

HIT AND MISS BRICK SCREEN

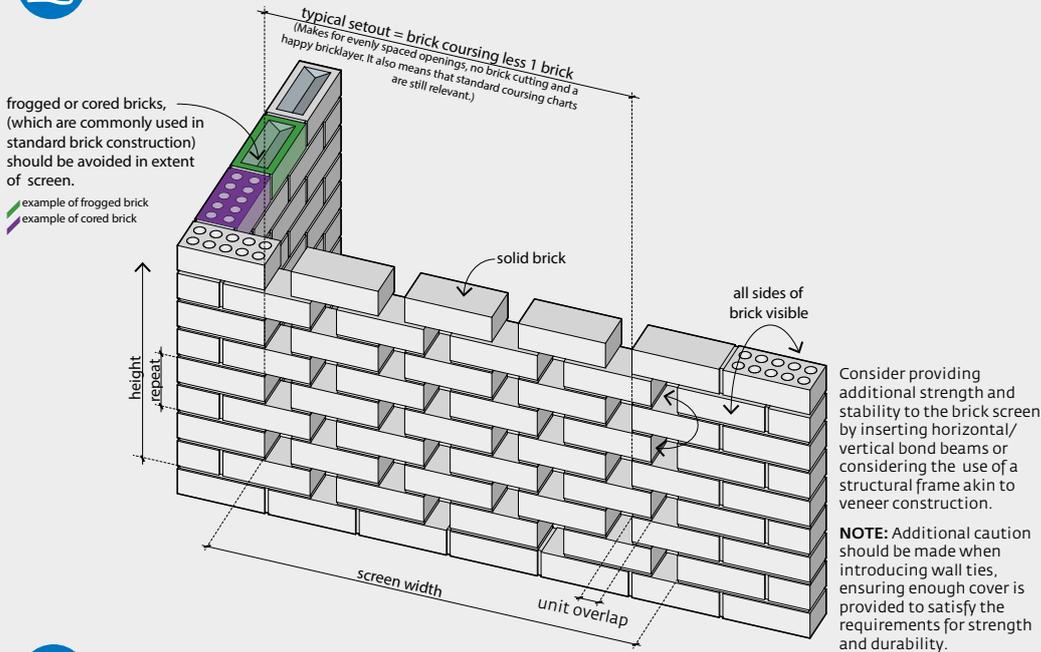
SHADE
PRIVACY

NON-COMBUSTIBLE
VENTILATION

SCREEN MOTIF
REDUCE GLARE

TRADE SKILL LEVEL:

SOME RULES OF THUMB

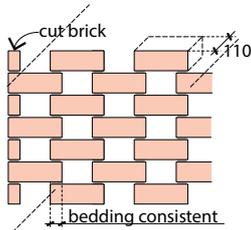


SOME OTHER BRICK SCREENS WE LOVE

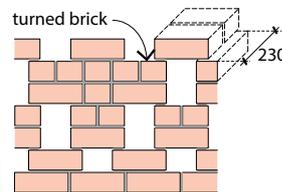
NOTE: Although the principles contained within this factsheet can be applied to designing the walls below, they were principally created for designing the hit and miss wall featured in the forefront above.



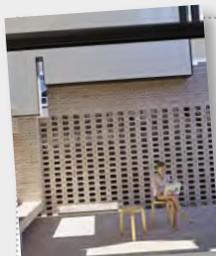
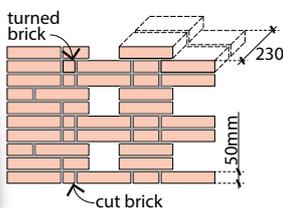
TRADE SKILL LEVEL: **Inglis Architecture**
Toorak House, Vic



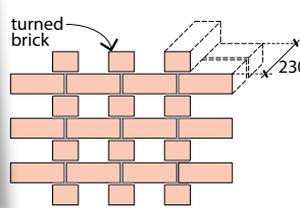
TRADE SKILL LEVEL: **Tridente Architects**
6 on 6th Apartments, SA



TRADE SKILL LEVEL: **Klopper & Davis**
Carr Place Residence, WA



TRADE SKILL LEVEL: **Cox Raynor Architects**
Aperture House, Qld



Consult with a structural engineer to ensure that the wall will be robust and structurally sound.

Wall thickness can be adapted to block out high summer sun but still allow winter sun to penetrate.

Take steps to ensure that the skill level and qualification of the bricklayer is appropriate for the project.

Try varying gap sizes to create dynamic effects and patterns.

Integrate fixed glazing or translucent materials behind the brick screen to create a watertight facade.

Consider different brick formats to achieve alternative pattern proportions.

Locate the screen so that it is out of reach for children who may be tempted to climb it. Other risks (e.g. security, flood, things that may bump into it, etc.) should also be considered.

Remember, all sides of the brick will be visible. Use solid bricks, or if frogged bricks are to be used, give some thought as to whether bricks should be frogged up or frogged down.

The allowable overlap (in mm) will depend on several parameters that dictate the wall's ability to provide sufficient robustness and bending resistance.

