



# Observations on the use of Reclaimed Clay Bricks

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**The advantages of specifying new bricks are that they are made to an established standard, BS 3921: 1985, "Specification for Clay Bricks", 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 situation it may be more "environmentally friendly" to use a reclaimed brick. Currently reclaimed bricks have a certain cachet, they are less widely available, more expensive and have a distinctive appearance. The following notes raise points to consider when comparing reclaimed bricks with new, and describe the process of reclaiming bricks.**

## **APPEARANCE**

### **Traditional Method Of Manufacture & Current Methods**

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, which has resulted as a process of reclamation, in the belief that there is no alternative. Several companies do continue to make handmade bricks however; some are traditionally clamp fired and produced in exactly 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.

### **Reclaimed Brick Aesthetic - Distressed Bricks**

Many reclaimed bricks often possess a distinct distressed appearance as a result of the process of reclamation. For some it is this very characteristic that makes them attractive or imparts a mature character to the brickwork. In recent years therefore some manufacturers have developed brick products that look as though they have been reclaimed, with chipped arises, paint remnants and random dark stains. Simulated reclaimed bricks are made by applying 'attractive' disfigurements to bricks during the manufacturing process in the form of blobs of paint, whitewash, etc., and sometimes 'fumbling" them to achieve the distressed appearance. They have the great advantage of being made to conform to British Standards and are competitively priced because they are mass produced.

## **Suitability Of Old Bricks For New Work**

Reclaimed bricks may be selected for aesthetic reasons, but they must be technically appropriate for new work. Many dealers supply reclaimed bricks graded by quality of appearance but cannot guarantee durability. In the absence of any specific assurance regarding the durability of particular 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 in accordance with a British Standard. If Planning Officers stipulate the exclusive use of reclaimed bricks in planning consents, specifiers are recommended to check with their insurers before complying with the Planning Officers requirements.

Frost resistance, soluble salts, strength, water absorption and size are all items that are covered by BS 3921 and only new clay bricks are covered by this standard as all the relevant tests relate to samples drawn from newly manufactured consignments.

A further consideration might be that spores of dry rot fungus could be present within the pores of bricks reclaimed from some locations.

## **Frost Resistance**

Clay bricks are made from a great variety of natural clay deposits which together with the firing characteristics of the manufacturing process govern a brick's 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 of quality within it cannot be fully known. Assessing strength and high density (low porosity or low water absorption) will not guarantee frost resistance. Strong and dense bricks of Engineering class are very often frost resistant, while others of low strength and low density (high porosity or high water absorption) may also be frost resistant. To assume that because a brick is old it must be of 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 manufacturers experience of the brick making material, the bricks would have been sorted on the basis of durability. Bricklayers too, with their experience of locally available materials, would have gained the ability to judge the relative frost resistance of well fired and less well fired bricks when selecting them for particular locations in the work. They would have selected those appropriate for the face of a wall and those adequate only for use in protected inner walls or partitions of buildings.

When a building is demolished the bricks being reclaimed may become mixed up and the non frost resistant and moderately frost resistant ones included with those that are frost resistant. Non frost resistant bricks are only suitable for internal use and are seldom made today. Before the commonplace use of concrete blocks, such bricks were frequently used in old buildings for internal walls. Often they are a 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 standardised guidelines or codes of practice currently exist to state the method by which bricks should be reclaimed. Consequently one cannot be sure of the durability of reclaimed bricks. Ideally the supplier should provide reliable assurance that their reclaimed bricks have been taken exclusively from external walling. In general, unless it is known the bricks have been obtained from an exposed situation and then they can be treated as frost resistant (equivalent to F designation to BS 3921), it should be assumed that their frost resistance should be treated as moderate (i.e. equivalent to M designation in BS 3921) and in the work, building design should feature details that provide protection from saturation. It is possible and if desired, that CERAM Building Technology, for example, could develop a code of practice based upon inspection, sampling and testing of bricks from a single site which could give greater confidence in their durability.

Selecting new bricks with regard to frost resistance is more straightforward as they are classified under BS 3921 into three categories of frost resistance. In BS 5628: 1985 - Part 3, "Code of practice for the use of masonry - Materials and components, design and workmanship", Table 13 explains where these should be specified in building works.

## **Soluble Salts Content**

Soluble salts can be present in reclaimed bricks because they naturally occur in certain clays, and because the bricks may have become contaminated with salts during their service life, for example by sulfates absorbed from the soil leaching up into the brickwork, or by sulfates absorbed from the products of combustion into bricks used in chimneys. They may also be contaminated during reclamation or storage. With any of these cases there is no way of knowing the salt content of a reclaimed brick except perhaps from the dealer's knowledge of the origin of the brick.

New bricks are classified by two categories of soluble salts content defined in BS 3921. This is important to know in order to specify the mortar. Category L bricks have defined low limits placed on the contents of acid-soluble sulfates and water-soluble, magnesium, potassium and sodium. Category N bricks are subject to higher limits.

