Simple House
Acceptable Solution

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Status of Compliance Documents

This 'Simple House Acceptable Solution' is a Compliance Document prepared by the Department of Building and Housing in accordance with section 22 of the Building Act 2004. A Compliance Document is for use in establishing compliance with the New Zealand Building Code.

A person who complies with a Compliance Document will be treated as having complied with the provisions of the Building Code to which the Compliance Document relates. However, a Compliance Document is only one method of complying with the Building Code. There will be alternative ways to comply.

Users should make themselves familiar with the preface to the New Zealand Building Code Handbook, which describes the status of Compliance Documents and explains alternative methods of achieving compliance.

Defined words (italicised in the text) and classified uses are explained in Clauses A1 and A2 of the Building Code or otherwise in the Definitions at the end of this Acceptable Solution.

SIMPLE HOUSE: Document History		
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Document Status

The most recent version of this document, as detailed in the Document History, is approved by the Chief Executive of the Department of Building and Housing. It is effective from 31 March 2010.

People using this Compliance Document should check for amendments on a regular basis. The Department of Building and Housing may amend any part of any Compliance Document at any time. Up-to-date versions of Compliance Documents are available from www.dbh.govt.nz

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Acceptable Solution SH/AS1

1.0 Scope

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1.1 Using the document

The 'Simple House Acceptable Solution' is a *Compliance Document* containing *Acceptable Solutions* for single storey, stand-alone *household units* that meet the definition for a *simple house*.

Comment:
This document is primarily intended for use by those wanting to design a simple building. It brings together in one place all the information needed to design a *simple house,* as using it will establish compliance with all the relevant *New Zealand Building Code* clauses. *Simple houses* that meet this *Acceptable Solution* will sit within Category 1 of the Licensed Building Practitioner Scheme, and have reduced *weathertightness* risk such that a 'Risk Matrix assessment' is not necessary with *building consent* applications.

Within this *Acceptable Solution* the impacts imposed by different climatic and geographical conditions such as earthquake, wind and snow loadings, and corrosion zones are standardised for simplicity rather than presenting a large range of individual solutions for many different site and environmental conditions. The resulting house may be sited on almost any plot of land in New Zealand. *Roof* and wall *claddings* are limited to a few generic selections, while the limitations in shape and material selection reduce the *weathertightness* risk and can simplify consenting and construction.

Notes shown under 'Comment', occurring throughout this Acceptable Solution are for guidance purposes only and do not form part of this Acceptable Solution.

Words in italics are defined terms and can be found in the Definitions section at the end of the document. The Definitions include the material properties, where applicable.

1.2 Simple house

This *Acceptable Solution* is for a *simple house* that is defined as follows:

(a) single storey, stand-alone *household unit* in *wind zones* up to Very High (ie, 50 m/s (metres per second) maximum as per NZS 3604 Section 5), and

(b) maximum length or width of floor of 24.0 m including any attached garage, and

(c) simple plan shapes such as rectangular, L, T or boomerang, and

(d) concrete slab-on-ground or suspended timber floor on piles, and

(e) maximum height of 2.0 m from finished floor level to adjacent *cleared ground level*, and

(f) simple *roof* forms, incorporating hips, valleys, gables or mono pitches, but excluding any *roof* element finishing within the boundaries formed by exterior walls (eg, the lower ends of aprons, *chimneys*, dormers, clerestoreys, box windows, etc), and

(g) *eaves* with a minimum width of 450 mm or maximum width of 750 mm to all *roofs*, and

(h) maximum overall height of 7.0 m from *roof* apex from lowest *cleared ground level*, and

(i) maximum *roof* height 3.0 m, and

(j) *roof* slope between 10º and 35º from the horizontal, and

(k) maximum span of *roof* truss 12.0 m, and

(l) *external walls* maximum of 2.4 m height *studs*, other than *gable* end walls and walls to mono-pitched *roofs* that shall not exceed 4.0 m, and

(m) timber *framing*, as specified in this *Acceptable Solution*, and

(n) the combination of a maximum of two wall *cladding* types, and

(o) aluminium exterior joinery, except for attached garage doors, and

(p) no *building element*, such as *eaves*, located less than 650 mm from any site boundary.

1.3 Limitations

This *Acceptable Solution* for a *simple house* is limited as follows.

1.3.1 General

Solutions are not included for site-specific items such as *site work*, plumbing connections to the network utilities and District Plan requirements. Approvals will be required by those relevant authorities.

Comment
The *simple house* provided for in this *Acceptable Solution* may be combined with other components such as skylights, solid fuel burners, separate garages, proprietary foundation systems, specifically engineered structural options, or alternative design solutions. In any of these circumstances, users will need to prepare additional consent documentation for their changes or alternatives for the *building consent authority* (BCA) to consider.

1.3.2 Location

This *Acceptable Solution* allows *simple houses* to be constructed throughout New Zealand except on sites:

(a) subject to specified local topographical effects – see Paragraph 2.2

(b) over certain elevations in specified snow zones – see Paragraph 2.4, or

(c) within 50 m of a geothermal bore, mud pool, steam vent or other geothermal fume source – see Paragraph 2.5.

1.3.3 Wall claddings

This *Acceptable Solution* applies only to exterior wall *claddings* of:

(a) bevel-back timber weatherboards

(b) rusticated timber weatherboards

(c) *masonry veneer*, and

(d) flat sheet *claddings* (fibre-cement or plywood),

as identified in Paragraph 6.0 Wall claddings.

Comment
Design features with a high risk of *weathertightness* failure are outside the scope of this *Acceptable Solution* for *simple houses*, eg, roof-to-wall junctions that require apron, parallel or transverse *flashings* (refer to Paragraph 1.2 g). For further information, refer to the Acceptable Solution E2/AS1 within the Compliance Document for New Zealand Building Code Clause E2 External Moisture.

1.3.4 Roof claddings

This *Acceptable Solution* applies only to *roof claddings* of:

(a) corrugated or *trapezoidal* long run steel

(b) pressed metal tiles, and

(c) masonry tiles,

as identified in Paragraph 7 Roof claddings.

1.3.5 Attached garages

Attached garages are limited to being on a concrete floor slab. Steel *lintels* are limited for use in an attached garage only, and in accordance with Paragraph 4.5.1.5.

1.4 Building Code clauses

This *Acceptable Solution* is for a *simple house* that, when constructed in accordance with this *Acceptable Solution*, will meet the relevant performances of the following clauses of the *New Zealand Building Code*:

B1 Structure

B2 Durability

C1 Outbreak of fire

C2 Means of escape

C3 Spread of fire

C4 Structural stability during fire

D1 Access routes

E1 Surface water

E2 External moisture

E3 Internal moisture

F2 Hazardous building materials

F4 Safety from falling

F7 Warning systems

G1 Personal hygiene

G2 Laundering

G3 Food preparation and prevention of contamination

G4 Ventilation

G5 Interior environment

G7 Natural light

G8 Artificial light

G9 Electricity

G10 Piped services

G11 Gas as an energy source

G12 Water supplies

G13 Foul water

H1 Energy efficiency.

2.0 Site

CONTENTS

2.1 Good ground

2.1.1 Ground conditions

The *foundation* provisions of this *Acceptable Solution* shall only apply for building sites such that:

(a) the *foundations* are supported on *good ground* (except where permitted and modified by the requirements of Paragraph 3.2), and

(b) any *foundation* for a *simple house* erected at the top of a slope shall be in accordance with Figure 2.1, and

(c) any fill (including hardfill) placed over certified fill or undisturbed ground, and within 3 m of a *simple house*, shall not exceed 600 mm in depth.

2.1.2 Determination of good ground

The soil supporting the *foundations* shall be assumed to be *good ground* if:

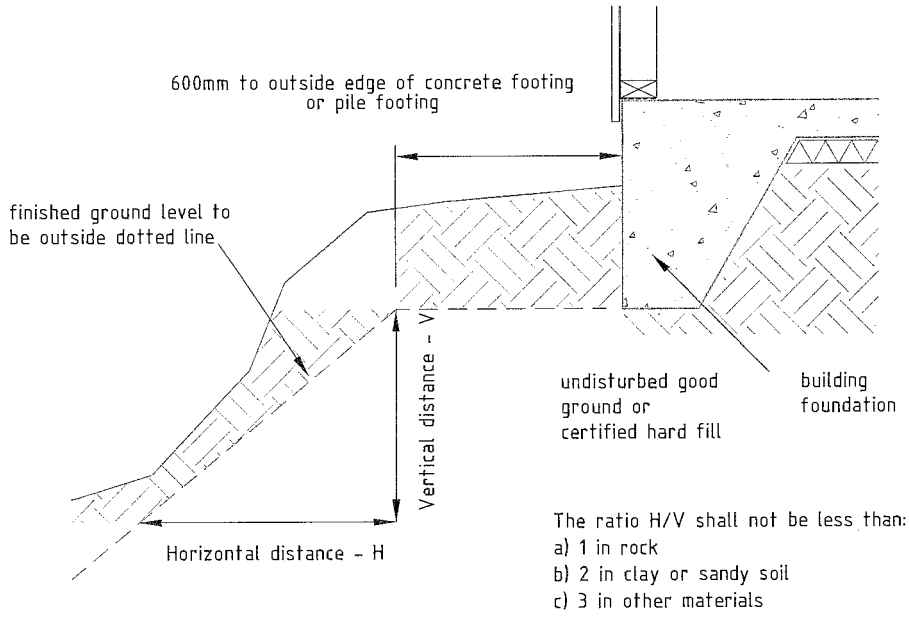
(a) no signs of unsatisfactory behaviour attributable to soil conditions is evident in adjacent established *buildings* of a similar type supported on *foundations* similar to those required by this *Acceptable Solution* and on similar soils, or

(b) a dynamic cone penetrometer test (also called a Scala penetrometer test) in accordance with Clause 3.3 of NZS 3604, has established *good ground*, or

(c) a subsoil investigation by a suitably qualified person, approved by the *building consent authority*, has established *good ground*, or

(d) a certificate of suitability of earth fill for residential development has been issued in terms of NZS 4431 in respect to the *building* site, and any limitations noted on that certificate are complied with.

Figure 2.1 **Relationship of foundation to sloping ground surface**
Paragraph 2.1.1



2.1.3 Site and soil conditions

2.1.3.1 Site and soil conditions that shall also be met are:

(a) site records and site observations show no evidence of buried services and none are revealed by excavation for *foundations*, and

(b) site records and site observations show no indications or records of land slips having occurred in the immediate locality, and

(c) reasonable enquiry shows no evidence of earth fill on the *simple house* site, and no fill material is revealed by excavation for *foundations*. This shall not apply where a certificate of suitability of earth fill for residential development has been issued in terms of NZS 4431 in respect to the building site, and any limitations noted on that certificate are complied with, and

(d) excavation for *foundations* does not reveal buried organic topsoil, soft peat, soft clay or expansive soils.

2.1.3.2 For the purposes of Paragraph 2.1.3.1 (d), peat or clay shall be regarded as soft if a natural chunk of the soil (not remoulded or loose shavings) can be easily moulded in the fingers. Soil that exudes between the fingers when squeezed in a fist shall be regarded as very soft.

2.1.3.3 For the purposes of Paragraph 2.1.3.1 (d), soils shall be regarded as expansive soils if their properties, in soil mechanic terms, exceed the values listed in the definition of *good ground* in this *Acceptable Solution*.

For *foundations* on expansive soils refer to Paragraph 3.2.

2.1.4 Bearing

2.1.4.1 All *foundations* shall bear upon solid bottom in undisturbed *good ground* material (except where permitted and modified by the requirements of Paragraph 3.2) or upon firm fill for which a certificate of suitability has been issued in terms of NZS 4431. Where *good ground* is at a depth greater than 600 mm, the excavation between the *good ground* and the underside of the *foundation* shall be filled with 10 MPa concrete.

2.1.4.2 The minimum depth of *foundations* below the *cleared ground level* shall be 200 mm.

2.1.5 Site preparation

2.1.5.1 Before a *simple house* is erected on any site, all rubbish, noxious matter and organic matter shall be removed from the area to be covered by the *simple house*.

2.1.5.2 In suspended timber floor construction, (but not slab-on-ground construction), firm turf and close-cut grass may remain provided that, for the purposes of complying with Paragraph 2.1.4.2, *cleared ground level* shall be taken as the underside of soil containing organic matter.

2.2 Wind

2.2.1 Application

This *Acceptable Solution* applies to construction in all areas of New Zealand, up to and including a Very High *wind zone* (ie, a maximum design wind speed of 50 m/s), with the following exclusions for local topography:

(a) sites within 250 m (measured horizontally) of the crest of a hill, ridge, spur or escarpment

(b) sites which have a slope steeper than 1:5 (vertical:horizontal), and

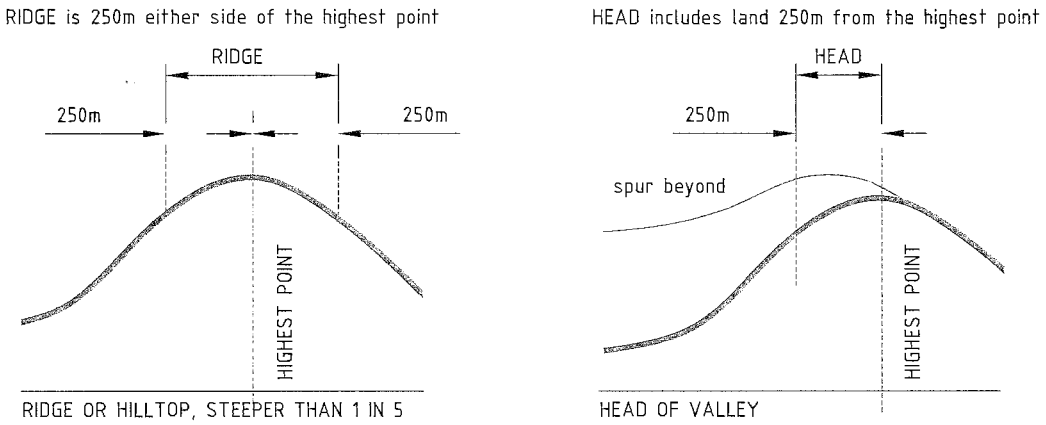
(c) sites within 250 m (measured horizontally) from the head of a valley – refer to Figure 2.2.

Comment

The *BCA* may have *wind zones* already identified for the given *simple house* site on their own locality maps.

Refer to Paragraph 4.2.1 for the effects on *stud framing* in the *simple house* when the *wind zone* is less than Very High.

Figure 2.2 **Ridge and head of valley**
Paragraph 2.2.1



2.2.2 Bracing demand

Wind *bracing demand* shall be calculated in accordance with Paragraphs 3.3.12.1 and 4.6.1.1

2.3 Earthquake

2.3.1 Application

This *Acceptable Solution* allows for construction in all areas of New Zealand with respect to earthquake load.

2.3.2 Bracing demand

Earthquake *bracing demand* shall be calculated in accordance with Paragraphs 3.3.12.2 and 4.6.1.2.

2.4 Snow load

2.4.1 Application

For *simple houses* in areas of up to 0.5 kPa snow loading, no adjustment is required to the tables provided in Paragraphs 4.0 and 5.0 of this *Acceptable Solution* for *lintels*, *rafters* and beams.

For *simple houses* in areas between 0.5 kPa and 1.0 kPa snow loading, refer to Figure 2.3 and apply the correction factors in Paragraph 2.4.3. Houses subject to a snow load of more than 1.0 kPa are outside the scope of this *Acceptable Solution.*

2.4.2 Maximum altitudes

Refer to Figure 2.3 Snow zones and Table 2.1 to determine maximum altitude above sea level that a *simple house* may be constructed in each snow zone. Houses constructed at higher altitudes than those allowed in Table 2.1 are outside the scope of this *Acceptable Solution.*

Figure 2.3 **Snow zones**
Paragraphs 2.4.1 and 2.4.2

Table 2.1 **Maximum allowable altitudes for snow loads**
Paragraph 2.4.2

0.5 kPa snow zone	
Zone	Max altitude (m)
0	NA
1	500
2	400
3	350
4	150
5	150

1.0 kPa snow zone	
Zone	Max altitude (m)
0	NA
1	750
2	550
3	550
4	250
5	450

2.4.3 Snow loads between 0.5 kPa and 1.0 kPa

For snow loads between 0.5 kPa and 1.0 kPa snow loading, *lintel*, *rafter* and verandah beams shall be read from Tables 4.4, 5.3.1, 5.3.3 and 5.4.1, and *spans* multiplied by the following factors:

(a) *rafters*, light *roofs* x 0.85

(b) *rafters*, heavy *roofs* x 1.0

(c) *lintels* x 0.8

(d) verandah beams x 1.0

(e) *ridge beams* x 0.85.

2.5 Durability

2.5.1 Application

This *Acceptable Solution* applies to corrosion zones 1, 2, 3, 4 and the sea spray zone, all in accordance with Figure 2.4, but excludes construction within 50 m of a geothermal bore, mud pool, steam vent or other geothermal fume source.

2.5.2 Sea spray zone

The sea spray zone is defined as within 500 m of the sea including harbours, or 100 m from tidal estuaries and sheltered inlets, as well as coastal areas. The sea spray zone also

includes all offshore islands including Waiheke Island, Great Barrier Island, Stewart Island and the Chatham Islands and those areas shown in white in Figure 2.4.

2.5.3 Industrial atmospheres

Localised areas subject to corrosive industrial atmospheres are outside the scope of this *Acceptable Solution*.

Figure 2.4 **Corrosion zones – North Island**
Paragraph 2.5

Figure 2.4 **Corrosion zones – South Island**
Paragraph 2.5

2.5.4 Protection of metal components

Metal components shall be protected as follows:

- steel fixings and fastenings excluding nails and screws, as per Table 2.2
- galvanising of steel components other than nails and screws, as per Table 2.3
- steel items such as nails and screws used for *framing* and *cladding,* as per Table 2.4.

Table 2.2 **Protection required for steel fixings and fastenings excluding nails and screws[1]**
Paragraph 2.5 and Figure 2.4

Zones/environment	Material/protection
Closed (dry, internal location, not subject to airborne salts or rain wetting)	
Anywhere in New Zealand	Mild steel (uncoated, non-galvanised)
Roof spaces	
Nail plates	Continuously coated galvanised steel [2]
Wire dogs, bolts	Hot-dipped galvanised steel [2]
Sheltered (open to airborne salts, but not rain washed), or Exposed (open to airborne salts and rain wetting)	
Sea spray zone, and zone 1 (refer to Figure 2.4)	Type 304 stainless steel
Zones 2, 3 and 4 (refer to Figure 2.4)	Hot-dipped galvanised steel [2]

[1] Items described in this table are steel fasteners used in joining timber, such as nail plates, bolts, brackets, *wire dogs* and similar, but not including nails or screws (refer to Table 2.4) and are required to last for the life of the *building,* or not less than 50 years.

[2] All galvanising weights to steel shall be as given in Table 2.3.

Table 2.3 **Galvanising of steel components other than nails and screws**
Paragraph 2.5

Component	Durability (years)	Standard	Protection required
Bolts in any location that require galvanising (see Table 2.2)	50	AS/NZS 4680 and AS 1214	375 g/m² average (check particular standards for details)
Nail plates and brackets used in 'sheltered' or 'exposed' locations	50	AS/NZS 4680	Not less than 390 g/m² (and to comply with Tables 1 and 2 of the Standard)
Nail plates used in *roof* spaces	50	AS 1397	Z275
Wire dogs in any location that requires galvanising (see Table 2.2)	50		260 g/m²
Mild steel angles for *masonry veneer*	50	AS/NZS 2699.3	600 g/m²
Wall ties	50	AS/NZS 2699.1	430 g/m²

Note 1: 50 year durability means the life of the *building*, being not less than 50 years.

Note 2: Sheltered refers to locations open to airborne salts, but not rain washed. Exposed refers to locations open to airborne salts and rain wetting.

Table 2.4 **Steel items such as nails and screws used for fixing framing and cladding[1]**
Paragraph 2.5 and Figure 2.4

Simple house location	Nail or screw use			
	Cladding that acts as *bracing* (50 year durability)	Non-structural *cladding* (15 year durability)	*Framing* in 'closed' areas including *roof* spaces	*Framing* in 'sheltered' and 'exposed' areas
Sea spray or zone 1 (see Figure 2.4)	Excluded	Galvanised steel	Mild steel	Galvanised steel
Other areas	Excluded	Galvanised steel	Mild steel	Galvanised steel

[1] Nails and screws fixed into piles within 600 mm of the ground shall be minimum Type 304 stainless steel.

Note 1: 50 year durability means the life of the *building*, being not less than 50 years.

Note 2: Sheltered refers to locations open to airborne salts, but not rain washed. Exposed refers to locations open to airborne salts and rain wetting.

2.6 Flashing and materials

2.6.1 Flashing and material selection

Flashings and *flashing* fixings shall be selected in accordance with Paragraph 2.6.2 and Tables 2.5 and 2.6.

2.6.2 Flashing materials

Flashings shall be selected from the following materials (refer to the Definitions for specific material requirements):

(a) *aluminium flashings*, minimum 0.7 mm thick

(b) *aluminium-zinc coated steel flashings*, with *BMT* of 0.55 mm generally or 0.4 mm for roll-formed ridge *flashings*

(c) *galvanised steel flashings*, with *BMT* of 0.55 mm generally or 0.4 mm for roll-formed ridge *flashings*

(d) *uPVC flashings,* minimum of 0.75 mm thick

(e) *stainless steel flashings*, minimum of 0.45 mm thick

(f) *sheet lead flashings*, minimum mass of 17 kg/m²

(g) *butyl flashings*, minimum of 1.0 mm thick.

Table 2.5 **Compatibility of materials in contact**
Paragraph 2.6

		Clay bricks (cement mortar)	Fibre cement, painted	Timber, copper treated, unpainted	Timber, painted	Aluminium, anodised or mill-finish	Aluminium, coated [1]	Lead (including lead-edged), unpainted	Roof tiles, masonry glazed or painted	Stainless steel	Steel, galvanised coil-coated [1]	Zinc/aluminium coated [1]	Zinc/aluminium, unpainted
Aluminium, anodised or mill-finish	Sea Spray, Zone 1	**N**	Y	**N**	Y	Y	Y	**N**	Y	**N**	Y	Y	Y
	Zones 2, 3, 4	**N**	Y	**N**	Y	Y	Y	**N**	Y	Y	Y	Y	Y
Aluminium, coated [1]	Sea Spray, Zone 1	**N**	Y	**N**	Y	Y	Y	**N**	Y	**N**	Y	Y	Y
	Zones 2, 3, 4	**N**	Y	Y	Y	Y	Y	**N**	Y	Y	Y	Y	Y
Lead (including lead-edged), unpainted	Sea Spray, Zone 1	Y	Y	**N**	Y	**N**	**N**	Y	Y	**N**	Y	**N**	**N**
	Zones 2, 3, 4	Y	Y	**N**	Y	**N**	**N**	Y	Y	Y	Y	**N**	**N**
Roof tiles, masonry glazed or painted	Sea Spray, Zone 1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Zones 2, 3, 4	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Stainless steel	Sea Spray, Zone 1	Y	Y	Y	Y	**N**	**N**	**N**	Y	Y	**N**	**N**	**N**
	Zones 2, 3, 4	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Steel, galvanised coil-coated [1]	Sea Spray, Zone 1	Y	Y	**N**	Y	Y	Y	**N**	Y	**N**	Y	Y	Y
	Zones 2, 3, 4	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Zinc/aluminium steel, coated [1]	Sea Spray, Zone 1	Y	Y	**N**	Y	Y	Y	**N**	Y	**N**	Y	Y	Y
	Zones 2, 3, 4	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Zinc/aluminium steel, unpainted	Sea Spray, Zone 1	**N**	Y	**N**	Y	Y	Y	**N**	Y	**N**	Y	Y	Y
	Zones 2, 3, 4	**N**	Y	**N**	Y	Y	Y	**N**	Y	Y	Y	Y	Y
Compatibility of fixings with *flashings*						*Flashing* materials							
Aluminium fixings	Sea Spray, Zone 1					Y	Y	**N**	Y	**N**	Y	Y	Y
	Zones 2, 3, 4					Y	Y	**N**	Y	Y	Y	Y	Y
Galvanised steel fixings	Sea Spray, Zone 1					Y	Y	**N**	Y	**N**	Y	Y	Y
	Zones 2, 3, 4					Y	Y	Y	Y	**N**	Y	Y	Y
Stainless steel fixings	Sea Spray, Zone 1					**N**	**N**	**N**	Y	Y	**N**	**N**	**N**
	Zones 2, 3, 4					Y	Y	Y	Y	Y	Y	Y	Y

Y = Acceptable, **N** = Unacceptable

Note 1: 'Coated' includes factory-painted, coil-coated and powder-coated

Note 2: Refer to Paragraph 2.5 Durability for descriptions of corrosion zones and fixings

Table 2.6 **Compatibility of materials subject to water runoff**
Paragraph 2.6

Material that water flows FROM ↓ / Material that water flows ONTO →	Clay bricks (cement mortar)	Fibre cement, painted	Timber, copper treated, unpainted	Timber, painted	Aluminium, anodised or mill-finish	Aluminium, coated [1]	Lead (including lead-edged), unpainted	Roof tiles, masonry glazed or painted	Stainless steel	Steel, galvanised coil-coated [1]	Zinc/aluminium coated [1]	Zinc/aluminium, unpainted
Clay bricks (cement mortar)	Y	Y	Y	Y	**N**	**N**	Y	Y	Y	Y	Y	**N**
Fibre cement, painted	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Timber, copper treated, unpainted	Y	Y	Y	Y	**N**	**N**	**N**	Y	Y	**N**	**N**	**N**
Timber, painted	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Aluminium, anodised or mill-finish	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Aluminium, coated [1]	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Lead (including lead-edged), unpainted	Y	Y	Y	Y	**N**	**N**	Y	Y	Y	Y	Y	**N**
Roof tiles, masonry glazed or painted	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Stainless steel	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Steel, galvanised coil-coated [1]	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Zinc/aluminium coated [1]	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Zinc/aluminium, unpainted	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Y = Acceptable, **N** = Unacceptable

Note 1: 'Coated' includes factory-painted, coil-coated and powder-coated.

Note 2: Refer to Paragraph 2.5 Durability for descriptions of corrosion zones and fixings.

2.7 Timber

2.7.1 Grade, species and treatment

The timber grade, species and preservative treatment for timber and timber products in this *Acceptable Solution* shall be in accordance with Table 2.7. Where not otherwise specified, they shall comply with NZS 3602. All timber preservative treatments shall be in accordance with NZS 3640. Timber grading shall comply with NZS 3622.

Table 2.7 Timber – grade, species, preservative treatment
Paragraph 2.7.1

Timber member	Paragraph	Grade	Species	Treatment – minimum
Timber pile	3.3.1.2, 3.4.4	to NZS 3605 and branded	Radiata pine	H5
Anchor pile	3.3.5	to NZS 3605 branded "A"	Radiata pine	H5
Timber subfloor framing – protected from weather	3.3.1.2	VSG 8 or MSG 8	Radiata pine or Douglas fir	H1.2
Timber subfloor framing – exposed to weather	3.3.1.2	VSG 8 or MSG 8	Radiata pine	H3.2
Flooring – particleboard	3.3.15.1	to AS/NZS 1859, CD grade		none
Flooring – plywood	3.3.15.1	to AS/NZS 2269, CD grade		H3 treated to AS/NZS 1604
Wet area flooring – plywood	3.3.15.1	to AS/NZS 2269, CD grade		H3 treated to AS/NZS 1604
Perimeter baseboard	3.3.16	Dressing	Radiata pine	H3.2
Timber *deck* and barrier	3.4.2	VSG 8 or MSG 8	Radiata pine	H3.2
Timber decking	3.4.2		Merchantable Radiata pine	H3.2
Wall *framing*	Section 4	VSG 8 or MSG 8	Radiata pine or Douglas fir	H1.2
Wall *bracing* – plywood	4.6.3.3	to AS/NZS 2269, DD grade		H3 treated to AS/NZS 1604
Purlin	5.1.4.1	VSG 8 or MSG 8	Radiata pine or Douglas fir	H1.2
Tile batten	5.1.4.1	No 1 Framing and free from knots	Radiata pine or Douglas fir	H1.2
Roof framing	Section 5	VSG 8 or MSG 8	Radiata pine or Douglas Fir	H1.2
Roof truss	5.2	VSG 8 or MSG 8	Radiata pine or Douglas Fir	H1.2
Skillion roof framing	5.3	VSG 8 or MSG 8	Radiata pine or Douglas Fir	H1.2
Verandah *framing*	5.4	VSG 8 or MSG 8	Radiata pine or Douglas Fir	H1.2
Verandah post, not in ground contact	5.4.2	VSG 8 or MSG 8	Radiata pine	H3.2
Timber joinery reveal	6.1.3.4	Select	Radiata pine	H1.2
Weatherboard, paint protected	6.2.1.2, 6.3.1.2	Dressing or finger-jointed	Radiata pine	H3.1
Exterior finishing timber, cover or corner board, cover battens, etc, paint protected	6.2.6, 6.3.7, 6.5.2.2	Dressing or finger-jointed	Radiata pine	H3.1
Plywood wall *cladding*	6.5.2	to AS/NZS 2269 CD grade		H3 treated to AS/NZS 1604
Timber door jamb	6.7.5	Select A	Radiata pine	H3.2
Valley board	7.1.7, 7.2.4.10, 7.3.4, 7.4.5	Merchantable	Radiata pine	H1.2
Anti-ponding board	7.4.4	to AS/NZS 2269, DD grade		H3 treated to AS/NZS 1604

2.7.2 Timber sizes

The cross-section dimensions of timber given in this *Acceptable Solution* are the actual finished sizes that shall be used.

2.7.3 Laminated members

Timber members 90 mm thick may be laminated from two 45 mm thick members of the corresponding depth or width specified. Members shall be nailed with 75 x 3.15 mm hand-driven or 90 x 3.15 mm power-driven nails at 250 mm centres along the full length, and nailed from alternate sides. Members more than 140 mm deep or wide shall have two rows of nails.

2.7.4 Timber connectors or fixings

Where the capacity of fixings are specifically identified in this *Acceptable Solution, proprietary fasteners* may be substituted (refer to Definitions for manufacturing requirements for *proprietary fasteners*).

2.7.5 Bolts

In bolted joints, washers shall be at each surface under the bolt head and the nut. For an M12 bolt the washers shall be not less than 50 x 50 x 3 mm if square or not less than 55 mm diameter x 3 mm if round. Bolts shall comply with the requirements of AS 1111.

2.8 Energy efficiency

2.8.1 Insulation

Insulating products with a minimum *thermal resistance* given in Table 2.8 shall be provided to *roofs*, walls, floors and glazing.

Table 2.8 R-value of installed insulation product
Paragraphs 2.8.1 and 2.8.2

Element	Position of insulation	Minimum *thermal resistance*
Trussed *roof*	over *ceiling battens*, between bottom chord	R 3.6
Skillion roof	between *rafters*	R 3.2
External walls	*framing* cavity	R 2.2
Glazing	all glazing, except: houses in Kaipara, Whangarei and Far North District Councils may be single-glazed with a minimum *R-value*	R 0.26 R 0.15
Floor – option 1	bulk insulation between floor joists	R1.4
Floor – option 2	concrete slab-on-ground	Not required

Comment:
NZS 4246: Energy Efficiency – Installing Insulation in Residential Buildings is a New Zealand Standard that provides guidance on the installation of insulation.

Additional insulation for comfort and energy efficiency can be achieved by providing:

(a) insulation to edge of floor slab, or

(b) underfloor insulation to slab (refer to Paragraph 3.1.1.2), or

(c) additional underfloor insulation to suspended timber floor, or

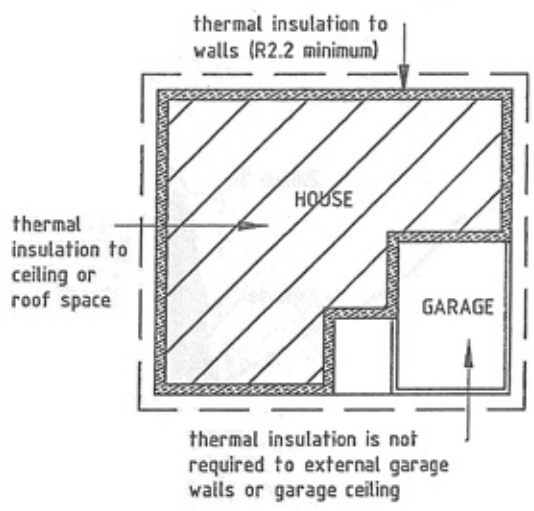
(d) high performance insulation to walls and additional insulation to ceilings.

Where additional levels of thermal insulation are desired, refer to the BRANZ House Insulation Guide.

2.8.2 Thermal envelope

An attached garage is not required to be part of the thermal envelope of the *simple house*, provided that any internal common walls separating the house and garage shall have the same *thermal resistance* as the *external walls* of the house. Refer to Table 2.8 and Figure 2.5.

Figure 2.5 **Thermal envelope**
Paragraph 2.8.2



2.8.3 Glazing

The *total glazed area* shall not be more than 30% of the *total wall area*.

A minimum of 30% of the *total glazed area* shall be orientated to the North. For the purposes of this paragraph, 'North' is determined as between 315 and 45 degrees of true north.

3.0 Foundations

3.1 Slab-on-ground

CONTENTS

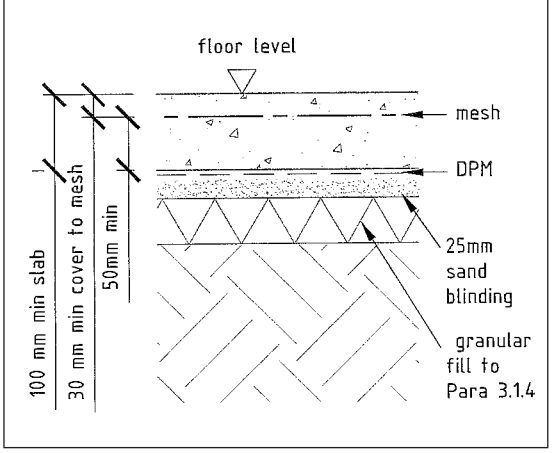
Figures

3.1.1 Thickness

3.1.1.1 Slab thickness

The minimum thickness of the floor slab shall be 100 mm – see Figure 3.1.1.

Figure 3.1.1 **Construction of slab-on-ground**
Paragraphs 3.1.1.1, 3.1.4 and 3.1.7.1



3.1.1.2 Underfloor thermal insulation

Thermal insulating material may be used under a concrete slab-on-ground provided there is no reduction in slab thickness. Where underfloor insulation (refer to Paragraphs 2.8 and 10.0) is used, it shall be laid over *damp-proof membrane (DPM)*. Underfloor insulation is not permitted under *foundations* to *loadbearing walls*.

3.1.2 Shrinkage control joints

3.1.2.1 General

Concrete slab shrinkage control joints shall be formed by saw cutting the slab after initial hardening. The saw cuts shall extend only to a quarter of the depth of the slab. *Reinforcement* is not to be damaged by saw cutting. Saw cutting shall take place no later than 24 hours after concrete placement for average ambient temperatures above 20° C, and 48 hours after concrete placement for average ambient temperatures below 20° C.

3.1.2.2 Placement

Concrete slab shrinkage control joints shall:

(a) be positioned to coincide with major changes in plan (see Figure 3.1.2)

(b) have supplementary steel placed in accordance with Figure 3.1.3, but not across *concrete slab shrinkage control joints*

(c) have supplementary *concrete slab shrinkage control joints* placed to ensure distances between control joints do not exceed 6 m

(d) have supplementary *concrete slab shrinkage control joints* placed to ensure slab bays are limited to a maximum ratio of length:width of 2:1.

Figure 3.1.2 **Concrete slab shrinkage control joint**
Paragraph 3.1.2.2

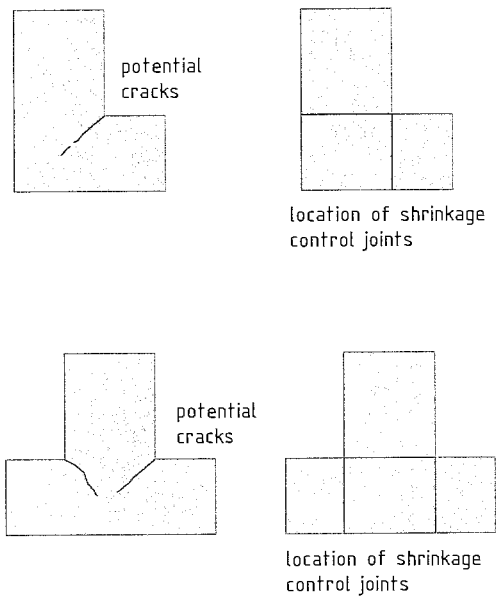
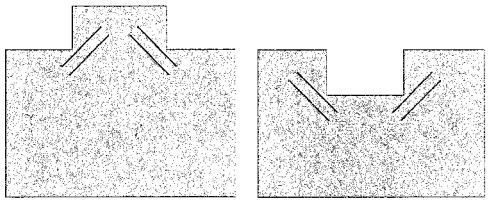


Figure 3.1.3 **Supplementary steel**
Paragraph 3.1.2.2



Supplementary reinforcing bars required at each internal corner, 2/D10, 1.2m long – but not across shrinkage control joints.

3.1.3 Ground clearances

3.1.3.1 Finished floor level

The height of the top surface of the floor slab above adjacent ground (refer to Figures 3.1.4 and 6.1.6) shall be no less than:

(a) for *cladding* other than *masonry veneer*:

(i) 150 mm if ground is permanently paved, or

(ii) 225 mm if ground is unpaved

(b) for *masonry veneer* wall *claddings*:

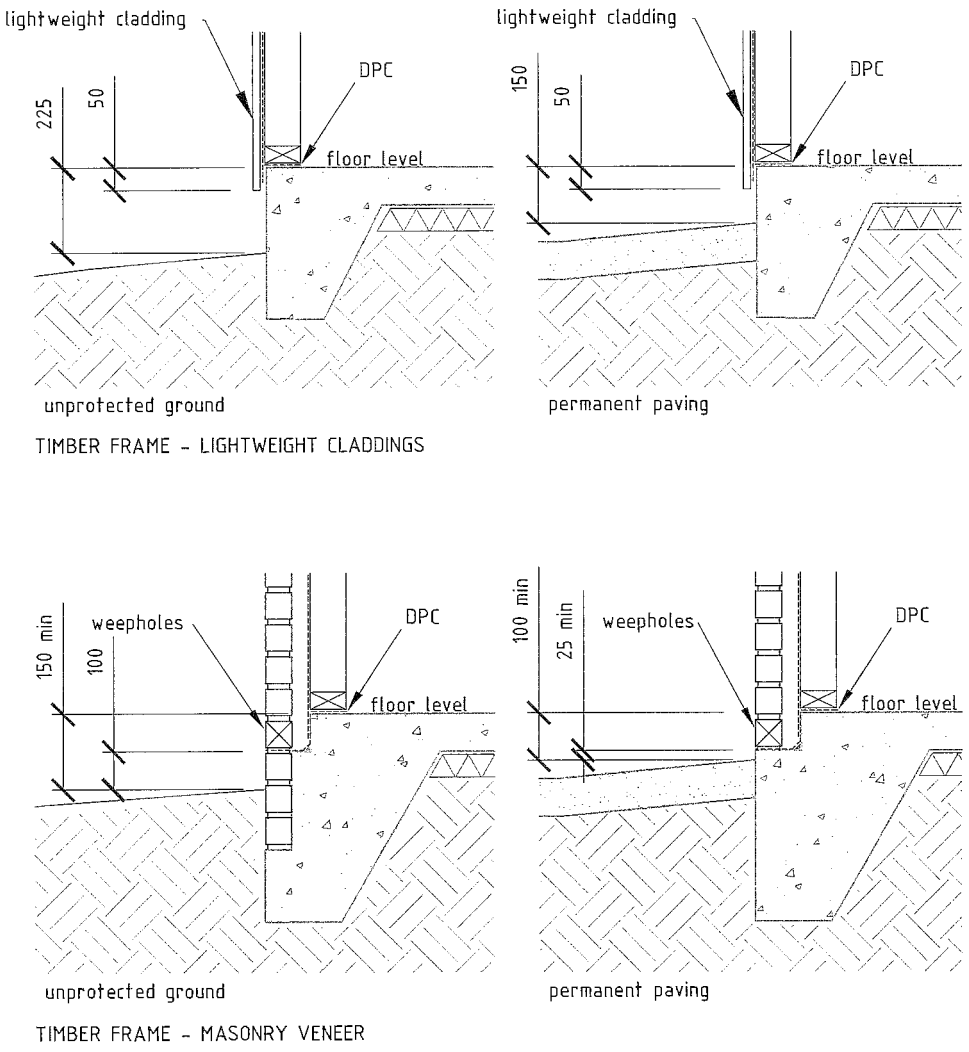
(i) 100 mm if ground is permanently paved, or

(ii) 150 mm if ground is unpaved.

3.1.3.2 The *finished ground level* adjoining the concrete slab-on-ground shall be formed at a slope of not less than 1 in 25 (1:25), for a distance of at least 1 m, falling away from the *simple house.*

3.1.3.3 At garage openings maintain clearance to *claddings* in accordance with Figure 6.1.6.

Figure 3.1.4 **Height of slab above ground**
Paragraph 3.1.3.1



3.1.4 Granular fill

3.1.4.1 General

Concrete slabs shall be cast on granular fill in accordance with Paragraph 3.1.4.2.

3.1.4.2 Granular fill

Granular fill material shall be composed of graded rounded gravel, crushed rock, scoria, or material approved by the *BCA* and:

(a) not more than 5% shall pass through a 2.2 mm sieve except where it can be demonstrated to the satisfaction of the *BCA* that site conditions ensure capillary water is unlikely to reach the underside of the slab

(b) 100% shall pass through either a 19 mm sieve for any fill thickness or a 37.5 mm sieve for a thickness exceeding 100 mm.

3.1.4.3 Granular fill material shall be placed and compacted in layers of 150 mm maximum thickness, over the area beneath the proposed ground slab, so that the total thickness of the granular fill is not less than 75 mm or more than 600 mm deep.

Compact each layer until the material is tightly bound together and does not visibly deform under the weight of a pressed adult heel.

Fill over 600 mm is outside the scope of this *Acceptable Solution.*

3.1.5 Damp-proof membrane (DPM)

3.1.5.1 The concrete floor slab cast on the ground shall have a *damp-proof membrane (DPM)* laid between the ground and the slab. The *DPM* shall be laid over the total area of the slab and be turned down into the excavation to finish at the outside edge of the *footing* – see Figures 3.1.5 and 3.1.6.

3.1.5.2 The *DPM* material shall consist of a single unprotected layer of polyethylene not less than 0.25 mm thick, and:

(a) have lap joints not less than 150 mm wide, sealed with pressure-sensitive plastic tape not less than 50 mm wide

(b) be protected from damage

(c) have penetrations by services, reinforcing or other objects sealed by taping.

3.1.5.3 Where the granular surface is likely to puncture the *DPM*, it shall be protected by sand blinding of a nominal maximum thickness of 25 mm.

3.1.6 Concrete strength

3.1.6.1 Concrete shall be ordinary grade as specified in NZS 3109.

3.1.6.2 Minimum specified concrete strength at 28 days shall be:

(a) 10 MPa for unreinforced concrete used in mass *foundations*

(b) 17.5 MPa for unreinforced concrete used in piled *foundations*

(c) 20 MPa for reinforced concrete slabs and *foundations* in zones 1, 2, 3 and 4.

(d) 25 MPa for reinforced concrete slabs and *foundations* in the sea spray zone.

Refer to Paragraph 2.5 for a description of the different corrosion zones.

3.1.7 Slab reinforcing

All slabs shall be reinforced. Reinforcing bars and hard drawn mild steel wire mesh shall conform to AS/NZS 4671.

3.1.7.1 Cover

Minimum concrete cover to steel *reinforcement* shall be:

(a) 75 mm when concrete is placed directly on or against the ground

(b) 50 mm when concrete is placed on *DPM* and in all other situations where concrete is placed in formwork

(c) 30 mm from the top of a wall or floor slab which is in an internal area (refer to Figure 3.1.1)

(d) 50 mm from the top of any exposed wall or floor slab.

3.1.7.2 Ground slab reinforcing shall extend to within 75 mm of the outside edge of the slab (including the *foundation*) and be supported in final position prior to pouring concrete. Reinforcing shall consist of a minimum of 2.27 kg/m^2 welded steel mesh complying with AS/NZS 4671. Minimum lap of reinforcing mesh shall be 225 mm at sheet joints.

3.1.8 Concrete slab edge details

3.1.8.1 The combined *foundation* edge details shall be constructed in accordance with Figures 3.1.5 and 3.1.6 or Figure 3.1.7

Figure 3.1.5 **Foundation edge details – lightweight cladding**
Paragraphs 3.1.5 and 3.1.8.1

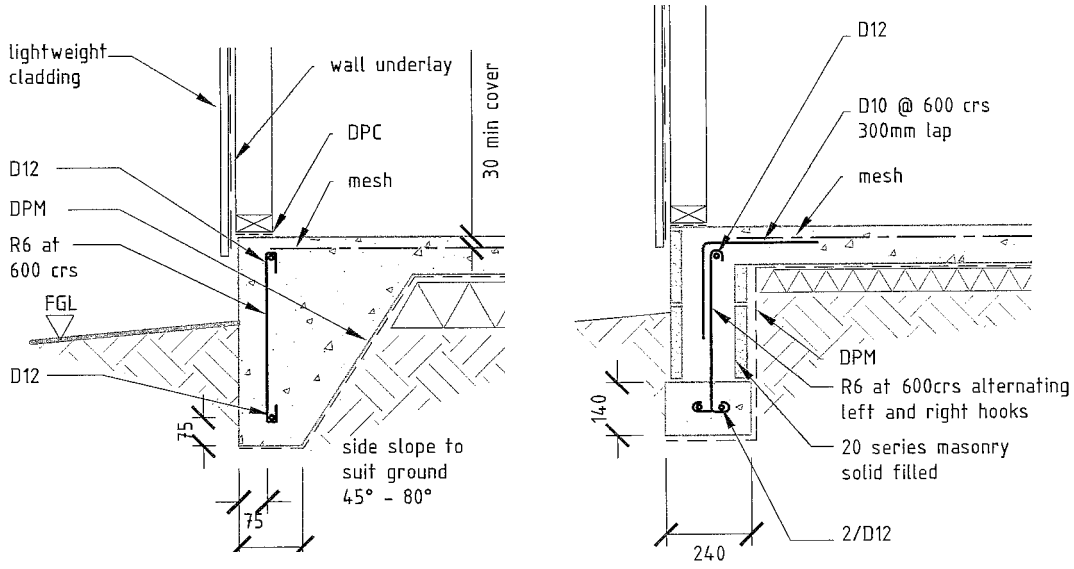


Figure 3.1.6 **Foundation edge details – masonry veneer cladding**
Paragraphs 3.1.5 and 3.1.8.1

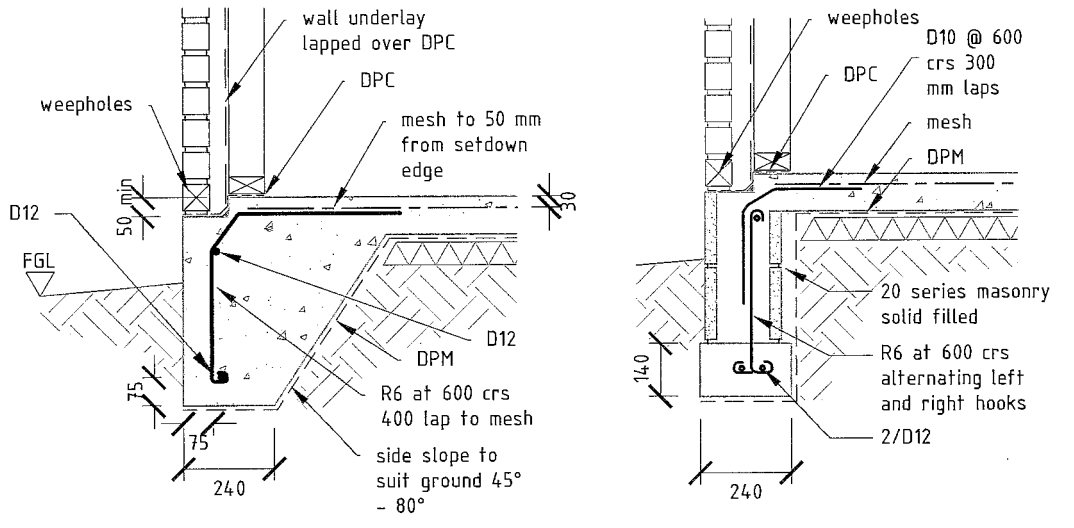
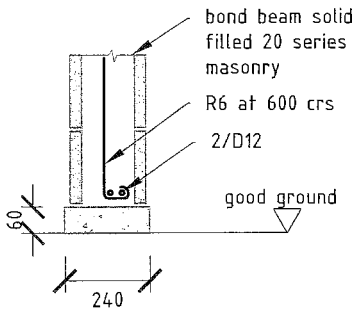


Figure 3.1.7 **Alternative concrete masonry footing**
Paragraph 3.1.8.1



3.1.9 Support of internal loadbearing walls

3.1.9.1 All internal walls may be supported on the reinforced floor slab without slab thickening, except for those slabs requiring thickenings in expansive soils (refer to Paragraph 3.2).

3.1.10 Construction moisture in concrete

Concrete floors shall be sufficiently dry to give a relative humidity reading of less than 75% at the time of laying fixed floor coverings when measured in accordance with BRANZ Bulletin 330 ‘Thin Flooring Materials – 2 – Preparation and Laying’.

3.2 Slab-on-ground in expansive soils

CONTENTS

3.2.1 Identification of expansive soils

3.2.1.1 Should reasonable enquiry as outlined in Paragraph 2.1.3.1 show any signs of expansive soils, the expansive soil class, as defined in AS 2870, shall be established. This shall be established by one or all of:

(a) enquiry to the local *territorial authority*

(b) reference to the certificate of suitability issued in terms of NZS 4431

(c) a soil test undertaken by a suitably qualified soils engineer.

3.2.1.2 Expansive soil class shall be defined as:

(a) Slightly 'S', having an I_{ss} Range of 0–1.9%, and a 500 year design characteristic surface movement return (y_s) of 22 mm, or

(b) Moderately 'M', having an I_{ss} Range of 2.0–3.7% and a 500 year design characteristic surface movement return (y_s) of 44 mm, or

(c) Highly 'H', having an I_{ss} Range of 3.8–6.5% and a 500 year design characteristic surface movement return (y_s) of 78 mm, or

(d) Extremely 'E', having an I_{ss} Range of 6.6– 7.5% and a 500 year design characteristic surface movement return (y_s) of 90 mm.

3.2.2 Maximum aspect ratio of concrete slabs

The aspect ratio of the concrete slabs or bays of concrete slabs, such as in the case of L, T or boomerang concrete slab shapes, shall not exceed 5 to 1 (length to width).

3.2.3 Foundation details

3.2.3.1 For the identified expansive soil class the *foundation* details, external and internal thickenings shall be as follows.

(a) For lightweight *claddings* refer to Table 3.2.1 and Figure 3.2.1.

(b) For *masonry veneer claddings* refer to Table 3.2.2 and Figure 3.2.2.

Table 3.2.1 **Reinforced concrete foundations in expansive soils for lightweight claddings**
Paragraph 3.2.1 and Figure 3.2.1

Expansive Soil Class	Slightly 'S'	Moderately 'M'	Highly 'H'	Extremely 'E'
Soil embedment (De)	375 mm	525 mm	575 mm	625 mm
Top steel (A_S top)	2/D 16	2/ D16	2/ D16	2/ D16
Bottom steel (A_S bottom)	1/ D16	1/ D25	1/ D20	1/ D25
Stirrups	R6/ 600 crs	R6/ 600 crs	R6/ 600 crs	R6/ 600 crs
Maximum spacing of internal thickenings	no internal thickening	no internal thickening	2.5 m crs	2.5 m crs
Depth of thickening (D1)	–	–	400 mm	450 mm
Base width (B1)	–	–	300 mm	350 mm
Top steel (A_S top)	–	–	2/ D20	2/ D20
Bottom steel (A_S bottom)	–	–	2/ D16	2/ D20
Stirrups	–	–	R6/ 600 crs	R6/ 600 crs

Table 3.2.2 **Reinforced concrete foundations in expansive soils for masonry veneer**
Paragraph 3.2.1 and Figure 3.2.2

Expansive soil class	Slightly 'S'	Moderately 'M'	Highly 'H'	Extremely 'E'
Soil embedment (De)	500 mm	550 mm	775 mm	800 mm
Top steel (A_S top)	2/ D16	2/ D20	2/ D20	3/ D20
Bottom steel (A_S bottom)	2/ D16	2/ D16	2/ D20	2/ D20
Stirrups	R6/ 600 crs	R6/ 600 crs	R6/ 600 crs	R6/ 600 crs
Maximum spacing of internal thickenings	–	2.5 m crs	2.5 m crs	2.5 m crs
Depth of thickening (D1)	–	350 mm	450 mm	500 mm
Base width (B1)	–	300 mm	300 mm	350 mm
Top steel (A_S top)	–	2/ D16	3/ D20	3/ D20
Bottom steel (A_S bottom)	–	2/ D16	2/ D16	2/ D20
Stirrups	–	R6/ 600 crs	R6/ 600 crs	R6/ 600 crs

3.2.3.2 Situations where no internal thickenings shall be required are limited to a rectangular slab with long side not exceeding 17 m. Where this limit is exceeded, add additional internal thickenings across the slab with the same cross section dimensions and reinforcing as the external *footing*, so that the centre to centre spacing of thickenings is always less than 17 m.

Figure 3.2.1 **Reinforced concrete foundations in expansive soils for lightweight claddings**
Paragraph 3.2.1 and Table 3.2.1

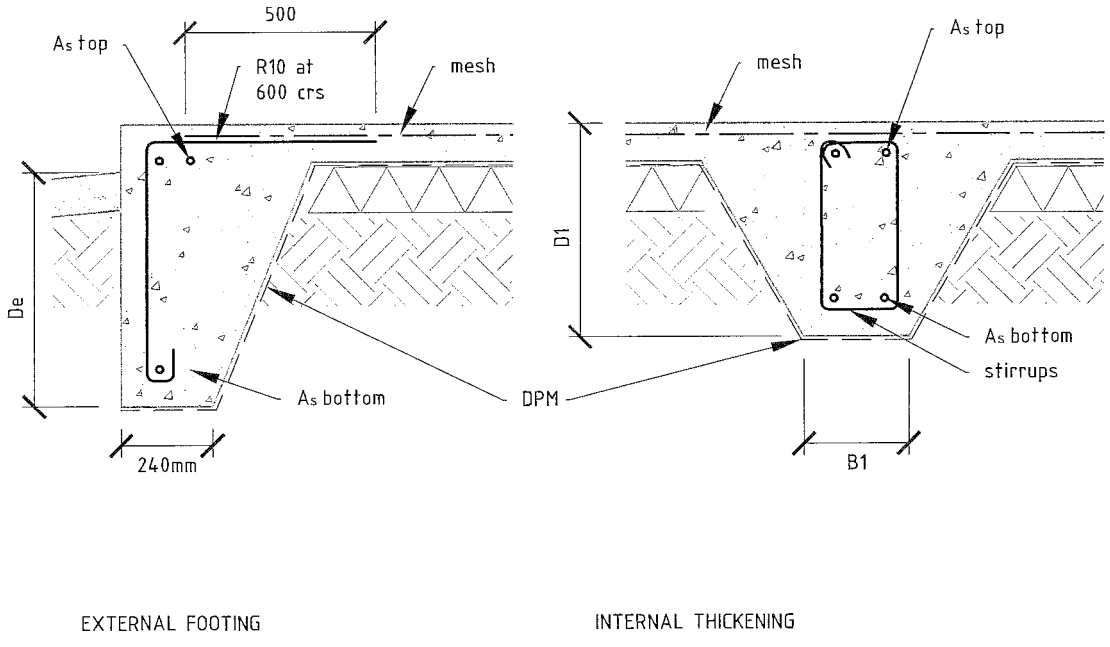
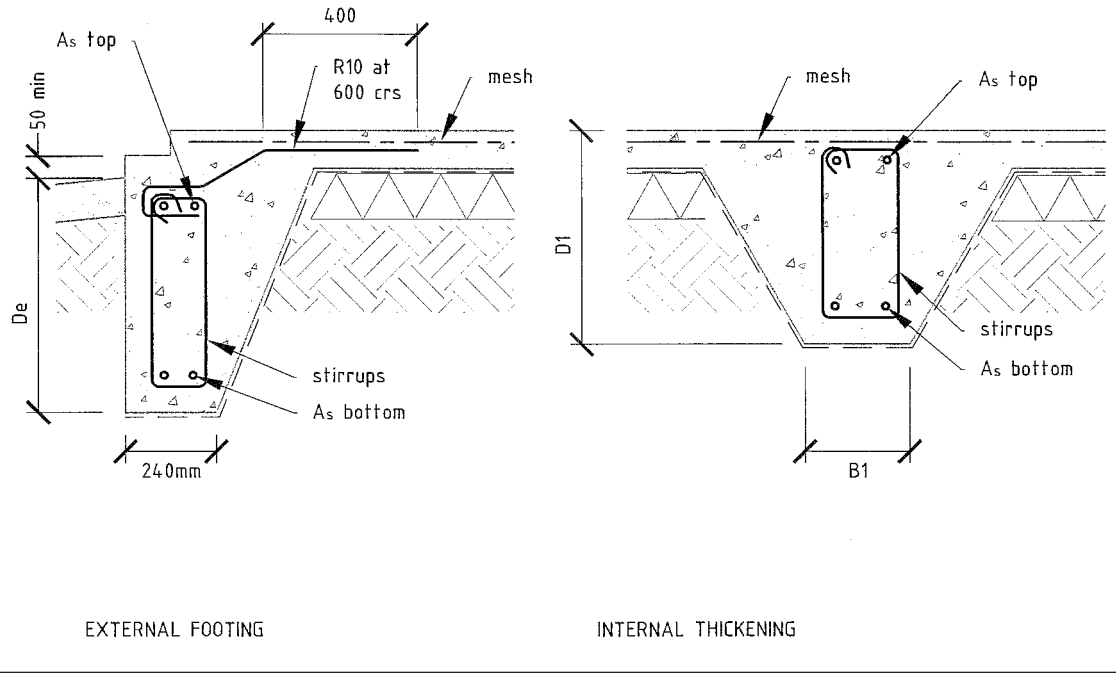


Figure 3.2.2 **Reinforced concrete foundations in expansive soils for masonry veneer**
Paragraph 3.2.1 and Table 3.2.2



Comment

Maintenance of foundations in expansive soils

Normal maintenance is that work generally recognised as necessary to achieve the expected performance over time of the *foundation* located on expansive soils. Unless otherwise specified by the designer and noted on the drawings, basic normal maintenance tasks shall ensure that:

(a) the drainage and wetting of the site is controlled so that extremes of wetting and drying of the soils is prevented

(b) the position and operation of gardens adjacent to the dwelling are controlled, and the planting of trees near to *foundations* is suitably restricted

(c) any leaks which develop in plumbing, stormwater or sanitary sewage systems are repaired promptly.

