STANDARDS
NEW ZEALAND
Paerewa Aotearoa

NZS 3604:1999

TIMBER FRAMED BUILDINGS

AMENDMENT No. 1

December 2000

Instructions for Amendment No.1

This Amendment has been published in two different formats.

Firstly, the Amendment consists of 'Revised text amendments' printed on green paper. The user should alter their copy of NZS 3604:1999 according to the instructions shown on these pages.

Secondly, Amendment No. 1 consists of 38 replacement pages. All pages are identified by a number at the bottom of the page and a section number and title at the top of each page.

Each alteration or addition to the text, tables or figures is identified by a marginal bar indicating the Amendment number and date of publication.

Holders of NZS 3604:1999 are advised to insert the new pages into their copy of the Standard and to discard the replaced pages. That this has been done should then be noted under 'AMENDMENTS' on the inside front cover of the document.

The following is a list of the replacement pages included with this Amendment. We recommend you keep this list as a reference against which a future check can be made that your copy of NZS 3604:1999 has been up-dated correctly:

Pages **1**-21 & **1**-22;
4-3 to **4**-12;
6-33 & **6**-34;
10-14A & **10**-14B, **10**-21 & **10**-22, **10**-31 & **10**-32, **10**-35 to **10**-38, **10**-43 & **10**-44;
11-3 to **11**-6;
14-5 & **14**-6, **14**-11 & **14**-12;
15-3 & **15**-4, **15**-12A & **15**-12B.

155 The Terrace, Wellington 6001, Private Bag 2439, Wellington 6020.
Phone (04) 498 5990 Sales (04) 498 5991 Fax (04) 498 5994
E-mail: snz@standards.co.nz Website: www.standards.co.nz

Single User PDF Terms & Conditions

You have material which is subject to strict conditions of use. Copyright in this material is owned by the New Zealand Standards Executive. Please read these terms and conditions carefully, as in addition to the usual range of civil remedies available to Standards New Zealand on behalf of the New Zealand Standards Executive for infringement of copyright, under New Zealand law every person who infringes copyright may be liable to a fine of up to $10,000 for every infringing copy or imprisonment of up to 5 years, or a fine of up to $150,000 or imprisonment not exceeding 5 years.

You have access to a single-user licence to read this non-revisable Adobe Acrobat PDF file and print out and retain ONE printed copy only.

We retain title and ownership of the copyright in this PDF file and the corresponding permitted printed copy at all times.

Under this license use of both the PDF file and the single permitted printed copy of this PDF file you may make are restricted to you. Under no circumstances are you permitted to save, sell, transfer, or copy this PDF file, the one permitted printed copy of this PDF file, or any part of either of them.

You undertake that you will not modify, adapt, translate, reverse engineer, decompile, disassemble or create derivative works based on any of the downloaded PDF file, nor will you merge it with any other software or document, even for internal use within your organization.

Under no circumstances may this PDF file be placed on a network of any sort without our express permission.

You are solely responsible for the selection of this PDF file and any advice or recommendation given by us about any aspect of this PDF file is intended for guidance only and is followed or acted upon entirely at your own risk.

We are not aware of any inherent risk of viruses in this PDF file at the time that it is accessed. We have exercised due diligence to ensure, so far as practicable, that this file does not contain such viruses.

No warranty of any form is given by us or by any party associated with us with regard to this PDF file, and you accept and acknowledge that we will not be liable in any way to you or any to other person in respect of any loss or damage however caused which may be suffered or incurred or which may arise directly or indirectly through any use of this PDF file.

Regardless of where you were when you received this PDF file you accept and acknowledge that to the fullest extent possible you submit to New Zealand law with regard to this licence and to your use of this PDF file.

NZS 3604:1999

TIMBER FRAMED BUILDINGS

AMENDMENT No. 1

December 2000

REVISED TEXT

EXPLANATORY NOTE

Amendment No. 1 incorporates technical and editorial changes and items by way of clarification.

APPROVAL

Amendment No. 1 was approved on 8 December 2000 by the Standards Council to be an amendment to NZS 3604:1999.

RELATED DOCUMENTS

NEW ZEALAND STANDARDS (pages 4 and 5)

Add "NZS 2295:1988 Building papers (breather type)".

Delete "NZS 3109:1987" and **substitute** "NZS 3109:1997".

Delete	"NZS 4229:0000	Concrete masonry buildings not requiring specific design (in preparation)" and **substitute**
	"NZS 4229:1999	Concrete masonry buildings not requiring specific engineering design".

Delete	"NZS 7202:- - - - -	Synthetic resin adhesives (phenolic and aminoplastic) for wood
	Part 1:1986	Specification for gap-filling adhesives".

JOINT AUSTRALIAN/NEW ZEALAND STANDARDS (page 6)

Delete	"H NZS/AS 1397:1993	Steel sheet and strip – Hot-dipped, zinc-coated or aluminium/zinc-coated".

Delete	"AS/NZS 1859:- - - -	Reconstituted wood-based panels" and **substitute**
	"AS/NZS 1859:- - - -	Reconstituted wood-based panels
	Part 1:1997	Particleboard
	Part 2:1997	Medium density fibreboard (MDF)".

Delete	"AS/NZS 2699:- - - -	Built-in components for masonry construction
	Part 1:1999	Wall ties
	Part 2:1999	Connectors and accessories
	Part 3:1999	Lintels and shelf angles" and **substitute**
	"AS/NZS 2699:	Built-in components for masonry construction
	Part 1:2000	Wall ties
	Part 2:2000	Connectors and accessories
	Part 3:2000	Lintels and shelf angles (durability requirements)".

Delete	"H NZS/AS 2908:- - - -	Cellulose-cement products
	Part 1-1992	Corrugated sheets
	Part 2-1992	Flat sheets" and **substitute**
	"AS/NZS 2908:- - - -	Cellulose-cement products
	Part 1-2000	Corrugated sheets
	Part 2-2000	Flat sheets".

Delete "AS/NZS 4200:- Pliable building membranes and underlays
Part 1:1994 Materials
Part 2:1994 Installation requirements".

AUSTRALIAN STANDARDS (page 7)

Add "AS 1214–1983 Hot-dip galvanized coatings on threaded fasteners (ISO metric coarse thread series)".

Add "AS 1397–1993 Steel sheet and strip – Hot-dipped zinc-coated or aluminium/zinc-coated".

Add "AS 3566–1988 Screws – Self drilling – For the building and construction industries".

Delete "AS 1650–1989 Hot-dipped galvanized coatings on ferrous articles".

(Amendment No. 1, December 2000)

1.1.2(h)(iv) (page **1**-5)
In line 2 **delete** "suspended concrete floor" and **substitute** "suspended timber or concrete floor".

(Amendment No. 1, December 2000)

Figure 1.2 (page **1**-11)
In the TWO STOREY and THREE STOREY figures measure the 10 m max. from the lowest ground level and not from the underside of footings as dimensioned.

In the THREE STOREY figure **delete** "Concrete masonry to NZS 4229" and **substitute** "Concrete masonry walls and suspended timber or concrete floor to NZS 4229".

In the THREE STOREY figure **delete** "Alternate foundation is concrete slab-on-ground" and **substitute** "On level sites the foundation wall shown would be replaced with a concrete slab-on-ground."

(Amendment No. 1, December 2000)

1.3 Definitions (page **1**-14)
Add the following new definitions:

"CONCRETE SLAB CONSTRUCTION JOINT. A joint that results from concrete in one section of the slab being poured up against another vertical section of slab that has already been poured and allowed to harden for 16 hours.

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.

CONCRETE SLAB BAY. The section of a concrete floor resulting from division of the slab by construction and control joints.

CONCRETE SLAB FREE JOINT. A construction joint where no reinforcement passes through the joint linking both sides of the concrete slab and the vertical faces of the joint are not in bonded contact with each other."

(Amendment No. 1, December 2000)

1.3 Definitions (page **1**-16)

GOOD GROUND.
In line 3 of (b) **add** the words "from the liquid limit" after "when tested".

(Amendment No. 1, December 2000)

1.3 Definitions (page **1**-16)
Delete the definition for JACK STUD and **substitute** the following:

"JACK STUD.
(a) A *stud* of less length than the full height, from *plate* to *plate* of wall of which it forms part; or

(b) A *stud* at *pile spacing* forming part of the supporting framing under the ground floor of a building."

(Amendment No. 1, December 2000)

Section 4. Contents. (page **4**-1)

Delete the title for table 4.2 and **substitute** "Galvanizing of steel components other than nails and screws"

Delete the title for table 4.3 and **substitute** "Steel items such as nails and screws used for framing and cladding"

(Amendment No. 1, December 2000)

5.1.5 (page **5**-3)
Delete the second and third sentences and **substitute** the following:

"When any building has discontinuous floor levels, there shall be an internal *bracing* line in the *storey* below (or subfloor), at the location of the discontinuity."

(Amendment No. 1, December 2000)

Table 5.1 (page **5**-4)
For topographic class T4 **delete** the heading "Sheltered" and **substitute** "Exposed".

(Amendment No. 1, December 2000)

Figure 5.2 (page **5**-7)
Delete "or spur" under "Escarpment" and provide arrows, from "Escarpment" to the dotted line above and from "Hill or ridge" to the dashed line.

(Amendment No. 1, December 2000)

5.3.3.4 ***Part storey basement*** (page **5**-11)
In the third line **delete** "or 3."

(Amendment No. 1, December 2000)

5.4.3.1(b) (page **5**-16)
Delete "6.2.4" and **substitute** "6.2.3".

(Amendment No. 1, December 2000)

6.4.1.1(b)(iii) (page **6**-5)
In the second line **delete** "including fixings for braces".

6.4.1.1(c) (page **6**-5)
Add "See 6.4.3.3 for pile treatment."

(Amendment No. 1, December 2000)

6.4.2 ***Cross sections of piles*** (page **6**-5)
Delete the text and **substitute** the following:

"The cross section of a *pile* shall have a minimum dimension of:

(a) 200 mm sides or diameter for parallel-sided concrete *piles*;

(b) 150 mm sides or diameter at the top and 200 mm sides or diameter at the bottom for tapered concrete *piles*;

(c) 190 mm sides for concrete masonry *piles*;

(d) 140 mm diameter for round timber *piles*. See NZS 3605.

(e) 125 mm sides for square sawn timber *piles*.

(Amendment No. 1, December 2000)

6.4.5.6 (page **6**-7)
Delete the second paragraph "Cast-in-situ piles .... of the building" and **add** the following new clause and commentary clause:

"**6.4.5.7** ***Loading***
Cast-in-situ piles or piles embedded in a concrete *footing* shall not be fully loaded with the dead weight of the building until the concrete is 24 hours old. The concrete shall not have a slump exceeding 60 mm at the time of placing and the ambient temperature shall not fall below 10 °C throughout the 24 hours. Where such conditions are not met then the waiting period shall be extended to 48 hours."

(Amendment No. 1, December 2000)

6.7.3.2 and **6.7.3.3** (page **6**-16)
In the second line of each clause **delete** "2" and substitute "two".

(Amendment No. 1, December 2000)

6.9.3 (page **6**-23)
In the second line **add** the words "as illustrated" after "locations".

(Amendment No. 1, December 2000)

Figure 6.10 (page **6**-25)
In the Note near top right **delete** "6.4.1.1(b)(ii)" and **substitute** "6.4.1.1(b)(iii)".

(Amendment No. 1, December 2000)

Figure 6.11 (page **6**-28)
Delete "150 min." footing depth and **substitute** "140 min.".

(Amendment No. 1, December 2000)

Table 6.4 (page **6**-30)
Add "with 2-D12 bars" to the Note at the bottom of the table.

(Amendment No. 1, December 2000)

Table 6.7 (page **6**-39)
Delete table 6.7 and **substitute** the following new table 6.7:

Table 6.7 – Stringer sizes and fixings (see 6.13.1 and 6.13.2)

Stringer nominal size (mm)	**Maximum span of floor joists** (m) **at a maximum M12 bolt spacing** (mm) **of:**				
	800	900	1200	1600	2400
200 x 50	6.0	5.0	4.0	3.0	2.0
150 x 50	6.0	5.0	4.0	3.0	–
125 x 50	6.0	5.0	–	–	–

(Amendment No. 1, December 2000)

7.1.3.2 (page **7**-7)
In the second line **delete** "within 300 mm of the end of the doubled floor joist." and **substitute** "within 300 mm of the end of the span of the doubled floor joist."

(Amendment No. 1, December 2000)

C7.1.5.1 (page **7**-10)
Delete subclause (a) and **substitute** *"Cantilever floors for bay windows are outside the scope of table 7.2".*

(Amendment No. 1, December 2000)

7.3.1 (page **7**-19)
Add the following commentary clause:

*"**C7.3.1***
A floor diaphragm permits wider spacing of bracing lines below the floor, but has no effect on bracing line (wall) spacing above the floor".

(Amendment No. 1, December 2000)

7.5.1 (page **7**-21)
Delete the text and **substitute** the following:

"This clause sets down requirements for concrete slab-on-ground floors with maximum dimension 24 m either way between *free joints*, or between *free joints* and the slab edge, for an occupancy loading of up to 3 KPa. Slabs exceeding the maximum dimension are outside the scope of this Standard and require *specific engineering design*. (See 7.5.8.5)."

(Amendment No. 1, December 2000)

C7.5.1 (page **7**-21)
Add a paragraph as follows:

"Slabs longer than 24 m may be constructed provided they are comprised of sections separated by free joints."

(Amendment No. 1, December 2000)

7.5.8.1(a) (page **7**-29)
In the first line **delete** "floor" and **substitute** "*storey*".

(Amendment No. 1, December 2000)

7.5.8.3 (page **7**-30)
Delete line 4 and **substitute** the following:

"welded steel mesh for slabs 12 m to 24 m long or 1.29 kg/m^2 welded steel mesh for slabs no longer than 12 m between *free joints* or edges. *Free joints* are joints that have no reinforcement passing through the joint that links both sides and no bonding between vertical concrete faces. Bonding shall be prevented with building paper or a bituminous coating. Mesh sheets shall be lapped by 225 mm at sheet joints."

(Amendment No. 1, December 2000)

7.5.8.5 *Slab dimensions* (page **7**-30)
Delete the text and **substitute** the following:

"Slabs may be of unlimited size provided the requirements of 1.1.2(n) and 7.5.1 are met."

(Amendment No. 1, December 2000)

7.5.8.6.1 *General* (page **7**-30)
Delete the text and **substitute** the following:

"Shrinkage control joints shall either be formed by saw cutting the slab after it has hardened, or by casting-in a crack inducer into the slab. Crack inducer placement shall not damage the *DPM*. The inducer or saw cuts shall extend to a quarter of the depth of the slab. Saw cutting shall take place no later than 24 hours for average ambient temperatures above 20 °C, and 48 hours for average ambient temperatures below 20 °C."

