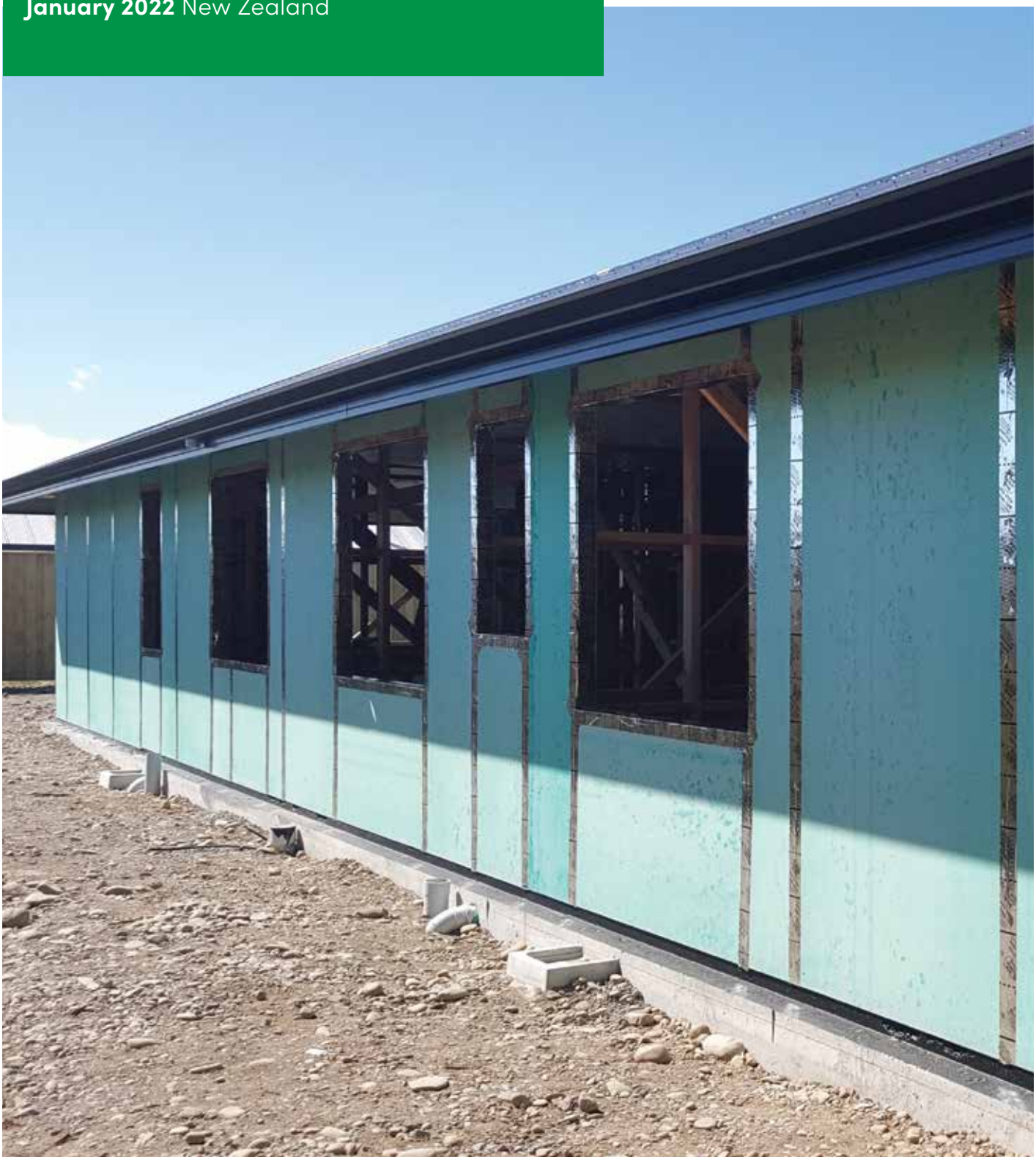
JamesHardie™

jameshardie.co.nz

Bracing

Design Manual

January 2022 New Zealand



We value your feedback!

To continue with the development of our products and systems, we value your input. Please send any suggestions, including your name, contact details, and relevant sketches to:

Ask James Hardie™
literaturefeedback@jameshardie.co.nz

Make sure your information is up to date

When specifying or installing Hardie™ fibre cement products, ensure that you have the current manual. Additional installation information, warranties and warnings are available at **www.jameshardie.co.nz** or **Ask James Hardie™ on 0800 808 868.**

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1 Application and Scope

1.1 Application

The Hardie™ fibre cement products are suitable to achieve structural bracing in timber framed buildings as per the requirements of NZS 3604 or (SED) Specific Engineering Design when installed in accordance with the bracing system published here in.

Refer to Table 2 – 14 for on bracing system capacity of various Hardie™ fibre cement products.

The following Hardie™ fibre cement products can be used to achieve bracing:

- Villaboard™ Lining, internal wall lining with recessed or square edges 6mm and 9mm; suitable for wet and dry areas.
- Hardie™ Groove Lining, internal wall lining with a 'tongue & groove' look.
- RAB™ Board 6mm or 9mm or HomeRAB™ Pre-Cladding 4.5mm, used as rigid air barrier.
- Hardie™ Flex Sheet 6mm cladding suitable for board and batten or used with other jointing options.
- Axon™ Panel, 9mm suitable for external wall claddings. with a 'Vertical Grooved' look.
-

Specifier

If you are a specifier or other responsible party for a project ensure that the information in this document is appropriate for the application you are planning and that you undertake specific design and detailing for areas which fall outside the scope of these specifications.

Installer

If you are an installer ensure that you follow the design, moisture management principles, associated details and material selection provided by the designer. All details provided in this document must be read in conjunction with this specification.

Make sure your information is up to date

When specifying or installing Hardie™ fibre cement products, ensure you have the current manual. If you're not sure you do, or you need more information, visit www.jameshardie.co.nz or Ask James Hardie on 0800 808 868.

1.2 Scope

This manual covers the installation of Hardie™ fibre cement products to achieve structural bracing for timber-framed buildings that fall within the scope of NZS 3604 or specific design buildings.

To achieve bracing ratings published in this literature, each product must be fixed in accordance with its respective details published in this manual.

1.3 Details

The bracing system details provided in this document are available in CAD format on our website www.jameshardie.co.nz.

1.4 Specific Design and Detailing

For buildings outside the scope of this literature, the designer/architect or engineer responsible for the project must undertake Specific Engineering Design (SED).

2 Design

2.1 Compliance

All Hardie™ fibre cement products as mentioned in Section 1.1 have been tested at SCION as per BRANZ P21 test method to determine their bracing capacity and bracing systems have been developed. Hardie™ fibre cement products, when installed and maintained in accordance to James Hardie's technical specification requirements, comply with the requirements of the New Zealand Building Code (NZBC).

2.2 Responsibility

The specifier or other party responsible for the project must run through a risk matrix analysis as per E2/AS1 to determine which construction method is applicable to install the external cladding on the project. The designer must also ensure that the bracing capacities published in this specification are appropriate for the intended application. The designer is responsible to calculate the bracing requirement for a building. The designers must also ensure that the intent of their design meets the requirements of the NZBC.

Substitution of Hardie™ fibre cement product with any other product will change the bracing capacity of a system and James Hardie accepts no liability due to this. James Hardie's bracing systems are not generic and therefore they must only be installed as per James Hardie's bracing details using a James Hardie product.

All dimensions shown are in millimetres unless noted otherwise. All New Zealand Standards referenced in this manual are current edition and must be complied with.

James Hardie conducts stringent quality checks to ensure that any product manufactured falls within our quality spectrum. It is the responsibility of the builder to ensure that the product meets aesthetic expectation before installation. James Hardie will not be responsible for rectifying the obvious aesthetic surface variations in product after its installation.

2.3 Site and Foundation

The site on which the building is situated must comply with Surface Water Clause E1 of NZBC. The grade of adjacent finished ground must slope away from the building to avoid any possibility of water accumulating.

Foundation design must comply with the requirements of NZS 3604 Timber Framed Buildings.

2.4 Ground Clearances

The clearance between the bottom edge of claddings and paved/unpaved ground must comply with section 9.1.3 of E2/AS1. The finished floor level must also comply with these requirements. These clearances must be maintained throughout the life of the building.

Hardie™ claddings must overhang the bottom plate by a minimum of 50mm as required by NZS 3604 and E2/AS1 of NZBC.

On the roofs and decks the minimum clearance must be 50mm.

Do not install external cladding such that it may remain in contact with the ground.

2.5 Moisture Management

It is the responsibility of the specifier to identify moisture related risks associated with any particular building design.

Wall construction design must effectively manage moisture, considering both the interior and exterior environments of the building, particularly in buildings that have a higher risk of wind driven rain penetration or that are artificially heated or cooled.

Walls shall include those provisions as required by NZBC Acceptable Solution E2/AS1 External Moisture. In addition, all wall openings, penetrations, junctions, connections, window sills, heads and jambs must incorporate appropriate flashings for waterproofing. The other materials, components and installation methods used to manage moisture in external walls, must comply with the requirements of relevant standards and NZBC.

2.6 Wind Loading

James Hardie's bracing systems are suitable for use in all wind zones as defined in NZS 3604. For wind speeds more than 55m/sec, (EH wind zone) a specific engineering design must be undertaken by the designer to calculate the bracing capacity required.

2.7 Height of Bracing Panels

Maximum Height:

The standard height of James Hardie's bracing systems is 2.4m. For bracing panels which exceed the 2.4m height, the bracing rating is to be reduced by a multiplication factor of 2.4/H, where H is the bracing panel height. Dimension H, however, must be limited to maximum of 4.8m. Refer also to clauses 8.3.1.4 (a) and (b) of NZS 3604 for further information.

Minimum Height:

For bracing panels which are less than 2.4m height, the bracing rating is to be used as for a 2.4m high wall.

The wall height with a sloping top plate should be taken as the average height.

2.8 Bracing Sheets Stopped Below Top Plate

Where a bracing sheet is stopped below the top plate an extra row of nogs (dwangs) must be installed below the top plate to facilitate the bracing sheet fixing. Refer to Figure 17 for details.

2.9 Bracing in wet area & water splash areas

Villaboard Lining can be used to achieve bracing in internal wet areas (shower) when the sheet is covered by an impervious lining eg. Hardie™ Glaze Lining/vinyl/acrylic shower lining.

When using tiles over a braced wall, designer/builder must ensure that the water proofing membrane used under the tiles meets 50 years durability requirements as per clause 2.3.1 (a) of B2 of the NZBC.

2.10 Impact Resistance

Hardie™ fibre cement products covered in this manual have adequate impact resistance which is likely to occur during the normal use of a building.

The impact resistance does not apply to rigid air barriers as they are covered by a cladding.

2.11 Maximum Bracing Units

A maximum of 150 BU/m can be achieved for concrete floors and 120 BU/m can be achieved for timber floors in buildings built in accordance with NZS 3604. Higher bracing ratings will exceed the structural capacity of anchors, slabs and foundations etc built as per NZS 3604 and therefore requires a specific engineering design (SED) input.

2.12 Specific Engineering Design

For some bracing systems using Hardie™ fibre cement product, bracing ratings higher than 150BU's/m can be achieved. Refer to Tables 2 to 8. As mentioned above, a specific engineering design must be undertaken to design the concrete foundation. This may require increasing foundation thickness using higher grade concrete the edge distance between hold down bolts and outer edge of slab.

2.13 Bracing Calculation

Refer to the online bracing calculation tool at www.jameshardie.co.nz. This tool enables a quick calculation of bracing demand and the selection of suitable bracing systems.

You can also use manual bracing calculation sheets provided in section 21 of this manual.

3 Timber Framing

3.1 General

James Hardie's bracing systems are suitable for timber framed buildings. The framing must comply with the minimum requirements of NZS 3604 'Timber Framed Buildings' or in accordance with the specific engineering design (SED).

Bracing capacities/ratings and fixing specifications are provided for each system in the respective details published for each product.

3.2 Dimensions

A minimum 90x45mm stud size is required for bracing systems. Refer to James Hardie's product technical specification/installation manuals for any additional specific framing requirements.

3.3 Structural Grade

Minimum timber grade requirement is SG8 framing grade used as per NZS 3604. Higher stress grade such as MSG10 can be used where needed.

3.4 Tolerances

In order to achieve an acceptable wall finish, it is imperative that framing is straight and true.

Framing tolerances must comply with the requirements of NZS 3604. All framing shall be made flush.

3.5 Durability

The external framing must be treated to a minimum H1.2 treatment. Refer to NZBC Acceptable Solution B2/AS1 Durability for further information about the durability requirements.

For timber treatment and allowable moisture content information refer to NZS 3602 (Timber and Wood-Based Products for use in Buildings) and NZS 3640 (Chemical Preservation of Round Sawn Timber) for minimum timber treatment selection and treatment requirements.

3.6 Frame Construction

Timber framing must comply with NZS 3604 and provided as per the following requirements.

Also refer to timber framing manufacturers' specifications before installation.

- Studs must be provided at 600mm centres maximum.
- Nogs or dwangs must be provided at 1200mm centres maximum.
- When a cladding is fixed over the cavity battens, the nogs must be provided in accordance with Section 9.1.8.5 of E2/AS1.

3.7 Bottom Plate Fixing/Hold Down Restraints

The timber framing must be fixed in accordance to table 8.19 of NZS 3604. Additional hold down restraints must be provided as per each bracing system's requirements. Refer to bracing systems details.

3.7.1 Concrete foundation

Pydra brace anchor kits or GIB® Handibrac® with a 15kN minimum uplift capacity holding down bolt can be used as end restraints.

3.7.2 Timber foundation

Pydra brace anchor kits or GIB® Handibrac® with a M12 x 150mm holding down bolt can be used as end restraints. Alternatively, holding down straps as per NZS 3604 can also be used. Refer to Figure 15.

