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B I Cut roofs

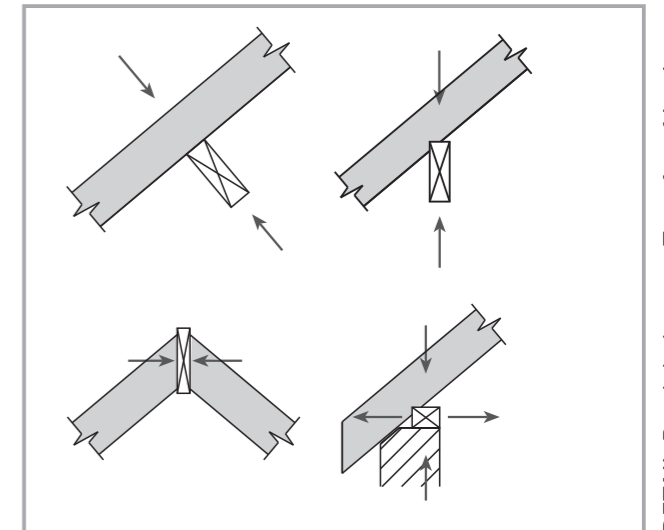
General

Swift 6 provides Non-Contradictory Complimentary Information (NCCI) for designs to Eurocode 5; this information mainly consists of load span tables for specified design criteria. In the U.K. TRADA have produced similar load span tables and it may be that BSI will also produce tables to Eurocode 5 to replace their permissible stress design tables to BS 5268-2 and given in BS 5268-7 and BS 8103-3.

B.1.1 STABILITY AND LOAD TRANSFER

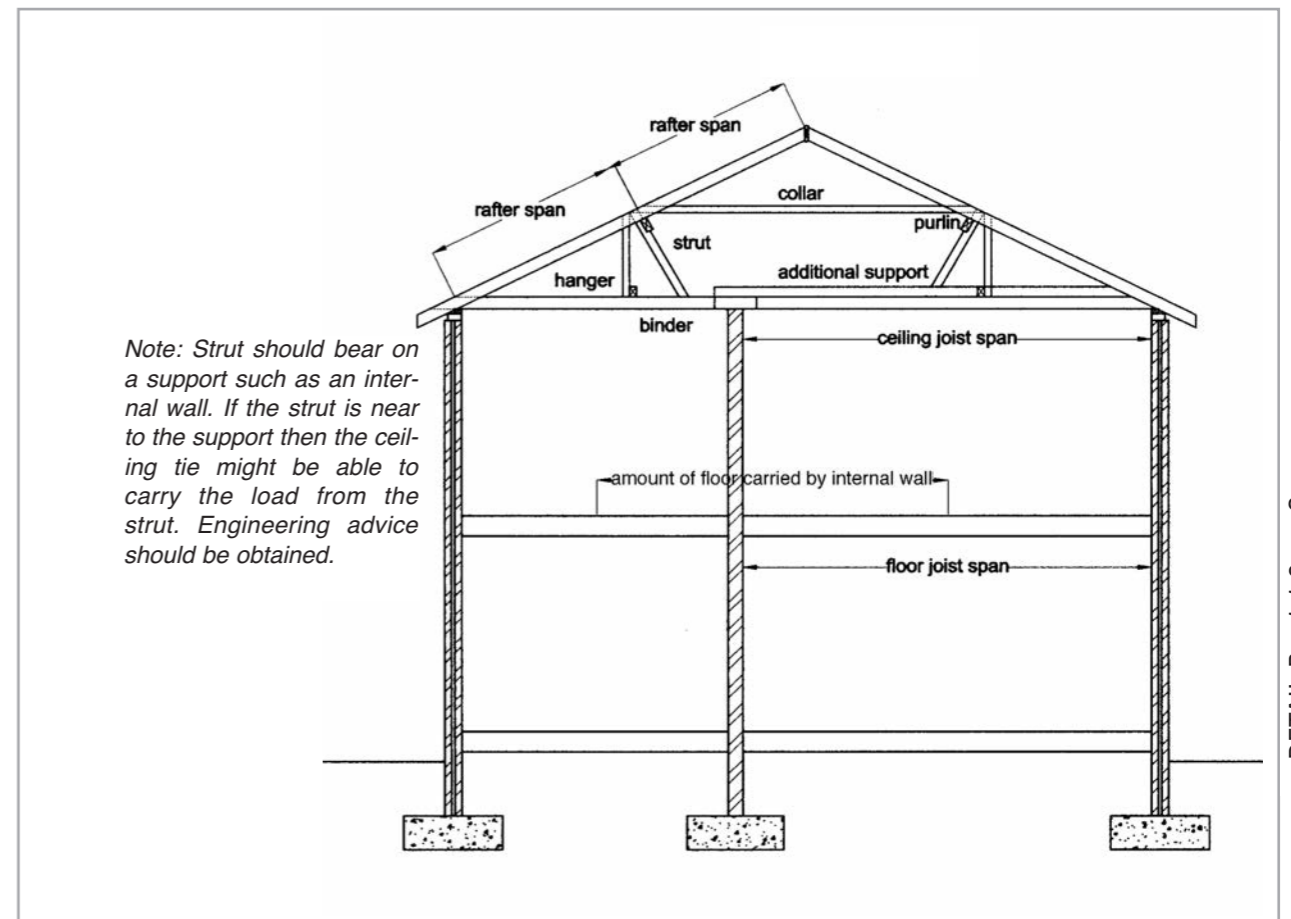
The stability of cut roofs is dependent on the triangulation or tying in of the different elements and in limiting the spans of the rafters, ceiling ties and purlins to the appropriate section size and timber strength class. The location of purlin supports should be carefully considered and identified to ensure loads are transferred to load bearing walls or supporting beams. With hip ends, particular attention must be paid to how purlins are supported as often there may be no load bearing walls to provide support to the purlins under the hip end.

Roof rafters produce a horizontal thrust at eaves level and this thrust is usually taken out by the ceiling ties. In a symmetrical dual pitched roof the horizontal thrusts on each side of the roof are cancelled out. In a roof that is significantly unsymmetrical or mono-pitched, alternative means of catering for the horizontal thrust may have to be found.



DETAIL B 1.1.1 Transfer of load

Where raised ceiling ties are used in a roof, the roof must be designed by a qualified engineer; generally the length of the raised rafter or position of the raised ceiling tie must be limited to reduce stresses and connection loads



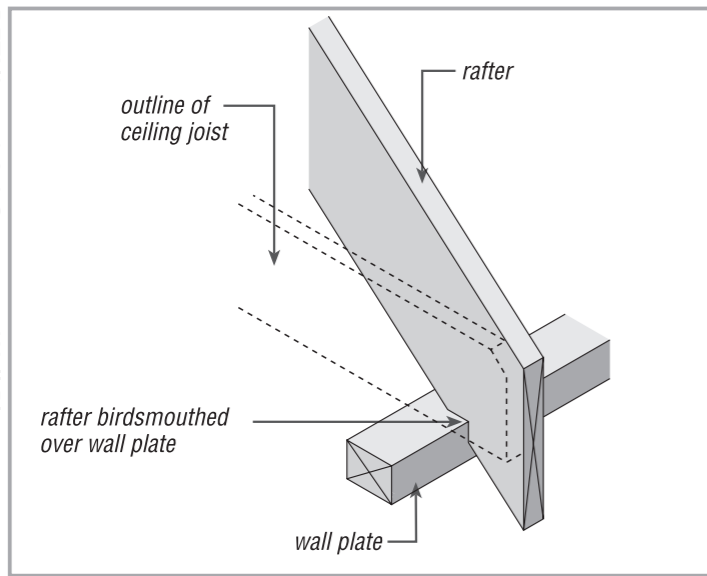
Note: Strut should bear on a support such as an internal wall. If the strut is near to the support then the ceiling tie might be able to carry the load from the strut. Engineering advice should be obtained.

DETAIL B 1.1.2 Spans

Note: In the absence of a purlin the rafter span extends from wall plate to ridge board.

B 1.2 CUT ROOFS - RAFTER DETAILS

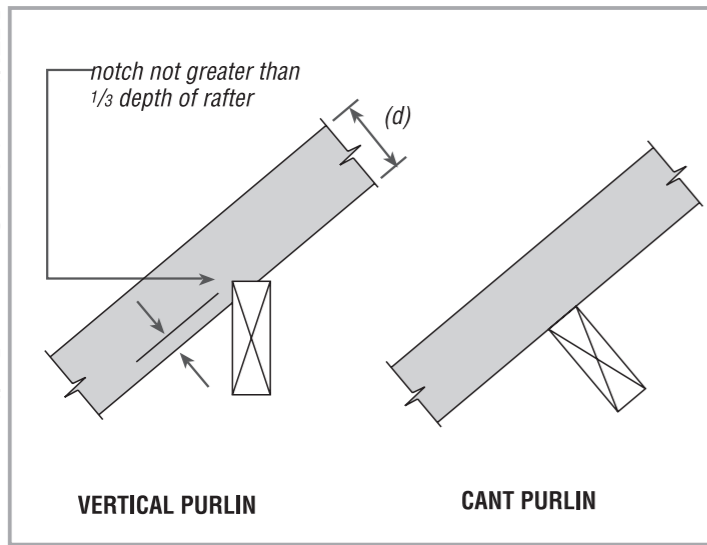
DETAIL B 1.2.1 Support at Wall Plates



Support at wall plates

The rafters are usually birdsmouthed over and skew-nailed to the wall plate although other details are possible. It is recommended that the wall plate and rafter ends as well as any site cut ends be treated with a suitable timber preservative. Rafters should be triangulated with a ceiling tie or walls reinforced with a ring beam to cater for any horizontal loads. Rafters should be fixed down to the supporting structure to cater for any uplift forces and the fixing details should be designed by a suitably qualified engineer.

DETAIL B 1.2.2 Support at Purlins



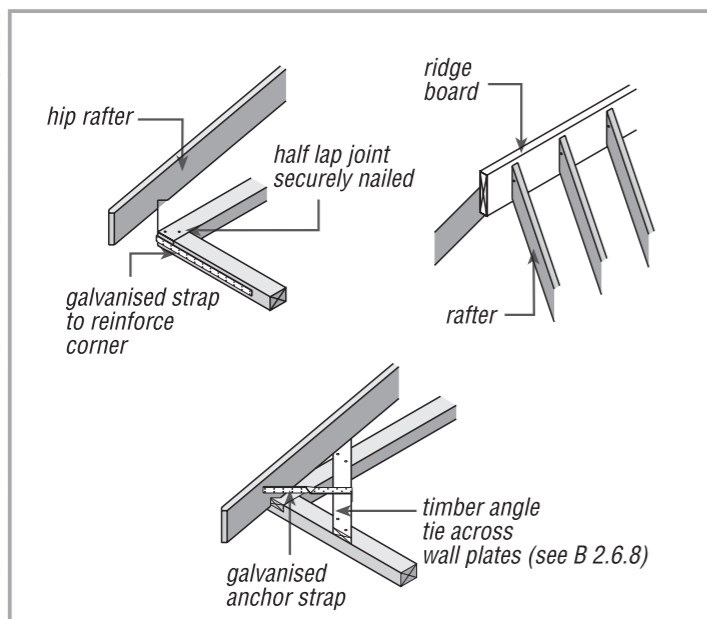
Support at purlins

The rafter should be fixed to a cant purlin by skew-nailing on each side of the rafter. Where a purlin is installed vertically the rafter should be birdsmouthed over and skew-nailed to the purlin. The depth of the notch should not exceed one third of the depth of the rafter. Where purlins are placed vertically there may be a horizontal thrust which would have to be catered for.

Support of purlins

Purlins must be supported by load bearing walls or by structural beams and any horizontal thrust from the purlin must be catered for. The strut and its associated connections and supports should be of adequate size and strength to resist buckling and to carry the appropriate loading. How the purlin is supported affects the bearing stresses acting on the purlin; Swift 6 recommends the use of 75 x 150 mm struts at each end of a purlin and that purlins use butt joints at their supports. Shear and bearing stresses may limit the purlin span especially for scarf and half joints and these joints are not covered in Swift 6.

DETAIL B 1.2.3 Support at Ridge and Hipped Ends



Support at hipped ends, ridge and valleys

In addition to skew-nailing hipped rafters at wall plate level, the wall plates should be reinforced either by using a steel strap tying the wall plates together, or a steel anchor strap may be fixed to a timber angle cut into or fixed to the wall plates (see detail B.1.2.3.). The steel straps should be galvanised steel or austenitic stainless steel and the nails used to fix these straps should be of the same material. There can be significant horizontal forces acting from a valley and these must be catered for; valleys must be designed by a qualified engineer.

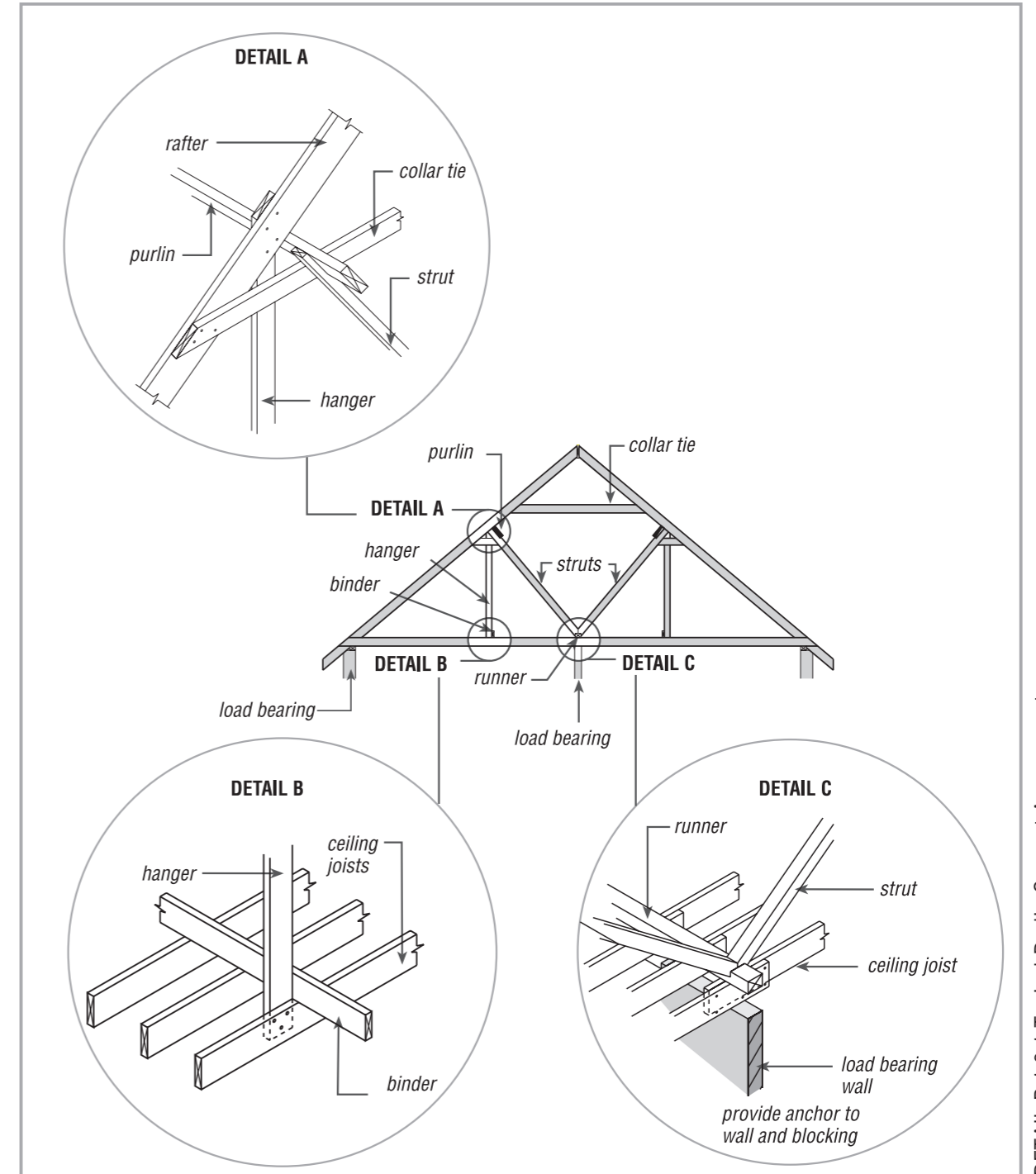
Support at ridge level

At ridge level the rafters should be skew-nailed to the ridge board. Care should be taken to ensure that the rafters are opposite each other and that the ridge board is capable of resisting any eccentric horizontal load. Any uplift forces at this level should be catered for as directed by the design engineer.

Uplift forces

Uplift forces acting on a roof will depend on a number of factors including; the weight of the roof covering, the location of the building, the roof angle and the height of the building. Uplift forces must be catered for and must be designed by a qualified engineer.

B 1.3 CUT ROOFS - PURLIN DETAILS



DETAIL B 1.3.1 Typical Purlin Support Arrangement

Purlin support and arrangement

Purlin loads must be transferred to load-bearing walls or properly designed joists or beams.

binder should be securely fixed to each ceiling joist and the hangers are usually provided at every third rafter.

The binder should be nailed to the ceiling joists and rafters after the roof is loaded but before plasterboard is fixed to ceiling.

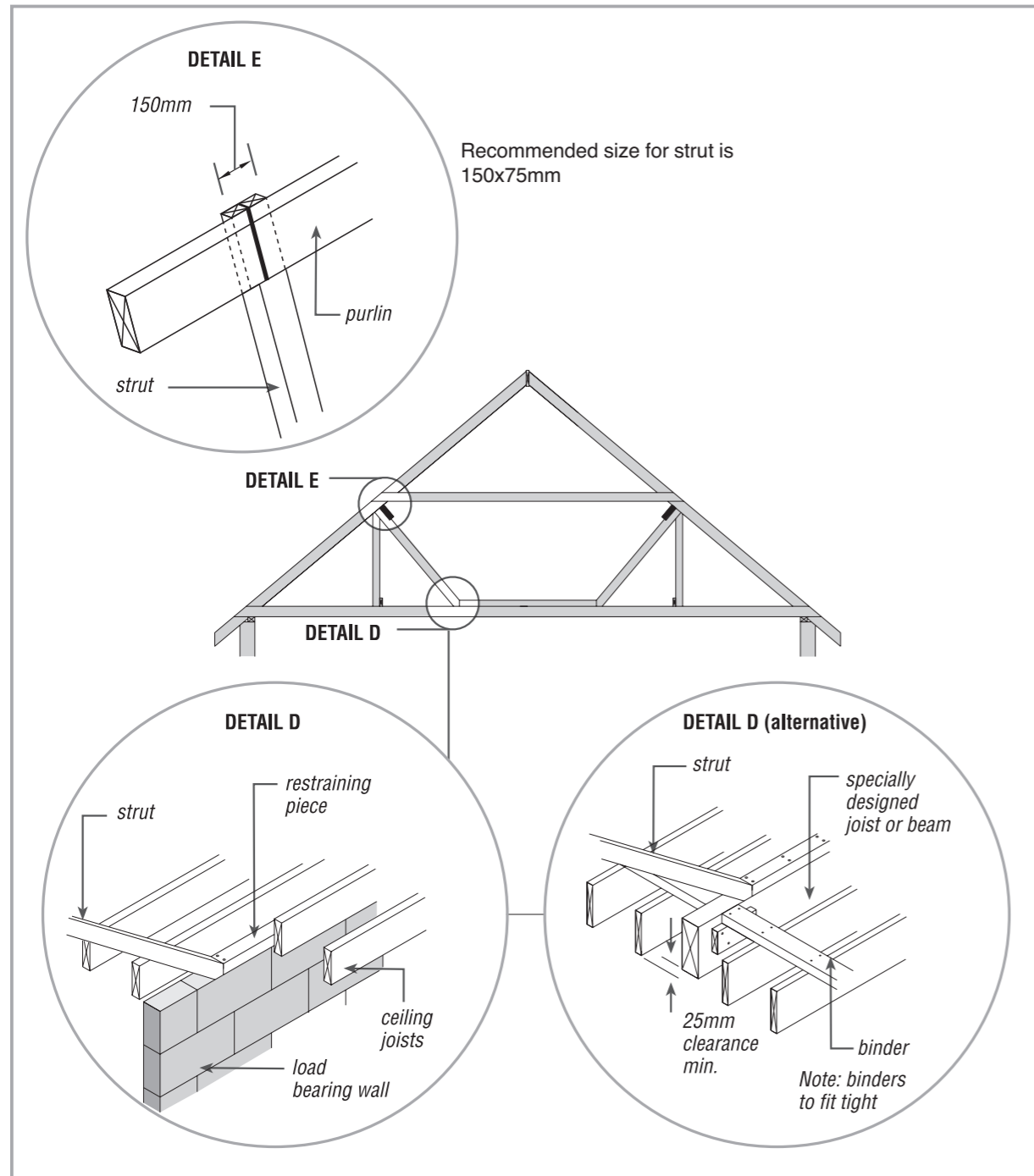
DETAIL A - Typical arrangement at junction of rafter, purlin, hanger and collar tie. Additional collars may be placed between purlin supports.

DETAIL C - Typical arrangement of struts at ceiling level where the ceiling joists overlap at a supporting wall. The lap should be a minimum of 300mm and double nailed at either end. The vertical loads from the strut are taken by the wall while the horizontal strut loads cancel each other out if the roof is symmetrical. The connections and general detail here should be provided by the design engineer.

DETAIL B - Typical arrangement at junction of hanger, binder and ceiling joist. Typical hanger and binder sizes are 100x36 mm but larger sections may be required. The hanger/binder provides support to the ceiling joists (and can limit the deflection of the ceiling tie if the connections and general arrangement are designed for this). The

B 1.3 CUT ROOFS - PURLIN DETAILS (CONTINUED)

DETAIL B 1.3.2 Typical purlin support and arrangement



DETAIL D - Strutting of purlin on to a load-bearing wall. The restraining piece caters for the horizontal thrust from the strut. Again the details here should be provided by the design engineer.

ALTERNATIVE DETAIL D - Where a purlin cannot be propped onto a load-bearing wall it may be propped on a specially designed joist(s) or beam which transfers the load to a load-bearing wall or structural frame.

A minimum of 25mm clearance should be left between the bottom of the beam and the underside of the ceiling joists to accommodate any differential deflection.

Purlin splices

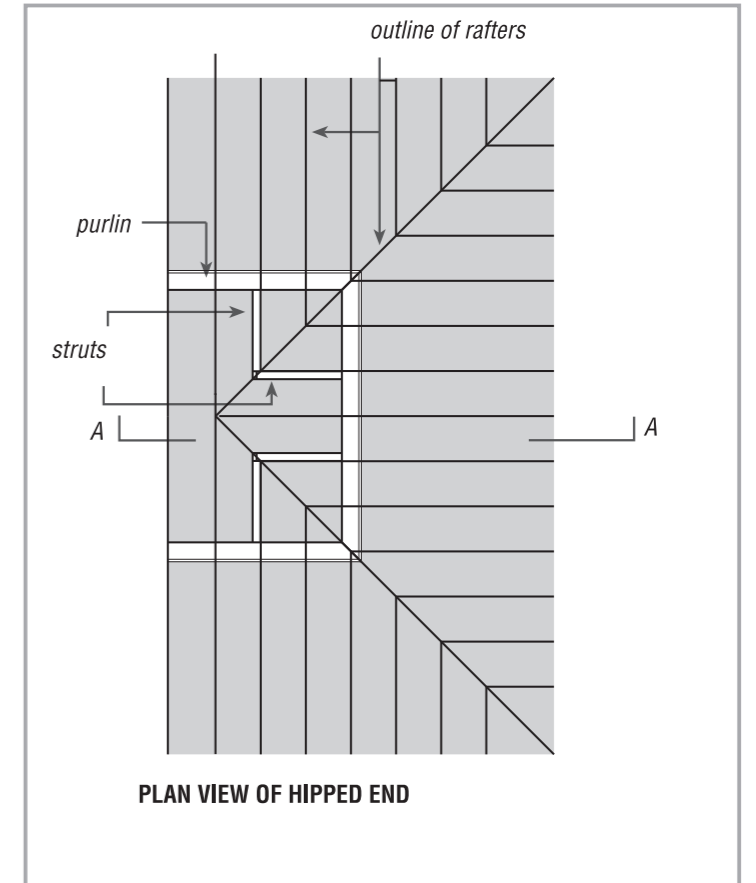
DETAIL E - Where purlins are to be connected by halving joints, the joints should be a minimum of 150mm long and support must be provided directly below the joint. The use of this joint is not recommended as the joint is often poorly cut on site and shear requirements result in short purlin spans. Swift 6 caters only for butt joints; purlins with half or splice joints require a special design; bearing and shear stresses must be checked and these depend on how the purlin is supported.

B 1.3 CUT ROOFS - PURLIN DETAILS (CONTINUED)

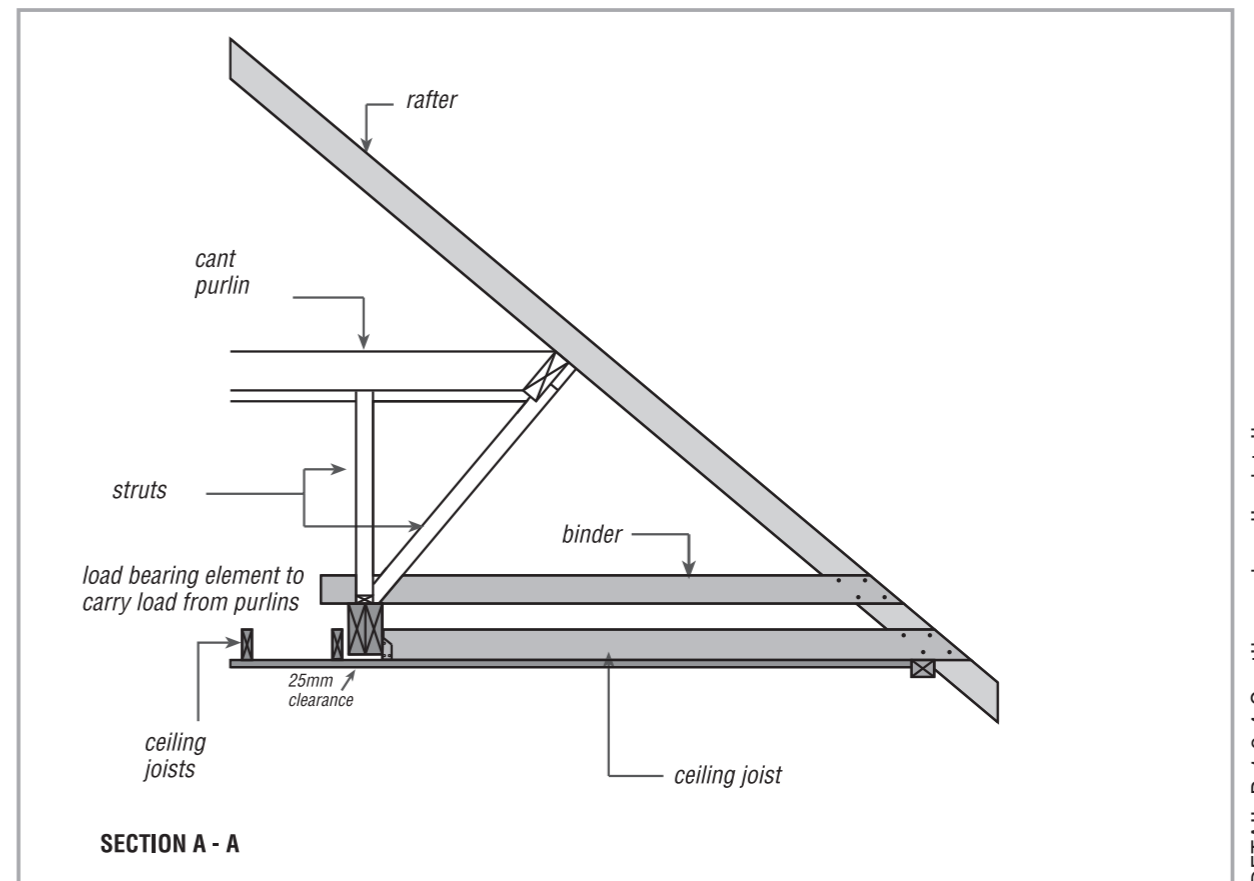
Cantilevered purlin

The hipped rafter must be adequately supported by the purlins at their intersection. The purlins should be mitred and securely nailed together. Purlins should not cantilever by more than 900mm and the struts should be supported by load-bearing members. Any cantilevered purlin should be continuous over the cantilevered support.

The hip board is usually birdsmouthed over the purlin so as the purlin provides support to the board.

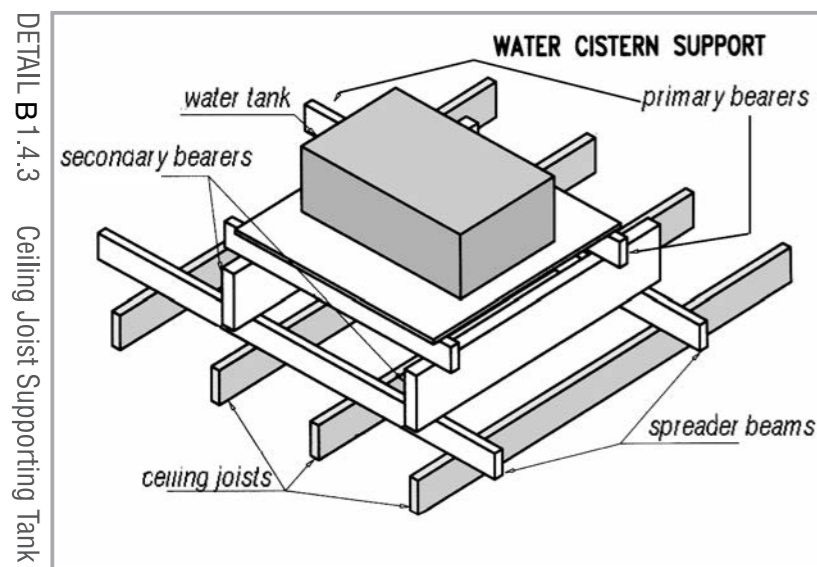
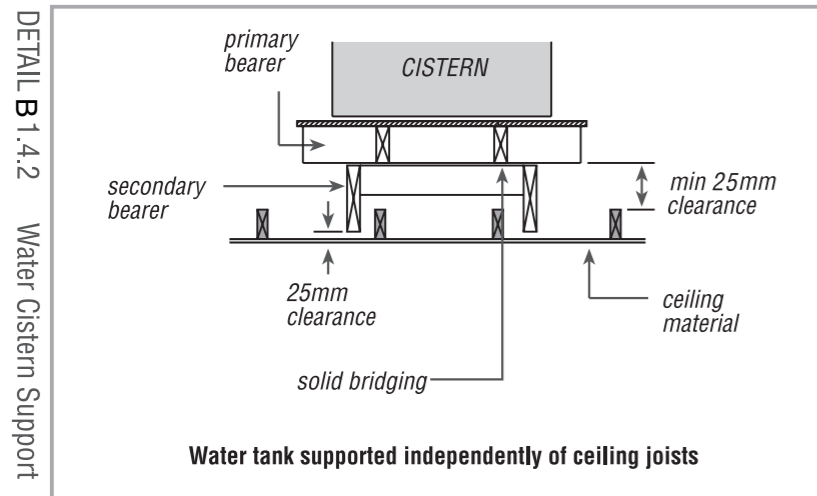
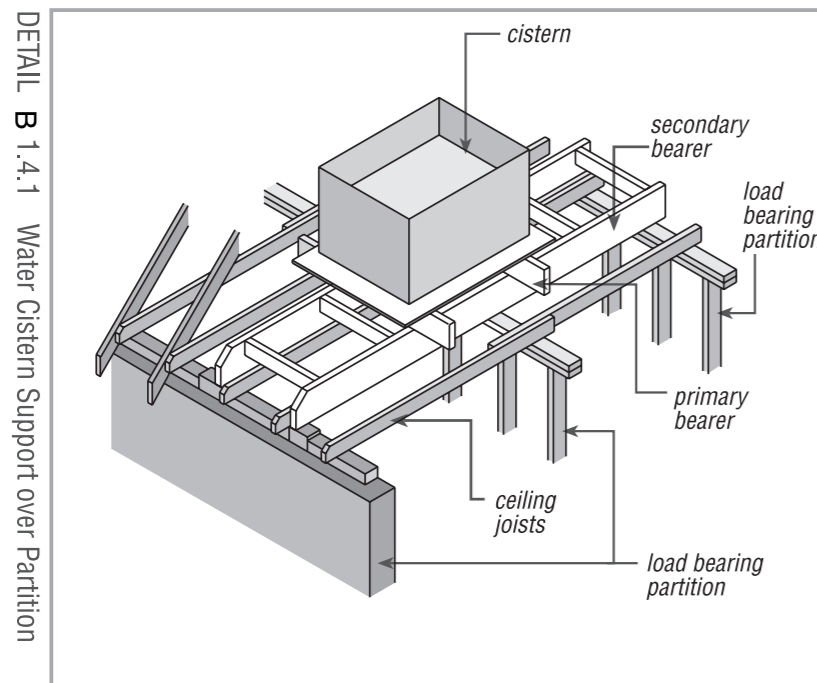


DETAIL B 1.3.3 Typical hip end purlin detail



DETAIL B 1.3.4 Cantilevered purlin detail

B 1.4 CUT ROOFS - WATER CISTERN SUPPORT



Water cistern support

The water cistern in a cut timber roof should be supported by a framework directly over and off load bearing walls. Alternatively the framework can transfer the cistern loads to a supporting wall or structure. The design of the framework will depend on the size of the cistern and the distance it has to span.

Typically twenty five millimetres clearance should be left between the underside of the framework and the ceiling slab, to allow for deflection. (Detail B1.4.2).

An alternate arrangement could involve spreading the load of the tank over ceiling joists as shown in B1.4.3. The spreader beams should span at least four joists; the framing and the joists must be designed for the cistern size and appropriate spans. See detail 2.5.3 for water tank supports on roof trusses.

B2 Trussed rafter roofs

B 2.1 GENERAL

Swift 5 provides Non-Contradictory Complimentary Information (NCCI) for designs to Eurocode 5; this information includes limits on bay lengths related to timber sizes. In the UK similar information is included in PD 6693. The system owners (see below) have design software for Eurocode 5 and can still provide designs to the permissible stress standards IS193 and BS5268-3.

Spans

The selection of truss configuration is dependant on a number of factors

- Span
- Loadings
- Timber size and strength class
- Roof profile

When measuring the span of a truss, measure between the intersection points of the lower edges of the rafters and ceiling ties.

Support

For a trussed rafter to perform satisfactorily, adequate restraint (usually through the use of bracing, straps and truss clips) and bearing must be provided. Truss designers should check bearing, wall plates and specify its' minimum strength class; typically C14 or C16.

To allow for tolerances, consider increasing the span by 25mm on either side to allow for adjustment on the wall plate.

Care should be taken not to introduce internal supports for roof trusses where the trusses have not been designed for such supports. In addition where trusses pass over non-load-bearing partitions, a gap (usually about 25mm) should be left between the top of the partition and the underside of the truss to allow for the thickness of plasterboard and truss deflection.

Design of overall stability

To act as a single structural unit the trussed rafters should be braced in accordance with the recommendations of the truss, roof and building designer.

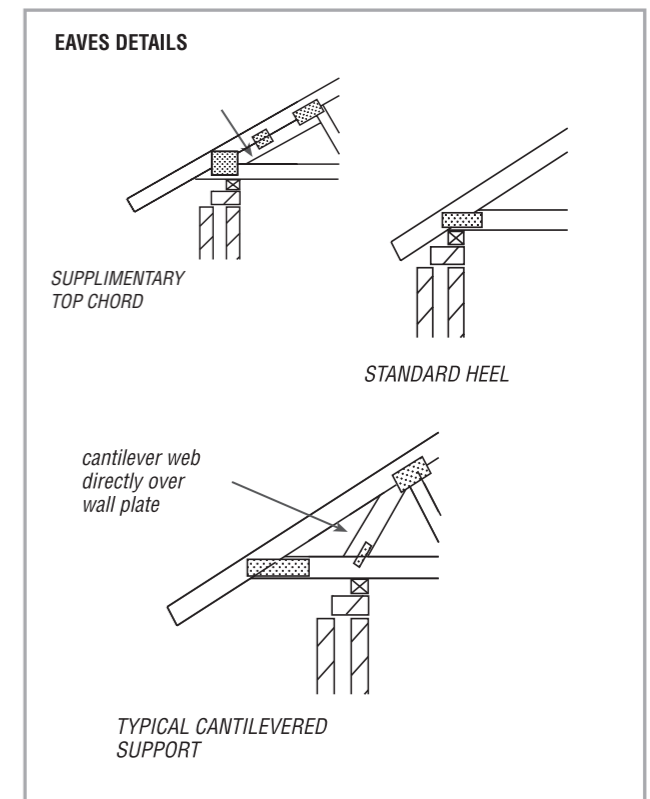
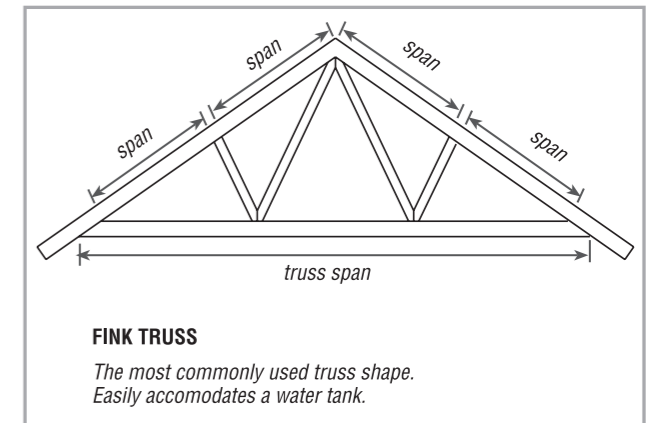
It is the responsibility of the trussed rafter designer to design the individual roof trusses and if requested the overall roof. The building designer may require additional bracing (for example to stabilise walls) in the roof structure.

Strength classes

Most roof trusses use C24 or TR26 timber. However, other strength classes may be used and the minimum strength class recommended for roof truss design and fabrication is C16.

Approved manufacturers

It is recommended that roof trusses be manufactured under a quality system subject to monitoring by an appropriate third party. The National Standards Authority of Ireland (NSAI) operates a Roof Truss Manufacturers Approval Scheme and maintains a National Register of



approved manufacturers; this register is available on the NSAI website. There are similar schemes in the UK operated for example by TRADA.

System owners

'System owner' is the term used to describe a company that provides truss fabricators with the design system, engineering backup, software and punched metal plates used in truss joints.

B 2.2 TRUSSED RAFTER ROOFS - DESIGN INFORMATION

DETAIL B 2.2.1 Roof Covering

roof covering	Typical load kN/m ²
asbestos slate	0.17 - 0.24
concrete tile	0.42 - 0.68
clay tile	0.86
natural slate	0.24 - 0.78

These loads are usually given on slope

EN14250, IS193 & BS 5268-3

Prior to the introduction of Eurocode 5, roof trusses were designed using permissible stress standards; IS 193 (Timber trussed rafters for roofs) in Ireland or BS 5268: Part 3 (Structural Use of Timber - Code of Practice for Trussed Rafter Roofs) in the U.K. In both cases the trusses should have been manufactured to EN 14250: Timber structures - Product requirements for prefabricated structural members assembled with punched metal plate fasteners.

In Ireland IS 193 has been withdrawn and designs should now be carried out to Eurocode 5. In the U.K. designs may be undertaken to Eurocode 5² or BS 5268-3 depending on the specification. For designs to Eurocode 5, reference should be made to not only the relevant National Annexes but also any Non-Contradictory Complimentary Information (NCCI) documents such as Swift 5 in Ireland and the proposed PD 6693 in the U.K.

For concrete roof tiles IS 193 gave a minimum dead loadings of 0.685kn/m² for rafters ²(measured on slope) and 0.25kn/m² for ceiling ties. The appropriate load from a standard 270 litre cistern should be taken as acting on the ceiling tie unless the cistern is larger. However, roof trusses should be designed for the actual weight of the roof covering and ceiling loads; heavier finishes will result in greater loads while lighter finishes may result in roof uplift and stress reversal.

This includes 0.11kn/m² for the weight of supporting structure.

The building designer should specify the proposed dead load or roof covering, water cistern capacity and geographical location to the truss rafter manufacturer.

The trussed rafter designer should be made aware of the geographical location to enable correct the design to take account of the topography and correct local wind speed.

Wind speed maps are given in EN 1991-1-4 for designs to Eurocode 5 and were located in Technical Guidance Document A (Structure) to the 1997 Building Regulations for designs to permissible stress.

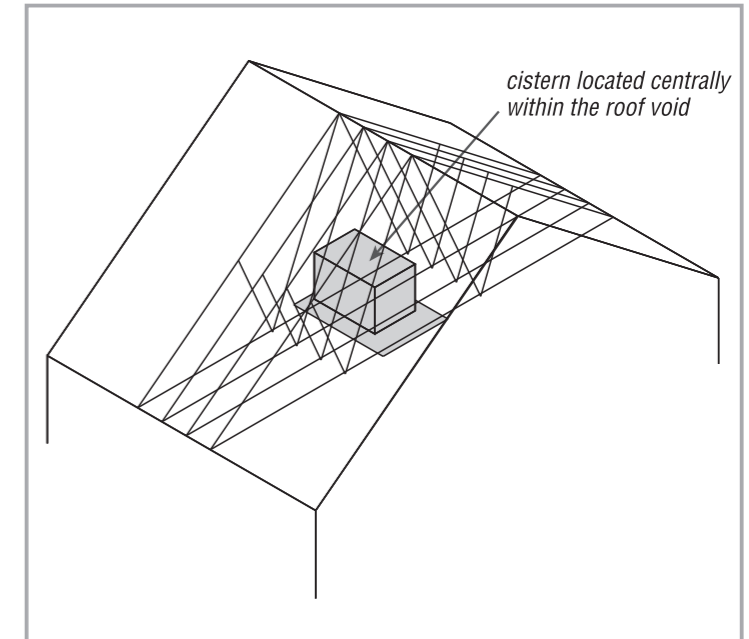
²The revised Technical Guidance Document A due to be published in 2012 will specify a date where designs must be to Eurocode 5. For the U.K. consult approved Document A or Building Control.

B 2.2 TRUSSED RAFTER ROOFS - DESIGN INFORMATION (CONTINUED)

Water cisterns

Where possible the water cistern should be placed centrally within the roof void and be supported by over a minimum of four trusses. Cistern supports should be provided to transfer the cistern load to node points of the supporting rafters.

Locating tanks in hipped ends should generally be avoided unless special provision is made for support.



DETAIL B 2.2.2 Water Cistern Location

Chimney and roof lights

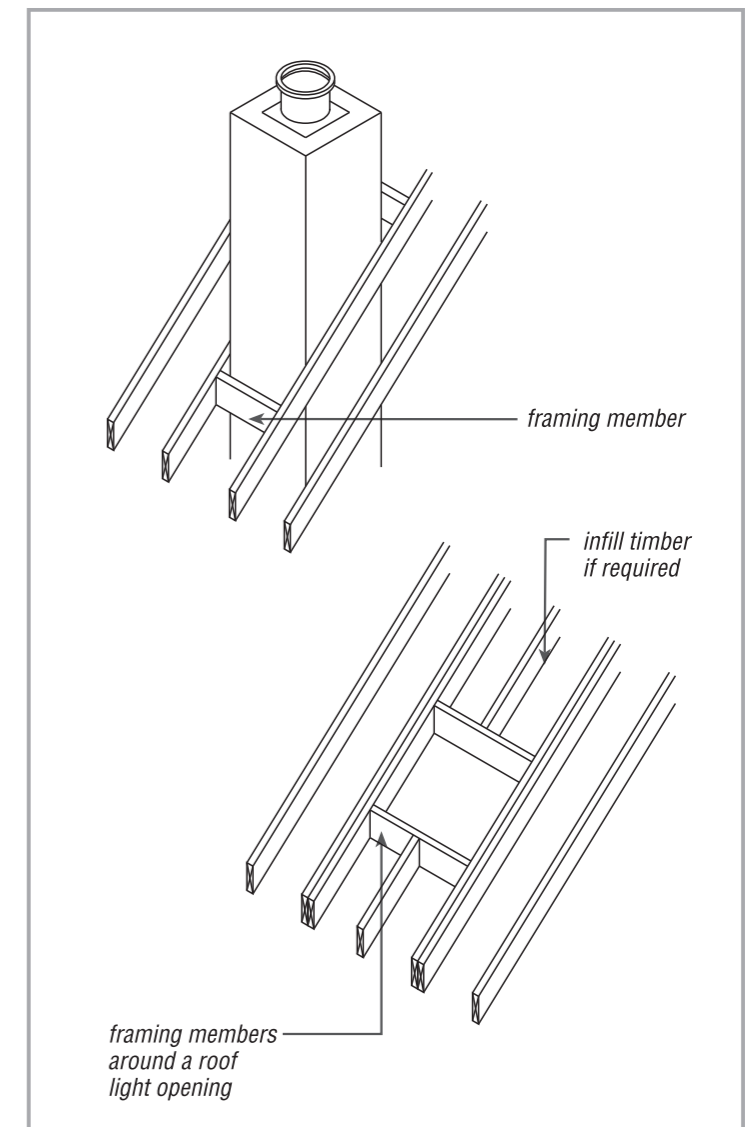
Where possible accommodate chimney, roof windows etc., in the standard spacing between trusses, and provide appropriate framing members.

Careful consideration at design stage should ensure that roof lights, dormer windows, chimneys, etc., do not coincide with the location of hipped or valley rafters and multiple trusses.

Technical Guidance Document J (Heat producing appliances) requires that there should be a 40mm space between combustible roof members and a chimney where the distance to the flue is less than 200mm. Any metal fixings should be at least 50mm from the flue. Similar requirements apply in the U.K.

It is recommended that cut rafters and framing members are supported by metal shoes rather than by skew nailing.

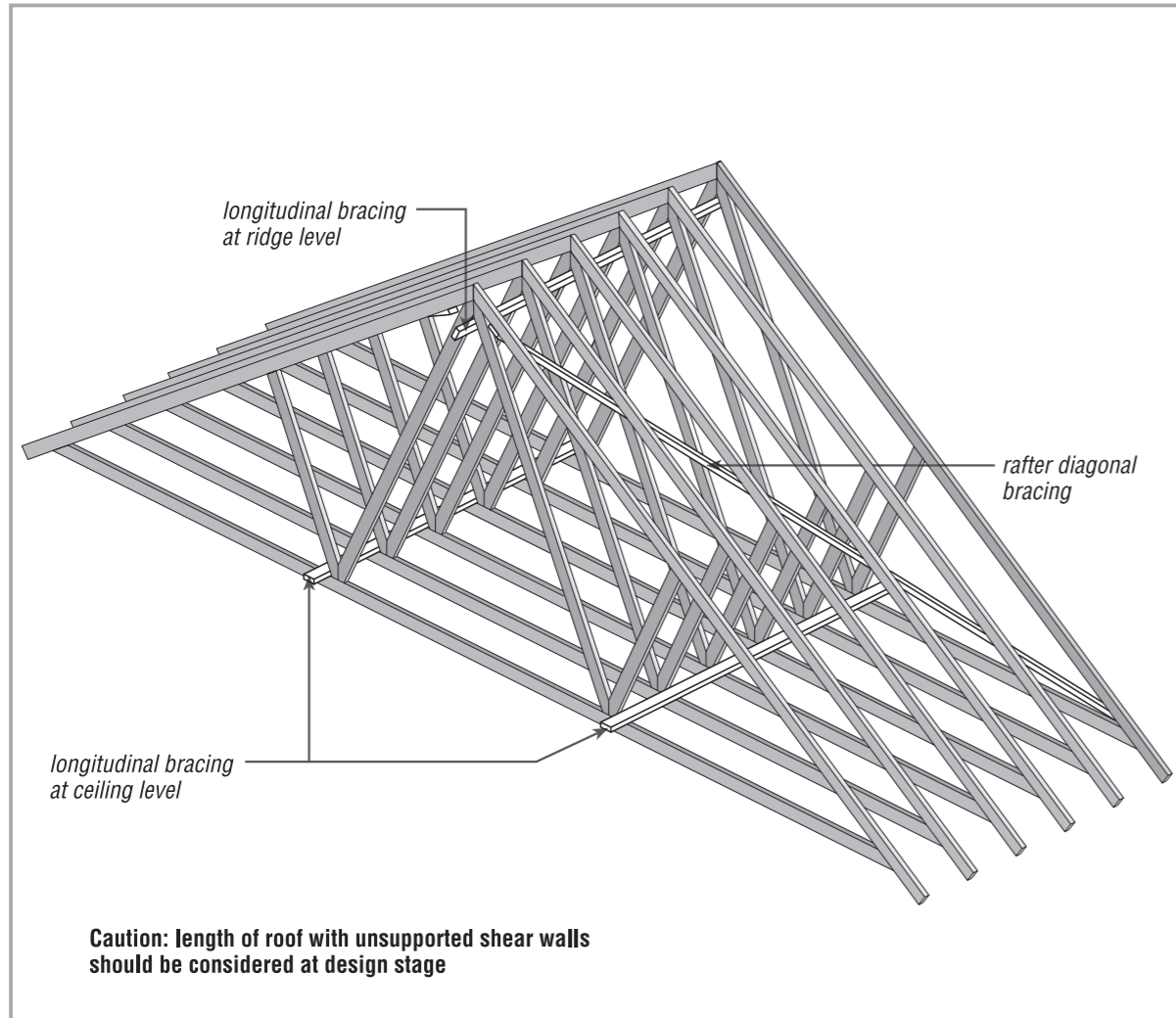
Refer to Section B6.6, drawings B6.6.5 to B6.6.7.



DETAIL B 2.2.3 Chimney & Roof Lights

B 2.3 TRUSSED RAFTER ROOFS - BRACING

DETAIL B 2.3.1 Prefabricated Roof Trusses - Minimum Bracing



General

Adequate bracing should be used to ensure that the prefabricated trussed roof acts as a single unit. The design of the bracing members is usually the responsibility of the roof designer and/or the truss manufacturer.

The recommended minimum bracing details for the majority of prefabricated trusses spaced up to 600mm are outlined in detail B2.3.1.

Longitudinal bracing (binders):

Located at ceiling level and at internal node points, they add to the overall roof stability and help with the truss erection. They run at right angles to the trusses and should extend the whole length of the roof, finishing tight against the party or gable wall. Longitudinal bracing should be installed at the ceiling tie junctions with the struts and at the rafter apex.

It is common now to brace all node points including the rafter and strut junctions. In steep roofs tension members (e.g. a queen tie) sometimes have longitudinal bracing at mid-span to cater for stress reversal from wind loads. Heavily loaded compression members (struts) may also

require additional longitudinal bracing. Examples of additional longitudinal bracing are shown in Details B 2.3.2 and B 2.3.3.

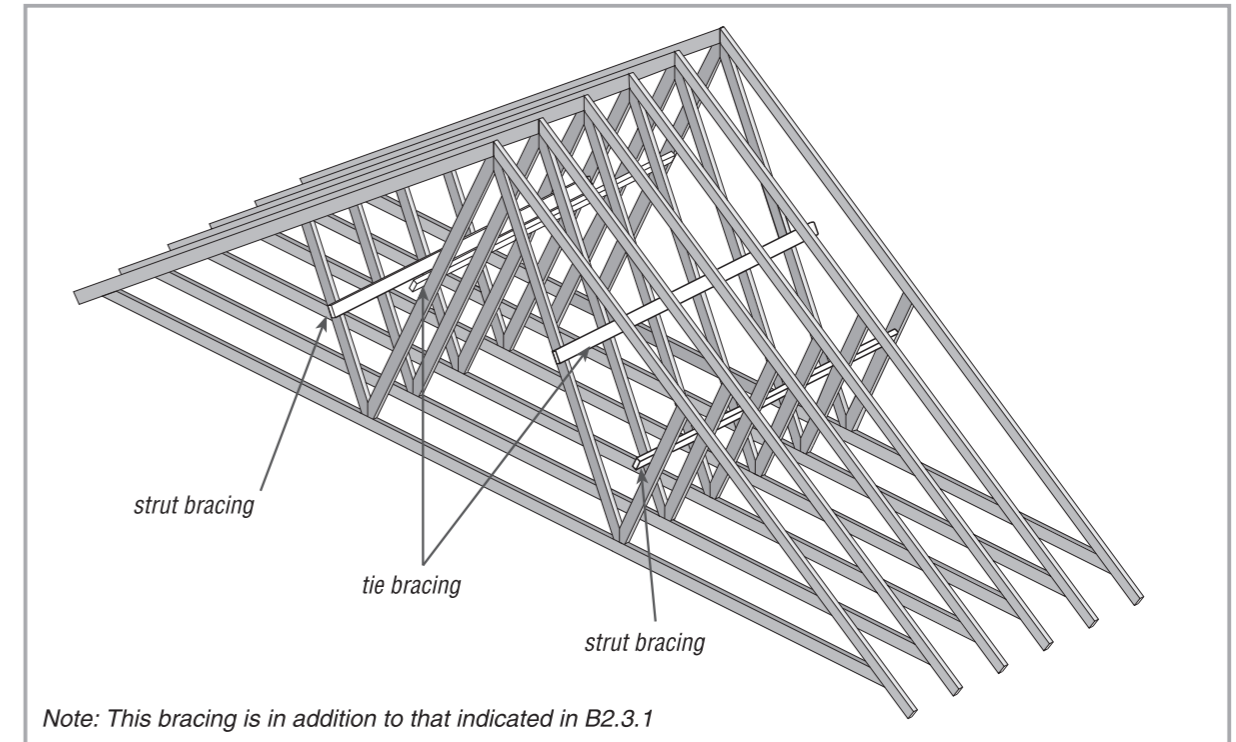
Rafter diagonal bracing:

They run from eaves to rafter apex on both sides of the roof, and help to provide resistance against lateral (side-ways) buckling. The rafter diagonal brace is nailed to the underside of the rafters, is often fixed to the wall plate and runs up to the rafter apex at an angle of between 35 and 50 degrees on plan. Longitudinal and diagonal bracing should extend over the whole length of the roof, with a minimum of four diagonal braces being provided in the roof.

Chevron bracing:

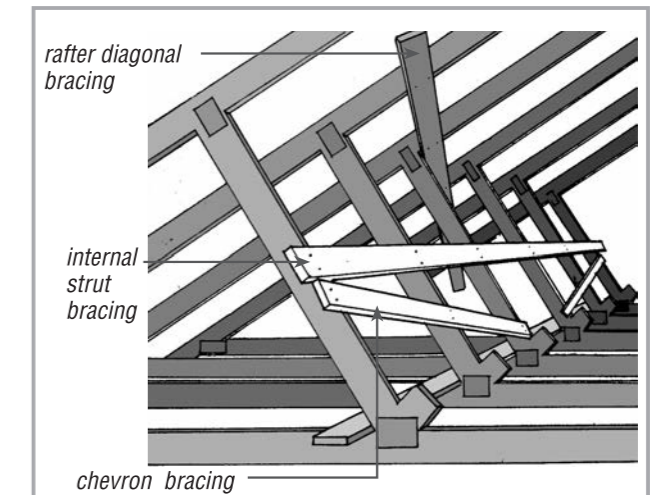
Examples of chevron bracing are shown in details B 2.3.3 and B 2.3.4 and usually are required when additional longitudinal bracing is inserted at the mid-point of members. Chevron bracing also helps to stabilise the whole roof but is rarely continuous over the whole roof usually being placed only at the roof ends.

B 2.3 TRUSSED RAFTER ROOFS - BRACING (CONTINUED)



Bracing is usually specified by the truss fabricator/designer and relates to the individual trusses and their erection. Swift 5 and BS 5268-3 (as did I.S. 193) specify a minimum amount of bracing. However, the roof designer and building designer may specify additional bracing e.g. to cater for roof diaphragm action and for wall stabilisation.

DETAIL B 2.3.2 Prefabricated Roof Trusses - additional bracing



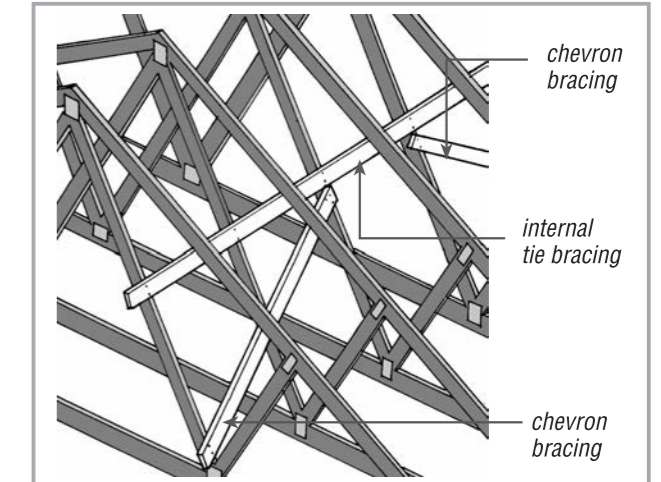
DETAIL B 2.3.3 Internal Bracing

Fixing bracing

Bracing timbers should be at least 97 x 22mm, free from major strength reducing defects and fixed with 2 No. 75mm x 3.1mm galvanised nails to every rafter.

Any laps in bracing members should be carried over at least two trusses, see Detail B2.3.5.

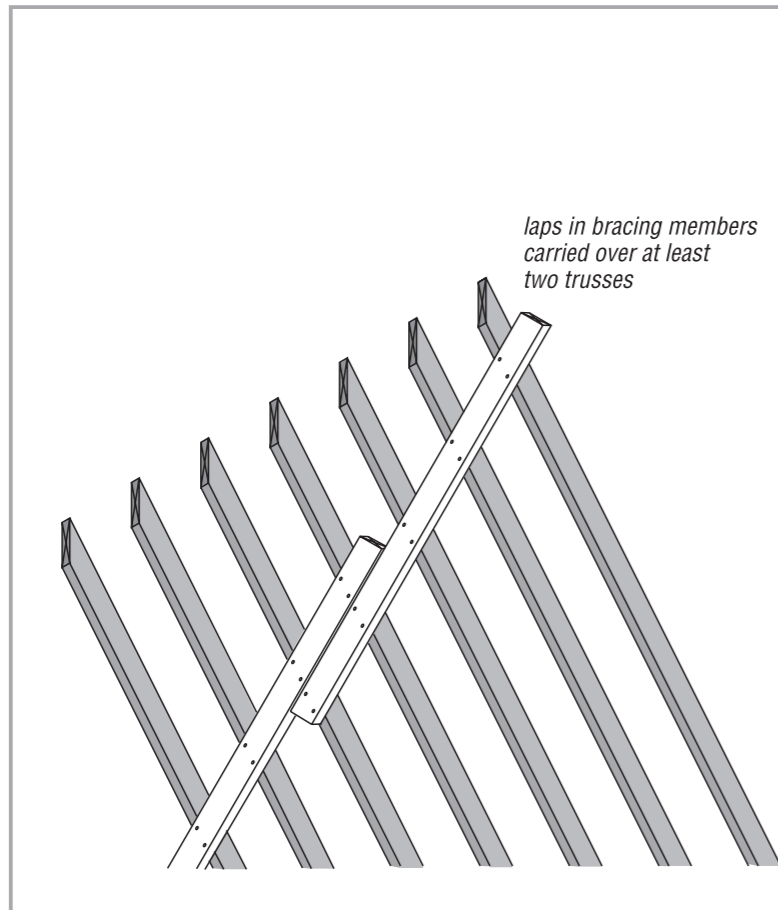
Where diagonal braces intersect, the junction should be completed with a splice plate at least 1200mm long, see Detail B2.3.6.



DETAIL B 2.3.4 Internal Bracing

B 2.3 TRUSSED RAFTER ROOFS - BRACING (CONTINUED)

DETAIL B 2.3.5 Fixing Bracing

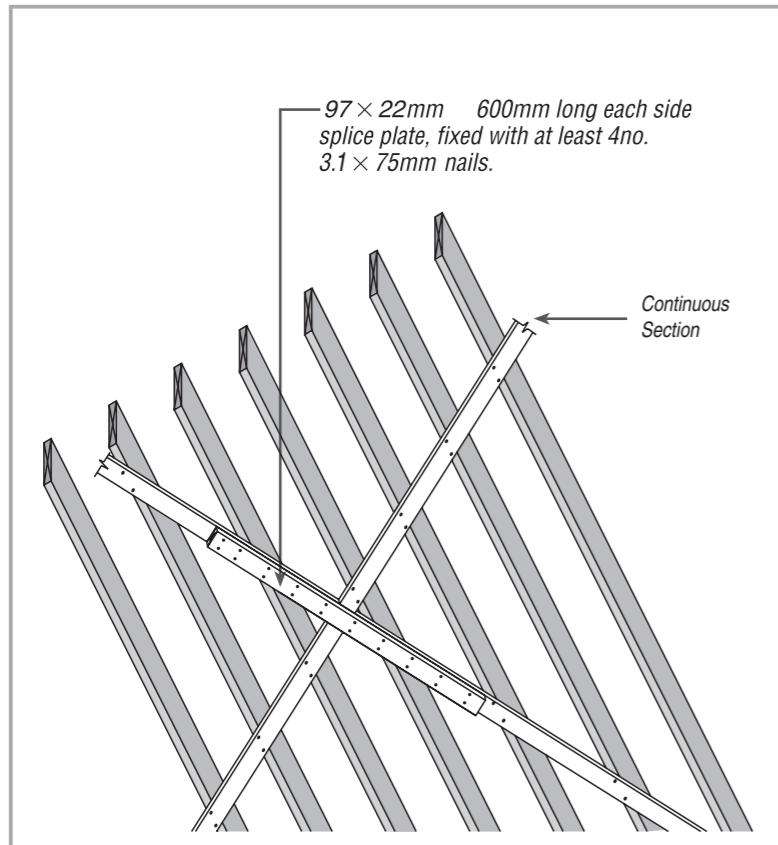


Fixing bracing

Bracing timbers should be at least 97x22mm, free from major strength reducing defects and fixed with two 75mm galvanised nails.

Any laps in bracing members should be carried over at least two trusses, Detail B2.3.5.

DETAIL B 2.3.6



Where diagonal braces intersect, the junction should be completed with a splice plate at least 1200mm long, Detail B2.3.6.

B 2.4 TRUSSED RAFTER ROOFS - ANCHORING DOWN

Truss fixing

Prefabricated trusses are subject to wind uplift and they should be anchored to the supporting structure. The preferred method for fixing a truss to a wall plate is to use proprietary truss clips. All the nail holes should be utilised using appropriate nails in accordance with the manufacturer's recommendations (B2.4.1).

An alternative method is to use a twist strap to provide a positive fixing between masonry and truss.

Skew-nailing should only be considered where the workmanship on site is of a standard high enough to ensure nail plates, joints and timber members will not be damaged by inaccurate positioning or overdriving of the nails. A minimum of two galvanised round wire nails of at least 4.5mm diameter and 100mm long should be used to secure each truss to the wall plate, one driven from each side.

Where nailing through the plate cannot be avoided the nails should be driven through the holes in the fasteners (B2.4.2).

Wall plate fixing

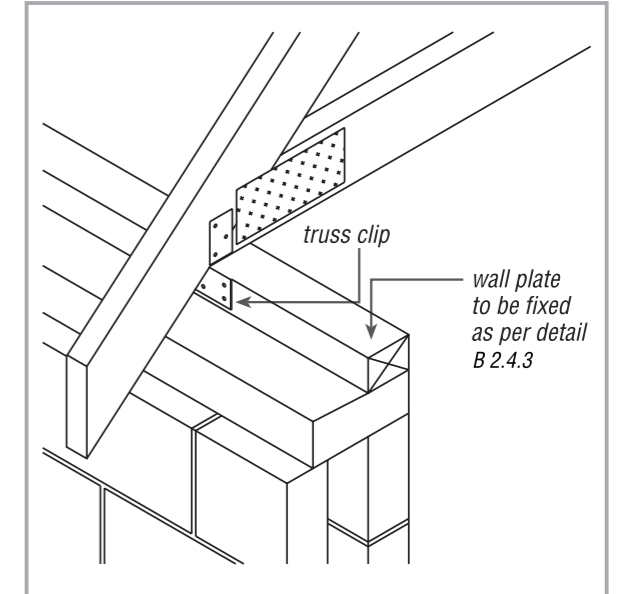
Wall plates should be fixed to the supporting structure usually by metal straps (or commonly bolts with concrete ring beams). When using straps they should be a minimum of 1000mm long, 30x5mm in cross section, galvanised or stainless steel and located between 1200mm and 2000mm centres. Straps should be fixed to masonry by means of suitable shot-fired nails, screws or have tail built into the mortar bed joint. A minimum of three fixings should be made to the masonry, at least one of which should be located within 150mm of the bottom of the strap (B2.4.3). Wall plates in contact with masonry should receive preservative treatment and it is good practice to place a DPC under the wallplate.

Care should be taken not to fix nails or screws into mortar.

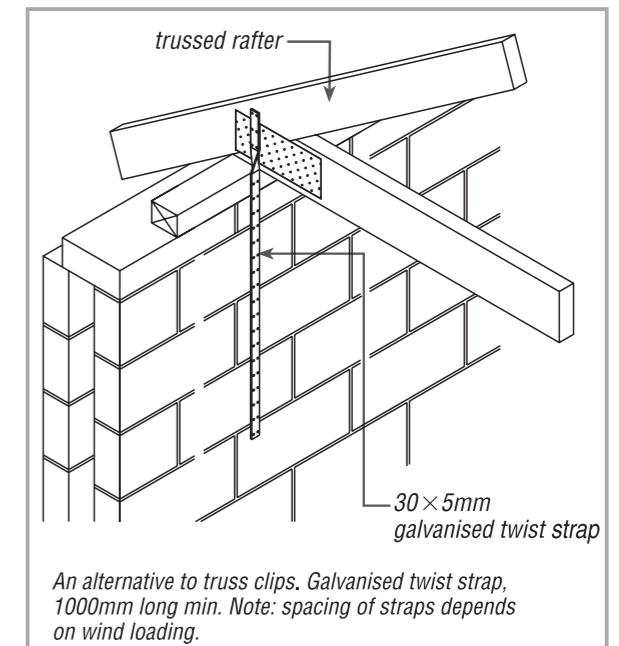
All holding down straps should conform to EN 845-1 (which refers to test standards). The fixings should be in accordance with the strap manufacturers' recommendations and should be specified by the design engineer for the forces acting on the trusses and roof.

