BRICK DEVELOPMENT ASSOCIATION

BDA comment on the use of Reclaimed Clay Bricks

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The BDA offers the advice in good faith, bricks are durable and therefore sustainable and reusable. While it is true that bricks that have been produced under EN 771-1 in recent years are likely to last for 150 years this may not be true of recycled bricks. Bricks reused require to be tested and qualified to confirm that they are suitable for the purpose intended. It is not advised that bricks are reused without testing unless they have been produced to EN 771-1. The Construction Skills (CITB) have worked with the BDA to produce this document. The BDA are very grateful for their assistance.

"...Bricks reused are required to be tested and specified to confirm they are suitable for the purpose intended..."

Introduction

The advantages of specifying new bricks are that they are made to an established standard, BS EN 771-1, "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.

Interior of the completed Holmesdale project
Teddington Case Study

"...Old brickwork often has a pleasing weathered appearance or natural patina..."

Technical Appearance

Traditional Method Of Manufacture and 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, resulting from the 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.

Weathered Appearance: Tips for Toning Down New Bricks

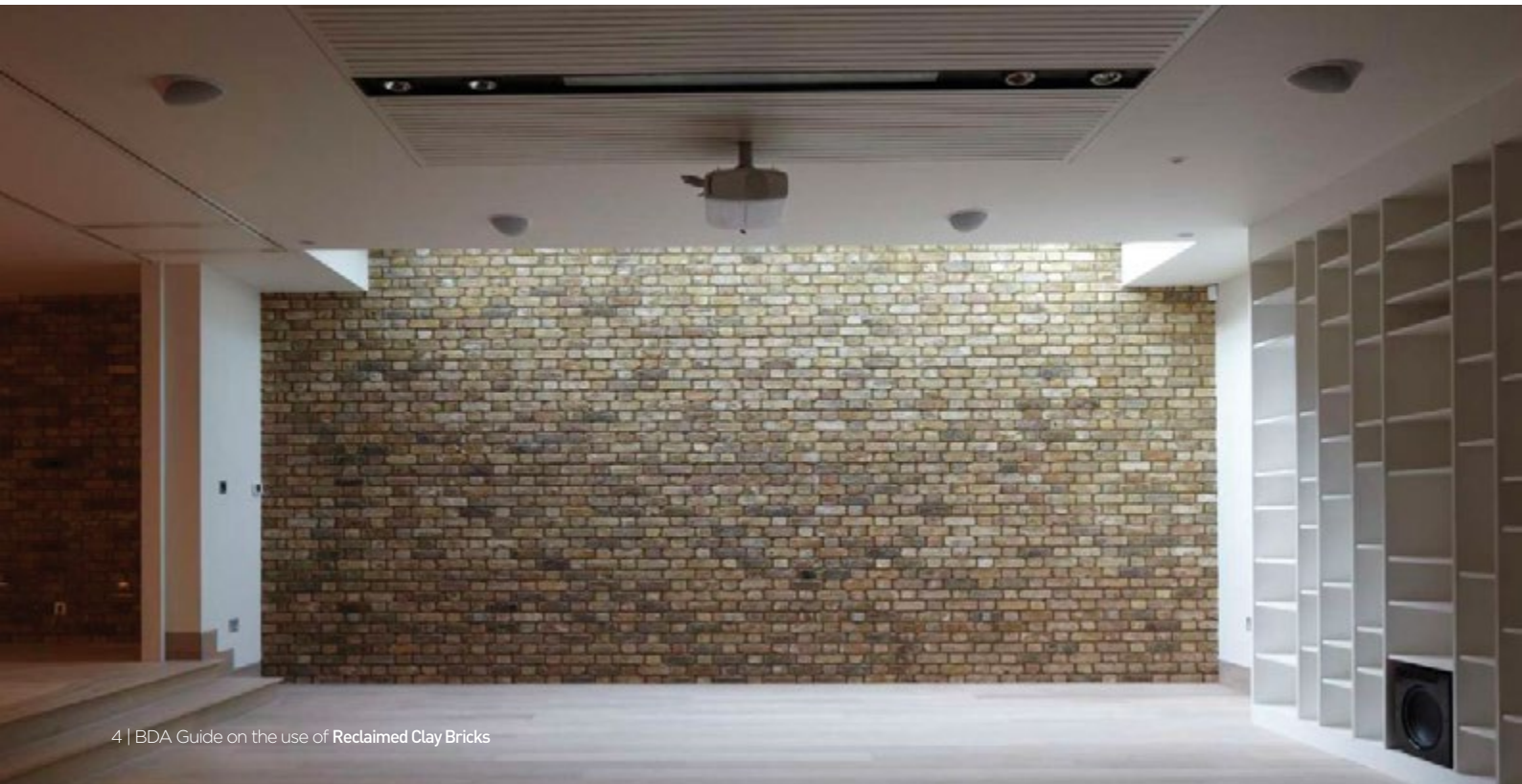
Old brickwork often has a pleasing weathered appearance or natural patina, suggesting that the reuse of reclaimed brick is the best way to obtain a mature character to newly built work.

