

The Brickwork Manual

A step-by-step guide to
installing clay bricks



THINK
BRICK
AUSTRALIA





This manual is here to assist

It's specifically designed to assist builders who work with clay bricks. While most builders have been working with clay bricks for a long time and are familiar with the key requirements of good brickwork, new products recently introduced by the industry have changed some methods of working with clay bricks. So it's now a good time for the industry to highlight new and re-iterate historical best practice.

This manual is the industry standard

This manual has been produced by Think Brick Australia on behalf of the Australian brick and paver manufacturers.

It is the 'Manufacturer's Installation Instructions' and overrules other general purpose guides such as the Victorian Building Commission's Guide to Standards & Tolerances, however, it is not intended to replace either the Building Code, the Australian Masonry Standard or specific Think Brick Australia technical manuals which provide a much greater depth of information.

The Australian clay brick industry, represented by Think Brick Australia, has put extensive thought into producing this manual. In creating something meaningful, we've considered the following five groups involved with brickwork:

1. The customer
2. The brick manufacturer
3. The builder
4. The bricklayer
5. The brick cleaner

This manual's with you every step of the way

This easy-to-understand manual is a 'brick journey'. It's logically structured in such a manner that every aspect is addressed from the customer selection of bricks to the finished wall. Each section will describe the best approach, the responsibilities of each group and mention some typical problems that have arisen in the past. We're committed to making your job easier and more efficient by offering helpful tips and advice that will lead to successful projects delivered to your customer's satisfaction.

Clay brick is the dominant building material for Australian residential construction and first choice among consumers because of its:

- superior strength
- superior quality
- impressive colour
- low maintenance

A rock solid manual for a rock solid industry

It's a national industry that produces more than 1.6 billion clay bricks annually. The industry employs 30,000 people across the manufacture and installation of a wide range of clay brick products.

Clay brick is the dominant building material for Australian residential construction and first choice among consumers because of its:

- superior strength
- superior quality
- impressive colour
- low maintenance

Plus customers all know that brick homes are warmer in winter, cooler in summer and quieter all year around. Australians have loved bricks for the last 200 years, and will hopefully continue to for the next 200 years to come. Particularly as the industry honours its commitment to product innovation, such as giving customers a greater range of colours and styles to create the unique look they're after.

The future of clay bricks looks bright.



Think Brick is supporting the industry and supporting you

The Australian clay brick industry is represented nationally by Think Brick Australia. The responsibilities are wide ranging and include:

- extensive research
- technical training
- marketing the industry as a whole

Think Brick Australia is also committed to bringing together architects, builders and bricklayers to ensure clay brick construction remains at the forefront of modern design for many years to come.

Some of the ways Think Brick Australia is helping builders include:

- Building better display centres to make it easier for customers to select bricks “in context”
- Developing a brick cleaning course to improve the quality of bricklayers



There are three crucial aspects to a good wall.

1. Correct brick selection.
2. Skillful brick laying.
3. Appropriate brick cleaning.

A few important things to remember

There are three crucial aspects to a good wall.

1. Correct brick selection.
2. Skillful brick laying.
3. Appropriate brick cleaning.

Knowledge is key

It's always important to remember that different bricks may require different mortar and preparation, so they must be treated in different ways.

Fully understand the product you are using. For example, you may have bricks with a high iron content, or surface coated bricks. Speak with your brick sales rep to make sure you know the issues that may exist with the selected brick and make sure the bricklayers and (especially) brick cleaners understand these issues too.



Thorough preparation and ongoing discussions

Thorough site preparation makes delivering and laying bricks easier and faster. Bricklayers work for the builder and the builder should always discuss the specific expectations of each job with the bricklayer directly - it's both prudent and efficient. This is especially important when it comes to mortar batching.



TIP: Go through the job with the bricklayer and ensure they are aware of any special detailing, the class of mortar to be used, site cleanliness and your expectations.

Create respect

Encourage trades to respect other trades on the site. After all, good bricklaying will create easy brick cleaning.