The amount of galvanising should be specified by the building designer, and austenitic stainless steel can be used for increased durability.

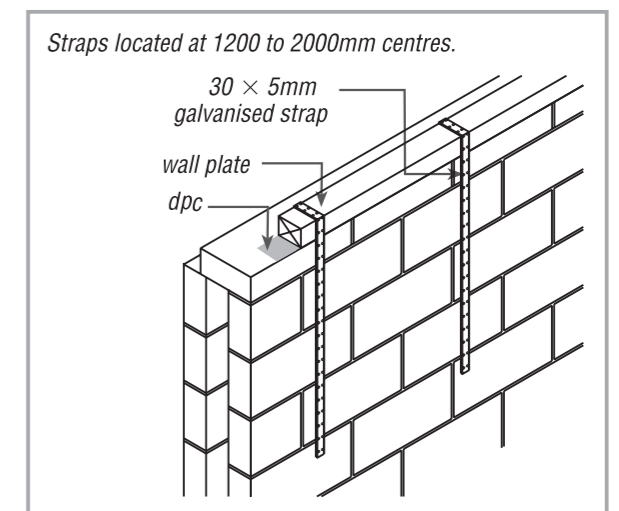
Fixings should be compatible with the strap to avoid electrolytic corrosion.



DETAIL B 2.4.1 Truss Fixing



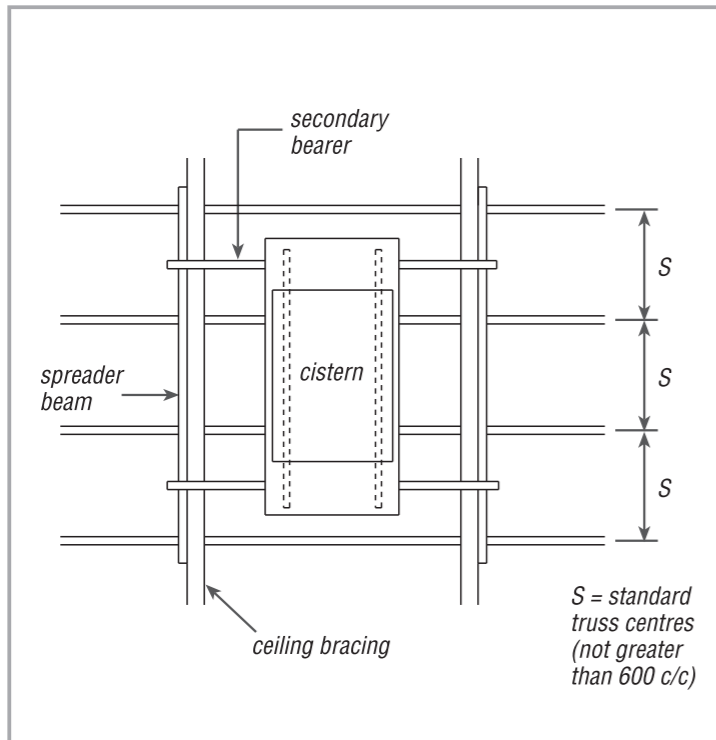
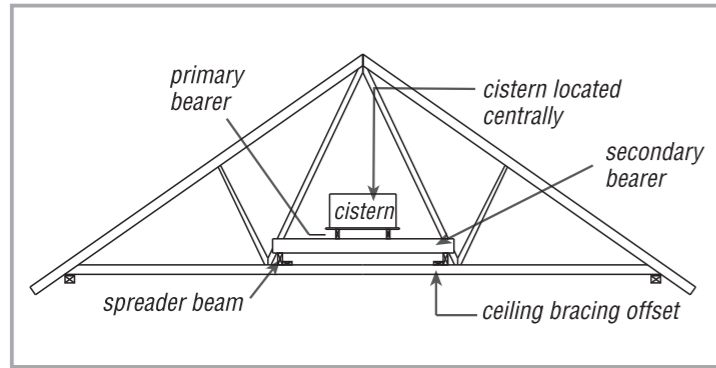
DETAIL B 2.4.2 Truss Fixing



DETAIL B 2.4.3 Wall Plate Fixing

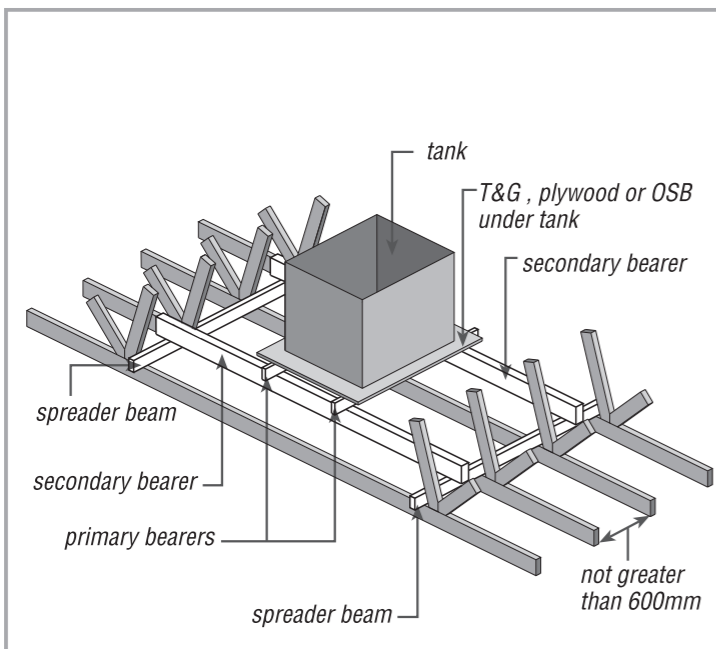
B. 2.5 TRUSSED RAFTER ROOFS - WATER CISTERNS

DETAIL B 2.5.1 Arrangement
DETAIL B 2.5.2 Plan



S = standard truss centres (not greater than 600 c/c)

DETAIL B 2.5.3 Location



Support

To reduce the likelihood of local deflection and ceiling cracking, the water tank should be supported on a system of spreader beams and bearers. These provisions are adequate for the majority of standard conditions.

The spreader beams should be located as near to the node points as possible (B2.5.1).

HOUSE TYPE	CAPACITY
3 bed	270 litres
4 bed	340 litres

Water tanks with a nominal capacity of up to 270 litres should be spread over four trusses.

Support for larger capacity tanks requires special design (B2.5.2).

Location

The water tank should be placed centrally within the bay, as illustrated in Detail B2.5.1, with the spreader beams located as close to the node points as possible. Skew-nail the secondary bearer to the spreader beam and the primary bearer to the secondary bearer (B2.5.3).

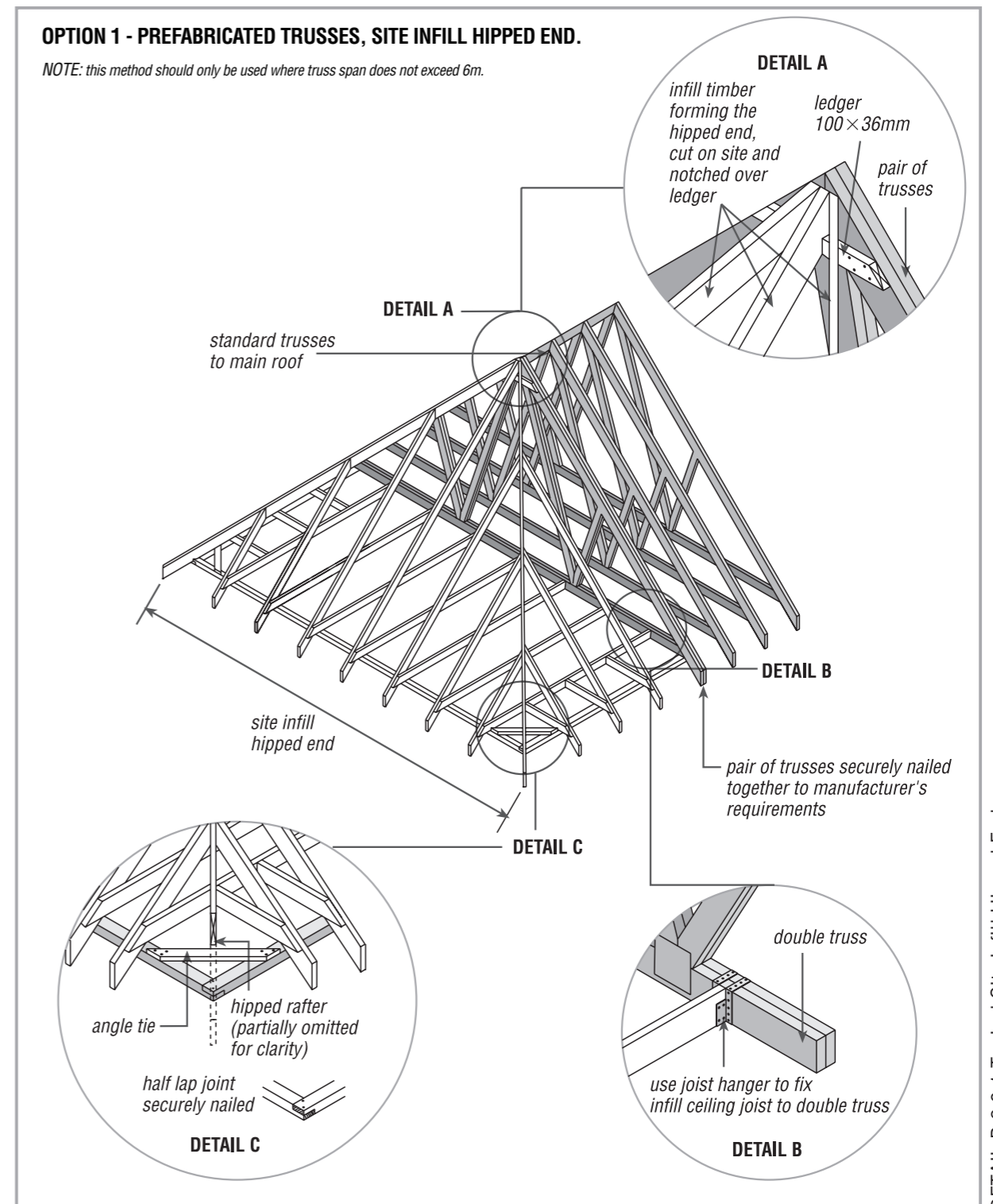
Where more than one water tank is required, no less than four trusses should carry the load of each tank (unless designed otherwise). The size of the tank support members can be taken from the table assuming the water tank itself is relatively light and its size is not greater than 270 litres; the minimum strength class should be C16.

minimum size of support members for 270L water tank			
limit of span of truss	primary bearers	secondary bearers	spreader beams
m	mm	mm	mm
8.0	36 × 100	44 × 175	44 × 100
11.0	36 × 100	75 × 150	44 × 100

B 2.6 TRUSSED RAFTER ROOFS - HIPPED ENDS

OPTION 1 - PREFABRICATED TRUSSES, SITE INFILL HIPPED END.

NOTE: this method should only be used where truss span does not exceed 6m.



DETAIL B 2.6.1 Typical Site Infill Hipped Ends

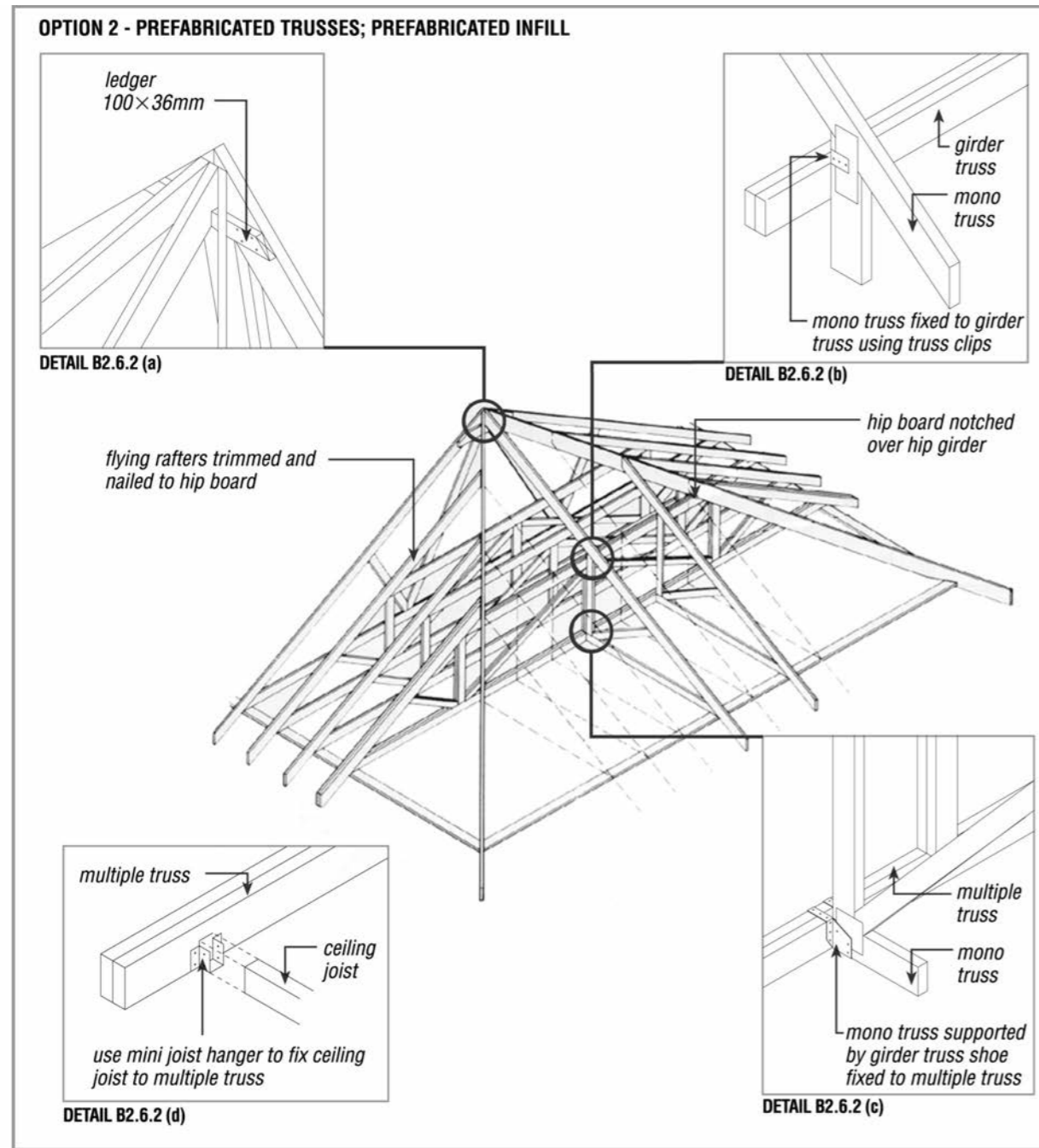
General

Hipped ends in a prefabricated trussed rafter roof can be formed in two ways:

1. Using site infill timbers to form the hipped ends, see Detail B2.6.1. This method should only be used where the span does not exceed 6m.
2. Using specially designed mono-pitch trusses, see Detail B2.6.3.

B 2.6 TRUSSED RAFTER ROOFS - HIPPED ENDS (CONTINUED)

DETAIL B 2.6.2 Prefabricated Hip



For trussed rafters with spans greater than 6m a common form of construction for a hip end comprises of a number of identical flat top hipped trusses, spaced at the same centres as the main trusses, and a multiple girder of the same profile supporting mono-pitch trusses.

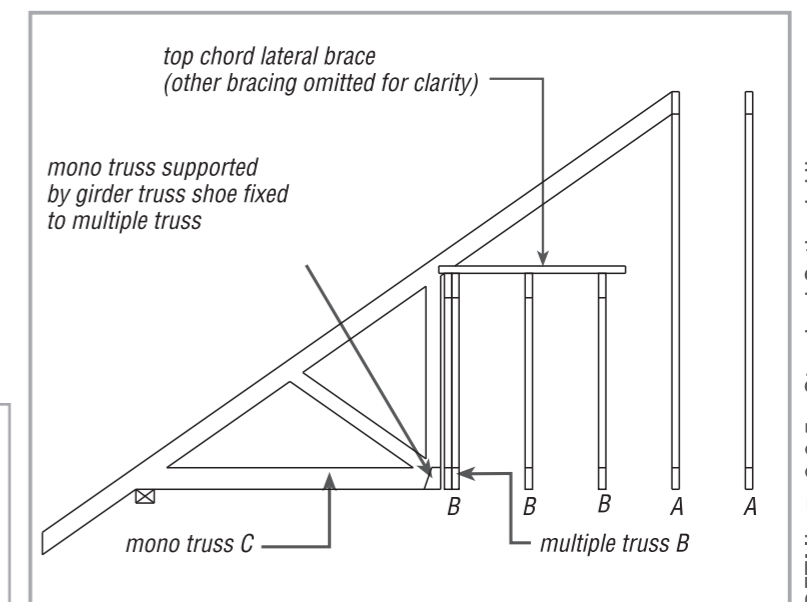
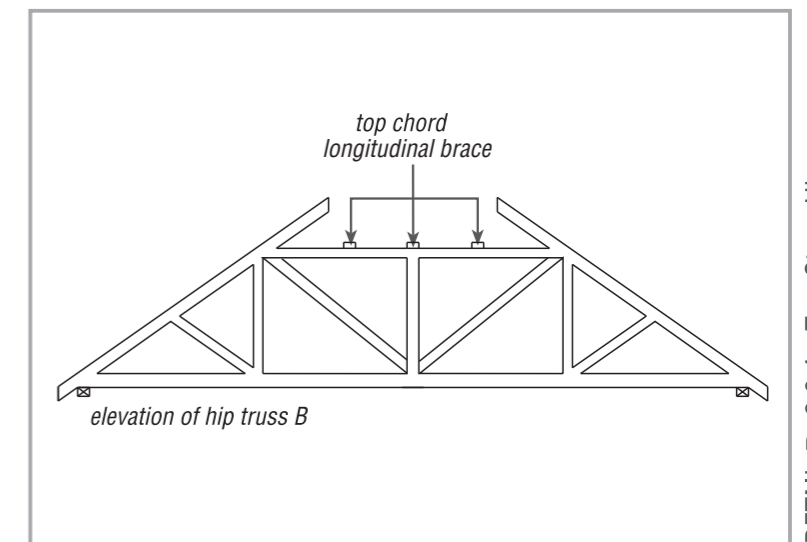
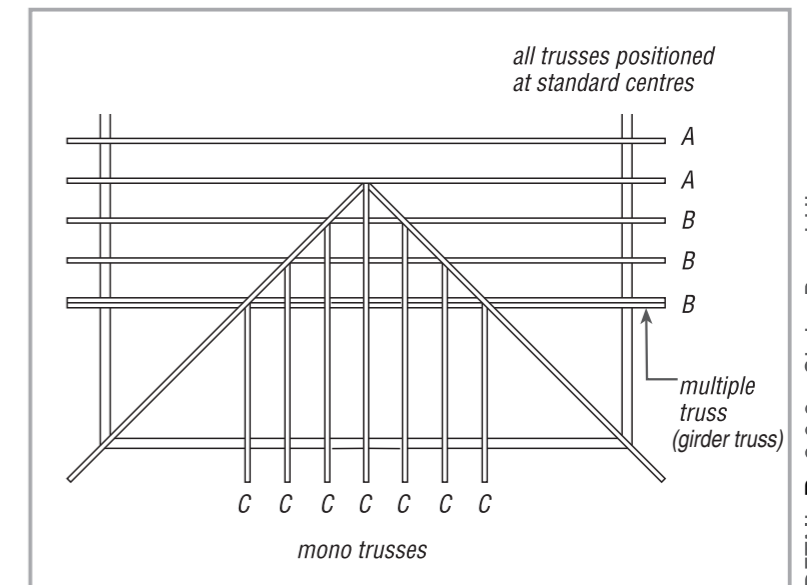
The flying rafters on the hip and mono-pitch trusses are usually supplied full length and are cut back on site to

ensure that they meet the hip rafter. The hip rafter is notched over the hip girder to provide a support and is taken to the apex of the hip, where it is usually supported on a ledger fixed to the last full profile truss.

The corner areas of the hip are completed by using site cut rafters onto the hip rafter and infill ceiling joists spanning onto the hip girder.

B 2.6 TRUSSED RAFTER ROOFS - HIPPED ENDS (CONTINUED)

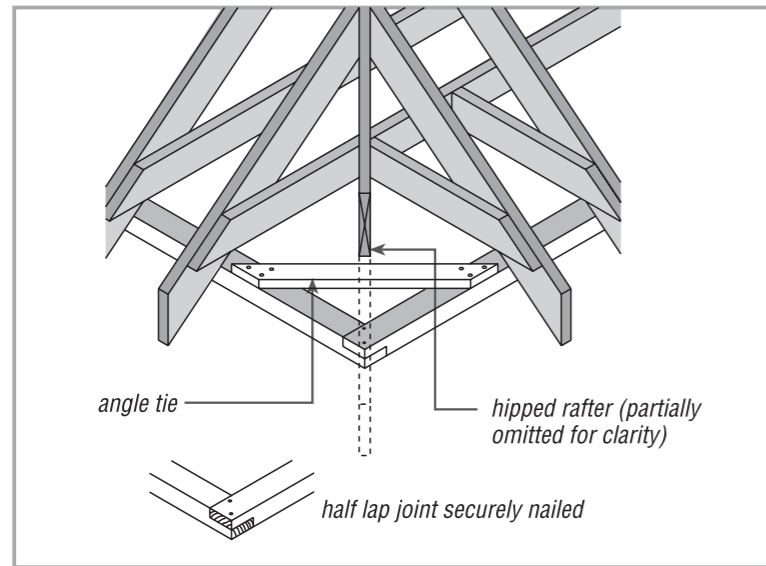
The horizontal top and bottom chords of the flat top hip trusses are usually braced of each other and also are braced to the hip girder truss (see Details B 2.6.4 and B 2.6.5).



Generally the ceiling joists of all trusses should be the same depth to aid the run and fixing of bracing. Flat-topped trusses should have the same configuration so that they can be braced off each other.

B 2.6 TRUSSED RAFTER ROOFS - HIPPED ENDS (CONTINUED)

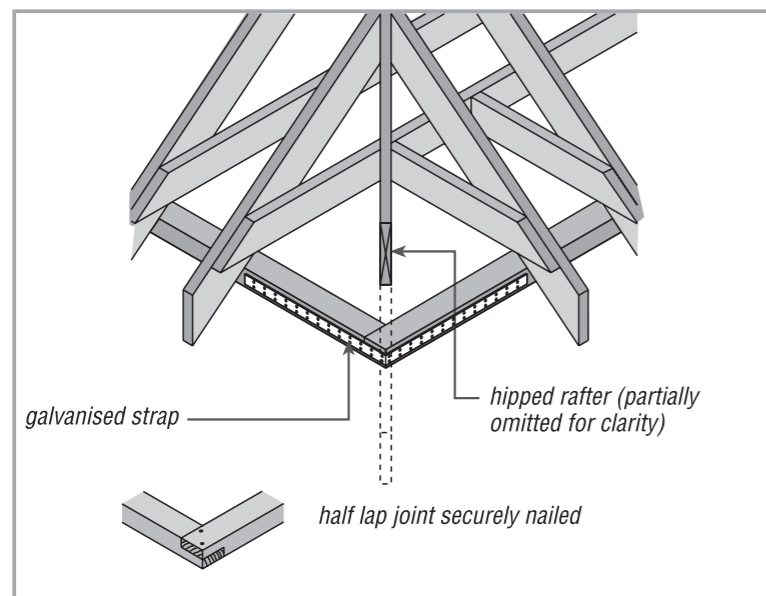
DETAIL B 2.6.6 Corner Details



Corner details

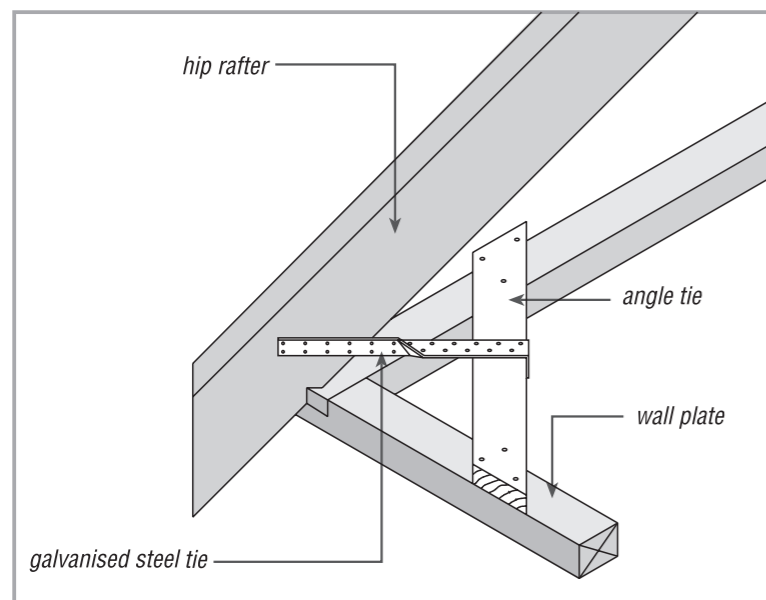
To cater for outward thrust at the corner under the hip, the wall plates should be half lap jointed and securely nailed.

DETAIL B 2.6.7 Corner Details



The corner should then be reinforced by means of an angle tie (Detail B2.6.6) securely nailed to the wall plates and/or a galvanised steel strap can be used to reinforce the corner. (Detail B2.6.7)

DETAIL B 2.6.8 Corner Details



A galvanised steel dragon tie may also be used to reinforce the corner junction (Detail B2.6.8).

Where there is a greater risk of corrosion consideration should be given to using austenitic stainless steel rather than galvanised steel whose durability is dependent on the amount of galvanising present on the strap.

Do not mix metals: use galvanised nails with galvanised straps and austenitic stainless steel nails with austenitic stainless straps.

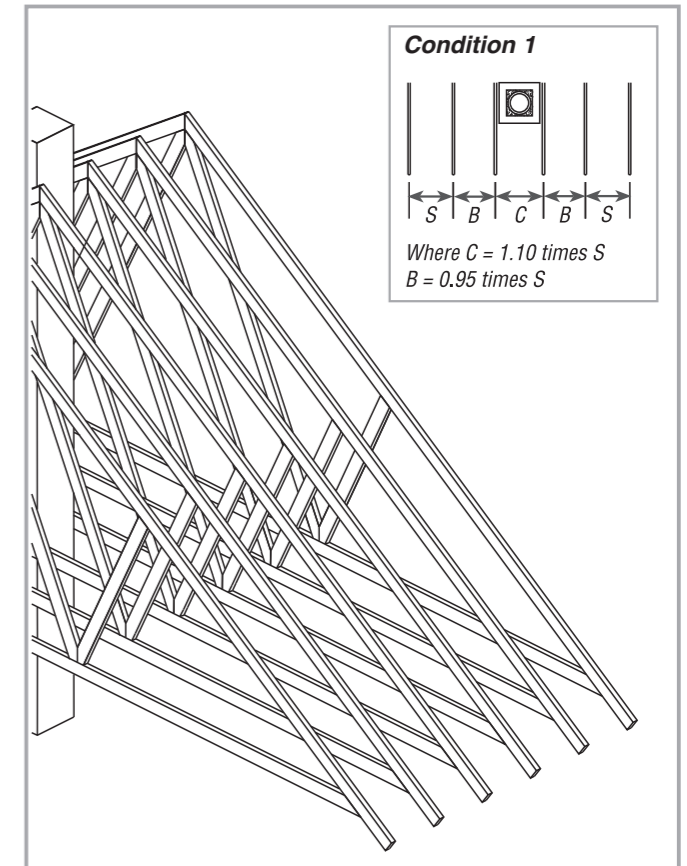
B 2.7 TRUSSED RAFTER ROOFS - SPACING CONDITIONS

Condition 1: Truss spacing up to 660mm

At openings increasing truss centres by up to 10% (i.e. 660mm approximately for 600mm centres) causes no significant over-stressing of the tiling battens or truss. (See B 2.7.1)

Definitions:

- S = standard truss spacing (normally 600mm)
- C = increased truss spacing
- B = reduced truss spacing

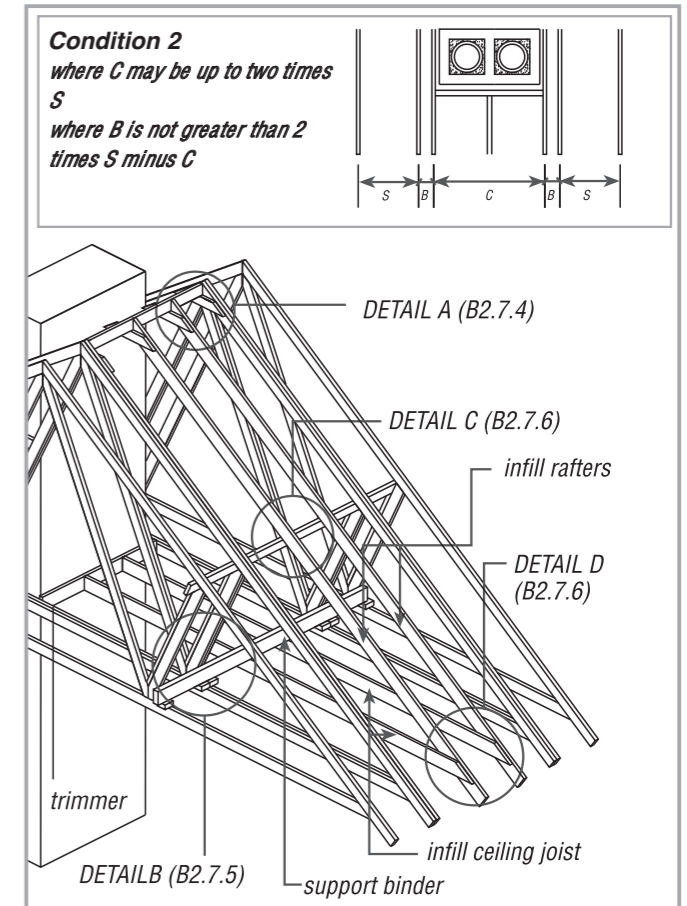


DETAIL B 2.7.1 Condition 1. Truss Spacing up to 660mm

Condition 2: Truss spacing between 660 and 1200mm

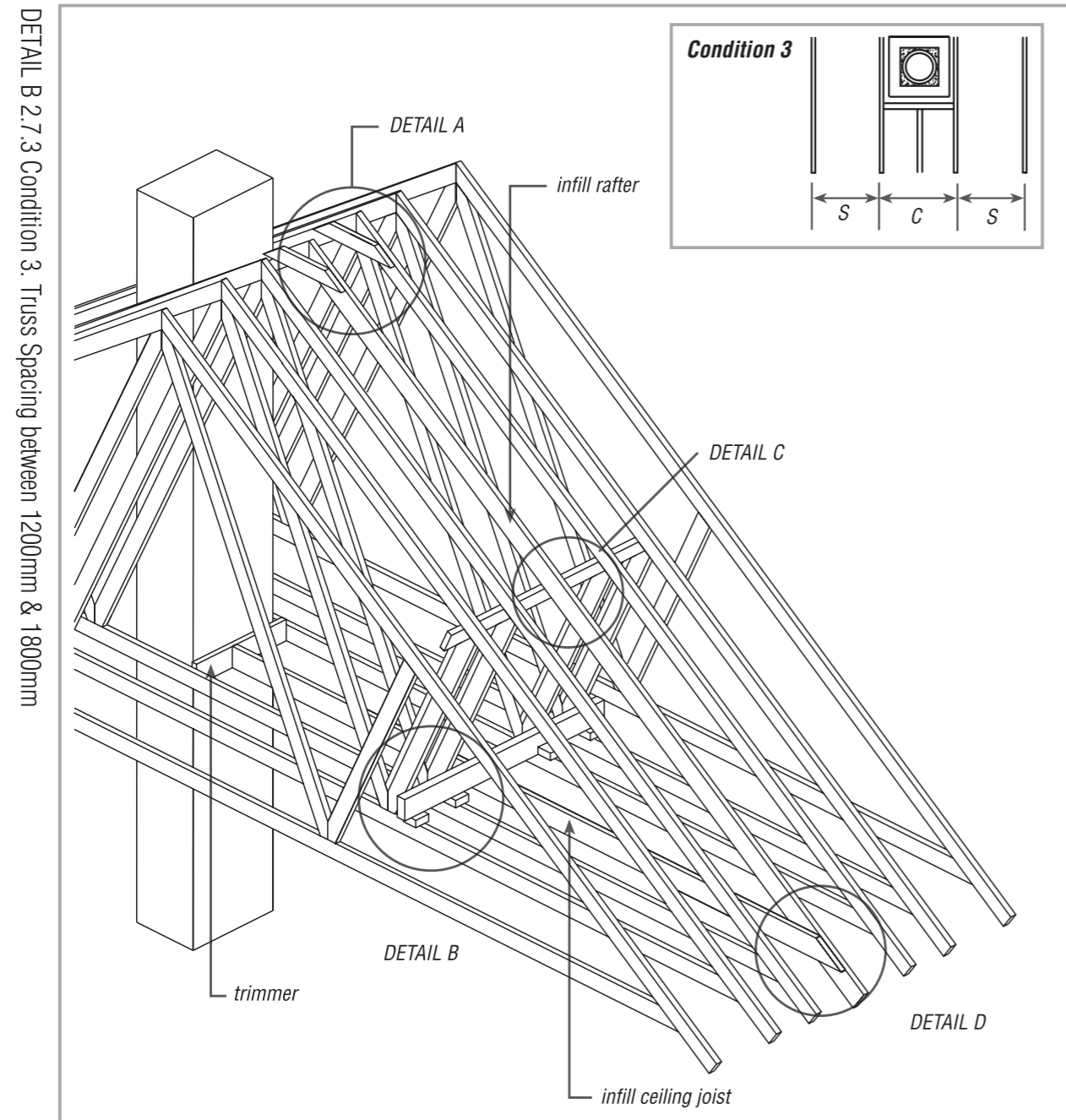
This caters for spacing adjustments for openings greater than 10% standard spacing and up to twice standard spacing (i.e. between 660mm and 1200mm). The roof and ceiling should be given extra support provided by infill rafters and ceiling joists (see B2.7.2). Support of the infill timbers is provided by purlins, binders and ridge boards and by trimmers at the actual opening. See Details B2.7.4/5/6.

The truss designer usually designs the above supports and supplies details for use on site.



DETAIL B 2.7.2 Condition 2. Truss Spacing between 660mm & 1200mm

B 2.7 TRUSSED RAFTER ROOFS - SPACING CONDITIONS (CONTINUED)



Condition 3: Truss spacing between 1200mm and 1800mm

Spacing adjustments for openings greater than twice standard truss spacing and up to three times standard truss spacing (i.e. between 1200mm and 1800mm) usually require multiple trusses to be used on either side of the opening (see B. 2.7.3).

If girder trusses are used then they must be fixed together in accordance with the truss designers instructions. Tiling battens and ceiling material should be given extra support provided by infill rafters and ceiling joists.

Support of the infill timber is provided by purlins, binders and ridge boards and by trimmers around the opening.

The truss designer usually designs the above supports and supplies details for use on site and should always be consulted for the precise details.

Condition 4: Truss spacing over 1800mm

The truss designer can supply special details for opening over 1800mm; usually these will be similar to those shown in detail B.2.7.3.

The truss designer should always be consulted for the precise details where large openings are used and the roof and building designer may have additional requirements.

B 2.7 TRUSSED RAFTER ROOFS - SPACING CONDITIONS (CONTINUED)

Site cut infill support

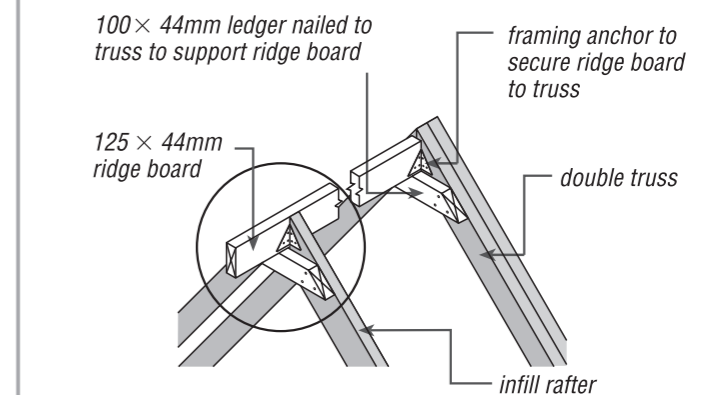
Where truss centres are increased to accommodate openings, trimming may be unavoidable in some cases. Under these circumstances, full site instruction must be obtained from the truss and/or roof designer. All site work should be supervised by appropriate personnel.

Note:

1. Infill rafter sizes must be designed and should be at least 25mm deeper than the rafters of the trusses to allow for a birds mouth at the wall plate.

2. For fire safety reasons all timber should be at least 40mm clear of the chimney where the distance to the flue is less than 200mm. It is recommended that timber members are not fixed directly to the chimney.

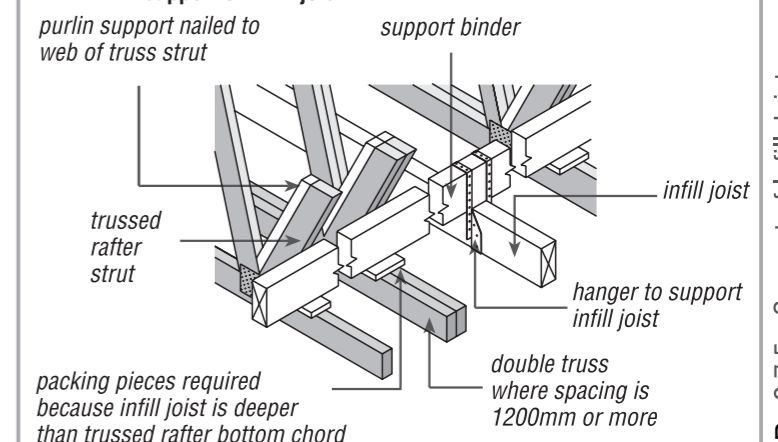
DETAIL A - ridge level



Infill rafter supported by purlin and fixed by skew nailing or metal shoes. Purlin size and strength class should be designed, a minimum 125 x 44mm C16 should be used.

DETAIL B 2.7.4 Ridge Level

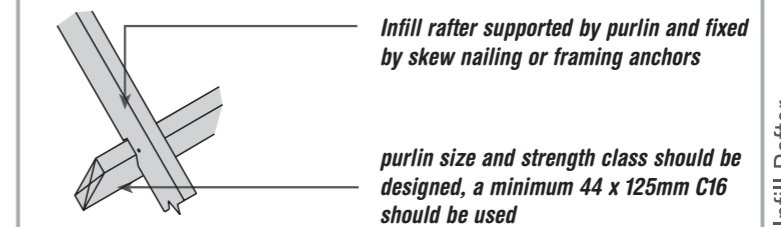
DETAIL B - support of infill joist



The loads on the infill timbers are transferred to the trusses on either side of the opening.

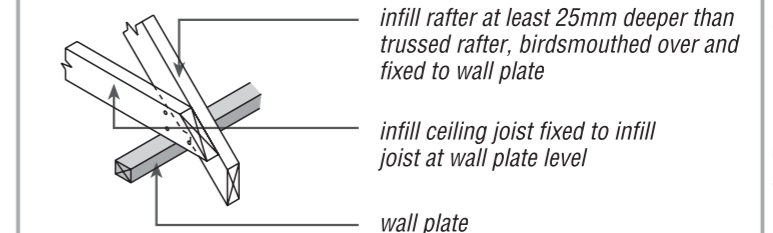
DETAIL B 2.7.5 Support of Infill Joist

DETAIL C - support of infill rafter at purlin



DETAIL B 2.7.6 Support of Infill Rafter

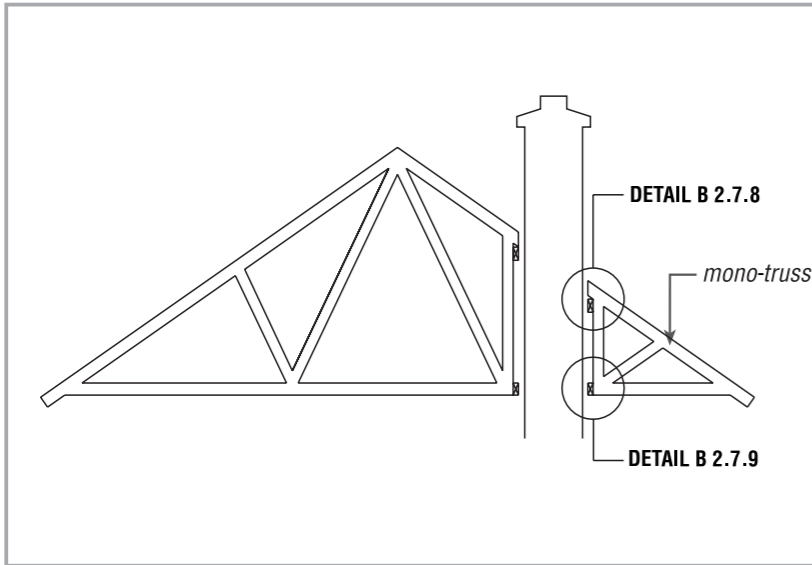
DETAIL D - support of infill rafter at wall plate



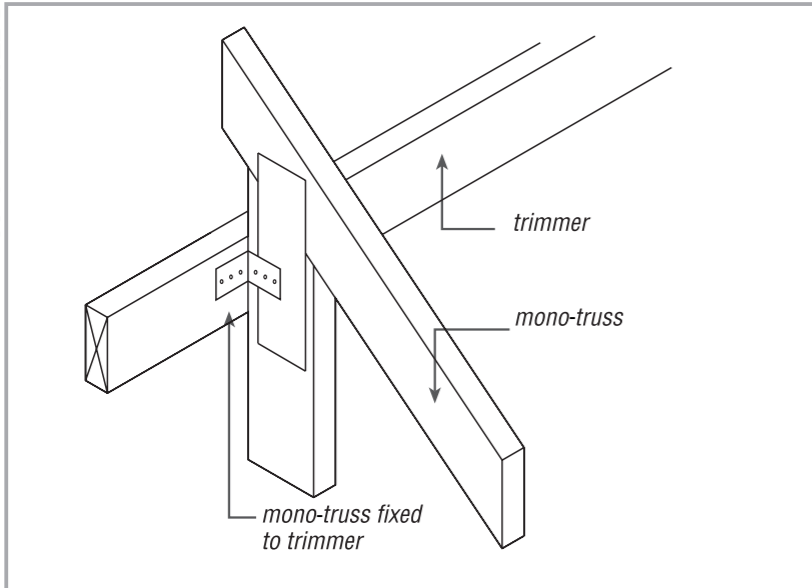
Where the supporting strut is not at right angles to the rafter/purlin, the purlin may have to be notched into the rafter or timber wedges used to provide adequate bearing. A qualified engineer should be consulted.

B 2.7 TRUSSED RAFTER ROOFS - SPACING CONDITIONS (CONTINUED)

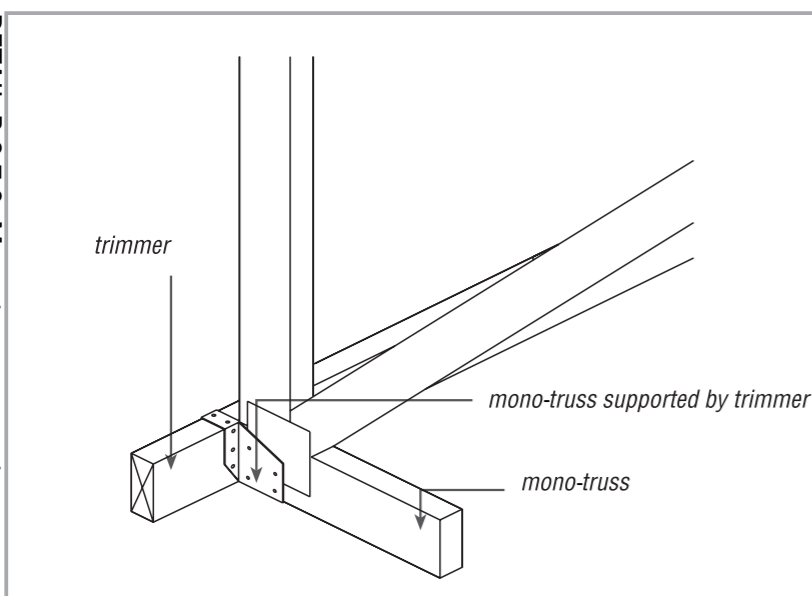
DETAIL B 2.7.7 Special mono-truss



DETAIL B 2.7.8 Mono-truss support



DETAIL B 2.7.9 Mono-truss support



Prefabricated infill support

As an alternative to using site cut infill timber around an opening, specially designed mono-trusses may be used.

As an alternative to using site cut infill timber around an opening, specially designed mono-trusses may be used.

The trusses should be specially designed and fabricated for such locations and not be adapted from an ordinary truss by site cutting. (See Details B 2.7.7 to B 2.7.9).

In some circumstances the truss and/or roof designer may permit ordinary trusses to be cut. However, the designer should provide full site details for this work and the work must be properly supervised.

Truss shoes should be specified by the truss designer.

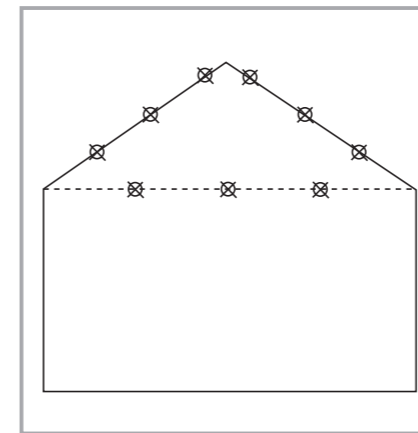
B 2.8 TRUSSED RAFTER ROOFS - LATERAL RESTRAINTS

General

The prefabricated trusses should be adequately fixed to the gable wall to provide the necessary lateral support to the wall at roof and ceiling level.

Note that different details are applicable to timber frame construction where the timber frame manufacturer will provide details for the support of gable walls.

DETAIL B 2.8.1 Strap Solutions



Location of straps

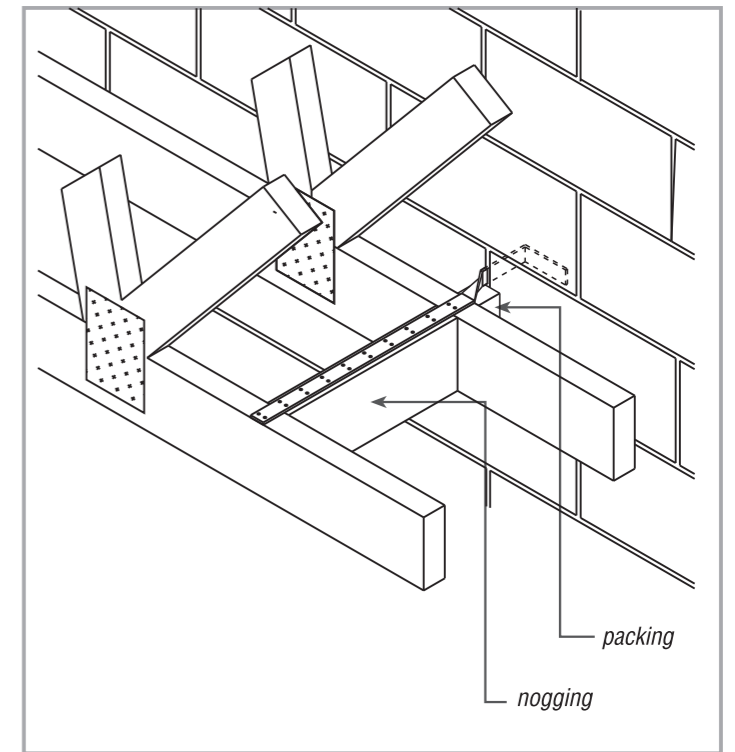
Straps should be provided at rafter and ceiling level, as illustrated by Detail B 2.8.1.

Straps should be 30 x 5 mm in cross section, galvanised and carried over a minimum of two trusses. Solid packing and noggins are to be securely fixed with 50mm long wire nails, at least one of which should be in the second joist or rafter. The nail diameter should relate to the size of the nail hole in the strap.

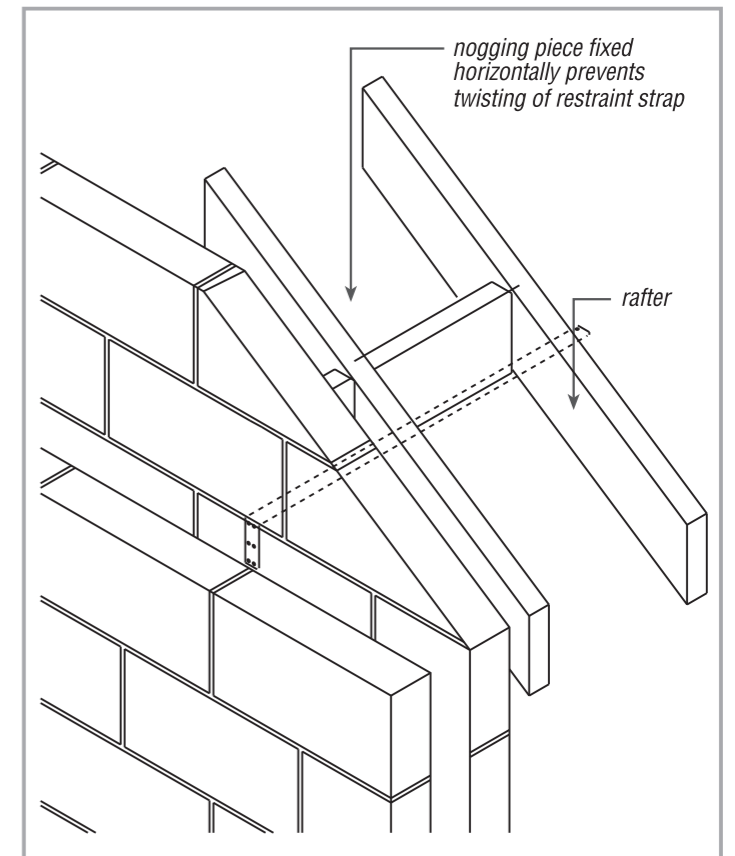
Straps should be located at a maximum of 2m centres.

The requirements for strapping at rafter level depends on the height of the apex and wall thickness, as specified in *Technical Guidance Document A* of the Building Regulations. In general it is required in all standard pitched roofs in domestic masonry construction.

Similar information is given in the U.K. approved Documents.



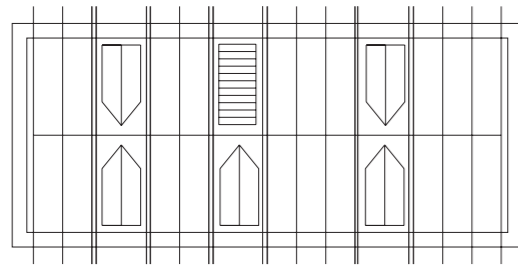
DETAIL B 2.8.2 Lateral Restraint



DETAIL B 2.8.3 Location of Straps

B 2.9 TRUSSED RAFTER ROOFS - DORMER TRUSSES

DETAIL B 2.9.2 Dormer & stairs layout



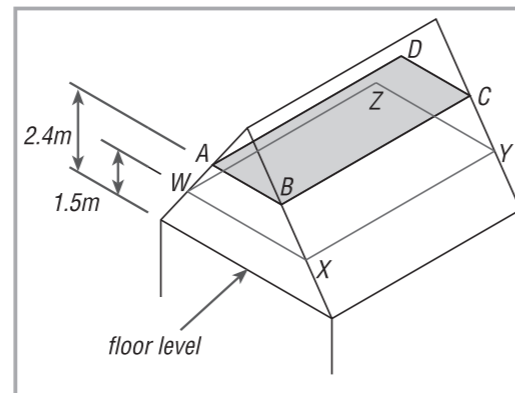
*suitable layout: stairs parallel to trusses
dormers opposite each other*

Arrangement

The prefabricated dormer truss often referred to as "Room-in-the roof" combines a structural floor and roof in the same component. This type of roof construction generally offers no restriction on the location of ground floor walls, as the trusses span onto the external walls, which in turn offers greater freedom to plan first floor layout.

Technical Guidance Document F (Ventilation) requires that the minimum ceiling height for any habitable room is 2.4m. In an attic truss the minimum ceiling height of 2.4m should be equal to or not less than half of the area of the room measured on a plane 1.5m above finished floor level, i.e. area ABCD to be at least half the area of WXYZ (see Detail B2.9.1).

DETAIL B 2.9.1



Design

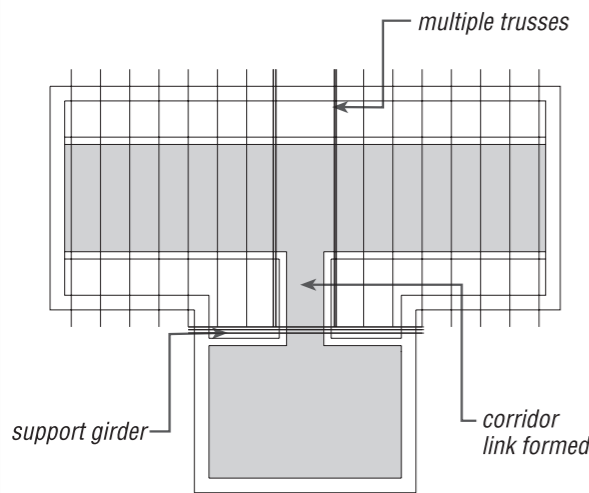
The application of a few basic principles at design stage can maximise the use of prefabricated components and minimise loose infill timber.

Dormer windows and stairwell openings should have multiple trusses either side with appropriate site cut infill timber between. Stairwells should be parallel to trusses and windows positioned opposite each other (Detail B2.9.2)

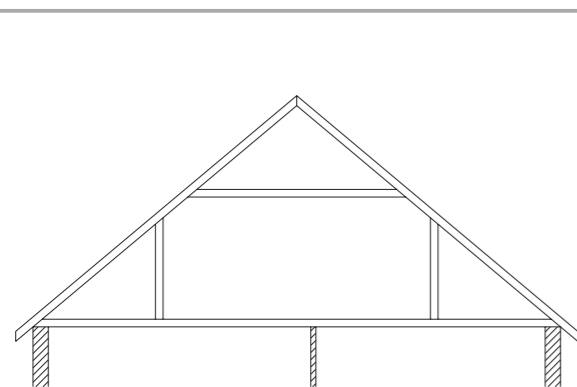
Where attic trusses are provided for future roof conversions, girder trusses must be provided for the future framing of the stair opening. The cutting of standard trusses should be avoided at all costs.

At T-junctions provide a corridor link between room areas as in Detail B2.9.3; this will reduce the number of site cut infill members. Use ground floor load-bearing walls to provide additional support to the attic trusses (see Detail B2.9.4).

DETAIL B 2.9.3 Truss configuration



DETAIL B 2.9.4 Attic truss support



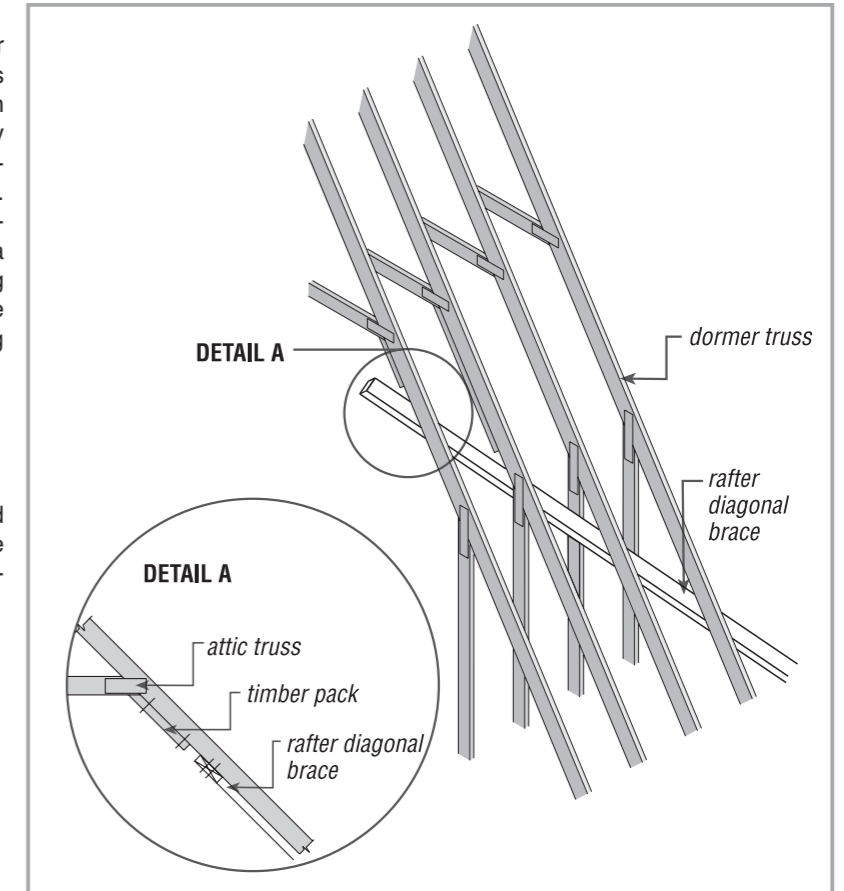
B 2.9 TRUSSED RAFTER ROOFS - DORMER TRUSSES (CONTINUED)

Bracing

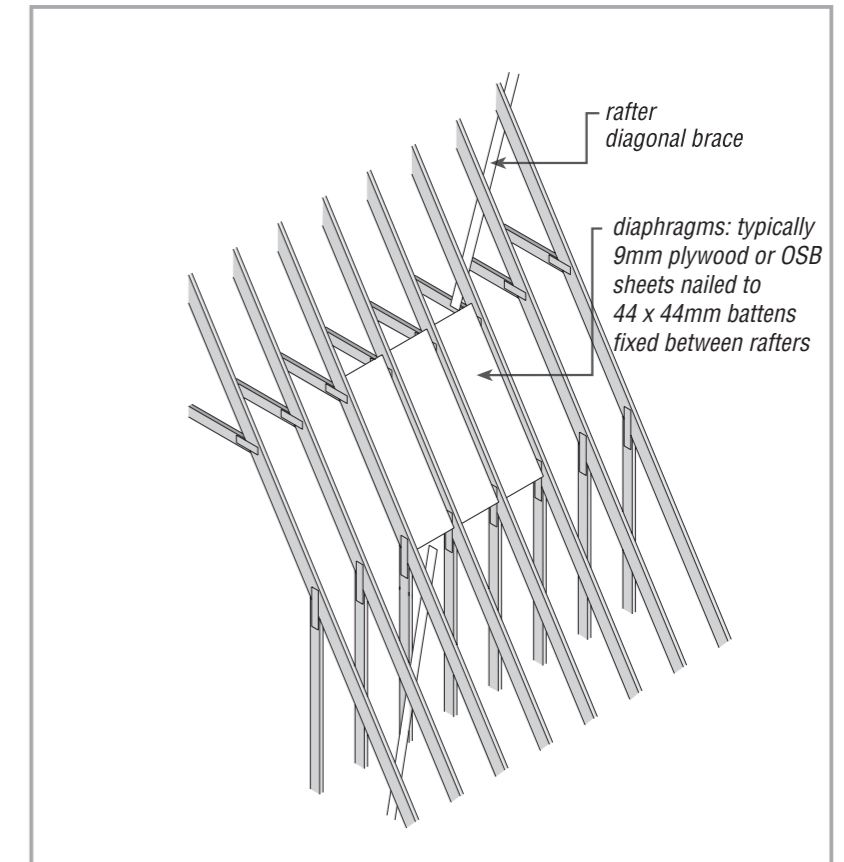
The bracing requirements for dormer trusses are the same as conventional truss roofs as shown in Details B2.3.1 to B2.3.6, the only essential difference being the location of the rafter diagonal brace. Where this particular bracing member protrudes into the room area this may be overcome by packing out the rafter by using a pack the same thickness as the bracing member (Detail B 2.9.5).

Bracing details should be provided by the truss and roof designer. The building designer may have additional requirements.

Alternatively, plywood or OSB diaphragms fixed to battens and inserted between the rafters may be used over the room area of the dormer truss. Sufficient diaphragms should be provided to allow the line of action of the brace to be continuous (Detail B 2.9.6).



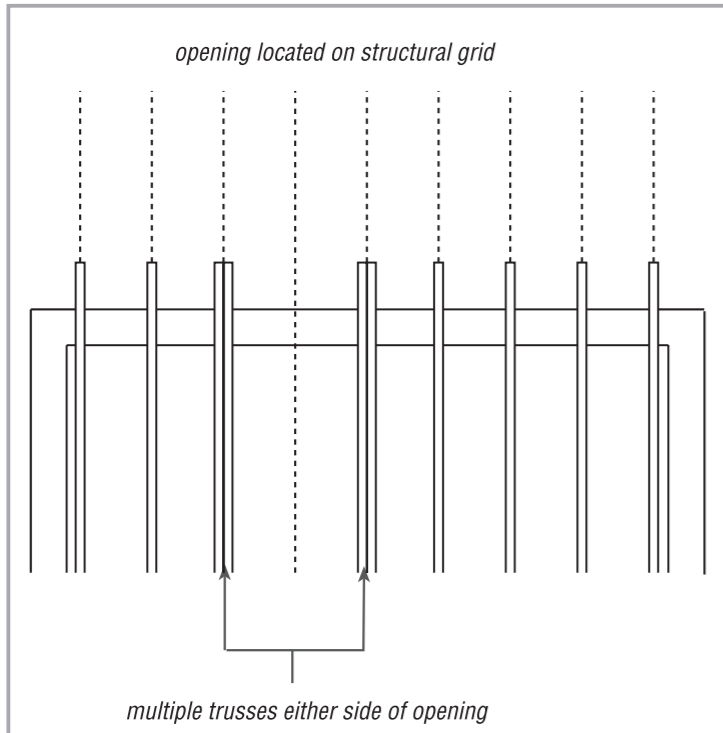
DETAIL B 2.9.5 Dormer Truss - Bracing



DETAIL B 2.9.6 Dormer Truss - Bracing

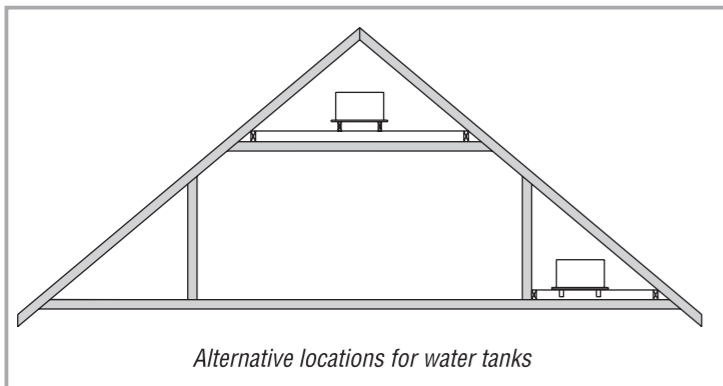
B 2.9 TRUSSED RAFTER ROOFS - DORMER TRUSSES (CONTINUED)

DETAIL B 2.9.7 Openings in grid



Where possible, locate openings on the structural grid (usually 600mm) to match the truss spacing, this will reduce the amount of site cutting (Detail B 2.9.7).

DETAIL B 2.9.8 Cisterns



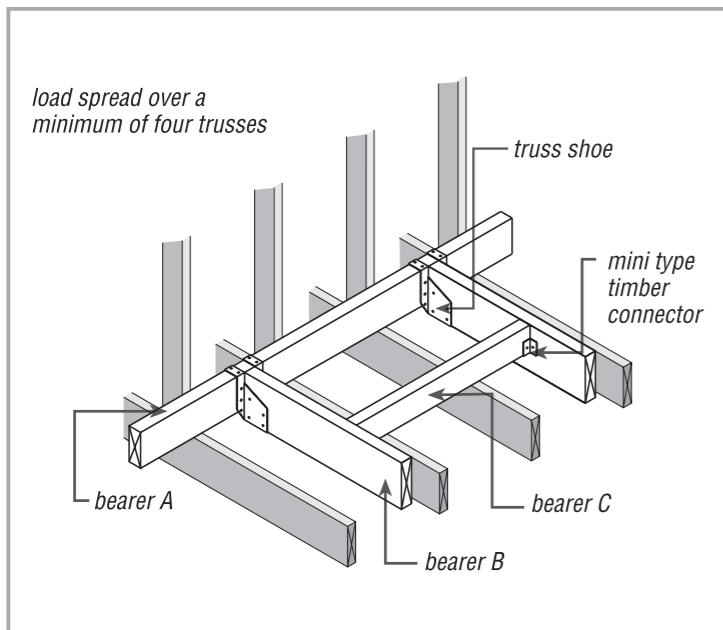
Ventilation

To ensure adequate airflow there should be a 50mm gap between the insulation and the top of the rafter/roof lining along the slope of the rafter.

