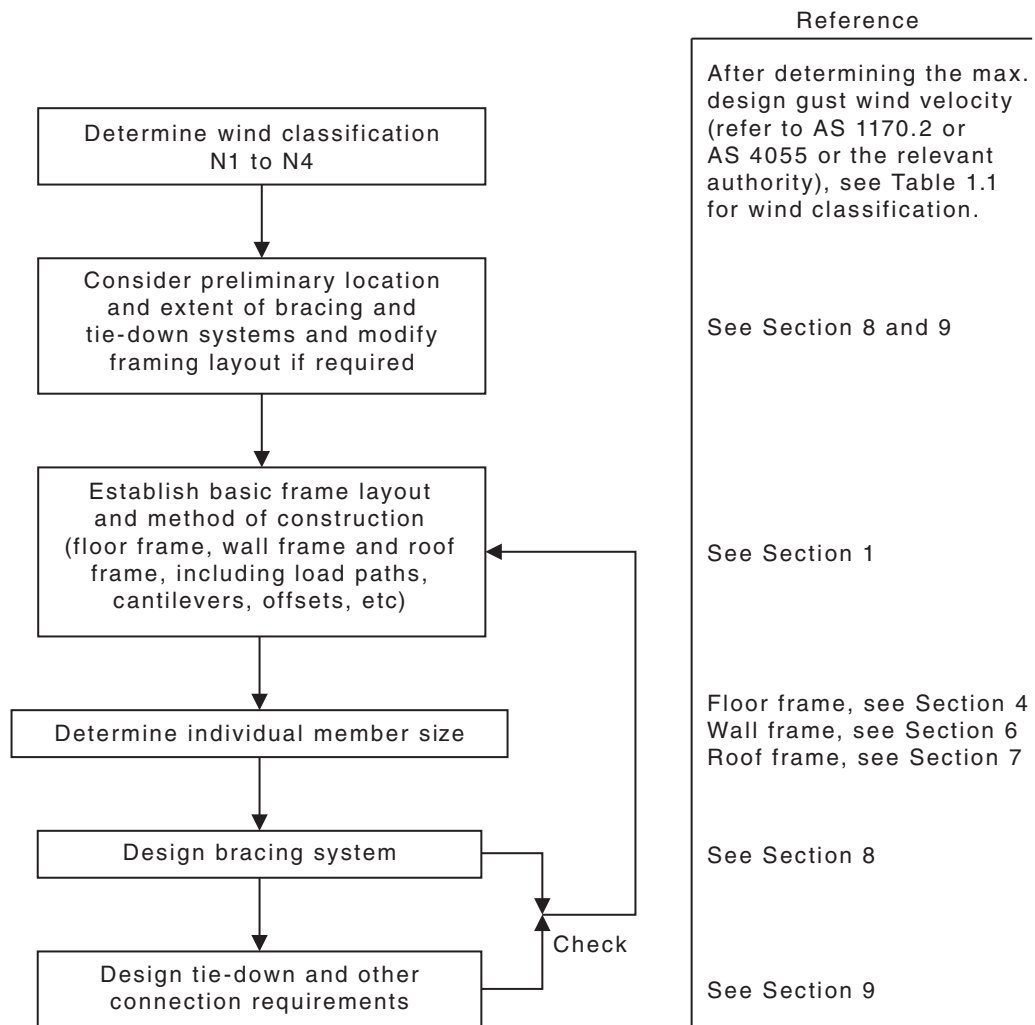


Figure 1.8 — Flow chart for design using this Standard

1.17 Interpolation

Interpolation shall be made in accordance with [Appendix C](#).

1.18 Alternative methods and materials

This Standard does not preclude the use of framing, fastening or bracing methods or materials other than those specified provided the minimum requirements specified herein are met.

NOTE Refer to the National Construction Code for any specific requirements where alternative methods or materials are to be used.

Section 2 Framing members

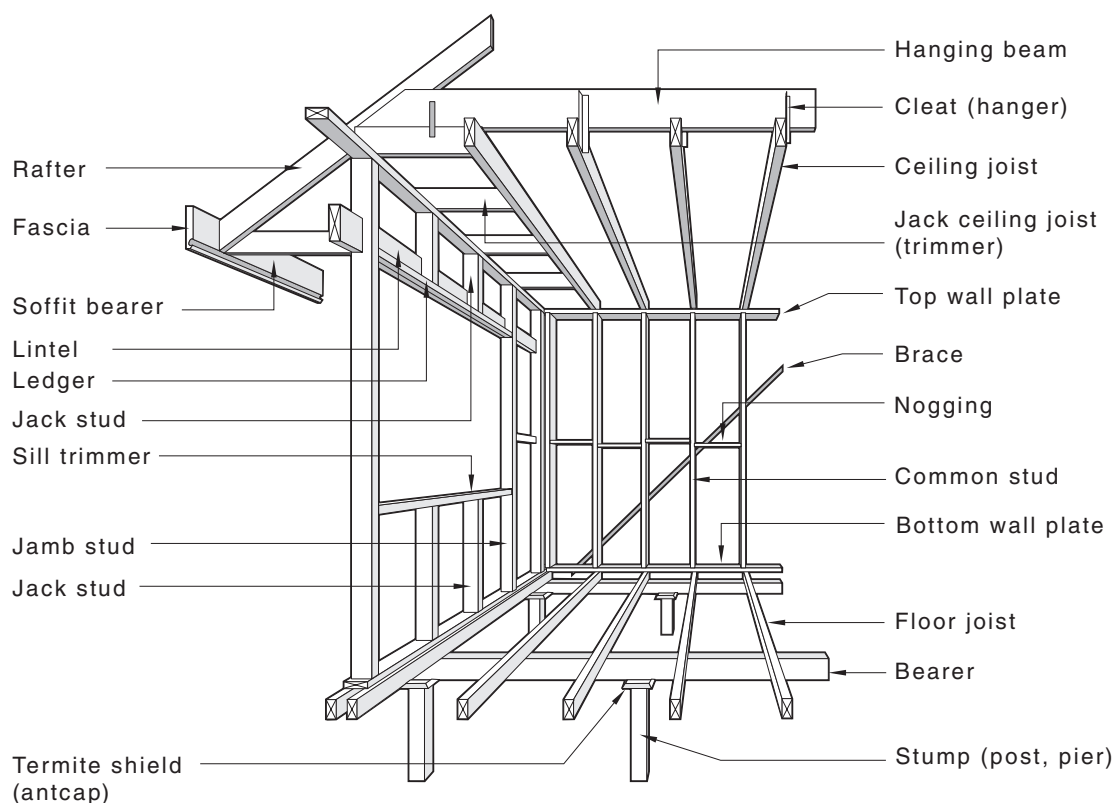
2.1 General

This Section provides terminology, general requirements and calculations for framing members.

2.2 Terminology of framing members

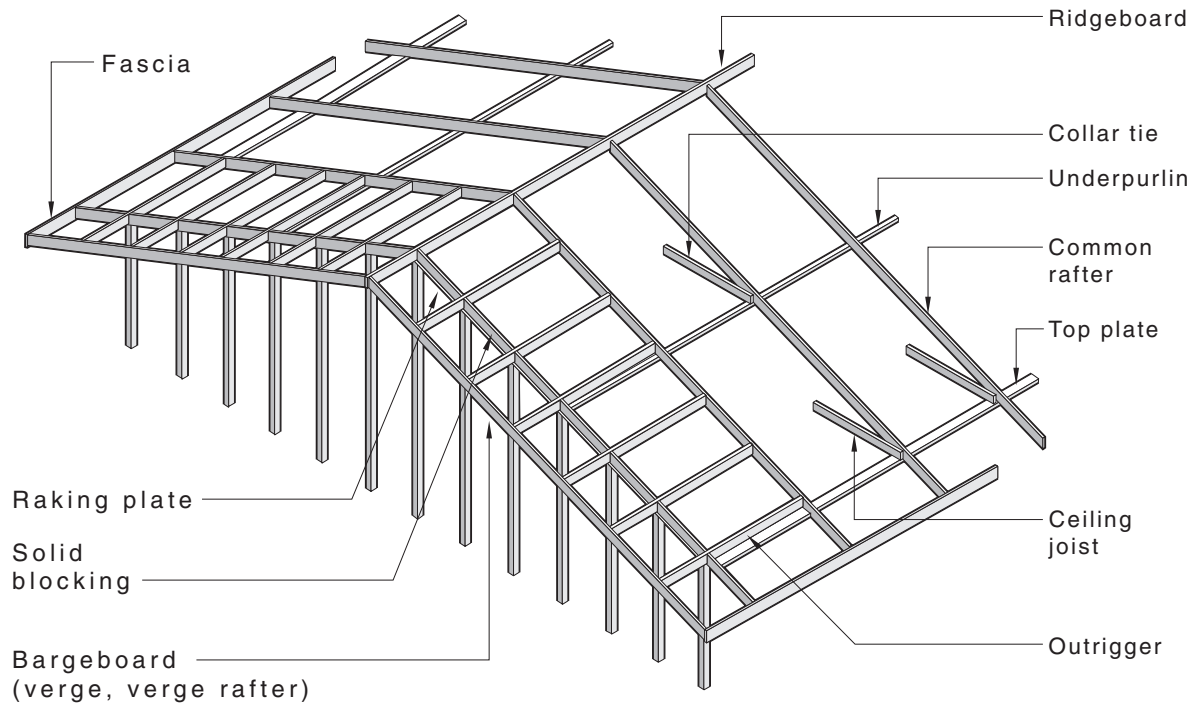
[Figure 2.1](#) details traditional floor, wall and ceiling framing members in general. An alternative wall frame detail is given in [Figure 6.1\(b\)](#).

[Figures 2.2](#) to [2.7](#) apply to roof framing.