(Amendment No. 1, December 2000)

Table 7.5 (page **7**-34)
In the floor framing column for the entry "Joist to plate on foundation walls" **delete** "18 (skewed)" in the column for power driven nails and **substitute** "18 (skewed) per 1.5 m length".

(Amendment No. 1, December 2000)

Table 8.1 (page **8**-4)
In the left hand column **delete** "Less than 0.5" and **substitute** "Less than 0.625".

Delete "More than 0.5 but less than 1.5" and **substitute** "More than 0.625 but less than 1.5."

(Amendment No. 1, December 2000)

8.3.3.4(b) (page **8**-5)
Delete the text and **substitute** the following:

"(b) At the *external wall* being considered, the *dragon ties* shall also be fixed within 100 mm of the *top plate* to a joist, truss or rafter; and"

(Amendment No. 1, December 2000)

8.5.1.5 (page **8**-13)
In line 1 **delete** the word "loadbearing" before "walls".

(Amendment No. 1, December 2000)

Figure 8.4 (page **8**-14)
In the right hand figure move 25 mm hole further below the top notch.

Add "NOTE (4) 100 min. offset between hole and notch."

(Amendment No. 1, December 2000)

Figure 8.5 (page **8**-15)
Delete the two figures at the top on the right hand side that show lintels comprised of 2/25 mm timbers.

(Amendment No. 1, December 2000)

Table 8.7 (page **8**-18)
Delete trusses multiplier "6" and **substitute** "SED".

(Amendment No. 1, December 2000)

Figures 8.8 and 8.9 (pages **8**-20 and **8**-21)
Substitute a truss in place of the roof details shown in figures 8.8 and 8.9.

Delete "roof" and **substitute** "framed roof or truss" in both figures.

(Amendment No. 1, December 2000)

Table 8.14 (page **8**-26)
In the heading **delete** "see 8.1.6.8 for fixings" and **substitute** "see 8.6.1.8 for fixings".

(Amendment No. 1, December 2000)

Figure 8.15 (page **8**-32)
After table headings "Capacities of metal plate joints" and "Capacities of nailed joints" **add** "(2)".

Delete "NOTE – See section 4 for durability requirements" and **substitute**:

NOTE –
(1) See section 4 for durability requirements.
(2) Not required when extra top plate is used.

(Amendment No. 1, December 2000)

Figure 8.19 (page **8**-36)
Add "Max. length 200" to both notch details.

Add "NOTE – 100 min. offset between edge of holes and notch."

(Amendment No. 1, December 2000)

8.7.5.1 (page **8**-36)
Add the following new commentary clause:

*"**C8.7.5.1***
Strengthening is required against loads vertical to, horizontal to, or along the plate."

(Amendment No. 1, December 2000)

Table 8.18 (page **8**-37)
In the heading **delete** "Truss spacing" and **substitute** "Roof member spacing".

(Amendment No. 1, December 2000)

8.7.6 (page **8**-37)
In line 1 **delete** "roof trusses" and **substitute** "roof members".

In line 2 **delete** "(see figure 8.12)".

(Amendment No. 1, December 2000)

9.1 (page **9**-3)
In lines 2 and 3 **delete** "The *lintel* sizes shall be obtained from tables 8.9 to 8.11." and **substitute** "The verandah beam sizes shall be obtained from table 10.8."

(Amendment No. 1, December 2000)

9.2.1 (page **9**-3)
In line 4 **delete** "with the relevant parts of sections 3 and 6" and **substitute** "with 9.2.2."

(Amendment No. 1, December 2000)

10.2.1.3.2 (page **10**-6)
In line 1 **delete** "Ordinary *rafter* dimensions" and **substitute** "*Rafter* and *valley rafter* dimensions".

(Amendment No. 1, December 2000)

10.2.1.5.1 (page **10**-17)
In line 3 **delete** "See table 10.3 and figure 10.7."

(Amendment No. 1, December 2000)

10.2.1.5.2 (page **10**-17)
Delete the clause and **substitute** "The *ridge beam* sizes shall be determined from table 10.6. The *ridge beam* shall be secured to the wall with a fixing type determined from table 10.6. The fixing shall be as required by table 10.3 and shown by figure 10.7. The built up *studs* shown in figure 10.7 shall be provided with base connections as required by table 10.3 and the wall base connection details of figure 8.12."

(Amendment No. 1, December 2000)

Table 10.3 (page **10**-17)
Delete the table and **substitute**:

"**Table 10.3 – Key to fixing types to restrain ridge beam uplift (see 10.2.1.5.2)**

Fixing type	**Fixing to resist uplift**		**Alternative fixing capacity** (kN)
	Base connection of built up studs	**Ridge beam to built up studs**	
A	2/100 x 3.75 skew nails into bottom plate	2/100 x 3.75 nails	0.7
B	4/100 x 3.75 skew nails into bottom plate	4/100 x 3.75 nails	2.7
C	6/100 x 3.75 skew nails into bottom plate	6/100 x 3.75 nails	4.7
D	25 x 1 strap with 6 nails to stud and plate(1)(3)	1/M12 bolt	6.7
E	2/25 x 1 strap with 6 nails to stud and plate. 12 nails total(1)(3)	1/M12 bolt	8.7
F	3/25 x 1 strap with 6 nails to stud and plate. 18 nails total(2)(3)	2/M16 bolts	18.6

NOTE –
(1) Fix plate to joist with 1/M12 x 150 coach screw.
(2) Fix plate to joist with 2/M12 x 150 coach screws.
(3) Strap nails to be 30 x 2.5 mm."

(Amendment No. 1, December 2000)

Table 10.6(c) (page **10**-23)
Delete NOTE – "(4) For ridge beam to wall fixing types and capacities see table 10.3." and **substitute** "(4) For ridge beam to wall fixings use the fixing type determined from the upper table and select the appropriate fixing from table 10.3."

(Amendment No. 1, December 2000)

Table 10.6(d) (page **10**-24)
Delete NOTE – "(3) For ridge beam to wall fixing types and capacities see table 10.3." and **substitute** "(3) For ridge beam to wall fixings use the fixing type determined from the upper table and select the appropriate fixing from table 10.3."

(Amendment No. 1, December 2000)

Table 10.6(d) (page **10**-24)
Delete "(d) Heavy roof in low, medium and high wind zone" and **substitute** (d) Heavy roof in low, medium, high and very high wind zone."

(Amendment No. 1, December 2000)

10.2.2.2(a) (page **10**-41)
Delete "*member span*" and **substitute** "*support span*".

(Amendment No. 1, December 2000)

Table 10.14 (pages **10**-54 and **10**-55)
Add new Note "(3) Proprietary fixings with the required fixing capacity indicated in the tables may be used".

(Amendment No. 1, December 2000)

Table 11.3 (page **11**-8)
Delete reference to NZS/BS 1449 for profiled zinc coated steel sheet.

(Amendment No. 1, December 2000)

Figure 11.1 Detail A (page **11**-12)
Add "NOTE – Two ties in adjoining courses are needed immediately above DPC."

(Amendment No. 1, December 2000)

11.7.4.3 (page **11**-13)
Add the following to clause 11.7.4.3:

"Where the first course is less than 75 mm in height, the *spacing* of weep holes shall be decreased to give a ventilation area of 1000 mm^2/m wall length."

(Amendment No. 1, December 2000)

C11.8.2 (page **11**-19)
Delete text of commentary clause and **substitute** the following:

*"**C11.8.2***
Proprietary rigid backing systems which use alternative materials or spacings are outside the scope of this Standard."

(Amendment No. 1, December 2000)

11.8.6.1 (page **11**-22)
Delete the following sentence:

"Breather type building paper shall be fixed directly to the *framing* prior to fixing the polystyrene."

(Amendment No. 1, December 2000)

12.1 (page **12**-3)
Add to clause "The interior *lining* on each side of a wall shall weigh less than 12.0 kg/m^2."

(Amendment No. 1, December 2000)

Table 14.6 (page **14**-8)
Delete the whole of the 3 storeys column on the right hand side of the table.

(Amendment No. 1, December 2000)

Section 15 (page **15**-1)
Delete the section title "**0.5 kPa SNOW LOADING**" and **substitute** "**0.5 kPa or 1 kPa SNOW LOADING**".

(Amendment No. 1, December 2000)

Table 15.6(a) (page **15**-8)
Delete table title "Rafters and valley rafters" and **substitute** "Rafters".

(Amendment No. 1, December 2000)

Table 15.7(a) (page **15**-13)
Delete NOTE – "(3) See table 10.13 for fixing types and capacity." and **substitute** "(3) For *ridge beam* to wall fixings use the fixing type determined above in table 10.3."

(Amendment No. 1, December 2000)

Table 15.7(b) (page **15**-14)
Delete NOTE – "(3) See table 10.13 for fixing types and capacity." and **substitute** "(3) For *ridge beam* to wall fixings use the fixing type determined above in table 10.3."

(Amendment No. 1, December 2000)

16.1 (page **16**-3)
Delete the last sentence and **substitute**:

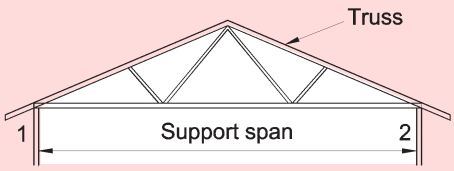
"Other requirements shall be as given in 8.6. The fixings shall be in accordance with tables 8.14 and 8.19 for spans up to 4.1 m and in accordance with figure 16.2 for spans greater than 4.1 m."

(Amendment No. 1, December 2000)

Figure 16.2 (page **16**-4)
In the ELEVATION **delete** "For fixing details see tables 8.14 and 8.19."

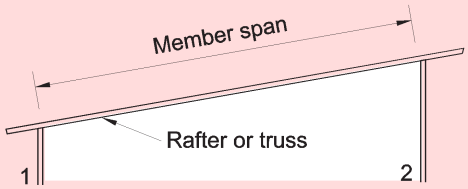
(Amendment No. 1, December 2000)

Amd 1 Dec '00



(A) SUPPORT SPAN

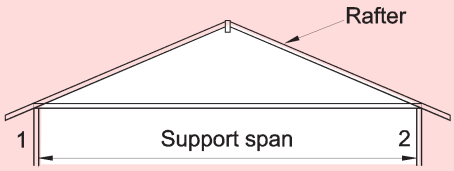
(A) For members 1 and 2:
Loaded dimension = $\frac{\text{Support span}}{2}$



(B) MONOSLOPE ROOF

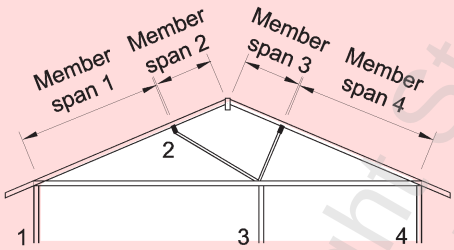
(B) For members 1 and 2:
Loaded dimension = $\frac{\text{Member span}}{2}$

Amd 1 Dec '00



(C) COUPLE CLOSE ROOF OR TIED RAFTERS

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



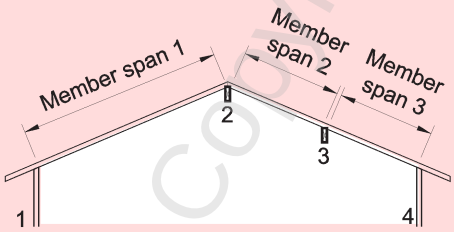
(D) FRAMED OR STRUTTED ROOF

(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 = $\frac{\text{span 1}}{2} + \text{span 2} + \text{span 3} + \frac{\text{span 4}}{2}$

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



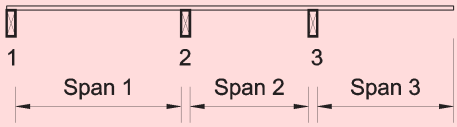
(E) RAFTERS SUPPORTED ON BEAMS OR WALLS

(E) 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 = $\frac{\text{span 3}}{2}$



(F) FLOOR STRUCTURE

(F) 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 = $\frac{\text{span 2}}{2} + \text{span 3}$

NOTE - Maximum eaves overhang dimension 750. Such overhangs may be ignored when calculating loaded dimensions.

Figure 1.3 – Definitions of spans and loaded dimensions (see 1.3)

NOTES

4 DURABILITY

4.1 General

This section provides a means of compliance with Clause B2 of the *New Zealand Building Code*.

4.2 Classification of exposure zones

4.2.1

Building sites shall be classified as being in sea spray zones or zones 1, 2, 3 or 4, depending on the severity of exposure to wind-driven sea salt or to geothermal gases.

4.2.2

Sea spray zones and zones 1, 2, 3 and 4 are shown in figure 4.1.

4.2.3

Amd 1 Dec '00

The sea spray zone referred to in table 4.1 is defined as within 500 m of the sea including harbours, or 100 m from tidal estuaries and sheltered inlets, as well as areas shown in white on figure 4.1. The sea spray zone also includes all offshore islands including Waiheke, Great Barrier, Stewart Island and the Chatham Islands.

4.2.4

Amd 1 Dec '00

"Geothermal hot spots" are mainly found in Zone 4 but may occur elsewhere.

4.2.5

Localized areas subject to corrosive industrial atmospheres are outside the scope of this Standard.

4.2.6

Amd 1 Dec '00

If local knowledge indicates that a zone is too conservative, the *Territorial Authority* may approve the use of a lesser zone, but this will be an alternative solution to the *NZBC*.

4.3 Timber and wood-based products

4.3.1

The timber species, grade, preservative treatment, in-service moisture range and their end use environment shall comply with NZS 3602.

C4.2

Section 4 presents a simple solution to what is a very complex problem. It is acknowledged that in some instances this may be a conservative solution. If the corrosion exposure zone, determined for a particular site from section 4, appears to be too severe, then the applicant may reclassify the site. Such reclassification however would be outside the scope of NZS 3604 as an Acceptable Solution to the New Zealand Building Code, and would be an alternative solution. The alternative solution would need to be submitted to, and approved by, the Territorial Authority as part of the building consent process.

To assist the Territorial Authority in its assessment of an alternative solution, it is suggested that the applicant would need to elaborate on all their considerations and in particular would need to address the following issues:

In Sea Spray Zones:

(a) Direction of prevailing wind from the sea;
(b) Prevalence of breaking surf;
(c) Existence of salt spray residue on windows or cladding of adjacent buildings;
(d) Existence of constant smell of salt in the air;
(e) Wind classification of site.

In Zone 1 areas

Shelter provided by ridges or spurs, large belts of trees or other such features.

In Zone 4

Location of building in relation to geothermal hot spots and prevailing wind.

