# BRICK VENEER BEST PRACTICE GUIDE

BRICK & BLOCK LAYERS

- FEDERATION OF NEW ZEALAND -

# BRICK VENEER BEST PRACTICE GUIDE - PREFACE

## Preface

This document is the result of a collaboration between the collective of Brick and Blocklayers associations within New Zealand and the manufacturing and distribution sector under the guise of the 'Brick and Blocklayers Federation of New Zealand (BBFNZ).

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 to the 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. In these areas, 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 Brick work.

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 by a 6.1m with diffused light viewing distance as per manufacturer's 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.

BBFNZ asks that you consider engaging the products and services of our members who have contributed and made this document possible.

# THE BRICK CAVITY

*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 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
73Dof E2/AS1. You can read this documentation here: E2/AS1 (part4).
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.
**The Brick and Blocklayers Federation 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 weep holes. 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 73DofE2/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.

**The Brick and Blocklayers Federation 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 or bituminous sheet or 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.

**The Brick and Blocklayers Federation 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. NZS4210:2001 Section2.7.1.7 advises that mortar should not encroach into the cavity more than 5mm.

**The Brick and Blocklayers Federation recommends specifying and installing 'wash-outs'.**

A 'wash- out' involves laying every corner brick and every subsequent brick at 800mm centres on a bed of sand (thus coinciding with weep hole requirements). 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

*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, ad mixture 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.

NZS4210:2001 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:
http://www.branz.co.nz/cms_show_download.php?id=8270db8e7e10636a60e5faedc2cd280ee6041b62

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 any mortar which is more than 1.5 hours old should be discarded and for temperatures below 5 degrees Celsius mortar should be discarded after 2 hours.
NZS4210:2001 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.
The Brick and Blocklayers Federation ask that if you do use bagged mortar that you support our manufacturing members:
Dricon (Firth)
http://www.firth.co.nz/product-information/dricon/dricon-product-range/trade-mortar.aspx

# MORTAR JOINTS

'Mortar joint' is the term for the space of mortar between bricks. According to NZS4210:2001 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.
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 can be achieved by creating different patterns in the mortar joint.
Varying mortar joint styles are created by bricklayers by running jointers, rakes or beaders across the mortar before it sets to achieve the desired look.
The most common mortar joint types are – grooved, weathered, 'V', raked, extruded or flush.

**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.
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 to 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. 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 weather tight 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** – The Brick and Blocklayers Federation 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 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 must use grooved (rolled) joints whereas colour through bricks with rumbled edges are better with raked joints.
It is important to adhere to the recommendations of your brick manufacturer when deciding on which type or mortar joint to use.

# BRICK TIES

*Brick ties provide strength and flexibility to brick veneer.*


Brick tie secured to framing


Dry tie bedding

## Brick Tie

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.
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 X12g 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: BRANZ DryBeddingMasonry Ties StudyReportno156:2006

**The Brick and Blocklayers Federation recommends that designers ensure they specify dry-tie bedding until NZS4210:2001 is updated.** This may mean that you will need to identify your building consent application as an alternative solution proposal–were commend 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 (BBFNZ 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)

The Brick and Blocklayers Federation ask that when selecting brick ties that you support our manufacturing members:

INNOVATIVE BUILDING PRODUCTS LTD– www.brickties.co.nz

# BRICK BONDING

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

## 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). You can read this document here: E2/AS1 (part4)

This means that the bricks of each course overlap the previous course by between 25% and 75% of the length of the bricks as per NZS4210: 2001 Section 1.3 Definitions

NZS3604:2011 Section 11.7.2.2 advises that no length of veneer wall or return can be less than 230mm.

While 70mm brick maybe laid to 1/3 bond (also known as metric bond) it is recommended that bricks always be laid to 1/2 bond (50%). This may mean cutting all 70mm corner bricks to 190mm in length.

Internal corners and junctions need to be stitch bonded.

**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: NZCMA information on Stackbonding design

# LAYING BRICKS

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

- Carefully reading **ALL** building consent documents and familiarising themselves with any standard 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").

NZS4210:2001 sets out the following tolerances for brick veneers walls:

| Item | Tolerance |
|---|---|
| Deviation from vertical within a storey | 10 mm per 3m of height |
| Deviation from vertical in total height of bldg. | 20 mm |
| Relative vertical displacement between masonry courses. | 5mm on structural face |
| Deviation from line in plan: | |
| (a)In any length up to 10m | 5mm |
| (b) In any length over 10m | 10 mm total |
| Average thickness of bed joint, cross joint or perpend joint. | 10mm+/-3mm on thickness specified |
| Tolerances cannot breach minimum cavity width requirements. | |

**BRICK BLENDING**

Bricks are natural products 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.