Start off on the right foot with proper brick selection

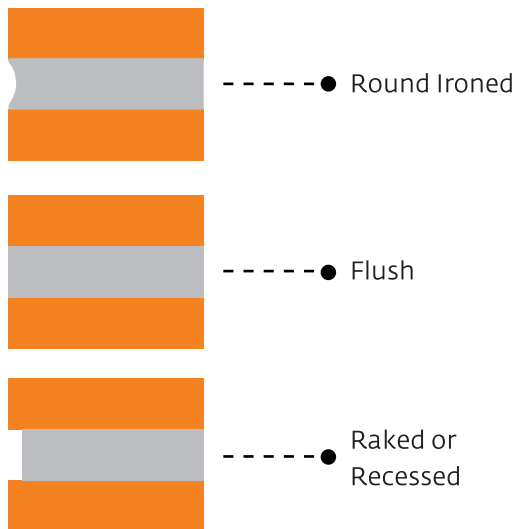
Manage a customer's expectations well and you've done half the job

The key is to help the customer visualise what the end result will look like which is why the process of brick selection is so critical. Typically, customers find it very difficult to select bricks based on a colour board or sample pack. That's why the brick industry has invested significantly in the brick selection process including the improvement of display centres that help customers better understand what the finish product will look like.

Helping your customer in this way can avoid problems such as:

- Customers not understanding that many bricks contain chips, cracks and colour variation.
- Raking can damage bricks if not done with care.

Typical mortar joints



The impact of mortar and joints

When selecting bricks there is one more thing to consider, namely the mortar colour and joint type. This will profoundly affect the end product, as will the combination of other building materials and colours that get used.

Three important points when selecting bricks

- Customers should research bricks from a variety of sources: ie display houses, display centres, display boards and sample packs, but ultimately it is best for the customer to choose bricks from an actual building or house to ensure they understand what the brick looks like in a finished wall.
- Select mortar colour and joint type with reference to the actual brick that you're using.
- Select the correct grade of brick.



TIP: Order all the bricks, sand and materials for mortar required at the start of the job to avoid batching colour differences.

Prevention is the best cure

As a builder, your goal is a straightforward flow of work on the site to deliver the project in line with your customer's expectations. For brickwork, a few important guidelines will help:

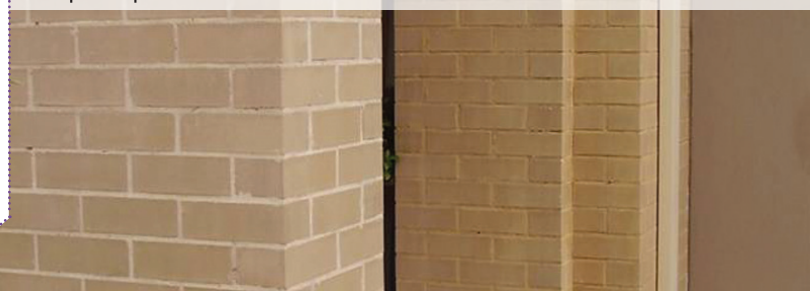
- Always discuss mortar colour and bond with the customer at the time of choosing the bricks, not afterwards. Avoid the term "natural mortar" as sand supply can vary the mortar colour considerably and if in doubt, samples should be made up from your sand supplier.
- Be clear about the environment of the project and whether any special consideration is needed. For instance, if the project is marine-based then the brick and mortar grades must be suitable.
- Make it as simple as possible for customers to select bricks. Use display homes and/or actual walls to assist them with their selection.
- Explain to customers examples of incompatible combinations of brick, mortar colour and joints, and why. Some examples include:

- A rough face brick with flush joints because it is difficult to clean, especially with a high contrasting mortar colour.
- Rolled edge tumbled bricks with flush joints. These emphasize the irregularity of the bricks and reduce the attractiveness of the finished wall.
- Surface coated and glazed bricks with a raked joint. These can expose the body colour beneath the coating.



TIP: Once the customer has selected their bricks, ask the brick sales rep for the locations of other houses with the brick so the customer can confirm their choice, when in a whole wall, is correct.

Impact of mortar colour variation



The combinations that work

Some of the combinations between brick, mortar colour and joints that we recommend include:

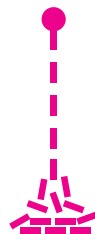
- A flushed joint with a straight-edged brick without a high-contrasting coloured mortar (which may stain the brick).
- A rolled/ironed joint when the mortar is a high-contrast colour to the brick.

Our experience shows that tooled joints with dense surfaces such as rolled, struck or weather struck joints provide better durability when in a severe marine environment.

Cracks in bricks

As a result of the material and manufacturing process, some bricks contain surface crazing and/or cracks (e.g. Melbourne pressed bricks). These are features of the bricks, and will be more visible on bricks with glaze or surface coatings. Cracks do not cause problems unless the crack causes a complete fracture of the unit. The industry allowance for bricks that are cracked or otherwise damaged and unsuitable for inclusion in a wall is typically 5%.

