

Australian Standard™

Installation of nailplated timber roof trusses

This Australian Standard was prepared by Committee TM-002, Timber Framing. It was approved on behalf of the Council of Standards Australia on 7 April 2004 and published on 1 June 2004.

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Australian Standard™

Installation of nailplated timber roof trusses

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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee TM/2, Timber Framing, to supersede AS 4440—1997, *Installation of nailplated timber trusses*.

The Standard is the result of a consensus among Australian and New Zealand representatives on the Joint Committee to produce it as an Australian Standard.

The objective of this Standard is to provide basic performance requirements and specifications for the bracing, connection and installation of nailplated timber trusses.

The objective of this revision is to incorporate latest technical information and performance criteria, which resulted from the continued development of timber framing systems in Australia and overseas. Reflected in this Standard, the following have been included in this revision:

- (a) Provision for limit state design methods.
- (b) Requirement for fixing to non-loadbearing external walls (Clause 2.2.3(d)).
- (c) Amendment to the definitions of bow (Clause 3.4.2) and plumb (Clause 3.4.3).
- (d) Provision for intermediate ceiling joists (Clause 3.6 and Appendix D).
- (e) Provision for internal top chord ties for north-light trusses (Clause 4.2.2.2) and top-hat trusses (Clause 4.2.2.3).
- (f) Deletion of the informative Appendix for the permanent bottom chord ties (the original Appendix G).

This Standard is intended to promote an agreement across different industries, and to replace the various installation manuals and inconsistent bracing details currently in use. It provides a unique method of bracing, connection and installation yet does not preclude the use of other methods that are approved and authorized.

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

The term ‘informative’ has been used in this Standard to define the application of the appendix to which it applies. An ‘informative’ appendix is only for information and guidance.

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STANDARDS AUSTRALIA

Australian Standard Installation of nailplated timber roof trusses

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard specifies requirements for the bracing, connection and installation of nailplated timber trusses in roof structures for typical application.

1.2 APPLICATION

This Standard is intended to apply to nailplated timber roof trusses within the following general limitations:

- (a) Residential structures (BCA Classes 1, 2, 3 and 10) and light commercial structures.
- (b) Maximum roof pitch of 45° (100:100).
NOTE: For roof pitch greater than 35°, supporting structure may need special consideration.
- (c) Shape in plan view to be rectangular or near rectangular, or a series or combination of rectangular shapes or near-rectangular shapes, including splayed-end and boomerang-shaped buildings and the like, and projections such as bay windows.
- (d) Maximum truss span of 16 m.
- (e) Maximum truss spacing of—
 - (i) 900 mm; or
 - (ii) 1200 mm, for lightweight roofs (e.g., metal sheet roofs) in wind classification N3 or lower.
- (f) Maximum design gust wind speed of 74 m/s (wind classification C3) for ultimate limit state method in accordance with either AS/NZS 1170.2 or AS 4055.

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.

NOTES:

- 1 Additional limitations are also included in the relevant Clauses of this Standard.
- 2 Subject to approval, this Standard may be used for other structures similar to those specified herein.
- 3 AS 1720.1 provides for the design of timber elements within nailplated timber trusses, which is not covered by this Standard.
- 4 Roof bracing and truss connection specified in this Standard does not cover nailplated timber truss subjected to snow load.
- 5 Specifications in this Standard are applicable for use in conjunction with non-trussed hip-end components.

1.3 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS

- 1170 Minimum design loads on structures
- 1170.4 Part 4: Earthquake loads
- 1397 Steel sheet and strip—Hot-dipped zinc-coated or aluminium/zinc-coated
- 1684 Residential timber-framed construction (all parts)
- 1720 Timber structures
- 1720.1 Part 1: Design methods
- 4055 Wind loads for housing

AS/NZS

- 1170 Structural design action
- 1170.0 Part 0: General principles
- 1170.1 Part 1: Permanent, imposed and other actions
- 1170.2 Part 2: Wind actions
- 4491 Timber—Glossary of terms in timber related Standards

ABCB

- BCA Building Code of Australia

1.4 USE OF ALTERNATIVE MATERIALS OR METHODS

This Standard does not preclude the use of materials or methods of bracing, fixing and installation other than those specified in this Standard, provided it can be shown that these satisfy the performance requirements met by the materials and methods described herein.

1.5 DEFINITIONS

For the purpose of this Standard, the definitions given in AS/NZS 4491, AS 1684 series, and those below apply.

NOTES:

- 1 The names of the various timber truss members used in this Standard are given in Figures 1.1 to 1.7.
- 2 The following abbreviations are used in this Standard:
 - (a) BC—bottom chord.
 - (b) HTC—horizontal top chord.
 - (c) TC—top chord.
 - (d) TG—truncated girder (truss).
 - (e) TS—truncated standard (truss).

1.5.1 Approved

As approved by the regulatory authority.

1.5.2 Approved specification

Documentation approved by regulatory authority.

1.5.3 Boxed eaves

Eaves that form a horizontal plane below the rafter or truss overhang; also called flat eaves.

1.5.4 Camber

A curvature built into a truss intended to compensate for the long-term deflection due to dead loads.

1.5.5 Eaves

The portion of main building outside the external wall line. Generally, it includes the truss overhang and also cantilevered portions if present.

1.5.6 Gable-end truss

The first truss at a gable end.

1.5.7 Galvanized steel

Steel having a minimum corrosion protection of Grade Z275 in accordance with AS 1397.

1.5.8 Girder truss

A truss that supports other trusses or beams (see Figure 1.6 and Figure 3.1).

1.5.9 Nailplates

Metal plate connectors manufactured predominantly from light gauge galvanized steel with teeth spaced and formed within the parent metal. Nailplates are normally pressed into opposite faces of the timber members to form a spliced or gusseted type of joint.

1.5.10 Truss overhang

The portion of top chord extending beyond the body of the truss to provide eaves.

1.5.11 Pitching point

The intersection of underside of top chord and underside of bottom chord (see Figures 1.1, 1.2 and 1.7).

1.5.12 Raking eaves

Eaves line that follows the line of the roof, also called flush eaves.

1.5.13 Raking truss

A gable-end truss, which has the top chord lowered to accommodate outriggers; also known as set-down or cut-down truss.

1.5.14 Regulatory authority

The authority that is authorized by legal statute as having jurisdiction to approve the design and construction of a building, or any part of the building design and construction process.

NOTE: In the context of this Standard, the regulatory authority may include local council building surveyors, private building surveyors or other persons nominated by the appropriate state or territory building legislation as having the legal responsibility for approving the use of timber trusses.

