



Cottages at The Marsh, Breamore

Historic buildings Brickwork

This leaflet describes the character of historic brickwork, identifies some of the problems associated with it and methods of repair.

There is a list of references and useful contacts on the last page.

Introduction

The English word 'brick' probably derives from the french work 'brique' and came into use in the C15th. Prior to this, the word 'waltye' was used. This referred to the flat, tile-like bricks originally used in Britain by the Romans.



Decorative brick tiles,
The Old School House, Lyndhurst

History

Brickmaking ceased when the Romans left in C5th, and only began again in any volume during the C13th.

Hand making bricks was laborious and slow, but in the south and south eastern counties, which had very little natural stone, it became a common sight. The raw clay was trodden down or passed through a pug mill to separate out the unwanted material. The clay was then formed by cutting from a thin slab, or shaped or thrown by hand into wooden moulds. The unfired bricks were placed in 'clamps'. These were large stacks of unfired bricks covered on the outside by clay. Inside there were layers of fuel, which usually consisted of brushwood and other undergrowth. Extra fuel was placed outside the clamp and fired. The whole could burn for several weeks. Up-draught kilns were also used. These involved creating a chamber for fuel on top of which was constructed a chamber of unfired or 'green' bricks. The firing temperature was generally more stable with up draught kilns, but major inconsistencies in the finished product remained.

The early methods of brick manufacture were inefficient and the progress of brick manufacture were inefficient and the progress of English brickmaking for four hundred years was very limited. However, with the advent of machine making at the end of the C18th, great volumes began to be produced. Downdraught kilns were more effective and the control possible created higher quality bricks. These kilns were straight-sided with domed roofs. Fireboxes were located at the base of the walls and heat passed between these walls and screen walls which were built nearby. Once the heat had risen in the kiln, it was deflected down towards the honeycomb of raw bricks and out through holes in the floor which were connected to a flue.

The mortar joints between hand made bricks were usually irregular, large and uneven. The joints consequently became finer as the bricks became more uniform in size and shape.

Taxes on brick meant that it remained the material of the wealthier classes. Fortified houses

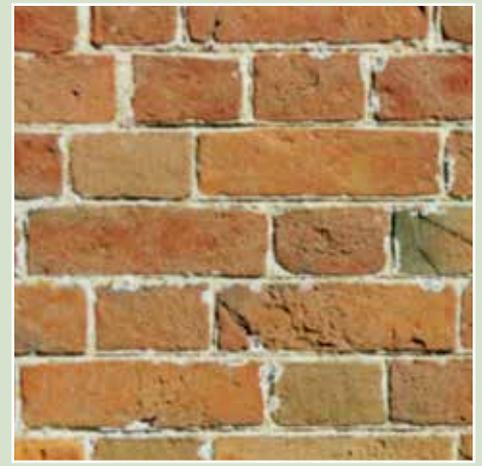




These old hand made bricks are in excellent condition. The impurities in the brick and weathered pointing give the wall character



These machine made bricks are more uniform in nature. The pointing is less noticeable but nevertheless adds quality to the overall form



and later, country mansions and large town houses were built using the fashionable 'new' material. Older buildings, owned by the wealthier classes and originally built of timber, were sometimes also refaced in brick. However, during the middle/late C19th the use of brick increased rapidly at all levels of society and with the expansion of the railways bricks were transported to locations that previously had none. There was more brick building carried out during the Victorian era than the sum of all remaining brick buildings constructed up to that time.

Description

Bricks are usually made from sand and clay. When clay was 'won' and thrown by hand, it also contained small quantities of gravel, stones and pebbles. Almost all geological periods have suitable brick clays. Some materials derive from lagoons and deep seas, while others come from the wind blown dusts of the ice age. The various colours of clay are determined by their age and location.

The appearance of bricks, as well as their density and durability, is a result of the clay used and also the technique of the individual brick maker. Poor sieving, inadequate application of pressure in the mould and the intensity and consistency of heat applied during firing could lead to inconsistencies, affect appearance and result in mis-shapen, underburnt or overburnt bricks. This created the

patchwork of interesting material that is now seen in the buff bricks of Beaulieu, the soft reds bricks of Lymington and the overburnt blue/purple coloured headers that adorn the facades of houses across the New Forest.

Mortar joints between bricks can either add to or detract greatly from the overall appearance of masonry. There are various methods of pointing. Historically, it was usually finished flush with the face of masonry. Since the introduction of mechanisation to brick manufacture, narrow even joints have subdued the appearance of the pointing and emphasised the brick and the bonding.



The use of burnt blue headers.