Cracking in brickwork should be assessed visually from the ground at a minimum distance of 6.1 metres (ASTM C 216-04). From this distance surface cracks are invisible, and generally only those cracked bricks that should not have been laid in the wall are obvious. As a guide the wall shouldn't contain more than approximately 5% cracked bricks when viewed in this way. Pressed bricks will usually have more cracks, while extruded bricks with no glaze or slurry on the face are likely to contain less cracks.



TIP: Order all the bricks for the job at one time. That, along with blending from up to four (4) packs, will significantly reduce the impact of colour variation.

Colours vary

Clay bricks are made from natural raw materials and when fired will produce a wide range of colours. Individual bricks can vary in colour from batch to batch and as such, it is important that bricks are blended from different packs.

Poor site preparation can lead to many problems

The importance of site preparation

Let's minimize all oversights on sites.

There are many possible issues on a site that can affect the finished product.

For example, arrival and placement of bricks on the building site is critical for correct blending and to minimise problems such as staining. For instance, if you leave clay bricks lying around on the ground they can absorb moisture and ground salts.

Poor site preparation can lead to many problems

To avoid some of the typical problems that can occur:

- Check brick packs on delivery. If incorrect bricks have been delivered, you want to be able to identify it before laying commences.
- Store bricks on pallets or boards. Bricks stored directly on the ground can absorb ground salts. This will produce efflorescence or other stains that will crystallize on the brick's surface. Also, be aware of red or black local clay soils which can stain bricks.

- Cover bricks. Uncovered bricks may absorb rainwater and mud splashes.
- Distribute brick packs around the site. Brick packs not positioned appropriately (blended) around the site can result in mismatched walls and extra unnecessary handling to blend the packs.

It is the responsibility of the builder or supervisor to check that every product delivered to the site is acceptable. This thorough approach will help reduce potential problems and delays.

Prepare flat, even ground

As far as possible, prepare for brick delivery by ensuring the ground is flat, firm and safe to place brick packs. It's also important to make sure there is sufficient access for trucks to deliver the bricks as close to the point of laying as possible.

Be careful with rough, uneven ground as delivering bricks across this surface can damage them.



Discuss mortar type, mixing, colour and special detailing with the bricklayer

A guide to bricklaying

It's no surprise that the quality of a finished brick wall lays heavily at the feet of the bricklayer and their particular skill level.

However, in the event that a customer selects bricks, mortar colour and joints that are incompatible, it is unlikely even the world's most skilled bricklayer won't be able to produce a quality outcome.

Good outcomes depend on good planning

As a builder you should ensure the bricklayer is working to the specifications outlined in the contract between you and the customer. This includes ensuring that mortar mixing and batching is appropriate.

If you stick to the following 5 points your chances of a good outcome are high:

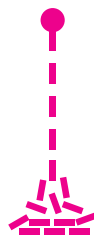
1. Ensure the customer has selected the best bricks for their desired finish (covered on pages 7-10).
2. Keep a close eye on all the bricklaying to make sure all the bricks are blended correctly so the finished walls look great.

3. Implement a quality control program that helps bricklayers mix mortar correctly (as set out in AS 3700).
4. If additional brick deliveries are required, the new packs should be blended with the existing bricks on site well before all bricks from the previous delivery have been laid.
5. Be aware of special detailing like gables which will necessitate additional bricks.

Keep a close eye on everything from the very beginning

When checking brickwork quality, stand a few meters back (three to six meters is ideal) and observe that 'everything is going to plan'.

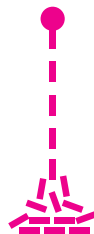
Look out for slightly lighter and darker areas of brickwork (within the same colour range), and in particular horizontal lines of different shades, which could indicate that brick packs are not being blended correctly. Generally joints should be reasonably even in size and appearance and the bricks should be visible with minimal mortar smears & dags. Brick headers always match the face colour: they are being laid incorrectly if they are a different colour or shade.



TIP: Mortar splashing can be a problem, especially on lower walls if you are using scaffolding. This can be reduced by placing a plank against the lower wall.

Alignment can be the difference between a good job and a bad job

Although perpendicular alignment is not covered under the Masonry Standard AS 3700, the size variation is. The hallmark of bricklaying is well blended bricks laid to a consistent gauge with straight level bed joints, the wall is plum and the perpendicular joints are reasonably in line.



TIP: Ask the bricklayer to inform you early if perpendicular joints are not aligning such that changes can be made as necessary.