3.3 Piled foundations

CONTENTS

Figures

Tables

3.3.1 General

3.3.1.1 Piled *foundations* to support a timber floor shall consist of a system of:

(a) ordinary piles, as described in Paragraph 3.3.4

(b) anchor piles, as described in Paragraph 3.3.5

(c) braced piles as described in Paragraph 3.3.6.

3.3.1.2 Materials

The grade, species and preservative treatment for timber piles in piled *foundations* shall be in accordance with Table 2.7.

The grade, species and preservative treatment for timber subframing (for example braces, bearers, floor joists, *blocking*) shall be in accordance with Table 2.7. This table identifies the separate requirements for timber that is protected from the weather but exposed to ground atmosphere, or timber that is exposed to exterior weather conditions but not in ground contact.

Concrete for pile *footings* shall be ordinary grade complying with NZS 3109. For strength see Paragraph 3.1.6.2.

Any steel connections within 600 mm of the *cleared ground level* shall be a minimum of Type 304 stainless steel.

3.3.2 Piles

3.3.2.1 Piles shall directly support the bearers.

3.3.2.2 Pile height

The maximum height of piles above cleared *ground level* (CGL) shall be:

(a) 600 mm to the centre of the highest fixing for anchor piles, and

(b) dimensioned so that height to *finished floor level* (FFL) does not exceed 2.0 m.

The minimum clear distance under a bearer, supported by a pile, to *cleared ground level* is 300 mm.

3.3.2.3 Cross section

Timber piles shall be a minimum of 140 mm diameter for round piles or 125 x 125 mm square for sawn piles.

3.3.3 Footings

3.3.3.1 Loading

Piles shall not be loaded with the dead weight of the *simple house* until the concrete is a minimum of 24 hours old. The concrete shall not have a slump exceeding 60 mm at the time of placing. If at any time during the 24 hours the ambient temperature drops below 10° C, then the time before loading shall be extended to 48 hours.

3.3.3.2 Minimum depth

The bottom of a pile *footing* shall be concrete cast in-situ against *good ground* at a minimum depth below *cleared ground level* of:

(a) for an ordinary pile – 200 mm

(b) for a braced pile – 450 mm

(c) for an anchor pile – 900 mm.

The minimum thickness of concrete shall be 200 mm.

3.3.3.3 Plan size

All *footings* shall be 350 x 350 mm if square or 400 mm diameter if circular.

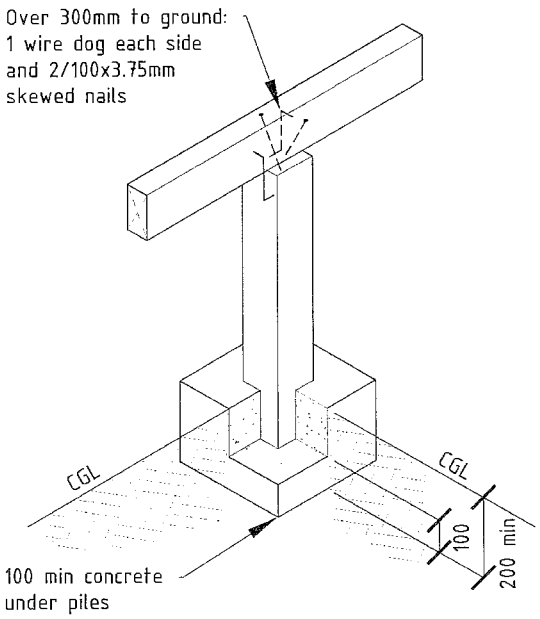
3.3.3.4 Embedment

Each pile shall be embedded in its *footing* such that there is a minimum depth of 100 mm concrete below the bottom of the pile.

3.3.4 Ordinary piles

The fixings of bearers to ordinary piles shall be 2/4.9 mm *wire dogs* together with 2/100 x 3.75 mm nails or 4/100 x 3.75 mm nails skew driven into the piles (see Figure 3.3.1).

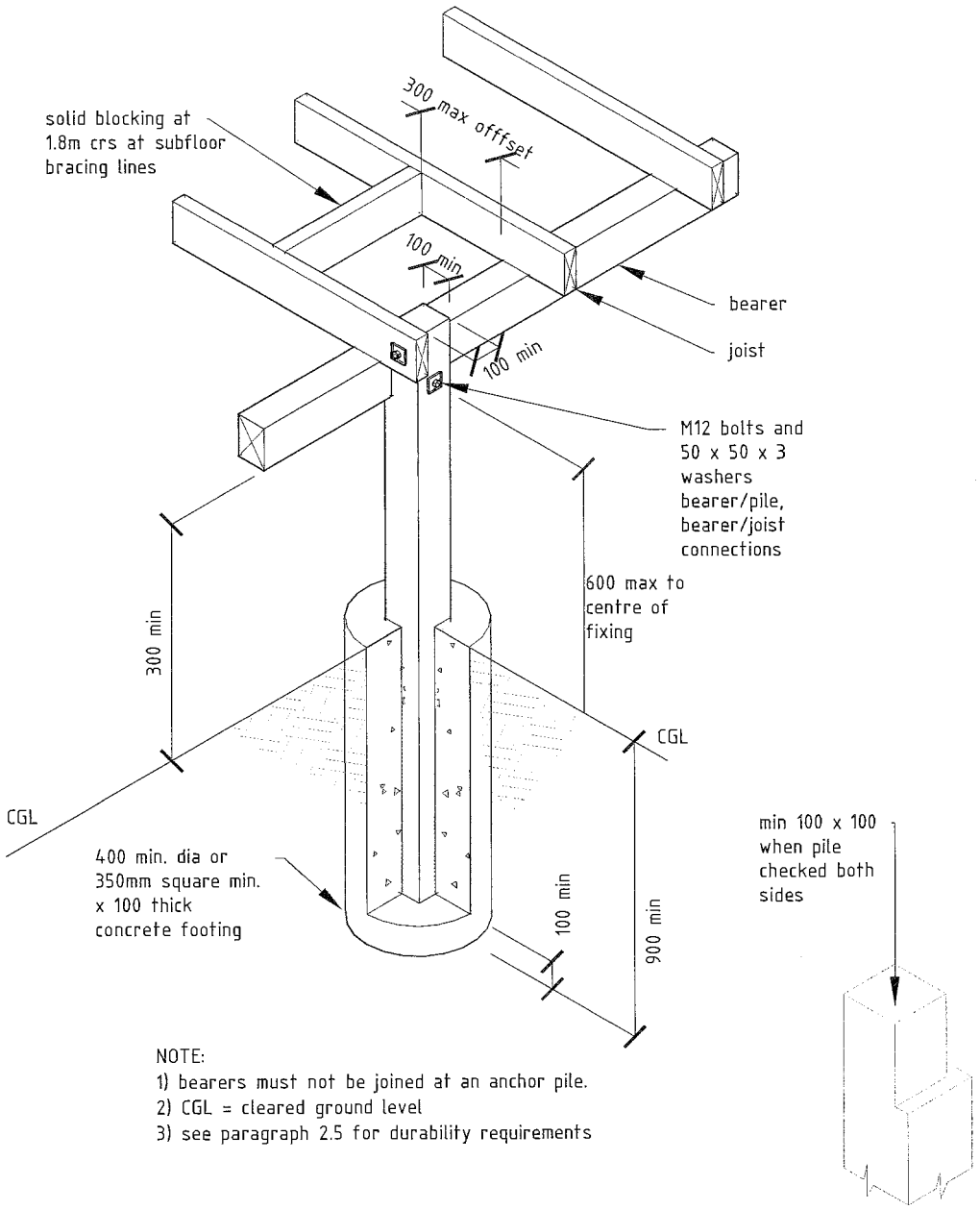
Figure 3.3.1 **Ordinary pile directly connected to bearer**
Paragraph 3.3.4



3.3.5 Anchor piles

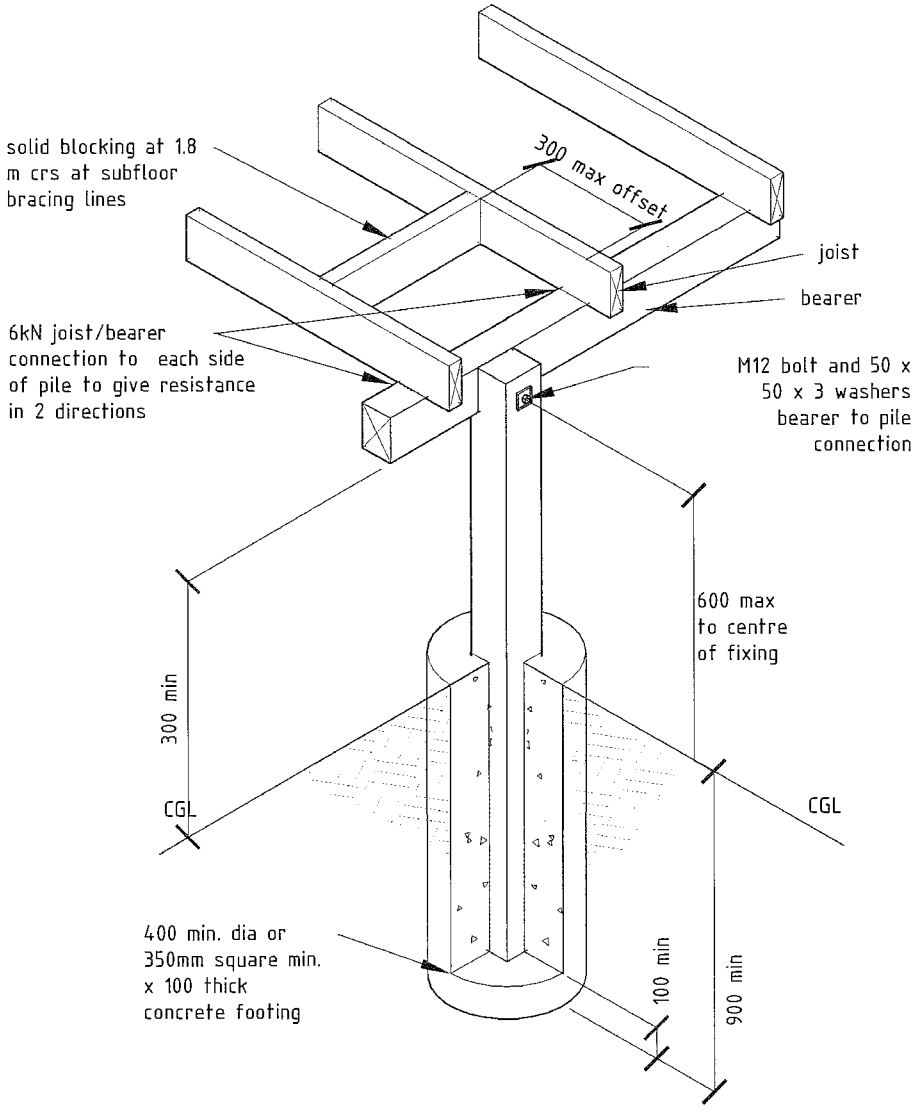
The fixings of bearers and floor joists to anchor piles shall be M12 bolts or 12 mm threaded rod as shown in Figures 3.3.2 and 3.3.3. Alternative *proprietary fixings* having a *capacity* of 12 kN in tension and compression along the bearer and timber joist may be used.

Figure 3.3.2 **Anchor pile directly connected to joist and bearer**
Paragraph 3.3.5



3.3.2 Anchor pile directly connected to joist and bearer

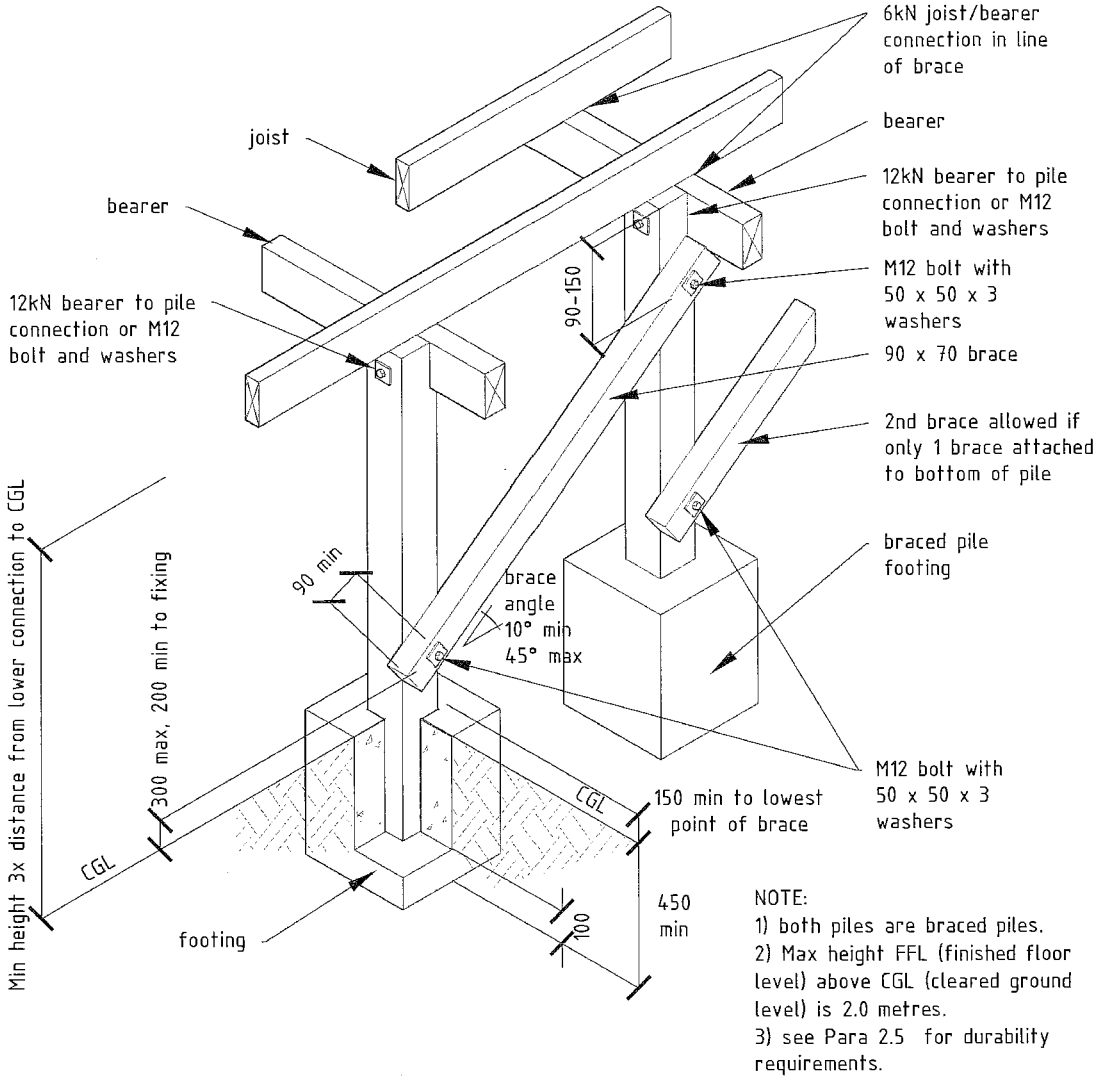
Figure 3.3.3 **Anchor pile directly connected to bearer only**
Paragraph 3.3.5



3.3.6 Braced pile systems

3.3.6.1 A braced pile system consists of 2 piles, each with a 450 mm deep *footing*, between which a *diagonal brace* is fixed in accordance with Paragraph 3.3.8 (see Figures 3.3.4 to 3.3.6).

Figure 3.3.4 **Braced pile system – brace connected to pile**
Paragraphs 3.3.6 and 3.3.8.3



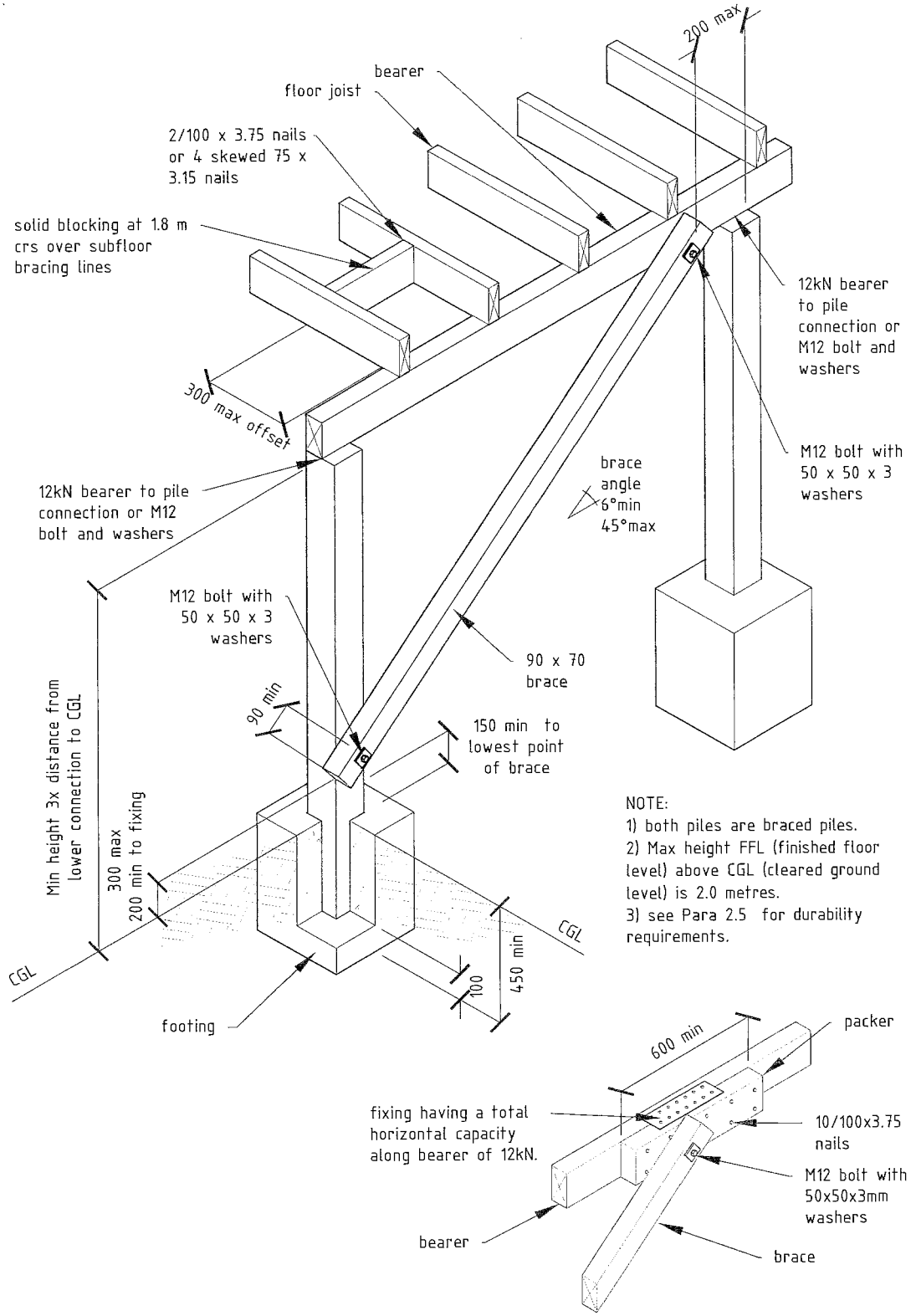
3.3.6.2 Where a braced pile system is repeated as a series of braced piles, with braces sloping in the same direction, it shall be in accordance with Figure 3.3.4.

3.3.6.3 Only one brace shall be attached to the top of a braced pile. Two braces may be attached to the bottom of a braced pile, but only if they are at right angles to each other and not in line.

3.3.6.4 Height

The minimum height of a braced pile above *cleared ground level* shall be three times the distance from *cleared ground level* to the lower brace fixing (see Figures 3.3.4 to 3.3.6).

Figure 3.3.5 **Braced pile system – brace connected to bearer**
Paragraphs 3.3.6 and 3.3.8.3



3.3.7 Diagonal braces

3.3.7.1 *Diagonal braces* shall slope between 10° and 45° to the horizontal except that a minimum slope of 6° may be used when the braces are connected to a bearer or joist.

3.3.7.2 A *diagonal brace* shall consist of one continuous length of 90 x 70 mm timber.

3.3.8 Brace connections

3.3.8.1 A *diagonal brace* shall be connected at each end by an M12 bolt with a 50 x 50 x 3 mm washer at each end passing through the centre line of the brace not less than 90 mm from its end and at right angles to the brace.

3.3.8.2 Brace, lower end connection

The lower end of the *diagonal brace* shall be fixed to the bottom of a braced pile by a M12 bolt through the centre line of the pile, between 200 and 300 mm above c*leared ground level.*

3.3.8.3 Brace, upper end connection

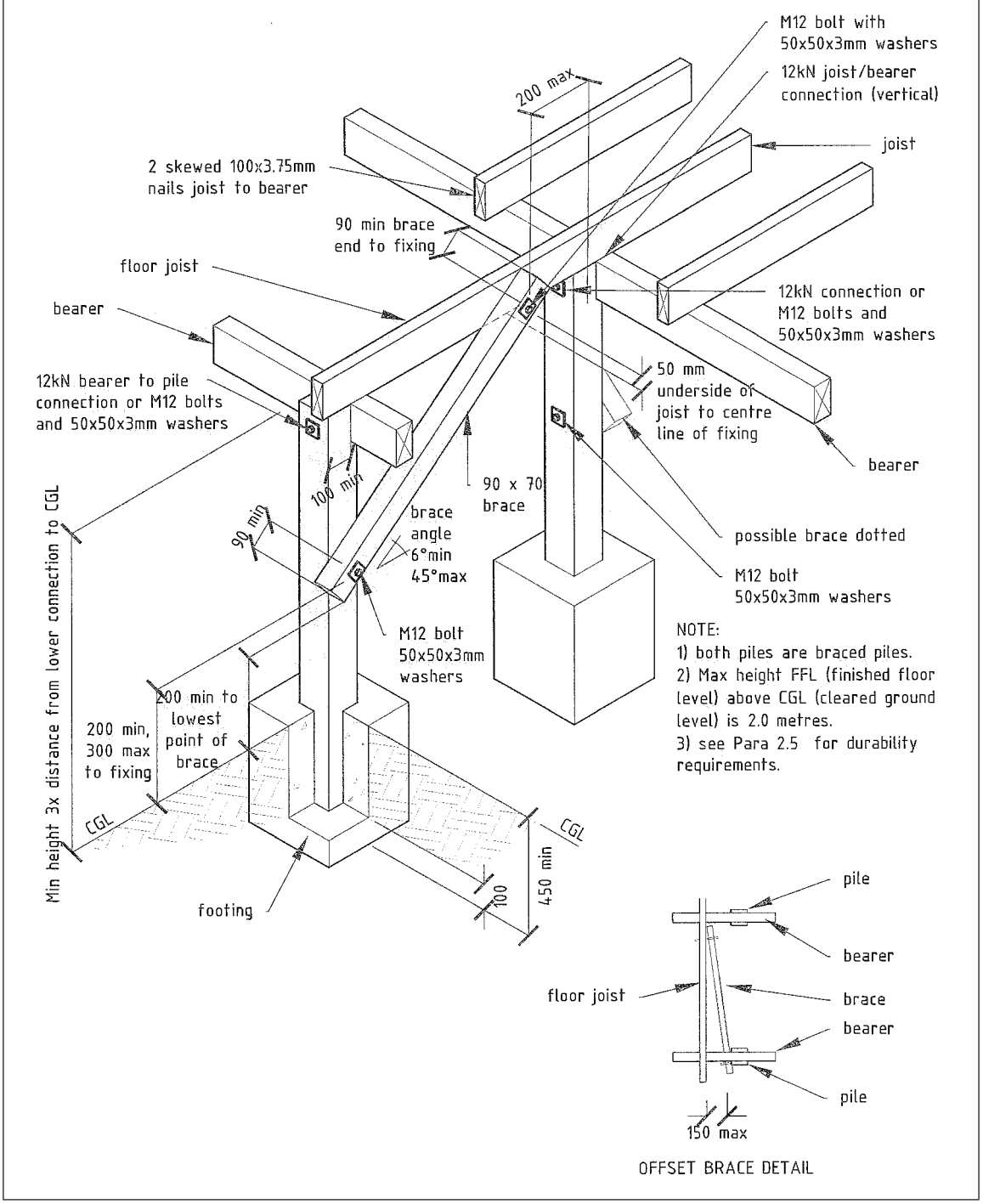
The upper end of the *diagonal timber brace* shall be fixed to one of the following members as set out below.

(a) Braced pile: the bolt shall pass through the top end of the pile not less than 90 mm, nor more than 150 mm, from the top of the pile. The bolt shall pass through the centre line of the pile (see Figure 3.3.4).

(b) Bearer: the bolt shall pass through the centre line of the bearer not more than 200 mm measured along the bearer from the centre line of the nearest support (see Figure 3.3.5). Where required for the alignment of the brace, the gap between the bearer and *diagonal brace* shall be bridged by a timber packer fixed to the bearer with 10/100 x 3.75 mm nails and a fixing having a *capacity* of 12 kN along the direction of the bearer. The packer shall be the same depth as the bearer and not less than 600 mm long.

(c) Joist: the bolt shall pass through the joist, not less than 50 mm from its lower edge and not more than 200 mm measured along the joist, from the centre line of the nearest pile (see Figure 3.3.6). The top of the diagonal timber brace shall not be more than 150 mm horizontally out of line from the bottom of the brace (see Figure 3.3.6).

Figure 3.3.6 **Braced pile system – brace connected to joist**
Paragraphs 3.3.6 and 3.3.8.3



3.3.9 Fixings of bearers and joists

3.3.9.1 The bearer shall be fixed to each braced pile with either:

(a) a M12 bolt, or

(b) a *proprietary fastener* of:

(i) 12 kN *capacity* in the horizontal direction where the brace is attached to the pile

(ii) 12 kN *capacity* in the vertical direction where the brace is attached to the bearer

(iii) 12 kN *capacity* in the vertical direction where the brace is attached to the joist.

3.3.9.2 Where the brace is attached to the pile, two floor joists in the area immediately above the upper end of the brace shall be fixed to the bearer with fixings each having a *capacity* in the horizontal direction of the brace of 6 kN.

3.3.9.3 Where the brace is attached to the joist, the joist to bearer fixing shall have a *capacity* in the vertical direction of 12 kN.

3.3.10 Subfloor bracing

3.3.10.1 Bracing lines

Bracing lines providing horizontal support shall run in two directions at right angles to each other and be located:

(a) in perimeter subfloor *framing*

(b) in internal lines parallel to perimeter subfloor *framing*

(c) at not more than 6 m *spacing*

(d) in the perimeter of timber deck structures projecting over 2 m from the *simple house*.

3.3.10.2 Internal bracing lines

Each internal *bracing line* shall have a *bracing capacity* not less than 70 *bracing units*. Bracing shall be evenly distributed along each line.

3.3.10.3 External bracing lines

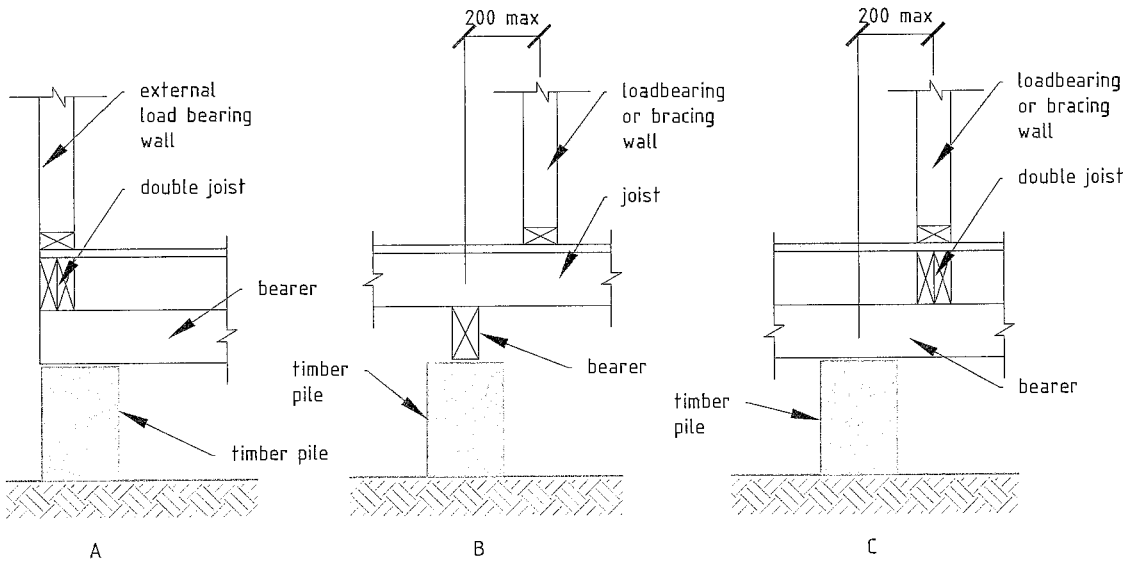
Each external subfloor *bracing line* shall have a total *bracing capacity* of not less than 10 *bracing units* per metre of *external wall*.

3.3.11 Support of loadbearing and wall bracing elements

3.3.11.1 A bearer shall be provided within 200 mm, centre-to-centre, of *loadbearing walls* immediately above, and which are at right angles to the joists (see Figure 3.3.7B).

3.3.11.2 Where a bearer supports a *loadbearing wall* or *wall bracing elements* running parallel to the floor joists, it shall itself be supported by a pile within 200 mm, centre-to-centre, of the *loadbearing* or bracing wall (see Figure 3.3.7C).

Figure 3.3.7 **Support of loadbearing walls**
Paragraphs 3.3.11.1, 3.3.11.2, 3.3.14.5 and 3.3.14.6



3.3.12 Subfloor bracing demand

3.3.12.1 Wind

The total subfloor *bracing demand* for wind shall be calculated by multiplying the *building* or *roof* length 'L' perpendicular to the wind direction by the *bracing demands* as determined by Table 3.3.1 and Figure 4.12. Timber *decks* can be ignored for wind demand.

Table 3.3.1 Subfloor bracing demand for wind
Paragraph 3.3.12.1

Height to apex (H)	Across ridge	Along ridge
	Bracing demand (BUs/m) of *building* or *roof* length 'L' perpendicular to wind direction	
4	93	111
5	130	147
6	154	166
7	191	203

3.3.12.2 Earthquake

The total subfloor *bracing demand* for earthquake shall be calculated by multiplying the *gross floor area* by the *bracing demand* as per Table 3.3.2.

Table 3.3.2 Subfloor bracing demand for earthquake
Paragraph 3.3.12.2 and 3.3.12.4

Wall *cladding*	*Roof cladding*	*Roof* pitch (degrees)	*Bracing demand* (BUs/m^2)
Weatherboard, sheet *cladding* – on piles	Profiled metal	10-25	9.4
Weatherboard, sheet *cladding* – on piles	Profiled metal	25-35	9.8
Weatherboard, sheet *cladding* – on piles	Masonry tile	10-25	12.1
Weatherboard, sheet *cladding* – on piles	Masonry tile	25-35	13.3
Timber *decks*	Not applicable	Not applicable	4.7

Note: *Decks* with stringers bolted to the *simple house* on one or more sides and which project no more than 2 m from the *simple house* do not require subfloor bracing.

3.3.12.3 Bracing capacity ratings of subfloor bracing elements

The bracing ratings of subfloor bracing elements are:

(a) braced pile system (consisting of two piles and a *diagonal brace*) – 120 BUs for earthquake and 160 BUs for wind

(b) anchor piles, rating per pile – 120 BUs for earthquake and 160 BUs for wind.

3.3.12.4 Bracing of timber decks

Decks with stringers bolted to the *simple house* on one or more sides and which project no more than 2 m from the *simple house* do not require subfloor bracing. *Decks* which project more than 2 m from the *simple house* shall have subfloor bracing provided by anchor and/or braced piles. See Table 3.3.2 for *bracing demand*.

3.3.12.5 Minimum number of subfloor braces

In no case shall any *simple house* that has subfloor bracing consisting only of braced pile systems or anchor piles have less than 4 braced pile systems or anchor piles, in each direction placed symmetrically around the *simple house* perimeter.

3.3.13 Bearers

3.3.13.1 Bearers of solid or nailed laminated timber (see Paragraph 2.7.3) shall be continuous over two or more spans and be laid in straight lines on edge.

3.3.13.2 Sizes

Bearers shall be a minimum of 2/140 x 45 mm or 140 x 90 mm and span a maximum of 1.65 m.

3.3.13.3 Cantilevered bearers

Bearers may project as cantilevers beyond the face of the support to a distance not exceeding 200 mm.

3.3.13.4 Landing

Bearers shall have a minimum landing on their supports of:

(a) where bearers are butted over the support: 45 mm

(b) in all other cases: 90 mm.

Any packing necessary beneath bearers shall be of a material as durable and as incompressible as the bearer itself.

3.3.13.5 Joints

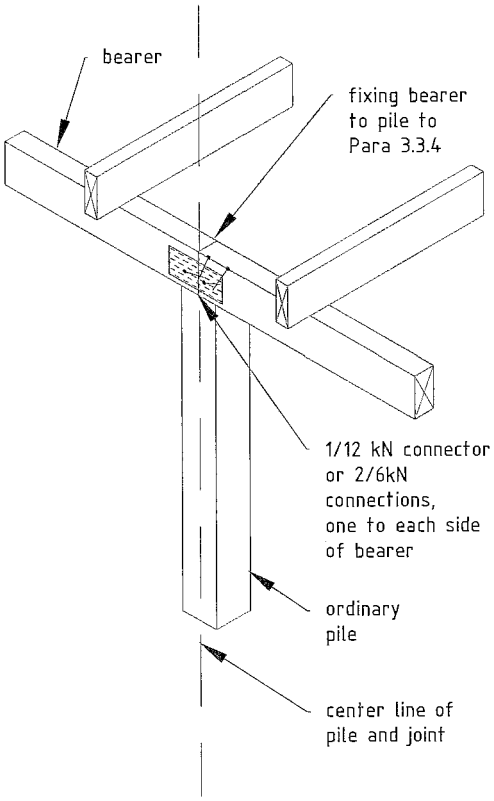
Joints in bearers shall be made only over supports with a connection having a *capacity* of:

(a) not less than 12 kN in tension or compression along the line of the bearer, or 6 kN each on both sides, if the bearer is one piece of timber, or

(b) 6 kN on one side of the joint when one laminate is continued over the support.

See Figure 3.3.8. Joints shall not occur where the bearer is fixed directly to an anchor pile or braced pile.

Figure 3.3.8 **Joints in bearers**
Paragraph 3.3.13.5



3.3.14 Floor joists

3.3.14.1 Floor joists shall be 140 x 45 mm with maximum spans in accordance with Table 3.3.3. Fix floor joist to bearers with 2 skewed 100 x 3.75 mm nails or 3 skewed 90 x 3.15 mm power driven nails.

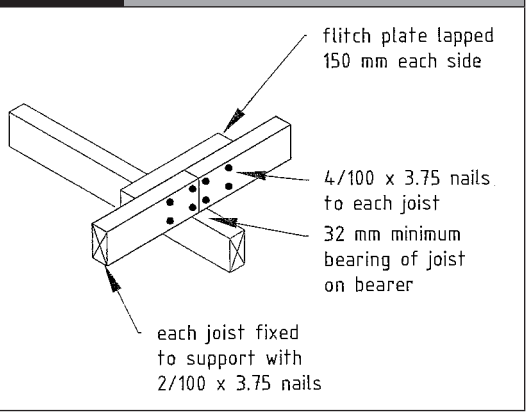
Table 3.3.3 **Maximum spans of floor joist**
Paragraph 3.3.14.1

Maximum span of joist (m)	Joist centres (mm)
2.70	400
2.60	450
2.00	600

3.3.14.2 Floor joists shall have minimum bearing on their supports of 32 mm.

3.3.14.3 Floor joists may be butted and flitched over a support with a piece of timber of the same dimensions as the joists and extending not less than 150 mm on each side of the joist ends and nailed to both lengths of joists from both sides (see Figure 3.3.9).

Figure 3.3.9 **Joints in floor joists**
Paragraph 3.3.14.3



3.3.14.4 Lateral support of floor joists

Lines of lateral support to floor joists shall be provided within 300 mm of all subfloor lines of horizontal support and shall consist of:

(a) at the ends of joists: a continuous *boundary joist* 25 mm minimum thick and the same depth as the floor joist's end nailed to each joist with 2/100 x 3.75 mm nails or 2/90 x 3.15 mm power driven nails, or

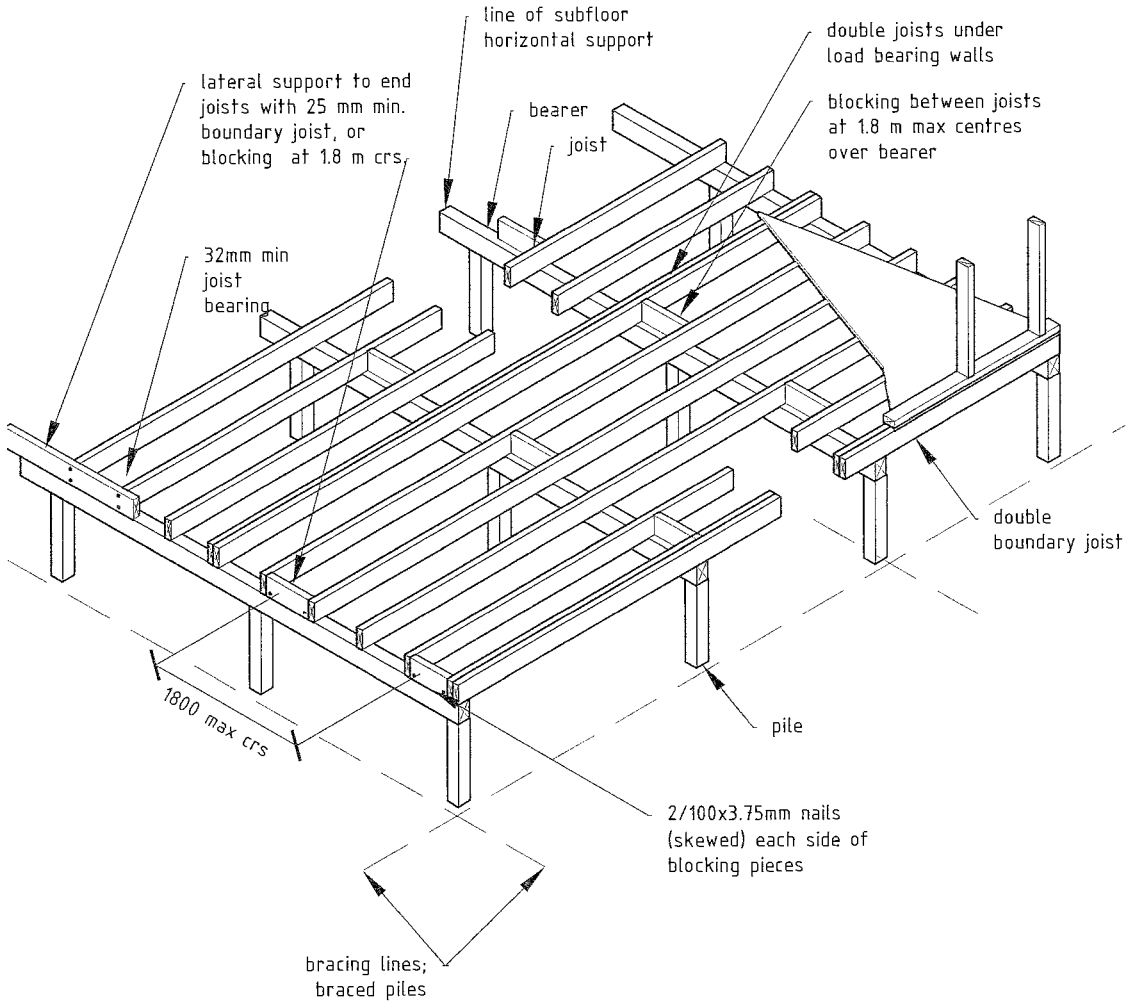
(b) at all other locations, including at joist ends: 140 x 45 mm solid *blocking* between adjacent floor joists, as described in Paragraph 3.3.14.8 at no more than 1.8 m centres. Solid *blocking* shall also be required between each 2 edge pair of joists.

3.3.14.5 Floor joists under walls

Where a *loadbearing wall* runs parallel to the line of floor joists beneath, it shall be supported by a pair of joists (see Figures 3.3.7A and 3.3.7C and Figure 3.3.10). Such a pair of joists may be separated by solid packing not exceeding 50 mm thick or half the thickness of the wall above, whichever is the lesser, at not more than 600 mm centres.

3.3.14.6 Where a *loadbearing wall* runs at right angles to the line of joists, such a *loadbearing wall* shall be located at not more than 200 mm centre-to-centre from a bearer (see Figure 3.3.7B).

Figure 3.3.10 **Floor joist layout criteria**
Paragraph 3.3.14



3.3.14.7 Where a *non-loadbearing wall*:

(a) contains wall *bracing elements* and runs parallel to the line of floor joists beneath, it shall be:

(i) over a joist, or

(ii) supported by solid *blocking* between the joists on either side of the wall in accordance with Paragraph 3.3.14.8 and set at each end of the wall above and at each side of any openings and at no more than 1.2 m centres

(b) does not contain a *wall bracing element*, it shall be within 150 mm of a joist measured between centrelines.

3.3.14.8 Blocking

Solid *blocking* shall be a minimum of 90 x 45 mm cut neatly between joists, with its top flush with the top of the joists. *Blocking* shall be fixed at each end with either 2/100 x 3.75 mm nails (or 2/90 x 3.15 mm power driven nails) end nailed or 4/75 x 3.15 mm nails skew nailed.

3.3.14.9 Cantilevered floor joists

Floor joists may cantilever beyond the bearer and support the floor, wall and *roof* by the distance shown in Table 3.3.4. Cantilevered floor joists shall be continuous over the outermost support. Do not put notches or holes in cantilevered joists.

The maximum height of walls supported by cantilevered joists shall be 2.4 m.

Table 3.3.4 Cantilevered floor joists
Paragraph 3.3.14.9

Joist spacing (mm)	Light *roof* span (m)			Heavy *roof* span (m)		
	4.0	8.0	12.0	4.0	8.0	12.0
600	300	200	150	200	150	100
450	300	250	200	250	150	100
400	350	250	200	250	150	100

3.3.14.10 Notches in floor joists

Notches in floor joists shall be:

(a) at a maximum of 450 mm from the face of the support

(b) a maximum of 28 mm deep

(c) at no closer than 140 mm between edges of notches.

3.3.14.11 Holes in floor joists

Holes in floor joists shall be:

(a) at a maximum of 450 mm from the face of the support

(b) a maximum of 28 mm diameter

(c) at no closer than 140 mm between edges of holes

(d) within the middle third of the depth of the joist.

3.3.14.12 Trimmers and trimming joists

Trimmers and trimming joists are not permitted.

3.3.15 Sheet flooring

3.3.15.1 Sheet flooring shall be either:

(a) particleboard sheet flooring manufactured to AS/NZS 1859 Part 1

(b) plywood flooring manufactured to AS/NZS 2269 and a minimum of 15 mm thick for joist spacing up to 450 mm and 19 mm thick for joist spacing up to 600 mm, laid with grain running across joists.

3.3.15.2 The structural grade, species and preservative treatment for sheet flooring shall be in accordance with Table 2.7.

3.3.15.3 Sheet flooring material shall, to the greatest possible extent, be laid in complete sheets.

3.3.15.4 Joints in sheet flooring material shall be made over supports, or with solid *blocking* in accordance with Paragraph 3.3.14.8.

3.3.15.5 Each sheet shall be fastened along edges at 150 mm centres to *framing* or *blocking* members and shall also be fastened to every intermediate *framing* member at 300 mm centres. Fastenings shall be not less than 10 mm from sheet edges. Fastenings shall be minimum 60 x 2.8 mm annular grooved nails.

3.3.16 Subfloor ventilation

The subfloor space of all suspended timber floors shall be ventilated by:

(a) a continuous gap, 20 mm wide, between baseboards around the entire perimeter of the *simple house*, and/or

(b) perimeter wall ventilators to give no less than 3500 mm^2 of net open area for every m^2 of floor area.

3.3.17 Access

Access shall be provided to permit visual inspection of all subfloor *framing* members. A crawl space for this purpose shall be not less than 450 mm high to the underside of the floor joists.

3.4 Timber decks

CONTENTS

3.4.1 General

Decks shall be constructed with the maximum dimensions of:

(a) 3 m centre-to-centre from house pile to outer *deck* pile

(b) 2 m from *cleared ground level* to the decking surface.

Stairs from the timber *deck* to the external ground level are outside the scope of this *Acceptable Solution*.

Decks from which it is possible to fall 1.0 m or more shall be fitted with a timber barrier in accordance with this section and Figures 3.4.1 to 3.4.4.

Comment:
Designs for an external stair or alternative design solutions for the deck barrier will need separate engineering documentation for the *building consent authority* to consider.

3.4.2 Materials

The grade, species and preservative treatment for timber in *decks* and barriers (for example the *framing*, posts, rails, *balusters* and *handrail* capping) shall be in accordance with Table 2.7.

Timber decking shall be a minimum 30 mm thick, merchant grade radiata pine treated to Hazard Class H3.2.

All bolt or coach screw fixings shall have a 50 x 50 x 3 mm washer inserted between the timber surface and the head and nut.

All metal components shall comply with Paragraph 2.5. Any steel connections within 600 mm of the *finished ground level* shall be a minimum of Type 304 stainless steel.

3.4.3 Piles

Deck piles shall be minimum 125 x 125 mm timber piles in accordance with Paragraphs 3.3.1 and 3.3.2. *Footings* shall be as per Paragraph 3.3, which specifies ordinary piles, anchor piles or part of a braced pile system.

3.4.4 Bearers

Bearers shall be 2/140 x 45 mm. The maximum span for bearers shall be 1.65 m.

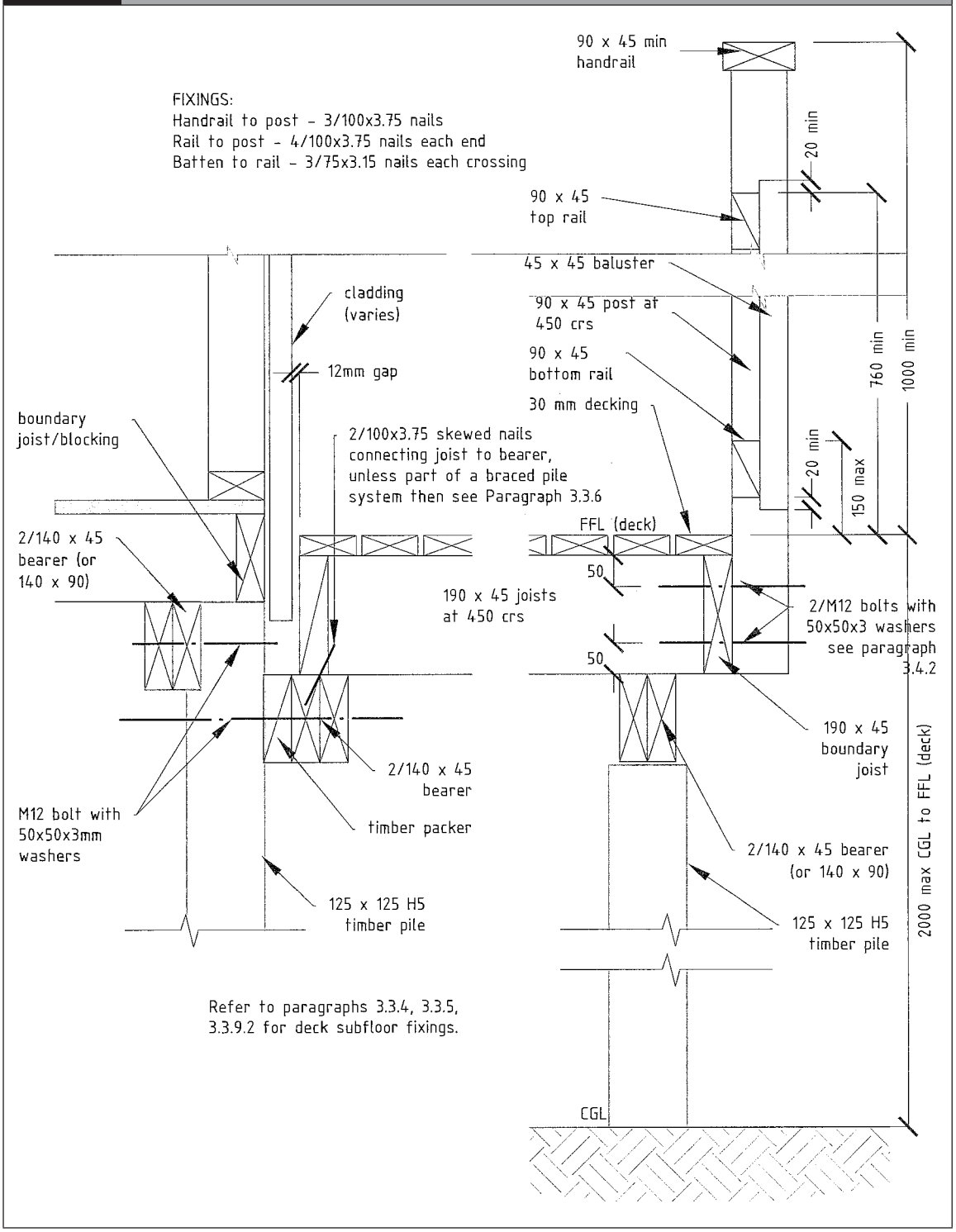
3.4.5 Timber Packer to pile/bearer

Packing to be 140 mm deep where required (width to ensure 12 mm minimum clearance to *cladding*).

3.4.6 Joists

Joists shall be 190 x 45 mm at 450 mm centres, fixed at bearers with 2 skewed 100 x 3.75 mm nails.

Figure 3.4.1 **Deck and barrier construction**
Paragraphs 3.4.1, 3.4.7, 3.4.8 and 3.4.10



3.4.7 Boundary joist

Boundary joists shall be 190 x 45 mm. Where a barrier is installed, the *boundary joist* shall be fixed to all joists as per Figures 3.4.1, 3.4.2 and 3.4.3.

3.4.8 End joist

Where a post is fixed to an end joist, 190 x 45 mm solid *blocking* pieces shall be inserted within 85 mm of the post and fixed as per Figures 3.4.1, 3.4.2 and 3.4.4.

3.4.9 Decking

3.4.9.1 Decking shall be minimum 30 mm thick, grip-tread type grooved radiata pine, as per Paragraph 3.4.2.

3.4.9.2 Fix decking with 75 x 3.15 mm annular-grooved decking nails. All decking joints and ends shall be drilled for nailing. Decking shall be spaced minimum 2 mm and fixed at each joist with a minimum of two nails. Joints in decking to be staggered and made over joists.

Figure 3.4.2 **Boundary and end joist layout**
Paragraphs 3.4.1, 3.4.7, 3.4.8 and 3.4.10

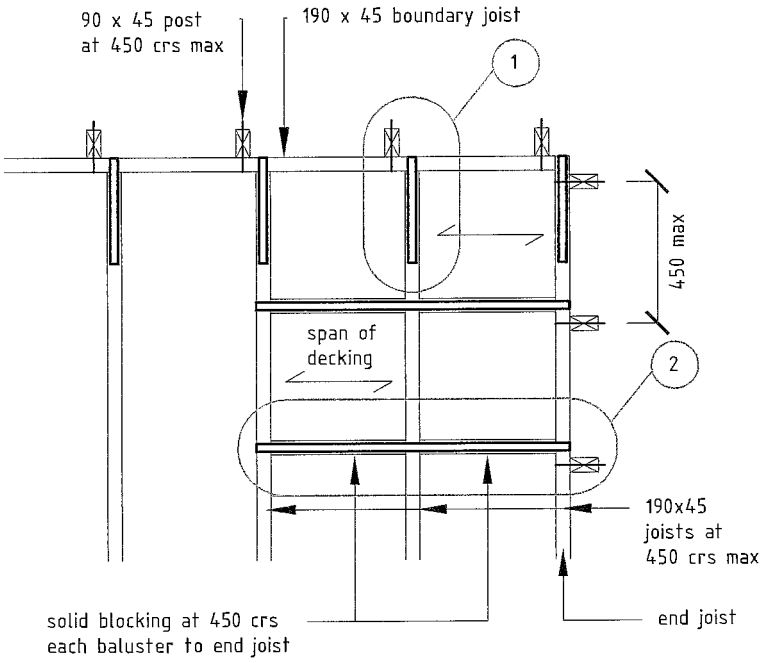
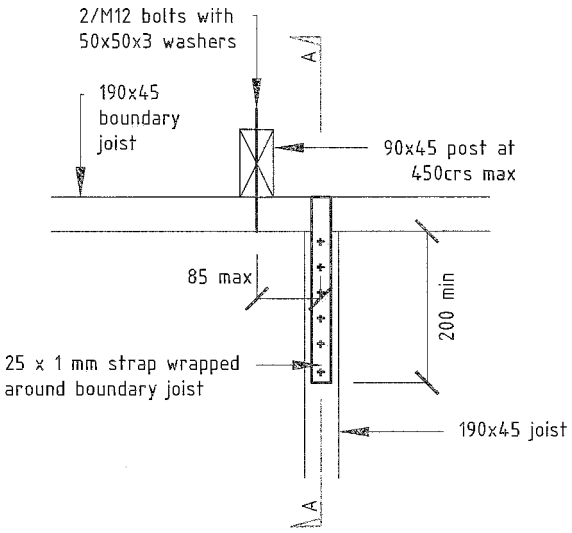
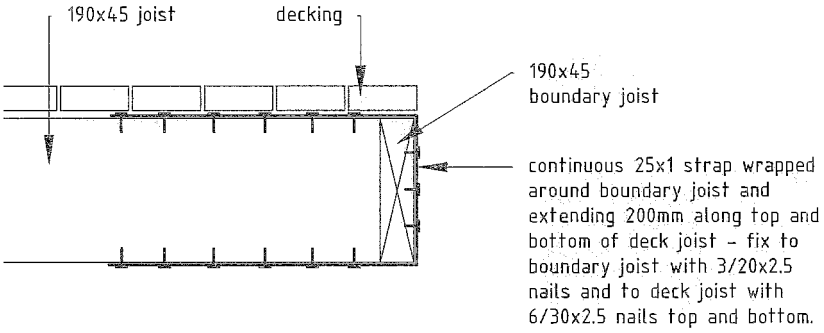


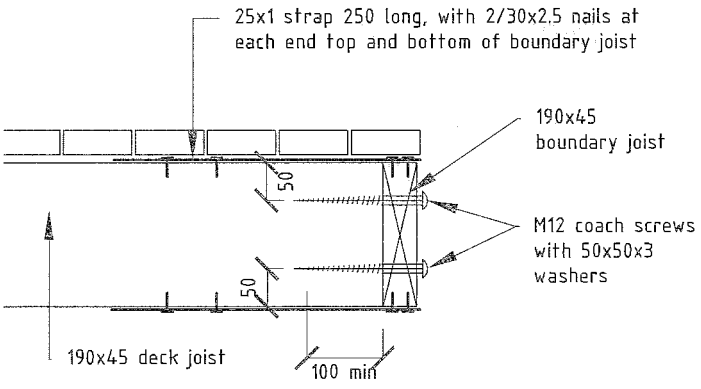
Figure 3.4.3 **Post, boundary joist and deck joist details**
Paragraphs 3.4.1 and 3.4.10



Detail 1: POST, BOUNDARY JOIST AND JOIST CONNECTION DETAIL

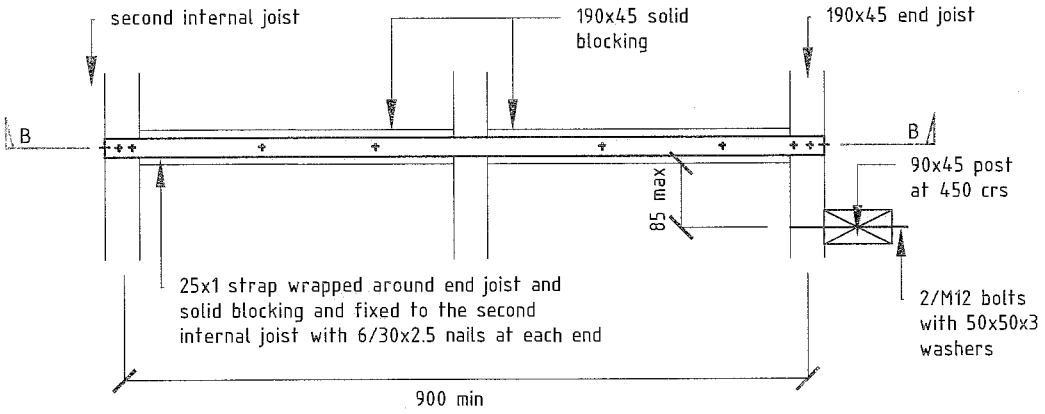


Section AA: FIXING DETAIL FOR BOUNDARY JOIST

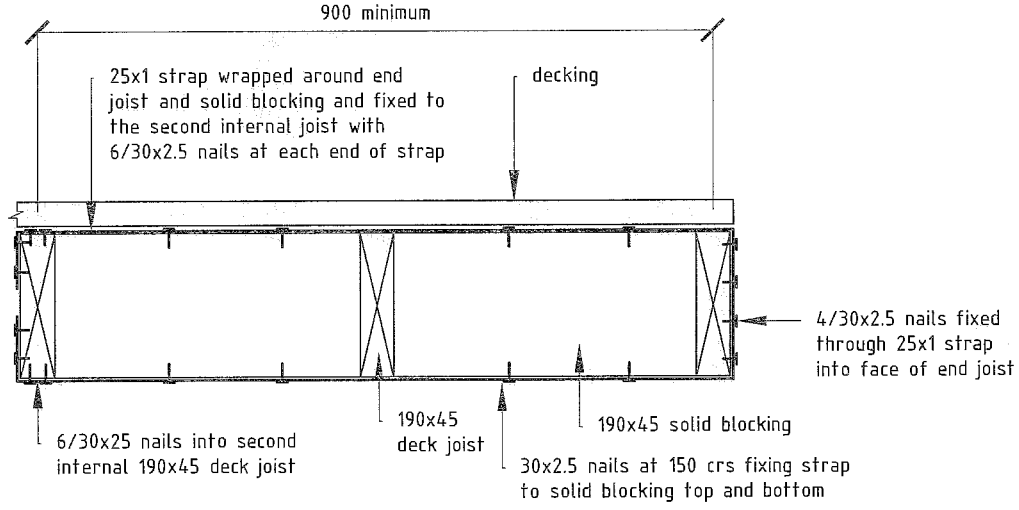


Section AA: ALTERNATIVE FIXING DETAIL FOR BOUNDARY JOIST

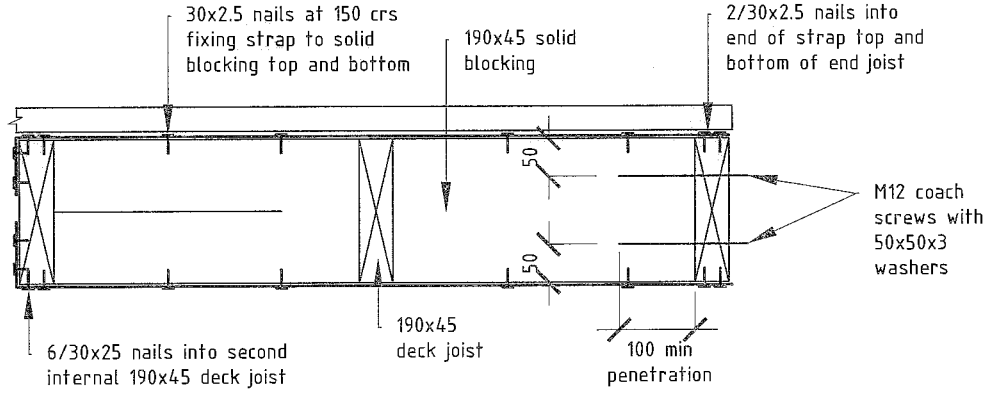
Figure 3.4.4 **Post, end joist and solid blocking details**
Paragraphs 3.4.1, 3.4.8 and 3.4.10



Detail 2: POST TO END JOIST



Section BB: FIXING DETAIL TO END JOIST



Section BB: ALTERNATIVE END DETAIL

3.4.10 Post

The barrier shall have 90 x 45 mm posts at 450 mm maximum centres and fixed to *boundary joists* or end joists with two M12 bolts as per Figures 3.4.1 to 3.4.4.