1.5.15 Reinforced-head nails

Nails with either an enlarged shank beneath the nail head or specially tapered head with enough thickness to eliminate the possibility of the head becoming brittle during driving or under load, and breaking off.

1.5.16 Spacing

The centre-to-centre distance apart of structural timber members or trusses.

1.5.17 Truss span

See Figures 1.1 and 1.2.

1.5.18 Station

The position of a truncated truss, a truncated girder truss, or a Dutch-hip girder truss, measured from the pitching point to the near face of the truss (see Figure 1.7).

1.5.19 Steelbrace

A steel-bracing member with properties as specified in Clause 4.3.2.

1.5.20 Structural fascia

A fascia that is capable of distributing truss-overhang loads to adjacent trusses.

NOTES:

- 1 The common timber fascia is taken as a structural fascia when fixed directly to the end of the truss overhang (see Figures 1.3 to 1.5). Other fascia or combination of members with similar stiffness may be used.
- 2 Light gauge steel fascia is not generally capable of carrying out this function.

1.5.21 Timber truss

Framework constructed with timber of uniform thickness and fastened together in one plane by connectors such as metal nailplates, bolts, plywood gussets, or other similar devices.

NOTE: Timber framework fastened by other connectors similar to nailplates, e.g., bolts, plywood gussets, and the like, is not covered by this Standard.

1.5.22 Truss engineer

A professional engineer, as specified in BCA, experienced in the design of nailplated timber truss systems.

1.5.23 Valley (saddle) truss

Frames that are supported on trusses and used to form the roof between roof segments (see Figures 1.6, 3.1 and 4.2).

1.5.24 Verge overhang

Truss overhang at a gable end (see Figure 1.3).

1.5.25 Waling plate

Timber member normally fixed to the face of a truss to support intersecting rafters or trusses.