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. Alternatively there are a wide variety of commercial tints and colours which can be used to alter or match a brick finish.

These 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 in the field with previous experience. It is always advised to test a small unimportant or sample panel before making a commitment for more extensive work.

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.



"...Specifiers should check that their indemnity insurance policies cover the specification of reclaimed brick..."

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, 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 paint marks, whitewash, etc., and sometimes 'tumbling" them to achieve the distressed appearance.

They have the great advantage of being made to conform to current European 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 Office requirements.

Frost resistance, soluble salts, strength, water absorption and size are all items that are covered by BS EN 771-1 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 in bricks reclaimed from some locations.

> “...Non frost resistant are only suitable for internal use and are seldom made today...”

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 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 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. They would have selected the bricks appropriate for the face of a wall and those adequate to only use in protected inner walls or partitions of buildings.

When a building is demolished, the bricks being reclaimed may become mixed up with the non frost resistant ones. Non frost resistant are only suitable for internal use. Before the commonplace use of concrete blocks, such bricks were frequently used in 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.

"...Greater variation within the properties of a reclaimed material should be expected..."

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, only if it is known the bricks have been obtained from an exposed situation should they be treated as frost resistant. It is possible in the future that an EU approved testing facility 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 regards to frost resistance is more straightforward as they are classified in BS EN 771-1 into categories of frost resistance. This standard and PD 6697:2010 (Recommendations for the Design of Masonry Structures to BS EN 1996-1 and BS EN 1996-2) explains what frost resistance requirements are required in various building situations.

Note and link to be inserted here when DRIDS project is complete

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 sulphates absorbed from the soil leaching up into the brickwork, or by sulphates 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 three categories of soluble salts content defined in BS EN 771-1. This is important to know in order to specify the mortar. Category S0 has no requirement; Category S1 bricks have defined low limits placed on the contents of acid-soluble sulphates and water-soluble, magnesium, potassium and sodium. Category S2 bricks are subject to more stringent limits.

Where there is a high risk of brickwork becoming saturated for substantial periods of time there can be a risk of sulphate attack on the mortar. This is a reaction involving a constituent of the Portland cement and sulphate salts in solution. The result is crumbling and disintegrating of mortar joints. It is sensible to treat reclaimed bricks as Category S1 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.

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

Strength

No assurance can be obtained regarding the strength of particular reclaimed 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 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 consistent units 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 PD 6697, 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 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 to 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 specials is covered by BS 4729, "Clay bricks of special shapes and sizes".

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).

RIBA

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. Traditional bricks had greater size variability.

This should be considered when undertaking a new scheme as the bricklayer's craft skills will become of greater significance in attaining a good 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. It should be appreciated that this will affect the overall appearance of the brickwork.

Paving

For use 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 in considering whether reclaimed walling bricks might be suitable for paving.

"...Today bricks are produced by technically more efficient and environmentally conscious methods than they were in the past..."

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.

