
Reuse of Clay Brickwork

General Guide

Last Updated: April 2023



The Brick Development Association

The Brick Development Association is the national authority on clay bricks and pavers.

The membership accounts for almost 99% of the bricks produced in the UK; the BDA members are committed to manufacturing products of outstanding quality and developing one of the nation's most productive and sustainable supply chains.

The BDA Guides and Technical Guides are continually updated to take account of the latest materials, systems and products developed in the clay brick and paver sector.

We are grateful to our various team of experts, contributors, staff as well as our membership whose support, we are eternally grateful for.

Keith Aldis

Chief Executive Officer
Brick Development Association

Scope of Document

This is an initial guidance document for the general public and members of the construction profession.

This document is not intended to be a comprehensive guide, but rather a summary of the key issues and a signpost to further information, if required.

Published by the Brick Development Association.(BDA).

The BDA are committed to providing impartial and authoritative information. We make every effort to ensure the accuracy and quality of information and guidance when it is published. However we can take no responsibility for the subsequent use of this information, nor for any errors or omissions it may contain.

UK Brick Manufacturers



Bulmer

www.bulmerbrickandtile.co.uk
Sudbury (7)

Forterra

www.forterra.co.uk
Accrington (1), Claughton Manor (13), Cradley (14), Desford (16), Howley Park (24), Kirton (27), Measham (31), Whittlesey (47), Wilnecote (49)

H.G. Matthews

www.hgmatthews.com
Bellingdon (23)

Ibstock

www.ibstockbrick.co.uk
Aldridge & Atlas (2,3), Ashdown (4), Cattybrook (9), Chailey (10), Chesterton (12), Dorket Head (17), Ellistown (18), Eclipse (19), Laybrook (28), Lodge Lane (29), Parkhouse (34), Ravenhead (36), South Holmwood (39), Swanage (41), Throckley (42), Union (44)

Ketley

www.ketley-brick.co.uk
Brierley Hill (25)

Matclad

www.matclad.co.uk
Wreham (30)

Michelmersh

www.mbhplc.co.uk
Michelmersh (32), Blockleys (6), Charnwood (11), Carlton (8), Freshfield (21)

Northcot

www.northcotbrick.co.uk
Blockley (33)

Raeburn

www.raeburnbrick.co.uk
Blantyne (35)

Sussex Handmade Brick

www.sussexhandmadebrick.co.uk
Sussex Handmade Brick (40)

W.H Collier

www.whcollier.co.uk
Marks Tey (48)

Wienerberger

www.wienerberger.co.uk
Denton (15), Ewhurst (20), Hartleybury (22), Kingsbury (26), Sandown (37), Smeed Dean (38), Todhills (43), Waresley (45), Warnham (46)

York Handmade

www.yorkhandmade.co.uk
Alne (50)

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Introduction

This document describes the process of reclaiming bricks and raises points to consider when comparing reclaimed bricks with new ones. Bricks are durable and therefore sustainable and reusable. In recent times bricks have been produced under the harmonised European product standard EN 771-1 and the vast majority will last for at least 150 years. However, this may not be true of recycled bricks.

The advantages of specifying new bricks are that they are made to an established product standard and the performance, such as durability and compressive strength, is confirmed against a suite of test methods. There is a wide selection available and they are typically more cost effective than reclaimed bricks.

The appeal of using reclaimed bricks is that they may have developed a particular character, being fully matured and weathered. Depending on the energy required to reclaim the brick they may be more sustainable solution, although reclaimed bricks are less widely available.

Before reuse, bricks should be tested and qualified to confirm that they are suitable for the purpose intended. Unless there is certainty of where reused bricks were previously located - geographically and within the building - it is not advised that bricks are reused without testing.



Specification of Reclaimed Brick

Modern Methods of Construction Definitions

Reclaimed bricks may be selected for aesthetic reasons, but they must be technically appropriate for new work. Many dealers supply reclaimed bricks graded by the quality of appearance but cannot guarantee durability. In the absence of any specific assurance regarding the durability of reclaimed bricks, they should be used with caution.

Specifiers should check that their indemnity insurance policies cover the specification of reclaimed brick, as these products are not covered by a British Standard. If planning permission stipulates the exclusive use of reclaimed bricks in planning consents, specifiers are recommended to check with their insurers before complying with the planning requirements.

Frost resistance, soluble salts, strength, water absorption and size are all performance declarations that are covered by BS EN 771-1. Only new clay bricks are covered by this standard as all the relevant tests relate to samples drawn from newly manufactured consignments.