4 Preparation

4.1 General

All Hardie™ fibre cement products must be kept dry and under cover whilst in storage prior to fixing.

4.2 Flexible Underlay or HomeRAB Pre-Cladding

Flexible underlay used must comply with the performance requirements of Table 23 of E2/AS1. The underlay must be installed in accordance with E2/AS1 and their manufacturer's requirements.

In buildings within the scope of NZS 3604 HomeRAB Pre-Cladding can also be used to replace the flexible underlay. HomeRAB Pre-Cladding has been tested and complies with the requirements of Table 23 of E2/AS1. Walls which are not lined on inside face e.g. garage walls or gable ends etc. must include a rigid sheathing or an air barrier behind the wall cladding. HomeRAB Pre-Cladding is suitable for use in these applications, up to and including VH wind zone.

4.3 Window and Door Installation

All windows and doors must be detailed such that they meet the requirements of E2/AS1, Clause 2.0.1. Refer also to NZS 3604 and the joinery provider.

5 Sheet Fixing

5.1 Fastener Durability and Size

Coach screws and holding down (HD) bolts, where used, must be M12 hot-dipped galvanised steel fitted with 50 x 50 x 3mm galvanised washers. The holding down bolts and washers must have a protective coating as per Table 4.2 of NZS 3604.

Pre-claddings:

All nails for fixing the pre-cladding bracing panels in Zone D must be Grade 304/316 stainless steel in accordance with NZS 3604.

All nails for fixing the pre-cladding bracing panels for Zone B and Zone C can be Grade 304/316 stainless steel or hot dipped galvanised steel nail.

Claddings:

All claddings when used for bracing applications, must be fixed with a Grade 304/316 stainless steel nail in accordance with NZS 3604.

Linings:

For dry area internal applications, standard hot dipped galvanised nails can be used.

For wet area internal applications, stainless steel nails must be used.

Note: Fastener sizes are given in the respective details section for each product or system.

5.2 Sheet Nailing

Nails can be hand driven or gun nailed at a minimum edge distance as shown in the bracing details within this specification. This also applies to dimensions from corners, vertically and horizontally. The sheets must be held hard against the framing during nailing to minimise sheet break-out at the back of sheet. Always drive all nails flush with the sheet surface. For sheet/panel systems do not punch the nail below the surface as it reduces the nail's holding power.

Fix all sheets from the centre working towards outer edges to avoid drumminess. Fixings at 150mm maximum centres.

Gun nails can be used on some bracing systems with fixings at 100mm maximum centres. **Refer to bracing tables for hand or gun nail options available.**

5.3 Sheet Orientation

For the bracing systems specified in this manual, all flat sheets must be fixed vertically with the exception of Villaboard Lining, which can either be fixed vertically or horizontally as per the bracing systems details.

Full-height sheets must be used for walls up to 3000mm in height. When bracing walls height exceed 3000mm, sheet jointing is acceptable. Only one horizontal sheet joint is permitted within the element height. The maximum height of bracing wall is limited to 4800mm.

A site cut bracing sheet must be minimum 300mm wide when used in a bracing element. Refer to Figure 17.

Always ensure that the sheet joint is on the centre line of the stud or nog to achieve sufficient cover of fixings.

In internal walls the lining sheet used for bracing must stop 6mm above the finished floor.

5.4 Service Penetrations

Holes/penetrations up to 100 x 100mm positioned no closer than 200mm of the edge or another penetration, are allowed for services. Maximum of two service penetrations are recommended per sheet.

No window/door penetrations are allowed within the bracing elements.

6 Jointing

6.1 General

Control joints in flush finished or monolithic claddings are required to accommodate movement created by shrinkage and thermal movement of plasters and framing subsides.

Expansion joints are provided in timber walls to allow for long-term frame movement that occurs due to structural loading and timber shrinkage.

Control joints and expansion joints must be determined at the design stage. For further guidance on jointing refer to the BRANZ publication 'Good Stucco Practice'.

When bracing walls contain control joint or expansion joints, the panels must be separated into separate bracing elements on either side of the joint.

7 Finishing

7.1 General

Protective coating of Hardie™ fibre cement sheet cladding is required in order to meet the durability requirements of the NZBC and to be covered under the James Hardie's Product Warranty. Claddings must be painted within 90 days of its installation. Use only quality exterior paints complying with AS 3730. Manufacturer's specification for the selected paint must be followed. **Note** that certain special paints require an undercoat before applying the finish coat. Refer to the relevant paint manufacturer for preparation required before commencing the coating work.

7.2 Sealants

All sealants must demonstrate they meet the relevant requirements of NZBC. Application and use of sealants must comply with the manufacturer's instructions. Check with the sealant manufacturer prior to coating over sealants as some sealant manufacturers do not recommend coating over their product.

8 Care and maintenance

8.1 General

The extent and nature of maintenance will depend on the geographical location and exposure of the building. As a guide, it is recommended that basic normal external maintenance tasks shall include but not be limited to;

For external claddings:

- Wash down exterior surfaces every 6-12 months using low pressure water and a brush, and every 3-4 months in extreme coastal conditions or sea spray zones. Do not use a water blaster to wash down the claddings and refer to your paint manufacturer for washing down requirements related to paint performance.
- Re-coating exterior protective finishes. Always refer to your paint manufacturer for re-coating requirements related to paint performance.
- Maintaining the exterior envelope and connections including joints, penetrations, flashings and sealants that may provide a means of moisture entry beyond the exterior cladding
- Cleaning out gutters, blocked pipes and overflows as required
- Pruning back vegetation that is close to or touching the building
- The clearances between the bottom of cladding and top of ground or paved surface must always be maintained
- Any surface drains running next to a wall cladding must be kept clear of debris to avoid blockage and flooding.

For internal linings:

It is recommended that basic normal internal maintenance tasks shall include but not be limited to;

- Integrity of various coatings maintained. Do not use a water blaster to wash down the lining. Refer to your paint manufacturer for washing down and re-coating requirements related to paint performance.
- Maintaining the interior envelope and connections including joints, penetrations, flashings and sealants that may provide a means of moisture ingress

9 Product Information

9.1 Manufacturing and Classification

James Hardie is an ISO 9001 Telarc certified manufacturer. Flat sheets are manufactured in accordance with AS/NZS 2908.2. *'Cellulose Cement Products'*, which is equivalent to ISO 8336 *'Fibre Cement Flat Sheets'*.

Each of the products covered by this manual are identified by its name embossed or printed on either the front or back face of the sheet.

9.2 Sizes

Refer to respective current product technical specification for further information about available product sizes.

10 Safe Working Practice

WARNING - DO NOT BREATHE DUST AND CUT ONLY IN WELL VENTILATED AREA

Hardie™ fibre cement products contain sand, a source of respirable crystalline silica may cause cancer if dust from product is inhaled. Causes damage to lungs and respiratory system through prolonged or repeated inhalation of dust from product.

Intact fibre cement products are not expected to result in any adverse toxic effects. The hazard associated with fibre cement arises from the respirable crystalline silica present in dust generated by activities such as cutting, rebating, drilling, routing, sawing, crushing, or otherwise abrading fibre cement, and when cleaning up, disposing of or moving dust.

When doing any of these activities in a manner that generates dust, follow James Hardie instructions and best practices to reduce or limit the release of dust.

If using a dust mask or respirator, use an AS/NZS1716 P1 filter and refer to Australian/New Zealand Standard 1715:2009 Selection, Use and Maintenance of Respiratory Protective Equipment for more extensive guidance and more options for selecting respirators for workplaces. For further information, refer to our installation instructions and Safety Data Sheets available at www.jameshardie.co.nz.

FAILURE TO ADHERE TO OUR WARNINGS, SAFETY DATA SHEETS, AND INSTALLATION INSTRUCTIONS MAY LEAD TO SERIOUS PERSONAL INJURY OR DEATH.

Crystalline Silica is

- Commonly known as sand or quartz
- Found in many building products e.g. concrete, bricks, grout, wallboard, ceramic tiles, and all fibre cement materials

Why is Crystalline Silica a health hazard?

- Silica can be breathed deep into the lungs when present in the air as a very fine (respirable) dust
- Exposure to silica dust without taking the appropriate safety measures to minimise the amount being breathed in, can lead to a potentially fatal lung disease – silicosis – and has also been linked with other diseases including cancer. Some studies suggest that smoking may increase these risks
- The most hazardous dust is the dust you cannot see!

When is Crystalline Silica a health hazard?

- It's dangerous to health if safety protocols to control dust are not followed when cutting, drilling or rebating a product containing crystalline silica
- Products containing silica are harmless if intact (e.g. an un-cut sheet of wall board)

Avoid breathing in crystalline silica dust

Safe working practices

- ✕ NEVER use a power saw indoors or in a poorly ventilated area
- ✕ NEVER dry sweep
- ✓ ALWAYS use M Class or higher vacuum or damp down dust before sweeping up
- ✕ NEVER use grinders
- ✓ ALWAYS use a dust reducing circular saw equipped with a sawblade specifically designed to minimise dust creation when cutting fibre cement – preferably a sawblade that carries the Hardie™ Blade name or one with at least equivalent performance – connected to an M Class or higher vacuum
- ✓ Before cutting warn others in the area to avoid dust
- ✓ ALWAYS follow tool manufacturers' safety recommendations
- ✓ ALWAYS expose only the minimum required depth of blade for the thickness of fibre cement to be cut
- ✓ ALWAYS wear a properly-fitted, approved dust mask or respirator P1 or higher in accordance with applicable government regulations and manufacturer instructions
- ✓ Consider rotating personnel across cutting tasks to further limit respirable silica exposures.

Use one of the following methods for cutting Hardie™ fibre cement products under 9mm

Best

- Hardie™ Knife
- Hand guillotine
- Fibreshear

Better

Dust reducing circular saw equipped with Hardie™ Blade Saw Blade and connected to a M Class or higher vacuum.

When cutting outdoors

- ✓ Make sure you work in a well ventilated area
- ✓ Position cutting station so wind will blow dust away from yourself and others in the working area
- ✓ Rotate employees across cutting task over duration of shift
- ✓ Cut products with a Hardie™ Blade Saw Blade (or equivalent) and a dust reducing circular saw connected to a M Class or higher vacuum
- ✓ When sawing, sanding, rebating, drilling or machining fibre cement products, always:
  - Wear your P1 or higher (correctly fitted in accordance with manufacturers' instructions), ask others to do the same.
  - Keep persons on site at least 2 metres and as far as practicable away from the cutting station while the saw is in operation
  - If you are not clean shaven, then use a powered air respirator with a loose fitting head top
  - Wear safety glasses
  - Wear hearing protection
- ✓ Make sure you clean up BUT never dry sweep. Always hose down with water/wet wipe or use an M Class or higher vacuum

When cutting indoors

- ✕ Never cut using a circular saw indoors
- ✓ Position cutting station in a well ventilated area
- ✓ Cut ONLY using a Hardie™ Knife, hand guillotine or fibreshears (manual, electric or pneumatic)
- ✓ Make sure you clean up BUT never dry sweep. Always hose down with water/wet wipe or use an M Class or higher vacuum

Use the following method for cutting Hardie™ fibre cement products over 9mm

Dust reducing circular saw equipped with Hardie™ Blade Saw Blade and M Class or higher vacuum.

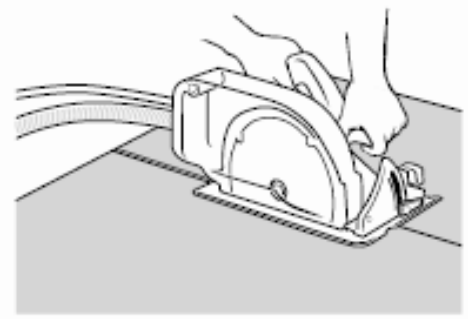
When cutting

- ✓ Work outdoors only
- ✓ Make sure you work in a well ventilated area
- ✓ Position cutting station so wind will blow dust away from yourself and others in the working area
- ✓ Rotate employees across cutting task over duration of shift
- ✓ Cut products with a Hardie™ Blade Saw Blade (or equivalent) and a dust reducing circular saw connected to a M Class or higher vacuum
- ✓ When sawing, sanding, rebating, drilling or machining fibre cement products, always:
  - Wear your P1 or higher (correctly fitted in accordance with manufacturers' instructions), ask others to do the same.
  - Keep persons on site at least 2 metres and as far as practicable away from the cutting station while the saw is in operation.
  - If you are not clean shaven, then use a powered air respirator with a loose fitting head top
  - Wear safety glasses
  - Wear hearing protection
  - When others are close by, ask them to do the same
- ✓ Make sure you clean up BUT never dry sweep. Always hose down with water/wet wipe or use an M Class or higher vacuum

If concern still exists about exposure levels or you do not comply with the above practices, you should always consult a qualified industrial hygienist or contact James Hardie for further information.

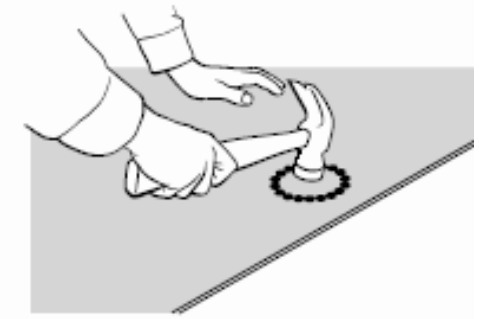
Working Instructions

Hardie™ Blade Saw Blade



The Hardie™ Blade Saw Blade used with a dust-reducing saw is ideal for fast, clean cutting of Hardie™ fibre cement products. A dust-reducing saw uses a dust collector connected to a M Class or higher vacuum. When sawing, clamp a straight edge to the sheet as a guide and run the saw base plate along the straight edge when making the cut.

