DESIGN NOTE A1

Height Limitations for Brick Veneer

April 2020

Limiting the Height of Brick Veneers

Brick Veneer is classified as a heavy weight cladding which must be supported by a structural timber or concrete structure. Under E2/AS1 Masonry and NZS4210, the maximum permitted weight is 220kgs/m^2. This maximum weight will permit 110mm clay bricks from Australia to be used in New Zealand.

However, over 95% of all clay brick veneers in New Zealand, are constructed using 70mm thick bricks, which range in weight from around 100kgs/m^2 to 140kgs/m^2 - significantly less than the maximum permitted.

The limits placed on the heights to which brick veneers can be constructed, has always been governed by the risk they imposed.

When these limitations were set, many years ago, 90mm bricks weighing approximately 180kgs/m^2, was the brick manufactured and used in New Zealand.

In addition, these much heavier bricks were fixed to the supporting timber structure by just 2 nailed on brick ties/ sq.yd.

Since 1995, the modern era, the new standard was set at 5 screw-fixed brick ties/ sq.m of veneer. The holding power of this new requirement, in securing this now much lighter, heavy-weight cladding to the supporting structure is ten-fold better.

The performance of modern brick veneers, during the Christchurch earthquakes, correctly installed, was exceptional.

Unfortunately the building industry is at this time restricted by the height limitations set in the distant past.

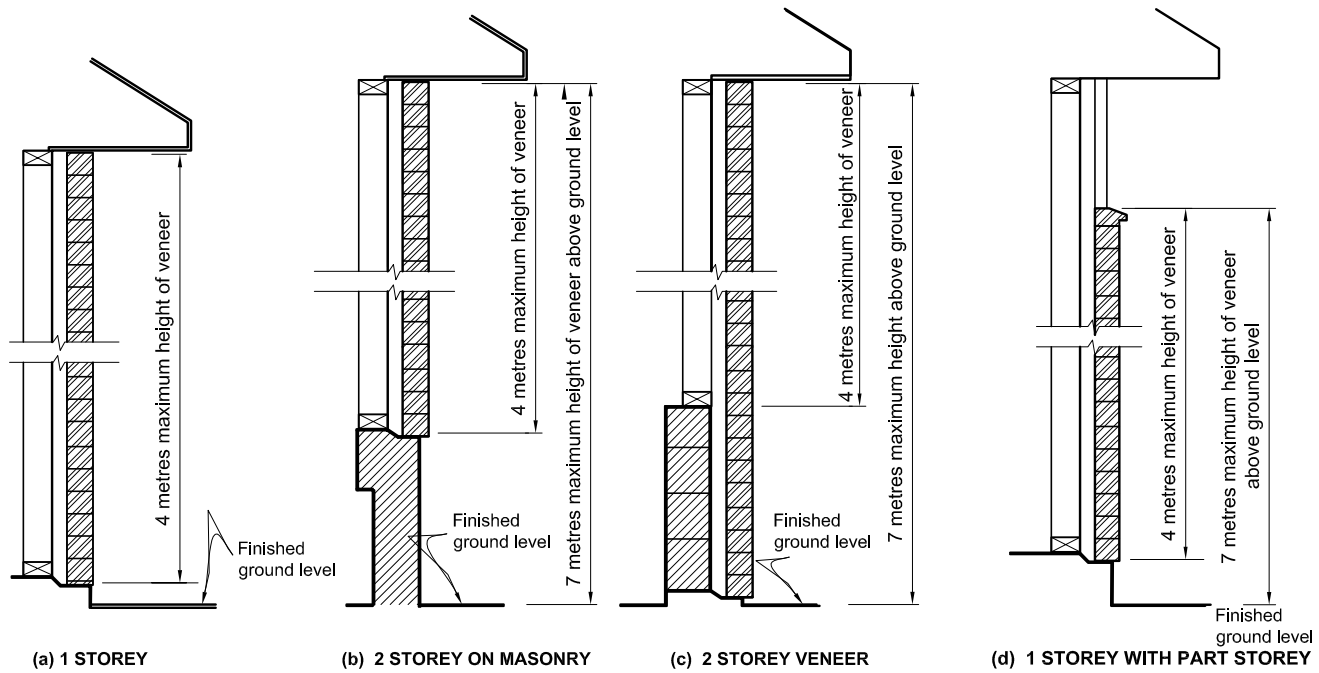
Single Storey Structures

Under E2/AS1 Masonry, the maximum height for a brick veneer adjacent and supported by a timber frame is 4.0m This applies to a standard panel of bricks. The maximum height of a gable or end wall is 5.5m.

The following diagrams are reproduced from E2/AS1 Masonry and should address most single storey situations.

It should always be remembered that E2/AS1 Masonry, is but one 'Acceptable Solution' to verify compliance with the NZ Building Code and the 'Performance Clauses' contained within.

Therefore, 'Alternative Solutions' presented by individuals with the experience and knowledge to do so, need to be judged by Building Consent Authority (BCA) and considering the information mentioned in the opening paragraphs, seriously evaluated.