Bricks in a kiln

Traditional Methods of Manufacture

Many specifiers choose reclaimed bricks in the mistaken belief that bricks of similar appearance are not available as newly manufactured materials. In particular, they are not aware that handmade bricks are still currently manufactured.

Many tolerate the distressed state of reused brick, resulting from the process of reclamation, in the belief that there is no alternative. Several companies continue to make handmade bricks, including traditional clamp fired, produced in the same way as brick makers have done for centuries. Other companies have developed simulated handmade bricks, which look handmade but have been manufactured by modern machine methods.



Hand made brick

Appearance

Distressed Bricks

Many reclaimed bricks possess a distressed appearance as a result of the process of reclamation. For some, it is this characteristic that makes them attractive by imparting a mature character to the brickwork.

In recent years, some manufacturers have developed brick products that replicate this appearance, with chipped arises, paint remnants and dark stains. These bricks have the advantage of being manufactured to modern quality standards.

Weathering Tips for New Bricks

New brickwork can sometimes contrast with established work, but there are methods available to match the appearance.

One method is to apply a soot wash made by soaking a sack of soot in water and applying washes to the brick until the required degree of darkening has been achieved. Commercial wash preparations are available that perform the same function and advice can be obtained from English Heritage regarding their application. It is best not to darken the brickwork too much as the surface of new brickwork will darken naturally.

Commercial tints generally are both successful and long lasting prior to the natural aging process taking over. Brick tinting using modern materials are best carried out by experts with previous experience. It is always advised to test a small, discreet area or sample panel before starting more extensive work.

Another common method is to apply a solution of yogurt and water. This encourages an ecosystem to form on the wall surface and promotes the growth of lichens and mosses.



Performance

Frost Resistance

Clay bricks are made from a great variety of natural clay deposits, which together with the firing characteristics during the manufacturing process, determine the frost resistance. With reclaimed bricks, there is difficulty in assessing frost resistance.

A sample of bricks can be subjected to a freeze-thaw cycle test, but the results of this test cannot be extended to classify the whole consignment, as consistency cannot be fully known.

Assessing compressive strength and water absorption does not guarantee frost resistance. Strong and dense bricks of Engineering class are very often frost-resistant, while others of lower strength and high-water absorption can be equally frost resistant. To assume that because a brick is old it must have proven frost resistance is incorrect.

Before the early part of the 20th century, brick manufacturers would have assessed bricks as they were drawn from the kiln. From the manufacturer's experience of the brick-making material, the bricks would have been sorted on the basis of durability. Bricklayers, with their experience of locally available materials, would also have gained the ability to judge the relative frost resistance of bricks when selecting them for particular locations. They selected the bricks appropriate for the exposed external face of a wall and those adequate to use for protected inner walls.

When a building is demolished, the bricks being reclaimed may become mixed up. Non-frost resistant bricks are only suitable for internal use and before the commonplace use of concrete blocks, such bricks were frequently used in buildings for internal walls. Often they are salmon pink in colour and do not make a clear ringing sound if tapped against each other. They could still be used internally.

Unfortunately no standard currently exists to state the method by which bricks should be reclaimed. Consequently, specifiers cannot be sure of the durability of reclaimed bricks. The supplier should provide reliable assurance that reclaimed bricks have been taken exclusively from external walling. Only if it is known that the bricks have been obtained from an exposed situation should they be treated as frost resistant.



Selecting new bricks with regards to frost resistance is more straightforward as they are classified in BS EN 771-1 into categories of frost resistance. The design standard PD 6697 then explains which frost resistance is required in specific exposure conditions.

