



Timber structures

Part 5: Nailplated timber roof trusses



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Australian Standard[®]

Timber structures

Part 5: Nailplated timber roof trusses

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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 Structures and Framing.

After consultation with stakeholders in both countries, Standards Australia and Standards New Zealand decided to develop this Standard as an Australian Standard rather than an Australian/New Zealand Standard.

The objective of this Standard is to provide a performance-based document for the design of nailplated timber roof trusses for residential and similar building applications in accordance with AS 1720.1, AS 4055 and the AS/(NZS) 1170 series. Guidance is provided as necessary for the interpretation of these Standards specifically for roof truss design within defined building parameters. Some prescriptive information is included for effective application of the Standard.

Statements expressed in mandatory terms in notes to tables are deemed to be requirements of this Standard.

The terms 'normative' and 'informative' have been used in this Standard to define the application of the appendix to which they apply. A normative appendix is an integral part of a Standard, whereas an informative appendix is for information and guidance only.

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FOREWORD

The design of nailplated timber roof trusses in Australia has evolved over the past 50 years, from simplified manual procedures encompassing standard designs, to the sophisticated computer design packages of today, which are used to individually design each truss within a roof system.

Over this period, methods of design, fabrication and construction, drawn from research, experience and reference to various Australian and international Standards, have been developed to suit the form and style of Australian buildings. This Standard is the result of a collaborative effort to document a common uniform method of designing nailplated timber roof trusses in Australia.

The methodology, design and performance criteria outlined in this Standard are suitable for preparing and checking the designs of nailplated timber roof trusses in residential and similar building applications in Australia. Additional information, such as the structural properties of proprietary nailplates, may be obtained from the supplier.

STANDARDS AUSTRALIA

Australian Standard Timber structures

Part 5: Nailplated timber roof trusses

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard sets out design considerations and methods for nailplated timber roof trusses for residential and other buildings within the following limitations:

- (a) Residential structures, light commercial structures, and non-habitable structures.
- (b) Maximum roof pitch of 45°.
- (c) Maximum truss span of 16 m.
- (d) Maximum truss spacing of 1200 mm.

1.2 APPLICATION

This Standard shall be used in conjunction with AS 1720.1, AS 4055 (where appropriate) and the AS/(NZS) 1170 series.

NOTES:

- 1 The design requirements and criteria contained herein provide a basis for the design of nailplated timber roof trusses to meet the structural safety and serviceability performance requirements of the NCC for the building types within the general limitations given in Clause 1.1.
- 2 This Standard may also be applied 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.
- 3 Some parts of the scope of this Standard are beyond the scope of AS 1684 and AS 4773. In those circumstances, the supporting structure shall be designed from first principles according to their material standards.

1.3 NORMATIVE REFERENCES

The following are the normative documents referred to in this Standard:

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

AS

1170	Structural design actions
1170.4	Part 4: Earthquake actions in Australia
1397	Continuous hot-dip metallic coated steel sheet and strip—Coatings of zinc and zinc alloyed with aluminium and magnesium
1649	Timber—Methods of test for mechanical fasteners and connectors—Basic working loads and characteristic strengths

AS	
1684	Residential timber-framed construction
1684.2	Part 2: Non-cyclonic areas
1720	Timber structures
1720.1	Part 1: Design methods
4055	Wind loads for housing
4440	Installation of nailplated timber roof trusses
4446	Manufacture of nailplate-joined timber products
AS/NZS	
1170	Structural design actions (series)
1170.0	Part 0: General principles
1170.1	Part 1: Permanent, imposed and other actions
1170.2	Part 2: Wind actions
1170.3	Part 3: Snow and ice actions

1.4 NOTATION

The following symbols are used in this Standard:

b	=	Breadth of member
d	=	Depth of member
G	=	Permanent action
L	=	Span
L_o	=	Horizontal span for overhang
Q	=	Imposed action
s	=	Spacing
W_u	=	Ultimate wind action
W_s	=	Serviceability wind action
W_{se}	=	Serviceability wind action—external
W_{si}	=	Serviceability wind action—internal
S_u	=	Ultimate snow action
S_s	=	Serviceability snow action
E_u	=	Ultimate earthquake action

1.5 DEFINITIONS

For the purpose of this Standard, the following definitions apply.