Water cistern

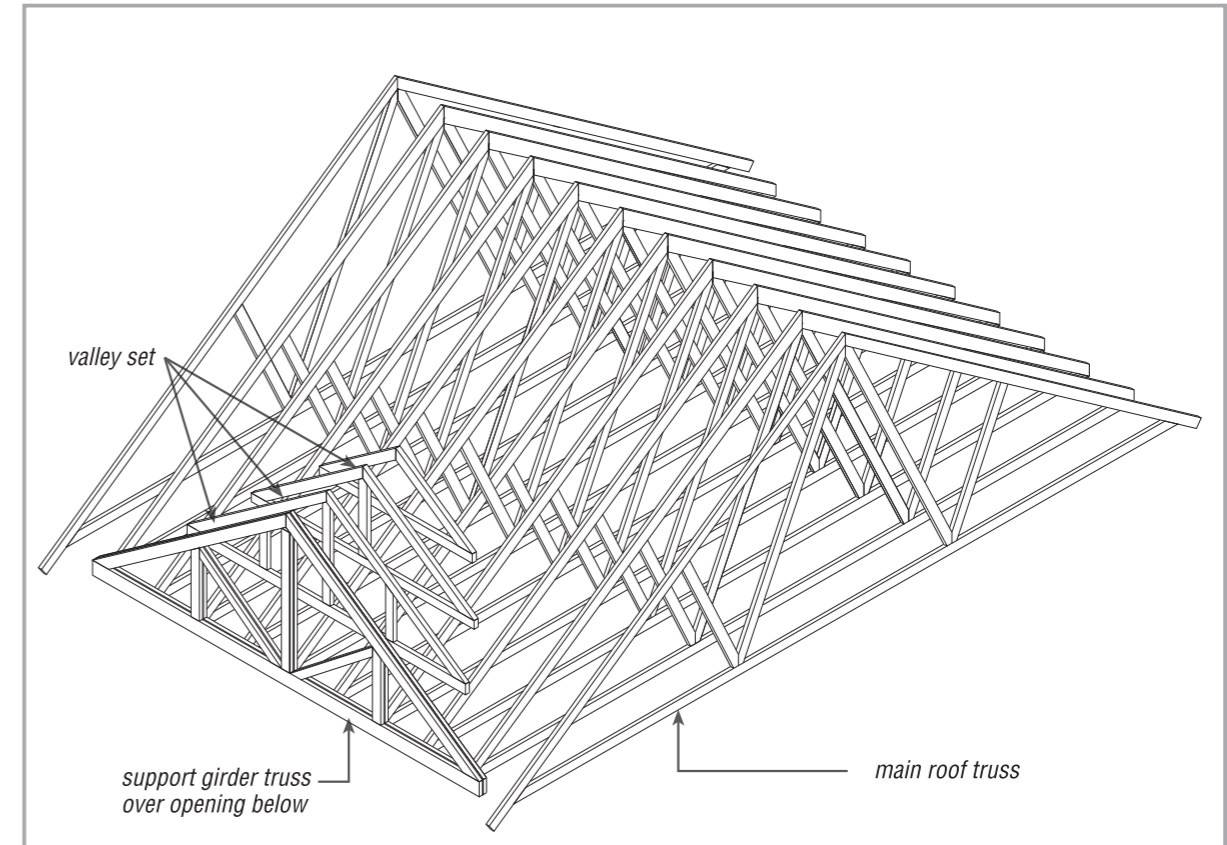
Detail B 2.9.8 illustrates alternative locations for the water cistern in a dormer truss. Where space is limited, two or more tanks in tandem may be required. The roof designer should inform the trussed rafter designer of the number of tanks, their location and capacity. Tanks may be supported as illustrated by Detail B 2.9.9. A minimum of 25mm should be provided between bearer B and the ceiling, to allow for long term deflection. Bearer C should be clear of the ceiling ties by a minimum of 25mm for the same reason. The cistern support should be designed by the truss or roof designer.

DETAIL B 2.9.9 Water cistern support



Care should be taken to ensure that all plasterboard edges are backed by timber. Particular attention should be made to ensuring an air tight construction between the room and the ventilated spaces; service penetrations should be sealed.

B 2.10 TRUSSED RAFTER ROOFS - VALLEYS



DETAIL B 2.10.1 Valleys - Arrangement

Arrangement

A valley intersection is formed by a series of specially fabricated diminishing trusses collectively called a valley set. The valley set transfers the rafter loads down to the underlying trusses in a uniform manner, by incorporating vertical webs normally at 1200mm centres. Each valley set truss in the set must be secured to each rafter it crosses

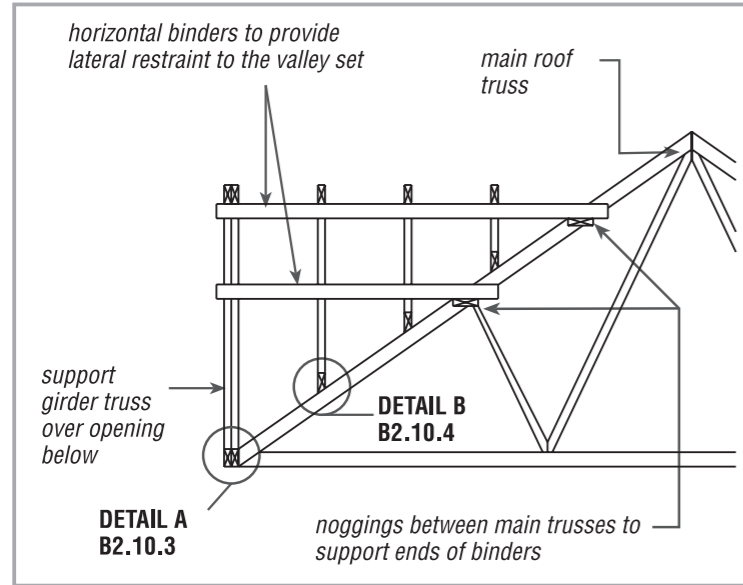
Design

Special instructions will need to be given to the manufacturer on the use of intersecting valley infill rafters.

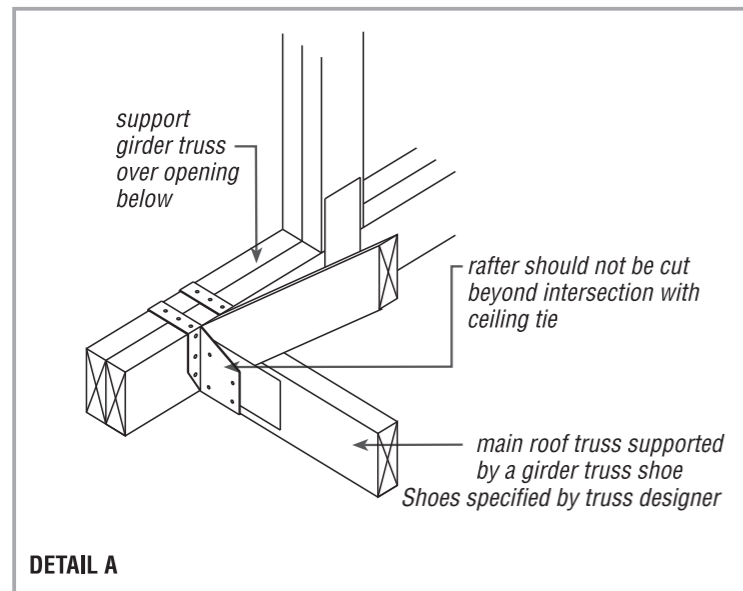
The truss designer should specify site details such as the restraint of the trusses under the valley set. Particular attention should be made to catering for wind forces especially uplift forces.

B 2.10 TRUSSED RAFTER ROOFS - VALLEYS (CONTINUED)

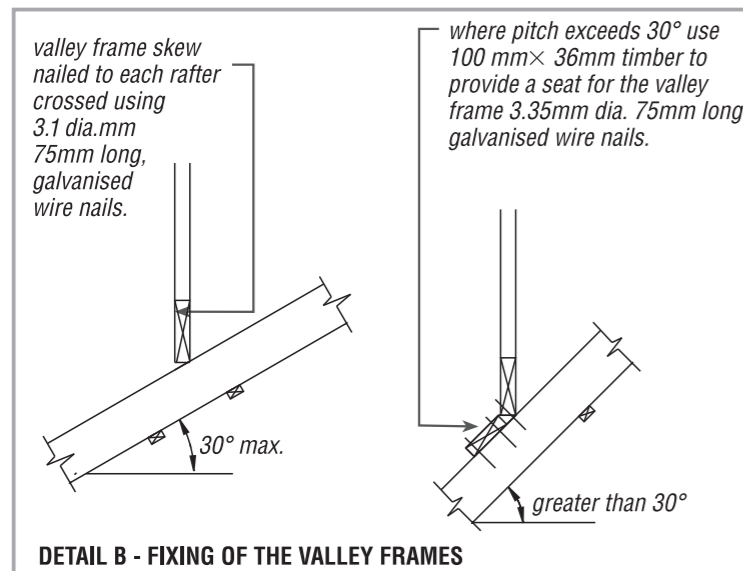
DETAIL B 2.10.2 Support over openings



DETAIL B 2.10.3 Support details



DETAIL B 2.10.4 Fixing of Valley Frames



Connections

Where the ends of the valley frames do not coincide with the rafters of the main trusses, additional support should be provided in this location by means of noggings between the main rafters, (Detail B 2.10.5).

Over openings, support of the main roof trusses is provided by a proprietary girder truss shoe securely connected to a multiple girder truss (Detail B 2.10.3).

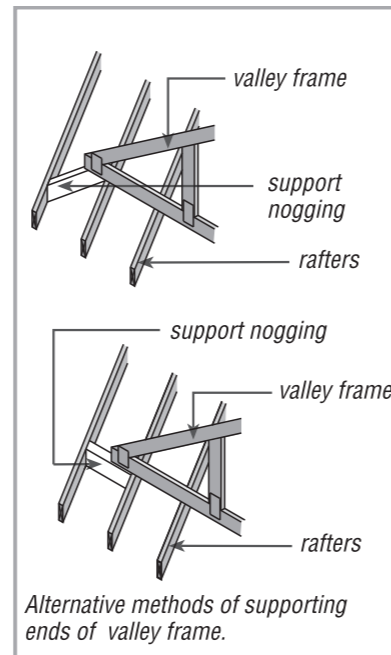
Girder trusses must be fixed together in accordance with the truss designers requirements.

Bracing

Bracing of the valley set is usually provided by horizontal binders fixed to the vertical webs and then fixed back to the main roof (Detail B 2.10.2). If the horizontal binders do not coincide with the rafters of the main roof then noggings should be provided to enable adequate connections to be made.

In addition, tiling battens or bracing members can be fixed to the underside of the rafters of the main roof and extend 1200mm beyond the valley line as a means of additional stability to the main roof.

DETAIL B 2.10.5 Alternative Supports



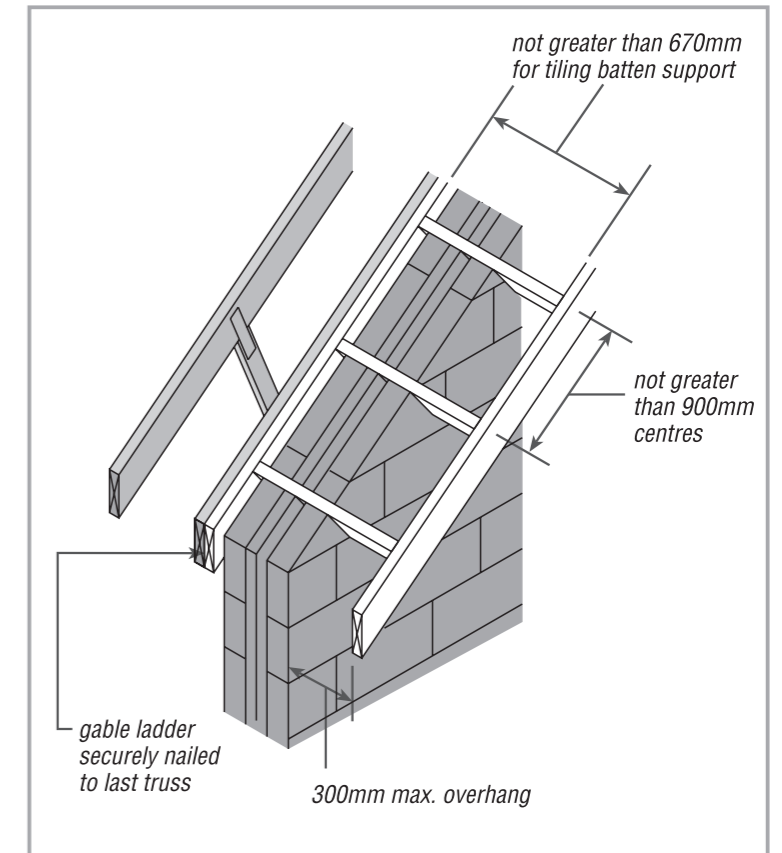
The bottom of the valley trusses may need to be chamfered to the roof angle. Roof battens may need to be continued across the valley trusses to brace the rafters of the main trusses.

B 2.11 TRUSSED RAFTERS ROOFS - AUXILIARY DETAILS

Gable ladders

Where a gable ladder is used, it should be nailed to the last truss with nails at 400mm maximum centres and be evenly supported by the gable blockwork. All components should be preservative treated.

Gable ladders should be designed for wind uplift forces and may need to be fixed to the external walls.



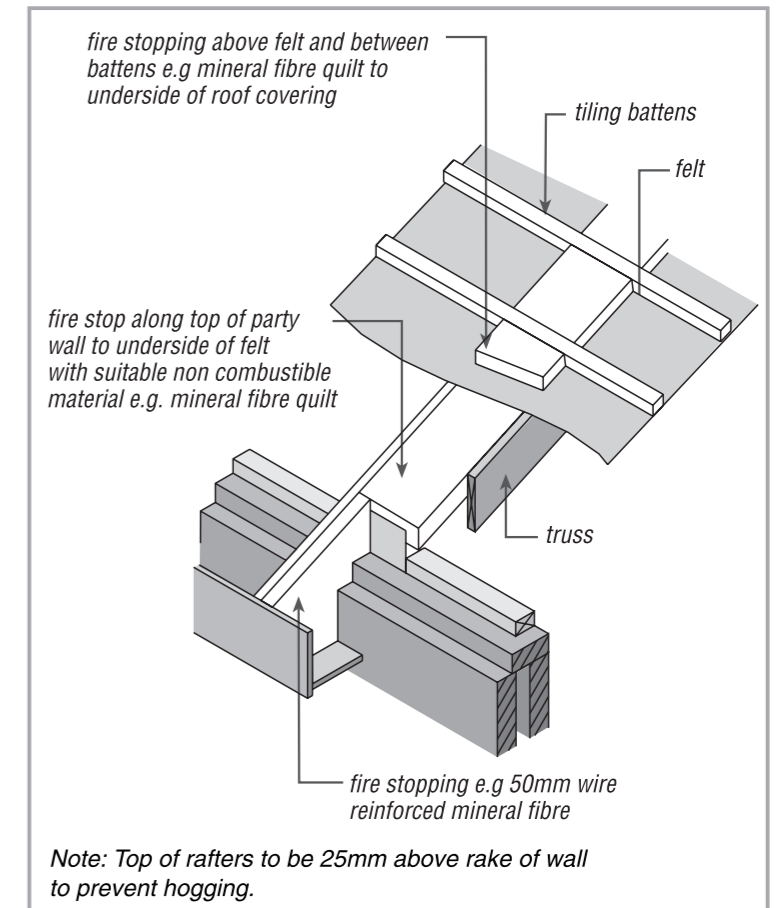
DETAIL B 2.11.1 Gable Ladders

Separating wall fire protection

To prevent the spread of fire between dwellings, ensure the party wall is completed along the line of the slope of the roof and adequately fire-stopped with a suitable material.

Proprietary fire stopping systems should have appropriate third party certification such as that provided by the Agrément Board.

Note: Detail B 2.11.2 is not appropriate for all buildings. Refer to Technical Guidance Document Part B (Fire Safety) of the Building Regulations.

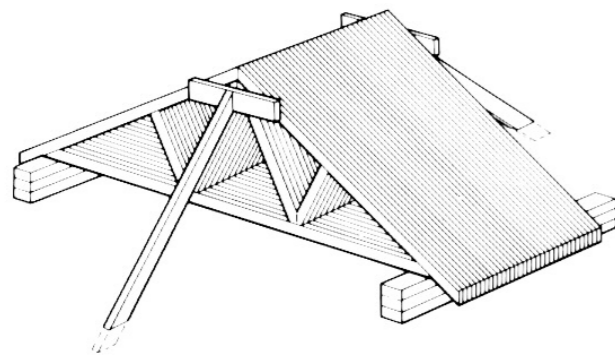


DETAIL B 2.11.2 Typical Separating Wall Fire Protection (From TGD 'B')

B 2.12 TRUSSED RAFTER ROOFS - SITE PRACTICE

DETAIL B 2.12.1 Vertical

VERTICAL STORAGE



keep overhangs clear of ground and vegetation

Site storage

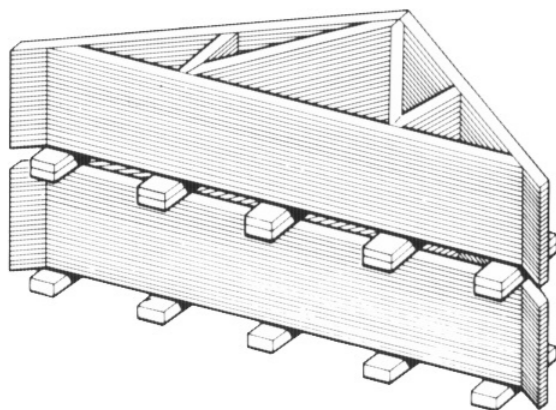
Site storage should be kept to the minimum. Store trusses clear of the ground, on bearers located at the support points, with suitable props provided where required (Detail B2.12.1).

Where trusses are laid flat, bearers at close centres should be provided to ensure level support (Detail B2.12.2). Where bearers are placed at different heights they should be vertically in line with those underneath. The timing of erection of the roof should be such that the trusses are exposed to the elements for the shortest possible time.

Where trusses are covered, the protection should be arranged so that there is adequate ventilation and any accumulated water can drain away.

DETAIL B 2.12.2 Horizontal

HORIZONTAL STORAGE



ensure all bearers are level

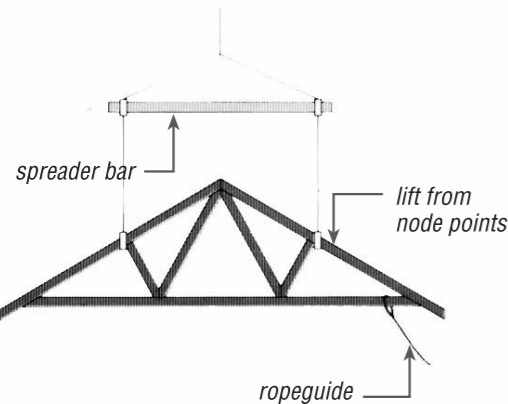
Handling

The greatest stress at truss joints is generally caused by handling. Handling of trusses should be planned to take into account weight, size, access, lift height and whether manual or mechanical handling is required. Where possible trusses should be lifted at node points, with the apex upright (Detail B2.12.3).

DETAIL B 2.12.3 Handling

MECHANICAL HANDLING

Note: Single support lifting of truss to be avoided



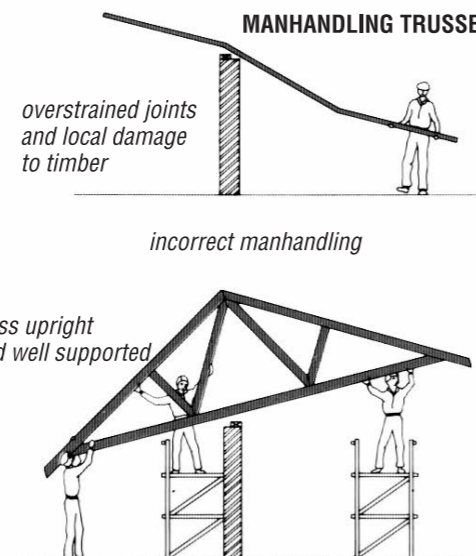
MANHANDLING TRUSSES

overstrained joints and local damage to timber

incorrect manhandling

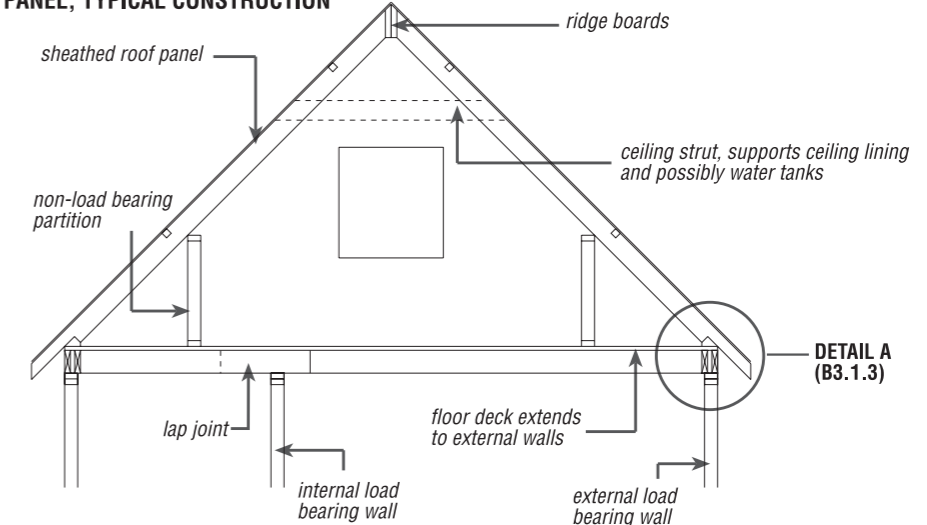
truss upright and well supported

correct manhandling



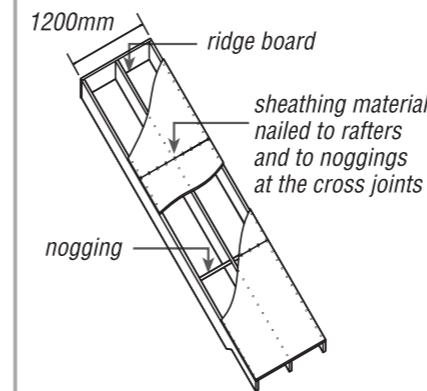
B3 Panel roofs

SHEATHED ROOF PANEL, TYPICAL CONSTRUCTION



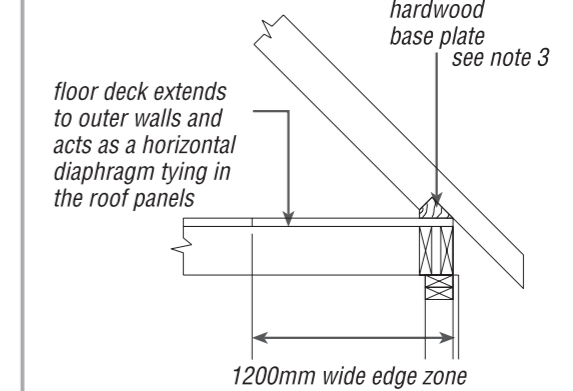
DETAIL B 3.1.1 Sheathed Roof Panels

TYPICAL PANEL DETAIL



DETAIL B 3.1.2 Panel Detail

DETAIL A



DETAIL B 3.1.3 Detail A

B 3.1 DESIGN AND LAYOUT

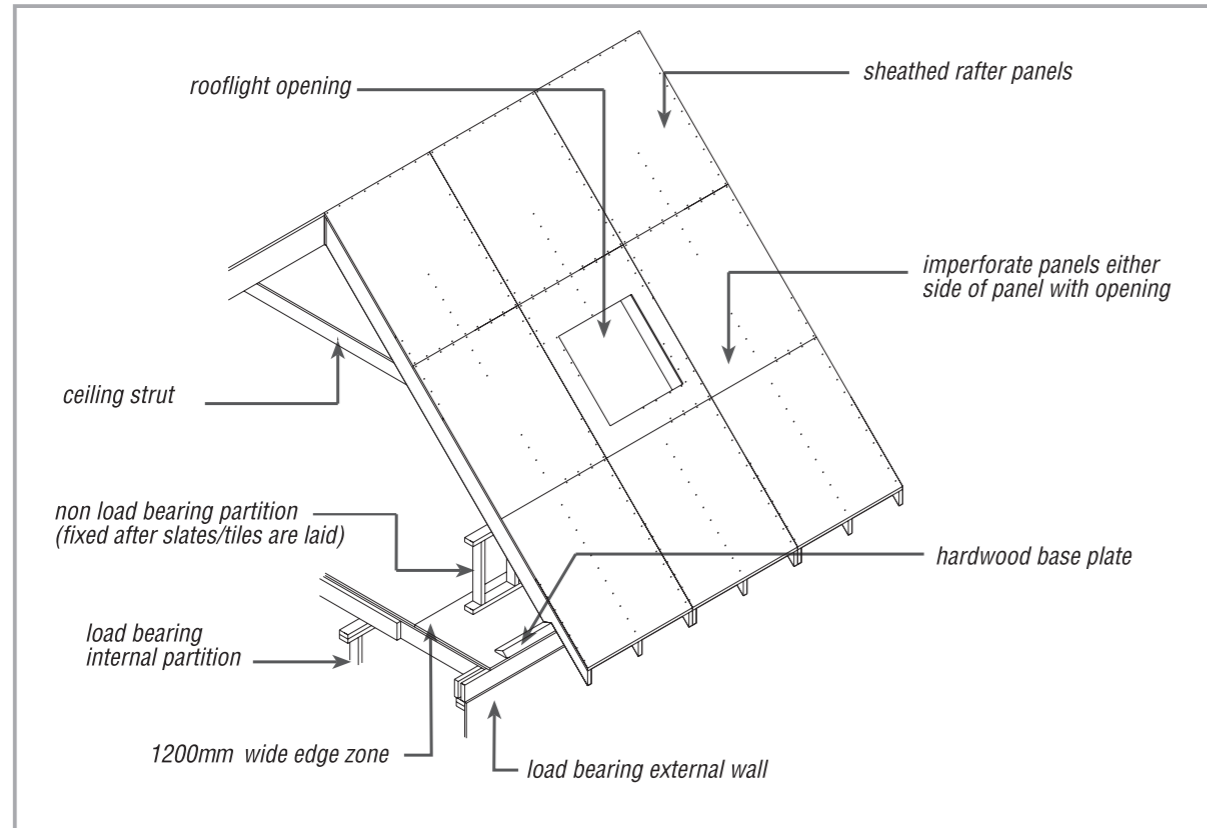
Sheathed roof panels may be used as an alternative to dormer trusses. They can provide a completely clear triangulated roof space free from struts, ties or bracing, and are suitable for most domestic dwellings, typically with horizontal spans between 6-9m and pitches of 35-50 degrees. The structure of the sheathed panel roof relies on four elements.

2. The panels are sheathed on top of the rafters to resist rafter buckling and racking forces. Some designs are conservative and ignore the structural contribution from the sheathing.
3. The horizontal thrust at eaves level is taken out by the floor structure. A common detail here is to use a hardwood base plate fixed to the floor sheathing, the baseplate and fixings must be designed. The floor sheathing is in turn fixed to the floor joists. The fixing and nailing pattern must be designed and carried out in accordance with the engineer's instructions.
4. The upper ceiling joist and small stud wall can be used structurally although this is not common. To limit any loads coming onto these members they should be fixed after the roof is fully loaded, the load coming on to them through wind, snow and long term deflection will be thereby reduced.

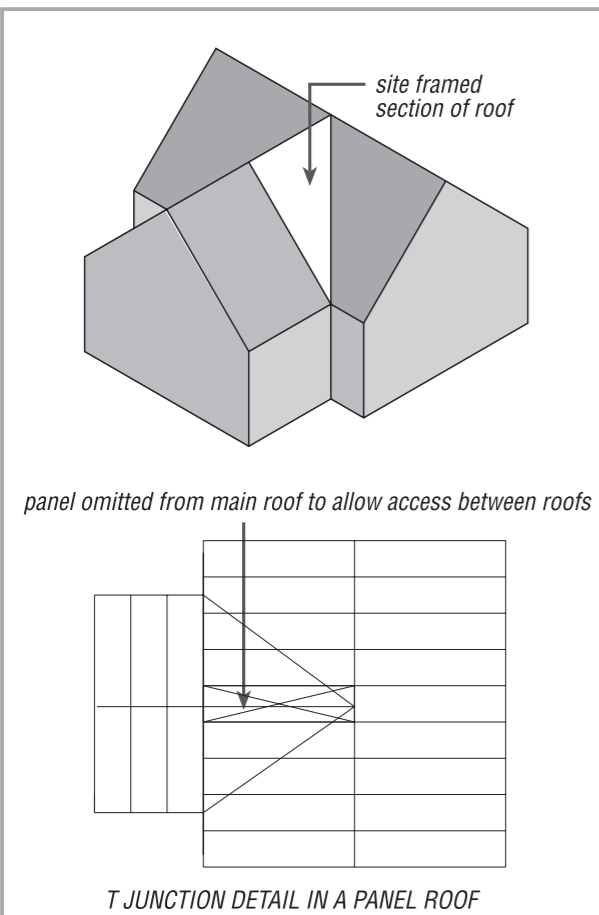
1. The floor structure, including lapped joints in the floor joists, act in tension to restrain the outward force of the roof panel at the eaves. A load-bearing internal wall is normally required to reduce the floor joist spans (Detail B3.1.1). Openings in the floor framing must not interrupt this function, unless they are specially designed. The stairwell opening should preferably be located parallel to the floor joists. Where the longer length of the stairwell is located perpendicular to the span of the floor joists, a special design will be required for the opening to transfer the horizontal and vertical loads safely into the adjacent floor joists and sheathing.

B 3.1 PANEL ROOF - DESIGN AND LAYOUT

DETAIL B 3.1.4
Roof Panels



DETAIL B 3.1.5
T-junction Detail



The sheathed roof panel system is most suitable for roofs with gable ends, but T-junctions can also be accommodated (Detail B 3.1.5). Rafter size varies according to loading and span (the thickness of the thermal insulation can also affect the depth). Insulation can be placed either between the rafters and sometimes rigid battens are fixed to the underside of the rafters to accommodate the thickness of the thermal insulation.

Panels may be trimmed subject to design and manufacture to permit a rooflight window or dormer to be incorporated. Where openings are formed for dormers the rafters on either side should be doubled up (large openings will require to be designed and may require additional trimming members and fixings). The trimmer loads are transferred to the supporting walls and may also require additional studs to provide support. (Detail B 3.1.4).

Panel roofs must be designed especially where the openings are large or where there are a number of openings close together.

To facilitate drainage, should any moisture penetrate the roof covering, the sarking felt/breather membrane should be tacked to counter battens, parallel to and in the same position as the rafters.

B 4 Flat roofs

B 4.1 FLAT ROOF TYPES

In domestic construction there are three common flat roof types.

Cold deck

The most common form of domestic flat roof construction (Detail B 4.1.1), is where the insulation is provided between the joists. A 50 mm minimum unobstructed air void must be maintained between the top of the insulation and the underside of the roof decking and be vented to the exterior. Glass fibre or mineral wool quilts are the most common type of insulations used. Provide a solar reflective finish as for warm deck roofs.

The vapour check must be used to prevent interstitial condensation and any openings in the ceiling must be sealed.

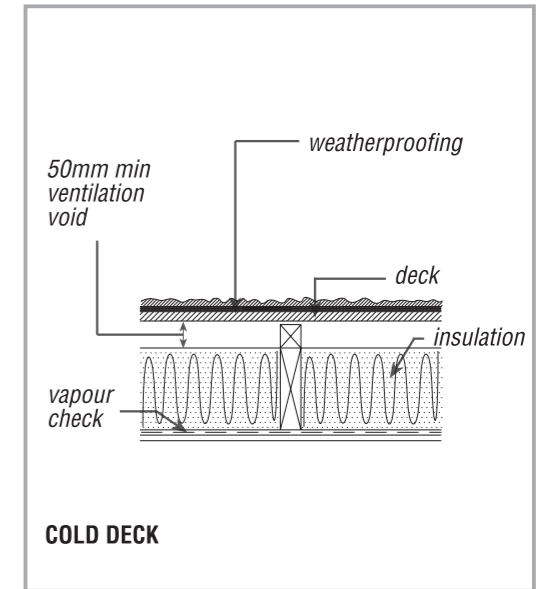
Generally this type of roof should be avoided because the risk of interstitial condensation is relatively high, where this type of roof cannot be avoided it is essential that moisture entering the roof is minimized and that adequate ventilation is provided. If condensation does occur, it will normally be at the underside of the roof decking or waterproof finish.

The vapour control layer should have a resistance of at least 250 MNs/gm, and should have sealed laps to preserve its integrity over the whole roof. Gaps in the ceiling should be minimized and service openings should be avoided; it is recommended that a service cavity be used so that the vapour control layer remains intact.

Ventilation openings should be provided to every roof void along two opposite sides of the roof and should be equivalent in area to a continuous opening of not less than 25 mm at each side. Adequate cross ventilation can be difficult to achieve with spans in excess of five metres; in these situations, both the openings and airspace over the insulation should be substantially increased. Where fire stops obstruct the cross ventilation, it will be necessary to provide ventilation through the roof covering; the use of a warm roof should be considered in these situations.

Timber not rated moderately durable or better should be preservative treated. During its life, it is likely that the decking will be subjected to periods of elevated moisture and the decking should be chosen accordingly.

Surface condensation on the ceiling is unlikely to occur due to the fast thermal response, provided there is adequate insulation over the whole ceiling and steps have been taken to minimize thermal bridging, especially at external wall/ceiling junctions.

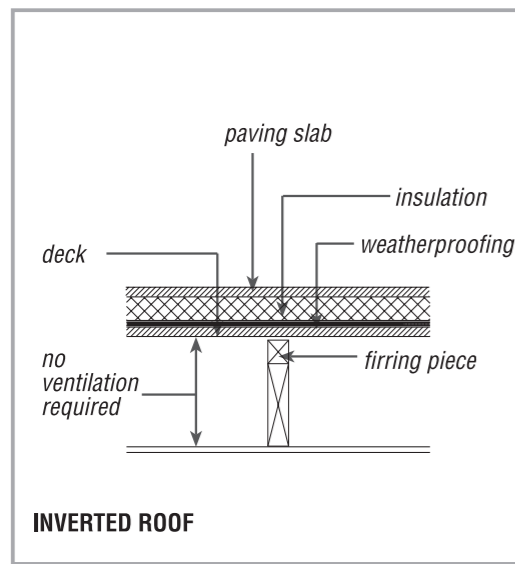


COLD DECK

DETAIL B 4.1.1 Cold Deck

Using a service cavity will help to ensure that the vapour check will remain imperforate.

DETAIL B 4.1.2 Inverted Deck



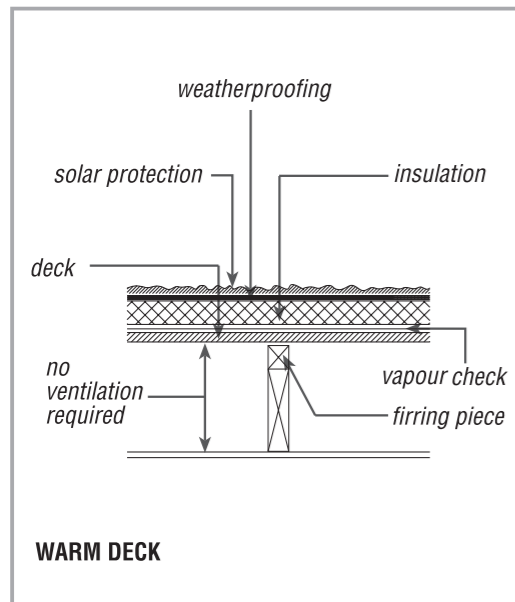
Inverted deck

Insulation is provided above the weather-proofing in this type of roof. The insulation must be of a type unaffected by moisture and the weather. To keep the insulation in position, ballast material can be used consisting of paving slabs or a similar material recommended by the manufacturer.

There is usually no need to provide a vapour check with this type of roof but this can be confirmed by a condensation risk analysis.

Surface condensation is unlikely to occur due to the fast thermal response, provided that there is sufficient insulation to maintain the weatherproof finish above the dewpoint over the whole roof. With this type of roof, rainwater seeping below the insulation will cool the waterproof membrane intermittently, increasing the risk of condensation on the membrane. When calculating the risk of interstitial condensation the thickness of insulation should be assumed to be 80 % of the actual thickness.

DETAIL B 4.1.3 Warm Deck



Warm deck

Like the inverted roof, insulation provided above the deck level but unlike the inverted roof the insulation is under the weather-proofing membrane. Insulations include polyurethane, polyisocyanate, glass fibre, rock fibre and cork board. Provide a solar reflective treatment of roof membranes in accordance with manufacturers' instructions.

Weather proofing

Suitable weatherproofing or roof covering materials must be used.

Proprietary membranes should be approved by a body such as the Agrément Board or have appropriate certification such as an ETA with accompanying information showing compliance with the Building Regulations.

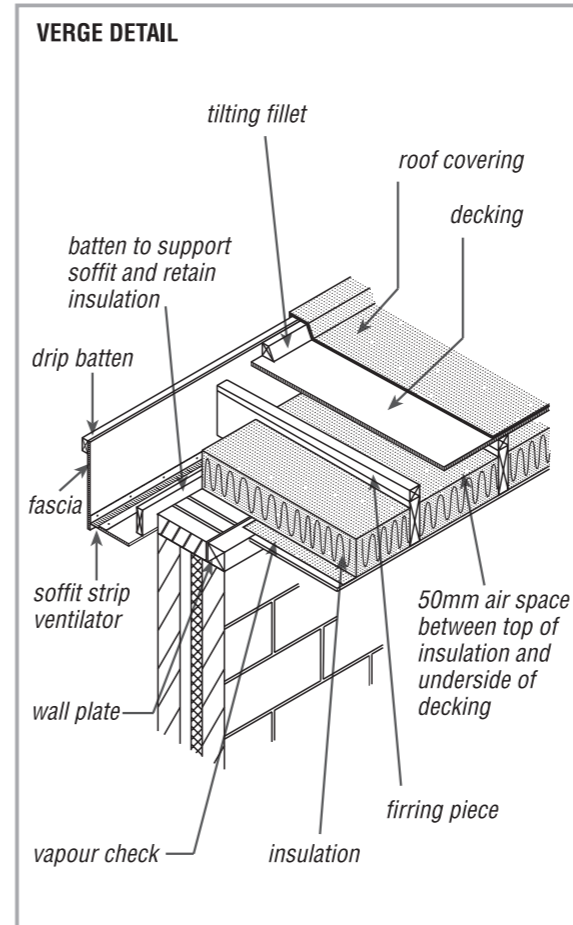
Decking materials

- Moisture resistant chipboards
- OSB 3
- Plywood to EN 636-2/3
- Preservative treated T&G boarding

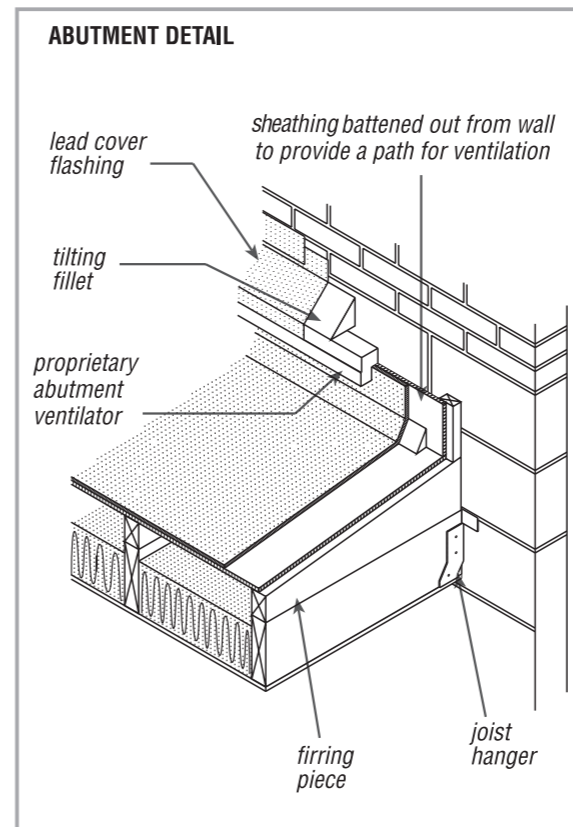
The onus is on the designer to specify the correct grade of material suitable for end use.

B 4.1 FLAT ROOF TYPES (CONTINUED)

DETAIL B 4.1.4 Verge Detail



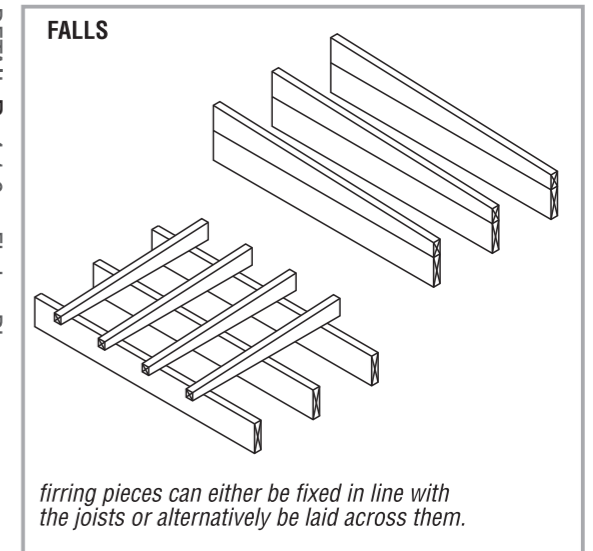
DETAIL B 4.1.5 Abutment Detail



Roof falls

Furring pieces should be provided to give the roof a minimum fall of 1 in 40. Care should be taken to ensure that drainage is adequate and cannot be blocked and that water cannot collect on the roof.

DETAIL B 4.1.6 Furring Pieces



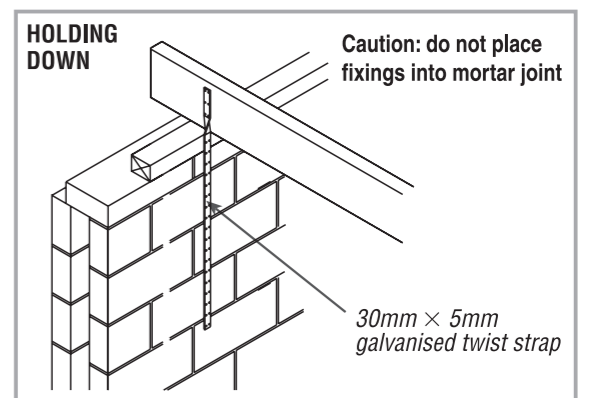
Holding down

Holding down requirements should be designed to Eurocode 5 (or BS 5268-2 if permissible stress design is used) and if appropriate to the relevant masonry standard (EN 1996 or BS 5628).

Holding down straps are typically 30x5mm in cross section, at least 1m long and provided at between 1.2 m to 2 m centres. Straps should be fixed to the masonry walls (in timber frame the design engineer should provide details of the fixing) by means of masonry nails or wood screws into plugs. The number of fixings should be in accordance with design requirements, with a minimum number of three, one of which should be at least 150mm from the bottom of the strap. The straps should be corrosion resistant and the fixings should have a similar protection. Note that often the holes in these straps are quite large and the fixings should be of a similar diameter.

Austenitic stainless steel is much more durable than galvanised steel.

DETAIL B 4.1.7 Holding Down



Where there is a greater risk of corrosion consideration should be given to using austenitic stainless steel rather than galvanised steel whose durability is dependent on the amount of galvanising present on the strap.

Do not mix metals: use galvanised nails with galvanised straps and austenitic stainless steel nails with austenitic stainless straps.

B5 Flooring

B 5.1 FLOORING - CONNECTION DETAILS

Bearing

Where floor joists are built into external masonry walls, a minimum of 90mm bearing should be provided and the joist should be totally surrounded by mortar (Detail B 5.1.1A.) Alternatively, joists can be supported by proprietary galvanised joist hangers (Detail B 5.1.1B). Bridging pieces should normally be installed between the ends of the joists to provide support to the edges of the flooring material and as an added precaution against joist rotation. First floor joists will also require timber noggins between the joist ends to provide support to the edges of the plasterboard ceiling. In all cases where timber joists are built into the masonry wall the ends should be adequately treated with preservative. It is normal practice for all ground floor joists, wall plates and bridging to be treated with timber preservative.

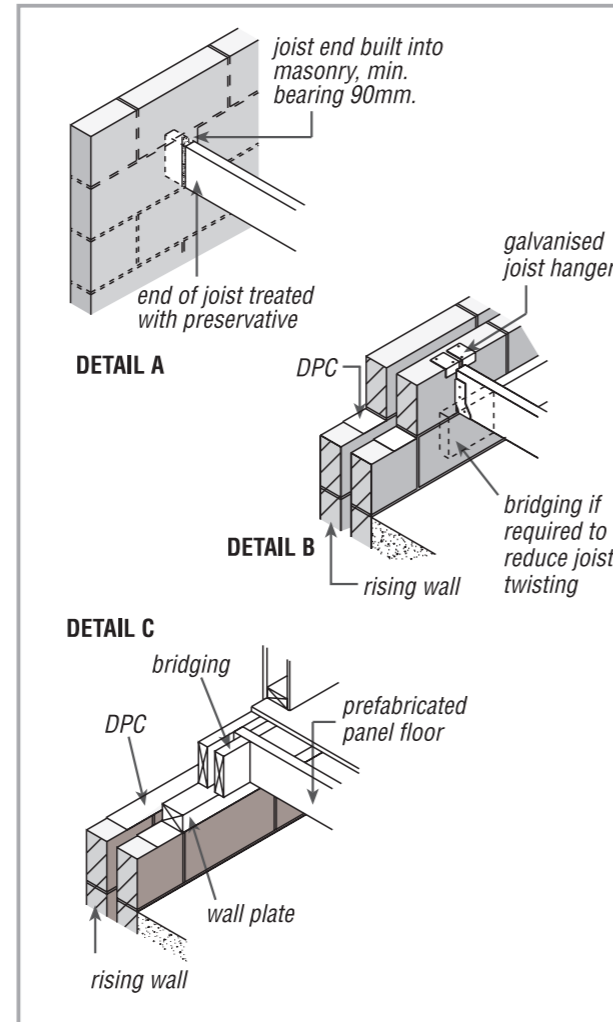
In timber frame construction, suspended timber floors are generally supplied as prefabricated panels. (Detail B 5.1.1C).

The designer/specifier should always specify which components are to be treated and the treatment type. It is recommended that all timber in a ground floor be treated with a timber preservative; the manufacturer of proprietary joists should be consulted for their advice on the need for treatment. Floor decking is not usually treated but again the manufacturer can be consulted for advice.

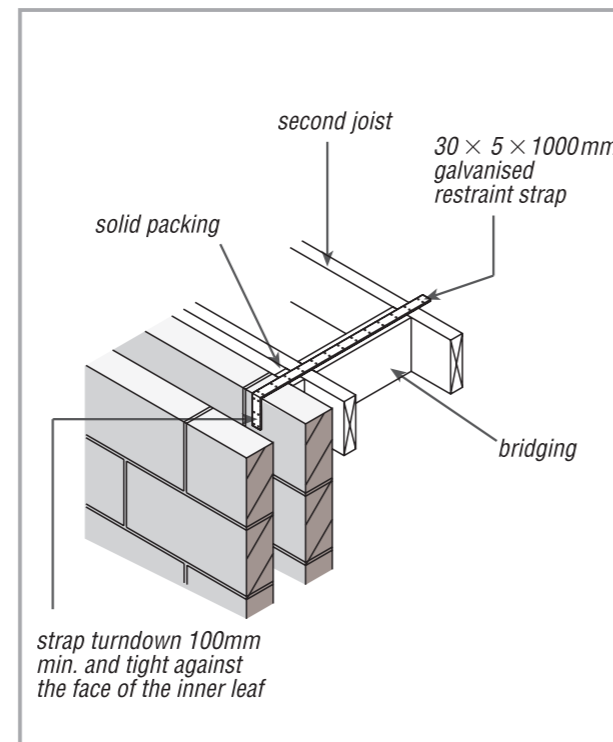
Lateral restraint

Floors, other than ground floors, should provide lateral restraint and support to external walls by means of galvanised straps, 30x5mm in cross section, carried over and securely fixed to at least two joists, packing and bridging. (See Detail B 5.1.2). The straps should be located at 2m max. centres. Where continuity is disrupted by openings e.g. a stairwell, the opening should not exceed 3m in length and strap centres on either side of the opening should be reduced to compensate for those omitted along the opening (Detail B 5.1.2).

In two-storey domestic construction, straps are usually not required in the longitudinal direction of the joists, providing the requirements of *Technical Guidance Document A (Structure)* are met.



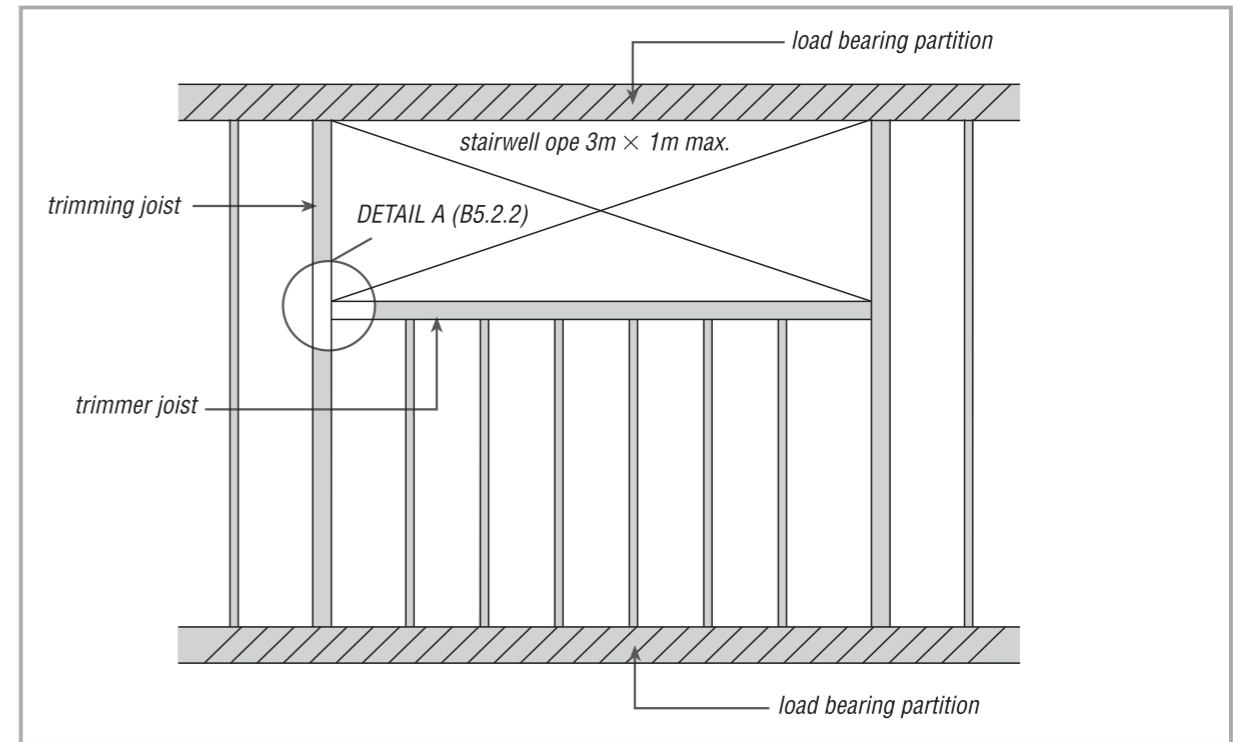
DETAIL B 5.1.1 Joist Support Detail



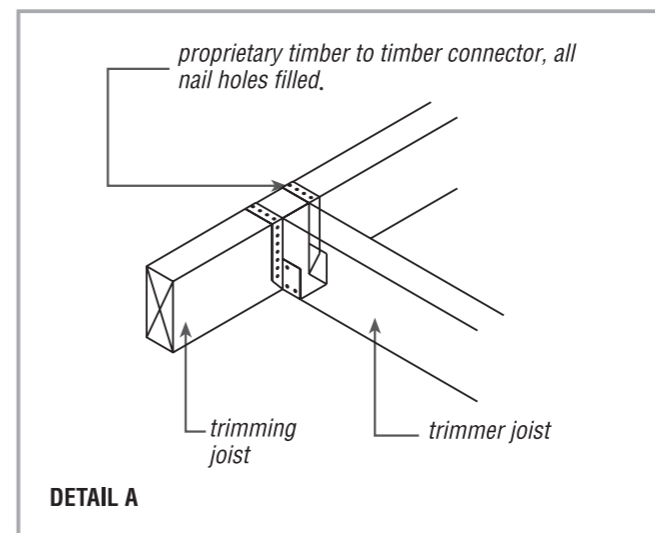
DETAIL B 5.1.2 Lateral Restraint

B 5.2 FLOORING – OPENINGS

DETAIL B 5.2.1 Trimming Openings



DETAIL B 5.2.2 Stairwell Trimmers



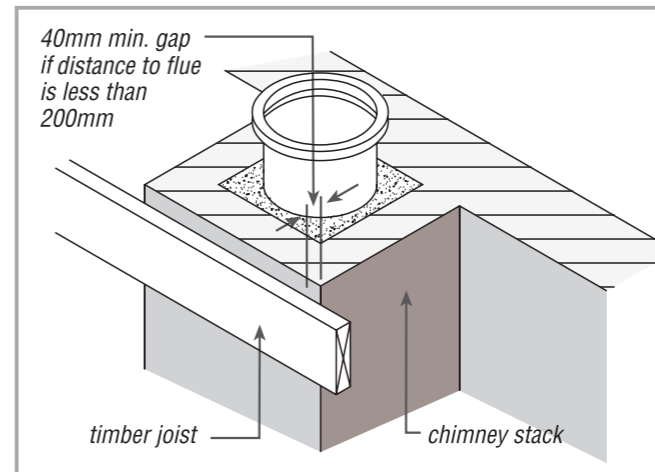
Trimming around openings

Stairwell openings in domestic construction should generally not exceed 3m in length and 1m in width and should be trimmed by trimmer/trimming joists of a suitable size and strength class.

Trimmer joists can be supported by proprietary timber connectors or by a ledger nailed to the face of the trimmer joist (Detail B5.2.2). The size and ledger fixing must be designed.

When using a pair of joists to form trimmer joists they should be nailed at least at 450mm centres, 20mm from top and bottom edges of the joist. Alternatively they can be bolted on the centre-line at approximately 1m centres. Heavily loaded or large span trimmers may require a special design.

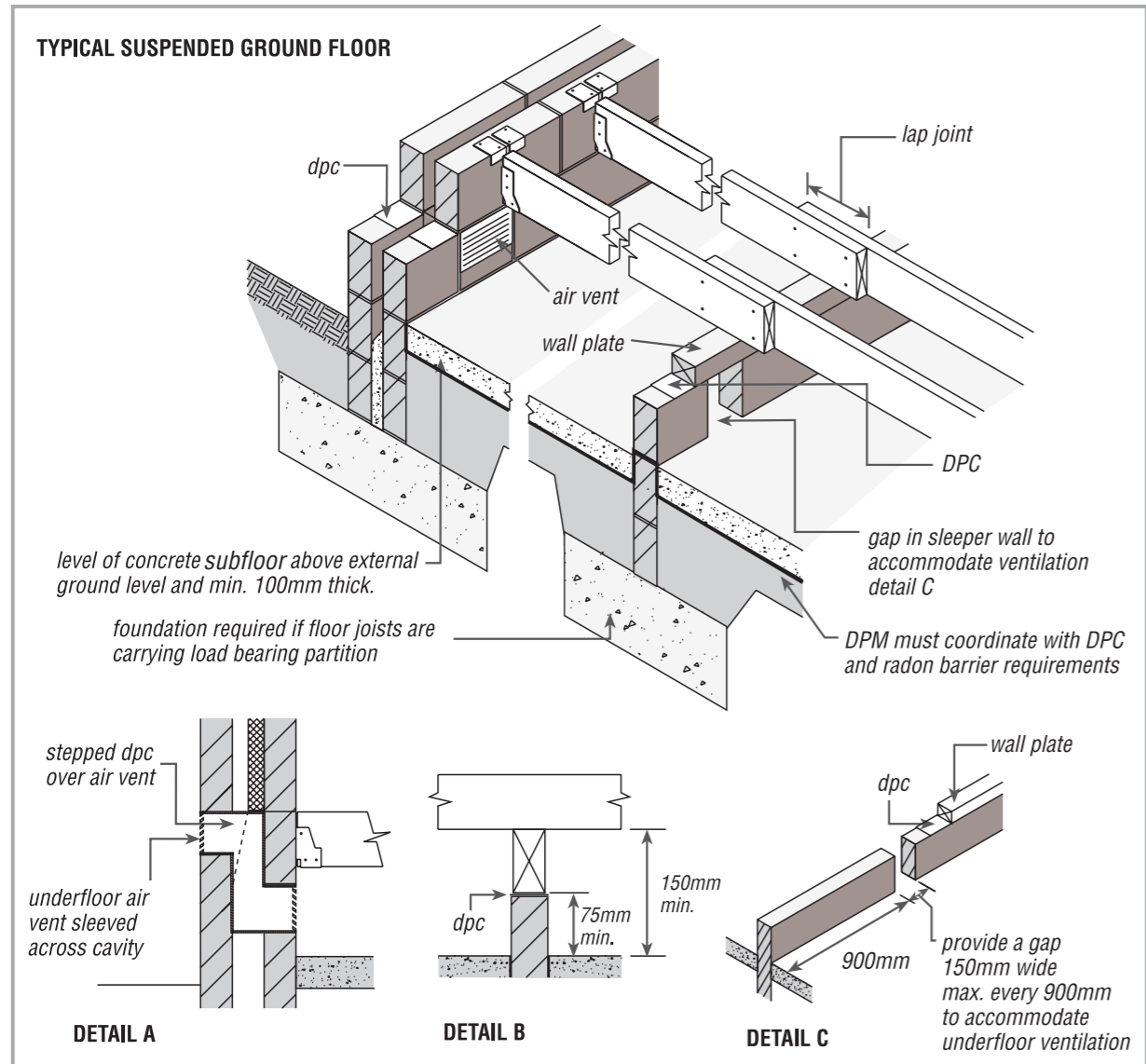
DETAIL B 5.2.3 Trimmer Joists



If the distance from the joist (or other combustible material) to the chimney flue is less than 200mm there must be a 40mm gap between the chimney and joist (or other combustible material).

Excluded from this requirement are floor boards, skirting, dado or picture rails, mantle shelf or architrave.

B 5.3 GROUND FLOOR REQUIREMENTS



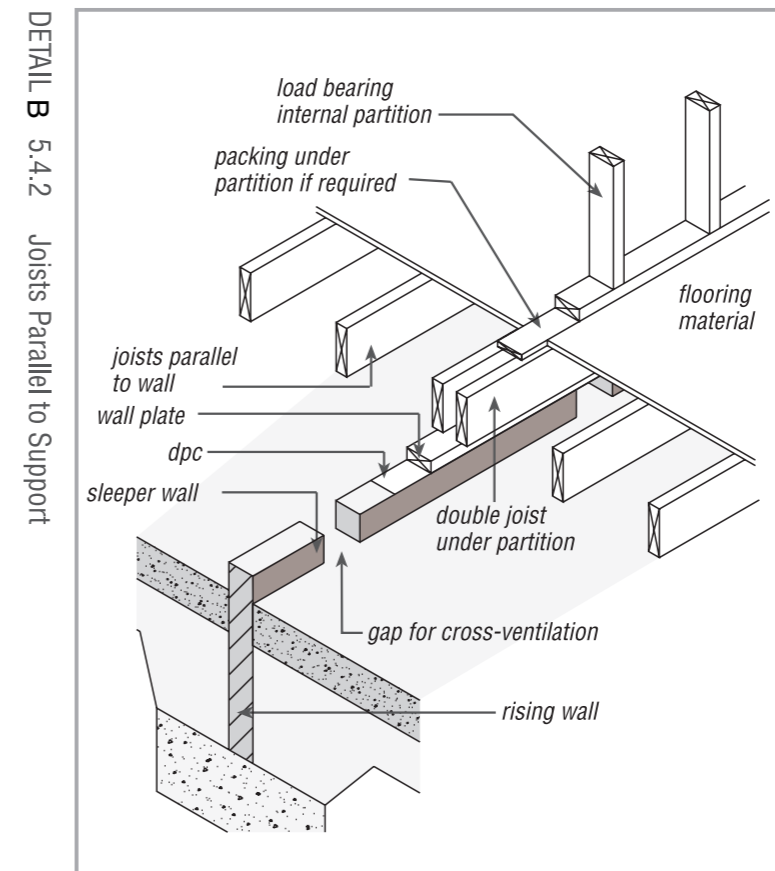
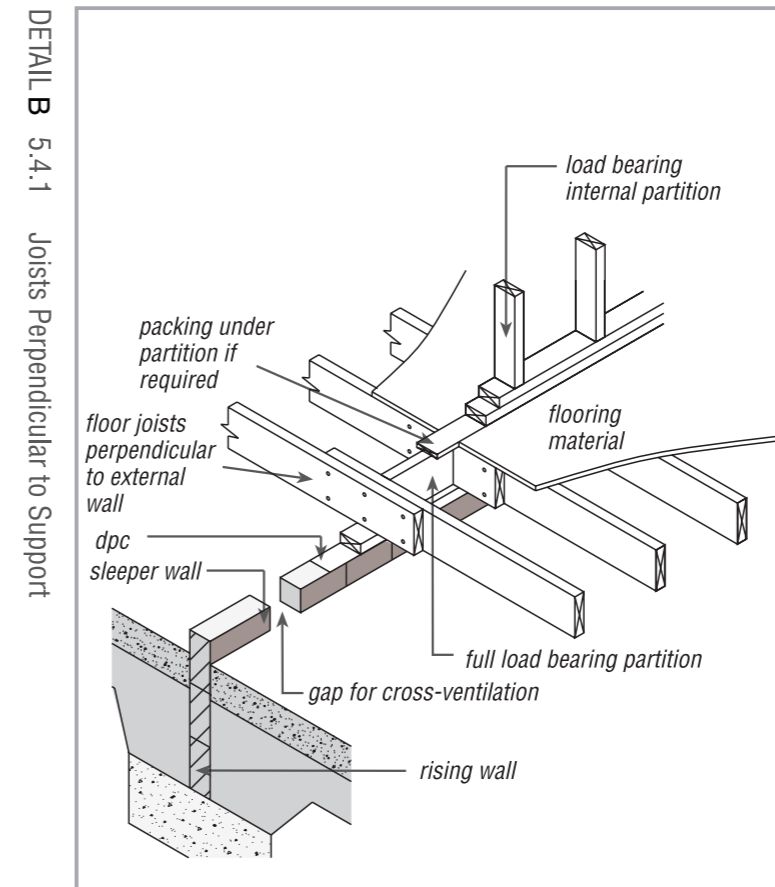
DETAIL B 5.3.1 Typical Suspended Ground Floor

In suspended timber ground floors the following should be adhered to:

- Underfloor ventilation openings are required in external walls. The frequency of the openings should be such as to provide an opening equivalent to 1500mm² for each metre run of wall. Any pipes needed to carry ventilating air should have a diameter of at least 100mm and extend across the cavity. Proprietary vent systems, including periscope vents, may be used.
- Provide a stepped DPC over the air vent (Detail B5.3.1A).
- Provide an unobstructed air space of at least 75mm from the top of the concrete subfloor to the underside of the wall plate and at least 150mm to the underside of the suspended timber floor (or insulation if provided in this location (Detail B5.3.1B).

- Provide a DPC to the underside of any wall plate (Detail B5.3.1B).
- The depth of concrete subfloor should be a minimum of 100mm. The level of the top of the subfloor should be higher than the finished external ground level.
- Honeycombed sleeper walls should be provided with an appropriate footing only where the floor joists are carrying a load-bearing partition, and provided with a gap not greater than 150mm at approx. 900mm centres to accommodate ventilation (Detail B5.3.1C).
- Refer to Building Regulations requirements for radon barriers.
- Care should be taken with the level of the subfloor and external ground so that there is no sump effect.

B 5.4 GROUND FLOORS – PARTITIONS



Suspended timber floors
Where a suspended timber floor meets an internal load-bearing partition, bridging pieces or additional joists may be required to transfer the loads to the rising wall.

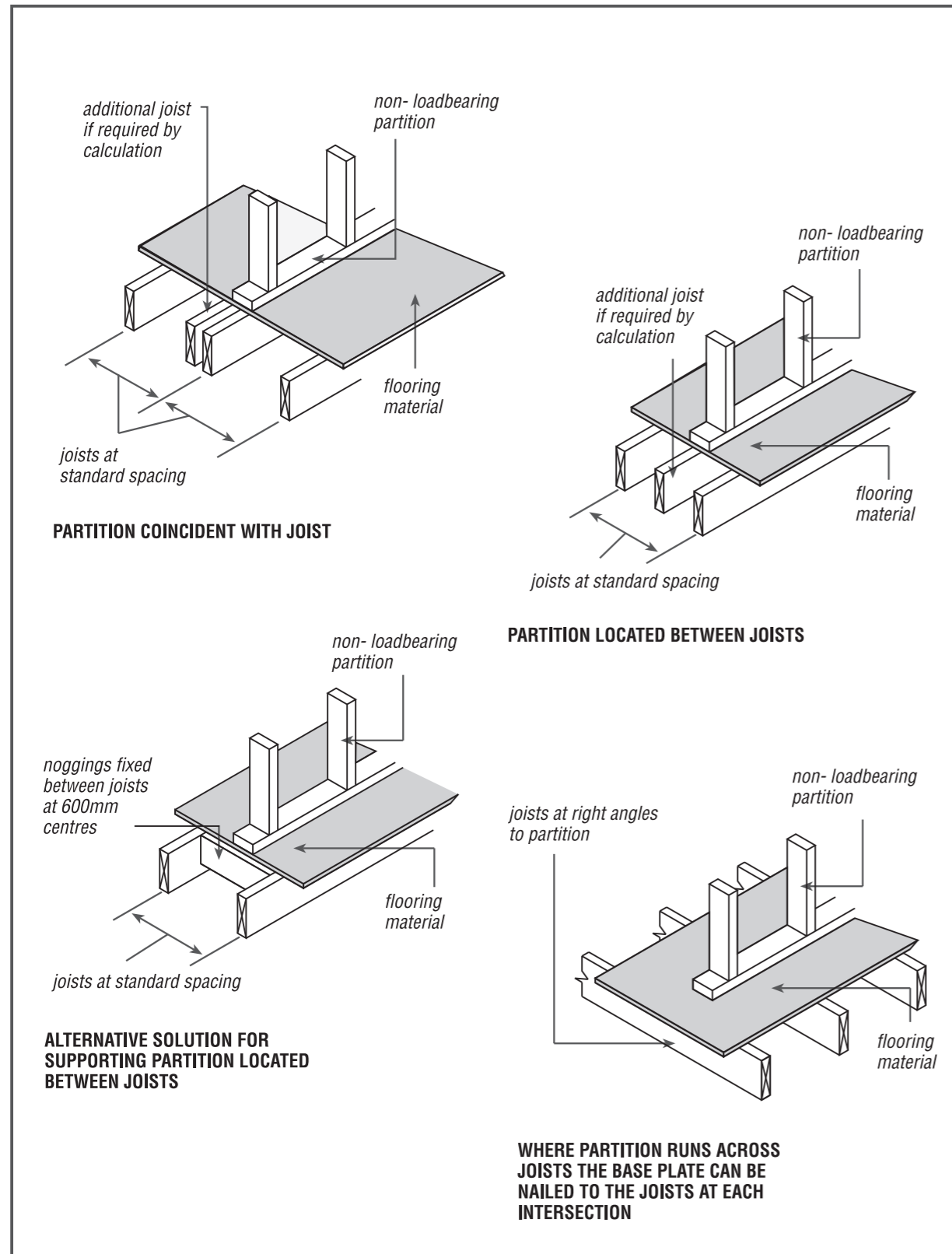
Detail B 5.4.1 illustrates this junction with the joists perpendicular to wall.