**The Brick and Blocklayers Federation 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.

# WEEP HOLES AND VENTS

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


## Weep holes and Vents

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

**WEEP HOLES**

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 'weep holes' are required to be placed along the bottom course.

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

Any weep hole wider than 13mm requires vermin proofing.

Weep hole 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 weep holes; 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 (part4).

**The Brick and Blocklayers Federation recommends that if you are installing vertical vents that you install these in the second brick from the top.**

This ensures that the bond of the bricks on the top row is not weakened.

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

**The Brick and Blocklayers Federation recommends that where windows exceed 2.4m in length that 1 or 2 vent holes are evenly spaced under the sill.**

**PLASTERED OR PAINTED BRICK VENEER**

Where a brick veneer is 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 weep holes to drain the veneer become less important.

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

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

The Brick and Blocklayers Federation ask that when selecting vents that you support our members:

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

# BRICK VENEER FLASHINGS

*It is the bricklayer's responsibility to ensure that all flashings have been correctly installed 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 73 Cof E2/AS1 which can be viewed here: E2/AS1 (part4)

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

**HEADFLASHINGS**

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 weep holes 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.

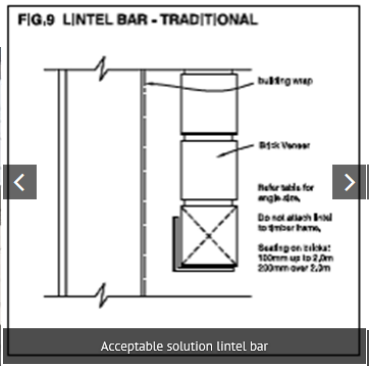
**SILL FLASHINGS**

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 3604S11.7.7 requires that flashings be extended

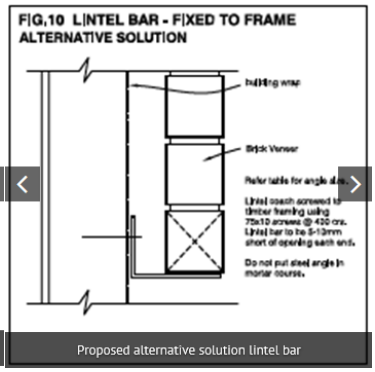
200mm past the sides of any openings where practical to do so.

# DESIGNING AND CONSTRUCTING BRICK SILLS AND LINTEL BARS


Brick Sill



Acceptable solution lintel bar



Proposed alternative solution lintel bar

## Designing and Constructing Brick Sills and Lintel Bars

**BRICK SILLS**

Brick sills must overhang the brick work below by 30 - 50mm with a minimum slop 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.

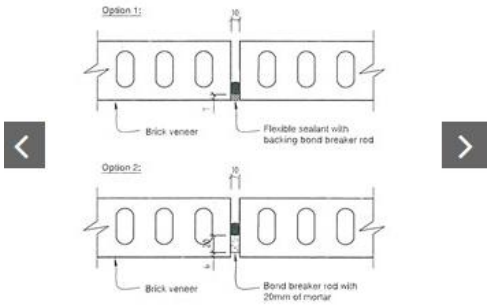
Alternative solution for lintel bar – The second method involves sitting the lintel back 20mm from the face of the veneer, and have correct seating. With this method, the angle is attached directly to the structure and kept 5mm short of the opening at each end to accommodate any movement in the frame.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

| Max.Span(mm) | Size of Angle |
|---|---|
| 3000mm | 80X80X6 |
| 3500mm | 100 x 100 x 6 or 125 x 75 x 6 |
| 4500mm | 125 x 75 x 8 |
| 4800mm | 125 x 75 x 10 |

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

# CONTROL JOINTS

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




Alternative Control Joint options.

## 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 in elastic materials, which allow brick 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 Tjoints;
- 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 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.

If possible, position a control joint behind down pipes to hide them.

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

## 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, NZZS4229:2001 permits a veneer height of 6.0 for the wall and up to 10m in a gable area.

