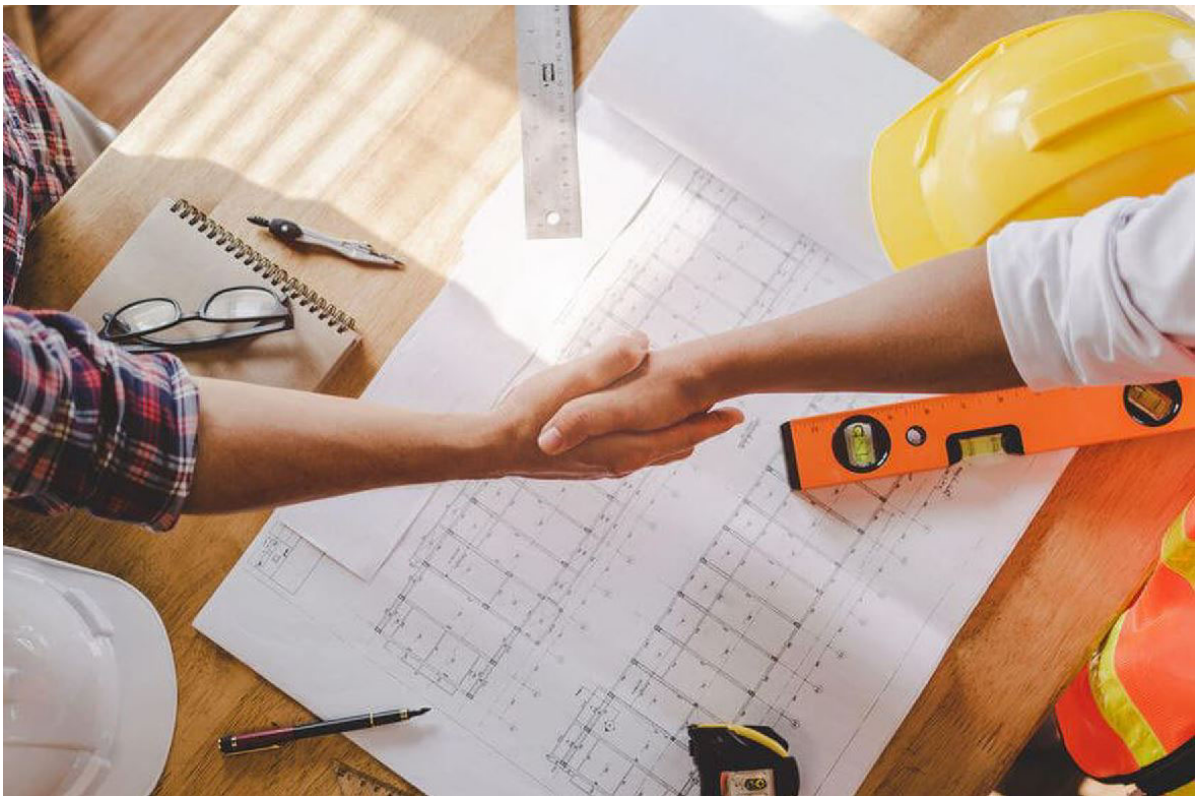
Master Brick & Blocklayers®



Brick Veneer Best Practice Guide

January 2025

Preface

This document is the result of a collaboration between the collective of Brick & Blocklayers Associations / Members within New Zealand and the Manufacturing and Distribution sector, under the guise of the 'Master Brick & Blocklayers of New Zealand'.

Since 1991 New Zealand has had a 'performance based' Building Code in place. What this means is that there is no set one way that buildings within New Zealand MUST be built, but instead focus is placed on how a building should perform once built.

The Ministry of Business, Innovation and Employment (MBIE) provides industry a set of 'Acceptable Solutions' as a means of complying with the Building Code. These documents however are not compulsory and at times the Best Practice Guide for Brick Veneer makes recommendations that are not part of, or contradict, the Acceptable Solutions. As the Standards are outdated by up to 20 years in cases we have endeavoured to point you towards information, or independent study reports, that show that these 'alternative solution proposals' should also meet the performance requirements of the NZ Building Code.

As an Industry we believe that we also need to consider Workmanship Quality with our guidance. Workmanship Quality describes the brick work that is not related to building performance, but the aesthetic finish that customers expect from Brickwork.

An acceptable Workmanship Quality standard has been met if a brick veneer has been laid to meet the performance requirements of the Building Code and achieves no visible defects when viewed at a distance of 6.1m with diffused light, as per Manufacturers specifications. This may be achieved without meeting all of the tolerances contained within this Best Practice Guide.

It is recommended when planning the design of a Brick Veneer that you engage a bricklayer early on, for their knowledge of design and product.

Master Brick & Blocklayers asks that you consider engaging the products and services of our Members who have contributed and made this document possible.

The brick cavity has meant that most brick homeowners managed to avoid owning a leaky home.

Designing and building brick cavities

A ‘cavity’, or ‘cavity gap’, is an area of space between the timber framing and the brick veneer that enables sufficient airflow and drainage to dry any moisture that may penetrate the brick veneer.
Without a cavity any moisture would be trapped between the brick and timber and may cause the timber to rot which has been the case with some other cladding products, particularly prior to 2004, resulting in ‘leaky home syndrome’.

CAVITY WIDTH
Unless a building consent states otherwise a cavity should be between **40–75mm** to comply with E2/AS1, which is the acceptable solution for claddings.
Designers and bricklayers should familiarise themselves with Section 9.2.6 Cavities and review Figure 73D of E2/AS1. You can read this documentation here: E2/AS1 (part 4)
It is important to remember that measurements for cavities are taken from the point where the brick tie is secured to the framing (which may not necessarily be the line of the supporting structure).
The cavity width should be clearly marked on all working drawings.

Master Brick & Blocklayers recommends that cavity gaps are designed to a 50mm cavity.
This provides a 10mm tolerance for variations in the framing or slab and accommodates should plywood bracing be a requirement. E2/AS1 allows for a maximum overhang of 20mm.

SLAB RECESSES

As a further weather tight design precaution brick veneers should be designed and constructed with a slab recess. This means that the veneer should be extended below the final floor level to ensure that any moisture that penetrates the cavity drains past the flooring level and out through the weepholes. This is intended to prevent moisture from potentially pooling and running to the inside of the dwelling.

Designers and Bricklayers should familiarise themselves with Section 9.2.5 and Figure 73D of E2/AS1 for options of slab recess. You can read this document here: E2/AS1 (part4) E2/ AS1 requires a step down of 50mm or more.

Master Brick & Blocklayers recommends a step down of 90-100mm and the placement of a sloping fillet at the base of the cavity to direct water to the outside.