3.4.11 Top rail

The barrier shall have a 90 x 45 mm top rail fixed to the posts with 4 skewed 100 x 3.75 mm nails.

3.4.12 Bottom rail

The barrier shall have a 90 x 45 mm bottom rail fixed to the posts with 4 skewed 100 x 3.75 mm nails.

3.4.13 Balusters

Vertical *balusters* spanning between the rails shall be a minimum of 45 x 45 mm battens with a maximum of 100 mm gaps between. The battens shall be fixed with 3/75 x 3.15 mm nails providing 25 mm minimum penetration to top and bottom rails.

3.4.14 Handrail (capping)

The *handrail* shall be 90 x 45 mm (120 mm maximum width) fixed with 3/100 x 3.75 mm nails to the top of each post.

4.0 Wall framing

CONTENTS

4.1 Bottom Plates

4.1.1 Materials

The grade, species and preservative treatment for *bottom plates* in wall *framing* shall be in accordance with Table 2.7.

Bottom plates shall be the same width as the *studs*.

Bottom plates shall be a minimum of 45 mm thick when continuously supported by either joists, solid *blocking* or a concrete slab or when used in conjunction with a light *roof*. When a *bottom plate* is not continuously supported and is used in conjunction with a heavy *roof*, the *bottom plate* shall be a minimum of 70 mm thick.

4.1.2 Protection of timber

All timber *framing* shall be separated from the concrete slab by a *damp-proof course (DPC)*.

4.1.3 Fixing bottom plates – external walls

External wall bottom plates shall be fixed to:

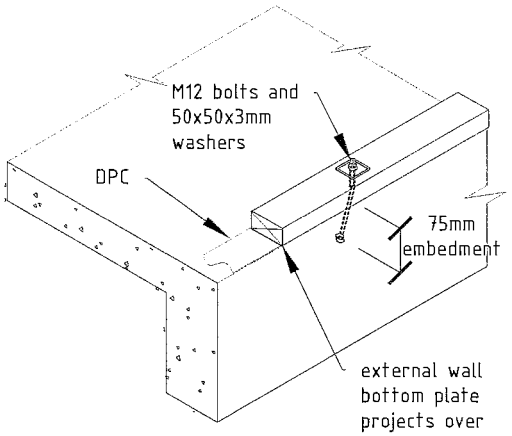
(a) a slab-on-ground floor using bolts and washers as per Paragraph 4.1.3.1, or *proprietary fasteners* as per Paragraph 4.1.3.2

(b) a timber suspended floor structure using 2/100 x 3.75 mm hand driven nails at 600 mm centres or 3/90 x 3.15 mm power driven nails at 600 mm centres.

4.1.3.1 Bolt fixings and washers

Bolt fixings to slab-on-ground floors shall be M12 bolts set not less than 75 mm into the concrete and projecting sufficiently to allow for a 50 x 50 x 3 mm square washer and fully threaded nut above the timber in accordance with Figure 4.1. Bolt fixings shall include washers to spread the load. Bolts shall be located not more than 300 mm from the end of the *bottom plate* at corners of the slab and at not more than 1.4 m centres along the length of the *plate*.

Figure 4.1 **Fixing of perimeter wall plates to slab**
Paragraph 4.1.3.1



Note: (1) Bolt minimum cover to exterior face of foundation, 40 mm

4.1.3.2 Proprietary fasteners – external walls

Proprietary fasteners may be used to fix external *bottom plates* to slab-on-ground floors provided they have a minimum *capacity*, when tested in accordance with the definition of *proprietary fasteners,* as follows:

(a) horizontal loads in the plane of the wall: 5 kN

(b) horizontal loads out of plane with the wall: 4 kN

(c) vertical loads in axial tension of the fastener: 8 kN.

Proprietary fasteners shall be located not more than 150 mm from each end of the *bottom plate* and at not more than 900 mm centres along the length of the *plate*.

Where header (concrete masonry) block perimeter *foundations* are used, fixings shall have a minimum embedment of 150 mm into the concrete *foundation*.

4.1.4 Fixing bottom plates – internal walls

4.1.4.1 Fixing bottom plates to concrete slab

For *internal walls*, other than *wall bracing elements, proprietary fasteners* securing *bottom plates* to slab-on-ground floors shall be used, provided they have a minimum *capacity* when tested as follows:

(a) in the plane of the wall: 4 kN

(b) out of the plane of the wall: 3 kN.

Proprietary fasteners to *internal walls* shall be within 150 mm of each end of the *plate* and at not more than 900 mm centres elsewhere.

4.1.4.2 Fixing internal bottom plates to timber floor framing

Internal *bottom plates* shall be fixed to the timber floor *framing* by:

(a) 1/100 x 3.75 mm hand driven nail at 600 mm centres, or

(b) 1/90 x 3.15 mm power driven nail at 600 mm centres.

4.1.5 Bottom plates generally

4.1.5.1 Where holes or face notches exceed 50% of the width of the *bottom plate*, fix the *plate* against sideways movement on each side of the hole or notch using:

(a) on concrete floors, a *proprietary fastener* of 3kN *capacity* in and out of plane of the wall

(b) on timber suspended floors, 1/100 x 3.75 mm nails.

4.1.5.2 Perimeter *bottom plates* shall overhang a concrete *foundation* by 6 mm.

4.2 Studs

4.2.1 General

4.2.1.1 The grade, species and preservative treatment for *studs* in wall *framing* shall be in accordance with Table 2.7.

4.2.1.2 *Studs* shall be 2.4 m maximum length generally (excluding *gable* end or raking *internal walls*), and 90 x 45 mm with a maximum *stud spacing* of 480 mm.

Where the *simple house* is in a wind zone shown to be less than Very High, the *stud spacing* may be increased, as an option, up to 600 mm in accordance with Table 4.1.

Comment:
The *simple house* is applicable to all areas of New Zealand up to and including Very High *wind zones*, with specific exclusions in accordance with Paragraph 2.2.

Where a *simple house* is to be sited in a *wind zone* less than Very High (i.e. up to a maximum of 44 metres per second) and the designer chooses to increase the *stud spacing* as per Paragraph 4.2.1.2, they will need to demonstrate what that lesser *wind zone* is. The calculation shall be in accordance with Section 5 of NZS 3604, or the BCA may have *wind zones* already identified for the given site on their own locality maps.

When *stud spacings* are increased to 600 mm with heavy *roofs*, the maximum *loaded dimension* for the wall shall be 3.7 m.

4.2.2 Gable end

Where longer *studs* are required they shall be sized as in Table 4.1.

Table 4.1 **Studs in external, gable and internal walls**
Paragraphs 4.2.1 and 4.2.2

Maximum height of *stud* (m)	All *wind zones* – *stud* size (mm x mm) and max *stud* centres (mm)	*Wind zones* up to and including High – *stud* size (mm x mm) and max *stud* centres (mm)
External walls		
2.4	90 x 45 at 480 centres	90 x 45 at 600 centres
3.0	2/90 x 45 at 600 centres	2/90 x 45 at 600 centres
3.6	140 x 45 at 480 centres	140 x 45 at 480 centres
4.0	2/140 x 45 at 400 centres or 190 x 45 at 600 centres	2/140 x 45 at 480 centres or 190 x 45 at 600 centres
Internal walls	All *wind zones*	
3.0	90 x 45 at 600 centres	
3.6	2/90 x 45 at 600 centres	
4.0	2/90 x 45 at 400 centres or 140 x 45 at 600 centres	

4.2.3 Wall junctions

Wall junctions shall be framed up with 3 *studs* blocked and nailed.

4.2.4 Notches and holes

Holes in the face and notches in the edge of a *stud* (see Figure 4.2) shall:

(a) be placed anywhere over the face of the *stud* except that:

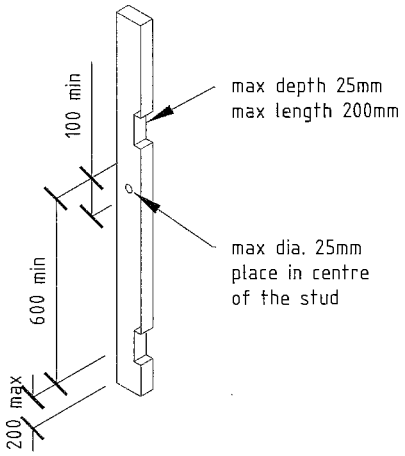
(i) in *masonry veneer cladding*, holes shall be at least 50 mm clear of the outside face of the *stud* supporting the veneer

(ii) for *trimming studs* refer to Paragraph 4.2.6.2

(b) be no greater in *diameter* or depth than 25 mm. This may be increased to 35 mm where not more than three consecutive *studs* are drilled or notched

(c) for notches in *studs,* be spaced vertically not less than 600 mm apart, irrespective of the edge containing the notch.

Figure 4.2 **Notches and holes**
Paragraph 4.2.4



NOTE:
1) The depth of notches and diameter of holes may be increased to 35mm where no more than 3 consecutive studs are drilled or notched.
2) Notches in studs to be spaced vertically 600mm apart (independent of edge containing the notch).
3) 100mm min offset between hole and notch.

4.2.5 Stud straightness

Timber to be used as a *stud* shall not have a crook exceeding 10 mm.

4.2.6 Trimming studs

4.2.6.1 A *trimming stud* shall be provided to each side of any opening that includes a *lintel* (see Figure 4.3 and Table 4.2).

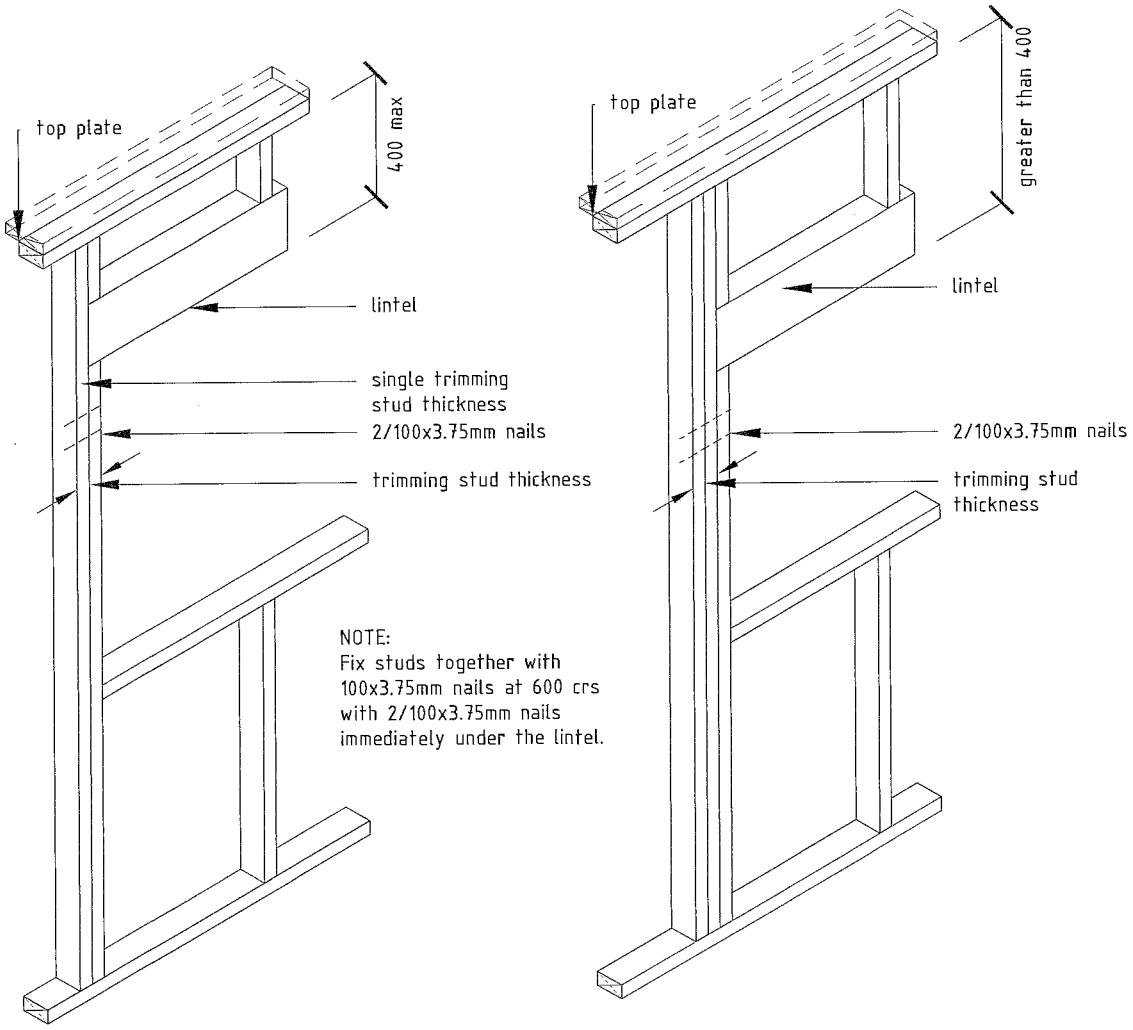
4.2.6.2 *Trimming studs,* whether single, double or quadruple, shall not contain holes, notches, checks or cuts in the middle third of their length, shall have the same width as the *studs* in the wall and shall have the thickness given by Table 4.2.

4.2.6.3 Where a doubling *stud* (see Figure 4.3) which provides support for a *lintel* is shorter by 400 mm or more than the full *stud* height, its thickness shall not be included as contributing to the thickness of *trimming studs* from Table 4.2.

Table 4.2 **Trimming studs**
Paragraph 4.2.6

Maximum clear width of opening (span of *lintel*) (m)	Thickness of *trimming stud* (mm)
Up to 1.8	45
1.8 to 3.7	90
3.7 to 4.8 (garage doors only)	180

Figure 4.3 **Trimming studs and lintels**
Paragraphs 4.2.6 and 4.5



4.2.7 Lateral support of studs

All *studs* shall be laterally supported by *dwangs*.

4.3 Dwangs

4.3.1 The grade, species and preservative treatment for *dwangs* in wall *framing* shall be in accordance with Table 2.7.

Dwangs shall be a minimum of 90 x 45 mm, and *spaced* at not more than 1.35 m centre-to-centre.

4.3.2 *Dwangs* for the support of *cladding* or *lining* shall be flush with the face of the *studs*.

4.4 Top plates

4.4.1 Loadbearing walls

The grade, species and preservative treatment for *top plates* in wall *framing* shall be in accordance with Table 2.7.

Top plates to *loadbearing walls* shall be a lamination of 90 x 45 mm plus 140 x 35 mm, or two equal sized laminations, each being 90 x 45 mm minimum. Where wider *studs* are used, the laminations of the *top plate* shall be at least the same width as the *studs*. The lower lamination shall be a minimum of 45 mm thick and the upper lamination a minimum of 140 x 35 mm.

Comment
The wider upper lamination also serves as a perimeter ceiling batten.

4.4.2 Non-loadbearing walls

Top plates of *non-loadbearing walls* shall be the same width as the *studs* and no less than 35 mm thick.

4.4.3 Joints in plates

4.4.3.1 In-line joints in *top plates* of walls shall be made only over supports being either a *stud* or *blocking* in accordance with Figure 4.4.

4.4.3.2

(a) For *top plates* connected over a *stud,* use a 75 x 1 mm (minimum thickness) metal nail plate of 300 mm minimum length with 6/30 x 3.15 mm nails per side or a *proprietary fastener* with a *capacity* in tension and compression of 6 kN.

(b) For *top plates* supported over solid *blocking,* the *top plates* shall be connected to the solid *blocking* using a minimum of 6/100 x 3.75 mm nails per side or a *proprietary fastener* with a *capacity* in tension and compression of 6 kN.

Figure 4.4 **Connecting top plates**
Paragraph 4.4.3

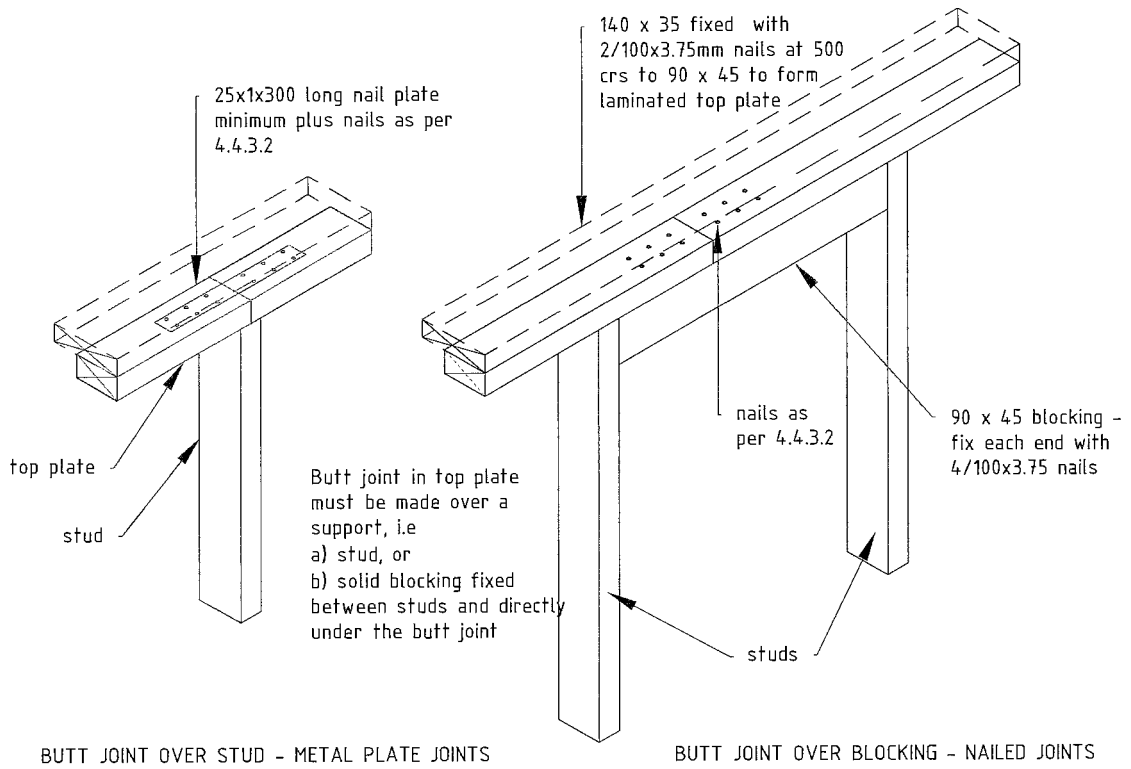
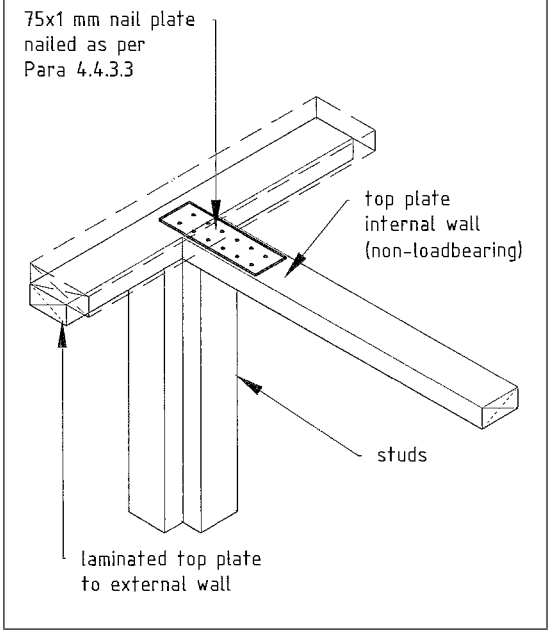


Figure 4.5 **Connecting top plates to external walls at right angles – walls containing bracing**
Paragraph 4.4.3.3



4.4.3.3 Each wall that contains one or more *wall bracing elements* shall be connected at *top plate* level, either directly or through a *framing* member in the line of the wall, to *external walls* at right angles to it. *Top plate* fixing(s) of the *capacity* in tension or compression along the line of the *wall bracing element* are given as follows. For each wall containing *wall bracing elements* with a total *bracing capacity* of:

(a) not more than 125 *bracing units* to at least one *external wall* by a 75 mm x 1 mm (minimum cross section) metal nail plate of 240 mm minimum length with 6/30 x 3.15 mm nails per side in accordance with Figure 4.5 or a *proprietary fastener* with a *capacity* in tension and compression of 6 kN

(b) not more than 250 *bracing units* to at least two *external walls* by a 75 mm x 1 mm (minimum cross section) metal nail plate of 240 mm minimum length with 6/30 x 3.15 mm nails per side in accordance with Figure 4.5 or a *proprietary fastener* each with a *capacity* in tension and compression of 6 kN

(c) more than 250 *bracing units* to at least two *external walls* by *proprietary fasteners* in accordance with Figure 4.5 each having a rating of not less than 2.4 kN per 100 *bracing units.*

4.4.4 Lateral support of top plates

4.4.4.1 *Top plates* shall be laterally supported by *framing* members *spaced* at not greater than 2.5 m.

4.4.4.2 Where the required *framing* support is not provided directly by intersecting *top plates, rafters,* trusses or *purlins,* then it shall be provided by mimimum 70 x 45 mm connecting members. The members shall run between the *top plate* and *roof framing* member that is parallel to the wall under consideration and to which ceiling *framing* is attached. Such connecting members shall be connected in accordance with Figure 4.6.

4.4.5 Holes, notches and slots in top plates

The sizes of holes or notches in *top plates* shall comply with the dimensions shown in Figure 4.7. Where the size of a hole or notch exceeds these dimensions, the plates shall be strengthened by one of the following methods:

(a) a 70 x 35 mm member x 600 mm long nailed to the exterior side of the *plate* with 4/75 x 3.15 mm nails on each side of the hole or notch, in accordance with Figure 4.8, or

(b) a 70 x 35 mm *eaves* bearer connected to all *studs* and no more than 250 mm below the *top plate*, or

(c) a 70 x 35 mm *blocking* fitted between trusses above cut *top plates* and a 40 x 40 x 1 mm steel angle shown in Figure 4.8.

Figure 4.6 **Connecting members providing lateral support to top plates**
Paragraph 4.4.4.2

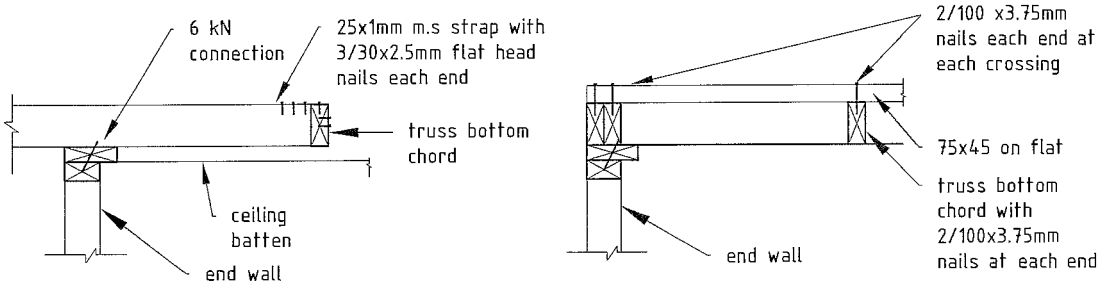


Figure 4.7 **Holes, notches and slots in top plates**
Paragraph 4.4.5

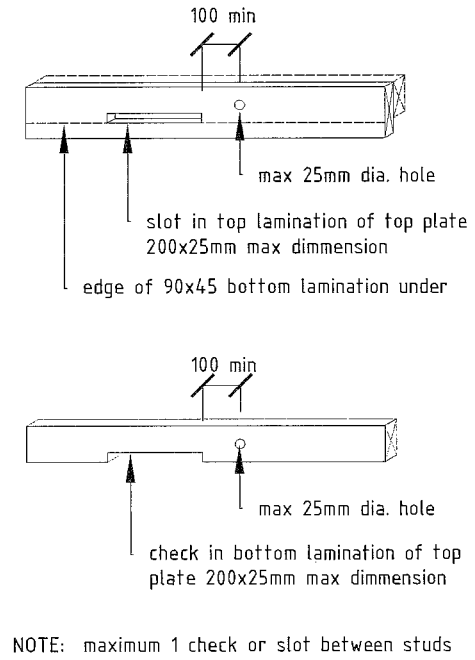
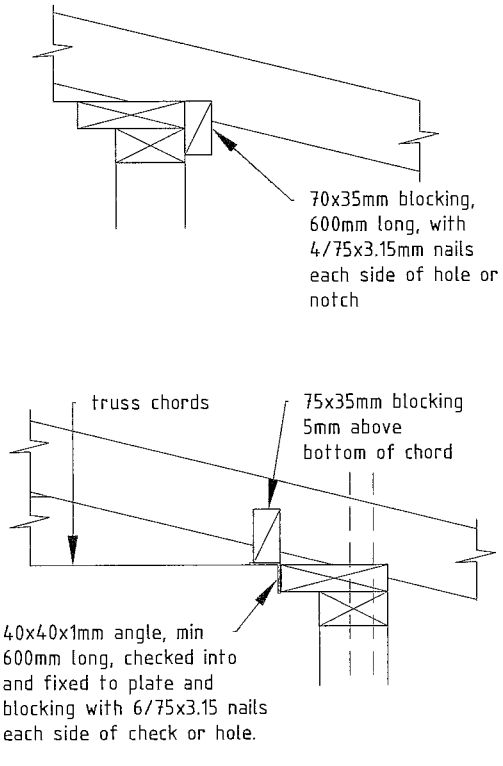


Figure 4.8 **Strengthening top plates**
Paragraph 4.4.5



4.4.6 Connection of plates to studs

Top plates supporting *roof* members shall be connected to wall *studs* or *lintels* with fixings as given in Table 4.3.

Table 4.3 **Fixing top plates supporting roof members to wall studs or lintels**
Paragraph 4.4.6

Loaded dimension of wall (m)	Fixings	*Capacity* of *proprietary fastener* (kN)
0 – 4.5	2/100 x 3.75 skewed nails + 2 *wire dogs*	4.7
4.5 – 6.0	2/100 x 3.75 skewed nails + 3 *wire dogs*	6.7

4.5 Openings

4.5.1 Lintels for openings

The grade, species and preservative treatment for timber *lintels* in wall *framing* shall be in accordance with Table 2.7.

4.5.1.1 *Lintels* shall be provided over all openings in *loadbearing walls* (see Figure 4.9).

4.5.1.2 Timber Lintels

Timber *lintels* shall be of the dimensions given by Table 4.4.

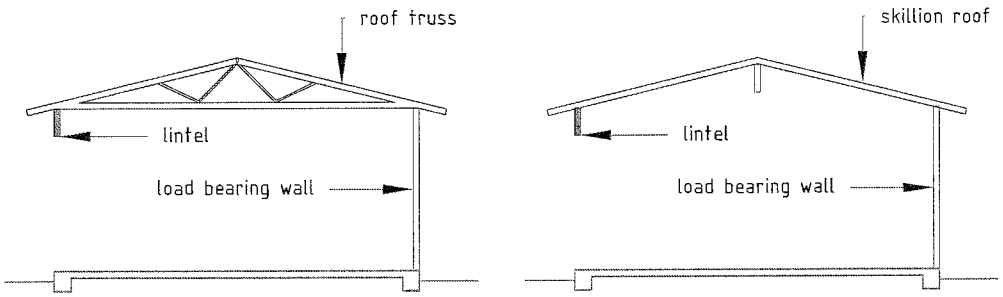
Table 4.4 **Timber lintels supporting roof only**
Paragraphs 2.4.3 and 4.5.1

Roofing	Loaded dimension of *lintel* (m)	Maximum span for *lintel* sizes listed below (m)				
		2/90 x 45 or 90 x 90 mm	2/140 x 45 or 140 x 90 mm	2/190 x 45 or 190 x 90 mm	2/240 x 45 or 240 x 90 mm	2/290 x 45 or 290 x 90 mm
Profile metal or metal tile	3	1.1	1.8	2.5	3.1	3.7
	4	1.0	1.6	2.3	2.9	3.2
	5	1.0	1.5	2.1	2.7	2.7
	6	0.9	1.5	2.0	2.2	2.2
Masonry tile	3	0.9	1.4	2.0	2.5	3.0
	4	0.8	1.3	1.8	2.3	2.8
	5	0.8	1.2	1.7	2.2	2.6
	6	0.7	1.2	1.6	2.0	2.5

Note:

1. 2/45 thick members shall be laminated in accordance with Paragraph 2.7.3.
2. For *lintels* supporting *roofs* with 1 kPa snow load the span shall be multiplied by a factor of 0.8.

Figure 4.9 **Lintel supporting roof only**
Paragraph 4.5.1 and Table 4.4



4.5.1.3 Timber *lintels* shall be supported at each end for the full thickness of the *lintel* by the minimum seating dimensions of (see Figure 4.10):

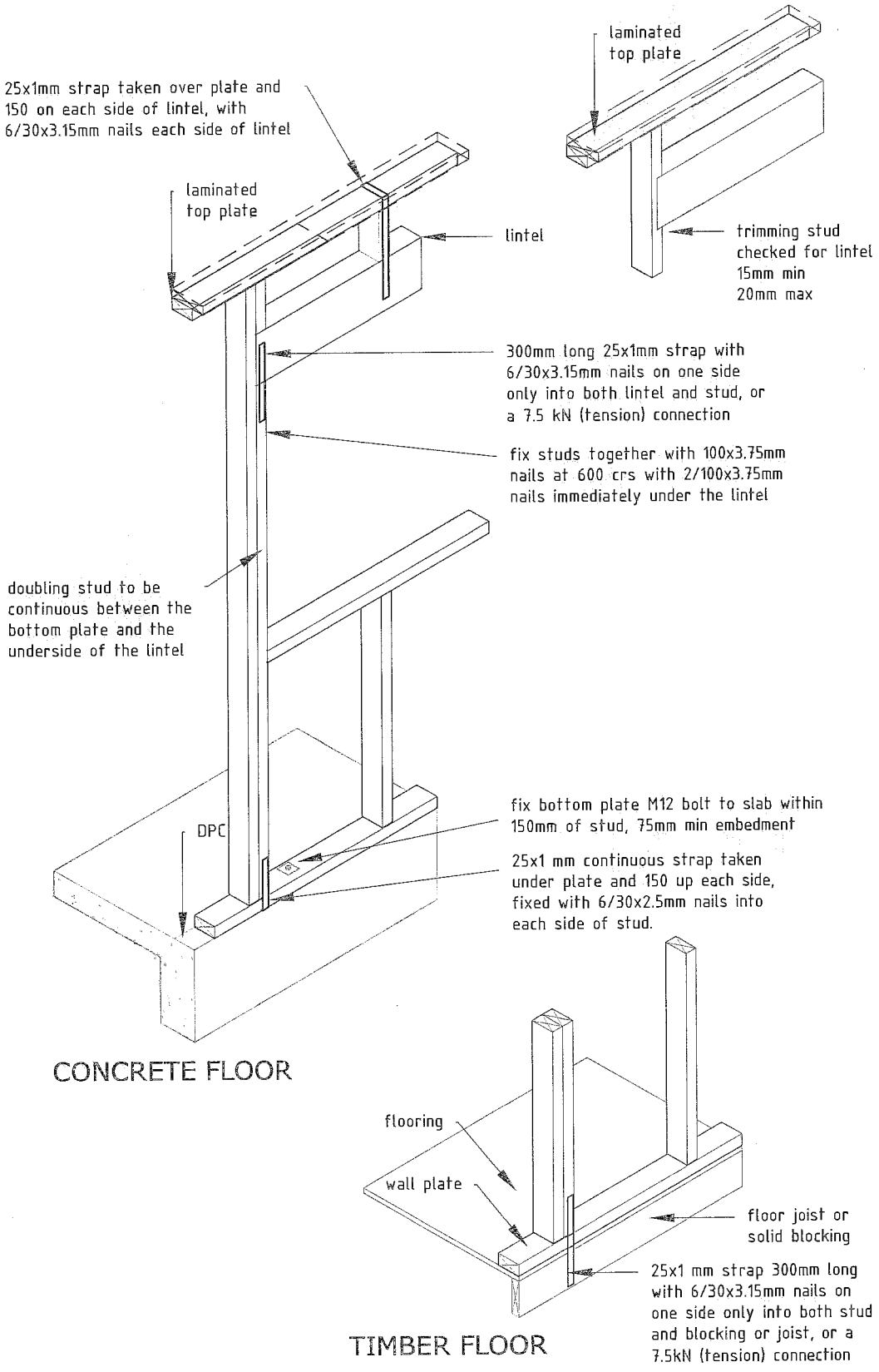
(a) for *lintels* not exceeding 140 mm deep: a *trimming stud* checked not less than 15 mm, nor more than 20 mm

(b) for *lintels* not exceeding 240 mm deep: a 35 mm thick doubling *stud*

(c) for *lintels* not exceeding 290 mm deep: a 45 mm thick doubling *stud*.

4.5.1.4 Timber *lintels* supporting *rafters* or trusses of *roofs* shall be secured against uplift at each end in accordance with Figure 4.10 or with a *proprietary fastener* of 7.5 kN *capacity* in tension along the line of the *trimming stud*.

Figure 4.10 **Fixing of lintels to prevent uplift**
Paragraphs 4.5.1.3, 4.5.1.4 and Table 4.5



4.5.1.5 Steel lintels (garage door only)

Steel *lintels* shall be connected directly to the underside of the *top plate* and shall be in walls with a maximum 2.4 m height of *studs*. Steel lintels are not permitted in *gable* or mono-pitch walls.

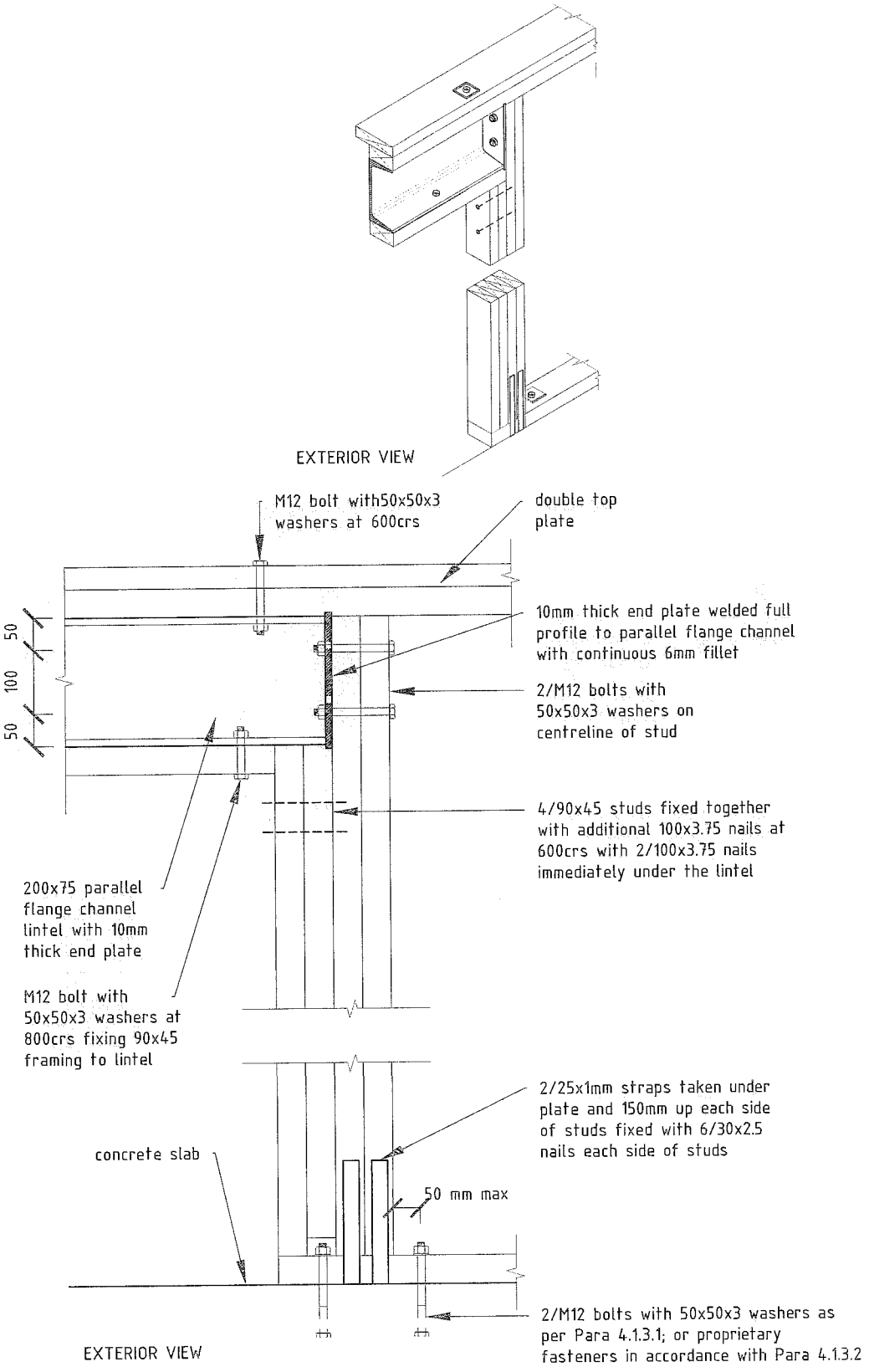
4.5.1.6 Steel *lintels* shall be hot rolled 200 x 75 mm Parallel Flange Channel sections with a maximum clear opening of up to 4.8 m and a maximum *loaded dimension* of 4.0 m.

4.5.1.7 Steel *lintels* shall be secured against uplift at each end in accordance with Figure 4.11 or with a *proprietary fastener* of 12 kN *capacity* in tension along the line of the *trimming studs*. The *top plate* shall be secured to the top of the garage door lintel with M12 bolts at 600 mm centres maximum.

4.5.1.8 Steel *lintels* shall be supported at each end by 4/90 x 45 mm *studs* in accordance with Figure 4.11.

4.5.1.9 For steel *lintel cladding* details, refer to Paragraph 6.7.

Figure 4.11 **Steel lintels, trimming studs and prevent of uplift**
Paragraphs 4.5.1.5 to 4.5.1.8



4.5.2 Sill and head trimmers

4.5.2.1 Sill and head *trimmers* to openings in *non-loadbearing walls* shall be of the same width as the *studs* and of the depth given by Table 4.5.

Table 4.5 **Sill and head trimmers**
Paragraph 4.5.2.1

Maximum clear width of opening (m)	Minimum depth of sill and head *trimmers* (mm)
2.4	45
3.0	90
3.7	140

4.6 Wall bracing

4.6.1 Wall bracing demand

Wall *bracing* shall be designed and constructed in accordance with this paragraph to resist the *bracing demand* for the greater of wind or earthquake (not acting together) determined from Paragraphs 4.6.1.1 and 4.6.1.2.

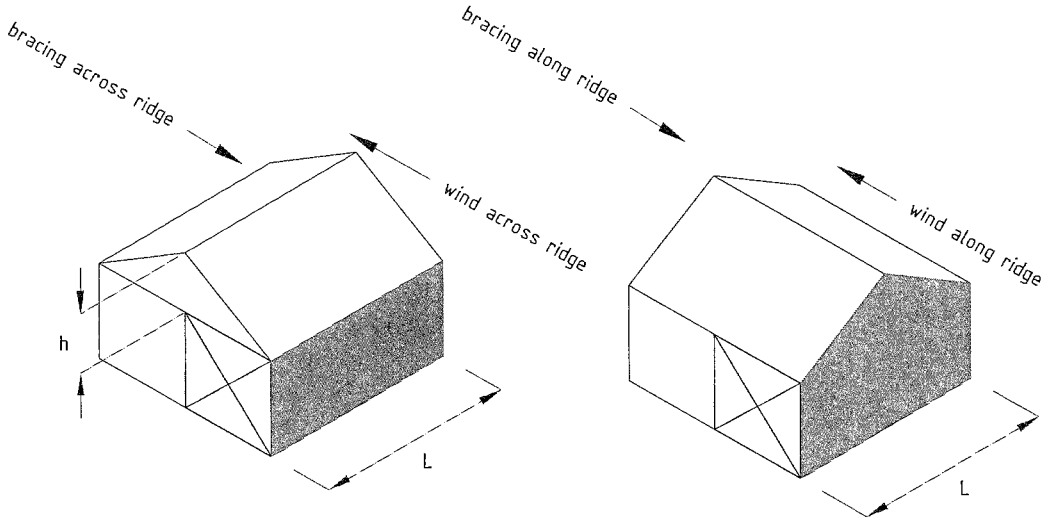
4.6.1.1 Wind bracing demand

The overall wind *bracing demand* on the *simple house* in both directions shall be determined by multiplying the value obtained from Table 4.6 by the *simple house* (or *roof*) length, where length is measured perpendicular to the direction of the wind (see Figure 4.12). The *simple house* length shall be used where the *roof* pitch is 25° or less, and the *roof* length where the *roof* pitch is greater than 25°.

Table 4.6 **Bracing demand for wind (BUs/m)**
Paragraph 4.6.1.1

Height of ridge above *eaves* (h) in metres	Across ridge	Along ridge
1	44	63
2	69	81
3	100	100

Figure 4.12 **Direction of wind and braced walls**
Paragraphs 3.3.12.1 and 4.6.1.1



4.6.1.2 Earthquake bracing demand

The overall earthquake *bracing demand* on the *simple house*, in both the length and width directions of the *simple house*, shall be determined by multiplying the values in Table 4.7 by the *gross floor area* in square metres.

Table 4.7 **Bracing demand for walls (BUs/m²)**
Paragraph 4.6.1.2

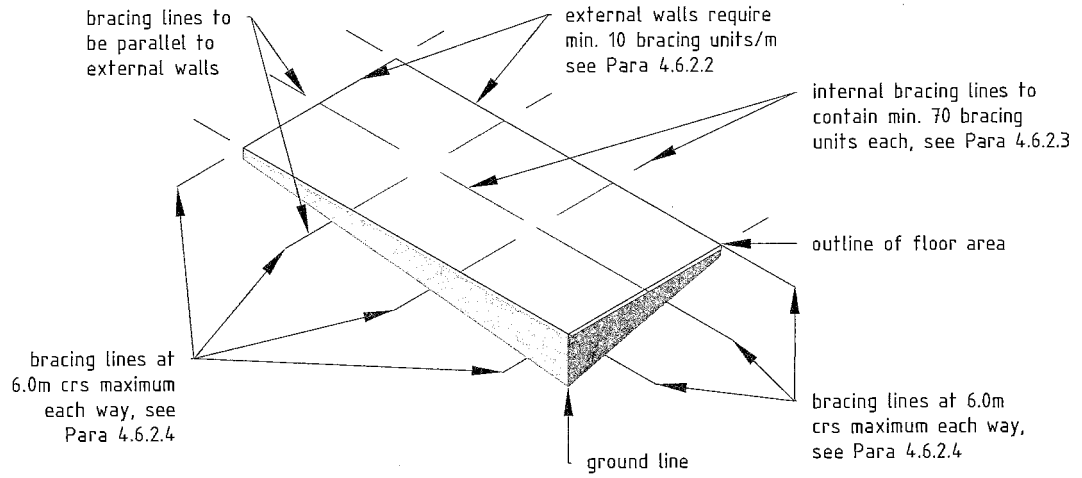
Cladding	*Roof*	*Roof* pitch degrees	BUs/m² of floor area (walls over subfloor *framing*)	BUs/m² of floor area (walls over concrete slab-on-ground)
Weatherboard, flat sheet	Profiled metal or metal tile	10–25	6.7	3.6
		26–35	7.1	4.0
Masonry veneer	Profiled metal or metal tile	10–25	11.6	5.2
		26–35	12.1	5.6
Weatherboard, flat sheet	Masonry tile	10–25	9.8	6.3
		26–35	11.0	7.5
Masonry veneer	Masonry tile	10–25	14.9	7.9
		26–35	16.3	9.1

4.6.2 Wall bracing requirements

4.6.2.1 Distribution

Wall *bracing elements* shall be located in external and internal braced walls on *bracing lines*, as close as possible to the corners of *external walls* and evenly along each internal *bracing line* as in Figure 4.13.

Figure 4.13 **Distribution of bracing lines**
Paragraph 4.6.2.1.



4.6.2.2 Minimum bracing capacity of external walls

Each *external wall* shall have a total *bracing capacity* of at least 10 *bracing units* per metre of length contributed by:

(a) wall *bracing elements* in *external walls,* and/or

(b) pairs of parallel *external wall bracing elements*, offset not more than 2 m from each other can be treated as being one *external wall*.

4.6.2.3 Minimum bracing capacity of internal walls

Each internal *bracing line* shall be parallel to *external walls* and have a total *bracing capacity* of not less than 70 *bracing units* contributed by either:

(a) *wall bracing elements* in *internal walls* on the *bracing line*, and/or

(b) pairs of *wall bracing elements* one on each side of the *bracing line*, in *internal walls*, not more than 2 m away and parallel to the *bracing line*.

4.6.2.4 Maximum spacing of internal walls

Bracing lines shall be at not more than 6 m centres in each direction between *external walls*.

4.6.2.5 Adjustment of bracing capacity for different wall heights

Adjustment of *bracing capacity* of walls of different heights and walls with sloping *top plates* shall be obtained by the following method.

(a) For *wall bracing elements* of heights other than 2.4 m, the *bracing rating* from Table 4.8 and Table 4.9 shall be multiplied by a factor equal to 2.4 divided by the element height in metres, except that elements less than 1.8 m high shall be rated as if they were 1.8 m high.

(b) Walls of varying heights shall have their *bracing capacity* adjusted in accordance with Paragraph 4.6.2.5 (a) using the average height.

4.6.2.6 Braced walls at angles

Where braced walls are at angles to the *bracing lines*, the braced walls shall contribute to the *bracing* as follows:

(a) 30º to one direction and 60º in the other direction, 0.87 and 0.5 times the value of the wall *bracing capacity* respectively

(b) 45º to both directions, 0.7 times the value of the wall *bracing capacity*

(c) values for other angles shall be obtained by multiplying the *bracing capacity* of the element by the cosine of the angle between the *bracing element* and the *bracing line* being considered.

4.6.3 Wall bracing systems

Use any of the following three wall bracing systems: proprietary BRANZ P21 Tested under Paragraph 4.6.3.1, plasterboard under Paragraph 4.6.3.2, or plywood systems under Paragraph 4.6.3.3.

4.6.3.1 Proprietary wall bracing element capacity

The *bracing capacity* of *wall bracing elements* to provide wall resistance to horizontal loads shall be the *bracing capacity* of a proprietary system determined by the BRANZ P21 Test procedure and the BRANZ supplement to P21 rating procedure.

Where proprietary *wall bracing elements* are used, the uplift *capacity* of the hold-down fixings shall be the greater of that required by the P21 test on the *wall bracing element* or a proprietary fastening of 8 kN *capacity* fixed in accordance with Paragraph 4.1.3 for *external walls* or Paragraph 4.1.4 for *internal walls*.

4.6.3.2 Plasterboard (non P21 Test option)

2.4 m high plasterboard *bracing elements* shall have the *bracing capacities* assigned in Table 4.8 and be fixed in accordance with the details in Figure 4.14. Plasterboard shall:

(a) be manufactured in accordance with AS/NZS 2588

(b) have a minimum width of 0.9 m

(c) have a minimum manufactured sheet length 2.4 m

(d) have a minimum density of 450 kg/m^3

(e) have a minimum thickness of 9 mm

(f) be installed vertically to the full height of the *bracing element* or horizontally with maximum of one joint in the *bracing element*

(g) be fixed to *framing* with 30 x 2.5 mm flat head nails, or 32 mm x 7 g zinc-plated screws or, where plasterboard is thicker than 10 mm, the nailing option shall be with nail lengths three times the plasterboard thickness

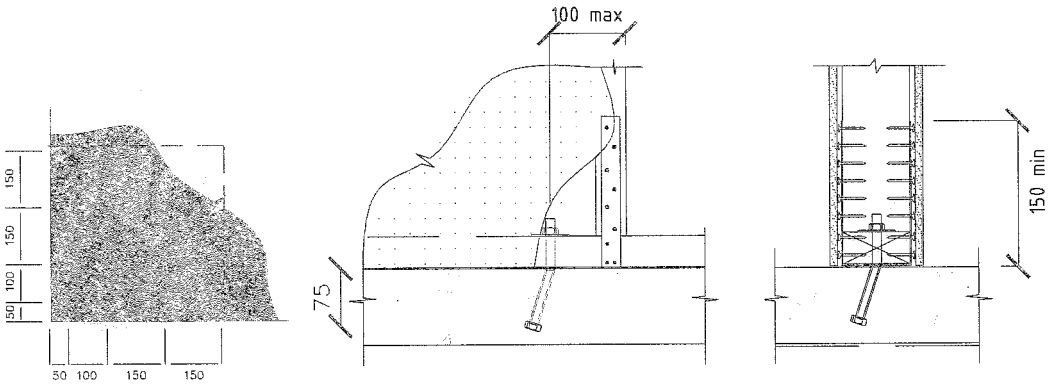
(h) have fixings no closer than 12 mm to bound paper edge and 18 mm to the cut edge

(i) have sheet corner fixings as per Figure 4.14.

Table 4.8 **Bracing values for plasterboard bracing systems**
Paragraph 4.6.2.5 and 4.6.3.2

Length (m)	Plasterboard sheet one side – BUs/m		Plasterboard sheet both sides – BUs/m	
	Wind	Earthquake	Wind	Earthquake
1.2	30	25	45	40
1.8	45	40	65	55
2.4	55	50	75	65

Figure 4.14 **Plasterboard bracing systems**
Paragraph 4.6.3.2

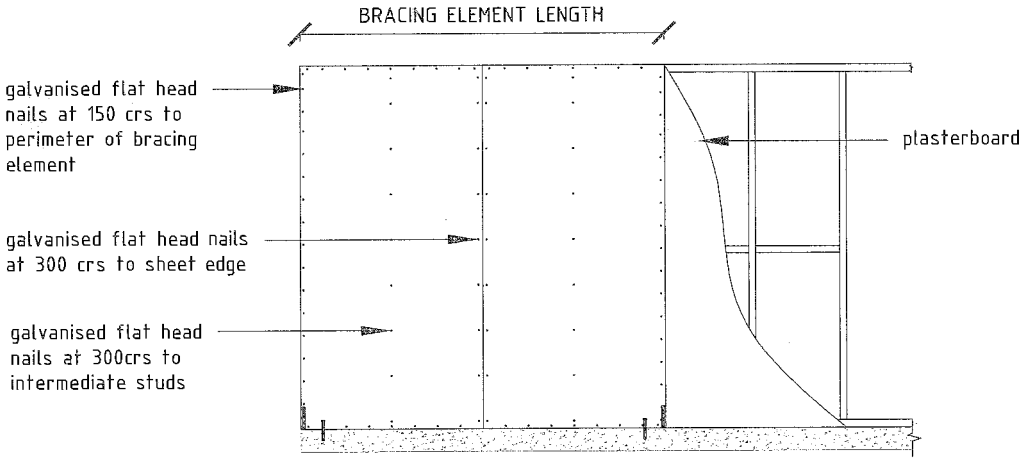


CORNER FIXING PATTERN FOR PLASTERBOARD BRACING ELEMENTS: nail length to be minimum 3x thickness of plaster board sheets.

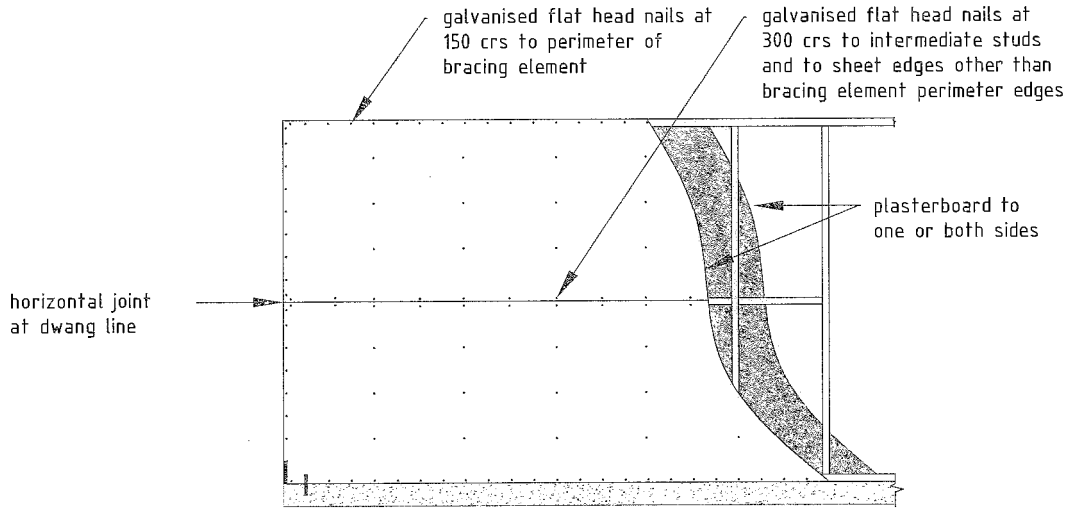
M12 bolts with 50x50x3mm washer, cranked and embedded 75mm into concrete, or use proprietary fixing.

400x25x1mm galvanised flat steel strap wrapped under plate and up 150 each side, 6/30x3.15mm galv. flat head nails into each side of stud, 3/30x3.15mm galv flat head nails into each side of bottom plate.