The set out of brickwork in the beginning of the project is critical to have some consistency in perpendicular alignment. Some variation will occur due to varying brick sizes.

Ask the bricklayer to measure mortar components by fixed volume containers such as 20 litre buckets rather than by shovel

Priceless tips for a correct mortar mix

Ensure mortar mixing is done correctly. Ask the bricklayer to measure mortar components by fixed volume containers such as 20 litre buckets rather than by shovel. Also ensure that the class of mortar required for the project and location (eg. Below damp-proof course – DPC – for aggressive soils) is correct.

Potential problems with mortar

- Mortar that's unnecessarily hard will force the brick cleaner to use excessive water pressure and acid when cleaning. This leads to acid burn, mortar pitting and damage to the surface of the brick.
- Mortar can be too hard and the wrong composition if you use a large bag of cement (say 20kg), and the mixer is less than 3 cubic feet.
- *We recommend using General Purpose cement. General Blended [GB] cement contains a percentage of additives such as fly ash, slag and other materials which may stain the brickwork.*

- Poor quality and coloured sand can stain brickwork and mortar. So try to ensure that sands are a suitable grade for bricklaying and contain the correct amount of clay. *This is especially important in inland areas where the only sand that is available is a type of river sand.*
- Mortar additives will influence colour and therefore should be consistent across the job.
- Sugar, excessive amounts of methyl cellulose and excess amounts of air entraining agents including detergents should not be included in a mortar batch.
- *Use the correct amount of lime to improve workability rather than plasticizers.* Lime makes mortar more plastic, enabling it to be more workable. It should be adjusted according to how “fatty” the sand is. Increasing the lime content in mortar makes it easier to lay low suction bricks.
- Keep cavities clean by checking for cavity droppings and/or bridging.



Preventing problems with mortar mixing

We recommend using either a scratch tester or chemical analysis to check for durability and mortar composition before bricklaying has finished to provide feedback to the bricklayer and to ensure adjustments can be made if necessary.



TIP: Make Building Consultants aware that a quality control program for mortar is in use to reduce the chance they will attempt to fault the wall.

The four Classes of mortar

In Australia, the Masonry Standard AS 3700 specifies the requirements for mortar in terms of a series of classes from **M1** to **M4**. Class **M1** mortar, lime mortar with no cement, is only permitted for use in the repair of heritage structures. The other three classes - **M2**, **M3** and **M4**- can be used in a range of structures depending on the requirements for strength and durability.

The most commonly used mortar is **M3**, which typically has a composition of 1 part cement, 1 part lime and 6 parts sand. While it's the most common type of mortar, it's a misconception that it is the 'standard' mortar ratio. **M3** mortar is only required in marine environments between 100m and 1km from a non-surf coast, or between 1km and 10 km from a surf coast. Inland of these areas **M2** mortar, which is 1 part cement, 2 parts lime, and 9 parts sand, is sufficient. **M4** mortar is required for severe marine environments which are up to 100m from a non-surf coast and up to 1km from a surf coast. Brickwork below a DPC or in contact with the ground may require a different class of mortar (and brick) than required for brickwork above, eg. **M4** with exposure grade bricks are required in aggressive soil.

The choice of mortar depends on the conditions

The four mortar classes reflect both the exposure and loads the building will be subjected to. It's not always true that the stronger the mortar, the better the wall.

Mortar primarily exists to give the wall flexibility so that in the event of movement, the wall maintains integrity. Under extreme movement such as earthquake, the

mortar will crack, thereby releasing the pressure on the wall. This is an example of the mortar doing its job and repairing the crack rarely requires the wall to be taken down and rebuilt. The use of lime in the mortar mix not only makes the mortar more workable it can allow small cracks to self-heal.

Stronger is not always better

There's no such thing as 'the stronger the mortar the better'. In fact, if too much cement is used, it makes it harder for brick cleaners to remove excess mortar without damaging either the mortar joints or the brick face by using stronger acid and higher pressure.



Different bricks need a different clean

Brick Cleaning

Brick cleaning is a specialist trade requiring expertise to minimise the potential for damage to the brick face. It's worth remembering that brick cleaning itself is an aggressive process, whereby the chemicals and high water pressure can easily damage the product if not done correctly.

In most cases the brick cleaner walks a fine line between under cleaning and potentially damaging the brickwork. That is why the quality of the brick laying is so important.