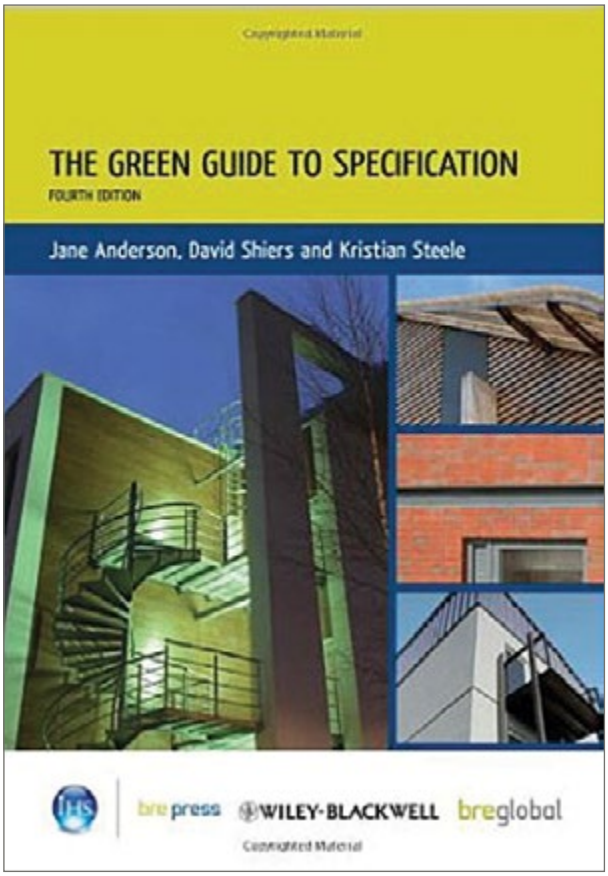
The Building Research Establishment's "Green Guide to Specification" suggests that a greater capacity exists for recycling bricks, but recycling may not represent best environmental practice especially where costly and polluting energy resources are consumed in reclamation. BRE found that using reclaimed 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. Lime mortars are generally not strong enough to conform to the current design requirements of some modern brickwork especially for taller construction unsupported at every floor level.

Today bricks are produced by technically more efficient and environmentally conscious methods than they were in the past. For current levels of brick production, the rate of extraction amounts to no more than 1% of the tonnage of quarried materials in the UK. 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 impacts 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 150 years and particularly low for the very long life characteristically observed for brick buildings. Clay bricks can also be reused.

The UK industry currently produces around two billion clay bricks per year. Over the last 20 years the energy requirement for their manufacture has been reduced by over 20%. Manufacturing performance is monitored and reported annually as part of the BDA Sustainability Key Performance Indicators. Also the emissions from the firing process have been greatly reduced. The UK brick industry uses large quantities of appropriate recycled raw material classified as MARSS (Materials from Alternative Recycled and Secondary Sources).



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 composites and into brick dust for use in lime mortars and in brick tinting.

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"...Currently in the UK there are over 1200 types of brick made from many different types of clay..."

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 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 (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.

http://www.buildinglimesforum.org.uk/

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 design note no.7 January 2011 Brickwork Durability.

http://www.brick.org.uk/2011/03/brickwork-durability/

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. Specialist brick makers who are members of the BDA have a large proportion of their output devoted to historic repair.

Hampton Court Palace

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.

"...Specialist brick makers who are members of the BDA have a large proportion of their output devoted to historic repair...."

Stabilisation of old brick surface

While the great majority of properly fired brick will easily reach 150 years life not all older bricks were made to our modern standards, bricks may also have damage from salt from gritting especially at low level adjoining pavements or roads. Chemical pollution from decades in an industrial environment may have altered the matrix of the brick face. You are advised to confirm the reused brick is free of these defects.

If the brick face is friable or starts to flake when used internally the alternatives are if possible a very brief (none saturating power wash) but only if the area is large and access is difficult. We suggest it is preferable to brush with a stiff bristle brush not a wire brush to remove all debris. After a brick is wetted efflorescence is always possible even with an older brick but this is not a permanent condition.

The conservation approach is to then used a lime wash which is binding, breathable and, non invasive. A coat

of properly applied lime wash is largely translucent and the form and texture of the bricks will still be visible. Alternatively a lime render can bind the surface but of course the appearance brick is lost. The wall will still be breathable to avoid the build up and retention of condensation.

A modern alternative is a silane/siloxane based water repellent which the makers claim still enables the brick to breathe as it lines the pores of the brick as opposed to providing a coating this is applied as a white cream it dries clear but unfortunately does give an initial slight sheen which will weather off in time.

We suggest a small area is tested and monitored before extensive work. Of course reclaimed bricks come in a huge variety of compressive strengths, water absorbency, textures and finishes so no one solution is suitable for all bricks or conditions and the user must contact the manufacturer to confirm the suitability or for larger projects carry out their own testing. http://www.ceram.com/

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. New bricks made to BS EN 771-1:2011 can be used with the confidence that they may be reused in the future up to and beyond the 150 year life.

"...Overall the percentage waste was low with 30% on yellow stock and only 10% on rubbed reds..."