HOLD DOWN STRAP DETAIL FOR PLASTERBOARD BRACING ELEMENTS



NAIL SETOUT FOR VERTICAL SHEET FIXING



NAIL SETOUT FOR HORIZONTAL SHEET FIXING

NOTE 1: To timber floor use 150mm long M12 galvanised coach screw with 50x50x3mm washer into floor joist.
NOTE 2: For proprietary fixings in concrete slabs refer to Paragraphs 4.1.3 and 4.1.4
NOTE 3: Fixings no closer than 12mm to bound paper edge and 18mm to cut edge.

4.6.3.3 Plywood bracing system (non P21 Test option)

2.4 m high plywood *bracing elements* shall not be used as *cladding* (see Paragraph 6.5.2.1) and shall have the *bracing capacities* assigned in Table 4.9 and be fixed in accordance with the details in Figure 4.15. Plywood shall:

(a) be to the grade, species and preservative treatment in accordance with Table 2.7

(b) have a minimum manufactured width of 0.9 m

(c) have a minimum manufactured sheet length of 2.4 m

(d) be installed vertically

(e) be three ply with a minimum thickness of 7 mm and a maximum of 12 mm

(f) be fixed to *framing* with fixings no closer than 10 mm to sheet edge

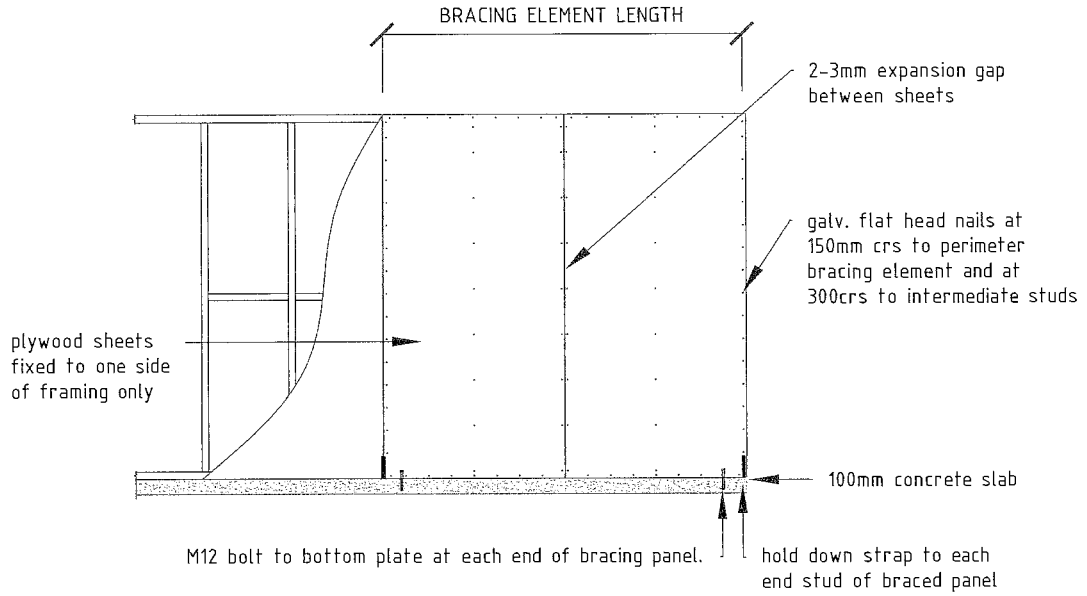
(g) be fixed at corners in accordance with Figure 4.15

(h) be fixed to *framing* members with 30 x 2.8 mm flat head nails. Where plywood is 9 mm, use 40 x 2.5 mm flat head nails and, where 12 mm thick, use 50 x 2.5 mm flat head nails.

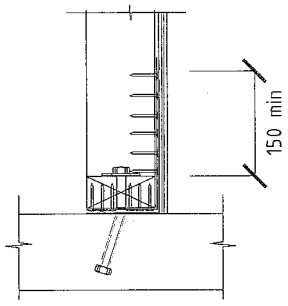
Table 4.9 **Bracing values for plywood bracing systems**
Paragraph 4.6.2.5 and 4.6.3.3

Length (m)	Plywood fixed one side – BUs/m	
	Wind	Earthquake
0.9	70	65
1.8	85	80

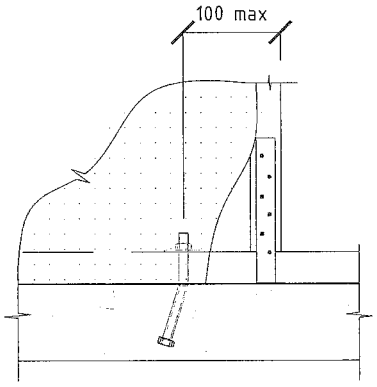
Figure 4.15 **Plywood bracing systems**
Paragraph 4.6.3.3



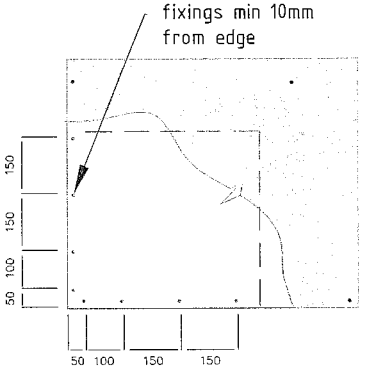
FIXING OF PLYWOOD BRACING SHEETS: Details apply to plywood, fixed one side, vertical fixing only.
NOTE: Strap fixings required at each end stud of brace panels.



a) Strap 300x25x1mm one side and under plate - 6/30x3.15mm galv. flat head nails into stud and into bottom plate.



b) M12 bolts with 50x50x3mm washer, cranked and embedded 75mm into concrete, or use proprietary fastenings.



CORNER FIXING PATTERN FOR PLYWOOD BRACING ELEMENTS

NOTE 1: For proprietary fastenings in concrete slabs refer to Paragraphs 4.1.3 and 4.1.4

NOTE 2: For timber floors use similar fixing detail, fix plate using 150mm long M12 galvanised coach screw with 50x50x3mm washer into floor joist, refer to Fig 4.14.

4.7 Linings

4.7.1 Barriers to airflow

This *Acceptable Solution* requires that *habitable spaces* have barriers to airflow in the form of interior *linings* with all joints stopped. Refer also to Paragraphs 6.1.1 and 6.1.2.

4.8 Nailing schedule

Table 4.10 lists the size, number and location of nails to be used in wall *framing*. The depth of penetration into the point side timber shall be at least 45% of the length of the nail.

4.9 Construction moisture in timber

4.9.1 Maximum acceptable moisture contents in timber

The maximum moisture contents shall be:

(a) for timber *framing*, 20% at the time of installing interior *linings*

(b) for timber weatherboards and exterior joinery, 20% at the time of painting

(c) for reconstituted wood products, 18% at all times.

Table 4.10 **Size, number and location of nails for fixing timber**
Paragraph 4.8

Joint	Hand driven nails	Power driven nails		
	Length (mm) x diameter (mm) and type	Number and location	Length (mm) x diameter (mm) and type	Number and location
Dwang to *stud*	75 x 3.5 or 100 x 3.75	2 (skewed) 2 (end nailed)	75 x 3.06 or 90 x 3.15	2 (skewed) 2 (end nailed)
Lintel to *trimming stud*	75 x 3.15 or 100 x 3.75	4 (skewed) or 2 (end nailed)	90 x 3.15	3 (end nailed)
Sill or head *trimmer* to *trimming stud* (max 2.4 m long)	100 x 3.75	2 (end nailed)	90 x 3.15	3 (end nailed)
Sill or head *trimmer* to *trimming stud* (max 3.6 m long)	100 x 3.75	3 (end nailed)	90 x 3.15	5 (end nailed)
Stud to *plate*	100 x 3.75 or 75 x 3.15	2 (end nailed) 4 (skewed)	75 x 3.06 90 x 3.15	4 (skew nailed) 3 (end nailed)
Top plate 140 x 35 mm to 90 x 45 mm and *top plate* to *lintel*	100 x 3.75	2 at 500 mm centres	90 x 3.15 90 x 3.15	3 at 500 mm centres
Trimming studs at openings, *blocking* and *studs* at wall intersections	100 x 3.75	600 mm centres	90 x 3.15 90 x 3.15	600 mm centres
Trimming stud to doubled *stud* immediately under *lintel*	100 x 3.75	2	90 x 3.15	2

Note:

Nail lengths and *diameters* are the minimum required.

Refer to Paragraph 2.5.4 for required protective coatings for metal fasteners.

5.0 Roof framing

5.1 General

CONTENTS

5.1.1 Scope

5.1.1.1 *Roofs* shall be either *framed* on site or constructed from prefabricated trusses.

5.1.1.2 The grade, species and preservative treatment for *roof framing* shall be in accordance with Table 2.7.

5.1.1.3 *Framed roofs* shall be *skillion roofs* in accordance with Figure 5.1.1.

Skillion roofs shall not incorporate valleys or hips.

5.1.2 Eaves

5.1.2.1 A *rafter* or truss may extend as a cantilever beyond its supporting *top plate* for a distance not exceeding one quarter of its maximum permitted *span*, or 750 mm measured horizontally from the face of the support, whichever is the lesser. Where 90 x 45 mm *rafters* are supported by *eaves bearers* (boxed), they may extend to 750 mm.

5.1.2.2 Within boxed *eaves*, the *eaves bearers* shall be attached to the ends of *rafters* or trusses and to *studs* or *ribbon boards* at not more than 1200 mm centres.

5.1.2.3 *Eaves bearers* shall be:

(a) 45 x 35 mm timber not exceeding 600 mm long

(b) 70 x 35 mm timber not exceeding 750 mm long.

5.1.3 Gable verges

5.1.3.1 *Gable* verges shall be framed by either:

(a) outriggers complying with Paragraph 5.1.3.3 and in accordance with Figure 5.1.2, or

(b) *purlins* extending as cantilevers beyond their end supports in accordance with Figure 5.1.2 for a distance not exceeding that given by Paragraph 5.1.3.2.

Figure 5.1.1 **Roof types**
Paragraph 5.1.1.3

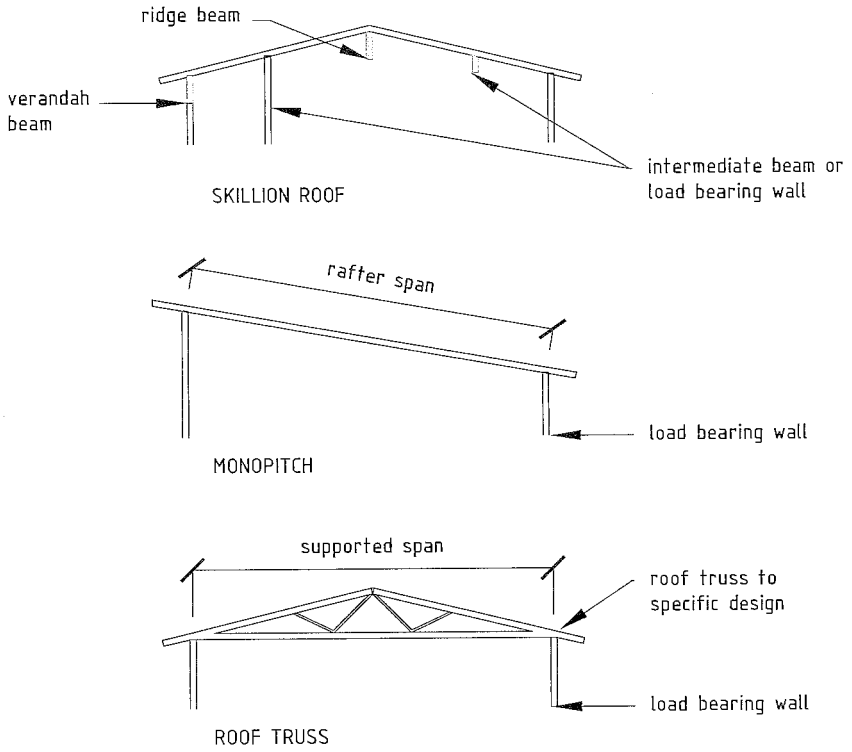
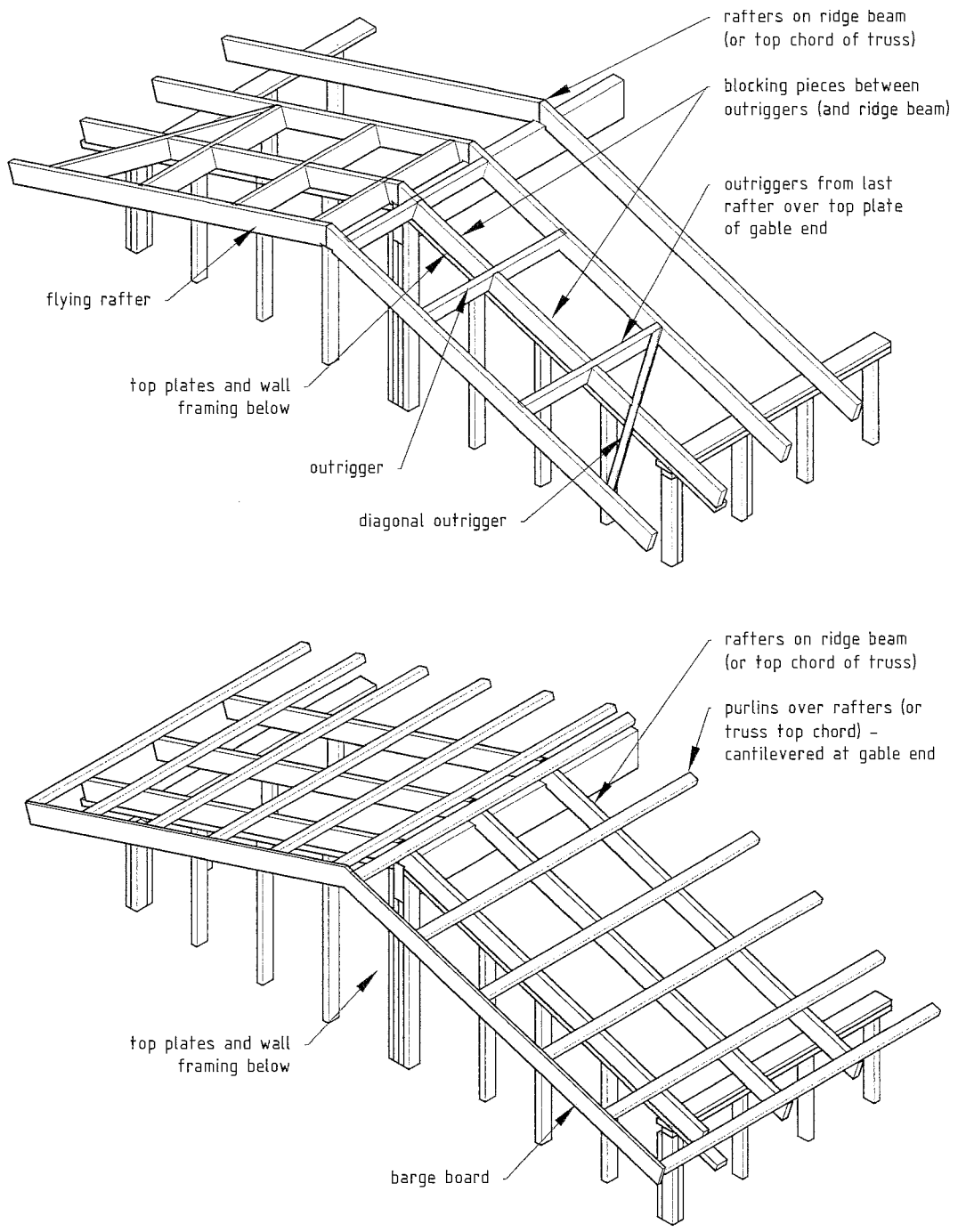


Figure 5.1.2 **Gable verge framing**
Paragraph 5.1.3



5.1.3.2 *Purlins* and *battens* supporting *roof claddings*, with a back span over at least 3 *rafters* or trusses may extend as cantilevers beyond their end supports for a distance not exceeding:

(a) laid on their flat:

(i) light *roofs*

50 x 50 mm *battens*: 300 mm

70 x 45 mm *purlins*: 500 mm

90 x 45 mm *purlins*: 600 mm

(ii) heavy *roofs*

50 x 50 mm *battens* at 400 mm crs: 300 mm

70 x 45 mm *purlins* at 400 mm crs: 400 mm

95 x 45 mm *purlins* at 400 mm crs: 500 mm

(b) laid on their edge:

(i) light *roofs*

70 x 45 mm *purlins*: 600 mm

90 x 45 mm *purlins*: 700 mm

(ii) heavy *roofs*

70 x 45 mm *purlins* at 400 mm crs: 500 mm

95 x 45 mm *purlins* at 400 mm crs: 600 mm.

5.1.3.3 Outriggers shall:

(a) be laid on edge

(b) be a minimum size of 90 x 45 mm

(c) be located at not more than 900 mm centres

(d) extend beyond their supports for a distance not exceeding 600 mm

(e) have a flying *rafter*, minimum size 90 x 45 mm, fixed to their ends

(f) have *blocking* pieces of the same size as the outriggers fitted and fixed between the outriggers along the line of the end support. *Purlins* shall be fixed to the *blocking* piece and to the flying *rafter*

(g) be fixed to wall *framing* with fixings determined from Table 5.1.1, as if the outriggers are *purlins*.

5.1.4 Purlins and tile battens

5.1.4.1 The grade, species and preservative treatment for *purlins* and *tile battens* shall be in accordance with Table 2.7.

5.1.4.2 The size of *purlins* and their fixings shall be taken from Table 5.1.1 and Table 5.1.2 using *spacing* to suit the spanning capability of the *cladding*.

Periphery areas as per Table 5.1.1 are as shown shaded in Figures 5.1.3 and 5.1.4.

5.1.4.3 The size of *tile battens* and their fixings shall be taken from Table 5.1.1 and Table 5.1.2 using *spacing* to suit the spanning capabilities of the tile. Periphery (shaded) areas shall be in accordance with Figures 5.1.3 and 5.1.4.

Table 5.1.1 **Purlin and tile batten size, span, spacing and fixing capacity and type**
Paragraphs 5.1.3.3, 5.1.4.2, 5.1.4.3, 5.1.4.5, 5.1.9.1 and Table 5.1.3

	Size (mm x mm)	Max span (mm)	Max *Spacing* (mm)	Fixing – main *roof*		Fixing – periphery (refer to Paragraph 5.1.4.3)	
				Capacity (kN)	Type Table 5.1.2	*Capacity* (kN)	Type (refer to Table 5.1.2)
Purlin							
	70 x 45	900	900	1.3	C	2.0	C
	70 x 45	900	1200	1.8	C	2.6	C
	70 x 45	900	1400	2.0	C	3.1	D
	70 x 45	1200	800	1.6	C	2.3	C
	90 x 45	1200	1000	2.0	C	2.9	D
Battens for metal tiles							
	50 x 40	900	400	0.7	B	1.0	C
	50 x 50	1200	400	0.9	C	1.3	C
Battens for masonry tiles							
	50 x 25	480	400	0.4	A	0.4	A
	50 x 40	600	400	0.4	A	0.4	A
	50 x 50	900	400	0.4	A	0.4	A

Table 5.1.2 **Fixings for purlins or battens**
Paragraphs 5.1.4.2, 5.1.4.3, 5.1.9.1 and Table 5.1.3

Fixing description	Type
1/100 x 3.75 mm nail or 1/90 x 3.15 mm power driven nail	A
2/100 x 3.75 mm skewed nails or 2/90 x 3.15 mm power driven nails	B
2/100 x 3.75 mm skewed nails + 1 wire dog or 2/100 x 3.75 mm skewed nails + 1/14 g Type 17 screw to AS 4566	C
2/100 x 3.75 mm skewed nails + 2 *wire dogs* or 2/100 x 3.75 mm skewed nails + 2/14 g Type 17 screws to AS 4566	D
If screw fixed, screws shall be sufficiently long so as to penetrate *rafter* by at least 50 mm.	

Figure 5.1.3 **Periphery roof areas – gable**
Paragraphs 5.1.4.2 and 5.1.4.3

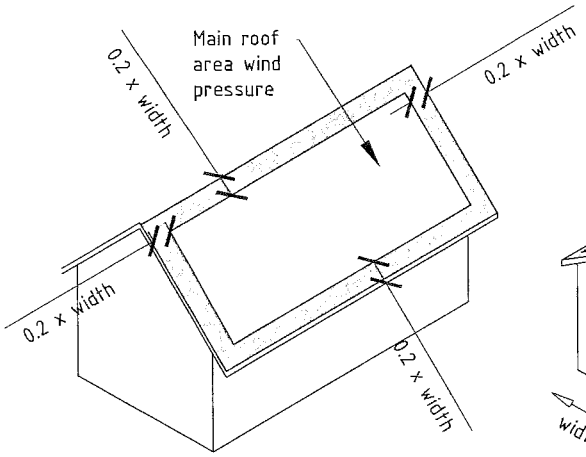
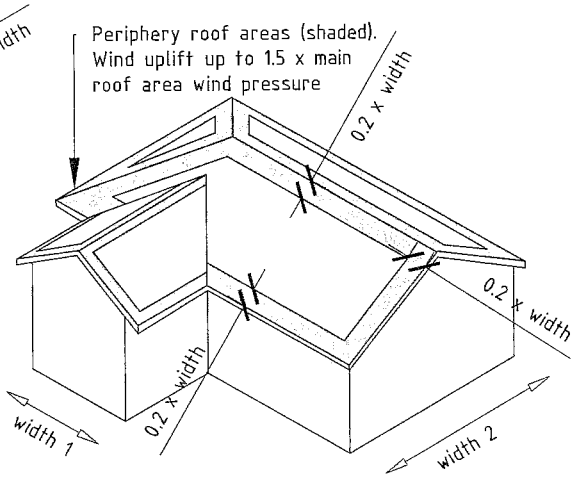


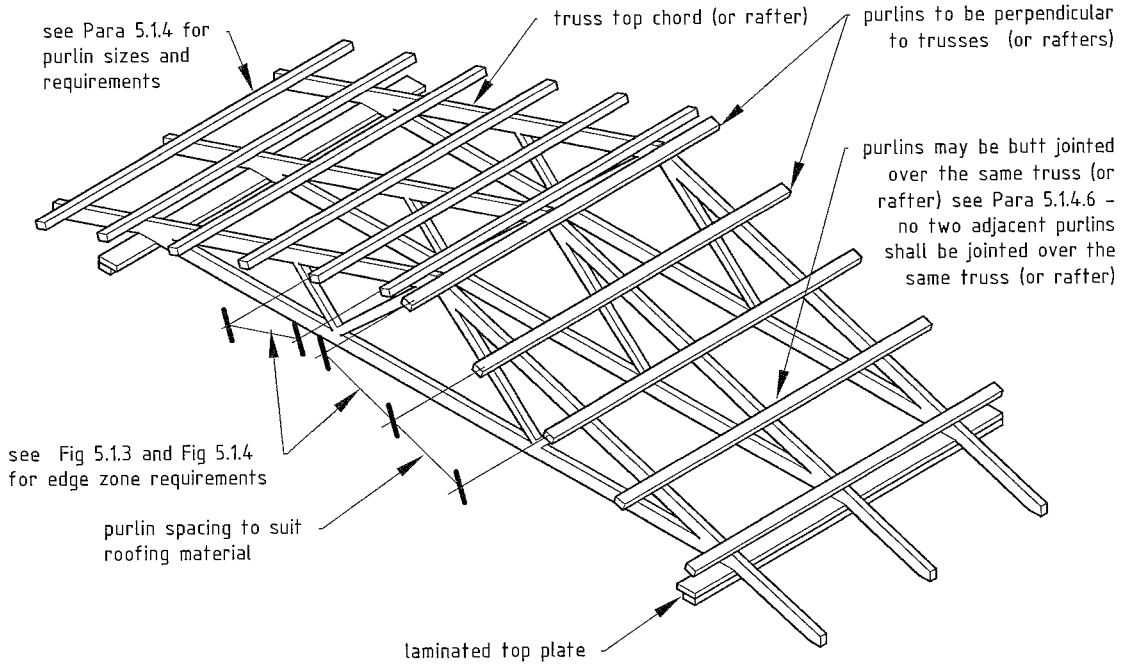
Figure 5.1.4 **Periphery roof areas – hip/valley**
Paragraphs 5.1.4.2 and 5.1.4.3



5.1.4.4 *Purlins* and *tile battens* shall be laid directly over *rafters* and truss top chords, parallel to the associated ridge or *eaves* line in accordance with Figure 5.1.5.

5.1.4.5 All *purlin* sizes given in Table 5.1.1 are on-flat. 70 x 45 mm on-flat may be substituted by 70 x 45 mm on edge, and 90 x 45 mm on-flat may be substituted by 70 x 45 mm on edge.

Figure 5.1.5 **Purlins fixed directly to rafters/top chords**
Paragraph 5.1.4.4



5.1.4.6 *Purlins* and *tile battens* shall be continuous over at least two *spans*, and may be butt jointed over supports provided that no two adjacent *purlins* or *tile battens* are jointed over the same truss or *rafter*.

5.1.5 Bracing

5.1.5.1 Light roofs

Each ridge line and its associated trusses or *rafters* shall be braced by not less than:

(a) three hip or valley trusses running clear from the ridge line to the *top plate* of a *loadbearing wall*, or

(b) one *roof* plane *diagonal brace* complying with Paragraph 5.1.6.1 in each plane of the *roof* for each 50 m², or part there of of plan area of that plane.

5.1.5.2 Heavy hip roofs

Each ridge line and its associated trusses shall be braced by:

(a) not less than three hip or valley trusses running clear through from the ridge line to the *top plate* of a *loadbearing wall*, and

(b) one *roof* plane *diagonal brace* complying with Paragraph 5.1.6.1 in each side plane of the *roof* for each 35 m² or part thereof of plan area of that plane.

5.1.5.3 Heavy gable roof

Each ridge line and its associated *rafters* or trusses shall be braced by:

(a) one *roof* plane *diagonal brace* complying with Paragraph 5.1.6.1 in each plane of the *roof* for each 25 m² or part thereof of plan area of each *roof* plane, and for trussed *roofs*

(b) one *roof* space *diagonal brace*, complying with Paragraph 5.1.7.1, for each 12 m² or part thereof of the plan area of each *roof* plane.

5.1.5.4 L-shaped roofs

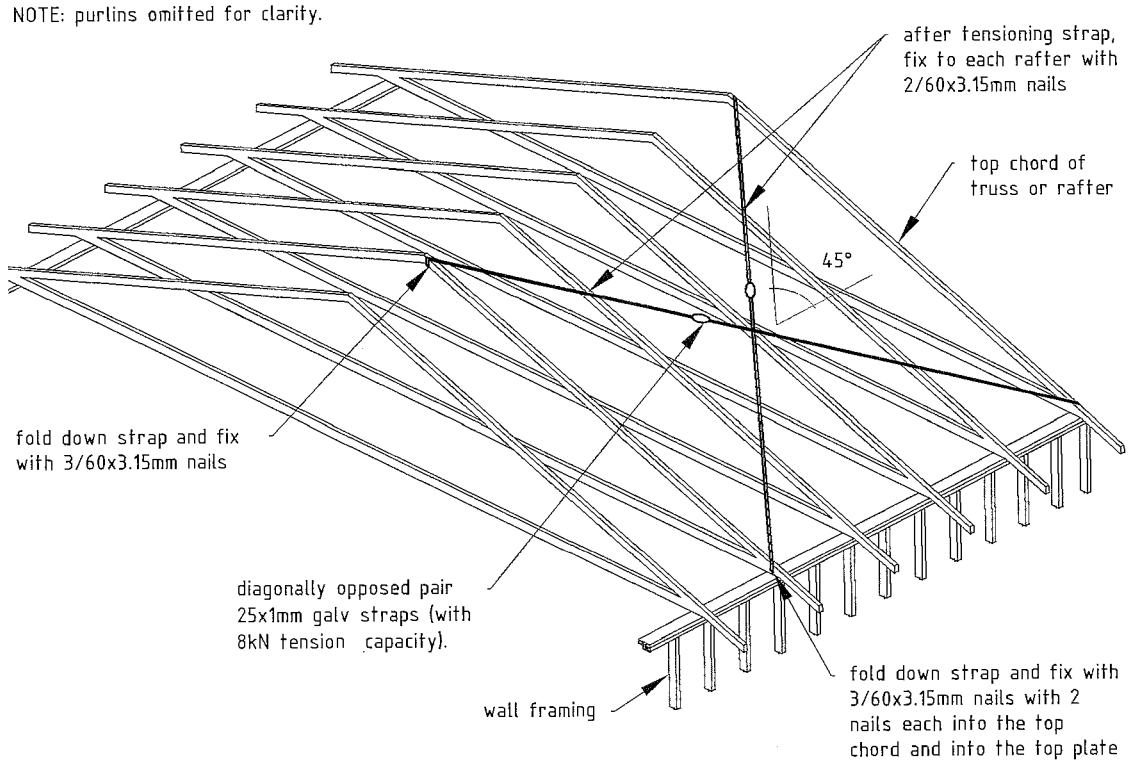
For L-shaped *roofs* with ridge lines at right angles to each other, the valley or hip formed between two *roof* planes may be counted as forming a *roof* plane *diagonal brace* for each *roof* plane. Refer to Paragraphs 5.1.5.1(b), 5.1.5.2(b) or 5.1.5.3(b) above.

5.1.6 Roof plane diagonal brace

5.1.6.1 Each *roof* plane *diagonal brace* shall be a diagonally opposing pair of continuous steel strips each having a *capacity* of 8.0 kN in tension, fixed from ridge to *top plate* at 45º to ridge and fixed to each top chord or *rafter* that is intersected, with nailing to Table 5.1.3.

5.1.6.2 When only one *roof* plane *diagonal brace* is required in accordance with Paragraph 5.1.5.1(b), this shall intersect one end of the ridge line. Where more than one *roof* plane *diagonal brace* is required, a brace shall intersect each end of the ridge line and any remaining braces shall be evenly distributed along the ridge.

Figure 5.1.6 **Roof plane diagonal brace**
Paragraph 5.1.6



5.1.7 Roof space diagonal brace

5.1.7.1 *Roof* space *diagonal braces* (refer to Figure 5.1.7) shall:

(a) be not less than 2 m from a parallel *external wall*, provided that at least half of all such braces shall be not more than 2 m from the ridge line

(b) be evenly distributed over the length of the *roof* and run alternately in opposite directions

(c) run not steeper than 45° to the horizontal from top chord level to bottom chord level

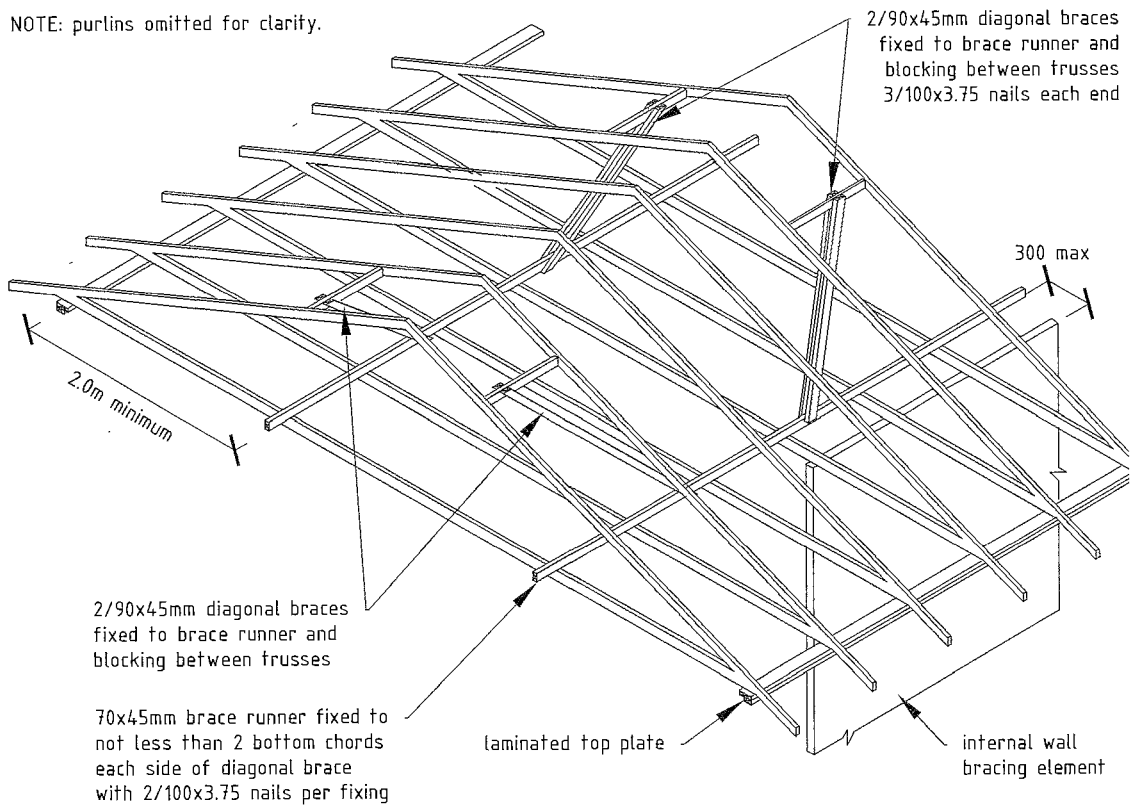
(d) in plan view be parallel to or at not more than 25° to the ridge line

(e) consist of:

(i) 90 x 45 mm up to 1.85 m long, or

(ii) 2/90 x 45 mm for spans up to 4.8 m. Where two members are required they shall be spaced 45 mm apart and nailed together through the spacing pieces at centres not exceeding 1 m.

Figure 5.1.7 **Roof space diagonal brace**
Paragraph 5.1.7



5.1.7.2 The top end of each *roof* space *diagonal brace* shall be fixed to a 90 x 45 mm *blocking* piece fixed between adjacent top chords with 3/100 x 3.75 mm nails to each side. *Blocking* to be fixed to the top chords with 2/100 x 3.75 mm nails to each end.

5.1.7.3 The bottom end of each *roof* space *diagonal brace* shall be fixed to a 70 x 45 mm brace runner with 3/100 x 3.75 mm nails to each side. The runner shall be fixed to not less than two bottom chords on each side of the *diagonal brace* with 2/100 x 3.75 mm nails to each bottom chord, and be within 300 mm centre-to-centre of a wall containing a *wall bracing element*.

5.1.8 Bottom chord fixings

The bottom chord of a truss that crosses an *internal wall* containing one or more *wall bracing element* shall be connected to the *top plate* of the wall, either directly, or by a *ceiling batten* running parallel to the *plate* and fixed to both the *plate* and the bottom chord. For fixing, refer to Table 5.1.3.

5.1.9 Nailing schedule for roofs

5.1.9.1 Table 5.1.3 lists the size, number and location of nails to be used in *roof framing*. Refer also to Tables 5.1.1 and 5.1.2 for further specific fixing details and requirements. The depth of penetration into the point side timber shall be at least 45% of the length of the nail.

Table 5.1.3 **Nailing schedule for hand driven and power driven nails**
Paragraphs 5.1.6.1, 5.1.8 and 5.1.9

Joint	Hand driven nails		Power driven nails	
	Length (mm) x *diameter* (mm) and type	Number and location	Length (mm) x *diameter* (mm) and type	Number and location
Truss or *rafter* to *top plate* of *internal wall*	100 x 3.75	2	90 x 3.15	2
Ceiling batten to parallel top plate of internal *wall bracing element*	75 x 3.15	2 at 400 mm centres	90 x 3.15	2 at 400 mm centres
Steel strip brace: (i) at ends (ii) other cases	 60 x 3.15 60 x 3.15	 3 2		
Blocking between *rafters* or truss chords	100 x 3.75	2 (end nailed)	90 x 3.15	2 (end nailed)
Outrigger to *rafter*	100 x 3.75 or 75 x 3.15	2 (end nailed) 4 skewed	90 x 3.15	3 (end nailed)
Flying *rafter* to outrigger	100 x 3.75	2	90 x 3.15	3
Outrigger *blocking* to *top plate*	100 x 3.75	4 skewed	90 x 3.15	4 skewed
Outrigger to *gable top plate*	As for *purlin* (see Tables 5.1.1 and 5.1.2)	As for *purlin* (see Tables 5.1.1 and 5.1.2)	As for *purlin* (see Tables 5.1.1 and 5.1.2)	As for *purlin* (see Tables 5.1.1 and 5.1.2)

5.2 Trusses

CONTENTS

5.2.1 Design and fabrication

Trusses shall be to *specific design* and the design shall meet the limiting criteria set out in this section.

The grade, species and preservative treatment for *roof trusses* shall be in accordance with Table 2.7.

5.2.2 Maximum dimensions and spacings

Roof trusses shall meet the following criteria:

(a) the *support span* of a *roof* truss shall not exceed 12 m, and

(b) the *eaves* overhang shall not exceed 750 mm measured horizontally from the face of the support, and

(c) truss *spacings* for profiled metal or metal tile *roofs* shall not exceed 1.2 m, and

(d) truss *spacings* for masonry tile *roofs* shall not exceed 900 mm.

5.2.3 Truss/top plate connections

The fixing of a truss at its support shall be as given by the truss design, but not less than that required in Table 5.2.1 and Figure 5.2.1. *Loaded dimension* shall be as shown in Figure 5.2.2.

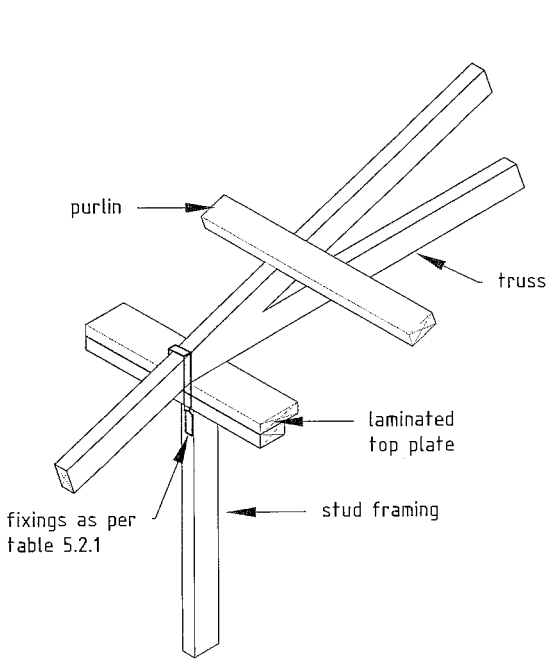
5.2.4 Truss connection to internal walls

When trusses are connected to the *top plates* of *non-loadbearing internal walls* as required by Paragraph 5.1.8, install all ceiling *framing* and *roof cladding* before connecting trusses. Do not support bottom chords at points other than those designated by the truss manufacturer.

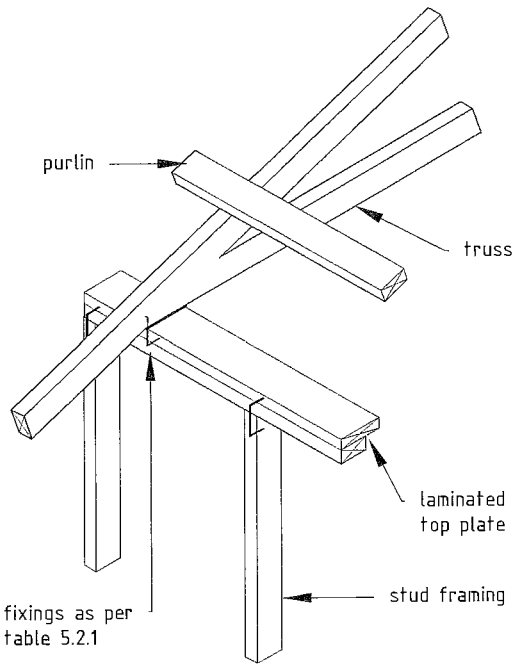
Table 5.2.1 **Fixing of roof trusses at supports**
Paragraph 5.2.3

Loaded dimension of support (m)				
	For light *roofs*	*Proprietary fastener capacity*	For heavy *roofs*	*Proprietary fastener capacity*
3.0	2/100 x 3.75 mm skewed nails + 3 *wire dogs*	6.7 kN	2/100 x 3.75 mm skewed nails + 2 *wire dogs*	4.7 kN
3.5	2/100 x 3.75 mm skewed nails + 4 *wire dogs*	8.7 kN	2/100 x 3.75 mm skewed nails + 2 *wire dogs*	4.7 kN
4.0	2/100 x 3.75 mm skewed nails + 4 *wire dogs*	8.7 kN	2/100 x 3.75 mm skewed nails + 2 *wire dogs*	4.7 kN
4.5	2/100 x 3.75 mm skewed nails + u strap of 25 x 1.2 mm with 10/ 30 x 3.15 mm nails at each end	16.0 kN	2/100 x 3.75 mm skewed nails + 3 *wire dogs*	6.7 kN
5.0	2/100 x 3.75 mm skewed nails + u strap of 25 x 1.2 mm with 10/ 30 x 3.15 mm nails at each end	16.0 kN	2/100 x 3.75 mm skewed nails + 3 *wire dogs*	6.7 kN
5.5	2/100 x 3.75 mm skewed nails + u strap of 25 x 1.2 mm with 10/ 30 x 3.15 mm nails at each end	16.0 kN	2/100 x 3.75 mm skewed nails + 3 *wire dogs*	6.7 kN
6.0	2/100 x 3.75 mm skewed nails + u strap of 25 x 1.2 mm with 10/ 30 x 3.15 mm nails at each end	16.0 kN	2/100 x 3.75 mm skewed nails + 3 *wire dogs*	6.7 kN

Figure 5.2.1 **Truss/top plate connection**
Paragraph 5.2.3

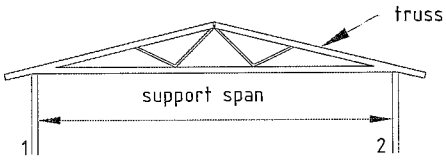


Truss landing over stud



Truss landing between studs

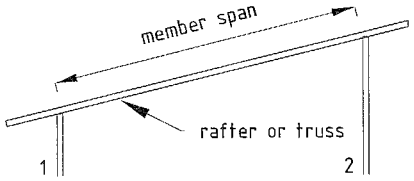
Figure 5.2.2 Loaded dimension
Paragraph 5.2.3



(A) DUO PITCH ROOF

(A) For members 1 and 2:

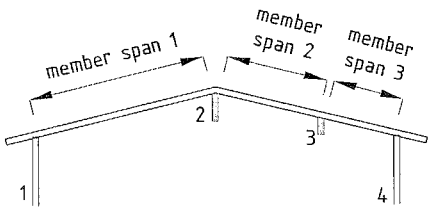
Loaded dimension = $\frac{\text{support span}}{2}$



(B) MONO PITCH ROOF

(B) For members 1 and 2:

Loaded dimension = $\frac{\text{member span}}{2}$



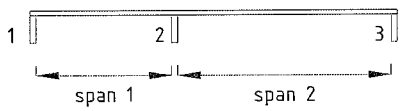
(C) RAFTERS SUPPORTED ON BEAMS OR WALLS

(C) For member 1: Loaded dimension = $\frac{\text{span 1}}{2}$

For member 2: Loaded dimension = $\frac{\text{span 1 + span 2}}{2}$

For member 3: Loaded dimension = $\frac{\text{span 2 + span 3}}{2}$

For member 4: Loaded dimension = $\frac{\text{span 3}}{2}$



(D) For member 1: Loaded dimension = $\frac{\text{span 1}}{2}$

For member 2: Loaded dimension = $\frac{\text{span 1 + span 2}}{2}$

For member 3: Loaded dimension = $\frac{\text{span 2}}{2}$

5.2.5 Ceiling framing

5.2.5.1 Ceiling linings

Ceiling *lining* material shall be less than 17.5 kg/m^2 and shall be supported from *framing* timbers as described in Paragraph 5.2.4.

5.2.5.2 Ceiling structure

The *framing* timbers required for the support of ceiling *linings* under trussed or *skillion roofs* shall be any one, or any combination, of:

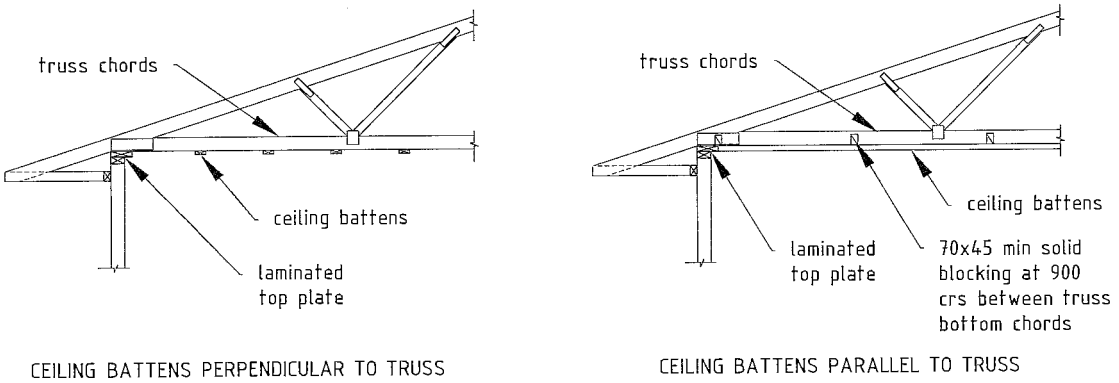
(a) bottom chords of trusses or bottom edge of *rafters*

(b) 70 x 45 mm solid *blocking* on edge, in accordance with Figure 5.2.3, or on flat, at not more than 900 mm centres and *spanning* between bottom chords or *rafters*

(c) *ceiling battens* attached to the underside of bottom chords or *rafters*.

5.2.5.3 *Ceiling battens* shall be 70 x 35 mm at not more than 600 mm centres and spanning up to 1200 mm, or may be proprietary metal *ceiling battens*.

Figure 5.2.3 **Ceiling lining supports**
Paragraphs 5.2.5.2 and 5.2.5.3



5.2.6 Openings in ceilings

5.2.6.1 Access to the ceiling attic spaces shall be provided via a removable hatch of the same thermal rating as the ceiling, with a minimum clear opening of 600 x 500 mm. Unobstructed access of at least 600 mm in height between the top of the bottom chords and other *roof* members shall be provided.

5.2.6.2 Openings in ceilings shall be bounded by *trimmers* and the bottom chord of the truss. *Trimmers* shall be the same width and thickness as the bottom chord and be fitted between adjacent bottom chords.

5.2.7 Fixing of ceiling members

Fixings for ceiling members shall be the minimum shown in Table 5.2.2.

Table 5.2.2 **Nailing to ceiling members**
Paragraph 5.2.7

Joint	Hand driven nails		Power driven nails	
	Length (mm) x *diameter* (mm)	Number and location	Length (mm) x *diameter* (mm)	Number and location
Ceiling batten (70 x 35 mm) to *rafter* or truss	75 x 3.15	2	75 x 3.06	2
Blocking piece to *top plate* and truss or *rafter*	100 x 3.75	4 – 2 each end	90 x 3.15	6 – 3 each end

5.3 Skillion roofs

CONTENTS

5.3.1 General

The grade, species and preservative treatment for *rafters* shall be in accordance with Table 2.7.

5.3.2 Rafters

5.3.2.1 *Rafters* shall span between any two of the following:

(a) *top plate*

(b) *lintel*

(c) *ridge beam*

(d) intermediate beam.

5.3.2.2 *Rafters* shall be sized from Table 5.3.1. The depth of the *rafter* shall be at least the depth of the insulation required to satisfy Paragraph 2.8.1 plus 25 mm clearance.

Table 5.3.1 **Rafter sizes and spans**
Paragraphs 5.3.2.2 and 5.3.2.4

Light *roof*						
Rafter size (width x thickness)	Maximum *span* of *rafters* at a maximum spacing (mm) and their fixing types					
	600		900		1200	
	Span	Fixing type	*Span*	Fixing type	*Span*	Fixing type
(mm x mm)	(m)		(m)		(m)	
70 X 45	1.4	A	1.2	B	–	–
90 X 45	1.8	B	1.6	B	1.4	B
140 X 45	2.9	B	2.5	B	2.3	B
190 X 45	3.5	B	3.0	B	2.7	C
240 X 45	3.8	B	3.3	B	3.0	C
290 X 45	4.1	B	3.5	B	3.2	C
90 X 70	2.1	B	1.8	B	1.7	B
140 X 70	3.3	B	2.9	B	2.6	C
190 X 70	4.5	B	3.9	C	3.6	C
240 X 70	5.7	B	5.0	C	4.5	D
290 X 70	6.3	C	5.5	C	5.0	D
Heavy *roof*						
Rafter size (width x thickness)	Maximum *span* of *rafters* at a maximum *spacing* (mm) and their fixing types					
	600		900			
	Span	Fixing type	*Span*	Fixing type		
(mm x mm)	(m)		(m)			
70 X 45	1.3	A	1.3	B		
90 X 45	1.7	A	1.5	B		
140 X 45	2.7	B	2.3	B		
190 X 45	3.6	B	3.2	B		
240 X 45	4.1	B	3.5	B		
290 X 45	4.3	B	3.8	B		
90 X 70	2.0	B	1.7	B		
140 X 70	3.1	B	2.7	B		
190 X 70	4.2	B	3.7	B		
240 X 70	5.3	B	4.6	C		
290 X 70	6.4	B	5.6	C		

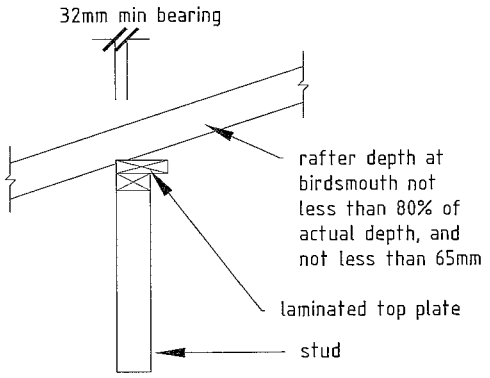
Note:

1. For 1.0 kPa snow load the maximum span of *rafters* to a light or heavy *roof* are to be multiplied by a factor of 0.85. Refer to Paragraph 2.4.2.
2. Timber members 70 mm thick may be substituted for two 45 mm thick members of the depth specified. Members shall be nailed together with 75 x 3.15 mm hand driven or 90 x 3.15 mm power driven nails at 250 mm centres along length driven alternately from either side (refer to Paragraph 2.7.3).

Table 5.3.2 **Fixing types for rafters**
Paragraph 5.3.2.4

Fixing type	Fixing to resist uplift	*Proprietary fastener capacity* (kN)
A	2/100 x 3.75 mm skewed nails	0.7
B	2/100 x 3.75 mm skewed nails + 1 *wire dog*	2.7
C	2/100 x 3.75 mm skewed nails + 2 *wire dogs*	4.7
D	2/100 x 3.75 mm skewed nails + 3 *wire dogs*	6.7

Figure 5.3.1 **Seating of rafters**
Paragraph 5.3.2.3



5.3.2.3 *Rafters* shall be seated on *top plates, lintels* and beams in accordance with Figure 5.3.1, and:

(a) the bearing width shall not be less than 32 mm, and

(b) the net width of the *rafter* at the notch or birdsmouth shall not be less than 80% of the actual width of the *rafter*, and not less than 65 mm.

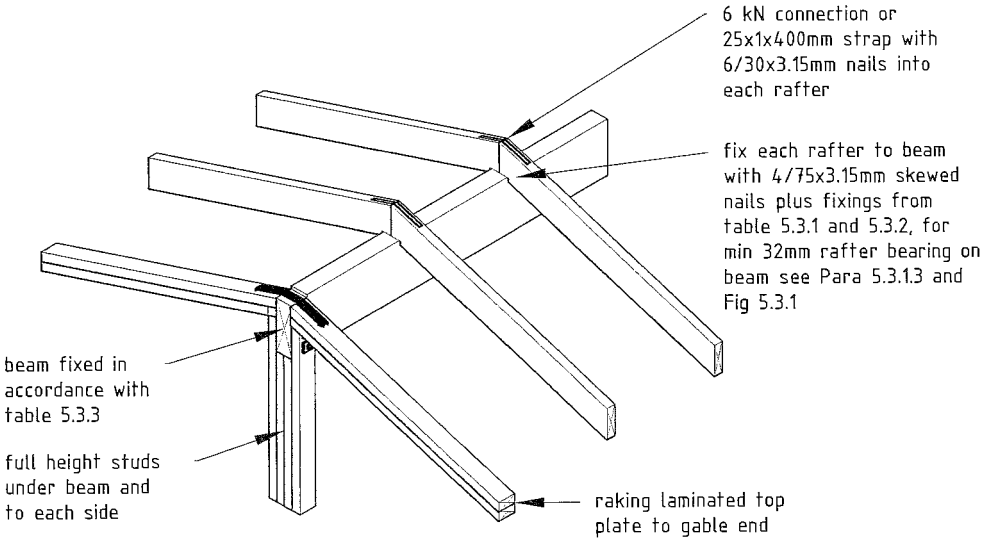
5.3.2.4 *Rafters* shall be fixed to:

(a) *top plates* as required by Table 5.3.1 and Table 5.3.2

(b) corresponding *rafters* in accordance with Figure 5.3.2. The 25 x 1 mm strap shown in Figure 5.3.2 may be replaced with a *proprietary fastener* of 6 kN *capacity* in tension and compression along the line of the *rafter*.

5.3.2.5 *Rafters* shall run at right angles to their associated ridge or *eaves* line.

Figure 5.3.2 **Fixing rafters – skillion roof**
Paragraphs 5.3.2.4 and 5.3.3.1



5.3.3 Ridge and intermediate beams

5.3.3.1 The *ridge beam* and intermediate beam sizes shall be determined from Table 5.3.3. The *ridge beam* or intermediate beam shall be secured to the wall with a fixing type determined from Table 5.3.4. The built- up *studs* shown in Figure 5.3.2 shall be provided with connections as required by Table 5.3.4.

Table 5.3.3 **Ridge and intermediate beams**
Paragraphs 2.4.3 and 5.3.3.1

Light *roof*								
Intermediate or *ridge beam* size (width x thickness)	*Loaded dimension* of *ridge beam* or intermediate beam (m)							
	1.8		2.7		3.6		4.2	
	Span	Fixing type	*Span*	Fixing type	*Span*	Fixing type	*Span*	Fixing type
(mm x mm)	(m)		(m)		(m)		(m)	
140 x 45	1.8	B	1.5	C	1.3	C	1.2	D
190 x 45	2.2	C	1.9	D	1.7	D	1.6	D
240 x 45	2.4	C	2.1	D	1.9	D	1.8	E
290 x 45	2.6	C	2.3	D	2.0	E	1.9	E
190 X 90	4.0	E	3.5	F	3.2	F	3.0	F
240 X 90	5.1	F	4.5	F	4.1	F	3.9	F
290 X 90	6.2	F	5.4	F	–	–	–	–
Heavy *roof*								
Intermediate or *ridge beam* size (width x thickness)	*Loaded dimension* of *ridge beam* or intermediate beam (m)							
	1.8		2.7		3.6		4.2	
	Span	Fixing type	*Span*	Fixing type	*Span*	Fixing type	*Span*	Fixing type
(mm x mm)	(m)		(m)		(m)		(m)	
140 x 45	1.4	B	1.2	B	–	–	–	–
190 x 45	2.0	C	1.7	C	1.4	C	1.3	C
240 x 45	2.5	C	2.0	C	1.7	D	1.6	D
290 x 45	2.7	C	2.3	D	2.0	D	1.9	D
190 X 90	3.1	C	2.7	D	2.5	E	2.3	E
240 X 90	4.0	D	3.5	E	3.1	F	3.0	F
290 X 90	4.8	E	4.2	F	3.8	F	3.6	F

Note:

1. Members 90 mm thick may be substituted with built-up, laminated members sized and nailed in accordance with Paragraph 2.7.3.
2. For 1.0 kPa snow load, the maximum span of the ridge/intermediate beams to a light or heavy *roof* are to be multiplied by a factor of 0.85.

Table 5.3.4	Key to fixing types to restrain ridge/intermediate beam uplift Paragraph 5.3.3.1		
Fixing type	Fixing to resist uplift		*Proprietary fastener capacity* (kN)
	Base connection to built-up *studs*	Ridge/intermediate beam to *studs*	
A	2/100 x 3.75 mm skew nails into *bottom plate*	2/100 x 3.75 mm nails	0.7
B	4/100 x 3.75 mm skew nails into *bottom plate*	4/100 x 3.75 mm nails	2.7
C	6/100 x 3.75 mm skew nails into *bottom plate*	6/100 3.75 mm nails	4.7
D	25 x 1 mm strap with 6/30 x 2.5 mm nails to *stud* and *plate*	1/M12 bolt	6.7
E	2/25 x 1 mm strap with 6/30 x 2.5 mm nails to *stud* and *plate* (12 total)	1/M12 bolt	8.7
F	3/25 x 1 mm strap with 6/30 x 2.5 mm nails to *stud* and *plate* (18 total)	2/M16 bolts	18.6

5.3.4 Purlins and tile battens

For *purlins* or *tile battens*, refer to Paragraph 5.1.4.

5.4 Verandahs

CONTENTS

5.4.1 General

The grade, species and preservative treatment for verandah *framing* shall be in accordance with Table 2.7.

5.4.2 Verandah beams

The verandah beam sizes shall be obtained from Table 5.4.1.