Performance

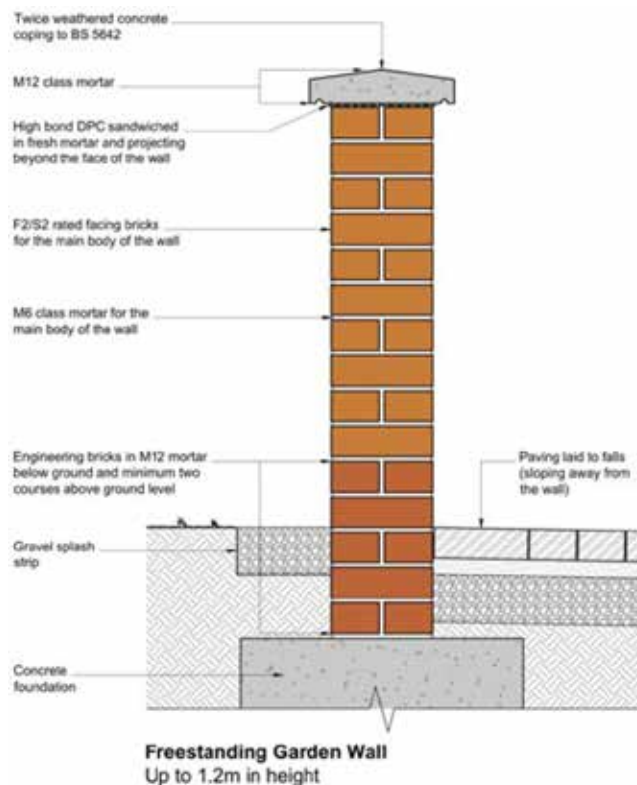
Soluble Salts Content

Soluble salts can be present in reclaimed bricks for a number of reasons. They naturally occur in certain clays or the bricks may have become contaminated during their service life, for example by leaching up from groundwater. Bricks may also be contaminated during reclamation or storage and there is no way of knowing the salt content of reclaimed brick.

New bricks are classified by three categories of soluble salts content defined in BS EN 771-1. Soluble salt content is required in order to specify the mortar, as an incorrect specification can lead to deterioration by sulphate attack. This is a reaction involving a constituent of the cement and sulphate salts in solution. The result is the crumbling and disintegrating of mortar joints. It is sensible to treat reclaimed bricks as Category S1.

Efflorescence

Similar to the above it is possible that reclaimed bricks may contain water-soluble salts. To reduce the risk of efflorescence, reclaimed brickwork should follow the same design and workmanship standards as new brickwork.



Performance

Strength

Newly manufactured bricks declare a compressive strength by testing a representative sample from bulk quantities. They are tested to destruction so it would generally be impractical to adopt this method for reclaimed bricks. Therefore it is difficult to be certain about the strength of reclaimed bricks.

Modern bricks are manufactured to more consistent methods than those of former times, to achieve consistency of performance. Greater variation within the properties of a reclaimed material should be expected. However, for three-storey domestic construction, it is unlikely that strength requirements would limit the use of reclaimed brick.

Water Absorption and Flexural Strength

For similar reasons to the performance properties above; water absorption and flexural strength of reclaimed bricks can be difficult to determine. However, these characteristics are unlikely to limit the application of reclaimed bricks in most types of residential construction.

Movement Joints

Although the irreversible moisture movement that occurs during the life of clay bricks will generally have taken place in reclaimed bricks, brickwork built with them will still be subject to cyclic thermal movement. Therefore, movement joints should be provided as recommended in PD 6697.

Sizes

Reclaimed bricks may often be used because it is assumed that new bricks are made in one size. Since metrication, standard bricks have been made to conform to a British Standard metric size (215 x 102.5 x 65mm). The metric standard brick size was adopted in 1974; it is slightly smaller than the former Imperial standard brick adopted in 1965 (8 5/8" x 4 1/8" x 2 5/8") (219 x 104.8 x 66.8mm). However, most manufacturers make and hold in stock bricks of various Imperial sizes.

These can be used to course with existing Imperial dimensioned work, where the height of the unit is most important. The most common imperial compatible bricks are 80mm, 73mm (2 7/8") 67mm (2 5/8") 50mm (2") high. The majority of these bricks are 215mm long and 102.5mm wide, but manufacturers can make any size required. A selection of standard specials is covered by BS 4729.



Performance

Standard Heights

Before 1965 two standard heights were adopted in the 1920s by the Royal Institute of British Architects (RIBA): 2 5/8" (66.8mm) allowing four courses to rise 12" (305mm) and 2 7/8" (73mm) allowing four courses to rise 13" (330mm).

They became known as the Southern and Northern bricks respectively, based on common regional usage. Prior to 1904 when the RIBA initially adopted the Southern Brick Standard there were no standards, only popularly used sizes.

Up to as late as 1965 many bricks did not conform to the standards mentioned above. Whether new or reclaimed Imperial sized bricks are selected to match existing work it is advisable to check detailed dimensions in relation to the size of the chosen brick to establish nominal work size.

Reclaimed bricks also tend to have greater size variability, which should be considered, as the bricklayer's craft skills will become of greater significance in attaining a satisfactory job. Also, check that there are sufficient supplies available to complete the work.

If using Imperial bricks with a standard metric concrete block inner skin, adjustable wall ties may be required to overcome the differences in alignment of the bed joints created between the two. When using reclaimed bricks of 1965 Imperial standard size in metric gauged brickwork - i.e. four courses to 300mm - horizontal bed joints will be thinner compared with when traditionally gauged (four courses to 12") or when using metric bricks at four courses to 300mm. This will affect the overall appearance of the brickwork.