NOTE: Appendix A illustrates generic terms applying to roof trusses and roof truss systems, and typical roof truss shapes. It also describes key truss types in terms of function and loading.

1.5.1 Apex

The truss joint formed where two sloping top chords of a truss intersect, generally at the highest point of the truss.

1.5.2 Attic truss

A roof truss supporting both roof and a habitable or non-habitable storage floor space contained within.

1.5.3 Bottom chord

A member forming the lower boundary of a truss and which generally supports a ceiling.

1.5.4 Camber

Upward vertical displacement built into the truss at truss panel points to compensate for long-term deflection due to anticipated permanent actions.

1.5.5 Cantilever

Part of a truss that extends beyond its outermost support, exclusive of the overhang.

1.5.6 Component

Hardware used in the manufacture and installation of roof trusses, including nailplates, bracing and other brackets and connections.

1.5.7 Cove truss

A truss supported at a point on the overhang, rather than the usual support at the heel, beyond the point where the bottom chord (or end-web) meets the top chord.

1.5.8 Girder truss

A roof truss that supports other trusses or structural members (e.g. beams).

1.5.9 Heel

The major truss joint formed where the sloping top chord meets the bottom chord. When this junction is used for the set out of the truss shape, it is also known as the pitching point.

1.5.10 Joint group

The classification assigned to a timber species or species group for the purpose of calculating joint capacity, as defined and applied in AS 1720.1.

1.5.11 Knee

The major truss joint formed where the sloping top chord meets the horizontal top chord of a truncated truss.

1.5.12 Lateral brace

An out-of-plane member connected to a chord or web of a truss and intended to resist out-of-plane buckling forces.

NOTE: Also known as a web brace, lateral tie, lateral restraint, chord tie or binder.

1.5.13 Member

A single structural element, including truss chords and webs.

1.5.14 Nailplate

A metal connector plate, with integral teeth, manufactured from structural quality steel protected with zinc coating, stainless steel or their equivalents and designed to transfer loads between different timber members at a joint.

1.5.15 Overhang

The outward extension of one truss chord (usually the top chord) beyond the other truss chord (usually the bottom chord), measured horizontally.

NOTES:

- 1 An external overhang refers to the part of the overhang outside of the outer wall.
- 2 Unless specifically noted otherwise, overhangs are considered external.

1.5.16 Panel length

The distance measured along a chord between adjacent panel points (nodes).

1.5.17 Panel point

Point of intersection of two or more truss members, excluding mid-panel splices.

1.5.18 Pitch

Angle of a truss chord relative to the horizontal, expressed in degrees.

1.5.19 Ply

The number of trusses fixed together to form a single structural element.

1.5.20 Rise

The maximum vertical dimension of a truss (as measured), excluding overhangs, and typically from the underside of the bottom chord to the underside of the apex joint.

1.5.21 Roof truss

A truss designed to support roof loads and any combination of floor and ceiling loads as or if required.

NOTE: See Appendix A for examples of various shapes and types of roof trusses.

1.5.22 Sarking

A membrane acting as a water barrier, to collect and discharge any water that might penetrate a building.

1.5.23 Scab

A timber member that is mechanically laminated to one or both faces of a truss member.

1.5.24 Standard truss

A roof truss acting in parallel with other trusses, as a series, to support common roof and, where applicable, ceiling loads.

1.5.25 Structural fascia

A timber member of minimum rigidity $86 \times 10^9 \text{ Nmm}^2$ fixed to the ends of overhangs and capable, via direct connections, of distributing concentrated imposed loads to adjacent trusses.