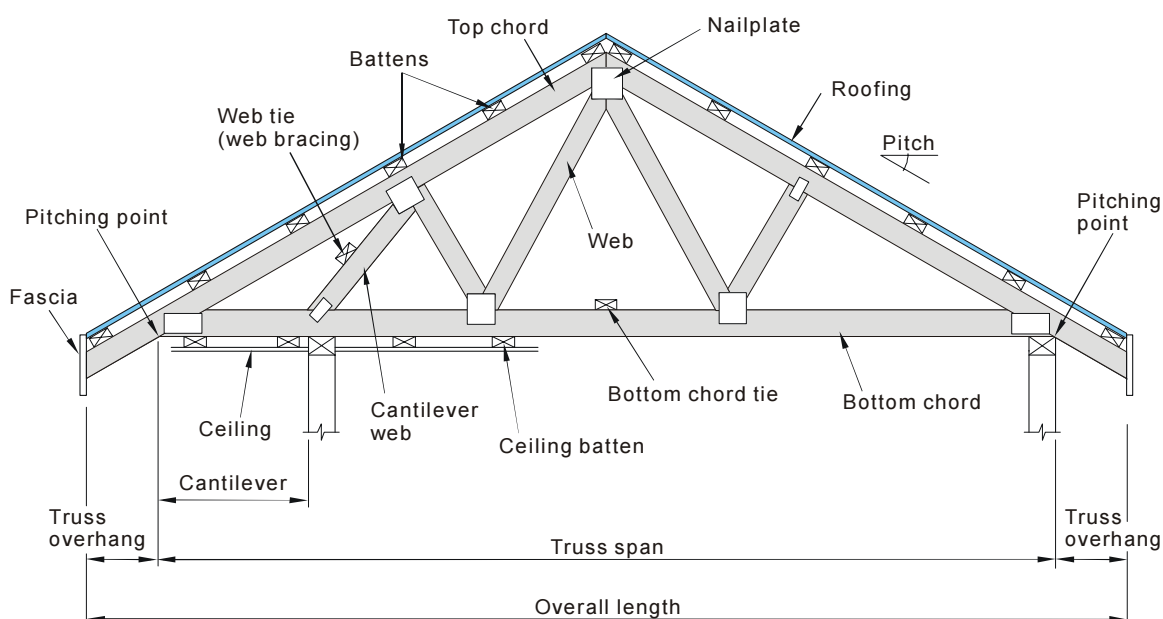


FIGURE 1.1 TERMS APPLYING TO TIMBER TRUSSES

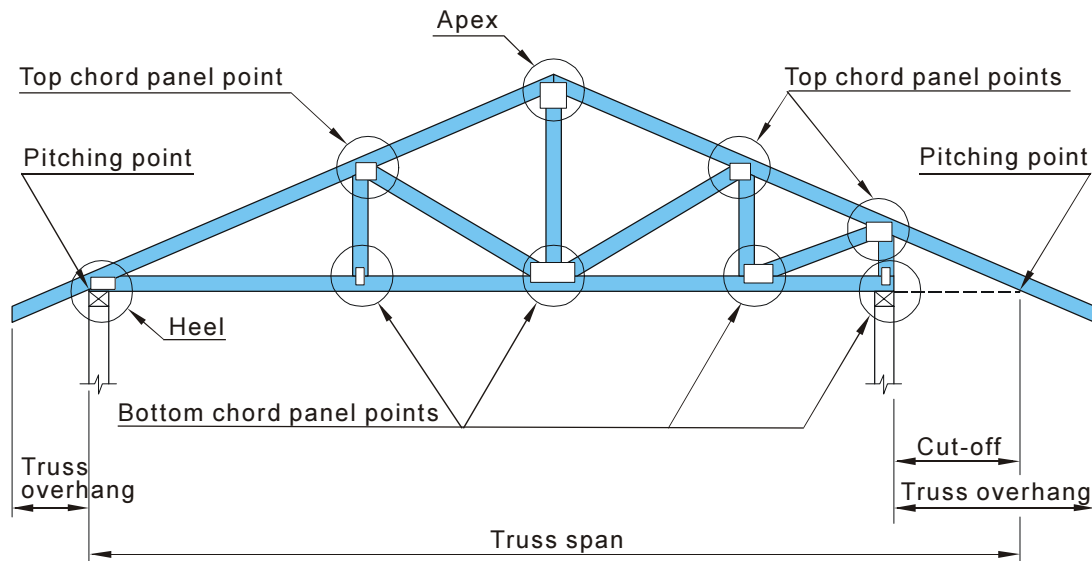


FIGURE 1.2 TERMS APPLYING TO CUT-OFF TRUSS AND PANEL POINTS

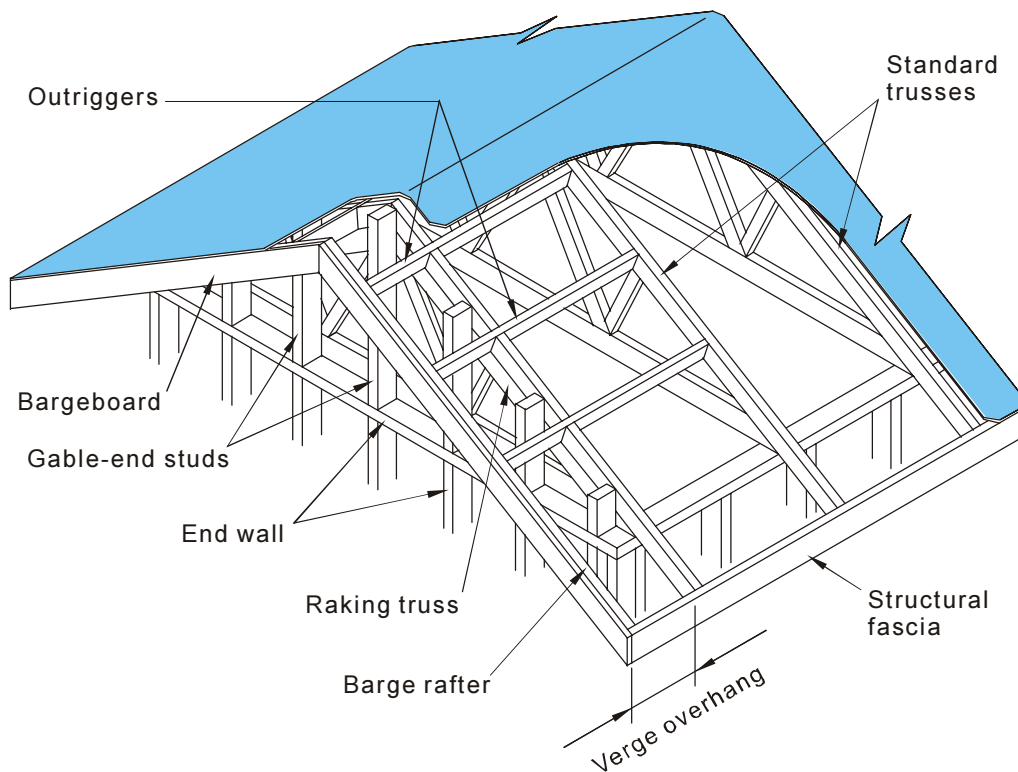


FIGURE 1.3 TERMS APPLYING TO ROOF TRUSS SYSTEM—GABLE END

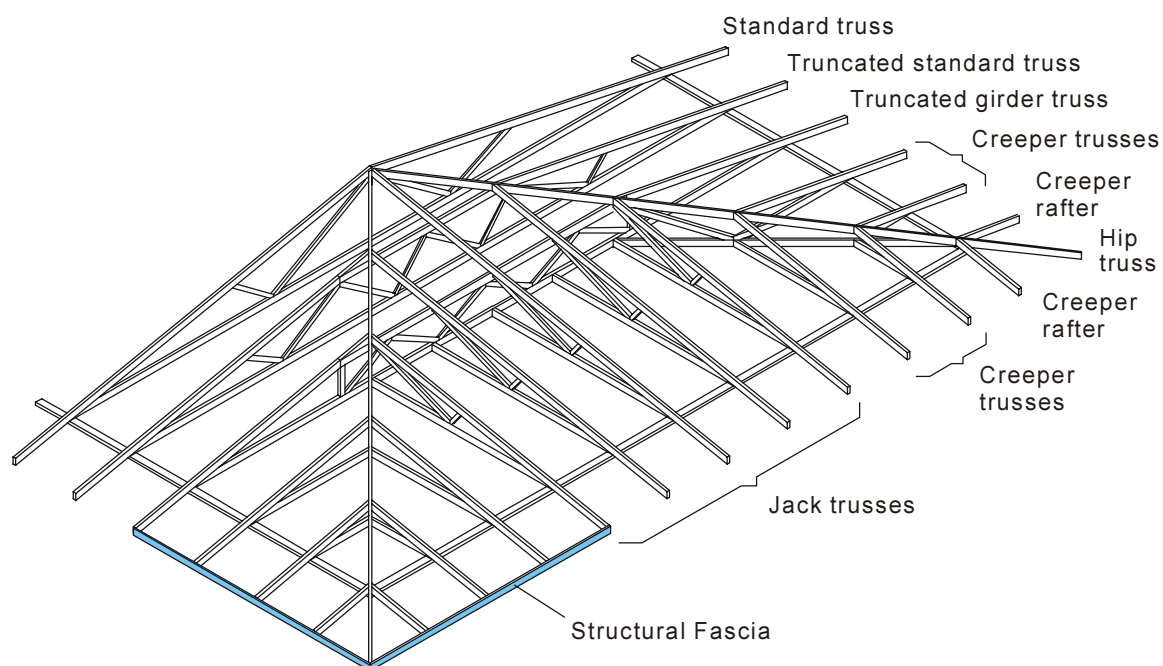


FIGURE 1.4 TERMS APPLYING TO ROOF TRUSS SYSTEM—HIP END

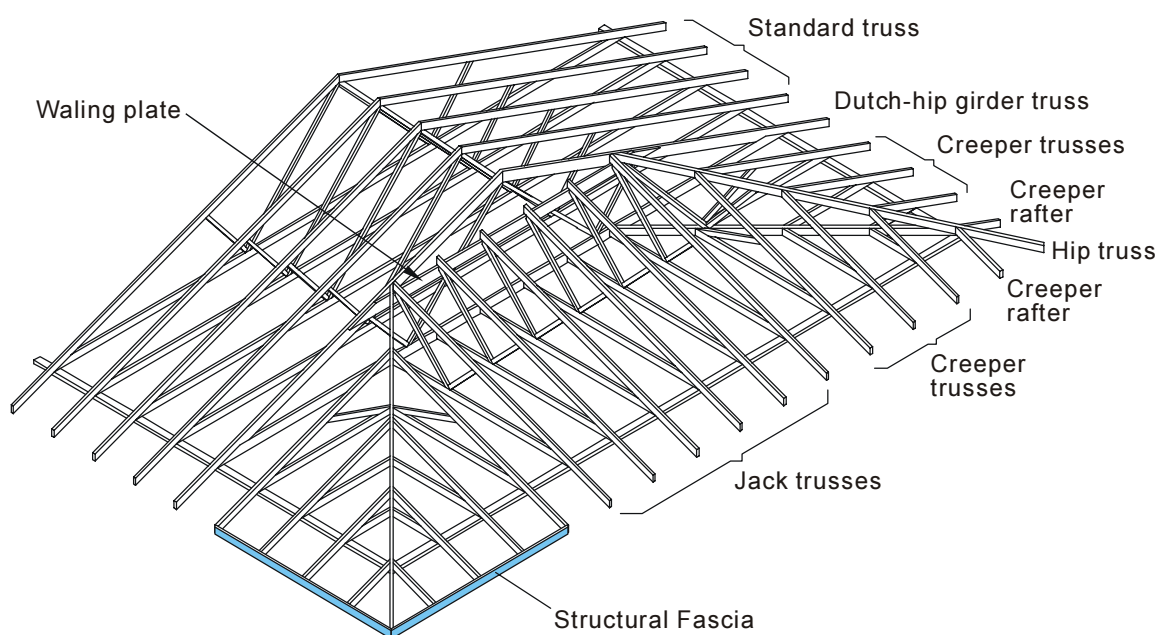


FIGURE 1.5 TERMS APPLYING TO ROOF TRUSS SYSTEM—DUTCH-HIP END

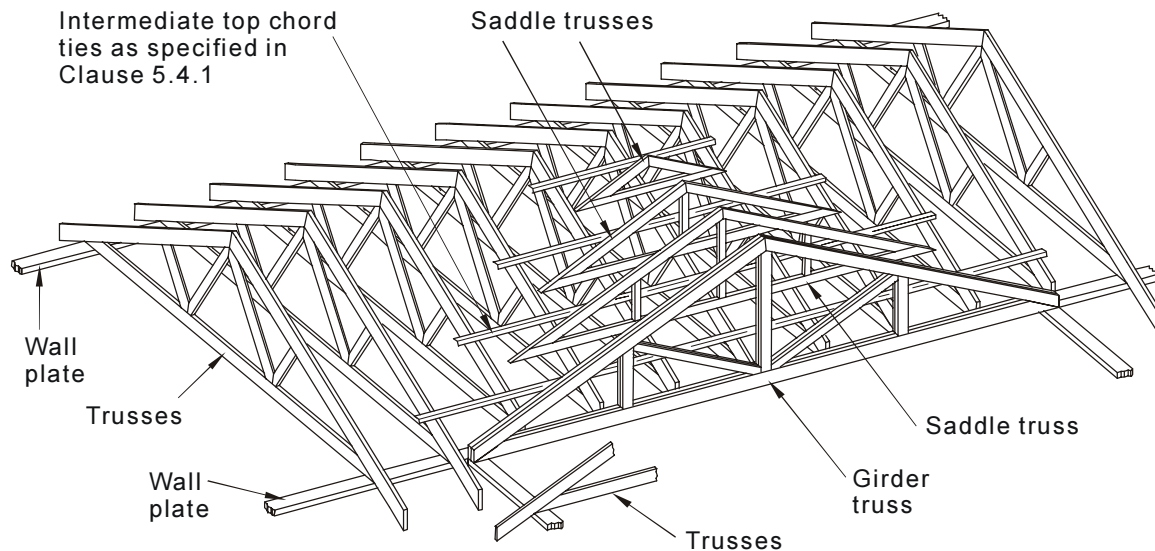


FIGURE 1.6 TERMS APPLYING TO GIRDER TRUSS AND SADDLE TRUSS

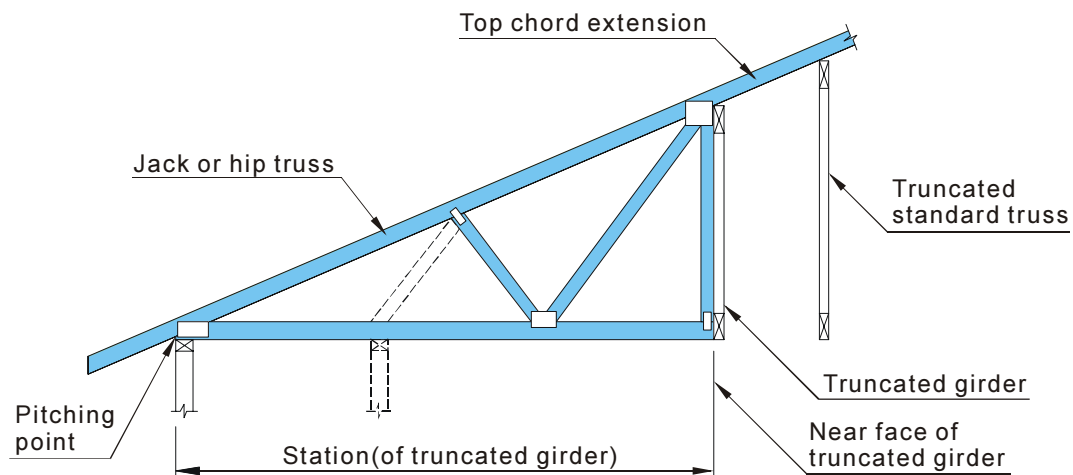


FIGURE 1.7 TERMS APPLYING TO STATION AND PITCHING POINT

1.6 LOADS

The standard loads, i.e., dead load, live load, wind load, and earthquake load, imposed on trusses shall be in accordance with AS/NZS 1170.0, AS/NZS 1170.1, AS/NZS 1170.2, and AS 1170.4, as appropriate.

Loads other than the standard loads shall not be imposed on the trusses without being approved. Typical fittings, which may induce special loads, are hot-water services, airconditioning, solar systems, protective handrails, and fall-resistant systems. Loads shall not differ, nor be located at positions other than those taken in design.

1.7 DOCUMENTATION AT APPROVAL STAGE AND DELIVERY

NOTE: Documentation that should be available at the approval stage and at the time of delivery is set out in Appendix A.

1.8 NAILS

Where 65 mm nails for connecting timber to timber are referred to in this Standard, they shall be a minimum of 2.5×65 mm nails.

NOTE: Nailing details in this Standard may be substituted by screws of equivalent capacity.

SECTION 2 SUPPORTING STRUCTURES

2.1 GENERAL

The correct information regarding location and dimensions of the supporting structures shall be provided prior to the manufacture of timber trusses. Due consideration shall be given to the reactions from any girder trusses.

CAUTION: THE SUPPORTING STRUCTURE SHALL BE STABLE AT THE TIME OF TRUSS INSTALLATION.