DAMP PROOFING OF SLAB RECESSES

The slab edge and the bottom of the cavity should be sealed to prevent any moisture sitting in the bottom of the cavity from entering the dwelling.

E2/AS1 requires that damp proofing material be either:

Rebates lower than the ground; or

Two coats of a bituminous liquid; or

1mm of butyl rubber or bituminous sheet; or

0.25mm polythene; or

Polyethylene damp proof membrane.

If the rebate is above ground level then either: 1mm of butyl rubber, bituminous sheet, 0.25mm polythene or polyethylene damp proof membrane are the only options available.

WIDTH OF SLAB RECESSES

The width of the recess at the base of the veneer, where the brick sits upon, is governed by three factors:

The desired cavity width;

The width of the brick;

The amount, if any, that the brick will overhang the foundation.

If the brick product has not yet been selected, or if it is subject to change, then it is important to ensure that this ledge is designed with flexibility.

Master Brick & Blocklayers recommends designing a 120mm wide ledge and planning to overhang the brick 10mm to provide a drip edge.

ENSURING THE CAVITY IS CLEAR

A clean cavity free of mortar bridging the gap is essential for preventing moisture transference. NZS 4210:2001 Section2.7.1.7 advises that mortar should not encroach into the cavity more than 5mm.

Master Brick & Blocklayers recommends installing 'wash-outs'. A 'washout' involves laying every corner brick, plus extras where the panels are long and without an opening, on a bed of sand. Once the veneer is approximately 800mm high these bricks are removed to facilitate the regular washing out of mortar at the base of the cavity.

Mortar is used to hold bricks together and fill and seal any gaps around them. Basically mortar used in brick veneer is a mixture of sand, cement, admixture and water. It is however critical that the components of mortar are properly proportioned and mixed correctly.

MIXING MORTAR

For brick veneer to function correctly it is important that the bricks are stronger than the mortar. This will ensure that in the event of seismic activity the tensile bond strength, or adhesion of the mortar, will fracture rather than the bricks themselves.

NZS 4210:2001 provides for a strength requirement for structural masonry but not for brick veneer and states that mortars for veneers shall follow the strength requirement of the masonry suppliers.

In 2011 BRANZ released SR258 – Critical properties of Mortar for good Seismic Performance of brick veneer.
You can read this report here: SR258 Report

This research indicates that mortar strength should be at least 6mpa and advises that this can be achieved with mortar mixes of 4:1 sand to cement.
A hydration process occurs between the water and cement which causes the cement to harden and bind with the sand and therefore cause the mortar to 'set'. If the mortar shows signs of powdering that may mean that hydration has not occurred properly and the resulting veneer will need to be pulled down.
One of the most common causes of mortar powdering is rapid loss of moisture when the bricks are first laid. If the temperature exceeds 27 degrees Celsius then it is important to ensure that the bricks are kept damp for the first 24 hours.
In summer and for temperatures below 5 degrees Celsius any mortar which is more than 1.5 hours old should be discarded. Mortar should be discarded after 2 hours.
NZS 4210:2001 Section 2.2.2.2(e) advises that bricklayers should avoid re-tempering mortar with water.
Mixing good mortar is a skill obtained through experience. Mixing times, humidity levels and even the type of sand used can all have an effect on the final product. Bricklayers should consider using bagged mortar for quality control issues and to obtain compliant mortar strength.
Chemical admixture shall comply with NZS 3113:1979 or AS 1478.1:2000. Admixtures shall be dosed in accordance with the manufacturer's instructions. **Master Brick and Blocklayers** ask that if you do use bagged mortar that you support our manufacturing members:

Dricon (Firth): Trade Mortar Click here
Cemix: cemix.co.nz Click here
Ezymix: ezymix.co.nz Click here

'Mortar joint' is the term for the space of mortar between bricks. According to NZS 4210:2001 the average thickness of a mortar bed, Cross or Perpend joint should be 10mm +/- 3mm. A joint thickness of up to 20mm may be accepted on the bottom course to accommodate any slab level issues. Perpend or vertical joints must vertically align to within 10% of the brick length.
While the thickness of mortar needs to ensure that an adequate seal and bond is achieved, the mortar joint itself also provides an aesthetic value to the brick veneer. Different looks and weather tight properties, including mortar joints to sills and reveals where they meet the frames are fully mortared, can be achieved by creating different patterns in the mortar joint. Varying mortar joint styles are created by bricklayers running jointers, rakes or beaders across the mortar before it sets to achieve the desired look.
The most common mortar joint types are:

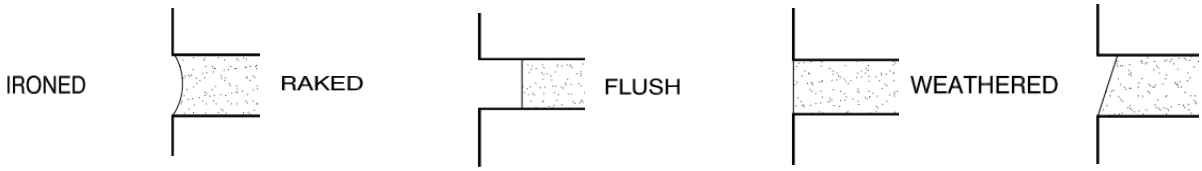
GROOVED JOINT – Also known as Concaved or rolled. This type of joint is formed by using a curved steel jointing tool. Its recessed profile and tight seal mean that it is very effective at resisting moisture penetration. This type of joint can be good for hiding small irregularities. Joints should be tooled to a maximum depth of 6mm after initial stiffening has occurred. **The delay of tooling is vital if a tight weatherproof joint is to be produced in horizontal, but particularly vertical joints.** It is recommended that all slurry coated bricks should use a grooved joint.

WEATHERED JOINT – The mortar forms a joint that is recessed from the bottom to the top. This type of joint can give brickwork a neat, ordered appearance. While not as weathertight as Grooved and 'V' joints, it can be used on external walls and should be tooled after initial stiffening has occurred. The delay of tooling is vital if a tight weatherproof joint is to be produced in horizontal but particularly, vertical joints.

'V' JOINT – This type of joint is formed with a V-shape jointer (or trowel). This type of joint can be good for hiding small irregularities. This joint has good weathertight properties. Joints should be tooled to a maximum depth of 6mm after initial stiffening has occurred. **The delay of tooling is vital if a tight weatherproof joint is to be produced in horizontal, but particularly vertical joints.**

RAKED JOINT – For this type of joint the mortar is raked out and once pointed and tooled shall not exceed a maximum depth of 6mm. It is important to compact the mortar to improve its weathertight performance. This design creates a form of ledge where water can pool.

EXTRUDED JOINT – This type of joint is formed without tooling. It is caused naturally as excessive mortar squeezes out between the bricks. Exposure to weather may degrade an extruded joints appearance.