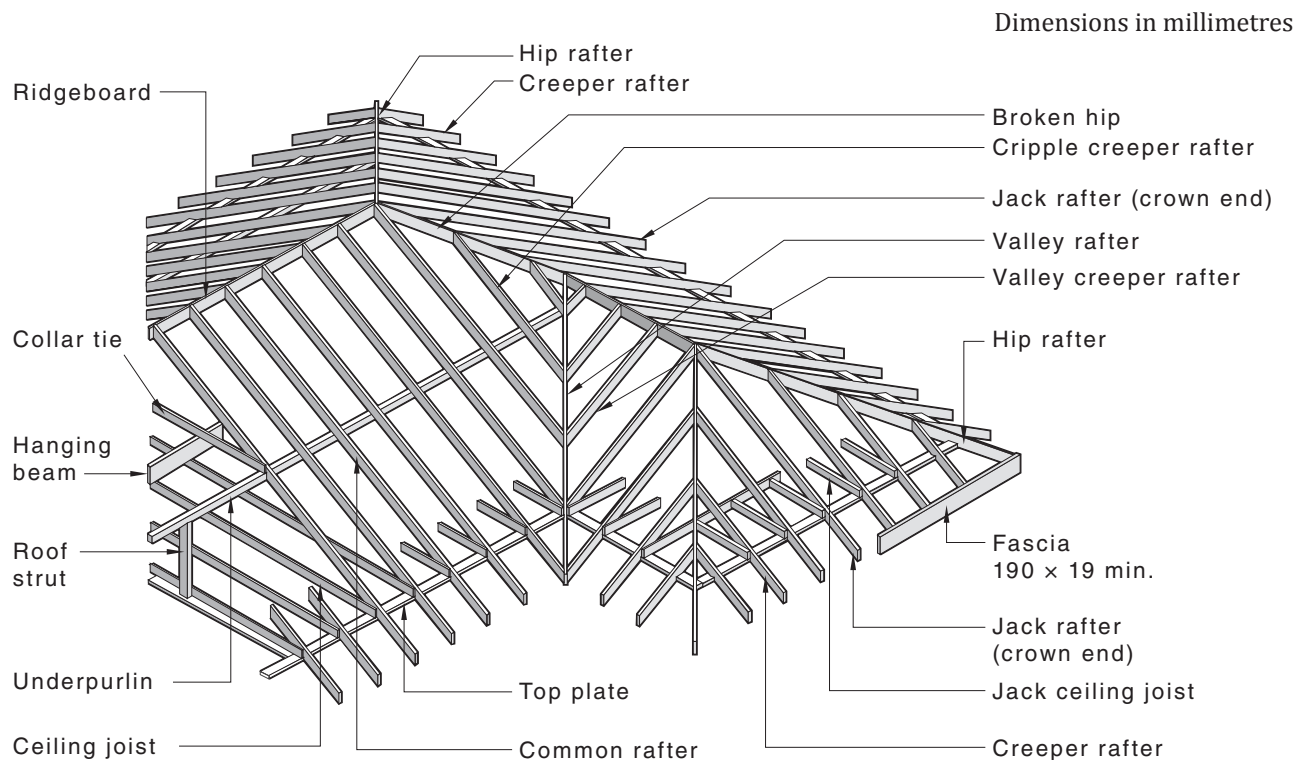
NOTE The ceiling and floor joists are shown parallel to the external loadbearing wall for clarity. In practice, the more usual case is for the joists to be located perpendicular to the external wall. Lintel location may also vary, see [Figure 6.9\(A\)](#).

Figure 2.1 — Framing members — Floor, wall and ceiling



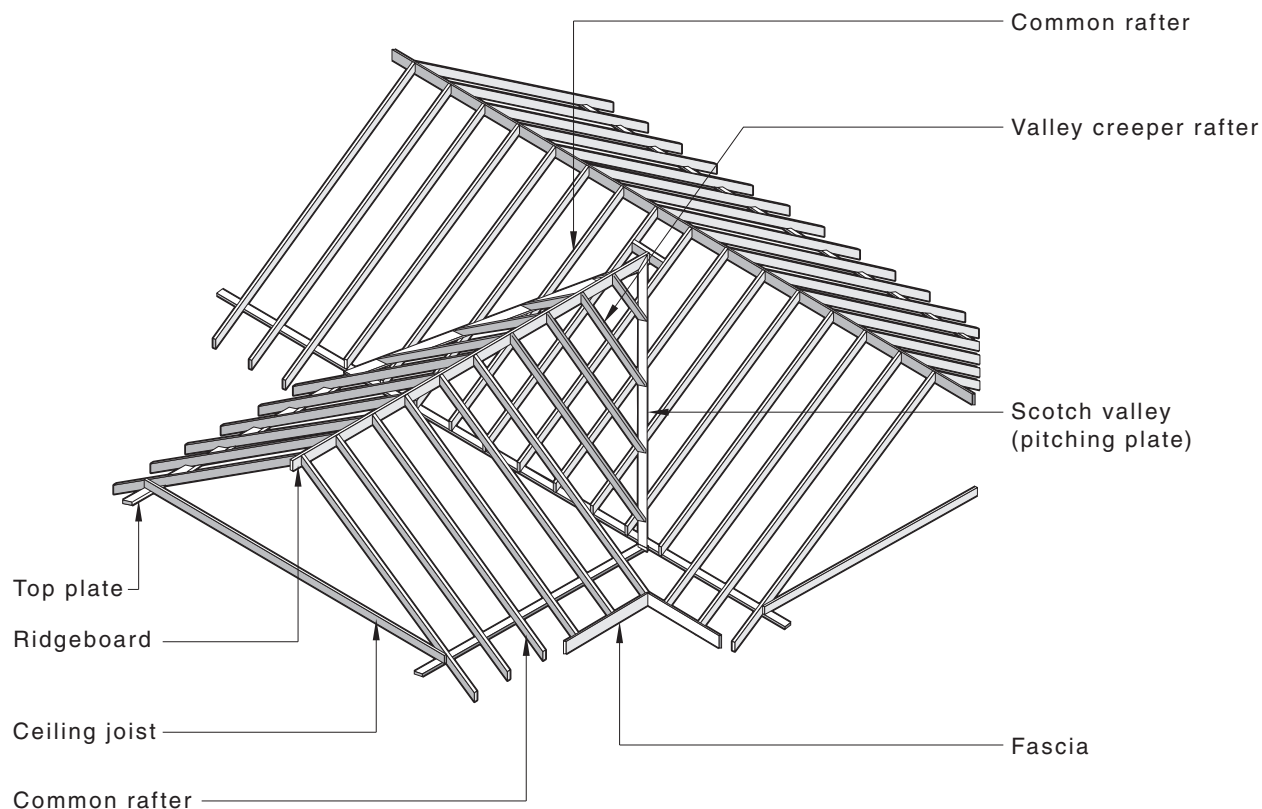
NOTE Some members have been omitted for clarity.

Figure 2.2 — Framing members — Gable roof construction



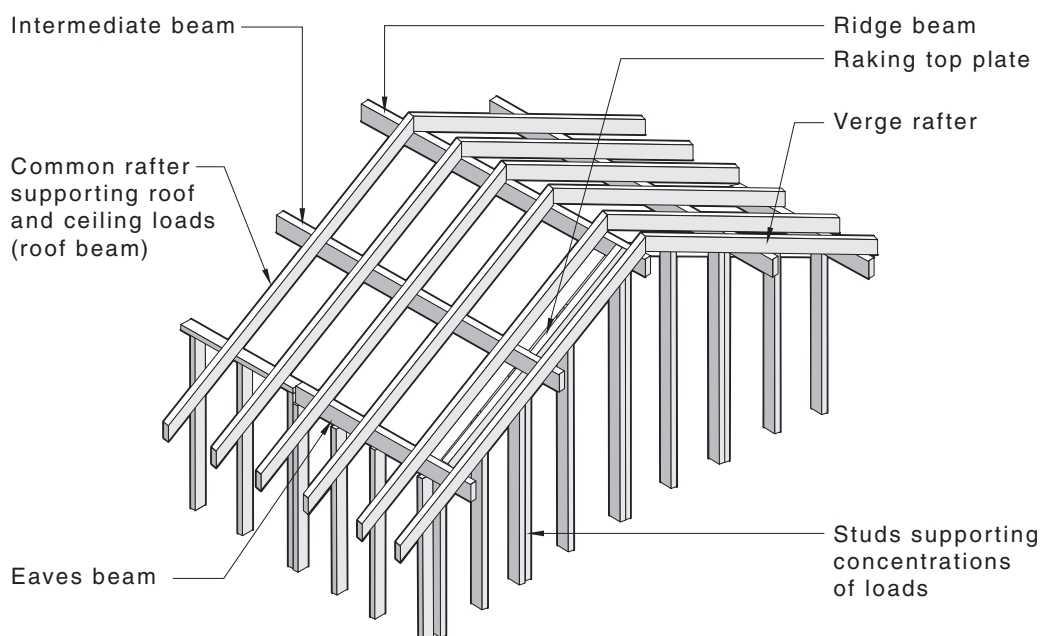
NOTE Some members have been omitted for clarity.

Figure 2.3 — Framing members — Hip and valley roof construction



NOTE Some members have been omitted for clarity.

Figure 2.4 — Framing members — Scotch valley construction



NOTE Some members have been omitted for clarity.