Teddington Case Study

This interesting project took down a humdrum existing property built in the 1880s and rebuilt it using part new and 40 sq metres reclaimed bricks which were processed on site. Overall the percentage waste was low with 30% on yellow stock and only 10% on rubbed reds. The rear and side elevations of this exciting modern property are built with new bricks. But in order for the front elevation of the property to fit in with the surrounding Teddington houses reused bricks are used.

Fortunately the surrounding properties have high ceiling heights and the front design was acceptable to the modern house developer and architect. Several problems had to be overcome including coursing heights and mortar mixes which is always an issue when dealing with older reclaimed bricks of uncertain providence. The end result is an attractive modern house which also proves the sustainability of the reclaimed brick by reusing what was found on site.

Rear elevation of the completed Holmesdale project Teddington Case Study

"...Several problems had to be overcome including coursing heights and mortar mixes..."

Salvage of the Holmesdale project begins Teddington Case Study

Great use of reused yellow stock for the Holmesdale project Teddington Case Study

Photocredits: Dennis Gilbert VIEW / Mel Yates / McDaniel Woolf
Credit: Main Construction [Main Contractor] and Malishev Wilson Structural Engineers

"...Much of the cellar is Roman origin and the Norman keep has reused bricks forming the string courses..."

Colchester Castle Case Study

Colchester the former Roman Camulodunum and sometime capital of Roman Britain was sacked and burnt by Boudica the Warrior Queen of the Iceni who in alliance with the Trinovantes tribe revolted against their former Roman allies. Colchester Castle is on the site of the last stand of the discharged Roman Legionnaires who fell defending the temple of Claudius in around AD 60.

Much of the current cellar is Roman in origin and the Norman Keep has reused bricks forming the string courses and the structural elements of the external walls. These reused bricks have been through fire petulance and war and are yet approaching their 2000 year, a fitting statement on the durability of brick. These bricks are still as attractive as laid 1000 years ago for the second time by the Normans as they built the Keep to exclude the Viking raiders penetrating up the nearby Colne River. Few if any natural but worked materials are as natural or can demonstrate similar longevity. The length of years that a brick lasts also rather minimises its Carbon impact!

"...These bricks are still as attractive as laid 1000 years ago for the second time by the Normans..."

"...Great use was made of building materials from the remains of the local Roman city of Verulamium, mostly brick and flint..."

The Cathedral and Abbey Church of Saint Alban

From its elevated situation on the site of the execution and burial of St Alban, our first British martyr, the Abbey church of St Alban has dominated its surroundings for over 900 years. It is a building of contrast, architectural styles from the Saxon period through to the great Victorian restoration and a 20th century Chapter house.

The only Saxon work now in the Abbey can be seen in the shafts up in the triforium (first floor gallery) of both the North and South Transepts

The Norman rebuilding of the Abbey Church began in 1077. Great use was made of building materials from the remains of the local Roman city of Verulamium, mostly brick and flint, along with blocks of limestone possibly from Barnack in Lincolnshire. The brick and flint structure was plastered throughout giving an ideal surface for painting.

What is now left of this early Norman work carried out during the abbacy of Paul of Caen, is the magnificent tower, the transepts (with some later alterations), the north and three bays of the south nave and aisles, and parts of the presbytery walls. The great tower is 144 feet high, weighing about 5000 tons above the piers, which themselves are founded on limestone, still visible beneath the south west pier.

"...The brick and flint structure was plastered throughout giving an ideal surface for painting..."

"...The only building is the nave of the priory church, built with much reused brick and stone from the Roman town..."

The Priory of St. Botolph

The Priory of St Julian and St Botolph was founded in 1103 by a community of priests who had previously served an important church of this site. The dedication of St Botolph, an East Anglian abbot who died in 680 indicates a Saxon origin for the community.

The only building to survive is the nave of the priory church, built with much reused brick and stone from the Roman town. The circular piers are strengthened by triple courses of brick and the shallow pilaster running up from the capitals mark the division of the bays and the position of the roof tie beams. At the west end, the great "Screen Facade" can be dated to circa 1160. The eastern half of the church does not survive, but its plan was revealed by an archaeological excavation in the early 1990s. The cloister lay to the south of the Church, surrounded on three sides by buildings.

"...The circular piers are strengthened by triple courses of brick..."

"...This end Gable wall at Layer Marney Hall in Colchester Essex adjoining the Tower is completely new using 500 year old bricks..."