FLUSH JOINT – Master Brick & Blocklayers does not recommend the use of flush joints unless they are compacted. If the mortar is flush jointed and not compacted it can lead to the following issues:

- When veneer is to be honed the mortar can 'flick' out with the honing process.
- When brick is to be plastered it can lead to hairline cracking in the plaster where the outline of the brick can be seen.

The type of brick selected plays a part in which type of mortar joint will work best. Straight edged bricks with a 'Vitratectm 'or 'slurry' coat should use grooved (rolled) joints, whereas colour through bricks with rumbled edges are better with raked joints.

Vitreous coated

Colour through

Master Brick & Blocklayers recommends discussing the Mortar Joint options for your chosen product with the installer who will take into account the Manufacturers recommendations.

TOOTHING

Toothing of the masonry is not permitted in many architectural specifications. Why does toothing provide less strength than raking, or stepping back of the masonry wall?

Toothing is not as strong because of the diificulty involved in properly filling and compacting the mortar for the full depth of the head and bed joints. Much of the mortar at the tooth portion of the wall must be installed by pointing the joints and it is difficult to point the mortar in the back portion of the joints (and into the cores). As a result these tooth joints are often poorly filled and as a result create a weak plane within the wall that is susceptible to cracking.

Toothing however is sometimes necessary when connecting to an existing wall. If the joint cannot be stepped back, providing a vertical expansion joint at such interfaces may be an alternative to toothing. When toothing must be done (eg: an infill in existing brickwork) extreme care must be taken to carefully point these joints to ensure that they are completely packed with mortar for the full depth.

Brick ties provide strength and flexibility to brick veneer.

Brick Ties

As the name suggests a brick tie is a connector that ties the brick veneer to the structural framing of a building. This feature both prevents the bricks from simply falling away from the framing and they also increase the strength of the brick veneer by transferring some of the force away from the brick and on to the structural element.

BRICK TIE DURABILITY

As brick ties are considered a structural element they are required under the New Zealand Building Code to have a 50 year durability.

If a building is within 500m of the high water mark, or within 100m of a tidal estuary (also known as the 'sea spray zone'), then Stainless Steel brick ties will be required. If you are unsure of this then we recommend talking with your local Council before commencing design or construction work.

BRICK TIE LENGTH

The length of the brick tie is dependent on two factors – the width of the brick cavity and the width of the brick being laid.

Brick ties generally come in four sizes– 85mm, 105mm, 115mm and 135mm.

To determine the minimum tie length required you need to ensure that the tie can sit flush with the framing and reaches at least half way across the width of the brick, while also maintaining 15mm end cover (mortar).

For example: If your cavity was 50mm and your brick was 70mm wide then you would need to ensure that a 85mm brick tie was used (50mm + 35mm).

BRICK TIE INSTALLATION

Brick ties must be screw tied using a 35mm X 12 g screw and must be installed with a 5 degrees slope down from the frame. The slope ensures that any water is moved away from the framing.

BRICK TIE BEDDING

Brick ties are required to be bedded into the brick with mortar. You need to ensure that there is a minimum mortar cover of 15mm of the end of the tie.

There are two trade practices for the bedding of brick ties. Wet-bedding is the process where the brick tie is held with a layer of mortar both above and below the tie. With dry-bedding the brick tie is placed directly on top of the brick and mortar is only placed on the top of the tie.

Tie bedding is an area of the trade where regulation has not kept up with building science. The current acceptable solutions for tie bedding are:

- on timber framing E2/AS1 requires wet-bedding
- on concrete block work E2/AS3 allows for either bedding methods.

In general bricklayers prefer to dry-bed brick ties. This is because it is a more efficient, productive and a proven method of installation. In 2006 BRANZ released a report that confirms that dry bedding is an acceptable procedure in brick veneer construction. You can read a copy of this report here: Click here

Master Brick & Blocklayers Association recommends that designers ensure they specify dry-tie bedding until NZS 4210:2001 is updated. This may mean that you will need to identify your building consent application as an alternative solution proposal – including the above reference to the BRANZ study report.

BRICK TIE PLACEMENT

Brick veneer is not assumed to have any structural strength and relies on support from the ties securing it to the structural timber framing. The ties themselves are designed to support a certain tributary area of masonry and it is important that the area per tie is not exceeded. The bottom brick tie when the rebate is sealed with a liquid applied damp proof course must be within 300mm, or two courses (whichever is smaller), of the base of the veneer. Brick ties are to be fixed to studs only with a maximum of 600mm centres horizontally and a maximum of 400mm vertically. Ties should also be positioned within 300mm horizontally of openings (MB&B recommends 200mm vertical spacing to meet the 220kg/m2 mass requirement in any seismic zone).

Designers and bricklayers should familiarise themselves with Section 9.2.7 Wall Ties and Tables 18A and 18B of E2/AS1. You can read this documentation here: E2/AS1 (part4)

Master Brick & Blocklayers recommend placing rows of In-joint reinforcement (eg: Brickweld) in the 2 joints above an opening, that extends to 2 full units on either side of the opening to reduce the risk of step cracking.

Brick Bonds

The way that bricks are arranged affects a veneers stability and strength and is referred to as a 'bond', or 'bonding'.

RUNNING OR STRETCHER BOND

Section 9.2.2 of E2/AS1 requires that bricks are laid with a 'running bond' (also referred to as 'stretcher bond'). E2/AS1 (part4).

To maintain a running, or stretcher bond, bricks of each course must overlap the previous course by between 25% and 75% of the length of the bricks (NZS 4210:2001 Section 1.3 Definitions).

Check bond pattern to ensure that ideally 1/2 or full bricks adjoin every opening, but no less than 25%. Master Brick & Blocklayers aesthetic standard is the greater of: ¼ the length of the units, or the width of the units.

A bond pattern should be consistent throughout the veneer.

BRICK CUTTING

To achieve a stretcher, or runner, bond and meet industry aesthetic standards the minimum size a masonry unit should be cut to is the greater of: ¼ the length of the units, or the width of the units.

The practice of brick cutting should comply with the Master Brick and Blocklayer Practice Advisory – Brick and Block cutting: Click here

MININUM WALL OR PANEL WIDTH

Section 9.2.3 of E2/AS1 advises that no length of veneer wall or panel can be less than 230mm.

If the wall or panel turns (usually 90°) then this is usually referred to as a return. The measurement of a return is taken as the total length of the wall, rather than treating the wall as two separate panels.

INTERNAL CORNERS

An internal corner should mirror an external corner as closely as possible. To meet industry standards and avoid the appearance of an undersized cut masonry unit, the length of the masonry unit visible in an internal corner should be the greater of: ¼ the length of the unit, or the width of the unit.