Gaps 150mm wide should be left in the sleeper wall to accommodate underfloor ventilation.

Where flooring material is fixed before the partition is erected, a single joist or bridging piece under the partition should generally be sufficient.

Detail B 5.4.2 illustrates support for a load-bearing partition where the joists run parallel to the partition and rising wall.

B 5.5 SUPPORT OF PARTITIONS



DETAIL B 5.4.3 Non-loadbearing Stud Support

Support for non load-bearing partition

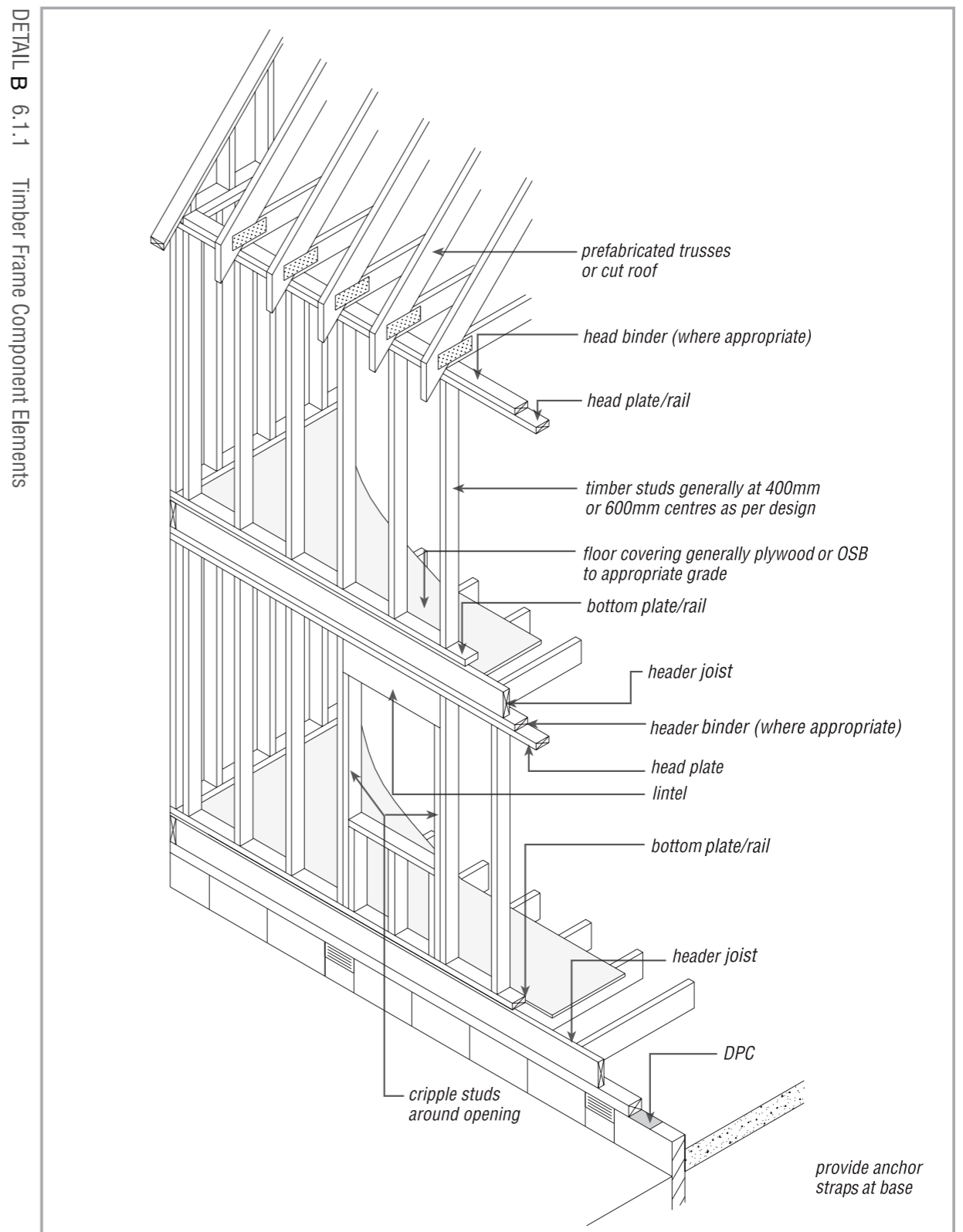
Non load-bearing partitions should be supported off suspended timber floors in accordance with Detail B5.4.3.

Partitions should not be supported by flooring material only; partitions should be fixed through the flooring into timber.

B 6 Timber frame

B 6.1 TIMBER FRAME - COMPONENT ELEMENTS

Details of a typical platform method of timber frame construction are shown below in Detail 6.1.1.



External wall – platform construction

Detail of typical wall platform construction method.

Typical two storey timber platform frame construction.

(note: breather membrane and sheathing material removed for clarity as is external masonry leaf).

B 6.2 TIMBER FRAME - ACCURATE SETTING OUT

Panel erection

Accurate setting out of the sub-structure on which the timber frame sits is vital to ensure that the wall panels bears properly on the sub-structure.

A dimensioned baseplan (usually supplied by the timber frame manufacturer) with diagonal measurements for cross checking the sub-structure should be used to ensure accuracy. This baseplan should be marked up (usually by the builder or agents of the timber frame manufacturer) and returned to the timber frame manufacturer. It is important that not only individual houses be checked but also that terrace housing be checked across a number of houses to ensure that the block of houses does not 'run off'; this can lead to problems with the location of soil vent pipes and other services. Where panels have to be altered on site this should only be carried out under strict supervision and under written instructions from the timber frame manufacturer.

It is important that panels are squared and plumb. Panels should not be out of plumb more than 10mm in any floor and not by more than 10mm over the full building height (these are maximum figures, the aim should be to have effectively a tolerance of 0mm). If the panels are out of plumb by more than 10mm the timber frame manufacturer should be contacted for advice.

If wall cavities run off (whether from poor setting out or panels being out of plumb) this can affect the appearance of the building, the ability of the cavity to provide an adequate barrier against wind driven rain and also affect the performance of cavity barriers and wall ties.

Wall ties and cavity barriers are readily available for cavity widths of 50, 75 and 100mm, the usual cavity barriers and wall ties delivered to site are normally suitable for 50mm cavities. Most wall ties, anchor straps, cavity barriers and fire stops have a range of effective cavity widths; where cavities are outside the normal 50mm then contact the timber frame manufacturer for advice and if needed alternative products can then be supplied,

Sole plate (when used)

Where no separate soleplates are used, the bottom rail of the panel will act as the soleplate. Level the sole plate before fixing wall frames; if the sole plate is not level it may be supported on a mortar bed (and slate if necessary). The mortar bed should be not more than 10mm thick and should extend the full width of the sole plate, where this is not the case the timber frame manufacturer should be contacted for advice.

The packing should be uniform under the sole plate rather than intermittent; it is important that any gaps in the external wall and in particular the party wall be sealed. There should be no need for packing at first floor or roof level if the base is properly levelled.

The fixing of the soleplate to the rising walls or substructure should be specified by the design engineer in the Site Fixing Schedule (supplied by the timber frame manufacturer). The type and thickness of packing can affect the performance of the fixings and it is recommended that the timber frame manufacturer be consulted where the packing is in excess of 10mm.

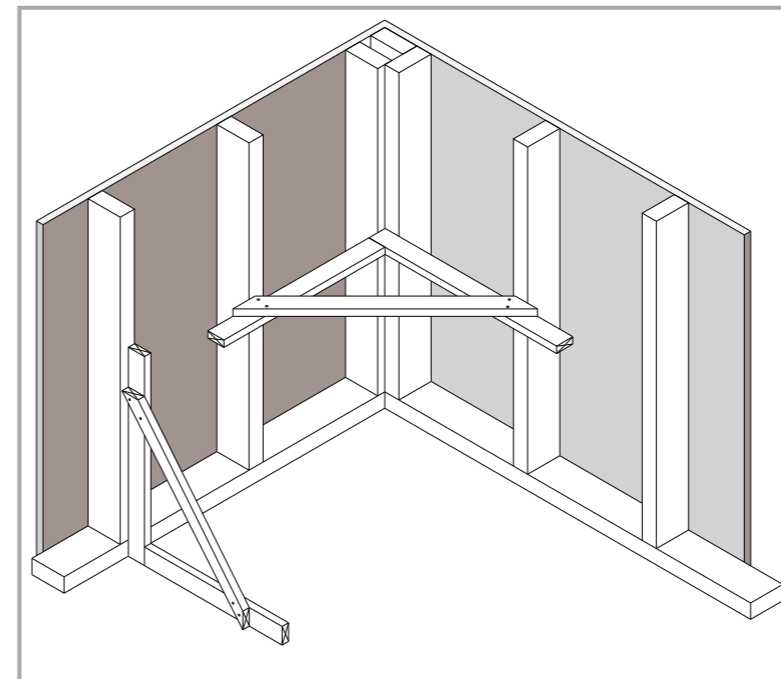
Care should be taken to ensure the level of the concrete slab as any rise in the concrete slab may result in non-load bearing walls becoming load bearing.

The sub-structure and concrete slab should be level to within +/- 6mm and a good builder should aim for less than half this value.

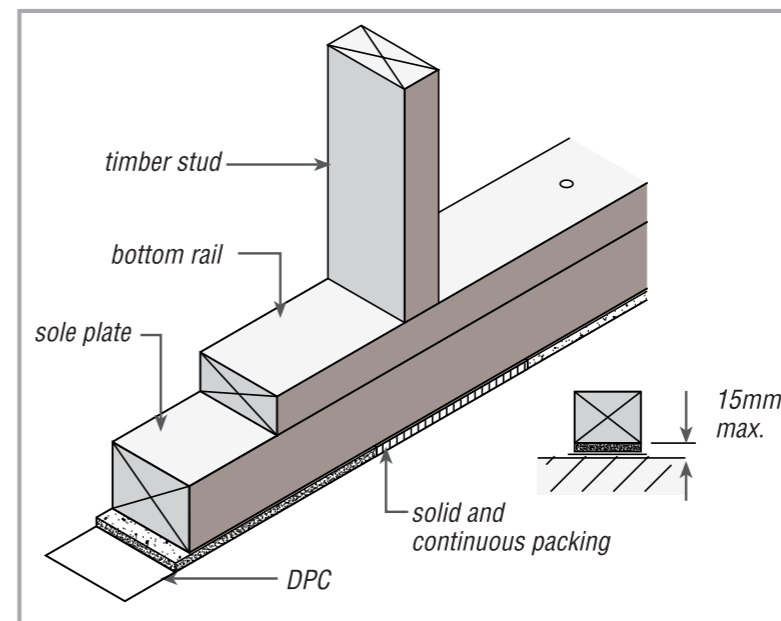
Sole plate overhangs

The sole plate should not overhang the sub-structure on which it sits by more than 12mm. On the cavity side, where ledges cannot be avoided they should be protected by the breather membrane; the membrane should always extend below the DPC (to the soleplate) by at least 50mm.

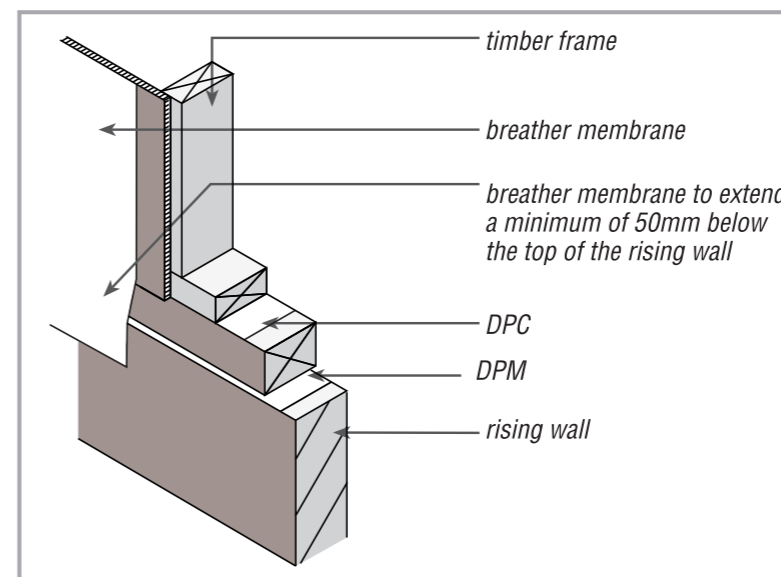
Where the soleplate bearing on the sub-structure varies by more than 12mm the timber frame manufacturer should be contacted.



DETAIL B 6.2.1 Set Out



DETAIL B 6.2.2 Level Sole Plate



DETAIL B 6.2.3 Overhangs

B 6.3 TIMBER FRAME - INSULATION DETAILS

Thermal insulation

The most common type of thermal insulation used in timber frame external walls is glass fibre. The glass fibre comes in rolls and is often compressed in the roll; care should be taken that the insulation is 'fluffed out' to its proper thickness before it is used. The rolled type must be supported and is normally stapled to the studs to hold it in place and to prevent it from sagging. Care should be taken to ensure that there are no gaps in the insulation (to avoid cold bridging) and if the insulation is fitted in small sections that each section is supported. It is recommended that each space between the studs is filled with a single piece.

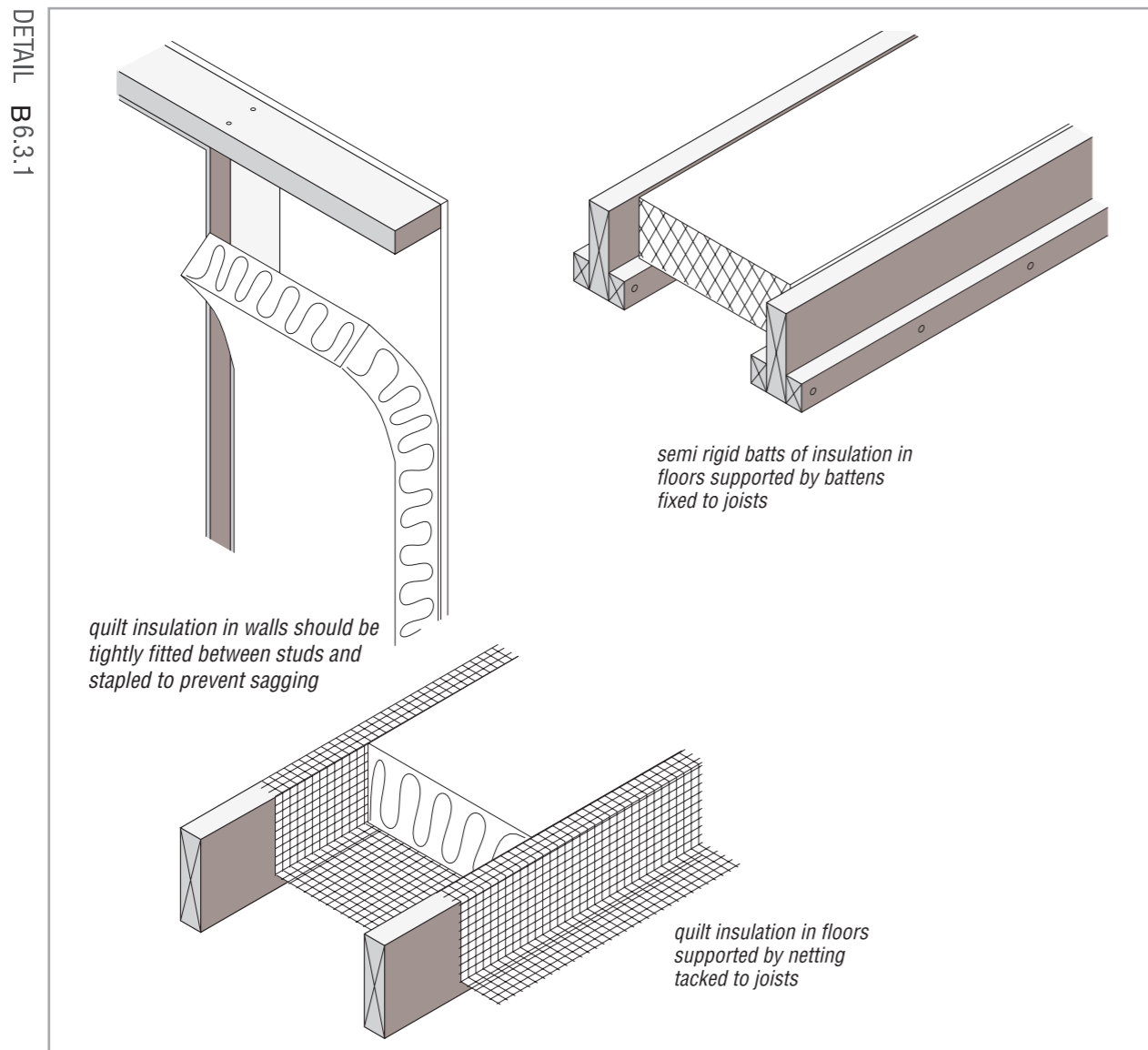
Semi-rigid insulation may be tightly wedged between studs (filling any gaps with foam). In floor construction, quilt insulation may be supported by netting and semi-rigid insulation supported by battens. The insulation should fit neatly between the joists without leaving any gaps.

It has become more common to fix a vapour control layer (VCL) to inside face of the timber studs and then add battens to the studs to create a cavity between the plasterboard and VCL. The services can run in this internal cavity and it can also be filled with thermal insulation to increase the wall's U-value; the VCL is not pierced by the services and it is protected from damage. The VCL is usu-

ally taped to the concrete ground floor to improve air-tightness. Some systems also use a wood fibre board on the outside (protected by a breather membrane) for added thermal insulation.

While fully filling the wall cavity with insulation is not recommended, some timber frame systems partially fill the wall cavity usually with a rigid insulation usually a close celled polyurethane board. These systems tend to use a cement boards fixed to battens for weather protection with a cavity between the weatherboard and the insulation. Care has to be taken to ensure that the insulation is fixed to the timber frame, that the battens are adequately fixed to the timber frame and that the weatherboard is properly fixed to the battens. The battens should be treated and the fixings should have a suitable durability as well as strength. This type of system reduces cold bridging and adds insulation without reducing the internal volume/area of the building. However, a condensation risk analysis should always be carried out with these forms of construction.

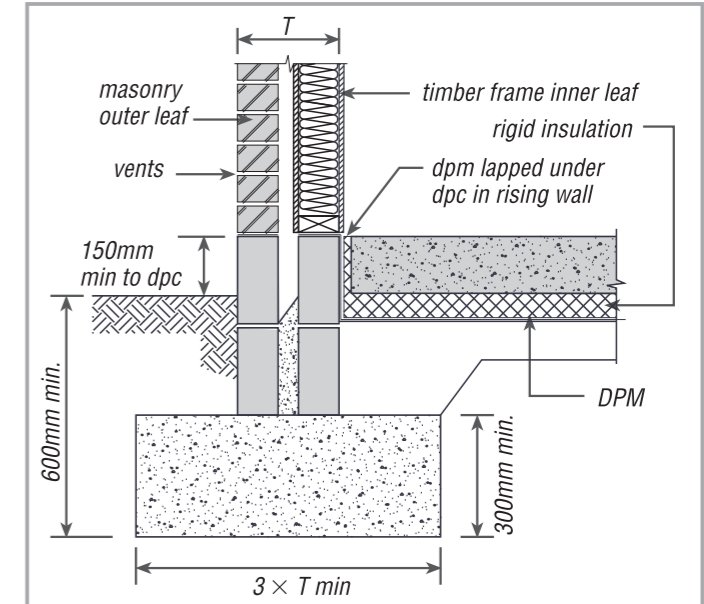
A condensation risk analysis should be carried out where necessary – generally where the VCL has a vapour resistance less than 250 MNs/g and/or where added insulation is placed outside the studs or where the construction does not follow standard practice.



B 6.4 TIMBER FRAME - FOUNDATIONS/SUBSTRUCTURE

Foundations

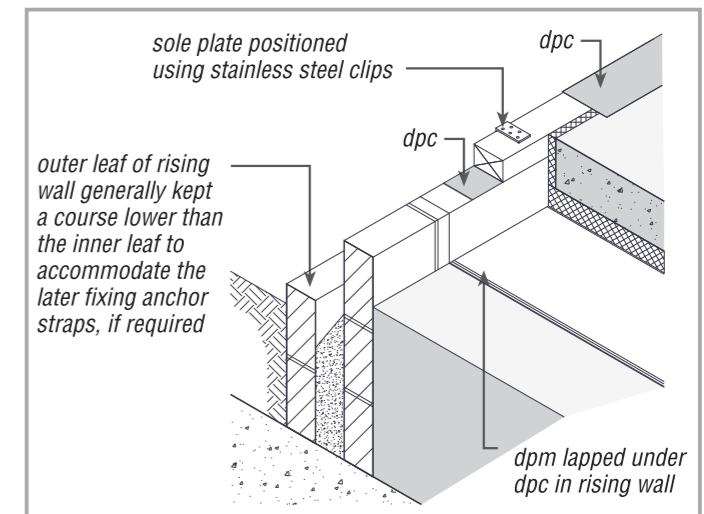
The most common type of foundation is the continuous concrete strip formed centrally under load-bearing and external walls depth, thickness and width of all foundations are dependent on the nature of the ground that the foundation bears on.



Rising walls

The sole (or the panel bottom rail) can be fixed to the rising wall by means of austenitic stainless steel fixing clips located at 1200mm centres; the clips should also be fixed in place with austenitic stainless steel nails. The function of the sole plate is to:

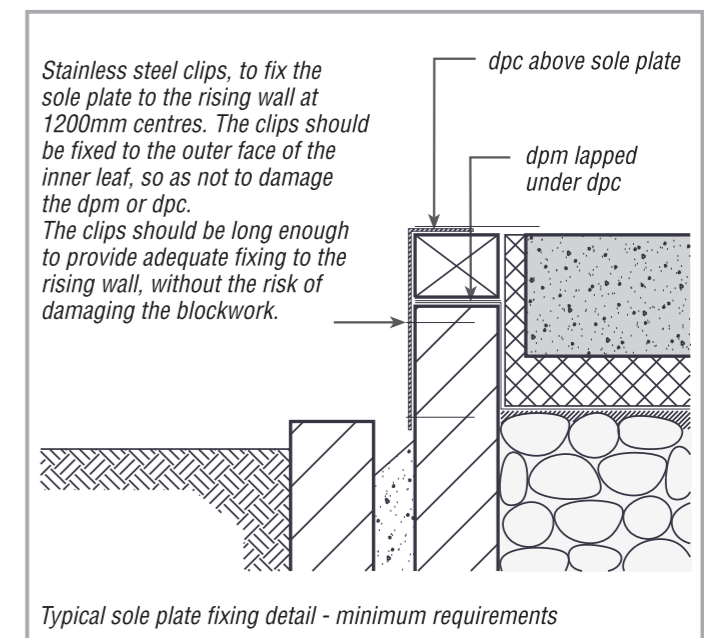
- Provide an accurate positioned base on which the timber frame and any timber suspended ground floor can then be fixed.
- Provide a nailing plate for the timber frame wall panels or ground floor joists.
- Secure and protect the DPC, DPM and/or radon barrier.



The soleplate may be fixed to the rising wall with appropriate nailing. The fixing of the sole plate (whether austenitic stainless steel nails or fixing clips) should be in accordance with the Site Fixing Schedule supplied by the timber frame manufacturer.

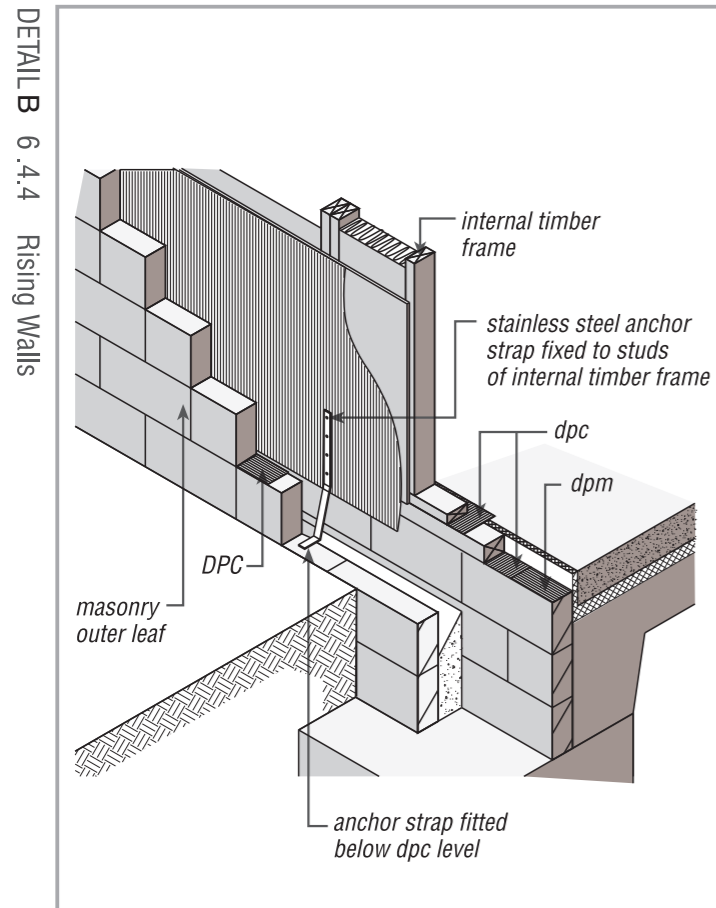
Sole plates should be pressure treated with preservatives. See *Designing for Durability in Section A4*.

The cavity void in timber frame construction must be drained and ventilated. This can be achieved by providing the equivalent of 1 open brick perpend (about 650mm² normally by the use of proprietary ventilators providing both functions) at 1500mm horizontal centres below DPC level in the external masonry leaf. These ventilators must be kept free of debris such as mortar droppings as should the wall cavity in general. It is also usual to provide wall vents at eaves level and if specified by the building designer on either of a cavity barrier at compartment floor level. The centres of the vents can be in proportion to the area of the vents but in general weep holes should not exceed 1500mm.



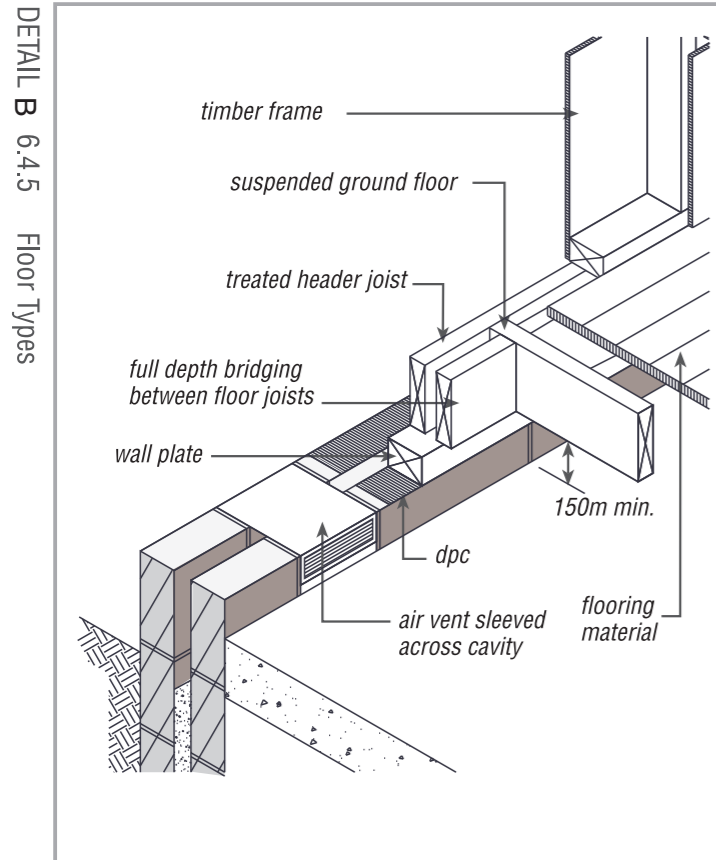
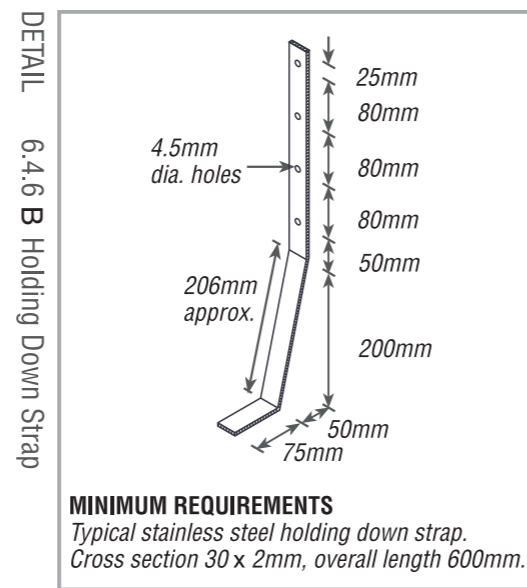
Typical sole plate fixing detail - minimum requirements

B 6.4 TIMBER FRAME - FOUNDATIONS/SUBSTRUCTURE (CONTINUED)



Rising walls (continued)

In certain cases timber frame wall panels may need to be anchored into the external masonry leaf, by means of stainless steel straps fixed to full height studs. The bend at the bottom of the strap bridges the cavity and is embedded into a horizontal bed joint, generally in the course below DPC level. It is recommended that anchor straps are located on either side of openings and at external corners and at a maximum of 1800mm or 1600mm centres depending on the stud spacing. The Site Fixing Schedule may detail additional holding down straps and may include the use of straps at higher levels.



Floor types

Timber-frame dwellings can be built with all the common types of ground floor. The selection of appropriate floor type will depend on a number of factors including:

- End user requirements.
- Site conditions.
- Insulation standards.
- Contractor's preference.
- Availability.
- Cost.

B 6.5 TIMBER FRAME - EXTERNAL WALL COMPONENTS

The external walls consists of three elements, the load bearing timber frame inner leaf, the ventilated cavity and the external non-load bearing masonry leaf. As an alternative to masonry cladding appropriate timber cladding fixed to vertical battens, or render on stainless steel mesh, can be used, (see B8.1 to 8.4 cladding). Any proprietary rain screen should have been assessed by an appropriate body such as the Agrément Board.

Timber framing

The function of the timber framework is to:

- act as the vertical load bearing skeleton of the external wall.
- resist lateral wind loads.
- provide a framework for the fixing of sheathing, internal linings, etc.

Vertical loads on the wall panel such as those from floor joists or roof trusses should occur over the studs or be offset from the centre-line of the stud by no more than the stud thickness. Where walls are made up of a series of smaller a head binder should be used to connect the panels together; head binders should generally be positioned and fixed on site. A top/head rail and head binder allows generally loads from floor joists, rafters etc., to be borne between studs. Heavier loads from trimmers, beams etc., may require additional support.

Noggings

Generally are not required for structural purposes. Where they are used their function is to:

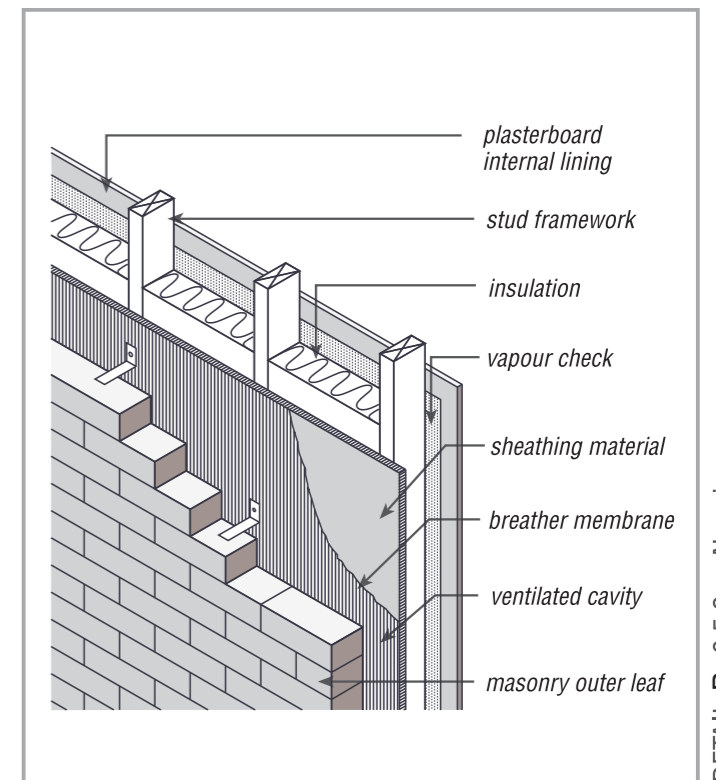
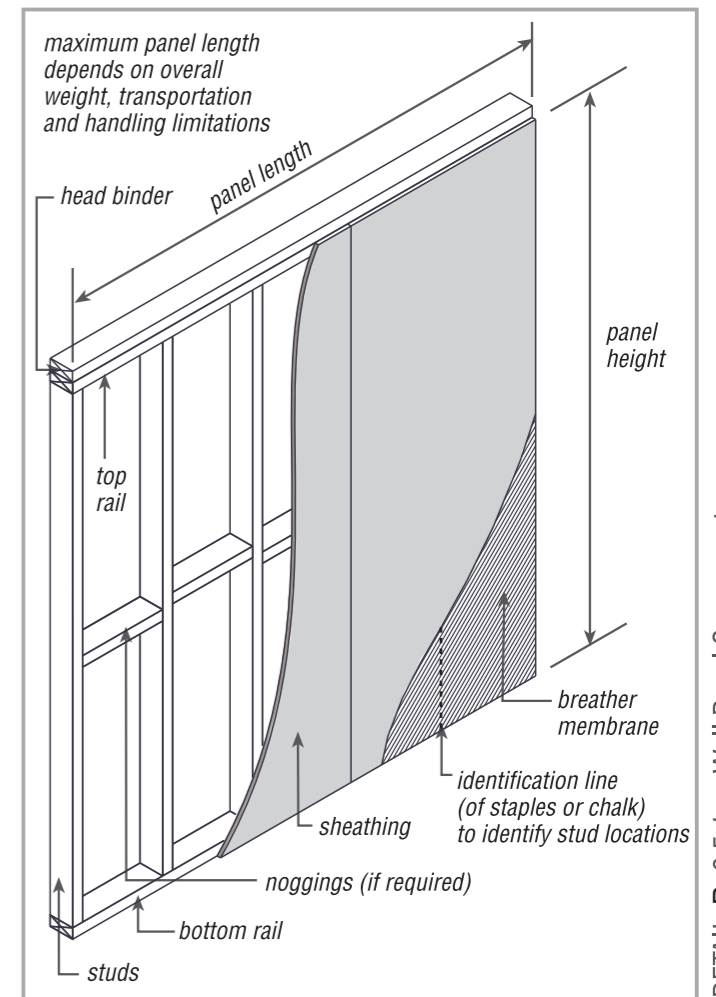
- provide support for partitions and/or plasterboard sheet edges.
- provide support for fixings and fittings.
- resist buckling of studs.
- support joints in external sheathing.

Sheathing

The function of sheathing is to :

- provide the necessary stiffness to resist lateral loads.
- resist wind penetration of the structure.
- enclose and support wall insulation.
- provide a solid background onto which the breather membrane is fixed.

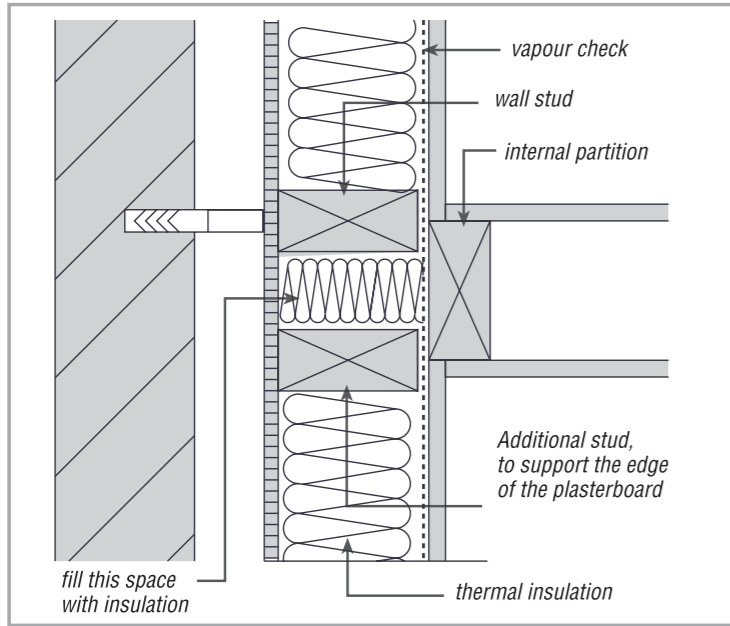
Appropriate sheathing materials include sheathing grade plywood and oriented strand board (OSB3). Sheathing materials should have an appropriate certificate of approval from a body such as the Agrément Board and/or conform to EN 13986 (for permissible stress designs to BS 5268-6 reference should also be made any requirements specified in BS 5268-2); other methods of proving their suitability such as a valid ETA and CE marking (to EN 13986) may be acceptable (depending on the claimed end use and other marks e.g. plywood should bear the mark EN 636-2 or EN 636-3). All sheathing materials must be suitable for their end use.



Where buildings are near the sea, sheathing fixings may need to be of austenitic stainless steel and/or a reverse wall construction used.

B 6.5 TIMBER FRAME - EXTERNAL WALL COMPONENTS (CONTINUED)

DETAIL B 6.5.3 Plan View of Typical Wall Junction



Thermal insulation

Improved 'U' values may be obtained by using a more efficient thermal insulation as well as by increasing the stud depth to allow extra insulation to be fitted.

Vapour check

By fitting a vapour check between the internal wall and warm side of the insulation the amount of water vapour passing through the wall and the likelihood of interstitial condensation occurring in the timber frame structure will be greatly reduced.

Suitable vapour checks commonly include 500-gauge un-recycled polythene. The use of vapour check plasterboard (which tend to have a considerably lower resistance to the passage of water vapour than polythene) is not recommended unless a condensation risk analysis is carried out.

Breather membrane

The external face of the sheathing material must be covered with a breather membrane. Its function is to protect the frame until the external cladding is complete and to provide a second line of defence against wind driven rain or moisture which may penetrate the outer cladding. The breather membrane must be waterproof but permeable to allow water vapour passing out through the inner leaf to enter the ventilated cavity.

It is recommended that the breather membrane should have a vapour resistance less than 0.6 MNs/g and comply with the requirements of BS 4016.

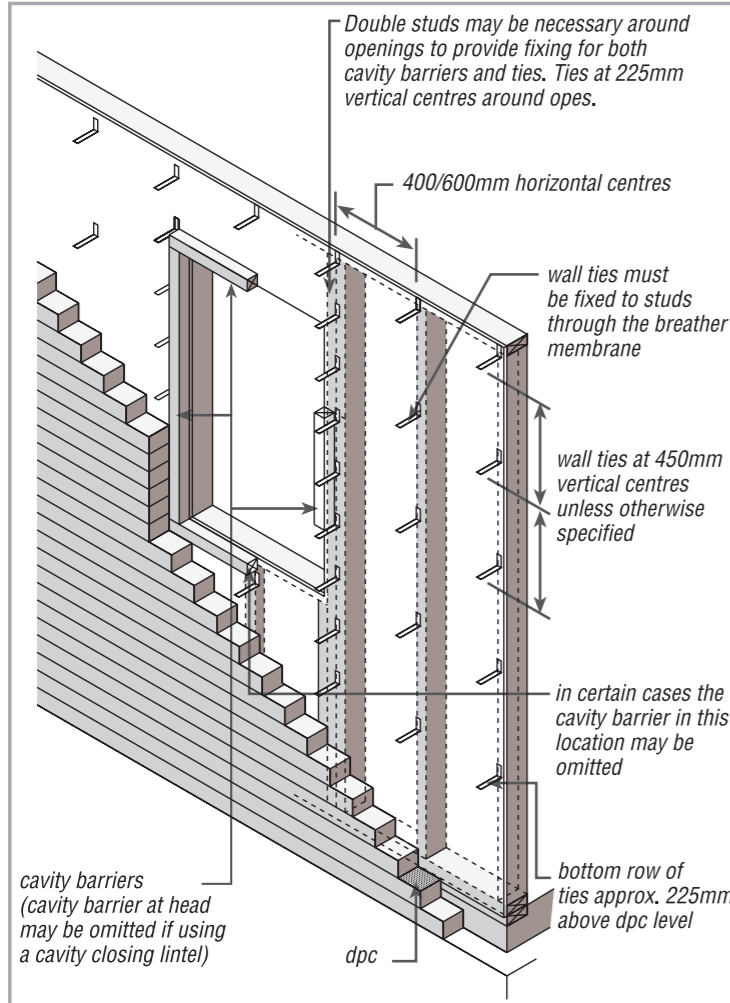
Wall ties

To assist the fixing of wall ties to studs the stud locations are usually identified on the outer surface by an indelible line, a line of staples or a tape of a different colour to that of the breather membrane.

Wall ties should have been tested to the relevant standards outlined in EN 845 and be manufactured from austenitic stainless steel (or a material with a similar degree of corrosion resistance). Wall ties should be nailed to the timber frame at stud locations and should not be fixed to the sheathing material only. The appropriate wall ties and fixings are usually supplied by the timber frame manufacturer.

Wall ties are generally spaced at 450mm vertical centres, horizontally at stud centres (usually 400 or 600mm), and at 225mm vertical centres around openings and at expansion joints, unless otherwise specified. Wall ties must always be appropriate to the width of external wall cavity in which they are used.

DETAIL B 6.5.4 General Arrangement



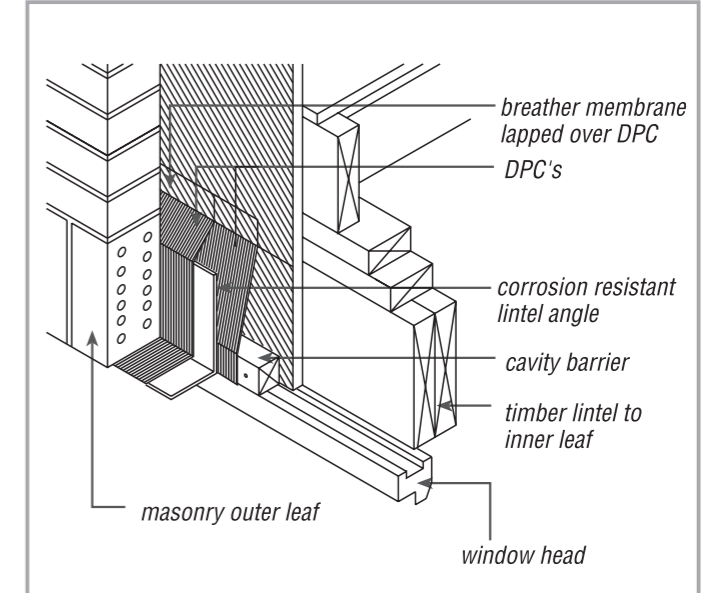
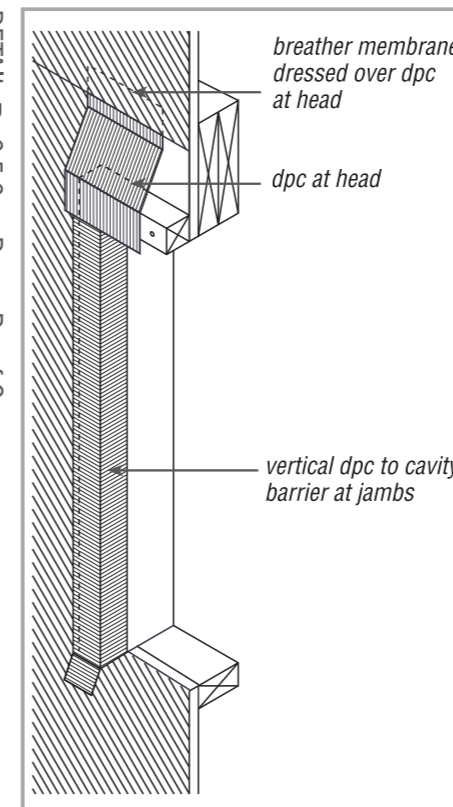
B 6.5 TIMBER FRAME - EXTERNAL WALL COMPONENTS (CONTINUED)

Damp proof course (DPC)

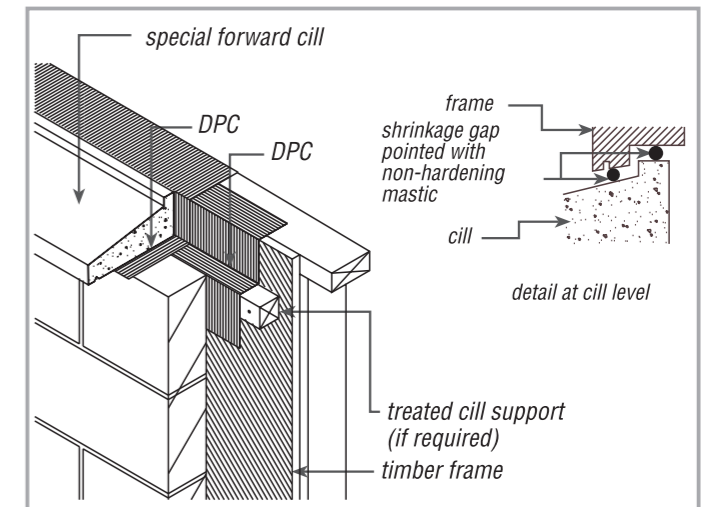
Timber frame panels usually come with a damp proof course fixed to their underside. The laps in the DPC at the panel ends should be released and used to provide a continuous barrier to moisture. The damp proof membrane (DPM and or Radon barrier) should be lapped with the DPC on the bottom of the sole plate across the full width of the internal wall leaf.

Damp-proof courses should be provided at all external openings and to all timber cavity barriers.

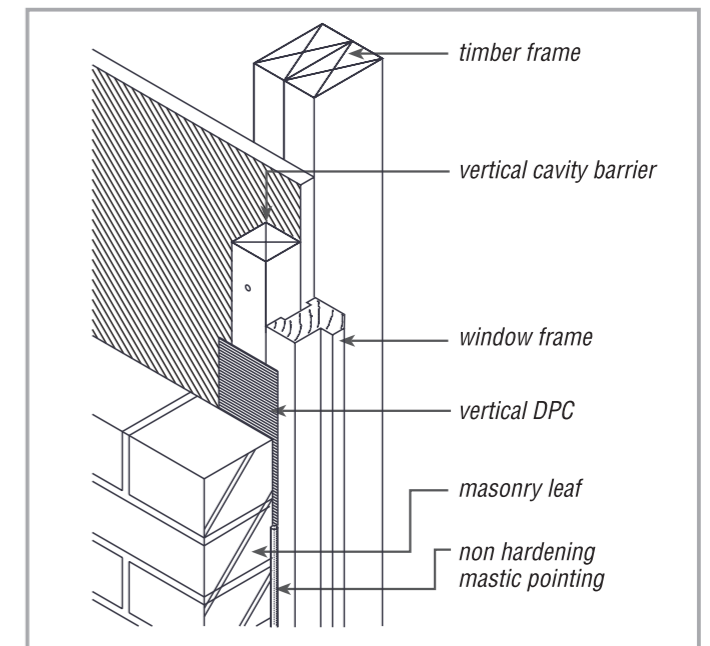
DETAIL B 6.5.9 Damp Proof Course



DETAIL B 6.5.6 Jamb Detail



DETAIL B 6.5.7 Cill Detail



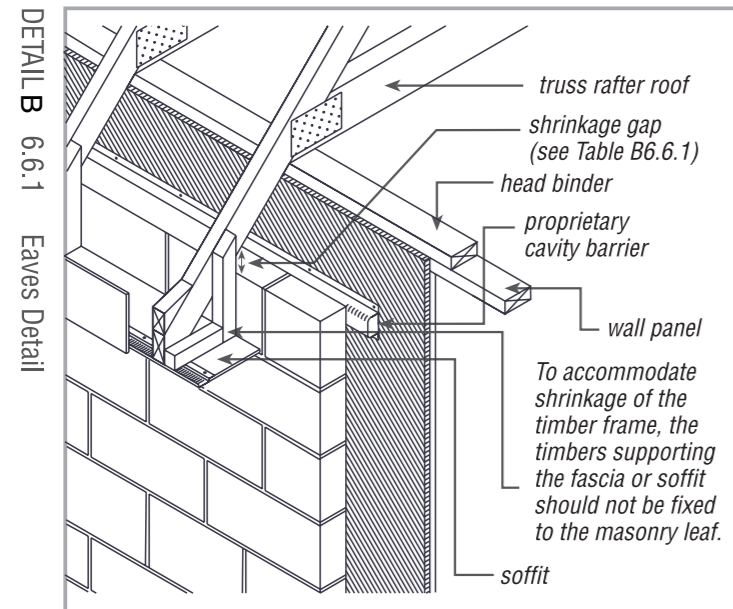
DETAIL B 6.5.8 Side Detail

Provide damp-proof course to the bottom, back and sides of all window sills.

Damp-proof courses must be provided to all steel lintels and lintel angles. The breather membrane must be dressed over the damp proof courses provided to the lintel.

The DPC should always be fixed so as to shed water away from the frame.

B 6.6 TIMBER FRAME - EXTERNAL WALLS



Eaves detail

At eaves, the soffit board should not be carried over the top of the masonry leaf. To accommodate natural shrinkage of the timber frame, a gap should be left between the roof timbers and the top of the masonry outer leaf. Typical dimensional requirements for this gap are outlined in Table B6.6.1.

Verge detail

Typical verge detail formed with gable ladder is shown in Detail B6.6.2. To accommodate natural shrinkage of the timber frame, a gap should be left between the roof timbers and the underside of the gable ladder. Typical dimensional requirements for this gap are outlined in Table B6.6.1.

Shrinkage

To accommodate natural shrinkage of the timber frame, provide a gap at the locations indicated, dimensions of which can be taken from Table B6.6.1 below.

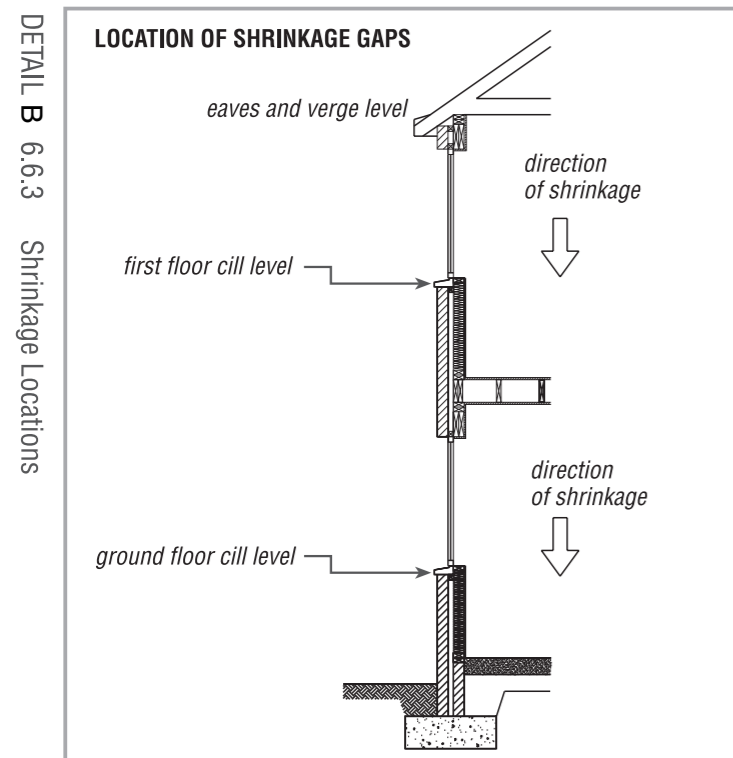
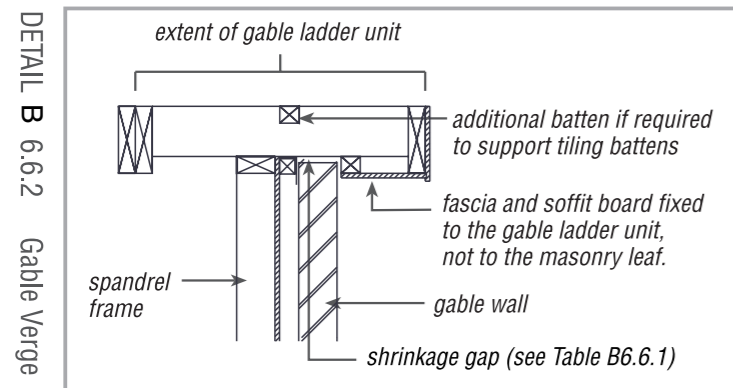


Table B6.6.1 Typical dimensional allowances for shrinkage gaps

	TYPES OF FLOOR CONSTRUCTION	
	Suspended timber ground floor *1	Other ground floor construction *2
allowances for ground floor openings	5mm	3mm
allowances for first floor openings	12mm	9mm
eaves and verge for a single storey house	8mm	6mm
eaves and verge for a two storey house	15mm	12mm

*1 Where wall panels are supported on timber ground floor joists or perimeter joists

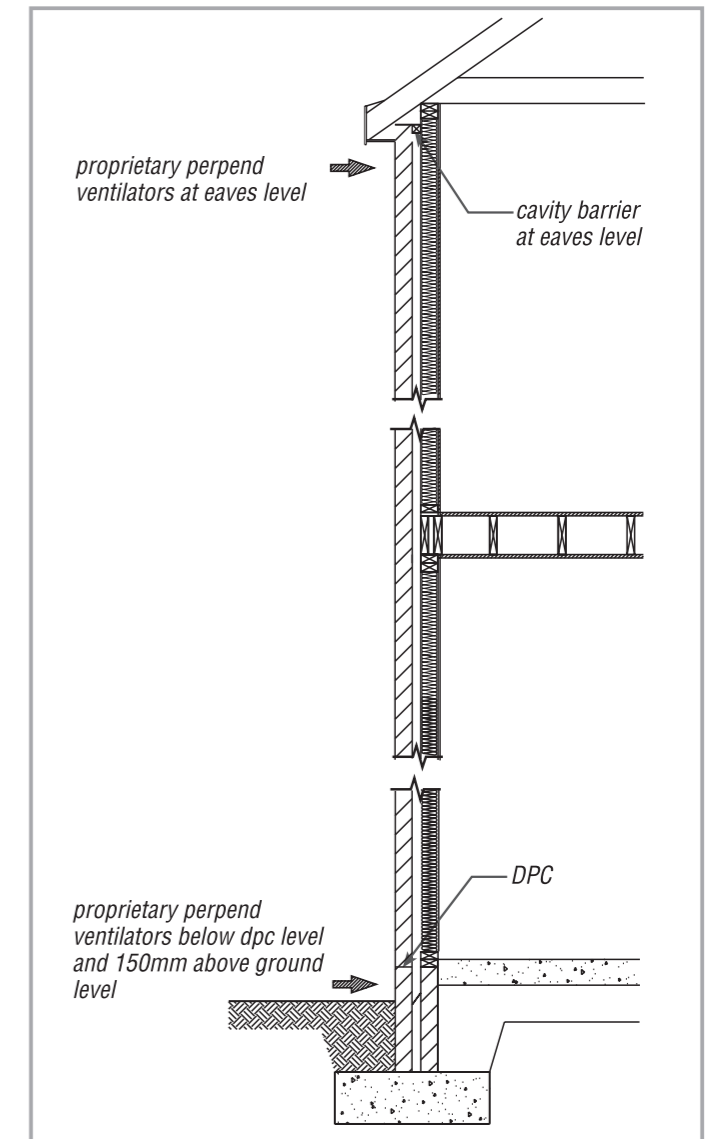
*2 i.e. where there is no movement associated with the ground floor or substructure.

B 6.6 TIMBER FRAME - EXTERNAL WALLS (CONTINUED)

Cavity ventilation

The external wall cavity in timber frame construction must be ventilated in order to dissipate any moisture that may enter the cavity. Ventilation is generally provided by a proprietary perpend vents (i.e. about 10mm by 65mm) fitted at 1500mm horizontal centres in the masonry outer leaf in the locations indicated in Detail B6.6.4. Consideration must also be given to the location of cavity barriers as set out in Section B6.12.

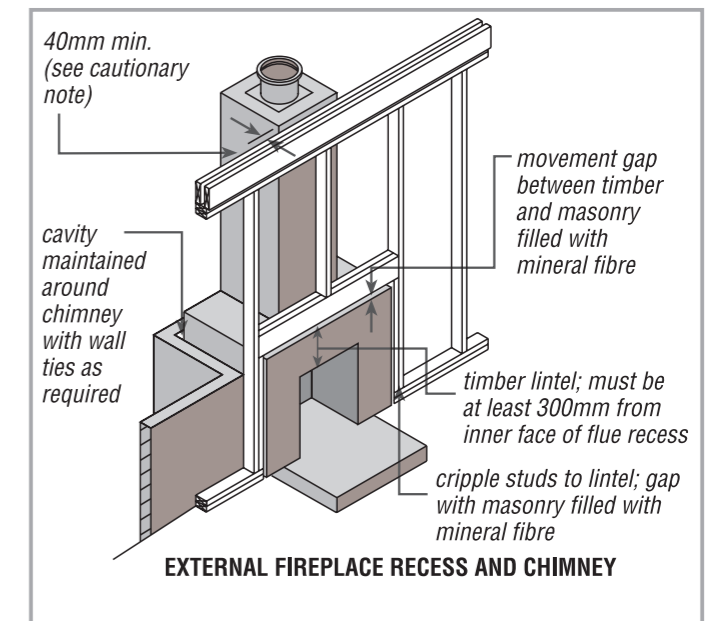
Often the proprietary cavity vents also act as weep holes and allow liquid water to escape. In some situations weep holes may be necessary in other locations such as over doors and windows. If larger vents (that the open perpend) are used at greater centres to give an equivalent area per metre) then weep holes should be provided at close centres.



Fireplaces and chimneys in external walls

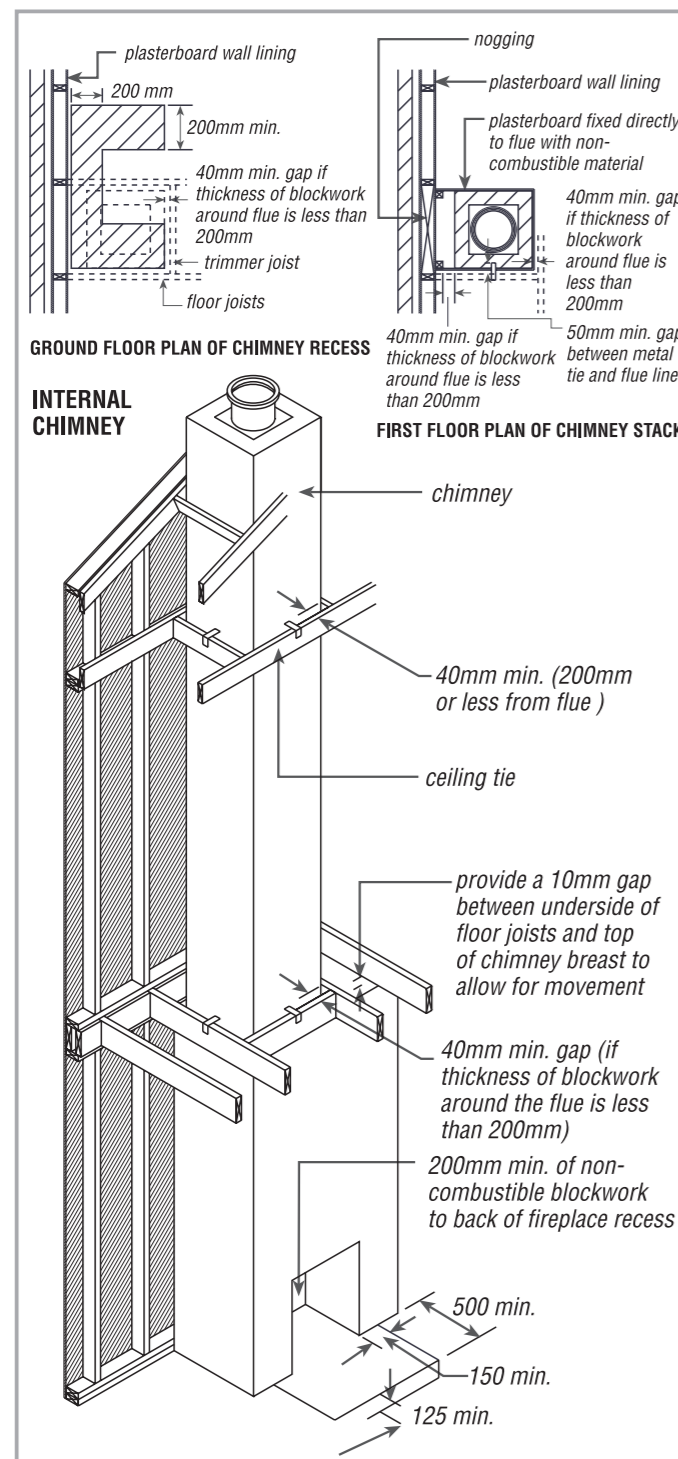
Generally there are two main methods of constructing chimneys in external walls.

The fireplace and chimney stack can be located on the outside of the timber frame external wall panel. (See Detail B6.6.5) The fireplace is in a preformed aperture in the timber frame wall panel. The structural integrity of the timber frame is maintained and specially trimmed openings in the roof are avoided.



B 6.6 TIMBER FRAME - EXTERNAL WALLS (CONTINUED)

DETAIL B 6.6.6 Fire Places & Chimneys



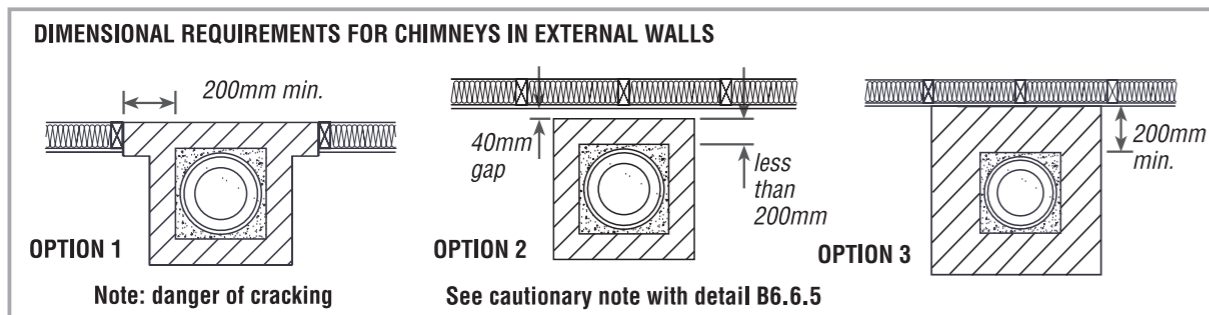
Fireplaces and chimneys in external walls (continued)

The fire place and chimney stack can also be built inside the room usually after the internal linings have been fixed. This type of construction requires that the floor and roof members be trimmed around the chimney stack (see Detail B6.6.6). Care should be taken at roof level when detailing flashings around the chimney to allow for movement of the timber frame. Where metal ties are required between the chimney stack and the floor and the roof timbers, these should be fixed in accordance with the chimney manufacturer's or design engineers' recommendations.

If the wall, floor or roof timber members are less than 200mm from the chimney flue there should be at least 40mm between these members and the chimney. More information is given in *Technical Guidance Document J*.

Where the chimney is built before the plasterboard or fire linings are put in place then there is a danger of the linings not being properly fixed; this is a particular risk for ground floor walls.

DETAIL B 6.6.7



B 6.7 TIMBER FRAME - SUPPORT TO OPENING LINTELS AND TRIMMER BEAMS

Lintels within timber frame panels

Openings in load-bearing wall panels will include a lintel at the head of the opening to transmit loads to cripple studs on either side of the opening. The number of cripple studs required depends on the size of the opening and the load being carried by the lintel.

Detail B6.7.1 shows typical load-bearing lintels in an external wall panel.

