BLK6-9 V1.0

Supercrete™

Sustainable Cost Effective Construction & Coating Systems

Block

Construction Guideline

Supercoat™

100% NZ
Owned & Operated

Contents

Drawing Index

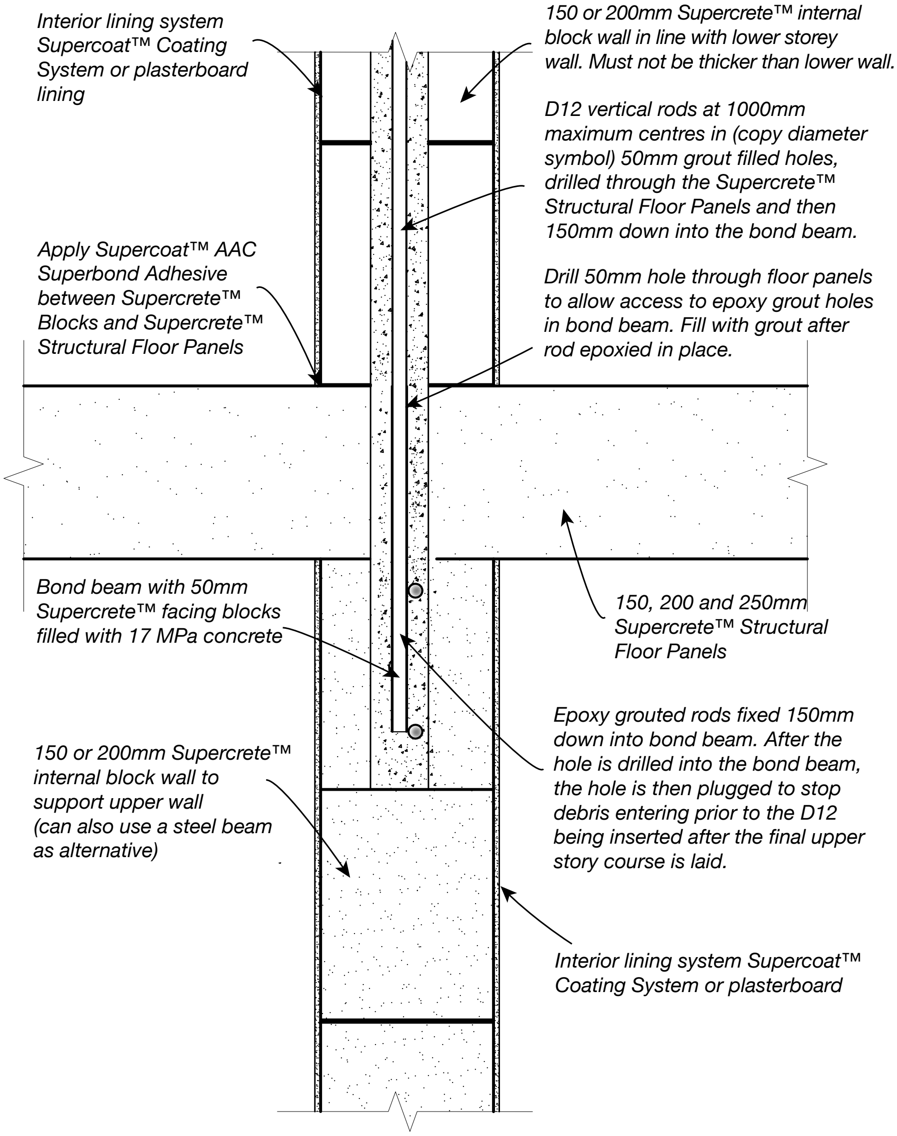
All drawings are available as downloadable CAD files at www.superbuild.co.nz (File types .pdf, .dxf and .dwg)

6.0 Block Construction and Design Guidelines

6.1 Preliminary Design Considerations

The following general rules and notes should be observed or recognized when designing and building with Supercrete™ Block:

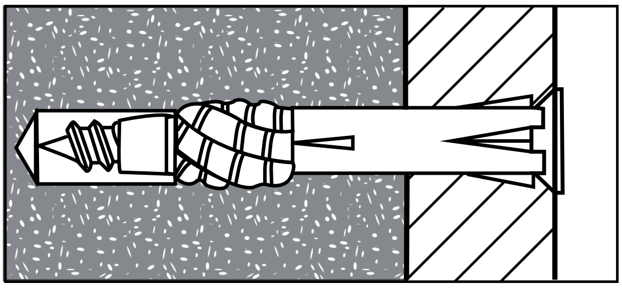
- Exterior walls should have a minimum thickness of 200mm. Walls thinner than this may exhibit cracking zadjacent to vertical reinforcing cores as the AAC area at the rod locations is reduced.
- Interior load bearing walls should have a minimum thickness of 150mm.
- Interior load bearing walls that provide end support to pairs of Supercrete™ floor panels should have a minimum thickness of 200mm to allow for the end seating required for the floor panel and the width of the floor panel ring anchor.
- It is best to align upper and lower level walls to avoid the use of secondary support beams. Supercrete™ Block walls on Supercrete™ Structural Floor Panels on upper levels must have direct support under the floor panels either from lower storey masonry walls, or from secondary support beams. The lower walls must always be the same thickness or thicker than the upper walls.



Details of upper & lower story walls in line.

- Foundation design where appropriate must be in accordance with NZS 4229. Note that this is conservative as the wall mass of Supercrete™ Block is lower than traditional concrete masonry.
- The top of all walls shall typically have a single course bond beam with 2 x D12 horizontal rods (refer Section 7.3 for more detail on bond beams). There are no intermediate bond beams required, nor one at the base of the wall. Bond beams do not require vertical stirrups or ties as shear forces can be dissipated by the Supercrete™ Block itself down through into the foundation.
- Vertical M12 rods shall have a maximum spacing of 1000mm or less.
- Vertical movement control joints shall be at a maximum of 6000mm centres (refer Section 6.3). As with the design of any structure in any material, thought should be given to movement control throughout the design process and not just addressed as an afterthought on completion. Ideally a structure should be designed as a series of discrete but interconnected units with movement control joints separating each part of the structure. Construction plans should detail the location of all movement control joints (including those in floors and at mid-floor) so that the different sections of the structure can also move as independent partitions.
- Wherever Supercrete™ Block is adjacent to a dissimilar material, a 10mm movement joint shall be left between the two materials.
- Designs using Supercrete™ Block for exterior walls only, with timber framed partitions for interior walls, will invariably struggle to achieve sufficient bracing units without some, internal Supercrete™ Block bracing walls.
- The first block course of exterior walls should always be placed in a 200mm wide rebate around the edge of the floor slab with a minimum depth of 50mm.

- All internal and external walls constructed on a full width concrete foundation should be placed on a full width layer of DPC, the DPC is designed to act as a slip joint to take up the differential movement between differential wall and floor materials. Where upper storey walls are constructed on a Supercrete™ Structural Floor Panel/Bond Beam junction, no DPC is required.

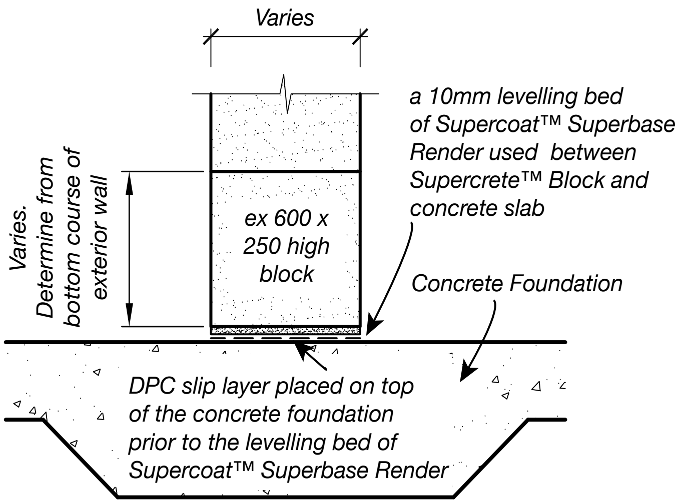


Typical fastener after expansion.

- Where Supercrete™ Structural Floor Panels are supported on a bond beam at the top of a lower storey wall, the 50mm facing blocks located under the Structural Floor Panel must NOT be included in the required seating dimensions. The Structural Floor Panel Design & Installation Guide can be downloaded at www.superbuild.co.nz.
- Freestanding walls without any returns, buttresses, or other lateral support from roof or floor diaphragms must not be used.
- Designs that have large openings throughout exterior and interior walls need sufficient well dispersed bracing walls to help them stand up. Supercrete™ is no different from any other construction material in this regard. Designers should ensure that design layouts include unbroken bracing walls and a top support system to link these together. Consideration of this requirement throughout the design process will avoid later rethinking and costly redesign.
- Stair treads using Supercrete™ Structural Floor Panel allow for any width stairways with a minimum 150mm rise and a 250 - 310mm finished tread covering the types of stairway in the NZ Building Code. Angled treads or landings can also be made using Supercrete™ Structural Floor Panels cut to fit.
- Unlike in traditional concrete masonry construction, there is no need to design in multiples of block lengths.

  Supercrete™ Block can be easily cut so wall and opening widths may be dimensioned to suit the design rather than the material.
- It is always better to design using a minimum number of material types so that relative initial and diurnal temperature and moisture content movement between different parts of a structure is reduced to a minimum.

  This is especially important when considering the use of long steel floor support beams or lintels as steel will move twice the amount of the surrounding AAC given the same temperature variation. Therefore slip joints need to be provided under long steel lintels and beams, and careful consideration must be given to encasement of steel inside Supercrete™ facings.
- In multi storey construction, upper walls should always be the same thickness or thinner than the lower support walls.
- Where high concentrated loads are required to be supported on Supercrete™ Block walls (e.g. under long lintels or support beams), short load spreading poured in-situ bond beams are preferable for spreading loads down into the walls over steel support columns. The latter requires encasement inside the block wall with movement control joints around them. Steel column to beam joints of this type only achieve minimal moment transfer so their action as a stiffening portal frame is limited, and negated by the need for movement joints.
- Floor slab thickening to 200mm minimum is required under all load bearing Supercrete™ Block walls
- Service chases or holes within walls must not exceed 1/3 of the wall thickness and should not be placed in bracing walls. If a Supercoat™ Plaster System finish is chosen over a plasterboard lining finish, then it is important to ensure that the services are securely fixed within the chase to stop them being able to move, if not securely fixed in place, there is potential for cracking to occur in the plaster system.
- All wiring should be placed inside plastic conduit set in chases cut into the wall. Wires set into chases on their own and then covered with filler, will invariably crack along the chase line if any tension is placed on the cable.

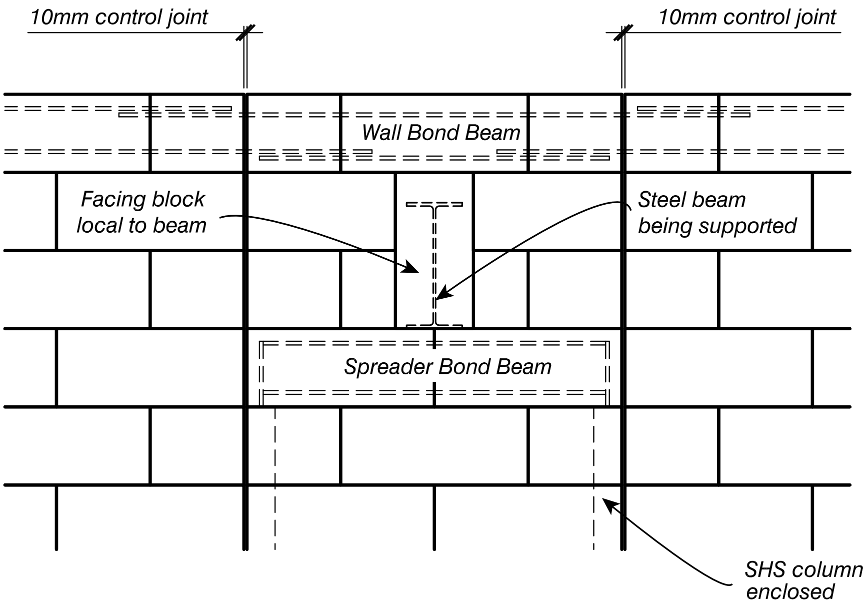


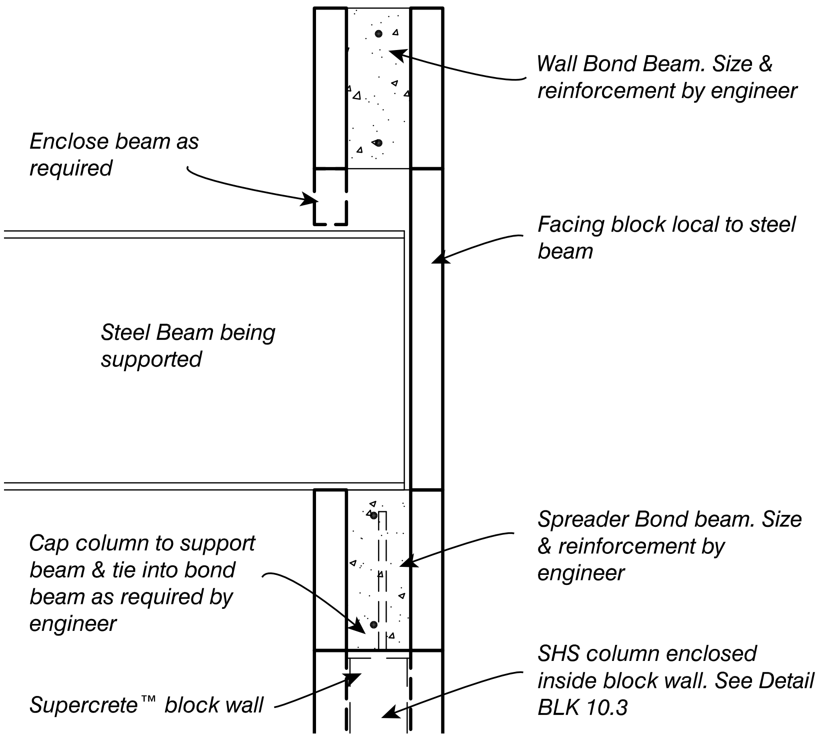
Section through slab thickening showing internal wall.

- Fasteners used in Supercrete™ Block should be of the type that cause a plastic sleeve to be drawn together longitudinally to form a knot. Simple expansive type fasteners where a plastic sleeve is just forced apart are rarely satisfactory. The knot formed in a plastic sleeve should be at least 50mm below the surface of the Supercrete™ Block.
- Covering of exterior walls with impervious decorative materials such as ceramic tile must be limited in area to allow the transfer of water vapour through the walls (see Section 8.5).

Underneath floor panels showing poured concrete of bond beam on panel side.

Bond beam reinforcing with facing blocks being fixed into place.





Typical arrangement of load spreader bond beam & Section through slab thickening

6.2 Slip Layers between AAC and Dense Concrete

There is some debate about the function of a slip layer between Supercrete™ Blocks and the supporting concrete foundation, particularly in respect to the transfer of wall diaphragm loads down into the foundation under seismic movements. This document outlines the background building science of slip layers and why they must be employed, even in seismically active areas.

A slip layer is made from any flat material that prevents bonding between two surfaces and allows slippage to occur, due to natural building movements. Supercrete™ wall to concrete foundation joints use plastic or bituminous Damp Proof Course (DPC).

6.2.1 Differential Movement of Dissimilar Materials and Elements

Walls and floors react to forces differently, primarily because of their relative orientations to the forces exerted. When they are made out of dissimilar materials, then the potential for differential movement between these elements is greatly increased. Different materials react to changes in heat and humidity with dimensional changes that are usually at different rates to each other, depending upon their material characteristics.

Greatest relative movements will be noticed within the first months of construction, as the building materials reach some level of moisture and temperature equilibrium with their surroundings. However, there are ongoing movements due to heating and cooling by the occupants and environmental conditions that need to be accommodated for throughout the life of the building.

6.2.2 Concrete Shrinkage

Over time, all concrete products tend to shrink in size rather than swell but dense concrete, with its higher site moisture content, cement volumes and density has the potential for shrinkage at a far greater rate than the more dimensionally stable Autoclaved Aerated Concrete. This is because the AAC has been through a crystallization process to convert it from sand & cement into a complex calcium silicate hydrate crystal (known as Tobermorite, with a plate matrix of 11 Angstrom). By comparison, site poured concrete is a wet gel CSH with a significantly higher moisture content.

