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March 2009

# MASONRY HOMES CONSTRUCTION MANUAL





## TIMELESS ELEGANCE , TODAY'S TECHNOLOGY

### The look that only solid masonry can deliver...

Masonry homes provide New Zealanders with the age old benefits of solid masonry construction, along with the strength, simplicity and good looks of a modern building method.

Many building technologies try to imitate the solid good looks of masonry construction. Firth masonry provides the components that deliver the real thing - from solid walls, to a range of interior and exterior finishes to suit every taste. Firth masonry products will provide enduring quality and looks for a masonry home, all for not much more than you would pay for a home built using a lightweight imitation system.

### Cool in Summer, warm in Winter...

With Firth HotBloc®, the thermal mass of the unit is in the interior of the house wall. This effectively stores heat from solar and off peak heating/cooling applications. Heat from solar gains can be absorbed by the walls without great changes in the interior temperature. When the gains stop, the warm walls conduct heat back to the interior air to make up for the losses, to the outside. The more mass, the more heat storage and the longer the indoor temperature can be maintained. In summer the reverse happens. The masonry is cooled by the night time temperatures and then as the outside temperature increases, the inside temperature is maintained by "giving off coolness" (absorbing the heat).

### Safer, healthier homes...

Naturally solid masonry homes are completely fire resistant and they are also healthier. One of the problems with "well sealed" light timber frame houses that rely on keeping heated or cooled air inside, is the condensation that builds up from cooking, showering, even breathing – the major benefit with masonry construction is that it is durable and will not rot. Because comfort temperatures are achieved through radiant heat from masonry walls, Firth masonry can provide homes with better ventilation. This means that the low humidity environment possible in a masonry home can lead to a lower number of dust mites and consequently reduce the incidence of asthma.

### Tranquility and peace...

The same high density makes masonry homes comfortable to live in makes it quiet and peaceful inside. A masonry home is inherently quiet. Its thick solid walls provide superior built-in sound insulation, without the expense and effort of additional soundproofing often needed by timber framed walls.

### Finishing touches...

In conjunction with the range of low maintenance landscaping products available from Firth, you can complete the picture with coloured concrete, exposed aggregate driveways, pavers and retaining wall options to suit every home style.



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## SECTION 1 - PLANNING AND DESIGN CONSIDERATIONS

### 1.1 Structural Masonry Homes

Masonry homes can be some of the most stunning and comfortable houses on the market, but as with any building they require careful planning before construction begins. While it is possible to alter once construction has started, it usually is more difficult than with traditional timber frame construction.

### 1.2 Design Considerations & Scope of this Manual

This document is intended as a **guide only** to assist Architects, Designers and Engineers who are appropriately experienced and qualified, in the design of concrete masonry residential buildings.

Architects, Designers, Engineers and Builders should be familiar with and make reference to NZS 4229:1999 "Concrete Masonry Buildings Not Requiring Specific Engineering Design" in conjunction with their use of this Manual. The Architect, Designer and Builder should also be familiar with the principles for dealing with external moisture under Compliance Document E2/AS1 issued by the Department of Building & Housing for timber frame structures. Though this does not apply directly to concrete masonry structures, similar principles are employed. Details for guidance in applying these principles to masonry construction can be found in two publications:

- Concrete Masonry - a guide to weathertight construction, available for free download from the NZ Concrete Masonry Associations website [www.nzcma.org.nz](http://www.nzcma.org.nz)
- Weathertight Solutions Volume 4- Masonry, details for junctions and openings in masonry walls. Available from BRANZ.

In all cases the Architect or Designer should provide sufficient detailing within the Plans to be submitted for Building Consent, so that sound structural and weathertight construction details are unambiguous to both Territorial Authorities and the Builder.

This document is also intended as a guide for Builders and Masons constructing structural blockwork for masonry homes. It is to be used in conjunction with NZS 4229:1999 "Concrete Masonry Buildings Not Requiring Specific Engineering Design" and NZS 4210:2001 "Masonry Construction Materials and Workmanship". Persons engaged in the construction of structural masonry homes should ensure that they comply with the requirements of Clause 1.5 "Workmanship" of NZS 4210:2001.

The Builder should ensure that copies of NZS 4229:1999 and NZS 4210:2001 are available for ready reference on site.

### 1.3 Geotechnical Report

A geotechnical report on the site is very good insurance for the future and is strongly recommended prior to construction. It would provide information about the site and the support capabilities of the ground.

### 1.4 Insulation of Masonry

Concrete masonry has inherent thermal storage properties making it the ideal construction material for 'comfort'. However, by itself, it does not have the required insulation to comply with the New Zealand Building Code (Clause H1).

Firth HotBloc®, shown below, being the premium Concrete Masonry Unit (CMU) on the market, provides the simplest means of compliance as the insulation is

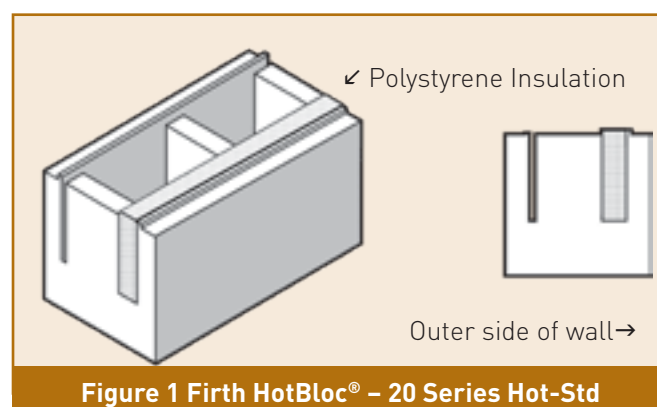


Figure 1 Firth HotBloc® – 20 Series Hot-Std

built in. It affords the structural strength of standard masonry (see 1.5 Engineering below) as well as providing options to exceed the R-values stipulated in the Building Code for solid construction, refer section 1.6.

Other methods involve adding insulation to the outer surfaces of the wall (where it can be easily damaged) or to the interior of the wall (reducing the thermal storage benefits).

To make the most of the thermal properties of masonry and concrete, contact the Cement and Concrete Association to obtain a copy of their booklet "Designing Comfortable Homes".

### 1.5 Engineering

NZS 4229:1999 "Concrete Masonry Buildings not Requiring Specific Engineering Design" covers the non-specific design of residential masonry buildings. (This is the masonry equivalent of NZS 3604:1999 "Timber Framed Buildings".) This Standard details the bracing requirements, lintel sizes, footing widths etc. and should cover most simple buildings.

Occasionally there will be areas of the house that fall outside the Standard and a structural engineer will be required. This does not necessarily mean that the entire building must be engineer designed – simply the areas that fall outside the scope of the Standard.

When designing a building in Firth Hotbloc®, it is important to consider the reduction in grout space caused by the presence of the internal polystyrene biscuit. The 20 Series Hotbloc® typically has a 30mm thick polystyrene biscuit, and the 25 Series approximately 80mm thick. When designing using the non specific design Standard NZS4229:1999, both the 20 and 25 Series Hotbloc® should be considered equivalent to a 15 Series block when considering bracing demand, bracing capacity, and reinforcement required.

### 1.6 “R” Values for Firth HotBloc® in Solid Walls as part of the Building External Envelope

The acceptable solution H1/AS1 of the Building Code clause H1- Energy efficiency, recognizes the benefits of thermal mass for solid masonry construction by allowing lower R-values than for non solid (timber frame) construction.

#### Schedule Method

Table 2(b) identifies the minimum R-values required if the schedule method is used. When using this table it is important to recognize the limitations to use the tables in particular the area of glazing. The new insulation requirements of H1 became effective from:

- 31st October 2007 for zone 3
- 30th June 2008 for zone 2
- 30th September 2008 for zone 1

#### Calculation Method

Lower R-values than are tabled in Table 2(b) of H1/AS1, can be, however, any reduction in R-value provided in one element must be compensated by an increase in another element. The process used to demonstrate equivalence is referred to as the “calculation method” and is described in section 3.2 of NZS4218. 20 Series Hotbloc® can only be used under the calculation method.

Post September 2008, the R-values required for masonry walls are:

- R0.8 for zone 1
- R1.0 for zone 2, however this can be reduced to R0.9 if R0.31 glazing is used.
- R1.2 for zone 3, however this can be reduced to R 1.0 if R0.31 glazing is used.

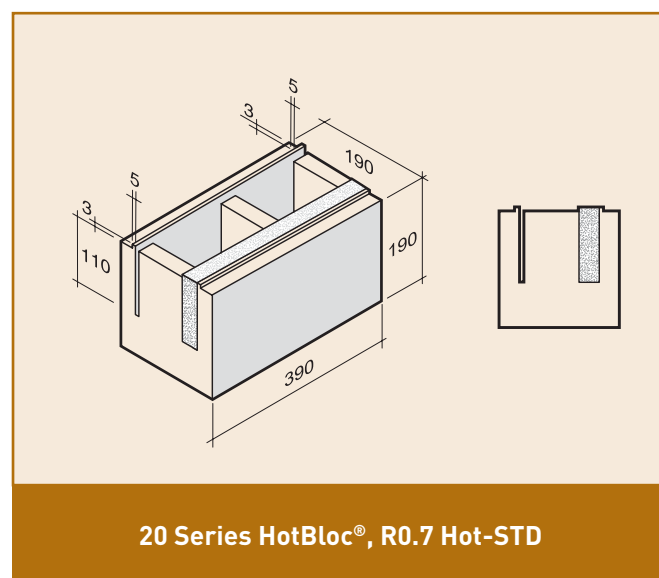
The R-values of various HotBloc® solutions are-

- R0.7 20 series HotBloc®, fully filled,
- R1.16 25 series HotBloc®, fully filled,
- R1.2 25 series HotBloc®, fully filled and interior lined with glue fixed gib board.

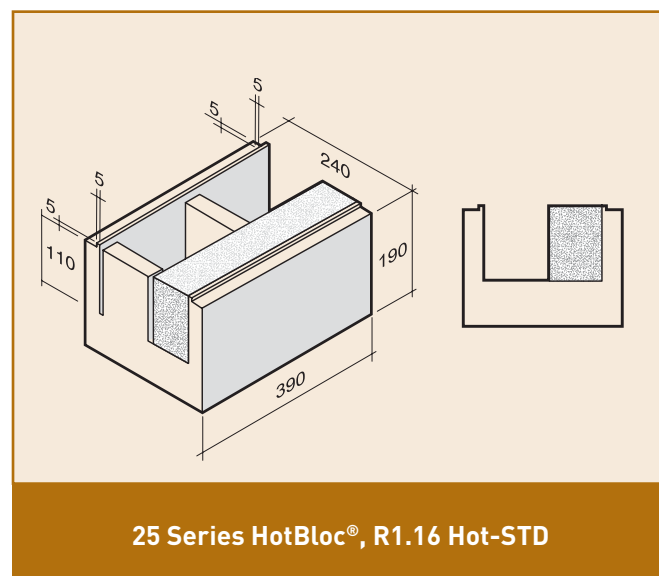
Importantly the R-values are obtained without the use of surface insulation, a unique feature to structural masonry homes built with Firth HotBloc®.

### 1.7 Specification of Firth HotBloc® in Structural Design to comply with NZS 4229:1999 and NZS 4230:2004

Architects, designers and engineers may design to the requirements of NZS 4229:1999 or NZS 4230:2004 “Design of Reinforced Masonry Structures”, where Firth HotBloc® is substituted for a conventional block within the limitations of clause 1.5.



Structural equivalent = 15 series



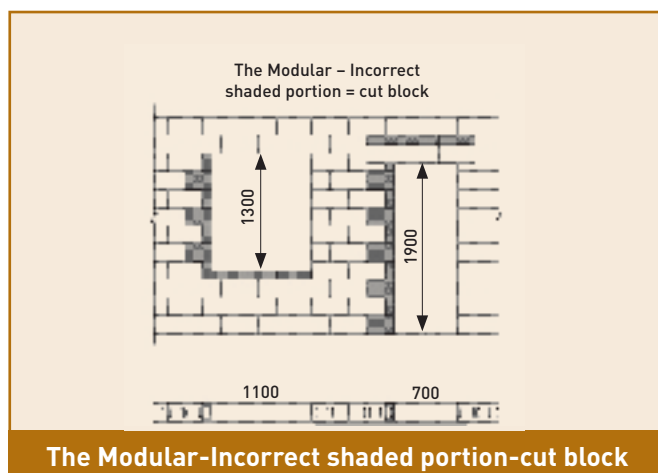
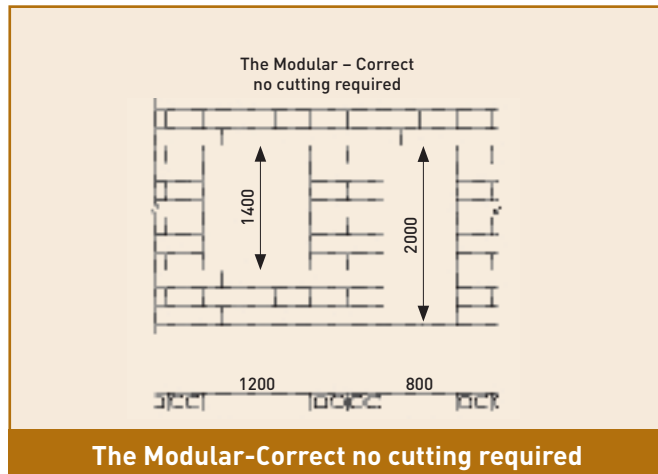
Structural equivalent = 15 series

## 1.8 Modular Layout

Designing wall dimensions to equal a multiple of the Concrete Masonry Unit (CMU) being used saves time and money by eliminating cutting. It also adds predictability and discipline to both design and construction. As such, dimensioning the design to fit the module is recommended. The critical dimensions are wall height, wall length, opening size and opening position.

The standard CMU is 390mm long, and 190mm high with an allowance for a 10mm mortar joint on each dimension (i.e. 400mm long, and 200mm high). When using a standard HotBloc® a module of 400mm long by 200mm high is normally adopted. Where necessary, a half block (190mm long) will be inserted to meet a specific length requirement. An example would be to make wall lengths 1200mm rather than 1189mm, as would be common in timber frame construction. Off-module dimensions require the blocklayer to cut the blocks, increasing costs. See the diagram below for an explanation of the importance of keeping the design to a modular layout.

Just as important is ensuring that the lintels and bond beams are only 190mm or 390mm deep. This eases construction and therefore keeps costs down.



## 1.9 Services

Typically services are placed in ducts in the cores of the masonry blocks. It is very difficult to do this after the walls are filled with blockfill, and as such, the locations for services need to be finalised before construction begins. This rule is relaxed where the masonry walls are to be strapped and lined with GIB® plasterboard as the services can be placed within the resulting cavity at any stage after filling with blockfill.

Another approach for solid filled walls is to leave a vertical core empty in order to place services within the wall. The bracing panels will be affected in this area so this needs to be decided upon before the bracing calculations are completed.

When using a suspended concrete floor in two-storey construction, a false ceiling can be taken advantage of to allow services to be carried within this space. It also makes sense to position the upper service room over the lower one to reduce the distance services are required to travel through the building.

### 1.10 Suspended Concrete Floors

The most common types of residential suspended concrete flooring systems are suitable up to 8m spans. However, this shouldn't limit the design of the building as there are commercial flooring systems that will easily span 15m or more if necessary. These can be up to 300mm - 400mm thick and typically require an increase in wall reinforcement and footing requirements.



All suspended concrete floor types need to be supported at the ends of the individual spans by a concrete masonry wall. Timber should never be used to support these floors.

### **1.11 Internal Walls**

Masonry homes do not need every internal wall to be masonry. It is common to only use masonry where necessary due to bracing or other structural requirements (such as supporting the concrete midfloor). Options for internal walls are 15 Series Masonry Units or timber partition walls, this choice maybe influenced by the desired finish required.

### **1.12 Openings**

Masonry lintels consist of a reinforcing cage within a masonry shell (usually 190mm or 390mm deep). These can span relatively large distances. For most situations, masonry lintels will suffice and the tables in NZS 4229:1999 detail the reinforcing requirements. However, where the lintel falls outside the scope of that Standard, (i.e. the load acting on the lintel being too great for the particular span), the lintel can be constructed from cast insitu reinforced concrete or with a precast beam such as Interspan. Both of these types will require specific engineering design.

## SECTION 2 - FOOTINGS AND FOUNDATIONS

### 2.1 Conventional footings

Conventional footings consist either of strip (or ring) footings or edge-thickened slab. Strip footings are made up of a small masonry wall (typically one or two courses) supported on a footing strip in an excavated trench. This footing strip can vary in width upward from 300mm depending on the design of the house. Edge thickened slabs combine the footing strip and slab into one without the need for a masonry footing wall. The edges of the concrete floor slab are thickened to support the building walls. Both types of footings require excavation and are therefore weather dependent.

Following completion of the excavation of the footings trench or trenches, the reinforcement steel needs to be placed in accordance with the job drawings. The stirrups are then tied to the main bars. NZS 3604 sets out the minimum cover requirements for steel in various scenarios.

When the concrete is poured for the footings, it is very critical that the concrete is placed in such a manner to avoid segregation (separation) of the concrete or changes to the location of the reinforcement. For construction details refer to Section 14.

### 2.2 RibRaft®

This system combines the footing and concrete floor into one and is one of New Zealand's most effective residential and light commercial flooring solutions.

The RibRaft® Manual can be obtained from Firth through Firth Information Service on 0800 800 576 or through [www.firth.co.nz](http://www.firth.co.nz). This document covers not only the non-

specific design details, but also contains details that will assist a designer in carrying out a specific design of a RibRaft® floor.

A basic overview and step-by-step construction guide is provided in the Firth RibRaft® Flooring Solutions brochure. For an in-depth explanation of the non-specific construction and design issues associated with RibRaft® construction see the RibRaft® Manual.