Table 5.4.1 Verandah beams
Paragraphs 2.4.3, 5.4.2 and Figure 5.2.2

Beam size (width x thickness)	*Loaded dimension* of verandah beam (m)							
	0.9		1.4		1.8		2.1	
	Span	Fixing type	*Span*		*Span*		*Span*	
(mm x mm)	(m)		(m)		(m)		(m)	
Light *roof*								
140 x 45	1.9	CC	1.4	CC	1.3	DD	1.2	DD
190 X 45	2.3	CC	1.8	DD	1.6	DD	1.5	DD
240 X 45	2.5	CC	2.0	DD	1.8	EE	1.8	EE
290 X 45	2.7	CC	2.2	DD	2.0	EE	1.9	EE
140 X 90	2.4	CC	2.0	DD	1.8	EE	1.7	EE
190 X 90	3.3	DD	2.7	EE	2.5	FF	2.4	FF
240 X 90	4.2	DD	3.4	FF	3.1	FF	3.0	FF
290 X 90	6.5	FF	5.2	FF	4.8	FF	–	–
Heavy *roof*								
140 x 45	1.5	CC	1.2	CC	–	–	–	–
190 X 45	2.0	CC	1.5	CC	1.4	CC	1.3	DD
240 X 45	2.3	CC	1.8	CC	1.6	DD	1.5	DD
290 X 45	2.4	CC	1.9	DD	1.8	DD	1.7	DD
140 X 90	2.0	CC	1.6	CC	1.4	CC	1.4	DD
190 X 90	2.7	CC	2.1	DD	2.0	DD	1.9	DD
240 X 90	3.4	CC	2.7	DD	2.5	EE	2.4	EE
290 X 90	5.2	DD	4.1	FF	3.8	FF	3.7	FF

Fixing type	Fixing to resist uplift	*Proprietary fastener capacity* (kN)
CC	6/100 x 3.75 mm nails	4.7
DD	1/M12 bolt	6.7
EE	1/M12 bolt	8.7
FF	3/M12 bolts or 2/M16 bolts	18.6

Note:

1. This table includes provision for the *rafters* cantilevering a maximum of 750 mm beyond the verandah beam to support a soffit.
2. Fixing for continuous *spans* shall have double the *capacity* to that listed in this table.
3. Members 90 mm thick may be substituted with built-up, laminated members sized and nailed in accordance with Paragraph 2.7.3.

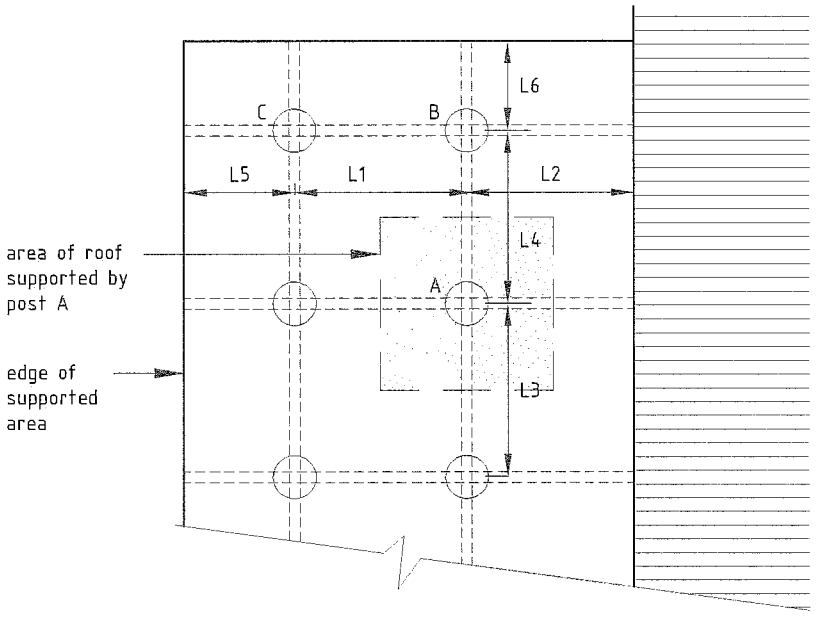
5.4.3 Verandah posts

Isolated 90 x 90 mm posts shall not exceed 3.0 m long, and shall be used to support beams which directly support *rafters*.

5.4.4 Area of roof supported by a verandah post

The area of the *roof* supported by the *post* shall be determined from Figure 5.4.1.

Figure 5.4.1 **Area of roof supported by post**
Paragraph 5.4.4 and Table 5.4.3



Interior post A, supported area = $\frac{L1+L2}{2} \times \frac{L3+L4}{2}$

Edge post B, supported area = $\frac{L1+L2}{2} \times (\frac{L4}{2}+\frac{L6}{2})$

Edge post C, supported area = $(\frac{L1}{2}+\frac{L5}{2}) \times (\frac{L4}{2}+\frac{L6}{2})$

5.4.5 Volume of concrete footing to resist uplift

The volume of the concrete *foundation* required to resist uplift shall be as given in Table 5.4.2.

Table 5.4.2 **Post concrete footings to resist uplift**
Paragraph 5.4.5

Volume of footing concrete (m^3) for area of *roof* supported (m^2)						
1 m^2	2 m^2	4 m^2	6 m^2	8 m^2	10 m^2	12 m^2
0.07	0.13	0.26	0.40	0.50	0.65	0.8

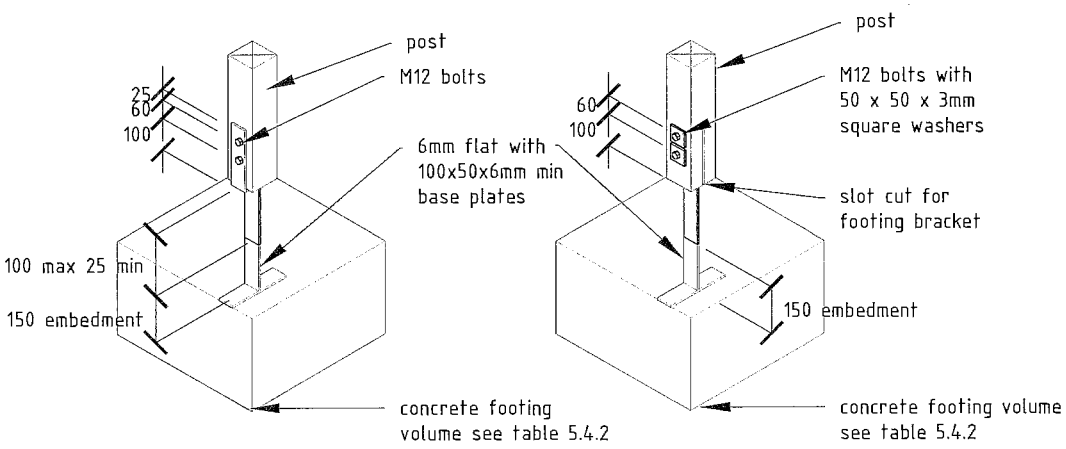
5.4.6 Connections

Each end of each a verandah post shall be provided with *proprietary fasteners* of the *capacities* as given by Table 5.4.3 or by connections as detailed in Figures 5.4.2 or 5.4.3. Refer to Paragraph 2.5 for durability requirements.

Table 5.4.3 **Connections to posts and beams to resist uplift**
Paragraph 5.4.6 and Figure 5.4.1

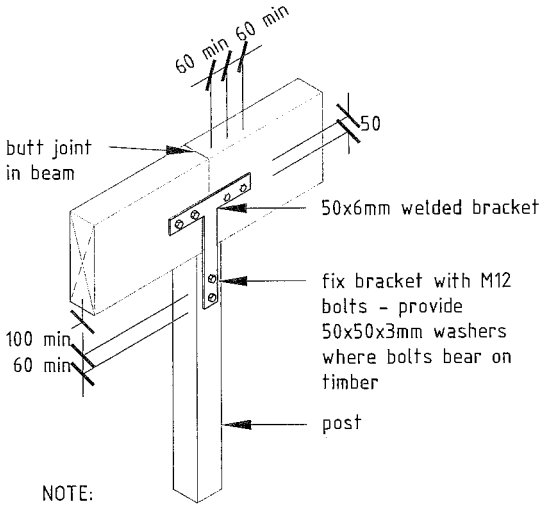
Capacity of *post* and beam connections (kN) for area (m^2) of *roof* supported						
1 m^2	2 m^2	4 m^2	6 m^2	8 m^2	10 m^2	12 m^2
2.0	4.0	0.7.9	11.9	15.8	19.8	23.8

Figure 5.4.2 **Post/footing connections**
Paragraph 5.4.6

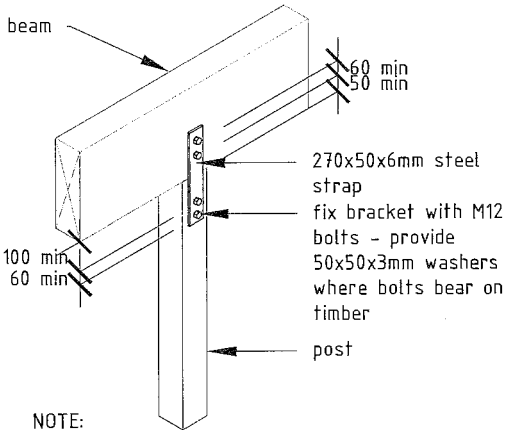


NOTE:
1) 1 bolt may be used when the footing volume is 0.2m^3 or less.
2) see Para 2.5 for durability requirements.
3) capacity 36.4kN.

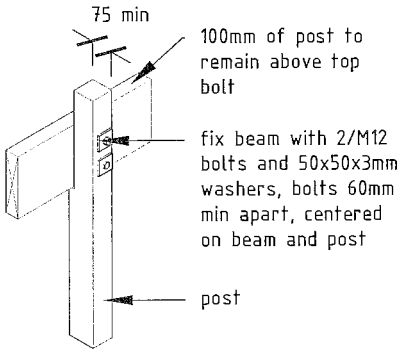
Figure 5.4.3 **Beam/post connections**
Paragraph 5.4.6



NOTE:
1) see Para 2.5 for durability requirements.
2) capacity 18.2kN for 1 bracket
3) capacity 36.4kN for 2 brackets



NOTE:
1) see Para 2.5 for durability requirements.
2) capacity 9.8kN for 1 bracket
3) capacity 19.5kN for 2 brackets



NOTE:
1) see Para 2.5 for durability requirements.
2) capacity 9.8kN

6.0 Wall claddings

6.1 General

CONTENTS

6.1 General

Lightweight wall *claddings* for a *simple house* are limited to the timber weatherboard (bevel-back or rusticated) or flat sheet (plywood or fibre-cement) materials in this *Acceptable Solution*.

All timber weatherboard and flat sheet wall *claddings* shall be installed over *wall underlay* and fixed directly to the *framing*.

6.1.1 Wall underlay

A synthetic *wall underlay* shall be installed to the exterior of all *external wall framing* prior to fitting wall *cladding*.

6.1.1.1 Installation

The *wall underlay* shall:

(a) be run horizontally, with minimum joints

(b) have upper sheets lapped over lower sheets

(c) be lapped not less than 75 mm at horizontal joints

(d) be lapped over *studs* at vertical joints at not less than 150 mm

(e) be added as a second layer over head *flashings* in accordance with window/door details, and

(f) extend from *top plate* to 50 mm below *bottom plate*, or below the timber floor structure.

6.1.1.2 Wall underlay at openings

Prior to window or door installation:

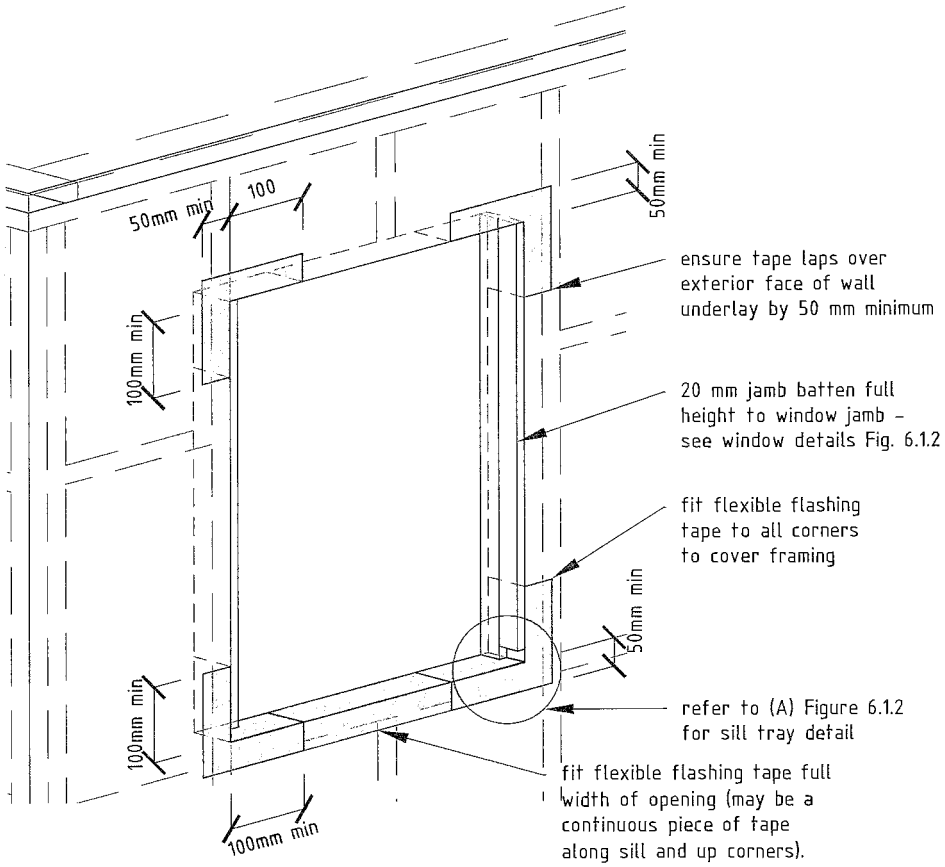
(a) *wall underlay* shall be cut and dressed into all sides of openings as per Figure 6.1.1, and

(b) *flexible flashing tape* shall be applied at the head and sill of the opening in accordance with Figure 6.1.1.

6.1.1.3 Barriers to airflow

Where walls are to be unlined, such as attic spaces or the exterior walls of an attached garage, then an air barrier complying with Table 23 of Acceptable Solution E2/AS1 shall be installed over the *framing* prior to fixing the *cladding*.

Figure 6.1.1 **Preparation of openings**
Paragraph 6.1.1.2



6.1.2 Air seals

Window, door and other penetration openings shall be provided with *flexible air seals* to minimise the risk of airflows carrying water into the *simple house*. The *air seal* shall be:

(a) on the dry side of the opening,

(b) provided between the reveal or frame and the wrapped opening,

(c) installed over a closed cell polyethelene (PEF) backing rod, and

(d) made of:

(i) self expanding polyurethane foam, or

(ii) sealant in accordance with Paragraph 6.1.2.1.

6.1.2.1 Sealant

Sealant shall be neutral cure sealant compling with:

(a) Type F, Class 20 LM or 25 LM of ISO 11600, or

(b) low modulus Type II Class A of Federal Specification TT-S-00230C.

6.1.3 Windows and doors

6.1.3.1 Window and doors shall be of aluminium construction and comply with the requirements of NZS 4211.

6.1.3.2 Glazing shall be sized as per NZS 4223 Part 4. Refer also to Paragraph 9.7.2 for human impact safety requirements.

6.1.3.3 Glazing to external windows and doors shall be double glazing except that houses in Kaipara, Whangarei and Far North District Councils may be single-glazed. Refer to Paragraph 2.8.1.

6.1.3.4 The grade species and preservative treatment of timber reveals shall be in accordance with Table 2.7.

6.1.3.5 The *simple house* is limited to maximum clear openings of 3.7 m wide, except for a steel *lintel* in an attached garage, as per Paragraph 6.7.

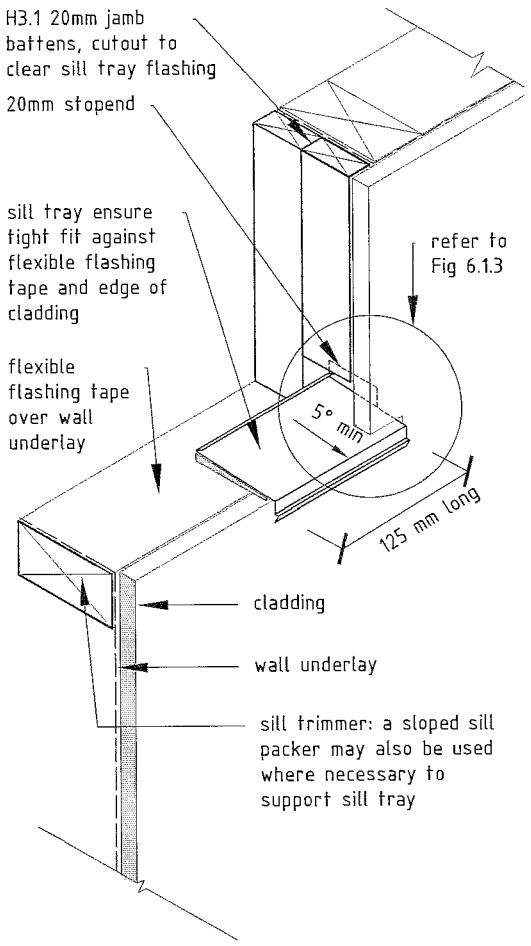
6.1.3.6 Raking or curved heads are outside the scope of this *Acceptable Solution*.

6.1.3.7 Window and door openings shall be *flashed* as shown for each *cladding* and in accordance with Paragraph 6.1.4.

6.1.3.8 Window and door openings shall be prepared for the placement of a sill tray *flashing* in accordance with Figures 6.1.2 and 6.1.3.

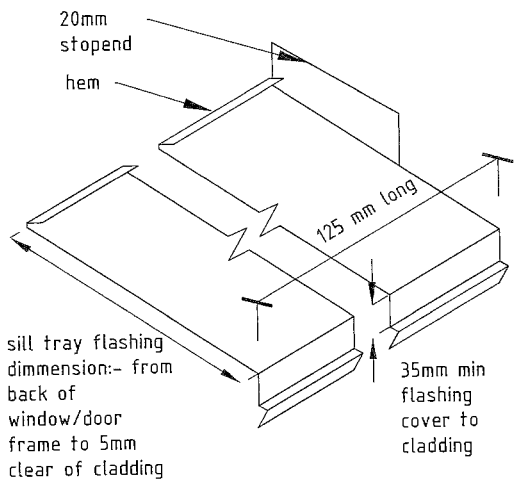
6.1.3.9 Where a sill support bar is required by the window or door manufacturer to carry the frame and glazing loads, they must be supplied as an integral part of the joinery installation and installed to the manufacturer's instructions.

Figure 6.1.2 **Preparation of window and door opening**
Paragraphs 6.1.1.2, 6.1.3.8 and 6.1.4.5



NOTE: Where sill support bars are required by the window manufacturer to carry the frame and glazing loads they must be supplied as an integral part of the window installation and be installed to the window manufacturer's instructions.

Figure 6.1.3 **Window openings – sill tray**
Paragraphs 6.1.3.8 and 6.1.4.5



6.1.4 Flashings

6.1.4.1 Flashing materials

Flashing materials shall be selected according to Table 2.5 and Paragraph 2.6.

6.1.4.2 Edge treatments for flashings

The edges of *flashings* are to be folded to form a *kick-out* or a *bird's beak* where shown on the details.

6.1.4.3 Metal flashing joints

Where possible, all *flashings* to windows and doors shall be full length. Where joints are unavoidable, lap *flashings* shall be a minimum of 100 mm and shall direct water to the outside, refer to Figure 7.1.1.

6.1.4.4 Head flashing

Head *flashings* shall have the upstand of the *flashing* either:

(a) lapped by an additional layer of *wall underlay* over the *flashing* upstand and run up to the soffit or the nearest horizontal lap above, or

(b) the upstand shall be taped to the *wall underlay* with *flexible flashing tape*.

6.1.4.5 Sill tray flashing

Sill tray *flashings* shall be installed in accordance with Figures 6.1.1, 6.1.2 and 6.1.3, be 125 mm long and fit into each bottom corner of the opening.

6.1.5 Eave and soffit design

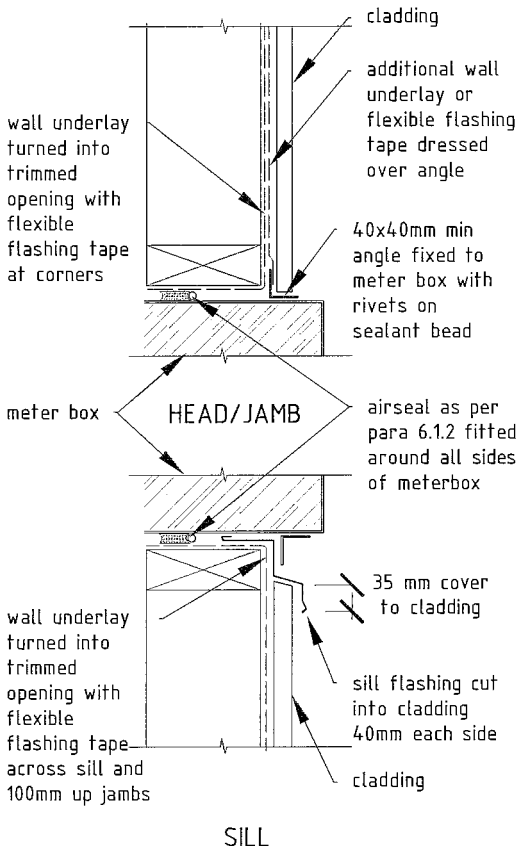
6.1.5.1 Minimum *eaves* width shall be 450 mm to outside fascia, as required in Paragraph 1.2.

6.1.5.2 Soffits and verges of all projecting *eaves* or raking *eaves* shall be closed in and constructed in accordance with Paragraph 5.1.2, and the particular installations shown in Figures 6.4.1, 7.1.2, 7.1.3 or 7.3.3.

6.1.6 Meterboxes

Meterboxes shall be made *weathertight* in accordance with Figure 6.1.4, or be installed behind a *weatherproof* glazed panel that is installed as for a window.

Figure 6.1.4 **Meterbox installation**
Paragraph 6.1.6

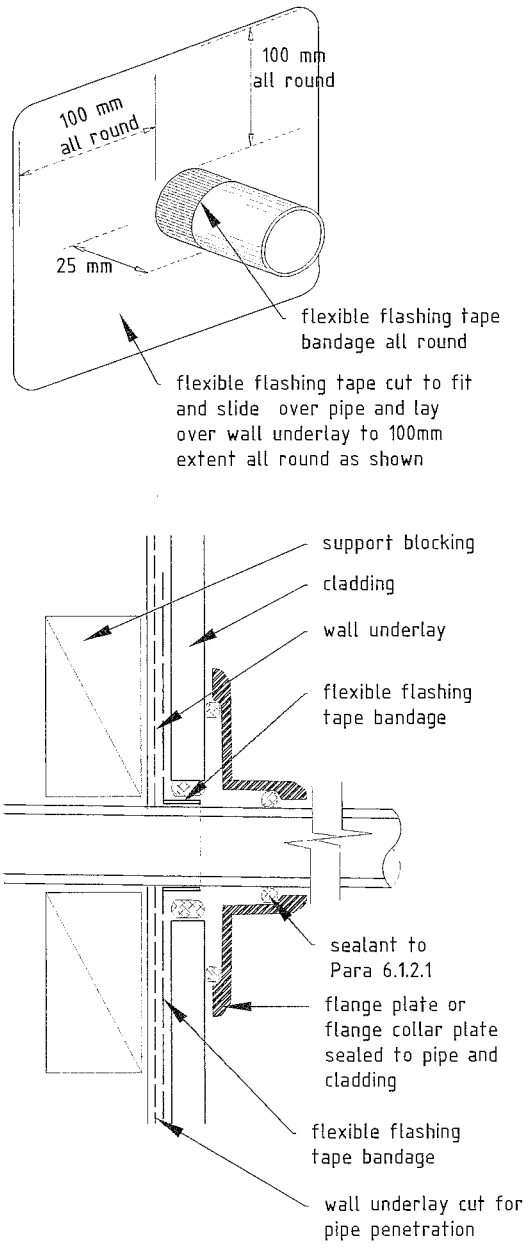


Comment:
Locate meterboxes where possible in sheltered areas, such as in a porch or behind a weatherproof glazed panel.

6.1.7 Pipe and service penetrations

Pipe and service penetrations shall be made *weathertight* in accordance with Figure 6.1.5.

Figure 6.1.5 **Pipe penetrations**
Paragraph 6.1.7



6.1.8 Bottom of cladding and ground clearances

6.1.8.1 Separations and *cladding* clearances from the ground shall be as per Figure 6.1.6 and Table 6.1.

6.1.8.2 Where level entry access is provided, refer to Paragraph 9.10.3 and Figure 9.5.

Figure 6.1.6 **Ground clearances**
Paragraphs 3.1.3, 6.1.8 and Table 6.1

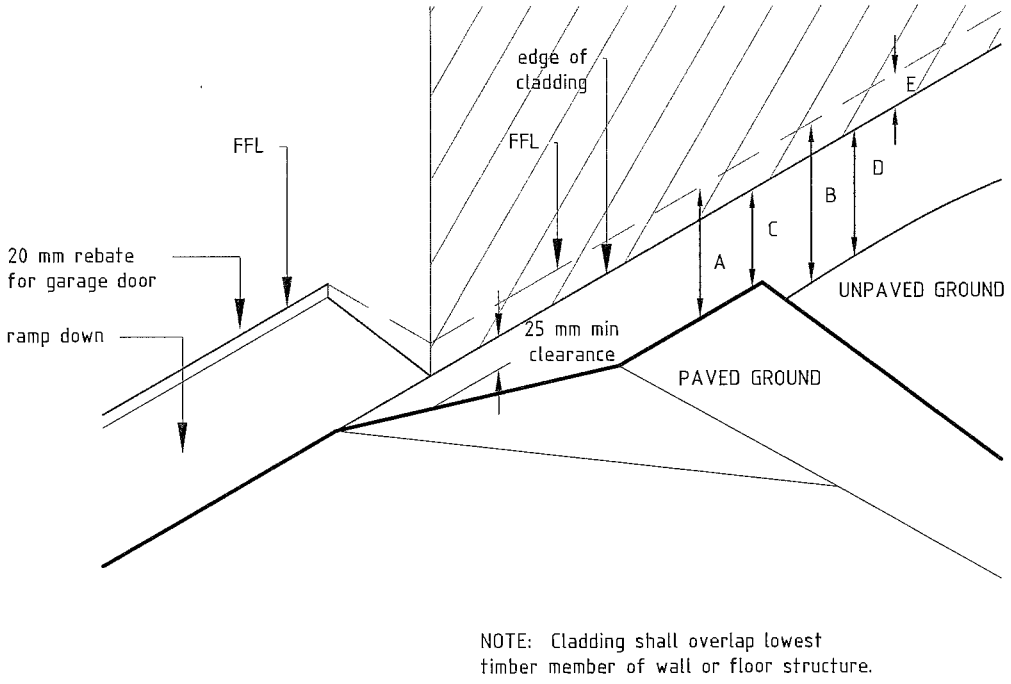


Table 6.1 **Ground clearances**
Paragraphs 3.1.3 and 6.1.8 and Figure 6.1.6

Minimum clearances (mm)	A	B	C	D	E
	Masonry veneer				
Concrete slab	100	150	25	100	50
Timber floor	Not applicable				
	Other *claddings*				
Concrete slab	150	225	100	175	50
Timber floor			100(1)	175 (1)	50
Note 1: mimimum clearance but requires ventilation to Paragraph 3.3.16 .					

6.2 Bevel-back weatherboard

CONTENTS

Figures

6.2.1 General

6.2.1.1 Refer to Paragraph 6.1 for general requirements for the installation of bevel-back timber weatherboard wall *claddings*, including *wall underlays, air seals, flashings,* sill trays, ground clearances, etc.

6.2.1.2 Weatherboards and exterior finishing timbers shall be radiata pine, dressing grade to NZS 3631 or finger-jointed, and treated to H3.1. Refer to Table 2.7.

6.2.1.3 Grading requirements additional to those set out in NZS 3631 are as follows:

(a) all holes, resin and bark pockets shall be excluded, and

(b) knot size shall not exceed 50 mm, or 25 mm width for intergrown spike knots.

6.2.1.4 All *flashings* shall comply with Paragraph 2.6.

6.2.2 Finishing

Timber bevel-back weatherboards shall have a paint finish in accordance with Paragraph 6.2.2.2.

6.2.2.1 Weatherboards and exterior finishing timbers shall be primed on all faces (including end grain and laps) prior to fixing.

6.2.2.2 After fixing, the following finish shall be applied:

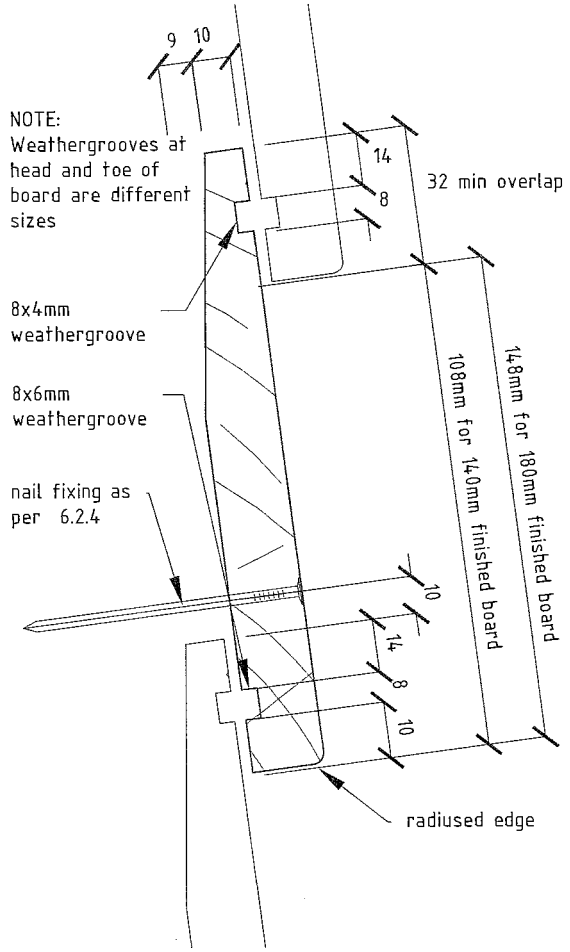
(a) one coat of wood primer, acrylic or solvent borne, and

(b) two coats of acrylic finishing paint system complying with AS 3730.

6.2.3 Profiles

Profiles shall be as given in NZS 3617 or BRANZ Bulletin 411, and in accordance with Figure 6.2.1.

Figure 6.2.1 **Bevel-back weatherboard**
Paragraphs 6.2.3 and 6.2.4.



6.2.4 Fixing

6.2.4.1 Timber weatherboard *claddings* shall be fixed using a single 75 x 3.15 mm jolt head hot-dipped galvanised nail at each *stud*, positioned within 10 mm above top of lower board with a minimum 32 mm lap, all in accordance with Figure 6.2.1.

6.2.4.2 Weatherboards shall be drilled for nailing at all joints and ends.

6.2.4.3 Nails shall be punched below the surface of the weatherboard and stopped prior to painting.

6.2.5 Joints

Joints shall be made only over solid support and have:

(a) soaker *flashings*, or

(b) splay joints.

6.2.6 External corners

External corners shall be weatherproofed by one of the methods shown in Figure 6.2.2 or 6.2.3:

(a) boxed corners with scribers in accordance with Figure 6.2.2, or

(b) mitred joints with back *flashings* in accordance with Figure 6.2.2, or

(c) soaker *flashings* in accordance with Figure 6.2.3.

Figure 6.2.2 **External corner options**
Paragraph 6.2.6 and Figure 6.2.3

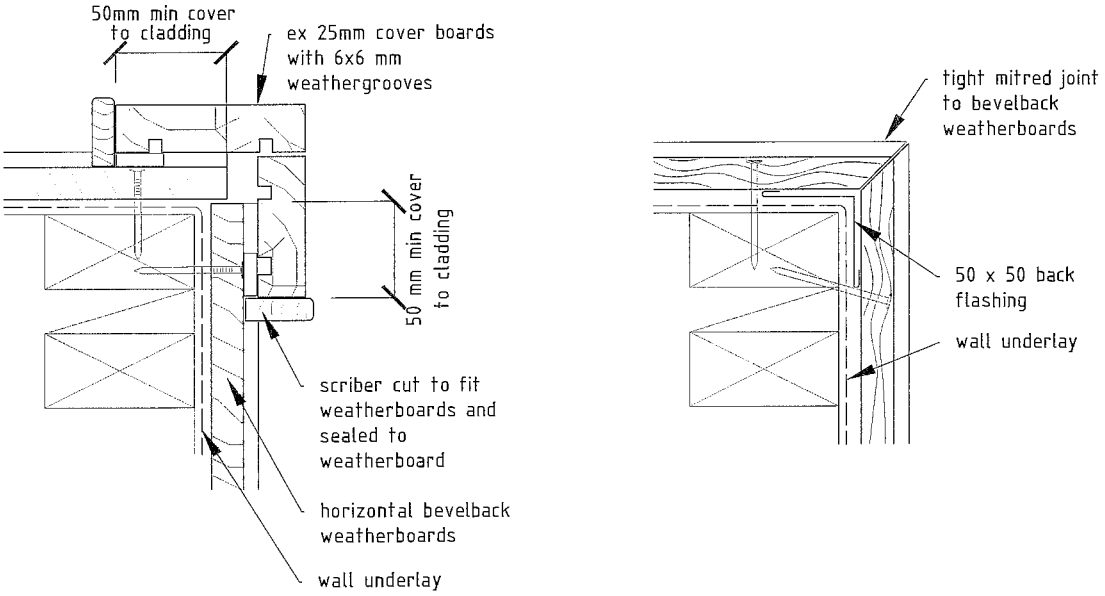
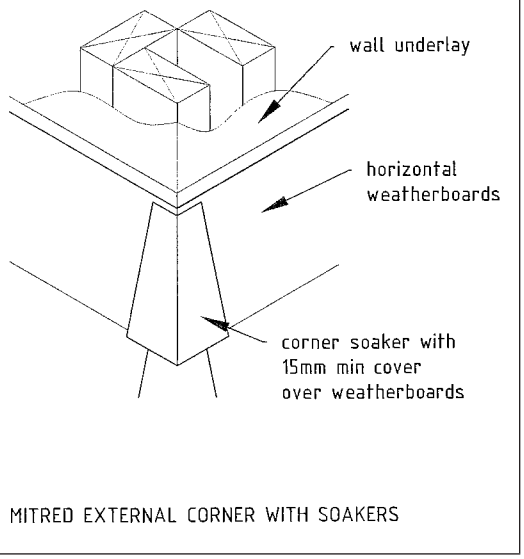


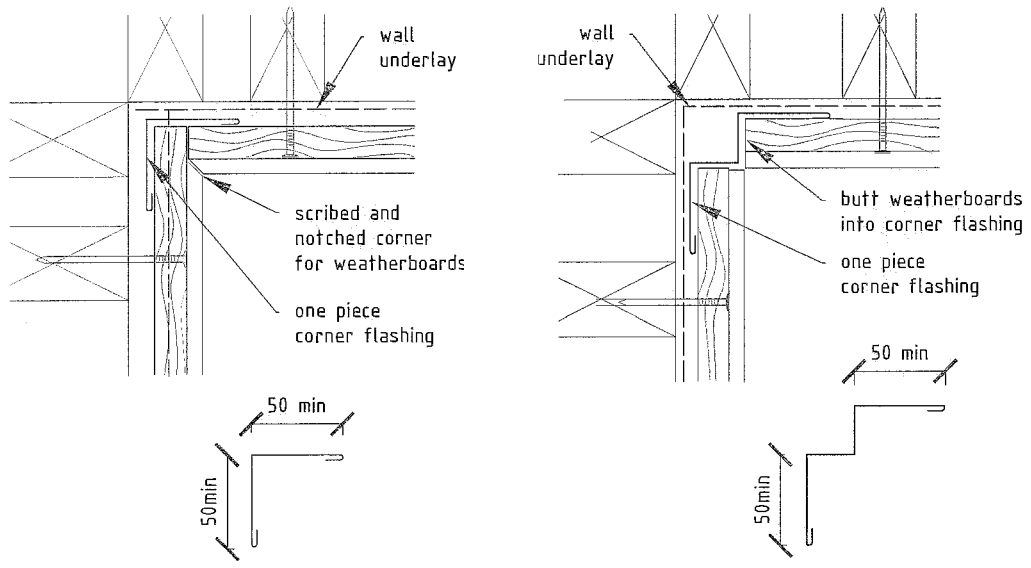
Figure 6.2.3 **Soaker flashing option**
Paragraph 6.2.6



6.2.7 Internal corners

Internal corners shall have a *flashing* fitted directly behind the weatherboards in accordance with Figure 6.2.4.

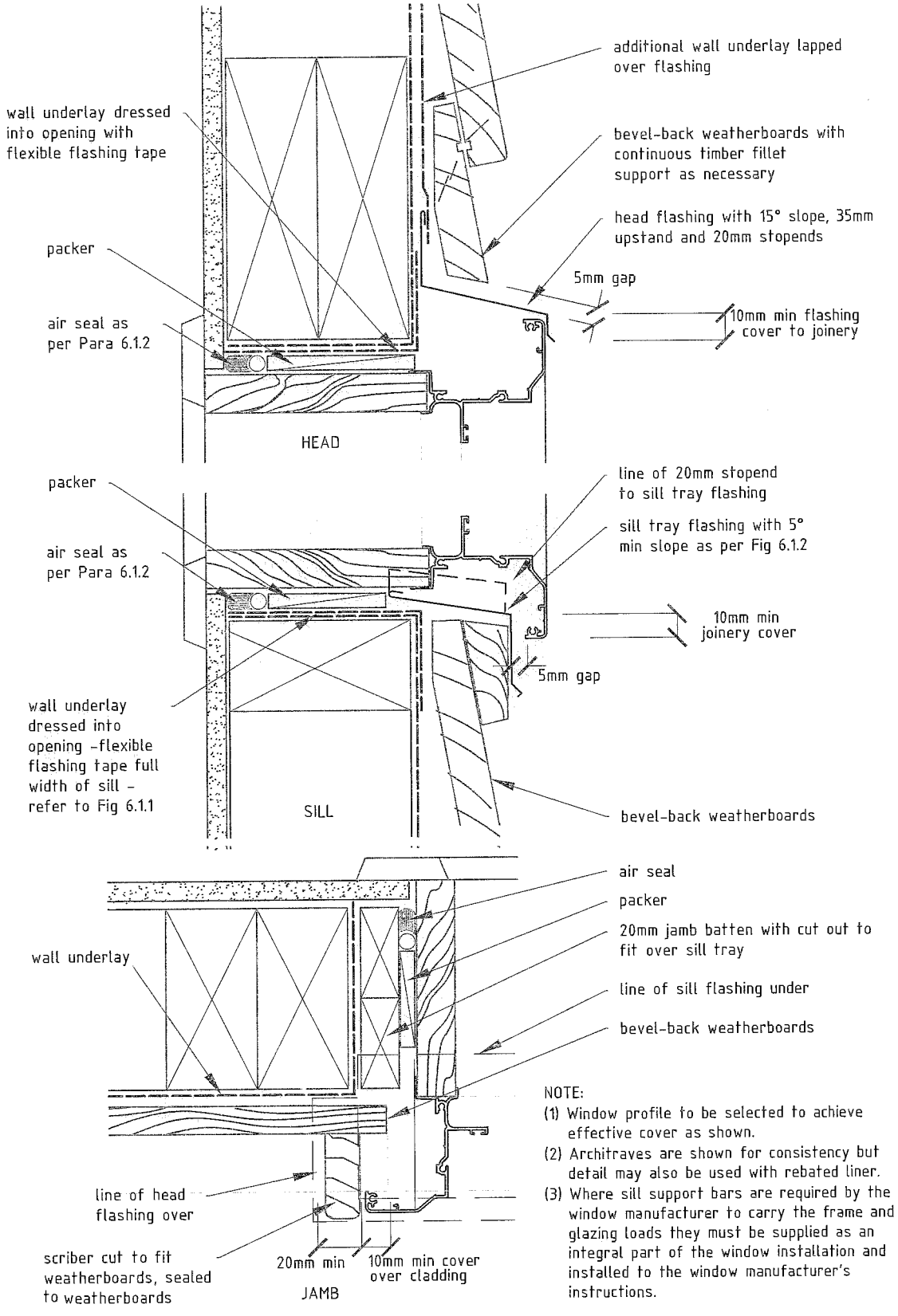
Figure 6.2.4 **Internal corner to bevel-back weatherboard**
Paragraph 6.2.7



6.2.8 Window and door penetrations

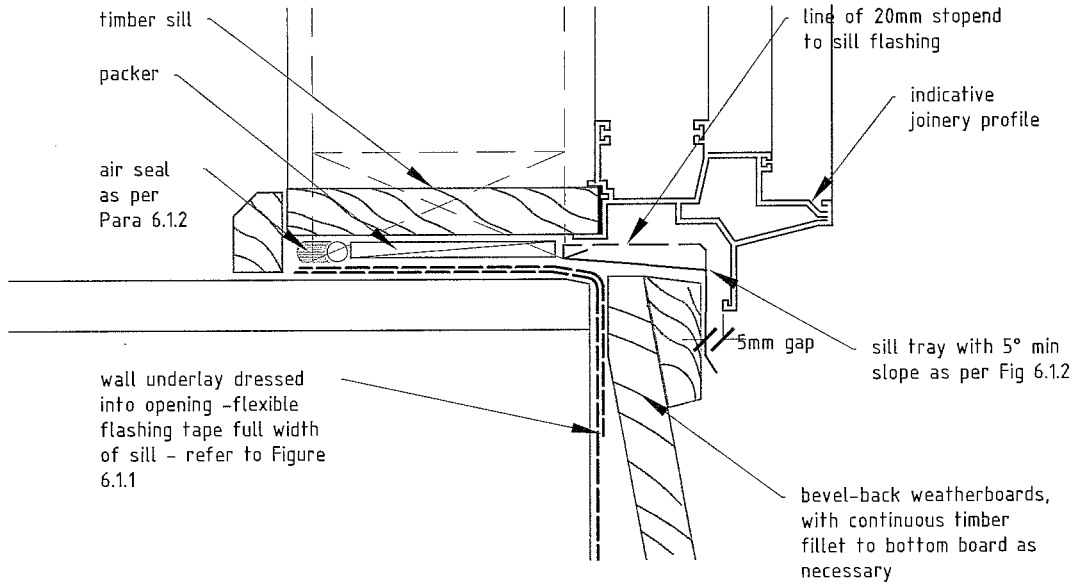
6.2.8.1 Windows to bevel-back weatherboard shall be installed in accordance with Figure 6.2.5.

Figure 6.2.5 **Aluminium window installation**
Paragraph 6.2.8.1



6.2.8.2 Door sills shall be installed in accordance with Figure 6.2.6.

Figure 6.2.6 **Installation of aluminium doors**
Paragraphs 6.2.8.2, 6.3.8.2 and 6.5.9.1



NOTE: Where sill support bars are required by the door manufacturer to carry the frame and glazing loads they must be supplied as an integral part of the door installation and installed to the door manufacturer's instructions.

6.3 Rusticated weatherboard

CONTENTS

Figures

6.3.1 General

6.3.1.1 Refer to Paragraph 6.1 for general requirements for the installation of rusticated timber weatherboard wall *claddings*, including *wall underlays*, *air seals, flashings*, sill trays, ground clearances, etc.

6.3.1.2 Weatherboards and exterior finishing timbers shall be radiata pine, dressing grade to NZS 3631 or finger-jointed, and treated to H3.1. Refer to Table 2.7.

6.3.1.3 Grading requirements additional to those set out in NZS 3631 are as follows:

(a) all holes, resin and bark pockets shall be excluded

(b) knot size shall not exceed 50 mm, or 25 mm width for intergrown spike knots.

6.3.2 Finishing

Timber rusticated weatherboards shall have a paint finish inn accordance with Paragraph 6.3.2.2.

6.3.2.1 Weatherboards and exterior finishing timbers shall be primed on all faces (including end grain and laps) prior to fixing.

6.3.2.2 After fixing, the following finish shall be applied:

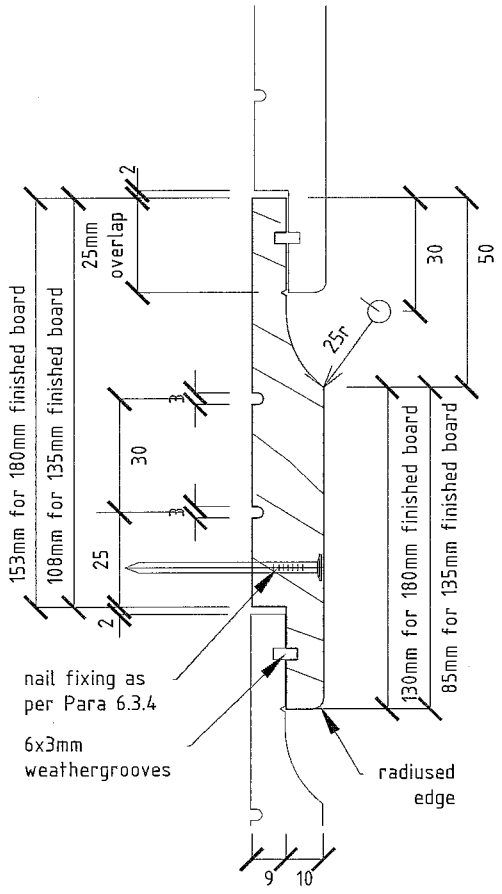
(a) one coat of wood primer, acrylic or solvent borne, and

(b) two coats of exterior acrylic finishing paint system complying with AS 3730.

6.3.3 Profiles

Profiles shall be as given in NZS 3617 or BRANZ Bulletin 411, and in accordance with Figure 6.3.1.

Figure 6.3.1 **Rusticated weatherboard**
Paragraphs 6.3.3 and 6.3.4.1



6.3.4 Fixing

6.3.4.1 Rusticated weatherboards shall be fixed using a single 60 x 2.8 mm jolt head hot-dipped galvanised nail at each *stud*, positioned within 10 mm above the top of the lower board, with a minimum lap of 25 mm and a 2 mm gap between boards, as per Figure 6.3.1.

6.3.4.2 Weatherboards shall be drilled for nailing at all joints and ends.

6.3.4.3 Nails shall be punched below the surface of the weatherboard and stopped prior to painting.

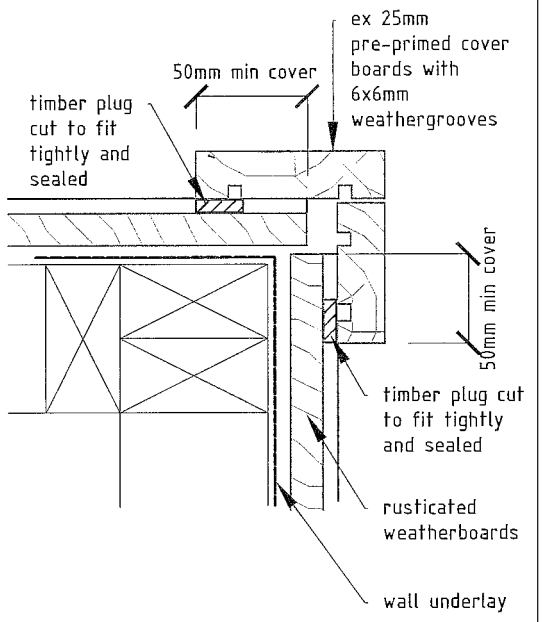
6.3.5 Joints

Joints shall only be made over solid support and have splay joints.

6.3.6 External corners

External corners shall be weatherproofed by using corner boxes with timber plugs in accordance with Figure 6.3.2.

Figure 6.3.2 **Boxed external corner**
Paragraph 6.3.6



6.3.7 Internal corners

Internal corners shall have a *flashing* fitted directly behind the weatherboards in accordance with Figure 6.3.3.

6.3.8 Window and door penetrations

6.3.8.1 Windows to rusticated weatherboards shall be installed in accordance with Figure 6.3.4.

6.3.8.2 Door sills shall be installed in accordance with Figure 6.2.6.

Figure 6.3.3 **Internal corner options**
Paragraph 6.3.7

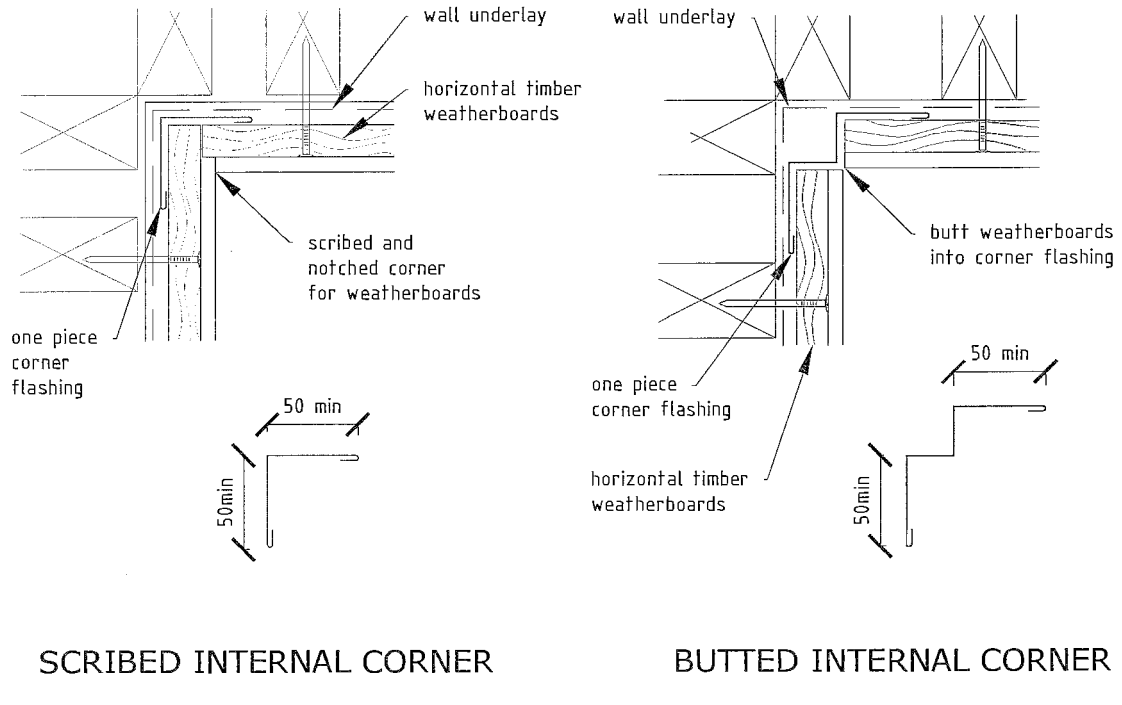
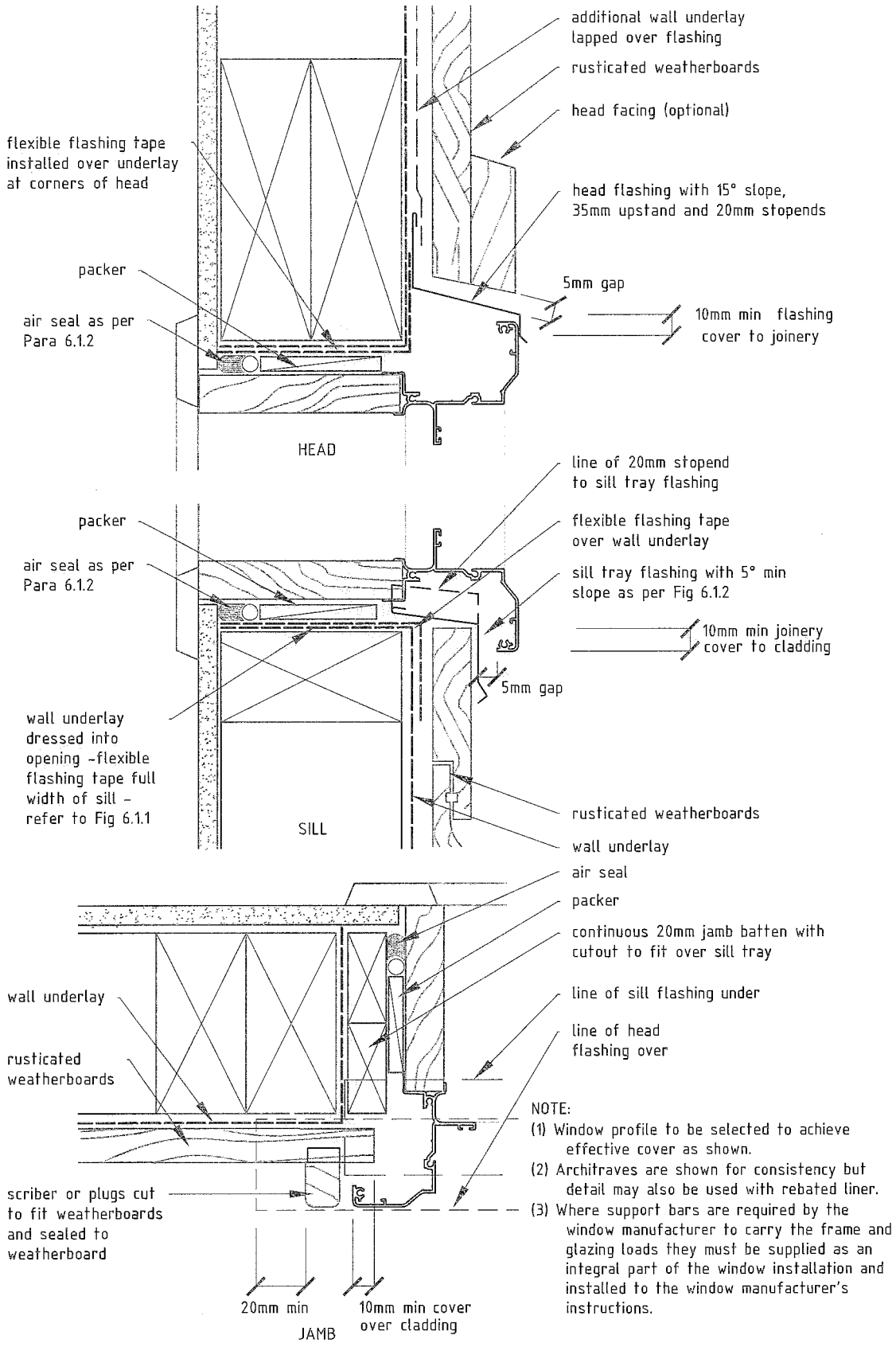


Figure 6.3.4 **Aluminium window installation**
Paragraph 6.3.8.1



6.4 Masonry veneer

CONTENTS

6.4.1 General

Refer to Paragraph 6.1 for general requirements for the installation of *masonry veneer* wall *cladding*, including *wall underlays, air seals, flashings,* sill trays, ground clearances, etc. *Masonry veneer* is either clay brick, or concrete brick or block.

6.4.1.1 This section covers clay and concrete *masonry veneer* on timber *framing*. *Masonry veneer* is limited to:

(a) a maximum mass of veneer of 220 kg/m^2

(b) units having a width of 70 mm to 90 mm

(c) a maximum height of veneer of 3.0 m

(d) walls or returns with a length of veneer not less than 230 mm, measured from the external face of the veneer.

6.4.1.2 The materials, tolerances and workmanship of *masonry veneer* shall be in accordance with NZS 4210.

6.4.1.3 Masonry less than 24 hours old shall not be subject to vibration.

6.4.1.4 Masonry shall have an unconfined compressive strength of at least 10 MPa and shall comply with AS/NZS 4455. Testing of bricks shall be done in accordance with AS/NZS 4456.

6.4.1.5 Units shall be laid up in straight uniform courses with *running bond*. Stack *bonding* is not permitted.

6.4.2 Cavity for masonry veneer

6.4.2.1 Refer to Paragraph 3.1 for slab, *foundation* and base of wall details, and to Paragraph 3.2 for *simple houses* on expansive soils.

6.4.2.2 *Masonry veneer* shall be supported on a continuous concrete *foundation* and may overhang its supporting *foundation* by up to 20 mm.

6.4.2.3 The cavity between the *masonry veneer* and the exterior face of the timber *framing* shall not be less than 40 mm or more than 75 mm.

6.4.2.4 Pipes and services shall not be placed in the cavity other than passing directly through the cavity with a fall to the exterior.

6.4.2.5 Drainage

The cavity shall have weep holes, 75 mm minimum in height, by the width of the vertical mortar joint, at centres not exceeding 800 mm or every third perpend along the bottom course of walls and above openings.

The concrete slab rebate at the bottom of the cavity shall be *waterproof* coated or have a *DPC* under the *masonry veneer* that extends up behind the *wall underlay*.

6.4.2.6 Venting

The cavity shall be ventilated at the top by either:

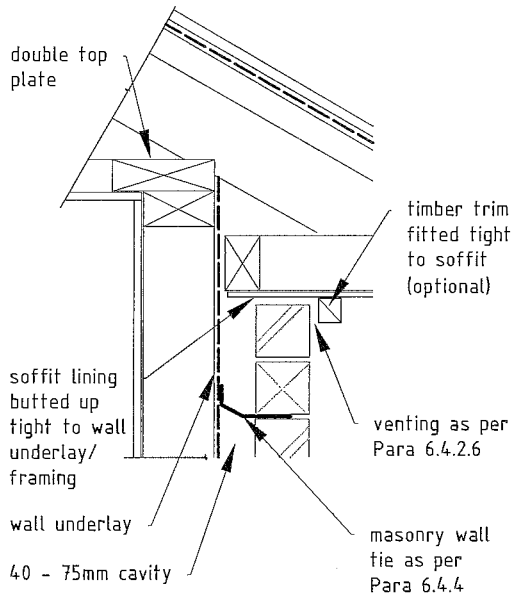
(a) vent holes, 75 mm minimum in height, by the width of the vertical mortar joint, at centres not exceeding 800 mm, or

(b) a continuous 10 mm gap between the top course and soffit.

6.4.2.7 Soffit

The cavity shall be sealed off from the *roof* space in accordance with Figure 6.4.1.

Figure 6.4.1 **Closure of cavity at soffit**
Paragraphs 6.1.5.2 and 6.4.2.7



6.4.3 Mortar

6.4.3.1 Materials

Mortar materials (cement, sand and admixtures) shall comply with NZS 4210.