Take care with chemicals

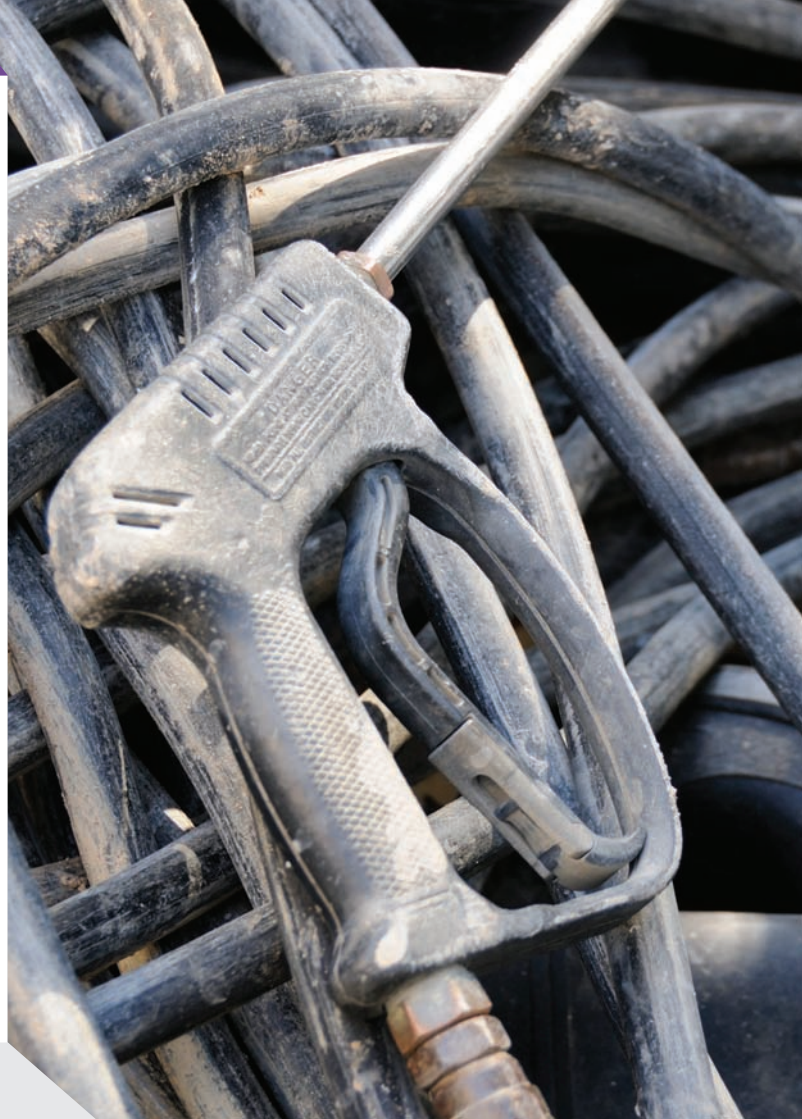
We may be stating the obvious but it's critical that you only use chemicals that are proven to be suitable for brick cleaning. *If the chemical has had a dye added, it may soak into and stain the brickwork. Diluted hydrochloric acid [HCl] is only used to dissolve the Portland cement component of the mortar. It won't remove other forms of staining. General stain removing chemicals should not be used to clean mortar from bricks.*

Different bricks need a different clean

Different brick textures and colours need different cleaning approaches. For example, matte or thrown textured bricks should not be cleaned with excessive pressure as it can damage their colour and texture. Many bricks made in Queensland, (particularly porous light coloured bricks with a black iron oxide core), and red bricks from Victoria, are particularly sensitive to high concentrations of acid. Failure to properly wet the bricks before cleaning can lead to staining *called acid burn*, as acid will soak into the brickwork and dissolve the iron within the brick. **For light-coloured bricks the water to acid ration is 20:1, and for darker bricks it is 10:1.**

When the wall becomes wet again, even weeks later, the dissolved iron can leach out and stain the brick face. It is advisable to neutralise the hydrochloric acid on light-coloured bricks with high iron content, by applying a bicarbonate soda solution and allowing it to soak into the brick face (refer to *"The Brick Cleaning Manual"* on the Think Brick Australia website for more detailed information).

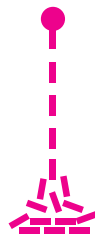
Note: Water alone does not neutralise acid that is applied to brickwork.



Good practice can mean goodbye to brick cleaning

Good practice can mean goodbye to brick cleaning

You can eliminate the need for cleaning by discussing with your bricklayers how they (or perhaps the apprentices or labourers) can clean the walls as they lay the bricks. This is the standard practice in Queensland, practically removing the need of brick cleaners all together.