The RibRaft® system is most economic on flat sites but there is also a range of details available to allow RibRaft® to be used on a sloping site. The use of these alternative details require specific design.

The non-specific design consists of an 85mm thick top slab supported by a grid of ribs normally 100mm wide at a maximum spacing of 1200mm x 1200mm centres. The overall depth is 305mm. Edge beams and ribs under loadbearing walls are 300mm wide to provide for the extra load carried by these members. Construction is directly on levelled ground covered with a DPM (damp proof membrane).

Polystyrene waffle pods 1100mm square and 220mm thick are placed directly on levelled ground. These are arranged in such a way that a reinforced concrete floor slab with a grid of reinforced concrete ribs and edge beams is formed when concrete is placed onto them. Pods may be cut to suit specific layout architecture and also to accommodate services.



## SECTION 3 - WALL INSTALLATION

### 3.1 Starter Bars

Starter bars are the steel reinforcing bars that connect the masonry wall to the floor. The number of bars and their location is defined by the construction drawings or NZS 4229:1999. The starter bars should be central to the grouted cavity. When using HotBloc® consideration must be made of the polystyrene thickness. It is important to confirm that the starter bars are in the correct location before pouring the concrete and then again once the concrete has been placed, but before the concrete sets. This allows any bars that were moved during the concrete placing to be corrected. If the bars are not located accurately then they will not fit correctly into the block cores which then would affect the structural performance of the wall. Unless specifically instructed by the Architect or Engineer, it is not acceptable to crank the bars on site to their correct alignment.

For internal walls, correction of a bar location is a simple process of grinding the bar off flush with the slab then drilling and epoxying a starter bar in the correct location. An engineer should be involved to ensure that the procedure is undertaken correctly.

### 3.2 First Course

#### *Laying Surface*

Surfaces for the blocks to be laid upon must be level, clean but slightly rough. This roughness is necessary to create a good bond between the mortar and base. Usually the finish achieved with a wood float is adequate. It is uncommon but if the floor is finished too smooth, roughness can be achieved with a scabbling gun (a compressed air gun with steel "fingers") to chip the surface of the concrete. Once an adequate surface has been prepared the first course of blocks can be laid. It is common for a bond beam block to be inverted and placed at the site of the starter bars for the first course to allow easy construction of the washouts.

#### *HotBloc®*

HotBloc® with its integral insulation is installed virtually the same as a traditional CMU's. The only difference is that the polystyrene biscuit is to be placed towards the outside face of the wall and the position of the starter bars needs to be modified to ensure they are central in the grouted cavity.

#### *Mortar*

Laying the first course should be done ensuring all blocks are level. The first course mortar joint maybe up to 20mm to achieve levelling. All subsequent mortar joints shall be

10mm ± 3mm as per NZS 4210:2001.

All mortar either site mixed or premixed must meet a 28 day compressive strength of not less than 12.5MPa.

### 3.3 Running Bond

The CMU's should be laid in straight uniform courses unless specified in the construction drawings. Running bond is the strongest type of laying configuration. This is where the blocks are offset horizontally by one half block from one course to the next. Other bond patterns are used to achieve particular aesthetics but unless specifically engineered, running bond should be used.

#### *Wall Reinforcement*

The reinforcement requirement for the wall is specified in NZS 4229:1999 or by Specific Design and is usually detailed in the construction drawings.

#### *Vertical Reinforcement*

The vertical bars need to be tied to the starter bars with at least 600mm lapping.

Note that where Firth HotBloc® is being laid then the vertical reinforcement must be placed central to the remaining grout space (the polystyrene biscuit will take up some space normally filled with grout in a conventional CMU) and not central to the overall block width.

#### *Horizontal Reinforcement*

The horizontal steel is placed in a course of knock-in bond beam or depressed web CMU's. To ensure correct placement within the wall cavity, the horizontal steel is then tied to the vertical steel.

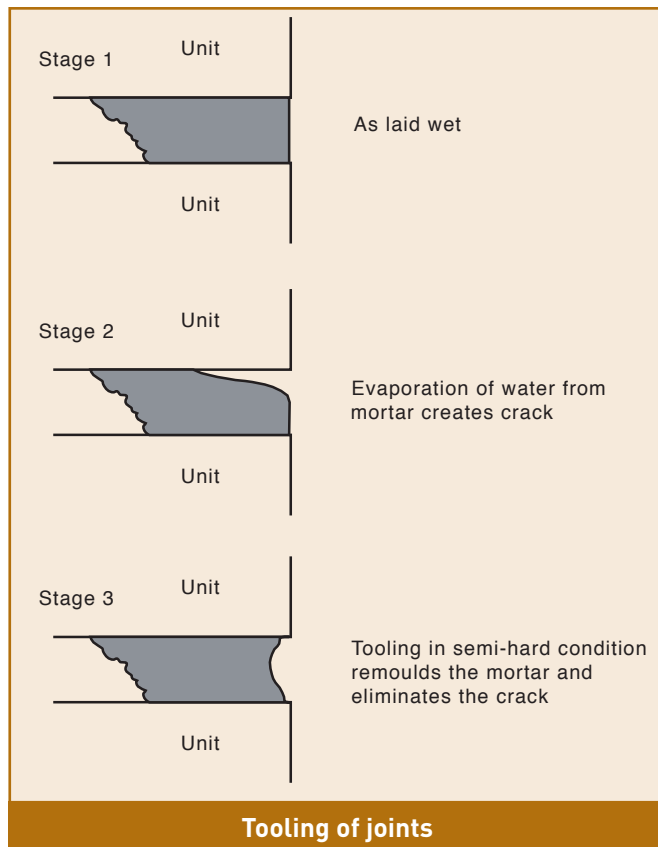
### 3.4 Tooling of Joints

Another aspect of masonry construction that is commonly overlooked (particularly when a plaster finish is required) is tooling of the mortar joints, this is when a special tool is used to compress mortar into the joint. Tooling is important as it contributes to the structural strength and water resistance properties of the wall.

Tooling to a depth of 6mm is allowable. The reconsolidation of the joint after the initial water loss is seen as being vital. When a plastered finish is to be applied, it is common to strike the mortar joint flush to make a smooth surface for the plasterer. The joint should still be tooled.

Often tooling is carried out too early. The mortar should be "thumb nail hard" before tooling. After tooling and when the mortar is sufficiently set, the work should be lightly brushed down with a soft bristle brush to remove

any particles of mortar sticking to the block face. Rubbing the face of the blockwork with a cut-off piece of masonry will also remove any overhang of mortar.



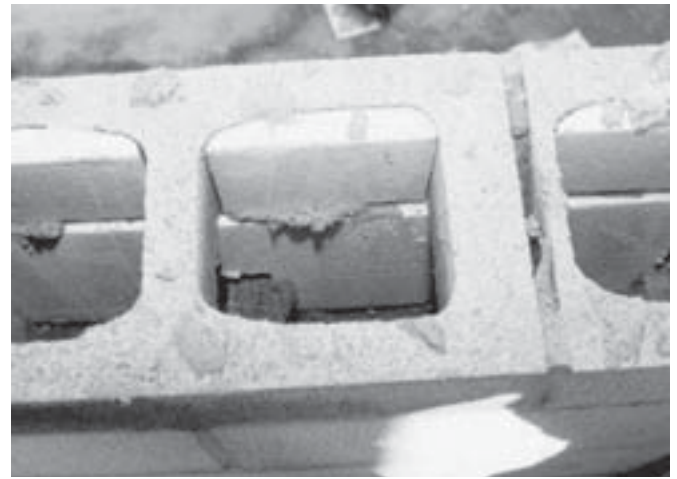
Sometimes tooling of the joints pushes mortar into the block cavity (see picture above, right). This either falls to the bottom or hangs on and causes an intrusion. The intrusions may partially block off the cavity and not allow the blockfill to reach the lower parts of the wall. This is very likely where horizontal steel is placed in the wall. As such the mortar intrusions must be removed while still workable.

Any mortar that has fallen to the bottom of the wall will interfere with the bond between the blockfill and starter bars and the blockfill and the base. For the wall to perform as designed the base must be clean.

### 3.5 Washouts/Cleanouts

To enable cleaning of all debris from the base of the wall, washouts or cleanouts are used. These are openings or inspection ports at least 100mm height x 75mm width cut into the face of blocks at the base of the vertical reinforcement bars. A common method is to use inverted bond beam blocks at these locations to allow simple removal of the face shell portions. Inspection of the steel and concrete junctions can also be made at these openings to confirm compliance with the relevant requirements.

Once inspections are complete, the washouts should be blocked off with formwork. A common method is to hold



the formwork in place with wire ties around the base of the vertical steel. This will allow the blockfill to finish flush with the outside face of the blocks. It is important to ensure that the formwork is braced adequately to prevent blow out under grout pressure. Often small gaps are left in the formwork at the washouts to allow the blockfill to flow out. These are to confirm that the blockfill has fully filled the wall and are plugged once confirmation has been made.

For exposed blockwork or architectural masonry, however, it is recommended to remove the entire face shell of a block rather than cut a section of the face. Following cleaning out and inspection, the face can then be mortared back in place and braced before blockfilling commences.

### 3.6 Bond beams and Lintels

#### Masonry

The two most common bond beams or masonry lintel types are either 190mm or 390mm deep. The 190mm deep version is simply one course of CMU's and most commonly only used as a bond beam below concrete mid-floors. The 390mm deep version is formed using two courses of knock-in bond beam or depressed web CMU's, with the top one inverted to create a larger cavity for the reinforcement steel. The steel is placed in before the top course is laid.

Where non-standard dimensions are required, it is usual to place other courses in between the two standard bond beam courses. This however, does affect the placement of the steel.

#### Reinforcement

The steel is formed into a cage made up of the top bar(s) and the bottom bar(s) separated by the stirrups (or links). The cage is placed and tied to the vertical steel where appropriate and the top bond beam course is laid.

For non-standard bond beams, the stirrups are tied to the bottom bar(s) and this is placed into the bottom bond

beam course. The intermediate bond beam courses are then laid, threading the stirrups through. Before the top course is laid, the top steel bar(s) are tied to the stirrups.

Where the lintel coincides with the bond beam, the two are simply combined. If the longitudinal steel requirement in the lintel exceeds that in the bond beam, then the steel in the bond beam at this location will be that required in the lintel and vice versa (the stirrup requirements are unchanged). In most single storey applications, the bond beam reinforcement exceeds that required in the lintels and the only difference is the spacing of the stirrups over the openings. (However it is crucial to check the job drawings for reinforcement requirements).

### *Temporary Supports*

Often it is necessary to support lintels with timber framing (props) until the blockfill has gained sufficient strength. Refer to the photograph above right.

### **3.7 Temporary bracing**

The need for temporary bracing of the masonry wall during construction is often overlooked (see photograph above). An unfilled wall is very susceptible to failure from strong winds. Typically walls over 1m in height are at



significant risk. It is important to take some measures to brace the wall in order to prevent its premature failure. Typically bracing at 3m centres is recommended in line on both sides of the wall.

Bracing may also be required to ensure that the pressure from the blockfilling operation does not alter the wall positions. This is particularly critical on tall narrow sections of walls. The blockfill procedure creates large hydrostatic pressures and where there is little blockwork to resist, it will force blocks to move, some-times even causing face shells of blocks to be blown out.

### **3.8 Consideration of Weather**

Generally masonry construction should not be carried out when the air temperature drops below 4°C, unless the following precautions are taken:

- (a) Water used for mixing mortar is heated.
- (b) Masonry is protected for not less than 24 hours after laying by covers, blankets, heated enclosures, or the like to ensure that the mortar can gain sufficient strength without freezing or harmful effect from cold winds.
- (c) No frozen materials nor materials containing ice shall be used.

When the air temperature rises above 27°C or there is a drying wind even when the temperature may be lower, it may be necessary to take some additional precautions:

- (a) Lightly dampening the CMU's before laying.
- (b) Keeping the mortar moist and not spreading it on the wall more than two unit lengths ahead of the units being placed.
- (c) Preventing both the mortar and the grout from drying out so rapidly that it cannot cure properly. This is most important during the first 24 hours.



## SECTION 4 - BLOCKFILL FOR GROUTING OF MASONRY

It is vital that a blockfill mix is used and not a standard concrete mix. The blockfill is far more fluid and will flow to all required parts of the wall, whereas the standard concrete mix is comparatively stiff. As the cores of the block are relatively small, the standard concrete mix is prone to blocking the cores and not filling the lower parts of the wall. Watering down of a standard concrete mix should never be done, as it reduces the concrete strength and increases the amount of shrinkage. Firth blockfill is designed to have the required strength and to flow easily into the cores to be filled. Grouting must always be carried out by a competent experienced professional.

### 4.1 Filling Options

There are two types of grouting that are in common design.

#### *Partial Filling*

This is where only the vertical cores containing reinforcement and the bond beam are filled with blockfill. All other cores are left empty. This is common where the weight of the wall is required to be kept to a minimum usually because of earthquake loads. This is the cheaper option in terms of materials as less concrete is used but is more difficult to achieve on site. There are many methods for blocking off the cores that are not to be filled. Two common methods are using the knock-in 'biscuits' from the bond beam units and laying them over the cores or using dampcourse laid across the hollow cores in order to prevent the blockfill entering them.

#### *Solid Filling*

This is where the whole wall is filled with blockfill, creating one solid mass. This is used where the design specified for horizontal steel other than in the bond beam (usually at half-height of the wall), or where the simplest construction approach is preferred. The hydrostatic pressures when solid filling a wall can be quite significant, and time should be allowed for the lower half of the wall to solidify slightly before filling the upper part of the wall. In the unlikely event of a fire, a solid filled wall will provide additional protection to the polystyrene in a HotBloc® unit.

### 4.2 Blockfilling Procedures

Once all the washouts have been blocked off and the required inspections made, the wall can be filled. A common practice is to lightly dampen the block cavities immediately prior to grouting. This is to ensure that the blockfill is not dried out by the blocks "sucking" out the water and therefore reducing its flowing ability. There are three procedures for grouting as detailed in NZS 4210:2001.

#### *4.2.1 High lift grouting with expansive admixture*

This allows pours up to 3.6m in height and uses an admixture to provide expansion after placement of the grout and before initial set occurs. The expansion compensates for water loss and plastic settlement. Grout is placed in the cells in a semi continuous operation allowing for consolidation as work proceeds.

#### *4.2.2 The low lift grouting method*

This is similar to the high lift with expansive admixture method but allows the blockfill to solidify fully before the next lift is placed. Maximum height of pour is 1.2m per lift. Again the blockfill should be mechanically vibrated into place.

#### *4.2.3 High lift with reduced compaction*

This is grouting the wall to a maximum height of 2.4m in a continuous pour, with thorough mechanical vibration during the pour.

### 4.3 Vibration of Blockfill

It is strongly recommended that all blockfill be placed in combination with mechanical vibration. Failing this, the walls should at least be rodded with a bar 16mm in diameter or greater to ensure the blockfill has reached all parts of the wall (see photograph below). Where services have been installed in the wall, it is critical to ensure blockfill has made it past these intrusions.

### 4.4 Filling Under Windows

A simple method for ensuring that the blockfill gets into the required cores under window openings is to leave out one or more sill blocks. The pump operator can then grout from the sill and once complete, the sill blocks can be mortared back into place.





## SECTION 5 - CONTROL JOINTS

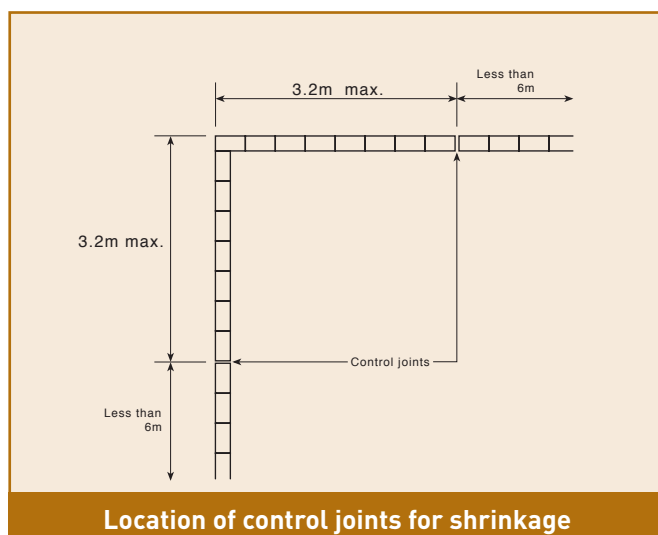
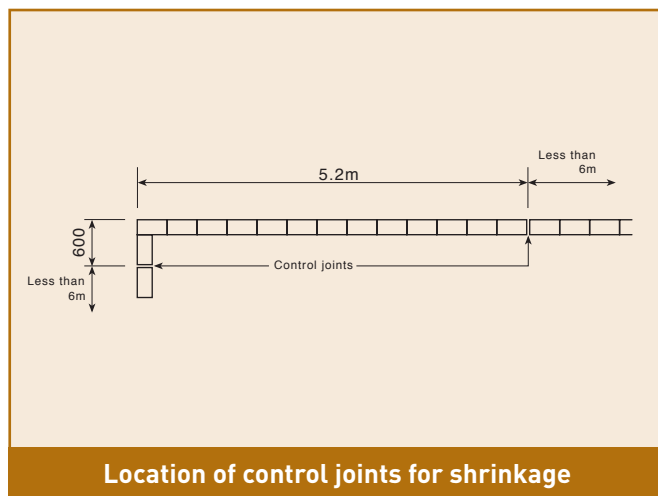
Concrete masonry in common with other building materials, is subject to movements caused by changes in moisture content and temperature. Since masonry will have a high moisture content initially, it loses moisture with time and consequently shrinks. It is usual to include shrinkage control joints in the design of the concrete masonry.