STACKBONDING

Stackbonding provides the ability to create a brick cladding that presents both vertical and horizontal lines and patterns that add new dimensions to the aesthetic appeal of the veneer.

Stackbonding is not recognised under the Acceptable Solution for brick veneers (E2/AS1) and therefore requires specific engineering design.

To assist with the design of stack bonded systems the New Zealand Concrete Masonry Association (NZCMA) has released design guidance that provides the following specification and limitations for stackbond use:

Studs are to be positioned at a maximum 400mm centres.

Screw fixed brick ties are to be installed at maximum 400mm centres horizontally and 400mm centres vertically (every 4th course commencing at two courses above the base, or equivalent in the case of a double height brick).

In-joint reinforcement is to be installed every 4th course (or maximum of 400mm) alternating with the rows of brick ties.

The maximum permitted height is 4.0m unless Specific Engineering Design has been undertaken to cover the additional required height specified.

You can read this information here:

Concrete: NZCMA MM 5.5 Stack Bond Veneer

Clay: CBPMA Stack Bond Design Appraisal

A good bricklayer carefully plans their work prior to laying. This involves:

- Carefully reading **ALL** building consent documents and familiarising themselves with any standards cited in the documents before starting
- Checking that the substrate has been properly prepared and sealed where required
- Calculating how many bricks are going to be required (and ensuring that factors such as mortar thickness are taken into account)
- Checking the bricks supplied are correct as per the building consent and contract
- Checking that there are no obvious issues / defects with the brick pallets provided
- Checking that all pallets display the same batch number
- Identifying what cuts may be required

Bricks should be laid to a straight line which generally involves running a string line at both ends of the wall. Bricks should be buttered to form perpends ("perps").

NZS 4210:2001 sets out the following tolerances for brick veneers walls:

ITEM	TOLERANCE
Deviation from vertical within a storey	10 mm per 3 m of height
Deviation from vertical in total height of bldg.	20 mm
Relative vertical displacement between masonry courses.	3 mm on nominated fair face (one side only) 5 mm on structural face
Deviation from line in plan: (a) In any length up to 10 m (b) In any length over 10 m	 5 mm 10 mm total
Average thickness of bed joint, cross joint or perpend joint.	+/- 3 mm on thickness specified

ALIGNMENT

Brick courses are to be within 10mm for every 3m rise in height within a single storey, or 20mm over the total height of a building (NZS4210: 2001)
Courses are to be horizontally level to within 5mm in any direction up to 10m or no more than 10mm in total in any direction over 10m (NZS4210: 2001)
Co

BRICK BLENDING

Bricks are a natural product that are subject to colour variance between batches. 'Blending' is the process used to vary brick pallets as they are laid as a means of avoiding any unwanted patterns caused by a variance.

Master Brick & Blocklayers recommends that bricklayers select bricks and blend vertically from at least three pallets, in order to achieve an adequate colour mix.

A bricklayer should also regularly check the veneer while laying from a viewing distance of 6.1m for obvious pockets of colour forming, that may be unacceptable.

Air flow and drainage are essential design features that ensure dry homes.

Weepholes and Cavity Ventilation

Weepholes and vents are components of brick design intended to assist with drainage and airflow within the brick cavity.

WEEPHOLES

It is important to remember that while brick veneers are an excellent rain shield, they are not waterproof. A considerable amount of water would be required before moisture is likely to flow down the back of the veneer.

In the event that this saturation does occur a series of gaps, or 'weepholes', are required to be placed along the bottom course.

A weephole of 75mm x 10mm is required to be placed every 800mm along the base, or alternatively 1000mm2/linear metre of wall.

Any weephole wider than 13mm requires vermin proofing.
Weephole requirements also need to be met across the heads of doors, windows and openings.

VENTS (VENTILATION)

Ventilation is the process of replacing air in any space with the intention of improving air quality. For the brick cavity this means replacing moist air within the cavity with drier air from the outside.
E2/AS1 provides two acceptable methods for venting brick veneer:

- Vertical vents installed as per the earlier weepholes in the top course or 2nd course down, or
- Leaving a 5mm gap around the top of the veneer

You can view these E2/AS1 requirements in Section 9.2.6(d) and Figure 73E here: E2/AS1 (part 4)

Note: Vent holes are not generally required under window sills as air can move freely around the frame.

PLASTERED OR PAINTED BRICK VENEER

Where a brick veneer is to be plastered or painted, the brick veneer exterior cladding is effectively a waterproof system. This means the need to have air circulation to dry the cavity and the weepholes to drain the veneer become less important.

The acceptable approach to weepholes in this scenario is 50mm x 10mm weep holes at 1m centres or 500mm2/linear metre of wall.

Vent holes are still required at the bottom of the plastered or painted veneer, however designers should check with their local council as requirements vary.

Master Brick & Blocklayers ask that when selecting vents that you support our members:

Victor Vents: http://www.victorvents.co.nz/

It is the bricklayers responsibility to ensure that all flashings have been installed correctly prior to the bricks being laid.

Brick Veneer Flashings

A flashing is an impervious material designed to prevent water from entering the brick cavity from joints such as those found in windows and doors.

The brick veneer system has functioned in New Zealand very successfully for many years with minimal flashings being installed, however in the modern environment flashings are an essential part of any cladding systems.

Designers and bricklayers should familiarise themselves with Figure 73C of E2/AS1 which can be viewed here: E2/AS1 (part4)

It is the bricklayers responsibility to ensure that all flashings are as per the consented plans and have been approved, prior to the bricks being laid.

HEAD FLASHINGS

If a metal head flashing is used and fixed to the framing you should ensure it is kept 5mm short at each end and the ends of the flashing should be turned up. This will allow for any movement in the framing without interfering with the bricks.

A 5 -10mm gap between the underside of the lintel bar and the flashing allows for both drainage and ventilation eliminating the need for weepholes in the bricks across the head of the opening.

JAMB FLASHINGS

Jamb flashings are simple and inexpensive. Use a 200mm wide polyethylene flashing tucked into the joinery flange. The open end of the flashing is to be held off the building wrap using a kick-out batten, or protruding clouts. The junction between the bricks and the joinery does not need to be sealed.

SILL FLASHINGS

Any moisture being driven up the sill brick needs to be stopped from reaching the timber framing and redirected into the bottom of the cavity. NZS 3604 S11.7.7 requires that flashings be extended 200mm past the sides of any openings where practical to do so.

Designing and Constructing Brick Sills and Lintel Bars

BRICK SILLS

Brick sills must overhang the brick work below by 30 - 50mm with a minimum slope of 15 degrees. Bricks must be evenly spread and of equal thickness across the width of the sill.

Another option is to have a header course spread evenly over the sill width. This applies to the heads of the windows as well.