Figure 2.5 — Framing members — Cathedral roof construction

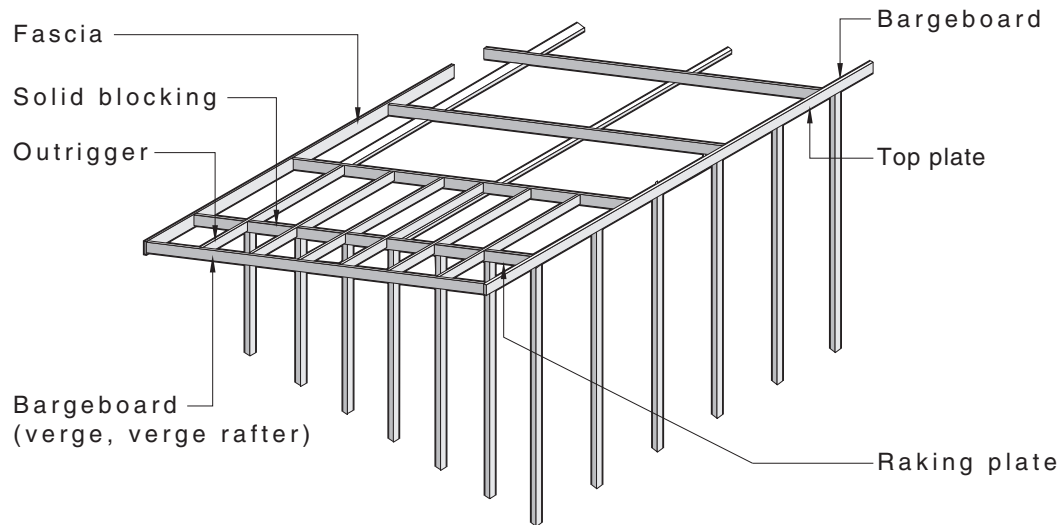
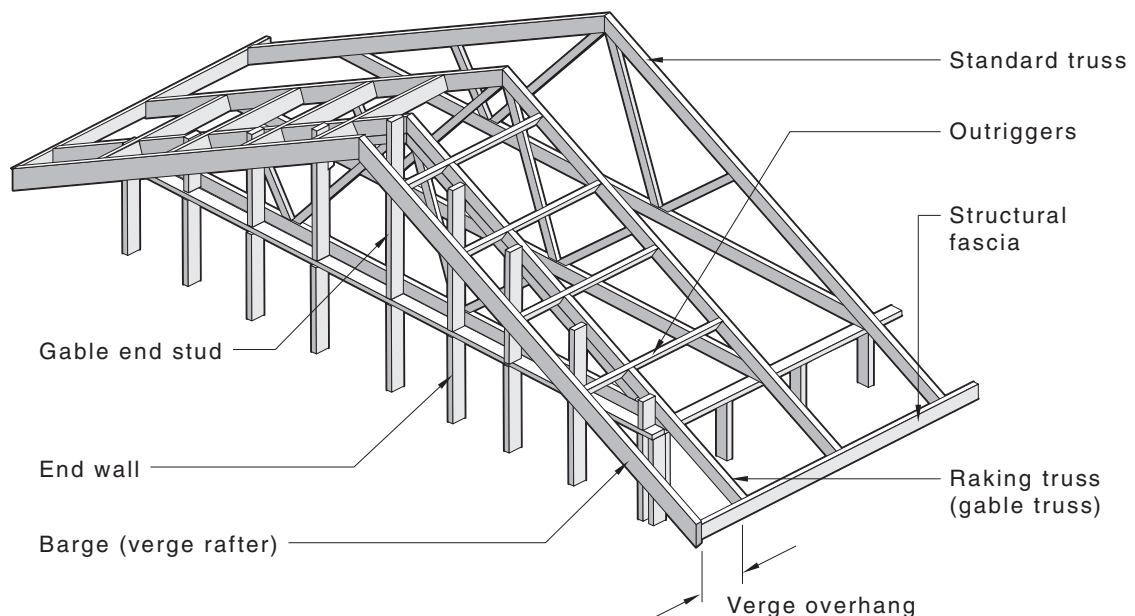


Figure 2.6 — Skillion roof



NOTE This diagram applies to verge overhangs greater than 300 mm from the raking or gable truss, refer to AS 4440.

Figure 2.7 — Gable end — Trussed roof

2.3 Vertical lamination

2.3.1 Vertical nail lamination

Vertical nail lamination may be used to achieve the required breadth for the larger section sizes given in the Span Tables of the Supplements using thinner and more readily obtainable sections. Where used, it shall apply only to seasoned timber laminations of the same timber type and stress grade. Laminations shall be unjoined in their length. Nails shall be a minimum of 2.8 mm in diameter and staggered as shown in [Figure 2.8\(a\)](#). They shall be through-nailed and clinched, or nailed from both sides.

Where screws are used in lieu of nails, they shall be minimum No. 10 screws. They may be at the same spacing and pattern provided they penetrate a minimum of 75 % into the thickness of the final receiving member.

NOTE See [Appendix J](#) for guidance on building practices for engineered wood products (EWPs).

2.3.2 Lamination of spaced ring beams

Ring beams that are made up of two spaced members shall be laminated in accordance with [Figure 2.8\(b\)](#).

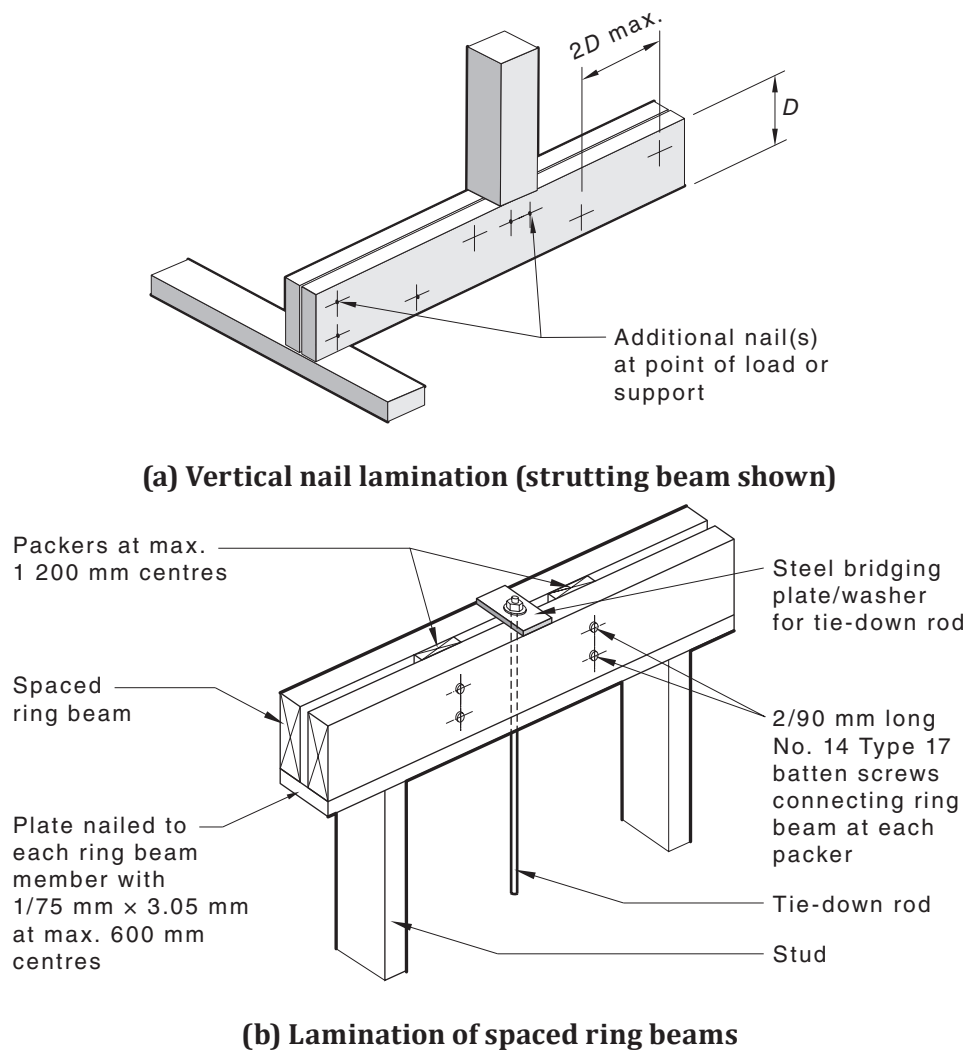


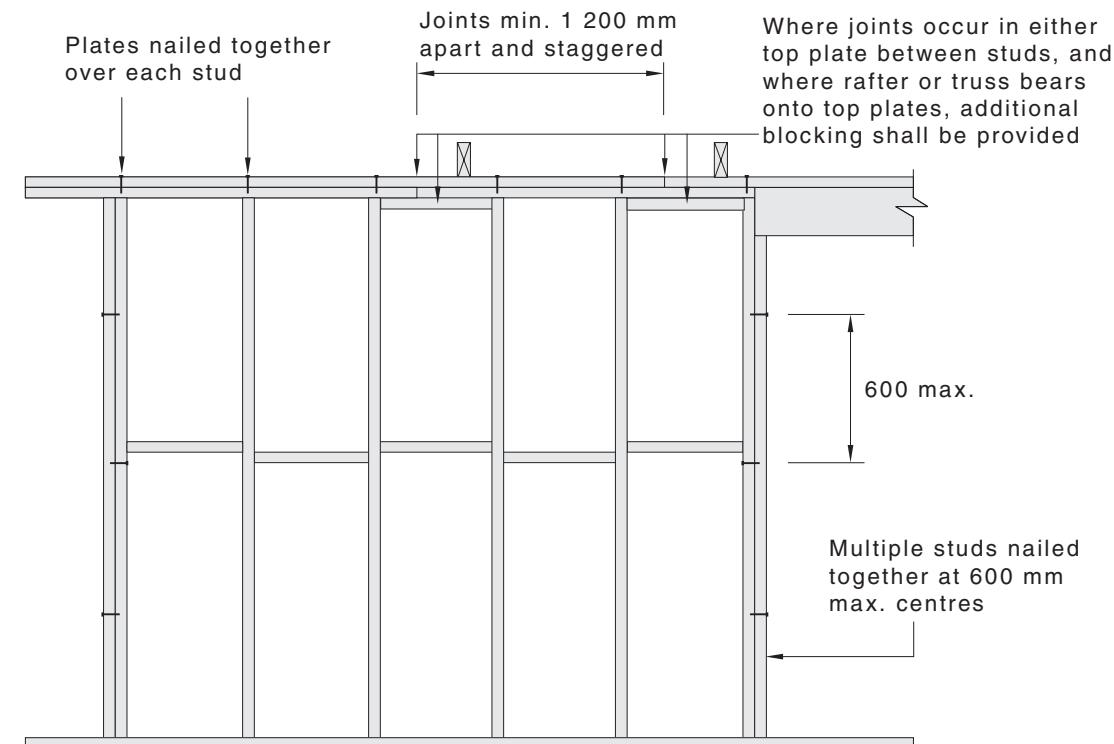
Figure 2.8 — Vertical lamination

2.4 Stud lamination

In the case of studs at sides of openings and studs supporting concentrations of load, the required size may be built up by using two or more laminations of the same timber type, stress grade and moisture content condition provided the achieved width is at least that of the nominated size. Studs up to 38 mm thick shall be nailed together with one 75 mm nail at maximum 600 mm centres. Studs over 38 mm but not exceeding 50 mm thick shall be nailed with one 90 mm nail at maximum 600 mm centres, see [Figure 2.9](#).