1.5.26 Structural fascia beam

A beam located along the eaves line, designed to support the overhang end of one or more otherwise insufficiently supported trusses and supported itself by the overhang end of two neighbouring trusses suitable for this purpose.

1.5.27 Tooth group

A classification assigned to a timber species or species group and associated timber stress grades for the purpose of calculating nailplate joint capacity.

NOTE: The term 'tooth group' is similar to the term 'joint group' used in AS 1720.1, but is specific to nailplate tooth shape. The nailplate supplier determines the design properties of a tooth group and assigns it to appropriate timber species and grades.

1.5.28 Top chord

Members forming the upper boundary of a truss and which generally support the roof battens or purlins.

1.5.29 Truss

An engineered, prefabricated structural framework designed to support any combination of roof, floor and ceiling loads.

NOTE: The joined truss members together form a rigid, plane, structural element and are, ideally, triangulated.

1.5.30 Truss span

- (a) Actual truss span: The overall horizontal distance across two adjacent load-bearing supports, typically measured from outside to outside of supporting plates.
- (b) Nominal truss span: Horizontal distance measured between pitching points.

NOTE: These alternative definitions are sometimes used for specific applications.

1.5.31 Webs

Members of a truss used to join and hold apart the top and bottom chords, which usually form a triangular pattern that gives truss action and essentially carry tension or compression forces.

1.5.32 Wind truss

A parallel chord truss in the roof/ceiling plane fixed to the chords of a truss system to transfer lateral wind loads on the building to appropriate wall bracing elements.

1.5.33 Z-sprocket

An outrigger rafter with its backspan set down to pass beneath the top chord of a gable end truss.

NOTE: See Appendix A, Figure A1(c).

1.6 GENERAL REQUIREMENTS

Trusses shall be manufactured in accordance with AS 4446, and their installation, bracing and fixing shall be in accordance with AS 4440.

NOTE: Additional manufacturing or installation requirements, or any deviations from the requirements in these Standards, should be indicated in the documentation.

1.7 BASIS FOR DESIGN

For the purposes of this Standard, the supporting structure is assumed to be stable in its own right under all loading conditions.

NOTE: Either AS 4055 or AS/NZS 1170.2 may be used to determine wind loads where the structure complies with the geometric and other limitations of AS 4055. Otherwise, AS/NZS 1170.2 is applicable. The design gust wind speed may be derived from the AS 4055 wind classification system.

1.8 OTHER METHODS

This Standard does not preclude the use of other design considerations or methods, or any other means of demonstrating satisfactory safety and serviceability performance in accordance with the requirements of the Building Code of Australia.

SECTION 2 DESIGN CONSIDERATIONS

2.1 PERFORMANCE

Timber roof trusses shall be designed to withstand combinations of loads and other actions as given in this Standard.

2.2 DESIGN METHODS

Design methods shall comply with AS 1720.1 except as otherwise stipulated in this Standard. Roof trusses shall be designed to resist the design action effects resulting from the appropriate combinations of actions in order to satisfy the requirements for safety (strength and stability) and serviceability limit states as specified in Sections 3 and 4 of this Standard.

2.3 DOCUMENTATION

2.3.1 Design

The design documentation shall include design, building or installation assumptions and corresponding limitations shall be noted and, where these limitations are exceeded, the circumstances requiring further design shall be specified. A description of the structural model/s and actions used as the basis of design shall be included and, where necessary, additional or alternative information shall be provided to address the following specific items:

- (a) Design load parameters such as roof and ceiling materials, wind speed, solar hot water systems, mechanical services and support of any external structures.
- (b) Roof framing plan showing the types and locations of all roof trusses, bracing, tie-down and buckling restraints.
- (c) Details of bracing and buckling restraints including, for timber products, size, spacing and timber species and/or joint group and, for steel products, product or size and spacing information.
- (d) Define any members or components additional to those in Item (b) that are expected to contribute to the bracing and/or buckling restraint system.
- (e) Specification of all connectors and fixings to be used for the roof truss installation, including those for bracing, tie-down and buckling restraints.
- (f) The stress grade, species and/or joint group and tooth group of the roof truss timber.
- (g) Protective treatment for the timber and/or any special maintenance requirements.
- (h) Nailplate identification and sizing details.
- (i) Corrosion protection for nailplates and other fixings and/or any special maintenance requirements.
- (j) The in-service moisture and temperature regime for which the roof truss system has been designed, including any requirement for the installation of sarking for moisture control of the roof space.
NOTE: See Clause 2.7 and Appendix B4 for information on moisture control in roof spaces.
- (k) Pre-camber details.
- (l) Reference to this Standard if compliance with this Standard is claimed.

2.3.2 Installation

The installation documentation shall include the necessary information for correct selection, location and installation of all truss system members and components, including instructions for lifting and placement, fixing of trusses, installation of tie-down, bracing and lateral restraints and any special requirements for bearing at supports. The documentation shall also include the following specific information:

- (a) The information specified in Clause 2.3.1, Items (a), (d), (f) and (i).
- (b) A statement requiring installation in accordance with AS 4440 where the requirements of AS 4440 need to be met.
- (c) Where alternative or additional requirements to AS 4440 need to be met, this shall be noted in the documentation and the alternative or additional information provided.
- (d) A warning label provided for attaching to trusses or framing immediately adjacent to all internal roof access points, as specified in Clause 2.3.3.

NOTE: The installation documentation should be provided in a form suitable for on-site use and supplied with the truss system in a protective cover suitable for on-site conditions.

2.3.3 Labelling

Completed roof trusses and ancillary members and components shall be labelled for identification purposes and to assist with their on-site location and installation, as specified in Clause 2.3.2.

A warning label shall be provided, as specified in Clause 2.3.2, to identify the manufacturer and warn that a structural assessment will be required if additional loading of the truss system is contemplated. If the roof truss system has been designed for additional loads, the loads shall be described on the label and the trusses that support them shall be clearly identified.

NOTES:

- 1 Whilst it is not a requirement that trusses, ancillary members and components be labelled individually, the labelling of the roof truss system should be sufficient for identification, location and installation purposes.
- 2 Additional loading is permanent loading over and above the standard roof and ceiling permanent loads, such as a water heater, air conditioner, solar panels or household storage and similar loads. It may also include imposed actions, such as those from access platforms, hoists and fall arrest systems.
- 3 The warning label may also be used to provide other information, including any specific design or use limitations and any maintenance or inspection requirements.

2.4 MATERIALS

2.4.1 General

The materials used for the manufacture of roof trusses shall be determined based on an assessment of their suitability for this purpose. For timber products, this assessment shall include consideration of structural properties (stress grade), any characteristics that affect joint performance, dimensional tolerances, species and preservative treatment. For steel nailplates, the suitability of the structural properties, withdrawal characteristics and corrosion protection requirements shall be included. For the purposes of this Standard, the products described in Clauses 2.4.2 and 2.4.3 are deemed to meet these requirements.

2.4.2 Timber products

The following timber products shall be deemed to meet the requirements of Clause 2.4.1:

- (a) *Standardized* Structural timber products complying with the requirements of the relevant Australian product Standard and for which there are characteristic values for design published in AS 1720.1.

- (b) *Proprietary* Structural timber products complying with the requirements of the relevant Australian product Standard and, for which there are no characteristic values for design published in AS 1720.1, but these values are publicly available in proprietary literature produced by an identifiable manufacturer.

NOTES:

- 1 Unseasoned and seasoned timbers should not be mixed within a truss.
- 2 All timber members in a single truss should be of similar moisture content ($\pm 5\%$) at the time of manufacture to prevent nailplate issues that could arise from differential shrinkage across a joint.
- 3 The use of mixed species unseasoned timber in a truss is not recommended unless care is taken to ensure the shrinkage characteristics of the species are similar.