### 5.1 Location of Joints

The spacing of control joints is specified as a maximum of 6m in NZS 4229:1999 unless specific design for shrinkage has been undertaken. The location of control joints is influenced by:

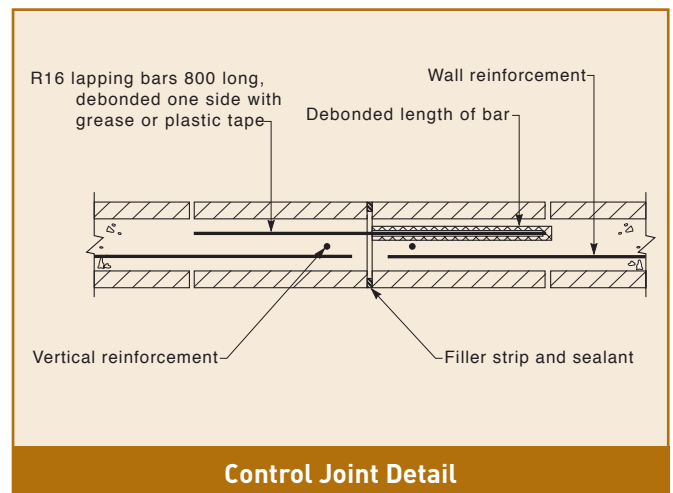
- (a) Major changes in wall height
- (b) Changes in wall thickness
- (c) Wall intersections
- (d) Opening locations.

The diagrams below are taken from NZS 4229:1999



### 5.2 Reinforcement through Control Joints

Reinforcement in lintels and bond beams shall continue through the control joints but all other horizontal reinforcement shall be discontinuous at the control joints. The detail below is as per NZS 4229:1999. This ensures that any movement in the wall will not be restricted by the reinforcement.



### 5.3 Sealing of Control Joints

Control joints will always undergo some movement and therefore it is necessary on exterior walls to form a suitable detail to allow for the sealing of the control joint against weather penetration. The weatherproof coating will also need particular care over the control joint to ensure that the expected movement is tolerated.

**Note that reputable plaster-coating systems manufacturers will have a proprietary solution for the sealing of control joints. It is important to follow the complete detail of your selected manufacturers plaster and coating system.**

## SECTION 6 - SUSPENDED CONCRETE FLOORS

Suspended concrete floors differ from timber floors in many ways. They are quieter, stronger, provide greater fire protection, and where large spans are required or where supporting walls are retaining fill, are usually cheaper. Most builders are impressed with the speed of installation of a suspended concrete flooring system.

### 6.1 Types of Concrete Floors

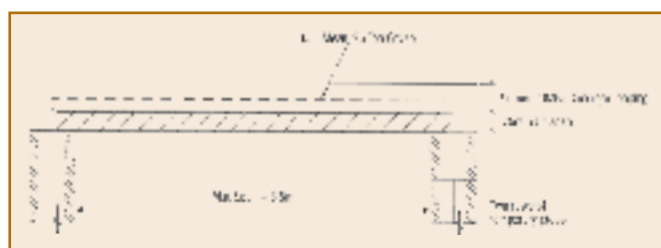
There are two types of suspended concrete floors. One being precast and the other being steel "tray". Both of these are placed on the supporting walls and a topping slab of concrete is then poured. This manual will focus on precast flooring systems, as they are more common. For information on the tray type of system, contact Dimond Industries. The main types of precast flooring systems used in a structural masonry system are Flat Slabs, or Rib and Infill systems. They can accommodate clear spans of up to approximately 8m. Manufacturers can provide an engineering service as part of the supply of these units. If there are any technical questions about these floors, contact your nearest manufacturer or [www.precastnz.org.nz](http://www.precastnz.org.nz)

The precast concrete floors are connected to walls by starter bars extending from the wall, and cast into the topping concrete. The flooring units should only be placed after the Blockfill has been poured and allowed to set.

### 6.2 Flooring Systems

Both these flooring systems below are designed to be composite floors made up of prestressed concrete panels/beams with a concrete topping poured on site. The units are available in lengths to suit the project design and must be placed as per the construction drawings prepared by the supplier. The units are uniquely identified for this purpose.

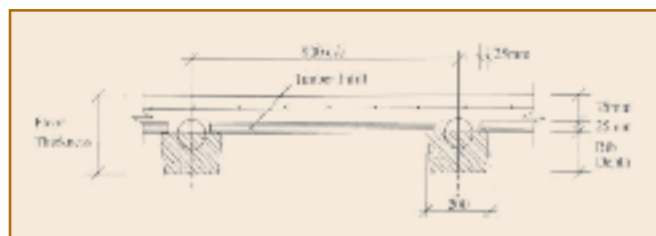
These systems are also designed to span between supporting walls. As such, the units are deliberately made discontinuous over concrete walls. The topping is continuous across the entire floor. Timber walls should not be load bearing under concrete suspended floors and should never be used to support either of these flooring systems.



Section of Prestressed Concrete Propped Floor

### 6.3 Prestressed Flat Slab Flooring System

Prestressed Flat Slabs come as 240mm or 1200mm wide and 75mm thick (other widths are possible if required). The topping depth varies from 75mm – 130mm. Props as required on the suppliers drawing must be in place before the slabs are placed.



Section of Beam Infill Floor

### 6.4 Rib and Infill Flooring System

The Rib and Infill system comes as a series of beams 200mm wide by 100mm (usually) placed at 800mm centres. Timber planks are placed between the beams to act as permanent formwork for the concrete topping. Props as required on the suppliers drawing must be in place before the 200mm wide ribs are placed.

### 6.5 Construction Considerations

Concrete floor units are heavy, so suitable lifting equipment will be required, in the form of a crane or a Hiab. Site access is a consideration, the further away from the building the crane has to park, the larger it has to be. However, in most residential situations the sites can be serviced with a Hiab.

### 6.6 Placing the Units

It is important to place the flooring units as required by the precast manufacturers drawings. Seating on blockwork is important. Too much seating on one end will mean not enough at the other, causing an overload of the supporting walls in compression. A good way to allow easy movement of the units once in place is to use a plastic bearing strip. This allows the units to be located accurately before the topping is poured, as the units can be shifted on the plastic instead of damaging the blockwork and/or units themselves. Once the topping is poured everything is locked in place.





It is important to locate the units next to each other in the manner detailed in the construction drawings. Flat Slabs should be butted hard against each other so there is no gap between units. This will minimise concrete leakage when the topping is poured. Rib units have a small amount of tolerance because of the timber infill planks. However, these timber planks require close alignment to minimise concrete leakage.

### 6.7 Temporary Propping

Before erecting, props must be installed at the positions and precamber levels as shown in the manufacturers drawings. The props must be levelled to an accuracy of  $\pm 3\text{mm}$ , must be adequate to safely carry the construction loads with out settlement and must be well braced in each direction. The photograph below shows timber props. These must be designed with suitable top and bottom bearing plates and bracing.

The props may be removed once the concrete topping has reached a compressive strength of 15MPa. This is usually around two weeks. An initial settlement may occur once the props are removed. The amount of initial and long term settlement depends on the overall depth and span of the floor system. The manufacturer can advise what this long term deflection can be.



### 6.8 Concrete Topping

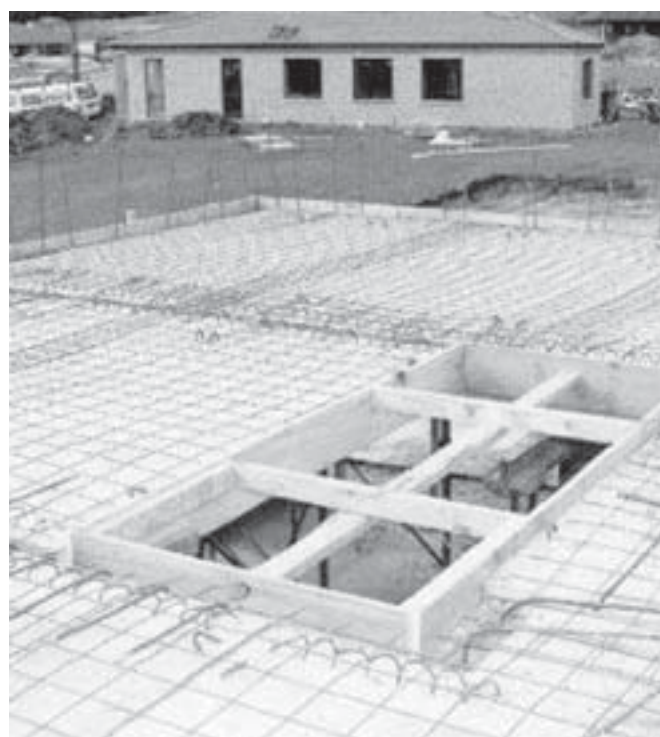
These flooring systems derive a large portion of their spanning capabilities from the concrete topping. This topping varies in thickness from 70mm to 130mm. Until this topping has gained sufficient strength (14 – 28 days after pouring) some propping will be necessary. Refer to the construction drawings prepared by the precast manufacturer, for the location of the propping.

The perimeter boxing can be placed once the units are located accurately. This can be set to a height so that it can be used as screed railing. It is essential to cure the topping correctly to ensure it reaches the required strength. Insufficient curing of the floor may result in greater deflections than designed for.

### 6.9 Topping Reinforcement

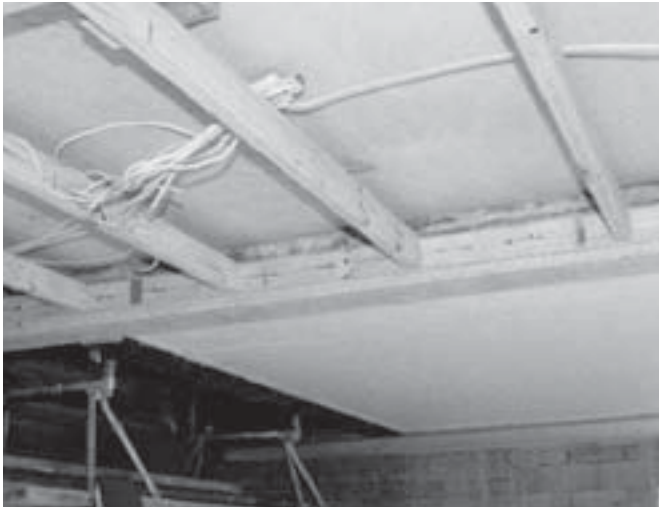
The flooring units are cast with pretensioning reinforcing strands. The reinforcement requirements in the topping will be detailed on the precast manufacturers drawings, as will any extra bars for cantilevered balconies etc. It is important that the reinforcement mesh is supported on mesh chairs to ensure correct location within the topping. Any supplementary reinforcement should be tied to the mesh either under or on top, depending on the thickness of the topping.

The reinforcement from the lower storey wall needs to be tied into the topping. For walls that are supporting units on both sides, the starter bars should bend alternate directions. Refer to the photograph below.



### 6.10 Services

It is possible to place services in the topping. Usually this is limited to 40mm diameter waste pipes. A thicker topping to accommodate the pipes will normally be used (up to 20mm thicker).



### 6.11 Penetrations in the Floor

When penetrations are required in the floor due to services, the precast manufacturer must be informed before the units are made, this ensures that the pretensioning strands are unaffected. It is not recommended that the units are cut on site unless specifically instructed by the precast manufacturer.



### 6.12 Balconies

It is beyond the scope of this document to provide detailing for balconies.

Balconies are to be specifically designed by the precast floor manufacturer and engineer.

### 6.13 Waterproofing

Any suspended floor exposed to the weather will require waterproofing on the surface to prevent penetration of moisture to a habitable room or garage below. Refer to the manufacturer for details.

Installation of services into a masonry home is a simple exercise. Exactly the same planning is required as for a conventional timber frame building. Changes are difficult to achieve after the grouting of masonry walls.



## SECTION 7 - SERVICES

### 7.1 Locations of Services

Methods of installing plumbing and electrical lines depend on whether they are run through, within or alongside the concrete masonry wall. Penetrations are necessary primarily to allow services to pass directly through the wall. Lines that run parallel to the wall can reside either within the masonry cores themselves or in the cavity created if the wall is to be strapped and lined. Any openings required in the face shell shall be formed with drills and saws. The use of hammers can crack adjacent block faces and/or disturb mortar joints, both of which can then leak.

#### *Penetrations*

Holes penetrating straight through a concrete masonry wall can be created as the wall is assembled or after assembly. During construction holes are left in the designated locations by cutting sections of the blocks before they are laid. An alternative is to drill through the wall after wall assembly. The advantage of this is that the blocklaying is uninterrupted and allows for delays in deciding precise locations for the penetrations. With either method, it is important to avoid the masonry webs and to seal around the holes before blockfilling.

#### *Services within Masonry Cores*

If the interior of the wall is to be plastered or left exposed, the services must be placed within the cores of the wall. Provision must be made for the services as the masonry is installed. Either the blocklayer or the service installer will make cut-outs in the block face shells where the electrical flush boxes and other service mounts will be fixed. After the wall is completed, the electrician will pull

wires, install boxes and other fixtures. In partially filled masonry, good planning will see the services installed in a hollow core of the block wall.

### 7.2 Electrical

The location of all electrical fittings needs to be confirmed prior to grouting. Electrical cable is usually run through PVC conduit that has been placed inside the block wall prior to grouting. It is not good practice to place more than one conduit within a single vertical core that is to be filled with grout.

The length of conduit and the number of bends should be kept to a minimum so as to not affect the installation of the cables within the conduit. With long, twisting conduits the friction can make it difficult to pull the wires/cables through.

The locations of the flush boxes should be marked out on the masonry wall prior to grouting. Then the face shell of the masonry block is cut out or drilled out and the conduit is placed within the core of the masonry wall extending out the wall at the location of the flush box. The hole is then sealed around the conduit and the wall is then grouted. Once the wall is grouted, the face of the masonry unit can be cut for the installation of the flush box.

In this photograph, the flush box is visible in the finished wall. Switchplate fixing is identical to that on a timber frame wall.

### 7.3 Plumbing

Consideration needs to be given to upstairs bathroom facilities and their location relative to external walls.



Where necessary it is possible to leave a core of the masonry blocks empty during pouring so that the waste pipes can be run inside the blockwork. This gives excellent noise dampening properties. This needs to be coordinated with the Architect or Engineer to ensure that the structural performance of the wall is unaffected.

For upstairs bathrooms and toilets located away from external walls, plumbing needs to be routed to these



walls. With a Prestressed Flat Slab floor the pipes can be placed within a false ceiling as it is not practical to run the large diameter toilet waste pipes in the concrete floor. Rib and Infill floors can have an advantage in this situation, as the beams create a natural 100mm deep space when using a plasterboard ceiling. The pipes must run parallel to the Rib Infill beams, as it is not possible to core through a beam without compromising strength.

#### **7.4 Services on Strapped and Lined Walls**



When the wall is to be strapped and lined, the services can simply be placed in the cavity between the masonry and the lining. This is very similar to that in traditional timber frame construction.

#### **7.5 Future Proofing**

Data cabling offers many advantages over conventional electrical cabling. With this type of system, the entire houses lights, curtains, alarm systems, and heating can be controlled from one point.

Installation of data cables is very similar to electrical cables but there are a few minor points to consider:

- Where any data cables run parallel to electrical cables, maintain at least 300mm separation. This is to stop any electromagnetic interference of the transmission of data as with any type of construction.
- When data and electrical cables have to cross, make sure they are at right angles to each other.

In some situations, data cabling can reduce the number of wires required to manage the houses electrical systems. Traditional cabling requires an individual wire for each electrical item to be controlled. With data cabling, a single control panel is capable of controlling the entire house.

## SECTION 8 - STAIRCASES

One of the benefits of solid structural masonry construction is the lack of foot impact noise from concrete suspended floors and the all round quietness provided by the downstairs concrete walls. This effect can be continued with a concrete staircase. There are a number of options available for the type of concrete staircase used and how it is installed.

### 8.1 Cast-in-situ Staircases

A cast-in-situ staircase is where the staircase shape is boxed on site, the steel is placed, and concrete is poured. A stiff concrete mix is used to ensure that the concrete does not slump to the bottom. Advantages with this system are that the staircase can be installed at any stage of the construction and any inaccuracies in wall or floor construction can be easily accommodated.

This type of construction works well when staircases have short spans or there is an unusual shape to be formed. It is important to ensure that the surface of the staircase is finished smooth enough to be used bare even if the stairs are to be covered, as it is easier to make the concrete smooth before it has cured, grinding off the surplus days can be an expensive exercise.



### 8.2 Precast Staircases

Precast staircases can be an economic solution when longer spans are required. This type of staircase offers great speed of construction and can also be made with a finished (exposed) surface. A greater accuracy in construction of the supporting walls is required.

One type of staircase is called monolithic, where the staircase is cast in one large unit. It is wise to consider the site access with this type, as the staircase requires heavy lifting equipment to install. Good construction planning can allow installation at the same time as the suspended concrete floor, requiring a crane to visit the site only once. Usually starter bars cast into the staircase extend from the ends of the staircase, to tie into the topping concrete of the suspended concrete floor.

Another type of precast staircase is made up of separate components – beams which support individual risers and treads, and can be installed at virtually any stage once the supporting walls have been grouted. As the components are relatively lightweight, most often they can be manhandled into place.



## SECTION 9 - ROOF CONNECTION

The two most popular methods of roof connection are by top plate and metal strap. Either one can be used in almost any circumstance. The top plate requires more material, but leaves greater flexibility for the roof members to be placed. It also leaves a nailing surface along the top of the wall, which is useful if a trim is to be installed. Metal straps can provide a stronger connection and for high-wind areas are often compulsory. They also leave the concrete masonry surface uninterrupted to the roofline (good for plastering).