In all zones

Performance of adjacent buildings.

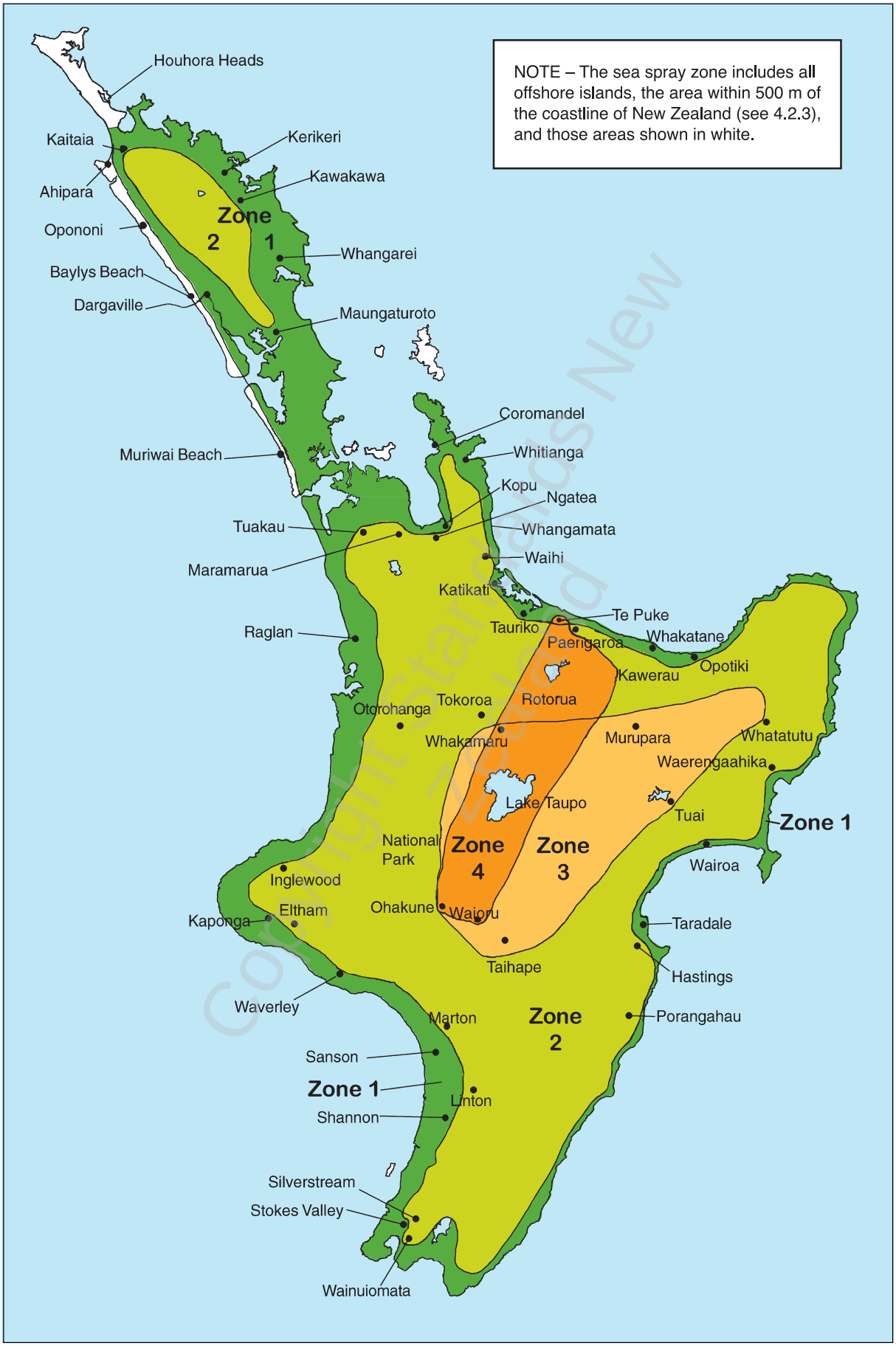


Figure 4.1 – Corrosion zone map (see 4.2)

Amd 1
Dec '00

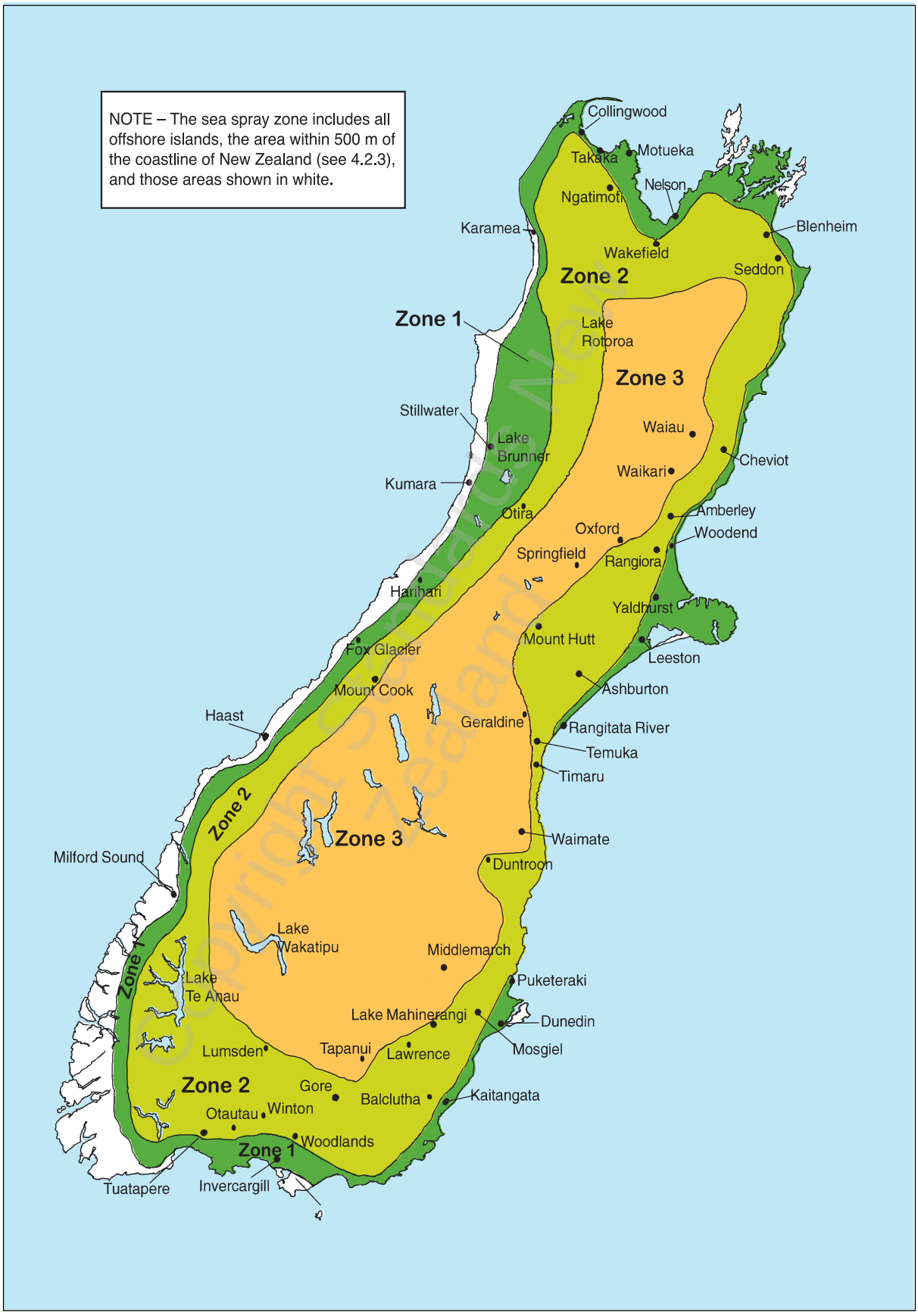


Figure 4.1 – Corrosion zone map (continued) (see 4.2)

Amd 1
Dec '00

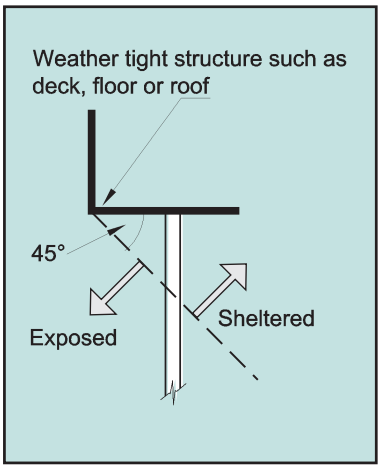


Figure 4.2 – "Sheltered" and "Exposed"
(see table 4.1)

Amd 1 Dec '00

C4.3.4.2
Perforated foil does not provide protection from ground atmosphere (refer to NZS 3602).

4.3.2
All timber and wood-based products shall be protected against damage from moisture, and against significant variations of moisture content, both before and after installation or enclosure.

4.3.3 *Timber*
Framing timber shall be separated from concrete or concrete masonry in accordance with 2.3.3.

4.3.4 *Wood-based products*

4.3.4.1
Wood-based products (e.g. particleboard, fibreboard) shall be manufactured to AS/NZS 1859. Wood-based products used for flooring in areas likely to be subject to watersplash such as in bathrooms, kitchens and laundries, shall be protected by an impervious finish or *lining* with sealed joints. *NZBC* E3/AS1 has a list of acceptable finishes and *linings*.

4.3.4.2
Wood-based products used for flooring shall be in accordance with AS/NZS 1859.1 Class 2 flooring. They shall be no closer to exposed ground than 550 mm and be protected from exterior exposure.

4.3.4.3
Medium density wood-based products shall not be exposed to ground atmosphere or be used externally. It shall not be used for flooring.

Amd 1 Dec '00

4.3.4.4
Plywood products manufactured to AS/NZS 2269 used for flooring in areas likely to be subject to water splash such as in bathrooms, kitchens and laundries, shall be H3 treated or protected by an impervious finish or *lining* with sealed joints. *NZBC* E3/AS1 has a list of acceptable finishes and *linings*. Where plywood is used in dry areas it does not need to be treated.

4.3.5 *Timber decks*
Preservation treatment of members of timber decks shall comply with NZS 3602. Steel fastenings and fixings shall be to 4.4.

4.4 Steel fixings and fastenings

C4.4
Steel fixings and fastenings will corrode at an accelerated rate in areas immediately surrounding geothermal fumeroles and boreholes within zone 4. The intensity and type of activity of the hot spot and the prevailing wind also affect the rate of corrosion.

Corrosion of ferrous fasteners will cause rapid deterioration of adjacent timber.

Manufacturers should clearly label their components to indicate the weight of the galvanizing.

4.4.1
Table 4.1 sets out the protection required for steel fixings and fastenings to meet durability requirements. The following conditions apply:

(a) For subfloor fixings and fastenings, provide a well drained subfloor area free of ponding;

(b) Components of fixings and fastenings of compatible metals shall all be of a durability at least equal to that required.

4.4.2
Galvanized steel components shall have galvanized coating masses in accordance with table 4.2. Refer also to table 4.1 which requires additional protection to be provided in some cases.

Table 4.1 – Protection required for steel fixings and fastenings excluding nails[1] (see 4.4.1)

Zones/Environment	Material/Protection
Closed (dry, internal location, not subject to airborne salts or rain wetting)	
(A) Anywhere in New Zealand	Mild steel (uncoated, non-galvanized)
Treated timber piles (sub-floor)	
(B) Connections within 600 mm of the ground	Treat as exposed, for the appropriate zone – see H – J below
(C) Connections more than 600 mm from the ground	Treat as exposed or sheltered, for the appropriate zone: see E – J below
Roof spaces (All zones, all roof claddings)	
(D) (a) Nail plates	Continuously coated galvanized steel nail plates[2]
(b) Wire dogs, bolts	Hot-dip galvanized steel[2]
Sheltered (open to airborne salts, but not rain washed)[4]	
(E) Sea spray zone	Stainless steel, type 304[3]
(F) Zone 1 (a) Subfloors and other situations vented more than 7000 mm^2/m^2	Treat as exposed – see H, I below
(b) Subfloors and other situations vented 7000 mm^2/m^2 or less	Hot-dip galvanized steel[2]
(G) Zones 2, 3	Hot-dip galvanized steel[2]
Exposed (open to airborne salts and rain wetting)[4]	
(H) Sea spray zone	Type 304 Stainless steel[3]
(I) Other zones (not geothermal)	Type 304 stainless steel[3] or hot-dip galvanized plus additional protection[5]
Geothermal areas	
(J) Within 50 m of a bore, mudpool, steam vent, or other fume source	Type 316 stainless steel, or hot-dip galvanized steel[2] + epoxy powder coating[5]

(1) Items described in this table are steel fasteners required to last 50 years, used for joining timber, such as nail plates, bolts, brackets, wire dogs and similar, but not including nails or screws (which are described in Table 4.3).
(2) All galvanizing weights to steel shall be as given in Table 4.2.
(3) Type 304 stainless steel is sufficient to comply with NZBC requirements, but may have surface rust. Type 316 may be used where appearance is a consideration but exceeds the requirements of the NZBC.
(4) "Sheltered" shall be that above a 45° line drawn from the lower edge of a projecting weather tight structure such as a floor, roof or deck. "Exposed" shall be below that 45° line. See figure 4.2.
(5) Epoxy powder coating and other additional protection shall be as given in 4.4.4 and 4.4.5.

Amd 1
Dec '00

Table 4.2 – Galvanizing of steel components other than nails and screws (see 4.4.2)

Component	Durability (years)	Standard	Protection required
Bolts in any location that requires galvanizing (see table 4.1)	50	AS/NZS 4680 and AS 1214	375 g/m^2 average (check Standards for detail)
Nail plates and brackets used in sheltered or exposed locations	50	AS/NZS 4680	Not less than 390 g/m^2 (but must 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 galvanizing (see table 4.1)	50		260 g/m^2
Mild steel angles for masonry veneer	50	AS/NZS 2699.3	600 g/m^2
Wall ties	50	AS/NZS 2699.1	430 g/m^2
Sheet metal fittings and reinforcing used in stucco	15	AS 1397	Z275
Stucco wire reinforcing	15	AS/NZS 4534	From 140 g/m^2 to 170 g/m^2 depending upon thickness of wire (check Standards for detail)
Hidden galvanized flashings	50	AS 1397	Z450 (1)(2)
Exposed galvanized flashings	15	AS 1397	Z450 (3)

(1) See 4.10.2.
(2) A coating of 50 µm minimum of a non-inhibitive epoxy primer plus 125 µm min. of high-build epoxy micaceous iron oxide. See AS/NZS 2699 for further details.
(3) See 4.10.3.