LINTEL BARS

A lintel bar is a load-bearing building component that spans across openings such as windows and doors to provide structural support.

Designers and Bricklayers should familiarise themselves with Paragraph 9.2.9 and Table 18D and Table 18E of E2/AS1. You can read this here: E2/AS1 (part 4).

Lintel seating – lintels shall have a minimum seating into adjacent veneer of:

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

(ii) 200mm for spans over 2m

There are two methods of installing a lintel bar with brick veneer:

Acceptable Solution for lintel bar – E2/AS1 provides a method where the angle spans the brick from one side to the other. The lintel should be kept either solely in the brick, or the timber framing, but not both. The angle sizes within Table 18E of E2/AS1 should be applied.

Alternative Solution for lintel bar – The second method involves sitting the lintel back 20mm from the face of the veneer, and have correct seating. With this method the angle is attached directly to the structure and kept 5mm short of the opening at each end to accommodate any movement in the frame. The following table applies to this method.

Master Brick & Blocklayers suggest that as the sizes specified in Table 18E are the minimum requirement increasing the size (thickness) where issues could develop (eg: wider openings, heavy units, significant height to carry).

Table 7	Veneer lintel table - steel angles					
Maximum lintel span (mm)	Veneer thickness 70 mm			Veneer thickness 90 mm		
	Maximum veneer height supported			Maximum veneer height supported		
	350 mm	700 mm	2000 mm	350 mm	700 mm	2000 mm
2000	80 x 80 x 8	80 x 80 x 8	80 x 80 x 8	90 x 90 x 8	90 x 90 x 8	90 x 90 x 8
2500	80 x 80 x 8	80 x 80 x 8	90 x 90 x 8	90 x 90 x 8	90 x 90 x 8	90 x 90 x 10
3000	90 x 90 x 8	90 x 90 x 8	125 x 75 x 8	90 x 90 x 8	90 x 90 x 8	90 x 90 x 10
3500	90 x 90 x 8	90 x 90 x 8	125 x 75 x 8	90 x 90 x 8	90 x 90 x 10	125 x 75 x 10
4000	90 x 90 x 8	125 x 75 x 8	125 x 75 x 10	90 x 90 x 10	125 x 75 x 8	150 x 90 x 10
4500	125 x 75 x 8	125 x 75 x 10	–	125 x 75 x 8	125 x 75 x 10	–
4800	125 x 75 x 8	125 x 75 x 10	–	125 x 75 x 8	125 x 75 x 10	–

NOTES:

a) All sections are steel angles.
b) Stainless steel sections of equivalent section modulus are a permitted alternative.
c) A minimum dimension of 80 mm x 80 mm x 8 mm is regarded New Zealand common practice.
d) Propping of lintels for 28 days is recommended to allow for sufficient curing and setting time.

The above is the CNZ CP01 Table for recommended Lintel sizing.

The durability requirements for lintel bars can be seen in Table 18D of E2/AS1 (part 4).

FIG.9 LINTEL BAR - TRADITIONAL

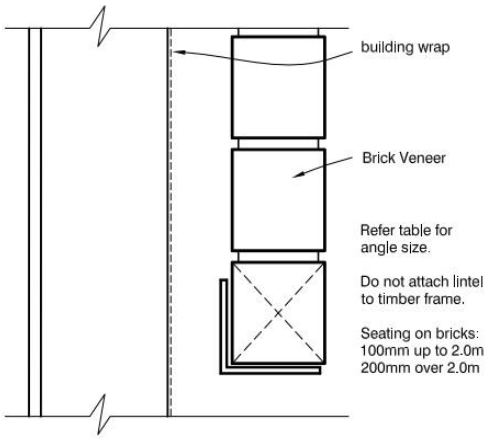
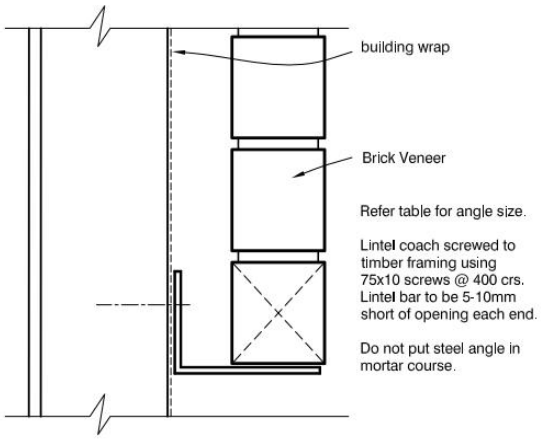
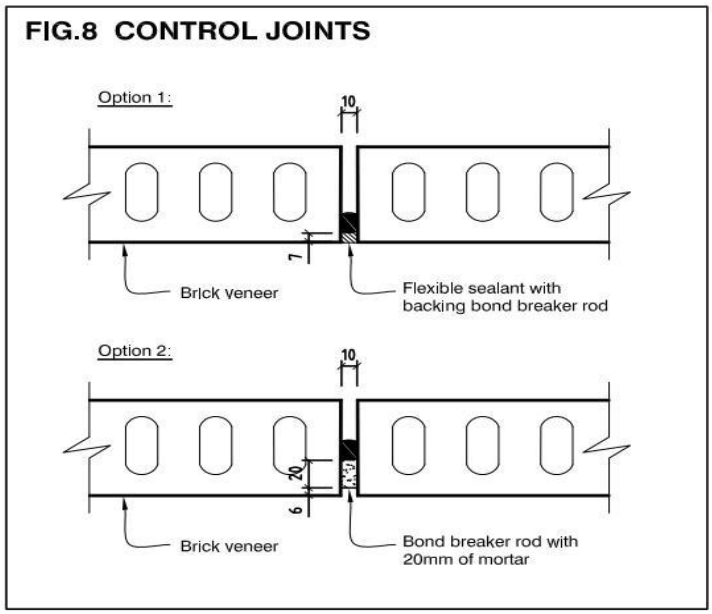


FIG.10 LINTEL BAR - FIXED TO FRAME



Control joints allow concrete brick veneer to respond to minor movement of the building.



Control Joints

Buildings and building components generally move slightly after construction. Often this relates to normal expansion due to acceptable moisture absorption. Control joints are vertical gaps usually filled with elastic type materials which allow the veneer to respond to these movements, usually by opening in response to expansion.

Generally clay brick veneer does not require control joints. Slight expansion can occur soon after manufacture, but this does not appear to present any issues in normal construction.

Concrete brick veneer however typically requires control joints. Designers and bricklayers should check manufacturers specifications and familiarise themselves with Section 9.2.8.2 of E2/AS1 which you can read here: E2/AS1 (part4).

DESIGNING OF CONTROL JOINTS

Control joints should also be designed and constructed as shown in Figure 73A of E2/AS1.