### 9.1 Top Plate

This is the most common approach where a wooden plate is installed along the top of the wall and the roofing members attach to it conventionally. Anchor bolts hold

the plate in place. These bolts are suspended in the bond beam prior to the wall being filled and upon grouting they lock into place. The top plates are drilled and screwed into place. As with any timber/masonry connection, the top plate needs to be protected from moisture by DPC or similar.

### 9.2 Metal straps

Metal straps or hurricane straps can also connect the wall to the roofing members. The straps are positioned in the blockfill at the design locations of the roofing members. The roof is built on top of the wall with each strap nailed to its representative member.

## SECTION 10 - WINDOW INSTALLATION

In general the most critical aspect of masonry construction is the installation of windows. If a house is going to leak, it is most likely to be caused by inadequate sealing around window frames. Masonry homes are just as prone to leaking around windows as any other home if incorrect installation techniques are used.

The Architect or Designer should carefully select a sealing and coating system from a reputable manufacturer. The directions of that manufacturer should be carefully followed, at all times.

The four "D's" for weather tightness design are, deflection, drainage, drying and durability. Penetrations through masonry walls may employ the D's by-

1. 'deflection' are building elements that shelter the wall or divert water away from critical junctions such as eaves, drip moulds and sealants.
2. drainage is achieved by ensuring that any water that gets in is drained back out generally through an unsealed joint along the bottom.
3. The unsealed bottom edge allows some circulation of air to aid drying.
4. Air seals installed around the inside edges of the openings restrict the passage of air through joints and prevent water being carried to the interior.

Details which employ these principles are summarized in two publications-

- Concrete Masonry- a guide to weathertight construction, available for free download from the NZ Concrete Masonry Associations website [www.nzcma.org.nz](http://www.nzcma.org.nz)
- Weathertight Solutions Volume 4- Masonry, details for junctions and openings in masonry walls. Available from BRANZ."

An illustration of a typical construction sequence is as follows.

Flush any block joints around the window opening with mortar. This removes any recesses in the surface that would require excess sealant to be applied.





Apply a waterproofing membrane around head, jamb, and sill. This waterproofing membrane should cover the entire thickness of the wall and be extended a minimum of 50mm on the exterior face around the penetration.



Fit joinery leaving a 5mm gap between the window frame and masonry rebate.



Ensure that the window frame is located accurately and square in the opening. This will ensure a uniform gap around the frame for further application of sealant.



A: Once the window is fixed and square install backing rod and foam airseal to the interior of the joinery.



B: apply a flexible seal to the gap between the top and sides of window frame and masonry wall. Do not seal along the bottom of the window frame.



With the paint system, it is very important that the paint coat is applied over the flexible sealant up to the joinery. This provides one extra defence against moisture ingress. The Architect or Designer should fully detail the weatherproofing procedures for window openings.

Ensure that all paint, sealants and coatings are compatible. The use of one selected, reputable manufacturer's products and system is strongly recommended.

## SECTION 11 - WATERPROOFING/COATING SYSTEMS

External waterproofing systems are one of the most critical aspects of the construction and also have a large visual impact. Coating of a masonry home is a simple process but there are a few areas that need special attention before applying the coating.

### 11.1 Dry Blockwork

Before coating, the blockwork must be dry. AS/NZS 2311:2000 provides a guideline for recommended drying times for recently constructed masonry. The recommended times are 8 weeks for solid-filled construction and 4 weeks for partial-filled construction.

Wet concrete masonry units shrink when drying. This movement is minute but is still significant if a brittle coating (such as plaster) is applied to wet blocks. Cracking is likely to occur in the plaster due to the block movement.

The following conditions have the most influence on shrinking:

- Masonry units stored on site and not covered are laid wet.
- Significant rainfall occurring during blocklaying (especially during winter).
- Insufficient time to allow drying prior to applying the coating.

Once sufficient drying has occurred the exterior coating should be applied as soon as practical to prevent further moisture entering the masonry.

### 11.2 Cleaning Blockwork

Ensure the blockwork is clean and free from surplus mortar/grout. All mortar joints should be free from dags and blocks should have smooth clean surfaces. A common practice is to brush the surface of the wall down with a wire brush or rub a piece of masonry on it to clean the wall.

### 11.3 Application

It is strongly recommended that an accredited applicator of the coating chosen for the job is hired. They have the “know how” and can deal with problems, if they arise, better than anyone. The accredited applicator normally has the manufacturer’s guarantee as support should anything go wrong.

It is vitally important to follow the coating manufacturers’ application instructions. Incorrect application may lead to the coating not providing the waterproofing expected. In multicoated systems, do not change from one brand to another from one layer to the next. Each manufacturer will have ensured that reaction occurs with the mixing of their products. This cannot always be guaranteed when products from different manufacturers are mixed.

*Firth does not claim to be the expert in the application of coatings on masonry. It is strongly recommended that the manufacturer of the preferred coating(s) be consulted for advice in this area.*

## SECTION 12 - EXTERNAL COATING SYSTEMS

### 12.1 Acrylic Paint

Good quality acrylic paint acts as a moisture barrier but not a vapour barrier. This allows the blocks to breathe removing any trapped water vapour while at the same time stopping moisture from rain from entering the blocks. Paint like this has no rendering ability so it is usually applied over a skim coat of sand-cement plaster but can be applied directly to blockwork if that look is desired. If this type of coating is to be used, it is recommended that three coats be applied, or in accordance with the manufacturers specification.

### 12.2 High-build Elastomeric Coatings

High-build elastomeric coatings are similar to a very thick acrylic paint. Using the latest paint and polymer technology they offer a coating system that can have a variety of looks, ranging from conventional paint look to a textured plaster finish. These are recommended as a coating system for masonry, as they have a great amount of flexibility and can cope with small amounts of movement that may occur.

### 12.3 Solid Plaster

Sand-cement plaster is the traditional method of coating masonry and it is usually coated with one of the above treatments for waterproofing.

The first treatment for the dry masonry surface is the application of a "scratch or "splatter" coat. This is a sand-cement slurry that is splattered onto the wall, creating a rougher surface for the main plaster coat to bond to. The plaster needs to adhere to the wall or there is potential for what is called 'drummy plaster' to occur. This is a condition where the plaster coat has not broken but has de-bonded from the masonry and when tapped it makes a slight hollow sound. After this preparation coat, it is common for two or three coats of plaster to be trowelled on. It is even possible to spray the plaster on which



speeds up the process. The top coat of the plaster can be coloured to match the paint just like an undercoat.

There is a wide range of surface finishes available. This can range from an undulating finish (achieving a rough "country" look) to straight plaster finishes (the smoothest type of finish available). The undulating plaster is usually the most cost effective, as it requires less labour to create. Other thinner coating systems cannot achieve this undulating appearance.

### 12.4 Modified Plaster

These are typically acrylic-based proprietary coating systems developed for use on masonry structures. They are designed to provide a substantial look while offering protection from ingress of moisture. They are applied in a similar manner to solid plaster, but refer to the relevant manufacturer for their recommendations.

### 12.5 Clear Sealants

Other types of coatings basically rely on their inherent thickness and elasticity to provide long term protection. But thick coatings are easily seen, defeating the purpose of using a clear sealant – that uncoated look. Refer to the clear sealant manufacturer for suitability, application and maintenance information.

### 12.6 Cement Based Paints

It is not recommend to use cement-based paints directly on blockwork. These paints are very brittle and once wall movement occurs, cracking of the coating is almost inevitable.



## SECTION 13 - INTERNAL COATING SYSTEMS

The choice of internal linings is basically limitless. As it has almost no impact on the structure, any type of finish can be accommodated.

### 13.1 Exposed Blockwork

Exposed blockwork (fair faced) has found new favour with the architectural community. This is the cheapest option. Internally there is no issue with leaving the blockwork uncoated as the waterproofing is provided from the outside. Where a fair faced finish is desired in a wet area such as a bathroom, a suitable sealing system may be selected. Refer to the sealant manufacturers recommendations prior to use.

### 13.2 Paint Finish



Paint over bare blockwork is a relatively low cost solution. This provides a uniform colour to the wall and still allows the mortar joints to be seen. It is important that the walls are as dry as possible before applying the paint. If any excess moisture is trapped, it is likely to bubble the paint over time. In order to hide the block lines, a high-build elastomeric coating with a levelling coat can be used.

### 13.3 Strapped and Lined

This method involves fixing strapping to the block wall and fixing GIB® plasterboard to it. The cavity can be utilised as service channels. This method may also incorporate insulation, however with HotBloc® there is no need to use this type of construction for insulation. Strapping and lining comes into its own is that it allows relatively easy installation of electrical services at a later date if the owner wishes to upgrade the services.



Where strapping and lining is used the thermal mass of the masonry wall is isolated from the interior and the heat storage capacity of solid construction is compromised. Guidance on R-values required for strapped and lined construction can be found in the Firth publication, Masonry Insulation Solutions.

### 13.4 Plasterboard

Blockwork with GIB® plasterboard glued directly to the masonry is a quick and economic method of coating the walls. This gives the GIB® plasterboard wall a much more solid feel as there is no cavity and ensures that that thermal mass benefits of solid construction are maintained.

This method does rely on a well maintained external waterproof coating.

Consult your GIB® plasterboard supplier to determine when the glue fixed GIB® plasterboard method should be used.







### 13.5 Tiling

The basic requirements for tiling do not change from wet areas to dry areas but there are some requirements that need to be followed in order to get a quality job. The basic requirements are:

- Blockwork needs to be flush-jointed in order to provide a flat surface for tile adhesive application or an adhesive designed for application directly to blockwork needs to be used.
- If tiling over a control joint in the blockwork, a control joint in the tiles must also be provided, as any movement that occurs in the block wall will be reflected in the tiling.
- It is of utmost importance to ensure that blockwork is dry before application of tiles as any shrinkage movement will reflect cracks in the surface due to their brittle nature.

### 13.6 Plaster finish

The same procedure applies as for the application of external plaster. First a splatter coat is applied followed by the topcoat(s).



## SECTION 14 - CONSTRUCTION DETAILS

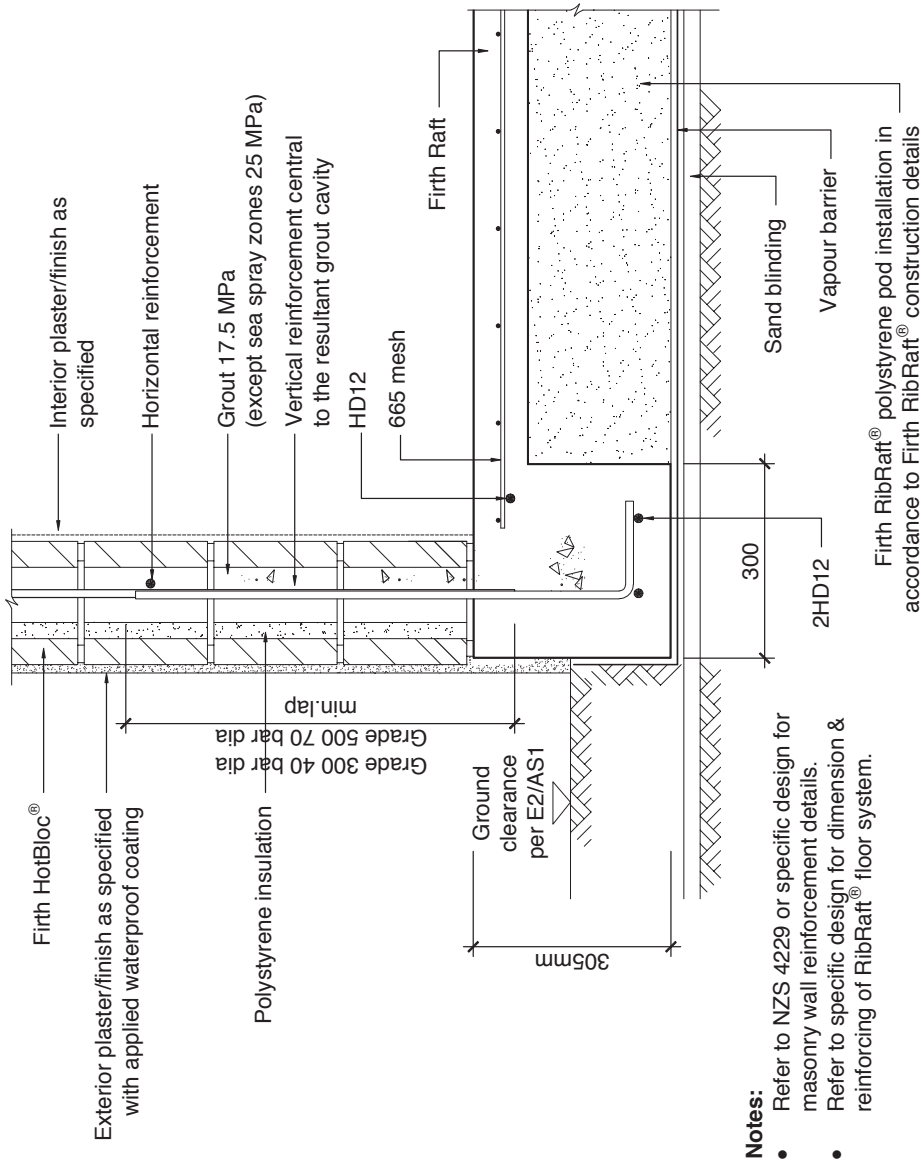
This section illustrates typical construction details. Other sources of information include –

NZS 4229 which provides details on retaining walls, foundations, bond beams and wall to floor and wall to roof details.

Weathertight Solution Volume 4 produced by BRANZ. This document provides numerous illustrations of details to ensure weathertightness. This document is available from BRANZ as a hard copy or a CD containing CAD drawings.

Standard Edge Beam Detail

Detail:100\_standard\_edge



Firth RibRaft Floor System  
Standard Edge Beam Detail  
Slab Foundation With Insulation

For Technical Advice: Ph. 0800 800 576

100\_standard\_edge.dwg

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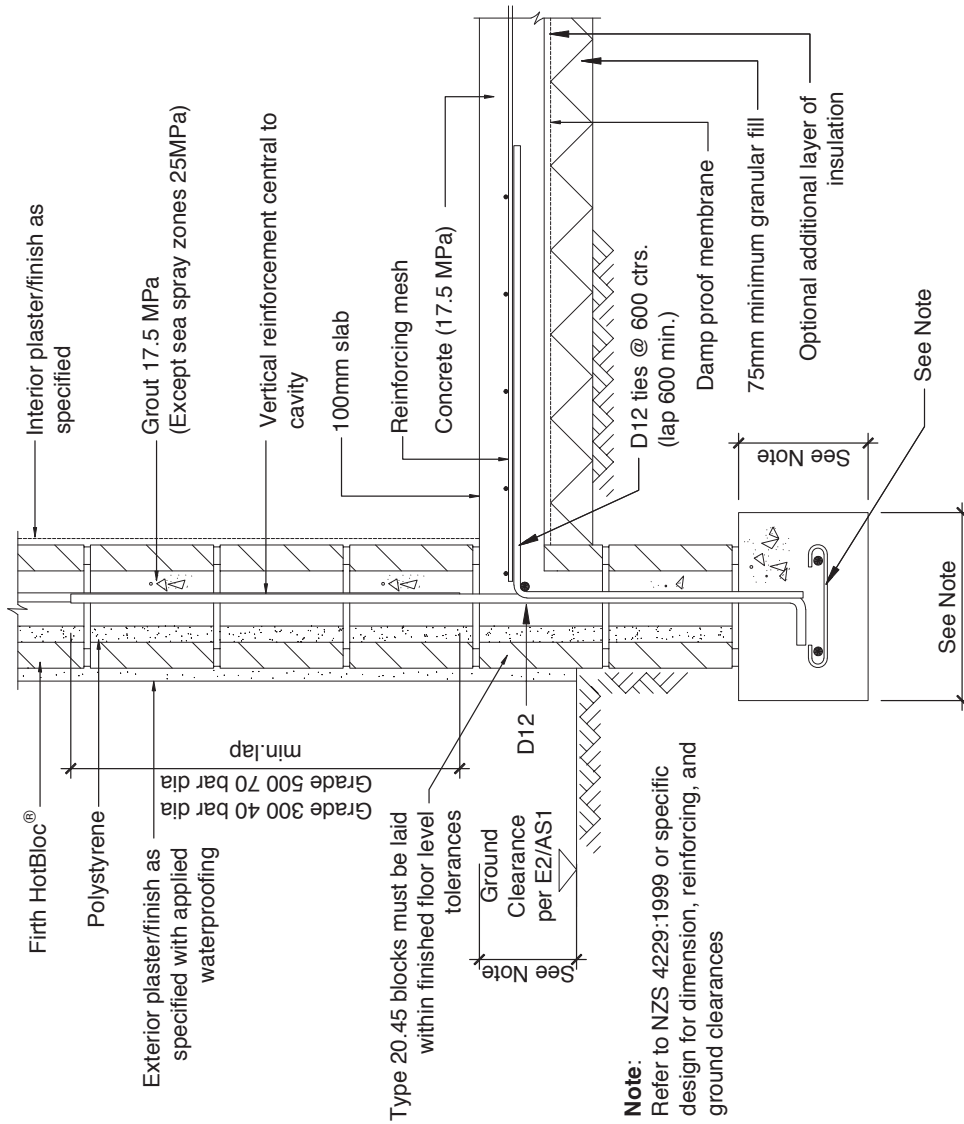
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100

