

MANUAL 20

BARKERS ROAD TOWNHOUSES, KAVELLIAN'S Urban Design.

THE BRICKWORK MANUAL

A step-by-step guide
to installing clay bricks



THINK BRICK
AUSTRALIA





INTRODUCTION

This manual is here to assist

The Brickwork Manual aims to assist builders who work with clay bricks. With a rich history spanning back to 8000 BC, the basic requirements for good brickwork is well understood while the industry is continually evolving to incorporate new products and processes. This manual serves to reinforce traditional best practices while highlighting recent innovations in an easy to understand format.

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 represents both common and best industry practices. However, it is not intended to replace 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's 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

Besides, customers all know that brick homes are warmer in winter, cooler in summer and quieter all year round. Australians have loved bricks for the last 200 years and will continue to for the next 200 years to come. The industry will always honour its commitment to product innovation, 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 is supporting you

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

- extensive research
- technical training
- promoting 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:

- Technical manuals and enquiry service
- Developing accredited brick cleaning courses to improve the quality of brick cleaners and the bricklaying process as a whole.

GYMPE AQUATIC RECREATION CENTRE, Liquid Blue

 Christopher Frederick Jones



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 brick wall.

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

Knowledge is key

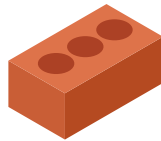
It's always important to remember that different bricks may require different mortar and preparation, so they must be treated in different ways.

Always try to fully understand the products 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 understand the issues that may exist with the selected brick and ensure 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 mortar mix to be used, site cleanliness and your expectations.

Create respect

Encourage respect between contractors on the site. After all, good bricklaying will lead to easy brick cleaning.





Start off on the right foot with proper brick selection

BRICK SELECTION

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

The key is to help your 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 improvement of display centers, to help customers with selecting the right bricks and understanding what the finished product will look like.

Helping your customers through these initial stages of a project can avoid problems such as:

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

Typical mortar joints



Round
ironed



Flush

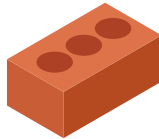


Raked or
recessed

The impact of mortar and joints

When selecting bricks there are two more things to consider; namely the mortar colour and joint type.

These two factors will profoundly affect the end product, as will the combination of other building materials and colours that are used.



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

Three important points when selecting bricks

1. Customers should research bricks from a variety of sources: e.g. display houses, display centres, display boards and sample packs.

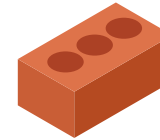
Ultimately, best practice is for the customer to have a visual look at how the chosen bricks will look on a finished home/building.

2. Select mortar colour and joint type with reference to the actual brick that you're using.
3. Select the correct grade of brick.

Prevention is the best cure

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

- Always discuss mortar bond and colour 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 acquired 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 their brick choice. Then the customer can confirm their choice, when in a whole wall.



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.
- A rolled/ironed joint when the mortar is a high-contrast colour to the brick.

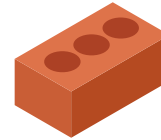
Our experience shows that tooled joints with dense surfaces such as rolled, struck or weather struck joints provide better durability in an exposure environment.

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 cracks cause 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 3700 Table 12.1 has exact figures for wall deviations. 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. Additionally 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.



Safe loading is vitally important. Loaded vehicles must be properly restrained to prevent injury to people and damage to property.

SAFE TRANSPORTATION OF BRICKS

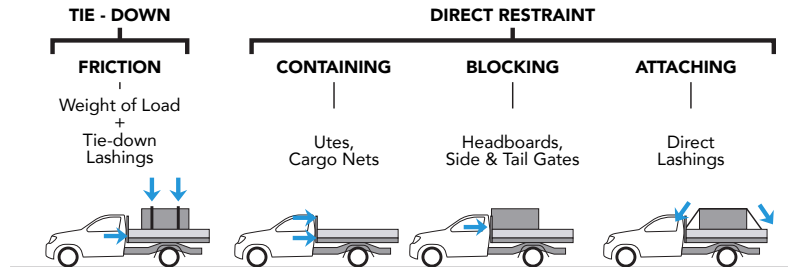
Safe loading is vitally important. Loaded vehicles must be properly restrained to prevent injury to people and damage to property. All Think Brick members have committed to comply with the TBA industry codes of conduct during transportation of bricks or blocks.

Heavy loads can be fixed on a vehicle either by **Tie – Down or Direct Restraint** methods. If you're

involved in packing, loading, moving or unloading a vehicle, you are responsible for complying with load restraint laws.

To ascertain a restraint method is sufficient for a load, Performance Standards from the Load Restraint Guide (LRG) by National Transport Commission must be followed, unless an alternative method is certified by a qualified engineer.

Bricks are generally packaged together and unitised during transport, general tips for ensuring



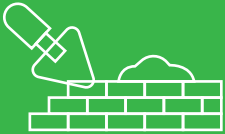
safely transporting brick loads are specified under the 'Brick' section of the Load Restraint Guide 2018.

General steps to follow for safely transporting bricks products:

1. Before loading bricks onto a truck - Plan the load: be familiar with the load, select appropriate vehicles and load restraining system to ensure the safety of the people and property.
2. While loading or unloading the bricks: ensure that the vehicle is stable and you understand the relevant safe work practices.
3. Drive according to the load and driving conditions: ensure you have allowed for changes in vehicle stability, steering and braking when driving; and check the restraints regularly during the journey.