Where screws are used in lieu of nails, they shall be minimum No. 10 screws. They may be at the same spacing and pattern provided they penetrate a minimum of 75 % into the thickness of the final receiving member.

Posts shall not be nail-laminated.



NOTE See [Section 9](#) for other nominal fixing requirements including plates to studs.

Figure 2.9 — Stud/plate lamination

2.5 Horizontal nail lamination — Wall plates only

Wall plates that are made up of more than one section (e.g. 2/35 mm × 70 mm) shall be horizontally nail-laminated in accordance with [Figure 2.9](#), using —

- (a) two 75 mm long nails for plates up to 38 mm deep; or
- (b) two 90 mm long nails for plates up to 50 mm deep, see also [Clause 9.2.8](#).

A minimum of two nails shall be installed at not greater than 600 mm centres along the plate. Where more than two plates are used, the nailing requirement applies to each lamination.

All joins in multiple bottom plates shall occur over solid supports such as floor joists, solid blocking between bottom plate and bearer or concrete slab.

2.6 Load width and area supported

2.6.1 General

The supported load width and area are used to define the amount of load that is imparted onto a member. Load width, coupled with another geometric descriptor such as spacing, will define an area of load that a member is required to support.

Floor load width (*FLW*), ceiling load width (*CLW*) and roof load width (*RLW*) shall be determined from [Clauses 2.6.2 to 2.6.4](#).

For uplift due to wind loads, the definition “uplift load width” (*ULW*) is used, as *ULWs* may differ significantly from *RLWs* depending upon where the structure is tied down. See [Clause 9.6](#) for a definition of *ULW*.

2.6.2 Floor load width (*FLW*)

Floor load width (*FLW*) is the contributory width of floor, measured horizontally, that imparts floor load to a supporting member. *FLW* shall be used as an input to the Span Tables in the Supplements for all bearers and lower storey wall framing members. The *FLW* input is illustrated in [Tables 2.1 and 2.2](#).

Table 2.1 — Floor load width (*FLW*) — Single or upper storey construction

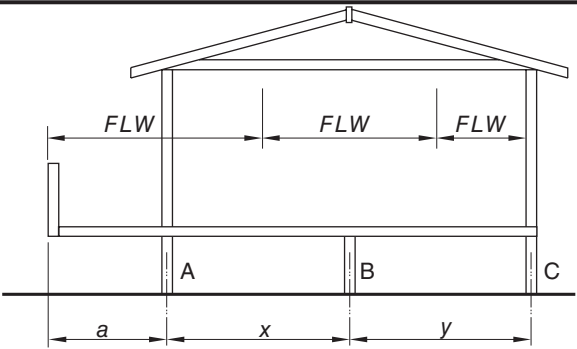
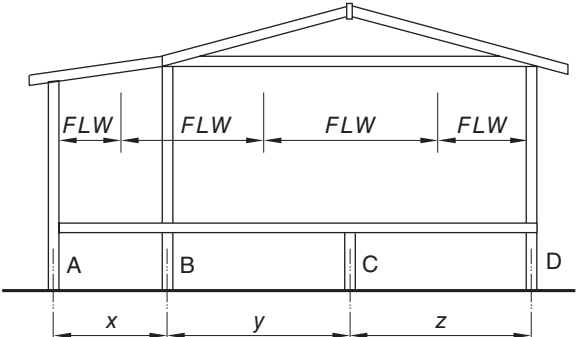
Type of construction	Location	Floor load width (<i>FLW</i>)
(a) Cantilevered balcony		Bearer A $FLW = \frac{x}{2} + a$
	Bearer B	$FLW = \frac{x + y}{2}$
	Bearer C	$FLW = \frac{y}{2}$
(b) Supported balcony		Bearer A $FLW = \frac{x}{2}$
	Bearer B	$FLW = \frac{x + y}{2}$
	Bearer C	$FLW = \frac{y + z}{2}$
	Bearer D	$FLW = \frac{z}{2}$

Table 2.2 — Floor load width (FLW) — Two storey construction

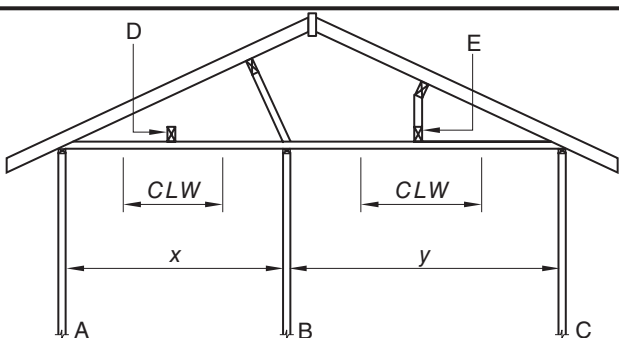
Type of construction	Location	Floor load width (FLW)
(a) Lower storey loadbearing walls	Wall A	Upper $FLW = \frac{x}{2} + a$
	Wall B	Upper $FLW = \frac{x + y}{2}$
	Wall C	Upper $FLW = \frac{y}{2}$
	Wall D	N/A ^a
(b) Bearers supporting lower storey loadbearing walls	Bearer A	Upper $FLW = \frac{x}{2} + a$ Lower $FLW = \frac{x}{2}$
	Bearer B	Upper $FLW = \frac{x + y}{2}$ Lower $FLW = \frac{x + y}{2}$
	Bearer C	Upper $FLW = \frac{y}{2}$ Lower $FLW = \frac{y + z}{2}$
	Bearer D	Upper $FLW = N/A^a$ Lower $FLW = \frac{z}{2}$
^a See Table 2.1 for floor load widths for single or upper storey construction.		

2.6.3 Ceiling load width (CLW)

Ceiling load width (CLW) is the contributory width of ceiling, usually measured horizontally, that imparts ceiling load to a supporting member.

CLW shall be used as an input to Span Tables for hanging beams, counter beams and strutting/hanging beams. The CLW input is illustrated in Table 2.3.

Table 2.3 — Ceiling load width (CLW)

Type of construction	Location	Ceiling load width (CLW)
	Walls A, B and C	N/A ^a
	Beam D (Hanging beam)	$CLW = \frac{x}{2}$
	Beam E (Strutting/hanging beam)	$CLW = \frac{y}{2}$

^a CLW is not required as an input to the Span Tables for wall framing or bearers supporting loadbearing walls.

2.6.4 Roof load width (RLW)

The roof load width (RLW) is used as a convenient indicator of the roof loads that are carried by some roof members and loadbearing wall members and their supporting substructure. The RLW value shall be used as an input to the relevant wall framing and substructure Span Tables. Tables 2.4 to 2.7 define RLW in relation to various types of roof construction.

For Tables 2.5 and 2.6, RLW may not be applicable where strut loads are supported by studs supporting concentrations of load and the remainder of wall C is deemed non-loadbearing. In these cases, the supported roof area shall be determined for the studs supporting concentrated loads.

Table 2.4 — Roof load width (RLW) — Non-coupled roofs

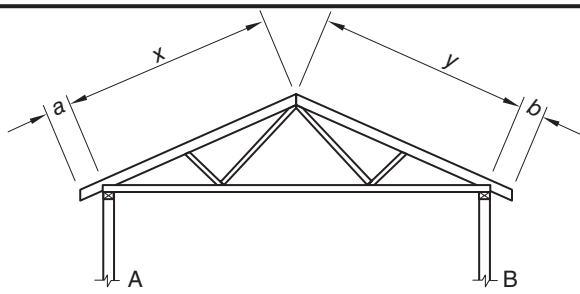
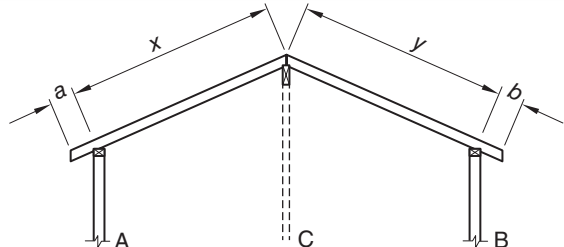
Type of construction	Wall	Roof load width (RLW) for member sizing
(a) Truss 	A	$RLW = \frac{x + y}{2} + a$
	B	$RLW = \frac{x + y}{2} + b$
(b) Cathedral 	A	$RLW = \frac{x}{2} + a$
	B	$RLW = \frac{y}{2} + b$
	C	$RLW = \frac{x + y}{2}$

Table 2.4 (continued)

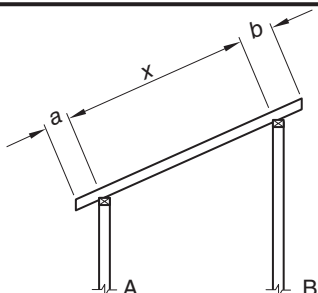
Type of construction		Wall	Roof load width (RLW) for member sizing
(c) Skillion		A	$RLW = \frac{x}{2} + a$
		B	$RLW = \frac{x}{2} + b$