Hole-Forming



For smooth clean cut circular holes:

- Mark the centre of the hole on the sheet
- Pre-drill a 'pilot' hole
- Using the pilot hole as a guide, cut the hole to the appropriate diameter with a hole saw fitted to a heavy duty electric drill

For irregular holes:

- Small rectangular or circular holes can be cut by drilling a series of small holes around the perimeter of the hole then tapping out the waste piece from the sheet face
- Tap carefully to avoid damage to sheets, ensuring that the sheet edges are properly supported

10.1 Storage and Delivery

Hardie™ fibre cement products should be stored in their original packaging, preferably under cover like a garage or in some other covered area protected from weather whenever possible. These products must be kept dry and should be kept covered on a pallet off the ground; they must never be stored in direct contact with the ground.

If Hardie™ fibre cement products become saturated, they must be laid on a flat surface and allowed to dry completely prior to installation.

James Hardie is not responsible for damage due to improper storage and handling of its products.

Hardie™ fibre cement products are robust and durable once installed. It is important to keep the product dry in storage and during installation.

If product becomes saturated prior to installation the following can occur.

- Shrinkage at joints.
- Staining. A deposit of soluble salts, usually white in colour.
- Difficulty in handling due to the increased weight and added flexibility once saturated.

Storage and delivery

Keeping products and people safe.

Off loading

✓ Hardie™ fibre cement products should be off-loaded carefully by hand or by forklift

✓ Hardie™ fibre cement products should not be rolled or dumped off a truck during the delivery to the jobsite

Storage

Hardie™ fibre cement products should be stored:

- ✓ In their original packaging
- ✓ Under cover where possible or otherwise protected with a waterproof covering to keep products dry
- ✓ Off the ground – either on a pallet or adequately supported on timber or other spacers
- ✓ Flat so as to minimise bending

Hardie™ fibre cement products must not be stored:

- ✗ Directly on the ground
- ✗ In the open air exposed to the elements

James Hardie is not responsible for damage due to improper storage and handling.

10.2 Tips for safe and easy handling of sheet products

- ✓ Carry with two people
- ✓ Hold near each end and on edge
- ✓ Exercise care when handling sheet products to avoid damaging the edges/corners

11 Details

Various details outlined in the following table are available on Pages 12 to 43.

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12 Bracing Table — Internal Linings

Table 2

Villaboard™ Lining 6mm and 9mm vertically fixed										
System number	Thickness (mm)	Length	Hold down	Refer figures	BU/M		kN/m		Fixing method	
					Wind	Earthquake	Wind	Earthquake	Hand nail	Screw
Vvn	6 & 9	1200	N	1	99	86	5.0	4.3	✓	×
Vv	6 & 9	400	Y	2,13,14	81	105	4.1	5.3	✓	×
Vv	6 & 9	600	Y	2,13,14	88	85	4.4	4.3	✓	×
Vv	6 & 9	1200 to 2400	Y	3,13,14	130*	101	6.5	5.1	✓	for 6mm Villaboard Lining
Vv	6	2400 to 4800	Y	3,13,14	125*	98	6.3	4.9	✓	×
Villaboard™ Lining 9mm vertically fixed										
Vv	9	2400 to 4800	Y	3,13,14	145*	133*	7.25	6.65	✓	×
Villaboard™ Lining horizontally fixed										
Vh	6 & 9	2400 to 4800	Y	4,13,14	161	135	8.1	6.8	✓	×

*A limit of 120BUs/m maximum applies to timber floors and 150BUs/m maximum to concrete floors built as per NZS 3604: 2011 unless a specific engineering design is carried out to ensure the uplift force generated by bracing elements does not exceed the maximum limit for each floor type.

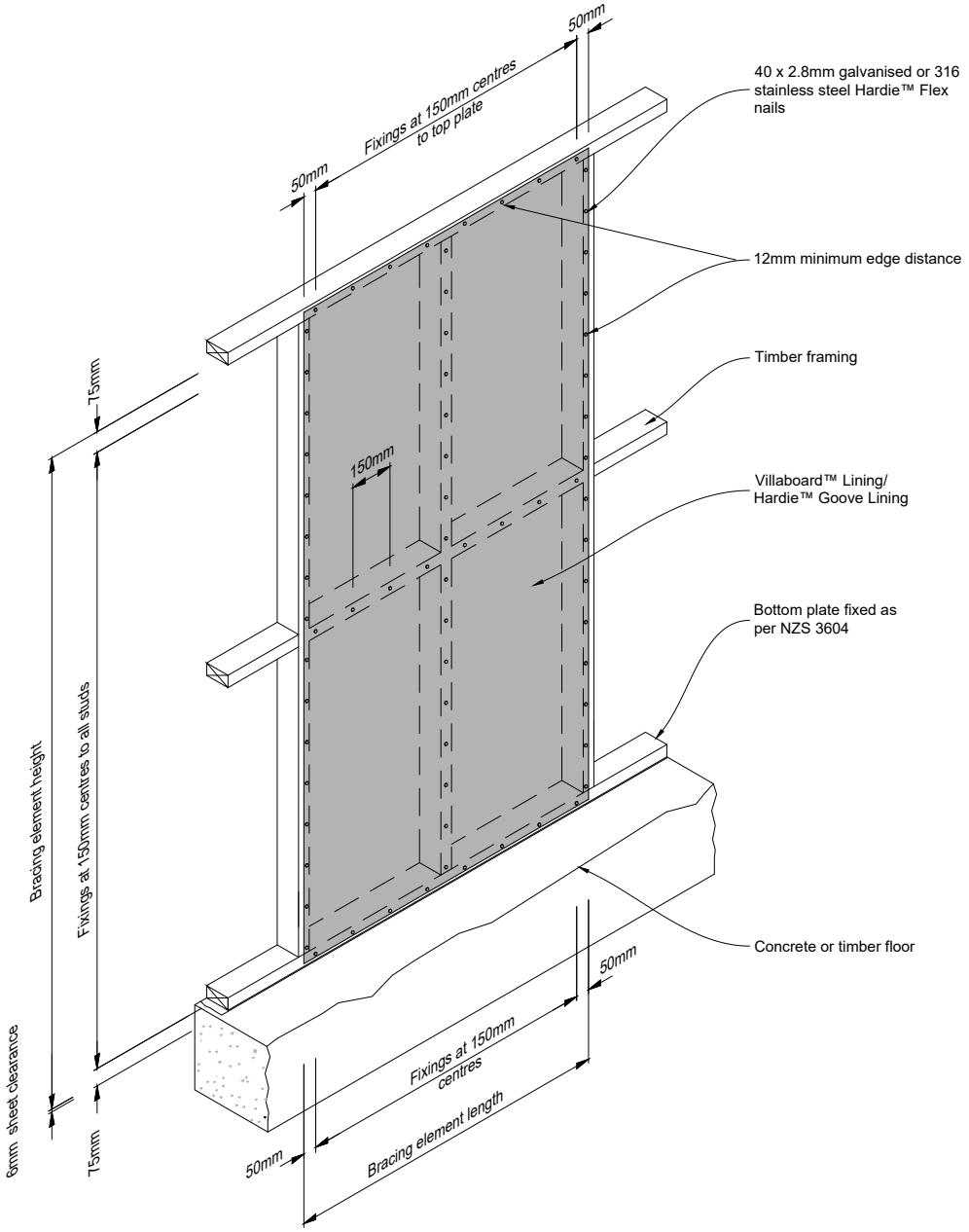
Table 3

Hardie™ Groove Lining vertically fixed									
System number	Length	Hold down	Refer figures	BU/M		kN/m		Fixing method	
				Wind	Earthquake	Wind	Earthquake	Hand nail	Screw
HGn	1200	N	1	101	96	5.1	4.8	✓	×
HG	1200 to 2400	Y	3,13,14	154*	153*	7.7	7.7	✓	×

*A limit of 120BUs/m maximum applies to timber floors and 150BUs/m maximum to concrete floors built as per NZS 3604: 2011 unless a specific engineering design is carried out to ensure the uplift force generated by bracing elements does not exceed the maximum limit for each floor type.

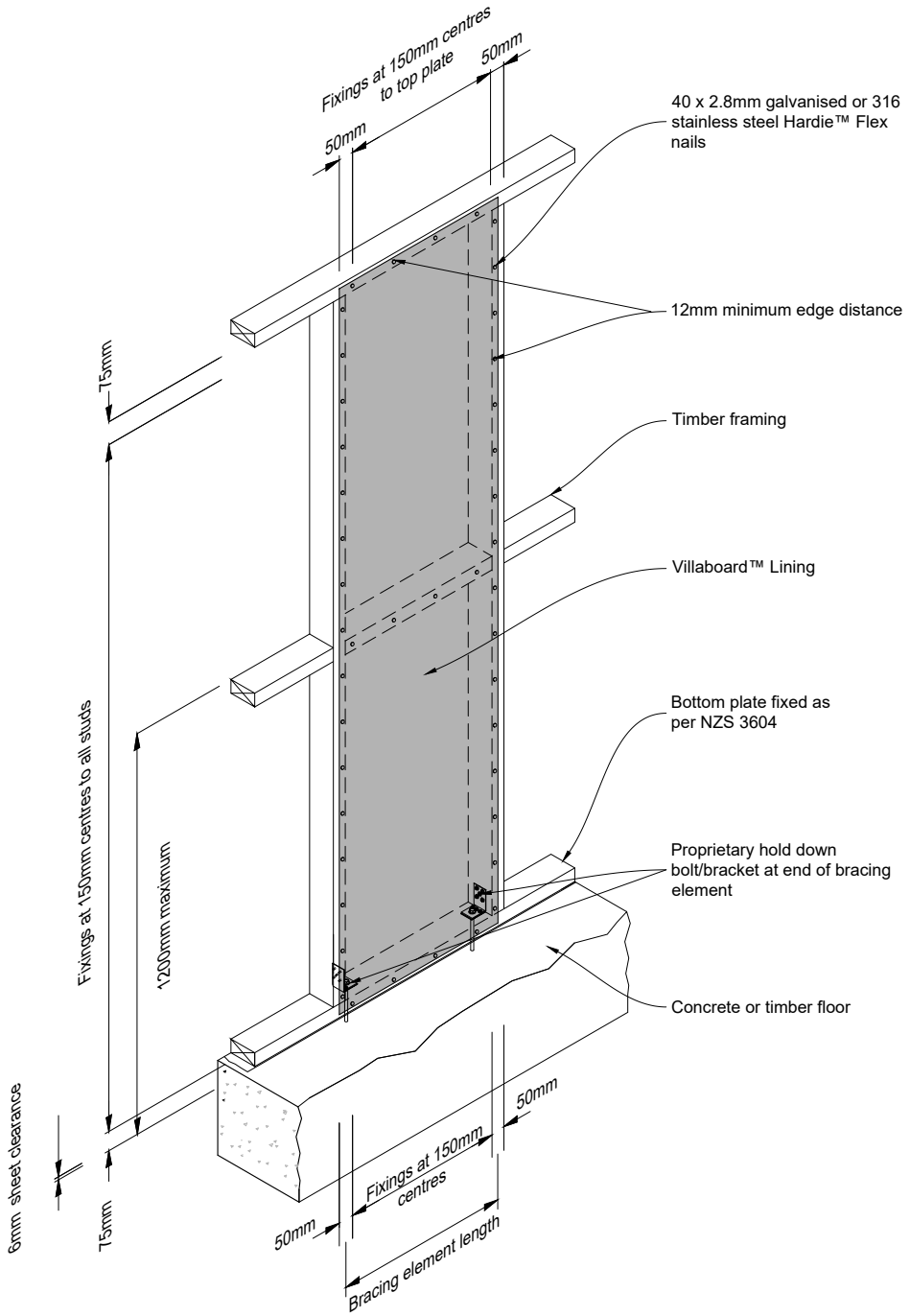
13 Bracing Figures — Internal Linings

Figure 1: 1200mm Villaboard™ Lining/Hardie™ Groove Lining with no hold down brackets



Product	System	Minimum length
Villaboard™ Lining	Vvn	1200mm
Hardie™ Groove Lining	HGn	1200mm

Figure 2: 400mm or 600mm Villaboard™ Lining to concrete or timber floor



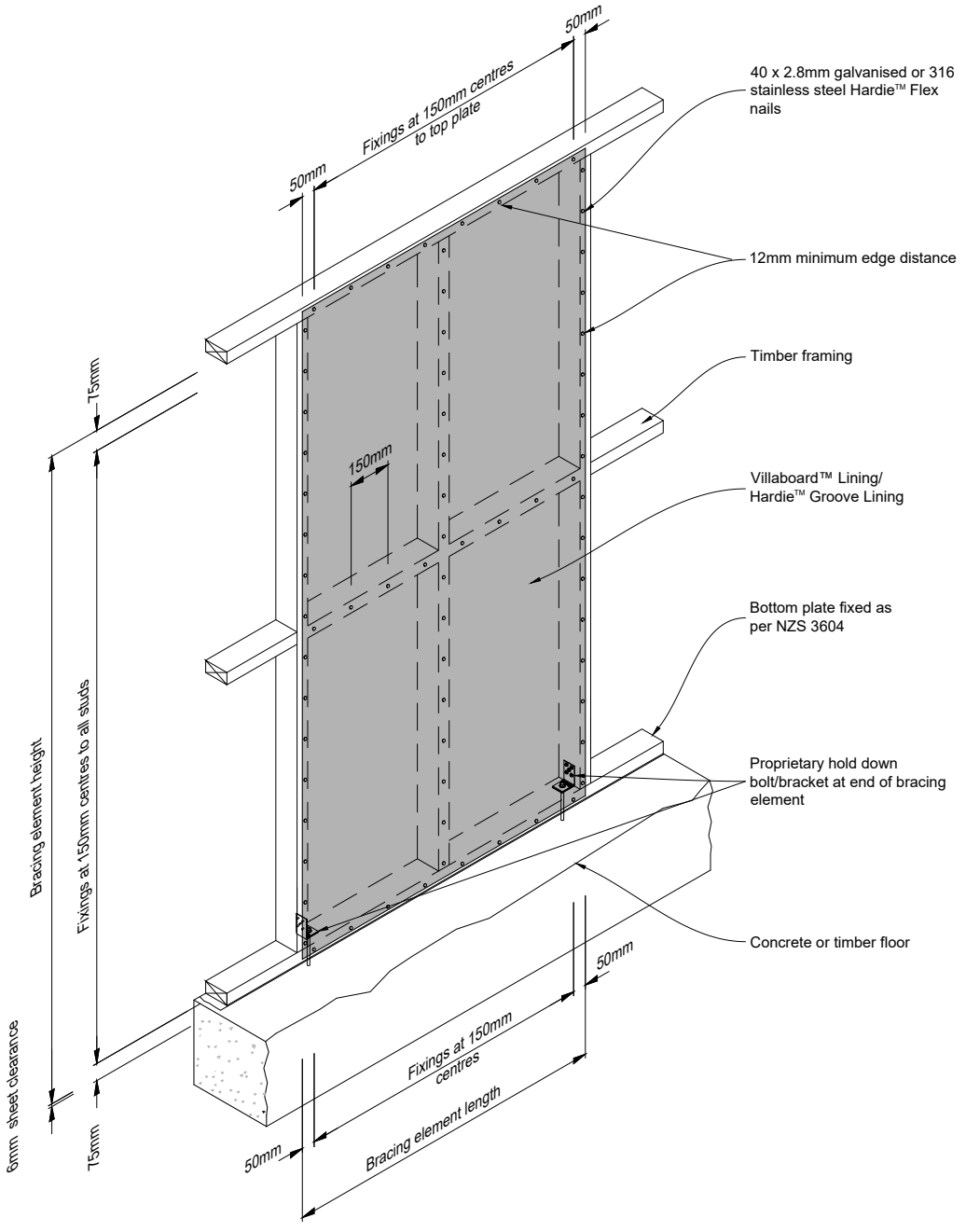
FIBRE CEMENT FIXING DETAILS

Notes for Figure 2:

- **Concrete floor** bottom plate fixing:- Ramset bracing anchor kit Concrete or GIB Handibrac® with 15kN anchor at each end of bracing element
- **Timber floor** bottom plate fixing:- Ramset bracing anchor kit Wood or GIB Handibrac® with a 12x150mm galvanised coach screw at each end of bracing element

Product	System	Minimum length
Villaboard™ Lining	Vv	400 or 600mm

Figure 3: 1200mm or more Villaboard™ Lining/Hardie™ Groove Lining to concrete or timber floor



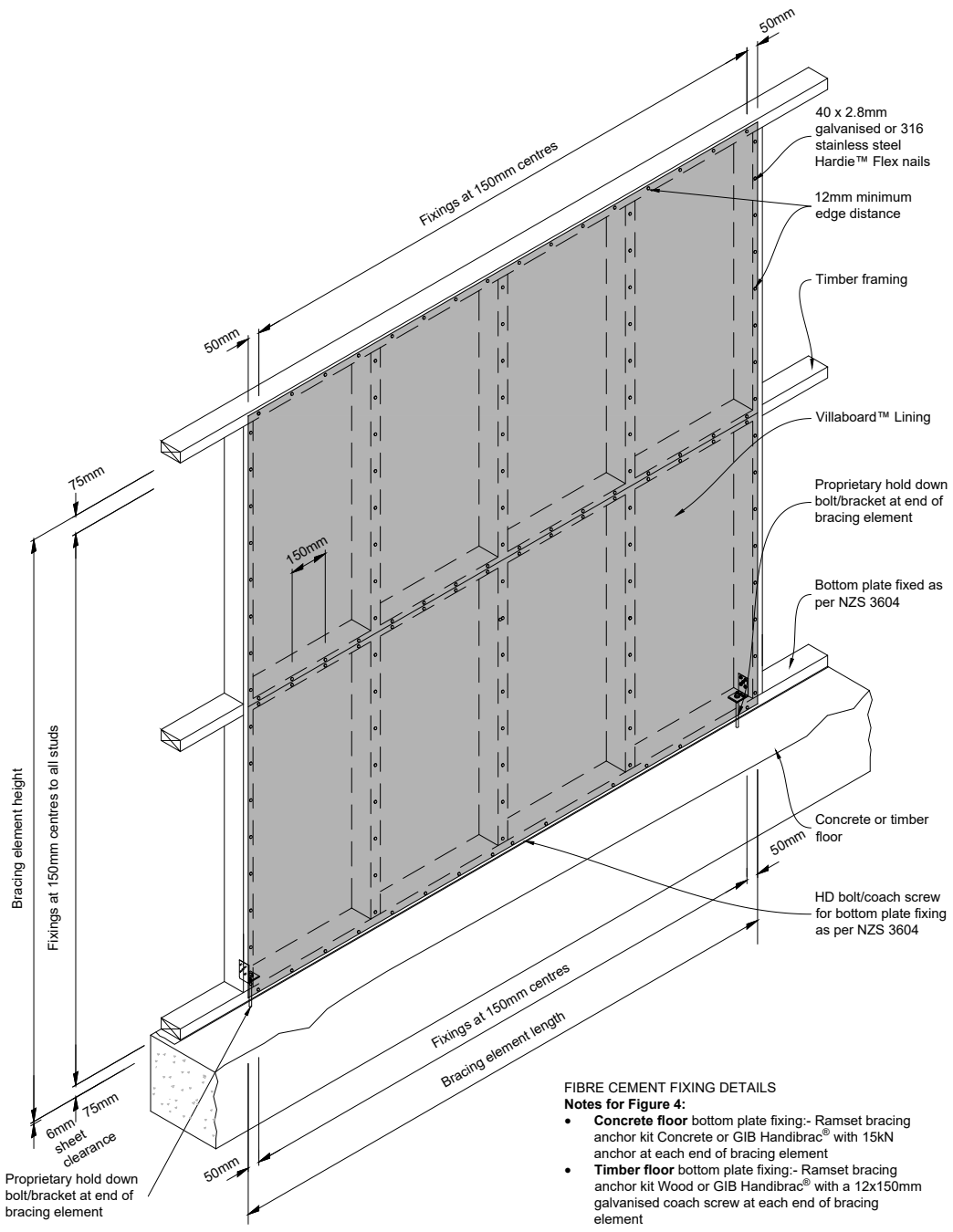
FIBRE CEMENT FIXING DETAILS

Notes for Figure 3:

- **Concrete floor** bottom plate fixing:- Ramset bracing anchor kit Concrete or GIB Handibrac® with 15kN anchor at each end of bracing element
- **Timber floor** bottom plate fixing:- Ramset bracing anchor kit Wood or GIB Handibrac® with a 12x150mm galvanised coach screw at each end of bracing element

Product	System	Minimum length
Villaboard™ Lining	Vv , Vv9	1200mm
Hardie™ Groove Lining	HG	1200mm

Figure 4: Villaboard™ Lining laid horizontally to concrete or timber floor



FIBRE CEMENT FIXING DETAILS

Notes for Figure 4:

- **Concrete floor** bottom plate fixing:- Ramset bracing anchor kit Concrete or GIB Handibrac® with 15kN anchor at each end of bracing element
- **Timber floor** bottom plate fixing:- Ramset bracing anchor kit Wood or GIB Handibrac® with a 12x150mm galvanised coach screw at each end of bracing element

Product	System	Minimum length
Villaboard™ Lining	Vh	2400mm

14 Bracing Tables – Pre-cladding

Table 4

HomeRAB™ Pre-Cladding vertically fixed									
System number	Length	Hold down	Refer figures	BU/M		kN/m		Fixing method	
				Wind	Earthquake	Wind	Earthquake	Hand nail	Gun nail
Hpn	1200	N	5	67	71	3.4	3.6	✓	x
HP	400	Y	6,13,14,15	85	91	4.3	4.6	✓	E
	600	Y	6,13,14,15	99	103	5.0	5.2	✓	E
	1200 to 2400	Y	7,13,14,15	133*	104	6.7	5.2	✓	E

*A limit of 120BUs/m maximum applies to timber floors and 150BUs/m maximum to concrete floors built as per NZS 3604: 2011 unless a specific engineering design is carried out to ensure the uplift force generated by bracing elements does not exceed the maximum limit for each floor type.

Table 5

HomeRAB™ Pre-Cladding vertically fixed with 10mm GIB® Standard plasterboard									
System number	Length	Hold down	Refer figures	BU/M		kN/m		Fixing method	
				Wind	Earthquake	Wind	Earthquake	Hand nail	Gun nail
HPg	400	Y	6,8,13,14,15	90	98	4.5	4.9	✓	E
	600	Y	6,8,13,14,15	127*	136*	6.4	6.8	✓	E
	1200 to 2400	Y	7,9,13,14,15	164*	138*	8.2	6.9	✓	E

*A limit of 120BUs/m maximum applies to timber floors and 150BUs/m maximum to concrete floors built as per NZS 3604: 2011 unless a specific engineering design is carried out to ensure the uplift force generated by bracing elements does not exceed the maximum limit for each floor type.

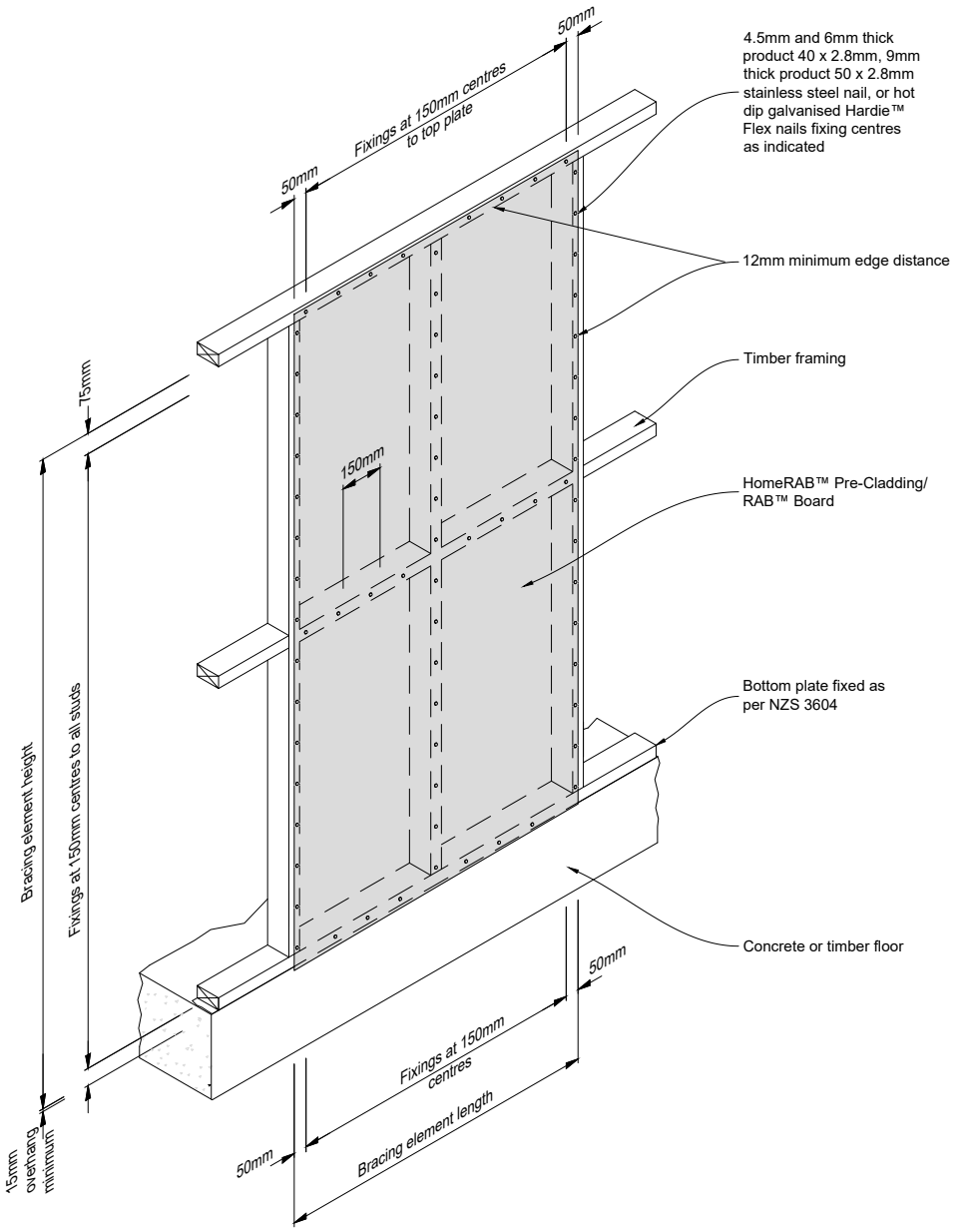
Table 6

RAB™ Board 6mm or 9mm									
System number	Length	Hold down	Refer figures	BU/M		kN/m		Fixing method	
				Wind	Earthquake	Wind	Earthquake	Hand nail	Gun nail
JHDn	1200	N	5	118	102	5.9	5.1	✓	x
JHD	400	Y	6,13,14,15	83	107	4.2	5.4	✓	E & P
	600	Y	6,13,14,15	99	107	5.0	5.4	✓	E & P
	1200 to 2400	Y	7,13,14,15	154*	140*	7.7	7.0	✓	E & P
	2400 to 4800	Y	7,13,14,15	133*	150*	6.7	7.5	✓	E & P
JHDg	600	Y	6,8,13,14,15	106	121	5.3	6.0	✓	E & P

*A limit of 120BUs/m maximum applies to timber floors and 150BUs/m maximum to concrete floors built as per NZS 3604: 2011 unless a specific engineering design is carried out to ensure the uplift force generated by bracing elements does not exceed the maximum limit for each floor type.
E = Ecko Pneumatic wireless coil nail
P = Paslode RounDrive ring shank nail