(a) 1 STOREY (b) 2 STOREY ON MASONRY (c) 2 STOREY VENEER (d) 1 STOREY WITH PART STOREY

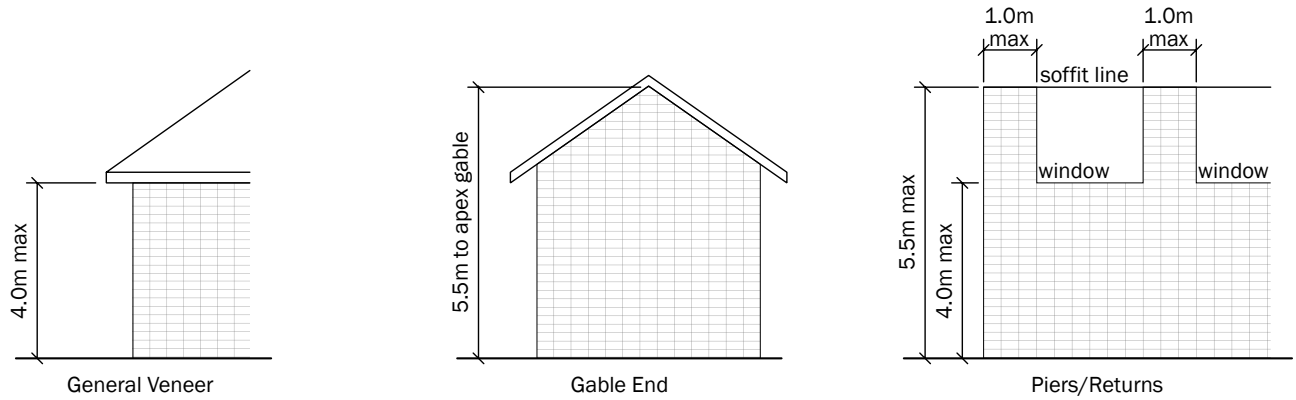
Design Note TB2 (Single Storey)

Design Note TB2 permits the heights below for Single Storey 'stack-bonded' clay brick veneers under Specific Engineering Design (S.E.D). Naturally these heights would equally apply for brick veneers that are stretcher bonded.

Please refer to Design Note TB2 for full requirements and limitations that are applicable.

Covered by BRANZ Appraisal 1045 – July 2019.

Maximum Veneer Heights in accordance with Design Note TB2



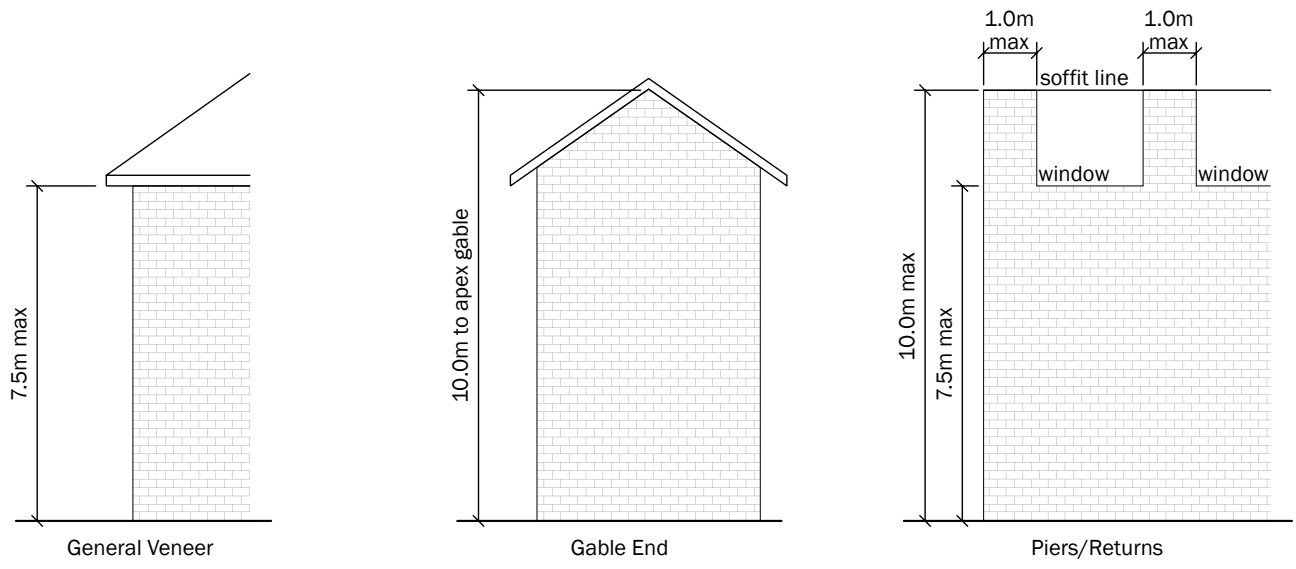
Design Note TB1 (Two Storey)

This design note covers all 2 storey structures, residential and commercial. The structure may be timber framed or a concrete structure such as concrete blocks or tilt-slab.