Table 2.5 — Roof load width (RLW) — Coupled roofs with no underpurlins

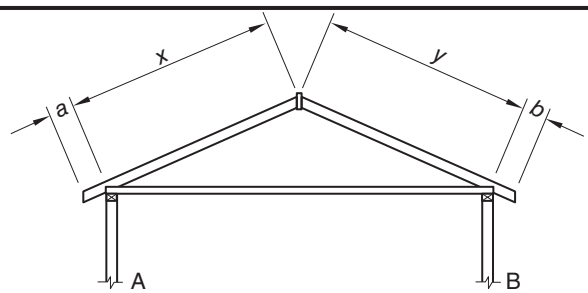
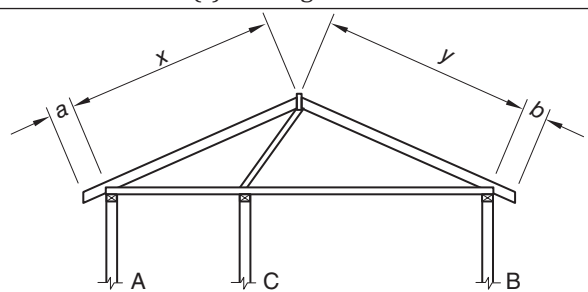
Type of construction	Wall	Roof load width (RLW) for member sizing
 (a) No ridge struts	A	$RLW = x + a$
	B	$RLW = y + b$
 (b) Ridge struts	A	$RLW = \frac{x}{2} + a$
	B	$RLW = \frac{y}{2} + b$
	C	N/A

Table 2.6 — Roof load width (RLW) — Coupled roofs with underpurlins

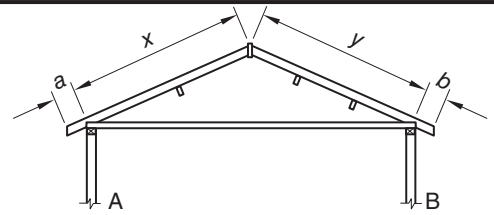
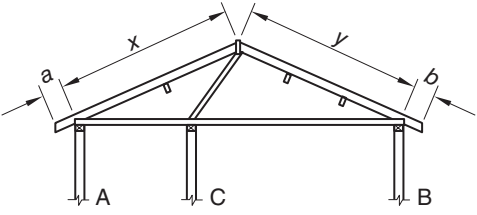
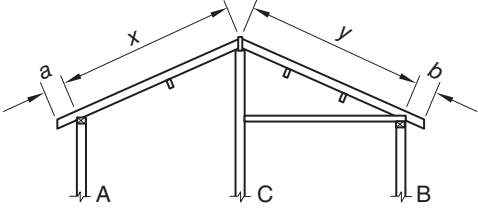
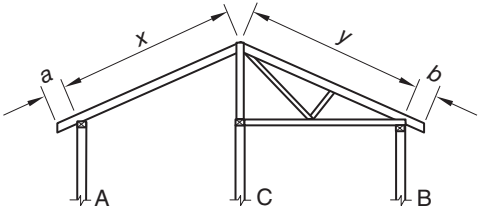
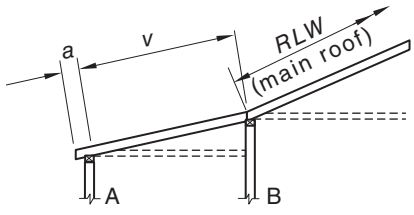
Type of construction	Wall	Roof load width (RLW) for member sizing
 (a) No ridge struts	A	$RLW = \frac{x}{2} + a$
	B	$RLW = \frac{y}{3} + b$

Table 2.6 (continued)

Type of construction	Wall	Roof load width (RLW) for member sizing
 (b) Ridge struts	A	$RLW = \frac{x}{4} + a$
	B	$RLW = \frac{y}{6} + b$
	C	N/A

NOTE Collar ties have been omitted for clarity.

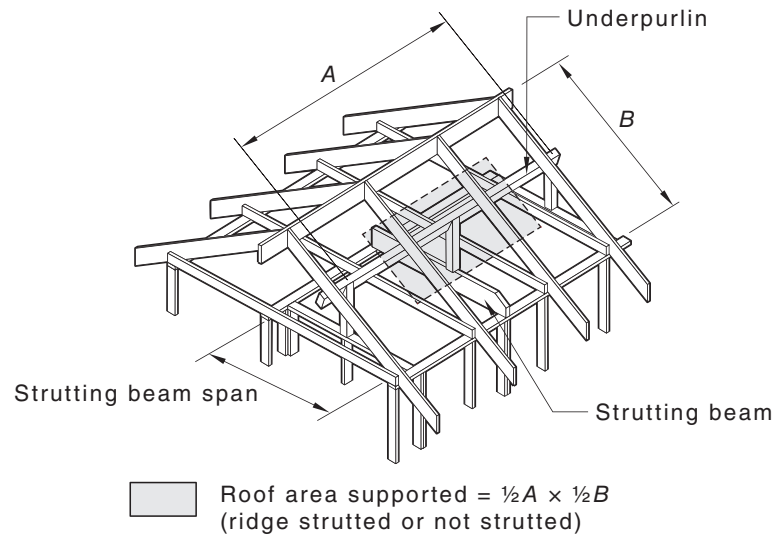
Table 2.7 — Roof load width (RLW) combinations and additions

Type of construction	Wall	Roof load width (RLW) for member sizing
 (a) Cathedral — Framed	A	$RLW = \frac{x}{4} + a$
	B	$RLW = \frac{y}{6} + b$
	C	$RLW = \frac{x}{4} + \frac{y}{6}$
 (b) Cathedral — Truss	A	$RLW = \frac{x}{2} + a$
	B	$RLW = \frac{y}{2} + b$
	C	$RLW = \frac{x + y}{2}$
 (c) Verandah	A	$RLW = \frac{v}{2} + a$
	B	$RLW = RLW \text{ for main roof} + \frac{v}{2}$

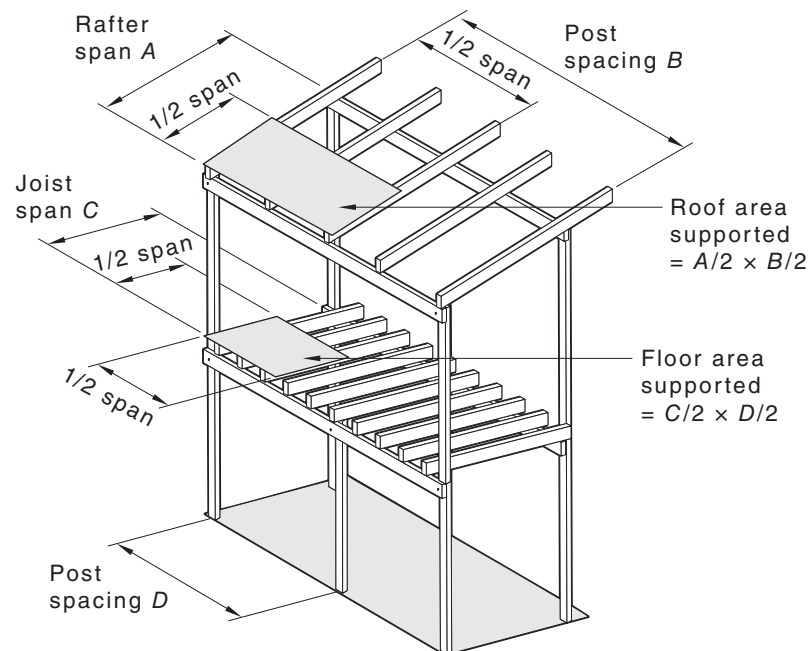
NOTE Collar ties have been omitted for clarity.

2.6.5 Area supported

The area supported by a member is the contributory area, measured in either the roof or floor plane, that imparts load onto supporting members. The roof area shall be used as an input to Span Tables in the Supplements for strutting beams, combined strutting/hanging beams, combined strutting/counter beams and studs supporting concentrated loads and posts. The floor area shall be used as an input to the Span Tables in the Supplements for studs supporting concentrated loads and posts. Typical “area supported” inputs for roofs and floors are illustrated in [Figure 2.10](#).



(a) Typical roof area supported by strutting beam



(b) Typical roof and floor area or supported by post

NOTE If the post was the central support for a continuous span verandah beam and bearer, the areas supported would be as follows: (a) Roof area supported = $A/2 \times B$; (b) Floor area supported = $C/2 \times D$.

Figure 2.10 — Area supported

Section 3 Substructure

3.1 General

This Section sets out requirements for site preparation, subfloor supports and the determination of footing sizes suitable for supporting timber-framed houses. This Section is based on AS 2870, using allowable soil-bearing stresses.

3.2 Site preparation and drainage

3.2.1 General

The clearing and drainage of the site on which the building is to be erected shall be adequate to ensure protection of any timber framing or components from the effects of prolonged dampness or insect attack.

3.2.2 Site clearing

The site shall be cleared of any logs, tree roots or stumps and other wood debris, including waste material from the construction, likely to increase the termite risk or cause damage to footings or concrete slabs or subsoil drainage, within and around the building.

3.2.3 Site drainage

Surface and subsurface water occurring on the building site shall be diverted to prevent it from flowing under the structure. Ponding of water under the structure shall be prevented by filling, grading or the provision of drainage or diversion channels.

NOTE The ground surface should be graded to fall away from the building.

3.3 Ground clearance and subfloor ventilation

Ground clearance and subfloor ventilation shall be provided.

NOTE Refer to the National Construction Code for requirements related to ground clearance and subfloor ventilation.

3.4 Durability

3.4.1 Termite management

Protection against termites shall be provided.

NOTE Refer to the National Construction Code for requirements related to protection against termites.

3.4.2 Species selection

Any species and durability classes of timber may be utilized for floor and subfloor framing where adequate ventilation and weather protection is provided, see also [Clause 1.8](#).

NOTE For extremely damp or unventilated situations or timber in contact with the ground, see [Appendix B](#).

3.5 Substructure bracing

The substructure shall be adequately braced against all of the applied loads, see [Section 8](#).

3.6 Subfloor supports

3.6.1 General

This Clause provides a procedure to determine typical vertical gravity loads and the capacity and size of some footings. Stumps, posts, piers, and similar members that are positioned beneath the floor shall be designed to support vertical gravity loads.

Alternatively, for wind classifications N1 and N2, footings, stump and post sizes may be determined from [Clause 3.7](#).

3.6.2 Soil classification

Details provided in this Clause are only applicable to A, S, M or H soil classification with a minimum allowable bearing capacity of 100 kPa. Soil classifications E and P are beyond the scope of this Section and further professional advice will be required.

Where the allowable bearing capacity of the soil has been determined from site investigation, then this capacity shall be used to determine the footing size in accordance with [Clause 3.6.6](#).

Site soil classifications shall be made in accordance with AS 2870.