Strip Footing Detail

Detail:102\_strip\_footing

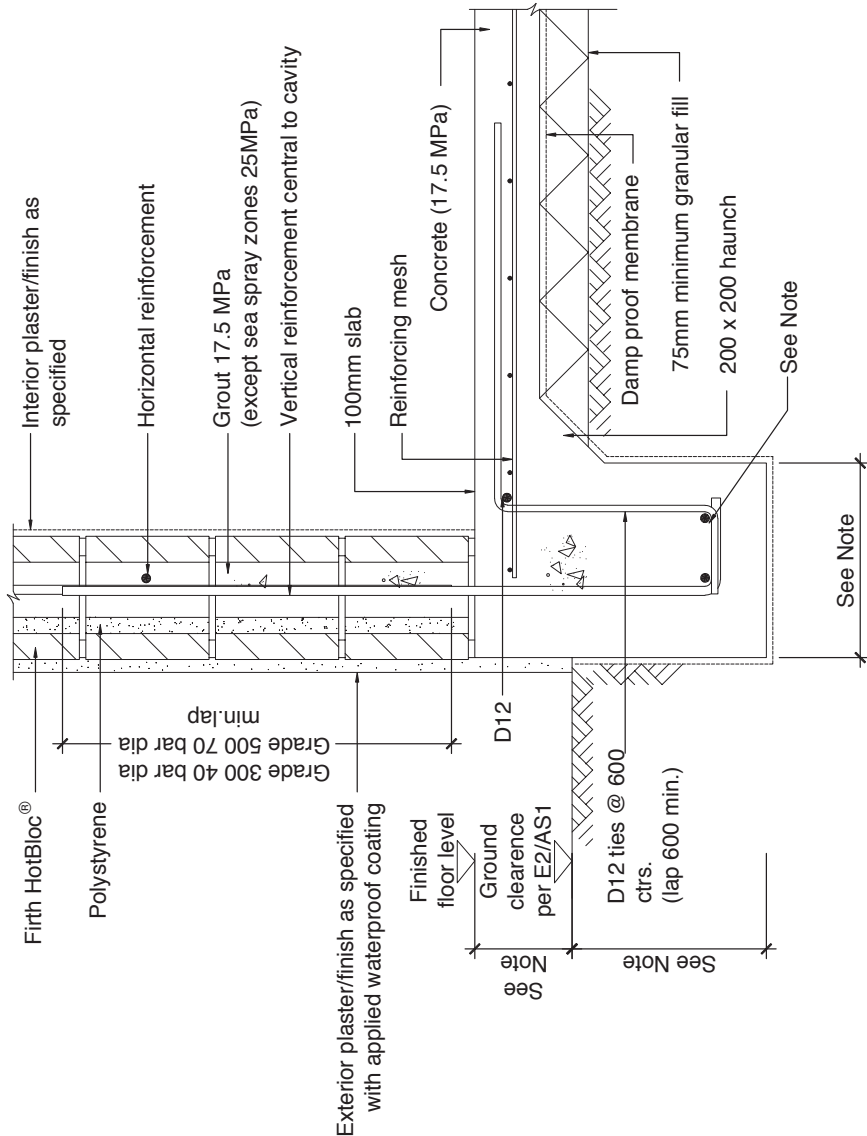


	<b>Firth HotBloc®</b> Strip Footing Detail	For Technical Advice: Ph. 0800 800 576 102_strip_footing.dwg	<b>Disclaimer:</b> This information is intended solely as a guide for use of Firth products. Before using a Firth product you should ensure that the product is suitable for use in the specific application. Nothing in this information constitutes a statement of fitness for particular purpose - appropriate expert advice should always be obtained. Firth makes no warranty regarding the use of this information with non-Firth product.	© 2009 . The copyright of this document is the property of Firth and shall not be reproduced, copied, loaned or disposed of directly, or indirectly, nor used for any purpose other than that for which it is specifically furnished without prior consent.
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Edge Thickened Slab Detail

Detail:103\_edge\_thickened



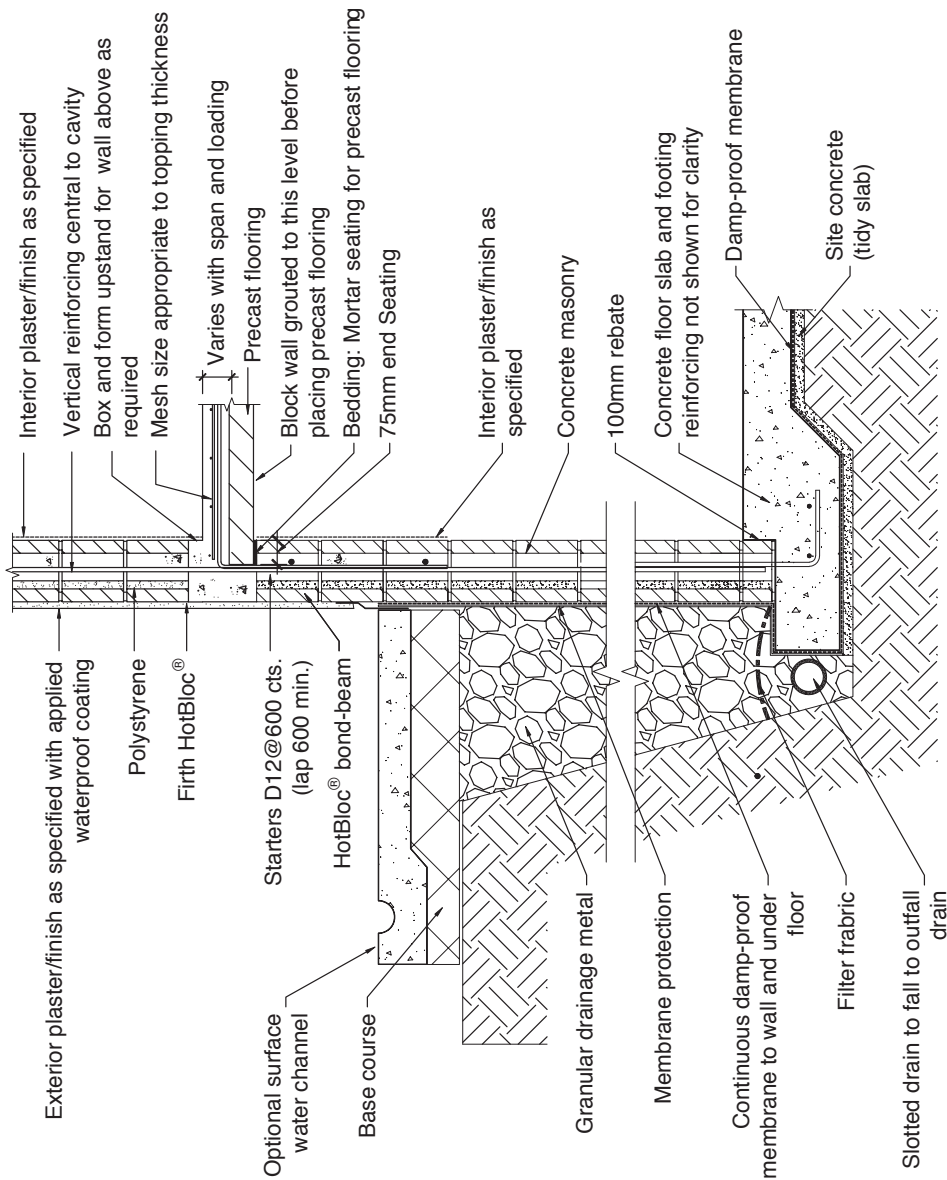
Note


Refer to NZS 4229 or specific design for dimension, reinforcing, and ground clearances

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For Technical Advice: Ph. 0800 800 576		103_edge_thickened.dwg	103	

Basement

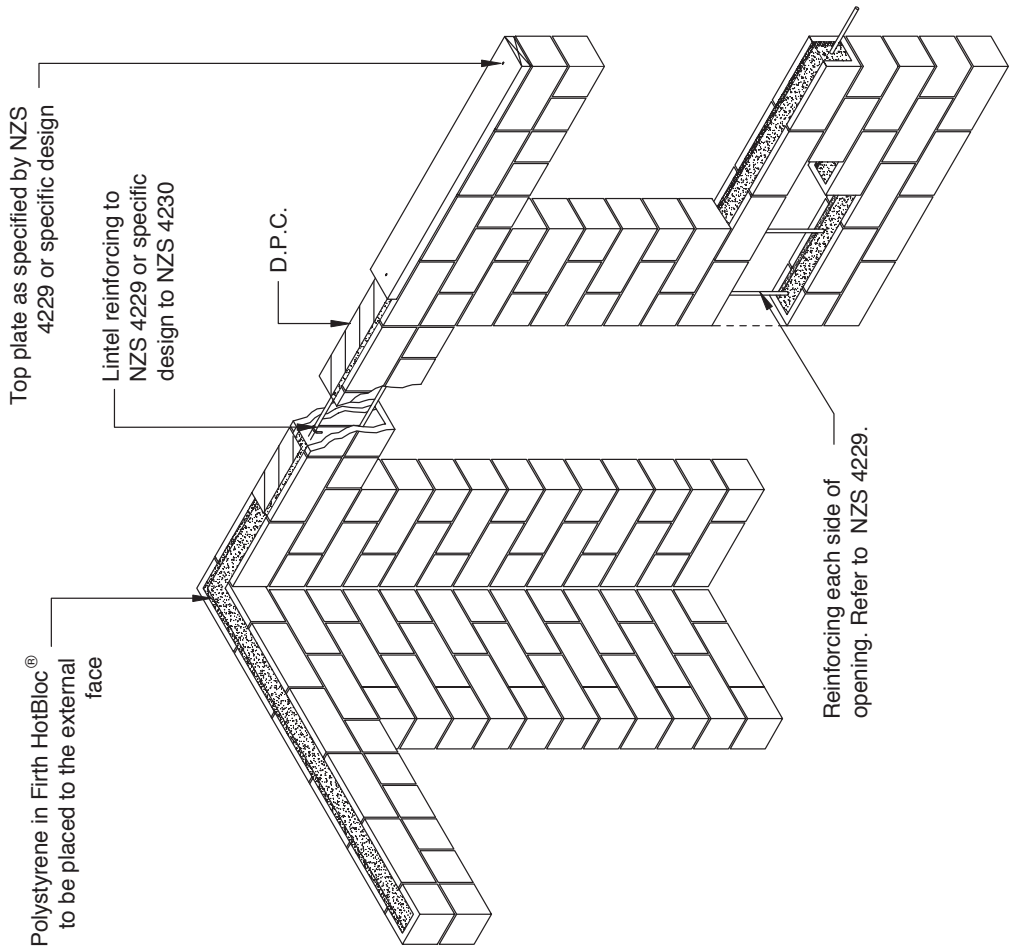
Detail:104\_basement



	<p><b>Firth HotBloc®</b> <b>Basement</b></p> <p>For Technical Advice: Ph. 0800 800 576</p> <p>104_basement.dwg</p>	<p><b>Disclaimer:</b> This information is intended solely as a guide for use of Firth products. Before using a Firth product you should ensure that the product is suitable for use in the specific application. Nothing in this information constitutes a statement of fitness for particular purpose - appropriate expert advice should always be obtained. Firth makes no warranty regarding the use of this information with non-Firth product.</p> <p><b>Note:</b> refer to NZS 4229 or specific design for masonry reinforcing</p>	<p>www.firth.co.nz Scale 1:20 February 2009</p> <p>104</p>
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# Sample Residential Construction

## Detail:200\_sample\_resident



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200\_sample\_resident.dwg

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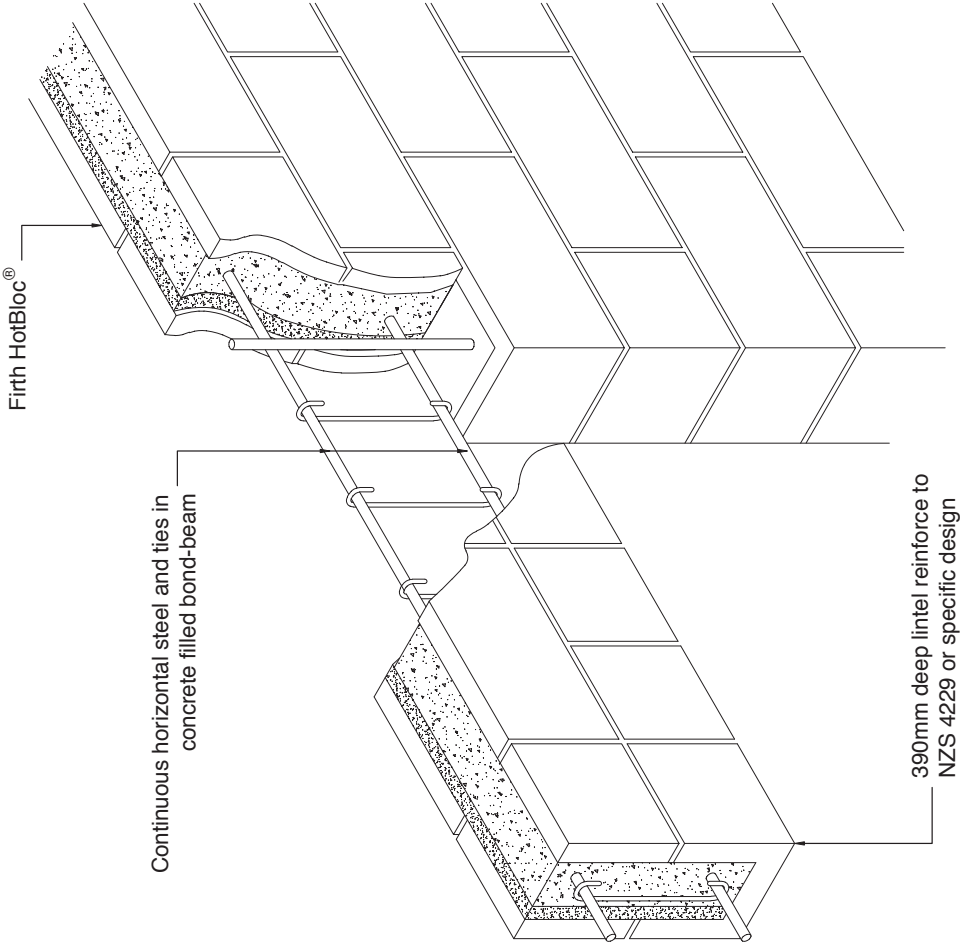
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200

Typical Lintel & Bond Beam

Detail:201\_typical\_lintel

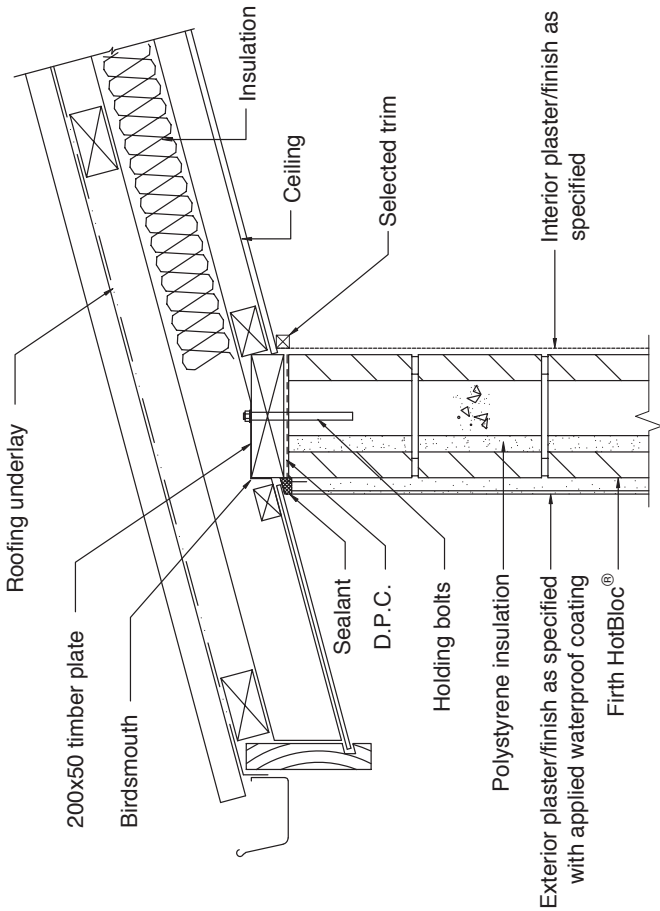


	<p><b>Firth HotBloc®</b> Typical Lintel &amp; Bond Beam</p> <p>For Technical Advice: Ph. 0800 800 576</p> <p>201_typical_lintel.dwg</p>	<p><b>Disclaimer:</b> This information is intended solely as a guide for use of Firth products. Before using a Firth product you should ensure that the product is suitable for use in the specific application. Nothing in this information constitutes a statement of fitness for particular purpose - appropriate expert advice should always be obtained. Firth makes no warranty regarding the use of this information with non-Firth product.</p> <p>© 2009 . The copyright of this document is the property of Firth and shall not be reproduced, copied, loaned or disposed of directly, or indirectly, nor used for any purpose other than that for which it is specifically furnished without prior consent.</p>	<p>www.firth.co.nz Scale 1:10 February 2009</p> <p><b>201</b></p>
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# Sloping Soffit and Ceiling

## Detail:300\_sloping\_soffit



### Notes:

1. Reinforcement not shown for clarity
2. Fix rafter to top plate with approved mechanical fix
3. Refer clause E2/AS1 section 8 of the NZ Building Code for full weathertightness detailing of the roof structure and eaves