The autoclaving process of AAC occurs at 190 degrees centigrade and 1.2 MegaPascals of pressure. The resulting chemical changes make AAC comparatively inert, although still with a tiny capacity for continued movement. It is generally accepted that the shrinkage range for dense concrete is around 0.7mm/ lineal metre, whilst AAC has less than a third of this shrinkage potential at approximately 0.2mm/m.

When one product moves at three or more times the rate of the adjacent product, this movement needs to be accommodated by a capacity to slip.

6.2.3 General Building Movement

Building elements experience ongoing movement throughout a buildings' lifecycle for a variety of reasons. These include (but are not limited to);

a) Seismic tremors
b) Wind impact loads
c) Ground subsidence/ subsoil moisture changes
d) Thermal expansion & contraction (diurnal & seasonal heat changes)
e) Shrinkage through moisture loss
f) Swelling through moisture gain
g) Long term sagging under dead load & vibration through daily use (slamming doors, etc)

Mechanisms to control movement such as vertical and horizontal control joints, slip layers and a variety of movement accommodating fixings, brackets and ties are therefore essential to ensure long term building performance.

Designers place these features where they know buildings are likely to express this movement and at spacing to suit the geometry of the building, its openings and the nature of its supporting foundations and subsoil.

6.2.4 Conflicting Engineering Principles

a) To best transfer loads from one element to the next (i.e. roof to wall, or wall to foundation) they should ideally be rigidly connected to one another.
b) To accommodate the differential movement between dissimilar materials, they should ideally be separated from one another.

Good building design is always a careful balance between these opposing principles. Of course, structural adequacy takes precedence, but if movement control is ignored, uncontrolled cracking, moisture ingress and building damage will result.

6.2.5 Desire for a Base Friction Joint

When a force is exerted upon a building, particularly in high winds or earthquakes, the way the building withstands these forces is to transfer the energy from the movements of the structure into the ground, where it can be absorbed by the Earth. To do this, roof or ceiling diaphragms spread the applied loads into the supporting walls and these in turn disperse this energy into the slab/foundation and down into the supporting subsoil.

By rigidly adhering the walls to the concrete foundations, a calculable degree of base friction could be achieved to contribute to the walls ability to disperse the forces into the slab.

6.2.6 Base Cracking

In a number of AAC block buildings this rigid bonding of wall to foundation has been attempted, both in New Zealand and worldwide. This involved eliminating the slip layer and instead using cement based adhesive mortar to stick the block walls onto the supporting concrete.

Unfortunately, in all cases, the differential movement between AAC walls and the concrete foundation has always resulted in a naturally occurring crack along this base junction. Sometimes the cracking occurred in the first few months, other times after many years, depending on site conditions and forces experienced by the walls. The much hoped for base friction was therefore lost in these cases, as the wall naturally de-bonded from any adhesion to its support. At this point any reliance on this base friction for load transfer, or numerical contribution to the bracing values for the wall, was totally lost.

Disturbingly, in at least one case, mechanical anchoring of the wall by way of reinforcing rods had been reduced due to this reliance on base friction, leaving the structure under-braced when the inevitable base cracking occurred.

Whilst these bonded AAC walls generally snapped cleanly at the junction to the foundation, base cracking does not always form a neat straight line. In some spots, where the AAC remained stuck to the foundation, perhaps due to a strong lump of adhesive, or maybe a small stone or protrusion in the concrete foundation locking a portion of the wall in place, cracking was then forced to meander off in a diagonal shear crack up the wall. This split the coating system and allowed moisture ingress (which caused the coatings tor blistering and delaminate), loss of insulation and interior damage and weakened the wall diaphragms.

6.2.7 Dowel Action of the Vertical Reinforcement

The way that Supercrete™ walls are pinned to the supporting foundation, to enable the transfer of diaphragm forces, is by way of dowel action of the vertical reinforcing rods which are epoxied into the foundation, pass through the slip layer and reinforce the full height of the wall. Any horizontal slippage (usually less than a millimetre or so) allowed by the slip layer, is accommodated by the flexural capacity of the steel rods, without compromising the integrity of the wall to foundation connection.

6.2.8 Never Eliminate the Slip Layer

Ideally, a building designer will be able to achieve the required bracing capacity for their Supercrete™ Block building without needing to deviate from standard methodology. If, for some reason, stronger base connections than those offered by Superbuild International's standard detailing and bracing capacity tables are required, then additional mechanical fastening can be adopted either by;

- closing up the spacing of the full height reinforcing rods
- installing intermediate base dowel pins between the usual rod spacing. These pins could be additional 12mm rods that reinforce the bottom two courses and are embedded into the foundation 150mm as per the full height rods.
- increase the diameter of the vertical rods to provide a stronger dowel capacity for each of the reinforcing rods.

Whatever you decide, do not eliminate the vital slip layer.

6.3 Movement Control Joints

6.3.1 Overview

All buildings move, regardless of construction materials used. This movement is caused by many things such as changes in ground conditions, initial drying shrinkage of components to stable moisture content, daily and seasonal heating and cooling, changes in loading from live loads etc. Recognizing and understanding that we must accommodate this movement while still keeping the structure waterproof and able to perform the functions for which it is designed, rather than locking the building up into a complete rigid structure, goes a long way toward designing a successful structure.

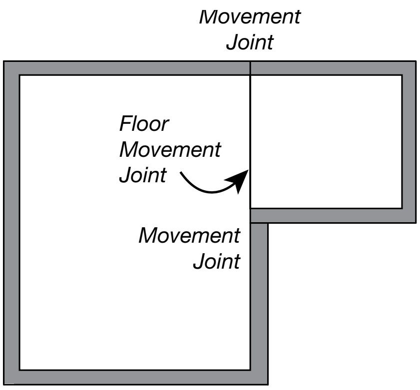
Movement control in structures is not an exact science, but the principal aim is to install movement joints at the locations where we would most expect the structure would want to express relative movement.

6.3.2 Movement joint location

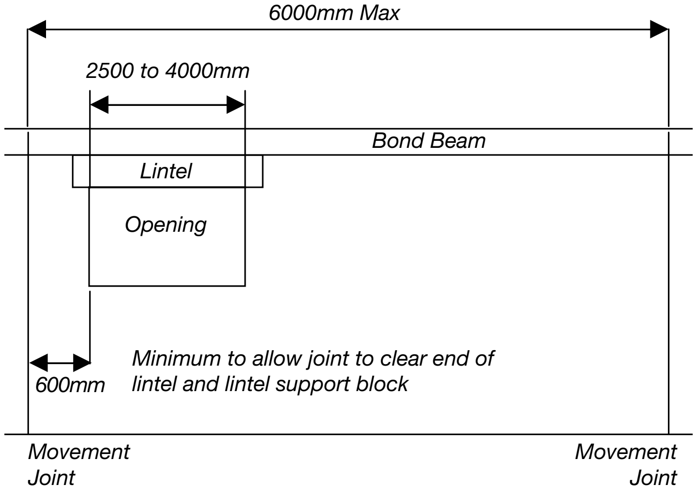
The project architect and engineer shall be responsible for determining the optimum location of movement joints, as their location is dependent on a variety of factors including most importantly the structural stability and bracing requirements of the building. Their location should not be left to the block layer on site as they may not be aware of many of the influencing factors such as the location of bracing walls. Typical locations of movement control joints are as follows:

- Where a large floor area joins to a small area or where there are significant changes in wall or floor shape
- At a change in level in foundations
- At changes in type of foundation soils
- Where there is a change in wall heights
- On one side of any opening that is greater than 2500mm wide but less than 4000mm wide
- At both sides of openings that are between 4000mm to 6000mm

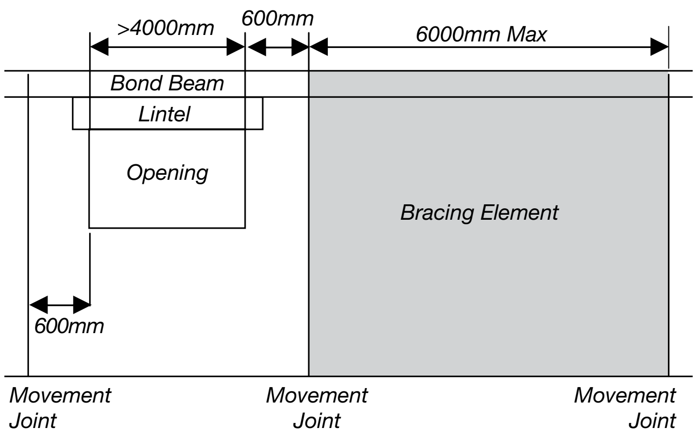
- Where internal bracing walls intersect with an exterior wall or where there are changes in thickness of wall.
- At junctions of different building materials.
- In long uninterrupted walls at 6000mm centres maximum.
- At either end of a section of block wall acting as a bracing element (never within this bracing element).
- Where floor slab movement joints meet walls.



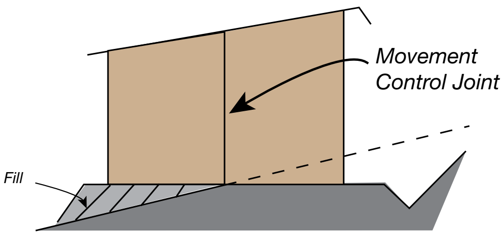
Where Large Floor Area meets Small Floor Area and where Floor Movement Joint Meets Wall



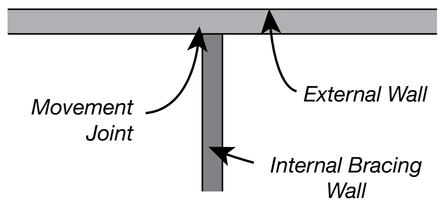
One side of opening between 2500 - 4000mm



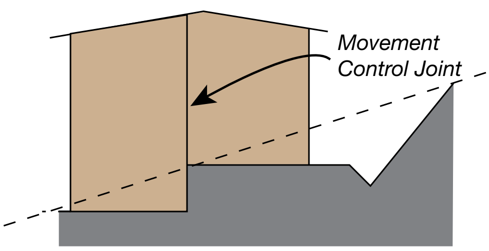
Both sides of opening over 4000mm and at ends of Bracing Element



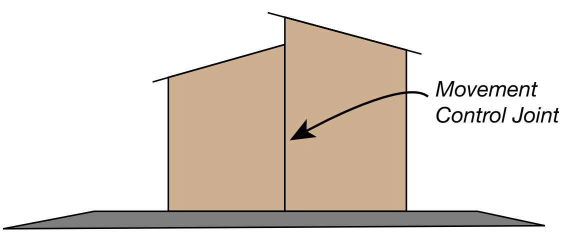
Change in Type of Foundation Soils



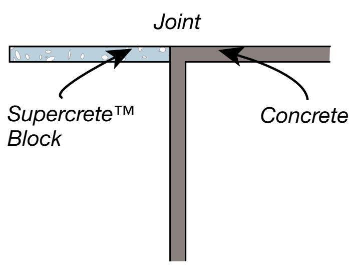
Where Internal Bracing Wall intersects External Wall



Change in Foundation Height



Change in Wall Height



Junctions of Different Materials

Ideally, the structure should be divided into sections which can move independently of each other using floor slab, wall and upper floor movement control joints. It must be remembered that the relative movements are very, very small, but the stresses that would build up in the structure if there were no movement joints would be sufficient to cause cracking and waterproofing failures.

To determine the location of a movement control joint, the structure as a whole must be looked at with a view to determining how the various parts are likely to move, and to install movement joints between them to accommodate this. Generally, movement control joints in Supercrete Block structures should be at a maximum of 6m centres, however, it is not always possible to align joints in floors with joints in walls (note that when measuring a 6m run of wall, the measurement continues around corners until an opening is reached or a movement control joint is required).

Another consideration is to try and have each section of wall between movement control joints have a return wall at one end to provide lateral bracing during construction.

In two storey structures, the upper wall joints should align with the lower wall joints.

During the design stage the project Architect and Engineer should collaborate to ensure interior wall control joints are aligned with the floor movement control joints. Once wall joints are located, the control joints in the ground floor slabs can be located.

Invariably, there is direct conflict with desired locations in floors and walls and a compromise must be made in assessing the best locations.

6.3.3 Forming movement control joints in Supercrete™ Block

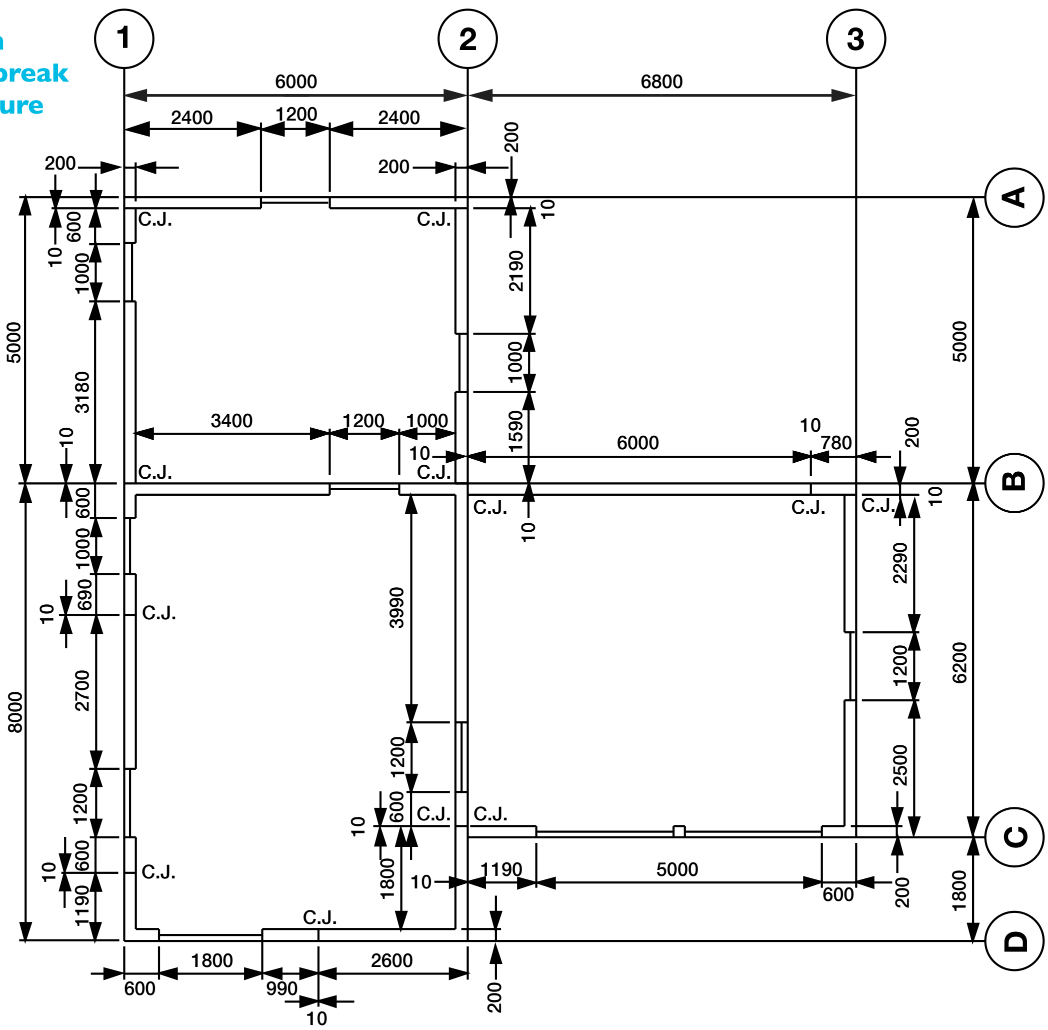
A typical movement control joint is formed by leaving a 10mm gap between adjoining sections of Supercrete™ Block walls. Every second course crimped wall ties are fixed in place crossing the joint. Then insert either a 13mm Holdfast PEF Backing Rod 10mm into the joint on both sides of the wall creating a nominal 10 x 10mm recess which is then filled with Holdfast Fix All 220 LM MS Sealant, or the joint is filled using Holdfast Gorilla Nailpower FLEXI Expanding Foam and finished with the Supercoat™ Pre-meshed Control Joint Bead to the internal and external face of the Blocks. Approved sealants for use with Supercrete™ Blocks are shown below in Table 7.