Pointing

A lot of unnecessary pointing of brickwork is carried out. Repointing is only needed where mortar has become so loose, powdery or eroded that water has begun to penetrate the joints. A recessed joint or mortar that is soft does not necessarily indicate the need for repointing. Only rarely is poor mortar the cause of water penetration leading to damp problems inside a building.

One of the most troublesome modern-day problems is caused by the use of cement mortar. It is dense and inflexible and neither allows water to pass in and out of the joint naturally, nor moves as the brickwork seeks to flex in response to climatic changes. Moisture in the wall has to come out through the bricks, which offer the path of least resistance. The excessive passage of water through the bricks causes spalling of the faces and the problem of damage by frost is exacerbated. The rate of deterioration increases as this process continues. It also significantly detracts from the character of the brick.

As a general guide, if mortar is not easily raked out manually to a depth at least twice the width of the joint, then repointing is not required. Mechanical tools should not be used to remove mortar. If they are needed then repointing is definitely not necessary.



Think carefully whether any repointing is really necessary. This brickwork and mortar is perfectly sound. The joints are full, the lime mortar is taking and expelling moisture effectively and the character of the wall is intact



Poor repairs and damage caused to brickwork due to the use of cement mortar

Where cement mortar pointing has been used and is noticeably resulting in the spalling of the faces of the bricks, it should be assessed whether it can be readily removed using non-mechanical tools.

Unfortunately on some occasions the mortar may be too rigid and firmly bonded to the brick to allow removal to be carried out without significant damage. Assessment may need to be carried out by a specialist.

If repointing is necessary, then it is important to investigate the cause of decay of the mortar and rectify any problem before commencing. It could be due for example to blocked rainwater goods.

It will rarely be necessary to repoint a wall completely. It is important to identify only the localised areas that need to be tackled. Once the joints have been raked out thoroughly, to a depth at least twice the width of the joint (and usually between 25mm and 38mm) using plugging chisels, toothed masonry chisels or hacksaw blades, they should be cleaned. A soft bristle brush will remove all debris. The joints must then be thoroughly flushed with clean water.

New mortar should be pressed into place with as much pressure as possible using pointing keys. These keys are sometimes improvised to suit the work in hand. Curved and flat irons are also available for

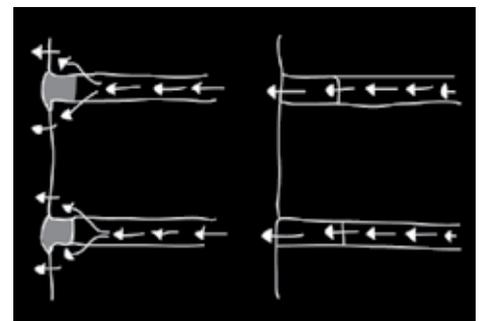
particular types of pointing. The joint should be finished to match the surrounding historic brickwork.

It is important to use a lime putty mortar since it allows moisture to pass out of a wall through both the bricks and the joints and allows for climatic movement in the brickwork, thus preventing the brick from spalling due to moisture movement and frost damage.

For most purposes a basic mix of one part lime putty to three parts gritty aggregate will be appropriate (with no cement). The choice of aggregate will give the colour and texture. Colour additives should not be used.

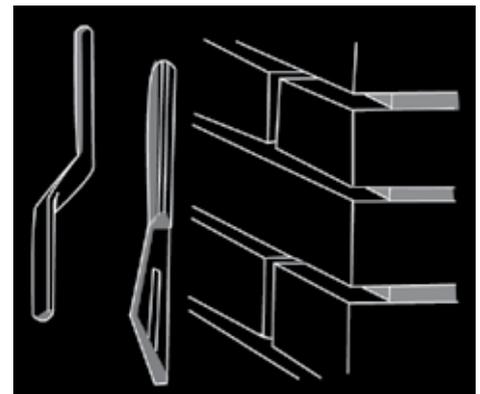


Example of poor repointing using cement mortar which not only looks unsightly but will damage the brickwork in the long term



Cement pointing **Lime pointing**

Cement pointing does not absorb or expel water, so it must come back through the brick itself, which eventually spalls. Lime mortar pointing allows the movement of moisture more effectively



This piece of wall has been raked out with the plunger and will be repointed using the iron shown. The width of the face of the pointing iron is slightly less than that of the joint, to ensure that it can compress the mortar into the joint correctly



◀ Bulging has occurred here. Subsidence and the corroding iron wall ties have allowed the outer leaf of brickwork to bow outwards

▶ Structural movement resulting in cracking



Problems

Fractures and bulges

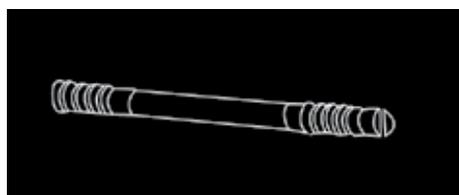
Foundation movement, a defective roof structure, failing timber lintels and extensions to the original building can all cause fractures. Bulges usually occur as a result of poor bonding between skins of masonry. Once a problem has been identified, the structural stability of a wall needs to be assessed and if necessary the cause rectified before repairs to the brickwork are undertaken.