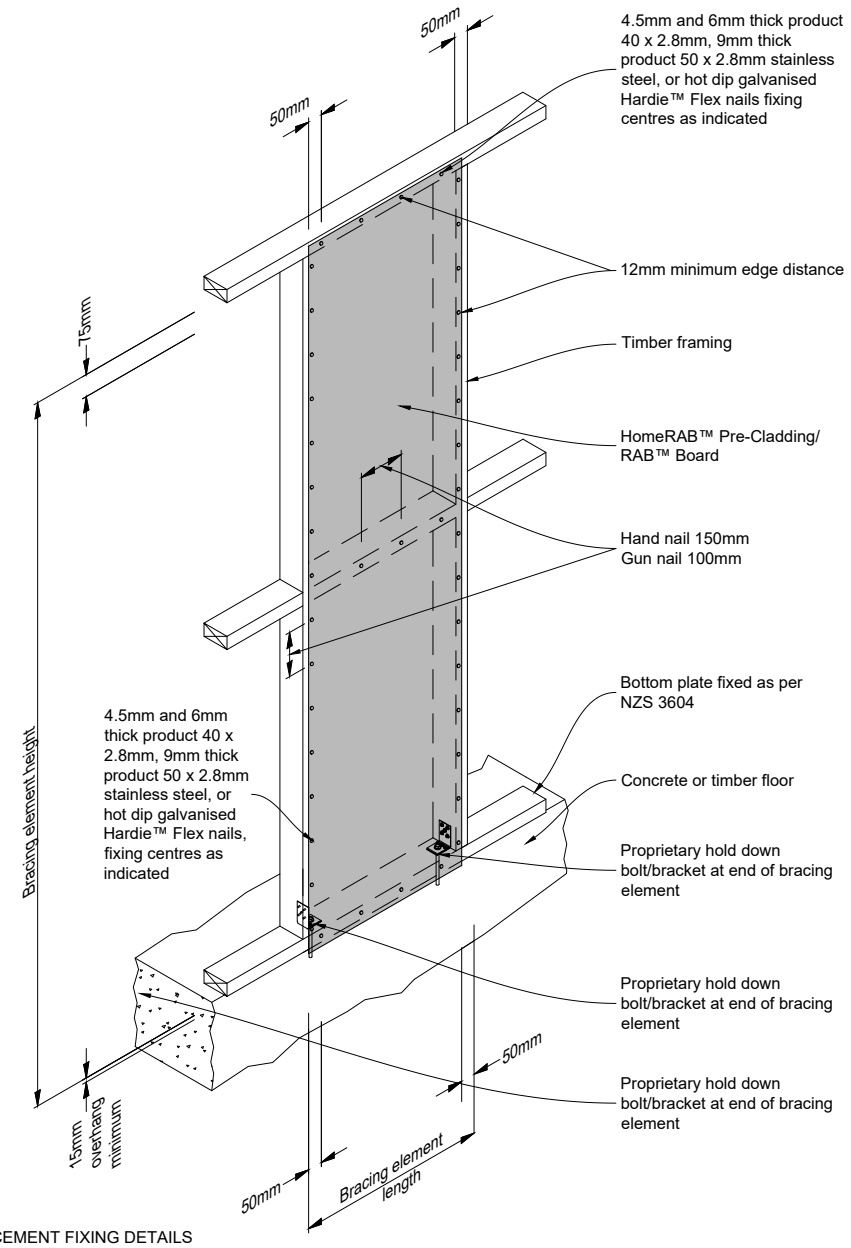
15 Bracing Figures - Pre-cladding

Figure 5: 1200mm HomeRAB™ Pre-Cladding or RAB™ Board to concrete or timber floor - no hold down brackets



Product	System	Minimum length
HomeRAB™ Pre-Cladding	HPn	1200mm
RAB™ Board	JHDn	1200mm

Figure 6: 400/600mm HomeRAB™ Pre-Cladding or RAB™ Board to concrete or timber floor



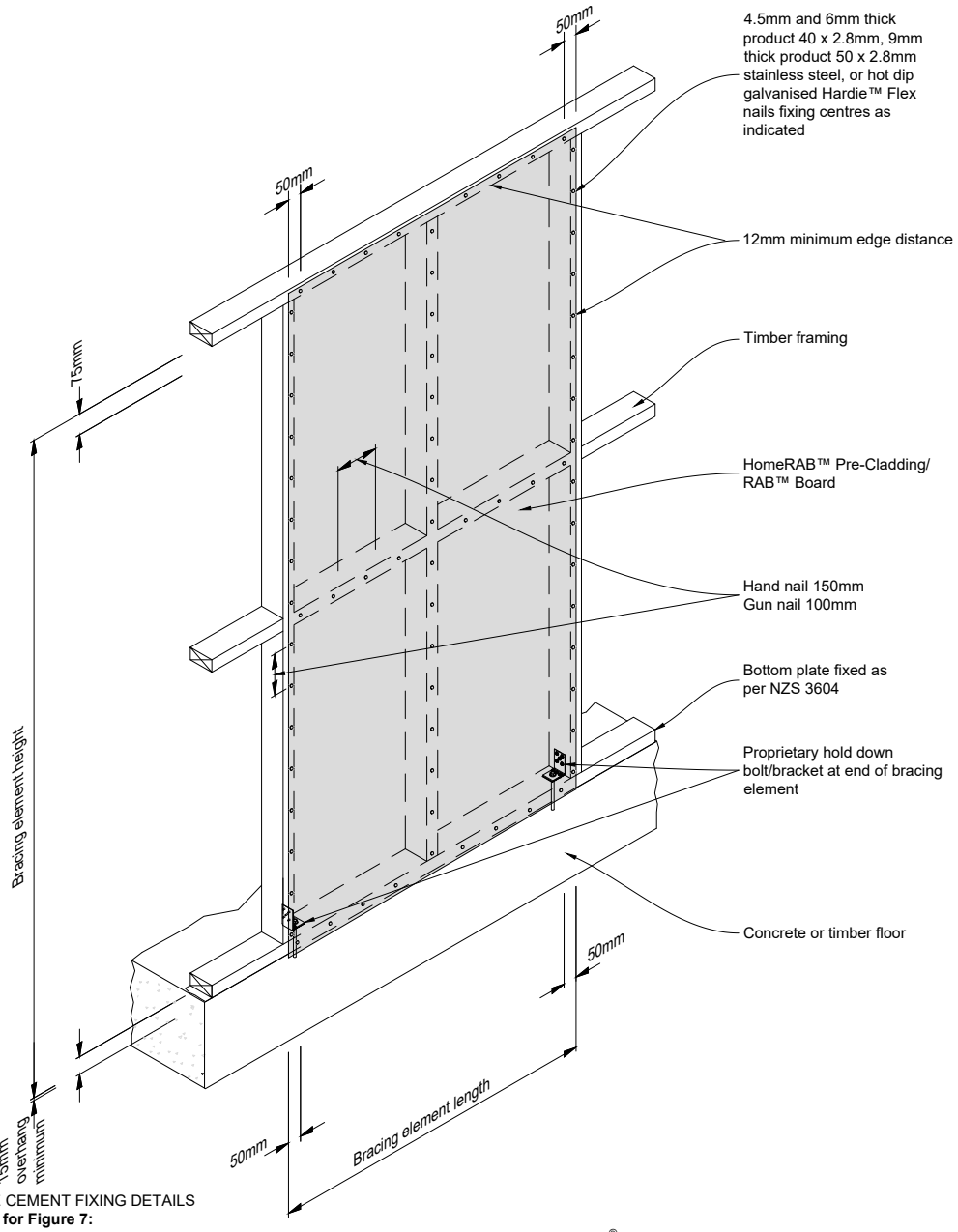
FIBRE CEMENT FIXING DETAILS

Notes for Figure 6:

- **Concrete floor** bottom plate fixing:- Ramset bracing anchor kit Concrete or GIB Handibrac® with 15kN anchor at each end of bracing element
- **Timber floor** bottom plate fixing:- Ramset bracing anchor kit Wood or GIB Handibrac® with a 12x150mm galvanised coach screw at each end of bracing element

Product	System	Minimum length
HomeRAB™ Pre-Cladding	HP	400 or 600mm
HomeRAB™ Pre-Cladding with 10mm GIB® Standard plasterboard	HPg	400 or 600mm
RAB™ Board	JHD	400 or 600mm
RAB™ Board	JHDg	600mm

Figure 7: 1200mm HomeRAB™ Pre-Cladding or RAB™ Board to concrete or timber floor



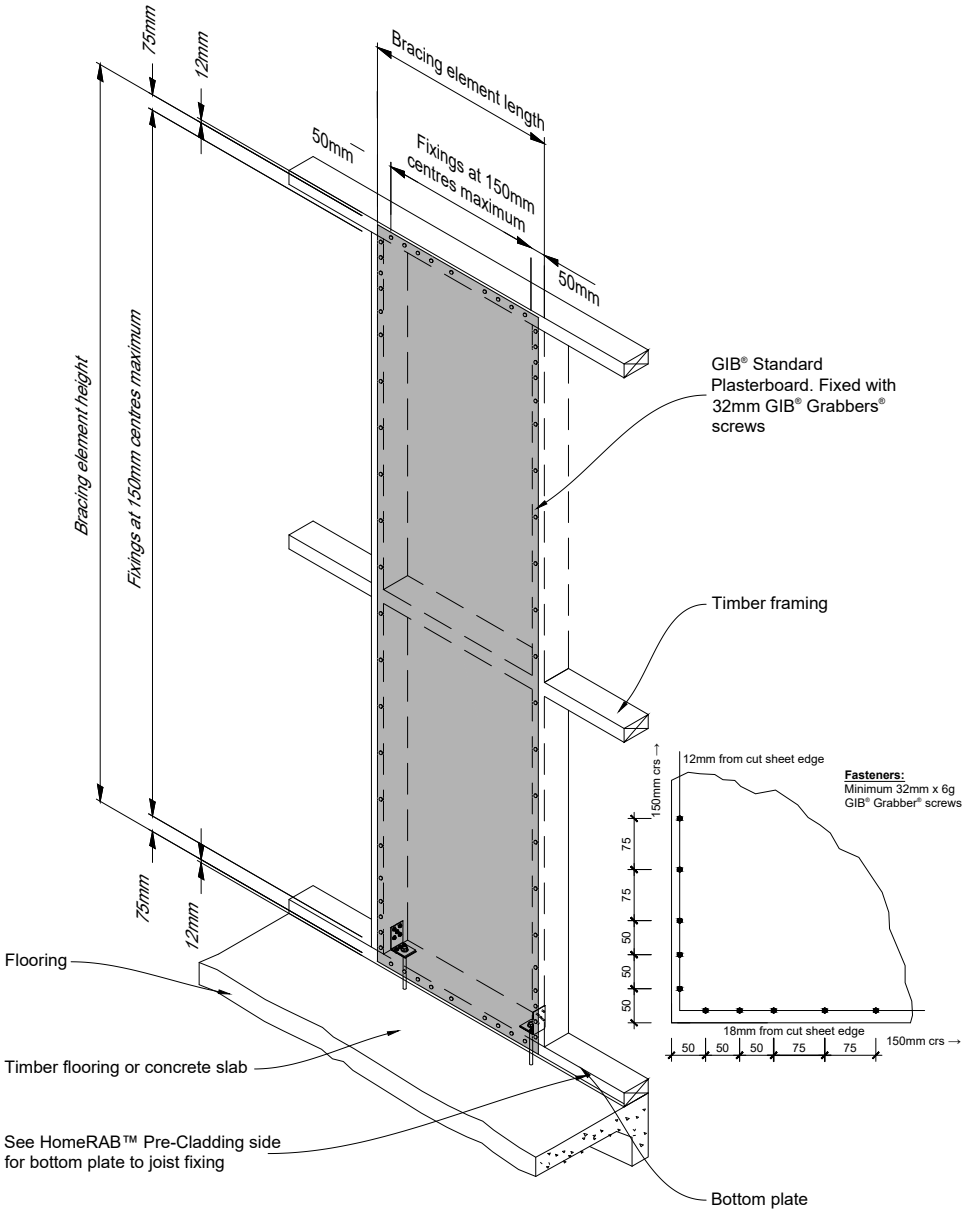
FIBRE CEMENT FIXING DETAILS

Notes for Figure 7:

- **Concrete floor** bottom plate fixing:- Ramset bracing anchor kit Concrete or GIB Handibrac® with 15kN anchor at each end of bracing element
- **Timber floor** bottom plate fixing:- Ramset bracing anchor kit Wood or GIB Handibrac® with a 12x150mm galvanised coach screw at each end of bracing element

Product	System	Minimum length
HomeRAB™ Pre-Cladding	HP	1200mm
HomeRAB™ Pre-Cladding with 10mm GIB® Standard plasterboard	HPg	1200mm
RAB™ Board	JHD	1200mm

