INFORM

REPAIRING TRADITIONAL BRICKWORK

HISTORIC ENVIRONMENT SCOTLAND | ÀRAINNEACHD EACHDRAIDHEIL ALBA

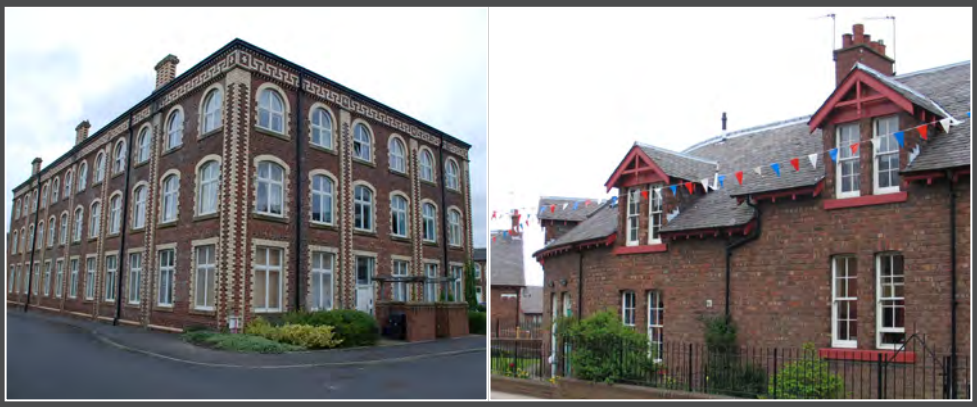

Fig. 1: Brick has been used widely in Scottish Traditional construction, particularly in industrial structures and housing.

REPAIRING TRADITIONAL BRICKWORK

This INFORM guide provides advice on the repair and maintenance of traditional brickwork in Scotland. Bricks can be defined as small rectangular blocks of fired clay and can be found in a variety of sizes, shapes and colours. They also vary in age and quality. Many Scottish traditional buildings utilize brick in some element of their construction (Fig. 1). As such, a correct understanding of the material is important for the repair of our built heritage.

History

Bricks were first used in Scotland by the Romans but fell into disuse thereafter. Whilst manufacture and use began again in the 17th and early 18th century, it was with the industrial revolution at the end of the 18th century that the use of brick began to be seen in Scotland in a significant way. Throughout the 19th century, Scotland had an extensive indigenous brick industry with many hundreds of brickworks formerly being in operation.

The rapid expansion of towns and cities, and the building of large industrial complexes, gave rise to a significant demand for the material. Continued improvements in the manufacturing process throughout the 19th century led to better quality bricks being produced and higher levels of production, with demand and use remaining high into the 20th century.

Deterioration of brickwork

As with all elements of a traditional building, brickwork will deteriorate and decay if not properly maintained. Such deterioration can be caused by a number of factors and can take various forms. The main signs of decay are spalling (deterioration of the surface of bricks) and soft, loose or crumbling mortar. Surface growth and staining or efflorescence (white powdery residue building up on the wall face) are further indicators of decay caused by the presence of excess moisture. Loose or misaligned bricks and cracking are indicative of

Fig. 2: Water ingress from sources such as blocked gutters or downpipes is a major cause of deterioration of brickwork.

structural faults. If brickwork begins to exhibit any of these signs it is important to identify the cause and rectify it as soon as possible. This will prevent the problem from spreading and further damage being caused.

Causes of deterioration

Water ingress

One of the most common and serious problems which can affect brickwork is uncontrolled water ingress. This can be a problem on exposed areas of a building, such as upper floors and chimney stacks, and in the vicinity of leaking gutters and downpipes (Fig. 2). Other areas at particular risk are parapets, chimneys and quoins (brickwork on the corner of a building). Once water has begun to penetrate brickwork, it can quickly spread to affect a large area. Causes of water penetration and associated deterioration can include failure of roof systems, including copings and flashings, blocked or damaged rainwater goods, infiltration through failed mortar, inadequate surface drainage and windblown rain.