Table 7. Approved Sealants

Name & Type
Holdfast FIX ALL 220LM MS Holdfast Gorilla Nailpower FLEXI Expanding Foam

Note that when installing floor coverings over movement control joints, if the covering is rigid (e.g. ceramic tile), then the control joint must be continued through the floor covering. This is difficult to do and best to avoid if possible. Flexible coverings may be fastened over the control joints without any further preparation.

Typical floor plan showing section break points in a structure

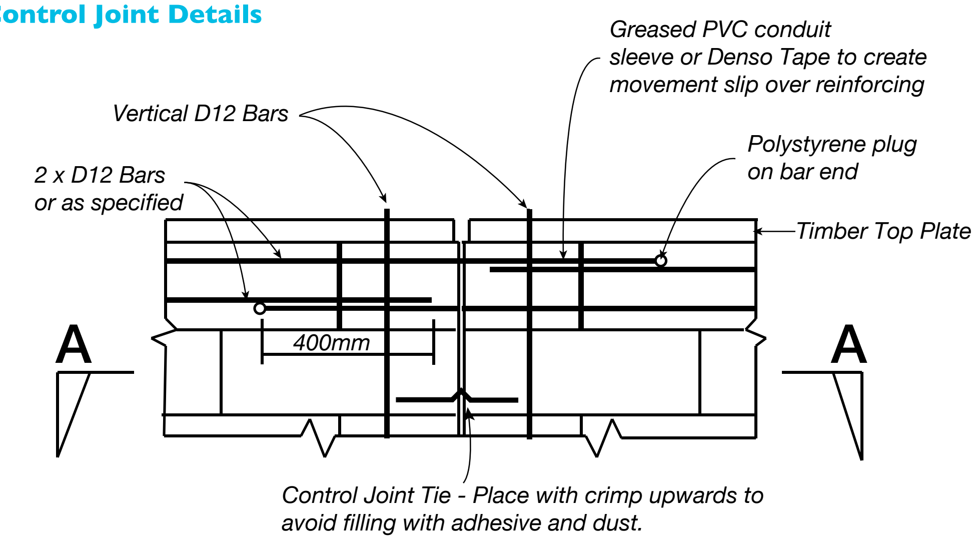


Control joints will usually be visible at close range when adopting the recommended methods but are rarely seen from a short distance away, and are a lot less unsightly than any cracking that would occur without them.

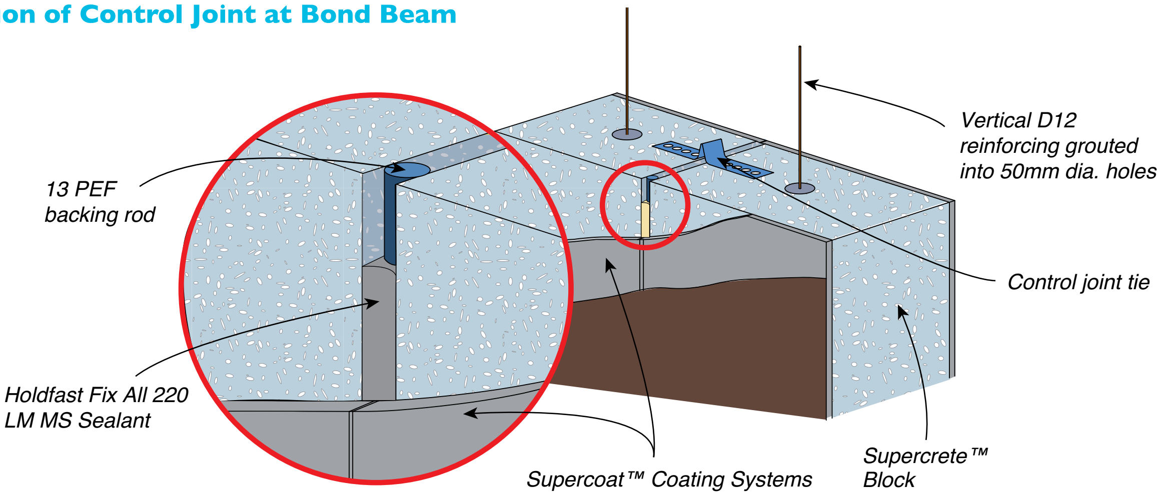
Thought given during the design phase can help eliminate joints detracting from the finished effect of a structure(e.g. locating down pipes in front of joints, or running them down the edge of accent panels or mouldings, or at changes in coating colours etc). Joints can also be accentuated as part of the overall appearance of a structure.

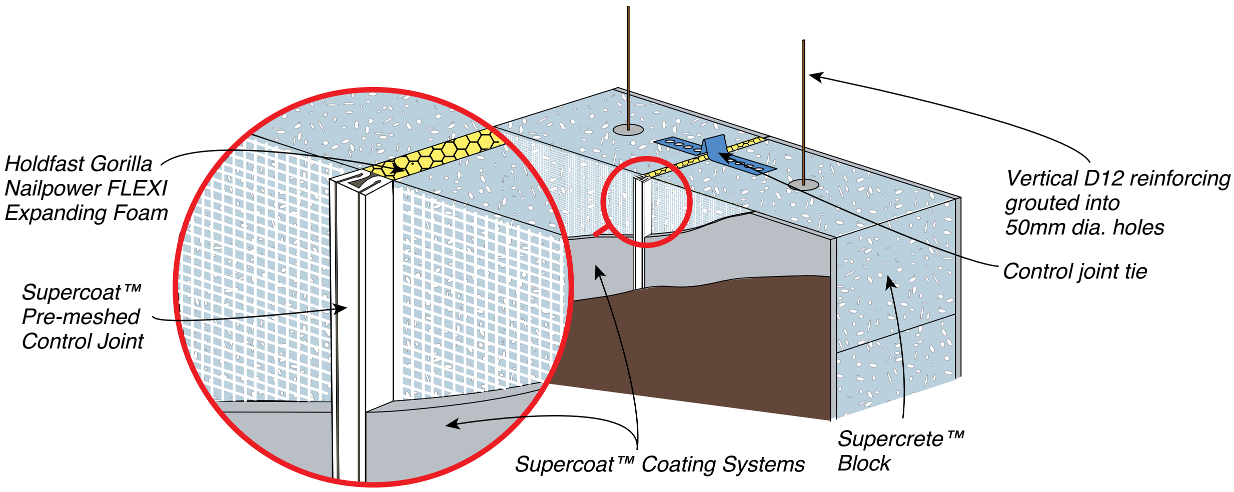
Movement Control Joint under Construction

Movement Control Joint Details



Section of Control Joint at Bond Beam





7.0 Walls

7.1 Base Rebate and first block course of exterior walls

The various types of ground level edge rebates are shown in Figure1. Variations are shown for rebate depths of 50 or 100mm and for wall thicknesses of 200, 250 and 300mm. All ground level edge rebates are 200mm wide with a 10mm drip edge and a 10mm gap at the back of the rebate between the concrete foundation and the Supercrete™ Blocks. This gap is to ensure that the installer can achieve a plum finishing line, even when the foundations rebate is not straight. The combination used dictates the size and orientation of blocks making up the first course. The Type Number shown in Figure 1 should be included on the foundation/floor slab drawings as this not only makes the required detail clear, it also avoids any confusion when the block take off is done to determine the block quantities required.

NOTE: Internal walls are to have their 1st course of blocks cut down to 150mm or 200mm to align the course height with that of the external walls. This is to allow any wall ties or control joint ties to be fitted as detailed.

The first block course is laid with a 10mm gap between the rear of the rebate and the block so that the block can move on the DPC clear of the floor slab. This also provides a 10mm overhang on the front of the block where it forms a drip edge.

The order of placement is the DPC, levelling mortar (Supercoat™ Superbase Render) and then the block. Ensure that the DPC is laid flush with the edge of the foundation and does not protrude out to the drip edge. The first block does not have any adhesive fastening it except on the end joints between blocks. It is held securely in position by the vertical rods grouted into the drilled cores.

Note that there is no detail showing the first course of exterior blocks sitting directly on the floor slab at floor level, a rebated foundation must always be used. Such a detail would have to rely solely on sealant for waterproofing and this would be contrary to the requirements of the NZBC.

On upper floors a rebate is not used as the face of the Supercrete™ Block needs to be flush with the edge of the floor, or with the lower section of the wall. In this case, the first block course of the upper wall only sits on DPC if the Supercrete™ Block is sitting on masonry blocks, a concrete floor or the combination of Supercrete™ Structural Floor Panels intersecting with a masonry block external wall. The DPC is used to provide a slip layer between dissimilar materials. Where Supercrete™ Structural Floor Panels intersect with an external Supercrete™ Block wall a DPC slip layer is not required and the upper floor Supercrete™ Blocks are directly fixed down using Supercoat™ AAC Superbond Adhesive. Where DPC is required, ensure that it is recessed back 10mm from the front face of the Supercrete™ Block so that a horizontal control joint can be inserted, a 10mm levelling bed of Supercoat™ Superbase Render is then applied prior to the first course of the upper story being laid.

Figure 1 Floor rebate arrangements for varying thickness of wall

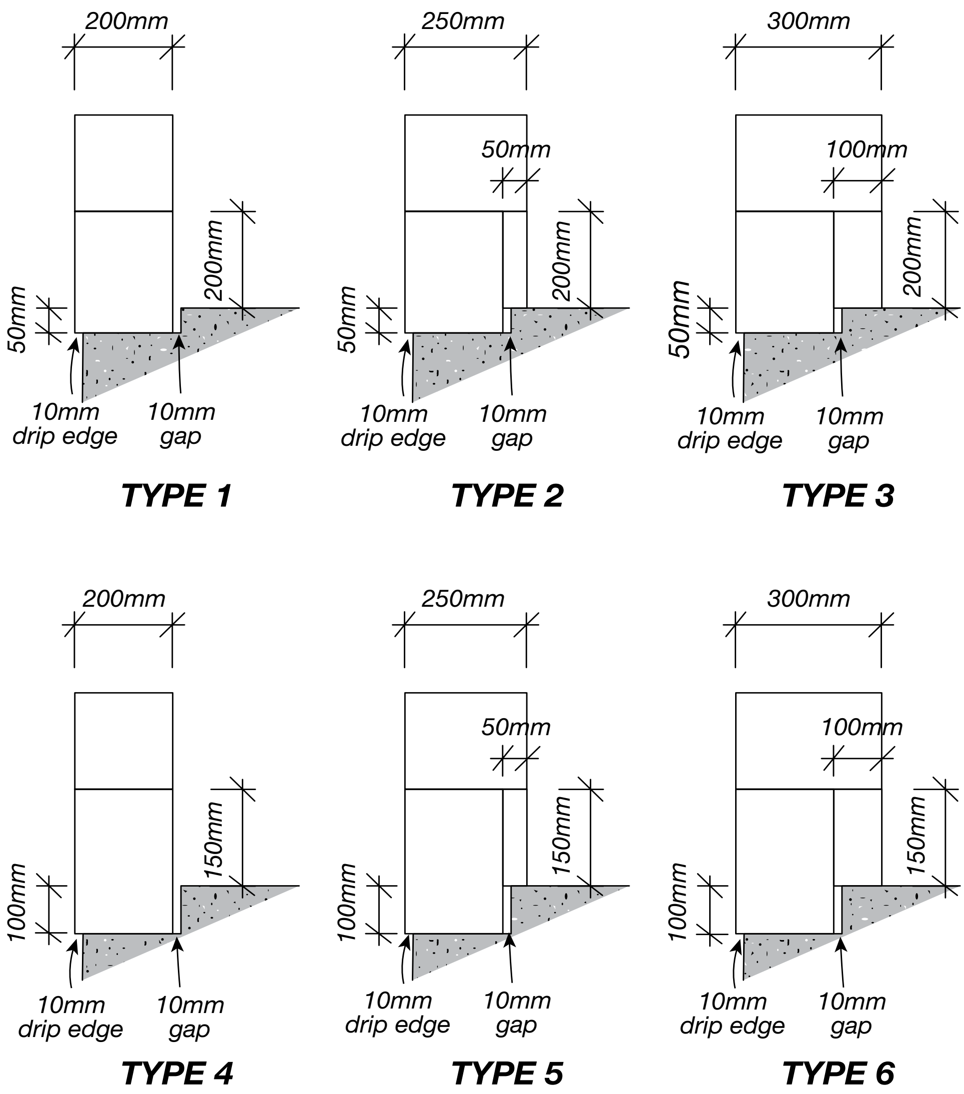
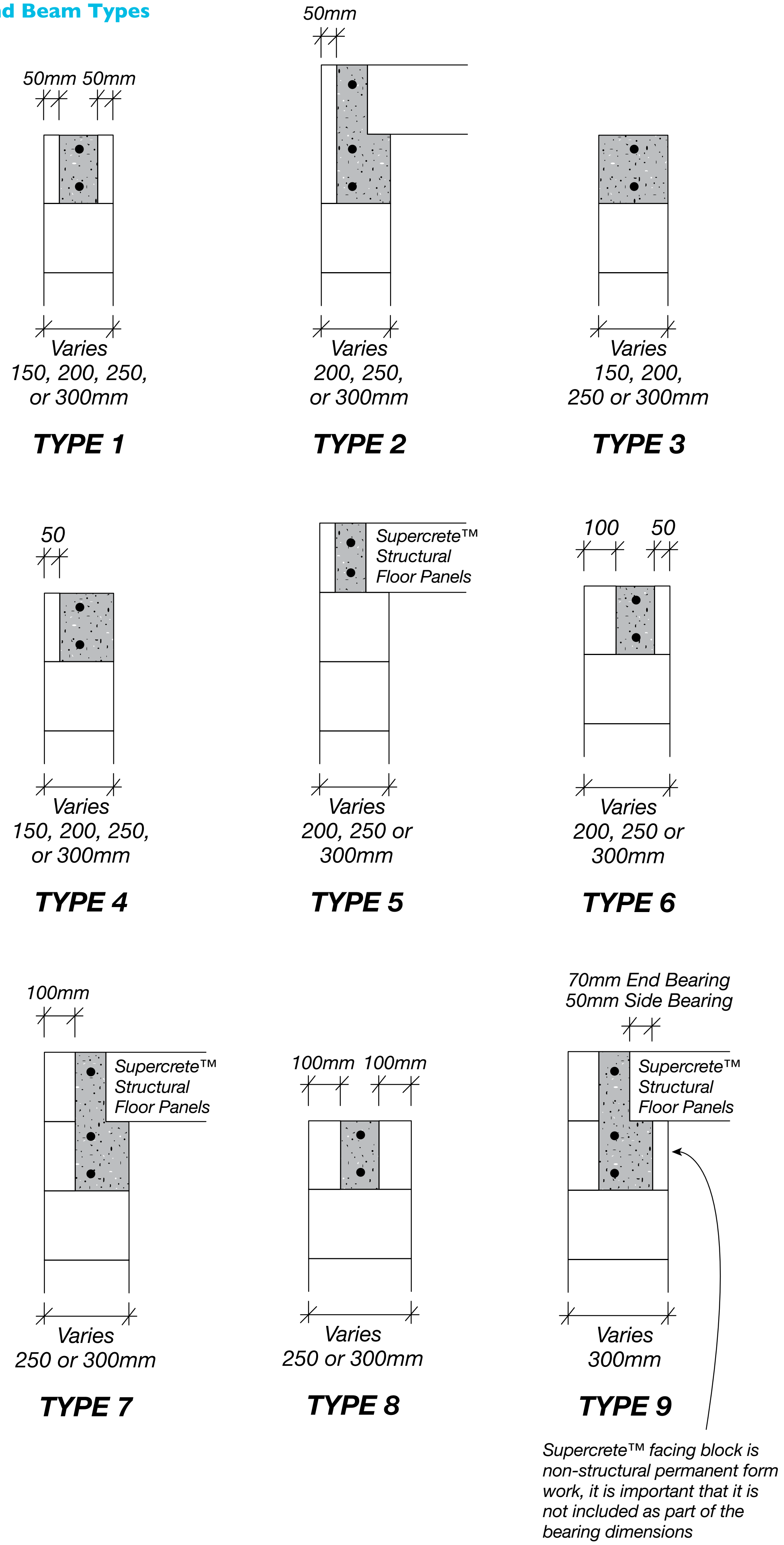
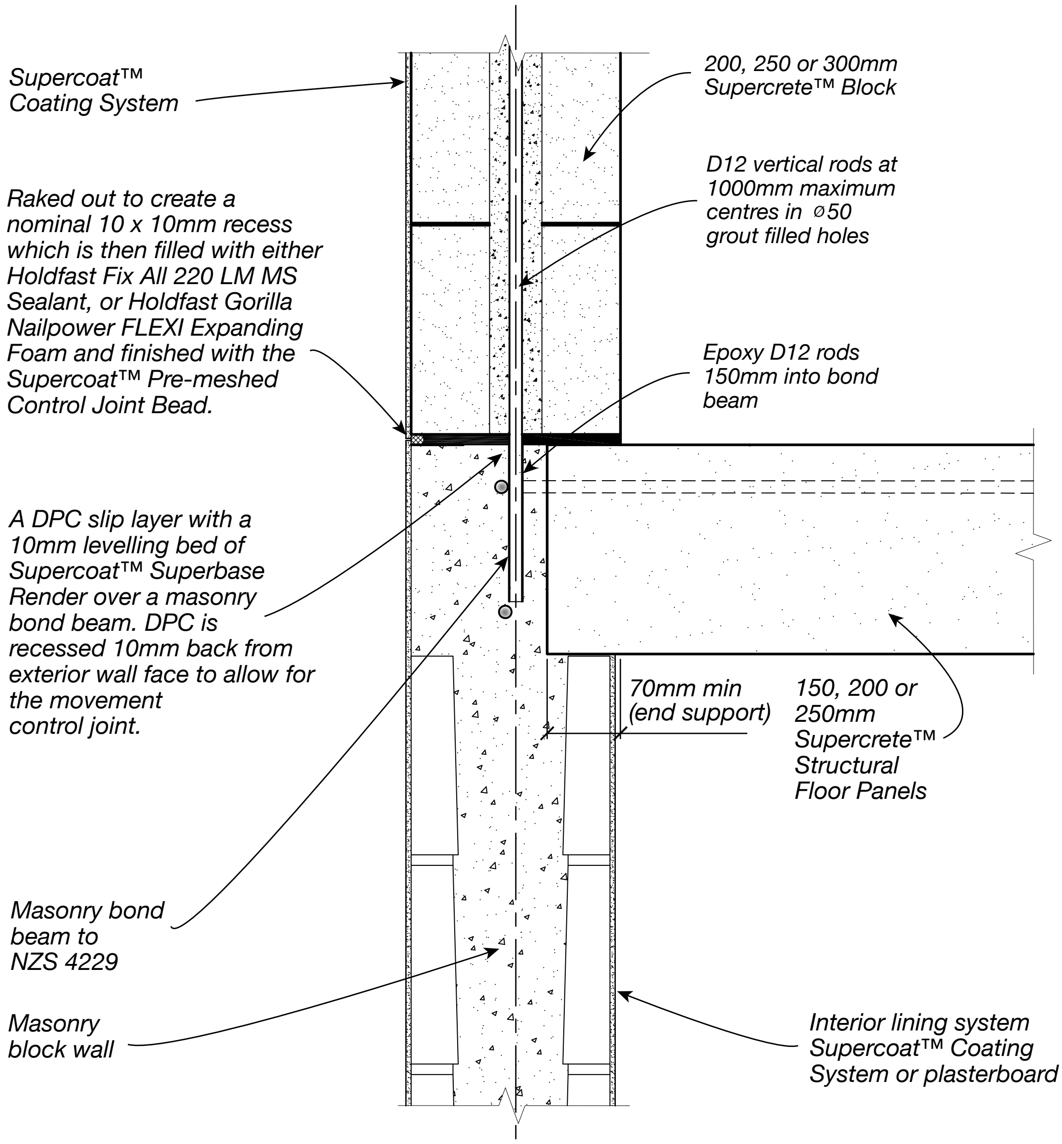