Layer Marney Hall

This end Gable wall at Layer Marney Hall in Colchester Essex adjoining the Tower is completely new using 500 year old bricks which have been taken from the new large windows seen on the long elevation. The wall was originally weather boarded but had been replaced many times over the centuries. The Hall was originally stables but is now used for functions as part of the Layer Marney Tower facilities.

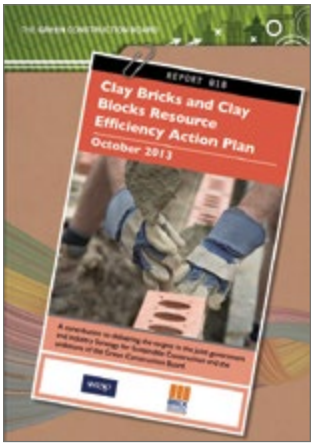
Relevant British Standards

1. BS EN 771-1:2011 Specification for masonry units part 1: Clay Masonry Units
2. PD 6697:2010 Recommendations for the design of masonry structures to BS EN 1996-1-1 and BS EN 1996-2
3. BS 8221-1:2012 Code of practice for cleaning and surface repair of buildings
4. BS 7533-9:2010 Pavements constructed with Clay natural stone or concrete pavers
5. PAS 70:2003 HD clay bricks guide to appearance and site measured dimensions and tolerance
6. BS EN 15804:2012 Sustainability of construction works
7. BS 8103-2:2012 Structural design of low rise buildings
8. BS 8000-3:2008 Workmanship on building sites
9. BS EN 1344:2003 Clay pavers – requirements and test methods
10. National Federation of Demolition Contractors: (NFDC). Demolition of refurbishment information data sheet 13. Nfdc-drids.com/sheet 13
11. BS EN 772-3:1998 Methods of test for masonry units determination of net volume
12. BS EN 772-1:2011 Methods of test determination of compressive strength
13. BS EN 1998-1.1:2005 and A1 2012: Design of masonry structures
14. BS EN 998-2:2010 Specification for mortar and masonry
15. BS EN 772-5:2001 Methods of test for masonry units' determination of the active soluble salts
16. BS EN 772-7:1998 Methods of test of masonry units. Determination of water absorption of clay masonry damp proof courses

"...The life cycle benefits of the re use and recycling of clay building products are generally addressed in Modules C and D of the EPD..."

LIFE CYCLE ASPECTS OF THE RE USE AND RECYCLING OF CLAY BUILDING PRODUCTS

Re-use of clay products



Because of their long service life clay building products can be reclaimed and re used as described in the body of this document provided that all appropriate technical considerations are addressed. If it is not possible for them to be re used then a number of opportunities exist for the materials to be recycled for appropriate construction purposes. It is essential that every effort should be made to eliminate the disposal of materials from deconstructed buildings to landfill. This forms one of the main conclusions of the Clay Brick and Clay Block Resource Efficiency Action Plan (REAP) which was issued in October 2013 http://www.brick.org.uk/wp-content/uploads/2013/10/Download-the-full-version-of-CBCB-REAP-October-2013.pdf

The life cycle impacts of the re use and recycling of clay building products have been addressed previously in the BRE "Environmental Profile" for clay bricks. It is this profile which underpins the Green Guide rating of A+ for the use of clay bricks in all common masonry wall formats in the UK. Life cycle impacts are now being included within the Environmental Product Declaration (EPD) for a construction product following the methodology established in BS EN 15804 – "Sustainability of construction works - Environmental Product Declaration – Core rules for the product category of construction products".

The life cycle benefits of re use and recycling of clay building products are generally addressed in modules C and D of the EPD according to the rules in BS EN 15804. Essentially the environmental impacts of preparing the material for re use or recycling have to be assessed and then balanced against the environmental benefits of this use whereby the requirement for virgin construction materials is replaced. It is beyond the scope of this document to go into detail about this methodology but the following sections give some examples of how clay building products can be appropriately re used or recycled.

Recycling of clay products

Clay products that cannot be directly reused are usually crushed and then used again in various construction applications including road construction (sub-layer), agricultural and quarry roads, embankments, tennis courts, etc. A generic definition of the principles of module C and module D of BS EN 15804 is given below.

