Brickwork

Traditional Details & Materials

Introduction

Brickwork is probably second only to timber framing as a means of constructing walls in East Anglia. The presence of abundant suitable clays and general absence of local stone meant that very often bricks were fired on site from locally dug clay.

Two types of brick are generally found on traditional buildings in Suffolk: common soft reds are made from a sandy iron-rich clay, and whites from a less common chalky clay best known from Woolpit near Stowmarket and Ballingdon near Sudbury. Reds are generally found in buildings from Tudor times onwards, whilst whites became very fashionable in the early nineteenth century when many timber framed buildings were refronted in brickwork.

Brick Bonds

Most brick walls to older buildings are one brick thick, about nine inches, built with bricks in varying patterns or bonds. In general bricks are bedded on their largest face, leaving two possible vertical faces appearing on the wall as we see it. The longer of these is called a stretcher face laid parallel with the wall; the shorter is approximately half the length and is called a header, passing through the wall and tying the two faces of stretchers together.

The earliest surviving walls appear to have no set pattern to the brickwork, but by the sixteenth century English Bond had become the norm. This consists of alternate courses of headers and stretchers, requiring equal numbers of each overall, a 1:1 ratio.

This was not very economic to achieve as the header faces bricks tended to fire darker in the kiln leaving them a poor match to the stretchers. In the extreme the headers would be a dark blue and these were often used to good purpose by incorporating diaper work patterns in the face of the wall.

Another two tone variant that became popular in the seventeenth century was the use of darker red headers as aprons, framing around the window and door openings.

By the end of the seventeenth century Flemish Bond had become more popular. It consist of alternating headers and stretchers in each course only requiring a 1:2 ration of headers to stretchers, somewhat alleviating the header supply problem.

In the eighteenth century, if blue headers were available, they were often used in Flemish bond to create an attractive chequer work pattern.

Click here to see a diagram of Diaper Work, English, Chequer Work, and Flemish brickwork styles.

Click here to see a diagram of Rat-trap, Monk, Header, Stretcher.

Whilst the fronts of buildings usually received the best if the materials, the sides and back were often relegated to cheaper materials or methods. Many white brick buildings have red brick rear elevations and these were often built in **Monk Bond**, a variant of Flemish Bond with alternating headers and pairs of stretchers in each course, which only requires a 1:4 header to stretcher ratio. The change is rarely noticed and only nominally weaker structurally.

Another variant of Flemish Bond involved laying the bricks on their edges, exposing the normal bed face. This is known as **Rat-trap Bond** and actually achieves a saving of 25% in bricks needed for a given area of wall. The saving consists of the one brick thick cavity occurring behind the stretcher, whilst the headers continue through the wall as ties, and would indeed give rates somewhere to climb. This is a good deal weaker than a solid wall and usually only found on relatively minor buildings.

The twentieth century has seen the rise of true cavity construction where an inner blockwork wall is given a single skin brick face for decoration. This, like traditional single skin half brick walls, is usually built in **Stretcher Bond**, with no headers at all other than snap headers (half bricks) to finish at the ends, or included to feign one of the more traditional bonds.

One historic use of Stretcher Bond is in **Crinkle Crankle** walls built to a sinuous ground plan achieving a pleasant decorative effect. Overall they produce a stronger wall using fewer bricks than the modern single skin with the brick piers equivalent, although they do not require more space on the ground.

Header Bond, without any stretchers except at corers. Is perhaps they strongest and best tied through form of brickwork. It was often used for curved parts of buildings such as bays and with its small unit size was easily adapted for decorative use.

Problems with historic brickwork

Dampness is perhaps the root cause of most of the problems with historic brickwork, underlying or being aggravated by most other problems. A wall can become damp in three main ways: water can get at it from outside; from inside or through the fabric of the wall itself.

External penetration can be caused by windblown rain or faulty rainwater goods and be aggravated by poor detailing, e.g. inappropriate mortar jointing directing water into the wall or inadequate drips on cills etc.

The internal faces of walls can get damp from condensation: the relatively high U-value of solid brickwork, coupled with poor ventilation of rooms, will often lead in winter to damp patches, especially in pockets of still air behind furniture.

Finally water can get into a wall from the ground: **rising damp** will bring with it dissolved salts which when they dry out leave **efflorescence** on the wall. Attempts to seal a wall with waterproof coatings outside or modern waterproof plasters inside inevitably fail as the wall acts like a wick and will continue to draw water up to a level at which it can evaporate: the efflorescence simply migrates higher up the wall. In extreme cases the damp can rot out a timber first floor construction if this is the only place it can escape. The only effective treatment for rising damp is a horizontal damp proof course at low level, and this can be difficult to insert retrospectively in a traditional manner, e.g. using a lead or a course of slates. An injected chemical d.p.c is often the only solution for a damp brick

wall, but need not entail the often recommended and expensive unnecessary removal of internal plaster to a height of 1 metre. This extreme action should only be considered if a year after installing the damp proof course there is still a problem with efflorescent salts erupting from the wall.

Poor quality bricks, often due to underfiring in the kiln, are vulnerable to the action of salts crystallising within the brick fabric causing them to **spall** and erode away on the face. Frost action on a damp wall can cause a similar effect with the formation of ice crystals. The temptation to seal the faces up with a silicon treatment should be avoided as this traps moisture ad ultimately leads to larger lumps falling off.