Figure 2 Bond Beam Types



Section through joint between upper and lower walls



7.2 First block course of interior walls

Interior block walls are started in the same way as exterior walls as noted above, using DPC for a slip layer where dissimilar materials are present, followed by a 10mm levelling bed of Supercoat™ Superbase Render and then the first block course. Where internal Supercrete™ Block walls are being laid over Supercrete™ Structural Floor Panels, the blocks can be direct fixed to the floor using Supercoat™ AAC Superbond Adhesive.

7.3 Bond Beams

7.3.1 Overview

Bond beams are used to stiffen the walls so that they can resist both out of plane loads such as wind loads, or in plane loads caused by timber roof framing shrinkage or spreading loads from rafters. They also provide a tension member at the top of bracing walls. Supercrete™ AAC like all concrete has low tensile strength so any path of tension loads must have steel reinforcing in place to take these tensile loads.

Typical bond beam locations are as follows:

- At the top of all walls
- Where floor or roof support beams are to be bolted to the wall
- Horizontally between gable end wall springings
- In the middle course of high walls where face loads require additional wall stiffening. The maximum wall height without an intermediate bond beam is 3.0 metres

Bond beams are normally formed by tying two horizontal D12 bars to the vertical D12 rods. Stirrups are not required in bond beams. Supercrete™ facing blocks are then edge glued on either side of the wall as permanent formwork and the space between filled with poured concrete. This allows the entire wall to have the same Supercrete™ substrate for the finished render or coating and avoids a horizontal band showing in the finished wall. There are several variations in bond beam types and these are shown in Figure 2.

Note that these type numbers are synonymous with the rebate type numbers and should also be noted on construction drawings to avoid confusion during block estimating and construction.

Typical locations for these bond beam types are as follows:

Type 1 This is the most common with a 50mm facing block on both sides. If in doubt, use this type at the top of all walls.

Type 2 This can be used anywhere you have floor panels sitting on one side of the top of the block wall with 50mm facing blocks on the other side.

Type 3 This is used where no facing blocks are wanted. This type is not commonly used.

Type 4 This type is used where you require the facing block on one face for a monolithic substrate, but require additional concrete in the bond beam for structural reasons.

Type 5 This type is used on all walls where you do not need a bond beam under the floor. This can only be achieved when you are using the floor ring anchor as the bond beam.

Type 6 This is used on walls where there is a requirement for increased insulation on the bond beams.

Type 7 This is the same as Type 2 but used on thicker walls for added insulation.

Type 8 This can be used for maximum insulation on thicker walls.

Type 9 Similar to Type 7 but where a monolithic substrate is required on the interior surface.

7.3.2 Combining bond beams and lintels

Lintels are used above openings to support the vertical loads above the opening due to roof, upper walls or floors. They are usually placed below the bond beam as a separately designed beam. Various arrangements of these are shown in Figure 3.

Where there is insufficient height above an opening to fit a lintel under the bond beam course, the lintel may be formed in a similar manner to the bond beam with 50mm facing blocks and combined with the bond beam. This will normally involve stepping down the bond beam on either side of the opening, and adding bottom steel reinforcing and stirrups.

Placing timber shoring in the opening to support the lintel during pouring also allows the use of a horizontal Supercrete™ facing block to form the soffit face of the opening. The side facing blocks are glued on top of this.

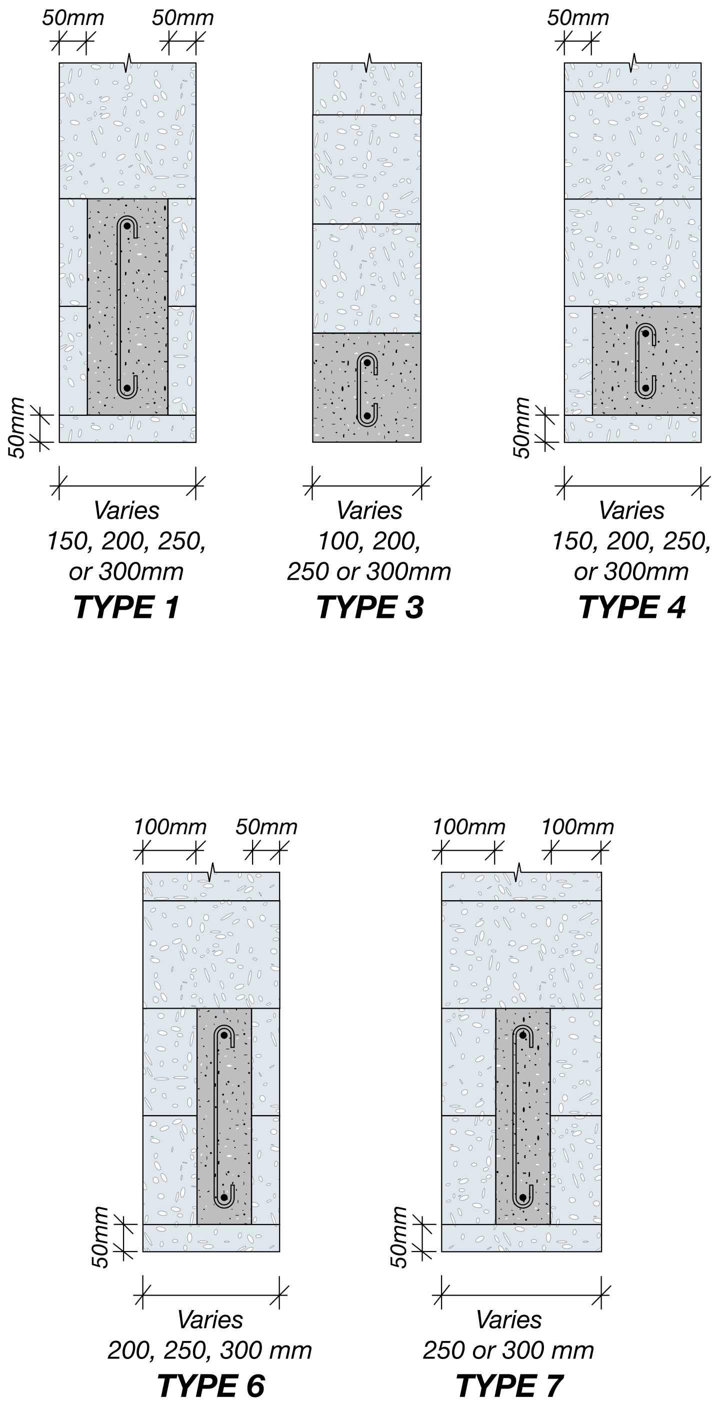
Note that the combined lintel and bond beam should extend past the opening by the required bearing distance given in Table 8. Cast in-situ lintels of this type may have their reinforcing size and number of bars determined using the design charts in NZS 4229 **as long as the width of the lintel is taken as the distance between the inside faces of the facing blocks.**

For very small openings, increasing the bond beam depth may not be required as the reinforcing in the bond beam may be sufficient to support the applied loads. Note however, that shear reinforcement in the form of vertical ties must be used over the opening in accordance with the requirements of NZS 4229.

Table 8. Lintel Bearing Length

Maximum clear opening (mm)	Minimum End Bearing Length (mm)
900	150
1500	200
1800	200
2400	300

Figure 3 Supercrete™ Block Cast insitu lintel types



As with bond beam and rebate details, the type number of the lintel should be included on the construction drawings to ensure that there are no misunderstandings as to the type of construction required.

7.3.3 Combining bond beams and floor ring anchors

Refer to the Supercrete™ Structural Floor Panel Design Guide for ring anchor requirements and layouts for Supercrete™ Structural Floor Panels.

Often in residential construction where the structure is not large or the applied loads are not excessive, it is possible to combine the floor ring anchor with the bond beam on exterior walls. This is advantageous in construction time and cost but should only be done for floor panels 200mm or thicker. In these cases, the Supercrete™ Structural Floor Panels are supported directly on the Supercrete™ block, and the outside of the ring anchor is formed by a 50mm Supercrete™ facing block glued flush with the exterior face of the wall. The ring anchor reinforcing is bent parallel to and lapped with the top bar of the bond beam steel. Note that this arrangement will reduce the poured concrete width to 80mm from the normal 100mm in a 200mm thick wall so there is a slightly reduced lateral capacity in these bond beams but this is more than compensated for by the diaphragm action of the panels themselves. This arrangement can always be used for 250 and 300mm thick walls.

Where a full bond beam is still required in addition to the ring anchor, the side of the bond beam supporting the floor panel must have poured concrete extending to the inner face of the wall. Otherwise, the floor panel would be largely supported on the edge of the Supercrete™ facing block and would be dependent on a very good bond between the poured concrete and the facing block and a perfectly flush surface between the top of the concrete and the top of the facing block.

Where floor panels are joined on internal walls, the requirement is for the wall thickness to be no less than 200mm. This allows a 60mm gap between the ends of the panels for the poured ring anchor. For internal walls, this is sufficient to also act as the bond beam.

However, it is advisable to tie the two D12 bars in place before installing the panels as there is little room for this to be done after panel placement.

7.3.4 Bond beam options on raking walls

Where there is a gable end wall or an end wall with a monoslope, there is the option of either putting the bond beam at the top of the wall on the rake, putting the bond beam horizontally across the wall from the lower end, or both. The choice of option depends on the following parameters:

- The angle of roof slope.
- The type of roof framing.
- The overall length of the wall.
- The overall height of the wall.

On raking walls, horizontal bond beams may be omitted when one or more of the following are present:

1. The overall height of the raking section will be less than 4 block courses or 1000mm.
2. There is a ceiling diaphragm at the lower level of the rake to resist horizontal out of plane loads.
3. There is a lintel within 1 block course of the lower level of the rake, that is more than ¾ of the wall length.
4. The overall length of the raking wall is less than 2000mm.

Horizontal bond beams on raking walls **must** be included in addition to a raking bond beam where one or more of the following occur:

1. The height of the raking wall at the lowest end is more than 3000mm.
2. There is a vaulted or sloping ceiling that will result in horizontal loads being applied to the walls intersecting the raking wall.
3. The overall height of the raking section of wall exceeds 4 block courses or 1000mm.
4. Any part of the wall length is being used as a bracing wall.
5. The overall length of the wall exceeds 6000mm.

The location of openings in raking walls may dictate whether a horizontal bond beam is physically able to be constructed. If the above conditions require that a horizontal bond beam is required, but there is no way to fit it in (e.g. a high raking window with a combined lintel/bond beam), then specific design of the wall will be required.

Raking bond beam

7.4 Wall reinforcing

7.4.1 General

Vertical D12 bars are used to reinforce the walls vertically.

There is no horizontal reinforcement except in bond beams, some window sills and cast in-situ lintels. This means that all walls are analyzed as having support at top and bottom edges but not on the vertical edges. This enables movement control joints to be installed at any location in the wall without compromising the walls ability to resist face loading or loads applied at right angles to the plane of the wall.

Vertical rods are located at nominal 1000mm centres in all walls unless specific design requires otherwise. In bracing walls, the spacing is still nominally 1000mm but care should be taken to specify the actual number of vertical rods for each bracing wall as given in the bracing tables. The designer should mark the location of all vertical rods on construction drawings so that there is no ambiguity as to rod location. 14mm diameter x 150mm deep holes drilled in the correct locations marked on the floor slab and edge rebates. The holes should be placed centrally in the width of the Supercrete™ Block wall (this is not necessarily in the centre of the rebate). The holes are best drilled as soon as possible after pouring the floor while the concrete is still soft. The holes are to be plugged to prevent dust, adhesive or rubbish from entering the hole while the wall is being constructed.

The D12 vertical rods are installed in 50mm diameter holes drilled in each block as required during installation. The Supercrete™ AAC material is relatively soft and drilling is very quick using the tungsten tipped spade bit supplied with the block, and can be used freehand with a portable electric drill, or in a specially set up drill press.

The first block course has the side of the hole cut out and removed on the exterior face to enable the vertical rod to be guided into the hole in the foundation once block laying has been completed (Pieces cut out should be numbered for each location to enable them to be glued back in once the rods are installed). This allows construction of the wall without having to drop blocks over rods that are already in place. Once laying has been completed up to the underside of the bond beam, the D12 rods are dropped down the drilled cores and epoxy grouted into the drilled holes in the foundation. Once the cut-outs in the first course are glued in and the adhesive cured, the cores are grout filled with 17MPa grout.

Holding down top plate

Depending on what is happening at the top of the wall, the vertical rods may be terminated in the bond beam, or continued upward to hold down timber framing.

In some higher stressed specifically designed walls, the use of D16 vertical rods will be specified. These are still installed in 50mm holes but special care should be taken due to the reduced clearance when grout filling, to ensure that grout is reaching the bottom of the hole.

The use of other types of reinforcing is permissible. Welding of vertical steel is not permissible.

Note that with the system of vertical reinforcing used; there is a tie right through the full height of the wall which effectively attaches the roof framing to the foundation.