Module C:

- Demolition/deconstruction of the clay product;
- Collection of the demolition materials at the building site;
- Transport from the building site to a sorting plant (if any, sometimes at the building site) including any packaging when necessary;
- Sorting process (sorting plant or at the building site);
- Transport of clay construction waste to waste processing;
- Primary crushing of clay construction waste up to the end-of waste state is reached (according to the criteria of BS EN 15804 – paragraph 6.3.4.5).

"...Demolished masonry units that can be crushed and used as a secondary raw material..."

Module D:

- Secondary crushing and size selection (if necessary, according to the new function of the material);
- Other processing steps in order to have a new product;
- Avoided extraction and processing of virgin materials used as granulates (e.g. gravel and sand).

Example 1: Demolished masonry units that can be crushed (recycling process) and used as secondary raw material in the production of new masonry units

In this case, it is assumed that crushed masonry units coming from the demolition of the building are used to replace a proportion of primary raw materials in the manufacturing of an equivalent masonry unit.

In this example, for the production of a declared unit of 1 tonne of clay bricks, 10% of crushed bricks (100 kg) is used at the production stage (A1), replacing raw clay/sand.

In fact, 1 declared unit (1 tonne) of clay bricks can generate up to 75% (750kg) of secondary material that could be used as input in a following life cycle.