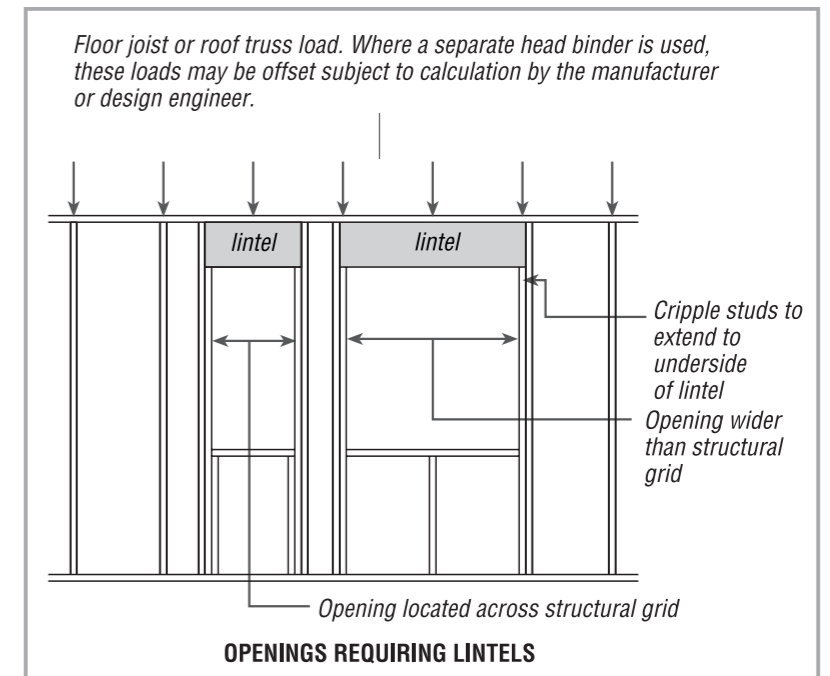
Detail B6.7.2 shows how heavy point loads from trimmer joists, multiple trusses, beams etc., are transmitted to the foundations by means of additional studs. The number of studs required is determined by calculation.

Detail B6.7.3 shows a typical load-bearing lintel in an external wall panel.

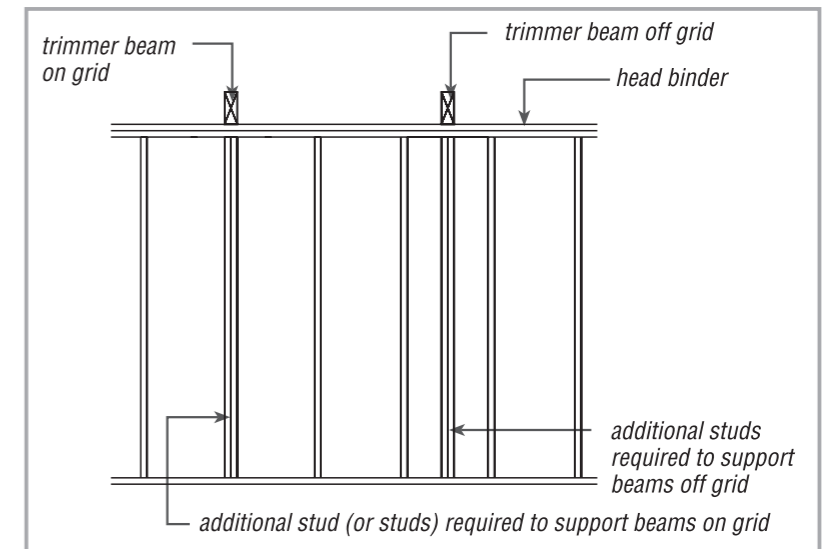
Occasionally steel columns may be required to transmit loads to foundations.

The timber frame panels will arrive on site with the stud supports already in place. Where studs are added on site (through error in manufacture or through mis-placement of the panel on site) they must be added in accordance with the timber frame manufacturer's instructions. Generally the sheathing should be fixed to all loose studs. If the sheathing cannot be accessed for nailing then all loose studs should be fixed together and timber bridging should be inserted between the additional studs and those held in place by the sheathing.

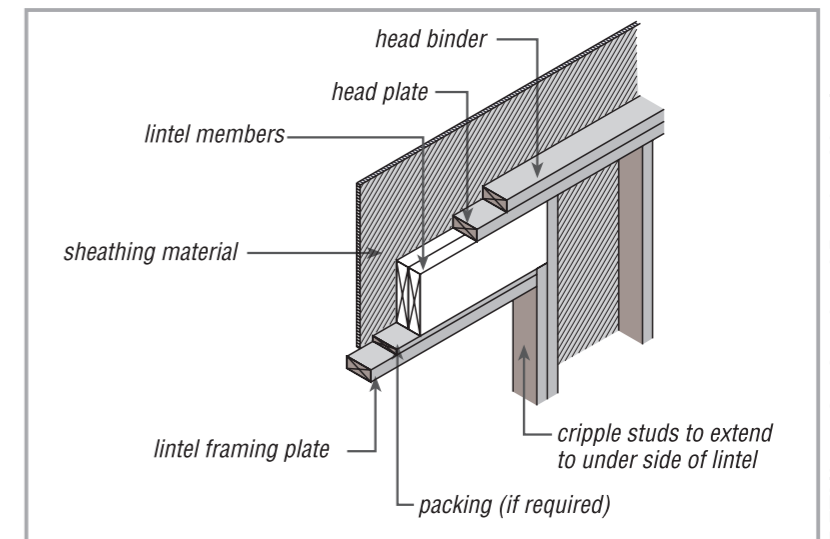
It is always a good idea to walk through a timber frame building and make sure that there is timber in place to transfer loads through floors and into lower wall panels. Multiple studs in an upper wall panel should normally have multiple studs directly below them in the lower wall panel and timber within the floor to transfer loads. A check should also be carried out at the same time to ensure that there is enough timber for plasterboard support and fixing.



DETAIL B 6.7.1 Lintel Opening Supports



DETAIL B 6.7.2 Trimmer Beam Supports



DETAIL B 6.7.3 Load Bearing Lintel

B 6.8 TIMBER FRAME - PARTY WALL CONSTRUCTION

Party walls are normally formed by two independent wall frames. Detail B6.8.1 illustrates a typical vertical section through a party wall in a two-storey semi-detached or terraced house. The function of the party wall is to provide an effective barrier against fire and sound transmission.

- The party wall should be completely imperforate. Gaps, irrespective of size, should be fire stopped (and acoustically sealed as well if necessary).
- The two leaves of the party wall must be unconnected for their full height. Light weight thin metal ties may be used at 1.2m centres (usually as an aid to erection) subject to agreement with the timber frame manufacturer. There may be proprietary products that transfer load across party walls, care should be taken that they do not permit sound transferral.
- Electrical sockets, switches, services, etc., should not penetrate or be fixed to the party wall linings. Where services have to be on a party wall, the wall should be battened out to form a services' cavity leaving the main fire and sound protection intact.
- Services, including cables, ducting etc., must not be located in the party wall cavity.
- Adequate fire stopping must be provided at roof level (see Details B6.8.1 and B6.8.3).
- Note that HomeBond does not permit conventional masonry chimneys in timber frame party walls.
- Sound insulation quilt should be fixed to at least one of the party wall frames and it should be held in place.

The combined width of the two frames should not be less than 220 mm (i.e. face of stud to face of stud; two 90mm studs plus a 40mm cavity) but a width of 250mm is recommended for improved sound insulation.

For fire stopping, use wire reinforced rock fibre which must be thicker than the cavity to ensure that it completely seals the space (e.g. 65mm fire stop in a 50mm cavity).

The cavity at the top of the party wall must be closed and the wall/roof junction fire stopped. This is usually achieved by covering the top rail of the party wall spandrel with a 9mm non-combustible building board, which should extend over the width of the party wall.

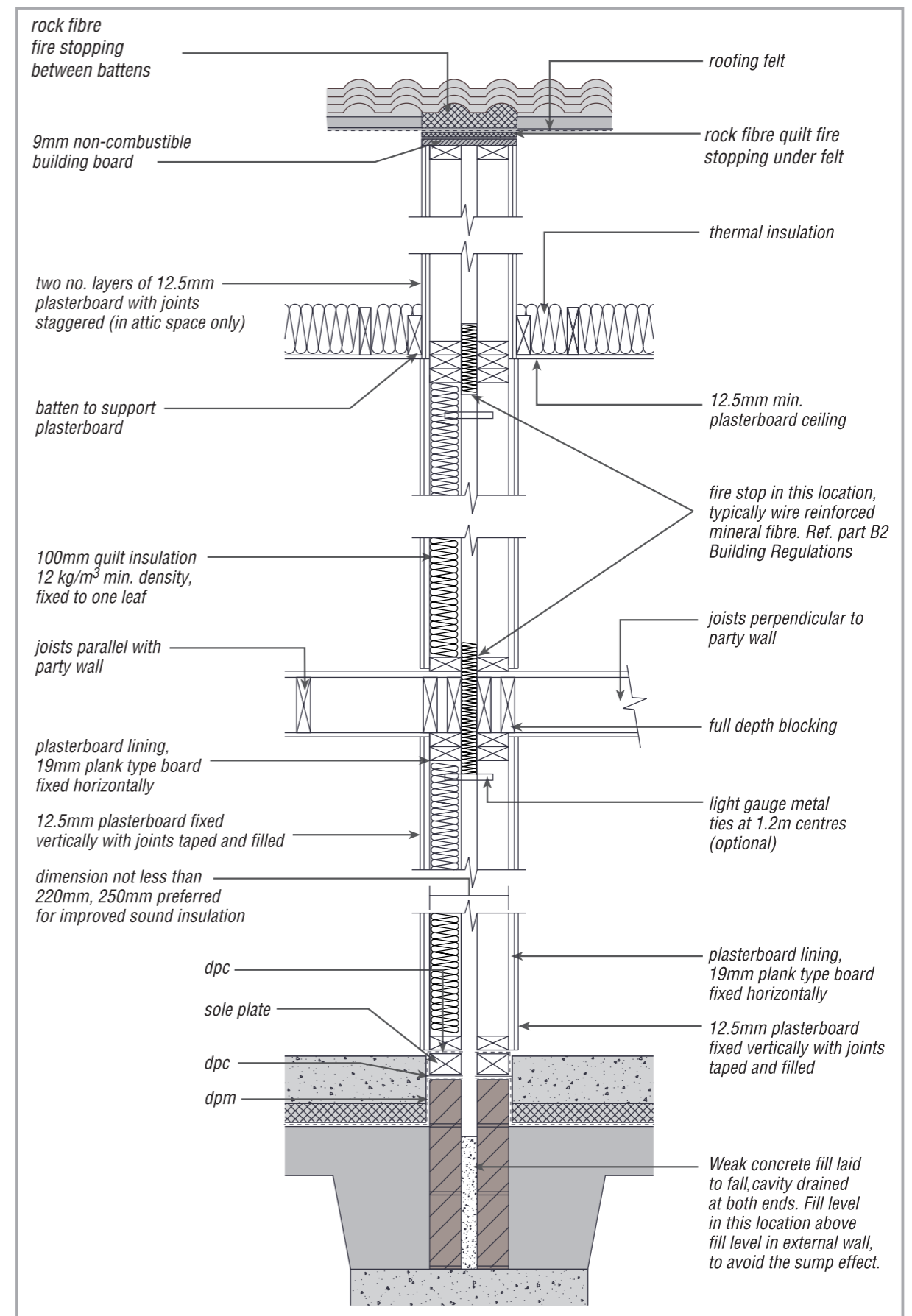
The good sound performance of timber frame party walls depends on a number of factors:

- The structural isolation the two leaves.
- The use of dense wall linings usually plasterboard in two layers, with a combined minimum thickness of 30mm. In the roof spaces (i.e. between 2 uninhabitable areas) the plasterboard thickness can be reduced to 25mm.
- The use, in at least one leaf, of sound insulation usually glass fibre with a minimum density of 12kg/m³. Thicker and denser insulating material (such as rock fibre) will provide better sound insulation. The insulation must be supported and must be held in place without any gaps.
- The provision of a minimum distance between the inside (room) face of studs of 220mm: However the preferred recommended distance is 250mm.

It is not recommended that ordinary block chimneys be constructed within the party wall. The junction of the chimney with the timber frame is difficult to seal properly for sound and fire requirements. However there are a number of proprietary systems that have Agrément certification and which may be suitable for use in the party wall. There are also prefabricated systems (again a number have Agrément certification) that form a chimney stack on either side of the party wall leaving the party wall intact and some join the chimney stacks together at roof level to form a single stack. The fixing of plasterboard behind these chimneys usually has to be carried out before the chimney is built; at least at ground floor level as the chimney width at ground floor is often greater than the maximum centres for plasterboard fixing (~600mm).

Party walls are required to be braced. This is usually carried out by fixing sheathing (normally plywood or OSB) to the ends of the panels; some manufacturers sheath the panels along the full length of the party wall.

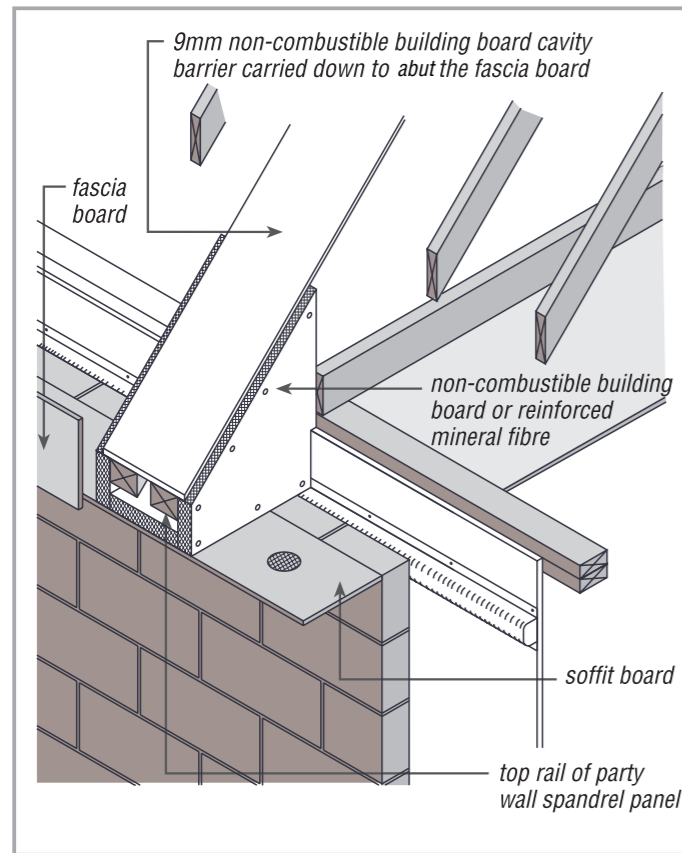
B 6.8 TIMBER FRAME - PARTY WALL CONSTRUCTION (CONTINUED)



DETAIL B 6.8.1 Party Wall Construction

B 6.8 TIMBER FRAME - PARTY WALL CONSTRUCTION (CONTINUED)

DETAIL B 6.8.2 Fire Stopping at Party Wall

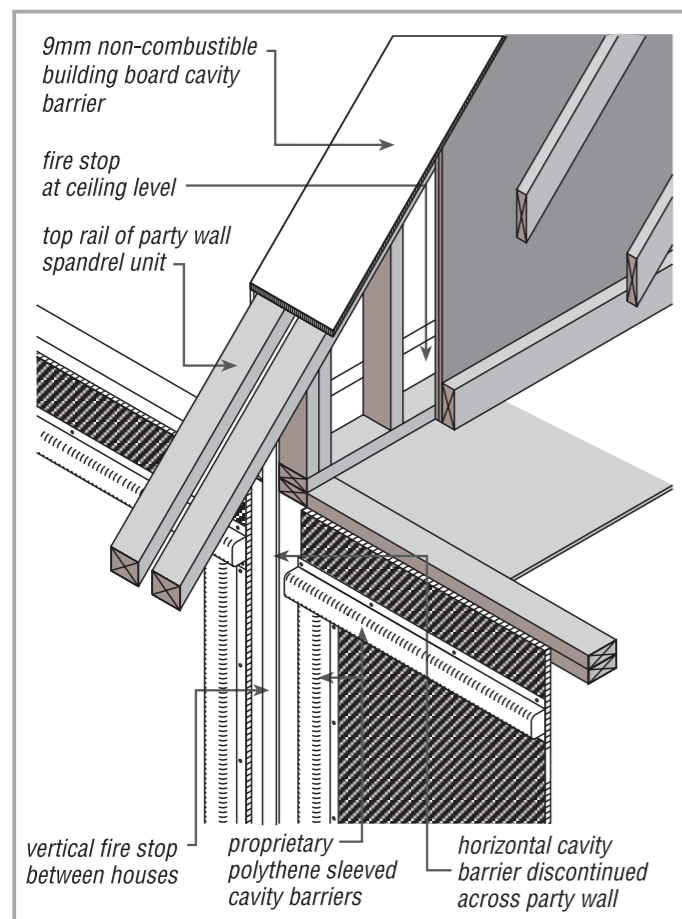


Fire stopping at eaves

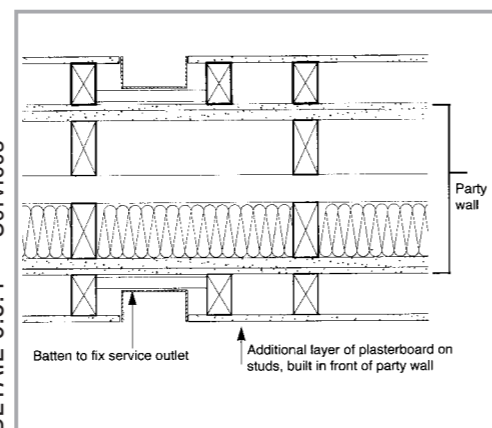
The void formed by the slope of the rafters and the horizontal soffit to the eaves must be adequately sealed against fire spread at each party wall position.

This is usually achieved by nailing 9mm non-combustible building board to a framing around the eaves projection and filling the void with reinforced rock fibre mineral fibre. This is often referred to as the eaves box. (Detail B6.8.2 and B6.8.3).

DETAIL B 6.8.3 Fire Stopping at Party Wall



DETAIL 6.8.4 Services



Services to party wall

Detail B6.8.4 shows an acceptable method for providing services on the party wall. Services must not be built into the party wall and a service cavity must be used (the UK may not be as strict as this but the service cavity is sensible and represents good practice).

B 6.8 TIMBER FRAME - PARTY WALL CONSTRUCTION (CONTINUED)

Fire stopping

The cavity, between the timber-frame party wall and the external masonry leaf, must be closed with vertical cavity barriers (Detail B6.8.5). In addition to the vertical cavity barriers, a vertical firestop seals the junction between the two party wall frames. This is usually achieved by using 65mm thick (providing the cavity is not greater than around 50mm) wire-reinforced mineral fibre quilt, stapled or nailed to each of the frames. This vertical firestop should be carried up to the top rail of the party wall spandrel panel.

A horizontal firestop should be placed at floor level and similar protection placed at roof ceiling level. The fire stop depth should be sufficient to cover the depth of the floor construction. Firestops are required to have a higher degree of fire resistance than cavity barriers.

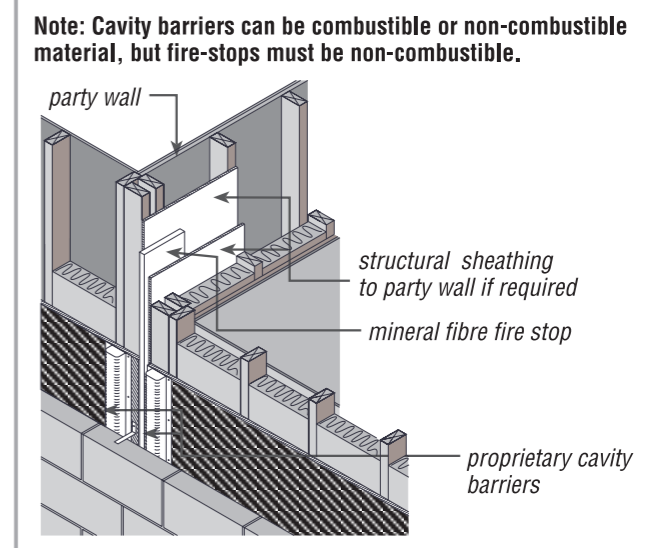
Structural stability

Where additional structural bracing is required, this will usually be in the form of sheathing materials. Generally partial sheathing of the party wall frame is sufficient although in some situations the timber frame designer may require additional sheathing. See Details B6.8.5/B6.8.6.

Sound insulation

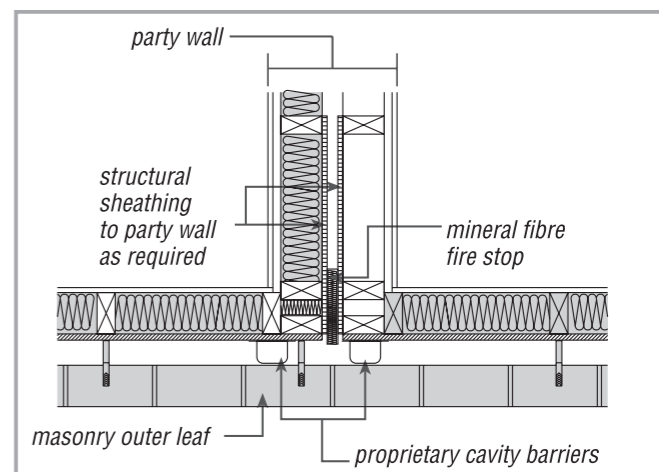
Sound insulation of party walls uses the structural separation of the two separate timber frame leaves, mass (provided by the plasterboard) and sound-absorbent quilt to achieve sound reduction. (Detail B 6.8.7A). This type of construction provides reasonable resistance to airborne sound as outlined in *Technical Guidance Document E (Sound)* and the equivalent Approved Document or the UK. There are also specific details given in the Robust Detail Handbook which might be appropriate to a specific construction.

Where sound resisting floors are required, these may be achieved in a number of ways. Detail B6.8.7B illustrates one such type of construction, a sandwich floor. The mass of the floor and the sound-absorbent blanket reduces airborne sound while the floating layer of the floor serves to reduce the transmission of impact sound. The ceiling should be battened out to form a services cavity; this will protect the integrity of the two layers of plasterboard forming the main barrier to the passage of fire and sound. Detail B6.8.7 should be read in conjunction with Part E of the *Technical Guidance Document* of the Building Regulations (or the relevant Approved Document for the UK).

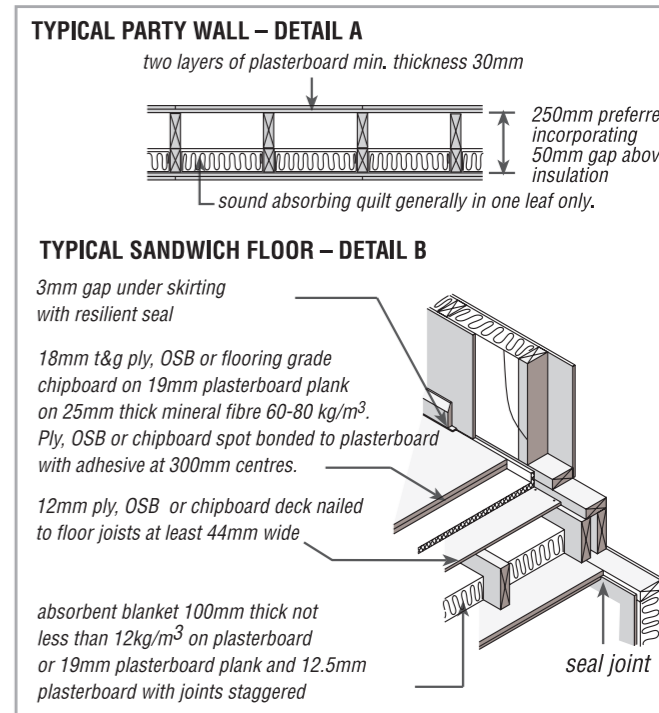


Note: Cavity barriers can be combustible or non-combustible material, but fire-stops must be non-combustible.

DETAIL B 6.8.5 Fire Stopping



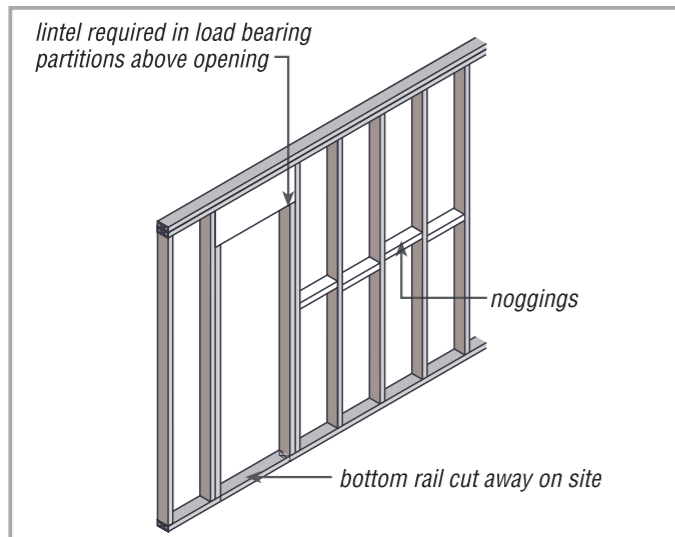
DETAIL B 6.8.6 Structural Stability



DETAIL B 6.8.7 Sound Insulation

B 6.9 TIMBER FRAME - INTERNAL WALLS

DETAIL B 6.9.1 Internal Walls



Internal wall construction is similar to external wall construction, with studs at either 400mm or 600mm centres. Often internal walls will be made with noggings (Detail B6.9.1) at mid-height; these can stiffen the panel for handling, can provide support to plasterboard edges and may be required to resist lateral buckling of the studs particularly for design of fire resistance. Internal load-bearing partitions are generally prefabricated by the timber-frame manufacturer and should be installed prior to the fixing of the ceiling plasterboard. A damp-proof course should be provided to the underside of all ground floor partitions when sitting on concrete or blockwork.

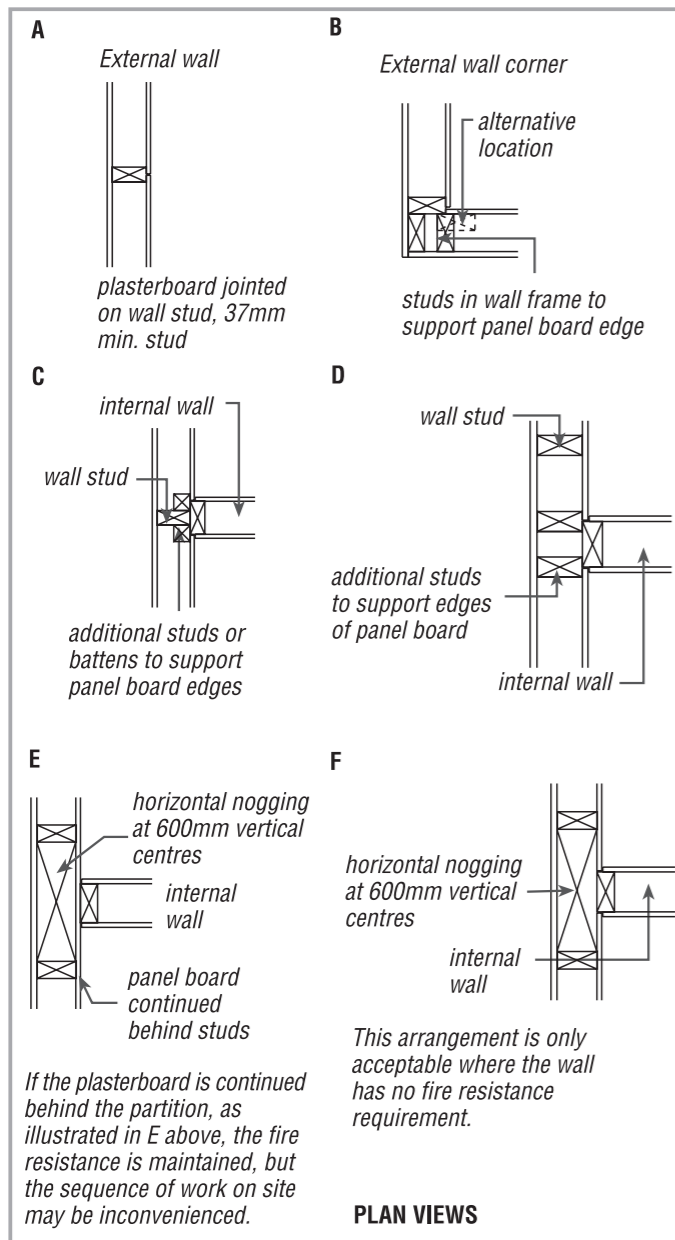
Internal partitions are usually lined with plasterboard, fixed in accordance with the plasterboard and/or timber frame manufacturer's recommendations. Load bearing walls should have the same fire resistance as the floor they support. The following is recommended:

- All plasterboard edges should be timber backed.
- Internal and external corner junctions must be arranged to provide support to both lining boards and may require an additional stud for this purpose. Usually about 20mm of timber is needed to ensure adequate timber and plasterboard edge and end fixing distances.
- Where internal wall junctions occur at stud centre-lines, additional studs or battens may be required to support adjoining board edges.

Screws provide a better fixing than nails and are more resistant to 'nail' popping. In general fixings should be simplified to no more than 2 centres and 2 lengths unless there is good quality control on site.

Care should be taken to ensure that non-load bearing walls do not interfere with the fire resistance of the floor.

DETAIL B 6.9.2 Internal Wall Junctions - Plan Views



B 6.10 TIMBER FRAME - INTERMEDIATE FLOOR CONSTRUCTION

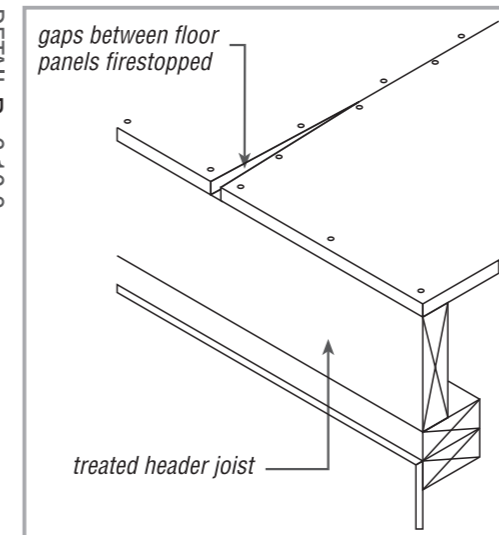
Floor type

The most common type of intermediate floor in domestic timber-frame construction is the platform floor, so called because it acts as a working platform from which the first floor or upper floor wall panels can be erected. The platform floor is generally factory made as a floor cassette.

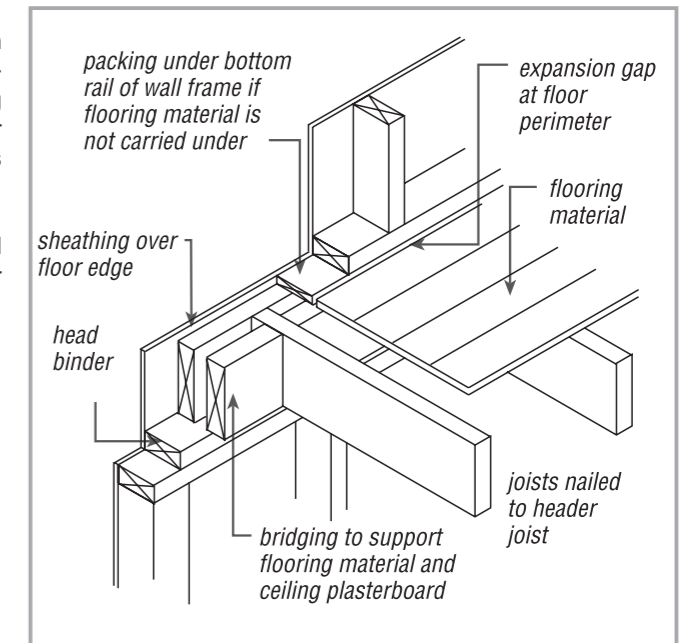
Details B 6.10.1 and B 6.10.2 shows the typical method of supporting a floor beam in a timber frame wall panel, using multiple studs or posts.

Detail B 6.10.2 shows the typical method of supporting a floor beam in a timber frame wall panel, using multiple studs or a post.

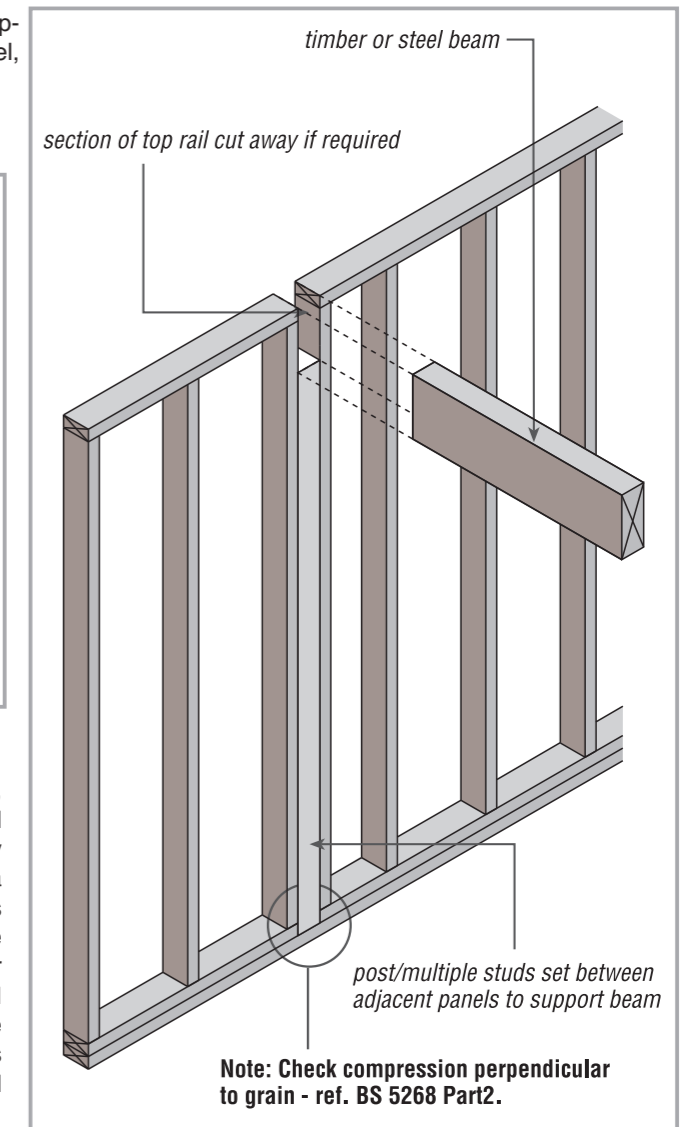
DETAIL B 6.10.3



At party walls any gaps between the floor panels, irrespective of their size, should be fire stopped (and sealed acoustically). In external walls any gaps between panels could be sealed with a waist band (usually OSB forming a continuous band between the first floor wall panel and the ground floor wall panel). Small gaps in the floor sheathing may require to be sealed. (Detail B6.10.3). The exposed header joist should be treated with a timber preservative although this may need to be specified specifically or applied on site (it is not a requirement of I.S. 440).



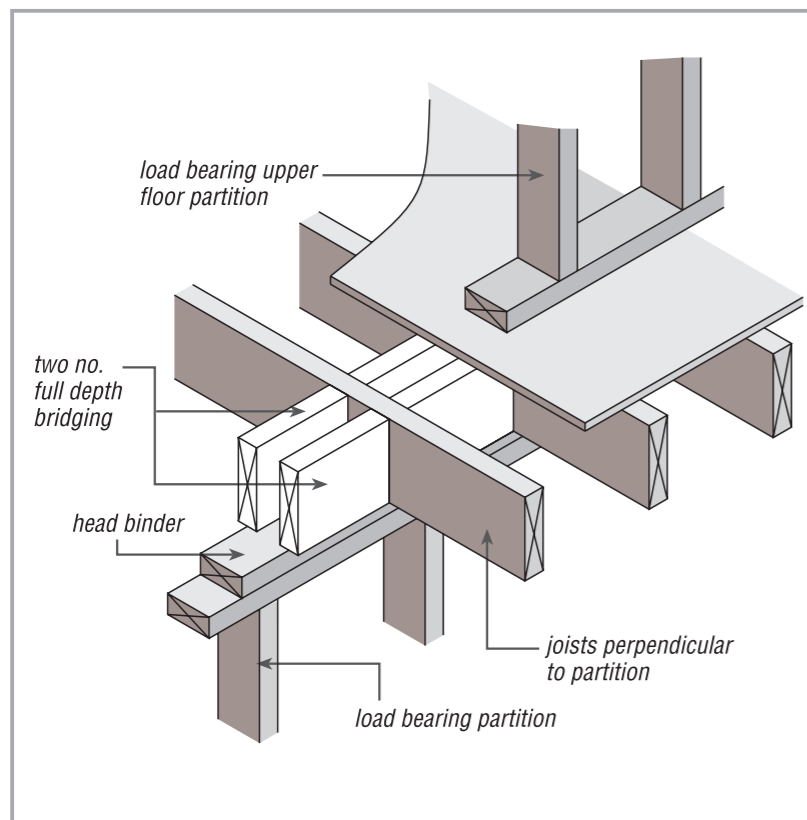
DETAIL B 6.10.1 Floor support on Wall Panel



DETAIL B 6.10.2 Floor Beam Support

B 6.10 TIMBER FRAME - FIRST FLOOR CONSTRUCTION (CONTINUED)

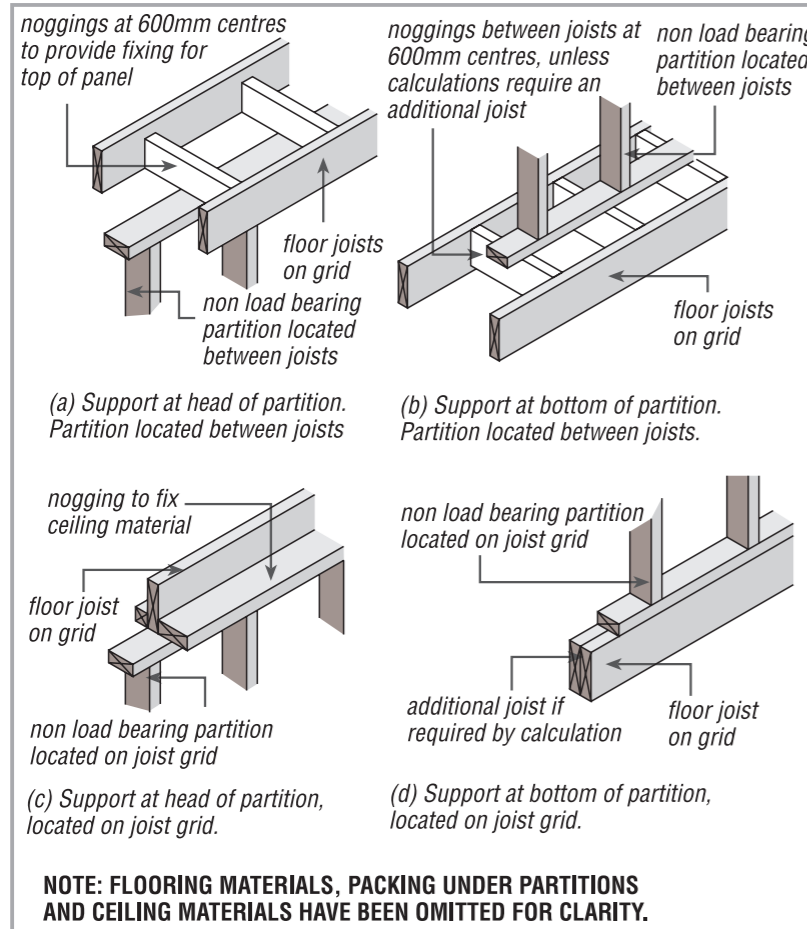
DETAIL B 6.10.4 Load Bearing Partitions



Support to internal partitions

Where load-bearing partitions occur above the floor, additional designed joists (if the partition is parallel to the floor joists) or full depth bridging (if partition is at right angles to floor joists) are normally required to transfer loads to the partition below (Detail B6.10.4).

DETAIL B 6.10.5 Internal Non-load Bearing Partitions



Additional joists may also be required to carry non load-bearing partitions which run parallel to the floor joists. Short lengths of non load-bearing partition can usually also be supported on noggings fixed between joists. The bottom rail of the partitions should be fixed to the joists or noggings (rather than only the flooring).

Internal non load-bearing partitions at right angles to the joist span can normally be carried by the joists, but the additional load of the partition must be allowed for when calculating joist sizes.

NOTE: FLOORING MATERIALS, PACKING UNDER PARTITIONS AND CEILING MATERIALS HAVE BEEN OMITTED FOR CLARITY.

B 6.11 TIMBER FRAME - TYPICAL FIXING SEQUENCE

The timber-frame manufacturer/design engineer should ensure that the site-fixing details specific to the project are supplied to the site. Nails used in the external walls should be corrosion resistant, e.g. galvanised, copper, silicon bronze or austenitic stainless steel. A critical feature of timber-frame construction is the on-site nailing of the various timber components. When site fixing, it is important that the Site Fixing Schedule supplied by the timber frame manufacturer is followed. The recommended minimum site fixing is outlined below, it is a typical schedule and is subject to the supplied Site Fixing Schedule.

• Sole plate to substructure

Sole plate located on rising wall by means of 4mm diameter stainless steel masonry nails at 300mm centres, long enough to provide a minimum penetration of 50mm into the rising wall. Alternatively stainless steel fixing clips located at 1200mm centres may be used. The clips should be long enough to provide adequate fixing into the face of the rising wall without damaging the blockwork (Detail B 6.4.3). The corrosion resistance of the fixings depends on the construction details and the level of risk to the exposure of moisture particularly to rising dampness. Austenitic stainless steel is more corrosion resistant than ferritic stainless steel and is usually recommended in these locations.

• Bottom rail to the sole plate

4mm x 85mm long nails at 300mm centres.

• Stainless steel holding down straps

fixed to the timber frame full length studs through the panel sheathing with the supplied strap manufacturer's stainless steel nails and fixed in accordance with their recommendations: 4 no. nails minimum.

• External panel to external panel

4mm x 85mm nails at 300mm centres, skew nailed and staggered.

• Head binder to wall panel

4mm x 85mm nails at 300mm centres the length should be long enough to provide a minimum of 38mm penetration into the panel top rail.

• Header joist to head binder/top rail

4mm x 85mm nails at 300mm centres, skew-nailed.

• Floor joist to header joist

4mm x 85mm nails 2 no. skew-nailed on each face.

• Blocking pieces between floor joists

4mm x 85mm long nails 2 no. each face, skew-nailed.

• Bottom rail to header joist

4mm x 85mm long nails, skew-nailed at 300mm centres.

• Solid bridging or blocking to joists

4mm x 85mm nails 2 no. each end of blocking skew-nailed.

• Herring bone strutting to joists

3.75mm or 4mm x 85mm nails 1 no. each side, skew-nailed.

• Joists lapped over internal partitions

4mm x 85mm long face nailed.

• Trimmers (i.e. two joists nailed together)

4mm nails at 300mm centres face nailed, long enough to provide 40mm point side penetration into the second joist.

• Flooring material to floor joists

4 no. 4mm x 85mm nails at 300mm centres face nailed and staggered.

• Floor panel to floor panel

3.25mm x 85mm nails at 300mm centres face nailed and staggered.

• Trussed rafter to head binder or top rail over studs

Proprietary truss clips fixed in accordance with manufacturer's instructions or 2 no. (1 no. each side) 3.75mm x 85mm long nails skew-nailed so as not to damage the nail plate.

• Bottom rail of spandrel panel to top rail/head binder of panel below

4mm x 85mm long nails face nailed at 300mm centres.

• Gable ladder to spandrel panel

4mm x 85mm long nails 2 no. each side of gable ladder bridging pieces, skew-nailed.

• Plasterboard fixings to party walls

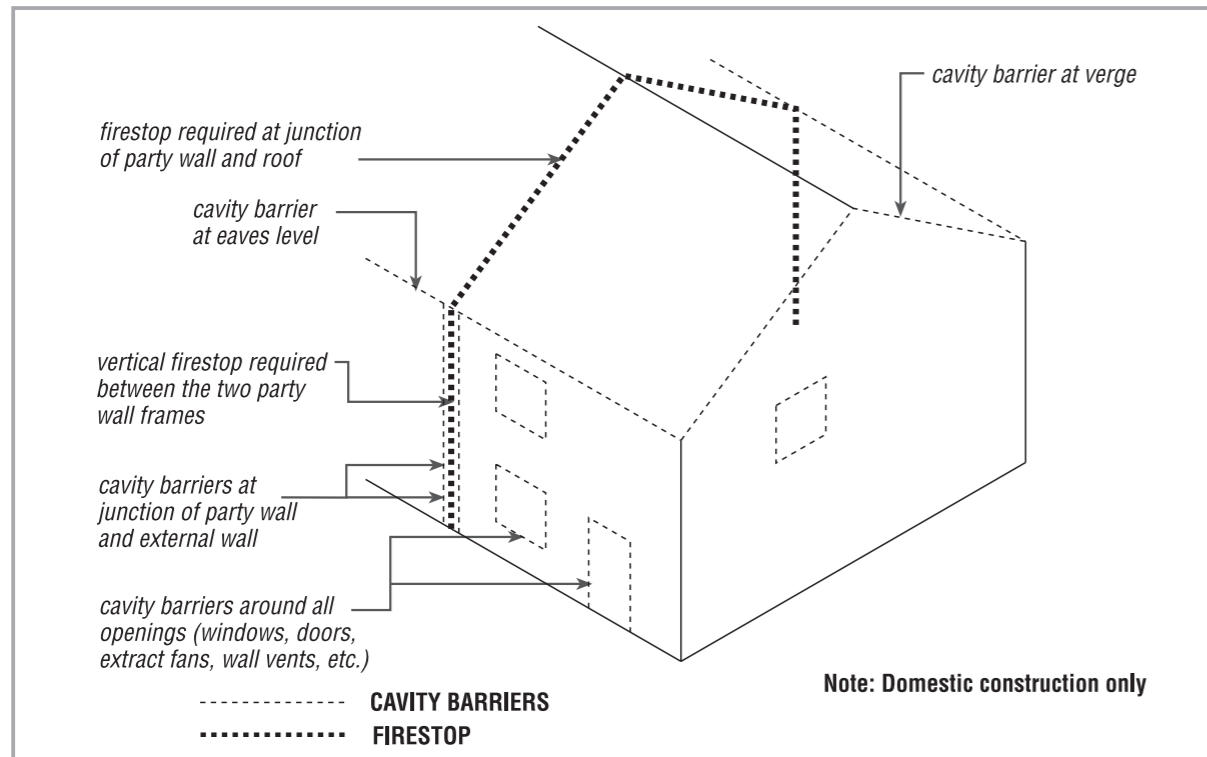
Single layer 12.5mm plasterboard laid vertically, 2.65mm x 40mm nails at 150mm centres. All plasterboard edges must be backed by timber. See also B6.12

• Plasterboard fixings to walls

All plasterboard edges should be backed by timber. Between habitable rooms: 19mm plank type plasterboard laid horizontally, 2.65mm x 50mm at 150mm centres; 12mm plasterboard laid vertically 2.65mm x 65mm long at 150mm centres. Between roof spaces: 12.5mm board. 2.65m x 40mm at 150mm centres; 12.5mm board on 12.5mm board 2.65mm x 50mm at 150mm centres. Stagger the vertical plasterboard joints. See also B 6.12.

Timber splitting can be reduced when hand nailing if the nails are blunted. Care should be taken to ensure that fixings actually go into timber and that they have adequate edge and end distances. Generally skew nailing should be used rather than face nailing (except when fixing plasterboard) especially when fixing panels together; skew nailing will help pull the panels together, however skew nailing will require longer nails. The fixings on site should be checked with what's specified in the Site Fixing Schedule and either the schedule should be altered (by the timber frame manufacturer and designer) or the correct nails obtained.

B 6.12 TIMBER FRAME - FIRE SAFETY



DETAIL B 6.12.1 Cavity Barriers & Fire Stops

Fire safety requirements for timber frame houses are the same as those for all other forms of house construction.

Fire resistance is a major means of specifying the performance of a building element (typically walls, floors and beams) in fire. Fire resistance is usually specified in minutes or hours; elements of a domestic dwelling are usually required to have a fire resistance of 30 minutes except for party walls (and compartment walls) which are required to have a fire resistance of 60 minutes.

Compartment floors (e.g. in an apartment) are required to have a minimum fire resistance of 60 minutes as are any elements supporting the floor (e.g. internal load bearing walls or external walls). Requirements for cavity barriers and fire resistance in *Technical Guidance Document B* vary with the building purpose group and the building height.

Fire resistance has 3 components: Stability, integrity and insulation. Stability means that the element will still be in place and able to carry load at the end of the specified period of fire resistance. Integrity refers to the passage of fire and smoke while insulation refers to the temperature rise on the unexposed face of the element.

The fire safety requirements for buildings are largely set out in *Technical Guidance Document B* and the equivalent UK Approved Document (there are some differences between the requirements for Ireland and the UK).

There are essentially three ways to demonstrate the adequate fire resistance of a component and particularly the plasterboard element; either by design, assessment or by fire test. Assessments are usually based on fire tests of similar components and perhaps design as well. Fire tests are either to the European Standards or to the relevant BS 476 part; the European Standards apply to designs to Eurocode 5 and the BS 476 tests apply to designs using BS 5268.

EN 1995-1-2 can be used for fire design (including the fire resistance of plasterboard) although it is probably more usual to use a mixture of the design standard and plasterboard fire tests. Designs to BS 5268 can use BS 5268 Part 4.1 and/or 4.2 to calculate fire resistance and the approaches are not too different to those in the EN.

Due to slight differences between the EN and BS fire tests there are slight differences in the specification of plasterboard. For designs based on fire tests, designs to Eurocode 5 usually require a 12.5mm Fireline board (or similar fire enhanced board) instead of the ordinary wallboard (this applies to single layer as well as two layers at party walls). However, the plasterboard manufacturer's requirements should always be referred to.

In obtaining a satisfactory degree of fire resistance and safety the following guidelines should be followed.

Cavity barriers

Detail B6.12.1 summarises the location at which cavity barriers occur in timber frame housing. To meet the recommendations for complying with *Technical Guidance Document B*, cavity barriers should be provided in timber frame walls as follows:

- around all openings, such as doors, windows, vents, openings for extract fans, meter cupboards etc
- in semi-detached and terraced units, at the junction of party walls and external walls. In the external wall on either side of a party wall.
- at eaves level.

Additionally I.S. 440 states that vertical cavity barriers should be placed at external wall corners and vertically at centres not exceeding 10m.

Apart from the cavity barrier practice set out above, the timber frame houses should, as a matter of course, incorporate all other relevant fire safety provisions indicated in

Technical Guidance Documents B and *J* to the Building Regulations particularly in respect of the following:

- means of escape
- Provision of fire alarms
- wall and ceiling linings
- Surface spread of flame
- Fire resistance
- integral garages
- roof covering
- radiation onto boundaries
- roof lights
- heating appliances, hearths, chimneys and flue pipes
- at the top of the external walls

Probably the most important aspect of fire safety is the provision of alarms and adequate escape routes.

Plasterboard fixing

Plasterboard (or similar fire resisting lining) provides the main protection to the timber framing in relation to fire and makes the largest contribution to fire resistance. For this reason it is important that the plasterboard is fixed properly particularly at party walls. Screws are generally recognised as a better fixing than nails; the recommendations for fixing screws are outlined below

The following is recommended (subject to the board manufacturer's recommendations or those of the timber frame manufacturer):

- **Screw lengths**
Single layer 12.5mm and 15mm plasterboard - 36mm
Single layer 19.0mm plank - 42mm
12.5mm plasterboard on 12.5mm board - 50mm
12.5mm plasterboard on 19.0mm plank - 60mm
Each layer must be independently fixed
- **Centres**
230mm for ceiling and 300mm for walls, 150mm in racking walls and around floor edges
- **Site control**
Unless control on site is very good it is recommended that the screw fixing schedule is simplified. No more than two screw lengths should be used (42mm and 60mm) and all screws put in at 200mm centres (the assumption being that party walls are stiffened at their ends) but for internal racking walls (where the racking is provide only by the plasterboard) the centres should be reduced to 150mm.
- **Plasterboard joints**
In general all joints and plasterboard edges should be timber backed (horizontal 19mm plank edges don't need to be timber backed providing both edges are bound edges). This applies especially to floor edges at the external wall, party wall and load bearing walls. In the party walls the 19mm plank should be laid horizontally with its vertical joints staggered if possible but the vertical joints must occur over timber. The 12.5mm fire enhanced plasterboard should be laid vertically; again the vertical edges should be staggered if possible with the vertical joints of the first board layer underneath. The vertical joints of the second 12.5mm board should be staggered with the vertical joints of an underlying 12.5mm board. It is good practice to have bound edge against bound edge; where boards are cut, the cut should always occur over timber.

- **3 Storey dwellings**
These are required to have a full 30 minutes fire resistance and smoke doors. The stairwell walls are usually lined on both sides with a high performance lining such as Fireline or similar. In the ceiling to the roof space a similar high performance board is normally used.

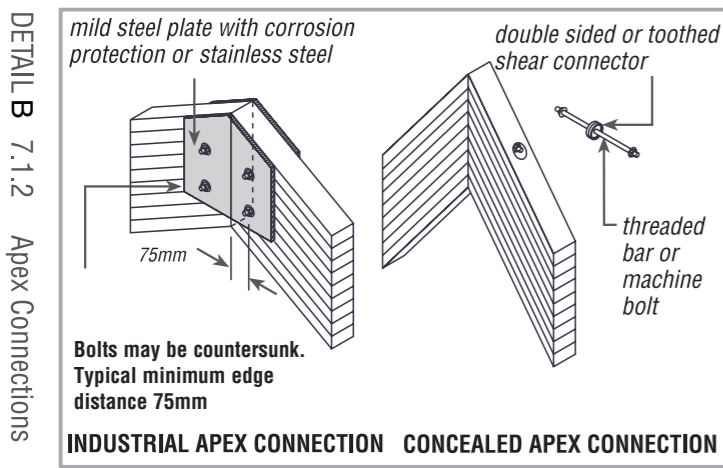
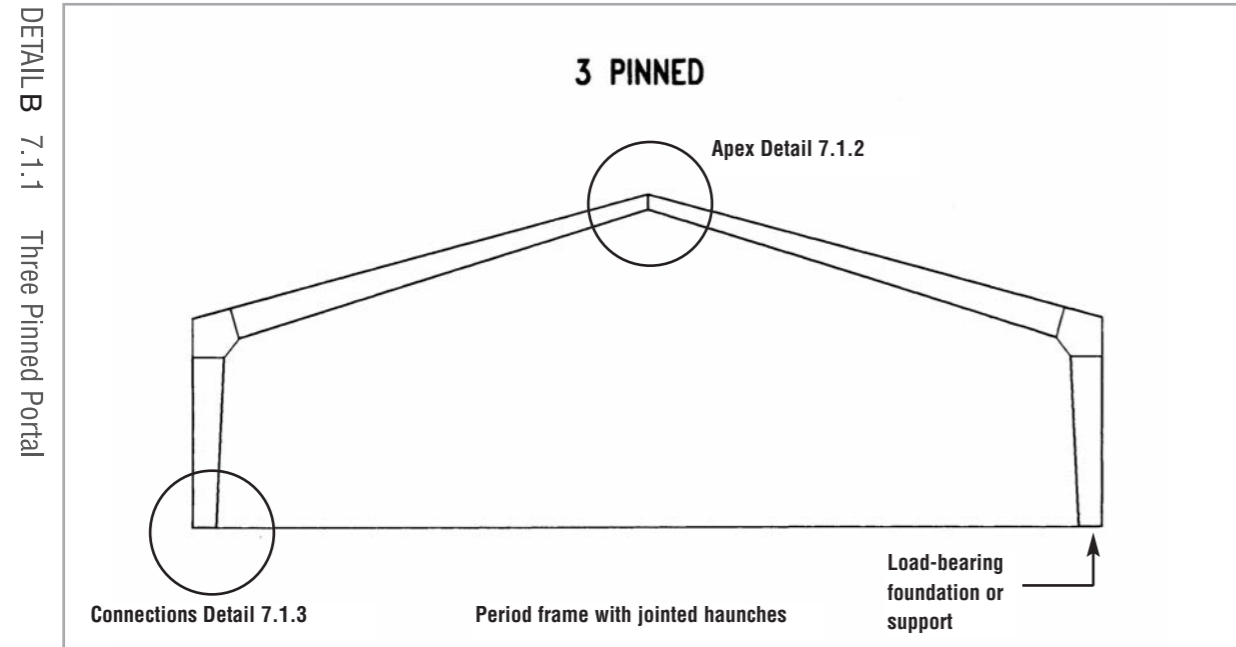
- **Compartment floors**
Compartment floors should be battened out to provide a service cavity. This means that lights and wiring can be placed within the services cavity without compromising the fire and sound performance of the floor. All joints of the plasterboard should be staggered and this requires careful planning of the plasterboard layout and the position of noggins to pick up the second layer of plasterboard. Any services within the floor (that is above the fire linings) should belong to the unit above the floor and not to the unit below the floor.

- **Compartment walls**
Where services exist on these walls, like compartment floors these should be battened out to provide a service cavity. Party walls (also called separating walls) are a form of compartment walls.

Consideration could be given at the design stage to include a service cavity in the walls to allow for the future provision of services on a wall; this would be more appropriate to walls over 3m in length.

B7 Components and systems

B 7.1 GLULAM



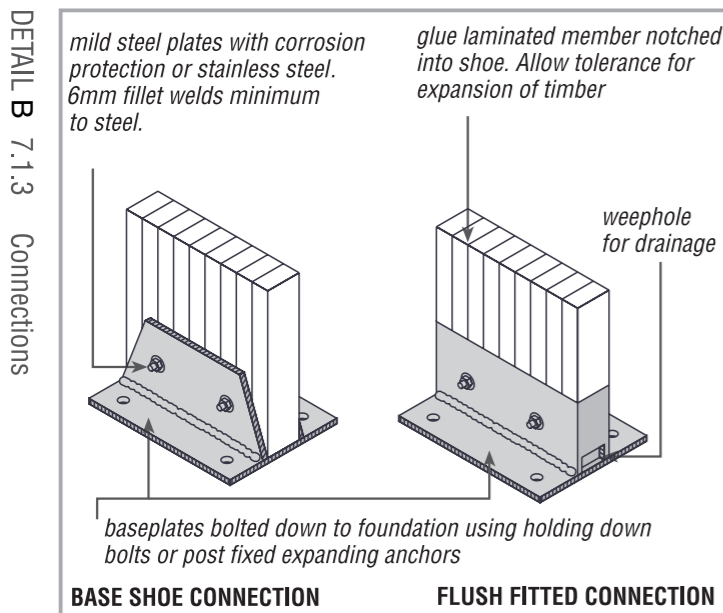
Glulam consists of sections of timber glued together to form a larger member. This process results in improved strength properties for the member as any weaknesses in the original smaller sections (such as knots) are distributed over the larger section. Glulam comes in a wide range of sizes and very large sections are available for heavy loading and long spans. In Ireland Glulam is commonly used for beams in timber frame construction as a replacement for steel beams.

All structural timber for glue-laminated elements must be strength graded as specified by the engineer. All glulam members must be designed by an experienced engineer and manufactured under an approved quality system.

All connecting plates should be neatly cut with smooth edges and where acceptable set flush with timber surface. The threaded section of bolts should not bear on timber or steel.

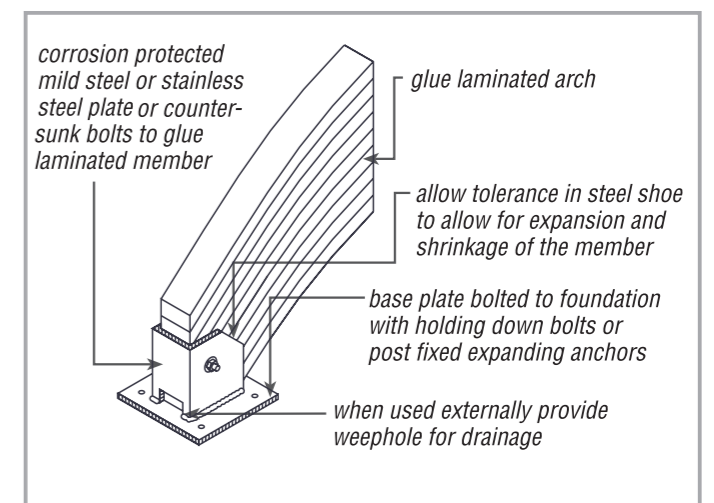
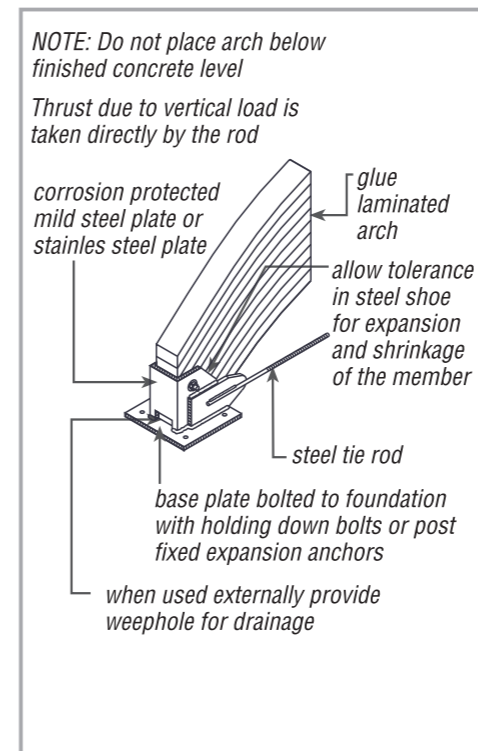
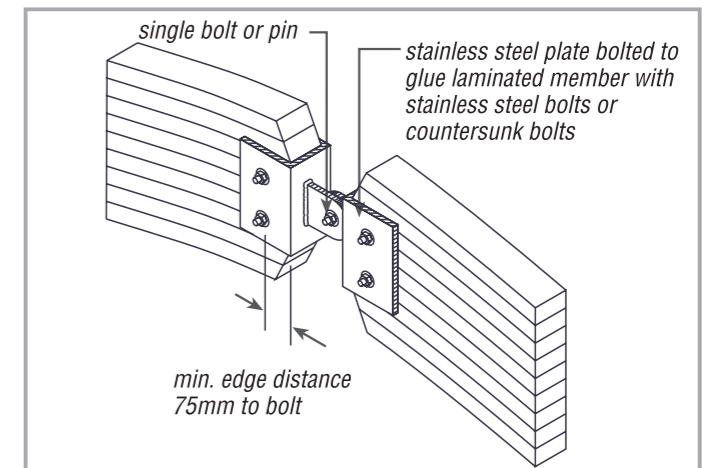
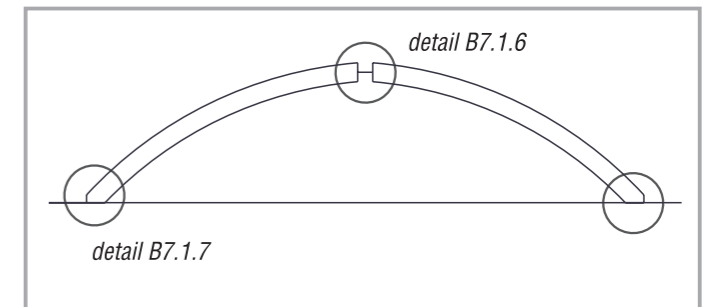
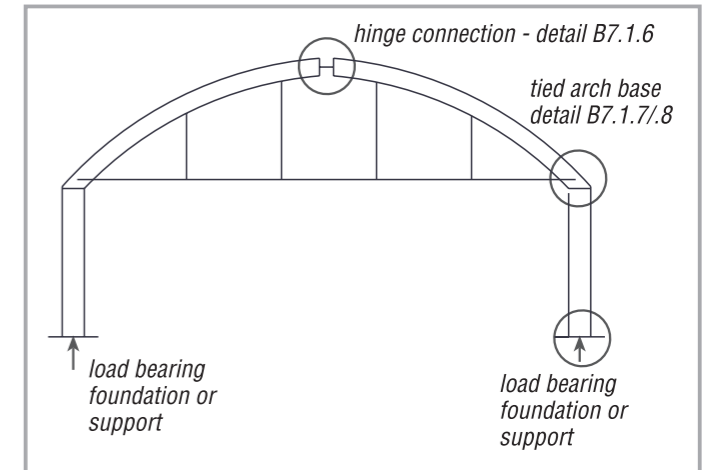
Stainless steel may deteriorate in the environment of a swimming pool and should only be used with great care in that environment.

Note: In all cases shown grade of steel, strength of bolts and other such data are examples only.

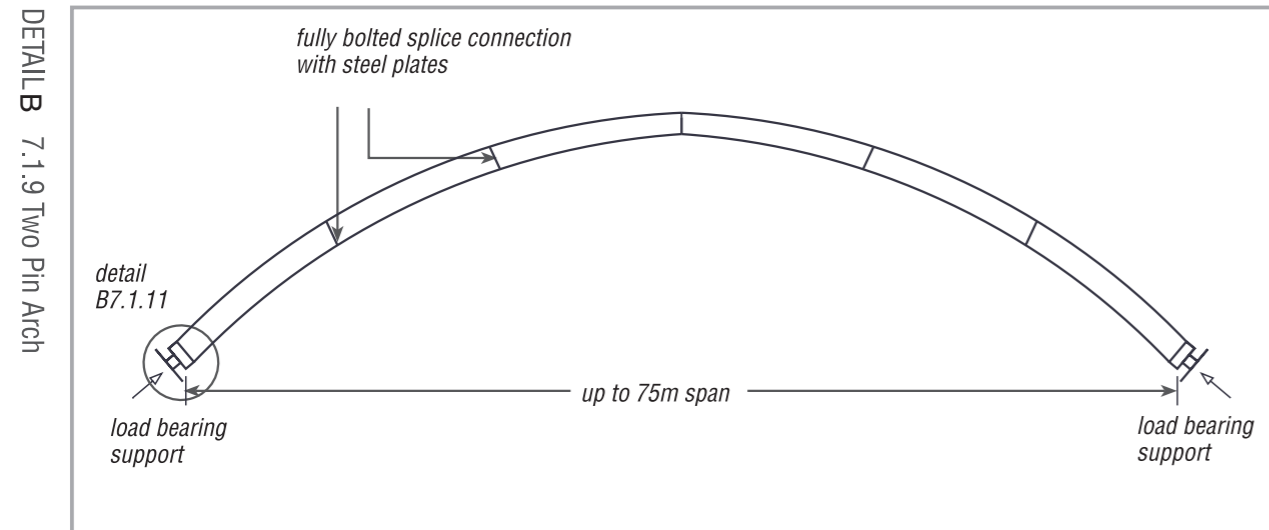


B 7.1 COMPONENTS AND SYSTEMS – GLULAM (CONTINUED)

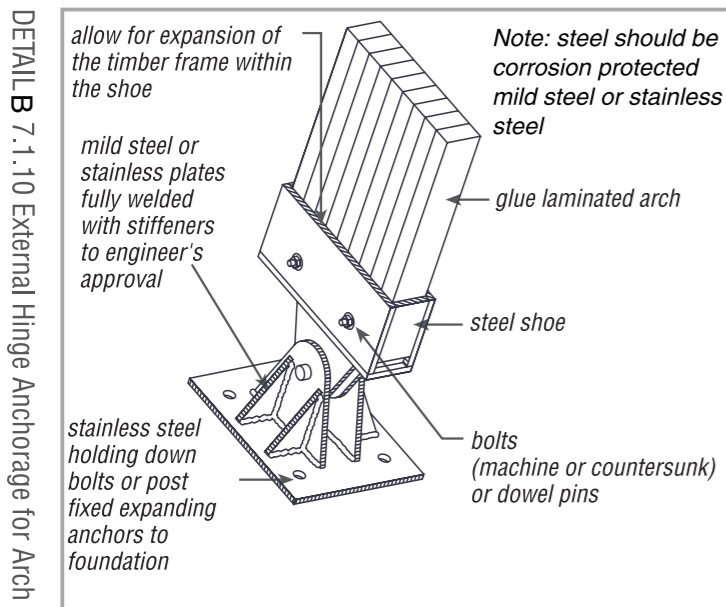
Tying action may be achieved with reinforced concrete slab if the base of the arch is at ground level. There must be sufficient dead weight to anchor the timber structure.