7.4.2 Window sills

The horizontal live loads from wind and seismic event on windows must be resisted by the surrounding Supercrete™ Block.

The fastenings used to attach the windows must be capable of transmitting the window forces into the Supercrete™ Block via shear. Both wind and seismic loads can act in either inward or outward directions so the window rebate is insufficient to resist these forces. Cast in-situ lintels are capable of resisting these forces and distributing them into the adjacent walls. However, if there is no horizontal reinforcing at the sill level, the force exerted on the sill by the window, may exceed the capacity of the unreinforced Supercrete™ Blocks. Therefore, horizontal sill reinforcing is required for wider openings and higher wind speeds. Reinforcement required is detailed in Table 9 on the next page.

This horizontal steel is bent at each side of the opening to lap with the vertical D12 rods on either side of the opening.

7.4.3 Reinforcement above and below openings

Block wall areas above and below openings wider than 800mm must have vertical D12 bars at maximum 1000mm centres. Under the opening, these will be installed in the same manner as all other vertical reinforcement beginning at the floor level, but the rods will terminate in the course below the sill block and where horizontal sill reinforcement is required, will terminate in the grout or concrete encasing this. Above openings, the vertical reinforcing will begin in the lintel.

If the lintel to bond beam distance is short, full height rods may be cast in the lintel at the time of pouring.

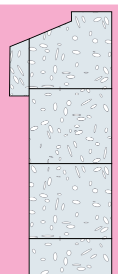
Where a combination of width, thickness and wind zone is not recommended, then it may still be possible to reinforce the wall section but this would require specific design.

Alternatively, the following solutions may be possible:

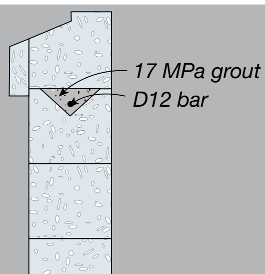
- Use a thicker block for the wall in question.
- Resize the opening.
- Shift the opening position within the wall area between the movement control joints.
- Relocate an intersecting wall so that it braces the wall in question.
- Install a buttress wall to brace the wall area.
- Incorporate a poured concrete or steel column into the wall in question.

Table 9. Sill reinforcement requirements for window in Supercrete™ Block walls

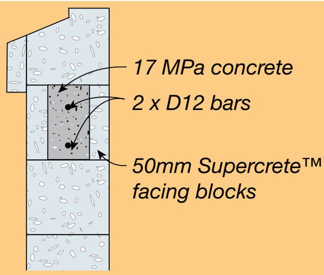
Design Wind Speed (NZS 3604)	Low	Medium	High	Very High
Maximum Design Wind Load (kPa)	0.75	1	1.25	1.5
Window Width (m)	200mm thick Supercrete™ Block			
Less than 1.8				
2.0				
2.2				
2.4				
2.6				
2.8				
3.0				
3.2				
3.4				
3.6				
3.8				
4.0				
4.5				
5.0				
	250mm thick Supercrete™ Block			
Less than 2.2				
2.4				
2.6				
2.8				
3.0				
3.2				
3.4				
3.6				
3.8				
4.0				
4.5				
5.0				
	300mm thick Supercrete™ Block			
Less than 2.8				
3.0				
3.2				
3.4				
3.6				
3.8				
4.0				
4.5				
5.0				



No horizontal reinforcing required



Single bar required grouted into chase in sill course



Full insitu bond beam required at sill course

***Note:** This table is for a maximum floor level to sill height of 2.0m*

7.4.4 Reinforcement and limitations on walls adjacent to openings

The forces applied to the windows and doors, as well as the wall areas above and below them, must be resisted by the wall areas adjacent to the openings. These forces are transferred both from the fastenings for the vertical parts of window and door frames, and from the shear forces in the Supercrete™ Block above and below the openings. As an opening increases in width, the section of block wall adjacent to the opening decreases in width, as the total width of the opening plus the adjacent wall areas is limited by the 6000mm maximum distance between movement control joints. Thus, some combinations of wall width, wall thickness and wind zone are not recommended as there is insufficient capacity in the block wall area adjacent to the opening to resist the total forces on the wall area between control joints. The requirements for walls adjacent to openings are shown in Table 10. This table is for free standing exterior or interior wall areas that are only supported at the top and bottom. In some cases this requires additional vertical rods (i.e. at closer spacing than 1000mm).

Where a combination of width, thickness and wind zone is not recommended, then it may still be possible to reinforce the wall section but this would require specific design.

Alternatively, the following solutions may be possible:

- Use a thicker block for the wall in question.
- Resize the opening
- Shift the opening position within the wall area between the movement control joints
- Relocate an intersecting wall so that it braces the wall in question
- Install a buttress wall to brace the wall area
- Incorporate a poured concrete or steel column into the wall in question

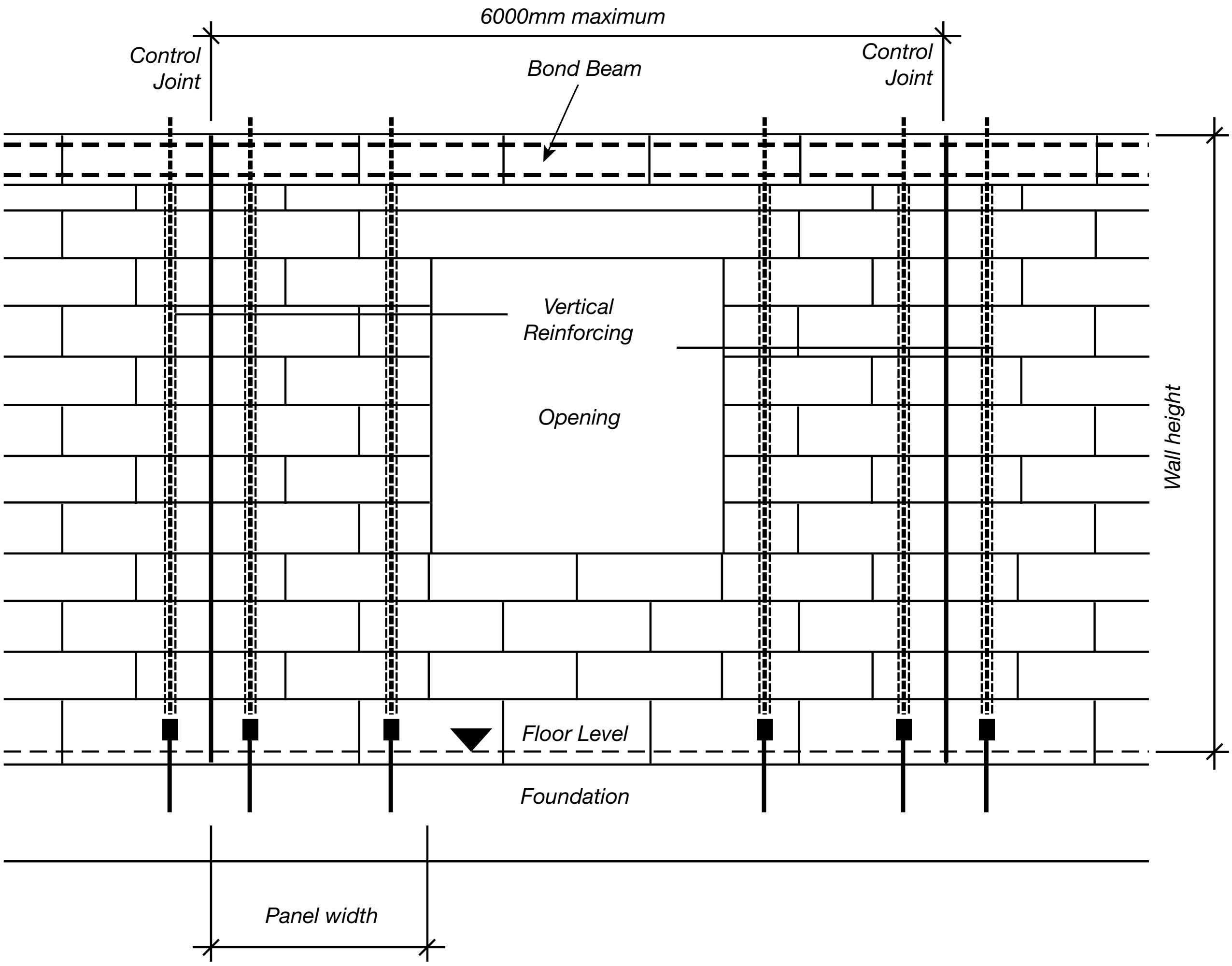


Table 10. Minimum vertical reinforcing requirements for Supercrete™ Block adjacent to openings

Wall Height	No. of blocks	Panel widthmm	200mm Low (32 m/s)	200mm Medium (37 m/s)	200mm High (44 m/s)	200mm V. High (50 m/s)	250mm Low (32 m/s)	250mm Medium (37 m/s)	250mm High (44 m/s)	250mm V. High (50 m/s)	300mm Low (32 m/s)	300mm Medium (37 m/s)	300mm High (44 m/s)	300mm V. High (50 m/s)
2400mm		300	Not recommended	Not recommended	2xD12	2xD12	Not recommended	Not recommended	Not recommended	Not recommended	Not recommended	Not recommended	Not recommended	Not recommended
	1	550	Not recommended	Not recommended	Not recommended	4xD12	Not recommended	Not recommended	Not recommended	Not recommended	Not recommended	Not recommended	Not recommended	Not recommended
	1.5	825	Not recommended	Not recommended	Not recommended	Not recommended	Not recommended	Not recommended	Not recommended	Not recommended	Not recommended	Not recommended	Not recommended	Not recommended
	2	1100	Not recommended	Not recommended	Not recommended	Not recommended	Not recommended	Not recommended	Not recommended	Not recommended	Not recommended	Not recommended	Not recommended	Not recommended
	2.5	1375	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12
	3	1650	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12
	3.5	1925	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12
	4	2200	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12
	4.5	2475	3xD12	3xD12	3xD12	3xD12	3xD12	3xD12	3xD12	3xD12	3xD12	3xD12	3xD12	3xD12
	5	2750	3xD12	3xD12	3xD12	3xD12	3xD12	3xD12	3xD12	3xD12	3xD12	3xD12	3xD12	3xD12
2700mm		300	Not recommended	Not recommended	2xD12	2xD12	Not recommended	Not recommended	Not recommended	2xD12	Not recommended	Not recommended	Not recommended	Not recommended
	1	550	Not recommended	Not recommended	4xD12	4xD12	Not recommended	Not recommended	Not recommended	4xD12	Not recommended	Not recommended	Not recommended	Not recommended
	1.5	825	Not recommended	Not recommended	4xD12	4xD12	Not recommended	Not recommended	Not recommended	Not recommended	Not recommended	Not recommended	Not recommended	Not recommended
	2	1100	Not recommended	Not recommended	Not recommended	4xD12	Not recommended	Not recommended	Not recommended	Not recommended	Not recommended	Not recommended	Not recommended	Not recommended
	2.5	1375	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12
	3	1650	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12
	3.5	1925	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12
	4	2200	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12
	4.5	2475	3xD12	3xD12	3xD12	3xD12	3xD12	3xD12	3xD12	3xD12	3xD12	3xD12	3xD12	3xD12
	5	2750	3xD12	3xD12	3xD12	3xD12	3xD12	3xD12	3xD12	3xD12	3xD12	3xD12	3xD12	3xD12
3000mm		300	2xD12	2xD12	2xD12	2xD12	Not recommended	Not recommended	2xD12	2xD12	Not recommended	Not recommended	Not recommended	2xD12
	1	550	Not recommended	4xD12	2xD12	2xD12	Not recommended	Not recommended	4xD12	2xD12	Not recommended	Not recommended	Not recommended	4xD12
	1.5	825	Not recommended	4xD12	4xD12	2xD12	Not recommended	Not recommended	Not recommended	4xD12	Not recommended	Not recommended	Not recommended	Not recommended
	2	1100	Not recommended	Not recommended	4xD12	3xD12	Not recommended	Not recommended	Not recommended	4xD12	Not recommended	Not recommended	Not recommended	Not recommended
	2.5	1375	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12
	3	1650	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12
	3.5	1925	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12
	4	2200	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12	4xD12
	4.5	2475	3xD12	3xD12	3xD12	3xD12	3xD12	3xD12	3xD12	3xD12	3xD12	3xD12	3xD12	3xD12
	5	2750	3xD12	3xD12	3xD12	3xD12	3xD12	3xD12	3xD12	3xD12	3xD12	3xD12	3xD12	3xD12

Notes:

1. *This table may be used for any door or window height up to the wall height less 200mm.*
2. *Block wall panels adjacent to openings outside the parameters of this table must be specifically designed.*