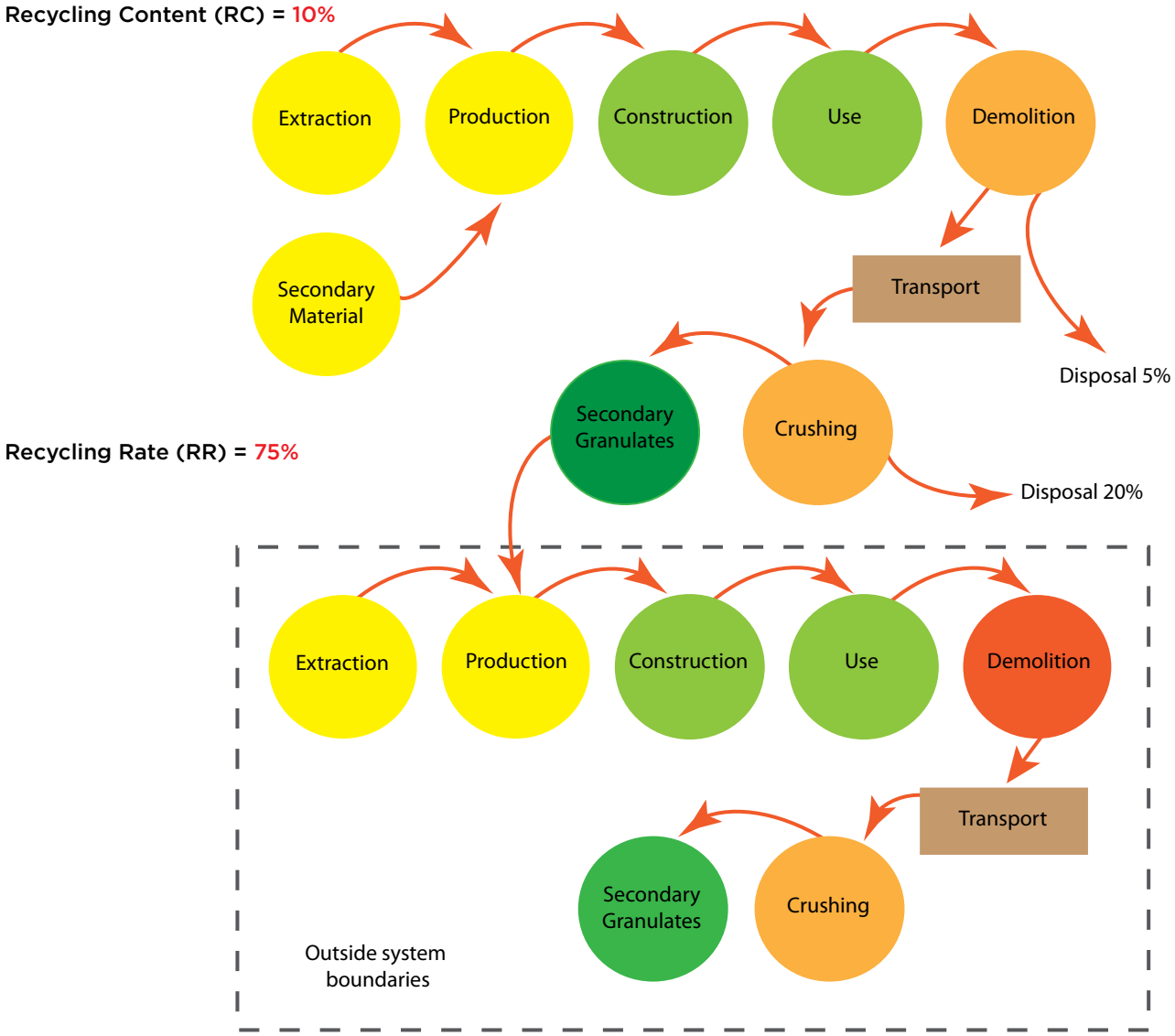


Figure 1 – Demolished clay bricks which are recycled and used as raw material for the production of new clay bricks

“...Elements like sheetrock, acoustical tile, roof tile material and other interior building components are removed...”

Using the methodology of BS EN 15804 it is possible to calculate the environmental benefits of this application due to the avoided environmental impact of virgin materials.

Example 2: Demolished masonry units that can be recycled towards raw material for another application: use in concrete aggregates

In example 1, recycled bricks were used to substitute secondary raw materials for the production of new bricks. Different fields of application are already technically used today. The purpose of example 2 is to show that crushed clay bricks can be used in the production of concrete aggregates.

After the demolition stage, the brick masonry is crushed and then used in the production of new concrete mixtures. A range of scientific studies have shown that crushed brick masonry can be used as a replacement for normal weight coarse aggregate ((Kesegić et al, 2008) and (Cavalline and Weggel, 2011)).

In certain cases, prior to the demolition of the brick masonry wall, elements like sheetrock, acoustical tile, roof material and other interior building components are removed in order to minimize the impurities in the brick masonry aggregate (Cavalline and Weggel, 2011).

In this example a recovery rate of 95% and recycle content of 0% are considered. For a declared unit of 1 tonne of masonry unit this results in a (net) production of 950 kg of secondary granulates for concrete aggregates.

Using the methodology of BS EN 15804 it is possible to calculate the environmental benefits of this application due to the avoided environmental impact of virgin materials.

Example 3: Demolished masonry units that can be recycled towards raw material for another application: roadwork

In example 1, recycled bricks were used to substitute secondary raw materials for the production of bricks. Different fields of application are already technically used today. The purpose of example 3 is to show that crushed clay bricks can be used in roadwork and related applications.

A study carried out by Mueller and Stark (2002) showed that recycled clay bricks can have a range of different applications, including embankments, construction fill, and roads (see Figure 2)