Precast panels to create details unachievable in hand set construction

Paving

To be used as paving, clay pavers must be fully frost resistant. Reclaimed pavers can be used with confidence, providing they have been previously laid in an area where they have been fully exposed to the weather. Great caution is advised when considering whether reclaimed walling bricks might be suitable for paving.



Sustainability Considerations

Sustainability of Modern Brick Production

Modern brick production is more energy-efficient than any previous period. Material extraction for brick production amounts to less than 1% of the tonnage of quarried materials in the UK. Clay deposits are usually deep, so quarries use up a relatively small footprint of land. Also, deposits are frequently adjacent to the factories, so the impact from transport during manufacture is small.

The energy used to manufacture construction products is generally less impactful than the energy required to run a building. At a minimum of 150 years, the embodied CO2 emission from brick manufacturing is spread over a very long-time frame. The nature of heavyweight construction also means that temperature fluctuations are mitigated, which will reduce the energy required to heat and cool a building.

UK brick manufacturers are committed to further sustainability improvements. The BDA annual sustainability report is a source of further detail on targets, monitoring and innovation.



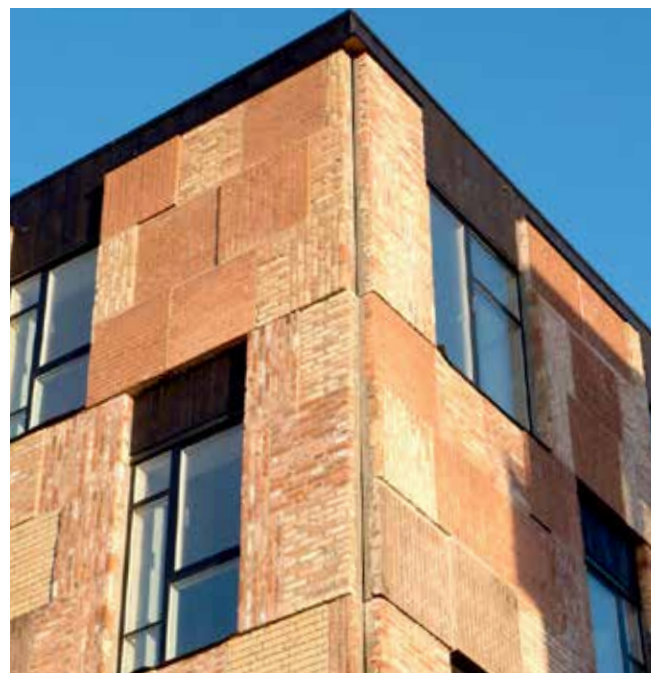
End of Building Life

At the end of the building life, clay bricks can be reused. Evaluating sustainability at the building level can be complex, due to the number of variables over the lifespan of any given building. The merits of using a reclaimed brick should be judged on an individual basis, as there is little point in reclaiming bricks that are not sufficient for the required purpose.

The Building Research Establishment suggests that a greater capacity exists for reusing bricks, but reuse may not represent best environmental practices. BRE evaluation found that using reclaimed bricks in the Centre for Building Heritage was not the most effective solution.

All bricks have the ability to be recycled, rather than reused, as graded aggregates. Recycled aggregates in sub-bases, hard-core and for concrete can reduce the need for extraction of virgin materials. Other applications include crushing into brick dust for use in lime mortars and in brick tinting.

Using lime mortars with new brickwork is sometimes suggested as a solution for making it easier to reclaim brickwork. However, lime mortars are generally not strong enough to achieve the necessary strength for cavity wall construction.



Lendager

Reusing Brick - The Process

Cleaning off Mortar

Bricks of the Victorian Period and earlier (i.e. pre early 20th Century) would normally be jointed in lime mortar which is easier to remove from the brick than modern Portland cement mortar. Nevertheless, good lime mortar can form a strong bond with the bricks. Removal needs patience and hard work with a heavy hammer and broad cold chisel for large lumps of mortar and a brick hammer (one with a replaceable hardened claw steel tip is useful) for dislodging smaller pieces. This should be done with extreme caution; a 'Chisel Hand Guard' is advised as well as all relevant PPE to ensure all health and safety regulations are adhered to.

Rubbing bricks on an abrasive gritstone may be useful for truing up some surfaces. The use of power tools is not advised as grinding wheels or discs and wire brushes are difficult to control and scoring or polishing can easily disfigure a brick's surface.

Chemical Cleaning

Proprietary, branded brick cleaning solutions are generally based on dilute hydrochloric acid and may be used to remove stubborn mortar or lime stains from the face of bricks. Care must be taken to wet the bricks first to reduce surface absorption and prevent penetration of the acid into the brick (see BDA 'Cleaning of Clay Brickwork' publication).