6.4.3.2 Mix

Mortar mix composition by volume shall be as follows: 1 part Portland cement, 0-0.25 parts hydrated lime and 3 parts sand.

6.4.3.3 Admixtures

If admixtures are used they shall meet the requirements of NZS 4210 Clause 2.1.8.

6.4.3.4 Colouring

Where mortar is to be coloured, this shall be achieved by the use of coloured cement or by the addition of mineral oxide pigment.

6.4.3.5 Compressive strength

The 28-day compressive strength of mortar when tested in accordance with NZS 4210 Appendix 2A shall not be less than 12.5 MPa.

6.4.3.6 Bond strength

The seven-day masonry-to-mortar bond strength when tested in accordance with NZS 4210 Appendix 2B shall be no less than 200 kPa.

6.4.3.7 Thickness

The thickness of mortar joints shall be 10 mm ± 3 mm except that a joint thickness up to 20 mm may be accepted on the bottom course in order to take up the permitted tolerances of the supporting concrete.

6.4.3.8 Solid and cored units shall have all joints completely filled with mortar. Furrowing of bed joints shall not exceed 25% of the joint thickness.

6.4.3.9 Pointing

Mortar joints shall be:

(a) concave tooled to a depth not exceeding 6 mm and burnished after the initial stiffening has occurred, or

(b) raked out, pointed and tooled to a depth not exceeding 6 mm after the initial stiffening has occurred.

6.4.3.10 Masonry units shall be protected from the weather prior to laying to ensure they are not laid in a saturated state, but shall be sufficiently damp to prevent excessive uptake of moisture from the mortar.

6.4.3.11 Cleaning

As work progresses and at completion of brickwork remove all mortar:

(a) that has collected on ties

(b) protruding more than 5 mm into the drainage cavity

(c) droppings and other loose material at the bottom of the cavity.

6.4.4 Masonry wall ties

6.4.4.1 *Masonry veneer* shall be attached to wall *framing* members with Type B, EM wall ties tested to the provisions of AS/NZS 2699: Part 1 for the specific cavity width.

6.4.4.2 Materials

Wall ties shall be made from:

(a) steel with 430 g/m^2 galvanised coating (in corrosion zones 2, 3 and 4 as defined in Paragraph 2.5), or

(b) minimum Type 304 Stainless steel (in corrosion zones 1 and the sea spray zone as defined in Paragraph 2.5).

6.4.4.3 Installation

The mortar bed shall completely fill the width of the masonry unit to secure the wall tie. The mortar bed shall be pre-laid and the tie placed into the wet mortar followed by flushing of mortar over the top surface of the tie. Wall ties shall be placed within 5 degrees of a right angle to the plane of the masonry and shall slope down away from the *framing*, toward the masonry.

6.4.4.4 Embedment

Wall ties shall have an embedment length of at least half the width of the veneer, and an end cover of 15 mm.

6.4.4.5 Spacing

Wall ties shall be spaced in accordance with NZS 4210.

6.4.4.6 Fixing of wall ties

Wall ties shall be fixed to *framing* members with screws that:

(a) are self-drilling

(b) are galvanised Class 4 in accordance with AS 3566: Part 2, or minimum Type 304 stainless steel screws with stainless steel wall ties

(c) are 35 mm long

(d) have a 4.4 mm shank

(e) have 14 mm outside *diameter* washers.

6.4.5 Lintels

6.4.5.1 Openings with *masonry veneer* installed above shall be spanned by a steel angle or flat *lintel* complying with the material requirements of Paragraph 2.5.4 and sized to Table 6.4.1.

6.4.5.2 Seating

Lintels shall have a minimum seating of:

(a) 100 mm for spans up to and including 2 m

(b) 200 mm for spans over 2 m.

Table 6.4.1 **Masonry veneer lintels**
Paragraph 6.4.5.1

Maximum *lintel* span (m)	Thickness of *masonry veneer* (mm)			
	70		90	
	Maximum height of veneer supported (mm)			
	350	700	350	700
0.800	60 x 10 flat	60 x 10 flat	80 x 10 flat	80 x 10 flat
2.000	60 x 60 x 6 L	60 x 60 x 6 L	60 x 60 x 6 L	60 x 60 x 6 L
2.500	60 x 60 x 6 L	80 x 80 x 6 L	60 x 60 x 6 L	80 x 80 x 6 L
3.000	80 x 80 x 6 L	80 x 80 x 6 L	80 x 80 x 6 L	80 x 80 x 8 L
3.500	80 x 80 x 6 L	80 x 80 x 6 L	80 x 80 x 8 L	90 x 90 x 10 L
3.700	80 x 80 x 8 L	125 x 75 x 6 L	80 x 80 x 10 L	125 x 75 x 6 L

6.4.6 Window and door penetrations

6.4.6.1 Windows and doors shall be installed in accordance with Figures 6.4.2, 6.4.3 and 6.4.4

Figure 6.4.2 **Aluminium window to brick veneer – head and sill**
Paragraph 6.4.6.1

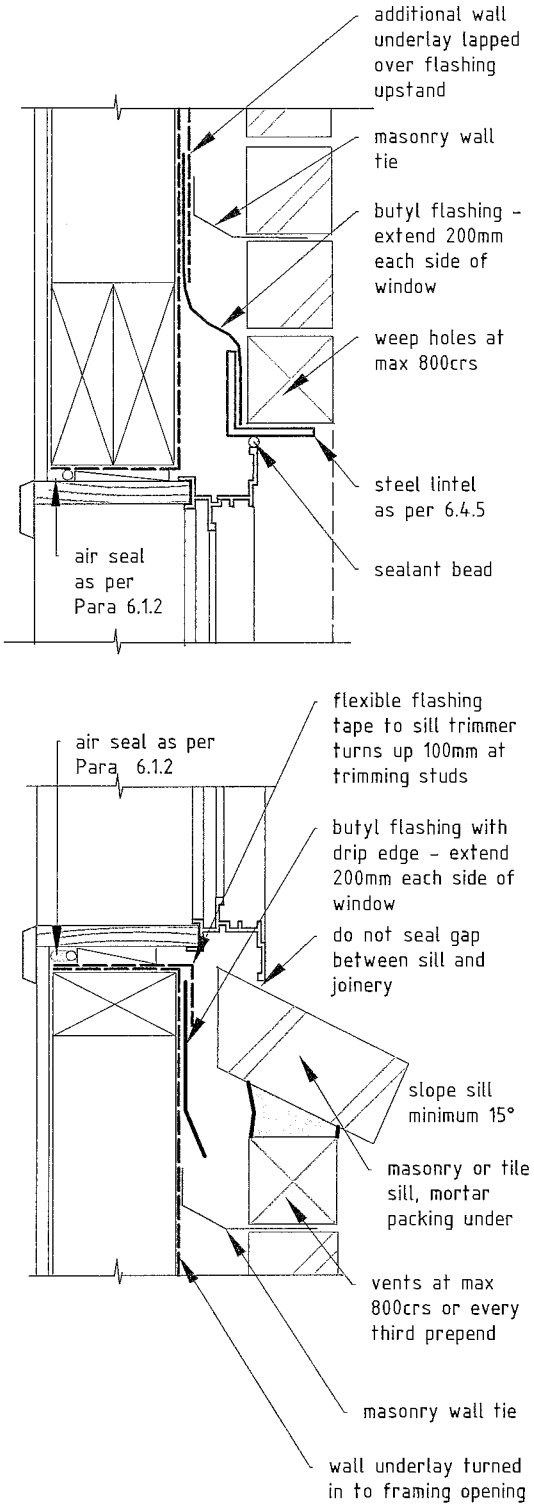
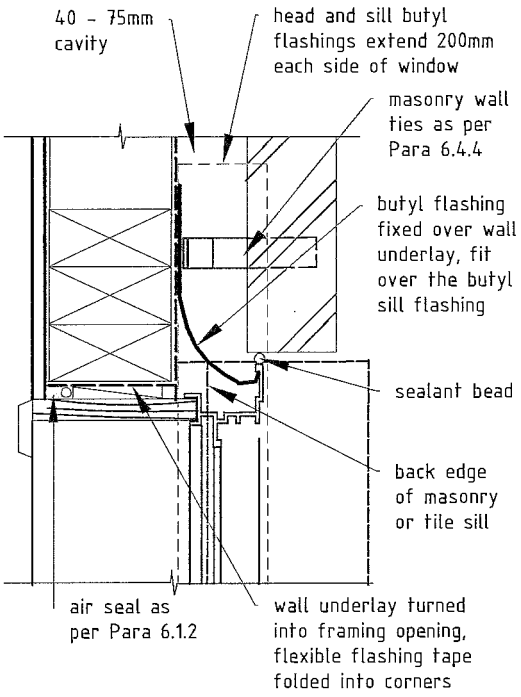
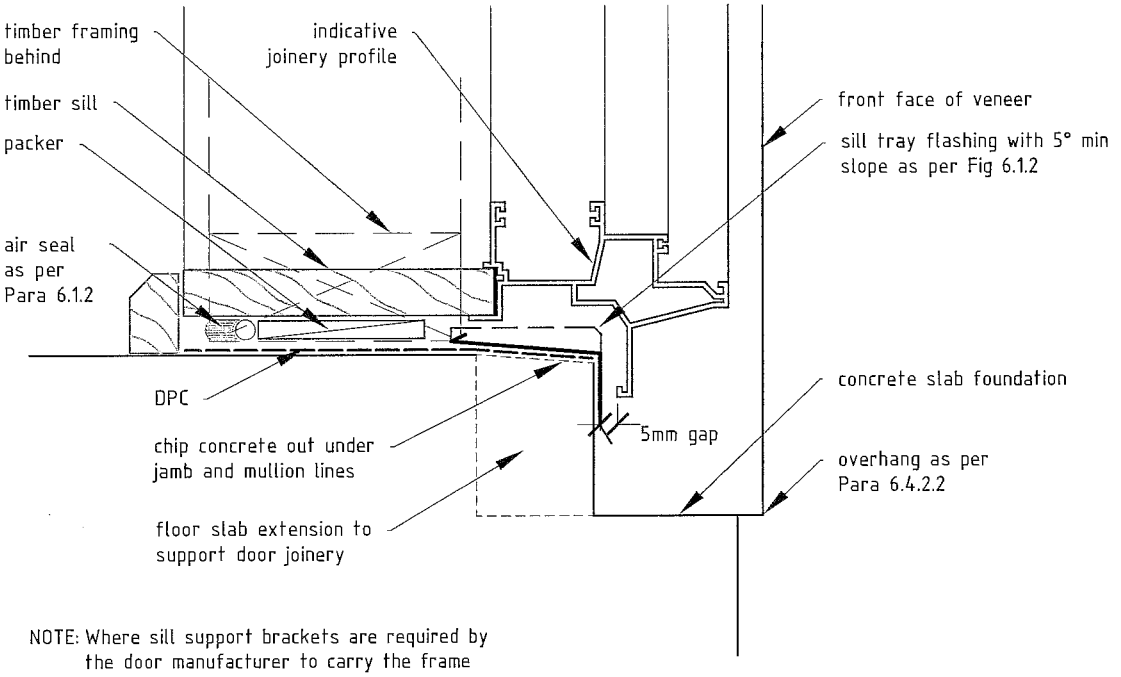


Figure 6.4.3 **Aluminium window to brick veneer – jamb**
Paragraph 6.4.6.1

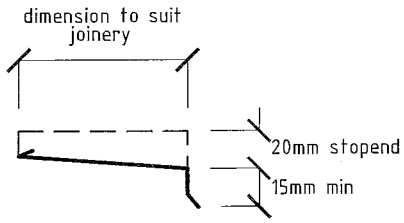


6.4.6.2 Aluminium door sills shall be installed in accordance with Figure 6.4.4

Figure 6.4.4 **Aluminium door sill**
Paragraphs 6.4.6.1, 6.4.6.2 and 6.5.9.2



NOTE: Where sill support brackets are required by the door manufacturer to carry the frame and glazing loads they must be supplied as an integral part of the door installation and installed to the door manufacturer's instructions.



FLASHING DIMENSIONS

6.5 Flat sheet claddings

CONTENTS

Figures

6.5.1 General

Refer to Paragraph 6.1 for general requirements for the installation of flat sheet (plywood and fibre-cement) wall *claddings*, including *wall underlays*, *air seals*, *flashings*, sill trays, ground clearances, etc.

6.5.2 Materials

6.5.2.1 Flat sheet wall *claddings* shall not be used as a *bracing* system and shall be limited to:

(a) plywood:

(i) in the grade, species and preservative treatment in accordance with Table 2.7

(ii) in a minimum of 5 ply, and

(iii) a minimum of 12 mm thickness,

(b) or to fibre-cement, minimum 7.5 mm thick, and complying with AS/NZS 2908: Part 2.

6.5.2.2 The grade, species and preservative treatment of cover battens, corner boards and exterior finishing timbers shall be in accordance with Table 2.7.

6.5.2.3 *Flashings* shall be selected in accordance with Paragraph 2.6.

6.5.2.4 *Fixings* shall be selected in accordance with Paragraph 2.5.

6.5.3 Limitations

This *Acceptable Solution* is limited to plywood or fibre-cement installed with:

(a) the sheets running vertically

(b) all horizontal joints flashed, and

(c) all vertical joints battened.

6.5.4 Fixings

Flat sheets shall be fixed as follows, for:

(a) plywood sheet:

(i) 40 x 2.8 mm flat head nails at 150 mm centres to edges of sheet (min 7 mm from edge) and at 300 mm centres to body of sheet, and

(ii) 65 x 3.2 mm annular grooved nails at 300 mm centres in centre of cover batten

(b) fibre-cement sheet:

(i) 40 x 2.8 mm fibre-cement nails at 150 mm centres to edges of sheet (minimum 12 mm from edge) and at 300 mm centres to body of sheet, and

(ii) 65 x 3.15 mm jolt head nails at 300 mm centres in centre of cover batten.

6.5.5 Joints

Joints in sheets shall be made over solid support and shall incorporate:

(a) for vertical joints, a 2 mm expansion gap, see Figures 6.5.1 or 6.5.2, and

(b) for horizontal joints, a 10 mm expansion gap as per Figure 6.5.3.

Comment:
Minimise the number of sheet joints to reduce the risk of leaking.

Figure 6.5.1 Vertical batten joint to plywood sheet
Paragraph 6.5.5

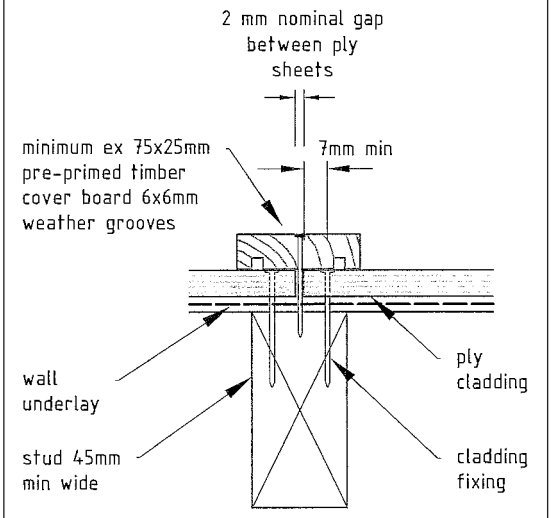


Figure 6.5.2 Vertical batten joint to fibre-cement
Paragraph 6.5.5

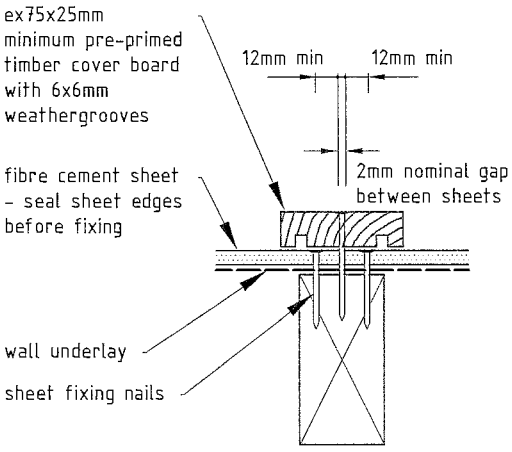
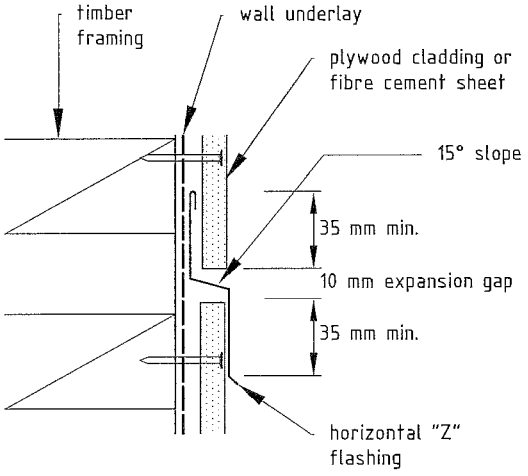


Figure 6.5.3 Horizontal joint to flat sheet claddings
Paragraph 6.5.5



6.5.6 Cover battens and cover boards

6.5.6.1 Cover battens

Timber cover battens shall be minimum ex 25 x 75 mm, and pre-primed. Sawn cover battens shall be installed with a dressed face against the *cladding*.

6.5.6.2 Corner boards

Timber corner boards shall be minimum ex 25 x 75 mm, and pre-primed.

6.5.7 Corners

6.5.7.1 External corners

External corners shall be made using cover boards in accordance with Paragraph 6.5.6.2 and Figure 6.5.4.

6.5.7.2 Internal corners

Internal corners shall be made using corner battens or trim in accordance with Figure 6.5.5.

Figure 6.5.4 **External corner**
Paragraph 6.5.7.1

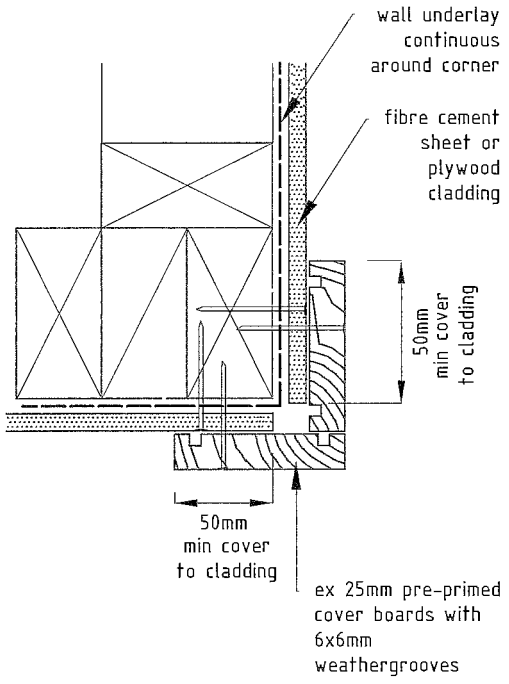
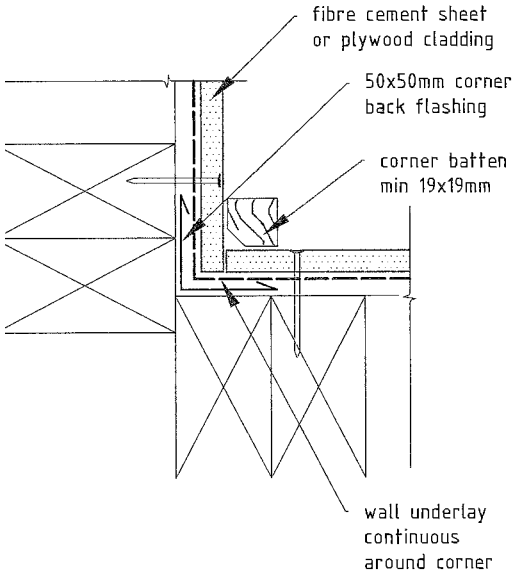


Figure 6.5.5 **Internal corner**
Paragraph 6.5.7.2

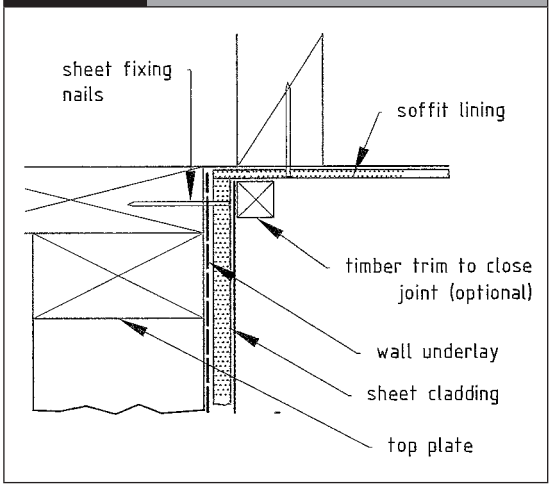


6.5.8 Soffit details

Soffits for flat sheet *claddings* shall be in accordance with Figure 6.5.6. Refer also to Paragraph 6.1.5.

Raking soffits shall have a corner *flashing* fixed behind soffit lining and over *cladding* in accordance with Figure 7.1.3.

Figure 6.5.6 **Finish at gable soffit**
Paragraphs 6.1.5 and 6.5.8



6.5.9 Windows and doors

6.5.9.1 Windows and doors shall be installed in accordance with Figures 6.5.7 and 6.2.6.

6.5.9.2 Door sills shall be installed in accordance with Figure 6.4.4.

6.5.10 Finishes

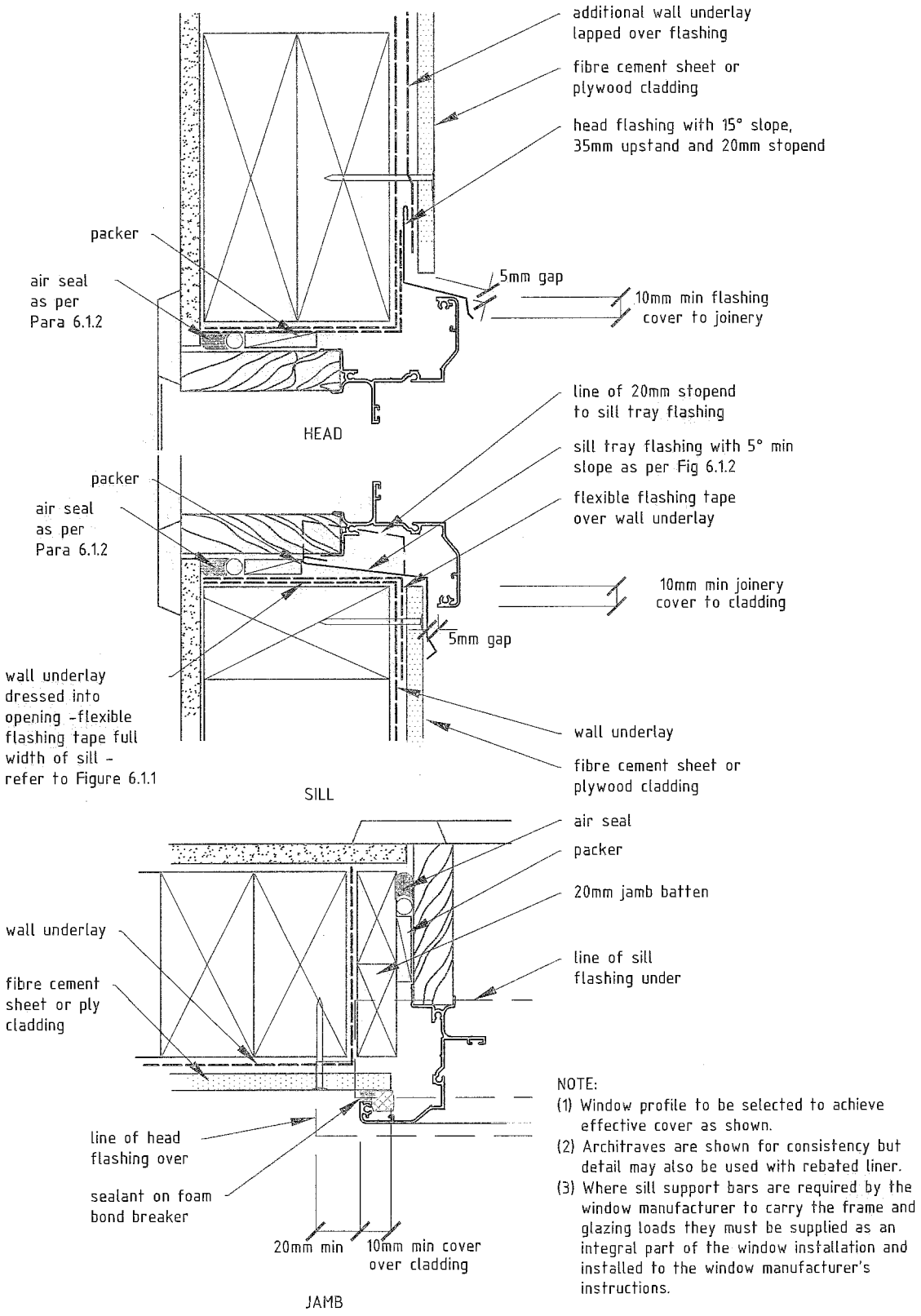
6.5.10.1 Both fibre-cement and plywood flat sheets shall be sealed on all edges prior to fixing.

6.5.10.2 Plywood shall be fully sealed on the back and finished as for timber weatherboards, in accordance with Paragraph 6.2.2.

6.5.10.3 Fibre-cement shall be fully sealed on the back and finished with a minimum two coat exterior acrylic paint system complying with AS 3730.

6.5.10.4 Cover battens, corner boards and exterior finishing timbers shall be finished as for timber weatherboards, in accordance with Paragraph 6.2.2.

Figure 6.5.7 **Window installation to flat sheet claddings**
Paragraph 6.5.9.1



6.6 Claddings junctions

CONTENTS

6.6.1 General

This section covers the horizontal and vertical junctions between the different wall *claddings* of this *Acceptable Solution* and how they shall be installed.

6.6.1.1 Refer to Paragraph 6.1 for general details and to the particular *cladding*:

(a) bevel-back weatherboard, Paragraph 6.2

(b) rusticated weatherboard, Paragraph 6.3

(c) *masonry veneer*, Paragraph 6.4

(d) flat sheet wall *claddings*, Paragraph 6.5, where a 'flat sheet' wall *cladding* may be either plywood or fibre cement.

6.6.1.2 For the wall *cladding* details to an attached garage with a steel *lintel* in accordance with Paragraph 4.5.1.5, refer to Paragraph 6.7.

6.6.1.3 *Flashings* shall be selected in accordance with Paragraph 2.6.

6.6.2 Horizontal junctions – 'Z-flashings'

For horizontal junctions between flat sheet wall *claddings*, the junction shall be installed in accordance with Figure 6.5.3.

6.6.3 Horizontal junctions – masonry veneer

Where weatherboard or flat sheet wall *cladding* is used above *masonry veneer*, the junction shall be installed in accordance with Figures 6.6.1 or 6.6.2.

Figure 6.6.1 **Horizontal junction – weatherboard or flat sheet over masonry veneer (sill brick)**
Paragraph 6.6.3

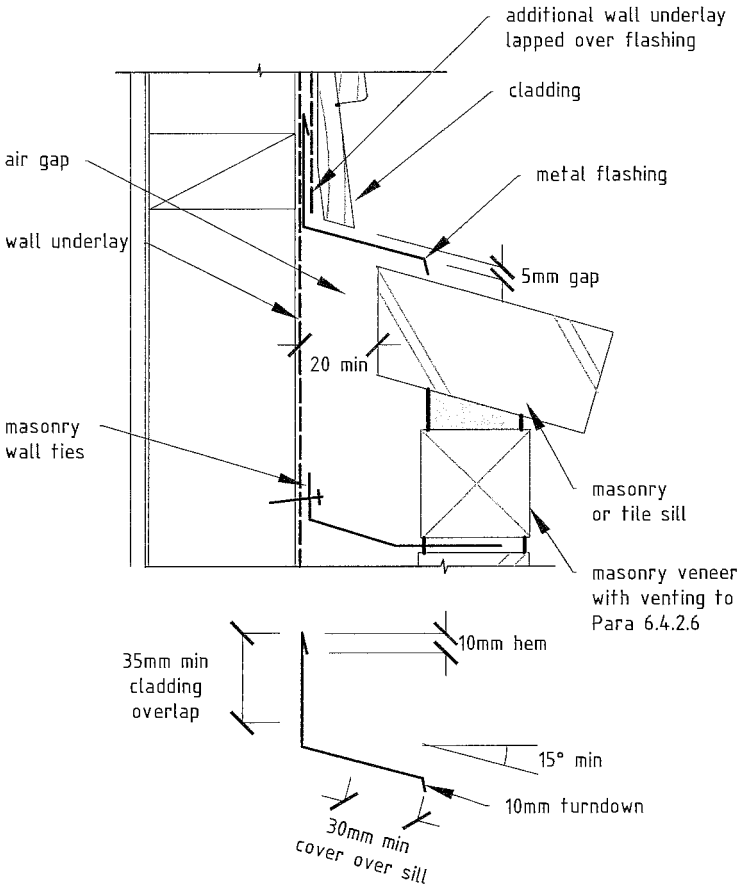
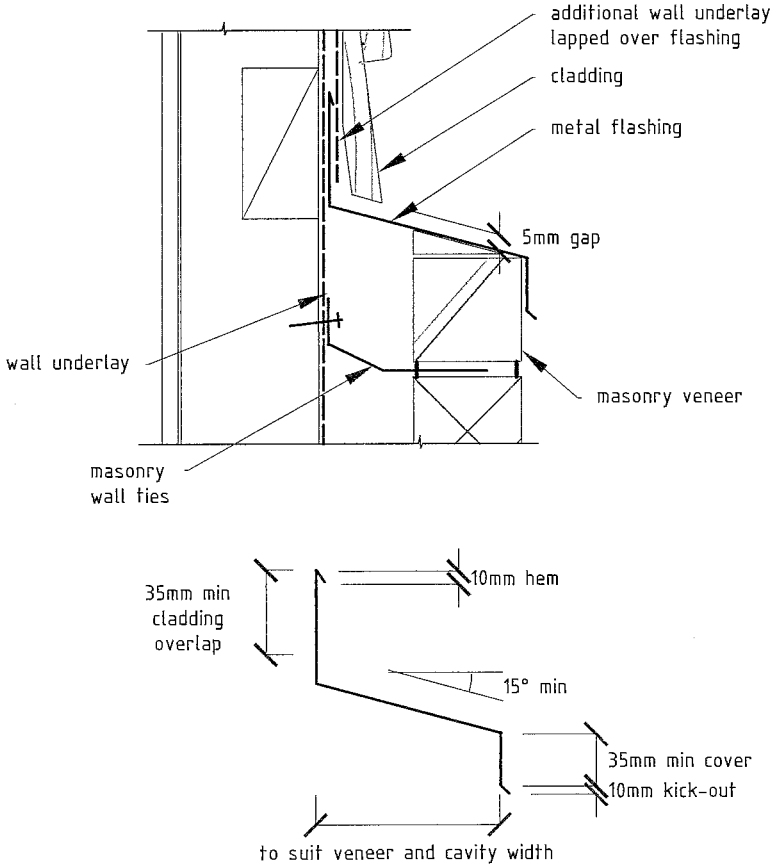


Figure 6.6.2 **Horizontal junction – weatherboard or flat sheet over masonry veneer (metal sill capping option)**
Paragraph 6.6.3



6.6.4 Vertical cladding junctions

6.6.4.1 Vertical junctions between the different *claddings* shall be installed as described in this *Acceptable Solution*.

6.6.4.2 Refer to Paragraph 6.1 for general details and for the particular vertical wall *cladding* junction:

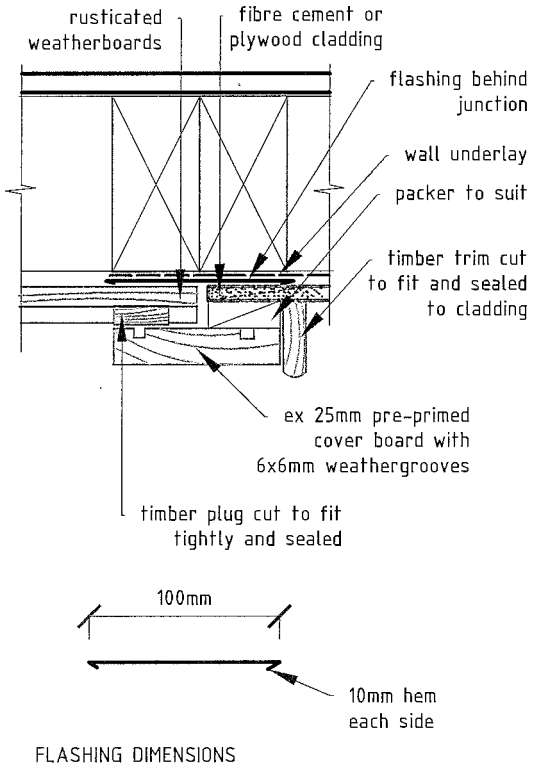
(a) rusticated weatherboard to flat sheet, refer to Figure 6.6.3

(b) bevel-back weatherboard to flat sheet, refer to Figure 6.6.4

(c) weatherboard to *masonry veneer*, refer to Figure 6.6.5

(d) flat sheet to *masonry veneer*, refer to Figure 6.6.6.

Figure 6.6.3 **Vertical junction – rusticated weatherboard to flat sheet**
Paragraph 6.6.4



FLASHING DIMENSIONS

Figure 6.6.4 **Vertical junction – bevel-back weatherboard to flat sheet**
Paragraph 6.6.4

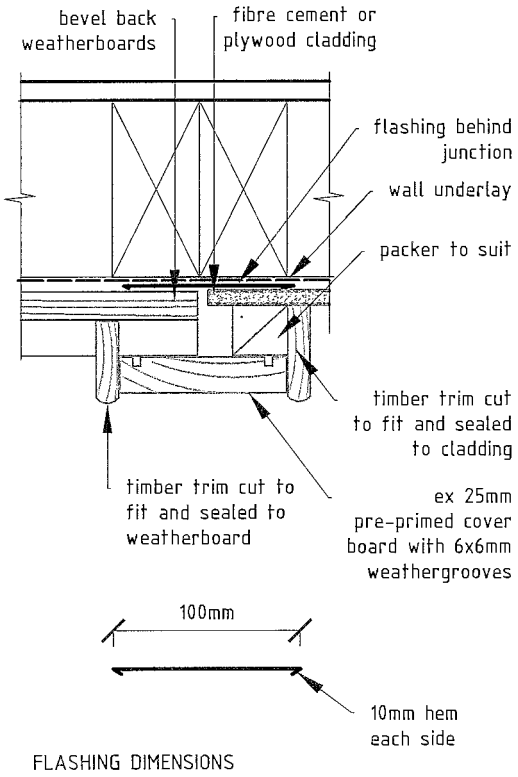
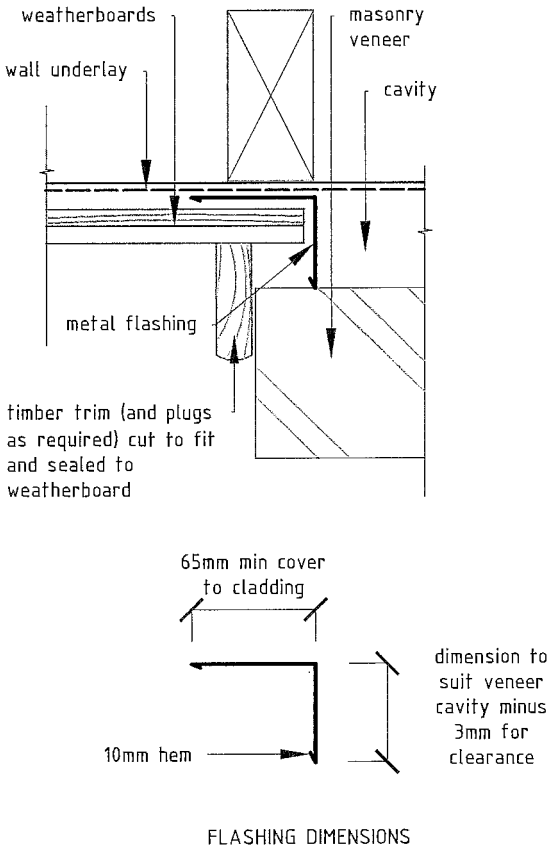
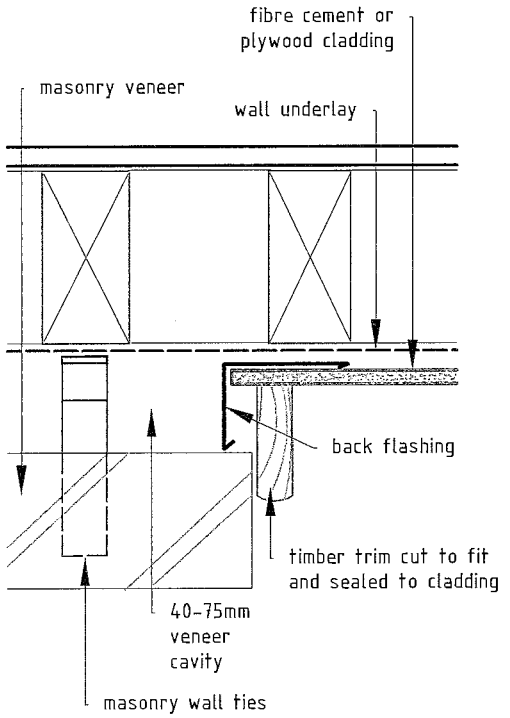


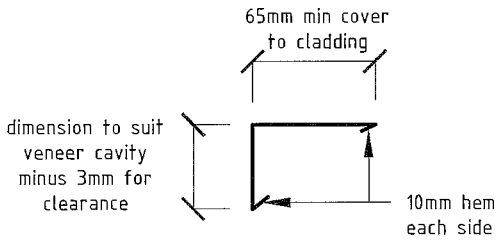
Figure 6.6.5 **Vertical junction – weatherboard to masonry veneer**
Paragraph 6.6.4



FLASHING DIMENSIONS

Figure 6.6.6 **Vertical junction – flat sheet to masonry veneer**
Paragraph 6.6.4





FLASHING DIMENSIONS

6.7 Attached garage – cladding details

CONTENTS

6.7.1 General

This section covers the wall *cladding* details for an attached garage, including those for where a steel *lintel* is used in accordance with Paragraph 4.5.1.5.

6.7.2 A garage that requires a *roof*-to-wall apron, parallel or transverse *flashing* is outside the scope of this *Acceptable Solution* for *simple houses*.

Comment
Roof elements finishing within the boundaries formed by exterior walls pose a high risk of *weathertightness* failure.

6.7.3 Refer to Paragraph 6.1 for general requirements for the installation of wall *claddings*, including *wall underlays*, *air seals, flashings*, ground clearances, etc.

6.7.4 For the details of a particular wall *cladding* in this *Acceptable Solution*, refer to:

(a) garage head for *masonry veneer*, Figure 6.7.1

(b) garage jamb for *masonry veneer*, Figure 6.7.2

(c) garage head for flat sheet wall *claddings* or weatherboards, Figure 6.7.3

(d) garage jamb for flat sheet wall *claddings* Figure 6.7.4

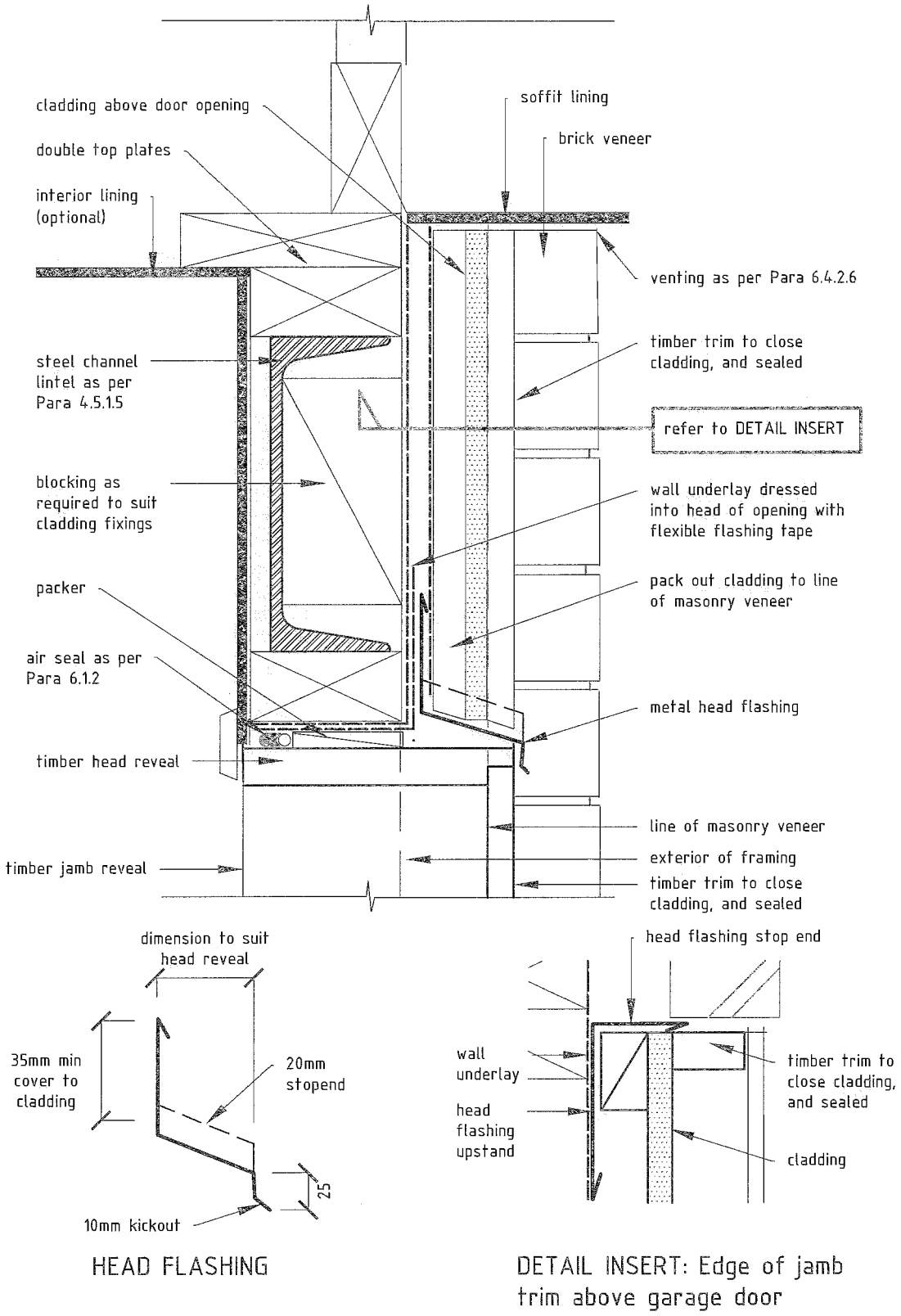
(e) garage jamb for weatherboards, Figure 6.7.5.

6.7.5 The grade, species and preservative treatment of cover boards or exterior finishing timbers shall be in accordance with Table 2.7.

The grade, species and preservative treatment of the timber jambs to any exterior joinery in an attached garage shall be in accordance with Table 2.7.

6.7.6 *Flashings* shall be selected in accordance with Paragraph 2.6.

Figure 6.7.1 **Garage head for masonry veneer with steel lintel**
Paragraph 6.7.4



NOTE: Where an attached garage is unlined, an air barrier is required as per Para 6.1.1.3

Figure 6.7.2 **Garage jamb for masonry veneer with steel lintel**
Paragraph 6.7.4

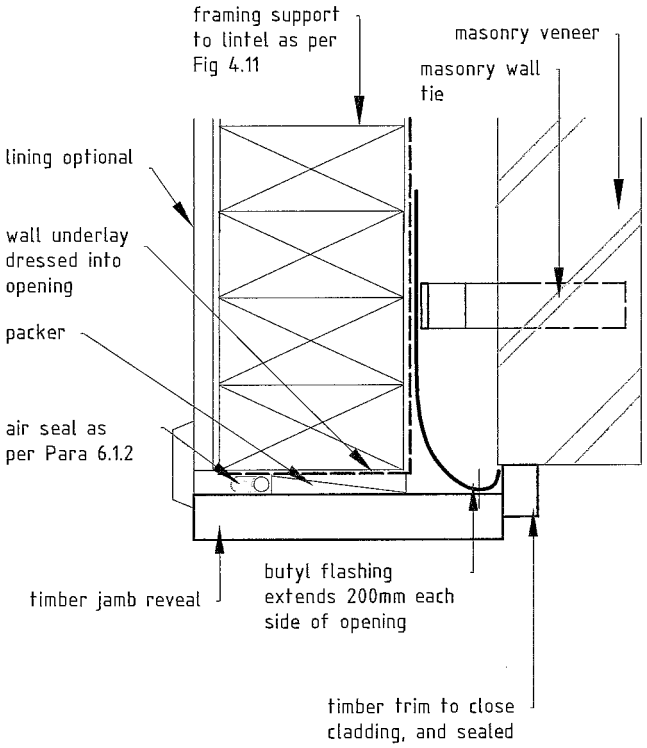
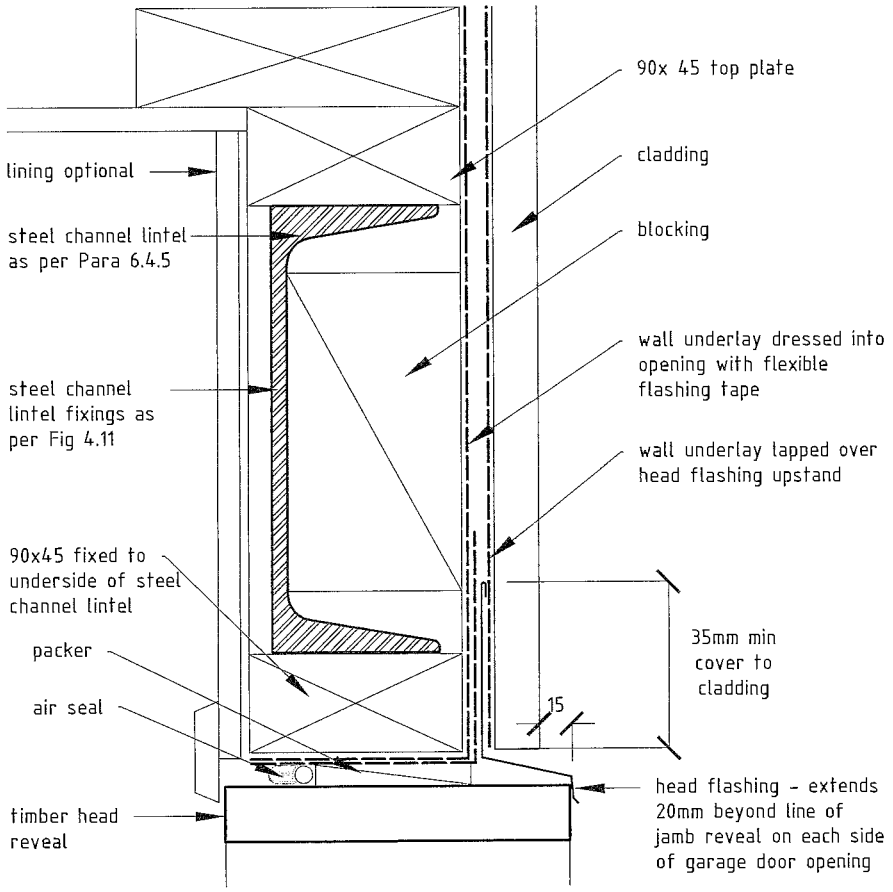
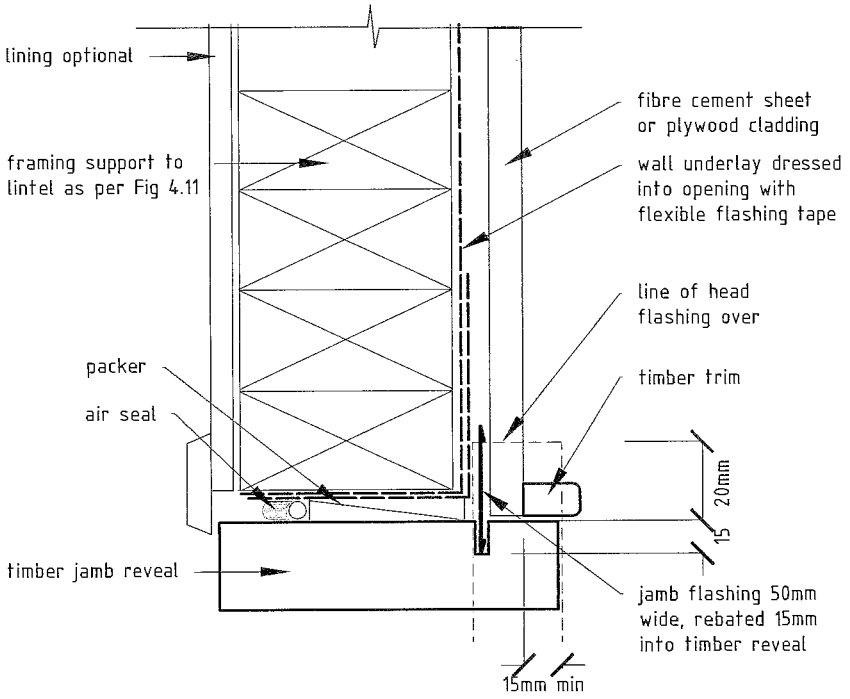


Figure 6.7.3 **Garage head for flat sheet claddings or weatherboard (with steel lintel)**
Paragraph 6.7.4



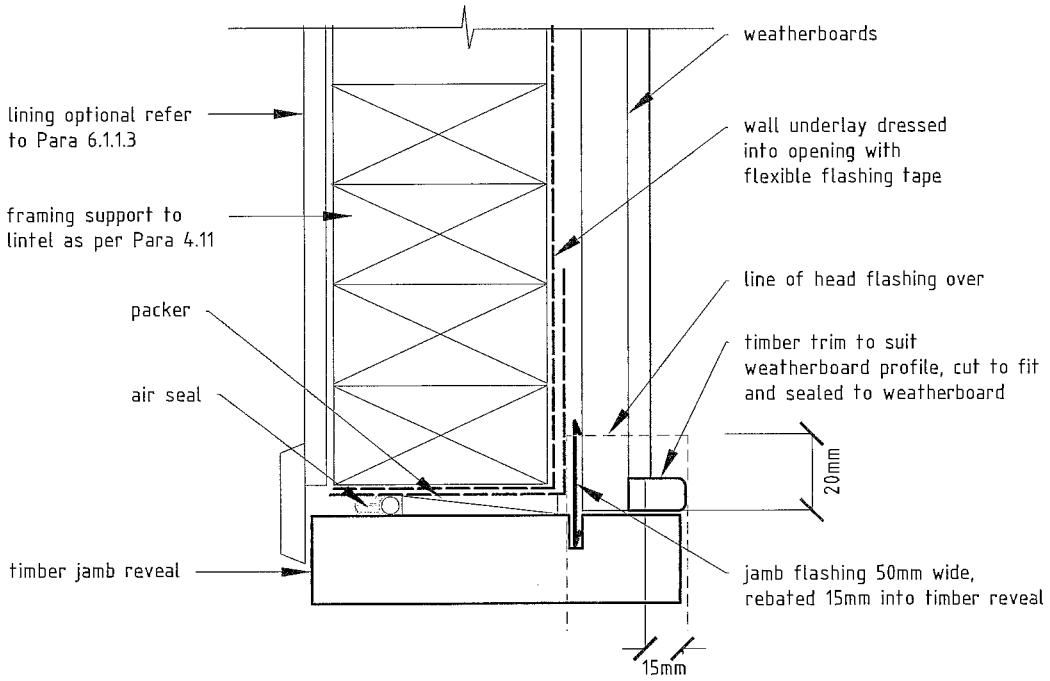
NOTE: Where an attached garage is unlined, an air barrier is required as per Para 6.1.1.3

Figure 6.7.4 **Garage jamb for flat sheet claddings (with steel lintel)**
Paragraph 6.7.4



NOTE: Where an attached garage is unlined, an air barrier is required as per Para 6.1.1.3

Figure 6.7.5 **Garage jamb for weatherboards (with steel lintel)**
Paragraph 6.7.4



NOTE: Where an attached garage is unlined, an air barrier is required as per Para 6.1.1.3

7.0 Roofing

7.1 General

CONTENTS

7.1.1 Pitch

Roof pitch shall comply with Paragraph 1.2 (j), or as modified below:

(a) for pressed metal tiles – refer to Paragraph 7.3.2

(b) for masonry tiles – refer to Paragraph 7.4.2.

7.1.2 Penetrations

7.1.2.1 *Roof* penetrations shall not interrupt *roof framing*.

7.1.3 Flashings

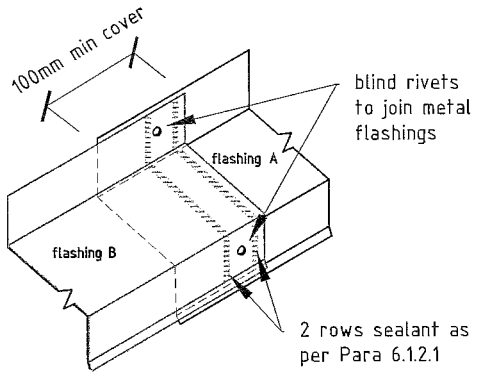
7.1.3.1 *Flashing* material shall be in accordance with Paragraph 2.6.

7.1.3.2 The roofing shall be flashed at the *roof* edges. In Very High *wind zones* (refer to Paragraph 2.2), the discharge to a gutter shall be flashed in accordance with Paragraph 7.1.4.1. All exposed *flashings*, such as barge and ridge *flashings*, are to be fixed along both edges.

7.1.3.3 Flashing joints

Metal *flashings* shall be joined using a neutral cure silicone *sealant* in conjunction with mechanical fasteners, where required in accordance with Figure 7.1.1.

Figure 7.1.1 **Flashing joints**
Paragraphs 6.1.4, 7.1.3.3 and 7.2.4.3



7.1.4 Eaves

7.1.4.1 Eaves flashings into gutter

Eaves shall be closed in and in accordance with either Figure 7.1.2 or 7.1.3.

7.1.4.2 Raking eaves flashings

Flashings to all upward raking *eaves* shall be installed in accordance with Figure 7.1.3.

Figure 7.1.2 **Eaves design**
Paragraphs 6.1.5.2 and 7.1.4

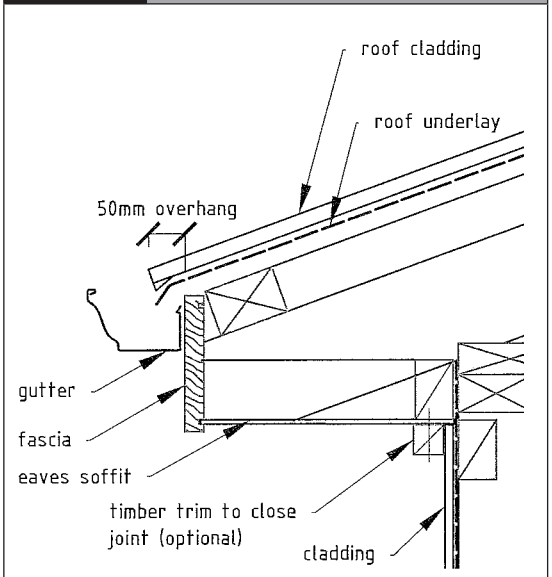
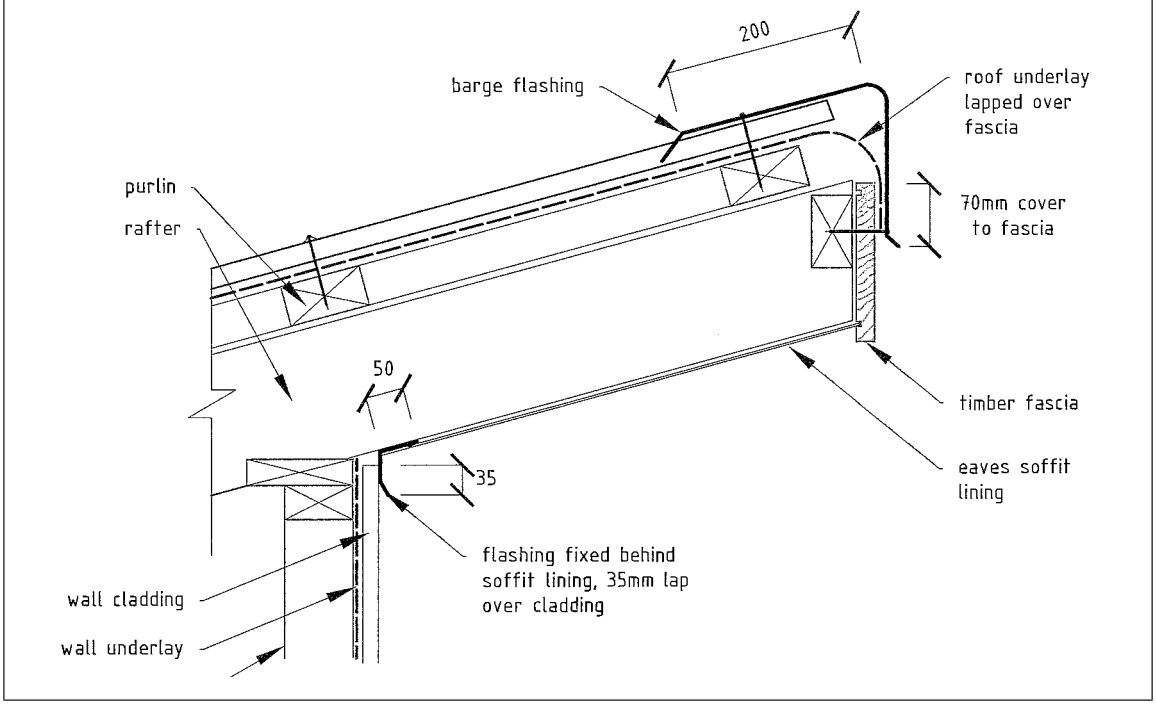


Figure 7.1.3 **Raking eaves flashings**
Paragraphs 6.1.5.2 and 7.1.4



7.1.5 Roof underlay

7.1.5.1 General

All roofing, except masonry tiles *roofs* in accordance with Table 7.4.1, shall have an absorbent, paper-based *roof underlay* that complies with NZS 2295.