It may be possible simply to leave the brickwork as it exists, accepting that cracking or movement has occurred but has long since ceased, but it is essential to establish that there is a danger of structural failure or penetration of damp. Where cracking has ceased but a crack will allow penetration of moisture, the damaged bricks should be carefully cut out, using hacksaw blades, or other small nonmechanical tools, replaced and the joints repointed. It may be necessary to stitch cracks and bond bulging brickwork in order to remove the possibility of further movement and there are various methods that can be used.

A structural engineer should ascertain the extent and direction of movement of the brickwork and then determine the most appropriate method. Sections of brickwork can be removed and concrete dovetail section cast in situ, before the brickwork is rebuilt.

Stainless steel mesh can be set into the new mortar beds as repair work proceeds, or the brick skins can be tied together using proprietary steel fixings bonded into the wall with an epoxy resin.

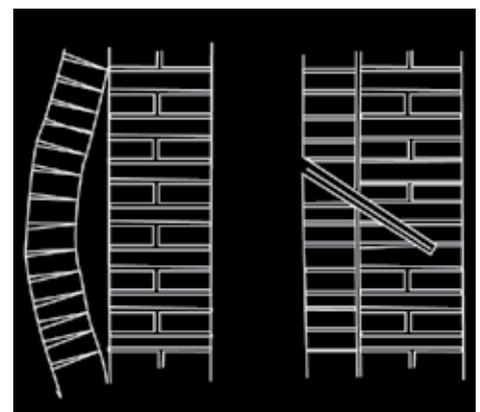
There are also double ended expanding head ties which are set into pre-drilled. Where walls are bulging or leaning and there is significant displacement around a crack then it may be necessary to take down and rebuild the section of the wall. This is the most drastic course of action and of course the least satisfactory in conservation terms. Detailed recording is essential before work starts and the reconstruction must match the original coursing, bonding and pointing. Materials should be salvaged and reused as far as possible (but it is important that bricks are carefully cleaned). Any special moulding or cut bricks should be numbered prior to removal to ensure they are repositioned accurately.



Double headed expanding ties are placed in pre-drilled holes and tightened up once in place



Vertical crack in brickwork due to movement. Brickwork has been repaired with a variety of hard mortars which have failed to address the problems



In the worst instance, a bulging skin of brickwork may need to be taken down, rebuilt and tied in using proprietary steel fixings in an epoxy resin



Severe efflorescence has occurred on this wall causing bands of salt stain



Eroded brickwork, unfortunately pointed very badly

Decay and disintegration

Inherent weaknesses caused by the materials used to make bricks and the early methods of manufacture, can in time become problems, leading to decay and disintegration.

Salts in the clay or mortar may crystallise on the surface of the brick, known as efflorescence, or they may be drawn up from the ground, resulting in staining of the face of brickwork and leading to disintegration and spalling of the surface.

The detailing of brickwork in buildings can play a part in its deterioration. Cornices, strings and copings are all subjected to large amounts of standing and driven rainwater. Similarly, brickwork adjacent to poorly detailed or finished leadwork to flashings and aprons is susceptible. This saturation can lead to a breakdown of the bricks and mortar. Also, bricks hidden from the natural washing action of rain tend to accumulate dirt and the slow build up of moisture can allow destructive salts to accumulate.

Frost can cause damage to the face of bricks. Moisture penetrates the pores, expands on freezing and causes the surface to break up and spall. The more porous the brick, the more likely it is to be damaged. Hand thrown bricks are usually therefore the most susceptible.

Cutting out

Cutting out and reversing damaged bricks can be an effective remedy. The use of slip facings is also possible. Slips are usually about 25mm thick and are mortared into a brick recess in the wall.

Replacements

Replacement of whole bricks may be a solution if they have become unacceptably damaged. The repair method which least disturbs the sound brickwork should be adopted. On no account should mechanical means, such as angle grinders, be used for cutting out old brickwork, as the joints become enlarged and unnaturally straight and bricks are easily damaged. Hacksaw blades and small plugging chisels are effective and minimise damage. Bricks should be reinstated to the original, not the eroded, face plane of the wall.



Sources of Bricks

Second hand bricks can sometimes be used, or perhaps salvaged bricks from the immediate vicinity.

However, when larger numbers are required, this can sometimes mean having new bricks sourced and possibly specially fired. 'Specials' can rarely be produced quickly and therefore advance planning is essential. The new bricks should match the appearance and the characteristics of the existing.