These parameters includes:

- wall thickness
- way the wall is supported
- masonry bond strength
- spanning distances between supports
- bonding pattern

This flyer raises some of the issues that an engineer may need to consider when advising on the design of a 'hit and miss' brick wall.

Although hit and miss brickwork is becoming increasingly popular, it has not thus far been subjected to much testing. This means that its capacity is not well known; therefore engineers should exercise caution when designing and building such walls.

Notably, a hit and miss wall is less structurally sound than a stretcher bonded wall, due to:

- the absence of perpend joints, and
- the discontinuous nature of horizontal mortar joints which in turn causes:
 - a reduced bedded area between each brick; and consequently
 - reduced unit overlap with the layers above and below it.

Due to the absence of perpend joints, hit and miss construction falls outside the scope of AS 3700 Masonry Structures sections 7.4.3 'Design for horizontal bending' and 7.4.4 'Design for two-way bending' and thus those provisions may not necessarily account for its actions accurately.

With almost an infinite number of potential designs, any guidance on hit and miss brickwork can only look at general principles and not provide definitive advice.

DESIGN CONSIDERATIONS

LOAD-BEARING

Due to the absence of testing, designers are advised to treat hit and miss walls as non-load-bearing systems. To ensure these walls have sufficient strength and stability, they should be supported on all four sides (or 3 sides, leaving the top edge free) and designed using AS 3700 section 7 'Structural Design of Unreinforced Masonry' with reference to bending and shear.

AS 3700 'MASONRY STRUCTURES'

Engineers are advised to pay attention to the following clauses within AS 3700 when completing their designs:

• Clause 4.6 'Design for Robustness'

Walls must satisfy the robustness requirements and be proportioned to resist a uniformly distributed out of plane load of 0.5 kPa;

• Clause 7.4 'Design for Members in Bending'

Due to the absence of perpend joints, the provisions on horizontal (section 7.4.3) and two-way bending (section 7.4.4) won't be applicable and will require some modification. Engineering judgement is therefore advised when interpreting these sections.

Notably, preliminary flexural testing has been conducted at the University of Newcastle on hit and miss walls with dimensions of 1190 mm x 1194 mm x 90 mm, and an overlap of 70 mm (thus consisting of 90 mm gaps between each unit). The researchers observed that although stepped failure is likely to dictate failure for smaller overlaps, both line and stepped failures will have to be considered for larger overlaps.

Equation 7.4.3.2(4) was applied to assess the horizontal bending capacity of the wall against line failure. Since hit and miss walls do not have perpend joints, the lateral section modulus (Z_p) was taken as zero.

The calculations made for determining the perpend spacing factor (k_p) (section 7.4.3.4) when assessing the horizontal bending capacity

against stepped failure criteria (equation 7.4.3.2(2) and 7.4.3.2(3)) will have to be carefully rationalised. Note how the section modulus of the resulting bedded area (Z_d) will account for the effect that the overlap will have on the resulting bending capacity.

The provisions relating to vertical bending (section 7.4.2) should also be applied to the design; ensuring that the flexural tensile bond strength (f'_{mt}) is at least 0.2MPa in accordance with section 3.3.3.

The amount of compressive stress placed on the bed joints (f_d) should be carefully considered with reference to section 7.5.5 when planning the amount of unit overlap or design cross sectional area (A_d) of the bed joint. This component (f_d) will influence both the bending and shear capacity of the wall.

• Clause 7.5 'Design for Members in Shear'

Shear requirements should be calculated with guidance from this section. Consideration and care should be made to ensure the amount of overlap allows for a bedded area that has adequate bond strength to achieve the required shear capacity.

• Clause 7.6 'Design of Masonry Veneer Walls'

Due to the non-load-bearing capacity of the member, it may be prudent to consider and incorporate any design/construction requirements applicable to veneer walls.

Notably, veneer wall construction requires the use of wall ties to transfer all lateral loads and forces applied to the face of the wall to the structural frame supporting the wall. Wall ties shall comply with the provisions of section 4.10 'Wall Ties' with the structural design of veneer walls having to comply with section 7.6. Notably AS 4773 also has sections specific for veneer wall design and construction.

The amount of overlap should allow for a mortar bedding area that can accommodate the insertion of wall ties whilst not compromising the requirements for durability and overall structural design. If these requirements are not adhered to, it may jeopardise the wall's stability and/or serviceability.

PROVIDING ADDITIONAL STRENGTH

Designers creating walls that exceed calculated allowable areas have options they can use to provide additional strength.

For example, they may divide the desired wall area into a number of allowable sections and support each section at horizontal and vertical interfaces using bond beams and/or engaged piers. Furthermore, additives can be used in the mortar composition to increase its bond strength as well as the implementation of wall ties which transfers loads to the structural frame.

Solutions such as these can help to minimise structural weaknesses and deliver a more reliable hit and miss wall.

 **ThinkBrickAustralia**

 **thinkbrick**

 **thinkbrickaustralia**

 **thinkbrick**

While the contents of this publication are believed to be accurate and complete, the information given is intended for general guidance and does not replace the services of professional advisors on specific projects. Think Brick Australia does not accept any liability whatsoever regarding the contents of this publication.