Not recommended

2xD12

3xD12

4xD12

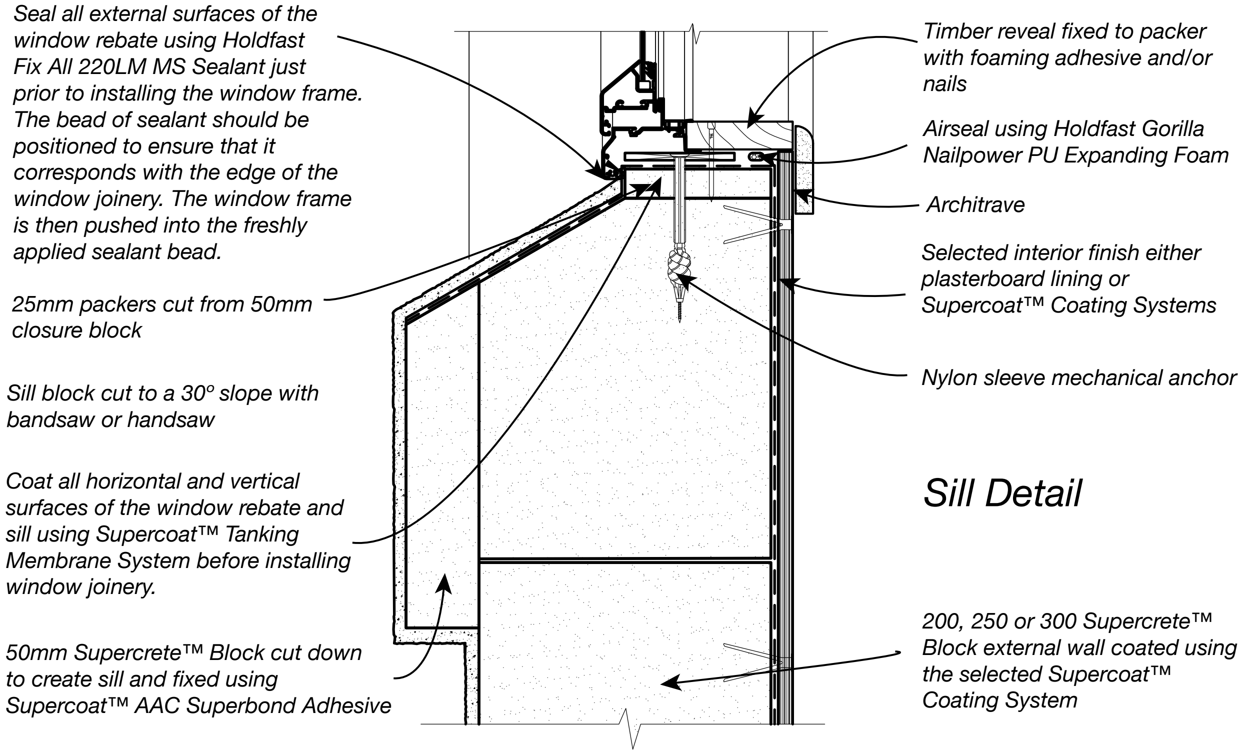
8.0 Design Details

8.1 Rebates around openings

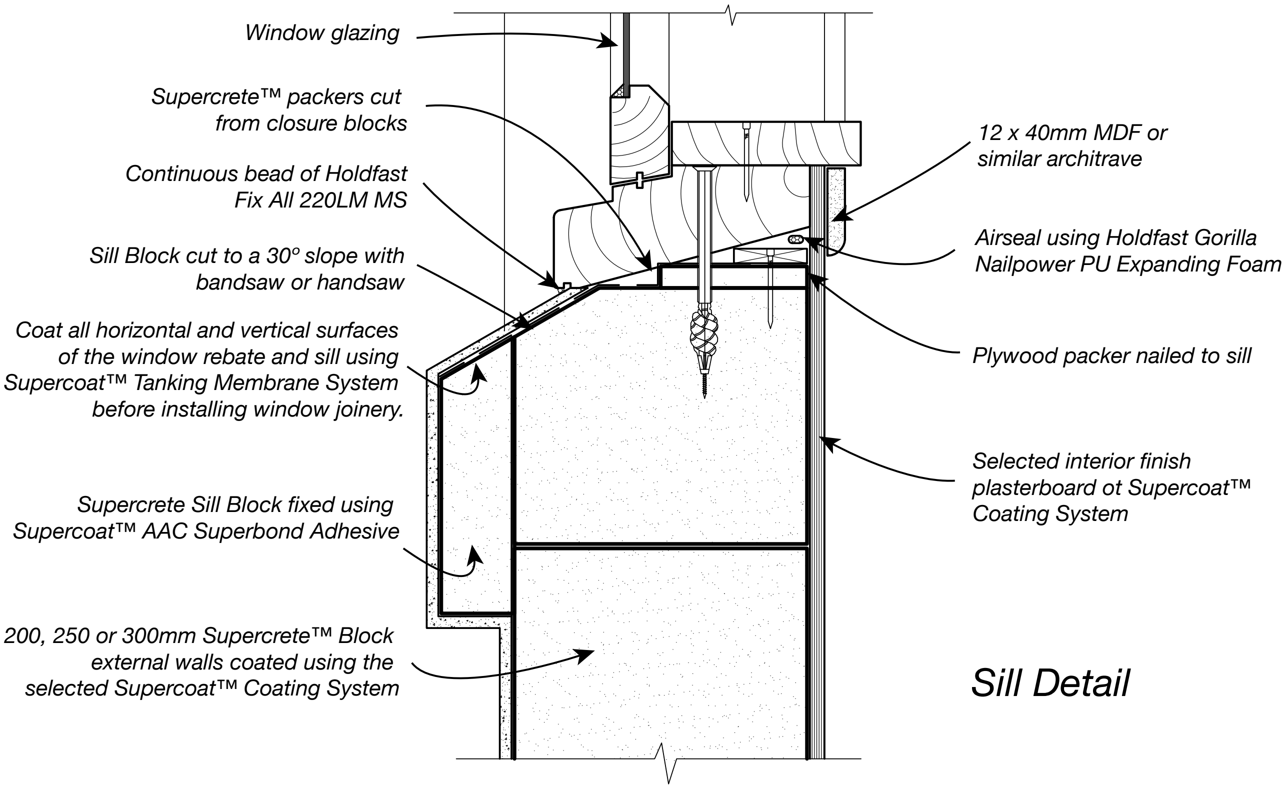
Typical cross sections through window openings in Supercrete™ Block walls are shown in Details **BLK 6.2** and **6.3** which can be found at www.superbuild.co.nz. There are two ways of forming the rebate for windows. Standard or oversize blocks can be cut to create the rebate and sill slope. Alternatively, just the sill slope can be cut, and then the rebate formed by gluing thin blocks which are the height of the rebate, around the inside edge of the opening. Either method is satisfactory. Windows should not be installed without the rebate.

The inner surfaces of the opening should be waterproofed using Supercoat™ Tanking Membrane prior to the window being installed, a bead of Holdfast Fix All 220LM MS Sealant is then run around the rebate face, before the window reveal is pushed back against the rebate.

Aluminium Window Sill



Timber Window Sill



8.2 Timber framing attachment to Supercrete™ Block

8.2.1 Top plates for roof framing

Timber top plates are simply attached to the top bond beam using vertical M12 bolts. These are extended through the plates and fitted with a square washer and nut.

These bolts are to be spaced as required by NZS 4229. With a top plate normally being only a nominal 100mm in width, a filler block of Supercrete™ can be cut to fit and glued in position outside the top plate so that there is solid Supercrete™ right up to the underside of the soffit. On the inside, this is not normally required as the space is largely filled by slipping the ceiling ribbon board into place for the ceiling lining, and the scotia can be fastened to the top of the Supercrete™ Block.

Note that all timber plates must be discontinuous at movement control joints with at least a 10mm gap between ends.

8.2.2 Timber stringers

Where timber stringers are bolted to the side of a Supercrete™ block wall, the bolts should either be cast into the adjacent bond beam, or expansive fasteners used, into the poured concrete of the bond beam. Note that the embedment depth required for the particular fastener type should be measured in the poured concrete. In other words, the thickness of material held by the fastener includes the stringer thickness as well as the Supercrete™ facing block thickness. Fastener spacing and size should be accordance with NZS 3604. Note that all holes in the timber should be at least 4mm oversize and the bolts and nuts should just be snugged up with locknuts fitted. This is to allow differential movement between the timber and Supercrete™. Ceiling or floor joists may be attached to the stringer using joist hangers, or by sitting them on top of the stringer. Always ensure that there is at least a 5mm gap between the end of the joist and the face of the Supercrete™ Block. There should always be a layer of DPC between the timber stringer and the Supercrete™ Block.

Where for any reason, a stringer needs to be fastened to a wall outside of a bond beam, it is still possible to fasten to the Supercrete™ Block using through bolts.

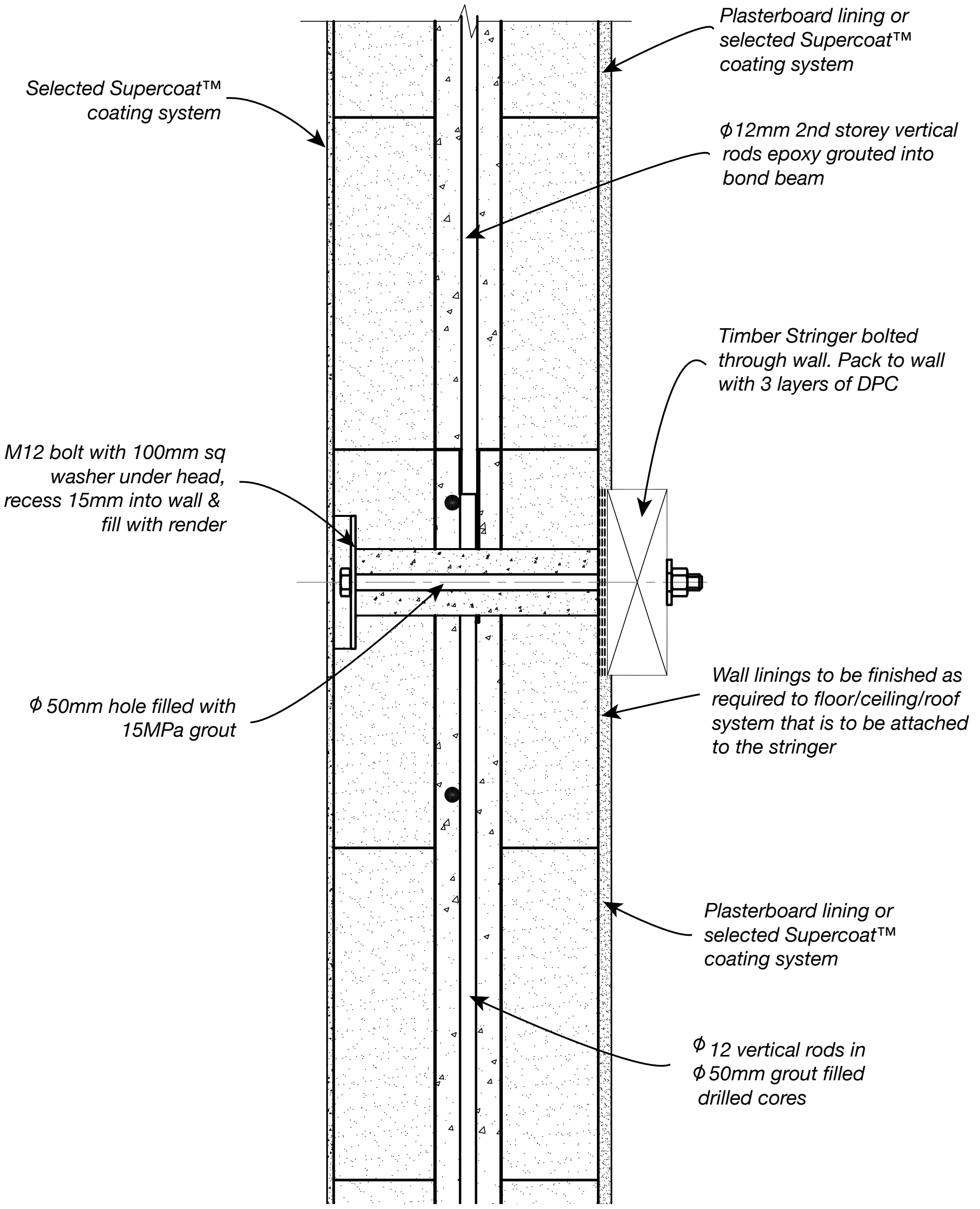
These pass right through the wall but must pass through a 50mm diameter horizontal core which is grout filled to spread the load into the Supercrete™. Refer Detail BLK 4.5.

Depending on the location of these cores, they can usually be filled by drilling another hole down from above on an angle from the inside to drop the grout in to fill around the bolt.

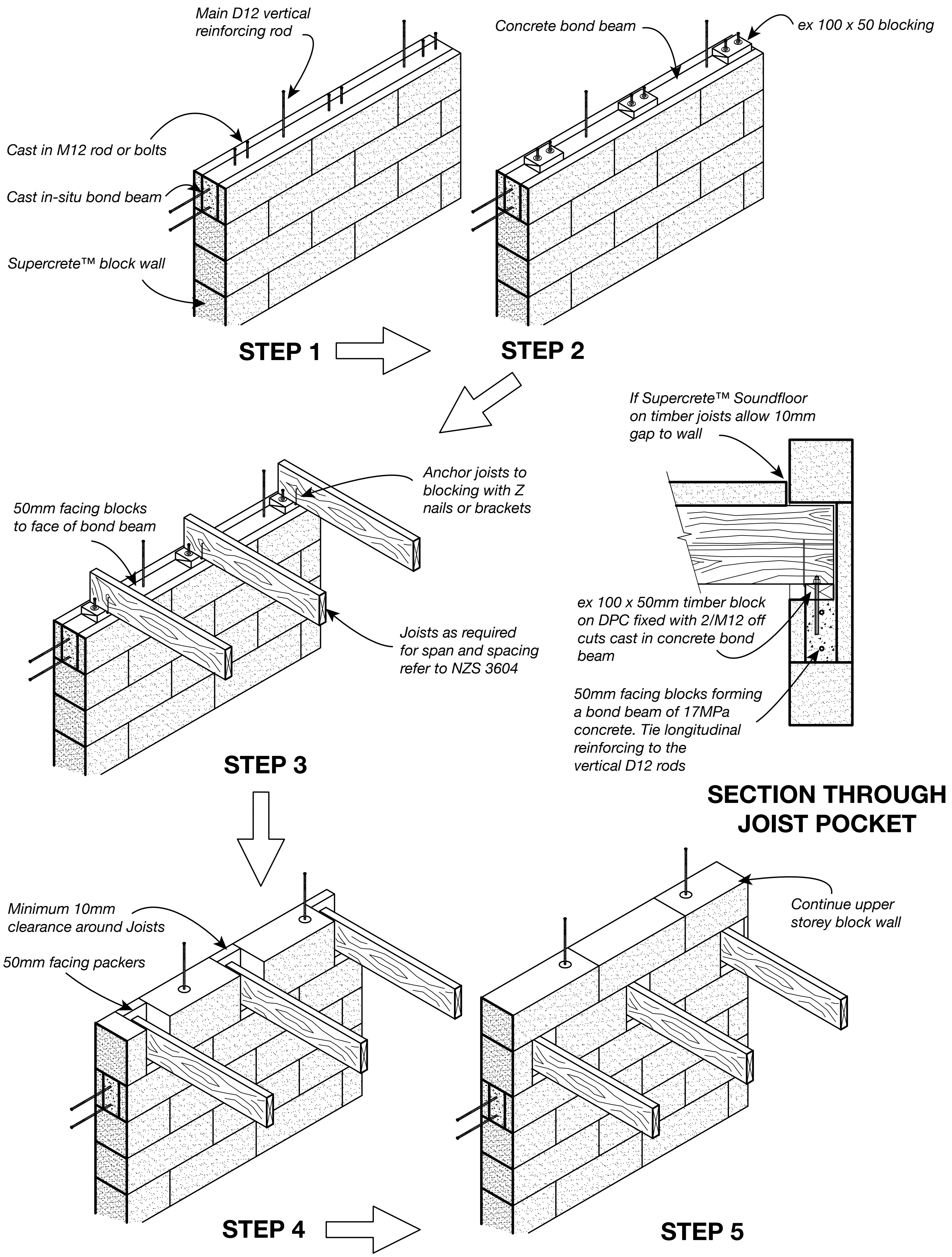
Failing this, formwork can be fastened to the side of the wall so it covers the bottom 2/3 of the hole, and grout forced into the gap at the top. It is only necessary to encase the bolt so that just over half of the hole height is filled as the load has only to be spread in a downward direction. The bolt end on the opposite side to the stringer needs to be recessed with a 100mm square plate under the nut, and this can be used for permanent formwork on one side, for the grout.

Note that all stringers must be discontinuous at movement control joints with at least a 10mm gap between ends.

Detail BLK 4-5
Attachment of Stringer to Supercrete™ Block



Detail BLK 4.1
Steps for encasing timber beams in block wall



8.2.3 Direct timber joist to block wall detail.

It is possible to install timber joists on a Supercrete™ Block wall without the use of a stringer but the timber construction needs to be carried out in conjunction with the Supercrete™ Block laying.

This is shown in detail **BLK 4.1** on previous page. Using this method, short timber plates are bolted to the top of the bond beam at each joist location, and the timber joists fastened to these. Blocks are then laid between the joists so that a course height finishes 10mm above the top of the joists. The next full course is then laid with full blocks spanning over the gaps for the timber joists, and block laying continued normally. Note that the short timber plates should sit on DPC and have 4mm (minimum) oversize holes for the bolts and have the nuts just snugged up to the washers with a locknut in place. This is essential as the longitudinal movement of the timber joists would otherwise exert avoidable face loads on the Supercrete™ Block wall.

8.2.4 Fixing Timber partitions to Supercrete™ Block walls

Where timber partitions are being used for some of the internal walls, care must be taken so that the timber shrinkage does not impose excessive face loads perpendicular to the Supercrete™ Block walls. The use of kiln dried timber is recommended so that only diurnal and seasonal moisture movement in the timber need be accommodated. If the timber framing is not dry, then nuts should be left loose right up until the time the interior lining is installed. The timber stud against the Supercrete™ should have two layers of DPC between it and the Supercrete™, and the best way of fastening the stud is using run bolts right through the Supercrete™ Block and stud. The Supercrete™ Block end should have a square washer and be countersunk below the block surface. The hole in the timber should be oversized at 14mm and the nut just snugged up with a locknut. Alternatively, if it is not possible to through bolt, then large expansive fasteners may be used in the Supercrete™ Block; but again, these should be in oversize holes in the timber and only snugged up rather than tightened.

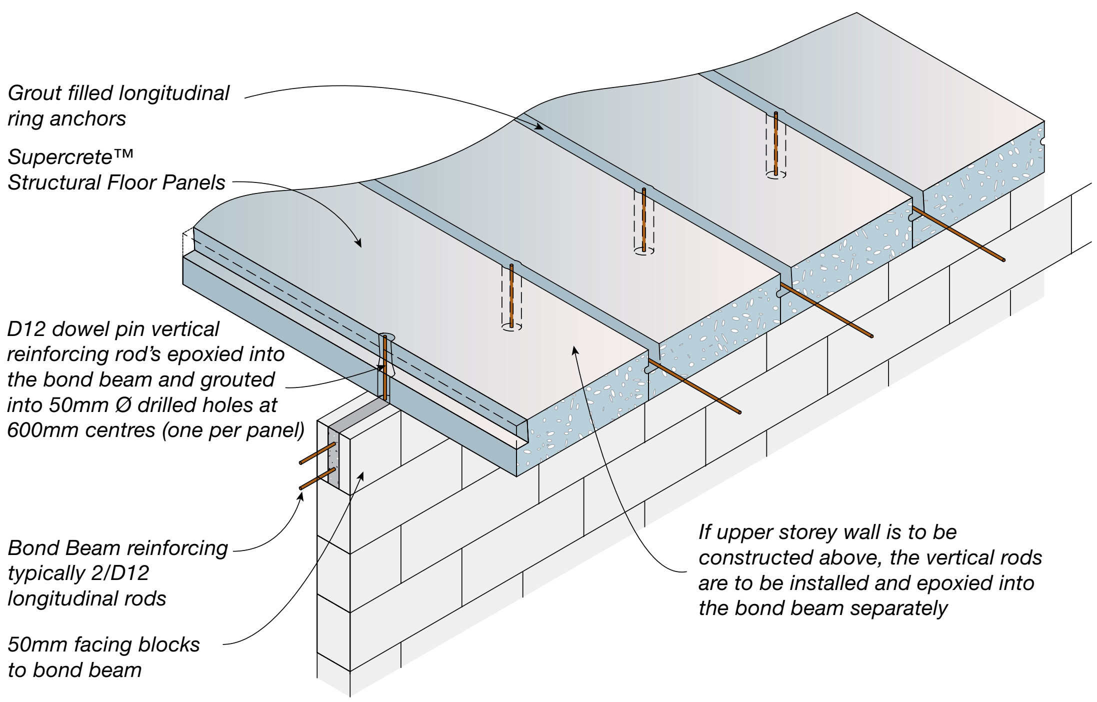
Note that when lining these timber partitions, the internal lining should be kept 5mm clear of the Supercrete™ Block, with the gap filled using Holdfast Fix All 220LM MS Sealant.