To learn more about load restraints for bricks or blocks, you can:

- Download [1] [Think Brick Australia - Industry Code of Conduct on Load Restraint - Summary](#)
- Download [2] [The National Transport Commission's 2018 Load Restraint Guide](#)
- Download [3] [Think Brick Australia's Transporting Clay Bricks Safely and Transport Safety Checklists](#)



Poor site preparation can lead to many problems

THE IMPORTANCE OF SITE PREPARATION

Let's minimise 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, leaving clay bricks lying around on the ground can lead to the absorption of 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, identify them 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 and 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 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 these surfaces can damage them.





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

A GUIDE TO BRICKLAYING

It's no surprise the quality of a finished brick wall relies heavily on the feel of a 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 would be able to produce a quality outcome.

Good outcomes depend on good planning

As a builder you should ensure the bricklayer is adhering 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 9-10).
2. Keep a close eye on all the bricklaying to ensure 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.

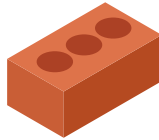
5. Be aware of special detailing like gables which will necessitate additional bricks.

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 and dags. Brick

headers always match the face colour: they are being laid incorrectly if they are a different colour or shade.



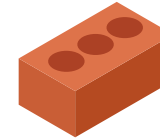
TIP: Mortar splashing can be a problem, especially on lower walls if you are using scaffolding. This can be reduced by placing a plank against the lower wall.

Alignment can mean 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, ensuring that the wall is plumb and the perpendicular joints are reasonably in line.

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



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



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 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 can lead to acid burn, mortar pitting and damage to the surface of the brick.
- Mortar can be too hard and

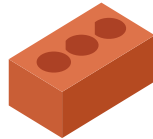
possess the wrong composition if a large bag of cement (say 20kg) and a mixer which is less than 3 cubic feet are used.

- *We recommend using General Purpose [GP] 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. Try to ensure sands are of 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 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 likelihood of the wall being faulted.

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, there is a misconception that it's 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 10km from a surf coast. Further 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 and for specially-purposed structures. Brickwork below a DPC or in contact with the ground may require a different class of mortar (and brick) than required for brickwork above the DPC, eg. **M4** while exposure grade bricks are also 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 in the event of movement, the wall maintains integrity. Under extreme movement such as earthquakes, the mortar will crack, thereby releasing the pressure on the wall. This is an example of the mortar doing its job. 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 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. This 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 ratio 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.*

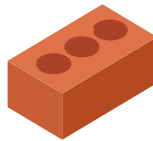




Good practice can mean goodbye to brick cleaning

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.

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 period of time before brick cleaning.

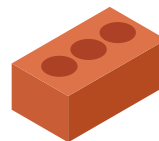


High pressure water damage

- Lay bricks with properly batched mortar. Aspects of the mortar to consider include the sand quality and the general dosage rates of 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 get a better bond.
- Work with acid in smaller sections so it doesn't dry on 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 easier 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.





**BRICK
CLEANING
ACCREDITATION**
THINK BRICK AUSTRALIA

WANT TO BECOME AN ACCREDITED BRICK CLEANER?

Think Brick Australia's (TBA) Brick Cleaning Course is run in partnership with TABMA Training. For the first time brick cleaners nationally will be able to achieve industry accreditation by successfully completing this course.



KEY COURSE INFORMATION

- 2-day course
- Targeting brick cleaners & brick layers
- **Accreditation provided upon successful completion**
- Details listed on the Think Brick Australia website



REGISTER NOW OR FIND OUT MORE

Email: brickcleaning@thinkbrick.com.au

Phone: 02 8035 8606

Website: thinkbrick.com.au

THINK BRICK
AUSTRALIA

TABMA
AUSTRALIA
TABMA TRAINING



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 ensuring an incident free process from brick selection to brick laying to brick cleaning.

This way, all Australians can enjoy the benefits of a brick home that is warmer in winter, cooler in summer and quieter all year round. In addition to this, a brick home 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

- ✓ **Read Clay Masonry Cleaning Manual**
- ✓ **Brick knowledge**
- ✓ **Customer sited complete brick wall**
- ✓ **Bricks loaded correctly**
- ✓ **Site ready for delivery**
- ✓ **Site access**
- ✓ **All bricks ordered for job**
- ✓ **Mortar composition**
- ✓ **Bricklayer supervision**

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. Are the bricks loaded correctly and restrained properly for transportation?
3. Is the site ready for brick delivery with firm (not muddy), flat, even ground?
4. Is there sufficient access for forklifts around the site so brick packs can be spread out to make batching easier?
5. Have you ordered all the bricks for the job at the same time?
6. Have you discussed mortar composition (type), mixing and colour, along with any special detailing with the bricklayer?
7. Will you be able to keep a 'general eye' on the bricklayers while they work to ensure the wall looks right?
8. Has the brick cleaner read and understood the Clay Masonry Cleaning Manual?
9. Do the brick cleaners know the type of brick that is being used and the types of problems that can occur during cleaning?



AUSTRALIAN EMBASSY BANGKOK, BVN.

 John Collings





Has your brick cleaner read and understood the Clay Masonry Cleaning Manual and are they accredited?

Think Brick Australia has produced a helpful manual for brick cleaners titled 'The Clay Masonry 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 detailed information on how some stains actually occur.

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

Download this free manual and many more at www.thinkbrick.com.au/technical



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