This requires that control joints consist of:

- A backer rod of compressible foam; and
- Sealant that complies with either Type F, Class 20 LM or 25 LM of ISO11600 or Low modulus Type II Class A of Federal Specification TI-S-00230C

PLACEMENT OF CONTROL JOINTS

To allow for the potential shrinkage in the length of concrete brick veneer E2/AS1 requires that vertical control joints are placed at not more than 6m centres.

Vertical control joints are also required to be located:

- Within 600mm of T joints;
- Within 600mm of L shaped corners or by restricting the space to the next control joint to 3.2m maximum;
- At changes in wall height that exceed 600mm;
- At changes in wall thickness

It is not uncommon to read reports from Geo-Tech Engineering for control joints in clay brick veneers due to expansive clay soils, but this is not necessary. Where such soil types occur, an appropriate foundation should be designed to manage this and there is no evidence that control joints would be necessary.

Control joints should be considered, however in clay and concrete brick veneer in the following circumstances:

- If a wall is 10m or longer and has no window or door openings – a control joint should be installed at an intermediate point.
- Where a small panel of brick work adjoins a large panel of brickwork, as movement within the framing may cause a crack, a control joint may be considered. An alternative however would be to strengthen the framing using additional brick ties and using reinforcing in mortar joints in these areas.

Where a control joint is used it is important to ensure that the framing details provide a stud within 200mm of each side of the joint for the fitting of brick ties.

It is important to remember that if a crack develops in an otherwise well constructed brick veneer it is an aesthetic issue only and should cause no problems as to weather tightness, or the overall integrity of the veneer. A control joint is in effect a controlled crack.

Brick Veneer Heights

E2/AS1 sets the limitations for Brick Veneer heights in Section 9.2.3 and Figure 73B. You can read this document here: E2/AS1 (part 4)

It advises that brick veneers with timber framing shall have:

- A maximum height of veneer above finished ground level of 7m;
- A maximum height of 4m from the foundation;
- A maximum height of 5.5m to the apex of a gabled area

If the veneer is supported by a masonry structure NZS 4229:2001 permits a veneer height of 6.0m for the wall and up to 10m in a gable area.

The **Clay Brick and Paver Manufacturers Association** has developed a combined 2 storey system for clay brick veneer - Design Note TB 1. Designers and Bricklayers should familiarise themselves with this document which you can read here: Click here

You may also want to consider the following Concrete Brick 2 Storey Solutions:

Concrete:
Firth: Click here
Bowers Brothers Concrete: Click here

Staining generally has only an aesthetic effect on brick veneer.

Stain removal

While it is perfectly normal for clay bricks to have a slight variance in colour, this is different than brick stains. All care should be taken during construction to prevent staining occurring, however this is not always possible.

Stain removal depends on the cause of the stain.

Master Brick & Blocklayers advises that prior to undertaking any brick cleaning, to consult the Manufacturer / Distributor of the brick for advice on the process and products to use.

VANADIUM STAINS

Light coloured clays often contain vanadium salt that are generally colourless, but under certain conditions may appear as yellow, green or reddish-brown discolouration of the brick. Vanadium stains are neither permanent nor harmful and do not indicate a defect in the brick.

Vanadium stains are often generated by the use of too strong a concentration of hydrochloric acid **(the use is not recommended)** during the initial cleaning process, or from excessive water penetration.

While vanadium stains will wash off overtime, an application of 4% Sodium Hypochlorite (Janola) or a mixture of Sodium Bicarbonate (Baking Soda) and water (60g per litre of water) will assist in their removal.

Note: Hydrochloric acid **(the use is not recommended)** may turn vanadium salts black and make it difficult to remove.

MANGANESE STAINS

This stain occurs characteristically along the edges of grey or brown clay bricks. It appears as a dark blue - brown discolouration.

If you suspect manganese staining contact your brick company for them to inspect and advise on a resolution.

COPPER AND BRONZE STAINS

Sometimes clay brick veneer may be in close proximity to metals such as copper or bronze. Water washing over these metal surfaces can result in a bluish-green stain appearing on the surface of the bricks.

These stains may be removed using a solution of 1 part acetic (vinegar acid) acid (80% or stronger): 1 part hydrogen peroxide (30%-35% strength):6 parts water.

IRON OXIDE (RUST)

Rust can be the result of using hydrochloric acid on clay bricks **(the use is not recommeded)**. This may be able to be removed by applying a solution of 1 part phosphoric acid to 4 parts of water. Allow up to 24 hours for it to work.

SMOKE STAINS

Common around domestic fireplaces, but can also be an issue with fire damaged buildings. Minor smoke stains can be removed with sugar soap which is a highly alkaline mixture. Mix approximately 500mls into 2 litres of water and apply liberally by brush. After the smoke stains disappear scrub with a mixture of detergent and household scouring powder containing Sodium Hypochlorite (Janola).

Master Brick & Blocklayers ask that when selecting Cleaning Products that you support our Members.

Cleaning Product links:

Firth - CT Cleaner

https://www.firth.co.nz/bagged-premix/additives-and-repairs/concrete-treatment/

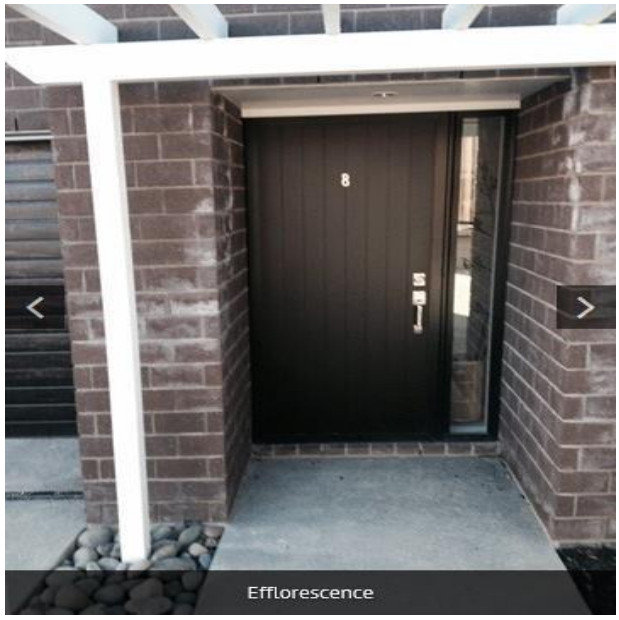
Cemix - Concrete Cleaner Efflorescence

https://www.cemix.co.nz/products/concrete-cleaner-efflorescence/

Horizon International - G.A.R & M.V.R

https://www.horizoninternational.co.nz/guardit-cleaning-sealing-and-protecting/

Efflorescence



Efflorescence is a calcium deposit that can form on clay or concrete veneer. It appears as a white powdery and sometimes 'fluffy' deposit on the brick.