Salts

Salts can be a major cause of deterioration in brickwork. Salt can enter bricks through water ingress. In coastal areas salt can come from the sea and, in winter, the application of road salt is a threat. Salt is damaging because it creates expansion of crystals within bricks. This can eventually force the structure of the brick apart. Salts can come from within the bricks themselves or from the application of inappropriate mortars or renders. Brick-lined chimney flues are also vulnerable as sulphates can be introduced when flue gases condense. This is a common problem where a chimney has been sealed without adequate ventilation. The most obvious sign of the presence of salts is efflorescence, a white powdery deposit on the brick (Fig. 3). In severe cases a thick build-up of white crystals can form. Efflorescence can also be caused by the improper use of cement mortars during repair. To prevent significant deposits of efflorescence from causing damage to bricks, it should be regularly brushed off the

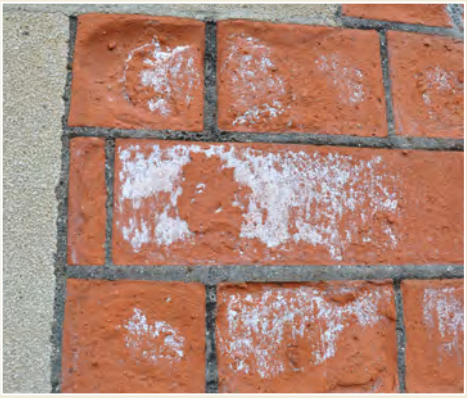

Fig. 3: The presence of salts within brickwork is most commonly seen by a white residue on the surface of the brick.

Fig.4: Cracking is the most common sign of structural problems. A careful assessment of the cause and likelihood of further movement should be made in such circumstances.

surface using a non-ferrous bristle brush and the source of water causing the build-up of the deposits rectified.

Structural faults

The most common sign of a structural fault in brickwork is cracking (Fig. 4). This can be caused by structural movement, unstable foundations or defects in the original construction. Minor cracking will be superficial and restricted to a few isolated bricks, but extensive cracking can be an indication of a more serious problem. Professional advice should be sought where structural movement is thought to be ongoing.

In minor cases of cracking, it will be necessary to carefully cut out the affected bricks and mortar joints. Fractured bricks should be replaced (as described later in this guide) with joints being repointed in an appropriate mortar. Where bricks are displaced due to structural movement, particular note should be taken of any areas where the wall face projects outwards. This will usually indicate the presence of some structural movement and lead to the creation of ledges on which water can gather and penetrate into the building.

There are also a number of structural elements which can fail and lead to associated deterioration. Where timber has been embedded in a brick wall (for example timber joists or lintels), these can rot and decay, if water is allowed to penetrate through the brickwork, leading to instability. Likewise, where structural iron or steel elements are incorporated, these can corrode and rust. Rust can lead to unsightly staining and, if the corrosion is serious enough, can also create instability due to expansion creating pressure on the surrounding brickwork.

Frost

Bricks vary in their ability to withstand frost. Porous bricks are more easily penetrated by water and, therefore, have much poorer frost resistance than denser ones. Frost damage results as water which has penetrated brickwork expands when it freezes, leading to the face of the brick spalling away. Where such damage occurs, it will often be necessary to replace the affected bricks.

Fig. 5: The presence of biological growth on brickwork is generally an indication of excess moisture from a building defect.

Vegetation

Vegetation can be very harmful to brick structures if left unattended. Ivy can cause serious damage particularly where some minor decay is already in evidence. This allows growth to gain a foothold on the surface of the brickwork and penetrate the wall core. Moss or lichen is likely to be a sign of a long-standing water penetration problem and will damage bricks further by encouraging more water to penetrate the wall (Fig. 5).

Repair and maintenance of brick structures

Tackling decay

Where decay has occurred, it will be necessary to carry out repairs to avoid further deterioration. The use of chemical treatments to stabilize or seal brick should only be considered with extreme caution. Whilst they may be effective initially, there has been insufficient research carried out on the possible long-term damage such treatments could have. Identifying the cause of the problem and repairing it, together with a long-term program of building maintenance, is likely to be more successful in the long run.