Where there is a high risk of brickwork becoming saturated for substantial periods of time there can be a risk of sulfate attack on the mortar. This is a reaction involving a constituent of the Portland Cement

and sulfate salts in solution. The result is crumbling and disintegrating of mortar joints. Table 13 of BS 5628: Part 3 gives guidance on specification to minimise this risk. It is sensible to treat reclaimed bricks as Category N bricks.

### **Efflorescence**

It is possible that reclaimed bricks may have water soluble salts contained within them. For this reason, to reduce the risk of efflorescence, the same guidance contained in codes of practice relating to workmanship for new work continues to apply when using reclaimed bricks.

### **Strength**

No assurance can be obtained regarding the strength of particular second-hand bricks. Modern bricks are classified by the crushing strength in relation to a sample taken from bulk quantities of newly manufactured bricks and it would be generally impractical to adopt this method for the assessment of the crushing strength of reclaimed bricks. Modern bricks are made by more controlled manufacturing methods than those of former times and consistency of the

product is achieved. Greater variation within the properties of a reclaimed material should be expected. However, for two-storey and three-storey domestic construction it is unlikely that strength requirements would limit the use of reclaimed brick.

### **Water Absorption**

The water absorption of a clay brick is significant in three contexts; the definition of Engineering and DPC bricks in BS 3921: 1985 and in the calculation of flexural strength in the design of structural brickwork. No guarantee can be given that samples of reclaimed bricks truly represent a consignment of reclaimed ones in this regard. However, this characteristic is unlikely to limit the application of reclaimed bricks in the types of construction for which they are commonly proposed.

### **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 BS 5628: Part 3: 1985, particularly for south and west facing elevations and when the construction is the outer leaf of a cavity wall fully filled with cavity insulation, or another highly insulated construction.

## 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 with a British Standard metric size (215 x 102.5 x 65mm). However, most manufacturers make and hold in stock bricks of various Imperial sizes. These can be used to course with existing Imperial dimensioned work, in which case it is the height of the unit that has most significance. 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 sizes is covered by BS 4729: 1990, "Specification for Dimensions of bricks of special shapes and sizes". The Brick Information Service can advise on which manufacturers keep Imperial bricks in stock.

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). 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. Before 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. Traditional bricks had a greater size variability. This should be born in mind when undertaking a new scheme as the bricklayer's craft skills will become of greater significance in attaining a good job. Check also if 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. It should be appreciated that this will affect the overall appearance of the brickwork.

Reclaimed special shaped bricks are not readily available, but can be manufactured new if a match is required.

## **Paving**

For use as paving, bricks must be eminently 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 in considering whether reclaimed walling bricks might be suitable for paving.

## **Cost**

Reclaimed bricks are quite expensive compared with new. For example in 1999 new stock bricks cost approximately £250 per 1 000 while reclaimed could cost £500 or more. One reason for this is the considerable labour involved in demolition, cleaning off old mortar, selecting, stockpiling and handling generally, all of which must be embodied into the selling price of reclaimed bricks. Typically it takes 1 person a day to take apart by hand and remove lime mortar from 2000 bricks and much longer with cement mortar.

Another reason reclaimed bricks cost more is because there is only a limited supply to meet the demand. Demand is also enhanced by a perception that reclaimed bricks have a certain 'quality' derived from the use of superior clays no longer obtainable. This is quite untrue as bricks today are made from the same clays as they have been for centuries. British clays are extremely varied in their mineralogical origins and brick earths, muds, marls, shales, gaults and fireclays are all common clay types traditionally and currently used for making clay bricks.

The cost of using reclaimed brick is also increased because a greater allowance will be required for wastage due to selection.

## **ENVIRONMENTAL ISSUES**

Concern exists about what constitutes best environmental practice. Ultimately this is a matter for the user to evaluate especially if this is a major consideration in specification. The merits of using a reclaimed brick should be judged on an individual basis, looking particularly at the key issues of the availability of the proposed brick and its location. The Building Research Establishment's "Green Guide to Specification" suggests that a greater capacity exists for recycling bricks, but recycling may not represent best environmental practice especially where costly and polluting energy resources are consumed in reclamation. BRE found that using reclaimed bricks in their new Centre for Building Heritage was not, in reality, best environmental practice because of the haulage costs to their site.

Some new brickwork could be built with lime mortars with the intention that at a later date the bricks can be more easily reclaimed. Currently the use of lime mortars, especially hydraulic lime mortars, is being developed. Because lime mortars are generally not strong enough to conform to the current

design requirements of some modern brickwork, manufacturers of lime mortars are in the process of developing guidance for their use in residential buildings up to 2 storeys high.