2.4.3 Steel products

All structural connections, including nailplates, brackets, straps and framing anchors of the following grades, properties and corrosion protection shall be deemed to meet the requirements of Clause 2.4.1:

- (a) Grade:
 - (i) Nailplates—minimum G300 as specified in AS 1397.
 - (ii) Other connectors—minimum G300 as specified in AS 1397.
- (b) Properties established by testing to AS 1720.1 prototype testing or AS 1649 and for which values are publicly available in proprietary literature produced by an identifiable manufacturer.
NOTE: Nailplate information are not publicly available but may be obtainable from the various nailplate suppliers.
- (c) Corrosion protection—minimum Z275 in accordance with AS 1397.
NOTE: In corrosive environments, an increased level of protection (e.g. stainless steel) may be required (see Appendix B6).

2.5 LOADS

2.5.1 General

Roof trusses shall be designed for the actions and combinations of actions specified in AS/NZS 1170.0. For the purposes of this Standard, compliance with Clauses 2.5.2 and 2.6.3, and Section 4 for specific member related provisions, shall be deemed to satisfy this requirement.

2.5.2 Design actions

Permanent, imposed, wind, snow and earthquake actions shall be determined in accordance with the following:

- (a) *Permanent* Permanent actions shall be calculated from the design or known dimensions of the structure and the unit masses of the construction materials.
- (b) *Imposed*.
NOTE: The imposed actions used for design generally correspond to those given in AS/NZS 1170.1. Specific interpretations for roof truss applications are given in Section 4 of this Standard.
- (c) *Wind* The wind actions for strength and serviceability shall be derived using AS/NZS 1170.2 or AS 4055 (see also Clause 1.4).
- (d) *Snow* Snow actions shall be determined in accordance with AS/NZS 1170.3.
- (e) *Earthquake* Earthquake actions shall be determined in accordance with AS 1170.4.

NOTE: Earthquake actions are generally not critical for timber truss design but may influence the design of fixing and bracing.

2.5.3 Design action combinations

Combinations of actions included for the determination of the strength limit states and the serviceability limit states, for each member, shall be those determined appropriate in accordance with AS 1170.0.

NOTE: See also Section 4 for specific member provisions.

SECTION 3 DESIGN METHODS

3.1 STRUCTURAL MODELS

The design action effects and deformations shall be determined in accordance with the principles of structural mechanics using elastic analysis. The structural models adopted for these purposes shall represent the application of the design actions and action combinations, the geometry of the roof trusses and the assumptions made for establishing node locations and determining member end fixities.

NOTE: Examples of commonly used structural models and associated information are provided in Appendix C.

3.2 CRITICAL DESIGN ACTION EFFECTS

The relevant structural models shall be subjected to combinations of maximum severe actions to obtain the critical design action effects for strength, stability and serviceability limit states.

3.3 CAPACITY FACTOR

3.3.1 General

Values of the capacity factor for determination of the design capacity of all members and joints shall be obtained from AS 1720.1.

3.3.2 Application category assessment

Roof trusses shall be assessed as Category 1, Category 2 or Category 3 applications as given in Table 3.3.2. Affected area shall be determined in accordance with Clause 3.3.3.

NOTE: For the purposes of this Standard, in Table 3.3.2, residential buildings are considered as for houses in AS 1720.1 since, practically speaking, the roof truss system and its loading is the same for both classifications. Application categories mean the structural application categories in Clause 2.3 and Tables 2.1 and 2.2 of AS 1720.1.

TABLE 3.3.2
APPLICATION CATEGORIES

Affected area	Standard trusses		Girder trusses	
	Residential	Other buildings	Residential buildings	Other buildings
≤25 m ²	Category 1	Category 1	Category 1	Category 2/Category 3*
>25 m ²	Category 1	Category 2	Category 2	Category 2/Category 3*

*For essential service or post-disaster function buildings, as specified in the design documentation.

3.3.3 Affected area

For single-span standard trusses, the affected area shall be taken as the actual span times twice the spacing. For standard trusses with multiple spans, the affected area shall be taken as the distance between the outermost supports times twice the spacing.