Amd 1 Dec '00

4.4.3
Where a galvanized fitting or fixing does not have the mass of galvanizing required in 4.4.2 but has a minimum of 250 g/m^2, a protective coating as outlined in 4.4.4 or 4.4.5 shall be used to bring it to the durability required of galvanized steel.

This clause does not apply to fixings or fastenings within 50 m of geothermal hot spots or to the last category in table 4.1.

4.4.4 *Bolts*
Additional protection for galvanized steel bolts as required by table 4.1 shall be:

(a) 100 µm epoxy powder coating of the entire galvanized bolt and nut system; or

(b) High build epoxy coatings. Reference No. 13, AS/NZS 2312.

4.4.5 *Plates*
Additional protection for galvanized steel plates as required by table 4.1 shall be:

(a) 100 µm thick epoxy powder coating; or

Amd 1 Dec '00

(b) For surfaces not in contact with treated timber, a roof paint system consisting of an oil-based galvanized steel primer and a high gloss acrylic exterior paint with a total minimum dry film thickness (DFT) not less than 120 µm; or

Amd 1 Dec '00

(c) Duplex coating of 50 µm minimum of a non-inhibitive epoxy primer plus 125 µm minimum of high-build epoxy micaceous iron oxide. See AS/NZS 2699 for further details.

4.4.6 *Nails*

The materials for nails shall be as given in table 4.3.

Table 4.3 – Steel items such as nails and screws used for framing and cladding (see 4.4.6)

Amd 1 Dec '00

Building location	Nail or screw use			
	Cladding that acts as bracing (50 year durability)	Non-structural cladding (15 year durability)	Framing in "Closed" areas(1) including roof spaces	Framing in "Sheltered" and "Exposed" areas(1)
Zone 1 and sea spray zone	Stainless steel (2) or silicon bronze or protected galvanized steel (3)	Galvanized steel (4)	Mild steel	Galvanized steel
Geothermal hot spots in specific areas	Stainless steel (2) or silicon bronze or protected galvanized steel (3)	Galvanized steel (4)	Mild steel	Galvanized steel
Zones 2, 3 & 4	Galvanized steel (4)	Galvanized steel (4)	Mild steel	Galvanized steel

(1) For definitions of "sheltered", "closed" and "exposed" see table 4.1.

(2) Stainless steel nails shall have annular grooves to provide similar withdrawal resistance to hot-dipped galvanized nails.

(3) Protection of galvanized steel nails shall consist of putty and an exterior painting system consisting of a primer undercoat and 2 top coats of oil-based or acrylic paint.

(4) Where the cladding is a corrosive timber, such as western red cedar or redwood, use stainless steel(2), silicon bronze or aluminium nails.

(5) Galvanized nails shall be hot-dipped galvanized; galvanized screws shall be mechanically zinc plated in accordance with AS 3566.

Amd 1 Dec '00

(6) Irrespective of the above, nails and screws must be compatible with any fixing plate they are used with.

(7) Nails and screws into piles within 600 mm of the ground shall be stainless steel.

4.5 Brick veneer ties and *lintels*

Table 4.4 gives the protection required for brick veneer ties and *lintels* supporting brick veneer, to achieve a 50 year durability.

Amd 1 Dec '00

4.6 Reinforcing and fixings in stucco

This Standard only applies to stucco that complies with NZS 4251. Protection of *reinforcement* and fixings shall, in all locations throughout New Zealand, be as given in table 4.2.

C4.6

NZS 4251 requires a protective coating to be applied to stucco.

4.7 Underlay or *sheathing*

Underlay and *sheathing* shall be in accordance with table 11.1. These underlays and *sheathings* will be durable for at least 15 years and are therefore acceptable under all *cladding* materials covered by this Standard, with the exception of masonry veneer. Details of underlays and *sheathings* proposed for this use shall be submitted to the *Territorial Authority* for approval. Sheathing used for bracing shall be durable for at least 50 years and is also subject to approval by the *Territorial Authority*.

Amd 1 Dec '00

C4.7

Underlays and sheathings under masonry veneers are difficult to access and therefore are required by the NZBC to last 50 years.

Table 4.4 – Protection for brick ties and lintels supporting brick veneer using AS/NZS 2699 (see 4.5.1)

Location	Protection/material of ties	Protection/material of lintels
Sea spray zone (R4 exposure to AS/NZS 2699)	316 or 316L stainless steel	316 or 316L stainless steel, or mild steel with 600 g/m^2 galvanized coating plus duplex coating(1), or abrasive blast cleaned coated mild steel(1)
Geothermal hot spots	Specific engineering design	Specific engineering design
Elsewhere (R3 exposure to AS/NZS 2699)	430 g/m^2 galvanized coating or 304 stainless steel	Mild steel with 600 g/m^2 galvanized coating or 316 or 316L stainless steel, or 300 g/m^2 galvanized coating plus duplex coating(1), or abrasive blast cleaned coated mild steel(1)
(1) Refer to AS/NZS 2699.3 tables 2 and 3 for coating requirements.		

Amd 1 Dec '00

4.8 Concrete

4.8.1

Minimum concrete cover to steel *reinforcement* shall be:

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

(b) 50 mm in all other situations where the concrete is placed in formwork provided the concrete specifications follow the provisions of clause 4.8.2;

(c) 30 mm from the top of a wall or floor slab which is in a closed area or 50 mm from the top of any exposed wall or floor slab.

Amd 1 Dec '00

4.8.2

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 applications, for reinforced concrete either not exposed to weather or exposed to the weather in Zone 2 and Zone 3 as shown in figure 4.1;

(c) 20 MPa for reinforced concrete exposed to weather, at least 500 m from mean high tide mark in Zone 1 as shown in figure 4.1;

(d) 25 MPa for reinforced concrete exposed to weather and within 500 m of the mean high tide mark;

(e) Specially selected from NZS 3101 table 5.3 where a direct wearing concrete floor is required;

Amd 1 Dec '00

(f) Geothermal hot spots shall be to specific engineering design.

4.8.3

Concrete masonry shall:

(a) Comply with the provisions of NZS 4210;

(b) Have minimum cover to steel reinforcement from an uncoated masonry external face and minimum grout strength of:

60 mm and 25 MPa for sea spray zone;
50 mm and 17.5 MPa for Zone 1;
45 mm and 17.5 MPa for Zones 2 and 3;
35 mm and 17.5 MPa for interior conditions.

Amd 1 Dec '00

C4.8

The provisions of this clause are based on NZS 3101 and provide for a life of not less than 50 years. More economic designs should result in some cases if the more detailed provisions of NZS 3101 are followed, but such designs are not within the scope of this Standard.

Some of the areas described will be outside the scope of this Standard because of wind exposure.

C4.8.3

NZS 4210 is currently being revised. Durability provisions will follow AS 3700. When a waterproof external coating is used such as 2 coats of suitable high build acrylic paint a cover of 35 mm using 17.5 MPa grout should be adequate. Note that AS 3700 covers are defined from the inside of a masonry face shell. An allowance of 30 mm has therefore been added to the AS 3700 values to account for shell thickness.

Amd 1 Dec '00

4.9 Sealant usage and durability

4.9.1 *Sealants in joint designs*

The use of sealants is outside the scope of NZS 3604. Where they are proposed to be used then full details, including sealant specification, joint design and preparation, installation instructions and information on sealant durability, need to be forwarded to the *Territorial Authority* for approval.

C4.9.1

Sealants cause many problems through incorrect sealant specification, joint design and preparation, and installation. BRANZ Bulletins 283 and 284 provide a guide to the joint design and the types of sealants to use.

4.10 Flashings

4.10.1 *General*

Galvanized steel flashings shall have a minimum mass of galvanizing of:

Amd 1 Dec '00

(a) Hidden flashings — Z450 plus protective coating in accordance with 4.4.5

(b) Exposed flashings — Z450

4.10.2 *Hidden flashings*

Flashings hidden behind masonry veneers, or in other similar places where it is difficult to inspect or replace the flashing, are required to last for not less than 50 years. Flashing materials shall be compatible with their surrounding materials. Hidden flashings shall be made from:

Amd 1 Dec '00

Amd 1 Dec '00

(a) Z450 galvanized steel plus a protective coating in accordance with 4.4.5(a) or (c);

(b) Type 304 or 316 stainless steel;

(c) Aluminium;

(d) Plastic/fibre reinforced plastic not less than 0.5 mm thick uncovered and UV stabilized to 50 years;

(e) Butyl rubber;

Amd 1 Dec '00

(f) Annealed lead having a mass not less than 10 kg/m^2.

C4.10.2

Table 4.5 is a guide to compatibility of materials but may exceed the requirements of the building code. For use with stucco, the Z450 galvanized steel should be epoxy powder coated prior to installation. Aluminium flashings are not recommended as their dependence on the integrity of any applied coating for resistance to alkali attack from the stucco is not reliable.

Amd 1 Dec '00

4.10.3 *Exposed flashings*

These are defined as flashings which can be inspected or replaced with moderate ease, requiring 15 year durability. Typical exposed flashings are roofing flashings, corner soakers, fascia/bargeboard flashings, window and door head and sill flashings. Flashing materials shall be compatible with their surrounding materials. Flashings which are exposed shall be made from:

Amd 1 Dec '00

(a) Z450 galvanized steel;

(b) Aluminium;

(c) Plastic/fibre reinforced plastic not less than 0.5 mm thick and UV stabilized to 50 years;

(d) Butyl rubber;

(e) Type 304 or 316 stainless steel;

(f) Copper;

Amd 1 Dec '00

(g) Uncovered annealed lead having a mass not less than 17 kg/m^2;

(h) Zinc.

C4.10.3

Table 4.5 is a guide to compatibility of materials but may exceed the requirements of the building code. In all cases, care should be taken to ensure that the flashing material also matches its durability requirements for the particular exposure environment as given in figure 4.1.

The information in table 4.5 is based on BRANZ Bulletin 304.

Amd 1 Dec '00

Table 4.5 Material compatibility chart: What works with what (see 4.10.2 and 4.10.3) **(Informative)**

Amd 1
Dec '00

Material water flows over \ Material water flows onto	Aluminium, anodized	Aluminium, mill-finish	Aluminium, powder coated	Butyl rubber	CCA-treated timber	Cedar	Cement plaster	Ceramic tiles	Clay bricks	Concrete dry	Concrete green	Concrete tiles	Copper	Fibre-cement	Glass	Lead	Plastics	Stainless steel	Steel coil-coated	Steel, galvanized	Zinc	Zinc/aluminium coating
Aluminium, anodized	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	X	X
Aluminium, mill-finish	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	X	X
Aluminium, powder coated	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	X	X
Butyl rubber	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	X	X
CCA-treated timber	X	X	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	X	X	X
Cedar [1]	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	X	X
Cement plaster (uncoated)	X	X	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	X	✓	✓	X	X	X	X
Ceramic tiles [2] **(cement grout)**	X	X	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	X	X	X
Clay bricks [2] **(cement mortar)**	X	X	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	X	X	X
Concrete dry (unpainted)	X	X	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	X	X	X
Concrete green (unpainted)	X	X	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	X	✓	✓	X	X	X	X
Concrete tiles	X	X	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	X	X	X
Copper [3]	X	X	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	X	X	X
Fibre-cement (unpainted)	X	X	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	X	X	X
Glass	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	X	X
Lead [3] [4] **(not lead edged)**	X	X	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	X	✓	✓	✓	X	X	X	X
Plastics	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	X	X
Stainless steel	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	X	X[5]
Steel coil-coated	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	X	X
Steel, galvanized (unpainted)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Zinc (unpainted)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Zinc/aluminium coating [6]	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	X	✓

LEGEND

✓ Materials satisfactory in contact or with water run-off as indicated.

X Contact between materials is not permitted. Water run-off is not permitted as indicated.

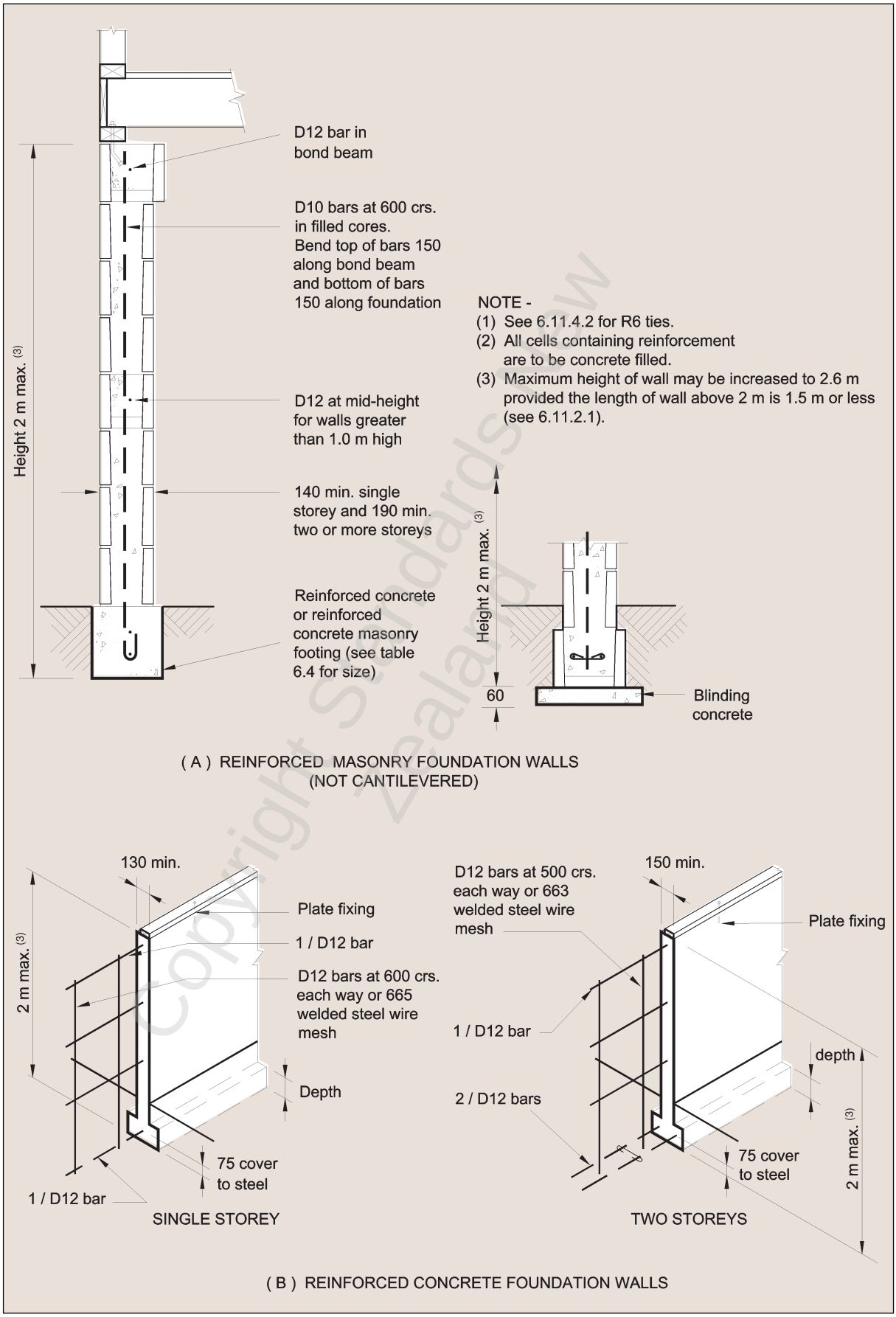


Figure 6.15 – Reinforced masonry and reinforced concrete masonry foundation walls (not cantilevered) (see 6.11.7.1)

Amd 1 Dec '00

Amd 1 Dec '00

6.11.8 *Subfloor bracing using foundation walls*

Foundation walls may be used as a subfloor *bracing element* provided that the wall length being considered does not have an opening exceeding 600 mm wide. *Bracing capacity ratings* are set out in table 5.11. These walls must be 1.5 m and over in length, and be connected to the *plate* supporting the floor *joists,* or the *wall plate* of a braced subfloor timber frame.