Today bricks are produced by technically more efficient and environment conscious methods than they were in the past. For current levels of brick production, the rate of extraction amounts to no more than 3% of the tonnage of quarried materials in the U K. As clay deposits are usually of great depth they use up relatively small areas of land. Also deposits are frequently adjacent to the brick making factories and so transport costs are minimised. The embodied energy content of brickwork is low in relation to the energy used within a building in a normal life span of 50-60 years and particularly low for the very long life characteristically observed for brick buildings. They can also be reused.

The UK industry produces currently around 2.8 billion clay bricks per year. Over the last 20 years the energy requirement for their manufacture has been reduced by over 20% and the brick industry takes great care to monitor these levels very closely and the research and testing body for the industry, CERAM Building Technology, undertakes continuing surveys. Emissions from the firing processes have also been greatly reduced. The UK brick industry uses a large quantities of waste material; for example landfill gas is utilised for firing some bricks and in others colliery spoil, PFA and blast furnace slag are used as a fuel additives.

All bricks have the ability to be recycled as graded aggregates for use in sub-bases, hard-core and for concrete. Other applications include crushing into granules for use with compost and into brick dust for use in lime mortars and in brick tinting.

## **RECLAIMING 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/sand mortar which is easier to remove from the brick than modern Portland cement / sand mortar. Nevertheless, good lime mortar can form a tenacious bond with the bricks and removal needs patience and hard work with a heavy hammer and broad cold chisel or bolster for large lumps of mortar and a brick hammer (one with a replaceable hardened claw steel tip is useful) for dislodging smaller pieces.

Rubbing bricks on an abrasive grit stone may be useful for truing up some surfaces. The BDA is aware of one brick cleaning machine, for the removal of mortar, called Brickmaster. 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. but care must be taken to wet the bricks first to reduce surface absorption and prevent penetration of the acid into the brick (reference BDA "Cleaning of Brickwork" Publications). The use of hydrochloric acid, or any other chemical, is not recommended for the initial removal of solid mortar.

## **Mortar**

Traditionally old brickwork was laid with hydraulic lime and sand mortar. This was particularly appropriate for the thick walls that characterised older forms of construction, but it is not normal modern practice. For restoration work where the use of the hydraulic lime/sand mortar would be desirable, hydraulic lime can be obtained from a specialist supplier who can also offer guidance on the relative proportioning of traditional mortar mixes. Suppliers for lime are listed in English Heritage's [1Directory on lime](#).

If there is no need to use traditional lime mortar then old bricks can be satisfactorily laid with Portland cement/sand mortars. The particular 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 publication "Brickwork Durability" and BS 5628: Part 3.

## **Weathered Appearance - Tips For Toning Down New Bricks**

Old brickwork often has a pleasing weathered appearance or natural patina, suggesting that the re-use of second-hand, or reclaimed brick is the best way to obtain a mature character to newly built work. New brickwork may stand out from established work, but it can be treated to tone it in. One method of doing this is to apply a soot wash made by soaking a sack of soot in a container of water and applying washes to the brick until the required degree of darkening has been achieved. Commercial wash preparations are now available that perform the same function and advice can be obtained from English Heritage regarding their application. Experimenting on a trial area first is wise, applying washes to the brick until the required degree of darkening has been achieved. In practice it is best not to tone the brickwork too much as the surface of new brickwork will darken naturally.

Another method which may be used in rural areas is to apply a solution of either soaked cow pats (manure) in water, or yogurt or sour milk in water. This promotes the growth of lichens and mosses and encourages an ecosystem into the wall surface.

## 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.

Currently in the UK there are over 1200 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. Further information is available from the Brick Information Service about where samples of brick can be seen and brick matching services available to assist with selecting the best brick.

## CONCLUSION

The use of reclaimed bricks should not be discouraged provided that users are conscious of their qualities and are able to correctly evaluate their fitness for purpose in the context of the proposed application. Their high cost is a reflection of demand and the cost of reclamation, rather than the intrinsic quality of the material.

Users should also be aware that new clay bricks are available in a very wide range of colours, textures, sizes and shapes, enabling a good match to be found for most existing brickwork. Many manufacturers also produce simulated reclaimed bricks if "distressed" characteristics are required. New bricks are made to conform to quality standards and physical properties specified by British Standards. They are generally much less costly than reclaimed bricks because of efficiency in contemporary production.

## REFERENCES

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3. "Managing Demolition and Construction Wastes" - Published by the Department of the Environment
4. British Standard BS 3921: 1985: Specification for clay bricks
5. BS 5628 : Code of practice for use of masonry
  - Part 1: 1992: Structural use of unreinforced masonry
  - Part 2: 2000: Structural use of reinforced and pre-stressed masonry
  - Part 3: 2001: Materials and components, design and workmanship.
6. BS 4729: 1990 Specification for dimensions of bricks of special shapes and sizes
7. BS 8103: Part 2: 1996: Code of practice for masonry walls for housing.