7.1.5.2 Installation

Roof underlay shall be laid with minimum 150 mm laps, and either across the *roof* slope or down it. When laid across the slope, the upper sheet shall lap over the lower sheet.

7.1.5.3 Underlay support

Roof underlays shall be supported on 0.9 mm galvanised wire mesh, unless it is self-supporting in which case it shall span no more than 1.2 m in any one direction.

7.1.6 Gutters and downpipes

7.1.6.1 There shall be no internal downpipes or internal gutters.

7.1.6.2 Materials

Gutters and downpipes shall be:

(a) AZ150 Aluminium-zinc coated steel to AS 1397 factory coated to AS/NZS 2728, or

(b) ZM275 or Z450 Zinc coated steel factory coated to AS/NZS 2728, or

(c) uPVC.

7.1.6.3 *Eaves* gutters shall have a minimum of 5,000 mm^2 cross-sectional area or sized in accordance with the *Acceptable Solution* E1/AS1 for Building Code Clause E1 Surface Moisture, and designed to overflow to the exterior of the *building*.

7.1.6.4 Downpipes shall be installed to serve the *roof* areas, as in Table 7.1.1. Shapes other than round are acceptable only with a minimum dimension of 50 mm and equivalent cross-sectional area.

Table 7.1.1 Downpipe size for given roof area
Paragraph 7.1.6.4

Downpipe minimum internal size (mm)	Cross-sectional area (mm^2)	Plan area of roof served (m^2)
63 mm diameter	3110	50
74 mm diameter	4300	70
100 mm diameter	7850	130

7.1.7 Valley gutters

Valley gutters shall be constructed as shown for the applicable *roof cladding* (refer to Figures 7.2.5, 7.3.4 or 7.4.4) and be continuously supported with gutter boards of the grade, species and treatment in accordance with Table 2.7, and:

(a) have a minimum width of 250 mm

(b) serve a catchment area feeding into the *valley gutter* of no more than 25 m^2 plan area

(c) if metal, be separated from any treated timber by *roof underlay*

(d) have no fixings in the gutter bottom or sides

(e) be fixed at the upper end only, and be secured with a purpose-made clip system for the remaining length

(f) have all joints lapped and sealed in accordance with Paragraph 7.1.3.3

(g) discharge to the *eaves* gutter

(h) receive no direct discharge from downpipes or spreaders

(i) not change direction in plan.

7.2 Profiled metal roofs

CONTENTS

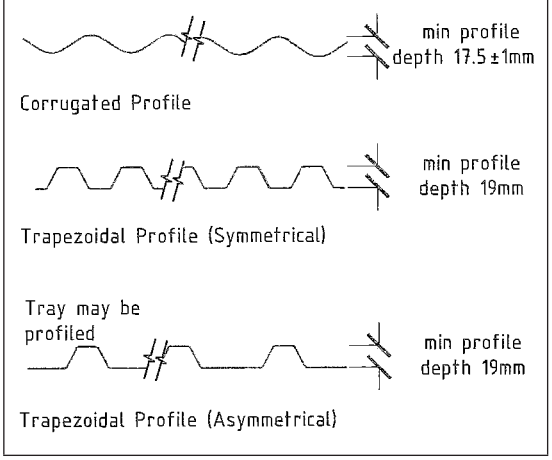
7.2.1 Profiles

Profiles shall be in accordance with Figure 7.2.1:

(a) corrugated – curved with a crest height of 17 mm minimum, or

(b) *trapezoidal* – symmetrical or asymmetrical, with a crest height between 27 and 32 mm and crest-to-crest spacing of 190 mm maximum.

Figure 7.2.1 Low-profile roofing profiles
Paragraph 7.2.1



7.2.2 Materials

7.2.2.1 Base metal thickness

Profiled metal roofing shall be made from steel with a minimum *BMT* of 0.4 mm in Grade G550, or Grade G300 for 0.55 *BMT* steel.

7.2.2.2 Protective coating

Steel shall have a minimum protective metal coating of:

(a) AZ150 Aluminium-zinc to AS 1397 with a factory-applied finish in accordance with AS/NZS 2728 Type 4, and in sea spray zone and corrosion zone 1 the factory-applied finish shall be Type 5 minimum

(b) Z450 steel zinc coated, unpainted, or ZM275 factory coated to AS/NZS 2728 Type 5 or better.

7.2.2.3 Spans

Every sheet of *roof cladding* shall:

(a) be measured between centre lines of support

(b) span at least three supports

(c) have end and internal spans in accordance with Table 7.2.1

(d) be continuous from top to bottom of the *roof* plane.

The maximum span of profiled metal *roof cladding* between *purlins* shall be as given in Table 7.2.1.

Table 7.2.1 Profiled metal roofing maximum spans
Paragraph 7.2.2.3

Type	Thickness (mm)	End span	Internal span
Corrugated			
	0.4	650	900
	0.55	900	1200
Trapezoidal			
	0.4	950	1450
	0.55	1100	1800

7.2.3 Fixings

7.2.3.1 Fixings for *trapezoidal* profiles shall be minimum 12-gauge screws which comply with Class 4 of AS 3566: Part 2.

7.2.3.2 Fixing pattern

Fixing pattern shall be in accordance with Table 7.2.2, and shall:

(a) be fixed through crests

(b) penetrate *purlins* by a minimum of 40 mm for nail fixings and 35 mm for screw fixings

(c) include sealing washers of:

(i) neoprene (having a carbon black content of 15% or less by weight)

(ii) load spreading washer and *EPDM* washer where required to allow for expansion of the profiled metal *roof cladding.*

Table 7.2.2 Fixings to profiled metal roofing
Paragraph 7.2.3.2

Profile	Ridge, hip, valley, barge, gabel and gutter line	Remainder of roof
Corrugated	Fix side laps and every second crest	Fix side laps, miss 2, hit 1, miss 2...
Trapezoidal (5 crests per sheet)	Fix every crest	Fix side laps, miss 1, hit 1... (ie, alternate)
Trapezoidal (6 crests per sheet)	Fix every crest	Fix side laps, miss 1, hit 2, miss 1...

7.2.4 Flashings

7.2.4.1 *Flashing* material shall be as required in Paragraph 2.6.

7.2.4.2 Where a turn-down to the cover *flashing* for profiled metal *claddings* is required, use:

(a) a soft edge *flashing* for corrugated profiles, or

(b) a notched turn-down with 5 mm clearance to roofing, or soft edge *flashing* for *trapezoidal* profiles.

7.2.4.3 Fixing flashings

Fix *flashings* using:

(a) to the structure – fixings as for roofing (see Paragraph 7.2.3)

(b) to other *flashings* or to roofing – 4 mm *diameter* aluminium blind rivets.

For *flashing* joints, refer to Figure 7.1.1.

7.2.4.4 Cover

Minimum *flashing* cover to profiled roofing shall be:

(a) along profile – 200 mm

(b) across profile – two ridges.

7.2.4.5 Stop ends

The top ends of roofing shall have stop ends formed by a turn-up created with a purpose-made tool.

7.2.4.6 Turn-down and discharge

At the bottom end of roofing where the *roof* discharges to a gutter, the end of the roofing shall:

(a) be turned down to form a drip-edge, and

(b) extend 50 mm past the fascia to discharge into the gutter.

7.2.4.7 Penetrations

Roof penetrations shall be flashed using an *EPDM* boot *flashing*:

(a) up to 80 mm *diameter* in accordance with Figure 7.2.2

(b) up to 500 mm *diameter* in accordance with Figure 7.2.3.

Figure 7.2.2 **Pipe penetrations up to 80 mm diameter**
Paragraphs 7.2.4.7 and 7.3.5

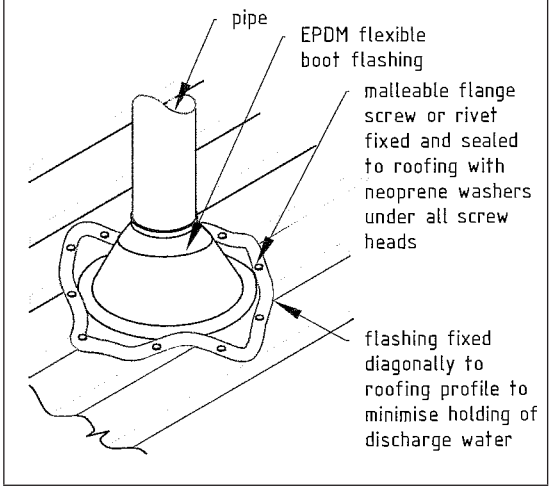
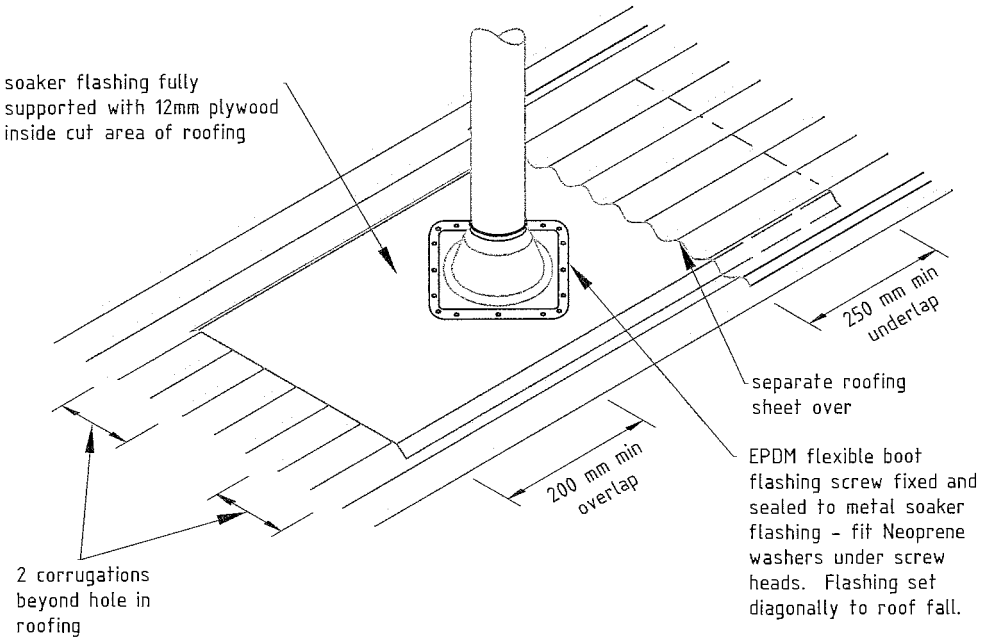


Figure 7.2.3 **Pipe penetrations up to 500 mm diameter**
Paragraphs 7.2.4.7 and 7.3.5



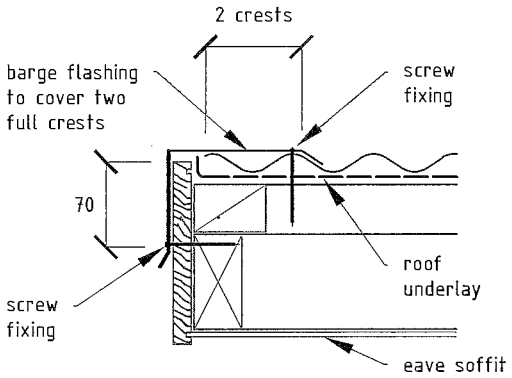
7.2.4.8 Ridge flashing

A purpose-made ridge *flashing* with soft edge or profiled turn-downs providing a minimum 200 mm cover to roofing shall be fitted to ridges and hips.

7.2.4.9 Barge flashings

Barge *flashings* shall be dimensioned in accordance with Figure 7.2.4.

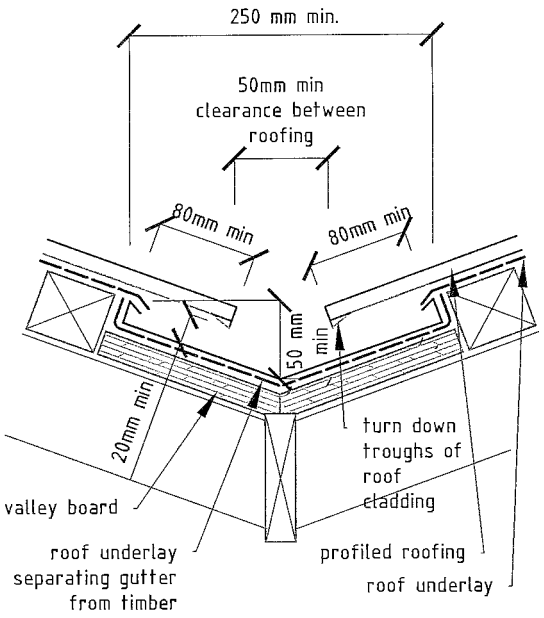
Figure 7.2.4 **Barge flashings**
Paragraph 7.2.4.9



7.2.4.10 Valley gutters

Valley gutters shall be in accordance with Paragraph 7.1.7 and dimensioned to Figure 7.2.5.

Figure 7.2.5 **Valley gutter**
Paragraphs 7.1.7 and 7.2.4.10



7.3 Pressed metal tiles

CONTENTS

7.3.1 Materials

Metal tiles shall be manufactured with a steel base metal to meet the requirements of NZS 4217 and shall:

(a) have a minimum *BMT* of 0.39 mm

(b) be grade G300

(c) have applied protective metallic coating of:

(i) aluminium-zinc AZ 150 to AS 1397, or

(ii) zinc ZM275 to AS 1397, and

(d) have a factory-applied finish complying with AS/NZS 2728 Type 4 minimum.

Comment
Additional protective and decorative coatings such as factory-painted or bonded resin and chip finish and a clear over coating may be applied.

7.3.2 Pitch

The minimum *roof* pitches for metal tiles shall be:

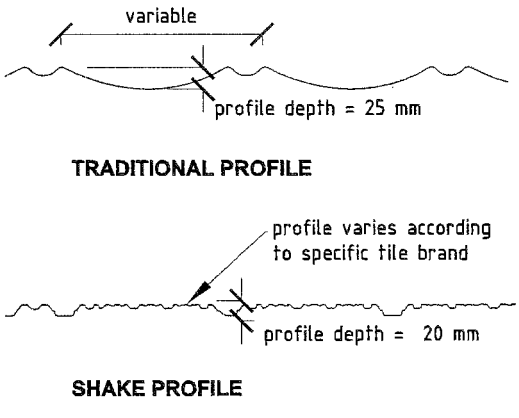
(a) 12° for profiles resembling traditional profiles, or

(b) 15° for profiles resembling shake profiles.

7.3.3 Profiles

Pressed metal tile profiles shall be in accordance with Figure 7.3.1.

Figure 7.3.1 Profiles for pressed metal tiles
Paragraph 7.3.3



7.3.4 Fixings

Pressed metal tiles shall be fixed in accordance with Figure 7.3.2, with:

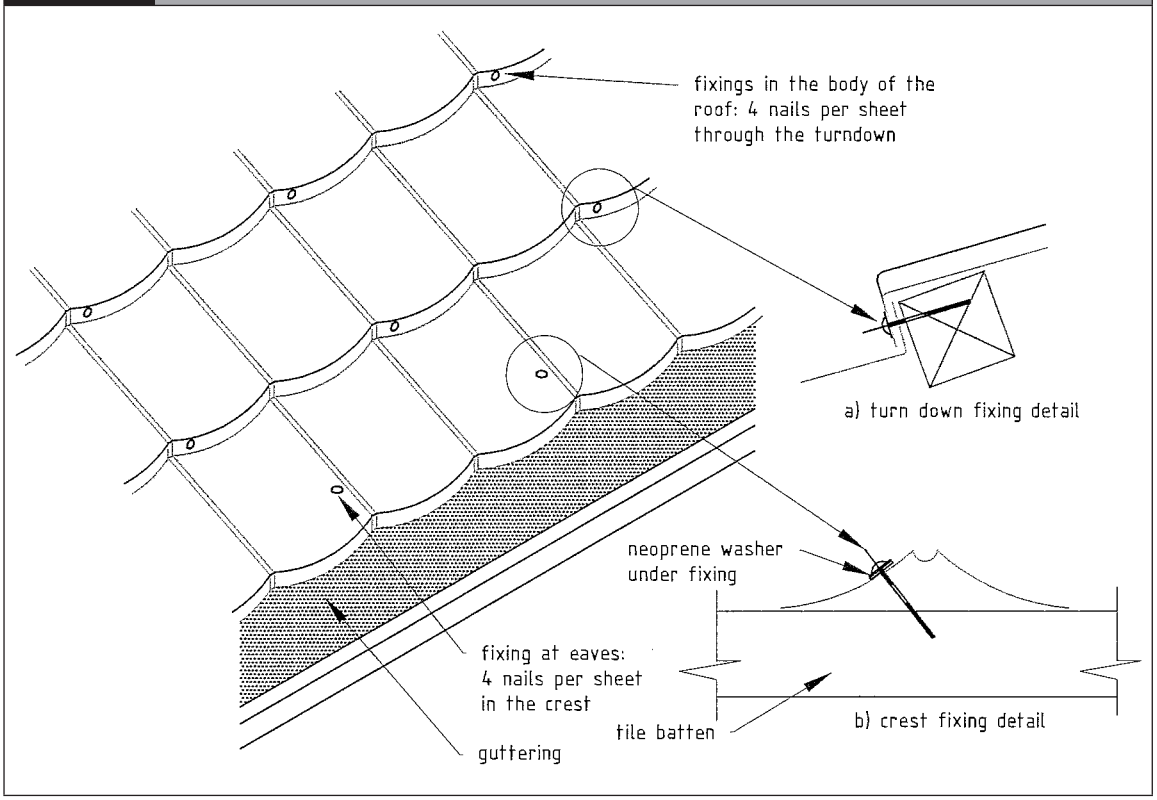
(a) 50 x 2.8 mm hot-dipped galvanised painted flat-head annular-grooved nails (or Type 304 stainless steel for sea spray zone or corrosion zone 1). For fixings through the top of the tiles, use neoprene washers containing no more than 15% by weight carbon black content, and with

(b) four fixings per sheet through:

(i) the turn-down of the tiles for the body of the *roof*, and

(ii) the top of the profile slope for sheets at the *eaves*, avoiding the weather channel of the tiles.

Figure 7.3.2 **Fixings to pressed metal tiles**
Paragraph 7.3.4



7.3.5 Penetrations

Penetrations for pipes shall be limited to 500 mm in *diameter* and shall be flashed using *EPDM* or silicone rubber boot *flashings* in accordance with Figures 7.2.2 and 7.2.3.

7.3.6 Flashings

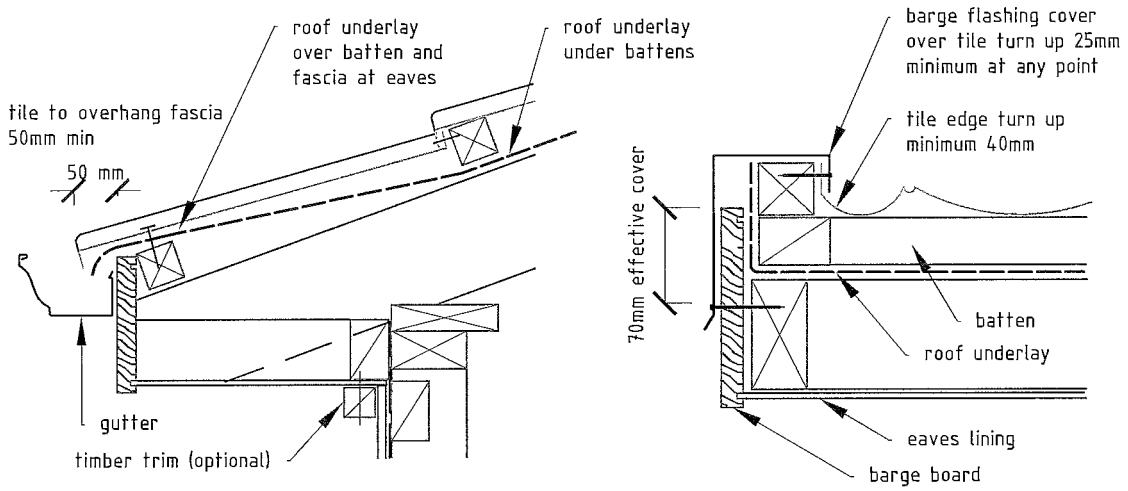
7.3.6.1 General

Flashings shall be purpose-made using the same material as the roofing being flashed.

7.3.6.2 Eaves and barge

Eaves and barges shall be in accordance with Figure 7.3.3. Refer also to Paragraph 7.1.4.

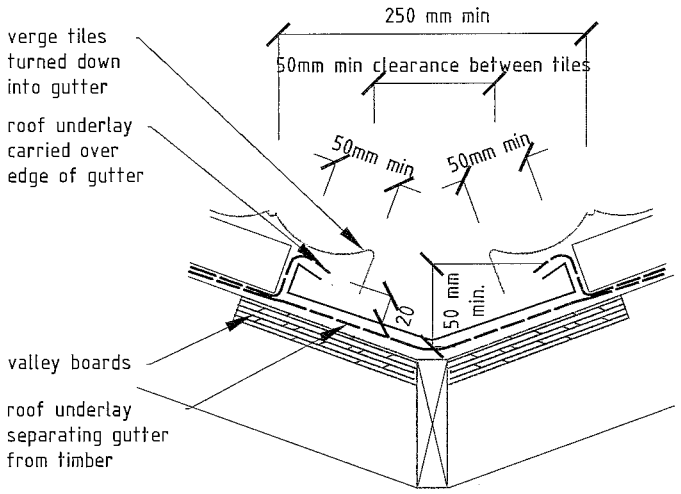
Figure 7.3.3 **Eaves finish and barge flashing**
Paragraphs 6.1.5 and 7.3.6.2



7.3.6.3 Valley gutters

Valley gutters shall be to the dimensions given in Figure 7.3.4.

Figure 7.3.4 **Valley gutters**
Paragraphs 7.1.1 and 7.3.6.3



7.4 Masonry tiles

CONTENTS

7.4.1 Materials

7.4.1.1 Masonry tiles shall have a mass not exceeding 60 kg/m^2, and:

(a) concrete tiles shall meet the requirements of NZS 4206

(b) clay tiles shall meet the requirements of AS 2049.

7.4.1.2 Tile profiles

For the purposes of this Paragraph 7.4, tiles shall be divided into three types:

(a) Type I: double profile tiles having two distinct watercourses and with a minimum watercourse depth of 18 mm

(b) Type II: single profile tiles having one watercourse, with a minimum of 25 mm in height, or

(c) Type III: tiles not fitting the Type I and Type II categories, and including flat tiles and those resembling slates, shakes and shingles.

7.4.2 Installation

7.4.2.1 Masonry tile *roof cladding* shall be installed in accordance with NZS 4206 onto battens, except the minimum pitch and *roof underlay* where required shall be in accordance with Table 7.4.1.

Table 7.4.1 Minimum pitches for masonry tiles
Paragraphs 7.1.5.1, 7.4.1 and 7.4.2

Tile Material	Profile type	With underlay	Without underlay
Concrete tiles	Type I	15°	20°
	Type II	20°	Not allowed
	Type III	25°	Not allowed
Clay tiles	Type I	20°	25°
	Type II	20°	Not allowed
	Type III	25°	Not allowed

7.4.3 Flashings and fixings

Materials for *flashings*, gutters and fixings shall be in accordance with Paragraphs 2.6 and 7.1.3 and be compatible with mortar and bedding.

7.4.4 Anti-ponding boards

Anti-ponding boards shall be installed where a roofing underlay is required (refer to Figure 7.4.3). Where *anti-ponding boards* are used, these shall be set to a minimum fall of 5°, and shall be 9 mm plywood of the grade, species and treatment in accordance with Table 2.7.

7.4.5 Details and flashings

Hips, ridges, valleys and barges shall be made *weathertight* by installing *flashings* and seals in accordance with Figures 7.4.1 to 7.4.5.

Figure 7.4.1 **Masonry tile – ridge**
Paragraph 7.4.5

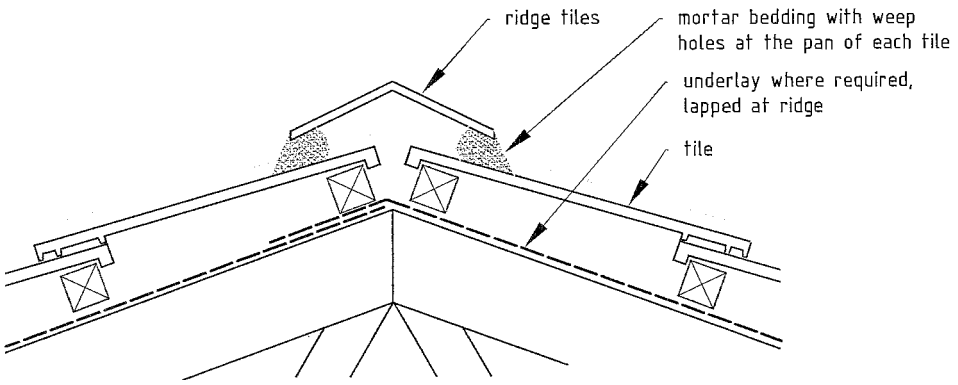


Figure 7.4.2 **Masonry tile – barge**
Paragraph 7.4.5

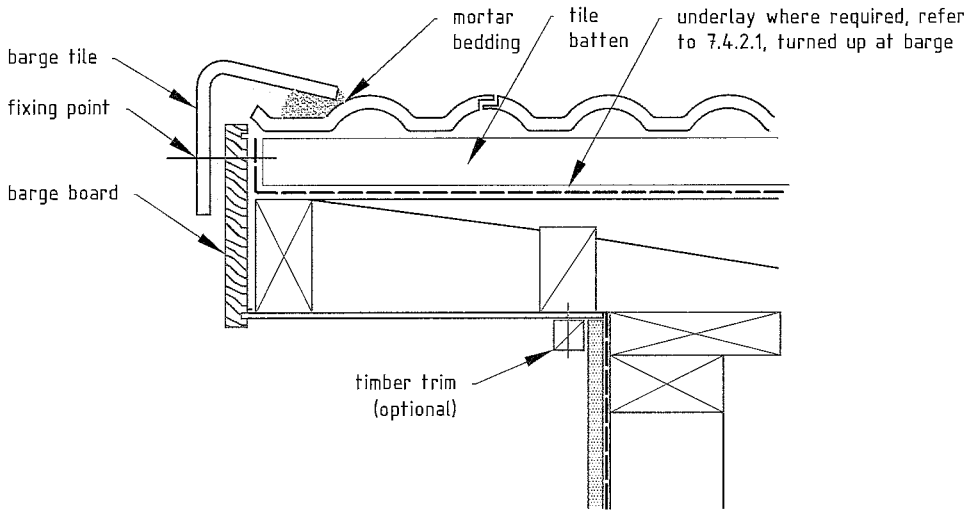


Figure 7.4.3 **Masonry tile – eaves**
Paragraphs 7.4.4 and 7.4.5

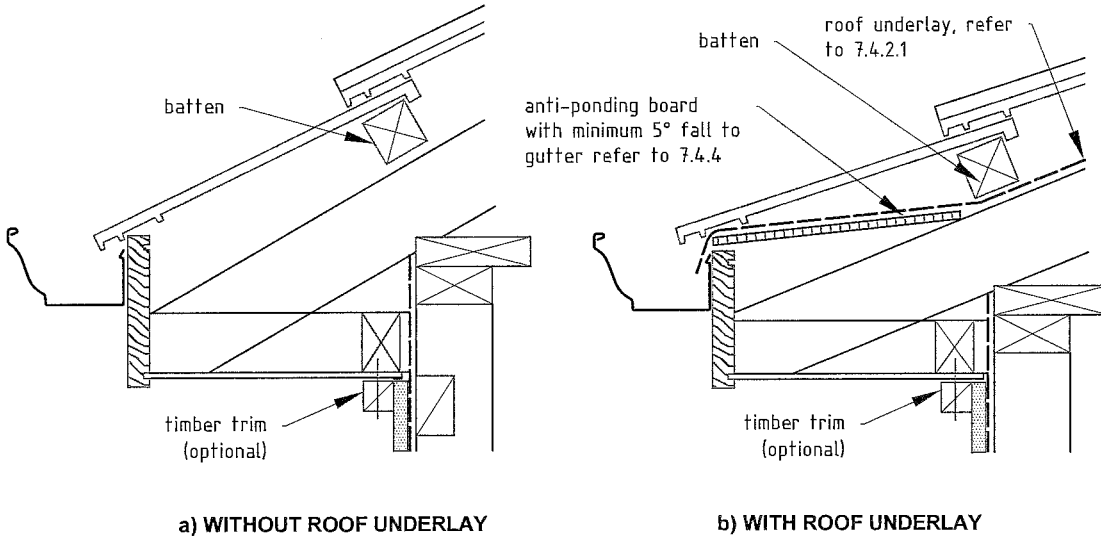
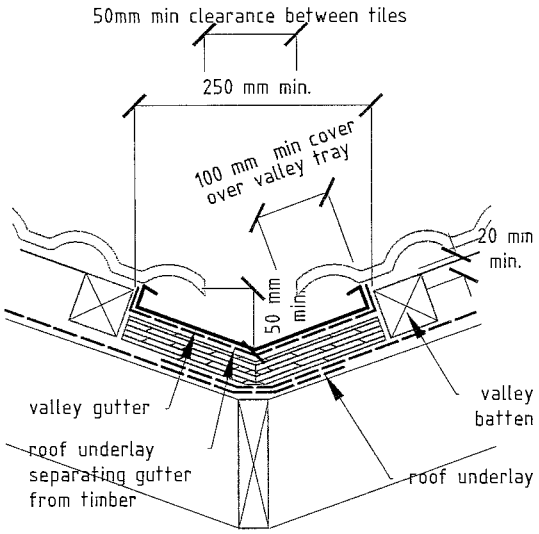


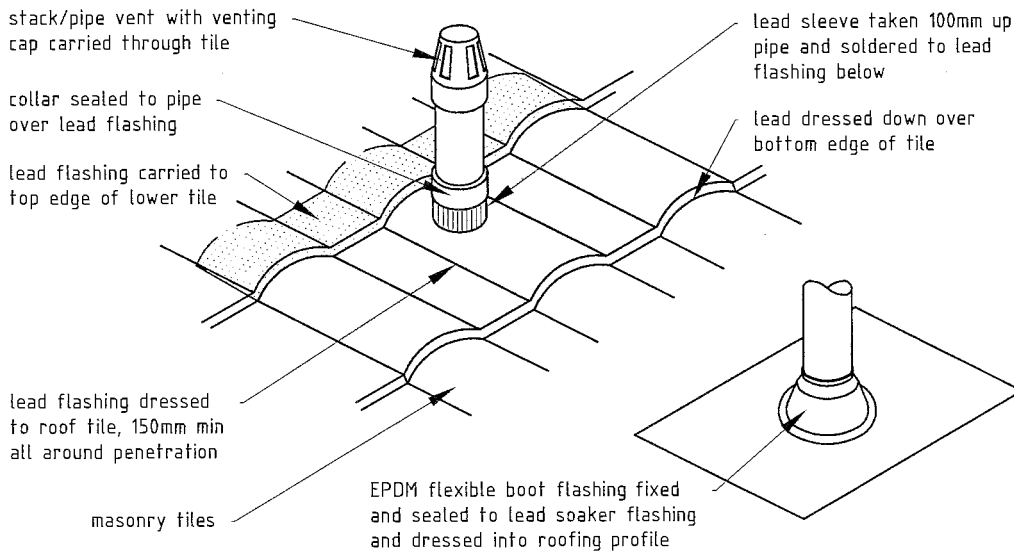
Figure 7.4.4 **Masonry tile – valley gutter**
Paragraphs 7.1.1 and 7.4.5



7.4.6 Penetrations

Penetrations for pipes shall be limited to 500 mm in *diameter* and shall be flashed using *EPDM* or silicone rubber boot *flashings* in accordance with Figure 7.4.5.

Figure 7.4.5 **Masonry tile – pipe penetration**
Paragraphs 7.4.5 and 7.4.6



8.0 Services

CONTENTS

8.1 Electrical

8.1.1 All electrical installations shall:

(a) comply with AS/NZS 3000, (known as the Australian/New Zealand Wiring Rules)

(b) be installed by a registered electrician.

8.1.2 An *energy work certificate* shall be supplied to the *BCA* and/or owner by the electrician at completion of all electrical work.

8.1.3 Power outlet sockets and light switches shall be fitted between 500 mm and 1.2 m from finished floor level (1.0 m recommended for all light switches) and a minimum of 500 mm from any corner.

8.1.4 Isolating switches to ovens and hob units shall not be mounted directly above the appliance.

8.2 Gas

8.2.1 The design and installation of a gas system shall:

(a) comply with NZS 5261, and

(b) be installed by a person authorised under the Plumbers, Gasfitters and Drainlayers Act.

8.3 Water supply

8.3.1 Scope

A cold water supply shall be installed and reticulated to:

(a) sinks

(b) tubs

(c) basins

(d) showers

(e) baths

(f) hot water heaters

(g) exterior hose taps

(h) other *sanitary fixtures* or *appliances* as required by the owner.

8.3.2 Installation

All pipework and fittings for the reticulation of water shall:

(a) comply with AS/NZS 3500.5 Section 2, and

(b) be installed by a person authorised under the Plumbers, Gasfitters and Drainlayers Act.

8.3.3 Connection

The house shall be connected to a water supply that complies with:

(a) Drinking Water Standards for New Zealand 2005, Ministry of Health, or

(b) Household Water Supplies: the selection, operation and maintenance of individual household water supplies, Ministry of Health (revised April 2006).

8.4 Hot water

8.4.1 Scope

A hot water supply shall be installed and reticulated to:

(a) kitchen sinks

(b) laundry tubs

(c) basins

(d) showers

(e) baths

(f) other *sanitary fixtures* and *appliances* as required by the owner.

8.4.2 Hot water heaters

Hot water heaters shall be installed in accordance with AS/NZS 3500.5 Section 3, and may be:

(a) electric mains or low pressure storage water heater complying with NZS 4606, or

(b) gas mains or low pressure storage water heater complying with NZS 5262 and NZS 4606, or

(c) gas instantaneous water heater complying with NZS 5262 or electric instantaneous water heater complying with AS/NZS 3350.2, or

(d) integrated heat pump storage water heater complying with AS/NZS 2712, or

(e) solar water heater complying with AS/NZS 2712.

8.4.3 Hot water temperatures

8.4.3.1 To prevent the growth of Legionella bacteria:

(a) storage water heaters shall have a thermostat set to store the water at a temperature of no less than 60°C, and

(b) solar hot water systems shall comply with G12/AS2 Paragraph 3.5.

8.4.3.2 The maximum water temperature delivered from the outlets of showers, baths, basins and other personal hygiene fixtures shall not exceed 55° C.

8.4.3.3 Installing a tempering valve complying with AS 1357.2 between the water heater and the outlet of personal hygiene outlets is an acceptable method of limiting the water temperature to not exceed 55° C.

8.4.4 Water supply

The water heater shall be supplied from the cold water supply.

8.5 Surface water

8.5.1 Scope

This *Acceptable Solution* provides for the collection of surface water by means of the gutters and downpipes and disposal by means of a drain to an *outfall*.

8.5.2 Installation

The *simple house* rainwater collection systems of gutters and downpipes shall comply with Paragraph 7.1.6 of this *Acceptable Solution*.

8.5.3 Connection to outfall

The *simple house* shall be connected to a piped surface water system complying with the provisions of *Acceptable Solution* E1/AS1. Where the *outfall* is owned by a *network utility operator*, the connection shall be in a manner acceptable to it.

8.6 Sanitary plumbing and drainage

8.6.1 Scope

This paragraph for sanitary plumbing and drainage covers the reticulation of *foul water* from all *sanitary fixtures* and *appliances* to a *gully trap* or *drain* and the site reticulation drainage system for *foul water* discharging to an *outfall*. Installations shall comply with this *Acceptable Solution*, or shall be in accordance with AS/NZS 3500.5 Section 4.

8.6.2 Materials

Materials for sanitary plumbing pipes, traps, valves and fittings shall be:

(a) air *admittance valves* in accordance with AS/NZS 4936

(b) PVC pipe and fittings in accordance with AS/NZS 1260.

8.6.3 Water traps

8.6.3.1 Discharges from *sanitary fixtures* and *sanitary appliances* shall have a *water trap* to prevent *foul air* from the plumbing system entering the *simple house*.

8.6.3.2 *Water traps* shall be:

(a) removable

(b) able to be dismantled.

8.6.3.3 Under normal operating conditions, *water traps* shall retain a *water seal* depth of not less than 65 mm, plus or minus 10 mm.

8.6.3.4 The *diameter* of a *water trap* and the *discharge pipe* shall be not less than that given in Table 8.1.

Table 8.1 **Fixture discharge pipe sizes**
Paragraphs 8.6.3.4 and 8.6.6.2

Sanitary fixture or *appliance*	Minimum trap and discharge pipe *diameter* (mm)	Minimum pipe gradient
Basin	32	1:20
Bath (with or without shower)	40	1:40
Floor waste gully	65	1:40
Clothes washing machine	40	1:40
Dishwashing machine	40	1:40
Kitchen sink (including waste disposal unit)	40	1:40
Combined discharge from kitchen sink and dishwasher	40 50	1:20 1:40
Laundry tub (with or without clothes washing machine)	40	1:30
Shower	40	1:40
Water closet pan	100	1:60

8.6.4 Fixture discharge pipes

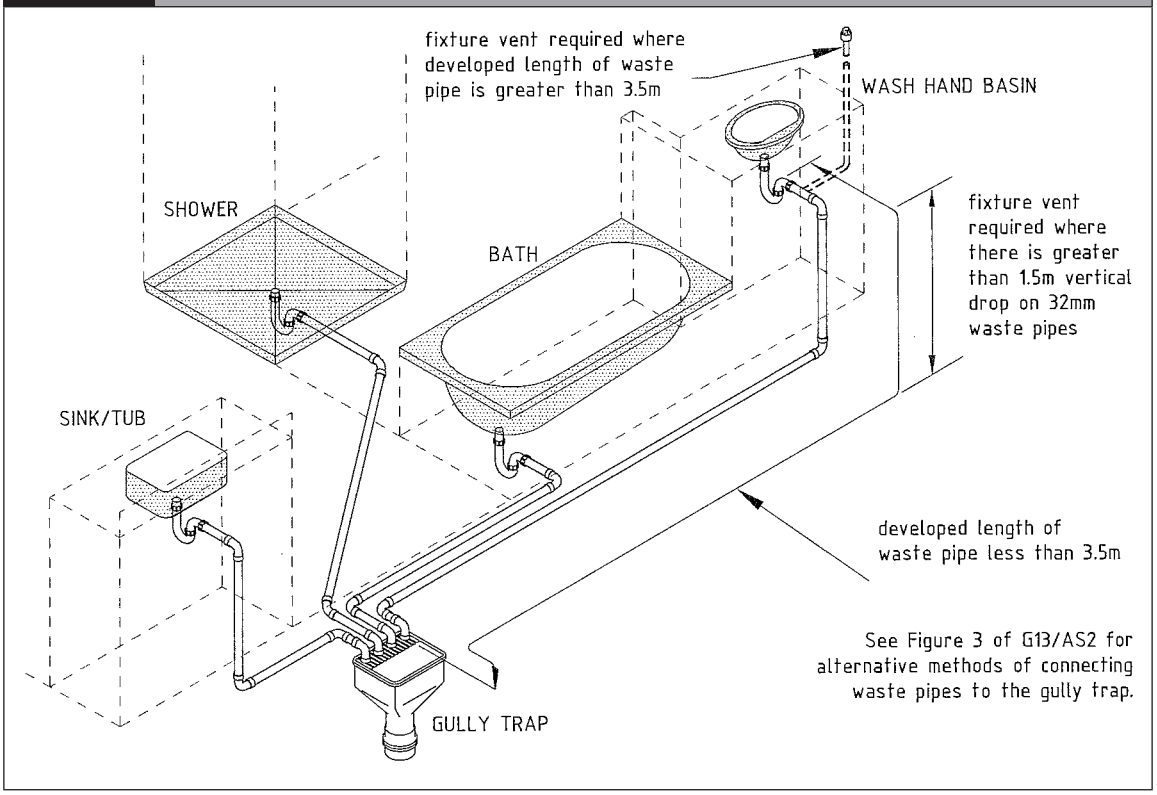
8.6.4.1 *Foul water fixture discharge pipes* shall separately discharge either to:

(a) a *gully trap* in accordance with Paragraph 8.6.5 and Figure 8.1, or

(b) a *floor waste gully* in accordance with Paragraph 8.6.6 and Figure 8.2, or

(c) the *drain* if it is a *floor waste gully* in a minimum size 65 mm *diameter* pipe.

Figure 8.1 **Waste pipes discharging to a gully trap**
Paragraphs 8.6.4.1 and 8.6.4.2



8.6.4.2 *Foul water discharge pipes* shall be vented by a *fixture* vent or *air admittance valve*:

(a) where their length is more than 3.5 m, or

(b) where the height from the fixture trap *water seal* to the *gully trap water seal* is 1.5 m or greater, with 32 mm *diameter* waste pipes.

8.6.5 Gully traps

8.6.5.1 All *gully traps* shall be constructed and installed to prevent the ingress of surface water and foreign bodies likely to cause a blockage, shall be located within the legal boundary of the land on which the *simple house* is erected, and shall have:

(a) the overflow level of the gully dish no less than:

  (i) 25 mm above paved surfaces, or

  (ii) 100 mm above unpaved surfaces

(b) a grating that will allow surcharge

(c) a minimum outlet pipe *diameter* of 100 mm

(d) a *water seal* depth of at least 65 mm

(e) at least one *discharge pipe* discharging to the *gully trap* to avoid *water seal* evaporation

(f) *waste pipes* that discharge to the *gully trap* arranged to permit easy cleaning of the *gully trap*

(g) *waste pipe* outlets located at least 20 mm above *water seal* level and at least 20 mm below the grating

(h) the top of the *water seal* no more than 600 mm below the top of the gully dish

(i) *adequate* support from bedding and backfilling with concrete no less than 75 mm thick surrounding the entire gully dish and which is separated from the *simple house foundation*

(j) a minimum of 600 mm clear access space above the gully dish.

8.6.5.2 In order to provide overflow relief for the drainage system, there shall be at least one *gully trap* which shall be:

(a) positioned so that the top of the gully dish is no less than 150 mm below the overflow level of the lowest *sanitary appliance* or *fixture* served by the drainage system

(b) located in a visible position

(c) installed so that surcharge cannot enter into or under *buildings*.

8.6.6 Floor waste gully

8.6.6.1 For the purposes of this *Acceptable Solution, floor waste gullies* shall be deemed to be a *fixture* trap.

8.6.6.2 Connection of fixtures

The following *fixtures*, contained within the same room, may discharge to a *floor waste gully*:

(a) basin

(b) bath, shower/bath

(c) shower.

Waste pipes connecting to a *floor waste gully* shall be sized in accordance with Table 8.1.

8.6.6.3 Waste pipes discharging to a floor waste gully

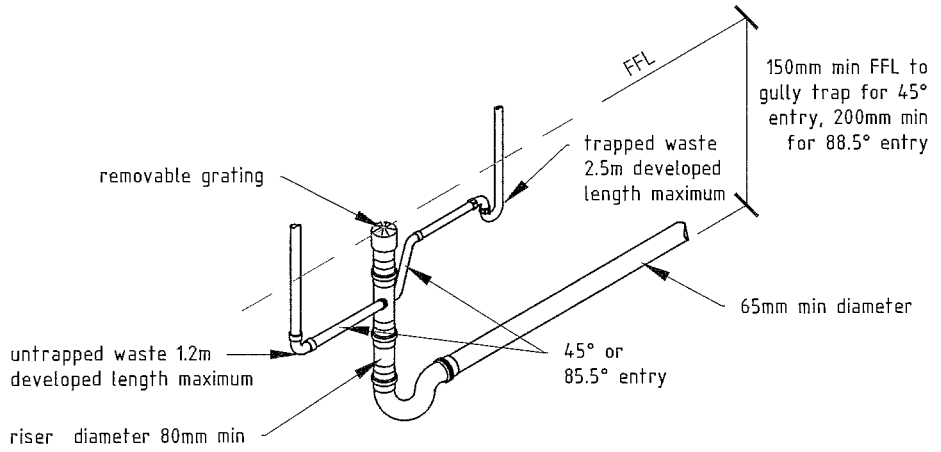
Each *fixture* shall be connected to a *floor waste gully* by an individual *waste pipe* connected to the gully riser, as shown in Figure 8.2, by either:

(a) a trapped *waste pipe* falling at a grade of not less than 2.5% (1 in 40) and with a maximum developed length of 2.5 m, or

(b) an un-trapped *waste pipe* falling at a grade of not less than 2.5% (1 in 40) and with a maximum developed length of 1.2 m.

The *discharge pipe* from a *floor waste gully* shall connect to a *drain* or discharge to a *gully trap*.

Figure 8.2 **Connection of wastes to a floor waste gully**
Paragraphs 8.6.4.1 and 8.6.6.3



8.6.6.4 Removable grate

Floor waste gullies shall be installed with a removable grate to which there is ready access, and a riser of 80 mm minimum *diameter* at floor surface level. Shower outlets may be connected to a *floor waste gully*.

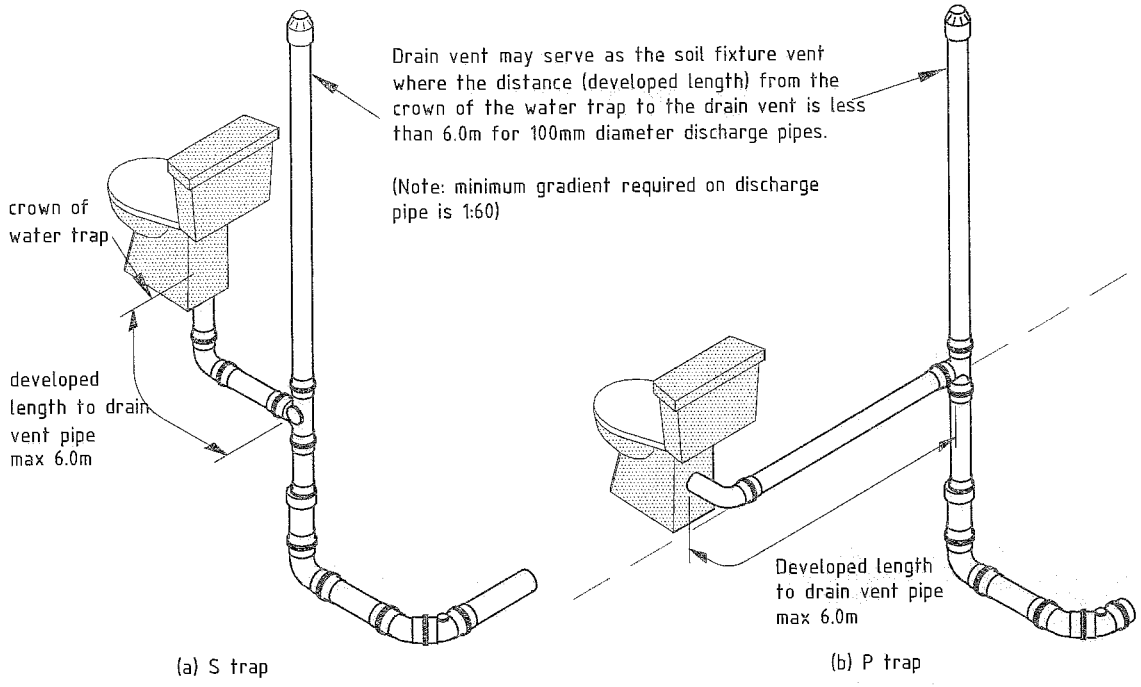
8.6.6.5 Height of gully riser

The minimum height of the *floor waste gully*, measured from the top of the *water seal* to the floor level, shall be 150 mm.

8.6.7 Fixture discharge pipes serving soil fixtures

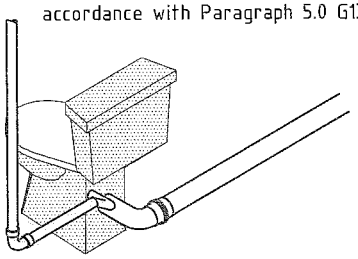
Fixture discharge pipes serving soil *fixtures* shall discharge directly to the *drain* in accordance with Figure 8.3.

Figure 8.3 **Soil fixture discharge pipes**
Paragraph 8.6.7

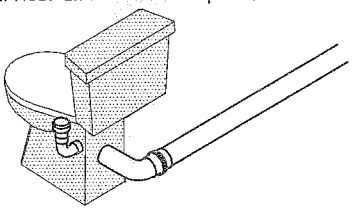


1) Discharge pipes serving soil fixtures connected individually to the drain and utilising a drain vent as fixture vent

a) S or P trap vented pan, fixture vent pipe connected to pan horn installed and terminated in accordance with Paragraph 5.0 G13/AS1

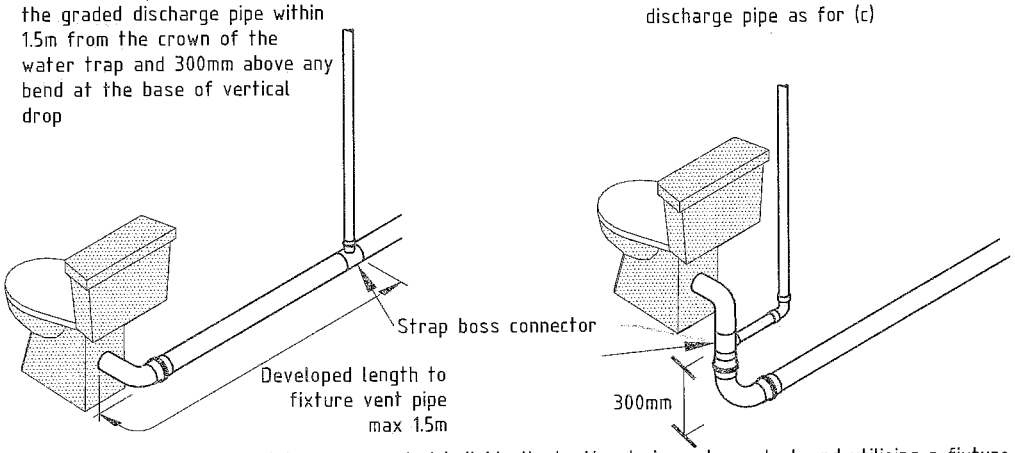


b) S or P trap vented pan, air admittance valve fitted to pan horn, valve to be installed in accordance with Paragraph 5.8 G12/AS1 (valve must be vertical and secured in place)



c) S or P trap non vented pan, fixture vent pipe connected to the graded discharge pipe within 1.5m from the crown of the water trap and 300mm above any bend at the base of vertical drop

d) S or P trap non vented pan, fixture vent connected to the vertical discharge pipe as for (c)



2) Discharge pipes serving soil fixtures connected individually to the drain or to a stack and utilising a fixture vent

8.6.8 Connection to drains

Gully traps and soil *fixture discharge pipes* shall be connected to the *drain*. The *drain* shall be laid in accordance with either *Acceptable Solution* G13/AS2 or with AS/NZS 3500.5 Section 4. *Drains* shall:

(a) have a *drain vent pipe* located so that the length of a *drain* upstream of the *drain* vent connection is less than 10 m with a minimum *diameter* of 80 mm and terminated to the requirements of Paragraph 5.7.3 of G13/AS1 Sanitary Plumbing

(b) be connected to the *network utility operator* sewer and in accordance with their requirements, or

(c) be connected to an on-site disposal designed in accordance with AS/NZS 1547 Part 4.

9.0 Facilities

CONTENTS

9.1 Wet areas

Wet areas shall include bathrooms and showers, laundries, sanitary compartments and kitchens areas.

9.1.1 Floor finish

Floor finishes to *wet areas* shall be *impervious* and easily cleaned. *Wet area* floor finishes shall be limited to:

(a) sheet vinyl with welded joints

(b) timber or cork, with a three coat polyurethane finish, on a *waterproof* membrane

(c) polished and sealed concrete, or

(d) ceramic or porcelain tiles having a 6% maximum water absorption, laid on a *waterproof* membrane on a concrete floor, and finished with a non-porous grout. They shall be installed so that the substrate, *waterproof* membrane, adhesive, grout and tiles are all compatible with each other.

For floor finishes to showers, refer to Paragraphs 9.2.2.2, or 9.2.3.1.

9.1.2 Wall finish

Wall finishes to *wet areas* shall be *impervious* and easily cleaned. *Wet area* wall finishes shall be limited to:

(a) washable gloss or semi-gloss paint surface

(b) pre-finished sheet linings, or

(c) ceramic or porcelain tiles having 6% maximum water absorption and finished with a non-porous grout. They shall be installed so that the sealed substrate, adhesive, grout and tiles are all compatible with each other.

For wall finishes to showers, refer to Paragraphs 9.2.2.3 or 9.2.3.2 and for showers over baths, refer to Paragraph 9.2.4.

9.1.3 Junctions to floors, walls and fixtures

Joints between floors, walls and fixtures shall be sealed with flexible sealant, to prevent water penetration to concealed spaces or behind linings.

9.2 Personal hygiene

9.2.1 Bathrooms

9.2.1.1 Houses shall contain at least one each of the following *sanitary fixtures*:

(a) water closet pan with flushing cistern

(b) hand wash basin, and

(c) shower or bath, or shower/bath combination.

9.2.1.2 Seal sanitary fixtures to floors or walls with flexible sealant, to prevent water penetration to concealed spaces or behind linings.

9.2.2 Enclosed shower cubicles

9.2.2.1 Enclosed showers shall be fitted with a screen, door or curtain at the opening to contain watersplash within the cubicle.

9.2.2.2 A shower base to an enclosed shower shall contain water and be constructed:

(a) on timber floors, from:

(i) stainless steel, or

(ii) moulded acrylic

(b) on concrete floors, from:

(i) stainless steel

(ii) moulded acrylic

(iii) sheet vinyl with welded joints, and laid to falls of not less than 1:50, or

(iv) ceramic or porcelain tiles in accordance with Paragraph 9.1.1(d) on a *waterproof* membrane and laid to falls of not less than 1:50.

9.2.2.3 Shower walls to an enclosed shower shall:

(a) be waterproofed over the shower tray as per Figure 9.1

(b) have an *impervious* wall finish to a minimum height of 1.8 m above the shower base and not less than 300 mm above the shower rose, and

(c) have an *impervious* wall finish that is limited to:

(i) fully enclosed moulded acrylic

(ii) pre-finished sheet linings with *impervious* joints

(iii) sheet vinyl with welded joints

(iv) toughened glass with impervious joints, or

(v) ceramic or porcelain tiles, in accordance with Paragraph 9.1.2(c) and on a *waterproof* membrane.

9.2.3 Open showers

9.2.3.1 An open shower floor shall be dimensioned in accordance with Figure 9.2, and:

(a) have no step or upstand and ensure easy level access

(b) be on a concrete floor

(c) have an *impervious* floor finish to a minimum horizontal distance of 1.5 m from the fixed shower head, or

(d) have the *impervious* floor finish increased by the length of the flexible shower hose in accordance with Figure 9.2, and

(e) the *impervious* floor finish shall be limited to:

(i) ceramic or porcelain tiles in accordance with Paragraph 9.1.1 (d), on *waterproof* membrane and laid to falls of not less than 1:50, or

(ii) sheet vinyl with welded joints and laid to falls of not less than 1:50.

9.2.3.2 Open shower walls shall be dimensioned in accordance with Figure 9.2, and:

(a) have an *impervious* wall finish to a minimum height of 1.8 m above the floor and not less than 300 mm above the shower rose

(b) have the *impervious* wall finish to a minimum horizontal distance of 1.5 m from the shower head, or increased by the length of the flexible shower connection in accordance with Figure 9.2, and

(c) the *impervious* wall finish shall be limited to:

(i) ceramic or porcelain tiles in accordance with Paragraph 9.1.2(c) on a *waterproof* membrane, or

(ii) sheet vinyl with welded joints.

9.2.4 Showers over a bath

9.2.4.1 Showers over a bath shall be fitted with a screen, door or curtain to contain watersplash within the bath.

9.2.4.2 Seal the bath enclosure to the floor and walls with flexible sealant, to prevent water penetration to concealed spaces or behind linings.

9.2.4.3 Shower walls where the shower is over a bath shall:

(a) be waterproofed over the bath as per Figure 9.3

(b) have an *impervious* wall finish to a minimum height of 1.8 m above the bath base and not less than 300 mm above the shower rose

(c) have an *impervious* wall finish that extends horizontally, in accordance with Figure 9.4, and includes the exposed sides of the bath enclosure, and

(c) have an *impervious* wall finish that is limited to:

(i) pre-finished sheet linings with *impervious* joints

(ii) sheet vinyl with welded joints, or

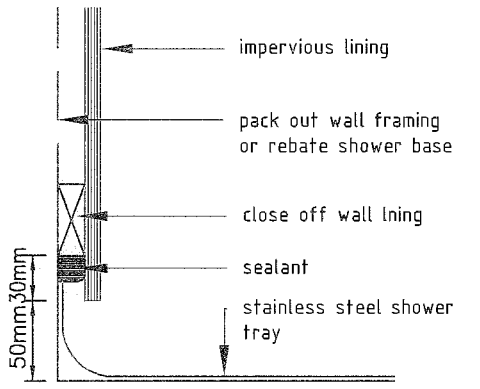
(iii) ceramic or porcelain tiles, in accordance with Paragraph 9.1.2(c) on a *waterproof* membrane.