For girder trusses, the affected area is considered to be the plan area of roof carried by all supported trusses plus any other contributory area.

NOTES:

- 1 The affected area is that part of the roof plan area that is likely to collapse due to the failure of the truss and any other trusses it is supporting.
- 2 Some girder trusses supporting other girder trusses can have quite complex affected areas and care should be taken when assessing these.

3.4 STRENGTH LIMIT STATES

3.4.1 General

Strength limit states for the chord and web members of roof trusses shall include an assessment of the effects of the action combinations specified in Clause 2.6.3 and confirmation that these effects do not exceed the design capacity of the members. The design capacity in bending, tension, compression and shear for the chord and web members shall be determined in accordance with AS 1720.1.

NOTE: The design capacity is based upon the characteristic value for the material, the relevant modification factors, the relevant section property and the capacity factor.

3.4.2 Modification factors

3.4.2.1 Load duration factor

The member design capacity shall include the load duration factor for timber (k_1), as given in Table 3.4.2.1.

TABLE 3.4.2.1
LOAD DURATION FACTORS (k_1)—STRENGTH

Action	Load duration factor for timber (k_1)
Permanent action—all permanent actions, including that portion of imposed actions that may be present for several years or more	0.57
Distributed floor imposed action; alpine snow action	0.80
Distributed roof imposed action; concentrated floor imposed action; sub-alpine snow action	0.94
Concentrated imposed roof actions	0.97
Wind action	1.00

3.4.2.2 Moisture content of timber

The member design capacity shall include the partial seasoning factor (k_4), as given in Table 3.4.2.2.

TABLE 3.4.2.2
PARTIAL SEASONING FACTOR (k_4)—STRENGTH

Load case	Partial seasoning factor (k_4)
Seasoned timber (normal case)	1.0
Unseasoned timber that can dry before full design load is applied, e.g. wind load case	1.0 to 1.15 (see AS 1720.1)

NOTE: The situation where seasoned timber can rise above 15% equilibrium moisture content in service may be ignored as trusses are kept protected [see Clause 2.3.1(j)].

3.4.2.3 Temperature factor

For residential buildings, the modification factor for the effect of temperature on strength (k_6) shall be taken as unity regardless of geographical location. For other buildings, k_6 shall be determined from AS 1720.1.

3.4.2.4 Bearing

All trusses shall be checked for bearing capacity at each support including the application of the length of bearing factor (k_7). The nominal width of the bearing support shall be considered and shall be a strength group of SD6, unless known otherwise. All supports (bearing areas) shall be taken to be within 75 mm of the end of the supported piece of timber, unless known otherwise, and in such cases $k_7 = 1.0$. Where this distance equals or exceeds 75 mm, the characteristic capacity in bearing perpendicular to the grain shall be increased by the value of factor k_7 determined from AS 1720.1.

NOTE: Where the bearing capacity is inadequate, it may be improved by increasing the bearing length, the bearing width or the strength group of the support or truss member (whichever governs). Alternatively a steel bearing plate may be provided under the truss or brackets used to transfer some of the reaction load via fixings (e.g. nails or screws) in shear.

3.4.2.5 Strength sharing factor

The member design bending capacity shall include the modification factor for strength sharing (k_9) to allow for sharing of the bending portion of actions between multiple members and between adjacent members. Factor k_9 shall be determined in accordance with AS 1720.1, using the geometric factors g_{31} and g_{32} given in Table 3.4.2.5, with L taken as the bending member length between panel points.