3.6.3 Procedure

The following procedure shall be used to determine the vertical gravity loads and the capacity and size of the footing:

- (a) Determine the individual dead and live loads that contribute to the total vertical gravity load combination, see [Clauses 3.6.4.2](#) and [3.6.4.3](#).
- (b) Calculate the total vertical gravity load from the load combination given in [Clause 3.6.5](#).
- (c) Determine the size of the footing, or bearing area required, for piers, stumps, posts, and similar substructures, see [Clause 3.6.6](#).

3.6.4 Determination of vertical gravity loads

3.6.4.1 General

Vertical gravity dead and live loads shall be determined in accordance with [Clauses 3.6.4.2](#) and [3.6.4.3](#).

3.6.4.2 Permanent (dead) loads (*G*)

Permanent loads shall be determined as follows:

- (a) *Floor loads* — The total floor loads (kN) shall be calculated by multiplying the floor area (m²) supported by the individual stump, pier, post or similar substructures under consideration by the unit weight of the floor system (kN/m²).

If supported floor areas have different weights, the contribution of individual areas shall be summed to determine the total load. Where items such as waterbeds, slate-based billiard tables, spas, hot tubs and other permanent loads are not included in the typical weights given in [Table 3.1](#) and the weight of these items, where present, shall be added to the total.

Ceilings are assumed to be either 13 mm plasterboard, or material of similar weight (0.12 kN/m²).

NOTE 1 [Table 3.1](#) provides guidance on the weight of typical floor systems. The weight of quarry or slate tiles and bedding compound are not covered by this Table.

- (b) *Wall loads* — The total wall load (kN) shall be determined by multiplying the floor area (m²) supported by the individual stump, pier, post or similar members under consideration by 0.4 kN/m². For two storey construction, the floor area of both upper and lower storeys shall be included in the floor area determination. Where the actual permanent wall load (kN) applied to individual footings has been calculated, this load shall be used.

NOTE 2 The value of 0.4 kN/m² applied to the floor area has been determined as a typical distributed wall load averaged over the floor area for most housing.

- (c) *Roof loads* — The total roof load (kN) shall be determined by multiplying the roof area (m²) supported by the individual stump, pier, post or similar members under consideration by 0.4 kN/m² for sheet roofs, and 0.9 kN/m² for tile roofs.

NOTE 3 The values of 0.4 kN/m² and 0.9 kN/m² have been determined as typical average unit weights for total roof weights for sheet and tile roofs respectively.

NOTE 4 Care should be taken when determining the contributory roof area and respective load paths applied to each footing under consideration.

Table 3.1 — Weight of typical floors

Floor and/or ceiling type	Weight, kN/m ²
Timber flooring up to 22 mm thick plus lightweight floor covering, i.e. carpet and underlay	0.30
Timber flooring up to 22 mm thick plus lightweight floor covering and ceilings	0.40
Timber flooring up to 22 mm thick plus ceramic or terracotta floor covering	0.60
Timber flooring up to 22 mm thick plus ceramic or terracotta floor coverings and ceilings	0.70

3.6.4.3 Live loads (*Q*)

Live loads shall be determined as follows:

- (a) *Roof and floor live loads* — Roof live loads up to 0.25 kPa do not need to be included in the calculation of total vertical gravity loads. Floor live loads (kN) shall be determined by multiplying the floor area (m²) supported by the individual stump, post, pier or similar members under consideration by 1.5 kN/m².

The value of 1.5 kN/m² shall only apply to the general floor and deck areas of Class 1 buildings.

For decks greater than 1.0 m above the ground, the live load contributed by the area of deck under consideration shall be 3.0 kN/m² except for decks greater than 40 m² where the live load reduces to 1.5 kN/m².

- (b) *Other live loads* — In alpine and sub-alpine areas, the contribution of snow loads exceeding 0.2 kPa, determined in accordance with AS 1170.4, shall also be added to the live loads.

3.6.5 Determination of total vertical gravity load combination for footings

The total vertical gravity load combination, *P* (kN), shall be calculated as follows:

$$P = G + 0.5 Q$$

where

G = sum of individual permanent floor, wall and roof loads, in kilonewtons

Q = sum of individual floor (and snow if applicable) live loads, in kilonewtons

NOTE The above load combination is derived from AS 2870.

3.6.6 Footing size or bearing area

The size of footing may be determined directly from [Table 3.2](#) for the total vertical bearing load, P (kN), determined from [Clause 3.6.5](#). Alternatively, the bearing area required for the footing, A (m²), may be determined as follows:

$$A = P/100$$

NOTE 1 The 100 kPa is the allowable bearing capacity of the foundation for [Table 3.2](#).

NOTE 2 For an alternative allowable bearing capacity, see the worked example in [Clause D.2](#).

Table 3.2 — Bearing load and footing size

Total vertical bearing load, kN	Minimum concrete pier/stump or sole plate diameter, mm	Minimum concrete pier/stump or sole plate size, mm × mm
4.9	250	225 × 225
7.1	300	275 × 275
9.0	350	300 × 300
12	400	350 × 350
16	450	400 × 400

3.7 Footings and supports for wind classifications N1 and N2

3.7.1 General

This Clause covers the selection of stumps and posts, and pad footings and sole plates required to transfer roof, wall and floor loads to the soil foundation.

The bracing requirements of [Section 8](#) shall be considered to ensure that the use of footing or post or stump details given in this Section are also adequate to resist lateral loads. For wind classifications greater than N2, see [Clause 3.6](#).

3.7.2 Simplified footing classification

For the purposes of this Clause, footings for stumps or posts are classified as types 1 to 5, as shown in [Table 3.3](#). Footing types 1 to 4 are for use in areas where the allowable foundation bearing pressure is at least 100 kPa. Type 5 footings are only suitable where the allowable foundation bearing pressure equals or exceeds 125 kPa.

Footings shall be proportioned to distribute evenly vertical and lateral loads from the building to the foundation material such that significant settlement or other movement is prevented.

Timber sole plates shall not project beyond any face of the stump or post they support by more than their own thickness, taken across the grain, or three times their own thickness measured along the grain.

NOTE Further information, including minimum depth requirements, is given in AS 2870.

Table 3.3 — Footing classification

Footing type	Minimum bearing area, m ²	Bearing capacity, kN	Minimum size of unreinforced concrete pad footing, mm	Nominal unseasoned size of timber soleplates, mm
1	0.045	4.5	230 × 230 × 100 deep or 250 dia. × 100 deep	200 × 225 × 38 thick
2	0.090	9.0	300 × 300 × 150 deep or 350 dia. × 150 deep	250 × 360 × 75 thick

Table 3.3 (continued)

Footing type	Minimum bearing area, m ²	Bearing capacity, kN	Minimum size of unreinforced concrete pad footing, mm	Nominal unseasoned size of timber soleplates, mm
3	0.120	12	350 × 350 × 200 deep or 400 dia. × 200 deep	300 × 400 × 75 thick
4	0.180	18	430 × 430 × 250 deep or 500 dia. × 200 deep	300 × 600 × 100 thick
5	0.180	22	430 × 430 × 250 deep or 500 dia. × 200 deep	300 × 600 × 100 thick

3.7.3 Stumps and posts

The following requirements apply:

- (a) *Sizes* — Stump and post sizes shall be appropriate to the footing type used, as given in [Table 3.4](#).

NOTE 1 The use of stumps or posts in material other than timber is subject to the requirements of the relevant authority. Refer to the National Construction Code for specifications for stumps or posts in material other than timber.

- (b) *Height* — The height, above-ground, of any stump or post determined using [Table 3.4](#) shall not exceed 15 times the minimum face width or diameter, unless designed in accordance with recognized engineering principles.

NOTE 2 Where posts or stumps are designed in accordance with engineering principles, the height limitation may not apply.

- (c) *Embedment* — Stumps or post embedment in the foundation material shall be at least 0.3 times the stump height above-ground level or 450 mm, whichever is the greater.

Table 3.4 — Stump/post sizes

Footing type	Stress grade					
	F4	F5	F7	F8	F11	F14
	Nominal unseasoned timber stump/post size, mm					
1	100 × 100 or 110 dia.	100 × 100 or 110 dia.	100 × 100 or 110 dia.	100 × 100 or 110 dia.	100 × 100 or 110 dia.	100 × 100 or 110 dia.
2	125 × 125 or 125 dia.	125 × 125 or 120 dia.	100 × 100 or 115 dia.	100 × 100 or 110 dia.	100 × 100 or 110 dia.	100 × 100 or 110 dia.
3	125 × 125 or 135 dia.	125 × 125 or 130 dia.	125 × 125 or 120 dia.	100 × 100 or 115 dia.	100 × 100 or 110 dia.	100 × 100 or 110 dia.
4	150 × 150 or 150 dia.	125 × 125 or 145 dia.	125 × 125 or 135 dia.	125 × 125 or 125 dia.	125 × 125 or 120 dia.	100 × 100 or 115 dia.
5	As approved					
NOTE 1 Stump or post size is also dependent upon height above-ground, see Clause 3.7.3(b) .						
NOTE 2 Timber durability/preservative treatment should be appropriate for the expected service conditions see Appendices B and G .						
NOTE 3 For termite protection, see Clause 3.4.1 .						

3.7.4 Footing type support limitations (load widths × bearer spans)

Tables 3.5, 3.6 and 3.7 give maximum permissible load widths and bearer spans for each footing type, based on footing capacity. The Span Tables give maximum bearer spans based on the capacity of the relevant timber cross-section. Both of these requirements shall be satisfied.

Table 3.5 — Load widths and bearer spans for footing types 1 to 5 for bearers supporting floor loads only

Footing type	Floor load width, mm						
	1 200	1 500	1 800	2 100	2 400	3 000	3 600
	Maximum permissible bearer span, mm						
1	2 400	1 900	1 600	1 400	1 200	1 000	800
2	4 800	3 900	3 200	2 800	2 400	1 900	1 600
3	6 400	5 200	4 300	3 700	3 200	2 600	2 100
4	9 700	7 700	6 400	5 500	4 800	3 900	3 200
5	12 100	9 700	8 100	6 900	6 000	4 800	4 000

NOTE 1 Maximum permissible bearer span is for each footing type. Bearer size is determined from the relevant Span Tables in the Supplements, see [Section 4](#).