8.3 Floor panels over intermediate walls

Where Supercrete™ Structural Floor Panels pass right over and sit on lower storey Supercrete™ Block walls using them as an intermediate support, the Supercrete™ Structural Floor Panels must be fastened into the lower storey Supercrete™ Block wall to provide some lateral restraint. This is most easily done after the floor panels are in place by drilling a 50mm hole through the floor panel down to the poured concrete in the bond beam. Then a 14mm diameter hole is bored 150mm into the concrete, and a 12mm D12 rod is then epoxy grouted in.

The rod should finish 50mm below the top of the Supercrete™ Structural Floor Panels. The 50mm bore hole is then filled with 17MPa grout. There is no advantage in putting these dowels into the floor panel ring anchor chases although this can be done if desired. There should be a dowel in each floor panel but note that in some specific designs, more dowels of larger diameter may be required.

Detail of floor/intermediate wall junction with dowel



8.4 Banding, mouldings and accent panels

Supercrete™ Blocks are very easy to sculpt, router and otherwise shape using tungsten tipped bits or woodworking tools. They therefore lend themselves to being used for decorative mouldings. Accents can also be added using 50, 75 or 100mm Supercrete™ panel to provide raised beam column or base relief panels depending on the architectural style.

Generally, these panels can just be face glued using Supercoat™ AAC Superbond Adhesive and are very quick to install (Refer the Supercrete™ Panel Cladding Systems Design & Installation Guide for panel details). Screws may have to be used to hold the panels in place while the adhesive sets. These panels are reinforced and should only be used to form larger raised areas. Shaped edges on these panels are better done using lengths of unreinforced Supercrete™ Block. Note that it is normally far easier to glue several shaped pieces together to make a single complex shape, rather than machining or hand shaping a single large block.

Photo of panel being glued to block wall as mouldings

8.5 Tiling and stone veneers

Supercrete™ in any form is an ideal substrate for application of ceramic tiles. However, it should be noted that any material that has a water vapour transfer rate less than the Supercrete™ Block (such as ceramic tile) must be limited in coverage area to ensure that internal moisture vapour is not impeded in exiting the building. As a general recommendation, surface coverings with little or no permeability should be limited to no more than 10% of the wall area. The designer should also give consideration to the breathable wall area for each room (e.g. do not tile the entire exterior walls of bathrooms or laundries as these are needed to vent water vapour).

Artificial stone veneers which have gained popularity in the last few years may be used against Supercrete™ Block although as with any construction, it is best if these sit on the wall foundation, rather than being glued to the wall.

Coating the wall with one of the various Supercoat™ Coatings prior to installing the veneer ensures that any free moisture that gets through the veneer is prevented from entering into the Supercrete™ Block. Dry stacked versions of these stone veneers are better as they allow the wall to breathe. Note that no cavity is required between the stone veneer and the Supercrete™ Block.

8.6 Steel beams and columns

Where steel beams are connected into Supercrete™ Block walls, consideration must be given to the design of the beam supports to allow the larger expansion of the steel with temperature variation than the Supercrete™ Block. Steel has approximately twice the expansion rate per degree of temperature than the AAC. This means that relative to the Supercrete™ Blocks, the steel will move longitudinally approximately 0.01mm/m/°C. This does not sound much, but for a surface operating temperature range of say -10 °C to +60 °C, this equates to a relative movement of 0.7mm per 1000mm of beam length. So for a 5000mm beam, we would have to accommodate 3.5mm of relative movement. Again this does not sound much, but for a beam supported on a wall perpendicular to the wall, it would mean that the wall would try and push over at the top by 3.5mm. This is easily sufficient to crack the wall. For this reason, wherever steel beams are supported and held down on Supercrete™ Block, the holes in the holding down plates must be slotted in the direction of the beam length, and the holding down nuts should just be snugged up and not tightened, using a locknut to keep them in this position.

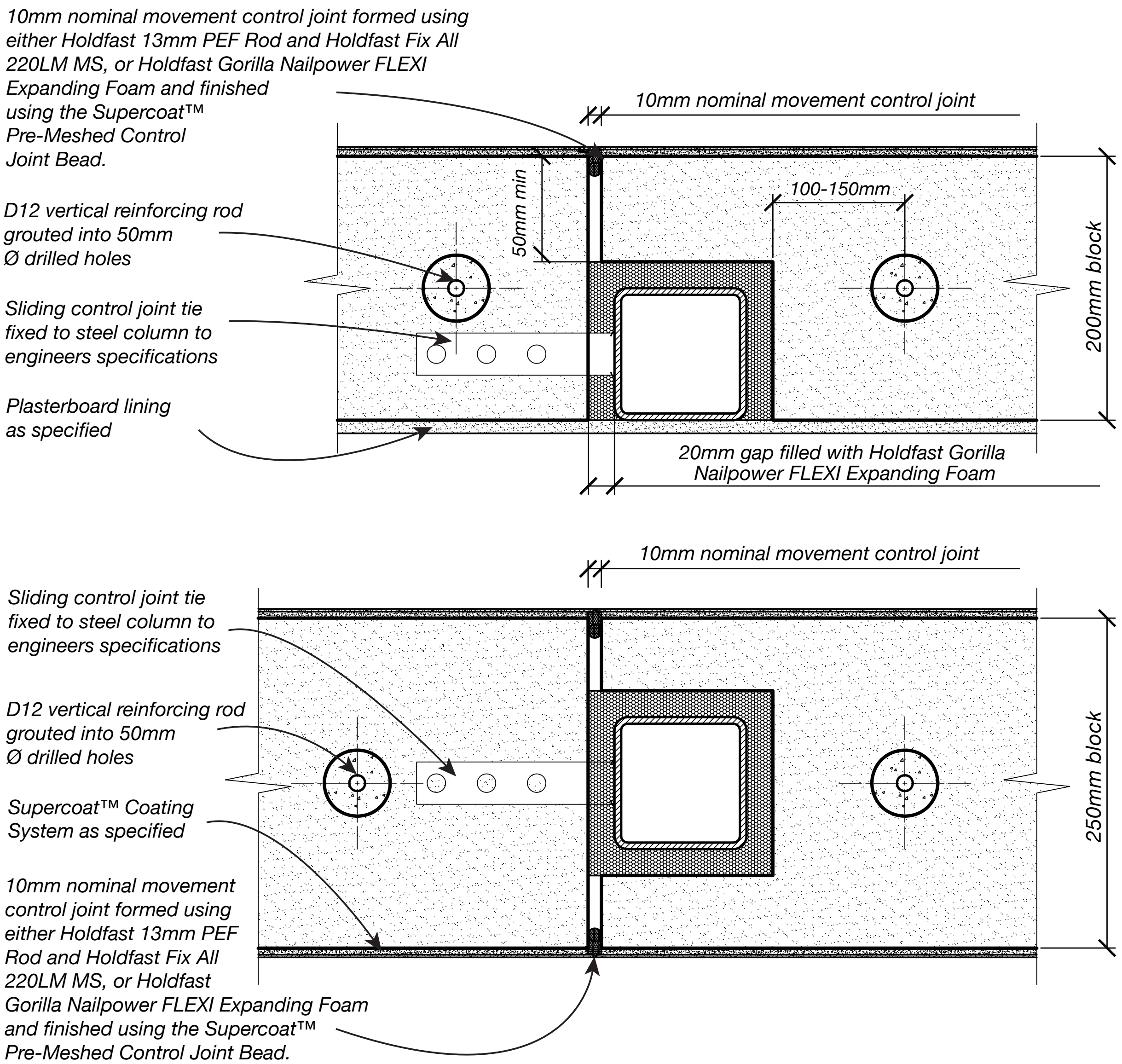
Where steel beams are used as lintels or supports for upper walls to achieve longer spans, and the desire is to have these blend in with the wall thickness, there is always a temptation to glue Supercrete™ Blocks to the sides and bottom of the steel beam. While this is possible, there is always the possibility that cracks will appear in the facings due to the steel expansion and contraction with temperature variations. It is a better practice to fasten horizontal Rondo battens to timber packers, and then fasten 50 or 75mm Supercrete™ facing panels to these. Refer to detail SPC 6-5 in the Supercrete™ Panel Cladding Systems Design & Installation Guide.

This allows more slippage between the facing and the steel beam. In this case, it is advisable to have a vertical movement control joint at the face of the opening at each end where the panel and Supercrete™ Block meet. If the steel beam size or the finished wall width does not allow the use of panel facings, then movement control joints should be placed in the Supercrete™ facing blocks along the beam at a maximum of 2000mm centres. Note that timber packing blocks in the webs of the steel beam should be mechanically fastened as well as glued so that in the event of a glue bond failure due to expansion and contraction, the facings will still be securely held. The construction adhesive used in this application should be Holdfast Fix All 220LM MS.

Installation of steel columns within Supercrete™ Block walls should be avoided if possible. However, if required, the following requirements must be met;

- The steel column must be tied to the adjacent block wall on one side with sliding control joint ties.
- A movement control joint should be located on one side of the column.
- There should be a minimum space of 20mm between the steel and the Supercrete™ which must be filled using Holdfast Gorilla Nailpower FLEXI Expanding Foam.
- Where the combination of wall thickness and column size do not allow a 50mm thickness of Supercrete™ on both sides, the column should be moved so that one side is flush with the face of the Supercrete™ wall. In this case, it is recommended that this wall face be lined as it is difficult to satisfactorily hide the face of the steel.

Detail BLK 10.3 Typical encasement of steel column in block wall



8.7 Supercrete™ Block and timber beams

Timber beams should not be used as structural support in any situation except in floor framing where the floor does not support any masonry walls. The moisture movement of timber beams and their live load deflections make them unsuitable for supporting the relatively stiff Supercrete™ Block.

As with all construction, limiting the number of types of structural materials used in a Supercrete™ Block structure to a minimum will induce much lower seasonal and live load movements of the various sections of the structure.

8.8 Supercrete™ Stair construction

Stairs can be made from standard Supercrete™ Structural Floor Panel. The types of stairs that can be used are specified in the NZ Building Code D1/AS1. Service Stairs and Secondary Private Stairs can be made from either 150 or 200mm thick panels. Common and Accessible Stairs can only be made from 150mm thick panel. Each panel is overlapped over the one below to obtain the stepped profile. The nosing profile can be shaped into the side of the panel or block of the correct profile can be glued along the edge of the panel. In both cases there should be a short vertical face left at the top so that the nose does not end in a point that will be easily broken off during normal service. It will also provide a seating for a safety nosing if required.

All treads are to be supported from below at each end with a minimum of 50mm bearing at each end. This can be either by block walls or steel runners with appropriately shaped brackets on which the panels can sit. Timber is not to be used to support the stair treads. The treads are built into the Supercrete™ block walls as the construction proceeds upwards with the difference between the rise of the treads and the height of the block courses being taken up by Supercrete™ packing blocks to suit. Similarly where the bearing at the panel end is less than the block wall width the difference is made up with Supercrete™ packing blocks to give a flat surface to the wall.

Where the required rise is greater than the panel thickness, the gap between treads may be packed with Supercrete™ packers to provide continuous bearing. Curved stairs may also be constructed using Supercrete™ Structural Floor Panel but the angles and length will have to be cut on site. When ordering the panels for this use the shape should be supplied so the factory can adjust the reinforcing accordingly.

Where stairs are not required to have a floor covering applied over them they should still be covered using the Supercoat™ Deckshield System to provide a durable, hard wearing surface for foot traffic.

When building the stairs into a block wall there is no requirement for additional fixings as capturing and gluing the treads into the wall is sufficient to secure them in place.

Stairs under construction in block wall

Note also that movement control joints should not be incorporated into a stairway. Any control joint would need to go through both side walls of the stairway and across the stair treads thus compromising the strength of the stairs. Movement control joints should be placed clear of the length of wall where the stair treads are to be located.

See the Supercrete™ Structural Floor Panel Design Guide for typical arrangements of the NZ Building Code stair types using Structural Floor Panel.

For more information on Supercrete™ Stairs contact Superbuild International Ltd.

8.9 Electrical and other wiring services

Installation of wiring in Supercrete™ Block walls is normally done by cutting chases into the side of the wall and fastening PVC conduit in place and then filling over the chase with Supercoat™ AAC Superbond Adhesive. In all cases, the installation of wiring must comply with the applicable safety regulations.

8.9.1 Location and size

The following rules must be observed when setting out chases to be cut in Supercrete™ Block walls:

- Chases should be no deeper than one third of the wall thickness.
- Chases should not be cut into any bracing walls unless the bracing calculations are based on the actual thickness of the wall between the bottom of the chase and the other side of the wall, to allow for the reduced effective thickness.

- Chases should not be cut on both sides of a wall unless the total depth of both chases does not exceed one third of the wall thickness.
- PVC conduit must be discontinuous at movement control joints.
- Localized recesses or holes right through walls are permissible for the installation of fittings but the opening size should only be as large or as deep as needed and thought should be given to its relative position in the wall (e.g. do not put a large hole through the wall adjacent to the end of the wall) In bracing walls, holes should not be any larger than 150mm diameter.
- Where Type 2, 3, 5 or 6 rebate details are used, and the additional thickness of the packing block on the bottom course is not needed for bracing, part of the packing block may be left out (i.e. not full height) to leave a large chase around the base of all external walls.

  This can be used as a service duct and be covered with a high skirting board. PVC conduit is not required in this case.

8.9.2 Cutting chases

The quickest way of cutting chases is to use a chasing tool.

These have two circular cutting blades which can be set at varying distances apart for the required chase width. A batten is temporarily fastened to the wall and used as a guide to run the chasing tool against. The section between the two saw cuts is then broken out. The saw cuts may alternatively be made using a single blade in a circular saw, or with a large router.

8.9.3 Conduit and wire installation

Wires are installed in PVC conduits for two reasons. Firstly, because the wall is solid, it is possible for a fixture to be fastened to the wall at any location and the conduit gives more protection for the wire. Secondly, when working with the wiring, if a wire is pulled on without the conduit, it is likely to cause a crack in the filler outside the wire along its path.