NOTES:

- 1 The stability of supporting structures may be achieved by temporary bracing in cases where the trusses will provide stability. When the trusses are in place and fixed correctly the temporary wall bracing may be removed.
- 2 Lintels should be designed to carry the load applied by the trusses. The location of point loads from any girder truss should be checked. Lintels may be chosen from relevant truss-span charts providing the correct specification of load magnitude and supported truss-spans are used.
- 3 Appendix B gives some recommended practices for the installation and fixing of nailplated timber trusses.

2.2 WALLS

2.2.1 Loadbearing walls

Loadbearing walls shall comply with the requirements specified in the relevant Standards, as appropriate to the material, and shall not be lower than the non-loadbearing walls when trusses are supporting a level ceiling.

If any internal walls are required for support, the truss itself and the layout shall be marked accordingly.

2.2.2 Non-loadbearing walls

Non-loadbearing walls shall comply with the requirements specified in the relevant Standards, as appropriate to the material. Non-loadbearing walls, as designated, shall not carry any truss loading and shall not be packed to touch the underside of trusses (see Figure 2.1).

NOTE: One way to ensure non-loadbearing is to set the non-loadbearing walls at a lower level than the loadbearing walls. The recommended difference in level is the ceiling batten depth, if any, plus 10 mm min..

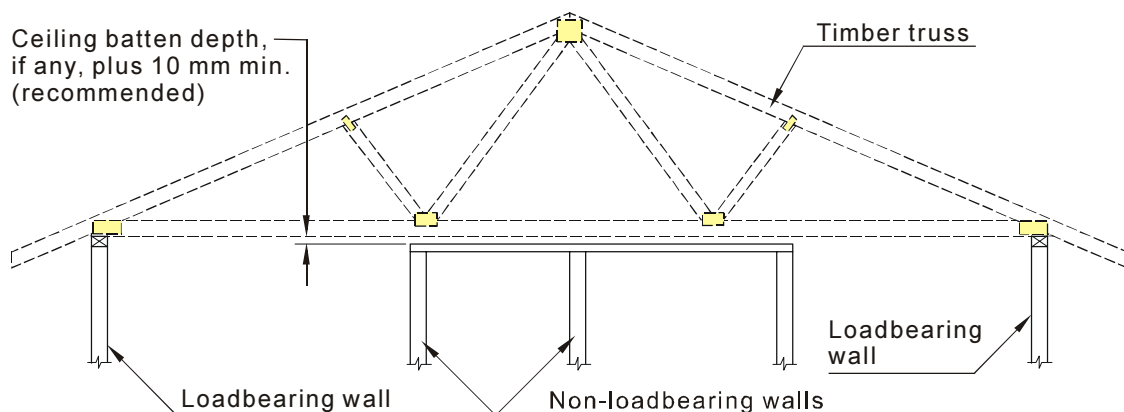


FIGURE 2.1 LOADBEARING AND NON-LOADBEARING WALLS

2.2.3 Fixing to top plates of non-loadbearing walls

The requirements for fixing of timber trusses to the top plates of non-loadbearing walls shall be in accordance with the following wall designations:

- (a) *Non-bracing wall* Where a non-loadbearing wall is stable in its own right, no stabilizing fixing is required.
- (b) *Bracing wall* Where a freestanding non-loadbearing wall is designated as a bracing unit in accordance with AS 1684.2 or AS 1684.3, the timber trusses shall be fixed to the top plate of the wall in such a way that the bottom chord of the truss is restrained horizontally but allows for deflection when the truss is loaded. Figure 2.2 gives an example of the fixing details.

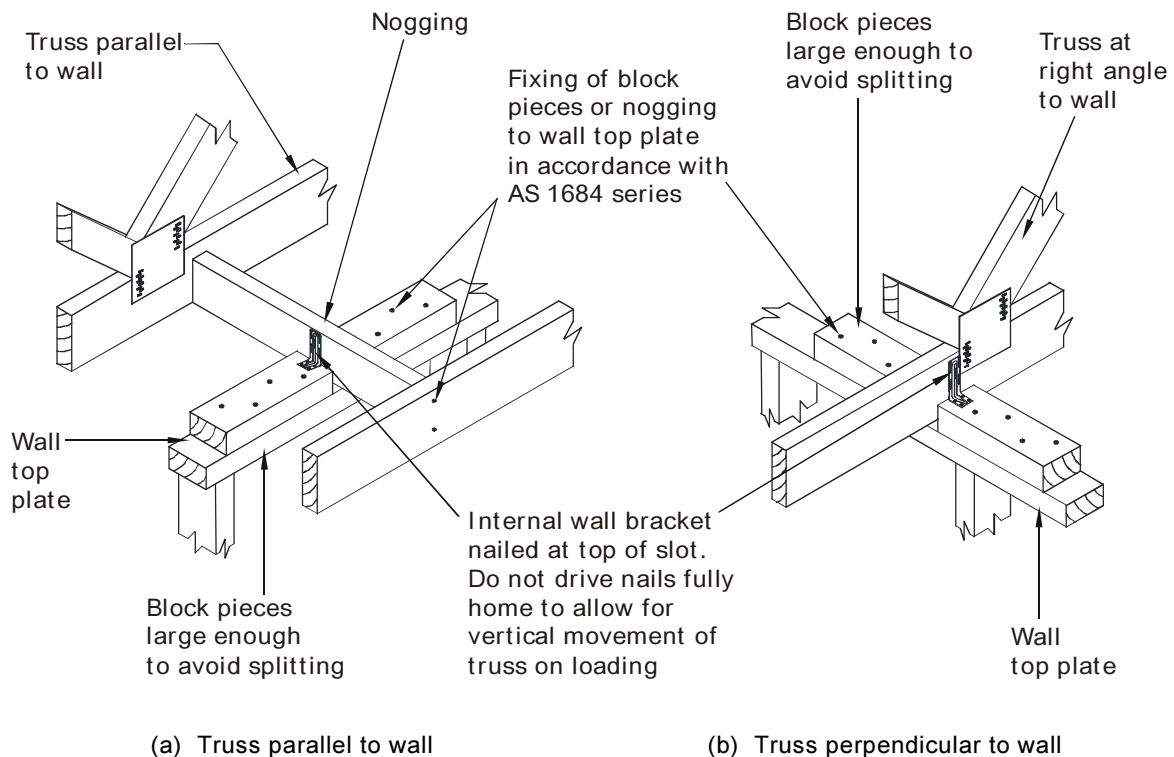


FIGURE 2.2 FIXING OF TRUSSES TO FREESTANDING NON-LOADBEARING WALL THAT IS A BRACING WALL

- (c) *Non-bracing wall* For an internal non-loadbearing wall not designated as a bracing unit, stability of the wall shall be required to resist normal applied force, e.g., when closing doors. The top plate of the wall shall be stabilized at maximum 1800 mm centres. Where trusses are parallel to the wall, nogging shall be used in between the bottom chords and fixed to the bracket. Figure 2.3 gives an example of fixing details.