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300\_sloping\_soffit.dwg

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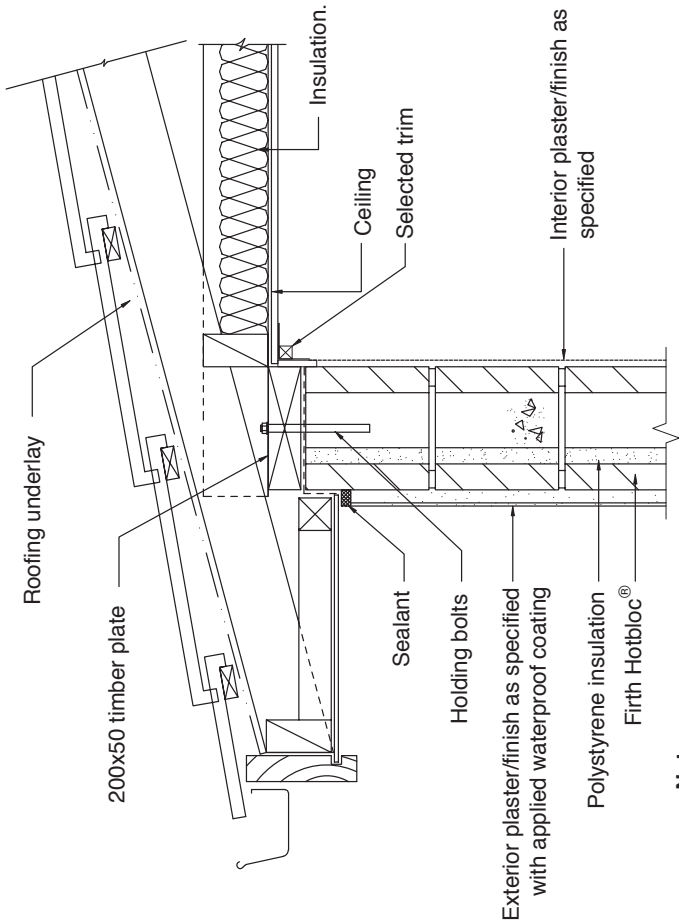
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300

# Horizontal Soffit And Ceiling

## Detail:301\_horizontal\_soff



### Notes:

1. Reinforcement not shown for clarity
2. Fix truss to top plate with approved mechanical fix
3. Refer clause E2/AS1 section 8 of the NZ Building Code for full weathertightness detailing of the roof structure and eaves



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301\_horizontal\_soff.dwg

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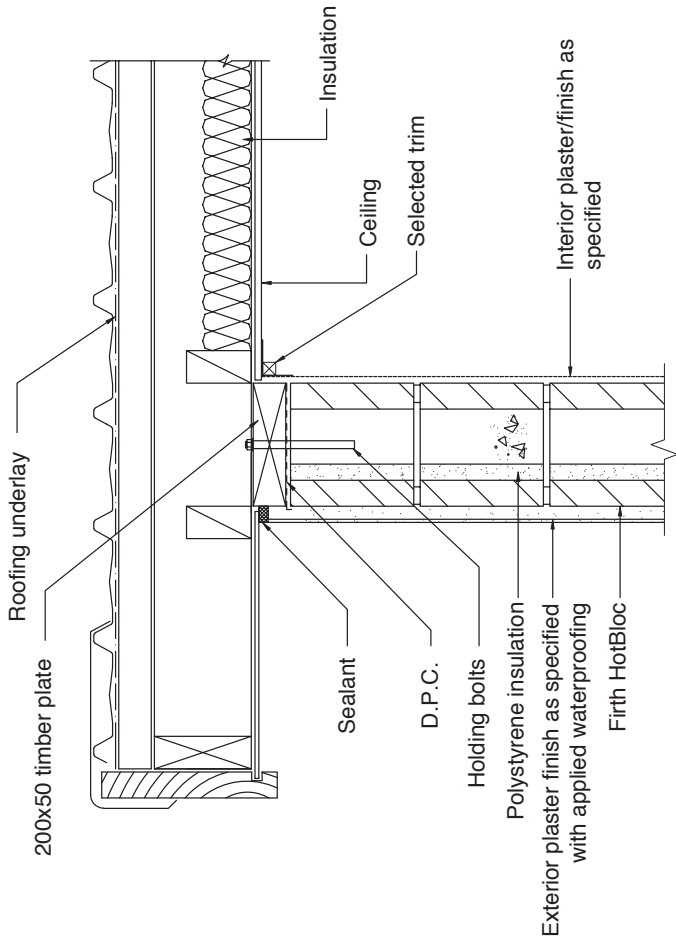
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301

# Gable End Connection

## Detail:302\_gable\_end\_con



### Notes:

1. Reinforcement not shown for clarity
2. Fix truss/rafter to top plate with approved mechanical fix
3. Refer clause E2/AS1 section 8 of the NZ Building Code for full weathertightness detailing of the roof structure and eaves



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Gable End Connection

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302\_gable\_end\_con.dwg

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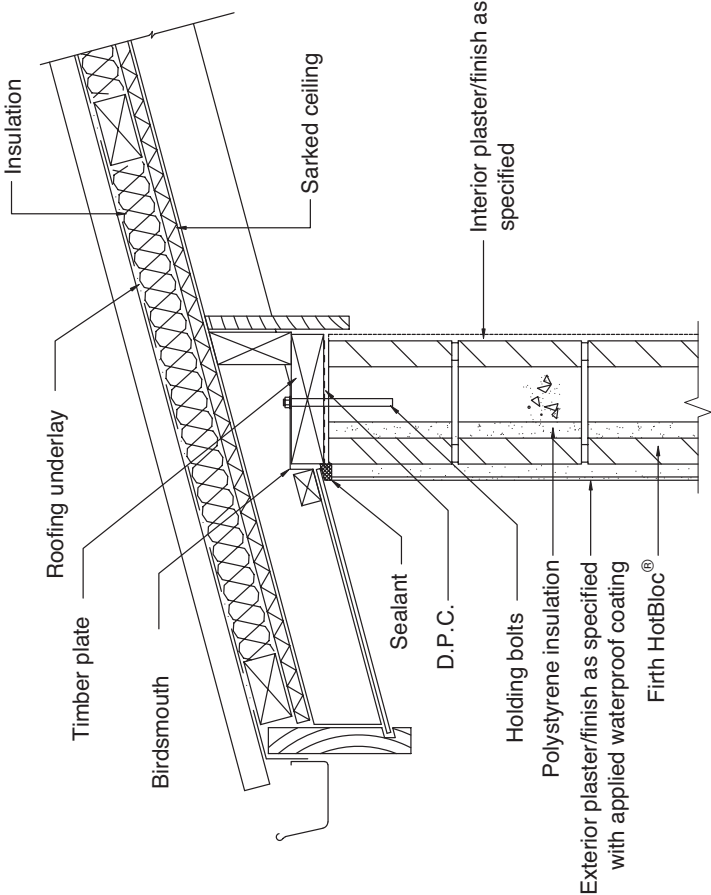
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302

Sarked Ceiling Over Rafters

Detail:303\_sarked\_ceiling



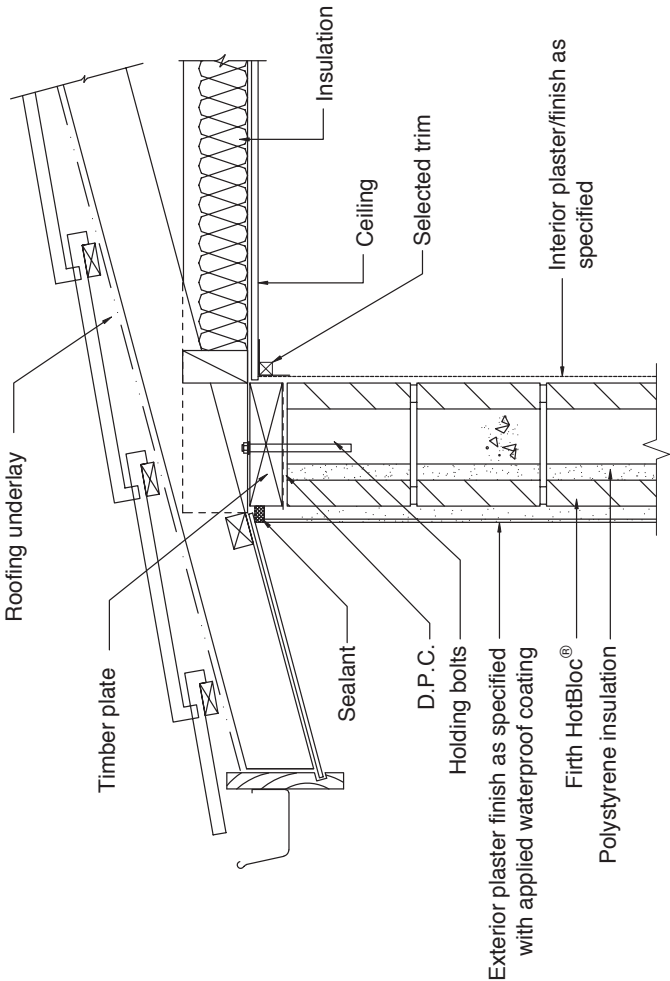
- Notes:**
1. Reinforcement not shown for clarity
  2. Fix rafter to top plate with approved mechanical fix
  3. Refer clause E2/AS1 section 8 of the NZ Building Code for full weathertightness detailing of the roof structure and eaves

	<b>Firth HotBloc</b> <b>Sarked Ceiling Over Rafters</b>		<p>For Technical Advice: Ph. 0800 800 576</p> <p>303_sarked_ceiling.dwg</p>	<p><b>Disclaimer:</b> This information is intended solely as a guide for use of Firth products. Before using a Firth product you should ensure that the product is suitable for use in the specific application. Nothing in this information constitutes a statement of fitness for particular purpose - appropriate expert advice should always be obtained. Firth makes no warranty regarding the use of this information with non-Firth product.</p>	<p>© 2008 . The copyright of this document is the property of Firth and shall not be reproduced, copied, loaned or disposed of directly, or indirectly, nor used for any purpose other than that for which it is specifically furnished without prior consent.</p>	<p>www.firth.co.nz Scale 1:10 17 October 2008</p> <p><b>303</b></p>




Sloping Soffit With Horizontal Trusses

Detail:304\_sloping\_soffit



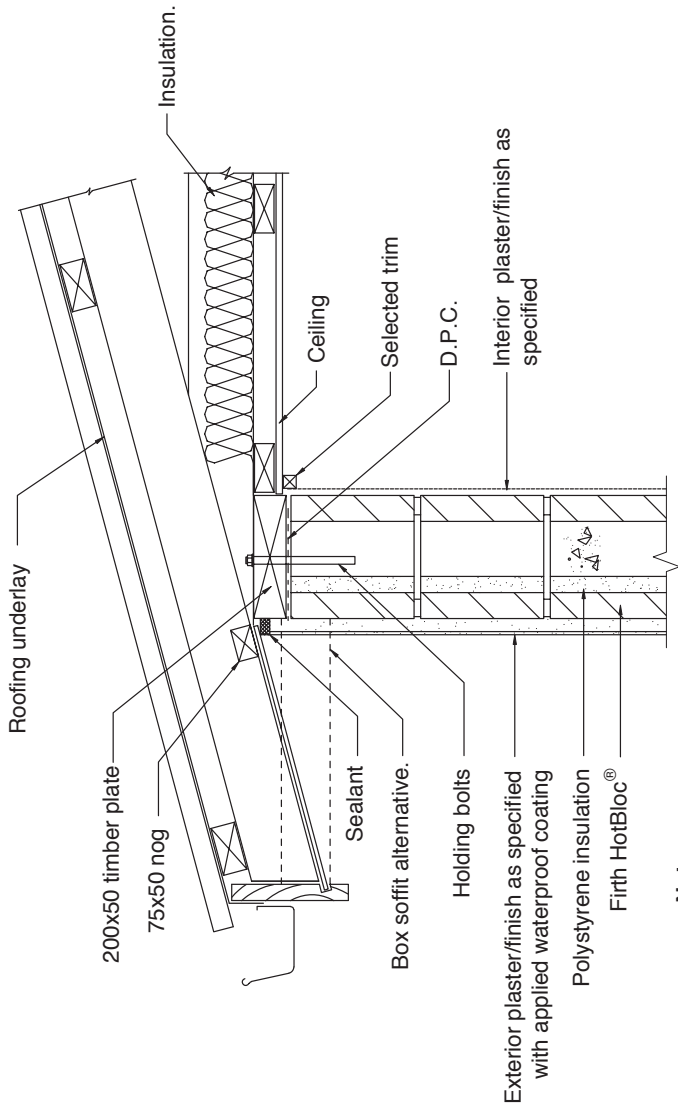
Notes:

- 1. Reinforcement not shown for clarity
- 2. Fix truss to top plate with approved mechanical fix
- 3. Refer clause E2/AS1 section 8 of the NZ Building Code for full weathertightness detailing of the roof structure and eaves

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# Truss Roof Fixing With Top Plate

## Detail:305\_truss\_roof\_fix



### Notes:

1. Reinforcement not shown for clarity
2. Fix truss to top plate with approved mechanical fix
3. Refer clause E2/AS1 section 8 of the NZ Building Code for full weathertightness detailing of the roof structure and eaves



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305\_truss\_roof\_fix.dwg

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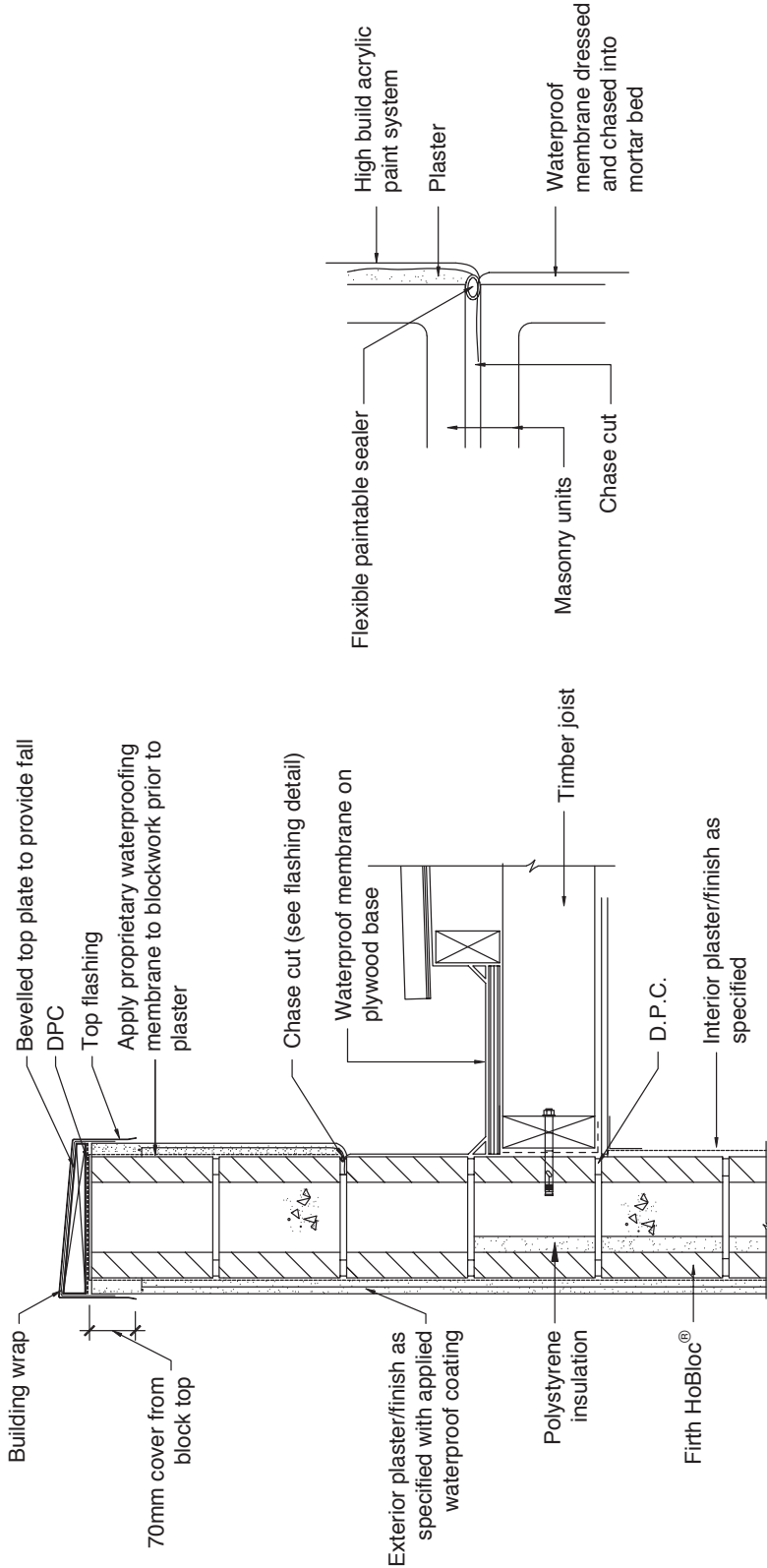
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305

Internal Gutter On Parapet Wall


Detail:401\_internal\_gutter



Note: Reinforcement not shown for clarity.