TABLE 3.4.2.5
GEOMETRIC FACTORS FOR PARALLEL SYSTEMS

Number of truss plies (n_{com})	g_{31}	Total number of trusses in parallel system ($n_{com} \times n_{mem}$)	g_{32}
1	1.00	1	1.00
2	1.14	2	1.14
3	1.20	3	1.20
4	1.24	4	1.24
5	1.26	5	1.26
6	1.28	6	1.28
7	1.30	7	1.30
8	1.31	8	1.31
9	1.32	9	1.32
10 or more	1.33	10 or more	1.33

NOTE: The following values of g_{31} and g_{32} are recommended for general use in each truss member:

- 1 For all laminated veneer lumber (LVL) elements..... g_{31} and $g_{32} = 1.00$.
- 2 For a parallel series of trusses (minimum 3) at a maximum nominal spacing of 1200 mm..... $g_{32} = 1.20$.
- 3 For all girder trusses..... $g_{32} = 1.00$.

3.4.2.6 Stability factor

The member design capacity shall include the modification factor for stability (k_{12}) calculated in accordance with AS 1720.1.

NOTES:

- 1 All k_{12} factors are functions of the appropriate slenderness coefficients, S_1 , S_3 and S_4 , as given in Table 3.4.2.6 and Figure 3.4.2.6.
- 2 Multi-ply trusses and T-stiffeners—Clause 3.4.5 gives modified slenderness coefficient values for out-of-plane buckling of chords or webs in compression.

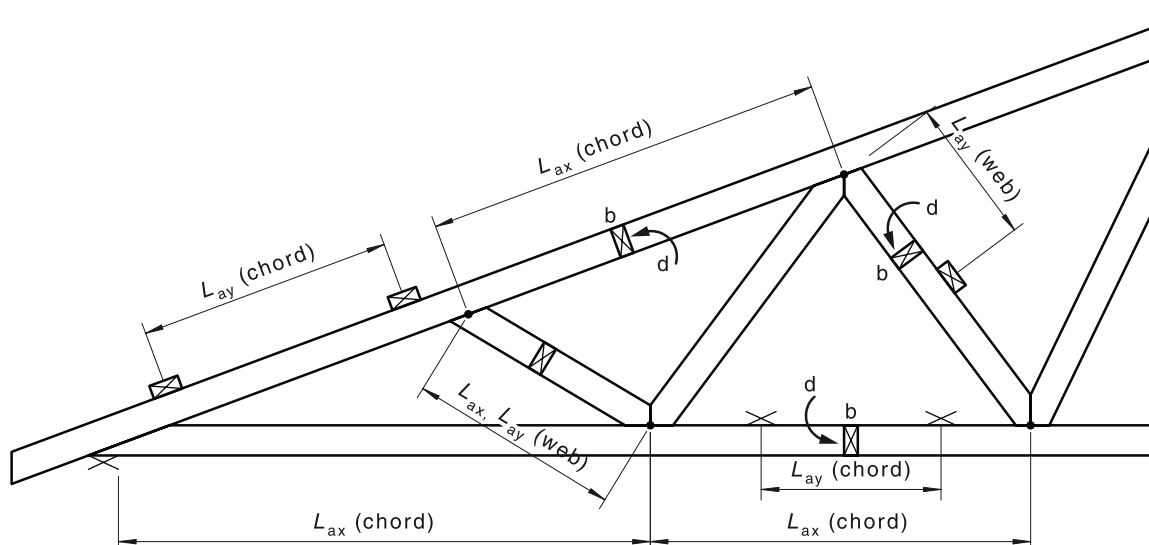


FIGURE 3.4.2.6 EFFECTIVE WEB AND CHORD BUCKLING LENGTHS

TABLE 3.4.2.6
SLENDerness COEFFICIENTS

Member		Slenderness coefficient	Modification factor(g_{13T})
Chords	Bending stability	$S_1 = 1.08 \sqrt{\frac{d \times L_{ay}}{b^2}}$	N/A
	In-plane buckling	$S_3 = g_{13T} \times \frac{L_{ax}}{d}$	$g_{13T} = 0.8$
	Out-of-plane buckling	$S_4 = g_{13T} \times \frac{L_{ay}}{d}$	$L_{ay} \leq 900 \text{ mm: } g_{13T} = 0.8$ $900 \text{ mm} < L_{ay} \leq 1200 \text{ mm: } g_{13T} = 0.9$ $L_{ay} > 1200 \text{ mm: } g_{13T} = 1.0$
Webs	In-plane buckling	$S_3 = g_{13T} \times \frac{L_{ax}}{d}$	$g_{13T} = 0.8$
	Out-of-plane buckling	$S_4 = g_{13T} \times \frac{L_{ay}}{d}$	$g_{13T} = 0.85$ (with up to one web tie) $g_{13T} = 1.0$ (with two or more web ties)