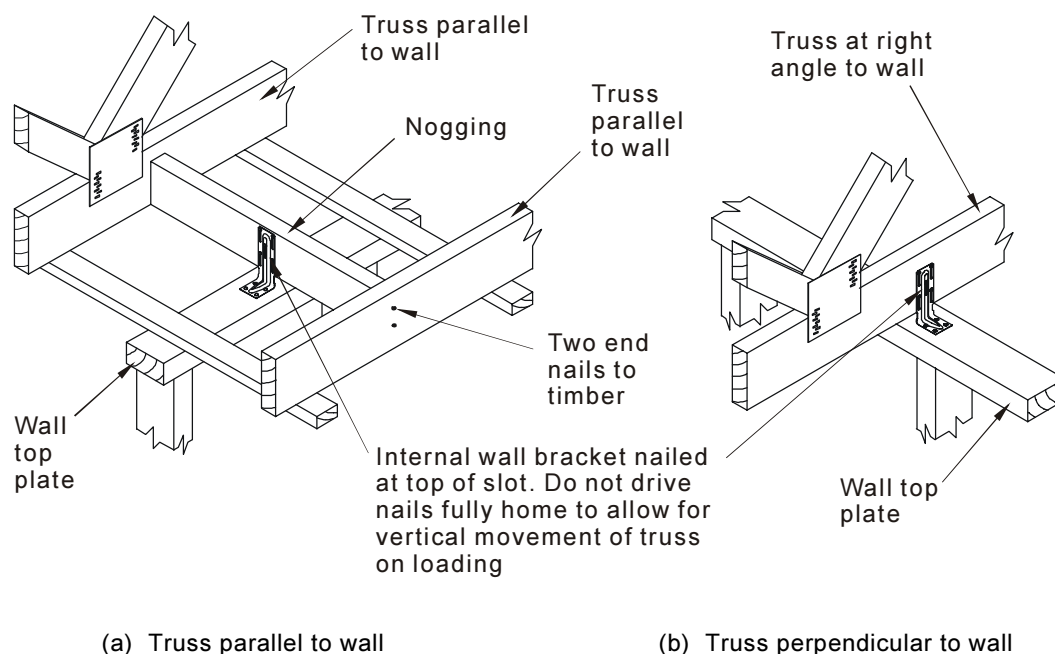


FIGURE 2.3 FIXING OF TRUSSES TO FREESTANDING NON-LOADBEARING WALL THAT IS NOT A BRACING WALL

- (d) *Non-loadbearing external wall* For a non-loadbearing external wall, such as verandah wall where trusses are pitched off verandah beams or other beams, the top plate of the wall shall be stabilized at maximum 3000 mm centres. Figure 2.4 gives an example of fixing details.

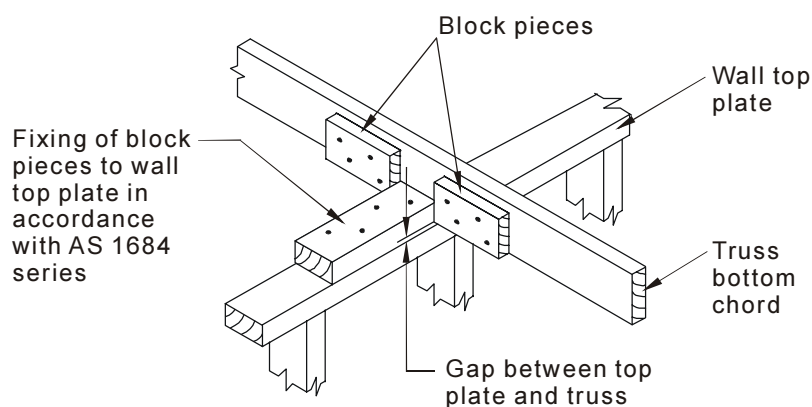


FIGURE 2.4 FIXING OF TRUSSES TO NON-LOADBEARING EXTERNAL WALL

SECTION 3 TRUSS INSTALLATION

3.1 TRUSS LAYOUT

A layout with sufficient information to correctly locate the timber trusses shall be available prior to the installation. If the information provided is unclear, guidance shall be sought before proceeding with the truss erection.

NOTE: A typical roof truss layout, in part, is given in Figure 3.1 with a particular emphasis on the girder truss location.

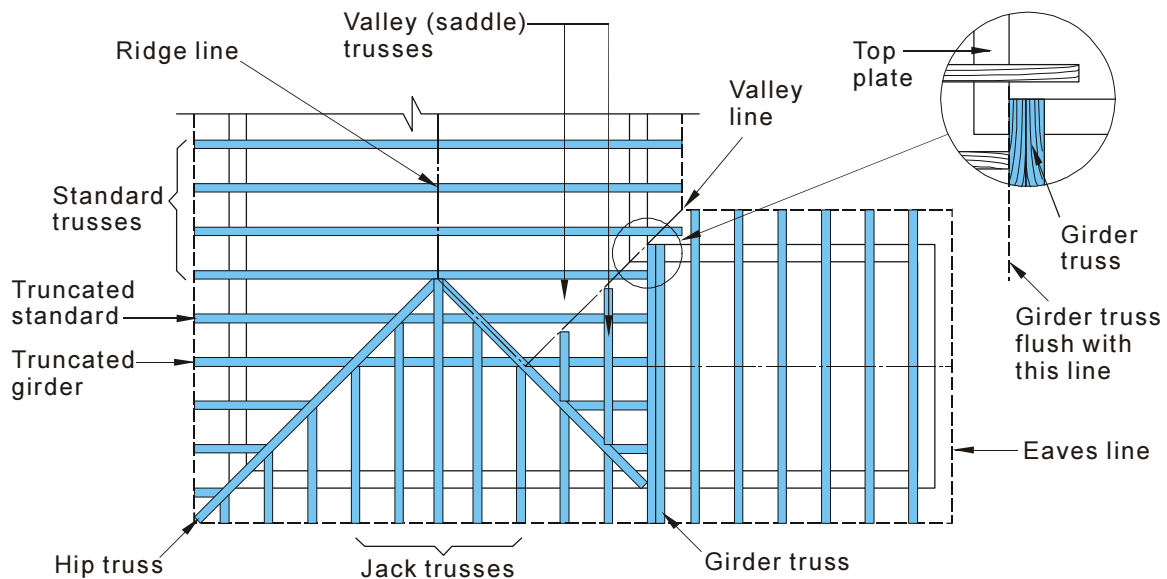


FIGURE 3.1 TYPICAL TRUSS LAYOUT

3.2 STABILITY DURING INSTALLATION

All trusses shall be braced (temporarily and/or permanently) and stabilized throughout the installation of the roof truss system. Any nailplated truss shall not be loaded, including stood on, until all temporary bracing for that truss is fixed in place and stabilized in accordance with this Standard. All relevant workplace safety practices shall be followed.