6.11.9 *Fixing of wall plates to foundation walls*

6.11.9.1

Wall plates shall be fixed to *foundation walls* by either:

(a) M12 bolts set not less than 75 mm into the concrete and projecting sufficiently to allow for a washer and a fully-threaded nut above the timber as shown in figure 6.16; or

(b) R10 steel dowels bent at least 90°, set not less than 75 mm into the concrete and projecting sufficiently to allow for not less than a 75 mm length of the dowel to be clinched over the timber as shown in figure 6.16.

Fixings shall be located not more than 300 mm from the end of the timber at corners of *foundation walls* and not more than 1.4 m centres along the wall for M12 bolts and 900 mm centres for R10 dowels, provided that where any length of *foundation wall* is regarded as one or more subfloor braces, each length of plate shall be fixed to it with not less than 2/M12 bolts.

6.11.9.2

On *external walls* the *wall plate* shall overhang the *foundation wall* by 6 mm (see figure 6.16). Amd 1 Dec '00

6.12 Bearers

Bearers of solid or nailed laminated timber shall be continuous over 2 or more spans and be laid in straight lines on edge.

6.12.1

Bearers directly supported by a *foundation wall* perpendicular to them shall be secured against lateral movement by one of the following methods (see figure 6.17):

(a) For *bearer spacings* not exceeding 2 m: Each *bearer* shall be bolted to the *foundation wall* with an M12 bolt set not less than 150 mm into the wall and located centrally on the *bearer* and the wall;

(b) For *bearer spacings* exceeding 2 m:

(i) Fixings as in (a), in conjunction with full depth *blocking* neatly cut between adjacent *bearers*. *Blocking* shall be fixed to the top of the *foundation wall* with a minimum of 2 fixings for each length of *blocking* (see figure 6.17(B)); or

(ii) Each *bearer* shall be set in a rebate in the top of the *foundation wall* to a depth 50 mm less than the depth of the *bearer,* and a 100 mm x 50 mm *wall plate* neatly cut between adjacent *bearers* shall be fixed to the top of the *foundation wall*, with a minimum of 2 fixings for each length of *wall plate* (see figure 6.17(C)); or

Table 10.2 – Rafters (continued) (see 10.2.1.3.2)

(g) Dimensions of valley rafters for all wind zones

Rafter size	Maximum span of valley rafters (m) and their fixing types for all wind zones			
	Light roof		Heavy roof	
	Span	Fixing type	Span	Fixing type
(mm x mm)	(m)		(m)	
100 x 40	2.0	B	1.8	B
125 x 40	2.3	B	2.1	B
150 x 40	2.4	B	2.4	B
75 x 50	1.7	B	1.5	B
100 x 50	2.1	B	1.9	B
125 x 50	2.6	C	2.2	B
150 x 50	2.9	C	2.6	B
200 x 50	3.1	C	3.2	C
250 x 50	3.3	C	3.3	C
300 x 50	3.5	D	3.5	C
100 x 75	2.4	B	2.1	B
125 x 75	2.8	C	2.5	B
150 x 75	3.3	C	2.9	B
200 x 75	4.1	E	3.6	C
250 x 75	4.5	E	4.2	D

Fixing type	Fixing to resist uplift	Alternative fixing capacity (kN)
B	2/100 x 3.75 skewed nails + 1 wire dog	2.7
C	2/100 x 3.75 skewed nails + 2 wire dogs	4.7
D	2/100 x 3.75 skewed nails + 3 wire dogs	6.7
E	2/100 x 3.75 skewed nails + 4 wire dogs	8.7

NOTE –

Amd 1 Dec '00

(1) For the full range of fixing types and capacity see table 10.13.

(2) Proprietary fixings that have the required fixing capacity indicated in tables may be used.

NOTES

Table 10.6 – Underpurlins and ridge beams (see 10.2.1.5.2 and 10.2.1.9.1 and figures 10.10 and 10.11)

(a) Light roof in low and medium wind zones

	Loaded dimension* of underpurlin or ridge beam (m)											
	1.8			2.7			3.6			4.2		
	Span	Fixing type		Span	Fixing type		Span	Fixing type		Span	Fixing type	
Wind zone		L	M		L	M		L	M		L	M
Underpurlin or ridge beam size												
(mm x mm)	(m)			(m)			(m)			(m)		
75 x 50	1.2	A	B	1.1	B	B	1.0	B	B	0.9	B	B
100 x 50	1.7	B	B	1.5	B	B	1.3	B	B	1.3	B	B
125 x 50	2.1	B	B	1.9	B	B	1.7	B	B	1.6	B	C
150 x 50	2.6	B	B	2.3	B	B	2.1	B	C	2.0	B	C
200 x 50	3.5	B	B	3.0	B	C	2.8	B	C	2.6	C	C
250 x 50	4.0	B	C	3.3	B	C	3.0	C	C	2.9	C	D
300 x 50	4.5	B	C	3.6	C	C	3.1	C	C	3.0	C	D
100 x 75	1.9	B	B	1.7	B	B	1.5	B	B	1.5	B	B
125 x 75	2.4	B	B	2.1	B	B	1.9	B	C	1.8	B	C
150 x 75	3.0	B	B	2.6	B	C	2.4	B	C	2.2	B	C
200 x 75	4.0	B	C	3.5	B	C	3.2	C	C	3.0	C	D
225 x 75	4.5	B	C	3.9	B	C	3.6	C	D	3.4	C	D
250 x 75	5.0	B	C	4.4	C	C	4.0	C	D	3.8	C	D
300 x 75	6.1	C	C	5.3	C	D	4.8	C	E	4.6	D	E
200 x 100	4.5	B	C	3.9	B	C	3.5	C	D	3.4	C	D
225 x 100	4.9	B	C	4.3	B	C	3.9	C	D	3.7	C	D
250 x 100	5.7	B	C	4.9	C	D	4.5	C	D	4.3	C	E
300 x 100	6.8	C	D	5.9	C	D	5.4	D	E	5.1	D	E

Amd 1 Dec '00

* For definition of loaded dimension see 1.3.

Fixing type	Fixing to resist uplift	Alternative fixing capacity
		(kN)
A	2/100 x 3.75 skewed nails	0.7
B	2/100 x 3.75 skewed nails + 1 wire dog	2.7
C	2/100 x 3.75 skewed nails + 2 wire dogs	4.7
D	2/100 x 3.75 skewed nails + 3 wire dogs	6.7
E	2/100 x 3.75 skewed nails + 4 wire dogs	8.7

NOTE –

(1) Span may be increased by 10 % for underpurlins continuous over 2 or more spans.

(2) Fixing types for continuous spans shall have double the capacity to that listed in the table.

(3) For the full range of underpurlin fixing types and capacities see table 10.13.

(4) For ridge beam to wall fixing use the fixing type determined from the upper table and select the appropriate fixing from table 10.3.

Amd 1 Dec '00

Table 10.6 – Underpurlins and ridge beams (see 10.2.1.5.2 and 10.2.1.9.1 and figures 10.10 and 10.11)

(b) Light roof in high wind zones

Underpurlin or ridge beam size	Loaded dimension* of underpurlin or ridge 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)	
75 x 50	1.2	B	1.1	B	1.0	B	0.9	B
100 x 50	1.7	B	1.5	B	1.3	C	1.3	C
125 x 50	2.1	B	1.9	C	1.7	C	1.6	C
150 x 50	2.6	C	2.3	C	2.1	C	2.0	D
200 x 50	3.0	C	2.6	C	2.3	D	2.2	D
250 x 50	3.2	C	2.6	C	2.4	D	2.3	D
300 x 50	3.5	C	2.9	D	2.5	D	2.4	D
100 x 75	1.9	B	1.7	C	1.5	C	1.5	C
125 x 75	2.4	C	2.1	C	1.9	C	1.8	D
150 x 75	3.0	C	2.6	C	2.4	D	2.2	D
200 x 75	4.0	C	3.5	D	3.2	E	3.0	E
225 x 75	4.5	D	3.9	D	3.6	E	3.4	F
250 x 75	5.0	D	4.4	E	3.9	F	3.7	F
300 x 75	5.3	D	4.5	E	4.1	F	3.9	F
200 x 100	4.5	D	3.9	D	3.5	E	3.4	F
225 x 100	4.9	D	4.3	E	3.9	F	3.7	F
250 x 100	5.7	D	4.9	E	4.5	F	4.3	F
300 x 100	6.8	E	5.9	F	5.4	F	5.1	F

* For definition of loaded dimension see 1.3.

Fixing type	Fixing to resist uplift	Alternative fixing capacity
		(kN)
B	2/100 x 3.75 skewed nails + 1 wire dog	2.7
C	2/100 x 3.75 skewed nails + 2 wire dogs	4.7
D	2/100 x 3.75 skewed nails + 3 wire dogs	6.7
E	2/100 x 3.75 skewed nails + 4 wire dogs	8.7
F	2/100 x 3.75 skewed nails + U strap of 27 mm x 1.2 mm 10/30 x 3.15 nails at each end	16.0

NOTE –

(1) Span may be increased by 10 % for underpurlins continuous over 2 or more spans.

(2) Fixing types for continuous spans shall have double the capacity to that listed in the table.

(3) For the full range of underpurlin fixing types and capacities see table 10.13.

(4) For ridge beam to wall fixing use the fixing type determined from the upper table and select the appropriate fixing from table 10.3.

Amd 1 Dec '00

Table 10.8 – Verandah beams (see 10.2.1.12)

Amd 1 Dec '00

Beam size	Loaded dimension of verandah beam (m)							
	0.9		1.4		1.8		2.1	
	Span	Fixing type	Span	Fixing type	Span	Fixing type	Span	Fixing type
(mm x mm)	(m)		(m)		(m)		(m)	
A Light roof in low to very high wind zone								
150 x 50	1.9	DD	1.8	DD	1.7	DD	1.6	DD
200 x 50	2.2	DD	2.0	DD	1.9	EE	1.8	EE
250 x 50	2.2	DD	2.1	DD	2.0	EE	1.9	EE
300 x 50	2.3	DD	2.1	DD	2.0	EE	1.9	EE
150 x 75	2.4	DD	2.3	EE	2.1	EE	2.0	EE
200 x 75	3.3	EE	3.0	FF	2.8	FF	2.6	FF
225 x 75	3.5	FF	3.2	FF	3.0	FF	2.9	FF
250 x 75	3.7	FF	3.4	FF	3.1	FF	3.0	FF
300 x 75	3.8	FF	3.5	FF	3.3	FF	3.2	FF
200 x 100	3.7	FF	3.4	FF	3.2	FF	3.1	FF
225 x 100	4.0	FF	3.8	FF	3.6	FF	3.5	FF
250 x 100	4.6	FF	4.3	FF	4.1	FF	3.9	FF
300 x 100	5.5	FF	5.1	FF	4.7	FF	–	–
B Heavy roof in low to very high wind zone								
150 x 50	1.9	CC	1.8	DD	1.7	DD	1.7	DD
200 x 50	2.5	DD	2.3	DD	2.1	DD	2.0	EE
250 x 50	2.5	DD	2.4	DD	2.2	EE	2.1	EE
300 x 50	2.6	DD	2.4	DD	2.2	EE	2.1	EE
150 x 75	2.2	DD	2.1	DD	2.0	DD	1.9	DD
200 x 75	3.0	DD	2.8	EE	2.7	EE	2.6	FF
225 x 75	3.4	EE	3.2	EE	3.0	FF	2.9	FF
250 x 75	3.8	EE	3.5	FF	3.3	FF	3.2	FF
300 x 75	4.3	FF	4.0	FF	3.7	FF	3.6	FF
200 x 100	3.4	EE	3.1	EE	3.0	FF	2.9	FF
225 x 100	3.7	EE	3.5	FF	3.3	FF	3.2	FF
250 x 100	4.3	FF	4.0	FF	3.8	FF	3.6	FF
300 x 100	5.1	FF	4.8	FF	4.5	FF	4.4	FF

Fixing	Fixing details	Alternative fixing capacity
		(kN)
CC	6/100 x 3.75 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

Amd 1 Dec '00

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 type for continuous spans shall have a double capacity to that listed in the table.

10.2.1.13.2
Collar ties shall (see figure 10.13):

(a) Be at 1.8 m centres or every third pair of rafters, whichever is the closer;

(b) Be fixed to the sides of the rafters immediately above each underpurlin;

(c) Consist of 150 mm x 25 mm or 100 mm x 50 mm timber.

10.2.1.13.3
Cleats shall (see figure 10.14):

(a) Be at 1.8 m centres or every third pair of rafters, whichever is the closer;

(b) Be fixed to the sides of the rafters immediately beneath the ridge board;

(c) Consist of 100 mm x 25 mm timber.

10.2.1.14 *Eaves*

10.2.1.14.1
A rafter 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 100 mm x 50 mm rafters are supported by eaves bearers (boxed) they may extend to 750 mm.

C10.2.1.14.1
The eaves of truss roofs are covered by the design requirements of 10.2.2.

10.2.1.14.2
Where the eaves are boxed, the eaves bearers shall be attached to the ends of rafters or trusses and to studs or ribbon boards, and shall be at not more than 1200 mm centres.

10.2.1.14.3
Eaves bearers shall consist of:

(a) Not exceeding 600 mm long: 50 mm x 40 mm timber;

(b) Not exceeding 750 mm long: 75 mm x 40 mm timber on edge.