Internal Gutter Detail

Flashing Detail

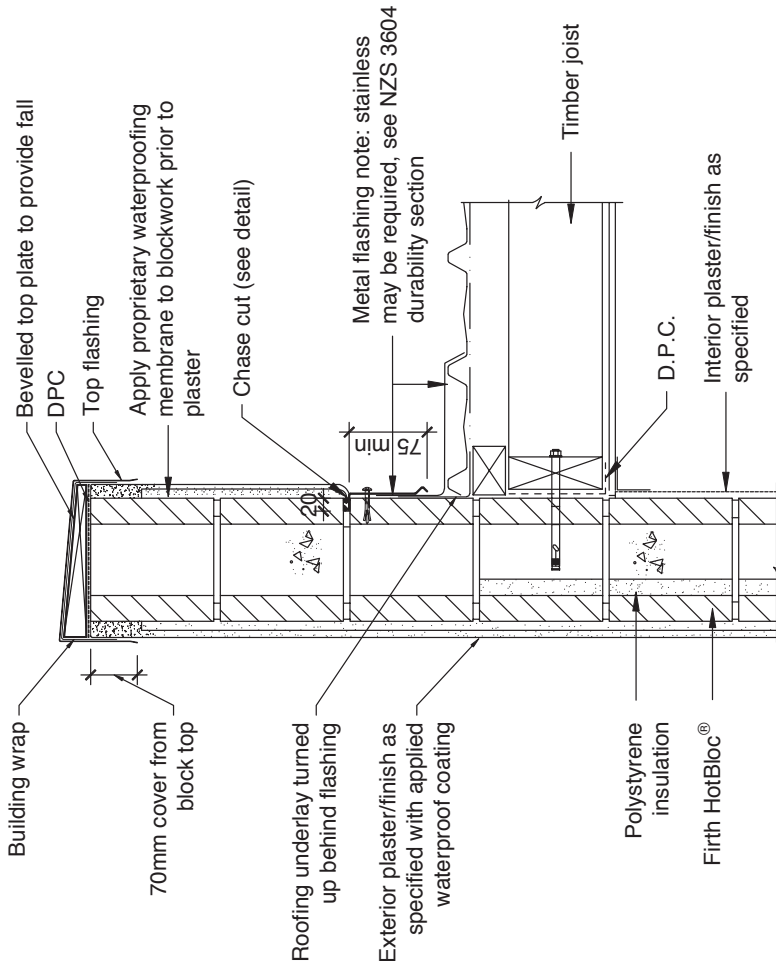
	<b>Firth HotBloc®</b> Internal Gutter On Parapet Wall		<p><b>Disclaimer:</b> This information is intended solely as a guide for use of Firth products. Before using a Firth product you should ensure that the product is suitable for use in the specific application. Nothing in this information constitutes a statement of fitness for particular purpose - appropriate expert advice should always be obtained. Firth makes no warranty regarding the use of this information with non-Firth product.</p>	<p>© 2009. The copyright of this document is the property of Firth and shall not be reproduced, copied, loaned or disposed of directly, or indirectly, nor used for any purpose other than that for which it is specifically furnished without prior consent.</p>	<p>www.firth.co.nz Scale 1:10 February 2009</p>
	For Technical Advice: Ph. 0800 800 576				

401\_internal\_gutter.dwg

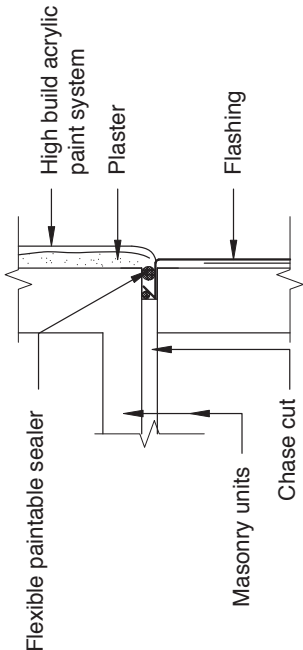
401

# Parapet Wall Waterproofing


# Detail:400\_parapet\_wall



Parapet Wall Detail



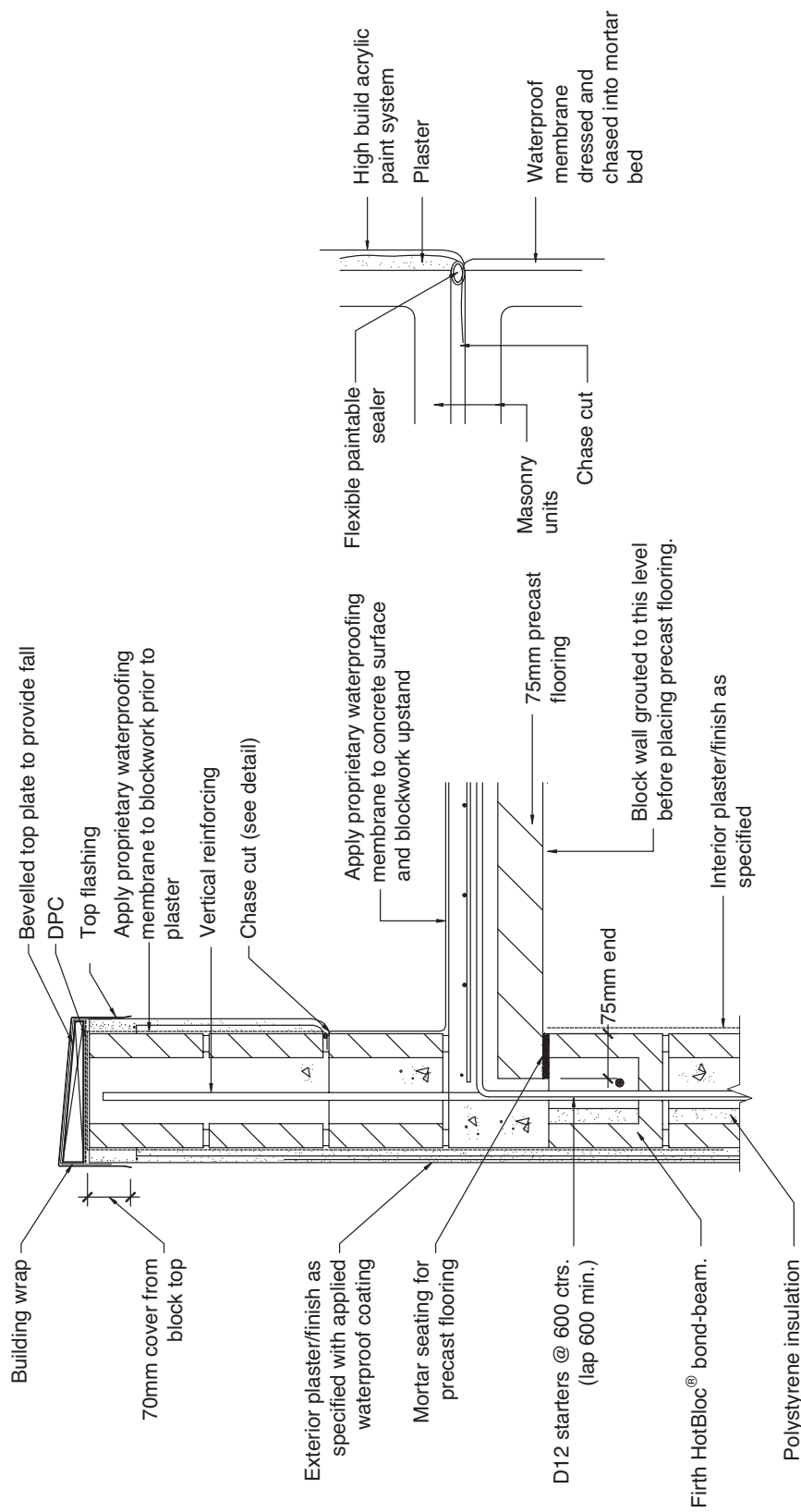
Flashing Detail

	<b>Firth HotBloc®</b> Parapet Wall Waterproofing		
For Technical Advice: Ph. 0800 800 576 400_parapet_wall.dwg		<p><b>Disclaimer:</b> This information is intended solely as a guide for use of Firth products. Before using a Firth product you should ensure that the product is suitable for use in the specific application. Nothing in this information constitutes a statement of fitness for particular purpose - appropriate expert advice should always be obtained. Firth makes no warranty regarding the use of this information with non-Firth product.</p>	<p>© 2009 . The copyright of this document is the property of Firth and shall not be reproduced, copied, loaned or disposed of directly, or indirectly, nor used for any purpose other than that for which it is specifically furnished without prior consent.</p>
		www.firth.co.nz Scale 1:10 February 2009	<b>400</b>




Precast Flooring Deck Waterproofing Detail

Detail:402\_precast\_deck



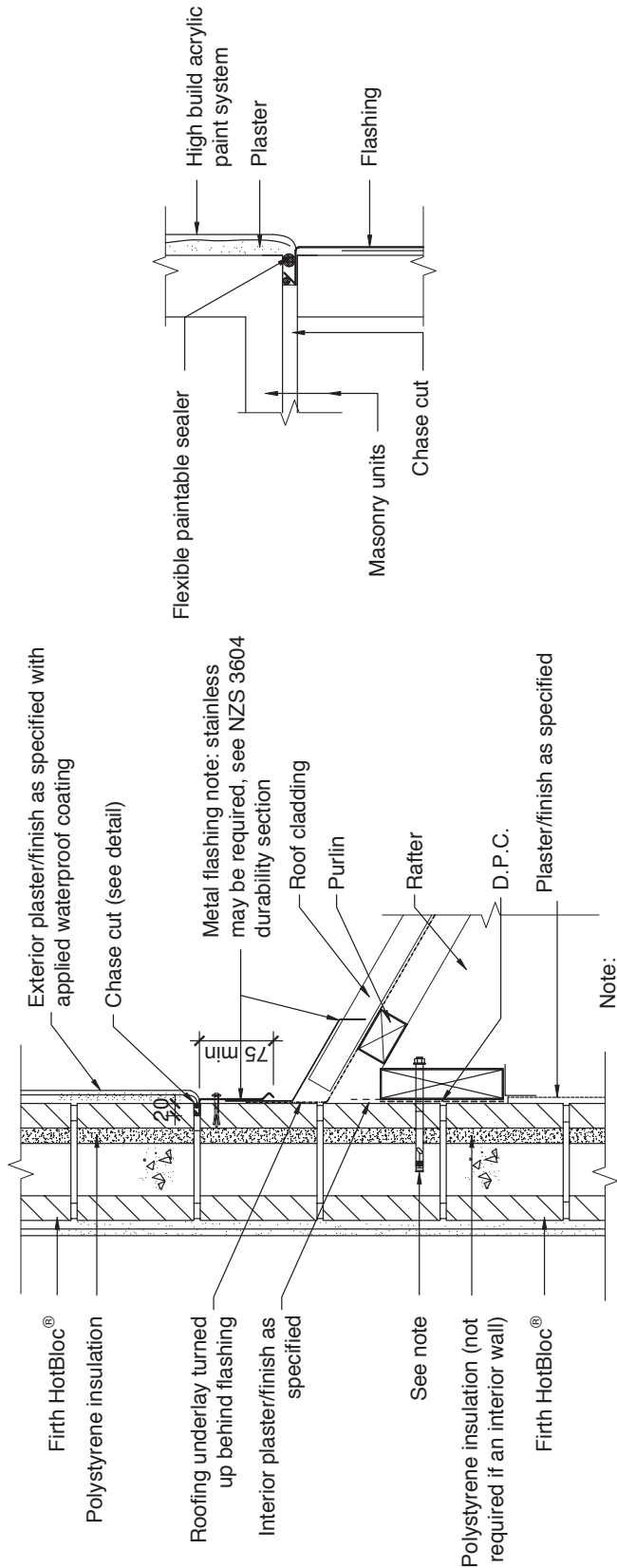
Precast flooring Deck Waterproofing Detail

Flashing Detail

	<b>Firth HotBloc</b> <b>Precast Flooring Deck Waterproofing Detail</b>		www.firth.co.nz Scale 1:10 17 October 2008
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# Cross-section Wall To Roof Junction

# Detail:403\_cross-section



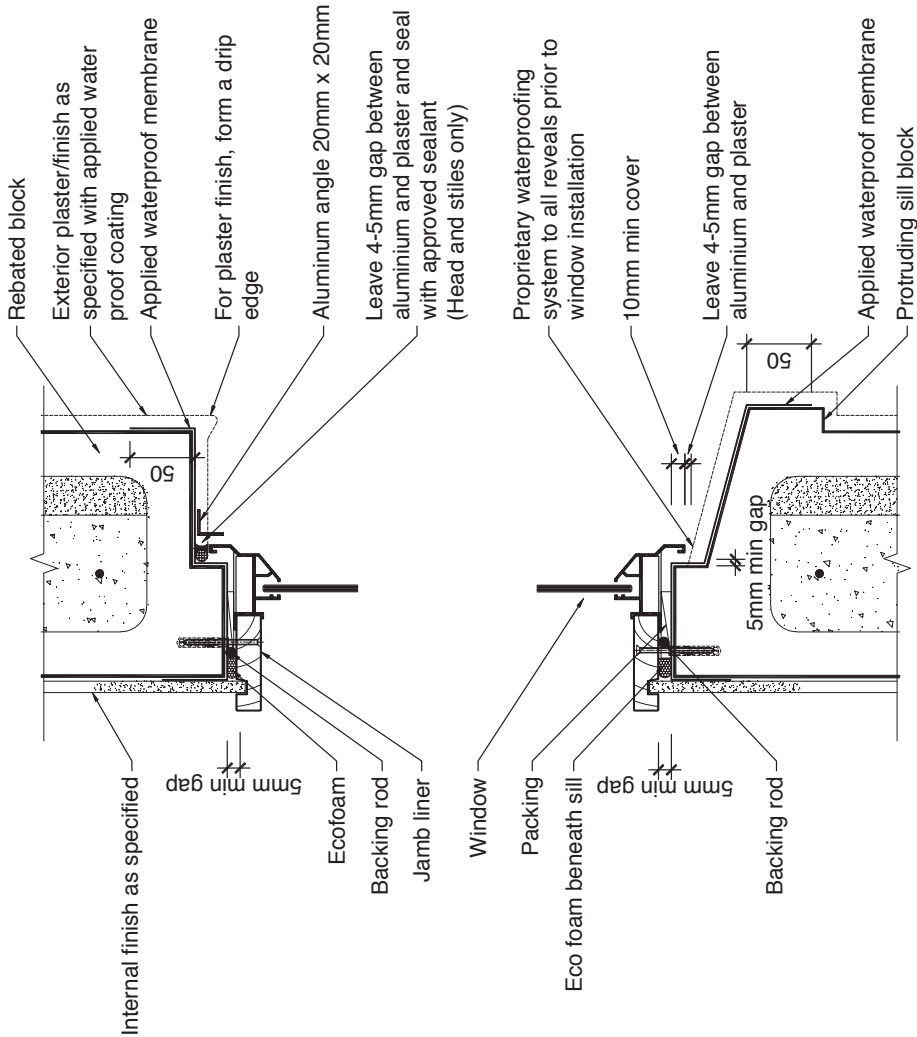
Parapet Wall Detail

Flashing Detail

		<b>Firth HotBloc®</b> <b>Cross-section Wall To Roof Junction</b>		<p>For Technical Advice: Ph. 0800 800 576</p> <p>403_cross-section.dwg</p>
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Window Head And Sill Detail

Detail:501\_window\_head



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Window Head And Sill Detail

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501\_window\_head.dwg

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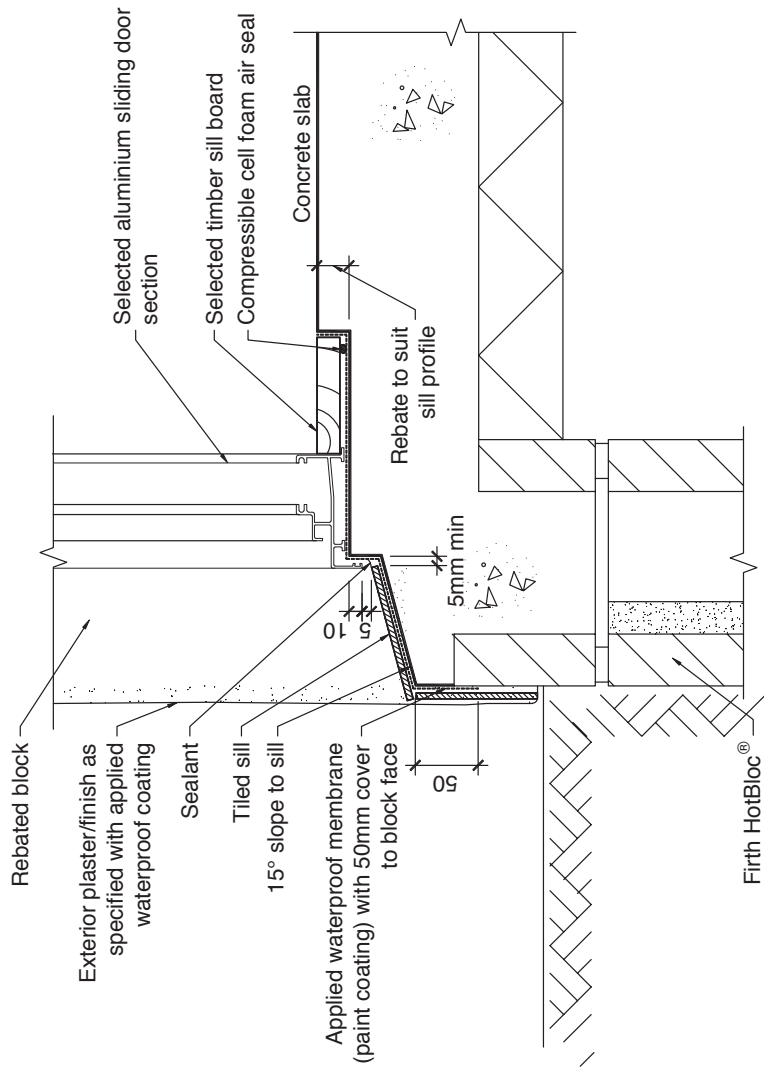
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501

Sliding/French Door Details

Detail:503\_sliding\_french

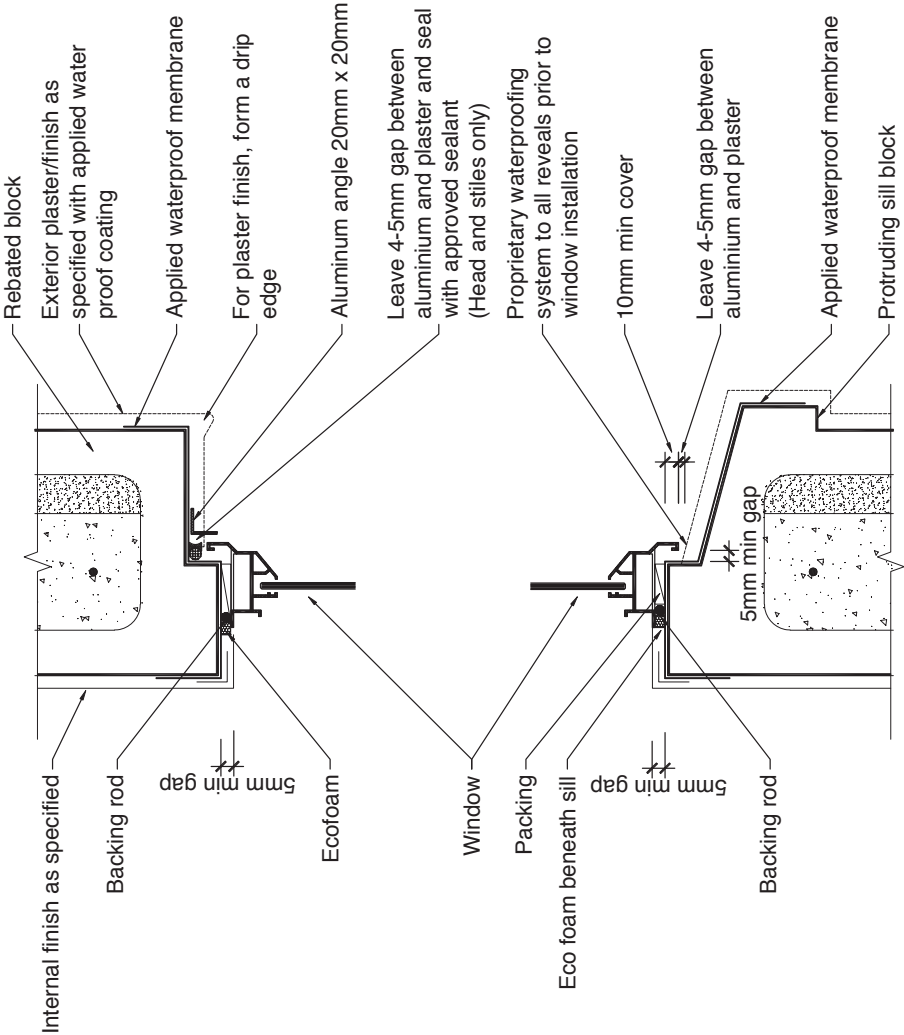



Note: Reinforcement not shown for clarity.