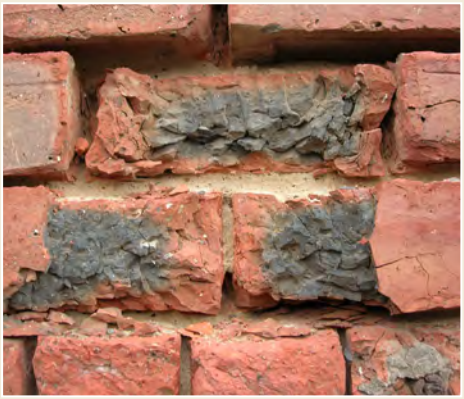

Fig. 6: Where bricks have spalled, cutting out and replacing will often be the most appropriate repair technique.

Replacement of bricks

In some cases, it may be necessary to replace single bricks or small areas of brickwork, particularly where spalling has occurred (Fig. 6). Care should be taken when cutting out the affected bricks not to cause new damage to the surrounding area. Only bricks which have suffered decay should be

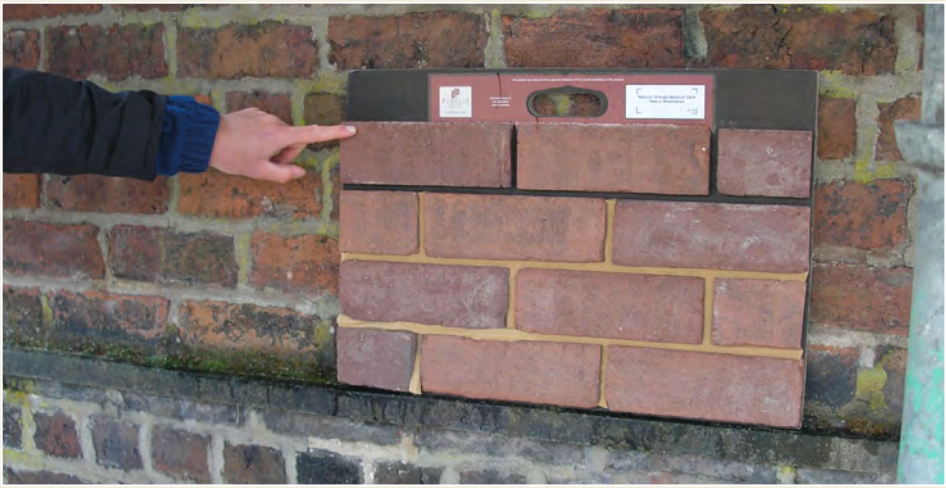

Fig. 7: Replacement bricks should match those in-situ as closely as possible; samples of bricks should be checked to gauge their suitability prior to a repair project.

replaced and a thorough survey of a wall should be carried out to identify which are sound and which need to be removed.

Replacement bricks should match as closely as possible the type, colour, texture, size and shape of those which they are replacing. It is also important to use bricks of sufficient durability; for modern bricks, this is likely to be those with an F2 rating for frost resistance and an S2 rating for soluble salts using the new European Standard. In some cases, replacement bricks may require to be specially manufactured in order to match those they are replacing; a number of companies offer a brick matching service (Fig. 7). When introducing new bricks, it is not advisable to use a colour stain to tone them in with the existing wall; the weather will do this over time and colour staining can introduce harmful agents to the brickwork. Second-hand bricks may be available through salvage yards and other building material suppliers. Careful inspection of these is necessary in order to ensure they have not been damaged by demolition or mishandling.

Cleaning

Cleaning soiled brickwork should be undertaken carefully, if at all. The use of inappropriate cleaning techniques can result in considerable damage to brickwork (Fig. 8-9). Unless it is felt that damage is being caused by surface deposits, there should be a presumption against carrying out cleaning. If considered essential, small scale tests should be employed to assess the effectiveness and potential damage which could be caused before any large-scale work is carried out. Brickwork can simply be washed down using water and a non-ferrous bristle brush to remove some surface deposits, but care should be taken to avoid exposing the brickwork to excess water. To avoid penetration into the brick, care should also be taken not to be too vigorous in scrubbing the face. The use of high-pressure hoses is also not recommended, as this will

Fig. 8: Brick before cleaning.