10.2.1.15 *Gable verges*

10.2.1.15.1
Gable verges shall be framed by either:

(a) Purlins extending as cantilevers beyond their end supports as shown in figure 10.15 for a distance not exceeding that given by 10.2.1.15.2; or

(b) Outriggers complying with 10.2.1.15.3 and as shown in figure 10.15.

10.2.1.15.2
Purlins with a back span over at least 3 *rafters* may extend as cantilevers beyond their end supports for a distance not exceeding:

(a) Laid on their flat:

(i) *Light roofs*
50 mm x 50 mm *purlins*: 300 mm
75 mm x 50 mm *purlins*: 500 mm
100 mm x 50 mm *purlins* : 600 mm

(ii) *Heavy roofs*
50 mm x 50 mm *purlins* at 400 mm centres: 300 mm
75 mm x 50 mm *purlins* at 400 mm centres: 400 mm
100 mm x 50 mm *purlins* at 400 mm centres: 500 mm

(b) Laid on their edge:

(i) *Light roofs*
75 mm x 50 mm *purlins*: 600 mm
100 mm x 50 mm *purlins*: 700 mm

(ii) *Heavy roofs*
75 mm x 50 mm *purlins* at 400 mm centres: 500 mm
100 mm x 50 mm *purlins* at 400 mm centres: 600 mm

10.2.1.15.3
Outriggers shall (see figure 10.15):

(a) Be laid on edge and be of minimum sizes 75 mm x 40 mm for *light roofs* and 100 mm x 40 mm for *heavy roofs*;

(b) Be located at not more than 900 mm centres;

(c) Extend beyond their end supports for a distance not exceeding 600 mm;

(d) Have a flying *rafter* of minimum size 100 mm x 40 mm fixed to their ends;

(e) 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* pieces and to the flying *rafter*.

(f) Be fixed to wall *framing* with fixings determined from table 10.9 as if the outriggers are *purlins*.

Table 10.9 – Purlins or battens (see 10.2.1.16.1)

(a) Light roof cladding (see figures 10.16 and 10.17)

Purlin or batten size	Maximum span	Maximum spacing and fixing loads in the following wind zones											
		Low			Medium			High			Very high		
		Spacing	Fixing capacity		Spacing	Fixing capacity		Spacing	Fixing capacity		Spacing	Fixing capacity	
			M(1)	P(1)		M(1)	P(1)		M(1)	P(1)		M(1)	P(1)
(mm x mm)	(mm)	(mm)	(kN)	(kN)	(mm)	(kN)	(kN)	(mm)	(kN)	(kN)	(mm)	(kN)	(kN)
50 x 40	900	400	0.3	0.4	400	0.4	0.5	400	0.5	0.8	400	0.7	1.0
50 x 50	1200	400	0.4	0.5	400	0.5	0.7	400	0.7	1.0	400	0.9	1.3
75 x 50	900	900	0.6	0.9	900	0.8	1.2	900	1.1	1.7	900	1.5	2.2
75 x 50	900	1200	0.8	1.2	1200	1.1	1.6	1200	1.5	2.3	1200	2.0	2.9
75 x 50	900	1800	1.2	1.8	1800	1.6	2.4	1800	2.3	3.4	1400	2.3	3.4
75 x 50	1200	1200	1.1	1.6	1200	1.4	2.1	1200	2.0	3.0	1100	2.4	3.6
75 x 50	1200	1400	1.3	1.9	1400	1.7	2.5	1000	1.7	2.5	800	1.7	2.5
100 x 50	1200	1800	1.6	2.4	1800	2.1	3.2	1400	2.3	3.5	1100	2.4	3.6

NOTE –
(1) M = Main roof; P = Periphery (see figures 10.16 and 10.17).
(2) Fixings with the capacity required by the table shall be selected from table 10.10.
(3) Purlin and batten sizes are on the flat.

(b) Heavy roof cladding

Purlin or batten size	Maximum purlin span	Spacing	Fixing loads (all wind areas all roof areas)
(mm x mm)	(mm)	(mm)	(kN)
50 x 25	480	400	0.4
50 x 40	600	400	0.4
50 x 50	900	400	0.4

NOTE –
(1) Fixings with the capacity required by the table shall be selected from table 10.10.
(2) Purlin and batten sizes are on the flat.

Amd 1 Dec '00

Table 10.10 – Capacity of fixings for purlins or battens (see 10.2.1.16.1 and 10.2.1.16.5)

Fixing description	Fixing capacity
	(kN)
1/100 x 3.75 nail or 1/90 x 3.15 power driven nails	0.4
2/100 x 3.75 skewed nails or 2/90 x 3.15 power driven nails	0.7
2/100 x 3.75 skewed nails + 1 wire dog or 2/100 x 3.75 skewed nails + 1/14 g Type 17 screw to AS 3566*	2.7
2/100 x 3.75 skewed nails + 2 wire dogs or 2/100 x 3.75 skewed nails + 2/14 g Type 17 screws to AS 3566*	4.7
* If screw fixed, screws shall be sufficiently long so as to penetrate rafter by at least 50 mm.	

Amd 1 Dec '00

NOTE –

(1) Purlins on flat may be substituted for the following sizes:

On flat	On edge
75 x 50	65 x 50
100 x 50	75 x 50

(2) Alternative fixings with required uplift capacity determined in accordance with 2.4.6 may be used.

(3) Where purlins are fixed over sarking or ceiling sheet lining material refer to 10.2.1.16.5(b).

Amd 1 Dec '00

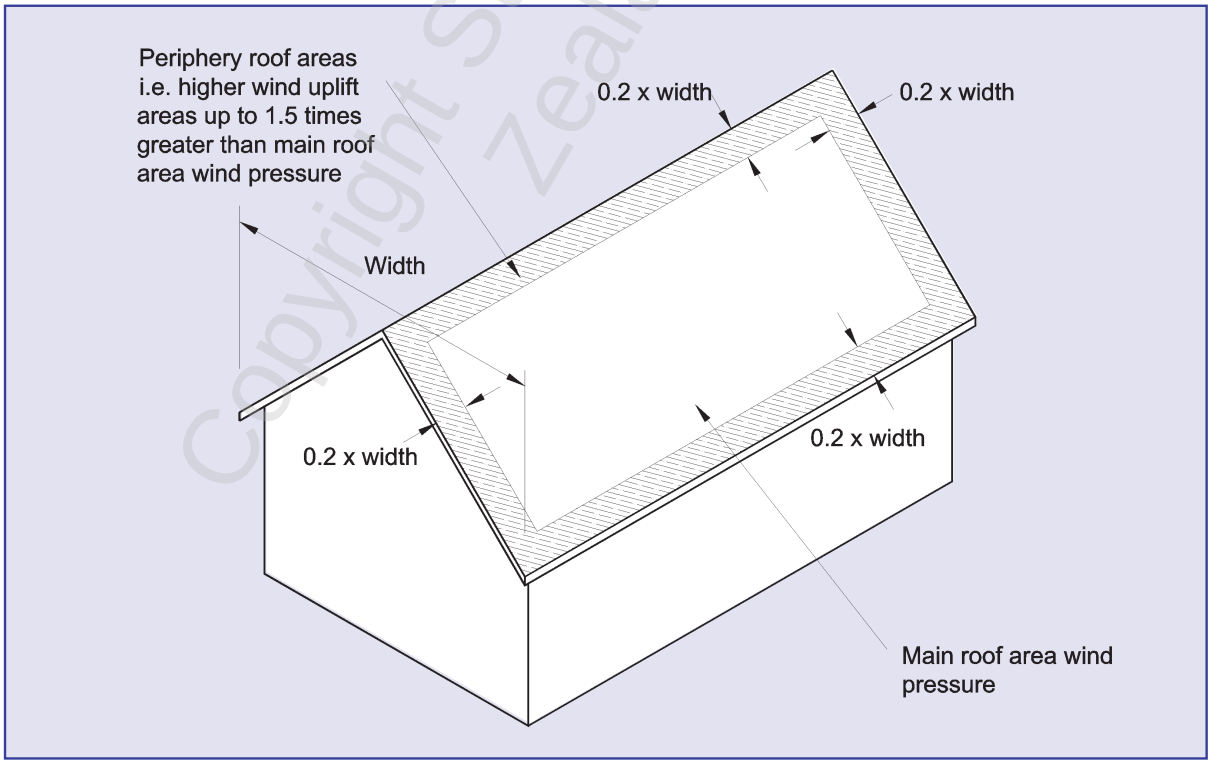


Figure 10.16 – Gable roof showing higher wind uplift areas requiring extra purlin and batten fixings (see table 10.9)

Amd 1 Dec '00

10.2.1.16 *Purlins*

C10.2.1.16.1
Purlin spacings should not be greater than those recommended by the manufacturer of the roof cladding.

10.2.1.16.1
The size of *purlins* shall be taken from table 10.9 using *spacing* to suit the spanning capability of the *cladding*. Fixings shall be selected from table 10.10 to have a capacity equal to or greater than that required by table 10.9. Amd 1 Dec '00

10.2.1.16.2
Purlins shall be laid directly over *rafters* or dummy *rafters* and parallel to the associated ridge or eaves line as shown in figures 10.18 and 10.19.

C10.2.1.16.3
The strength of purlins is increased by being a continuous length over as many spans as is possible.

10.2.1.16.3
Purlins shall be continuous over at least 2 spans, and may be butt jointed over supports provided that no 2 adjacent *purlins* shall be jointed over the same truss or *rafter*.

10.2.1.16.4
Purlins may extend as cantilevers to form a *gable verge* as provided by 10.2.1.15.1.

10.2.1.16.5
Purlins shall be fixed in accordance with the following:

(a) Laid directly over *rafters* and fixed to *rafters* in accordance with the fixing capacity set out in table 10.10;

(b) Where *purlins* are laid directly over sheet *sarking* or ceiling sheet *lining material* of maximum 13 mm thickness, the *purlin* shall be fixed as shown in figure 10.20(B). Amd 1 Dec '00

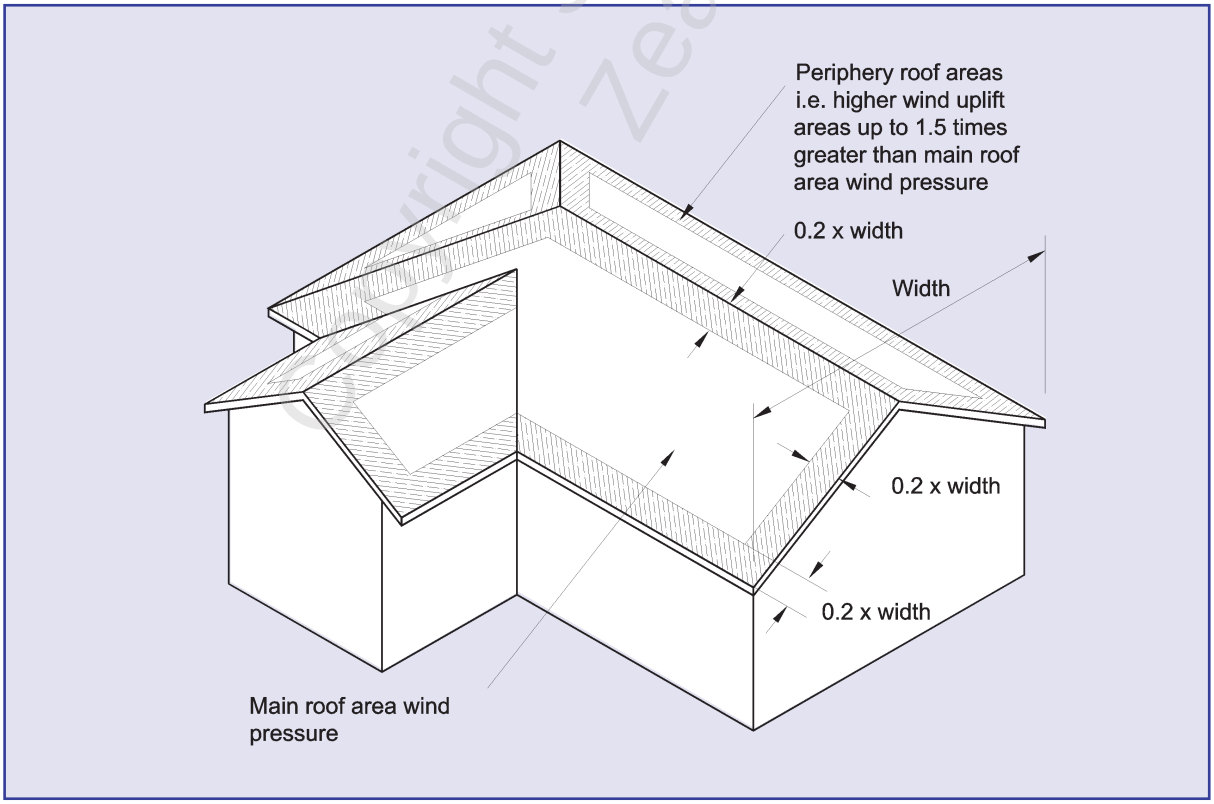


Figure 10.17 – Hip and valley roof showing higher wind uplift areas requiring extra purlin and batten fixings (see table 10.9) Amd 1 Dec '00

Amd 1 Dec '00

10.2.2.6 ***Anchorage***

The fixing for a roof truss at its support shall be as given by the truss design but not less than that required in tables 10.12 and 10.13 and figure 10.21.