	<div> <div> Firth HotBloc®  Sliding/French Door Details  On Conventional Footing </div> <div> For Technical Advice: Ph. 0800 800 576  503_sliding_french.dwg </div> </div>	<div> <div> Disclaimer: This information is intended solely as a guide for use of Firth products. Before using a Firth product you should ensure that the product is suitable for use in the specific application. Nothing in this information constitutes a statement of fitness for particular purpose - appropriate expert advice should always be obtained. Firth makes no warranty regarding the use of this information with non-Firth product. </div> <div> © 2009 . The copyright of this document is the property of Firth and shall not be reproduced, copied, loaned or disposed of directly, or indirectly, nor used for any purpose other than that for which it is specifically furnished without prior consent. </div> </div>	<div> <div> www.firth.co.nz  Scale 1:5  February 2009 </div> <div>503</div> </div>
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Window Head And Sill Detail

Detail:502\_window\_head

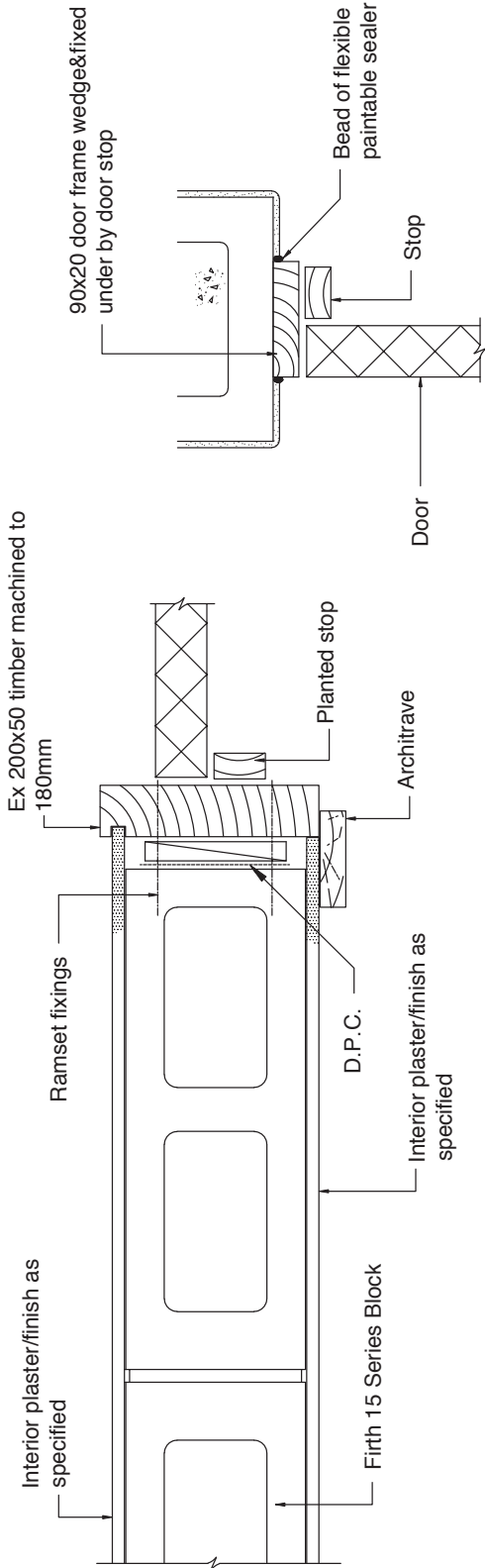


	<b>Firth HotBloc®</b> Window Head And Sill Detail		<p>For Technical Advice: Ph. 0800 800 576</p> <p>502_window_head.dwg</p>
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# Interior Door Jamb/head Details


# Detail:505\_interior\_door



Note: reinforcement not shown for clarity .

Interior Timber Jamb Detail

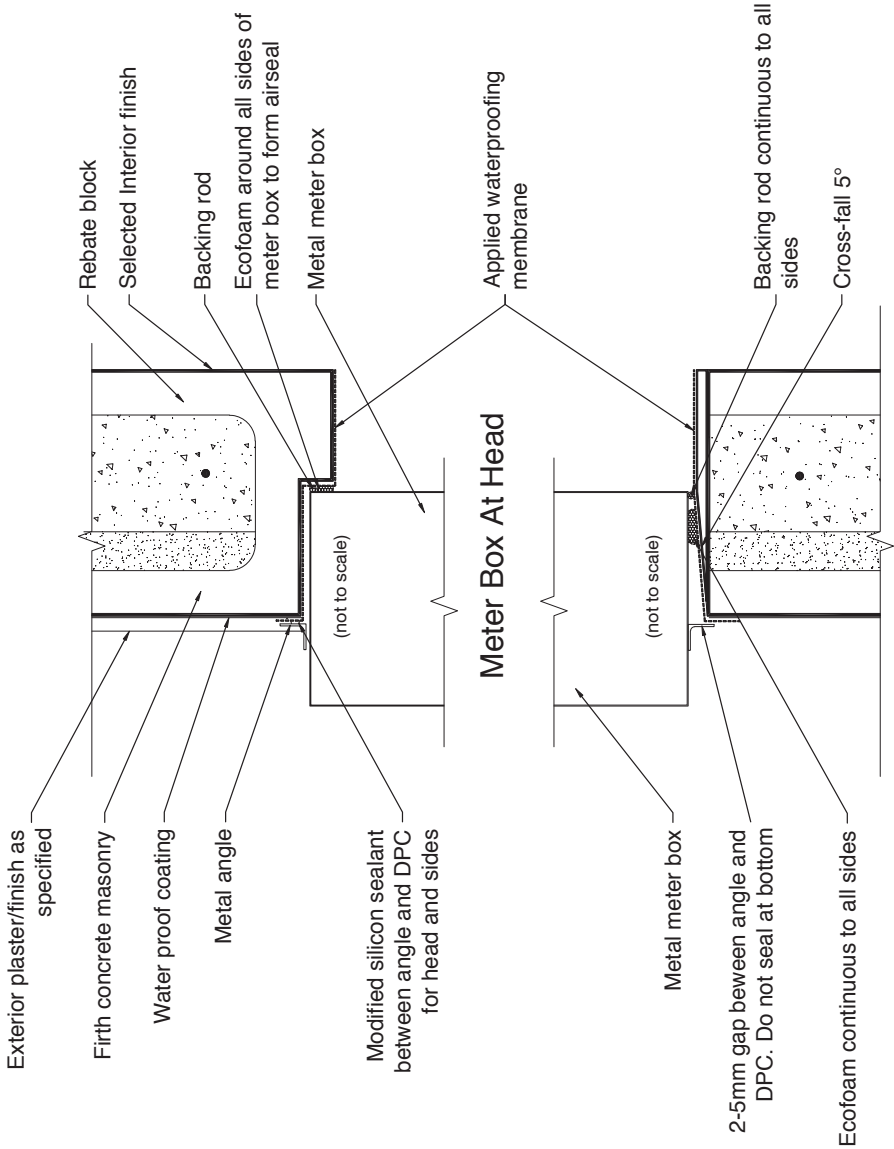
Interior Timber Head Detail


	<b>Firth Grey Masonry</b> Interior Door Jamb/head Details		<p>© 2009 . The copyright of this document is the property of Firth and shall not be reproduced, copied, loaned or disposed of directly, or indirectly, nor used for any purpose other than that for which it is specifically furnished without prior consent.</p>	<p>www.firth.co.nz Scale 1:5 February 2009</p> <p><b>505</b></p>
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505

Meter Box

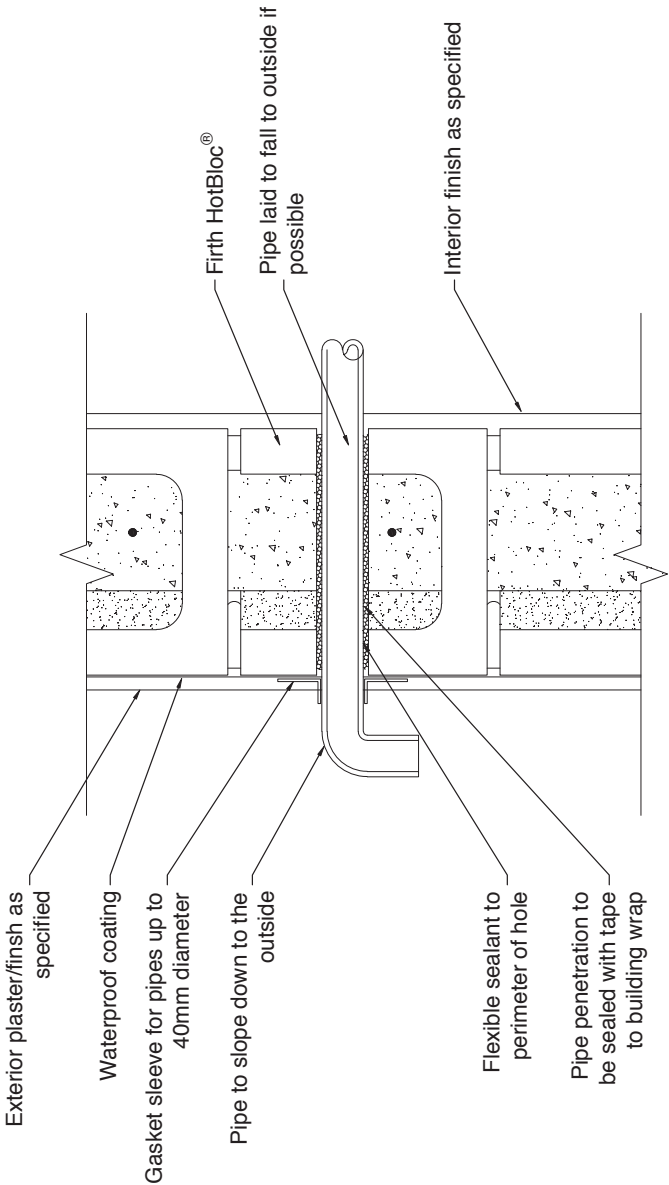
Detail:506\_meter\_box




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For Technical Advice: Ph. 0800 800 576		506_meter_box.dwg	<b>506</b>		

# Pipe Penetration

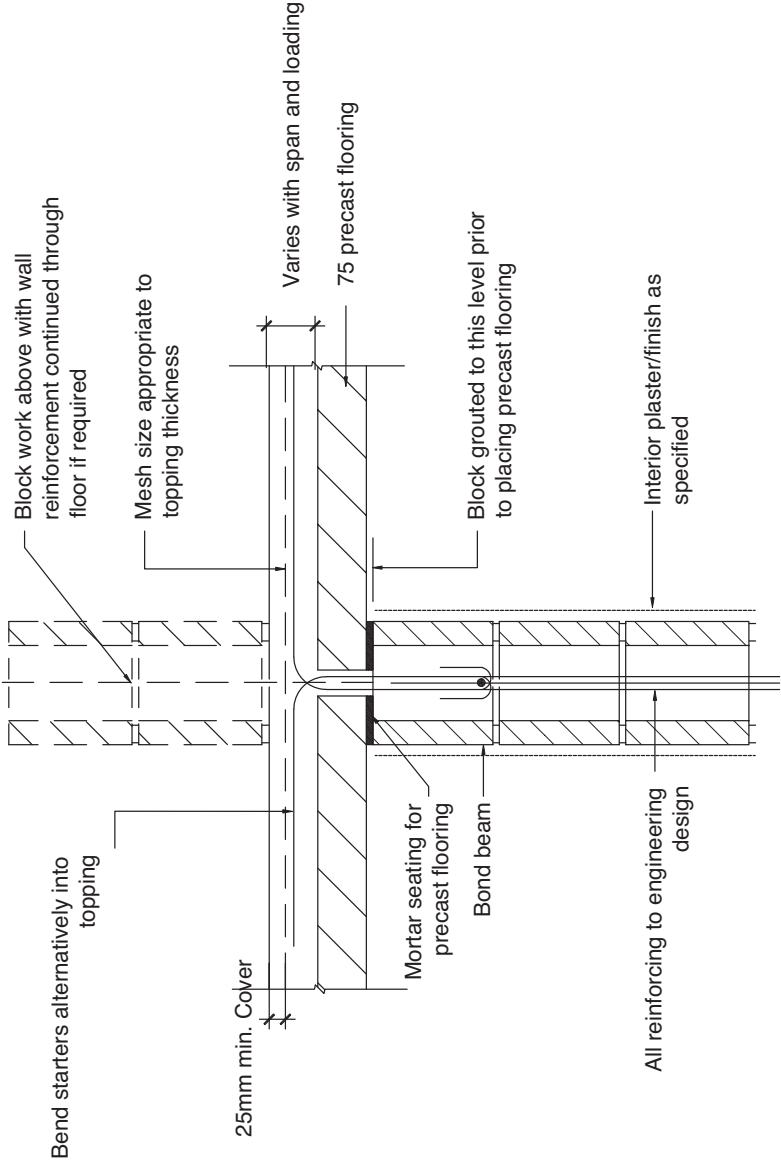
## Detail:507\_pipe\_penetrate




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www.firth.co.nz Scale 1:5 February 2009	507_pipe_penetrate.dwg	<b>507</b>	

Precast Flooring Intermediate Support

Detail:601\_precast\_interm



	<h1>Precast Flooring</h1> <h2>Precast Flooring Intermediate Support</h2> <p>For Technical Advice: Ph. 0800 800 576</p> <p>601_precast_interm.dwg</p>	<p><b>Disclaimer:</b> This information is intended solely as a guide for use of Firth products. Before using a Firth product you should ensure that the product is suitable for use in the specific application. Nothing in this information constitutes a statement of fitness for particular purpose - appropriate expert advice should always be obtained. Firth makes no warranty regarding the use of this information with non-Firth product.</p> <p>© 2008 . The copyright of this document is the property of Firth and shall not be reproduced, copied, loaned or disposed of directly, or indirectly, nor used for any purpose other than that for which it is specifically furnished without prior consent.</p>	<p>www.firth.co.nz Scale 1:10 17 October 2008</p> <p><b>601</b></p>
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## References

Various portions of this Manual were prepared with the assistance of CCANZ, NCMA, and NZCMA. The three documents used were "The New Zealand Concrete Masonry Manual" from the Cement and Concrete Association of New Zealand, "ResTek2" from the National Concrete Masonry Association from the USA and "Concrete Masonry – a Guide to Weathertight Construction" produced by BRANZ and funded by the Department of Building and Housing, Building Research and NZCMA Inc.





## SUSTAINABILITY: THE FIRTH CONCRETE & CONCRETE MASONRY SUSTAINABILITY LIFECYCLE

- ✓ Environmentally compliant manufacturing plants
- ✓ Surplus water and some aggregates recycled
- ✓ Low transport impacts
- ✓ Leftover concrete returned from construction sites
- ✓ Passive solar heated thermal mass makes completed buildings more energy-efficient

- ✓ Most wash water returned from construction sites
- ✓ Highly durable, low maintenance buildings and no rot
- ✓ High degree of noise control
- ✓ Inherent fire resistance
- ✓ Overall longer effective building life
- ✓ Demolished concrete can be recycled as hard fill or aggregate

For more on Firth's contribution to building a sustainable tomorrow today, visit [www.firth.co.nz](http://www.firth.co.nz) or call us on 0800 800 576 for our free brochure.

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