The use of hydrochloric acid, or any other chemical, is not recommended for the initial removal of solid mortar.

Mortar

For restoration work it is generally best practice to use the same mortar specification as originally specified, which traditionally was hydraulic lime and sand mortar. If there is no need to use traditional lime mortar then old bricks can be satisfactorily laid with Portland cement/sand mortars. The mix of mortar should be chosen in relation to the exposure of the walling or paving in question and guidance on this selection is given in the BDA's 'Mortar for Brickwork' document.



Matching Colour and Texture

Sometimes it is assumed that because a building is old the only way to match a brick is by using one that is reclaimed. It is interesting to note that when Hampton Court and Kew Palace have bricks replaced new bricks are specified, albeit made to the particular sizes and special shapes required. There are a number of specialist brick makers who focus on historic repair.

Currently, in the UK there are over 4,000 types of brick made from many different types of clay. The colour and texture of clay bricks are essentially dependent on the manufacturing method and the firing characteristics of the clay. It is quite feasible that a suitable match can be found within these ranges.

References and Further Reading

EN 771-1, Specification for masonry units Part 1: Clay masonry units

BS EN 845-1, Specification for ancillary components for masonry – Part 1: Ties, tension straps, hangers and brackets

BS EN 845-2, Specification for ancillary components for masonry – Part 2: Lintels

BS EN 845-3, Specification for ancillary components for masonry – Part 3: Bed joint reinforcement of steel meshwork

BS EN 998-2, Specification for mortar for masonry – Part 2: Masonry mortar

BS EN 1990, Eurocode – Basis of structural design

BS EN 1996-1-1, Eurocode 6 – Design of masonry structures – Part 1-1: General rules for reinforced and unreinforced masonry structures

BS EN 1996-1-2, Eurocode 6 – Design of masonry structures. General rules. Structural fire design

BS EN 1996-2, Eurocode 6 – Design of masonry structures – Part 2: Design considerations, selection of materials and execution of masonry

BS EN 1996-3, Eurocode 6 – Design of masonry structures. Simplified calculation methods for unreinforced masonry structures

PD 6697, Recommendations for the design of masonry structures to BS EN 1996-1-1 and BS EN 1996-2

BS 8000-3, Workmanship on building sites – Part 3: Code of practice for masonry

brick.org.uk/about/our-members

brick.org.uk/admin/resources/cleaning-of-clay-brickwork.pdf Cleaning of brickwork

brick.org.uk/admin/resources/whole-life-performance-of-clay-masonry-adrian-bown-2007.pdf

brick.org.uk/admin/resources/brick-epd.pdf

brick.org.uk/sustainability-reports

Brick Development Products & Services

Brick Awards

The Brick Awards celebrate the best examples of clay brick in our built environment. Each year the awards attract over 350 entries from leading architects, housebuilders, developers and contractors; across 17 hotly contested categories. It is FREE and simple to enter on our web site: www.brick.org.uk

Technical Publications

The BDA provides a range of technical publications and guides; which are freely available to Architects, Developers, Builders and General public on our web site: www.brick.org.uk

The Fourth Edition of 'Guide to Successful Brickwork' is available at all good book shops.

Brick Works Events

The BDA regularly runs courses and seminars for all those professionals involved with the design and construction of brick buildings. Please contact George Spreckley our Events & PR Manager on email: georgespreckley@brick.org.uk

Brick Bulletin

This widely acclaimed e-magazine features the latest developments in brick design and is recognised world wide as the foremost journal of contemporary brickwork. It is available free through the 'Brick Bulletin' tab our website: www.brick.org.uk.

Brickmakers Quality Charter

Clay brick makes a significant contribution to the UK's safe, healthy and sustainable built environment. The Brickmakers Quality Charter scheme promotes the responsible sourcing of clay brick, through credentialling and the flexibility businesses seek from an established and audited supply chain.

Training and Education

The BDA offers lectures and other educational services for Architects, Engineers, Developers as well as support for students and public interested in creating successful brickwork. We also provide technical input to events for practicing architects, engineers and organisations involved in continuing professional development.

Research and Testing

The BDA identifies specific areas where independent research and testing programmes are required to further the confident use of clay brick and to ensure quality.

Statistical and Marketing Information

The Brick Development Association is an independent body committed to providing authoritative information about the use of clay brick in construction.

We collate statistical information on brick production, UK deliveries, and related supply for imported products together with volume information including testing, research and development.

We provide free technical support on the use of clay brick, and encourage best practice in the use of brick in the built environment.



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