LEGEND

- L_{ax} = for chords, effective chord panel length
 = for webs, effective length of web between chords
 L_{ay} = for chords, distance between lateral restraints (e.g. batten spacing)
 = for webs without web ties, effective length of web between chords
 = for webs with web ties, effective length/(number of ties + 1)
 g_{13T} = effective length factor for truss design to this Standard
 S_3, S_4 = max. 65 for permanent, imposed and snow actions
 = max. 80 for wind actions

3.4.3 Tension capacity

Where one or more pre-drilled holes for bolted connections reduces the total cross sectional area by more than 15%, the tension capacity of the member shall be based on the net cross-sectional area. The reductions in area from staggered holes that are spaced within a distance of 5 times the bolt diameter (5D) along the grain of the member shall be combined for this consideration.

NOTES:

- 1 There is no requirement in design to reduce the timber cross-sectional area to allow for nailplate teeth cutting fibres and holes formed from nail and screw fixing in truss members. These are not considered to contribute any reduction in section properties for member design.
- 2 See Clause 5.2.2.4 for tension member capacity at joints.

3.4.4 Birdsmouth overhangs

The design of birdsmouth overhang strength when the birdsmouth notches are less than one third of the depth of the overhang shall be as specified in Appendix D4. Otherwise the notch procedure given in AS 1720.1 shall be applied.

3.4.5 Lateral restraint**3.4.5.1 Top chords**

The fixing of battens to every ply of truss top chords with screws or nails in conjunction with diagonal bracing shall be deemed to provide lateral restraint. For hip trusses and girder trusses, the fixing of supported trusses to the chords shall also be deemed to provide lateral restraint to the chords in addition to the battens. The spacing of batten restraints on hip trusses shall take into account the angle the battens make with the truss.

Timber roof battens butt spliced over a truss shall be disregarded from providing lateral restraint unless specific splicing details that deliver restraint are provided. For concrete tile roofs, every second roof batten shall be regarded as an ineffective lateral restraint.

NOTES:

- 1 For top hat metal battens to be effective in providing lateral restraint, they should be fastened at their base feet to every ply of truss chord.
- 2 Top hat metal batten profiles screwed to top chords only through the crest of the batten are not deemed to provide adequate lateral restraint.
- 3 Where required, splices in battens or purlins should be arranged such that in any top chord no more than one-third of battens or purlins are spliced and no two splices are adjacent. There should be no splices in battens or purlins over girder trusses.
- 4 For light roofs (e.g sheet metal), all roof batten splices should employ specific details to render them effective for lateral restraint against the top chord.
- 5 Top hat metal battens simultaneously fixed at their base feet through overlapping splices are generally assumed to provide adequate continuity.
- 6 Where the further design methods for members given in AS 1720.1 are used to assess forces on lateral restraints, n should be taken as the number of equally spaced restraints over the entire length of a straight chord (including splices) between pitch changes and not just the length of a single panel between joints. In typical circumstances, n is the chord length divided by the batten spacing, rounded down to the nearest integer.

3.4.5.2 Bottom chords

A plasterboard ceiling directly fixed to truss bottom chords or fixed through a ceiling batten system shall be deemed to provide lateral buckling restraint to the bottom chords. Where ceiling battens are used, they shall be fixed directly to the trusses.

NOTES:

- 1 The lateral restraint centres for direct fixed ceilings attached with glue and nails or screws may be taken as 600 mm.
- 2 Battens that are clipped off hangers or suspended from bottom chords are not suitable to provide lateral restraint.