B 7.1 COMPONENTS AND SYSTEMS – GLULAM (CONTINUED)

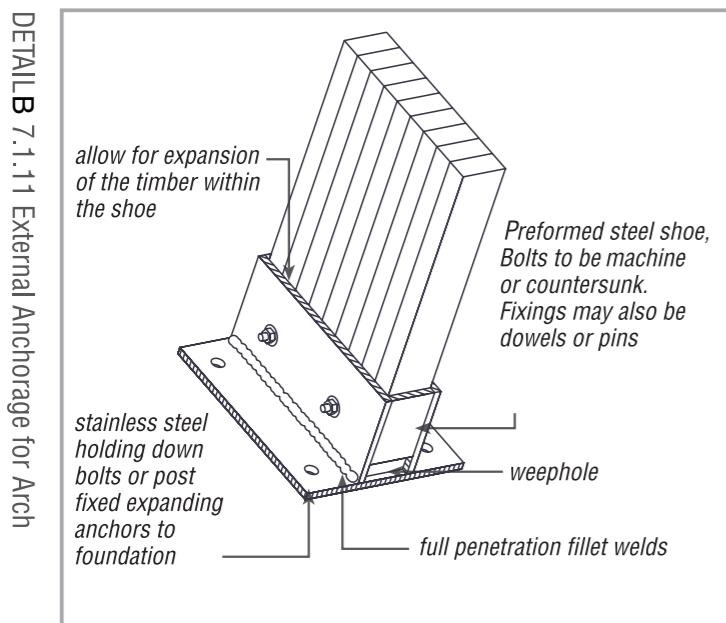


DETAIL B 7.1.9 Two Pin Arch



DETAIL B 7.1.10 External Hinge Anchorage for Arch

Where steel shoes are exposed externally, provisions should be made for the drainage of water. Where possible, recessed steel shoes to timber members should be used for a neater and more effective joint for weathering.

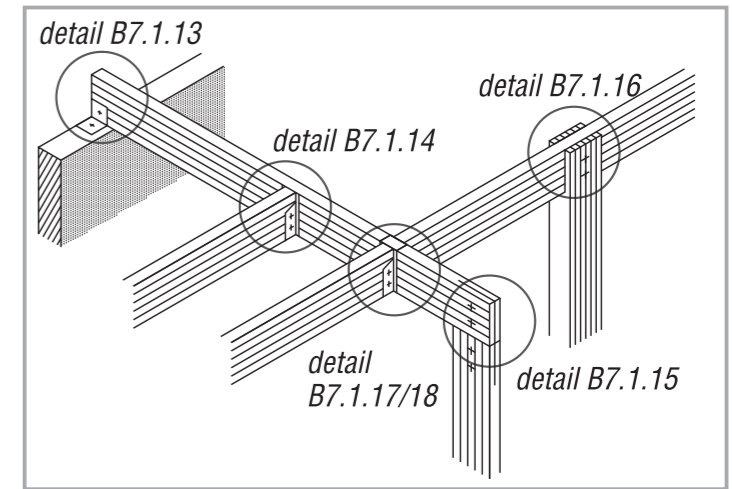


DETAIL B 7.1.11 External Anchorage for Arch

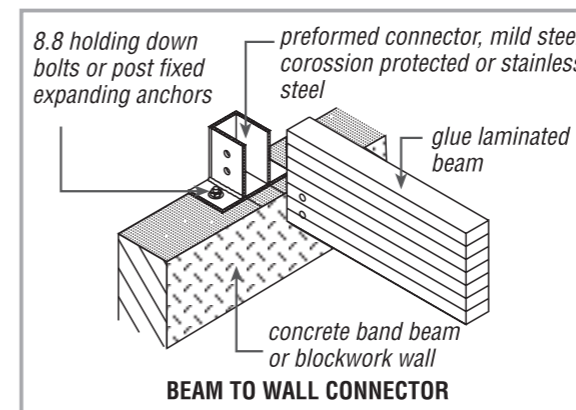
B 7.1 COMPONENTS AND SYSTEMS – GLULAM (CONTINUED)

Typical fixings of glulam beams to supports are shown in Details B7.1.12 to B7.1.18.

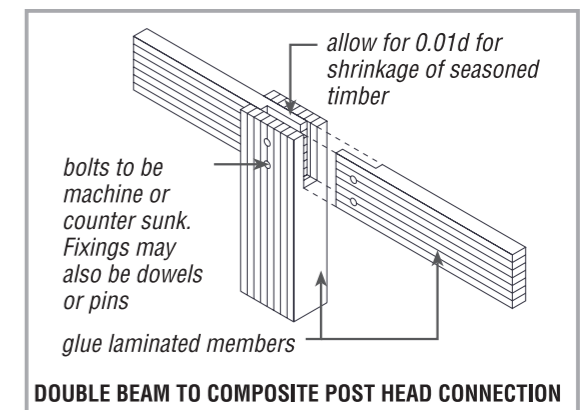
Refer to EN 386 for further details.
Note: All connections in metal work should be galvanised or of austenitic stainless steel.



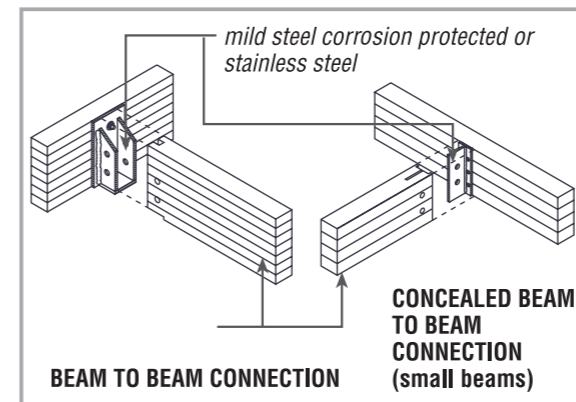
DETAIL B 7.1.12 Anchor Glulam Beams



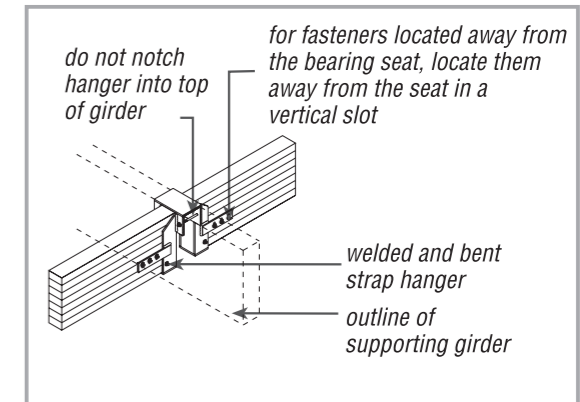
DETAIL B 7.1.13 Connectors



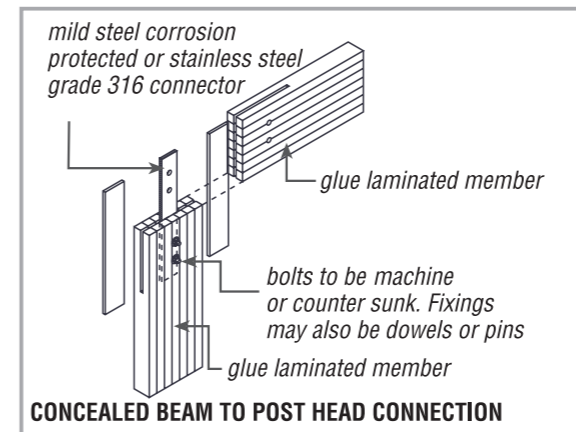
DETAIL B 7.1.16 Connectors



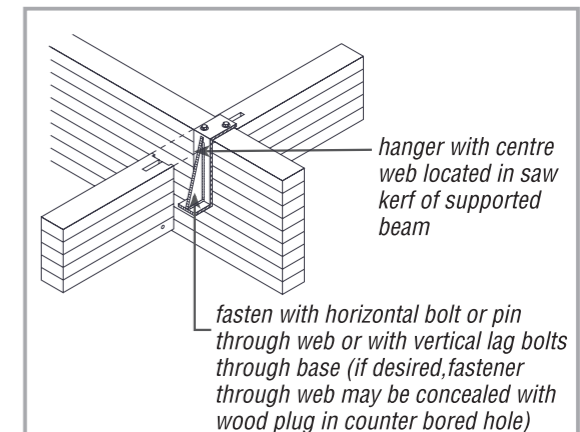
DETAIL B 7.1.14 Connectors



DETAIL B 7.1.17 Connectors

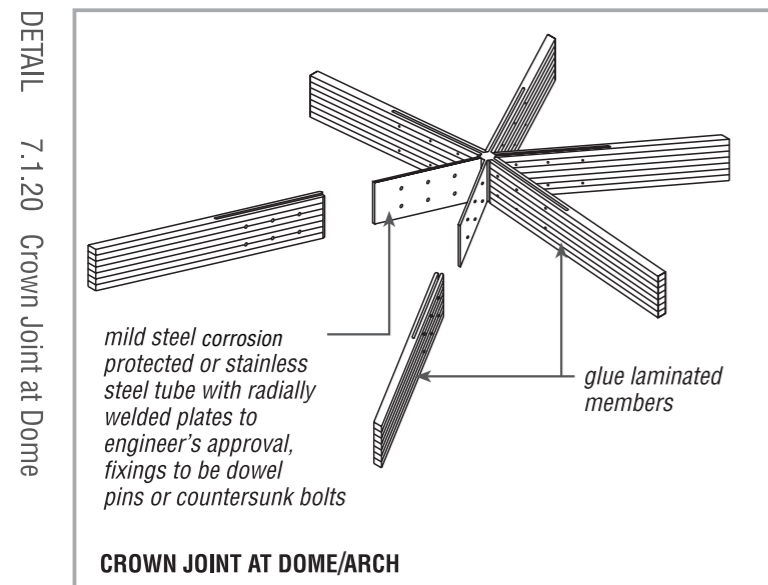
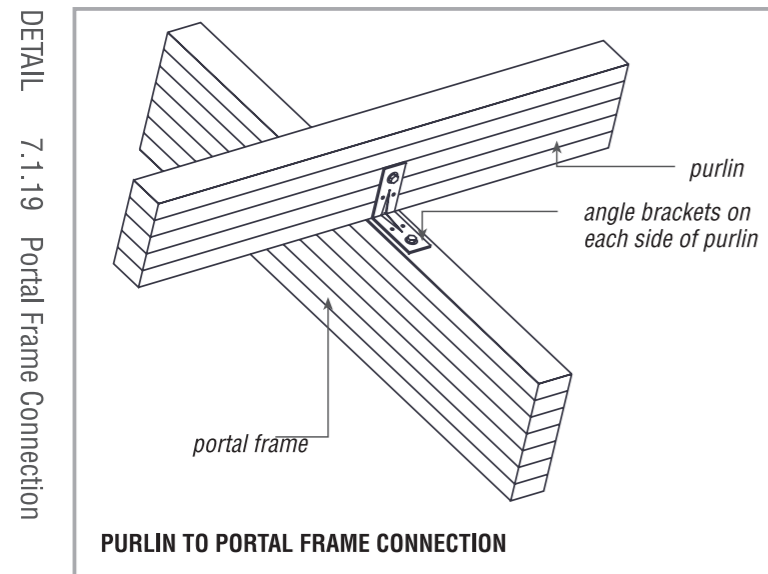


DETAIL B 7.1.15 Connectors

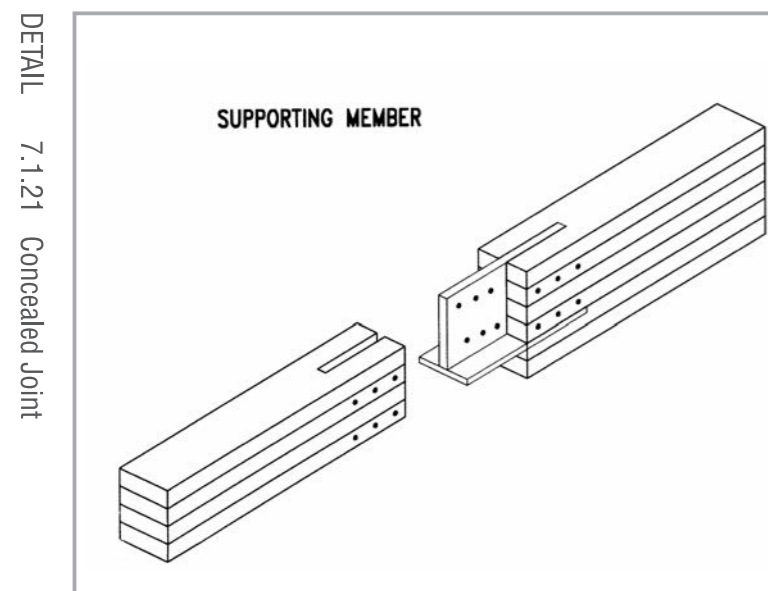


DETAIL B 7.1.18 Connectors

B 7.1 COMPONENTS AND SYSTEMS – GLULAM (CONTINUED)



Details 7.1.20 and 7.1.21 allow the concealment of steel plate connections within the glulam member



B 7.2 COMPONENTS AND SYSTEMS PARALLEL STRAND LUMBER (PSL)

The most commonly available parallel strand lumber (PSL) is Parallam (a trade name). Parallam typically comes in the range of sizes shown below.

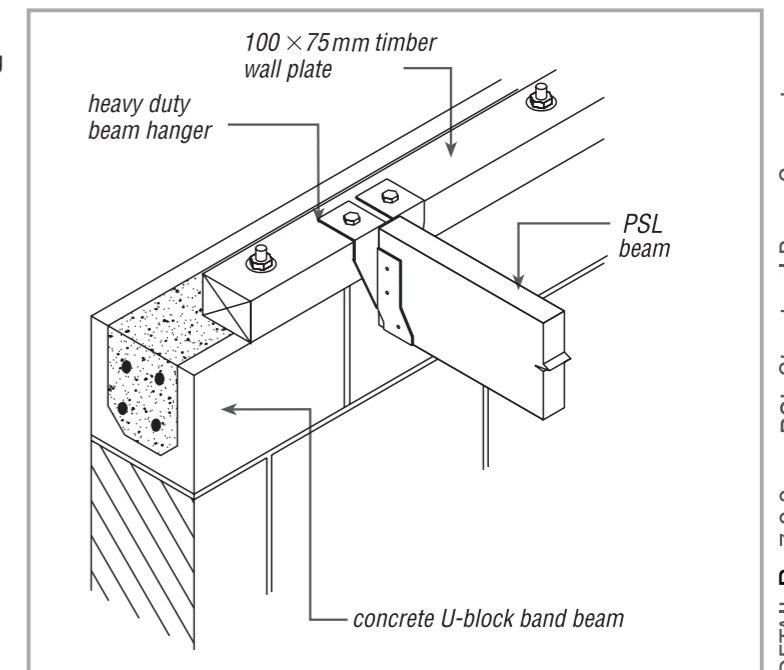
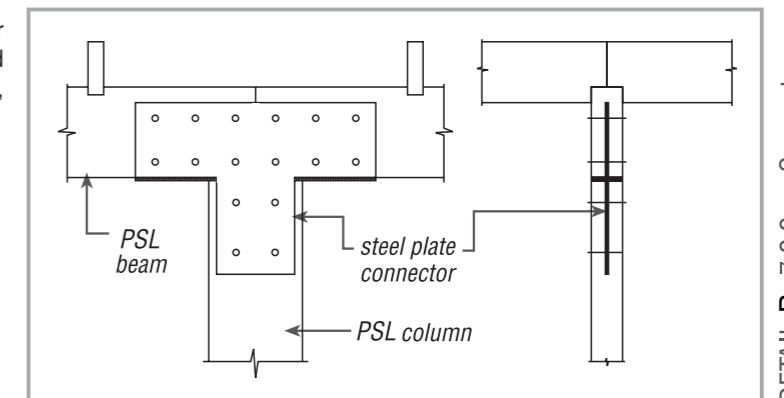
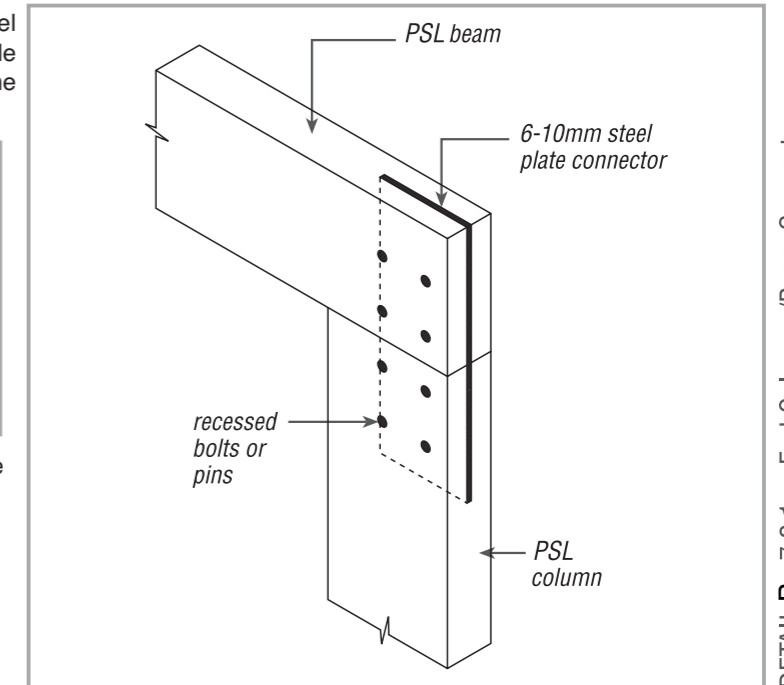
Width mm	Depth mm
15	241
68	302
89	356
133	406
178	457

Combinations of depths and widths are available.

Joints may be formed using mild steel or stainless steel connector plates connected within PSL timber by means of bolts, nails, screws or dowels.

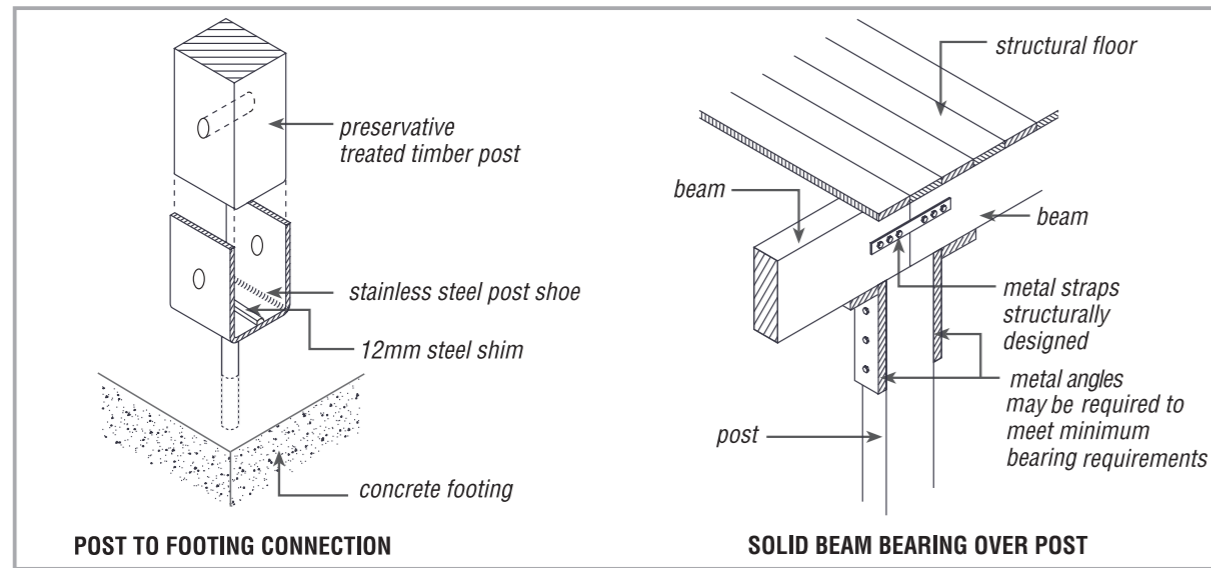
Beam support

Floor joists may be seated on top or hung from steel hangers off the PSL beam.

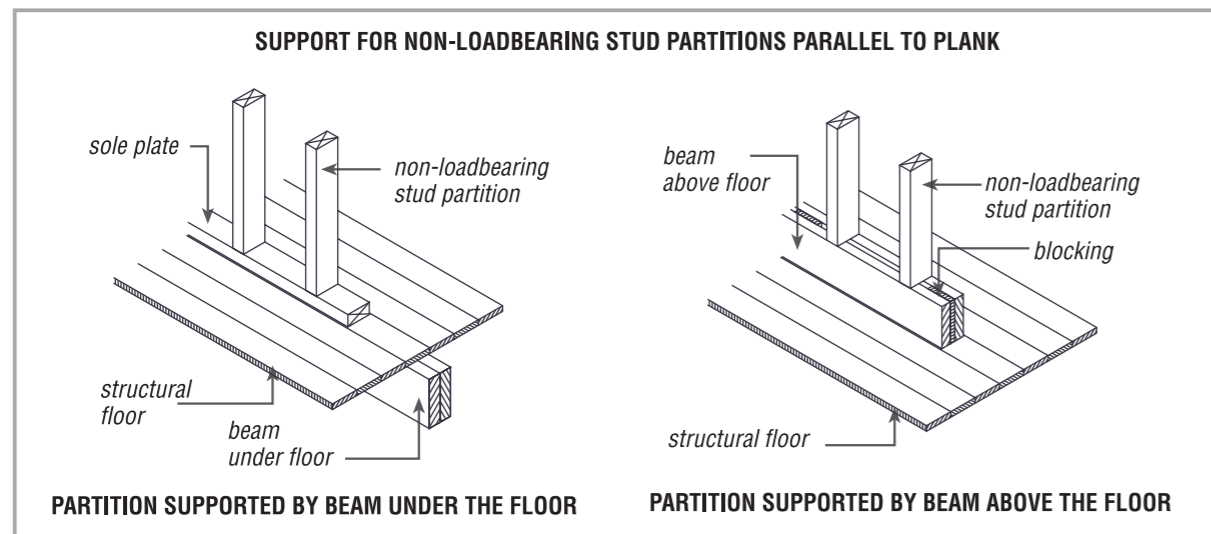


B 7.3 COMPONENTS AND SYSTEMS - POST AND BEAM

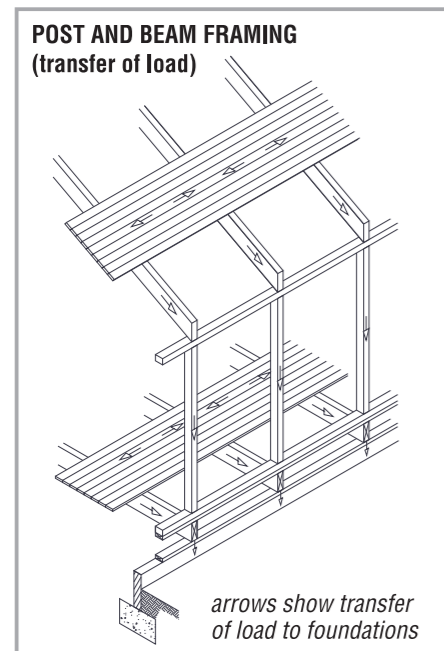
DETAIL B 7.3.1 Post & Beam



DETAIL B 7.3.2 Partition Supported by Beam



DETAIL B 7.3.3 Partition Support by Beam



Details

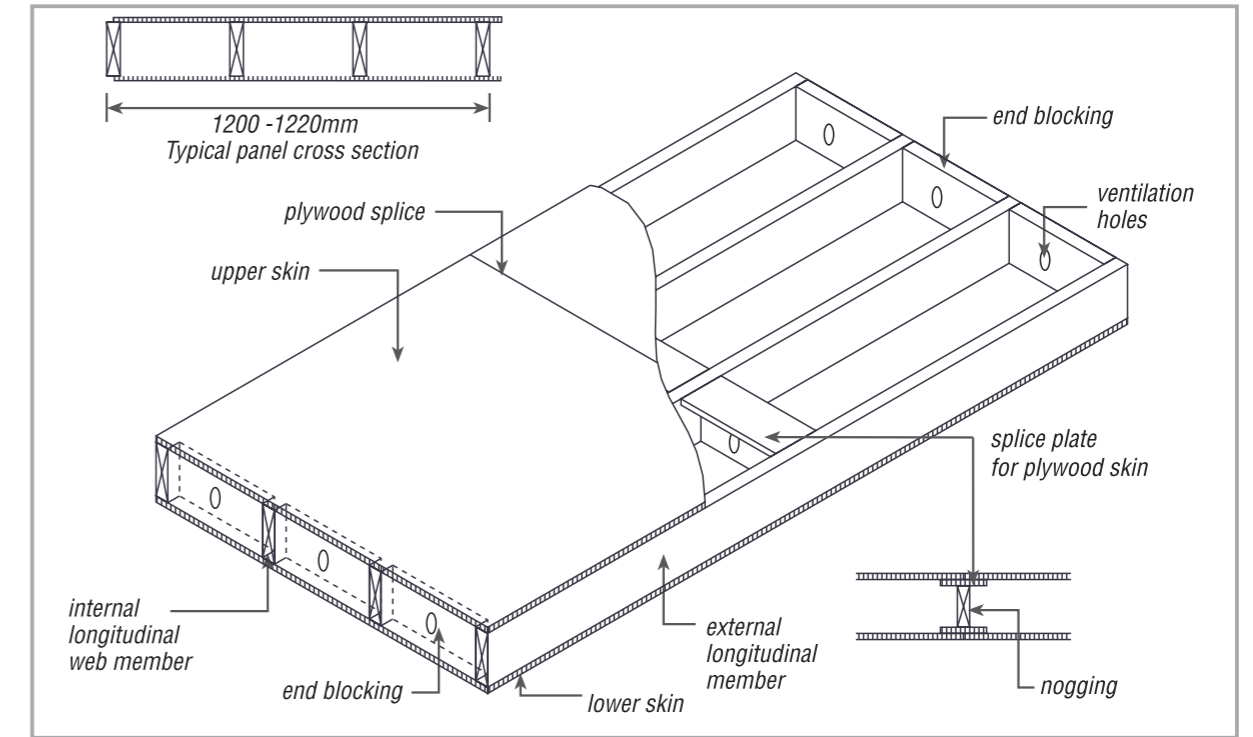
- To reduce the possibility of water entering the end grain at the base of posts, shoes or concrete footings can be used.
- Beams meeting at a post can be supported as shown in Detail B7.3.1.

Partitions

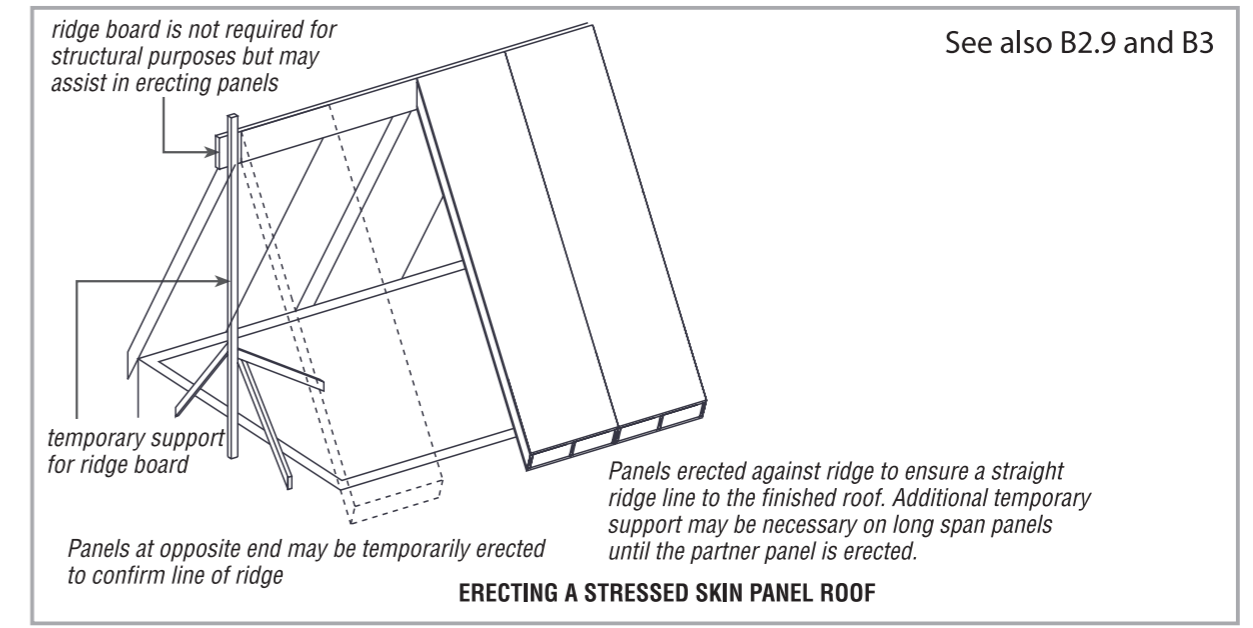
- Partitions in post and beam construction do not normally carry vertical loads.
- Where load-bearing partitions do occur they should be placed over beams or a number of floor joists which should be designed to carry this additional load.

B 7.4 COMPONENTS AND SYSTEMS - STRESSED SKIN PANELS

DETAIL B 7.4.1 Stressed Skin Panels



DETAIL B 7.4.2 Stressed Skin Panel Roof



Dimensions

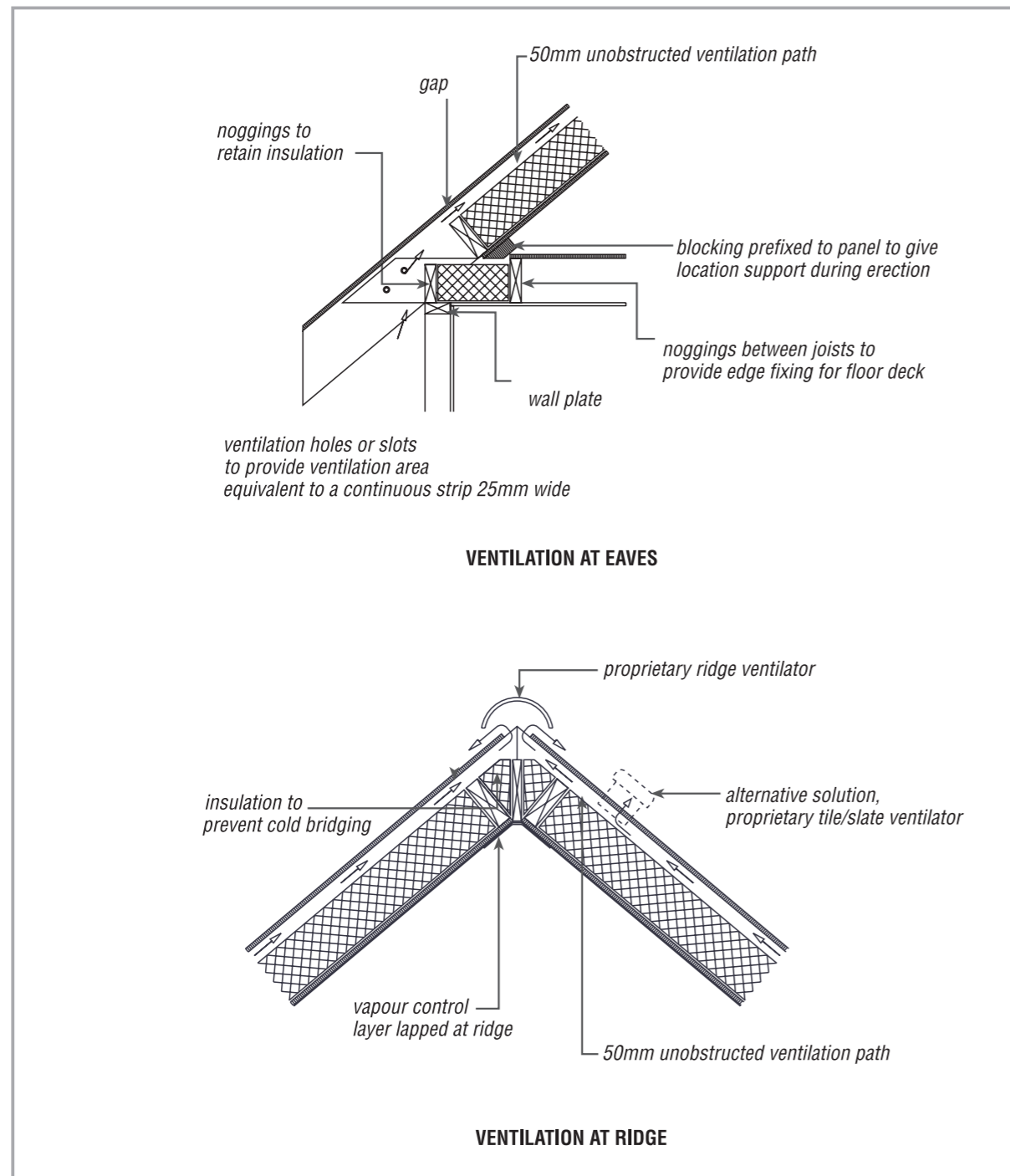
Panels are normally 1200mm or 1220mm wide with three or four intermediate strength graded timber web members. Web members can be finger jointed in accordance with the appropriate design standards. Web spacing, size and thickness of sheathing are related to the span and load. Panel length is dependent on design requirements with a structural joints being formed in the sheathing where appropriate.

Construction

Panels are usually designed to span from eaves to ridge in dual pitch structures. Floor construction can be a conventional timber floor joists or a stressed skin panel system. Floor joists must generally span in the same direction as roof panels. Provision must be made to restrain the horizontal thrust at eaves level. Monopitch roofs can be constructed subject to any design constraints.

B 7.4 COMPONENTS AND SYSTEMS - STRESSED SKIN PANELS (CONTINUED)

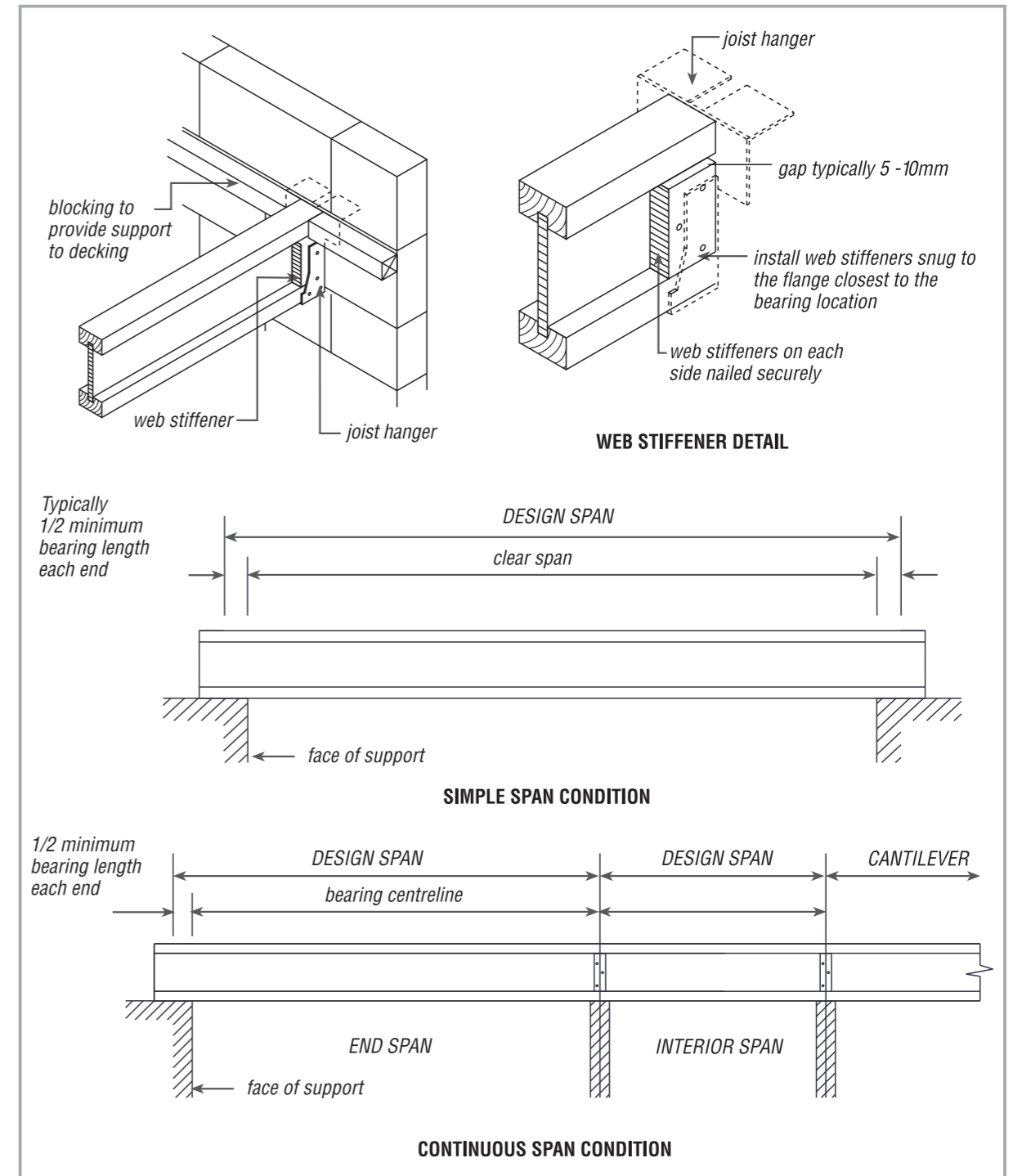
DETAIL B 7.4.3 Ventilation at Eaves & Ridge



Specific details

- 50 mm unobstructed ventilation space must be provided above the insulation layer.
- Roof windows and dormer window openings can be provided within the panels to suit design requirements.
- Plastic conduits can be incorporated into the panel during design and manufacture to accommodate services.
- See also sections B.3 (Panel Roofs) and B.4 (Flat Roofs).

B 7.5 COMPONENTS AND SYSTEMS - WOOD COMPOSITE I-JOISTS



Spans (floors only)

- Typical masonry supports are outlined in B7.5.1.
- Maintain a single direction for the joists span wherever possible.
- Generally run the joists in short direction.
- Maintain constant depth and centres wherever possible.
- Joist hangers are usually part of the I joist system
- Joists should be designed and erected in accordance with the manufacturers recommendations
- Only joists with appropriate certification (e.g. Agrément Board) and/or ETA should be used

DETAIL B 7.5.1 Spans

B 7.5 COMPONENTS AND SYSTEMS - WOOD COMPOSITE I-JOISTS (CONTINUED)

GENERAL

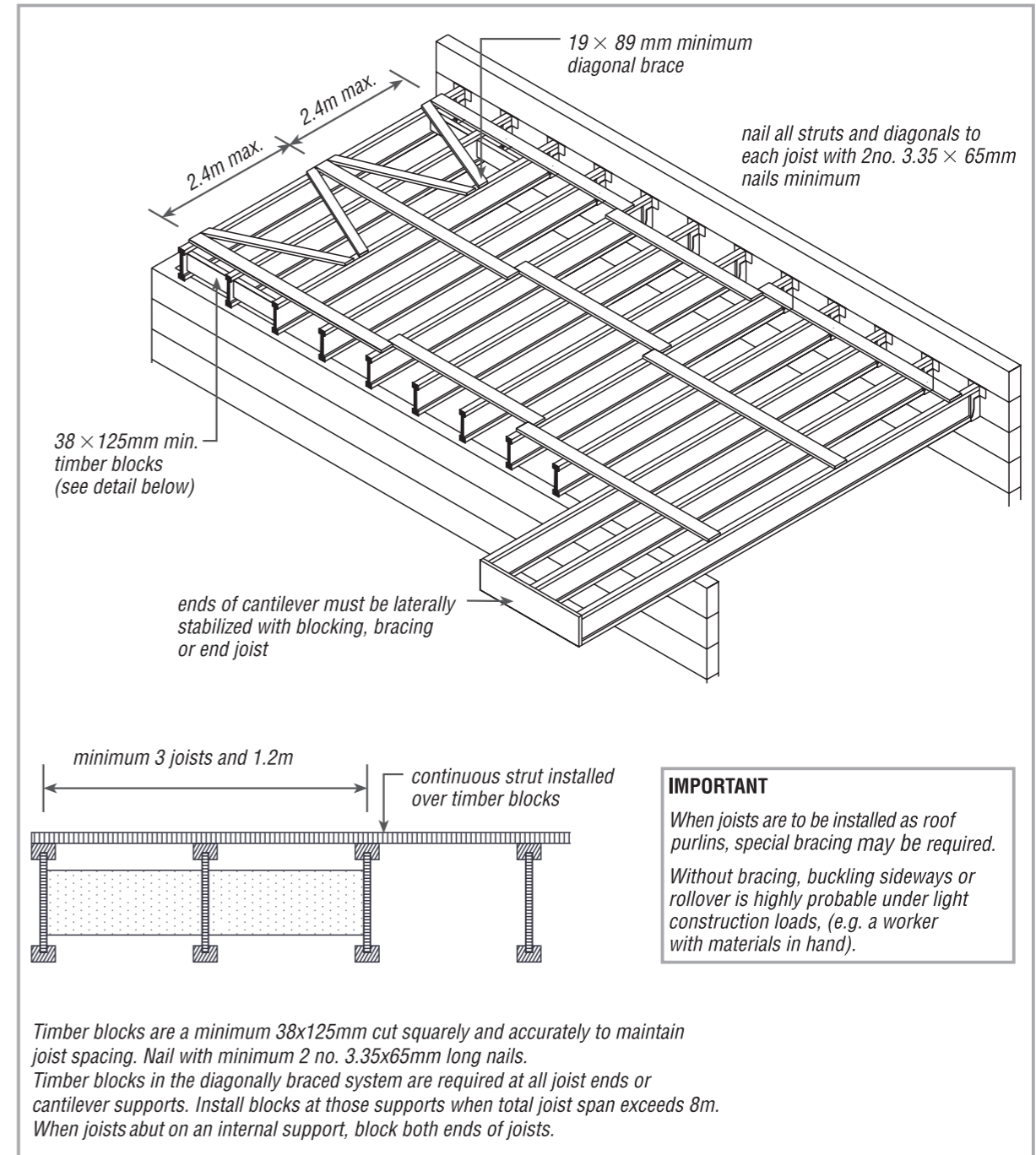
- Never cut a flange
- Never drill through a flange
- Make sure that the joists are restrained horizontally (usually by the flooring)
- Replace or repair (subject to design requirements) any damaged joists
- All joists must be designed

Timber frame

I-joists are widely used in timber frame construction as well as increasing on masonry buildings. One feature of I-joists in timber frame is the use of 'rim boards' as header joists (to run around the floor perimeter of a dwelling) which are the same depth as the I-joists and are usually made of LVL. The fire resistance of I-joists is largely based on the ceiling lining (usually plasterboard). The following recommendations are made in relation to timber frame construction:

- Header joists in the external wall should be LVL or solid timber rather than I-joists
- The header joist at the party wall should be LVL or solid timber rather than I-joists. Subject to design, party walls might have a header joist (LVL/solid timber) and a single I-joist.
- The connections between the first floor panel and the floor structure and between the floor structure and the ground floor panels must be designed taking into account the limitations in fixing into I-joists
- The plasterboard ceiling is of vital importance in relation to fire resistance. For 30 min. fire resistance 15mm plasterboard should be used or a special fire resistant lining used (e.g. Fireline or similar). Generally the plasterboard should be specified so that it alone provides the required fire resistance.
- **Note:** 12.5mm ordinary plasterboard is generally not suitable where European fire test standards are specified; the fire lining should always be specified by the designer. All openings (e.g. at light fixings) should be fire stopped.
- All plasterboard edges should be timber backed. Provide timber noggings between joists at the external wall perimeter, internal load bearing walls, at party walls and where the plasterboard is discontinued
- Fix the plasterboard with the correct fixings at the correct centres. Generally screws provide a better fixing than nails
- Do not alter any I-joists on site without written instructions from the manufacturer or design engineer. All site remedial work should be carried out under supervision and in strict accordance with the issued instructions
- All fixings should be in accordance with the manufacturers' recommendations. However, the design engineer may have additional fixing requirements
- Timber noggins should be inserted between joists at their ends to support the flooring
- If I-joists (or the LVL rim boards) are inserted between joists at their end, then these can be used to restrain the ends of the joists against twist, can support the plasterboard, can help transfer vertical load from the wall panel above and can help in providing space and a base for additional fixings.

B 7.5 COMPONENTS AND SYSTEMS - WOOD COMPOSITE I-JOISTS (CONTINUED)



Bracing

- This covers only temporary bracing during erection.
- Joists are unstable until braced laterally

DETAIL B 7.5.3 Typical Erection Bracing

B 8 Cladding

B 8.1 GENERAL

Timber-frame construction is a method of building, not a system of building. As such it is flexible in its design and use. External timber cladding can achieve a wide variety of visual effects as well as giving a long lifespan on both timber-frame and conventional construction.

The three most important factors are:

- long term durability of cladding (50 years plus), either through the selection of naturally durable species or the preservative treatment of non-durable timbers with pressure impregnated preservative (minimum Use/Hazard Class 3A) or by heat treatment;
- control of moisture content through tight specification ($16\pm 3\%$) and site inspection;
- detailing of cladding to provide: an adequate air space behind the cladding for ventilation (minimum 25mm); end grain protection at all junctions; a board profile, thickness (minimum 25mm) and method of fixing (stainless steel or silicon bronze nails) that will shed water, give long life and visually weather well (vertical cladding weathers best).

Tests have shown that the heartwood of iroko, white oak and western red cedar will give 50 years service life without treatment if properly detailed and if kept out of ground contact. Other less durable softwoods such as Douglas fir, Scots pine and Norway spruce have been tested to a 50 year service life following high-quality pressure preservative treatment.

It is important to remember that it is only the heartwood of durable species which is durable. Sapwood for all species is not durable unless treated with pressure preservative treatment. We recommend pressure preservative treatment to minimum Use/Hazard Class 3A for all cladding timbers.

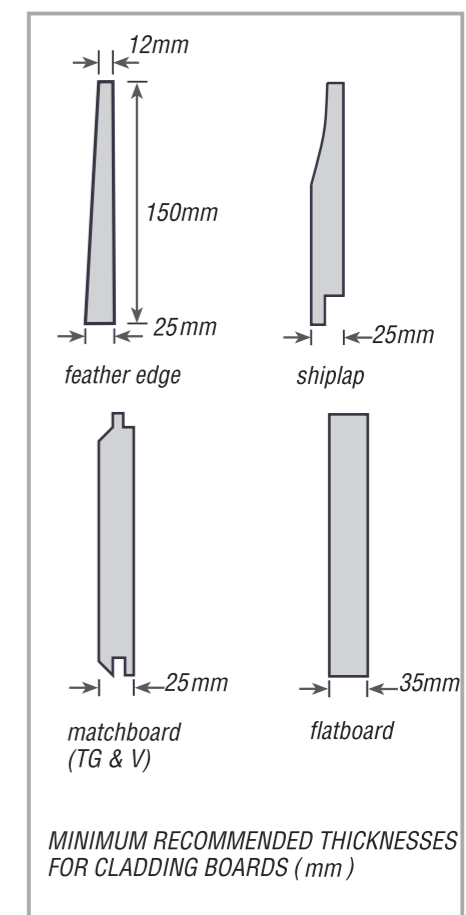
Durable and/or preservative treated species can be stained or allowed to weather naturally. The Irish climate is not conducive to natural weathering for most timber species due to its high relative humidity and discolouration can occur, especially on shaded surfaces.

Finishing systems should be applied to all surfaces of cladding boards before fixing. Any cut ends should be re-finished.

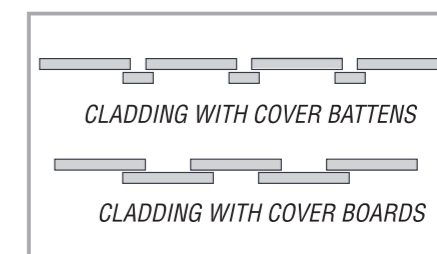
There are no current European standards for cladding board profiles. Some "typical profiles" are given in Appendix E of BS1186 Pt. 3 – "Specification for wood trim and its fixing". A number of conventional profiles such as matchboard and shiplap are available from timber merchants but it is possible to have your own designed sections machined to order by a joinery workshop.

The illustrated details give an idea of what is possible and what is good practice. Plywood cladding is generally not recommended due to problems of blistering, checking and edge/panel junction problems.

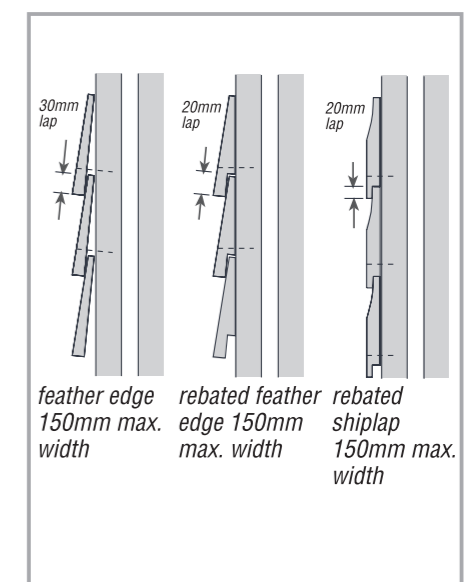
See B12.2 Working Details for examples of machined to order cladding boards.



DETAIL B 8.1.1 Board profiles

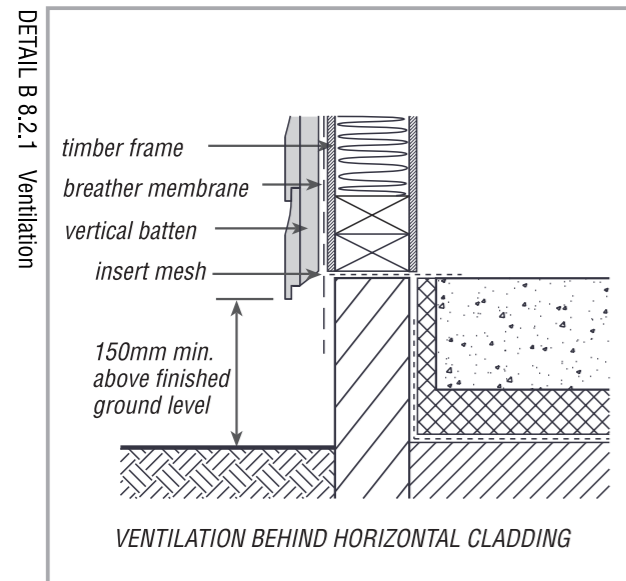


DETAIL B 8.1.2



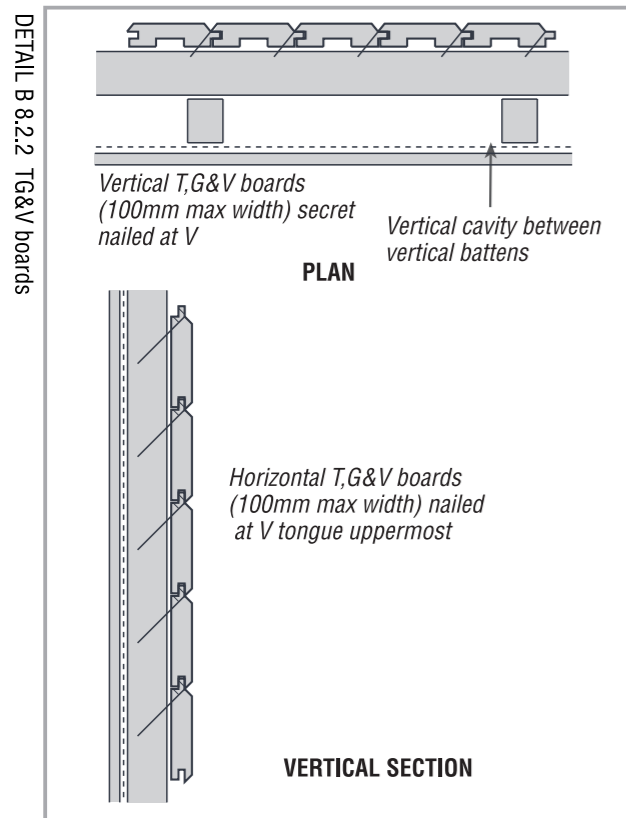
DETAIL B 8.1.3 Fastening boards

B 8.2 CLADDING - TONGUED, GROOVED AND V-JOINTED BOARDING



The bottom ends of vertical cladding boards should be splayed to shed water away from the end-grain. All sawn ends, drill holes etc. should be liberally treated with preservatives on site. When tongued and grooved boards are fixed, horizontally or diagonally, the groove must always face downwards to avoid water lodging. Ground contact should be avoided, all cladding should finish at least 150mm above ground level or other projections to minimise the effects of soaking due to rain splash-up.

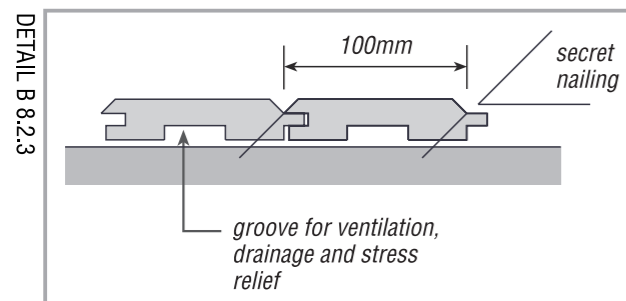
Boards should be fixed with a 1mm gap at joints to allow for movement.



It is important that ventilation is not only to the outside surface through vapour permeable coatings, but also to the inside surface. This allows effective and quick drying of both surfaces of timber cladding after heavy rain conditions. A minimum of 25mm continuous clear cavity is recommended. Vertical battens are fixed over the breathing membrane to maintain this free air space. Where horizontal battens are required, they should be laid over vertical battens. The battens should not exceed 600mm centres. Battens should be at least 38mm wide and the depth 1.5 times the thickness of the cladding board. Battens should also be preservative treated to the same standard as the cladding.

Tongued, grooved and V-jointed profile boards should be nailed with either stainless steel or silicon bronze ringshank nails. Provide a stress relieving channel or groove on the back face of the cladding board. This controls cupping and provides additional ventilation.

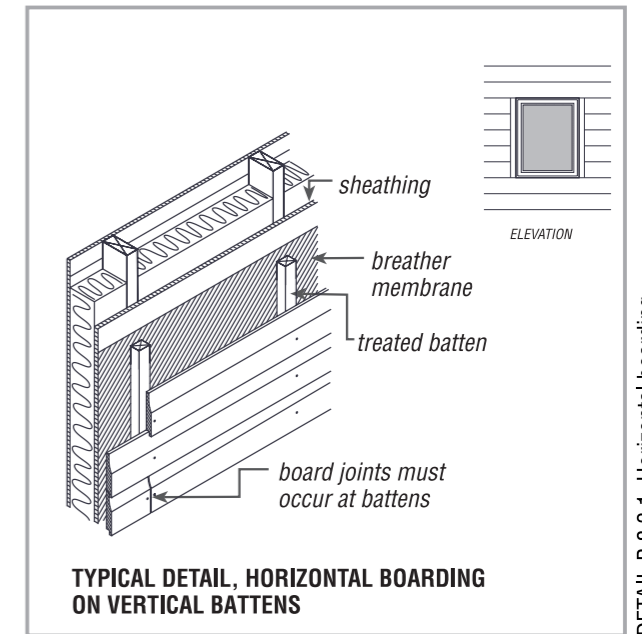
See working Detail B 12.2.4 for examples of board profiles and method of fixing.



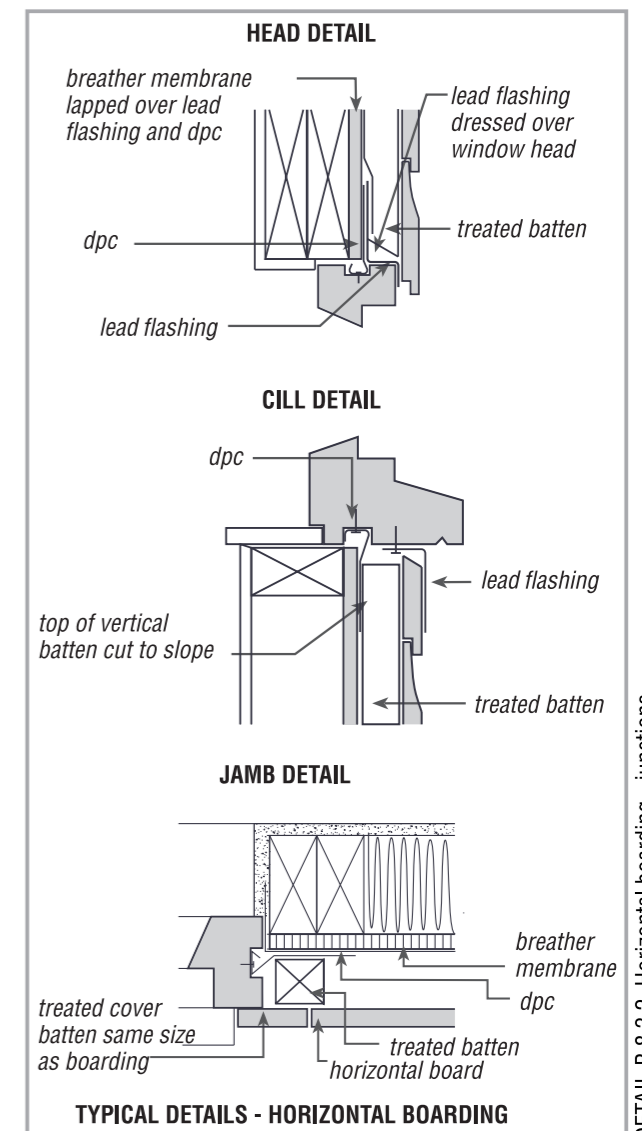
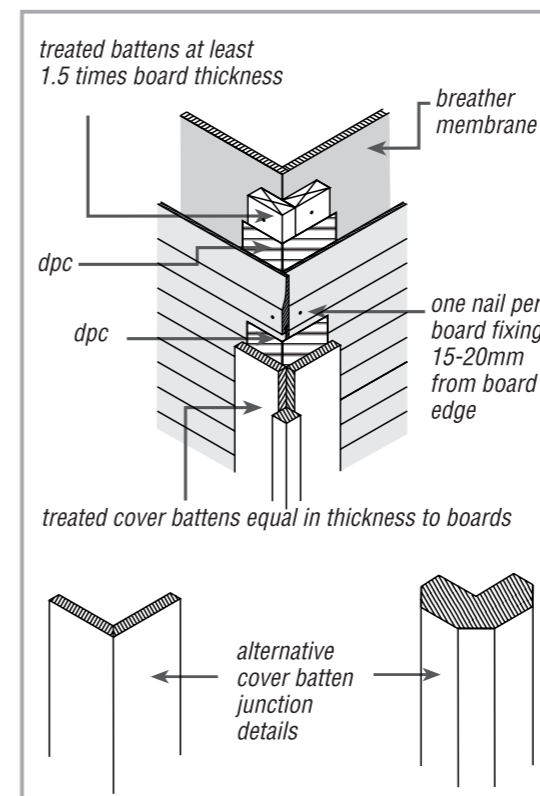
B 8.3 CLADDING - HORIZONTAL BOARDING

Horizontal cladding boards, other than Western red cedar, should have a minimum thickness of 25mm. The boards should be fixed to preservative treated timber battens. The battens are nailed to the studs in the timber frame panel. The vertical battens which support horizontal cladding (Detail B8.3.1) permit drainage of moisture which may penetrate the cladding.

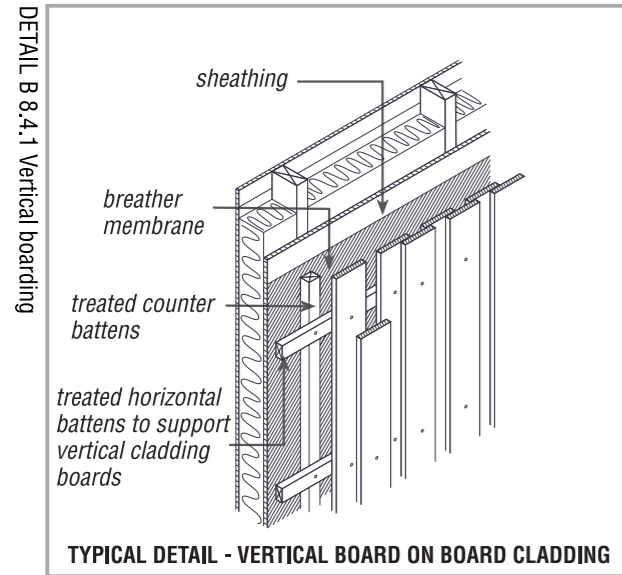
External cladding boards should be fixed with stainless steel or silicon bronze ringshank nails. Do not use aluminium, wire or galvanised/sherardised nails as they will stain the cladding after a few years. Double nailing of boards across their width can cause splitting and so is not recommended. All external timber cladding should be carefully detailed around openings and corners. In the case of horizontal cladding the end grain is vulnerable and requires specific detail (see Detail 8.3.2 and 8.3.3). The design of a special window sub-frame as part of the joinery detail can solve the technical difficulty of cladding/window junctions (see Working Detail B12.2.2).



An alternative and more elegant detail to B 8.3.3 can be found in Working Details B12.3 detail 14.



B 8.4 CLADDING - VERTICAL BOARD-ON-BOARD

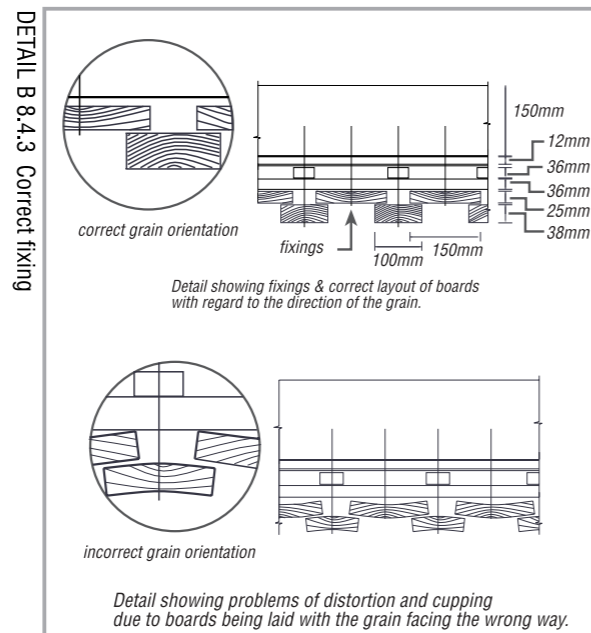
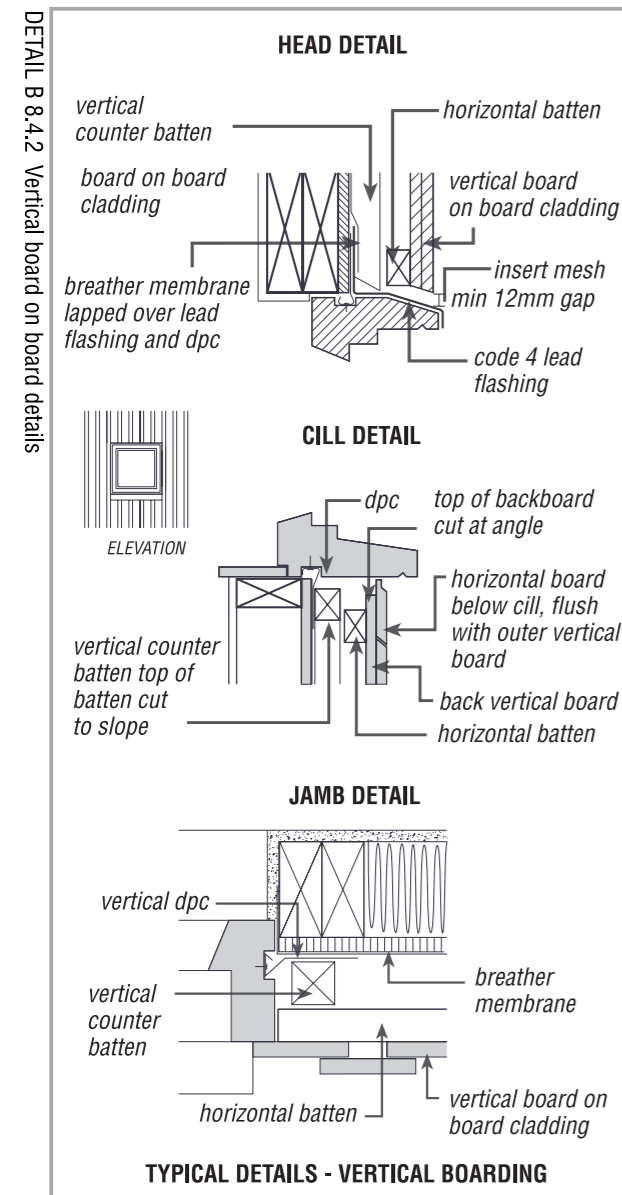


Vertical board-on-board external cladding should be carefully detailed around openings and corners. The inner boards should be fixed with corrosive resistant fasteners to the horizontal battens.