Efflorescence occurs where excessive amounts of water enters a veneer that has soluble salts present. When the water dries out the salts are then deposited on the surface of the veneer. Soluble salts can enter the veneer from various sources:

- Mortar components, particularly cement
- Soil or fill in contact with the wall
- Sea spray in coastal areas
- Masonry units (not a common source)

Master Brick & Blocklayers recommends that bricklayers protect new brick work with adequate coverings when rain is imminent, or interrupts construction.

Persistent efflorescence may act as a warning sign that water is entering the wall through faulty copings, flashings or pipes.

CLEANING EFFLORESCENCE

Most efflorescence will naturally disappear over time, however its removal can be accelerated by brushing with a stiff dry brush. The use of a dust pan or vacuum cleaner to collect the salts after brushing is recommended as this will prevent salts from re-entering the brickwork, or any porous paving materials below.

After brushing and cleaning up an absorbent cloth (wrung out until damp only) can be used to pick up any residue. Frequent rinsing of the cloth in fresh water is advisable. Rinsing brick work with water will only cause the salt to be re-absorbed in to the bricks and reappear when dry.

Brick Tolerances and Aesthetic Appearance

It is possible for a brick veneer to be building code compliant but not have the visual look that reflects the skills of an experienced bricklayer. This is referred to as 'workmanship quality'.

It is important to discuss with your bricklayer the aesthetic look you are hoping to achieve with your brick veneer and if possible include them in your selection process.

Master Brick & Blocklayers recommends that parties to a brick veneer construction enter into a clear written contract that sets out the expectations of parties, including agreed workmanship quality standards, quality checking responsibilities and an agreement on how disputes will be managed – even if it is not a compulsory requirement under legislation.

VIEWING DISTANCE

Due to the nature of bricks no two bricks are the same and no brick is perfect when examined closeup. ASTMC90 has been adopted as the industry standard for viewing brickwork – it states that: 'for exposed wall construction chips and imperfections shall not be evident when viewed from a distance of not less than 6.1m in diffused light'.

DRYING CRACKS

During the manufacturing process hairline cracks can appear in a small number of clay bricks. This occurs during the drying process when excess moisture is removed from the clay prior to it entering the kiln. Bricks with these cracks conform to AS/NZS 4455 and do not compromise the structural integrity, or weather tightness of the brick.

From an aesthetic standpoint the relevant American Standard Test Method (ASTM) has been adopted. ASTM C216-04 specifies that bricks must contain less than 5% visible cracking when viewed from a distance of 6.1 metres.

CHIPPING

Bricks may be transported several times before arriving onsite and occasionally chipping can occur. Chips are more noticeable on bricks that have a surface colour different from the body of the brick. A workmanship quality standard is achieved if imperfections, including chips, are not visible when viewed from a distance of not less than 6.1m under diffused light as per ASTM C90.

New Zealand does not have a standard to assist a Bricklayer to evaluate the level of chipping acceptable in a brick prior to laying, however ASTM C216-15 has been adopted by the MB&B. ASTM C216-15 for a general purpose face brick (FBS textured) basically has the following requirements:

- Chips from the edge should not be deeper than 8mm
- Corner chips should not be deeper than 13mm
- When all the length of the chips are added up that the total does not exceed 10% of the perimeter of the brick face (as an example the accumulative lengths of the chips for a 230mm X 75mm brick shall not exceed 61mm).

It is good practice for Bricklayers to set aside bricks that do not meet this standard and to assess whether to discard it or use it for cuts.

DIMENSIONAL CATEGORY

AS/NZS 4455 Masonry Units and Segmental Pavers calls for bricks to be classified into dimensional categories based on their deviation from their work size, or the size specified in manufacture.

To test if bricks meet the standard 20 bricks should be placed in a row and the total length should be measured. This can be done with height, width and length. Tolerances for these are:

TABLE 2.1

DIMENSIONAL DEVIATIONS OF MASONRY UNITS

Category	Work size dimensions, mm		
	Under 150	150 to 250	Over 250
DW0	No requirement		
DW1 (see Note 1)	±50	±90	±100
DW2 (see Note 1)	±40	±60	±70
DW3	Values declared by the supplier or by agreement between the supplier and purchaser		
DW4 (see Note 2)	Standard deviation of not more than 2 mm and a difference between the mean and the work size of not more than 3 mm		

NOTES:

1 For DW1 and DW2 refer to the AS/NZS 4456.3 test method for determination of cumulative dimensions. The values given are measured over 20 units.

2 For DW4 refer to the AS/NZS 4456.3 test method for determination of measurements for individual units.

2.2.4 Dimensional consistency between deliveries

For dimensional categories DW1 and DW2, the overall dimensions of 20 units taken fro separate deliveries of units of the one type and the subject of a single order shall not diff by more than 40 mm.

RUBBING

During transportation bricks may rub together on the pallet. This can sometimes cause light rubbing on the face of the bricks. Excessively rubbed bricks should be discarded, or used for cuts.

COLOUR VARIATION

Clay and concrete bricks are both subject to some variation in colour between batches. This is part of the inherent beauty of brick.

Unusual discolouration patterns can be limited by blending the bricks. Should there be any concern regarding significant colour variation laying should cease and the manufacturer contacted.

Link to the MBIE Guide To Tolerances:
https://www.building.govt.nz/assets/Uploads/ projects-and-consents/guide-to-tolerances/ guide-to-tolerances.pdf

Unless specifically outlined in the contract specifications, imperfections that are only visible under critical light do not indicate defective workmanship.

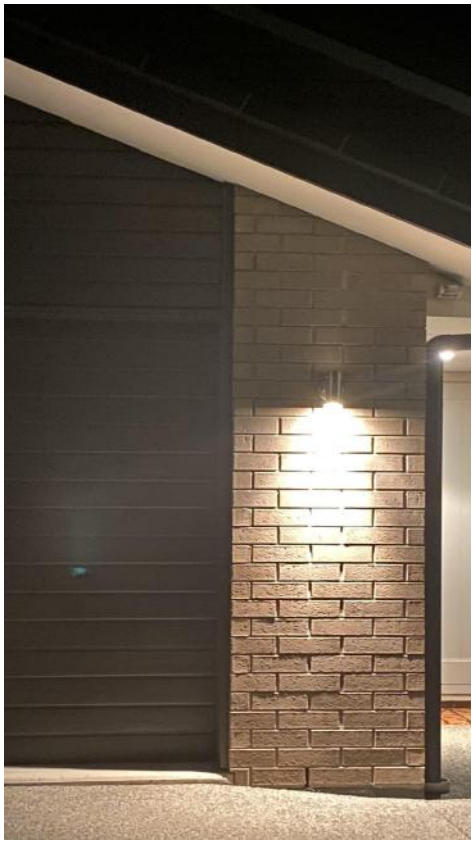
Critical lighting occurs when sunlight or an intense artificial light source strikes a wall or other flat surface at a low angle, typically 15° or less. Because of the low angle of the light any small variations or irregularities on the surface cast a relatively large shadow which can highlight imperfections that would not normally be visible under more diffused lighting conditions.