Figure 8: 400mm/600mm HomeRAB™ Pre-Cladding with 10mm GIB® Standard Plasterboard



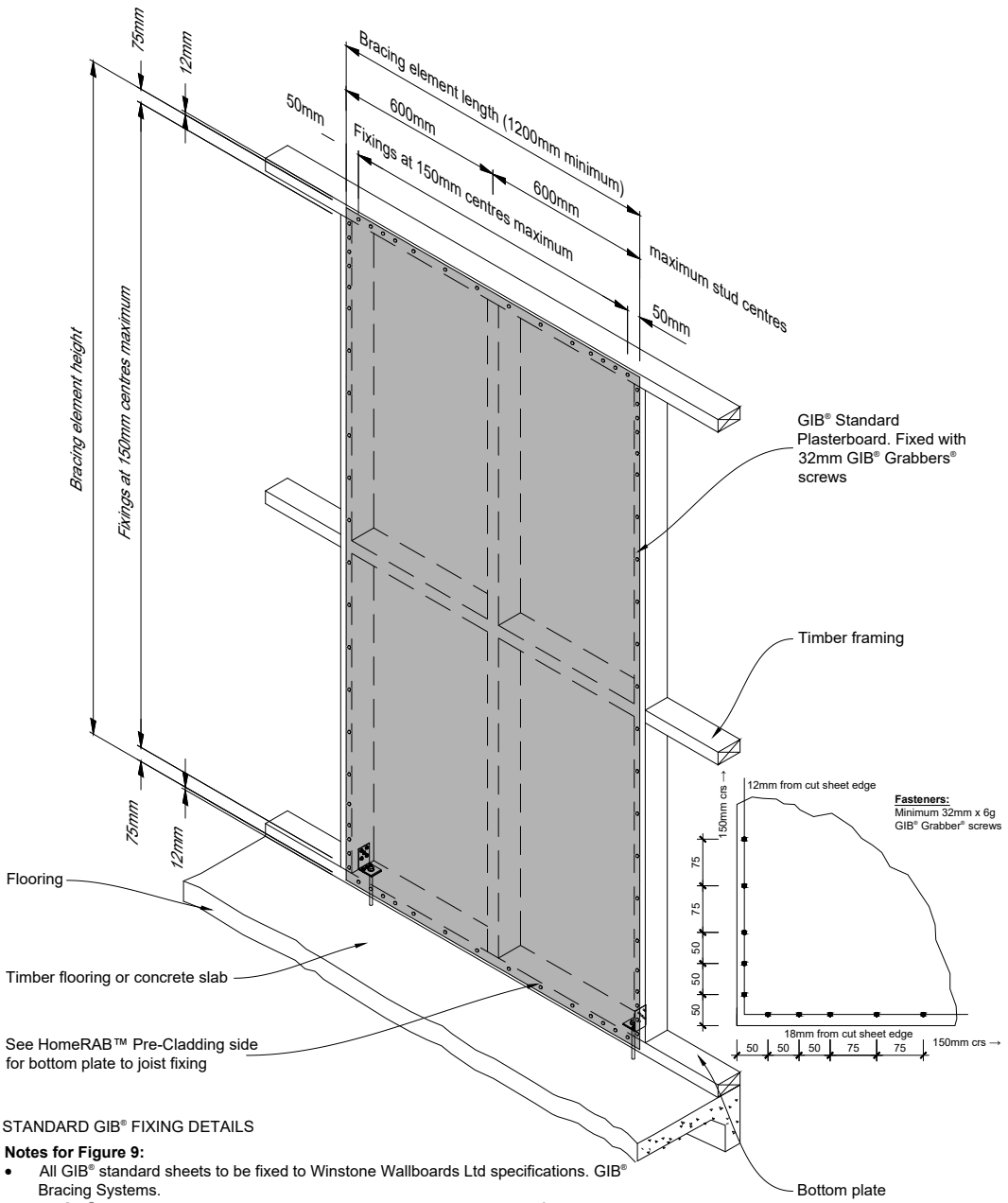
STANDARD GIB® FIXING DETAILS

Notes for Figure 8:

- All GIB® standard sheets to be fixed to Winstone Wallboards Ltd specifications. GIB® Bracing Systems.
- All GIB® bracing sheets to be stopped to Winstone Wallboards Ltd specifications. GIB® Site Guide.
- Refer Winstone Wallboards Ltd specifications for edge distance.

Product	System	Minimum length
HomeRAB™ Pre-Cladding	HPg	400 or 600mm
RAB™ Board	JHDg	600mm
RAB™ Board	JHD	1200mm

Figure 9: 1200mm HomeRAB™ Pre-Cladding with 10mm GIB® Standard Plasterboard



STANDARD GIB® FIXING DETAILS

Notes for Figure 9:

- All GIB® standard sheets to be fixed to Winstone Wallboards Ltd specifications. GIB® Bracing Systems.
- All GIB® bracing sheets to be stopped to Winstone Wallboards Ltd specifications. GIB® Site Guide.
- Refer Winstone Wallboards Ltd specifications for edge distance.

Product	System	Minimum length
HomeRAB™ Pre-Cladding/GIB® Standard Plasterboard	HPg	1200mm

16 Bracing Tables – Claddings

Table 7

Hardie™ Flex Sheet 6mm									
System number	Length	Hold down	Refer figures	BU/M		kN/m		Fixing method	
				Wind	Earthquake	Wind	Earthquake	Hand nail	Gun nail
JHDn	1200	N	10	118	102	5.9	5.1	✓	
JHD	400	Y	11,13,14,15	83	107	4.2	5.4	✓	E & P
	600	Y	11,13,14,15	99	107	5.0	5.4	✓	E & P
	1200 to 2400	Y	12,13,14,15	154*	140*	7.7	7.0	✓	E & P
	2400 to 4800	Y	12,13,14,15	135*	150*	6.7	7.5	✓	E & P

*A limit of 120BUs/m maximum applies to timber floors and 150BUs/m maximum to concrete floors built as per NZS 3604: 2011 unless a specific engineering design is carried out to ensure the uplift force generated by bracing elements does not exceed the maximum limit for each floor type.

E = Ecko Pneumatic wireless coil nail
P = Paslode RounDrive ring shank nail

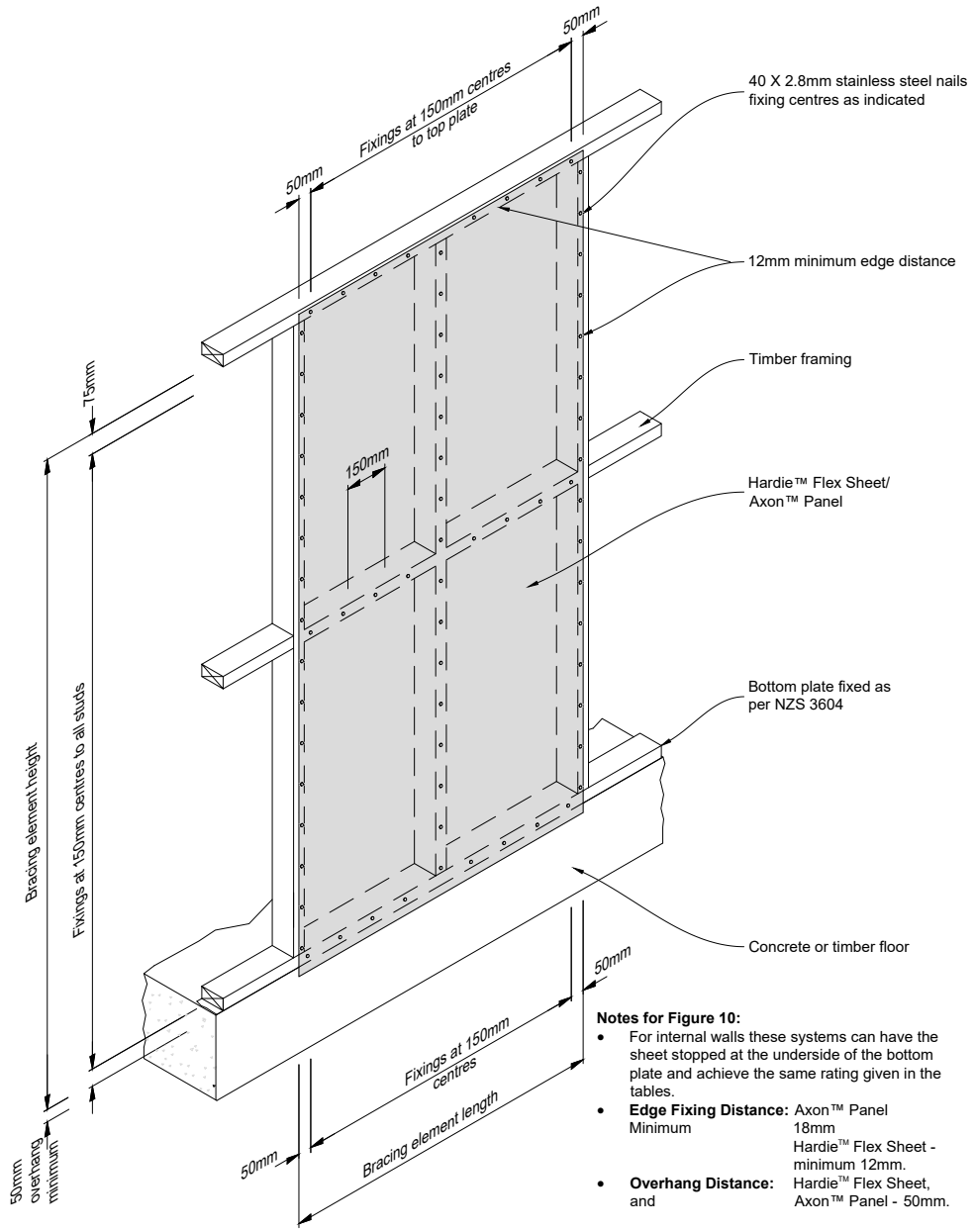
Table 8

Axon™ Panel									
System number	Length	Hold down	Refer figures	BU/M		kN/m		Fixing method	
				Wind	Earthquake	Wind	Earthquake	Hand nail	Gun nail
APn	1200	N	10	122*	106	5.6	5.3	✓	
AP	1200 to 2400	Y	12,13,14,15	150*	157*	7.5	7.9	✓	
	2400 to 4800	Y	12,13,14,15	149*	135*	7.5	6.8	✓	

*A limit of 120BUs/m maximum applies to timber floors and 150BUs/m maximum to concrete floors built as per NZS 3604: 2011 unless a specific engineering design is carried out to ensure the uplift force generated by bracing elements does not exceed the maximum limit for each floor type.

17 Bracing Figures Claddings (Direct Fix)

Figure 10: 1200mm Panel no hold down brackets

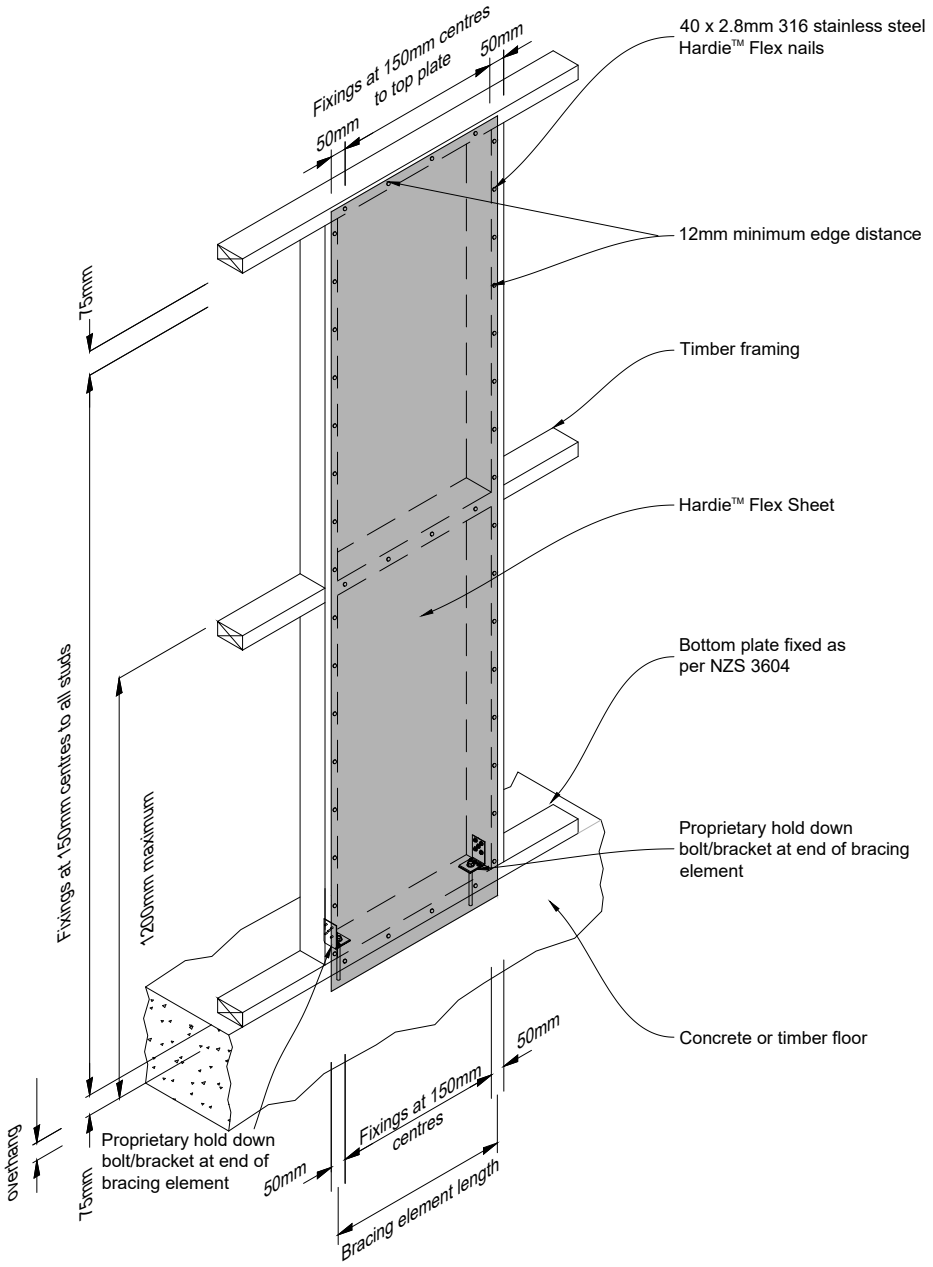


Notes for Figure 10:

- For internal walls these systems can have the sheet stopped at the underside of the bottom plate and achieve the same rating given in the tables.
- **Edge Fixing Distance:** Axon™ Panel Minimum 18mm
  Hardie™ Flex Sheet - minimum 12mm.
- **Overhang Distance:** Hardie™ Flex Sheet, and Axon™ Panel - 50mm.