NOTE 2 The Table values are based on a distributed load of 1.55 kPa being 0.4 kPa non-loadbearing wall load spread over the floor area, 0.4 kPa floor load and 0.75 kPa permanent live load.

Table 3.6 — Load widths and bearer spans for footing types 1 to 5 for bearers supporting single storey loadbearing walls

Footing type	Roofing type	Roof load width, mm				
		1 500	3 000	4 500	6 000	7 500
		Maximum permissible bearer span, mm				
Floor load width 900 mm						
1	Sheet	2 300	1 700	1 400	1 200	1 000
2		4 500	3 500	2 800	2 400	2 000
3		6 000	4 600	3 800	3 200	2 700
4		9 000	6 900	5 600	4 700	4 100
5		11 300	8 700	7 000	5 900	5 100
1	Tile	1 600	1 000	800	NS	NS
2		3 300	2 200	1 600	1 300	1 100
3		4 400	2 900	2 200	1 800	1 500
4		6 600	4 400	3 300	2 600	2 200
5		8 200	5 500	4 100	3 300	2 800
Floor load width 1 800 mm						
1	Sheet	1 300	1 100	1 000	800	NS
2		2 600	2 300	2 000	1 700	1 600
3		3 500	3 000	2 600	2 300	2 100
4		5 300	4 500	3 900	3 500	3 100
5		6 600	5 600	4 900	4 300	3 900
1	Tile	1 100	800	NS	NS	NS
2		2 200	1 600	1 300	1 100	900
3		2 900	2 200	1 800	1 500	1 300
4		4 300	3 300	2 600	2 200	1 900

Table 3.6 (continued)

Footing type	Roofing type	Roof load width, mm				
		1 500	3 000	4 500	6 000	7 500
		Maximum permissible bearer span, mm				
5		5 400	4 100	3 300	2 700	2 400

NOTE 1 NS = not suitable.

NOTE 2 Maximum permissible bearer span is for each footing type. Bearer size is determined from the Span Tables in the Supplements, see [Section 4](#).

NOTE 3 The Table values are based on roof loads of 0.4 and 0.9 kPa for sheet and tile roofs respectively, and a distributed load of 1.55 kPa being 0.4 kPa wall load spread over the floor area, 0.4 kPa floor load and 0.75 kPa permanent live load.

Table 3.7 — Load widths and bearer spans for footing types 1 to 5 for bearers supporting two storey loadbearing walls

Footing type	Roofing type	Roof load width, mm				
		1 500	3 000	4 500	6 000	7 500
		Maximum permissible bearer span, mm				
Floor load width (upper + lower storey) 2 400 mm						
1	Sheet	1 000	900	800	NS	NS
2		2 100	1 800	1 600	1 500	1 300
3		2 800	2 400	2 200	2 000	1 800
4		4 200	3 700	3 300	2 900	2 700
5		5 200	4 600	4 100	3 700	3 300
1	Tile	900				
2		1 800	1 400	1 200	1 000	900
3		2 400	1 900	1 500	1 300	1 100
4		3 500	2 800	2 300	2 000	1 700
5		4 400	3 500	2 900	2 500	2 100
Floor load width (upper + lower storey) 3 600 mm						
1	Sheet	NS	NS	NS	NS	NS
2		1 500	1 300	1 200	1 100	1 000
3		1 900	1 800	1 600	1 500	1 400
4		2 900	2 700	2 400	2 300	2 100
5		3 600	3 300	3	2 800	2 600
1	Tile	NS	NS	NS	NS	NS
2		1 300	1 100	900	800	NS
3		1 700	1 400	1 200	1 100	1 000
4		2 600	2 200	1 900	1 600	1 500
5		3 200	2 700	2 300	2 000	1 800
Floor load width (upper + lower storey) 4 800 mm						
1	Sheet	NS	NS	NS	NS	NS
2		1 100	1 000	1 000	900	800
3		1 500	1 400	1 300	1 200	1 100
4		2 200	2 100	1 900	1 800	1 700
5		2 800	2 600	2 400	2 300	2 200
1		NS	NS	NS	NS	NS

Table 3.7 (continued)

Footing type	Roofing type	Roof load width, mm				
		1 500	3 000	4 500	6 000	7 500
		Maximum permissible bearer span, mm				
2	Tile	1 000	900	NS	NS	NS
3		1 400	1 200	1 000	900	800
4		2 000	1 800	1 600	1 400	1 300
5		2 600	2 200	2 000	1 700	1 600

NOTE 1 NS = not suitable.

NOTE 2 Maximum permissible bearer span is for each footing type. Bearer size is determined from the relevant Span Tables in the Supplements, see [Section 4](#).

NOTE 3 The Table values are based on roof loads of 0.4 and 0.9 kPa for sheet and tile roofs respectively, and a distributed load of 1.55 kPa being 0.4 kPa wall load spread over the floor area, 0.4 kPa floor load and 0.75 kPa permanent live load for each floor.

Section 4 Floor framing

4.1 General

4.1.1 Application

This Section sets out the requirements for the construction of timber-framed floors and, where applicable, decks, verandahs, and similar constructions. This Section shall be used in conjunction with Span Tables 1 to 6, 33 to 35 and 49 and 50 given in the Supplements.

4.1.2 Materials

Any timber species may be used for floor framing provided it is kept dry, i.e. it is not exposed to weather, it is well ventilated, and is not in contact with or close to the ground, see [Clause 1.8](#) and [Clause 3.3](#).

When constructing floors that will be exposed to the weather (e.g. decks, verandahs), attention shall be given to the durability of materials and detailing required to ensure an adequate service life, see [Clause 1.8](#).

NOTE 1 For information on durability, see [Appendix B](#).

NOTE 2 For information on moisture content and shrinkage, see [Appendix E](#).

4.1.3 Framing configurations

Various configurations of bearers and joists may be used to support flooring at either the ground level or at the first floor level, including conventional joists over bearers and joists in line with bearers (low-profile floor framing).

4.1.4 Weatherproofing

The detailing of wall cladding, flashings and damp-proof course in any construction shall be such that timber floor frame members will be protected from the weather or ground moisture rising through the substructure.

4.1.5 Shrinkage

Where large unseasoned timber members or members with different shrinkage characteristics are used, allowance shall be made for shrinkage.

NOTE Shrinkage associated with the use of seasoned or small section unseasoned bearers and joists (overall depth of floor frame less than 200 mm) is usually of minimal significance to the overall performance of the structure, see [Figure E.1](#).

4.1.6 Cuts, holes and notches in bearers and joists

Cuts, holes and notches shall not exceed the sizes, nor be at closer spacing than those, given in [Figure 4.1](#).

Unless otherwise specified, the member size shall not be reduced by any other method to a net section size less than that required to achieve the span requirements.

Only one surface at the end of any member shall be notched.

NOTE 1 Significant imperfections, such as knots, should be regarded as holes with respect to the hole spacing limitations given in [Figure 4.1](#).

NOTE 2 Engineered timber products and EWP's may have their own specific limitations, see [Clause 1.12](#).

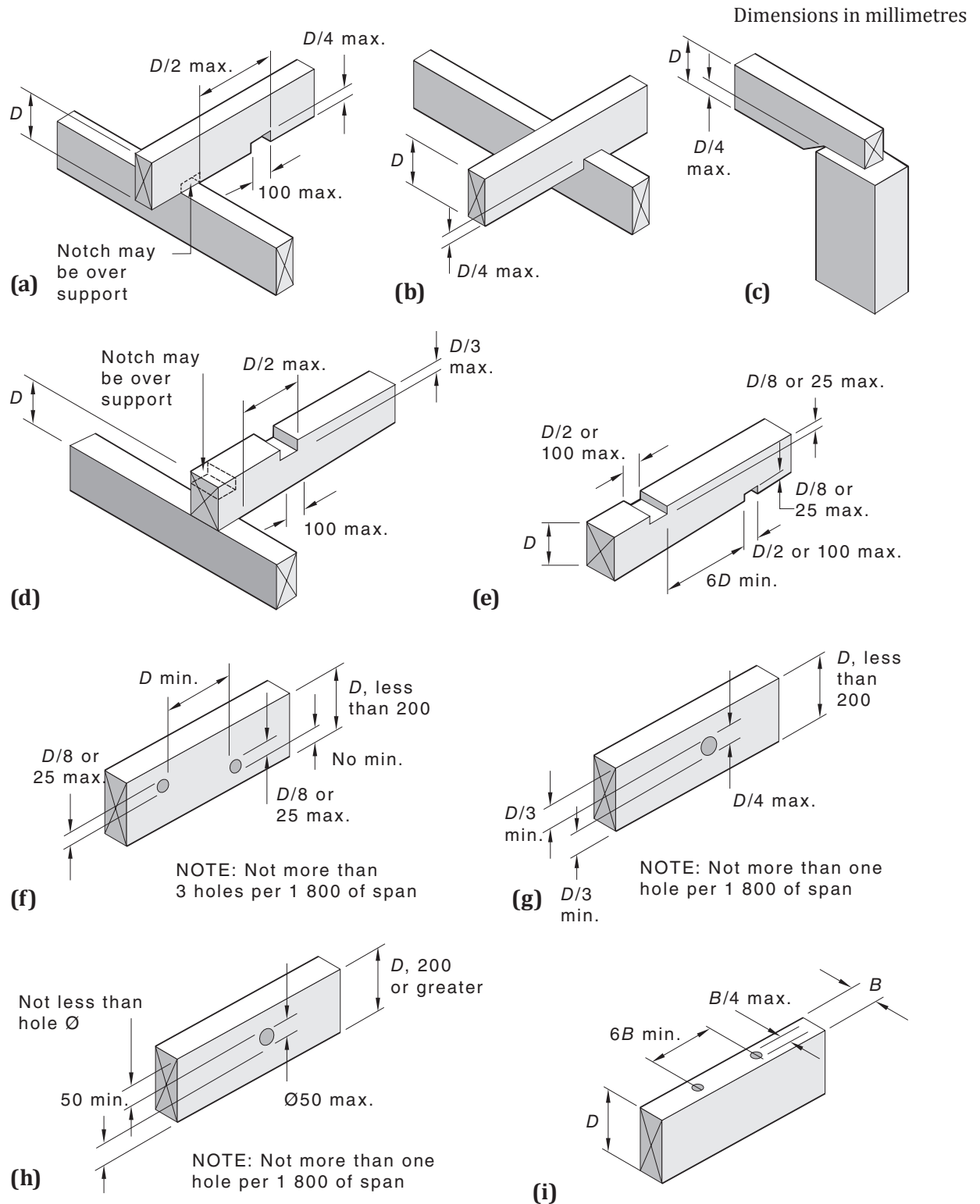


Figure 4.1 — Notches, cuts and holes in beams, bearers, joists, rafters

4.2 Building practice

4.2.1 Bearers

4.2.1.1 General

Bearers shall span between subfloor supports or walls. Bearers may either be single or continuous span over supports, see [1.3.9.3](#) and [1.3.9.4](#).