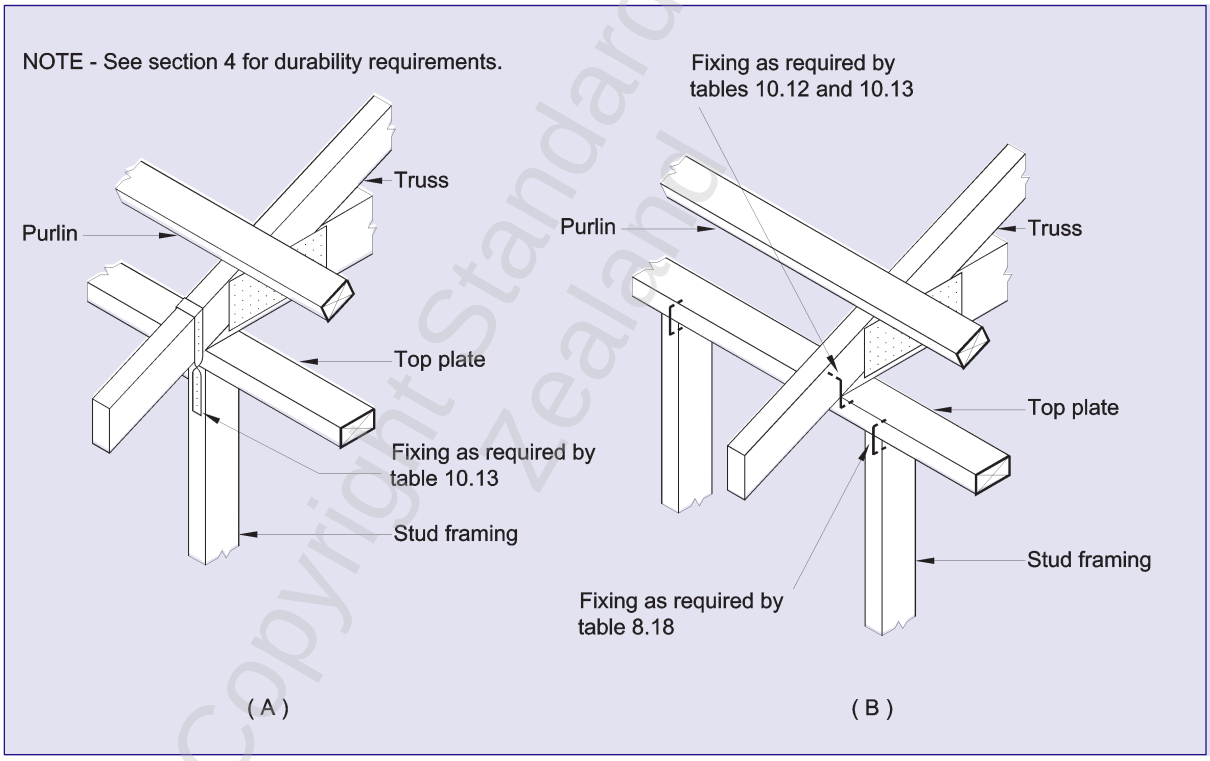
Amd 1 Dec '00

C10.2.2.6

Table 10.12 provides fixings for roof trusses at their supports for simple truss layouts only. It does not provide fixings for girder trusses, hip trusses or other complex truss roof systems. The load paths and fixings for these are to form part of the overall truss system design. Alternative fixings can be selected provided they meet the minimum capacity requirements of table 10.13.

Amd 1 Dec '00

Amd 1 Dec '00



Amd 1 Dec '00

Figure 10.21 – Truss/top plate connections (see 10.2.2.6)

Amd 1 Dec '00

Amd 1 Dec '00

Table 10.12 – Fixing types of roof trusses at supports (see 10.2.2.6)

Truss spacing (mm)	Fixing type											
	Light roofs								Heavy roofs			
	900				1200				900			
Wind zone	**L**	**M**	**H**	**VH**	**L**	**M**	**H**	**VH**	**L**	**M**	**H**	**VH**
Loaded dimension of support (m)												
3.0	C	C	C	D	C	B	C	D	A	A	C	C
3.5	C	C	C	D	C	C	D	E	A	A	C	C
4.0	C	C	C	D	C	C	D	E	A	C	C	C
4.5	C	C	D	E	C	C	D	F	A	C	C	D
5.0	C	C	D	E	C	C	E	F	A	C	C	D
5.5	C	C	D	E	C	C	E	F	A	C	C	D
6.0	C	C	D	F	C	D	E	F	A	C	C	D

Amd 1 Dec '00

Table 10.13 – Key to fixing types and capacity for rafters, roof trusses, underpurlins, ridge beams and strutting beams (see 10.2.2.6)

Fixing type	Fixing to resist uplift	Alternative fixing capacity
		(kN)
A	2/100 x 3.75 skewed nails	0.7
B	2/100 x 3.75 skewed nails + 1 wire dog	2.7
C	2/100 x 3.75 skewed nails + 2 wire dogs	4.7
D	2/100 x 3.75 skewed nails + 3 wire dogs	6.7
E	2/100 x 3.75 skewed nails + 4 wire dogs	8.7
F	2/100 x 3.75 skewed nails + U strap of 27 mm x 1.2 mm 10/30 x 3.15 nails at each end	16.0

11 THE BUILDING ENVELOPE – ROOF AND WALL CLADDINGS

11.1 General

11.1.1
The *cladding* shall consist of the following:

(a) Roof and wall *cladding* with or without underlay or *sheathing*;

(b) Exterior joinery units consisting of windows, doors and skylights.

C11.1.1
Wall claddings may form part of wall bracing elements. The type of cladding will influence the bracing demand for earthquake loading.

Timber shingles and shakes, unpainted stucco and unpainted fibre cement products are not covered by this Standard.

These materials and some other absorbent cladding materials are affected by solar driven moisture which accumulates in the wall and roof cavity causing decay. They require individual design and testing. BRANZ Reprint 122 deals with this subject.

11.1.2 *Durability*
All fixings shall comply with the relevant requirements of section 4.

11.2 Roof cladding underlays

11.2.1
A roof *cladding* underlay shall be provided under all metal and fibre cement roof *claddings* and under concrete roof tiles, as specified by NZS 4206 (see table 11.2).

11.2.2
Roof *cladding* underlay where used (see table 11.2) shall consist of sheets laid either horizontally or vertically with minimum laps of 100 mm, provided that:

(a) They shall only be run vertically on pitches of 8^{o} or more;

(b) When laid horizontally, the upper sheets shall be lapped over the lower sheets on the roof;

(c) There shall be minimum laps of 150 mm when fire retardant underlay is used; and

(d) There shall be minimum laps of 150 mm for underlays under concrete or clay tiles. Where a lap occurs under a tile *batten*, the overlap can be reduced to 75 mm.

11.2.3
Roof *cladding* underlays shall satisfy the requirements of table 11.1.

11.3 Roof claddings
Materials for roof *claddings* shall comply with table 11.2.

C11.3
Table 11.2, under the heading of 'Informative provisions', also gives some information and guidance on requirements for cladding fixings, flashings and finishing although these details are not complete. Exact details of what is proposed must be submitted to and approved by the Territorial Authority.

11.4 Wall cladding underlays or sheathings

11.4.1
A rigid or non-rigid wall *cladding* underlay or *sheathing* shall be provided behind all wall *claddings*. Underlays or *sheathing* under timber weatherboards in the situations described in 11.5.2.6 and under stucco on non-rigid backing described in 11.8.8 are also required to be wind barriers. Table 11.1 identifies materials suitable as wind barriers.

Table 11.1 Underlays and sheathings (see 11.2.2, 11.4.1, 11.4.2, 11.4.3 and 11.4.4)

Material	Relevant Standard	Surface absorption capacity (g/m^2)	Vapour trans-mission resistance (MNs/g*)	Airflow resistance (MNs/m^3)	Additional properties
Roofing underlays					
Lightweight and heavyweight building paper and roofing felts	NZS 2295	Greater than 100	Equal to or less than 7		For anti-ponding requirements see note
Non-rigid wall cladding underlay or sheathing					
Lightweight building paper	NZS 2295	Greater than 100	Equal to or less than 7		
Heavyweight building paper	NZS 2295	Greater than 100	Equal to or less than 7		This can be used as a wind barrier when it has a bursting strength of not less than 500 kN/m^2 when wet and tested in accordance with BS 3137
Rigid wall cladding underlay or sheathing					
Plywood	NZS 2269 to the require-ments of NZS 3602 and treated to MP 3640	Greater than 100	Equal to or less than 5	Equal to or more than 1	This is a wind barrier; it shall be treated to H3 of NZMP 3640
Fibre cement sheet	NZS/AS 2908:Part 2			Equal to or more than 1	This is a wind barrier; it shall be sealed with 2 coats acrylic paint including edges (edges may be sealed with bead of sealant in the gap between sheets)
* Vapour transmission shall be measured using ASTM E96 procedure B or BW.					

Amd 1 Dec '00

NOTE – Install anti-ponding boards at the bottom edge of tiled roofs with less than 15° pitch. These boards are to be placed below the underlay adjacent to the fascia so that water is not trapped by sagging underlay.

Table 11.2 – Roof claddings (see 11.3)

Normative (mandatory) provisions				Informative provisions (also refer manufacturer's technical information)		
Type of cladding	**Relevant Standard**	**Special requirements**	**Underlay**	**Fixing**	**Joint closure**	**Finishing / outer membrane**
Profiled galvanized steel	NZS 3403	Seal end laps* with neutral cured silicone sealant at top of bottom sheet	Roofing underlay	To purlins	Flashings	Pre-finished paint, or paint on site, or unpainted
Profiled zinc/ aluminium alloy coated steel	AS 1397		Roofing underlay	To purlins	Flashings	Pre-finished paint, or paint on site, or unpainted
Corrugated cellulose cement	NZS/AS 2908: Part 1		Roofing underlay	To purlins	Flashings	Paint – 2 coats acrylic
Concrete interlocking tiles	NZS 4206		As specified in NZS 4206. Roofing underlay if: – pitch is 17° or less – roof is of skillion construction	To purlins, as specified in NZS 4206	Self and flashings	Self
Pressed metal tiles	NZS 4217: Parts 1 & 2		As specified in NZS 4217 for roofing underlay	As specified in NZS 4217: Part 2	Self	Self
Copper	BS EN 1172		Roofing underlay	Fix to sarking with copper nails and clips	Self	Self
Lead	BS 6915		Roofing underlay	Fix to sarking with copper nails and clips	Self	Self
Mastic asphalt	BS 6925		–	To sarking	Self	Self or stone aggregate
Clay tiles	AS 2049		As specified in AS 2050	Fix to battens with nails or screws to AS 2050	Self	Self

Amd 1 Dec '00

* This is to prevent condensation from lying in the joints and is the minimum required to achieve 15 year durability requirement. Priming side laps may extend the durability but is not required to comply with clause B2 of the NZBC.

Amd 1 Dec '00

Table 11.2 – Roof claddings (see 11.3) (continued)

Normative (mandatory) provisions				Informative provisions (also refer manufacturer's technical information)		
Type of cladding	**Relevant standard**	**Special requirements**	**Underlay**	**Fixing**	**Joint closure**	**Finishing/ outer membrane**
Aluminium	BSCP 143: Part 15		Roofing underlay	Varies with profile: – corrugated sheet nailed or screwed to sarking – trough sections, use proprietary clips to sarking	Flashings	Paint or unfinished
Zinc	BSCP 143: Part 5		Roofing underlay	To sarking	Flashings	Paint or unfinished
Asphalt shingles	NZS 4408			To sarking	Flashings	Self

11.4.2
Non-rigid underlay or *sheathing* shall consist of a building paper as specified in table 11.1 and shall be fixed as follows:

(a) Run horizontally;

(b) Lapped no less than 75 mm at joints, with the direction of lap ensuring water is shed to the outer face of the paper;

(c) Adequately secured to *plates*, *bearers*, and *studs*; and

(d) Extended from the upperside of the *top plate* to the underside of the *bearers* or *wall plates* supporting the ground floor *joists*;

(e) For wind barriers, heavy weight breather type building paper complying with NZS 2295 for water absorbency and resistance to water penetration, and having a bursting strength of no less than 500 kN/m^2 when tested to BS 3137;

(f) Repaired or replaced if punctured or torn, immediately before exterior coverings are fixed.

11.4.3
Materials for non-rigid wall *cladding* underlays or *sheathing* shall comply with the provisions of table 11.1.

11.4.4
Materials for rigid wall *cladding* underlays or *sheathing* shall comply with the provisions of table 11.1.

Table 14.2 – Bracing demand for various combinations of claddings for 2 storey buildings on subfloor framing, 3 kPa floor loads (see 5.3.1)

Bottom storey cladding	Top storey cladding	Roof cladding	Roof pitch degrees	Foundation structures			Bottom storey			Top storey		
				Earthquake zones								
				A	B	C	A	B	C	A	B	C
				Bracing demand in BUs/m^2 of floor area								
Light	Light	Light	0-25	17.0	12.7	8.5	14.9	11.2	7.5	7.4	5.6	3.7
			26-45	17.4	13.0	8.7	15.3	11.5	7.7	8.0	6.0	4.0
			46-60	18.1	13.6	9.0	16.1	12.1	8.1	9.0	6.7	4.5
Medium	Light	Light	0-25	18.9	14.2	9.5	16.6	12.5	8.3	7.6	5.7	3.8
			26-45	19.3	14.5	9.7	17.0	12.8	8.5	8.2	6.2	4.1
			46-60	20.0	15.0	10.0	17.8	13.4	8.9	9.2	6.9	4.6
Heavy	Light	Light	0-25	24.4	18.3	12.2	21.3	16.0	10.7	8.3	6.2	4.1
			26-45	24.7	18.6	12.4	21.8	16.3	10.9	8.8	6.6	4.4
			46-60	25.5	19.1	12.7	22.5	16.9	11.3	9.9	7.5	5.0
Light	Light	Heavy	0-25	19.7	14.8	9.8	17.8	13.4	8.9	11.1	8.3	5.5
			26-45	20.8	15.6	10.4	19.0	14.3	9.5	12.5	9.4	6.2
			46-60	22.4	17.2	11.5	21.3	16.0	10.6	15.1	11.3	7.5
Medium	Light	Heavy	0-25	21.6	16.2	10.8	19.5	14.7	9.8	11.4	8.6	5.7
			26-45	22.8	17.1	11.4	20.7	15.6	10.4	12.9	9.7	6.4
			46-60	24.9	18.7	12.5	23.0	17.2	11.5	15.5	11.6	7.8
Heavy	Light	Heavy	0-25	27.1	20.3	13.5	24.3	18.2	12.1	12.3	9.2	6.1
			26-45	28.2	21.2	14.1	25.5	19.1	12.8	13.8	10.4	6.9
			46-60	30.4	22.8	15.2	27.8	20.8	13.9	16.6	12.5	8.3
Medium and Heavy	Medium	Heavy	0-25	24.0	18.0	12.0	21.7	16.3	10.8	12.5	9.3	6.2
			26-45	25.1	18.8	12.6	22.9	17.2	11.4	13.9	10.5	7.0
			46-60	27.3	20.4	13.6	25.1	18.9	12.6	16.6	12.5	8.3
Medium	Medium	Light	0-25	21.3	16.0	10.6	18.8	14.1	9.4	8.7	6.5	4.4
			26-45	21.6	16.2	10.8	19.2	14.4	9.6	9.3	7.0	4.6
			46-60	22.4	16.8	11.2	20.0	15.0	10.0	10.3	7.7	5.1
Heavy	Medium	Light	0-25	26.7	20.0	13.4	23.5	17.6	11.7	9.3	7.0	4.7
			26-45	27.1	20.3	13.5	23.9	17.9	12.0	9.9	7.4	5.0
			46-60	27.8	20.9	13.9	24.7	18.5	12.3	11.0	8.3	5.5
Heavy	Heavy	Heavy	0-25	36.0	27.0	18.0	32.4	24.3	16.2	16.3	12.2	8.7
			26-45	37.1	27.8	18.6	33.6	25.2	16.8	17.8	13.4	8.9
			46-60	39.3	29.4	19.6	35.9	26.9	18.0	20.7	15.5	10.3
Heavy	Heavy	Light	0-25	33.3	24.9	16.6	29.5	22.1	14.8	12.4	9.3	6.2
			26-45	33.6	25.2	16.8	29.9	22.4	15.0	12.9	9.7	6.5
			46-60	34.4	25.8	17.2	30.7	23.0	15.3	14.0	10.5	7.0

