Fixings for Brickwork

In the third of this series Mark Salmon shares some of the solutions offered by members of the Construction Fixings Association for coping with this most awkward of materials. Most will be familiar to you but there may be a new idea or two.

Brickwork! Of all the problems your customers bring to you I suspect among the most awkward are those involving fixings to masonry - brickwork, blockwork and stonework. Due to space limitations I am restricting this article to brickwork but many of the principles apply equally to blockwork and stonework. Bricks may vary in strength from as little as 5N/mm² up to 70N/mm², they may be solid or have holes all the way through and all are joined together - or held apart - by mortar which may vary just as much in strength and may not even be there in some cases. The depth of a single skin brick wall will be a mere 102mm thick and a modern drilling machine can easily punch its way through the back of the brick long before the tip reaches it.

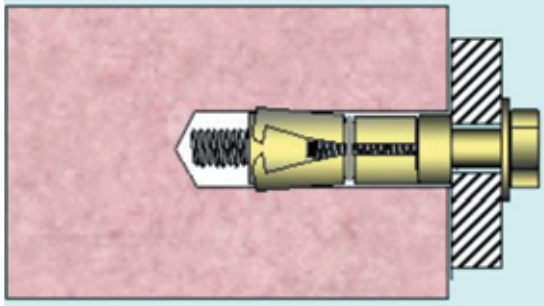
Where older buildings are constructed from 9" solid brickwork you not only have to cope with some of the softest bricks around and the weakest mortar joints but the gap between the two leaves may well be devoid of mortar.

The fixer's problems are compounded by the fact that quite frequently he has no idea what the substrate actually is before he drills into it, and sometimes not afterwards. If it's plastered or rendered he won't be able to avoid the joints but he's standing at your trade counter expecting your staff to sell him a fixing that will work in whatever material he encounters.

There is a truly bewildering array of fixings available nowadays to fix into brickwork.

The shield anchor is the most obvious place to start. The “original expansion anchor” - shield anchors are still widely available and well proven for both concrete and brickwork. In brickwork the separately retained segments expand readily making setting easy (See figure 1)

Figure 1: Shield anchor in brickwork

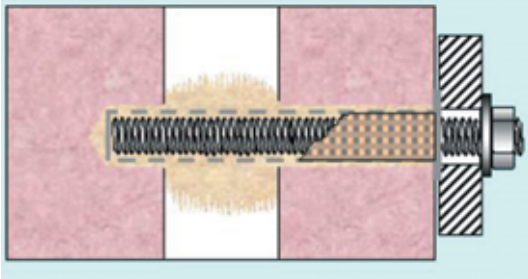


Separately retained segments expand readily for easy setting even in soft bricks with enlarged holes.

and the large expansion ratio gives a strong grip even in enlarged holes common when powerful drilling machines are used in softer bricks. The high expansion ratio can crack the bricks in larger diameters so M12 bolt diameter, requiring a 20mm diameter hole, is usually the limit. The variety of configurations from hex bolt and bolt projecting to hook and eye versions means this is one of the most versatile fixings available. Thin-walled sleeve anchors will also work in bricks. These have a much smaller expansion ratio than shield anchors so tend to be less strong and less inclined to crack the bricks. They will work in perforated as well as solid bricks whereas shield anchors are less reliable in perforated bricks. Other expansion anchors such as throughbolts or hammer set socket anchors are not suitable for bricks and should not be considered. One of the most common applications into brickwork is the fixing of door and window frames. Frame fixings made of nylon are now very well developed for these uses with clever designs that will get a good grip irrespective of whether the brick is hard or soft, solid or perforated.

But if your customer needs a really strong fixing that will work in this wide range of possibilities then it is the resin anchor that may provide the best solution albeit requiring a degree of care. This is also the area that has seen the most developments over the last twenty years. The injection system is now well accepted as it has the flexibility to cope with poorly filled mortar joints while plastic or steel mesh sleeves will give a strong fixing in perforated bricks. Most people are familiar with this concept as illustrated in figure 2. A mesh sleeve of plastic or wire is inserted

Figure 2: Stud set in perforated brick with injection resin and mesh sleeve.



The mesh controls the resin which will bond with material adjacent to the sleeve and interlock into the void. A single large perforation is shown.