Where required, bearers shall be levelled, preferably by checking (notching) out the underside over supports. Packing of minor deficiencies in depth is permitted provided the packing is a corrosion-resistant, incompressible material over the full area of support.

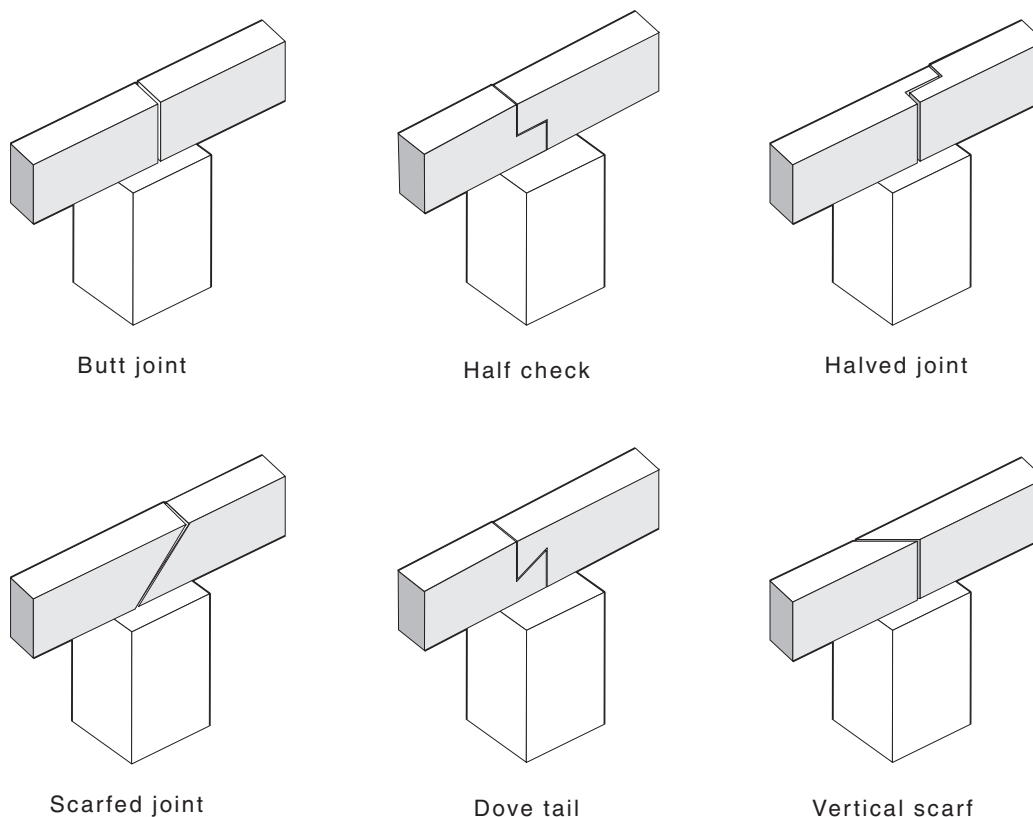
Bearers with minor spring, within the allowable limits, shall have the spring placed upwards to allow for straightening under loading.

Joints in bearers shall occur only over supports with adequate bearing for both members. [Figure 4.2](#) shows various connection methods that may be used over supports. All cuts shall be located over a support. The minimum bearing each side of a joint shall be 50 mm.

Regardless of their length, if bearers are partially cut through (crippled) over supports to correct bow or spring, they shall be deemed to be supported at two points only, i.e. single span.

NOTE 1 Bearers may be planed to within the allowable tolerances of the member specified.

NOTE 2 Some engineered nail-plated products may permit joints to occur other than over supports, see [Clause 1.12](#).



NOTE Bearers may also be lapped over supports.

Figure 4.2 — Connection methods over bearer supports (alternatives)

4.2.1.2 Fixing of bearers to supports

Bearers shall be fixed to their supporting stumps, posts or columns so as to give adequate bearing and provide restraint against lateral movement, see [Clause 9.7](#).

4.2.1.3 Built-up bearers

The required breadth of larger section bearers may be obtained by vertically nail-laminating thinner sections together, see [Clause 2.3](#).

4.2.1.4 Double bearers (spaced bearers)

The required breadth of larger bearers may be obtained by using spaced double bearers. Spacer blocks shall be placed between the bearers and, where relevant, at supports, at the intervals specified in [Table 4.1](#), see [Figure 4.3](#).

Table 4.1 — Spacer block location and fixings

Bearer span, m	Block location	Fixing requirements
Under 2.0	Midspan	For 38 mm thick, 2/75 mm nails each side For 50 mm thick, 2/100 mm nails each side
2.0 to 3.6	One-third span points	4/75 mm nails each side
Over 3.6	One-quarter span points	2/M10 through bolts

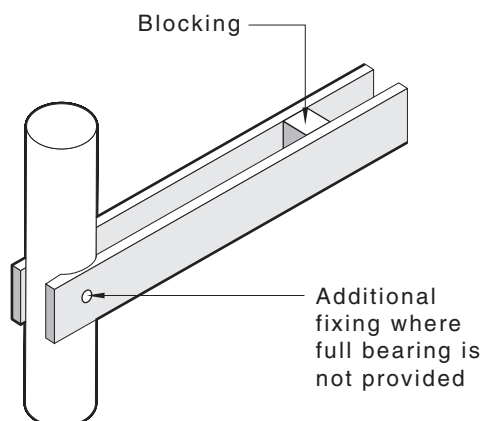


Figure 4.3 — Double bearer

4.2.2 Joists

4.2.2.1 General

Joists shall be laid with their top surfaces level to receive flooring. The undersides of joists having minor excesses shall be notched over bearers in order to bring them to the required level. Packing of joists having minor deficiencies in depth may be utilized provided the packing is fixed and is of corrosion-resistant and incompressible material over the full area of contact.

Spacing of joists shall be determined by the span capacity of the flooring, see [Section 5](#). Additional single or double joists shall be provided, where required, to support loadbearing walls parallel to joists (see [Clause 4.3.2.4](#)) or flooring, see [Clause 5.3](#).

Joists having minor spring (within allowable limits) shall be laid such as to allow for straightening under loading. Regardless of their length, if joists are partially cut over supports to correct bow or spring, they shall be deemed to be supported at two points only (single span). Where cuts are used

to correct bow or spring, they shall be located centrally over the support, so that each side of the cut section is adequately supported.

Joints in joists shall be as shown in [Figure 4.4](#) and shall be made only over bearers or supports. Joists joined over bearers or supports shall have a minimum 30 mm bearing for each joist. Joints in joists that are required to be in line (e.g. supporting wall plates or fitted flooring) shall be butted or scarfed, but not lapped.

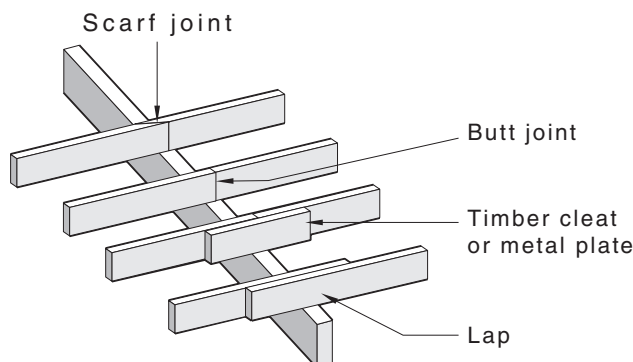


Figure 4.4 — Methods of joining joists

4.2.2.2 Location of joists

The following shall apply:

- (a) *Fitted flooring* — For flooring that abuts wall plates, a pair of joists shall be provided under each wall that is parallel to the direction of the joists. These joists shall be spaced to provide solid bearing and fixing for the bottom wall plate and to project not less than 12 mm to give support for fixing of the flooring, see [Figure 5.1](#).
- (b) *Platform flooring* — Where flooring is continuous under wall plates, joists shall be provided directly under all loadbearing walls parallel to the joists. A single joist only is required under external non-loadbearing walls.

Joists are not required under internal non-loadbearing walls except where needed to support flooring.

4.2.2.3 Deep joists

Where the depth of floor joists is equal to or exceeds four times the breadth (deep joists), the joists shall be restrained at their supports with either —

- (a) a continuous trimming joist provided to the ends of joists above external bearers or wall plates; or
- (b) solid blocking or herringbone strutting between the outer pairs of joists and between intermediate pairs at not more than 1.8 m centres.

Trimmers or solid blocking may be 25 mm less in depth than the joists, as shown in [Figure 4.5](#), or other equivalent method for the purpose of ventilation. Trimmers or solid blocking shall be a minimum thickness of 25 mm.

In addition, for deep joists in unseasoned timber where the span exceeds 3.0 m and there is no ceiling installed on the underside of joists, herringbone strutting or solid blocking shall be provided between all joists in evenly spaced rows not exceeding 1 800 mm centres.

Where rim boards (see [1.3.5](#)) are used in conjunction with deep joists, including I joist and floor systems, they shall be suitable to carry relevant uniform and point loads that may be transferred to the rim board via the plates.