Table 14.3 – Bracing demand for various combinations of claddings for single storey and 2 storey buildings on concrete slab-on-ground, 3 kPa floor loads (see 5.3.1)

Lower storey cladding	Single or top storey cladding	Roof cladding	Roof pitch degrees	Two storey buildings						Single storey		
				Lower storey			Top storey walls			Single storey walls		
				Earthquake zones								
				A	B	C	A	B	C	A	B	C
				Bracing demand in BUs/m^2 of floor area								
Light	Light	Light	0-25	10.9	8.2	5.4	5.8	4.3	2.9	3.6	2.7	1.8
			26-45	11.3	8.5	5.6	6.2	4.7	3.1	4.0	3.0	2.0
			46-60	12.0	9.0	6.0	7.1	5.3	3.5	4.7	3.6	2.4
Medium	Light	Light	0-25	12.2	9.1	6.1	6.0	4.5	3.0	3.6	2.7	1.8
			26-45	12.5	9.4	6.3	6.4	4.8	3.2	4.0	3.0	2.0
			46-60	13.3	9.9	6.6	7.3	5.5	3.7	4.7	3.6	2.4
Heavy	Light	Light	0-25	14.5	10.8	7.2	6.3	4.7	3.2	3.6	2.7	1.8
			26-45	14.8	11.1	7.4	6.8	5.1	3.4	4.0	3.0	2.0
			46-60	15.6	11.7	7.8	7.7	5.8	3.9	4.7	3.6	2.4
Light	Light	Heavy	0-25	13.6	10.2	6.8	8.9	6.7	4.4	6.3	4.8	3.2
			26-45	14.7	11.0	7.4	10.1	7.6	5.1	7.5	5.6	3.7
			46-60	16.9	12.7	8.4	12.5	9.3	6.2	9.6	7.2	4.8
Medium	Light	Heavy	0-25	14.9	11.1	7.4	9.2	6.9	4.6	6.3	4.8	3.2
			26-45	16.0	12.0	8.0	10.5	7.9	5.2	7.5	5.6	3.7
			46-60	18.2	13.6	9.1	12.8	9.3	6.4	9.6	7.2	4.8
Heavy	Light	Heavy	0-25	17.2	12.9	8.6	9.7	7.3	4.8	6.3	4.8	3.2
			26-45	18.3	13.7	9.2	11.0	8.6	5.5	7.5	5.6	3.7
			46-60	20.5	15.3	10.2	13.4	10.1	6.7	9.6	7.2	4.8
Medium and Heavy	Medium	Heavy	0-25	16.6	12.4	8.3	10.1	7.6	5.0	6.9	5.2	3.5
			26-45	17.7	13.3	8.9	11.4	8.5	5.7	8.1	6.0	4.0
			46-60	19.9	14.9	9.9	13.8	10.3	6.9	10.2	7.7	5.1
Medium	Medium	Light	0-25	13.9	10.4	6.9	6.9	5.2	3.4	4.2	3.2	2.1
			26-45	14.2	10.7	7.1	7.3	5.5	3.7	4.6	3.4	2.3
			46-60	15.0	11.2	7.2	8.2	6.2	4.1	5.3	4.0	2.7
Heavy	Medium	Light	0-25	16.2	12.1	8.1	7.2	5.4	3.6	4.2	3.2	2.1
			26-45	16.5	12.4	8.3	7.7	5.8	3.9	4.6	3.4	2.3
			46-60	17.3	12.9	8.6	8.6	6.5	4.3	5.3	4.0	2.7
Heavy	Heavy	Heavy	0-25	21.9	16.4	11.0	12.2	9.1	6.1	7.9	5.9	4.0
			26-45	23.1	17.3	11.5	13.5	10.1	6.8	9.1	6.8	4.5
			46-60	25.2	18.9	12.6	16.0	12.0	8.0	11.2	8.4	5.6
Heavy	Heavy	Light	0-25	19.2	14.4	9.6	8.9	6.6	4.4	5.2	3.9	2.6
			26-45	19.6	14.7	9.8	9.3	7.0	4.7	5.6	4.2	2.8
			46-60	20.3	15.2	10.2	10.2	7.7	5.1	6.3	4.7	3.2

Amd 1 Dec '00

Table 14.11 – Reference table for lintel load cases

Table No.	Supporting			Load type			
	Roof	Walls	Floor	Roof	Snow (kPa)	Walls	Floor (kPa)
14.12	✓	✓	✓	Light	0	Light	3
	✓	✓	✓	Light	0	Medium	3
	✓	✓	✓	Heavy	0	Light	3
	✓	✓	✓	Heavy	0	Medium	3
14.13		✓	✓			Light	3
		✓	✓			Medium	3
Amd 1 Dec '00 14.14			✓				3

Table 14.12 – Lintels supporting roof, wall and floor for 3 kPa floor load (see figure 8.9)

Roof pitch up to 45°

	Loaded dimension* of lintel (m)	Maximum span for lintel sizes listed below (m)				
		100 x 100	150 x 100	200 x 100	250 x 100	300 x 100
Light roof Light wall	3	0.8	1.3	1.7	2.2	2.6
	4	0.8	1.2	1.7	2.1	2.5
	5	0.8	1.2	1.6	2.1	2.5
	6	0.8	1.2	1.6	2.0	2.4
Light roof Medium wall	3	0.8	1.2	1.6	2.1	2.5
	4	0.8	1.2	1.6	2.0	2.5
	5	0.8	1.2	1.6	2.0	2.3
	6	0.7	1.1	1.5	1.9	2.2
Heavy roof Light wall	3	0.8	1.2	1.6	2.0	2.4
	4	0.8	1.2	1.6	2.0	2.3
	5	0.7	1.1	1.5	1.9	2.1
	6	0.7	1.1	1.5	1.8	2.0
Heavy roof Medium wall	3	0.8	1.2	1.6	2.0	2.3
	4	0.7	1.1	1.5	1.9	2.2
	5	0.7	1.1	1.5	1.8	2.0
	6	0.7	1.0	1.4	1.8	1.9

* For definition of loaded dimension see 1.3.

NOTE – Determine the loaded dimension of the lintel at floor level and the loaded dimension of the wall above the lintel at roof level and use the greater value in this table.

Table 14.13 – Lintels supporting wall and floor only for 3 kPa floor load (see figure 8.10)

	Loaded dimension* of lintel (m)	Maximum span for lintel sizes listed below (m)			
		150 x 100	200 x 100	250 x 100	300 x 100
Light wall	3	1.3	1.7	2.2	2.6
Medium wall	3	1.2	1.7	2.1	2.5
* For definition of loaded dimension see 1.3.					

Amd 1 Dec '00

Table 14.14 – Lintels supporting floor only for 3 kPa floor load (see figure 8.11)

Loaded dimension* of lintel (m)	Maximum span for lintel sizes listed below (m)			
	150 x 100	200 x 100	250 x 100	300 x 100
3	1.3	1.8	2.2	2.7
4.5	1.1	1.5	1.8	2.0
* For definition of loaded dimension see 1.3.				

Amd 1 Dec '00

15 0.5 kPa or 1 kPa SNOW LOADING

15.1 General

NZS 3604 as modified by this section shall be used for the design of buildings that are required to carry snow loadings of 0.5 kPa or 1 kPa. See tables 15.1 – 15.8.

15.2 Snow loading

15.2.1

Allowance for snow loading is not required in Zone 0 or at altitudes less than 200 m in Zones 1, 2 and 3. Buildings in Snow Zones 1 to 5 (see figure 15.1) shall be designed to carry snow loadings of 0.5 kPa or 1 kPa depending on the altitude of a building site as given in the table in figure 15.1.

15.2.2

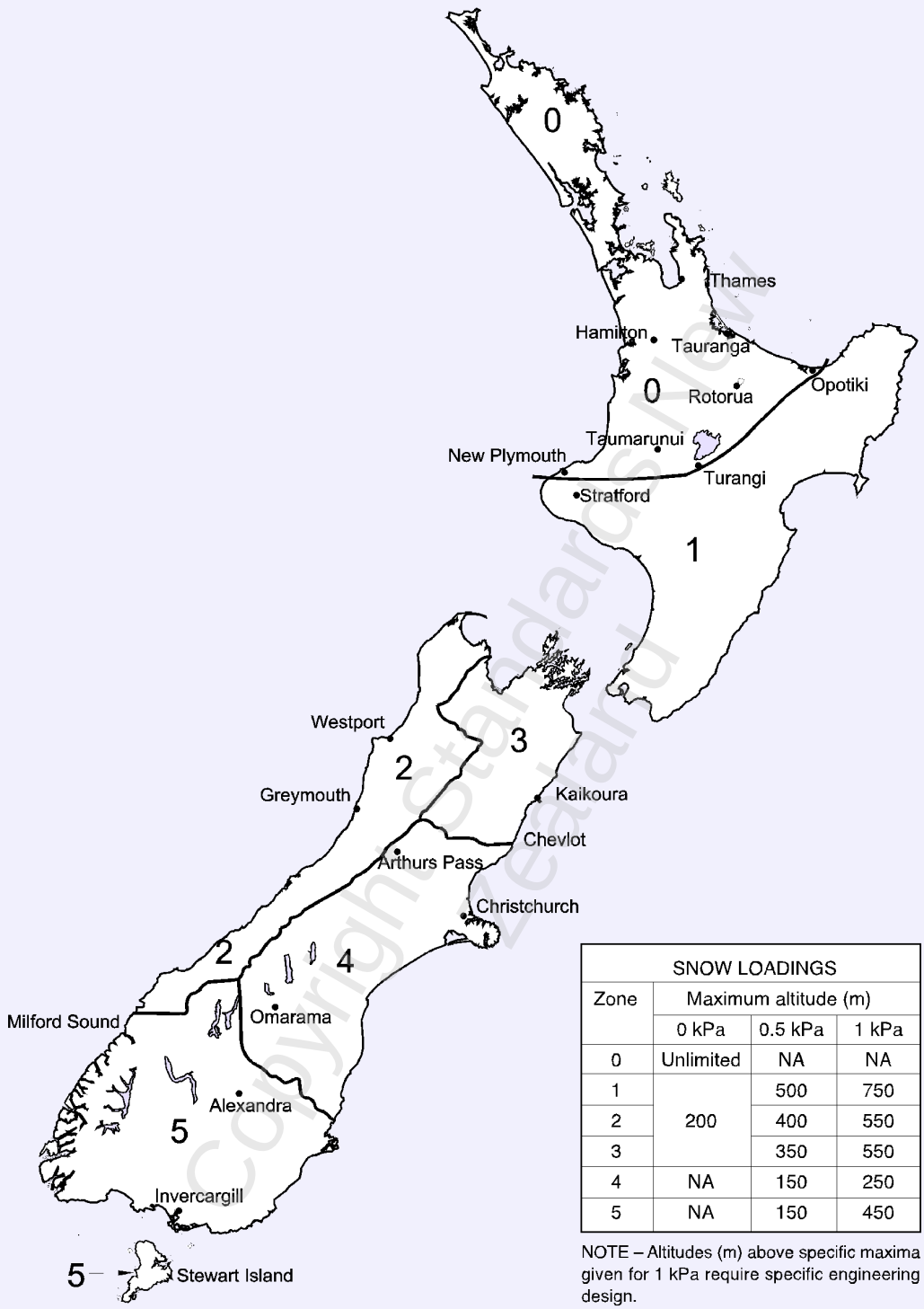
At higher altitudes than those given by 15.2.1 the building shall be the subject of *specific engineering design*.

15.2.3

Member sizes, spans and fixings shall comply with tables 15.2 – 15.8 for 0.5 kPa snow loading.

For 1 kPa snow loading, member sizes and fixings shall be read directly from tables 15.2 – 15.8 as if the snow loading was 0.5 kPa. Member spans however shall be multiplied by the following factors:

Table	Description of member	Factor
15.2	Lintels supporting roof only	0.8
15.3	Lintels supporting roof and wall	0.9
15.4	Lintels supporting roof and wall with 1.5 or 2 kPa floor loads	1.0
15.5	Lintels supporting roof and wall with 3 kPa floor loads	1.0
15.6 (a)(b)(c)	Rafters, light roof	0.85
15.6 (d) (e)	Rafters, heavy roof	1.0
15.6 (f)	Valley rafters	1.0
15.7 (a)(b)	Underpurlins and ridge beams	0.85
15.8	Verandah beams	1.0



SNOW LOADINGS			
Zone	Maximum altitude (m)		
	0 kPa	0.5 kPa	1 kPa
0	Unlimited	NA	NA
1	200	500	750
2		400	550
3		350	550
4	NA	150	250
5	NA	150	450

NOTE – Altitudes (m) above specific maxima given for 1 kPa require specific engineering design.

Amd 1 Dec '00

Figure 15.1 – Snow zones

Table 15.6 – Rafters (continued) (see 10.2.1.3.2)

(f) Dimensions of valley rafters for all wind zones

Rafter size	Maximum span of valley rafters (m) and their fixing types for all wind zones			
	Light roof		Heavy roof	
	Span	Fixing type	Span	Fixing type
(mm x mm)	(m)		(m)	
100 x 40	2.0	B	1.8	B
125 x 40	2.3	B	2.1	B
150 x 40	2.4	B	2.4	B
75 x 50	1.7	B	1.5	B
100 x 50	2.1	B	1.9	B
125 x 50	2.6	C	2.2	B
150 x 50	2.9	C	2.6	B
200 x 50	3.1	C	3.2	C
250 x 50	3.3	C	3.3	C
300 x 50	3.5	D	3.5	C
100 x 75	2.4	B	2.1	B
125 x 75	2.8	C	2.5	B
150 x 75	3.3	C	2.9	B
200 x 75	4.1	E	3.6	C
250 x 75	4.5	E	4.2	D

Fixing type	Fixing to resist uplift	Alternative fixing capacity (kN)
B	2/100 x 3.75 skewed nails + 1 wire dog	2.7
C	2/100 x 3.75 skewed nails + 2 wire dogs	4.7
D	2/100 x 3.75 skewed nails + 3 wire dogs	6.7
E	2/100 x 3.75 skewed nails + 4 wire dogs	8.7

NOTE –
(1) For the full range of fixing types and capacity see table 10.13.
(2) Proprietary fixings that have the required fixing capacity indicated in tables may be used.

Amd 1
Dec '00

NOTES