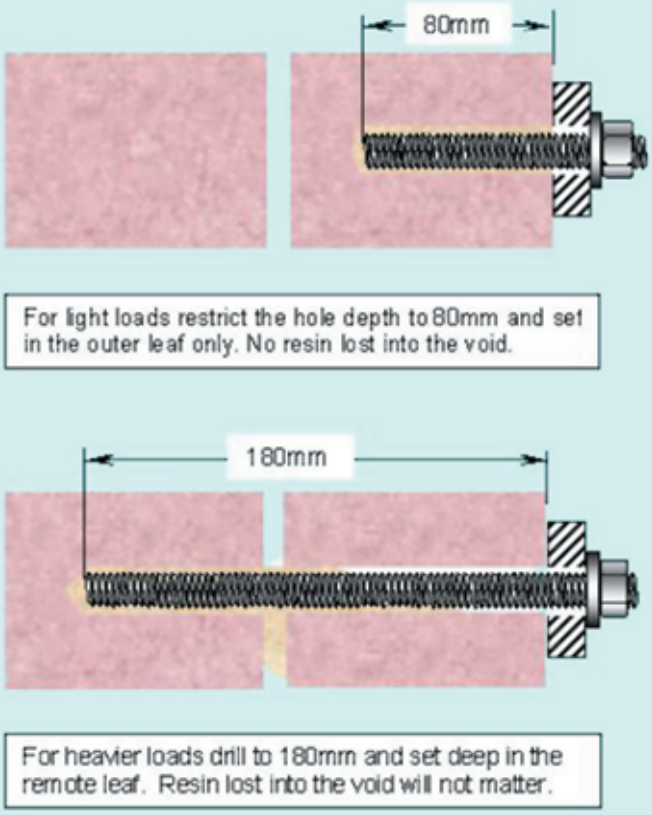
into the drilled hole and filled with resin before the stud is twisted into place thus displacing the resin to bond with the brick adjacent to the mesh or form a hard mass in the void to give a strong interlock. The same technique may also be used, with longer mesh sleeves, for fixing into solid 9" brickwork where the gap between the leaves may be devoid of mortar. But there is a technique that avoids the need for mesh sleeves and can be tailored to provide the strength needed. Figure 3 shows two diagrams. For light loads the embedment depth is limited to 80mm thus avoiding the loss of resin into the gap. For higher loads the idea is to bond the stud deep in the remote leaf by drilling to 180mm. Resin is then injected to fill the hole in the remote leaf. The overall strength of the anchorage comes from the stud being bonded into the remote leaf which gains strength from the front one. Any loss of resin into the void does not matter. The point to remember is that embedment depths between the two risk most of the resin being lost into the void.

The strength of modern resins and the versatility of the injection system means it can cope with blind fixings through render where the hole may be drilled into a mortar joint but in this case multiple fixings should really be used to share the load in case one fixing is weaker than expected.

When load capacity is critical and the strength of the brickwork is unknown, tests on site are needed to determine the loads which may be applied. A Guidance Note detailing how to do this may be downloaded from the CFA website at **wwww.fixingscfa.co.uk**. It includes a technique for working out the allowable loads but if this looks complicated there is a simpler one on the website in the FAQs.

Having thought about the choice of system it is worth reminding your customer - if you get the chance - of the positioning rules.

Figure 3: Studs set directly into solid (9") brickwork (mortar missing from joint)



These are very important for safety critical applications but should be born in mind for less critical jobs too. We need to think about the position in the brick and in the wall. Ideally individual fixings should be positioned within the meat of the brick, say 35mm from the end of a solid brick and on the horizontal centreline, this minimises the risk of bricks cracking and, in the case of frogged bricks will miss that void. Within the wall itself we need to make sure there is enough structure surrounding the fixing to support the required loads. This means never fixing closer than 280mm from the edge of a wall, never go closer than 1000mm to the top of an unrestrained wall, avoid putting two fixings into the same brick - if joints can be seen this means a minimum spacing in the order of 100mm but if plastered or rendered a minimum of 275mm must be allowed. If the load is high and the application is safety critical, avoid putting fixings into adjacent bricks. This means the minimum spacing between fixings will be 350mm if joints are visible and 500mm if not! Again there is more to this than one might have thought and more advice is available on the website in the FAQs with Guidance Notes covering a range of associated subjects.