TIP: Where a wall is particularly dirty or the mortar is particularly hard it is better to clean multiple times than to use excessive acid or water pressure.

High pressure water damage



Tips for a good result

- Lay the bricks as cleanly as possible. This will significantly reduce the need to clean later on. Follow this up by scraping the bricks at the end of each day. This removes residual mortar and will reduce the need to clean bricks (or at least the extent of cleaning required).
- On double storey houses, it is particularly important to lay bricks as clean as possible as they generally sit for a longer time before brick cleaning.
- Lay bricks with properly batched mortar. Aspects of the mortar to consider include the sand quality and the general dosage rates of the lime and cement.
- Laying dry bricks and covering brickwork at the end of the day will reduce white staining, manganese staining and incidents of efflorescence.
- A good practice on hot days is to wet the bed of face bricks to slow down suction rates and to get a better bond.
- Work with acid in smaller sections so the it doesn't dry and the wall. This allows you to wash the wall when the mortar smear is at its softest.

Take care when cleaning

- If the brick cleaner is unaware of the brick type, they should do a test panel in an inconspicuous area, such as behind water tanks.
- If brick cleaning is done in stages, be careful that the acid doesn't run down and stain the lower walls, or even dry on the wall. Furthermore, it is recommended that you wet the wall thoroughly to avoid streaking.



TIP: It's easiest to clean bricks as soon as possible after the mortar has dried (24-36 hours depending on weather) and ideally it should be done within 14 days of laying. The longer mortar is left uncleaned, the more difficult it is to remove from the face of the brick.

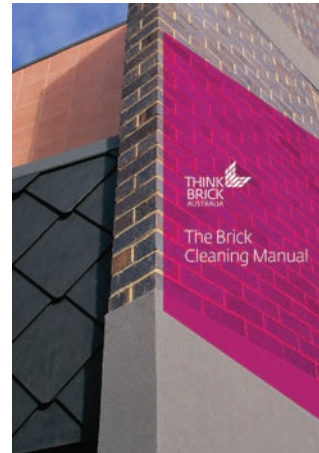


Has your
brick cleaner
read &
understood
the Brick
Cleaning
Manual?

Get the brick cleaning manual

Think BrickAustralia has produced a helpful manual for brick cleaners titled **The Brick Cleaning Manual**. It provides comprehensive details, along with pictures, of every common type of stain. It has specific cleaning instructions, advice for preventing stains, and even detailed information on how some stains actually occur.

We recommend that all builders obtain a copy of the manual and that way you can ensure that brick cleaners follow all the guidelines. This will prevent unnecessary problems and costs once walls have been laid.



Building with bricks is a breeze when done properly

Building a stylish house with bricks is simple. In fact, the entire process and the result should both be a pleasure. That's why the industry as a whole, along with every Australian brick manufacturer, is committed to ensure an incident free process from brick selection to brick laying to brick cleaning.

That way, all Australians can enjoy the benefits of a brick home that is warmer in winter, cooler in summer and quieter all year round. Plus a home that is solid, maintenance-free, durable and secure.

If you have any questions about this manual or you would like further information visit www.thinkbrick.com.au or call our technical help number 1300 667 617.



IMPORTANT NOTICE

This manual should only be used as a general guide and does not purport to provide complete or specific advice on the suitability of clay brick products and/or procedures associated with clay brick. Whilst every care has been taken in the preparation of this guide Think Brick Australia accepts no liability for the accuracy or suitability of the information supplied. Think Brick Australia strongly recommends that readers of this guide undertake their own investigations on the suitability of using clay brick products, or processes identified in this guide, and to seek expert advice before commencing any work.

The Checklist

1. Has the customer seen their chosen brick, mortar and joints as a complete wall either on another house or at a selection centre?
2. Is the site ready for brick delivery with firm (not muddy), flat, even ground?
3. Is there sufficient access for forklifts around the site so brick packs can be spread out to make batching easier?
4. Have you ordered all the bricks for the job at the same time?
5. Have you discussed mortar composition (type), mixing and colour, along with any special detailing, with the bricklayer?
6. Will you be able to keep a “general eye” on the bricklayers while they work to ensure the wall looks right?
7. Has the brick cleaner read and understood the Brick Cleaning Manual?
8. Do the brick cleaners know the type of brick that is being used and the types of problems that can occur during cleaning?



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