NOTE: As truss installation invariably involves working at heights, a risk assessment should be undertaken with any construction site.

3.3 TEMPORARY BRACING

Trusses shall be temporarily braced during installation to ensure they are held straight and plumb to the installation tolerances, as specified in Clause 3.3, prior to fixing the permanent bracing.

NOTES:

- 1 Recommended temporary bracing details are given in Appendix C.
- 2 If trusses are installed without adequate temporary bracing, the following problems may occur:
 - (a) Collapse of trusses during installation.
 - (b) Exceeding tolerances may cause overloading, buckling and possible permanent damage to the trusses.
- 3 It is recommended that the first truss be erected correctly, straight and vertical, and temporarily braced in position; the remaining trusses are then set in line with the first one.

The temporary bracing shall not be removed until the permanent bracing has been installed.

3.4 INSTALLATION TOLERANCES

3.4.1 General

Trusses shall be installed straight and vertical and in their correct position as specified in Clauses 3.4.2 to 3.4.4.

NOTE: The best method for ensuring correct truss positioning is to mark the locations on the top plate or other supporting elements in accordance with the truss layout prior to truss installation.

3.4.2 Bow

Trusses shall be erected with minimal bow, in the truss and in any chord, with a tolerance not exceeding the lesser of $L/200$ and 50 mm, where L is as defined in Figure 3.2(a) or Figure 3.2(b).

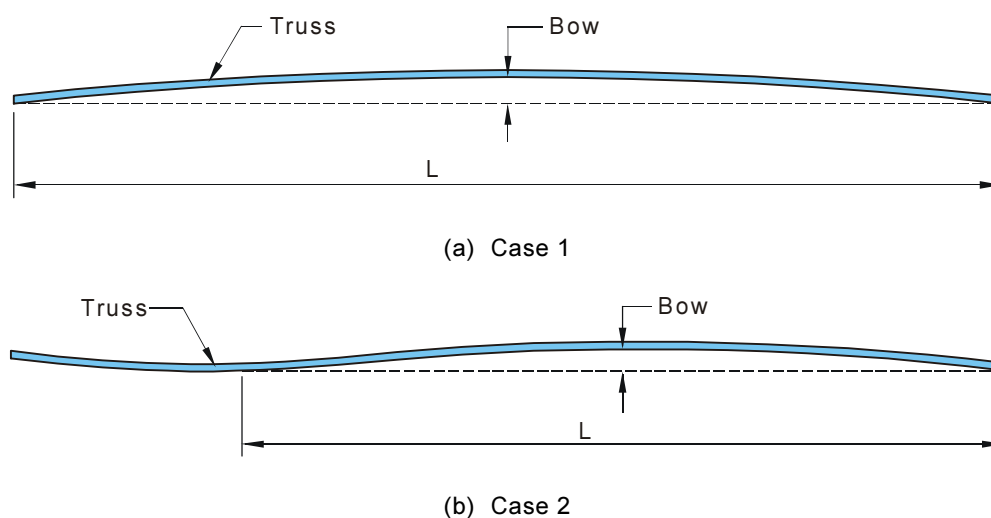


FIGURE 3.2 BOW

3.4.3 Plumb

Trusses shall be so erected that no part of the truss is out of plumb with a tolerance exceeding the lesser of height/50 and 50 mm (see Figure 3.3).

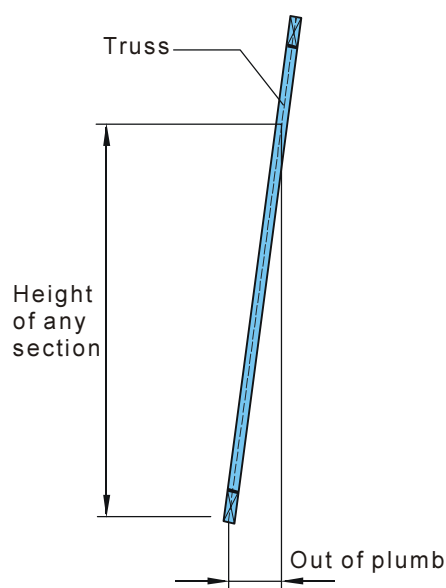


FIGURE 3.3 PLUMB

3.4.4 Spacing

Trusses shall be erected at a spacing not exceeding that specified in the design specifications or truss layout.

3.5 PLASTERBOARD FIXED DIRECTLY TO BOTTOM CHORDS

Where plasterboard is fixed directly to the bottom chord of trusses, supplementary noggings shall be supplied with the roof trusses. The supplementary noggings shall be not less than 70 mm × 35 mm F4 on edge, and shall be fitted as follows:

- (a) *At hip ends* The supplementary noggings shall be fitted where the bottom chords of the hip-end system do not continue to run parallel to the main run of trusses. They shall be fixed at a spacing required by the plasterboard.
- (b) *Elsewhere* The supplementary noggings shall be fitted between trusses where internal walls run parallel to the common trusses. They shall be fixed at a spacing not exceeding that for the common trusses.

3.6 INTERMEDIATE CEILING JOISTS

NOTE: Recommendations for the fixing of intermediate ceiling joists are given in Appendix D.

3.7 TIE-DOWN REQUIREMENTS

The requirements for fixing trusses to supporting structures shall be in accordance with the approved specifications. In the absence of any tie-down documentation, the provisions for tie-down set out in the AS 1684 series shall be used.

3.8 MULTIPLE (MULTI-PLY) TRUSS

A truss that is designated as double- triple- or multi-ply shall be nailed or bolted, or both, in accordance with the truss details before the truss is loaded.

NOTES:

- 1 The laminating of a multiple (multi-ply) truss should be done at the time of manufacture.
- 2 If a multi-ply truss is to be laminated on site, the truss components should be labelled appropriately.