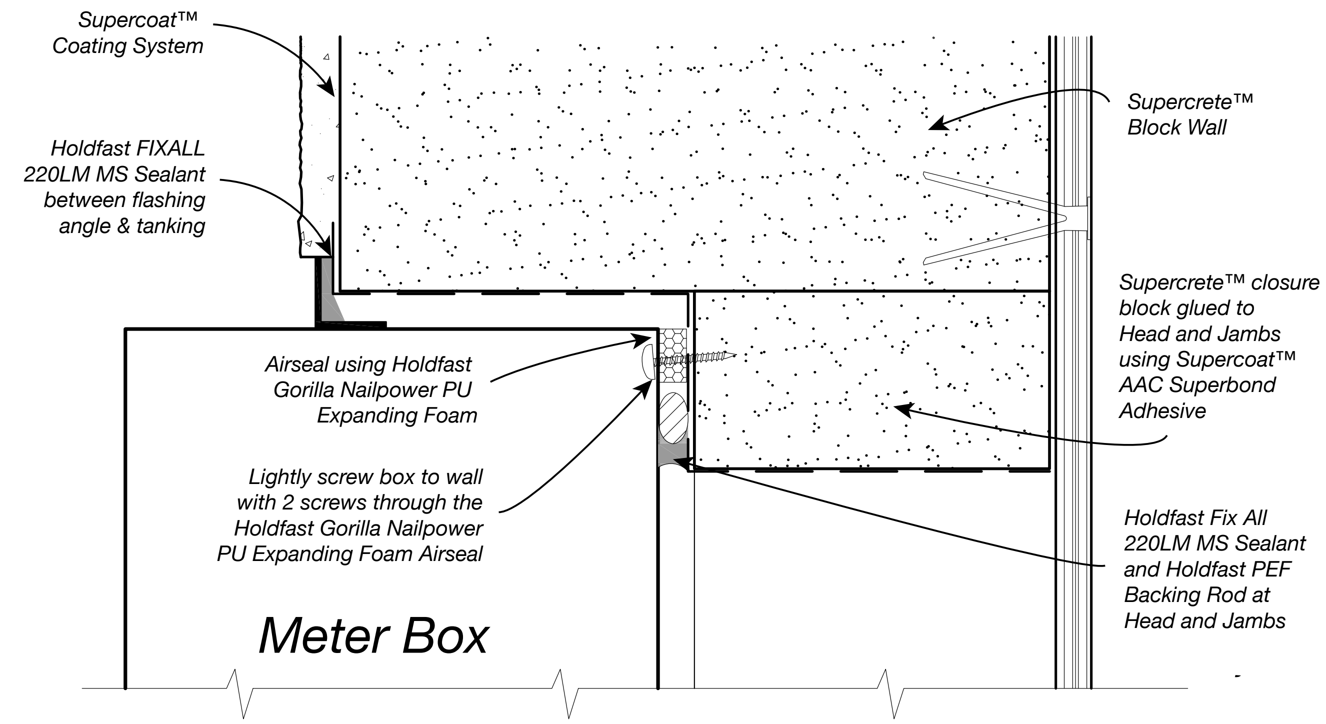
It is often more convenient to thread the wires through the PVC conduit before installation in the wall, including the various elbows and bends. The conduit and fittings are cut to length and can be dry fitted first. Then each section has the wires inserted and the pipes installed in the walls in sections.

In some designs where the bulk of the wiring can be run in ceiling or upper floor spaces, it is possible to pre drill blocks at each fitting location so that there is a vertical hole from the ceiling or upper floor to each location.

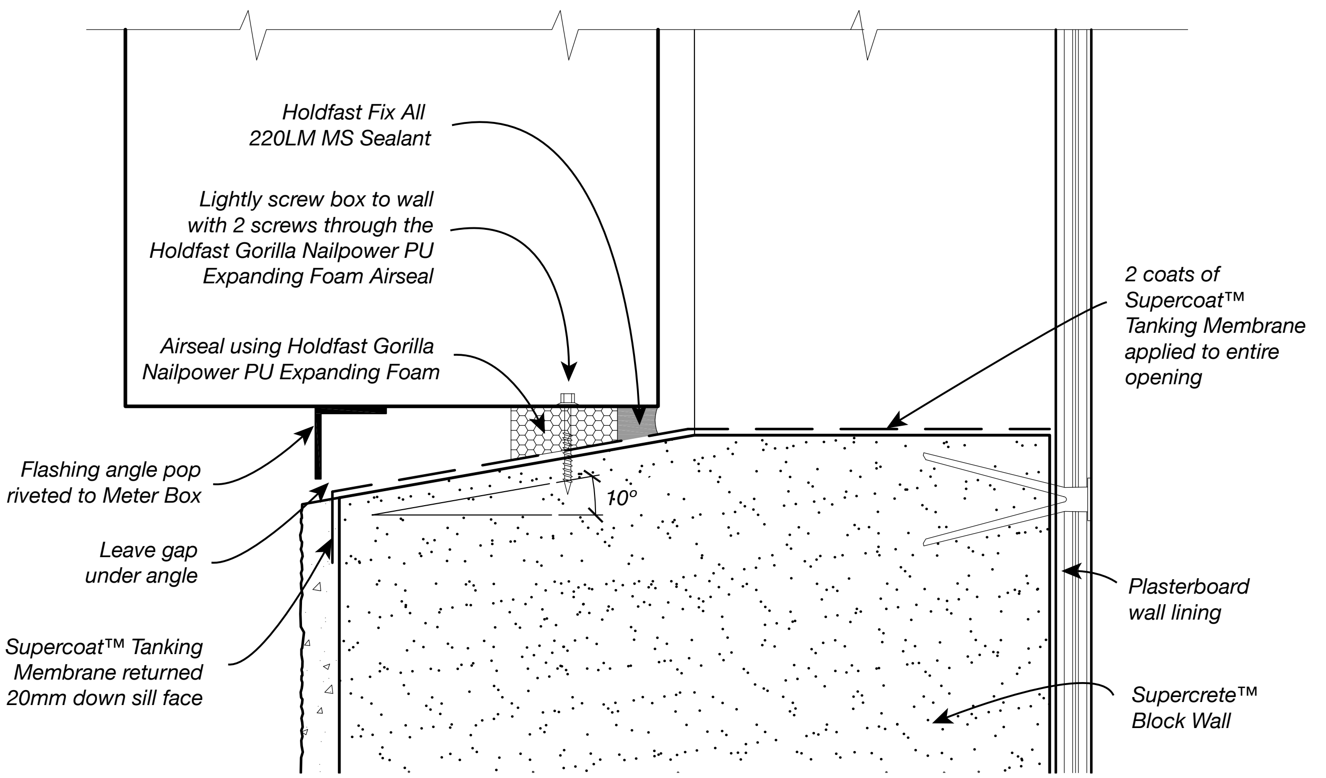
This requires some forethought and early involvement of electricians etc but can greatly reduce the time of installation. With this method, the 50mm drill used for the vertical rod cores is used so that the wires can be easily dropped down inside the wall when it is finished without draw wires. If these holes are centrally located in the wall, there is no need to encase them in conduit which is an additional cost saving. Note that the holes must continue through the bond beams and this is easily done by using a piece of 50mm pipe set in the top of the last bored hole before pouring the bond beam concrete.

Photo of conduit being installed in chases cut in wall after construction

Detail BLK 10.2 Typical Meterbox installation



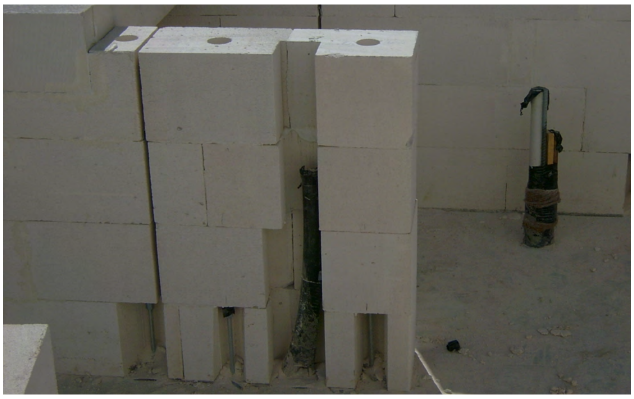
Section at Head
Jamb section similar



8.10 Plumbing installation

The same rules for chase size apply to the installation of plumbing pipes. Larger pipes such as waste pipes and sewage pipes may be too large to allow in wall installation when the one third thickness rule for chases is adhered to.

There are some ways around this, particularly for running pipes vertically in the wall. However, these should only be considered in consultation with the project engineer to ensure the strength and/or bracing capacity of the wall is not compromised. This must be done if it is desired that the pipe be run in the wall through the line of a bond beam. Large waste pipes up to half the block thickness in diameter may be installed adjacent to a movement control joint buy cutting a U shape in the blocks on one side of the control joint similar to encasing a steel column. Refer to detail **BLK 10.3** on page 24 of this Design Guide or it can be found at www.superbuild.co.nz.



Picture demonstrating the U shape recessed into the wall with plumbing pipe

The vertical rod adjacent to the control joint in this case would be moved along the wall away from the control joint just enough to clear the pipe. These pipes need to be installed as the block walls are laid.

Pipes up to one third of the wall width in diameter may be installed centrally in a wall using holes through the block that are bored as the blocks are laid. Holdfast Gorilla Nailpower FLEXI Expanding Foam is not necessary for these pipes.

In some cases it may be necessary to provide framed service ducts, or false walls, particularly between floors in multi storey construction. As with all types of construction, the designer should consider the options and possible problems of locating services, while undertaking all phases of the design process from preliminary drawings right through to final construction drawings. As with electrical construction, it is often easier to install a timber backing board for services (e.g. taps, shower valves etc), rather than fix the fitting direct to the Supercrete™ as many fittings have insufficiently sized screw holes for the larger expansive fittings required for direct fixing to Supercrete™ Block. In all cases, the installation of plumbing services must comply with the relevant NZ codes.

8.11 Arches

Supercrete™ Block construction, as with all masonry construction, lends itself to the construction of arched lintels and beams.

Arches can be built up in the traditional manor using wedge shaped blocks circumferentially around the curved part of the opening. This type of construction is self supporting and does not need any additional support, although low flat arches should be specifically designed. Alternatively, a shaped formwork can be used to support blocks cut around the arch that are still laid in the same courses as adjacent blocks. In this type of construction, a poured in-situ lintel is installed as soon as the block laying reaches the top of the arch. This takes the upper loads and the arched blocks under it are held in place by the adhesive. Alternatively, with an arched formwork again in place, the arch can be made up by laying 50mm blocks transversely around the curve, and then 50mm facing blocks built up on each side to form a permanent formwork for a poured concrete arch. Any of these methods will provide effective construction for an arch integral with the wall.

8.12 Balustrades

Balustrades around decks or on the side of stairs can be formed by continuing block walls from below up to the required level. All should be finished off with a bond beam that is capped with a 50mm facing block. Note that if a handrail is required on top of the balustrade, this should be fastened into the side of the wall and not to the top as this would be contrary to the NZ Building Code. The top of all exterior balustrades must be tanked using the Supercoat™ Tanking Membrane System.

8.13 Walls between openings

When determining the size and position of openings, the designer should be aware of the structural requirements to enable lintel seatings and movement control joints to be correctly positioned. In an ideal world, the minimum distance between two openings should be 1200mm or two block lengths, to allow each lintel to be seated on a full length block. If a movement control joint is required between the two openings, then this is the realistic minimum. If a movement joint is not required, then the minimum distance between two openings can be reduced to 600mm or a single block length, or the sum of the lintel bearing distances given in Page 13, Table 8 of this Design Guide for both lintels. Often in designs, a client will want an entire wall of a structure to be window where it faces a particular view, or is adjoined by an outdoor area. Such walls are very difficult to brace properly, not only to achieve sufficient capacity, but also to comply with code requirements of bracing wall location. Extra effort on the part of the designer is required in these cases to ensure that there is at least one section of blank wall that can be used for bracing so that the complete bracing does not have to be provided by a roof diaphragm.

8.14 Sloping lintels

Where end gable walls with sloping ceilings have windows that follow the roof line, sloping lintels are required. Often, height limitations require these lintels to be cast integral with the bond beam. The upper support can be left as is and supported on an angled Supercrete™ Block cut to suit.

8.15 Retaining walls/basement walls

Supercrete™ Block construction is not suitable for retaining walls.

It is better to use higher strength traditional core filled masonry construction for retaining walls. The Supercrete™ Block construction can then be started from the top of the retaining walls. Note that this Supercrete™ construction should start with a slip joint, the same as if starting from a concrete floor slab.

8.16 Exposed rafters/open ceilings

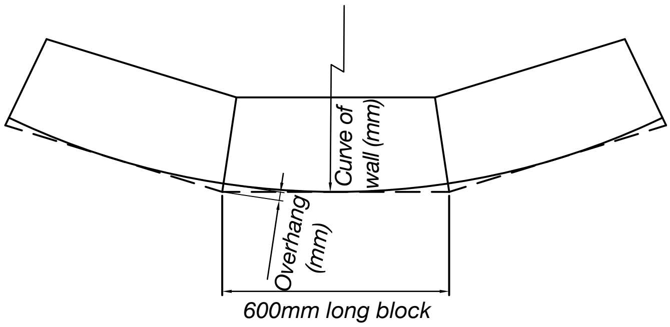
Where an open roof is incorporated in the design so that the ceiling is parallel with the rafters, the top of the support walls for the roof have additional horizontal loads applied to them from the raking rafters. A raking rafter requires both a horizontal and vertical support as it is in effect a simplified arch. In this situation, there are no ceiling diaphragms to adequately resist these horizontal loads.

The top bond beam must therefore act as a horizontal beam and designed specifically as one. This can however be avoided if there is an adjoining room or roof area which does have a diaphragm at the rafter support level.

Buttress walls can also be used on the rafter support walls to reduce the longitudinal steel in the bond beam. Note that collar ties on the rafters can also be used to reduce the outward horizontal load from the rafters, but these are only effective if placed at, or very close to the rafter springing.

8.17 Curved Walls

Supercrete™ Block construction lends itself to curved walls, more than traditional core filled masonry. In larger radii walls, the ends of the blocks are simply cut to the correct angle and the wall constructed as a series of short arcs. The high points are then sanded off the convex surface and the wall rendered smooth. On tighter radius walls, blocks can either be cut in half lengthwise to reduce the versine per block, or the blocks bevelled longitudinally and laid as a 600mm high course. The overhang of blocks for varying radii walls and standard 600mm long blocks is given in Table 11 below.



Plan view of curved wall showing location of overhang in table

Table 11. Curved Walls

Wall Radius (m)	2	3	4	5	6	7	8
Maximum Overhang (mm)	22.4	15	11.2	9	7.5	6.4	5.6

9.0 Observations during construction inspections

The following notes are some of the more important items that should be specifically checked when on site, to ensure that construction is being carried out in accordance with this design guide.

- Ensure that vertical rod locations and movement control joint locations are as specified and that floor joints or saw cuts are coincident with wall joints. Confirm that all movement control joints and openings have a vertical rod located on each side.
- The Supercoat™ AAC Superbond Adhesive should be mixed on site in accordance with the instructions on the Technical Data Sheet (TDS).
- The blocks being laid should be dry.
- The blocks at the top of the previous course should be protected from rain and dew to ensure they are kept dry.
- Block laying should not be done if there is a possibility of the temperature exceeding the range of 5°C to 30°C. The minimum operating air temperature of the Supercoat™ AAC Superbond Adhesive is 5˚C, it is important to ensure that the temperature does not drop below this during the entire curing process. The maximum operating air temperature is 30˚C in which the same rules apply.
- Sufficient adhesive should be applied so that it squeezes out of the joint as the block is placed. Excess adhesive is then trowelled off the wall surface, this ensures that you have achieved a full depth adhesive joint.
- Walls should have excess adhesive sanded off using a sanding float before it has fully hardened, this is best done at the end of the day or the following morning, depending on temperature. If the Supercoat™ AAC Superbond is left too long it can become difficult to remove without taking the surrounding block with it.
- If construction is being undertaken in areas of high wind or possible high wind, walls should be temporarily braced laterally until grout cores are filled. This should be included in the specification.
- Ensure that the concrete foundation base course is sitting on a layer of DPC and that on external walls, the 10mm gap between the rear (inside) face of the block and the edge of the rebate, is not filled with adhesive, this could potentially lock up the slip layer.
- Ensure that control joint ties are placed with the crimp facing upward, and that the crimped section within the actual joint does not get filled with surplus adhesive or dust.
- Ensure that rod cores are grouted before pouring of bond beams.
- Ensure that lintels have correct bearing length and are supported by full length blocks.
- Make sure that end faces of blocks are adequately glued – under no circumstances should you be able to see daylight in the vertical joints.
- Upper floors constructed using Supercrete™ Structural Floor Panels should not have concentrated loads placed on them during construction e.g. pallets of blocks. Supercrete™ Block ready for laying should only be one block deep over the floors surface.
- Ensure that bond beam types are as specified in the drawings, in the correct course, (particularly important where stringers and support beams are to be bolted to walls) and have the correct steel, and that all poured in-situ lintels have shear steel.
- Ensure that bond beams have a 10mm gap at movement control joints, and that the horizontal reinforcing on one side of the joint is sleeved or taped to allow longitudinal movement.
- Ensure that timber plates bolted to the top of walls have a 10mm gap at movement control joints.
- Steel columns encased within Supercrete™ Block walls have sliding control joint ties fastening them to the Supercrete™ Block.

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