The Clay Brick and Paver Manufacturers Association have 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: 2StoreyClayBrickVeneerConstruction- MadeEasy

You may also want to consider the following concrete brick 2Storeysolutions:

Firth 2StoreyBrickVeneersolutionforDevonstoneand70mmBrickVeneers

Firth 2StoreyBrickVeneersolutionforFirth 10seriesHollowMasonry, Manorstoneand 90mmBrick Veneers

# BRICK STAINING

*Staining generally has only an aesthetic effect on brick veneer.*

## Stain removal


Vanadium Staining


Manganese stains

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.

**The Brick and Blocklayers Federation recommends that you consult your bricklayer or brick supplier before attempting stain identification and removal.**

**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 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 and water (60g per litre of water) will assist in their removal.

Hydrochloric acid may turn vanadium salts black and make it difficult to remove. It is therefore important that vanadium salts are removed before attempting to clear mortar residue from clay brick veneer with hydrochloric acid.

**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 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. 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.

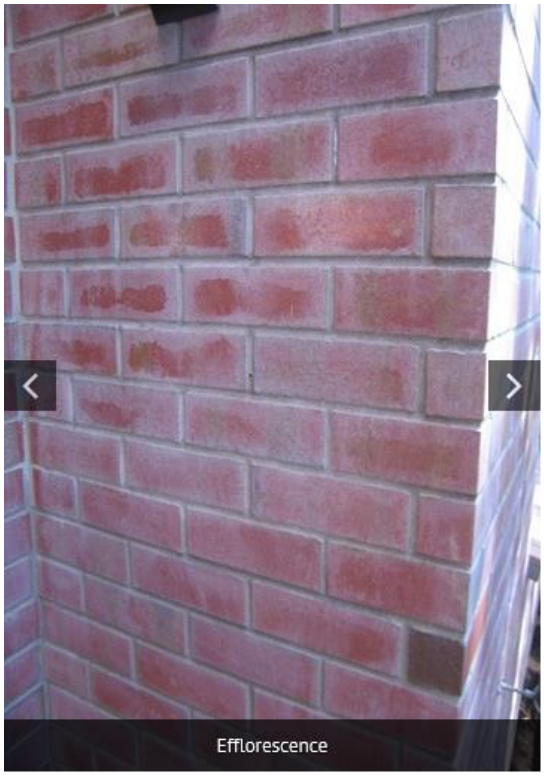
**SMOKE STAINS**

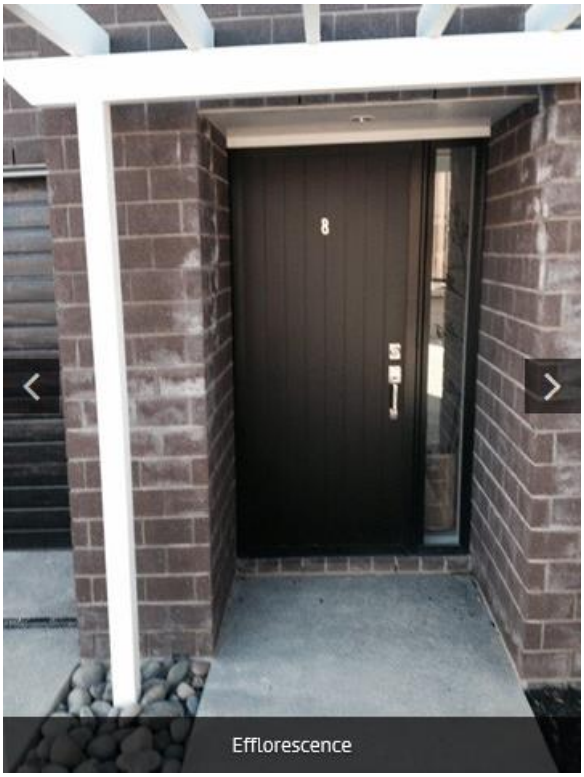
Common around domestic fireplaces but can also be an issue with fire damaged buildings.

Minor smoke stains can be removed with sugar soap–which is a highly alkaline mixture. Mix approximately 500g in to 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).

# EFFLORESCENCE

## 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).

**The Brick and Blocklayers Federation recommends that bricklayers protect new brick work with adequate coverings when rain 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

## 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.

**The Brick and Blocklayers Federation 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 close-up. 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/NZS4455 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 meters.

**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 BBFNZ.

- 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 is 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/NZS4455 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:

| Category | Height | Length | Width |
|---|---|---|---|
| DW1 | ±90mm | ±50mm | ±50mm |
| DW2 | ±60mm | ±40mm | ±40mm |

**RUBBING**

During transportation brick 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.