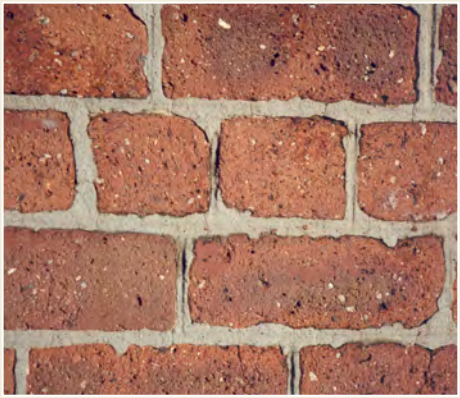

Fig. 9: Brick after cleaning showing the potential damaging effects of abrasive cleaning methods. Note the loss of the protective external surface making the bricks more prone to decay.

force water deep into the structure. Other methods using chemicals or mechanical means should only be used where absolutely necessary, following thorough assessment of the effect the cleaning method has on test panels.

Repointing

Throughout the life of a brick building, there will always be some loss of the original mortar. This can lead to a need to repoint areas of brickwork, although weathered pointing can still function adequately provided the joints are not allowing the ingress of excess moisture. Where repointing is necessary, the raking out of the old mortar should be carefully carried out in order to avoid damage to bricks. The joints between bricks should be raked out to a depth at least two and half times their height, i.e. if a joint is 10mm in height, it should be raked back at least 25mm or until sound mortar is reached. The raked-out joints should then be brushed clean and well dampened down prior to new mortar being inserted (Fig. 10). The after care of repointing work is also important; this should be protected from excess moisture, frost and too rapid drying.

For traditional brickwork the most appropriate repair mortar will generally be lime based. Modern cement mortar should not be used as

Fig. 10: Joints should be well raked out and dampened before repointing work takes place.

a replacement for lime mortar as this removes the ability of the wall to allow moisture to be released. Whenever repointing is being undertaken, it is important to use a matching mortar type to that used originally; this may require the use of mortar analysis.

Conclusion

Brick has been used extensively in Scottish traditional construction, particularly in the 19th century (Fig. 11). As with all traditional building materials, its correct repair and maintenance requires careful use of materials and techniques. This INFORM guide has provided an introduction to some of those, including repointing and replacing decayed bricks. More detailed guidance can be found in the sources listed overleaf.

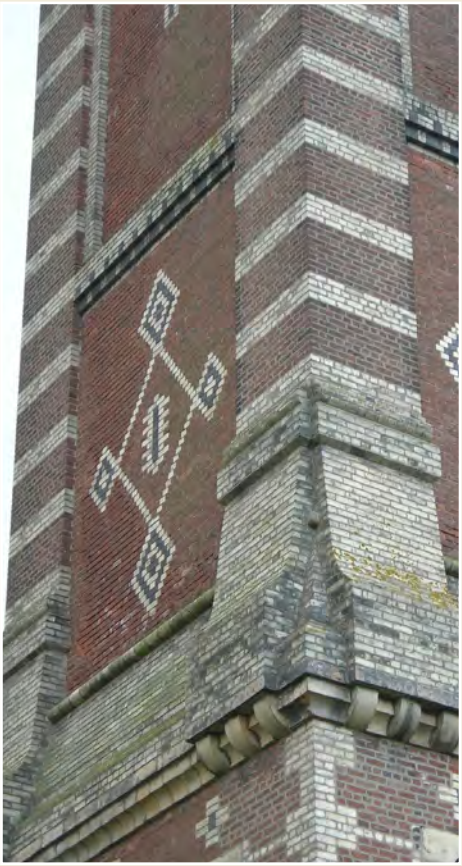

Fig. 11: Brick is an integral part of Scotland's built heritage and is, in many cases, highly decorative.

Further reading

Practical Building Conservation, Earth, Brick and Terracotta, English Heritage, Ashgate (2014).

Short Guide 7: Scottish Traditional Brickwork, Historic Scotland (2014).

Short Guide 6: Lime Mortars in Traditional Buildings, Historic Scotland (2014).

Brickwork: History, Technology and Practice, Volumes 1 and 2, G. C. J. Lynch, Donhead Publishing (2008).

BDA Guide to Successful Brickwork, The Brick Development Association, Butterworth-Heinemann (2000).

European Standard: BS 771-1:2011 + A1: 2015 Specification for Masonry Units: Clay Masonry Units

Further information

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THE ENGINE SHED

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