Erosion by frost ad salts is worsened by the presence of **cement** in mortars. This is a fairly impervious material which forces all evaporation from the wall to occur form the faces of the bricks, concentrating the problem. Traditional lime-based mortars are more absorbent and porous, allowing water to diffuse more freely and evaporate more quickly from a larger area.

Cement is also bad for brickwork because its thermal properties and rigidity make it incompatible with relatively soft bricks. **Lime mortars** keep the bricks apart equally well, but with relatively less adhesion allowing gentle movement to occur, whereas cement tends to stick more firmly and under stress will damage the brick before giving way itself. Bricks are less likely to fail in lime mortar walls, but if they do their removal and replacement is no so difficult; indeed mortars generally ease the re-use of bricks from demolished buildings, allowing repairs to be made with like for like materials.

Brickwork can appear to be damaged by pollution and dirt accumulating, leading to a temptation to clean it. Blasting with sand or other fine particles can cause irreparable damage by removing the fireskin or outer face of the bricks, making them more vulnerable to damp penetration and the more rapid accumulation of further dirt on a more porous surface. If cleaned at all, brickwork should be simply sprayed with water jets or treated with a dilute non-alkaline chemical cleaner by a specialist contractor.

JOINTING

Both the performance and appearance of a brickwork wall can be seriously affected by the quality of jointing. Traditional bricks often had one of the bedding faces hollowed out to form a **'frog'**. This saved clay and helped key the bricks to mortar, although this was often minimal as they were usually laid frog down. Modern

specifications are often for 'frog up' to give the wall greater strength and maintain the wall's density.

Traditionally brick walls were simply jointed as they were built, but more recently the practice adopted has been to rake out the joints and point the wall up once the bedding mortar has set.

Pointing

Five specific types of joint should **NOT** be used on historic brickwork. **Reverse Struck** and **Recessed** joints have a tendency to collect water into the wall from the ledges formed at the top of each brick. **Ribbon** pointing similarly collects water on top of the mortar and places undue visual emphasis on the joining material, rather than the bricks themselves. **Buttered** joints are similarly visually intrusive giving an untidy smeared effect with mortar over the brick face. **Weatherstruck** joints are tidier and do throw the water off, but are relatively modern and not appropriate on historic buildings.

Most historic brickwork was constructed with flush joints or some variety thereof (see over). This could be literally **Flush**, **Rubbed** to a slightly concave shape to expose the aggregate or even **Semi - recessed**. A flush joint could also be incised with a coin applied along a straight edge to give a shadow line as in Penny Round joints.

The very best brickwork in the eighteenth century was carried out with **rubbers,** soft bricks rubbed down to the most exact dimensions to allow ultra-thin joints. This was much copied in the nineteenth century using Tuck Pointing. Here, however, ordinary bricks were used but pointed up using a mortar coloured with brick dust to match the bricks. A fine groove cut in thiswas then filled with a fine silver sand-lime mortar, or even pure lime putty, to give a thin white line joint reminiscent of rubbed brickwork.

Click here to see an example of Good Pointing.

Click here to see an example of Bad Pointing.

Repointing

On an older brick wall built using a lime mix, the mortar is naturally softer than the bricks and weathers back over many years. Eventually this will **require** repointing, where the decayed mortar is raked out to about an inch depth and then replaced. Only loose mortar should be raked out, including any easily removable lumps

or cement mortar from previous repointings. On no account should mechanical means such as chisels or angle grinders be resorted to, as they invariably damage the brick themselves.

In addition repointing rarely needs doing over an entire wall at once, as the most vulnerable points are damp areas at low level where a high corner catches the weather. One other minor problem with lime mortars in brickwork that makes repointing necessary is attacks by masonry bees (Osmira rufa). These can cause a lot of damage when they colonise a wall or chimney, each solitary bee excavating a tunnel in the mortar within which it raises its young.

Repointing is thus best done in limited areas where necessary and to match in with the existing still serviceable mortar. The match should be both in terms of colour and texture by choosing the right sand and to the same profile.

Mortar Mixes

As a general guide a 1:3, lime to sharp sand mortar mix is best. Analysis of existing mortar can provide some help in the choice of a suitable sand to match the final appearance of the mortar as well as helping to identify the additives that may have been used in the original. Very often additives such as crushed chalk or limestone were used to maintain a light colour, or even ash or soot for a darker mortar. Such additives can also have a 'pozzolanic' effect helping a lime based mortar to set more rapidly.

Brickwork Repairs

A brick wall or chimney will very rarely need to be completely demolished and rebuilt. Individual bricks that have spalled can easily be removed and replaced in lime mortar based wall. The practice of turning a brick around to present a good face is sometimes adopted, but can only be done once and invariably leaves a poor brick in the wall that will fall again.

Advice

If you require further advice on this topic please write or telephone the Conservation Officer,

Council Offices,
131 High Street,
Needham Markt,
Suffolk,

IP6 9DL.
Telephone 01449 727298 / 720711

A list of builders able to carry out repairs is kept by the Council. Please note that these are not recommended companies and that you should satisfy yourself that they are able to meet your requirements before placing an order.

The information on this page iis based on parts of the following publications:

'Brick, Terracotta & Earth',
J & N Ashurst, Gower (1988).

'Pointing Stone and Brick Walling',
G B A Williams, SPAB Technical Pamphlet no.5 (1991)

'Brick Building in Britain',
R W Brunskill, Gollancz (1990)

'Georgian Brickwork',
Georgian Group Guides no.2 (1987)

'Repointing Old Brickwork',
R Carpenter, Essex C C (1986)

'The Pointing of Brickwork',
English Heritage (1994)

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