3.9 TRUSS MODIFICATION

Under no circumstances shall a truss be modified by cutting, drilling, or by any other method that may interfere with its structural integrity, without being approved.

3.10 REJECTION CRITERIA

Trusses designed and manufactured for criteria other than those being used on site shall not be used without being approved.

NOTE: Design criteria for trusses should be checked when they are delivered to site to ensure that they are the correct trusses. If any truss has been cut, drilled, damaged, or manufactured in such a way as to impair performance, notification should be given to the truss engineer in order to provide adequate rectification to the truss.

Trusses with severely degraded timbers or nailplates due to poor storage shall not be loaded prior to rectification or replacement.

NOTES:

- 1 Manufacturing error or damage deemed severe enough to warrant attention should include but not be limited to the following:
 - (a) Broken or split timbers.
 - (b) Missing nailplates on one or both sides of a joint.
 - (c) Nailplates obviously misplaced, for example, missing a member at a joint or nailplate not properly embedded.
 - (d) Any nailplate showing evidence of flattening of the teeth, or excessive splitting of the timber under the nailplate.
- 2 A truss supported away from the design location may be rejected.
- 3 If a fault is discovered after the truss has been loaded, the load should be supported to alleviate the load on the truss until rectified.

3.11 TRANSPORT, STORAGE, LIFTING AND HANDLING

NOTE: Recommended practices for the transport, storage, lifting and handling of timber trusses are described in Appendix E.

SECTION 4 ROOF BRACING

4.1 GENERAL

This Section specifies the permanent bracing requirements for roof trusses. These requirements are suitable for restraining loads imposed by the direct action of wind on the roof structure and do not make any allowance for wind loads on walls.

Before being loaded, roof trusses shall be permanently braced to a building element such as supporting walls, which in turn can transfer these bracing loads to the structure, to prevent rotation or buckling of trusses under the weight of roofing and ceiling materials or under wind uplift.

Roof bracing shall comply with the following Clauses:

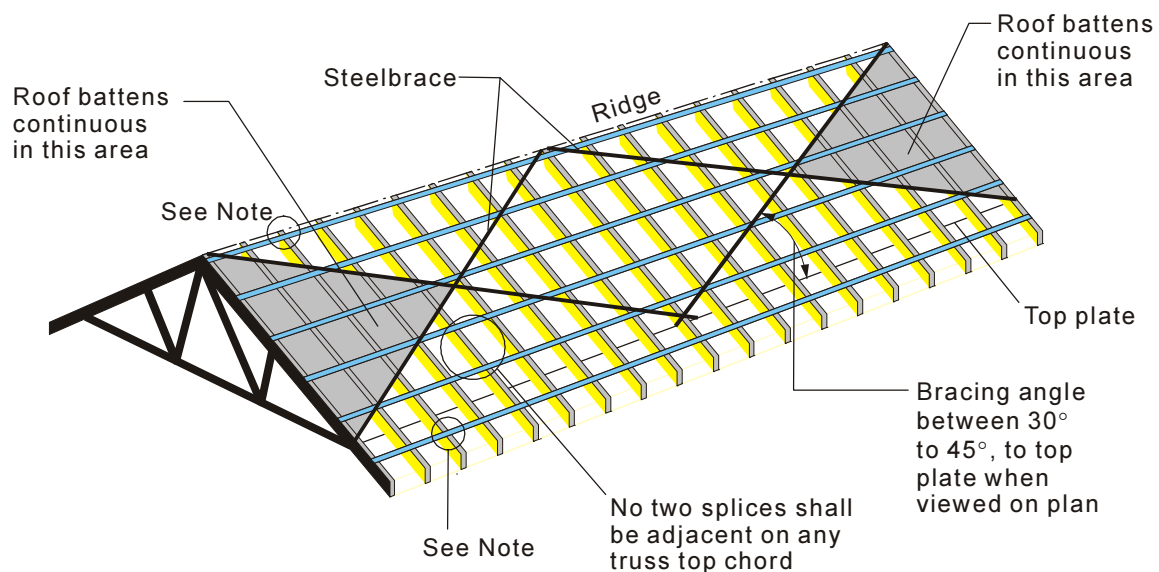
- (a) Lateral restraints to truss top chords, i.e., roof battens or purlins Clause 4.2.
- (b) Diagonal bracing to truss top chords using steelbrace Clause 4.3.
NOTE: Typical specification for and examples of steelbraces are given in Appendix F.
- (c) Bottom chord bracing Clause 4.4.
- (d) Web ties Clause 4.5.

4.2 ROOF BATTENS

4.2.1 General

The size, spacing and fixing of roof battens or purlins shall be in accordance with the approved specifications. Battens shall be fixed to every truss, including each ply of the multiple-truss.

In areas where battens or purlins are not bound at each end by diagonal bracing, battens shall be continuous (see Figure 4.1).



NOTE: Not more than 1 in 3 battens are spliced on any truss top chord.

FIGURE 4.1 TYPICAL BRACING LAYOUT

In addition to providing support to the roof cladding, roof battens or purlins prevent truss top chords from buckling. The buckling action is due to the compressive force in the top chord of the roof truss. This buckling action is resisted by the roof battens or purlins, which in turn transfer it to the steel roof bracing and down to the supporting structure. Each element and fixing along this sequence is essential for the stability of the roof structure.

Where required, splices in battens or purlins shall 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 shall be no splices in battens or purlins over girder trusses.

4.2.2 Intermediate and internal top chord ties

4.2.2.1 *Intermediate top chord ties for valley intersection*

Due consideration shall be given to the restraint requirement for the supporting truss top chords where the valley trusses are located. Where the spacing of valley trusses is greater than the restraint spacing in design, either the roof battens shall be continued at the design spacing or intermediate top chord ties shall be fixed to the supporting trusses as shown in Figure 4.2(a) (see also Clause 5.4).

4.2.2.2 *Internal top chord ties for north-light or similar trusses*

With north-light or similar trusses fabricated typically as shown in Figure 4.2(b), the internal top chord shall be restrained with top chord ties as specified. The ties shall also be restrained with diagonal timber, or cross steelbraces (see Clause 4.3).

4.2.2.3 *Internal top chord ties for top-hat trusses*

Some extremely deep trusses are fabricated in two segments, with a smaller upper truss sitting piggyback on a lower truncated truss (see Figure 4.2(c)). The horizontal top chord of the lower truss shall be restrained with top chord ties as specified. The ties shall also be restrained with diagonally crossed steelbraces (see Clause 4.3).