Please refer to Design Note TB1 for full requirements and limitations that are applicable

This system was designed in 2010 by Brick Consulting Ltd in conjunction with BRANZ (Appraisal 690). It permits a clay brick veneer, supplied by The Brickery, to be constructed to a standard panel height of 7.5m and gables to be 10.0m in height.

Maximum Veneer Heights in accordance with Design Note TB1



Brick Veneer – 3 Storey Timber Framing

Over recent years, the cost of building, coupled with the exorbitant land costs, has meant builders and developers have needed to build 3 storey brick veneer structures to ensure the development is profitable. They have wanted to do these buildings using timber framing and this has presented compliance issues, especially around the height of the veneer.

The Brickery, along with the support of the brick industry, has endeavoured to get NZ Standards and MBIE to address this major concern.

Specific Engineering Design is required and has been successful with several building consents in the Auckland Region.

It invariably may involve the use of steel portal frames on the ground floor to provide the required bracing for the building. Although never included in the solution, the rigid and very strong brick veneer, secured to the timber framing with approximately 8 screw-fixed brick ties per sqm., is with little doubt, the strongest bracing element in these structures.

Brick Veneers Over Two Storey (Commercial)

This would generally apply to 'Commercial' buildings and is covered by NZS4230:2004 Appendix F and requires Specific Engineering Design. These types of buildings are of either concrete construction and floors or a combination of structural steel and concrete floors. Brick Veneer is considered a rigid building element as are buildings as described, therefore the degree of movement between to two elements, is likely to be minimal and part of the engineer's consideration.

These types of buildings, if they are not constructed using tilt-slabs, have timber framing in panels between supporting structures such as columns. The brick veneer is simply secured to the timber framing.

In NZS4230:1990 Appendix F, they referred to vertical reinforcing of 90mm brick veneer. Fortunately, we do not build like that anymore, it was a difficult, costly and seriously flawed system that had disastrous results. When NZS4230:2004 was produced, once again those involved in this process of updated, failed to learn from the industry and it is still in the document. We do not use 90mm bricks, we use 70mm bricks and the screw-fixed brick tie was developed and introduced in 1995.

The definition for reinforced brick veneer is therefore open to interpretation. However, it is our opinion that veneers that are reinforced horizontally using MASONS 4.0mm Bricklock STR and CNR joint reinforcement, satisfy the definition of reinforced brick veneer.

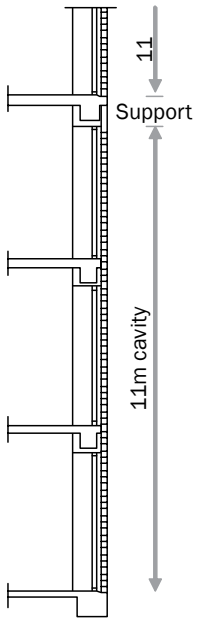
Lots of high-rise buildings have been constructed in New Zealand, very successfully, clad in clay brick veneers and structural engineering satisfied by competent engineers. The major consideration for all involved is the security of the bricks to the supporting structure.

Although one would always want to limit any damage to a brick veneer in an earthquake, the fundamental objective is always to prevent bricks from falling during an earthquake. This is highly unlikely to happen with a brick veneer that has been properly specified and project managed during the installation process.

The Brickery would recommend that the architect/engineer consider including the following in their specification of a veneer, supplied by The Brickery, in their design.

- Use a high bond strength manufactured bagged mortar
- Specify an ironed mortar joint
- 90 x 45 studs at 400mm crs
- HD 90mm brick ties
- 50mm cavity
- MASONS 4.0mm Bricklock at 600mm +/-100mm over the height of the veneer, avoid courses with brick ties in them.
- Bricks to be half-bonded
- Weep holes in the second course from the top or leave a 5mm gap at the top. Ensure the top brick on each panel of bricks is secure.
- Install ties at 400mm crs horizontally and max. 400mm vertically.
- Shelf angles every second floor on floor edge beams or steel angles
- Shelf angles – Galvanised 100x100x6mm fixed at 450mm crs using 12mm fixings.
- Angles to be fixed at each level once the bricks have been laid
- Check angles for square, rec. maximum length 3.0m
- Project manage the brick veneer installation to ensure high quality
- Recommend the finished veneer be given one coat of Surfapore R water repellent.

Max. height of each Vertical panel NZS4230



Exit Ways

NZS4230 App.F calls for either a canopy over exit ways or the bricks above the exit to be reinforced to protect people escaping from a building subjected to an earthquake. Based on experience from Christchurch, and what we now know on how well modern veneer will perform, it is The Brickery's opinion that the risk factors are considerably less than previously thought.

The architect/engineer may wish to consider installing either additional MASONS 4.0mm Bricklock above exit ways or specifying a drop wire NET system into the hollow cores of the bricks, called Bricklock NET droppers. This will help prevent loose bricks falling. Galvanised wire 700mm long with 50mm right angle turn at the top, left loose in the core holes.

Refer to the attached diagram for consideration by the architect/engineer.

Potential Engineering Solution