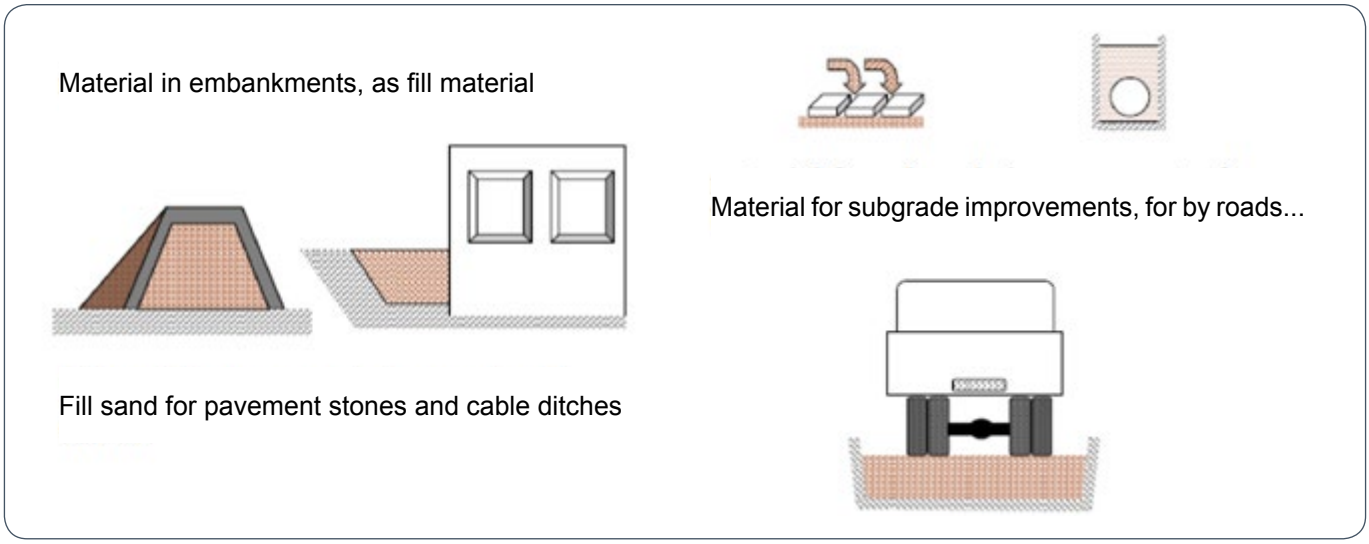


Figure 2 – Examples for the application of clay masonry Construction and Demolition Waste in unbound systems (Source: Mueller (2002))

“...Demolished clay bricks which are recycled and used as a raw material in roadworks...”

In example 3 a recovery rate of 95% and a recycle content of 0% are considered. For a declared unit of 1 tonne of masonry unit this results in a (net) production of 950 kg of secondary granulates for roadwork (see Figure 3).

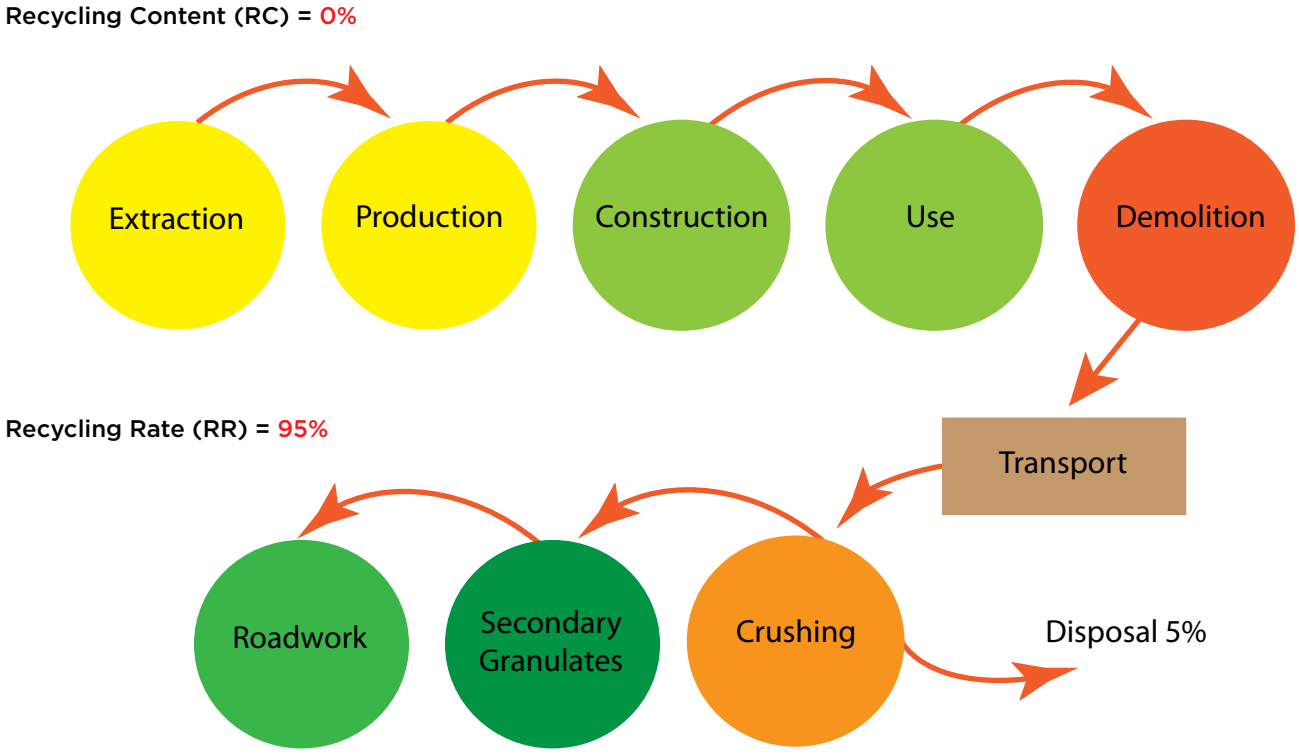


Figure 3 – Demolished clay bricks which are recycled and used as raw material in roadworks

Using the methodology of BS EN 15804 it is possible to calculate the environmental benefits of this application due to the avoided environmental impact of virgtin materials.

References

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