Product	System	Minimum length
Axon™ Panel	APn	1200mm
Hardie™ Flex Sheet	JHDn	1200mm

Figure 11: 400mm or 600mm Panel to concrete or timber floor



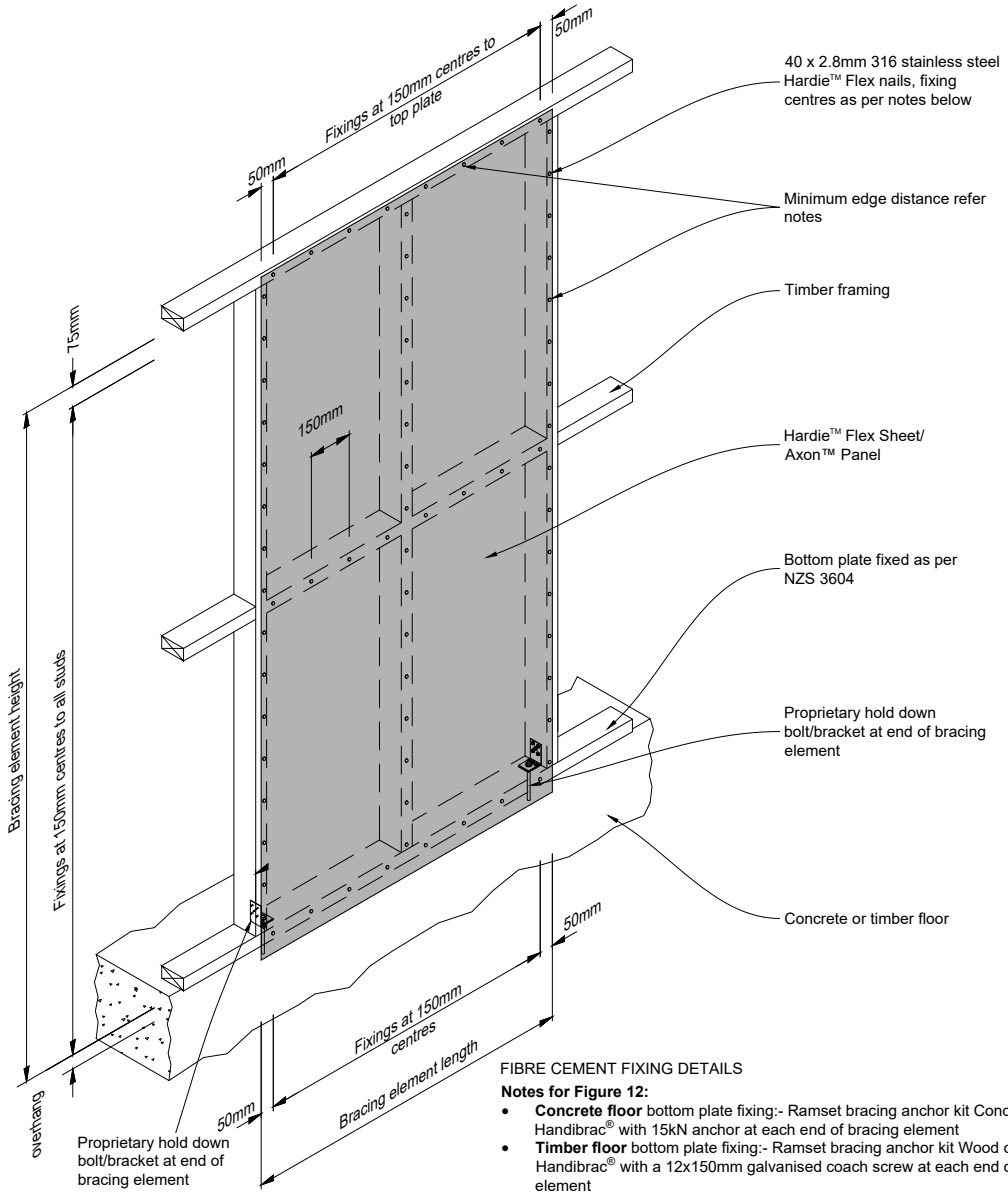
FIBRE CEMENT FIXING DETAILS

Notes for Figure 11:

- **Concrete floor** bottom plate fixing:- Ramset bracing anchor kit Concrete or GIB Handibrac® with 15kN anchor at each end of bracing element
- **Timber floor** bottom plate fixing:- Ramset bracing anchor kit Wood or GIB Handibrac® with a 12x150mm galvanised coach screw at each end of bracing element
- **Edge Fixing Distance:** Hardie™ Flex Sheet, - minimum 12mm.
- **Overhang Distance:** Hardie™ Flex Sheet- 50mm

Product	System	Minimum length
Hardie™ Flex Sheet	JHD	400 or 600mm

Figure 12: 1200mm or more Panel to concrete or timber floor



FIBRE CEMENT FIXING DETAILS

Notes for Figure 12:

- **Concrete floor** bottom plate fixing:- Ramset bracing anchor kit Concrete or GIB Handibrac® with 15kN anchor at each end of bracing element
- **Timber floor** bottom plate fixing:- Ramset bracing anchor kit Wood or GIB Handibrac® with a 12x150mm galvanised coach screw at each end of bracing element
- For internal walls these systems can have the sheet stopped at the underside of the bottom plate and achieve the same rating given in the tables.
- **Edge Fixing Distance:** Axon™ Panel - minimum 18mm
  Hardie™ Flex Sheet, - minimum 12mm.
- **Overhang Distance:** Hardie™ Flex Sheet,
  and Axon™ Panel - 50mm.

Product	System	Minimum length
Axon™ Panel	AP	1200mm
Hardie™ Flex Sheet	JHD	1200mm

18 Bracing Connection Figures (Direct Fix)

Figure 13: End bracket to concrete slab

Notes for Figure 13:

- **Concrete floor** bottom plate fixing:- Ramset bracing anchor kit Concrete or GIB Handibrac® with 15kN anchor at each end of bracing element

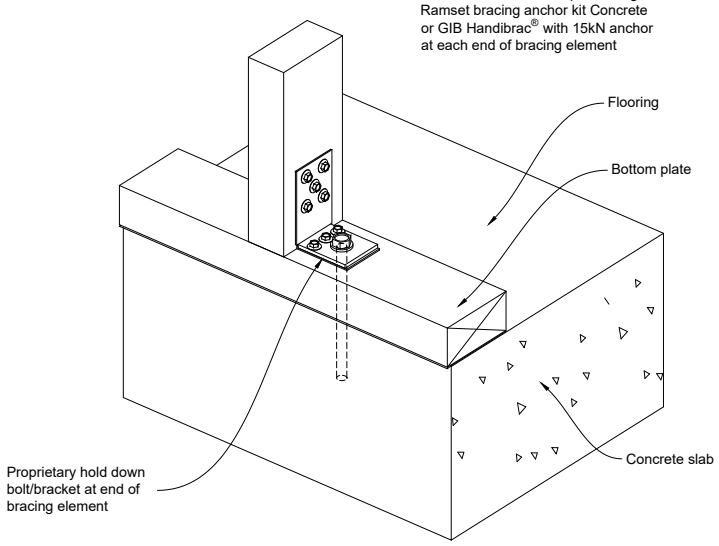


Figure 14: End bracket to timber joist

Notes for Figure 14:

- **Timber floor** bottom plate fixing:- Ramset bracing anchor kit Wood or GIB Handibrac® with a 12x150mm galvanised coach screw at each end of bracing element

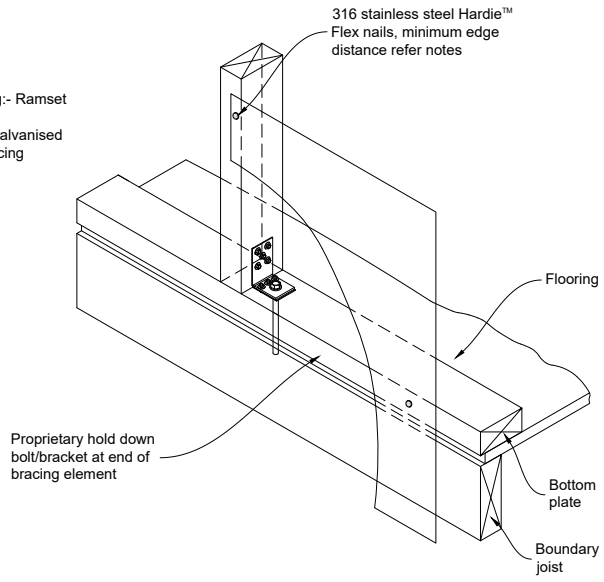


Figure 15: Hold down straps to timber joists

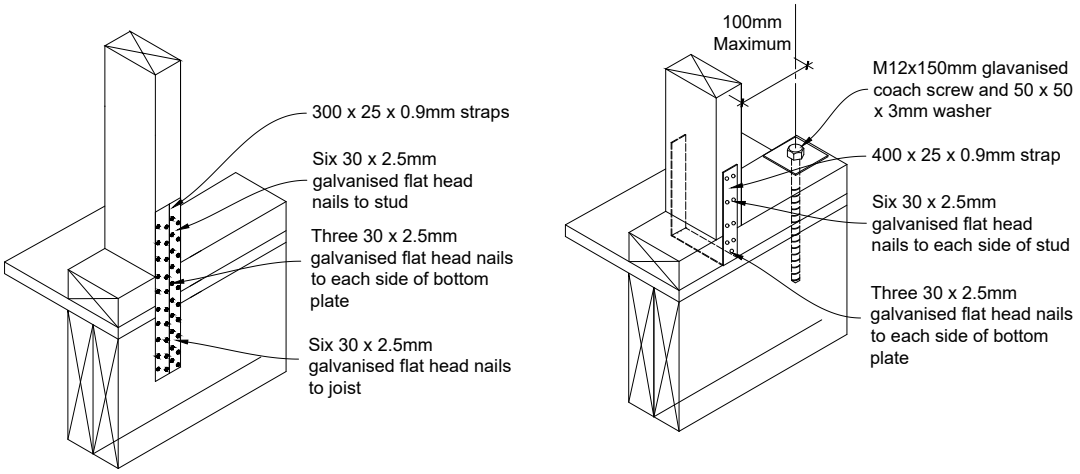


Figure 16: 300mm wide detail

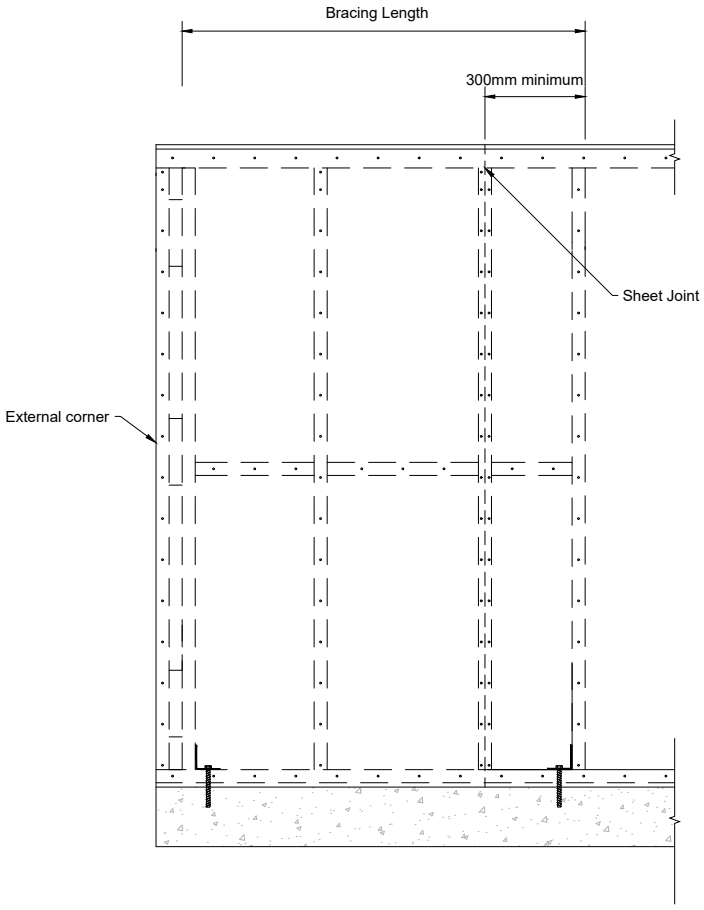
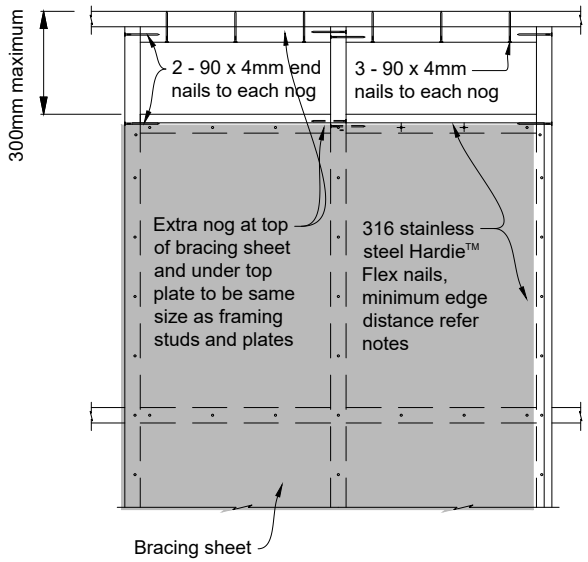


Figure 17: Bracing panel stopped below top plate



Notes for Figure 17:
Fixings:

1. All sheet nailing shown must be as for the various bracing systems
2. The bracing values for full height sheet for each system can be used when this detail is followed.
3. **Edge Fixing Distance:-**
   Axon™ Panel - minimum 18mm
   Hardie™ Flex Sheet and RAB™ Board - minimum 12mm.