Toning In

Don't! Attempts to artificially age or distress new bricks usually prove ineffective. In time they will weather naturally to match the existing, provided they are an appropriate match for the original.

The deterioration of this chimney at Milford-on-Sea could be caused by a combination of the sea air and by the sulphurous gases emitted from the chimney, both of which contain high levels of salt



◀ The cornice has created a splash back against the brickwork. It is consequently staining and eroding the brick above and below the cornice dripping water is also staining the brickwork

▶ Corrosion and staining exacerbated by grit and salt



Cleaning

Cleaning should be carefully considered and several questions should be answered before reaching a decision.

Will the appearance of the building improve or not, if it were cleaned?

A thorough understanding of the existing surface must be gained. Poor pointing or mismatched brickwork may be hidden behind a uniform layer of dirt. Alternatively, a high quality of finish or particular patterning may be revealed.

Is the dirt creating or adding to the deterioration of the masonry?

Generally, heavy encrustations are detrimental to the surface of the brick. Discolouration and light soiling affects appearance, but usually causes little problem.

Once the decision has been taken to clean brickwork it is necessary to decide on the most appropriate method.

Washing is effective, but heavy encrustations may require saturation of the masonry, which is not desirable. Pulse or intermittent sprays can reduce the volume of water used on heavily soiled masonry, whilst still removing soiling effectively. Water sprayed at pressure that could damage the face of the brick should not be used.

Glazed and engineering brickwork can be cleaned using water lances with a soap that is neither acid nor alkali (pH neutral).

Brushing is also sometimes required to achieve satisfactory results. Brushes for normal facing brickwork should be non-ferrous or bristle never steel. More delicate brick and rubbed or gauged work should be gently scrubbed using a soft bristled nail brush.

Mechanical cleaning methods should not be used. Grit blasting pits the surface of the brick, which consequently increases the rate at which it will deteriorate. Carborundum discs 'dish' the surface, which is unacceptable. Chemical cleaning of masonry can be effective. Weak solutions of hydrofluoric acid of no more than 8% concentration can be used. The masonry must be pre-wetted and very careful masking of all other features, such as windows, should be carried out before application. Once the acid has been applied by brush, the brickwork should be allowed to stand for approximately five minutes before being thoroughly washed.



◀ Gloss paints are plastic based. Once cracked these paints can hold moisture against the surface of the masonry.

▶ Graffiti can be a problem for masonry when applied with a solvent spray



Surface treatments

Excessively porous masonry can deteriorate through continued movement of moisture into and out of the brick and frost action, which can in time severely damage the face. Soluble salts in both the mortar and rainwater can exacerbate this spalling action.

Before any treatment, it is advisable that a detailed assessment of the problem is made by an expert. If it is decided to treat the masonry with a repellent, then a recognised professional should be used and a test area treated to assess the appearance and effect on the masonry.

Water repellent generally act by lining the pores in the brick. Water can still permeate the surface and evaporate. Waterproofing materials should be avoided as they seal the surface and prevent breathing. As a natural material, brick must be allowed to 'breathe' in order that it can continue to take in and expel moisture.

Graffiti

Graffiti can be a problem for masonry, particularly when applied with a solvent spray which can carry the paint deep into the pores of the wall, making cleaning more difficult.

Graffiti applied without solvent may be treated with paint stripper in a poultice. These poultices must be removed when dry and the wall thoroughly washed afterwards.

Graffiti applied with solvent is more difficult to remove. Water rinsable paint stripper or a 1:5 solution of water and trisodium phosphate may prove effective. The stripper must be left in contact with the paint long enough to make it soft. It should then be scraped off and rinsed with a pH neutral soap.

If a section of wall is susceptible to graffiti, the application of a proprietary graffiti barrier may prove effective in protecting it from further, more damaging attack. Before using any graffiti barrier, careful investigation of the effects of cleaned walls should always be requested from contractors.

These barriers aim to prevent pigment getting into the pores by either blocking the pores permanently or temporarily by softening and expanding in the presence of moisture. Some barriers attempt to line the pores of the masonry with a water repellent coating. These repellents work reasonably well to prevent permanent damage from graffiti.

Painting

Painting unpainted surfaces significantly changes the character of a building and in the case of a listed building will require listed building consent. If the brickwork is already painted, repainting in a colour significantly different from the existing would also require listed building consent.

It is recommended that the microporous paints be used to cover brickwork. These paints breath better than emulsion and glosses and consequently allow moisture to move more freely.

Gloss paints are plastic based and prevent any movement of moisture. Additionally, once cracked, these paints can hold moisture against the surface of the masonry, consequently creating or exacerbating problems of dampness.

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Further information

Click on the website
address for link



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