Critical lighting occurs naturally for a short period each day, typically 30–60 minutes in the early morning and late afternoon when the sun is low in the sky.

It is common practice to use high output lighting to accentuate areas requiring attention during the construction phase, but this level of lighting is not suitable for performing a subjective visual inspection of interior surfaces.

More information on critical lighting and its effects is available from:

> AS/NZS 2589:2007 - Gypsum linings - Application and finishing (particularly Appendix C)
> AWCIANZ Trade Guidelines and Information Booklet Oct 2012 (www.awci.org.au/nationalpublications/ trade-guidelines-information booklet)
> AWCIANZ Insight Newsletter: Critical light August 2014 (awci.org.nz/critical-light)



Diffuse light is light that is scattered, causing it to fall on the crop from all sides. The light is evenly distributed leaving no sharp shadows. Diffuse light arises when direct light is scattered naturally (e.g. by clouds), or with artificial means (e.g. a diffuse coating).

Direct light is a light where no obstacle is between the light source and the subject. The light rays all go in the same direction and are completely rectilinear from their point of departure to their destination.

On the contrary, diffuse light is a light whose light rays go in different directions.

GUIDANCE FROM - CLAY BRICK & PAVERS MANUFACTURERS ASSOCIATION

Introduction

What is a brick slip? We like to refer to a brick slip as the solution to achieving the genuine look of clay brick virtually anywhere you wish to put brick. It is a piece of brick approx 18mm thick cut from the face of a brick using a diamond saw and glued to a substrate as you would for a ceramic tile.

The thickness of the brick slip is important. It should be a minimum of 15mm and a maximum of 25mm, the optimum being 20mm. Stone slips are thicker. There are four basic reasons for this requirement: to keep the weight to a minimum; to provide a smooth surface (free of the holes) upon which to spread the glue; to avoid forming a pocket that can trap moisture that could freeze in the winter, or boil in the summer creating possible problems, and to have sufficient thickness to achieve a suitable mortar joint.

Cutting Brick Slips

It is desirable to cut the brick slips on site. The advantages of doing this are: that you know the slips have come from the same batch number as other bricks on the job; wastage is kept to a minimum and there are no breakages due to transport. There are approx. 50 brick slips per square metre of wall. The slips may be cut as stretchers, headers and even right-angle slips (L-shape) to go around corners and use up the sides of windows. If the brick is a rumbled brick add approximately 3mm to the thickness of the cut to allow for the rumble.

Installation

The brick slip system is an excellent system, provided all involved follow the specifications of which there are three components involved: the brick slip itself; the substrate it is going on and the adhesive used. If the installation is not carried out correctly there is a high risk of failure, which could be very expensive to repair.

The Brick Slip

- Cut the brick slips to the required thickness - 20mm recommended
- Ensure the slips are dry prior to installing them
- Remove all dust from the back of the slip with a damp cloth prior to applying the adhesive

The Substrate

If the substrate is concrete panels, or concrete blocks movement control joints need to be installed through both the concrete substrate and the brick slips that are adhered to the surface.

PLEASE NOTE: Over recent years some major manufacturers/suppliers of fibre-cement board products have withdrawn their approval for brick slips to be installed on their products. It is important that approval is obtained from any supplier/manufacturer of a fibre-cement board as to its suitability as a substrate for brick slips prior to proceeding with design and installation.

The Adhesive

Although there are several good adhesives on the market we recommend one of the following:
Wall n Floor is marketed by Flexco 09 268 6970 http://www.flexco-nz.co.nz

The Laticrete Adhesive system is supplied by Global Tile Ltd: Laticrete NZ provide a full instruction sheet for fixing brick slips using the Laticrete System; the following are the major points covered in these instructions.

For small jobs a tube of H.B Fullers Sturdibond will do the job.

Substrate Surface Preparation

IMPORTANT: If the substrate is precast concrete it is essential that all 'releasing agents' have been thoroughly removed from the concrete prior to commencing laying brick slips and that all brick dust has been washed off the brick slip.

- The surface must be clean, dry and free of contaminants. No primer is required as the waterproof membrane Laticrete Hydro Ban water proofing and crack prevention membrane provides a barrier.
- Seal all joints by using a brush or roller to apply a thick coat of Laticrete Hydro Ban to a strip 75mm either side of the joint.
- Immediately bed the reinforcing fabric bandage into the wet liquid to bridge the joint.
- Coat the remainder of the wall with Laticrete Hydro Ban and at the same time apply a

  second liquid coat over the reinforcing bandage. Note: 5 litre bottle covers 10m2; drying time is approximately 12 hours.

Applying the Brick Slip Adhesive

By just mixing with Laticrete 254 Platinum powder will make a high strength flexible and shock resistant latex thin-set adhesive – coverage 7.4 – 8.8m2 per 23kg bag using 6mm x 6mm notched trowel.

- Mix 5:2 litres of fresh water with 23kg bag of Platinum. Mix until creamy and workable. Adjust quantity of liquid to achieve the proper working consistency.
- Allow to stand for 5–10 minutes and re-mix.
- Using the edge of a trowel scrape a film of adhesive, working it into the substrate. Apply the adhesive to the back of the brick slip with the trowel, working it into the surface. It is essential that sufficient adhesive is used to completely cover the back of the slip with a minimum 2.5–3.0mm thick uniform adhesive bed.
- Place the brick slips while the adhesive is wet and tacky. Take care to firmly bed the brick slips onto the wall substrate.
- If mortar is being applied at the same time as the adhesive, bricks may be pointed as the job progresses. In other words, laid the same as if laying normal bricks. I recommend this method. If not, joints may be pointed once the adhesive has firmly set. Note 10mm spacers are required if this method is adopted.

General Comments

- It is not essential, but we recommend a waterproofing product (Surfapore R) be applied over the wall surface once dry and completed for extra protection.
- It is essential that control joints be installed where brick slips abut a different cladding, either horizontally, vertically or as required.

PLEASE NOTE: The Clay Brick & Pavers Manufactuers Association and its members take no responsibility for the installation of brick slips; the information provided here is done so as a guide for our customers and to aid the process of installing brick slips. It is the responsibility of the owner, the builder, the bricklayer and the architectural designer to ensure that acceptable and correct procedures are followed and carried out by professionals who know what they are doing.