The detailing of external timber cladding at openings is important. The openings should be sealed; however, room for expansion of the boards has to be incorporated.

As the moisture content of exterior cladding varies considerably, adequate accommodation for moisture movement should be provided to avoid stress and eventual cracking. Cladding boards should be free to move independently of each other and where overlapping occurs, care should be taken to avoid nailing through underboards. Staggered nailing permits the timber to resist movement stress more easily. It is also important when laying vertical board-on-board to face the boards as shown in Detail B8.4.3, to avoid further problems with cupping and distortion of the timber sections.

Finished battens should be at least 36mm thick and 44mm wide to avoid splitting when nailing.



B 8.5 CLADDING - SHINGLES AND SHAKES

Shingles for roofing are sawn from selected western red cedar logs. They are produced in three grades:

- No. 1, Blue Label,
 - No. 2, Red Label, and
 - No. 3, Black Label,
- with No.1 being the best quality.

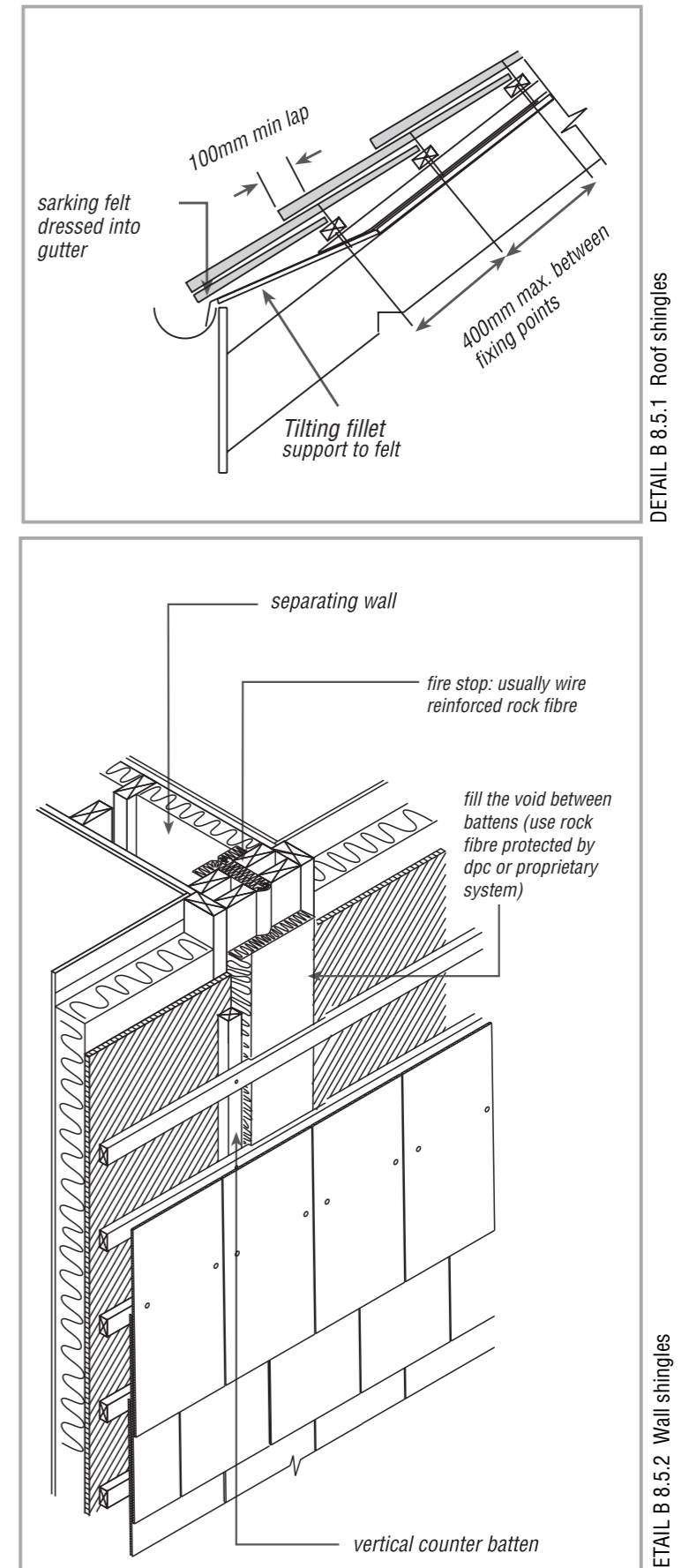
Experience has shown that untreated cedar shingles, when used as roofing, have a limited life in Irish conditions. Pressure treatment with an appropriate water-borne preservative is recommended. Untreated shingles used for vertical wall cladding have performed satisfactorily.

A good shingle roof is never less than three layers thick (2 ply) and the amount of shingle exposed should not exceed one third its length. Adequate roof ventilation must be provided in the ratio 3.35mm²/m² of ceiling area.

Shingles must be doubled along the eaves and tripled for a superior roof. Side joint spacing between adjacent shingles should be 5mm. Joints in any one course should be separated by not less than 40mm from joints in adjacent courses and joints in alternative courses should not be in direct alignment.

Each shingle should be fixed with two austenitic stainless steel, silicon bronze or copper nails. Each nail should be placed 20mm from the side edge and 38mm above the butt-line. Nail lengths should be 32mm for both 400mm and 450mm shingles and 38mm for 600mm shingles.

All flashing materials should be bitumen based to avoid the corrosive action of western red cedar on most metals. Only steep roof pitches are suitable for shingle use. Refer to manufacturer's instructions for specialist detailing.



B 9 Flooring

B 9.1 GENERAL

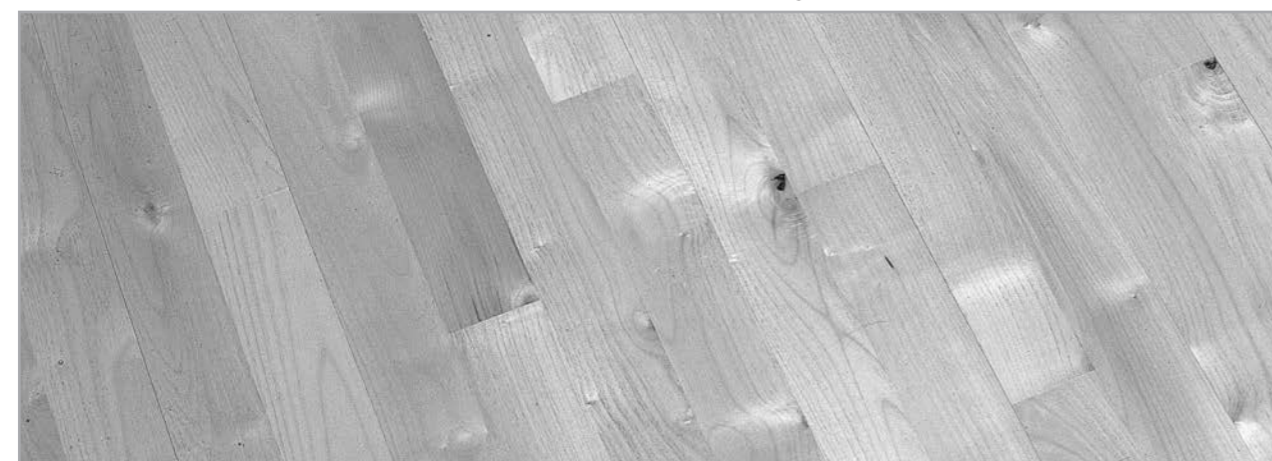
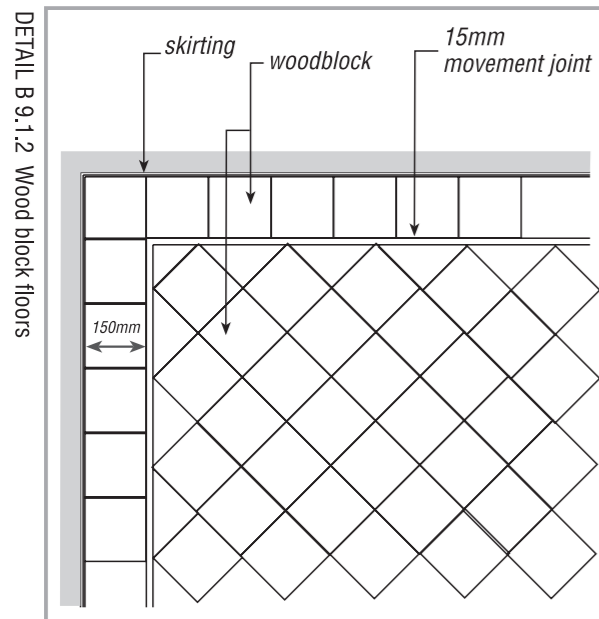
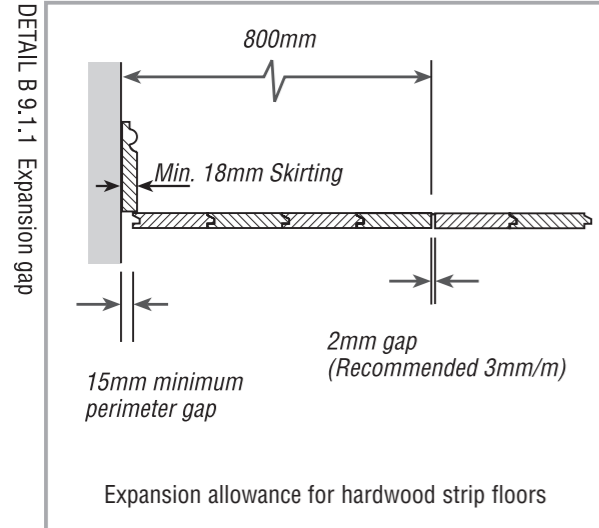
The standard for flooring is BS 8201 *Code of Practice for flooring of timber, timber products and wood-based panel products*, but other proprietary systems are also now available and some European Standards cover specific types of flooring. The standard contains tables relating to the suitability of different species of timber for particular levels of pedestrian traffic. Species such as hard maple and white oak are suitable for public areas provided they are protected from water and grit. See table A 11.2 for timber species selection. Wet trades must be completed, the heating system commissioned and moisture content of the sub-floor and timber material checked for compliance with specification prior to laying.

Special purpose floors such as sports halls and floors with underfloor heating have particular requirements which should be taken into account before installation. As a general rule the thicker and narrower the board the less movement problems will be encountered.

In general, allow a 15mm expansion gap at both sides of the floor, with intermediate gaps of 3mm per metre for large areas. Provide an expansion gap between dissimilar floor materials such as wood and tiling by use of a stainless steel or brass cover strip. Alternatively a profiled timber strip can be used. Where timber flooring abuts glazing without a skirting to mask the perimeter expansion gap at their junction, a neoprene, cork or similarly flexible joint insert can be used.

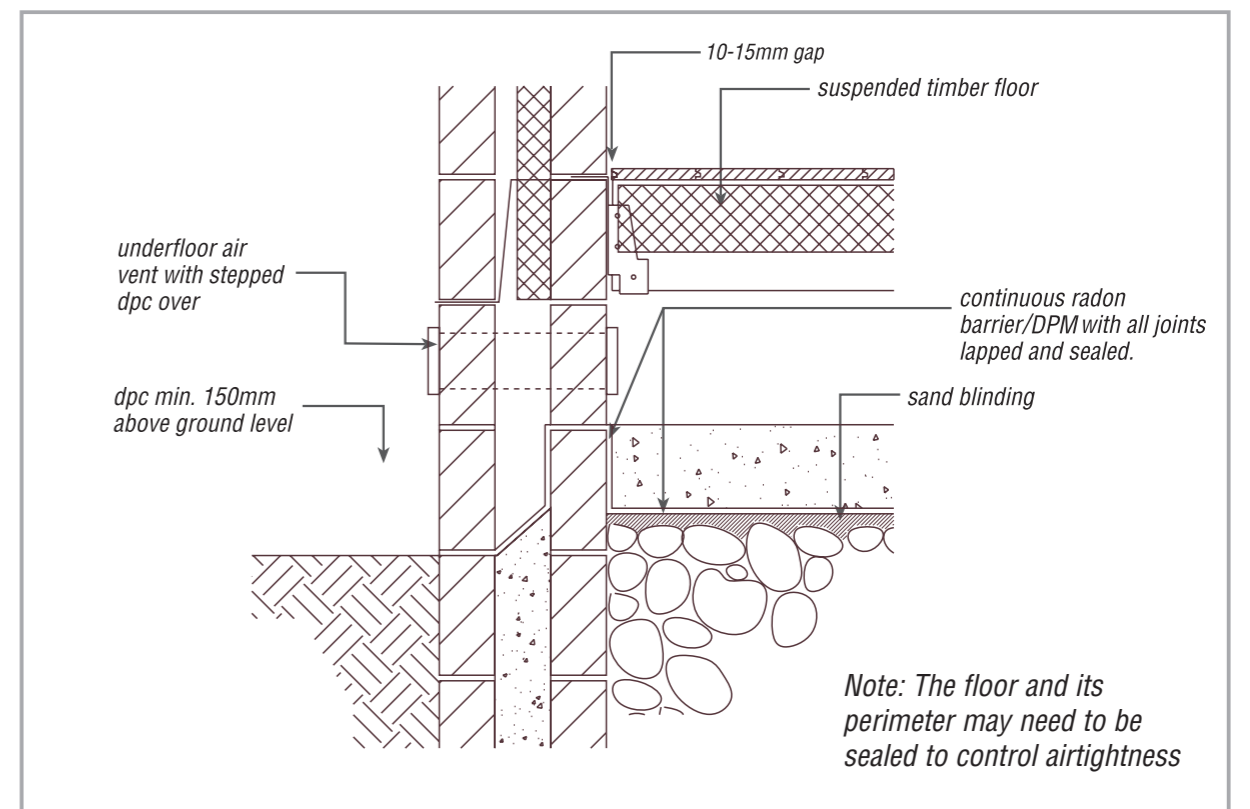
Consideration should be given to reducing footwear impact noise on hardwood floors by the use of an acoustic mat between (but not on top of) timber support battens. Alternatively, woodblock floors set in mastic will solve this problem on concrete sub-floors.

Sealing the timber floor is vital to its long term success. Many products are now supplied with a hard-wearing factory applied finish. Oils and wax finishes must be frequently maintained. For light-coloured woods such as hard maple in domestic situations, an acid catalysed lacquer, similar to that used on furniture, could be used as it does not yellow with age. However, the hardest-wearing site-applied finish is a two-pack product such as polyurethane and it should be used in public areas or hard-wearing domestic locations.



Narrow board sycamore hardwood floor laid with quick clip system

B 9.2 FLOORING - TONGUED AND GROOVED



DETAIL B 9.2.1 Suspended Timber Ground Floor Junction with External Wall

The most common type of softwood flooring; tongued and grooved boards, is designed to give a lap at joints, therefore reducing the risk of gaps and creaking. Tongued and grooved boards are normally fixed to joists but they can also be fixed to battens on concrete subfloors.

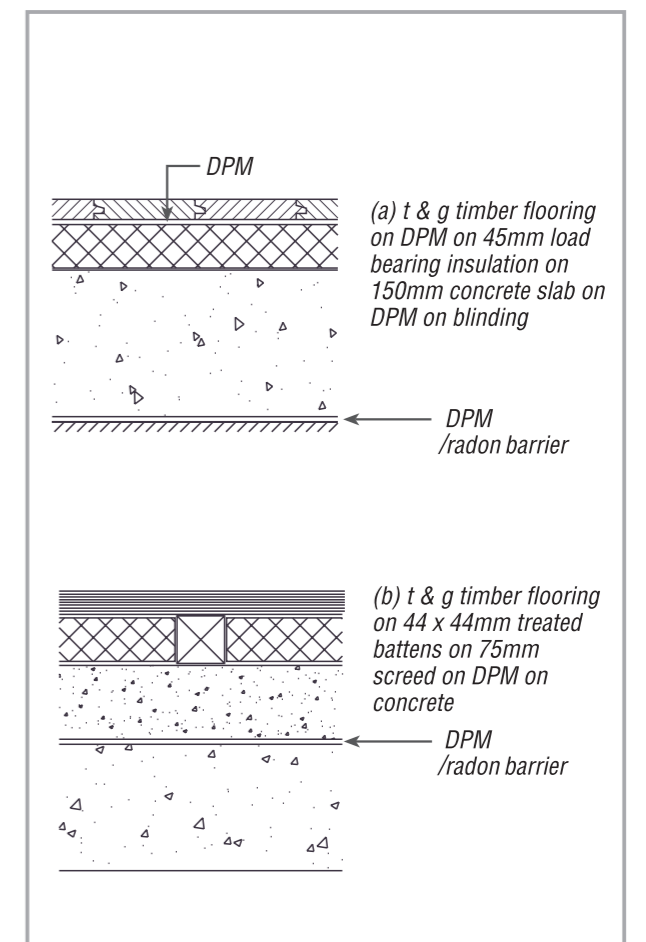
Joists or batten centres are recommended as follows:

Domestic floor	600mm max
Commercial floor	411mm
Sports floor	411mm

It is preferable that the DPM is laid beneath the screed as shown in Detail 9.2.2.

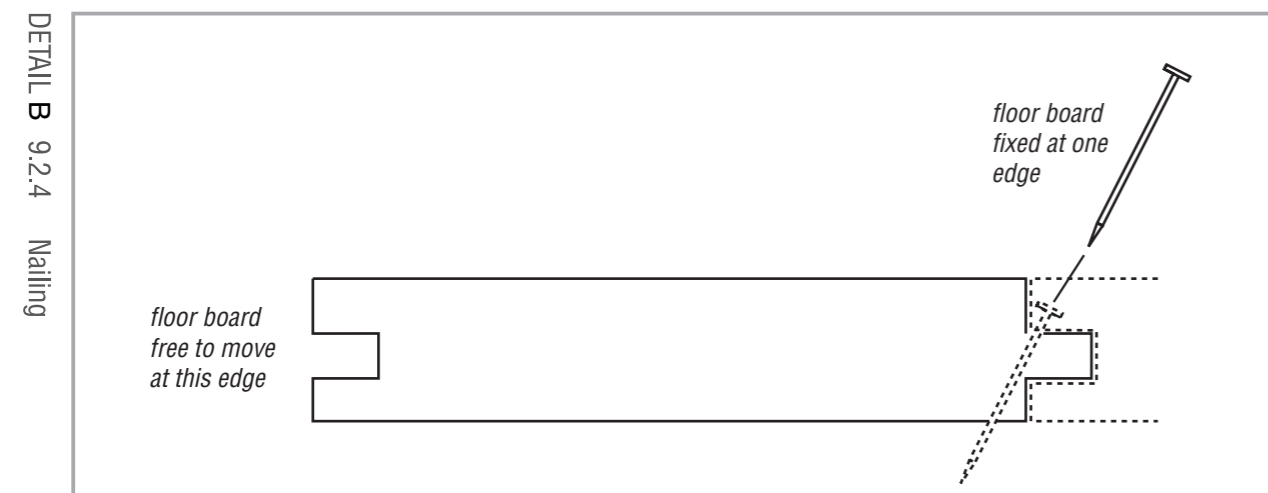
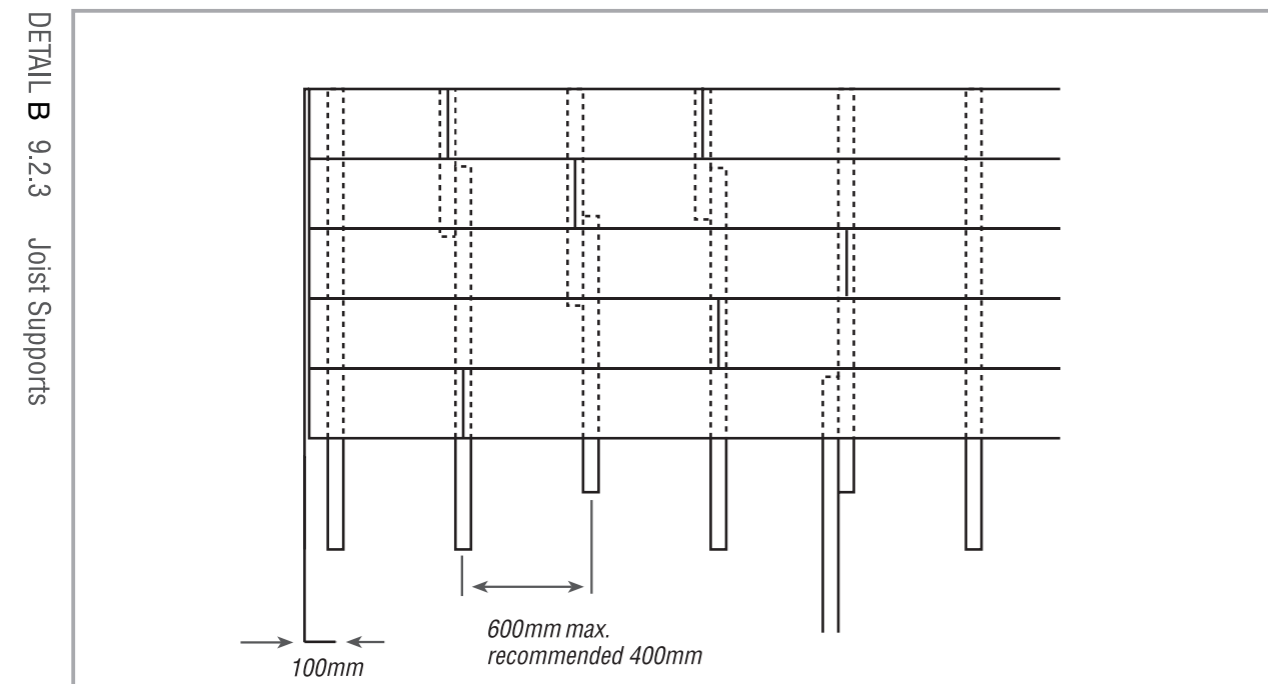
In standard domestic housing it is recommended that boards of finished dimensions 88x18mm be used. This will reduce the risk of distortion and gapping of boards in service due to movement. Cut steel flooring brads should be used.

"Allowance for moisture movement of the floor boards should be provided at the perimeter of the floor, typically 12-15mm or by calculation (particularly for wide areas). This gap is normally concealed by skirting boards. To meet the requirements for air infiltration in the Building Regulations a compressible strip or other seal may be necessary."



DETAIL B 9.2.2 Typical Floating Floor Details

B 9.2 FLOORING - TONGUED AND GROOVED (CONTINUED)

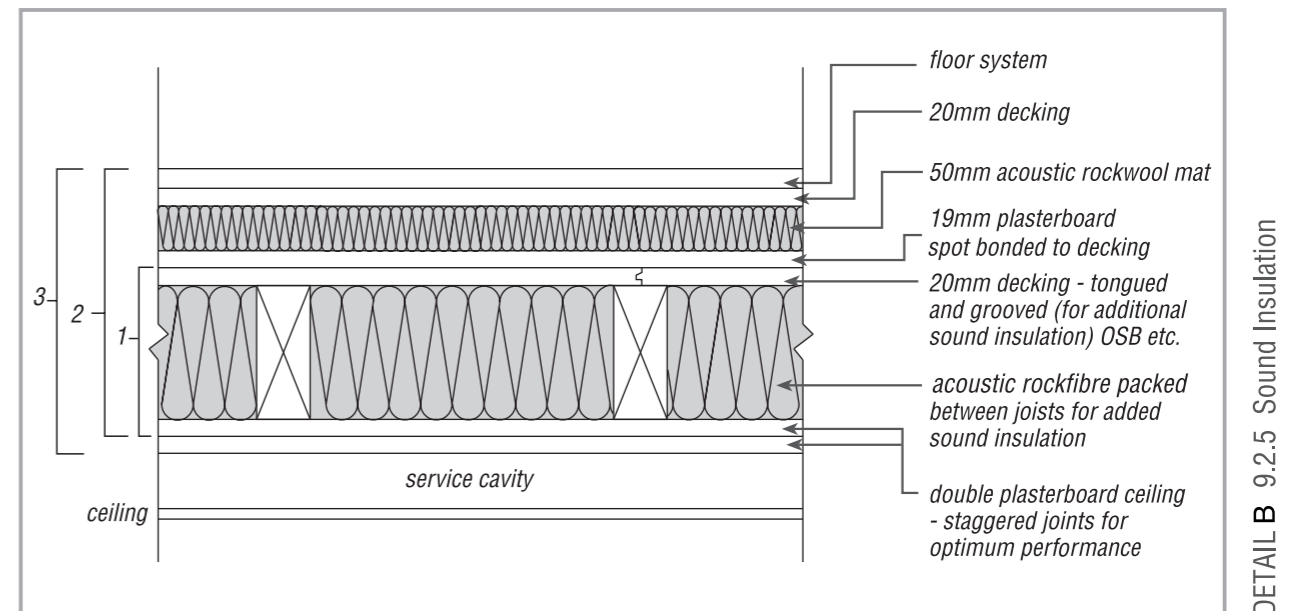


The boards should be laid at right angles or diagonally to the joists. Boards should be laid to give a random joint pattern. This is normally achieved by using the offcut of one row of boards to start the next row. Adjacent strip end joints must be a minimum of 80mm from each other. Board end joints must fall in line no closer than at intervals of three boards. All header joints should bear directly on a joist or batten to give the maximum bearing. This is essential for square-ended boards.

An expansion gap of 15mm min should be allowed on all sides. This can be covered later by a skirting board which should be fixed independently 2mm above the floor. A cork or rubber foam can be used to fill the expansion gap (see B9.2.3).

The boards can be either face nailed or secret nailed to the joists or battens. If the floor is to be left exposed it is advisable that the boards be secret nailed at an angle of 45° through the top of the tongue using 50mm or 65mm lost head ring shank wire nails (see B9.2.4).

B 9.2 FLOORING - TONGUED AND GROOVED (CONTINUED)



Sound insulation

The biggest problem affecting suspended timber floors is the transmission of sound. There are different options which can help in the sound insulation of a timber floor.

Option 1 involves insulating between the joists with acoustic rockfibre – in order for this to be effective the rockfibre should be packed tightly between the joists (allowing no gaps); the rockfibre should also be packed up behind the skirting. This method reduces transmitted sound. In order to soften impact sound a build-up of layers is necessary. These are described below as Option 2.

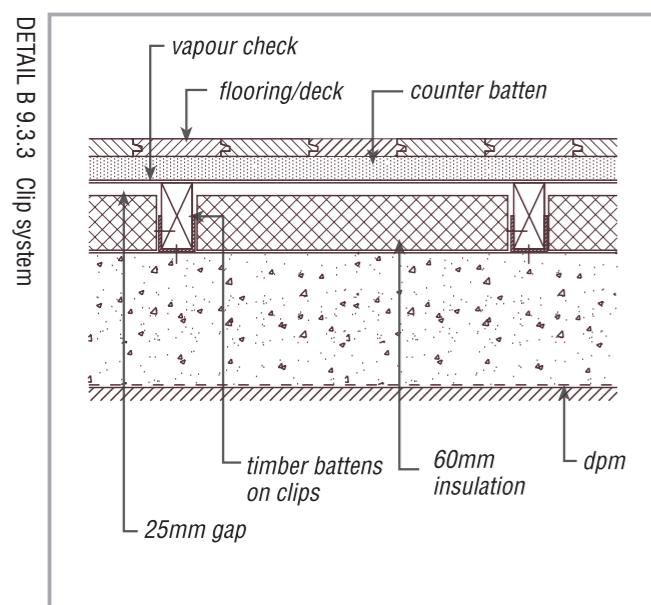
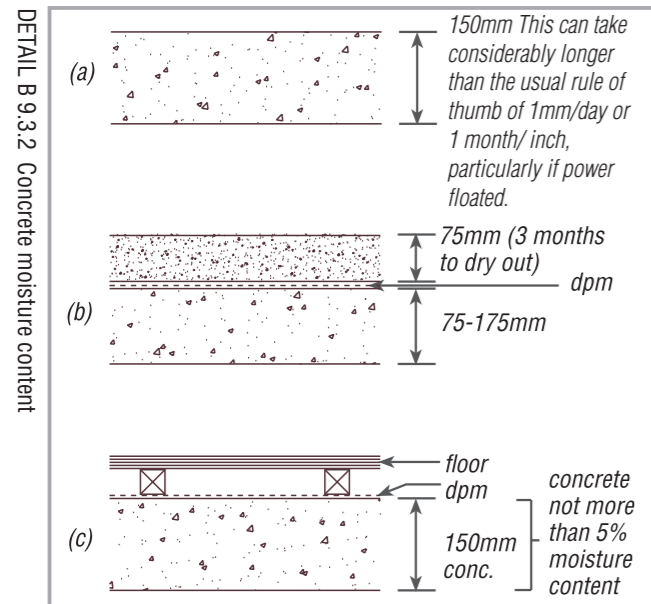
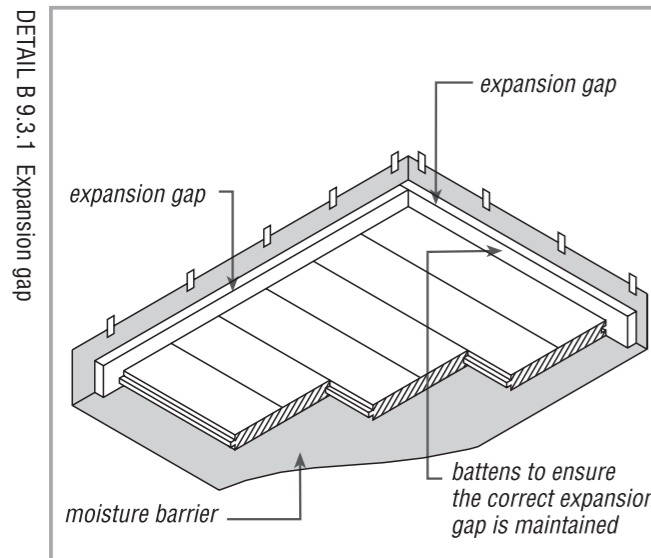
Option 2

- Acoustic rockfibre as per option 1.
- 20mm decking (T&G for additional sound insulation)
- 19mm plasterboard
- 50mm acoustic rockfibre mat
- 20mm decking
- Chosen flooring system

Option 3

Detail B9.2.5, illustrates a third option which combines both Option 1 and Option 2. Option 3 involves the addition of a further layer of plasterboard to the ceiling, with staggered joints for optimum performance. If budget allows, Option 3 provides the best solution for sound insulation.

B 9.3 FLOORING - TIMBER FLOORING ON CONCRETE SUBFLOORS



When a timber floor is to be laid on a concrete subfloor, it may be necessary to lay a moisture barrier first. This moisture barrier should be laid between the screed and the concrete floor slab. This offers protection to the moisture barrier and thus ensures its performance; however, in some cases, e.g. an existing floor, a moisture barrier may not have been laid. The moisture barrier should be unrolled and extended up the walls so as to finish just above the skirting finishing height. All edges should be lapped by 200mm and taped with waterproof tape. The underlay, if required, can be laid on top of this. There are products available on the market which incorporate both the moisture barrier and an underlay.

Temporary wooden spacers should be used to achieve the correct size of expansion gap, at the perimeter and all fixed points. These are removed at a later stage.

It is important that the concrete subfloor or screed is thoroughly dry before the timber floor is laid. Generally this means that the concrete floor should have a moisture content of 5%, but some suppliers require even lower values, particularly if underfloor heating is specified. Detail B9.3.2 shows the time suggested to allow a concrete floor to dry out.

When fixing a timber floor using a clip system, attention should be paid to the manufacturer's instructions and details as these proprietary systems differ from one manufacturer to another.

All board ends should be glued with an adhesive appropriate to the flooring system; this is usually recommended by the manufacturer. The adhesive should never be applied along the long joint as this would restrict the movement of the floor. End joints within the floor must be staggered to produce a random strip pattern similar to that as described for tongued and grooved boarding.

B 10 Windows

B 10.1 GENERAL

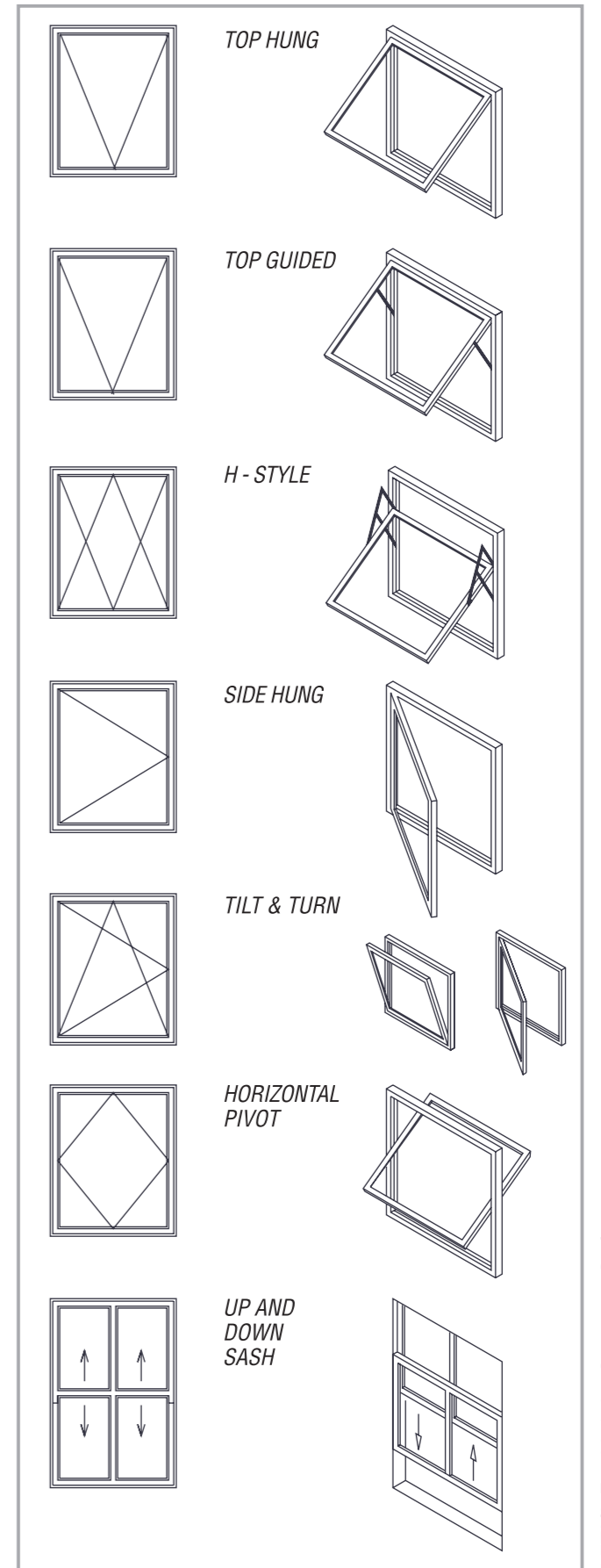
Common styles of window

Some of the most common styles are listed below. When selecting a particular style the following criteria should be considered.

- Durability
- Location
- Ease of maintenance
- Aesthetics
- Ventilation
- Security

For example if a window is located on an upper floor a 'H-style' window may prove preferable as both sides can be cleaned from the inside. The commonly used and available styles illustrated opposite are:

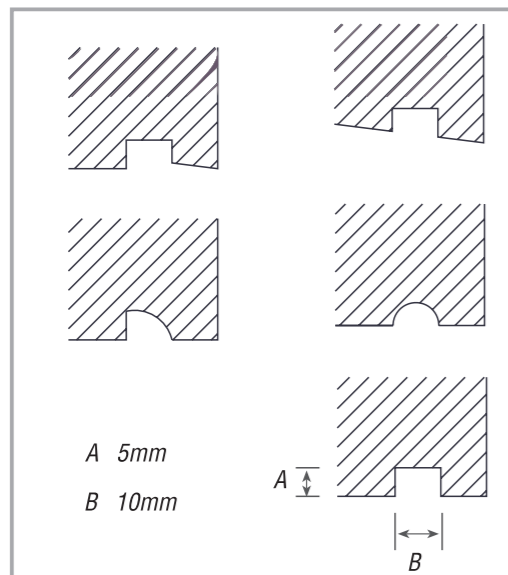
- Top hung
- Top guided
- H-style
- Side hung
- Tilt and turn
- Horizontal pivot
- Up and down sash



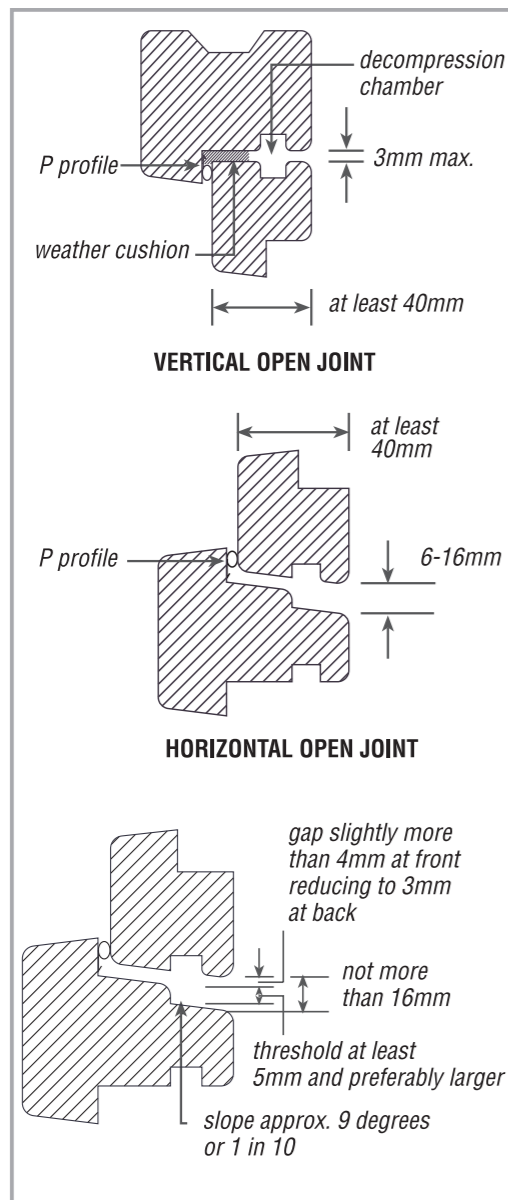
DETAIL B 10.1.1 Common Styles

B 10.1 WINDOWS – GENERAL (CONTINUED)

DETAIL B 10.1.2 Weather Drips



DETAIL B 10.1.3 Open Joints



Weather-tightness

Air and water-tightness are the basic requirements of window design. In Irish climatic conditions, adequate and effective detailing capable of protecting against wind and rain penetration is essential. The critical areas are the junctions between opening sections and fixed lights. Mastic and glazing beads must provide the necessary sealing.

Weather drips

Weather drips should be fitted to the underside of horizontal joints to prevent rain being held underneath by surface tension and blown towards the joint. Weather bars and down-stands will also improve this performance.

Weather seals

Weather seals fitted to the rebate of the fixed frame should be correctly positioned, well back from the exposed face to be kept dry, and an 'air cushion' created in the joint. Proprietary neoprene weather seals, in the form of a 'P' profile, should be fitted into a groove at the rebate of the fixed frame.

'Open' joints

'Open' joints between fixed frame and opening section provide a capillary break which prevents water seeping in and lodging in the joint. These open joints can also be covered with an external rebate to provide further protection against wind-driven rain.

Water channel

A water channel should be grooved into the top and sides of the opening section to drain water that enters the joint and form a decompression chamber that prevents driving rain from reaching the sealed joint. The top of horizontal members exposed to weather should have a run-off of not less than 1:10.

Weather strips

Plant-on horizontal weather strips can be glued and pinned to the lower part of the outside surface of an upper section to provide extra weathering and protection. Reference: *Design Principles of Weather-sealed Timber Windows* – The Swedish Finnish Timber Council.

B 10.2 WINDOWS – TYPICAL SECTION

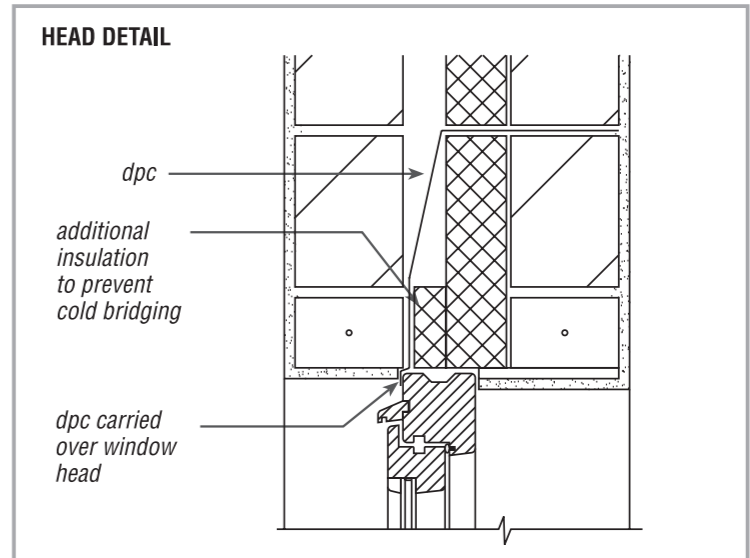
The detailing of a timber window is crucial to its performance and durability. Many manufacturers and joiners provide good details, which can be incorporated into the working drawings. The main areas, which require careful attention are:

- DPC and insulation
- junction between window frame and structure
- opening section

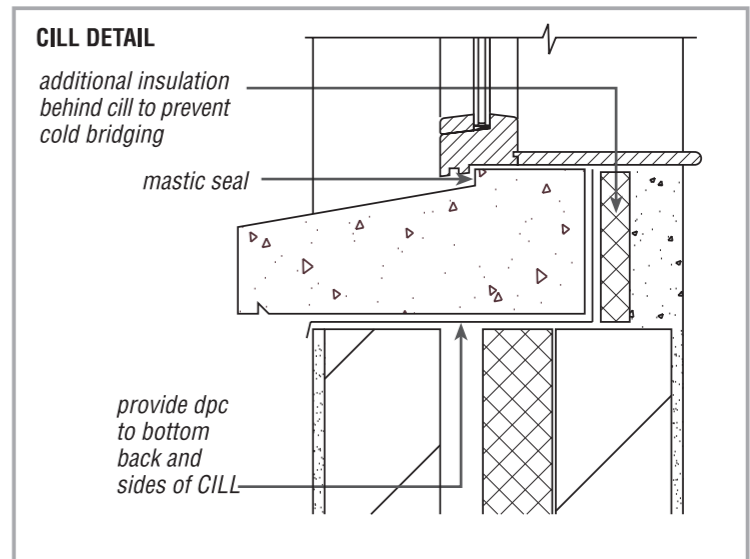
The DPC should always be lapped and sealed by 150mm at all joints. It is also advisable that the DPC is continued between all masonry and the timber window frame. The DPC should not, however, be fixed to the timber frame, but a 10mm gap should be allowed which provides for the ventilation of any moisture that may become trapped. A seal should be provided on the inside of this joint, and a trim to the outside of the DPC should be carried throughout the insulation to wrap around the block above the lintel. The insulation should be carried down to meet the head of the window, so as to avoid any cold bridges. Particular attention should be paid to open joints and weather drips. These weathering details are shown in B10.2.1/2/3.

Reference: *Design Principles of Weather-sealed Timber Windows* – The Swedish Finnish Timber Council.

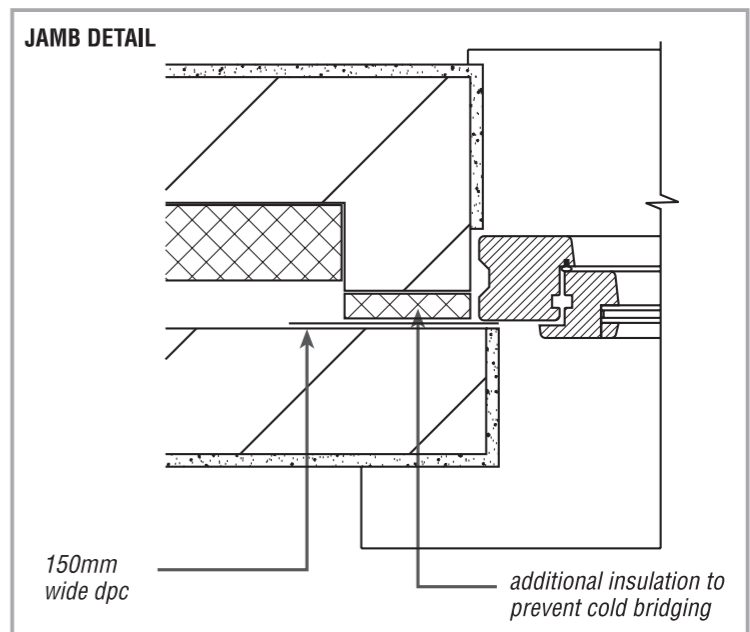
See section B12, *Working Details*, for proven window detailing for simple windows and for a glazed screen, as an alternative to metal curtain walling.



DETAIL B 10.2.1 Head Detail



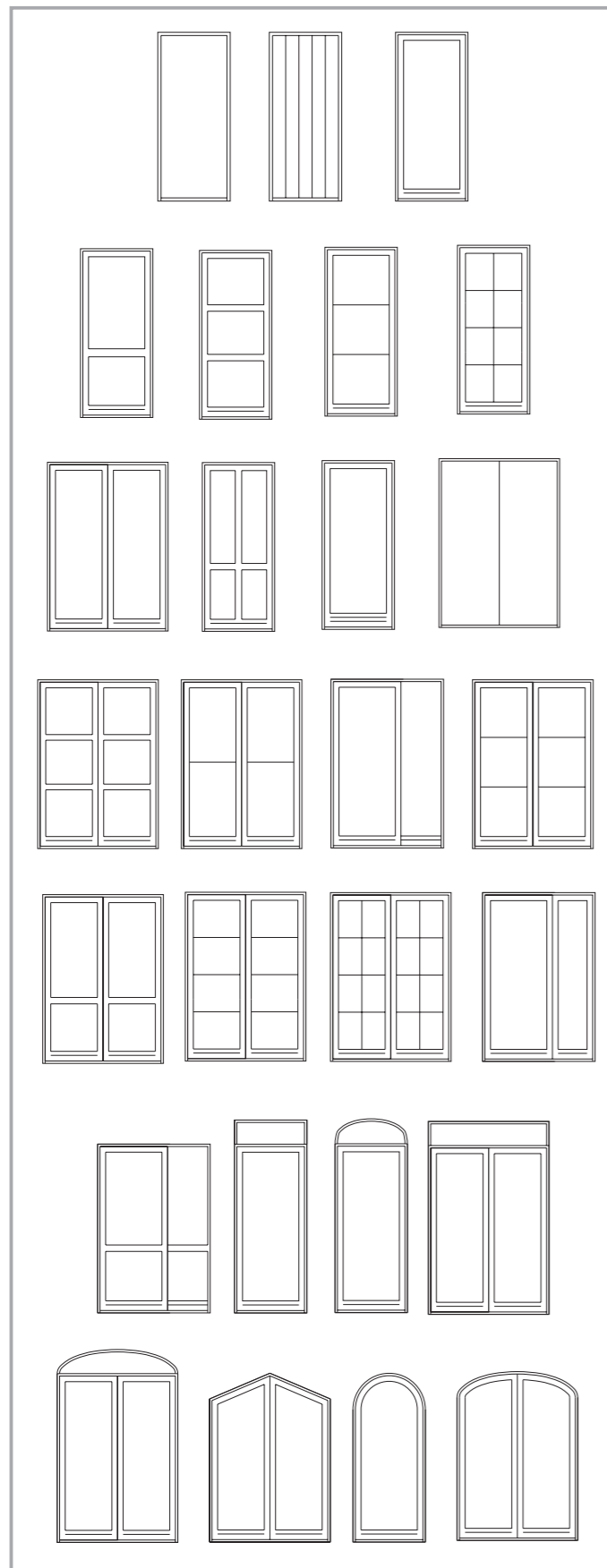
DETAIL B 10.2.2 Cill Detail



DETAIL B 10.2.3 Jamb Detail

B II Doors

DETAIL B 11.1.1 Styles of Door Available



B 11.1 GENERAL

External doors form a barrier between two different climates. They are similar in their design and construction to that of windows. Particular attention may be necessary in the detailing of the threshold, which can be the most vulnerable area of a door. Details vary from door to door but the obvious differentiation is that between inward and outward opening doors.

Types of doors

- Panelled door
- Framed and glazed door
- Ledged and braced
 - framed
 - unframed
 - hollow core
 - pressed panel hollow core (Masonite type)
 - solid core

Door opening systems

Hinged

- Single swing
- Double swing
- Folding
- Stable door type

Sliding

- Single leaf door (with fixed side panel)
- Double leaf doors (with concealed sliding gear mechanism)

Components of doorsets

- Door leaf or leaves
- Fixed door frame and linings
- Saddle/Threshold
- Architrave
- Ironmongery

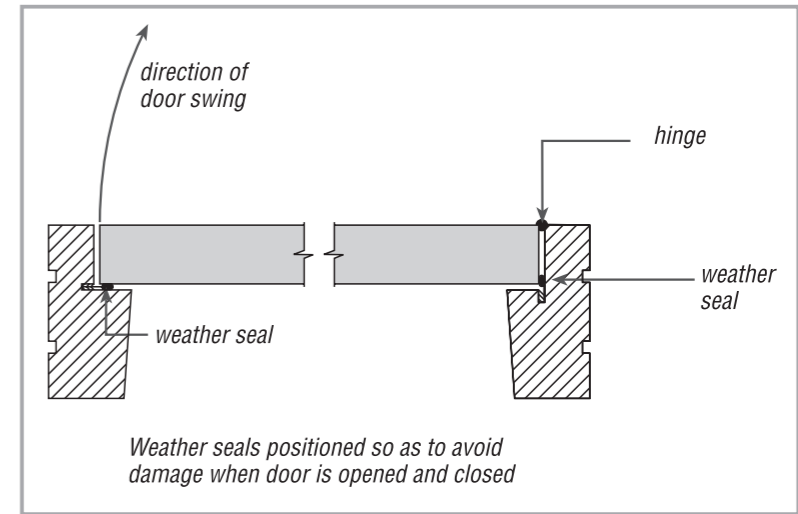
B 11.2 DOORS - EXTERNAL DOORS

Direction of opening

As mentioned previously there are two basic types of external door, which require different detailing:

- Inward opening
- Outward opening

In both of these cases it is important that the weathering profile is placed in a secure and effective position where it will not be damaged on the opening and closing of the door.

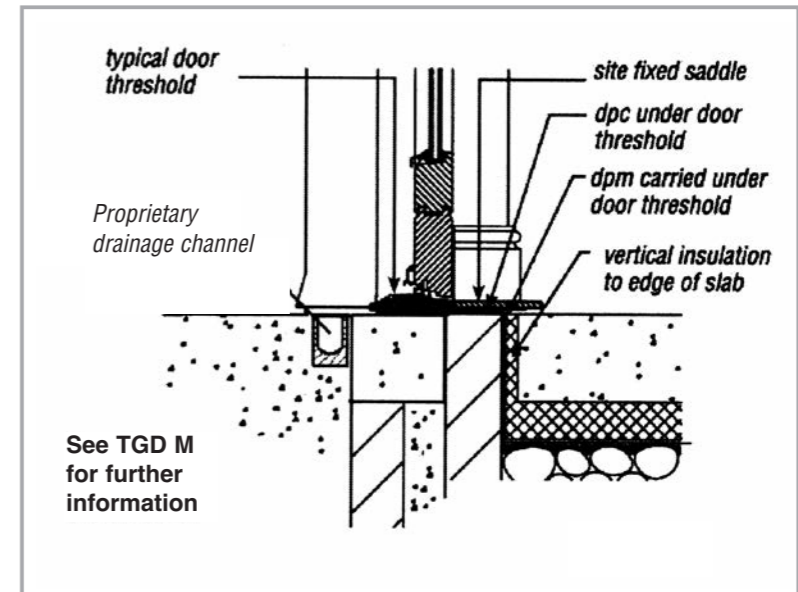


DETAIL B 11.2.1 Direction of Door Opening

Threshold

The threshold detail is particular to different proprietary door systems. Again there are differences between the detail of an inward opening external door and that of an outward opening external door.

Section B12 *Working Details*, shows an example of an external sheeted timber door, and related details.



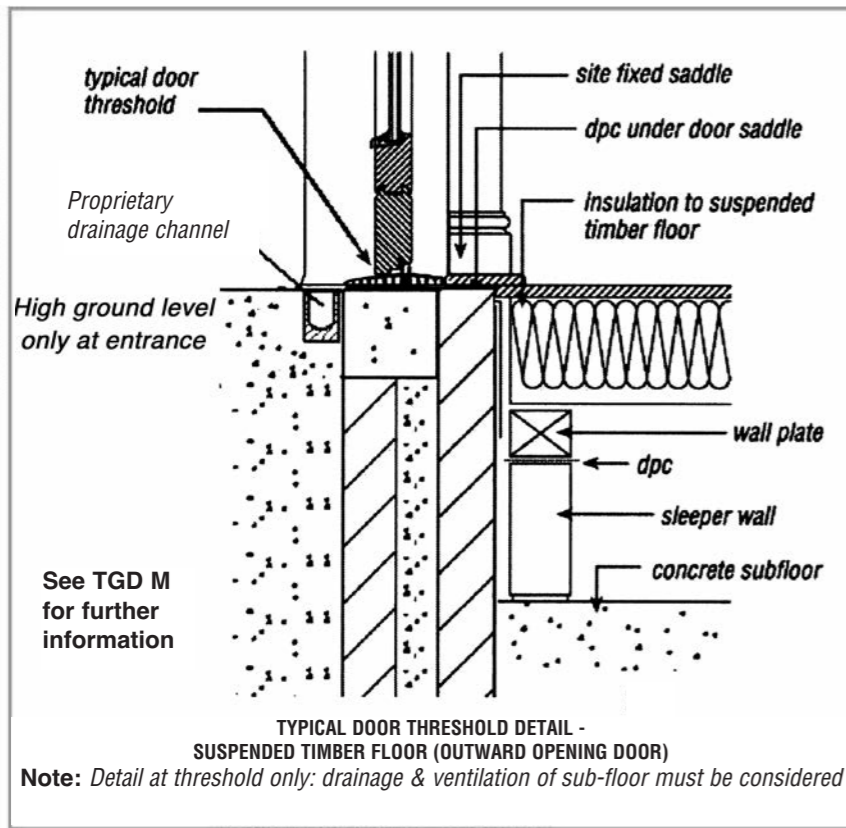
DETAIL B 11.2.2 Typical Threshold Detail for Concrete Floor (Inward Opening Door)

Access for all

Under part M of Technical Guidance Documents access for all requires that there be no step at external doors in order to assist wheelchair access. Particular care is needed in regards to the overlap of the dpm and door dpc. Specialist door thresholds are recommended. The ground level externally should fall away from the door threshold.

B 11.2 DOORS - EXTERNAL DOORS (CONTINUED)

DETAIL B 11.2.4 Door threshold

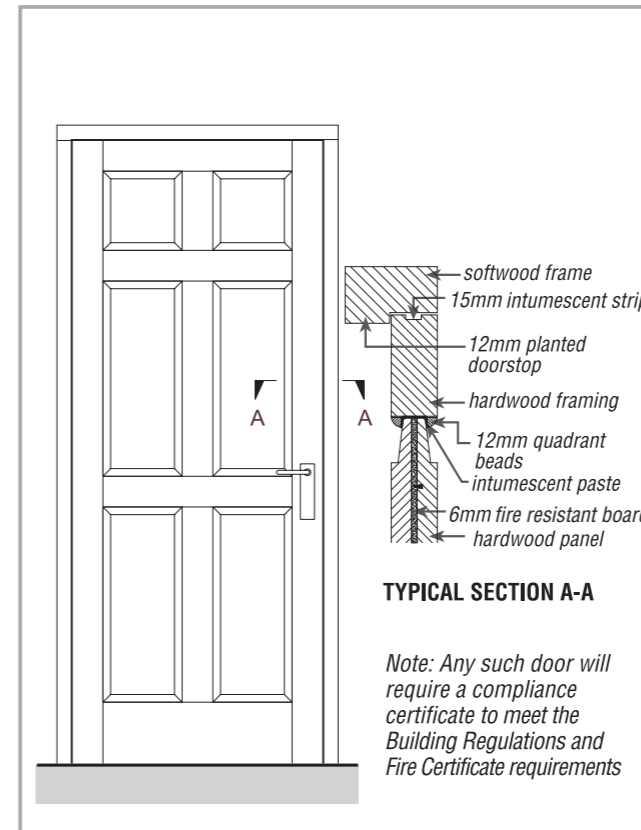


Dimensional stability

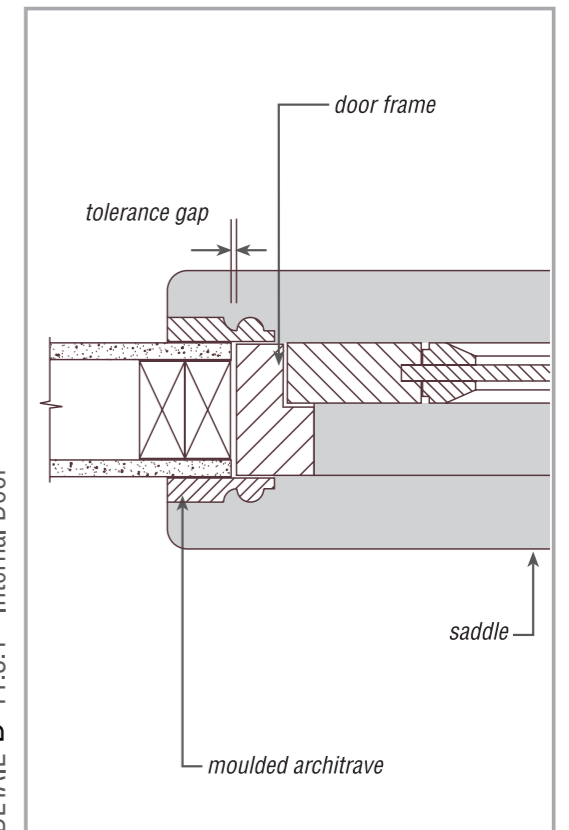
Exterior door-faces are exposed to significantly different interior /exterior environmental conditions on both surfaces. This can cause differential movement resulting in possible distortion. Care should be taken to shelter, weather and protect exterior doors, thereby minimising this distortion.

Special tanking details will be required for high ground levels. A sump effect should be avoided where possible; the sub-floor will need to be drained and ventilated.

B 11.3 DOORS – INTERNAL DOORS



DETAIL B 11.3.1 Internal Door



DETAIL B 11.3.2 Plan

Frame

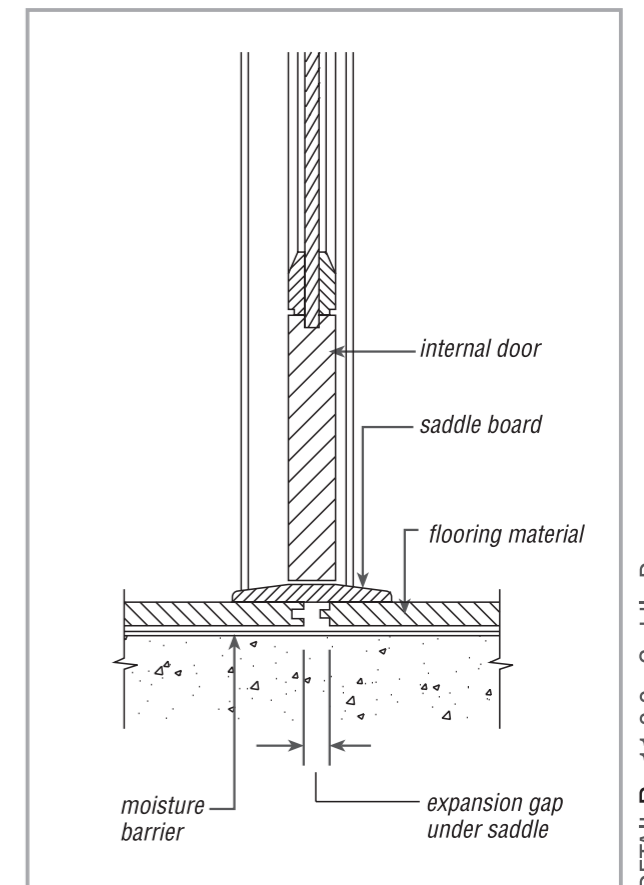
The timber should be sized to suit the door, allowing room for expansion. For side-hung single-swing openings, a rebate or planted stop is fitted. To achieve a more effective draught or sound sealing, a second rebate can be fitted between the door and the frame.

Saddle

The saddle is fitted under an internal door. It is designed to raise the bottom edge of the door so that it can clear the floor finish, it also closes the gap thereby reducing draughts. It is important to allow enough of a gap between the base of the door leaf and the saddle to ensure free movement. In some cases the designer may prefer to omit the saddle and carry the floor finish through the doorway. In this case, a slightly larger gap will be necessary at the base of the door. The saddle should only be fixed to the flooring at one side to allow for movement.

If this is done, consideration must be given to the overall width of the floors and the need to provide for movement. Proprietary metal or wood strips, shallower than saddles, are available to cover expansion gaps at doorways.

Section A-A in Detail B11.3.1 shows a traditional raised and fielded internal door with upgraded fire resistance properties.



DETAIL B 11.3.3 Saddle Door

B 11.4 DOORS – FIRE DOORS

All fire resisting doorsets require intumescent seals which vary in size, thickness and location depending on the performance of the door. These proprietary strips are fitted into grooves in the door jamb and frame to seal the gap between the door and the frame from spreading fire. They swell up to close the gap typically at temperatures of 150°C or above. Intumescent seals can be fitted with brush pile draught seals that control cold smoke from leaking.

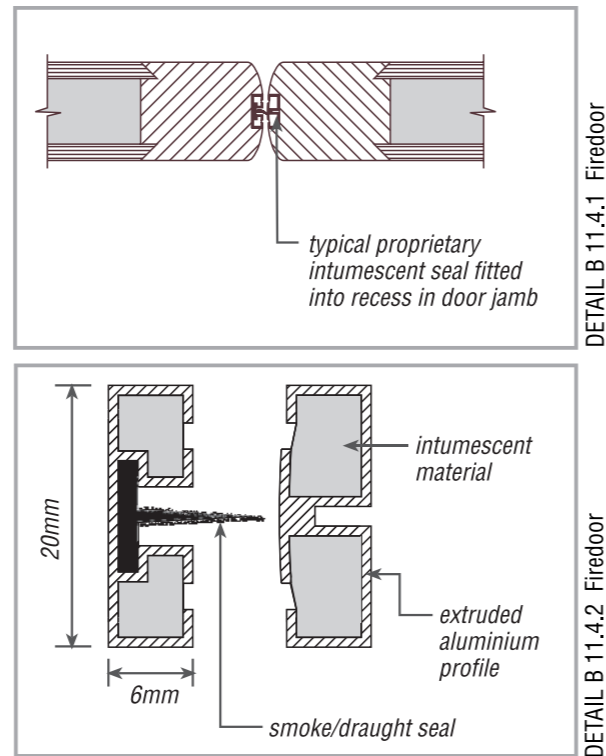
Glazed viewing panels fitted in fire resisting doors are essential in many locations to alert occupants of the fire conditions beyond the door, thus allowing proper judgment for escape routes. They should be fitted at suitable heights allowing children and the physically impaired, as well as adults, adequate viewing. To achieve the required performance, the glass should be fitted using proprietary fire channels.

Any gaps between the rear of the door frame and the wall opening should be sealed with an intumescent mastic, plaster or paste which is injected into the gaps before the architraves are fitted, subject to the fire test report. Gaps of up to 5mm between the door leaf and the door frame or usually between leaves may be tolerated. These gaps are necessary to allow for swelling/shrinkage cycles and prevent jamming. The intumescent and some brush pile seals will swell in fire to seal this size of gap. Shrinkage of doors leaving gaps in excess of 5mm, can cause a breach of 'integrity' and insulation.

When specifying a fire door it is essential to check with the manufacturer that the door complies with the relevant fire test standard (see A.5. Fire Performance, Fire Door Sets), for the specified minimum fire resistance in minutes (i.e. the door's integrity). All fire doors shall have the appropriate performance outlined in *Technical Guidance Document B, Appendix B, Table B1* of the Irish Building Regulations or the appropriate Approved Document in the UK. Any reference to a fire door is intended to mean a complete door assembly which includes the door leaf or leaves, the door frame, ironmongery and any seals.

Where restricted to smoke leakage at ambient temperatures is needed an additional classification of 'Sa' is used for doors for fire tests to the European Standard and 'S' for tests to BS476 Part 22.

Note: Any such door will require a compliance certificate to meet the Building Regulations and Fire Certificate requirements.



B 12 Sample Working Details

The working details illustrated in this section are based on the experience of built examples in Ireland, and are sets of drawings which aim to respond to the most frequently asked queries of architects interested in the use of timber. They relate to the principles shown in the previous design and detail sections and translate them into scaled technical drawings. They show the architectural intent of the designer and craft ability of the joinery workshop, and acknowledge the requirements of site buildability and long term durability. These drawings should be read in conjunction with the Specification Section.

Double vacuum preservative treatment will greatly improve the performance of all non-durable species suitable for external cladding (when protected by a finish). Clear or very light wood stains are not as ultra violet protective as reds or browns, while varnish is unsuitable for use in the Irish climate. If specifiers wish to omit wood-staining maintenance or have an aged 'natural look' then preservative impregnation is even more important to prevent deterioration and control surface mould growth. Preservative treatment should be to a minimum of Hazard Class 3A. External joinery timber should be specified as having a moisture content of 16±3%. Metal fixings should be either steel or silicon bronze to avoid corrosion problems especially from acidic timbers such as oak and Western red cedar. Do not use aluminium, wire or galvanised sherardised nails as they will cause staining. If stainless steel bolts are used for connecting timber to galvanised or mild steel columns or beams, remember to use isolation sleeves to avoid bimetallic corrosion.