19 Structural Ceiling Diaphragm

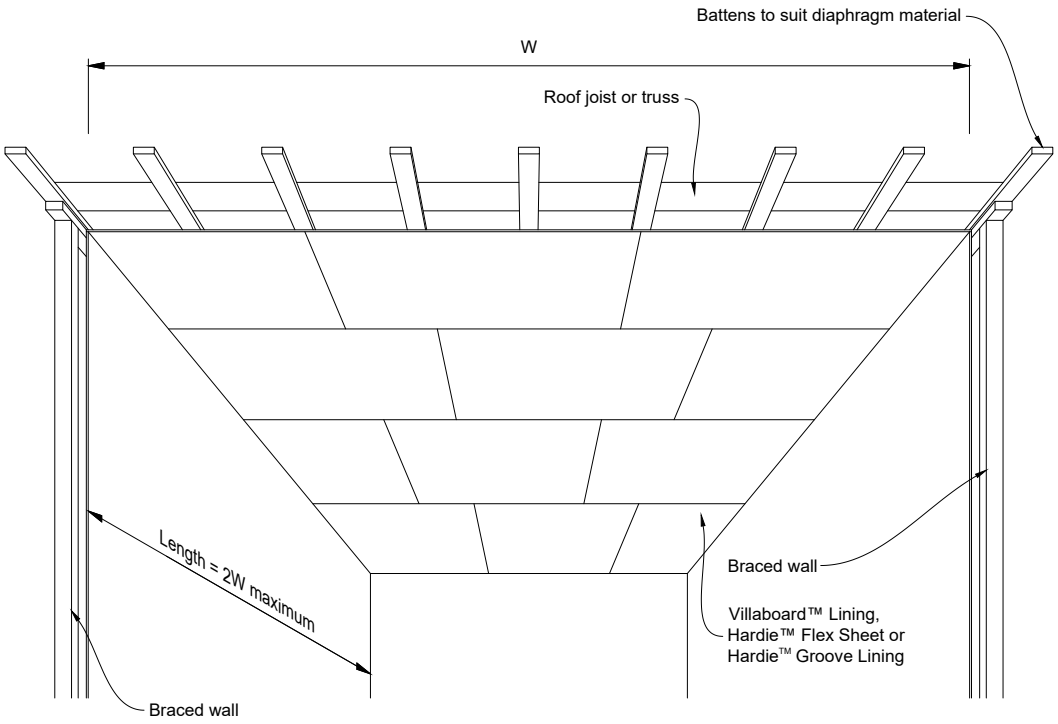
Hardie™ lining products can also be used for a ceiling diaphragm construction in accordance with NZS 3604.

- The following products can be used as a structural diaphragm
- Villaboard Lining 6mm and 9mm or
- Hardie™ Flex Sheet 4.5mm and 6mm.
- Hardie™ Groove Lining 7.5mm

The ceiling diaphragm shall be constructed to comply with the following requirements;

- The length of a ceiling diaphragm must not exceed twice its width. The length and width will be measured between supporting walls. They shall be no longer than 12m with an aspect ratio (length divided by width) no greater than 2.
- The sheet size must not be less than 1800 x 900mm except where building's dimensions restricts the use of this size.
- The sheets are to be installed as per Figure 20.
- All sheet edges must be supported with framing behind. Always maintain a minimum 12mm edge distance for sheet fixing.
- Hardie™ lining products can also be used to construct sloping ceiling diaphragms where the slope of ceiling is not over 45 degree from the horizontal plane.
- The sheets must be laid in a staggered pattern as shown.
- Each bracing line along length = L or along width = W shall have a bracing capacity of not less than 15bu/m of L or W measured at right angles to the line being considered.
- Refer to NZS 3604, section 5.6 for further information on diaphragms
- For dry area internal applications the standard hot dipped galvanised nails can be used. For wet area internal applications stainless steel nails must be used.

Figure 18: Structural ceiling diaphragm

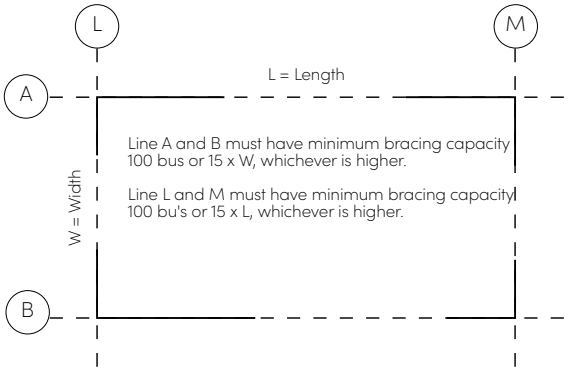


Fix sheets with 40 x 2.8mm Hardie™ Flex nails

- at 150mm centres around diaphragm boundary and sheet perimeter and
- at 200mm centres to intermediate supports and
- 12mm from the edge of the sheet.
- to batten spacing at maximum 600mm centres

Minimum sheet size 1800 x 900mm. Cut sheets permitted to complete diaphragm.

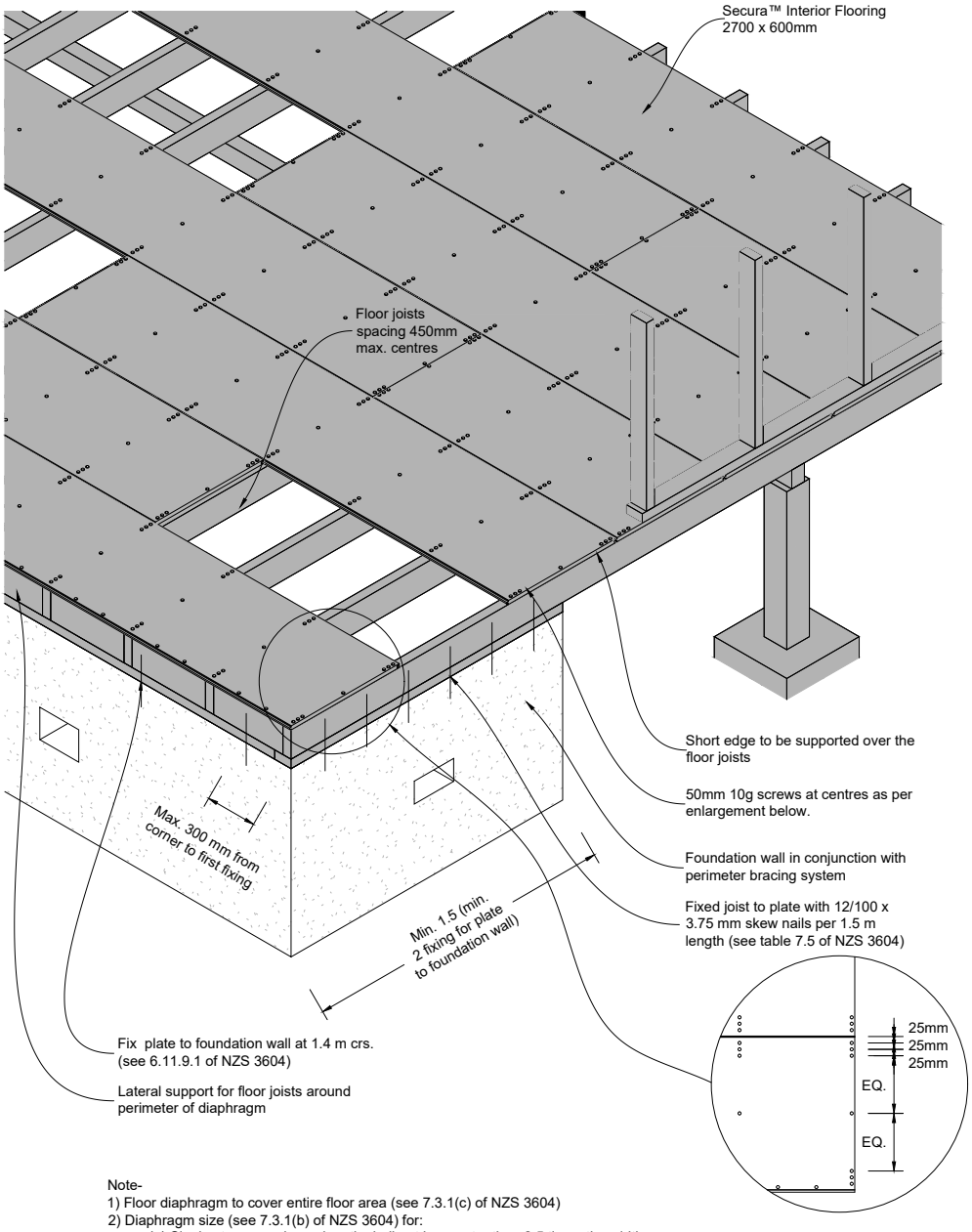
Note: Flat ceiling shown, similar criteria apply for raking ceilings



20 Floor Diaphragm

Secura Interior flooring has been tested to ISO 8339-09 (AS/NZS 2908.2) along with a review of its material properties to verify that a serviceable life of 50 years will be achieved when Secura Interior Flooring is installed as per its installation manual.

Figure 19: Secura™ Interior Flooring diaphragm floor



Note-
1) Floor diaphragm to cover entire floor area (see 7.3.1(c) of NZS 3604)
2) Diaphragm size (see 7.3.1(b) of NZS 3604) for:
(a) Single storey maximum length shall not be greater than 2.5 times the width;
(b) Double storey maximum length shall not be greater than 2.0 times the width.
(3) See section 4 of NZS 3604 for durability requirements.

21 Bracing Calculation Tables

WALL BRACING CALCULATION SHEET

For use in conjunction with NZS 3604

Name of Project: .....

Site of Address: .....

Lot and DP Number: .....

BRACING DESIGN INFORMATION AS PER NZS 3604

1. Wind Bracing Demand:

Determine wind region		A / W	Refer Figure-5.1
Determine ground roughness:		Urban / Open	Refer Clause 5.2.3
Determine site exposure:		Sheltered / Exposed	Refer Clause 5.2.4
Determine topographic class:		T1, T2, T3, T4 - Refer Clause 5.2.5, Figure 5.2, Table 5.2 and 5.3	
Determine wind zone:		L, M, H, VH, EH	Refer Table 5.1
Wind zone from Table 5.4			Minimum Number of BU's/m for building length and width from table 5.5, 5.6, and 5.7.
Building height to apex:		H =	W Across  = BU/m Length of wall *(Applies across ridge for gable roof, Applies across and along for hip roof)*
Roof height above eaves:		h =	
Stud height:		=	W Along  = BU/m Length of wall *(Applies along ridge for gable roof)*
Storey location: *(Strike out which is not applicable)*	Wall in foundation		**Total Bracing Required For Wind:**
	Wall above subfloor structure — single storey or upper storey		W Across x Length of Wall Across =
	Wall above subfloor structure — lower of two storeys		W Along x Length of Wall Along =

*Use separate sheet for each storey.

2. Earthquake Bracing Design:

Refer to Figure 5.4 and select the Earthquake Zone. Zone:		
Wall cladding weight: • Light • Medium • Heavy	Roof cladding weight: • Light • Heavy	Roof slope: • 0°-25° • 26°-45° • 46°-60°
Select storey location to be assessed as per Table 5.8, 5.9 and 5.10		
• Single storey building on subfloor frame. Refer Table 5.8 • Two storey building on subfloor frame. Refer Table 5.9 • Single or two storey building on concrete slab-on-ground. Refer Table 5.10		
Select bracing demand in BU's/m^2 of floor area from one of the above mentioned Tables ..... BU/m^{2*}		
Part storey in roof space Yes / No	If yes, increase bracing demand obtained above by 4 BU's/m^2. Refer to NZS 3604 Section 5.3.4.3	
Part storey in basement Yes / No	If yes, building shall be regarded as two buildings, refer section 5.3.4.4 of NZS 3604 for information	
Total floor area : ..... m^2	Total bracing required for earthquake: Area ..... x ..... BU's/m^{2*} = ... BU's	

*Use separate sheet for each storey.

Wall Bracing Calculation Sheet B

Name of Project: .....

ALONG 

WALL OR BRACING LINE			BRACING ELEMENTS PROVIDED				EARTHQUAKE			WIND		
1	2	3	4	5	6	7	8EQ	9EQ	10EQ	11W	12W	13W
Line Label	Minimum BU's Required Wind	Minimum BU's Required Earthquake	Bracing Element No.	Bracing Type	Length Element (m) L	Height Element (m) H	Rating BU's from JH Tables EQ/m	Rating BU's required EQ/m	BU's achieved (BU x L) EQ	Rating BU's from JH Tables W/m	Rating BU's required W/m	BU's achieved (BU x L) W
A												
B												
C												
D												
E												
Total metres bracing =												

From sheet A: W required	TOTALS ACHIEVED EARTHQUAKE	WIND
EQ required	TOTALS REQUIRED EARTHQUAKE (From sheet A)	WIND

! If W req / EQ req is 1 or less complete EQ column only. If W req / EQ req is 1.5 or more complete W column only. Otherwise complete both W and EQ

ACROSS 

WALL OR BRACING LINE			BRACING ELEMENTS PROVIDED				EARTHQUAKE			WIND		
1	2	3	4	5	6	7	8EQ	9EQ	10EQ	11W	12W	13W
Line Label	Minimum BU's Required Wind	Minimum BU's Required Earthquake	Bracing Element No.	Bracing Type	Length Element (m) L	Height Element (m) H	Rating BU's from JH Tables EQ/m	Rating BU's required EQ/m	BU's achieved (BU x L) EQ	Rating BU's from JH Tables W/m	Rating BU's required W/m	BU's achieved (BU x L) W
M												
N												
O												
P												
Q												
R												
Total metres bracing =												

From sheet A: W required	TOTALS ACHIEVED EARTHQUAKE	WIND
EQ required	TOTALS REQUIRED EARTHQUAKE (From sheet A)	WIND

! If W req / EQ req is 1 or less complete EQ column only. If W req / EQ req is 1.5 or more complete W column only. Otherwise complete both W and EQ

Product Warranty

All products by James Hardie have a standard product warranty. Refer to the relevant literature for the product warranties

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