Table 9.1 **Impervious flooring**
Paragraphs 9.1, 9.2.2, 9.2.3 and 9.2.4, and Figures 9.1, 9.2, 9.3 and 9.4

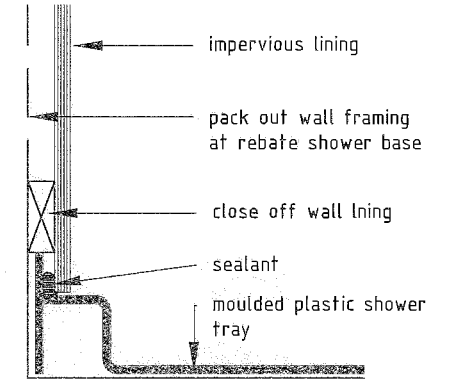
	Wet areas		**Shower cubicle[1]**		**Open Shower**		**Shower over bath[1]**	
	Floor	Wall	Floor	Wall	Floor	Wall	Floor	Wall
Timber flooring								
Sheet vinyl	Yes						Yes	
Stainless steel			Yes					
Moulded acrylic			Yes					
Timber/cork overlay	Yes							
Concrete flooring								
Sheet vinyl	Yes		Yes		Yes		Yes	
Stainless steel			Yes					
Moulded acrylic			Yes					
Polished concrete	Yes							
Tiles	Yes		Yes		Yes		Yes	
Walls								
Sheet vinyl				Yes		Yes		Yes
Moulded acrylic				Yes				
Tiles		Yes		Yes		Yes		Yes
Paint		Yes						
Pre-finished sheets		Yes		Yes				Yes
Toughened glass				Yes				

Note [1] Screen, door or curtain required.

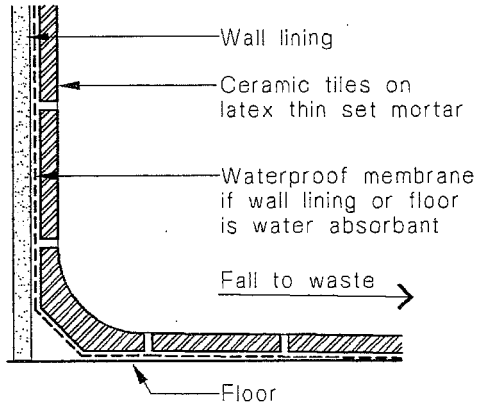
Figure 9.1 **Finish of linings to shower tray**
Paragraph 9.2.2.2



(a) Stainless steel shower tray

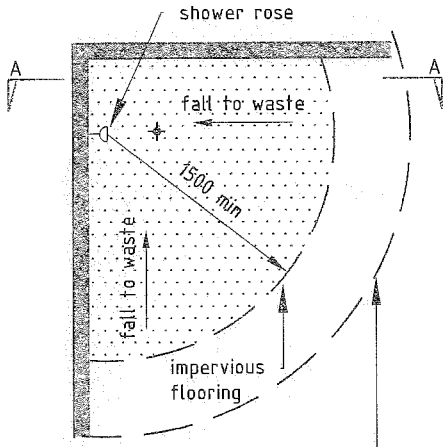


(b) Moulded plastic shower tray



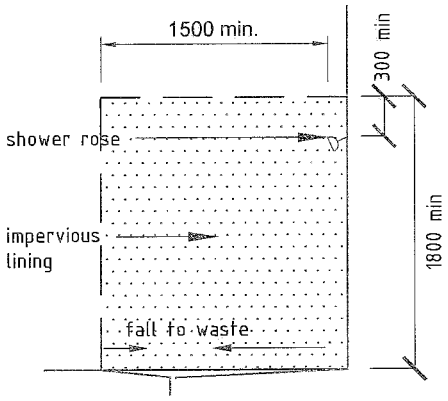
(c) Tiled shower tray

Figure 9.2 **Impervious floor and wall linings about shower head**
Paragraphs 9.2.2.2 and 9.2.2.3



Where a flexible shower head is provided the minimum radius for impervious floor and wall lining shall be increased by the length of the flexible hose.

(a) Plan



(b) Section

Figure 9.3 **Finish to bath**
Paragraph 9.2.2.2

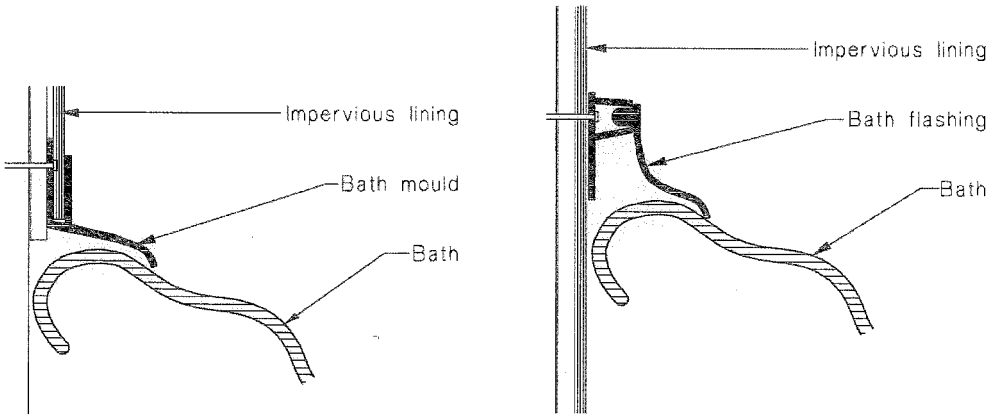
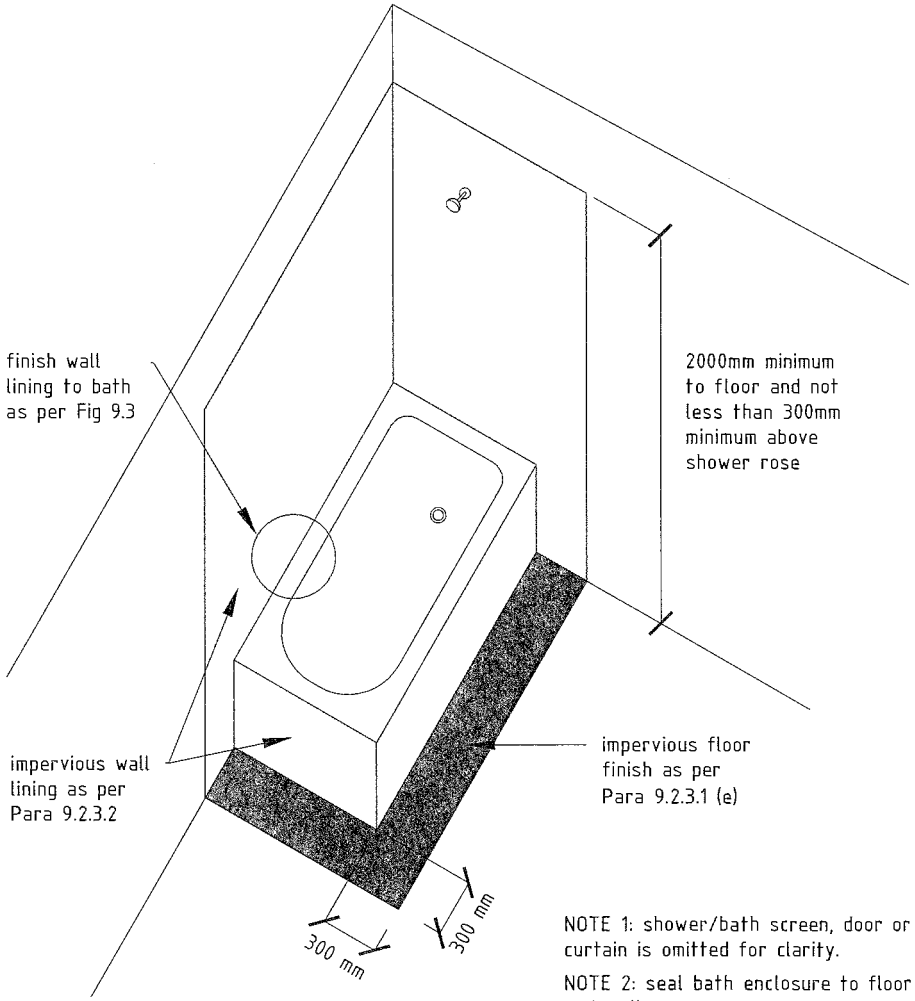


Figure 9.4 **Shower over bath**
Paragraph 9.2.4



9.3 Cooking and food preparation

9.3.1 Kitchens shall have at least one sink for food preparation and dish washing, and associated self-draining bench space of at least 0.5 m² with an additional 1.0 m² minimum of easily cleaned, non-absorbent bench space for food preparation.

9.3.2 Kitchens shall have a minimum of an operational:

(a) free-standing oven with at least three hot plates or burners, or

(b) wall or under bench oven with separate hob, with at least three hot plates or burners.

9.3.3 Floor space for a refrigerator shall be a minimum 650 x 650 mm with 1.8 m height of clear space.

9.4 Laundries

9.4.1 Laundries shall contain a minimum of:

(a) a laundry tub with hot and cold water supply and waste to *drain* in accordance with Paragraph 8.6

(b) sufficient floor space and service connections for a washing machine and clothes drier (including vent to exterior of the *simple house*).

The service connections shall include, for hot and cold water, waste pipes and an electrical power point.

9.5 Ventilation

9.5.1 Natural ventilation of *habitable spaces* shall be achieved by providing a net openable area of windows or other openings, such as sliding or bi-fold doors, of no less than 5% of the floor area of each room.

Windows or doors shall have hardware to hold them in a ventilating position. Refer to G4/AS1.

9.5.2 Ventilation of the toilet, bathroom or laundry shall be by window openings of no less than 5% of floor area and/or mechanical extract ventilation.

9.5.3 Mechanical extract ventilation, where installed, shall exhaust to the exterior (this includes extract ventilation from the rangehood, clothes drier, bathroom and toilet).

9.6 Fire

9.6.1 Boundary separation

No *simple house* element (including guttering) shall be located less than 650 mm from any site boundary.

9.6.2 Smoke alarms

9.6.2.1 Battery or mains-powered smoke alarms shall be installed to the minimum configuration of one in each bedroom, or one within 3.0 m of each bedroom door.

9.7 Natural light

9.7.1 *External walls* of each *habitable space* shall have a total glazed area of no less than 10% of the net floor area of that space. (Note the maximum glazing area is restricted by energy efficiency requirements in Paragraph 2.8.2.)

9.7.2 Glazing shall be in accordance with:

(a) NZS 4223 Part 1 and 2 for Selection and Installation

(b) NZS 4223 Part 3 for Human Impact, and

(c) NZS 4223 Part 4 for Wind Loads.

Comment
The type and thickness of glass required depends on the area and location of the glazing.

Safety glass (toughened or laminated glass) may be required in some situations where the glazing may be subject to human impact, such as:

- sidelights (glazing alongside doors)
- doors
- low level glazing
- glazing in bathrooms (where people may slip)
- where glazing could be mistaken for an unimpeded path of travel.

9.8 Artificial lighting

9.8.1 Minimum lighting levels

The requirement under the *Building Code* for artificial lighting is to achieve a minimum illuminance at floor level of 20 Lux to enable safe movement.

Comment
The 20 Lux level is for safe egress, and not sufficient for normal living activities.

9.9 Heating

9.9.1 There is no requirement under the *Building Code* for heating to be provided to this *simple house*.

Comment
Heating of the following types may be provided:

(a) solid fuel burner to comply with Resource Management (National Environmental Standards Relating to Certain Air Pollutants, Dioxins and Other Toxins) Regulations 2004 (NESAQ) and installed to AS/NZS 2918

(b) flued gas heater installed to NZS 5261

(c) permanently wired electric radiator or convector complying with AS/NZS 60335, or

(d) heat pump complying with AS/NZS 60335.

Some local authorities may have specific air quality emissions requirements for the use of solid fuel burners.

9.10 Access

9.10.1 Slip resistance

Walking surfaces on the approach to the main entrance of the *simple house* shall have a slip resistance mean coefficient of friction (μ) of not less than 0.4 when wet, in accordance with the test in AS/NZS 4586. Refer to *Acceptable Solution* D1/AS1 Table 2 for acceptable surfaces.

9.10.2 Accessibility

Comment:
There is no requirement under the *Building Code* for accessibility features, however many *universal access* features are simple to incorporate at the time of construction of a new *building*, but are difficult to retrofit. Designing for *universal access* allows for visitors and future users of all abilities to easily use the *simple house*.

NZS 4121 contains information for designing for *universal access*, including:

- wider doors and corridors to allow for wheelchair users
- adequate circulation space in kitchens, laundries and bathrooms for wheelchair users
- grab rails to bathroom and toilet areas.

Particular examples of such accessibility features to be considered include:

(a) 1.2 m wide passageways and 1.5 m manoeuvring space to kitchens, bathrooms and laundries, etc

(b) main circulation doors, including those to bedrooms and bathrooms, sized to provide an unobstructed clear opening of 760 mm when open.

9.10.3 Level entry

9.10.3.1 Where level entry access is provided, the wall *cladding* clearances to the ground, in accordance with Figure 6.1.6, shall be maintained.

9.10.3.2 Finished ground or paving shall slope away from the level entry.

Comment:
Provide where possible shelter in the form of an entry recess or verandah to protect an entry with level access against prevailing wind and rain.

9.10.3.3 Level entry access shall be in accordance with Figure 9.5, and either:

(a) a drainage channel across the door opening for concrete level entries, in accordance with Paragraph 9.10.3.4, or

(b) a free draining open slot that is spaced away from the *simple house* by 12 mm minimum for timber level entries.

9.10.3.4 The drainage channel shall have:

(a) a minimum depth of 150 mm

(b) 1:200 minimum fall along length of channel towards a drainage outlet

(c) exterior paving that has a minimum fall of 1:40 away from the channel, and

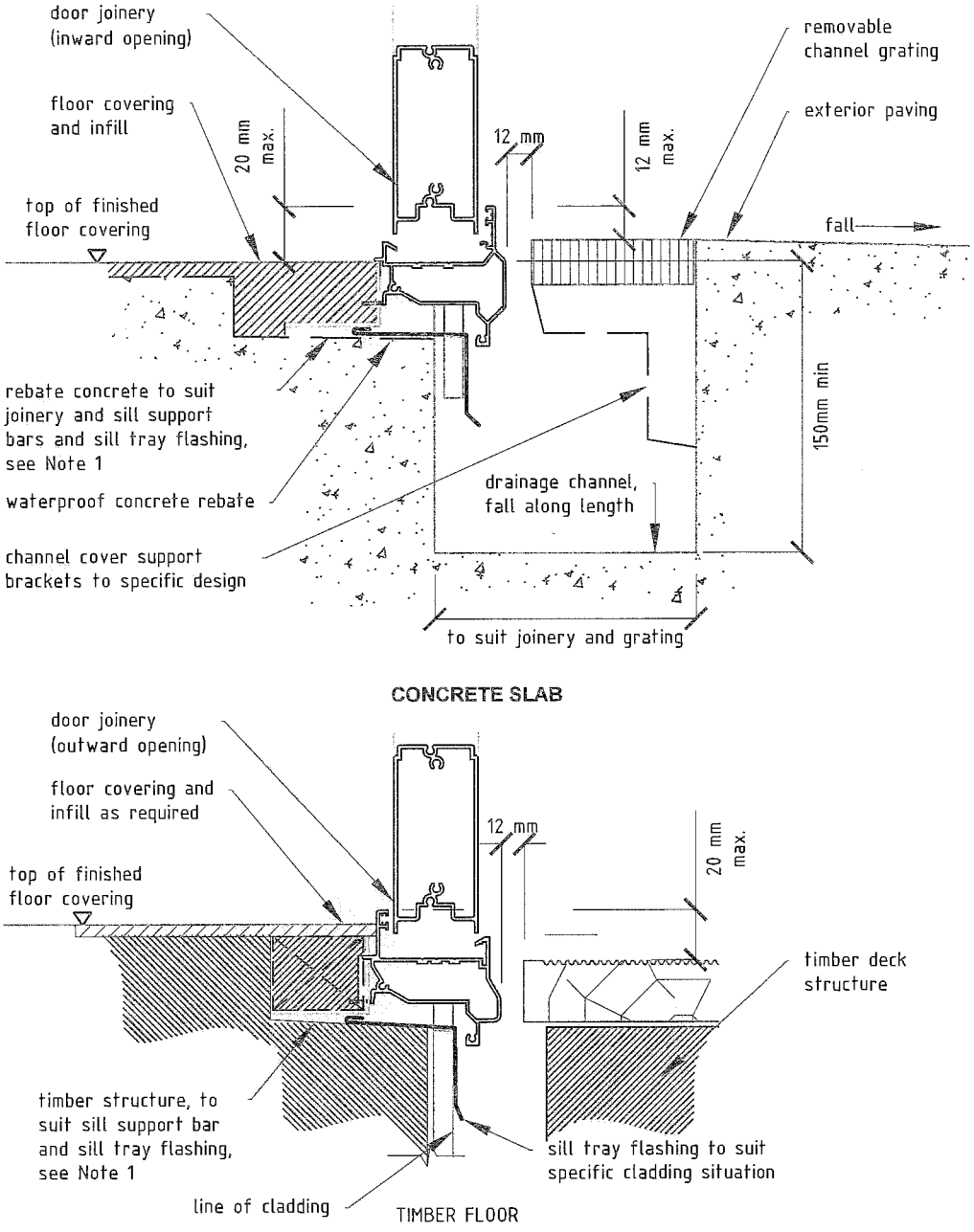
(d) a galvanised steel, PVC or timber grating designed for the purpose over the channel that is:

  (i) supported independently of the door frame

  (ii) removable to allow access for cleaning

  (iii) specifically designed to accommodate imposed loads.

Figure 9.5 **Level threshold at ground level**
Paragraphs 6.1.8.2 and 9.10.3.4



Note 1: Where sill support bars are required by the door manufacturer to carry the frame and glazing loads they must be supplied as an integral part of the door installation and installed to the door manufacturer's instructions.

10.0 Sustaining resources

Comment

Features to sustain natural resources are not required by this *Acceptable Solution* and are outside the scope of the *simple house*.

Such features may include solar water heating, grey water reuse, rainwater collections systems or special underfloor thermal insulation.

In such circumstances, users will need to prepare additional consent documentation for their changes, additions or alternatives for the *building consent authority (BCA)* to consider.

Appendix 1 – Optional design summary – sample

Comment:
During the design process for any *building* project, designers make decisions on how compliance with the *Building Code* will be achieved. In this case compliance is established through the use of this *Acceptable Solution*.

To help the *building consent authority (BCA)* check the *building consent* application, it is useful for the designer to attach a design summary to the application. The design summary can explain why particular choices have been made and references relevant sections of this *Acceptable Solution*.

The following is a sample of a completed design summary. Use it as a guide to completing the blank copy for your project. The use of the design summary is optional – it is not necessary for compliance with this *Acceptable Solution*.

Use this table to check how the design fits with the Scope in Section 1 of the Acceptable Solution.

Address of proposed work	*17 Pleasant Road, Goneville*
(a) single storey stand-alone, up to Very High Wind Zone (50 m/s)	*Yes, in High Wind*
(b) maximum length or width of floor (max 24.0 m)	*10x12 largest floor with garage included*
(c) simple plan shapes	*L-shape*
(d) concrete slab or suspended timber floor on piles	*Slab on ground*
(e) maximum 2.0 m finished floor level to adjacent cleared ground	*1.65 m from front deck edge*
(f) simple roof forms, incorporating hips, valleys, gables or mono pitches	*Mono pitched*
(g) eaves minimum 450 mm to all roofs	*Yes 450 and 600 mm*
(h) maximum overall height of 7.0 m from roof apex from lowest cleared ground level	*5.4 m at front of building*
(i) maximum roof height 3.0 m	
(j) roof slope between 10º and 35º	*12 deg*
(k) maximum span of roof truss 12.0 m	*Yes 7.5 m*
(l) external walls maximum 2.4 m – other than gable ends and walls to mono-pitched roofs maximum 4.0 m	*Yes and 3.3 m front wall*
(m) timber framing, as specified in this Acceptable Solution	*Yes*
(n) maximum two wall claddings	*Yes, ply and rustic weatherboard*
(o) no building element located less than 650 mm from any site boundary	*Yes, 1.8 m minimum*

Use this table to checking if detailed aspects of the design fit with Sections 2 – 10.

BCA use	Key aspect/ building component	Identify relevant section of Acceptable Solution	Location of details in consent application	Component selections (tick appropriate box)	Comments
	Site	Ref 3.1	Site plan Pg 2 Specifications Pg 4 and Bracing calculations Pg 6 of plans.	◯ Wind zone (not crest zone) ◯ Corrosion zone ◯ Topography ◯ Ground bearing ◯ Expansive soils	Slightly sloping site over building area. The wind zone is high and the corrosion zone is 1. Max excavation of 600 mm to create level platform for dwelling. Test holes show good ground conditions.
	Foundation	To figure 3..1.5	Pg 3 of plans.	◯ Slab ◯ Isolated footings (posts) ◯ Pile	Foundation is a thickened edge slab on ground. Ground suitability confirmed by penetrometer to para. 2.1.2.
	Wall framing	4 Framing	Refer to plans and Pg 7 of specifications.		Wall framing 90x45 msg8 treated to H1.2, lintels to table 4.4, cast-in bolt bottom plate fixings.
	Roof framing	5 Roof framing	Refer to Pg 7 of plans.	◯ Trusses ◯ Skillion roof	Prefabricated truss, (manufacturer …) fixed with 2 x wire dogs, 75x45 purlins to table 5.1.1
	Roofing	Section 7.2	Refer to cross-section Pg 5 and roof plan Pg 7. Also Pg 10 of specifications.	◯ Profiled metal ◯ Pressed metal tiles ◯ Concrete tile	Corrugated iron with factory finish 12 deg pitch (name brand), 450 (and 600) eaves fig 7.1.3
	Cladding	Paras 6.3 and 6.5	Refer to elevations Pg 2 and cross-section Pg 5. Also Pg 10 of specifications.	◯ EIFS ◯ 70 mm brick ◯ 90 mm brick ◯ Plywood ◯ Fibre cement flat sheet ◯ Weatherboard	Rustic to window heads, ply above with flashing in Fig 6.5.3 sized to suit, aluminium joinery to fig 6.1 and 6.2.
	Bracing	4.6 Bracing	Refer to bracing calcs Pg 6 of plans.	◯ Plywood ◯ Plasterboard linings	Bracing will be provided by plasterboard internal linings, horizontally fixed
	Insulation	2.8 Energy efficiency	Refer to cross-section Pg 5 and Pg 10 of specifications.		Batts r3.6 ceiling r2.2 wall, double glazed aluminium joinery
	Internal linings	Para 4.7	Refer to cross-section Pg 5. And Pg 10 of specifications		Plasterboard to ceilings and walls

BCA use	Key aspect/ building component	Identify relevant section of Acceptable Solution	Location of details in consent application	Component selections (tick appropriate box)	Comments
	Bathrooms	9.1 Wet areas	Refer to bathroom details Pg 5 of plans. And Pg 12 of specifications.	◯ Wet area floors ◯ Prefabricated shower units	Acrylic shower unit, fig 9.1, waste water to gully trap, lino floor with welded joints. Ventilate with opening window. Paint wall finish with tiled splash areas.
	Plumbing	8.3 Water supply and 8.4 hot water	Refer to floor plan Pg 2 of plans and Pg 12 of specifications.	◯ Mains cylinder ◯ Solar	Polybutylene water supply. 180tlr mains pressure HWC to table 8.1
	Drainage	8.6 plumbing and drainage	Refer to site plan Pg 2.		Foul water to council main, storm water to kerb and channel, wc to drain
	Laundry	9.4 laundry	Refer to laundry details Pg 5 of plans. And Pg 12 of specifications.		Lino floor, tub, washing machine, dryer on wall, vents to exterior, waste water to gully trap. Paint wall finishes.
	Kitchen	9.3 cooking and food preparation.	Refer to kitchen details Pg 5 of plans. And Pg 12 of specifications.		Built in electric oven with electric hobbs, stainless steel bench, painted walls, lino floor, waste water to gully trap
	Smoke alarms	9.6 Fire.	Refer to floor plan Pg 2.		1 in hallway 1 in lounge
	Natural light	9.7 windows in all areas	Refer to floor plan Pg 2.		
	Heating	9.9 Solid fuel burner	Refer Specification Page 13 and manufacturer's installation and datasheets		Fire zone, model 2357-1.
	Access	Hallway and door widths to 9.10.2	and door schedule pg 8	◯ Approach to entrance ◯ Doors and passages ◯ Other access features	Textured concrete. On entrance path.
	Sustaining resources				N/A

Appendix 2 – Optional design summary – blank

Use this table to check if the design fits with the Scope outlined in Section 1 of the Acceptable Solution.

Address of proposed work	
(a) single storey stand-alone, up to Very High Wind Zone (50 m/s)	
(b) maximum length or width of floor (max 24.0 m)	
(c) simple plan shapes	
(d) concrete slab or suspended timber floor on piles	
(e) maximum 2.0 m finished floor level to adjacent cleared ground	
(f) simple roof forms, incorporating hips, valleys, gables or mono pitches	
(g) eaves minimum 450 mm to all roofs	
(h) maximum overall height of 7.0 m from roof apex from lowest cleared ground level	
(i) maximum roof height 3.0 m	
(j) roof slope between 10º and 35º	
(k) maximum span of roof truss 12.0 m	
(l) external walls maximum 2.4 m – other than gable ends and walls to mono-pitched roofs maximum 4.0 m	
(m) timber framing, as specified in this acceptable solution	
(n) maximum two wall claddings	
(o) no building element located less than 650 mm from any site boundary	

Use this table to check if detailed aspects of the design fit within Sections 2 – 10.

BCA use	Key aspect/ building component	Identify relevant section of Acceptable Solution	Location of details in consent application	Component selections (tick appropriate box)	Comments
	Site			◯ Wind zone (not crest zone) ◯ Corrosion zone ◯ Topography ◯ Ground bearing ◯ Expansive soils	
	Foundation			◯ Slab ◯ Isolated footings (posts) ◯ Pile	
	Wall framing			◯ Slab ◯ Isolated footings (posts) ◯ Pile ◯ Gable ends	
	Roof framing			◯ Trusses ◯ Skillion roof	
	Roofing			◯ Pressed steel tiles ◯ Profiled metal ◯ Concrete tile	
	Cladding			◯ 70 mm brick ◯ 90 mm brick ◯ Plywood ◯ Fibre cement flat sheet ◯ Weatherboard	
	Bracing			◯ P21 Proprietary ◯ Plywood ◯ Plasterboard	
	Insulation				
	Internal linings				

BCA use	Key aspect/ building component	Identify relevant section of Acceptable Solution	Location of details in consent application	Component selections (tick appropriate box)	Comments
	Bathrooms		.	◯ Wet area floors ◯ Prefabricated shower units	
	Plumbing			◯ Mains cylinder ◯ Electric ◯ Gas	
	Drainage				
	Laundry				
	Kitchen	.			
	Smoke alarms				
	Natural light				
	Heating				
	Access			◯ Entrance ◯ Doors and passages ◯ Other features	
	Sustaining resources				

References

For the purposes of New Zealand Building Code compliance, the acceptable New Zealand and other Standards, or other documents referred to in this *Acceptable Solution* (primary reference documents) shall be the editions, along with their specific amendments, listed below. Where the primary reference documents refer to other Standards or other documents (secondary reference documents), which in turn may also refer to other Standards or other documents, and so on (lower order reference documents), then the applicable version of these secondary and lower order reference documents shall be the version in effect at the date this *Acceptable Solution* was published.

Standards New Zealand		**Where quoted**
NZS 2295: 2006	Pliable, permeable building underlays	7.1.5.1
NZS 3109: 1997	Concrete construction *Amendments 1 and 2*	3.1.6.1, 3.3.1.2, Definitions
NZS 3602: 2003	Timber and wood-based products for use in building	2.7.1
NZS 3603: 1993	Timber structures standard *Amendments 1, 2 and 4*	Definitions
NZS 3604: 1999	Timber framed buildings *Amendments 1 and 2*	1.2, 2.1.2(b), 2.7.1, Table 2.7, 4.2.1.3
NZS 3605: 2001	Timber piles and poles for use in buildings	Table 2.7
NZS 3617: 1979	Specification for profiles of weatherboards, fascia boards and flooring	6.2.3, 6.33
NZS 3622: 2004	Verification of timber properties *Amendment 1*	2.7.1
NZS 3631: 1988	New Zealand timber grading rules	6.2.1.3, 6.3.1.2, 6.3.1.3
NZS 3640: 2003	Chemical preservation of round and sawn timber *Amendment 4*	2.7.1, Table 2.7
NZS 4121: 2001	Design for access and mobility – buildings and associated facilities	9.10.2 Comment
NZS 4206: 1992	Concrete interlocking roof tiles	7.4.1(a), 7.4.2.1
NZS 4210: 2001	Code of practice for masonry construction: materials and workmanship	6.4.1.2, 6.4.3.1, 6.4.3.3, 6.4.3.5, 6.4.3.6
NZS 4211: 1985	Specification for performance of windows *Amendments 1, 2 and 3*	6.1.3.1
NZS 4217: 1980 Part 1: Part 2:	Pressed metal tile roofs Specification for roofing tiles and their accessories Code of practice for preparation of the structure and the laying and fixing of metal roofing tiles	7.3.1

		Where quoted
NZS 4223:	Code of practice for glazing in buildings –	
Part 1: 2008	Glass selection and glazing	9.7.2(a)
Part 2: 1985	The selection and installation of manufactured sealed insulating glass units *Amendments: 1, 2*	9.7.2(a)
Part 3: 1999	Human impact safety requirements *Amendment 1*	9.7.2(b)
Part 4: 2008	Wind, dead, snow and live actions	6.1.3.2, 9.7.2(c)
NZS 4246: 2006	Energy efficiency – Installing insulation in residential buildings	2.8.1 Comment
NZS 4402:	Methods of testing soils for civil engineering purposes	Definitions
Part 2, Section 2:1986 Test 2.2 Determination of the liquid limit.		
NZS 4431: 1989	Code of practice for earth fill for residential development *Amendment 1*	2.1.2(d), 2.1.3.1(c), 2.1.4.1, 3.2.1.1(b)
NZS 4606:	Storage water heaters	8.4.2(a) and (b)
Part 1: 1989	General requirements *Amendments 1, 2 and 3*	
Part 2: 1989	Specific requirements for water heaters with single shells *Amendment A*	
Part 3: 1992	Specific requirements for water heaters with composite shells *Amendment: A*	
NZS 5261: 2003	Gas installation *Amendment 1*	8.2.1(a), 9.9.1 Comment (b),
NZS 5262: 2003	Gas appliance safety *Amendment 1*	8.4.2 (b) and (c)
Standards Australia		
AS 1111:	ISO metric hexagon bolts and screws – Product grades A and B	2.7.5
Part 1: 2000	Bolts	
Part 2: 2000	Screws	
AS 1214: 1983	Hot-dip galvanised coatings on threaded fasteners (ISO metric coarse thread series)	Table 2.3
AS 1397: 2001	Steel sheet and strip – Hot-dipped zinc coated or aluminium/zinc-coated	Table 2.3, 7.1.6.2(a) 7.2.2.2(b), 7.3.1(c)(i) and (ii), Definitions
AS 1547: 2000	On-site domestic wastewater management	8.4.3.3
AS 1804: 1976	Soft lead sheet and strip	Definitions
AS 2049: 2002	Roof tiles	7.4.1.1(b)
AS 2870: 1996	Residential slabs and footings – Construction	3.2.1.1

		Where quoted
AS 3566:	Screws – Self-drilling – For the *building* and construction industries	
Part 2: 2002	Corrosion resistance	6.4.4.6(b), 7.2.3.1,
AS 3730:	Guide to the properties of paints for buildings	6.2.2.2(b), 6.3.2.2(b)
Part 7: 1992	Latex – Exterior – Flat	6.5.10.3
Part 8: 1992	Latex – Exterior – Low gloss	
Part 9: 1992	Latex – Exterior – Semi-gloss	
Part 10: 1992	Latex – Exterior – Gloss	
Standards Australia – New Zealand		
AS/NZS 1260: 1999	PVC pipes and fittings for drain, waste and vent applications	8.6.2(b)
AS/NZS 1547: 2000	On-site domestic wastewater management	8.6.8
AS/NZS 1604:	Specification for preservative treatment	Table 2.7
Part 3: 2002	Plywood	
AS/NZS 1734: 1997	Aluminium and aluminium alloys – Flat sheet, coiled sheet and plate	Definitions
AS/NZS 1859	Reconstituted wood-based panels	Table 2.7, 3.3.15.1(a)
Part 1: 2002	Particleboard	
AS/NZS 2269: 2004	Plywood – Structural	Table 2.7, 3.3.15.1(b)
AS/NZS 2588: 1998	Gypsum plasterboard	4.6.3.2
AS/NZS 2699:	Built-in components for masonry construction.	
Part 1: 2000	Wall ties	Table 2.3
Part 2: 2000	Connectors and accessories	Definitions
Part 3: 2002	Lintels and shelf angles (durability requirements)	Table 2.3
AS/NZS 2712: 2007	Solar and heatpump waterheaters – Design and construction	8.4.2(d) and (e)
AS/NZS 2728: 2007	Pre-finished/prepainted sheet metal products for interior/exterior building applications – Performance requirements	7.1.6.2(a) and (b), 7.2.2.2(a) and (b), 7.3.1(d), Definitions
AS/NZS 2908:	Cellulose-cement products	
Part 2: 2000	Flat sheets	6.5.2.1(b)
AS/NZS 2918: 2001	Domestic solid fuel burning appliances – installation	9.9.1 Comment (a)
AS/NZS 3000: 2007	Electrical installations	8.1.1
AS/NZS 3350:	Safety of household and similar electrical appliances	8.4.2
Part 2.35: 1999	Particular requirements of instantaneous water heaters	

		Where quoted
AS/NZS 3500:	National plumbing and drainage code	8.3.2(a), 8.4.2,
Part 1: 2003	Water services	8.4.2(c), 8.6.1,
	Amendment 1	8.6.8
Part 2: 2003	Sanitary plumbing and drainage	
	Amendment 1	
Part 4: 2003	Heated water services	
	Amendment 1	
Part 5: 2003	Domestic installations	
AS/NZS 4200:	Pliable building membranes and underlays	Definitions
Part 1: 1994	Materials	
	Amend 1	
AS/NZS 4256:	Plastic roof and wall cladding materials	Definitions
Part 2: 1994	Unplasticized polyvinyl chloride (uPVC) building sheets	
AS/NZS 4455: 1997	Masonry units and segmental pavers	6.4.1.4
AS/NZS 4456: 2003	Masonry unit and segmental pavers – Methods of test	6.4.1.4
	Amendments 1 and 2	
AS/NZS 4586: 2004	Slip resistance classification of new pedestrian surface materials	9.10.1
AS/NZS 4671: 2001	Steel reinforcing materials	3.1.7, 3.1.7.2
AS/NZS 4680: 2006	Hot-dip galvanised (zinc) coating on fabricated ferrous articles	Table 2.3
AS/NZS 4936: 2002	Air admittance valves (AAVs) for use in sanitary plumbing and drainage systems	8.6.2(a)
AS/NZS 60335	Household and similar electrical	9.9.1 Comment
Part 2.30: 2009	Safety appliance – Particular requirements for room heaters	(c) and (d)
International Standards		
ASTM C1549: 2002	Standard test method for determination of solar reflectance near ambient temperature using a portable solar reflectometer	Definitions
ASTM D6134: 1997	Standard specification for vulcanised rubber sheets used in waterproofing systems	Definitions
ASTM E96: 1992	Standard test methods for water vapour transmission of materials	Definitions
ASTM E903: 1996	Standard test method for solar absorbance, reflectance and transmittance of materials using integrating spheres	Definitions
ISO 11600: 2002	Building construction – Jointing products classification and requirements for sealants	6.1.2(d)(ii), Definitions
ISO/TS 15510: 2003	Stainless steels – chemical composition	Definitions
Fed.spec TT-5-002230C		6.1.2(d)(ii), Definitions

	Where quoted
New Zealand Organisations	
BRANZ Bulletin 330: 1995 Thin flooring materials – Preparation and laying	3.1.10
BRANZ Bulletin 411:2001 Recommended domestic wastewater management	6.2.3
BRANZ House Insulation Guide – 3rd Edition, with 2008 Supplement	2.8.1 Comment
BRANZ Technical paper P21: 1991 A wall bracing test and evaluation procedure	4.6.3
BRANZ Evaluation Method EM1 Structural joints – strength and stiffness evaluation	Definitions
BRANZ Supplement to P21 An evaluation method of P21 test results for use with NZS 3604: 1990	4.6.3, 4.6.3.1
Ministry of Health: 2005 Drinking Water Standards for New Zealand	8.3.3
Ministry of Health: 2006 Household water supplies: the selection, operation and maintenance of individual household water supplies	8.3.3
Resource Management (National Environment Standards relating to certain Pollutants, Dioxins and other Toxins) Regulations: 2004 (NESAQ)	9.9.1 Comment (a)
New Zealand Legislation	
Plumbers, Gasfitters, and Drainlayers Act 2006	8.2.1(b), 8.3.2(b)

Definitions

This is a list of definitions for words or terms relevant to this *Acceptable solution*.

Acceptable solution A solution that must be accepted as complying with the *Building Code.*

Adequate *Adequate* to achieve the objectives of the *Building Code*.

Air admittance valve A valve that allows air to enter but not to escape in order to limit pressure fluctuations with the sanitary plumbing or drainage system.

Air seal A continuous seal fitted between window or door reveal and the surrounding wall *framing* to prevent the flow of air into the interior of the *building*.

Aluminium flashings Aluminium *flashings* shall be a minimum thickness of 0.7 mm, and formed from 5000 series in accordance with AS/NZS 1734 and, where pre-painted, have a factory-applied finish complying with AS/NZS 2728.

Aluminium-zinc coated steel flashings Aluminium-zinc coated steel flashings shall be:

(a) *BMT* 0.55 mm minimum of steel for *flashings* generally

(b) *BMT* 0.4 mm of steel for roll-formed roll-top ridge *flashings*

(c) in aluminium-zinc coating of AZ150 to AS 1397, with a factory-applied finish in accordance with AS/NZS 2728 Type 4, and in sea spray zone and corrosion zone 1 the factory-applied finish shall be Type 5 minimum.

Apron flashing A near flat or sloping *flashing* with a vertical upstand, used at junctions between *roofs* and walls.

Backing rod Closed cell polyethylene foam (PEF) rod inserted into gap to provide backing support for foam *air seal* or *sealant*.

Baluster An infil member that provides support for the top and bottom rails of a barrier.

Base metal thickness *(BMT)* The thickness of the bare or base metal before any subsequent coating, such as galvanising.

Batten See **ceiling batten**, **tile batten**.

Bird's beak A double fold applied to the edge of a horizontal metal *flashing* to stiffen the edge and to assist in deflecting moisture away from the *cladding* system. Refer also to **kick out** and **drip edge**.

Blocking Solid timber having the same depth as the joists and set at right angles between the joists to stiffen and prevent them from buckling

Bond, **running** or **stretcher** The *bond* when the units of each course overlap the units in the preceding course by between 25% and 75% of the length of the units.

Bottom plate A plate placed under the bottom end of *studs*.

Boundary joist A joist running along the outer end of the floor joists.

Bracing Any method employed to provide lateral support to a *building*.

Bracing capacity Strength of *bracing* of a whole *building* or of elements within a *building*. *Bracing capacity* is measured in *bracing units* (BUs).

Bracing demand The horizontal forces to be resisted by a whole *building* or by an element within a *building*. These horizontal forces are a result of wind or earthquake action. *Bracing demand* forces are measured in *bracing units* (BUs).

Bracing line A line along or across a *building* containing *wall bracing elements*.

Bracing rating The lateral load resistance assigned, for example, to a *wall bracing* system.

Bracing unit (BU) A *bracing* unit is a measure of:

(a) the horizontal force (*bracing demand*) on the *building* (1 kiloNewton is equal to 20 bracing units)

(b) the resistance to horizontal force (*bracing capacity*) of *building elements.*

Building has the meaning given to it by sections 8 and 9 of the Building Act 2004.

Building Code or **New Zealand Building Code** means the regulations made under section 400 of the Building Act 2004.

Building consent A consent issued by a building consent authority for building work to begin in accordance with the approved plans and specifications.

Building consent authority (BCA) A person whose name is entered in the register referred to in section 273(1)(a) of the Building Act 2004.

Building element Any structural and non-structural component or assembly incorporated into or associated with a *building*. Included are *fixtures*, services, *drains*, permanent mechanical installations, glazing, partitions, ceilings and temporary supports.

Building wrap or **building underlay** See **wall underlay**.

Butyl rubber and **EPDM flashings** *Butyl rubber* and *EPDM flashings* shall be a minimum thickness of 1.0 mm, and shall comply with the following parts of Table 1 in ASTM D6134:

(b) tensile strength

(c) elongation

(d) water absorption

(e) water vapour transmission

(f) heat aging followed by:

i) tensile strength

ii) elongation.

Capacity The load resistance of a connector or fixing.

Ceiling batten A horizontal member fixed below *rafters*, or truss bottom chords to which the ceiling *lining* is attached.

Cladding The exterior weather-resistant surface of a *building*.

Cladding system The weatherproof wall or *roof* enclosure of a *building*, including underlays, *claddings* and their fixings, windows, doors and all penetrations, *flashings*, seals, joints and junctions.

Cleared ground level (CGL) The *ground level* after completion of site excavation and removal of all harmful material, but before excavation for *foundations*.

Concrete slab shrinkage control joint A line along which the horizontal strength of the slab is deliberately reduced so that any shrinkage in the slab will result in a crack forming along that line.

Control joint A joint designed to prevent damage by accommodating movement. See also **expansion joint**.

D A deformed reinforcing bar of the stated *diameter* in millimetres.

Damp-proof course (DPC) A narrow strip (generally up to 300 mm wide) of *durable vapour barrier* greater than 90MN s/g to ASTM E96 and placed between *building elements* to prevent the passage of moisture from one element to another.

Damp-proof membrane (DPM) A sheet material, coating or vapour barrier, having a low water vapour transmission, and used to prevent water and water vapour movement through concrete in contact with the ground (also known as a concrete underlay).

Deck An open platform projecting from an *exterior wall* of a *building* and supported by *framing*.

Diagonal brace A member of a framed *building* fixed diagonally and used to resist tension or compression or both.

Diameter (or bore) The nominal internal *diameter*.

Direct fixed A term used to describe a wall *cladding* attached directly to the wall *framing*, without the use of a *drained cavity*.

Discharge pipe Any pipe that is intended to convey discharge from *sanitary fixtures* or *sanitary appliances*.

Drain A pipe normally laid below ground level including fittings and equipment, and intended to convey *foul water* or *surface water* to an *outfall*.

Drain vent pipe Any pipe which is intended to permit the movement of air into and out of the *drain* and *sewer*.

Drip edge Fold(s) applied to the edge of a metal *flashing* to deflect moisture away from the *cladding system*. Refer also to **bird's beak** and **kick-out**.

Dwang or **nogging** A short horizontal member fixed between *framing* timbers.

Eaves That part of the *roof construction*, including *cladding*, fascia and gutter, that extends beyond the exterior face of the wall.

Eaves bearer or **soffit bearer** or **sprocket** A horizontal member attached to the end of a truss or a *rafter* and to a *stud*, or a ribbon board, or a soffit plate, and to which the *eaves lining* is attached.

EPDM Ethylene Propylene Diene Monomer – a thermosetting synthetic rubber. See **butyl rubber**.

Expansion joint A joint designed to prevent damage by accommodating movement. See also **control joint**.

External wall An outer wall of a *building*.

Finished ground level (FGL) The level of the ground after all backfilling, landscaping, and surface paving have been completed.

Fixture An article intended to remain permanently attached to and form part of a *simple house*.

Fixture discharge pipe A *discharge pipe* that is used to convey waste from a single *sanitary fixture* or *sanitary appliance* to a *branch discharge pipe*, a *discharge stack* or directly to a *drain*. It does not include any pipes forming part of a *sanitary appliance*.

Flashing A component formed from a rigid or flexible *waterproof* material that drains or deflects water back outside the *cladding system*.

Flexible flashing tape A flexible self-adhesive *waterproof* tape. Usually used as an accessory for *wall underlays* to seal corners and intersections

Floor waste gully A disconnector gully for installation inside a *building*, for use with a floor grating or waste outlet fitting on a riser pipe and with provision, where required, for connection of waste pipes for *sanitary fixtures*.

Footing That portion of a *foundation* bearing on the ground and any adjoining portion that is reinforced so as to resist the bearing forces.

Foul water The discharge from any *sanitary fixture* or *sanitary appliance*.

Foul water drainage system *Drains*, joints and fittings normally laid underground and used specifically for the conveyance of water from the plumbing system to an *outfall*.

Foundation Those parts of a *building* transmitting and distributing loads to the ground through a *footing*.

Framing Timber members to which *lining, cladding*, flooring or decking is attached; or which are depended upon for supporting the structure, or for resisting forces applied to it.

Gable Triangular part of an *external wall* between the planes of the *roof* and the line of the *eaves*.

Galvanised steel flashings Galvanised steel *flashings* shall be:

(a) *BMT* of 0.55 mm minimum for *flashings* generally

(b) *BMT* of 0.4 mm minimum for roll-formed roll-top ridge *flashings*

(c) Hot-dipped zinc coated Z275 with a factory-applied finish that complies with AS/NZS 2728 Type 4, and in Sea Spray and corrosion Zone 1 the factory-applied finish shall be Type 5 minimum.

Good ground Any soil or rock capable of permanently withstanding an ultimate bearing pressure of 300 kPa (ie, an allowable bearing pressure of 100 kPa using a *factor of safety* of 3.0) but excluding:

(a) potentially compressible ground such as top soil, soft soils such as clay which can be moulded easily in the fingers, and uncompacted loose gravel which contains obvious voids;

(b) expansive soils being those that have a liquid limit of more than 50% when tested in accordance with NZS 4402 Test 2.2, and a linear shrinkage of more than 15% when tested from the liquid limit in accordance with NZS 4402 Test 2.6, and

(c) any ground which could foreseeably experience movement of 25 mm or greater for any reason including one or a combination of: land instability, ground creep, subsidence, seasonal swelling and shrinkage, frost heave, changing ground water level, erosion, dissolution of soil in water, and effects of tree roots.

(Note that soils, excepting those described in (a), (b) and (c) above, tested with a dynamic cone penetrometer in accordance with NZS 4402 Test 6.5.2, shall be acceptable as *good ground* for *building foundations* if penetration resistance is no less than:

(i) 3 blows per 75 mm at depths no greater than the footing width

(ii) 2 blows per 75 mm at depths greater than the footing width.

Depths shall be measured from the underside of the proposed *footing*.)

Gross floor area The area contained within the outside face of the exterior timber wall *framing* of a *simple house*.

Ground level See **cleared ground level**, **finished ground level**.

Gully trap A fitting designed to prevent foul air escaping from the *foul water drainage system* and used to receive the discharge from *waste pipes*.

Habitable space A space used for activities normally associated with domestic living, but excludes any bathroom, laundry, water closet, pantry, walk-in wardrobe, corridor, hallway, lobby, clothes-drying room, or other space of a specialised nature occupied neither frequently nor for extended periods.

Handrail A rail to provide support to, or assist with the movement of a *person*.

Household unit For a *simple house*, means a *building* or part of a *building* that is used or intended to be used for residential purposes.

Impervious That which does not allow the passage of moisture.

Internal wall A wall other than an *external wall*.

Kick out See **bird's beak**

Lead flashings Lead sheet *flashings* that:

(a) comply with AS 1804, and

(b) have a minimum unit mass of 17 kg/m².

Lightweight wall cladding Timber weatherboard (bevel-back or rusticated) or flat sheet (plywood or fibre-cement) *wall claddings* for use in this *Acceptable Solution*.

Lining The rigid sheet covering for a wall, ceiling or other interior surface.

Lintel A horizontal *framing* member spanning an opening in a wall.

Loadbearing stud A *stud* in a *loadbearing wall*.

Loadbearing wall A wall supporting vertical loading from a *roof*.

Loaded dimension The loaded dimension of structural elements which support other members at right angles. Refer to Figure 5.2.2.

M A steel bolt of the stated *diameter* in millimetres.

Masonry veneer Clay or concrete block veneer *cladding*.

Member span The clear distance between supports, measured along the member.

MSG Machine stress graded refers to timber that is initially sorted by machine, calibrated to NZS 3603. See also **VSG**.

Network utility operator A person who:

(a) undertakes or proposes to undertake the distribution or transmission by pipeline of natural or manufactured gas, petroleum, or geothermal energy, or

(b) operates or proposes to operate a network for the purpose of:

(i) telecommunication as defined in section 5 of the Telecommunications Act 2001, or

(ii) radio communications as defined in section 2(1) of the Radiocommmunications Act 1989, or

(c) is an electricity operator or electricity distributor as defined in section 2 of the Electricity Act 1992 for the purpose of line function services as defined in that section, or

(d) undertakes or proposes to undertake the distribution of water for supply (including irrigation), or

(e) undertakes or proposes to undertake a drainage or sewerage system.

Nogging See **dwang**

Non-loadbearing stud A stud in a *non-loadbearing wall.*

Non-loadbearing wall A wall other than a *loadbearing wall*.

Outfall That part of the disposal system receiving *surface water* or *foul water* from the drainage system. For *foul water*, the *outfall* may include a *sewer* or a septic tank. For *surface water*, the *outfall* may include a natural water course, kerb or channel, or soakage system.

Plate A timber member supported by a *foundation* or *studs* to support and distribute the load from floors, walls, *roofs* or ceilings. See **bottom plate**, **top plate**.

Plumbing system Pipes, joints and fittings, laid above ground and used for the conveyance of *foul water* to the *foul water drain* and including *vent pipes*.

Post An isolated vertical member acting as a support.

Proprietary fasteners *Proprietary fasteners* may be used where the fixing *capacity* of fixings are specifically identified in this *Acceptable Solution*.

Manufacturers of a timber connector or fixing shall provide the following information on each package of fixings, or on a securely attached label:

(a) the name, or registered trade name, or make and address of manufacturer

(b) the materials used in manufacture including fasteners and corrosion protection

(c) the load capacity of the timber connector or fixing in kN determined in accordance with the following equation:

$R = \varphi \times Q_k \times n \times k$

Where:

R = connector capacity in kN

φ = capacity reduction factor from NZS 3603

Q_k = characteristic value obtained by test in accordance with BRANZ Evaluation Method EM1 or AS/NZS 2699: Part 2 as appropriate

n = number of tested elements making up the complete joint

k = modification factors from NZS 3603 (Section 4) as appropriate to specific application.

(d) fastener's requirements

(e) details of *intended use*

(f) durability in accordance with Paragraph 2.5.4.

Purlin Includes **tile batten.** A horizontal member laid to span across *rafters* or trusses and to which the *roof cladding* is attached.

R A plain round reinforcing bar of the stated *diameter* in millimetres.

Rafter A *framing* timber normally parallel to the slope of the *roof* and providing support for the *purlins* or *roof* covering, or ceiling *lining*.

Reinforcement Any form of reinforcing rod, bar or mesh that complies with the relevant requirements of NZS 3109.

Ribbon board Includes **soffit plate**. A horizontal *framing* timber secured to, or checked into, the edges of *studs* and supporting *eaves bearers*.

Ridge beam A single beam that supports *rafters* of a *skillion roof*.

Roof underlay An absorbent, permeable paper that absorbs or collects condensation or water that may penetrate the *roof cladding*.

The *roof underlay* shall have the properties in Table 23 of the *Acceptable Solution* E2/AS1 for Building Code Clause E2 External Moisture:

(a) absorbency of 100 g/m^2 or greater

(b) vapour resistance 7 MN s/g or less

(c) water resistance of 100 mm or greater

(d) pH of extract of between 6.0 and 9.0

(e) shrinkage no more than 0.5%

(f) mechanical edge tear and tensile strength to AS/NZS 4200.

Roof That part of the *building* having its upper surface exposed to the outside and at an angle of between 10º and 35º to the horizontal. See **skillion roof**.

Running bonds, See **bond**

R-value The common abbreviation for describing the values of both *thermal resistance* and *total thermal resistance*.

Sanitary appliance An appliance which is intended to be used for *sanitation*, but which is not a *sanitary fixture*, for example a washing machine.

Sanitary fixture Any permanently attached *fixture* to a building which is intended to be used for *sanitation*.

Sealant A flexible neutral cure sealant for gap filling and weatherproofing that complies with:

(a) Type F, Class 20 LM or 25 LM of ISO 11600, or

(b) low modulus Type II Class A of Federal Specification TT-S-00230C.

Simple house A house that is described in Section 1 of this *Acceptable Solution*.

Sitework Work on a *building* site, including earthworks, preparatory to or associated with the construction, alteration, demolition or removal of a *building*.

Skillion roof A pitched *roof* where the ceiling *lining* is parallel and close to the *roof cladding*. The *roof* may be mono-pitch or may consist of more than one *roof* plane. These *roofs* may have *rafters* exposed below the ceiling.

Soffit bearer See **eaves bearer**.

Soffit plate See **ribbon board**.

Soft edge A compatible soft edging seamed onto *flashings* to provide closure to profiled *roof cladding*.

Spacing or **spaced** The distance at which members are spaced, measured centre to centre.

Spans See **member span** and **support span**.

Specific design Design and detailing of a proposed *building* or parts of a *building*, demonstrating compliance with the Building Code, that shall be provided to the *building consent authority* for assessment and approval as part of the *building consent* process. *Buildings*, or parts of *buildings*, requiring *specific design* are beyond the scope of this *Acceptable Solution*.

Stainless steel flashings Stainless steel *flashings* shall be:

(a) minimum thickness of 0.45 mm, and

(b) Type 304 or 316 stainless steel in accordance with Table 1 of ISO/TS 15510.

Stretcher bonds, See **bond**

Stud A vertical *framing* member.

Support span A clear distance along a member between supports, measured in plan (horizontally).

Surface water All naturally occurring water, other than sub-surface water, which results from rainwater on the site or water flowing onto the site, including that flowing from a *drain*, stream, river, lake or sea.

Territorial authority City or district council (as named in Schedule 2, Part 2 of the Local Government Act 2002) responsible for community wellbeing and development, environmental health and safety (including building control, civil defence, and environmental health matters), infrastructure (roading and transport, sewerage, water/stormwater), recreation and culture, and resource management including land use planning and development control.

Thermal resistance The resistance to heat flow of a given component of a *building element*. It is equal to the temperature difference (°C) needed to produce unit heat flux (W/m^2) through unit area (m^2) under steady conditions. The units are $°Cm^2/W$.

Tile batten See **purlin**.

Top plate A plate placed over the top end of *studs*.

Total wall area In relation to a *simple house*, means the sum (expressed in square metres) of the following:

(a) the wall area of the *building*, or

(b) the area (expressed in square metres) of all vertical glazing in *external walls* of the *building*.

Trapezoidal A type of profiled metal *roof cladding* with symmetrical or asymmetrical crests, with troughs between the crests.

Trimmer A member supporting the wall *framing* beneath, or over an opening in a *non-loadbearing wall* and carrying wind loads to the *trimmer studs*.

Trimmer stud A *stud* located on the side of an opening.

Universal access Where elements and spaces are accessible to and usable by people of all ages and abilities to the greatest extent possible.

uPVC flashings uPVC *flashings* shall be a minimum of 0.75 mm thick and:

(a) comply with the requirements of the following Clauses of AS/NZS 4256: Part 2:

ii) Clause 9.2 Impact resistance

iii) Clause 9.3 Tensile strength

iv) Clause 9.4 Colourfastness and impact resistance following ultraviolet light exposure.

(b) where exposed to the weather, shall also comply with Section 8 of AS/NZS 4256: Part 2.

(c) have a finish colour with a reflectance of 40% or more, when measured in accordance with ASTM C1549 or ASTM E903.

Valley board A board laid to support a *valley gutter*.

Valley gutter A gutter running down the valley formed by the intersection of two pitched *roof* surfaces.

Vent pipe A pipe for the purpose of protecting *water seals* that at its upper end is either open to the atmosphere or fitted with an *air admittance valve*, and at its lower end is connected to a *discharge pipe*.

VSG Visual stress graded, refers to verified timber that is initially sorted visually in accordance with NZS 3603. See also **MSG**.

Wall bracing element A section of wall that performs a *bracing* function.

Wall underlay An absorbent synthetic wrap used as part of the wall *cladding system* to assist the control of moisture by ensuring moisture which may occasionally penetrate the wall *cladding* is directed back to the exterior of the *building*.

The *wall underlay* shall have the properties in Table 23 of the *Acceptable Solution* E2/AS1 for Building Code Clause E2 External Moisture:

(a) absorbency – no requirement

(b) vapour resistance 7 MN s/g or less

(c) water resistance of 20 mm or greater

(d) pH of extract of between 6.0 and 9.0

(e) shrinkage no more than 0.5%

(f) mechanical edge tear and tensile strength to AS/NZS 4200.

Waste pipe A *discharge pipe* that conveys the discharge from waste water *fixtures* to a *gully trap* or *floor waste gully*.

Waterproof and **waterproofing** The complete and total resistance of a *building element* to the ingress of any moisture.

Water seal The depth of water that can be retained in a *water trap*.

Water trap A fitting designed to retain a depth of water that prevents foul air and gases escaping from the *plumbing system* or *foul water drainage system* and entering a *building*.

Weathertightness and **weathertight** Terms used to describe the resistance of a *building* to the weather.

Wet area An area within a *building* supplied with water from a water supply system including bathrooms and showers, laundries, sanitary compartments and kitchen areas.

Wire dog Galvanised or stainless steel wire, D or Z shaped nail, spiked at each end. Used for fixing timber together to resist uplift.