Screen details

The group of six drawings, B12.1 (pages 223–228), shows how timber can compete with any other man-made material in providing a repetitive glazed screen or curtain walling system. The 'assembly' drawing, B12.1 (page 224), illustrates the integration of the primary steel structure of a single storey building with the glazed timber screen. The steel is designed and assembled to facilitate the architectural intent of a visually light screen. The timber screens are fixed to the steel columns by fixing cleats. Adjoining timber screens are joined together along the line of the vertical column cleats. A hardwood T-section, fixed and bedded in mastic, is covering the jointing of adjoining screens, while at the same time allowing for moisture/thermal movement along the overall length of the screen and on-site ease of assembly. A steel cross rail provides additional wind restraint and is integrated and concealed within the overall timber screen construction.

Suitable hardwood timber species include Irish or American white oak, teak and iroko. Western red cedar has similar natural durability as these species but would require larger section sizes to carry the imposed wind loading and the dead weight of large double-glazed units. The low density of western red cedar of 390kg/m³ compared to American white oak's 770kg/m³ means that abrasion, indentation and its poorer ability to hold fixings can be a problem.

Suitable preservative-impregnated softwoods include Douglas fir, larch, pitch pine, Scots pine and Norway spruce. All profiling mortising and tenoning must be carried out prior to preservative treatment. Assembly of the components takes place after preservative treatment. See Section C Sample Specification for further information.

Timber frame

This set of four drawings, B12.2 (pages 229–232) illustrates timber as the structural framework and material for external and internal cladding and joinery. Drawing B12.2 (page 229) shows a breather membrane layout for junctions and overlaps although other practices and layouts may be used. Timber frame panels should come from the factory with the breather membrane already attached as this maximises the protection to the panels from the breather membrane. A breather membrane complying with BS 4016 should be used.

Drawing B12.2 (page 230) illustrates the junctions of an individual window set into a timber frame wall. Of particular interest is the use of the timber sill section for the side reveals and its adaptation for the head detail. This detail provides end grain protection to the adjoining vertical or horizontal cladding while giving additional framing definition to the window within the wall cladding. The junction between the external breather membrane and internal vapour check should be noted as well as the option of providing a 'services' void behind the internal wall finish to protect the vapour check from mechanical damage while providing a concealed route for building services.

Drawing B12.2 (page 231) shows bespoke external and internal corner junctions using stainless steel trims to give a visually lighter corner detail than the more conventional corner junctions.

The junction detail between the timber-frame construction and an adjoining blockwork wall, shown in detail B12.2 (page 231), allows for differential movement between the two materials. Note should be taken of the interface between the folded vertical DPC of the masonry wall and the breather membrane to the timber wall. Semi-rigid insulation batts suitable for timber frame construction should be specified.

Drawing B12.2 (page 232), illustrates a variety of cladding profiles. The external vertical cladding board shown here has a 25mm finished thickness as against the more conventional UK and Irish 16mm. The 25mm board is derived from Swedish building regulations and is to be recommended from built examples here in Ireland. Each board is fixed with one ringshank nail (silicon bronze or stainless steel) per batten. The fixing is made through the v-joint which has two distinct advantages over more conventional face nailing. Firstly it allows the cladding board to move according to seasonal variations in relative humidity without causing stress-induced cracking. Secondly, the visual impact of the nail fixing is greatly reduced by virtue of its location in the v-joint.

Stress relieving channels on the inside face of external cladding boards may help to reduce cupping and also assists ventilation to the batten cavity behind the cladding. When used in this manner, in association with staggered battens, adequate ventilation can be achieved without the use of counterbattens, so that the vertical and horizontal cladding can be used on the same level surface without difficult junction problems.

The profile of the internal cladding boards for walls or ceilings allows for concealed fixing. Depending on their end-use location and extend fire-retardant treatment to Class 1 or Class 0 will be required.

Rainskin

This group of three drawings (B12.3.1-B12.3.3) illustrate the novel use of timber as a 'rainskin' cladding to a non-timber structure behind the cladding. A cavity wall type of construction is provided without the need for an additional external masonry wall. Detailing is otherwise similar to timber frame construction except where shown. A pressed

and folded stainless steel flashing could be used in lieu of lead flashing shown in detail B12.3.3.

External timber door

This drawing (B12.4.1), shows a sheeted timber door. To achieve a door resistant to moisture movement, the thickness of sheeting is equal on both sides of the concealed framing. The profile of the bottom rails is designed to protect end-grain and avoid capillary water attraction.

Column base

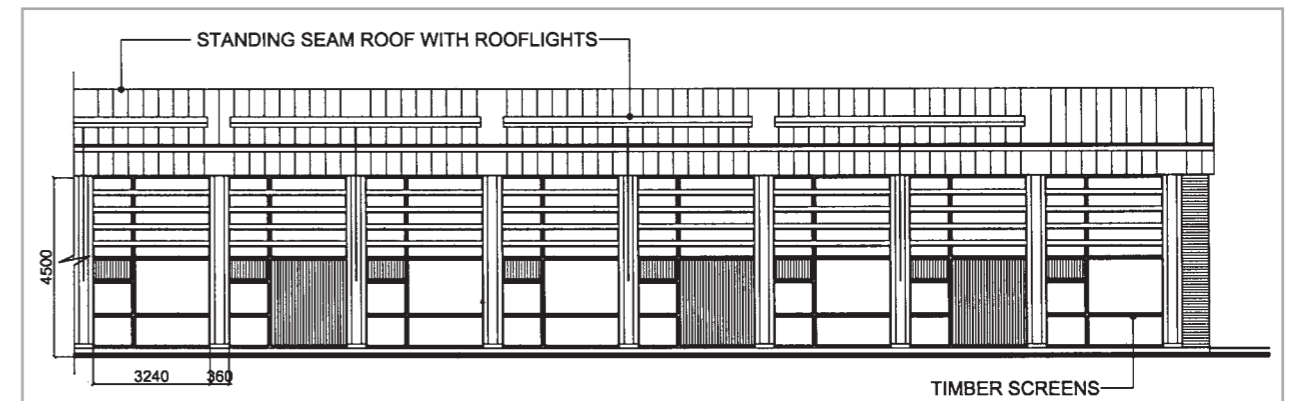
These details (B12.5.1-B12.5.2), illustrate a steel base detail suitable for post and beam or pergola column construction. It has the advantage of keeping the timber column out of ground contact. It also allows the beams for floor or roof support to pass through the split and makes their interconnection very simple. A series of these bases can give a timber post and beam house an elegant connection with the landscape, as the building appears to hover above the ground.

B 12.1 WORKING DETAILS - GLAZED SCREENS

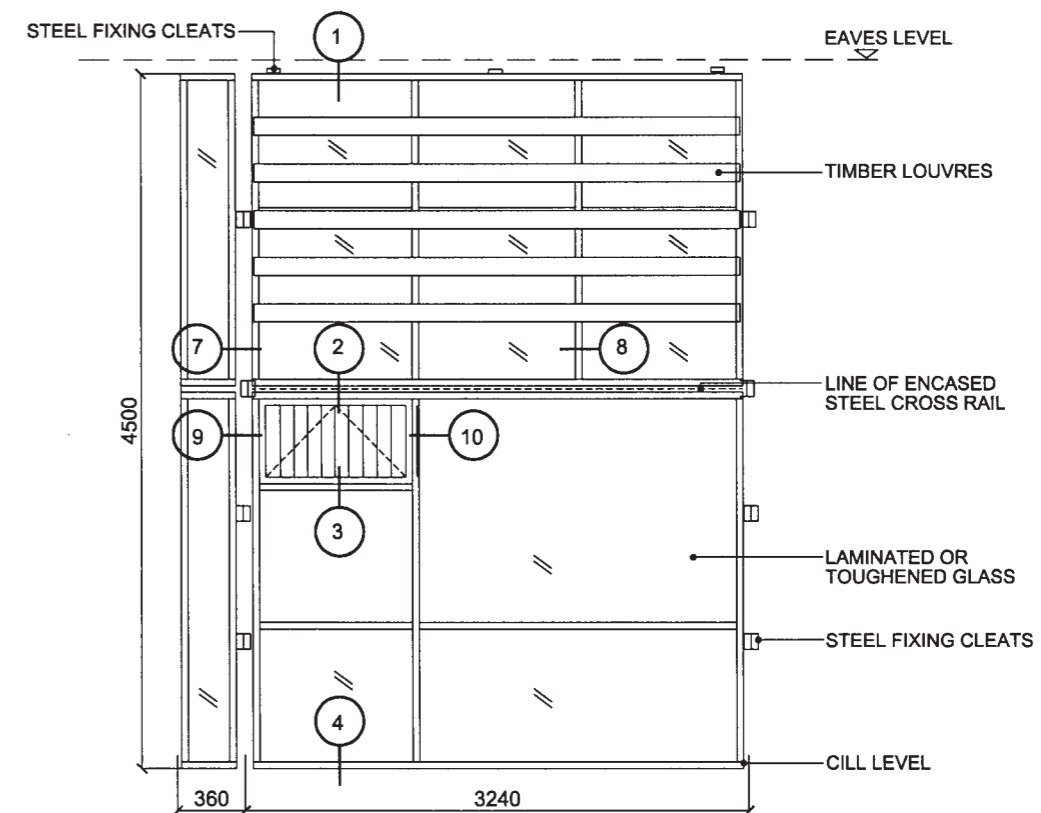


European Commission Food and Veterinary Office, Grange, Co.Meath.

Evening view of dining hall elevation. The opening sections are expressed by using solid timber cladding within frames.



SAMPLE ELEVATION SHOWING REPETITIVE TIMBER SCREENS
SCALE 1:200



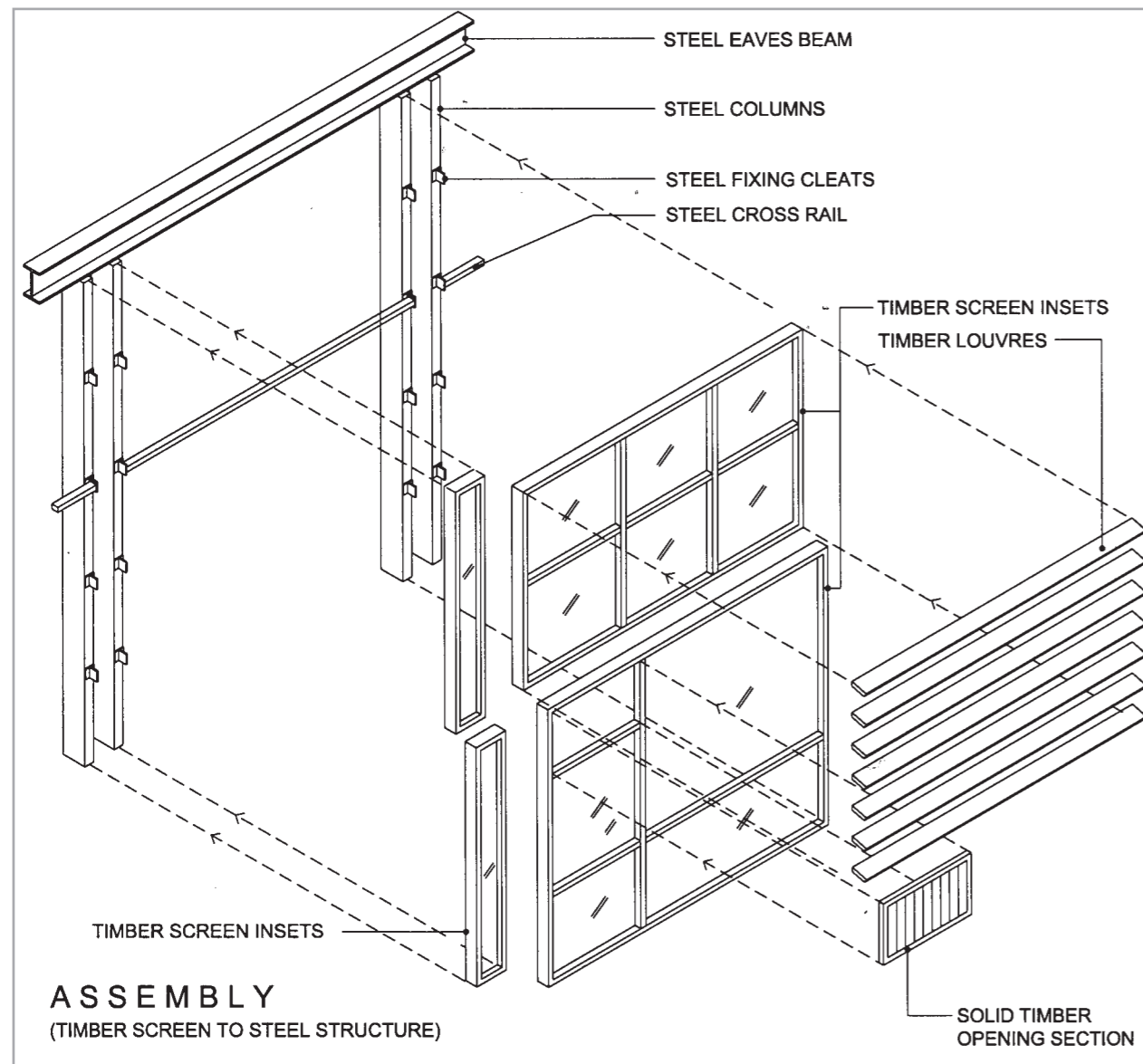
TYPICAL GLAZED TIMBER SCREEN ELEVATION
WITH REFERENCE KEYS ATTACHED
SCALE 1:50

DETAIL B 12.1.1

B 12.1 WORKING DETAILS - GLAZED SCREENS (CONTINUED)

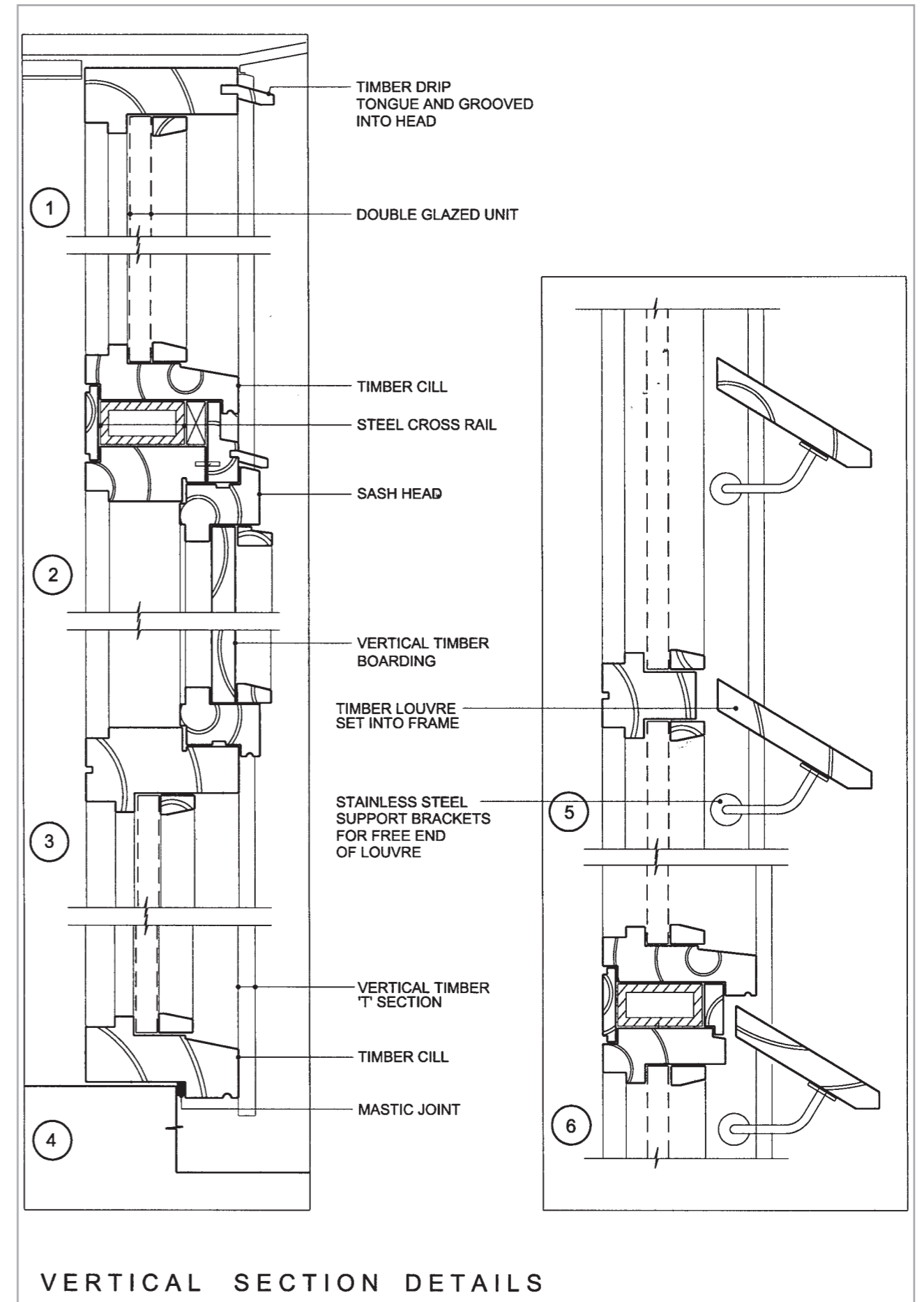


European Commission Food and Veterinary Office, Grange, Co.Meath. View of internal courtyard and timber screen with integrated louvres.



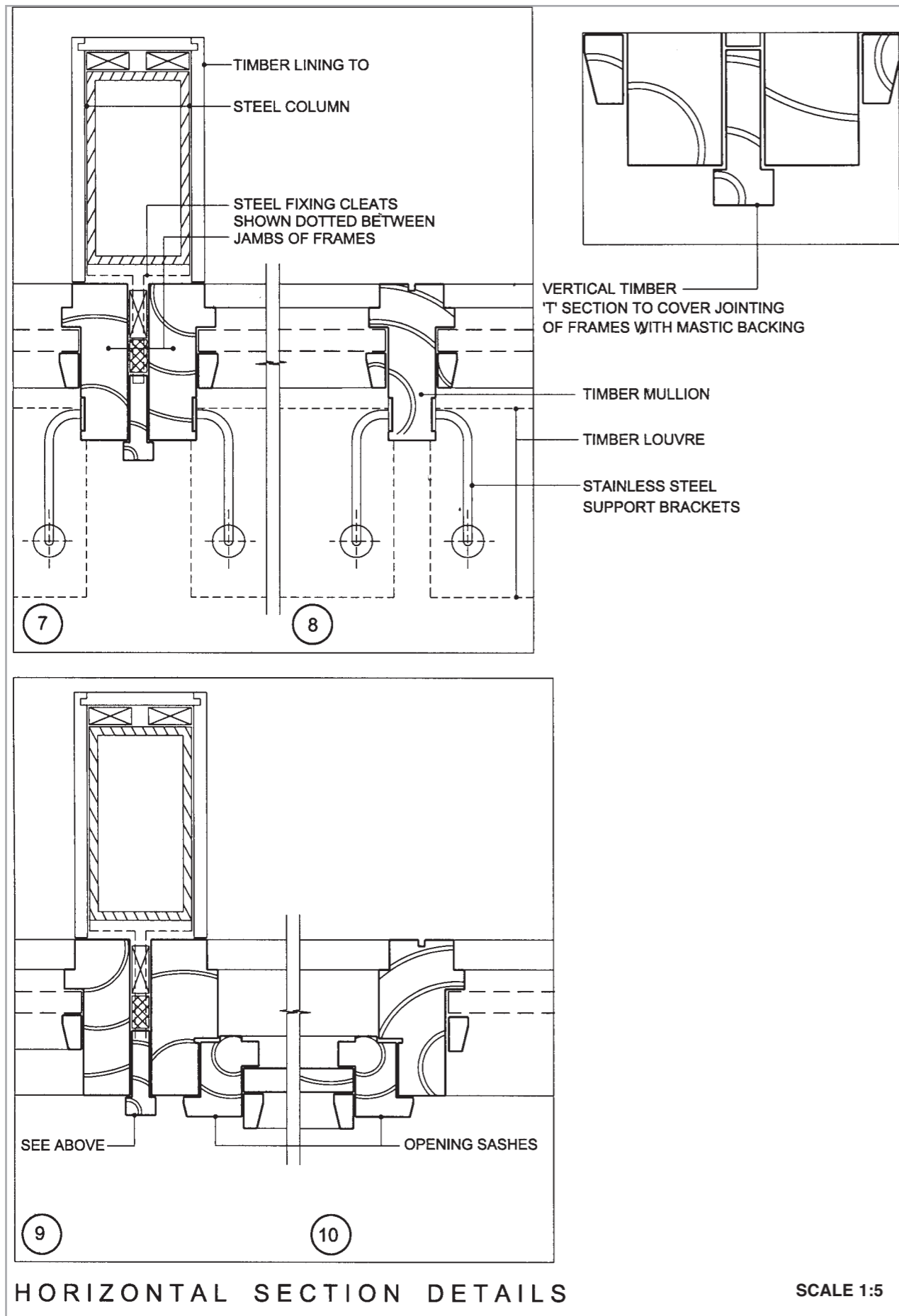
DETAIL B 12.1.2

B 12.1 WORKING DETAILS - GLAZED SCREENS (CONTINUED)



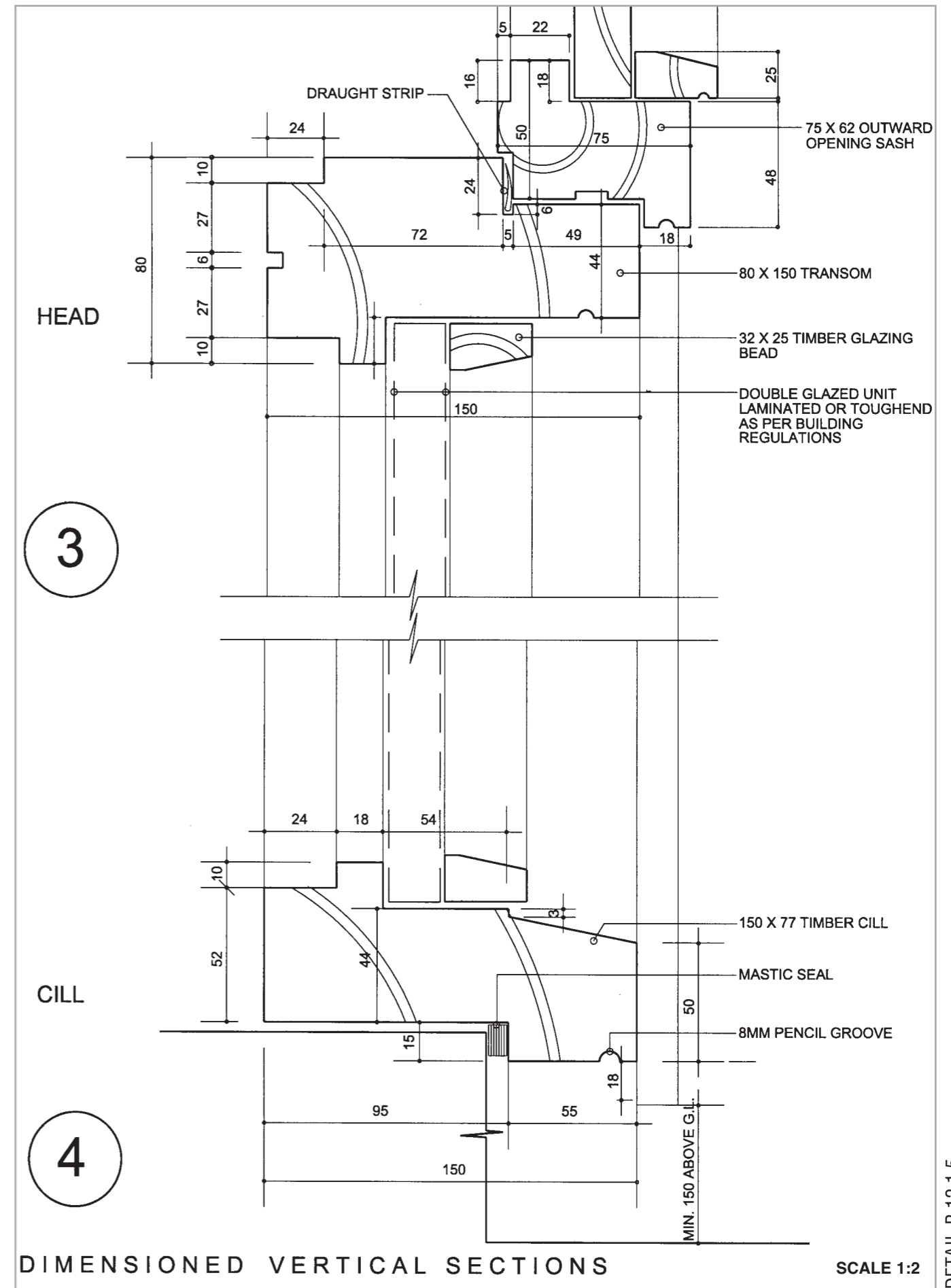
DETAIL B 12.1.3

B 12.1 WORKING DETAILS - GLAZED SCREENS (CONTINUED)



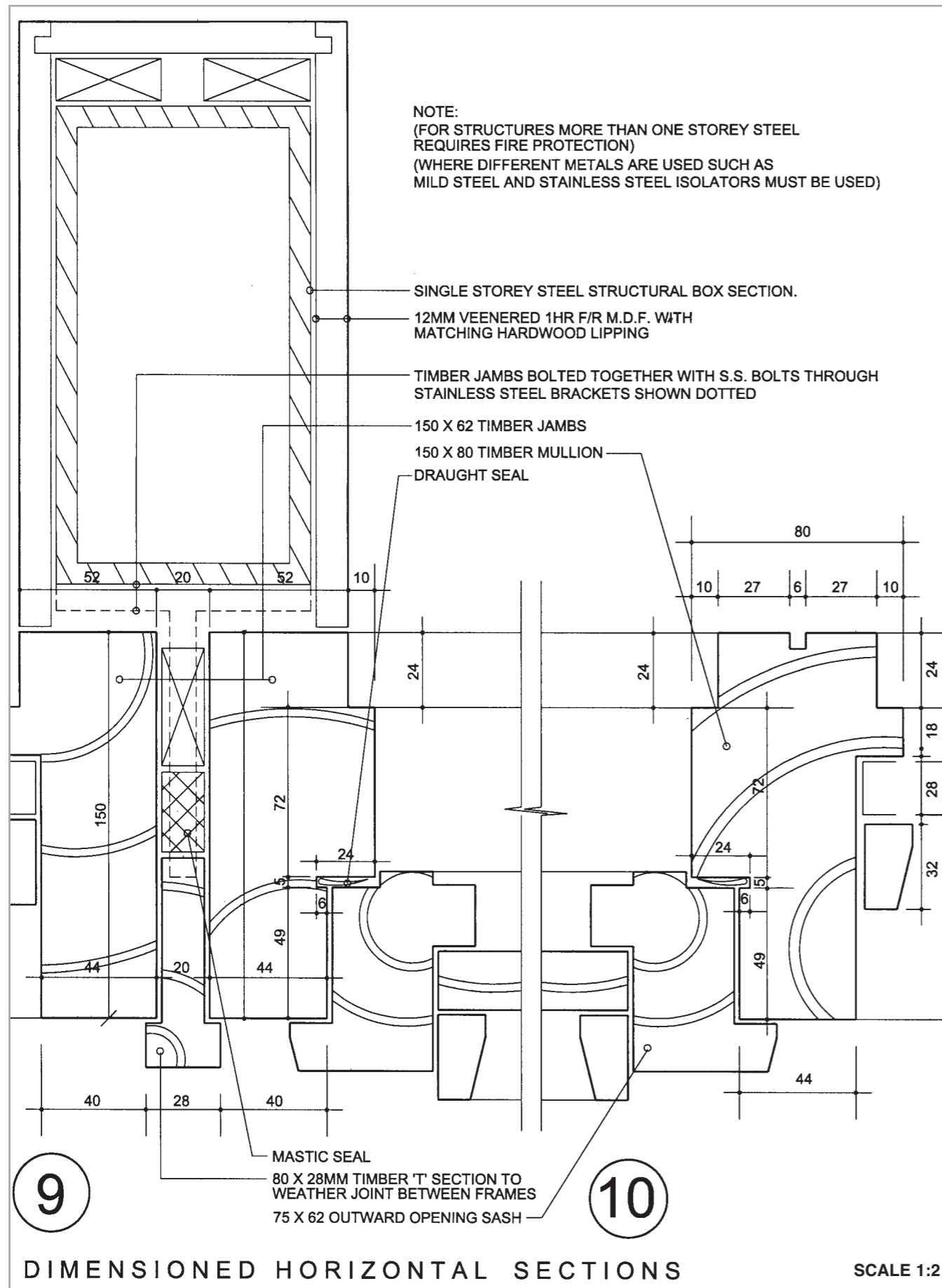
DETAIL B 12.1.4

B 12.1 WORKING DETAILS - GLAZED SCREENS (CONTINUED)



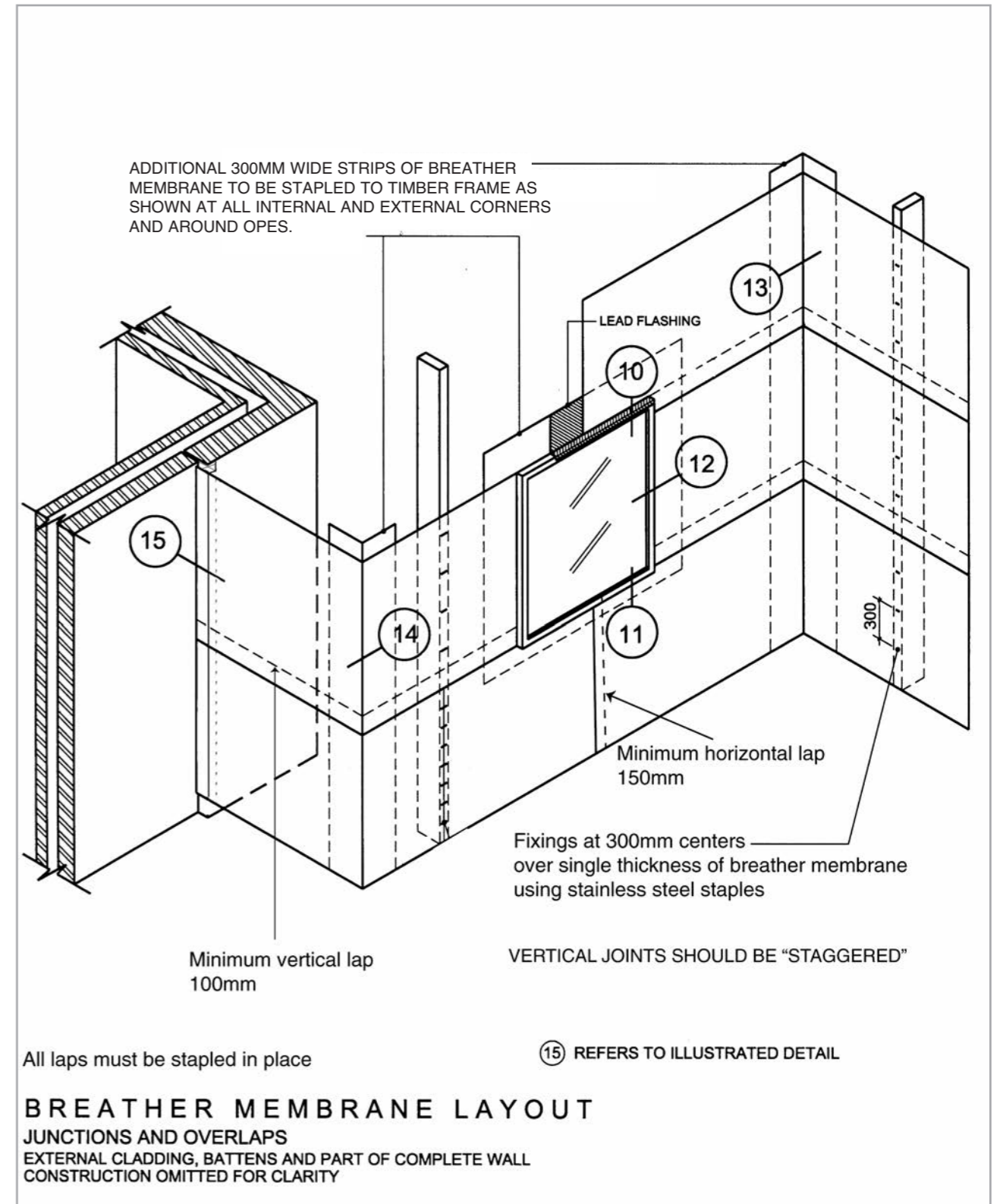
DETAIL B 12.1.5

B 12.1 WORKING DETAILS - GLAZED SCREENS (CONTINUED)

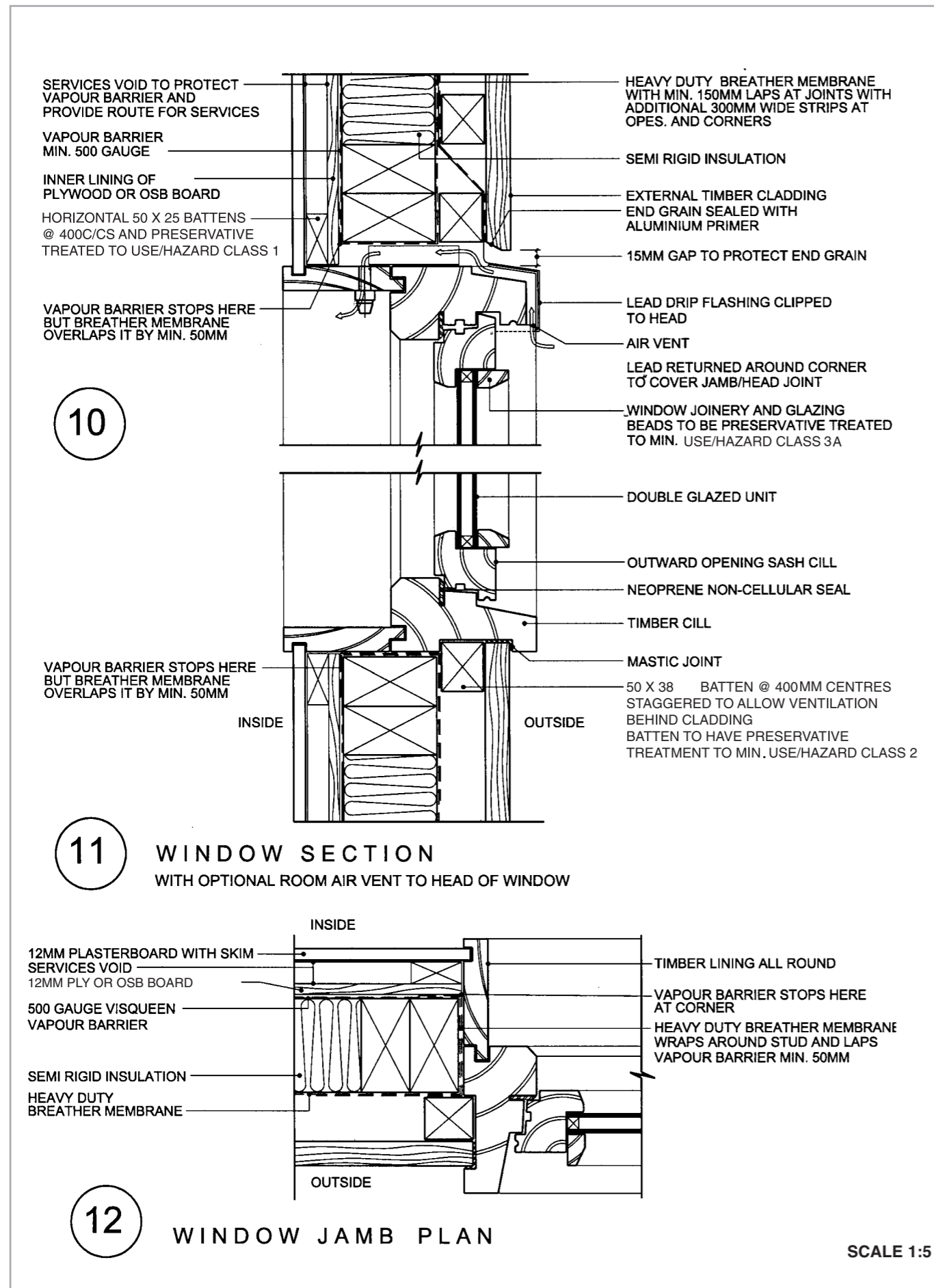


DETAIL B 12.1.6

B 12.2 WORKING DETAILS - TIMBER FRAME

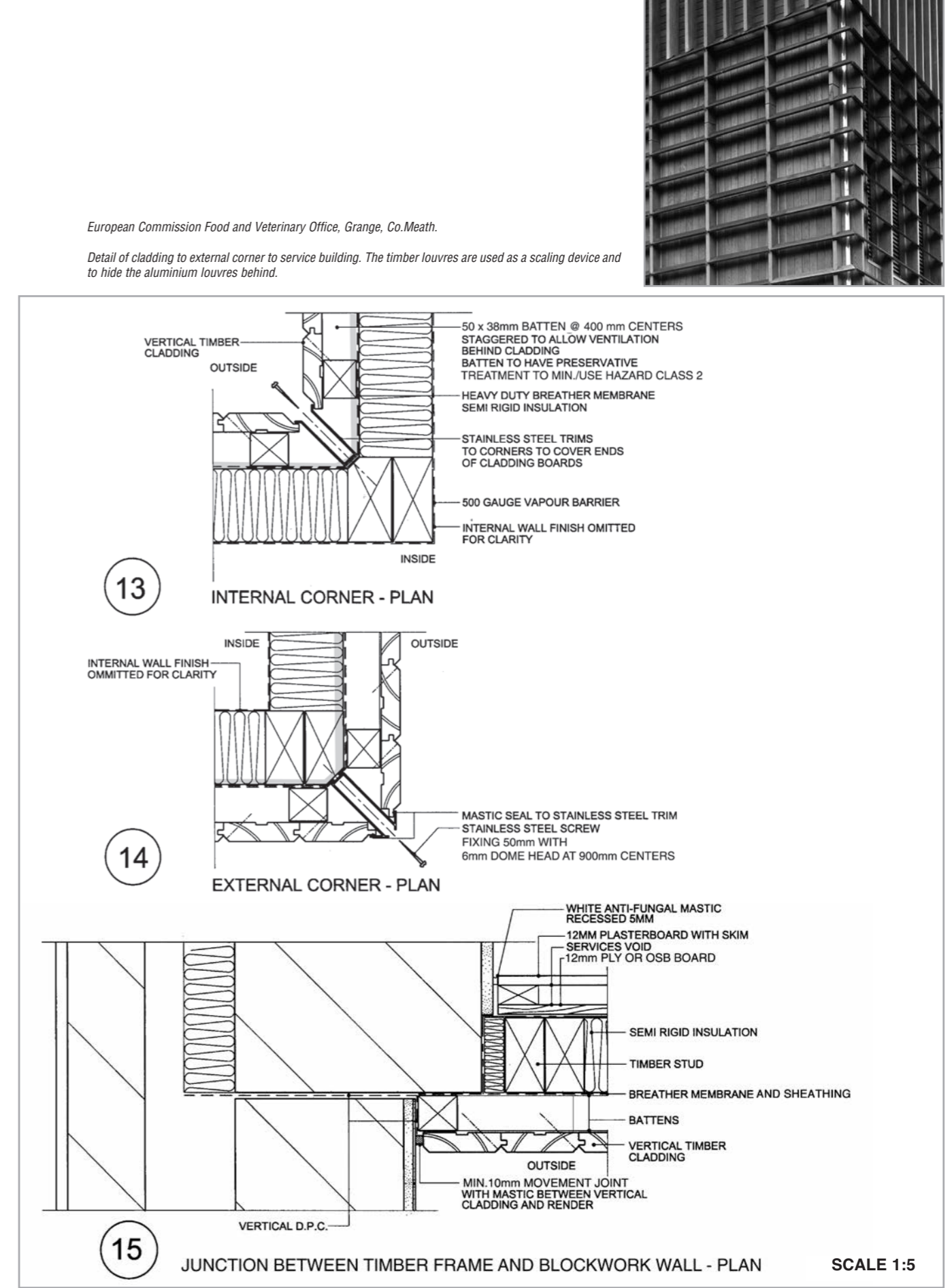


B 12.2 WORKING DETAILS - TIMBER FRAME (CONTINUED)



DETAIL B 12.2.2

B 12.2 WORKING DETAILS - TIMBER FRAME (CONTINUED)



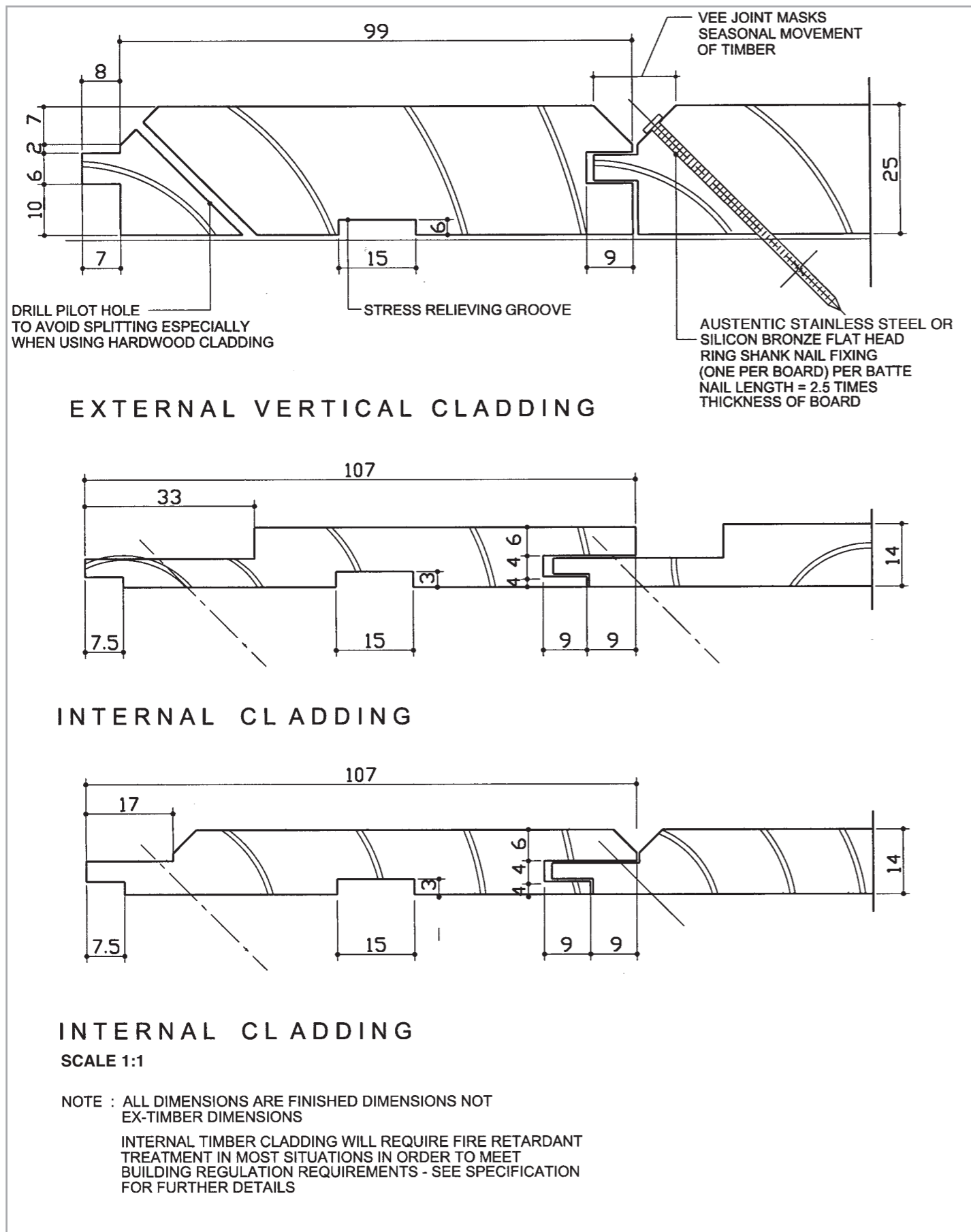
European Commission Food and Veterinary Office, Grange, Co.Meath.

Detail of cladding to external corner to service building. The timber louvres are used as a scaling device and to hide the aluminium louvres behind.

DETAIL B 12.2.3

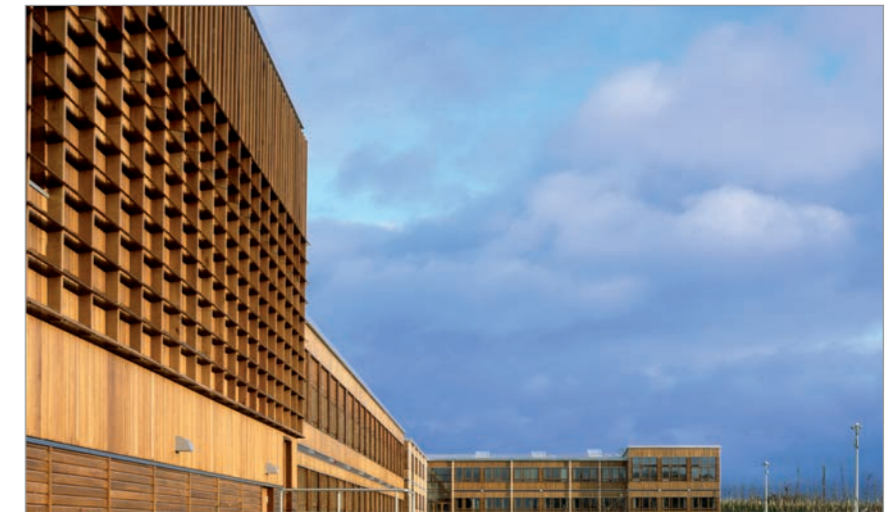
NOTE: The layout shows guidelines for the fixing of a breather membrane on site. However, in line with good practice, most timber frame buildings have the breather membrane fixed in the factory and only the laps need to be secured. To ensure weather-tightness the breather membrane should always be backed by board materials such as sheathing.

B 12.2 WORKING DETAILS - TIMBER FRAME (CONTINUED)



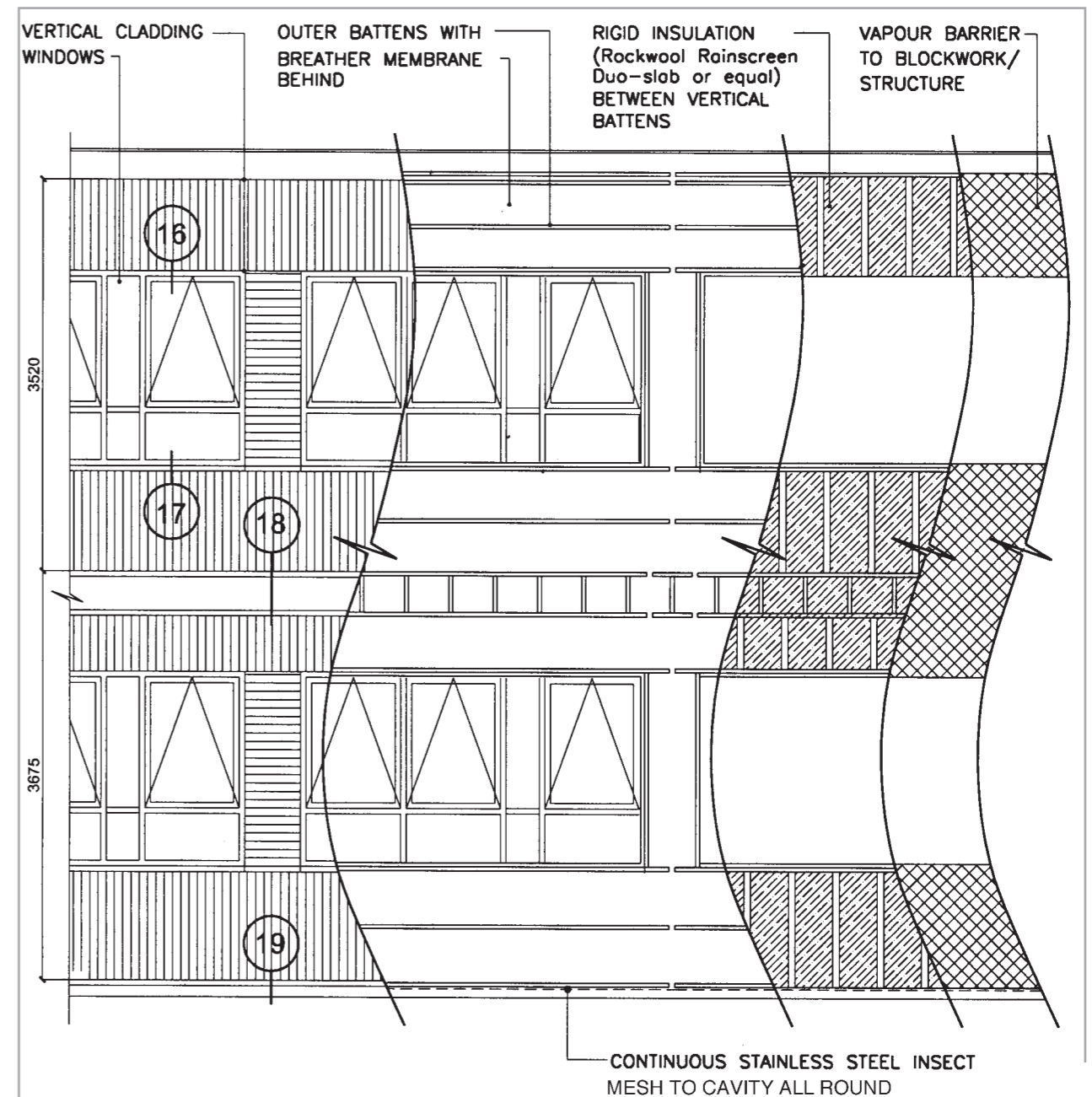
DETAIL B 12.2.4

**B 12.3 WORKING DETAILS -
TIMBER CLADDING -
BLOCKWORK WALLS**



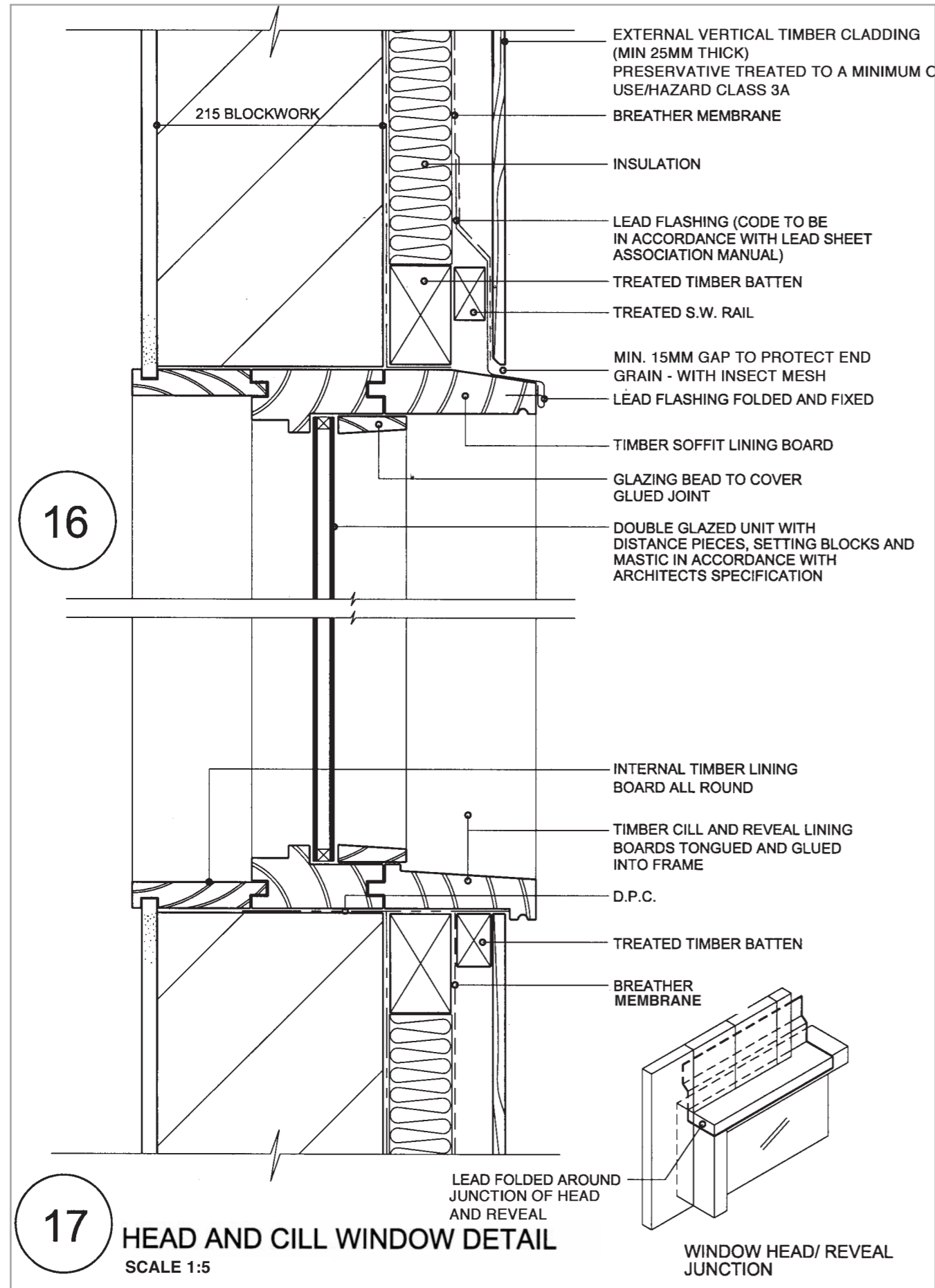
European Commission Food and Veterinary Office, Grange, Co.Meath.

View of the timber cladding to the south-west elevation of the building.



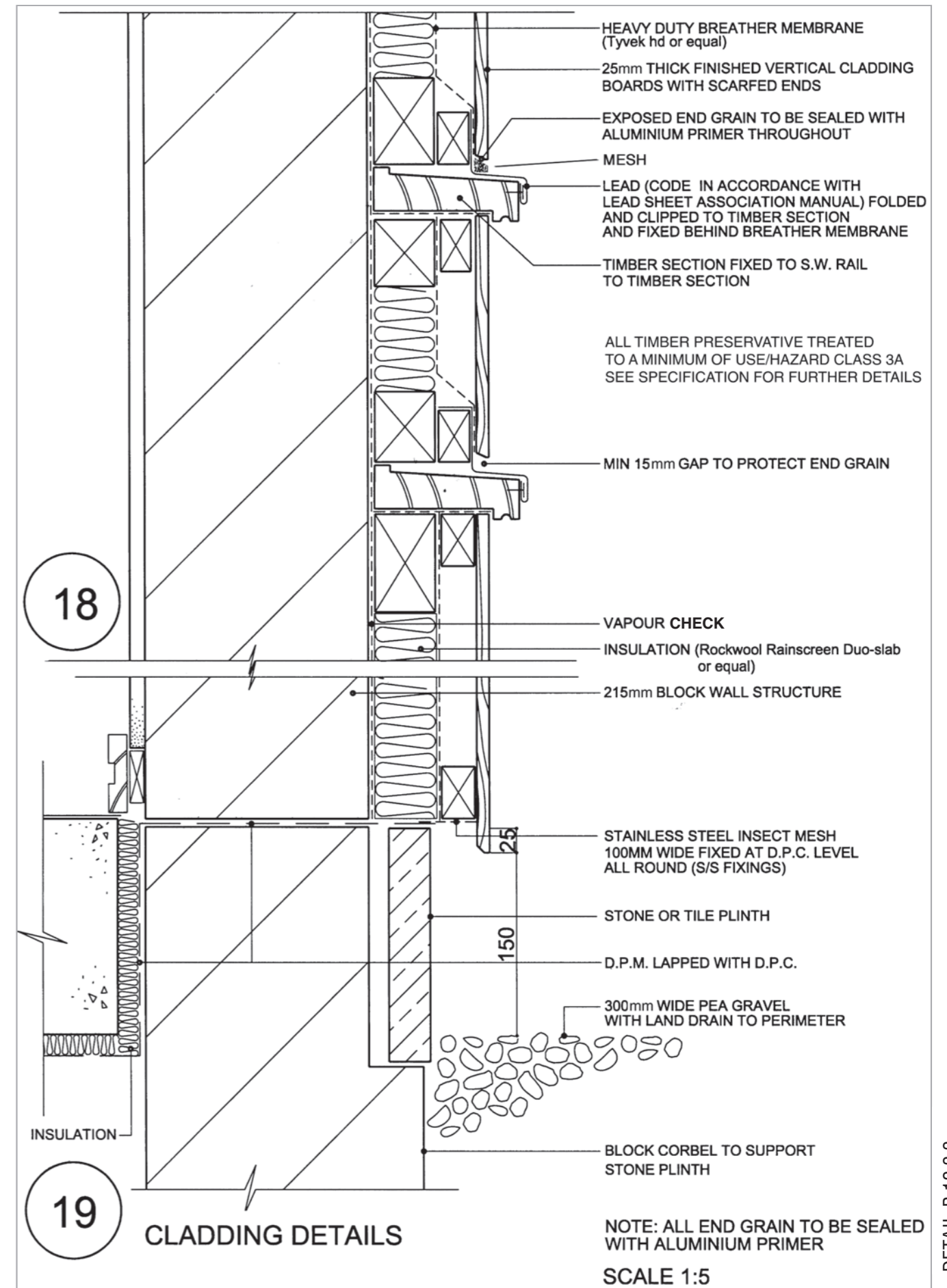
DETAIL B 12.3.1

B 12.3 WORKING DETAILS - TIMBER CLADDING - BLOCKWORK WALLS (CONTINUED)



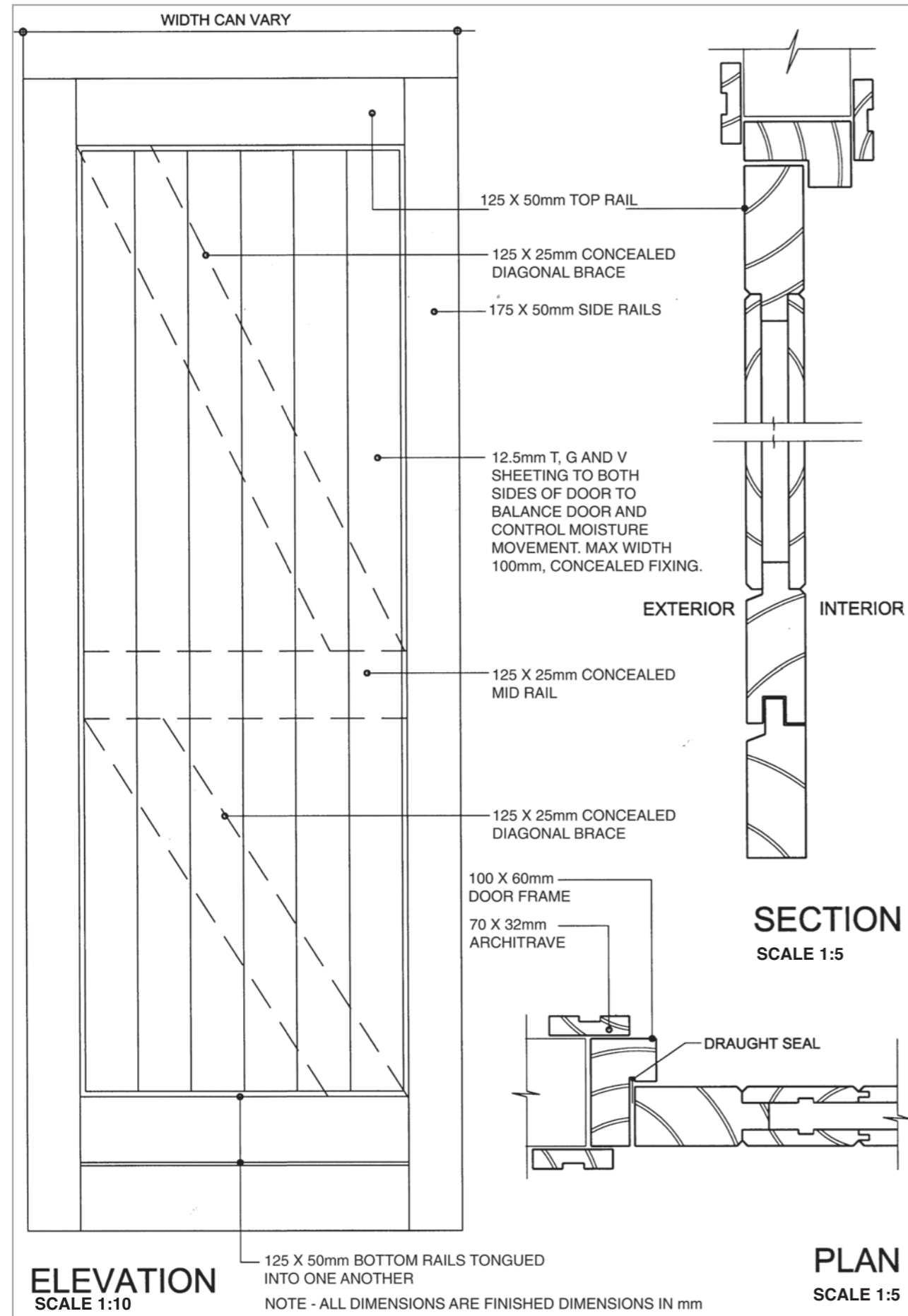
DETAIL B 12.3.2

B 12.3 WORKING DETAILS - TIMBER CLADDING - BLOCKWORK WALLS (CONTINUED)



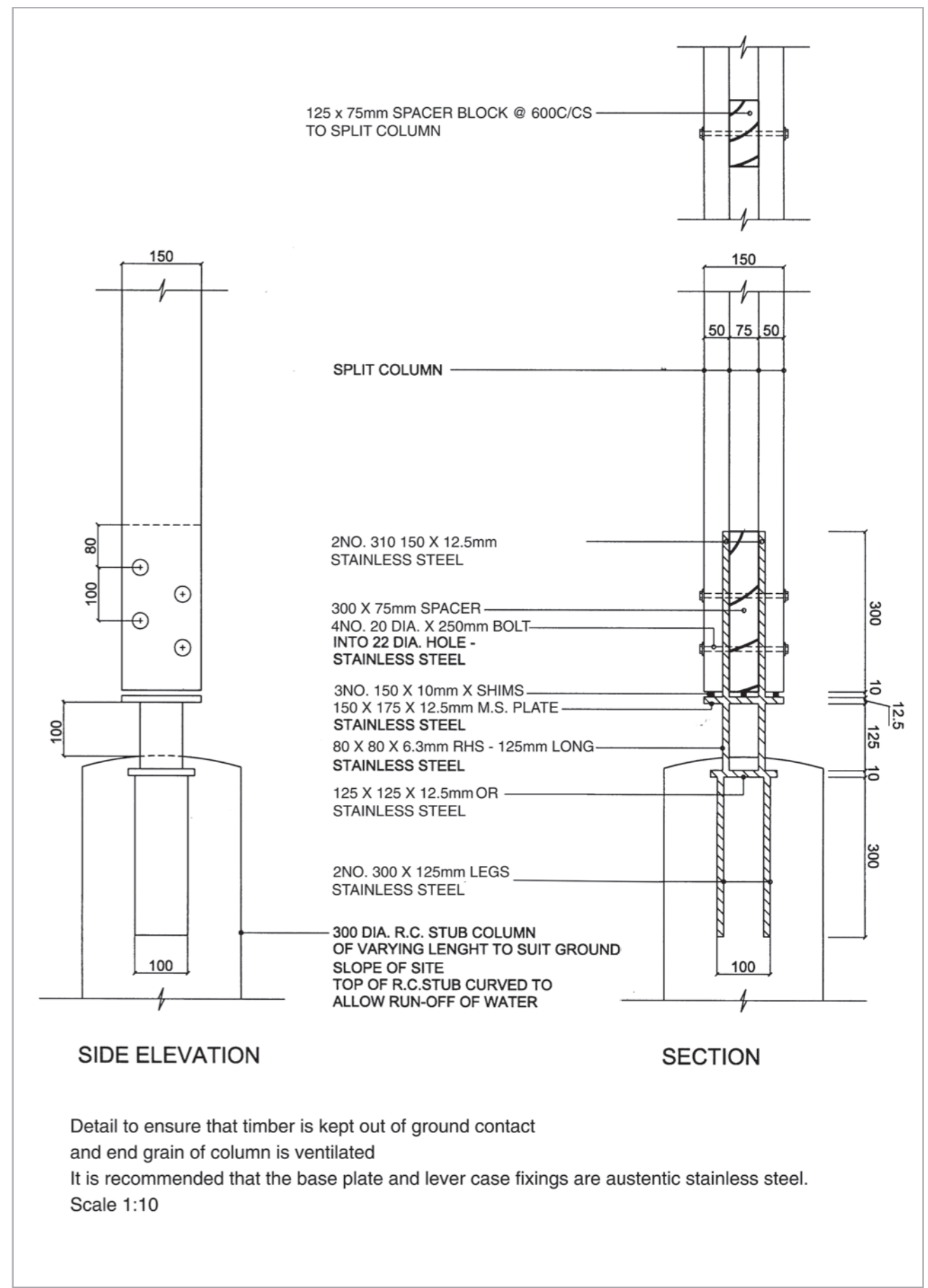
DETAIL B 12.3.3

B 12.4 WORKING DETAILS - TIMBER DOOR DETAILS



DETAIL B 12.4.1 Sheeted door detail

B 12.5 WORKING DETAILS - A TIMBER COLUMN BASE DETAIL



DETAIL B 12.5.1 Typical Column Base Detail

B 12.5 WORKING DETAILS - A COLUMN BASE DETAIL CONTINUED

