

INFORM

INDENT REPAIR FOR SANDSTONE ASHLAR MASONRY



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Fig. 1: Visible bedding planes in this sandstone ashlar.

INDENT REPAIR TO SANDSTONE ASHLAR MASONRY

This INFORM guide introduces the practice of replacing damaged stone in ashlar-built sandstone walls. Referred to as 'indenting', this technique involves replacing badly decayed or damaged masonry units with stone of similar dimension and physical characteristics.

Appropriate methods and compatible materials are essential in ensuring the success of an ashlar indent. This guide highlights the practical considerations of indenting ashlar, it explains why aesthetic factors alone should not dictate replacement, and why the mineralogical composition of the existing stone is important in this process.

Characteristics of ashlar build

Despite the geological diversity of Scotland, sandstone is the most commonly used stone type for construction of ashlar walling. In creating ashlar builds, stonemasons

were guided by the natural qualities of the sandstone, using the bedding planes of the stone – the visible layers marked by differences in size or composition of the sand grains making up the rock (Fig. 1) – as markers for correct alignment.

The strength and durability of sandstones, highlighted by their evident longevity as building materials, comes primarily from the materials and processes that shaped them through geological time, but also in the mason's understanding of the stones' natural characteristics. When laid with the natural bedding planes horizontal, the stone exhibits its maximum compressive strength. However, when set vertically, not only is strength reduced, but the stone is much more vulnerable to erosion by natural forces. Blocks set in this way, with their bedding planes vertical, are described as being 'on cant'. Where the bedding planes are set parallel to the external face of the building, the stone is said to be 'face bedded' (Fig. 2). Such blocks are prone to failure through 'delamination', a process whereby layers or sheets of the stone detach and sheer off. This relatively



Fig. 2: Face bedded sandstone, pointed with cement mortar, exhibiting delamination.

rapid weathering process can trigger the need for a considerable degree of indent work, as the characteristic failure of the bedding planes can lead to the complete loss of the exposed face across a building's elevation. Fortunately, it is more usual to find buildings constructed in the appropriate manner, with only a few individual stone blocks face bedded.

The choice to replace stone

Ashlar walling is, by definition, constructed of squared masonry units and is inherently stronger than rubble stone structures. As a result, ashlar can withstand a considerable degree of erosion and distress before any indenting work is required. However, it is commonplace to find that unnecessary repair work is carried out when only superficial, surface damage to stones has occurred, due to a greater emphasis on building aesthetics. A minimal intervention approach is often considered to be 'best practice' in conservation, as it minimises the physical disturbance to a building. In some cases, this may involve the use of mortar for surface repairs to stone, rather than cutting out original material,

or even taking no action at all.

However, there are instances where deterioration of masonry, whether it be from natural forces or the use of incompatible materials or other man-made factors, has progressed to such a degree that it interferes with how the building functions. Where alteration in the surface profile of a building - caused by this deterioration - is likely to lead to the penetration of rainwater, remedial action should be a priority. The technical aspects of how a building performs should always be considered as a higher priority than the aesthetics.

As a result of extreme masonry decay, structural distress or the loss of purpose, circumstances do emerge where the need to indent is inevitable. In such situations, once a decision is taken to start indenting, it can be equally difficult to decide where to stop. Stone should only be replaced when it has decayed to such a degree that the structural stability and function of the surrounding stonework is adversely affected.

Stone matching

Choosing to indent ashlar, rather than opting for a mortar repair to the stone surface, may be favourable as this follows a 'like-for-like' conservation approach. However, given the vast range of stone types in Scotland, it is not sufficient to simply choose a stone. Even two Scottish sandstones can be incompatible when placed in close proximity, due to differences in their physical characteristics, which can result in the preferential decay of the softer, more permeable stone.

Although two stones may be similar in appearance, this gives little indication of their microscopic

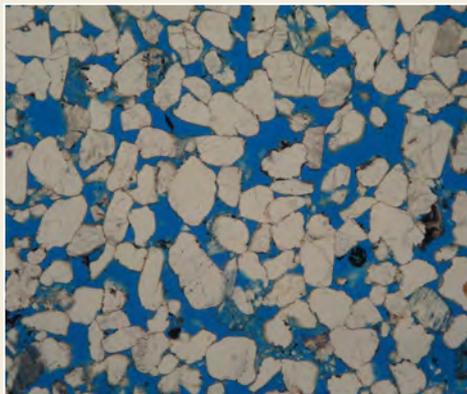


Fig. 3-4: Studying sandstones under the microscope can reveal significant differences in stone structure. The images show red sandstones from different quarries, which appear visually similar, but have very different physical properties.

properties and, as such, should not be relied upon in isolation for stone matching (Figs. 3-4). In order to ensure compatibility and success of the indent, the replacement stone should have physical properties as close as possible to those of the original stone. This includes strength, porosity and water absorption characteristics. A specialist in the field of stone matching should be consulted to assess the compatibility of potential replacement stones.

Due to the limited number of building stone quarries currently in operation in Scotland, it is often difficult to find an exact match with which to carry out an ashlar indent. Where an exact match is not possible, the new stone should be slightly less resistant to the effects of weathering compared to the existing stone (i.e. softer), acting sacrificially so as to preserve the original masonry. Choosing the wrong replacement stone can have unfortunate and permanently disfiguring effects. Using the correct sizing for the individual replacement blocks is also important. Size differences can make the replacement block sit uneasily with the original (Fig. 5); the uneven

surface can encourage local patches of biological growth to flourish; joint patterns can be disrupted; and the surrounding original masonry may be unnecessarily notched to accommodate the larger dimensions of the new blocks.

How to carry out indent repairs

A reputable masonry contractor, with the relevant craft skills of sizing,



Fig. 5: Ill-fitting replacement stones in the top corner. Circular saw marks can also be seen on the stone faces.

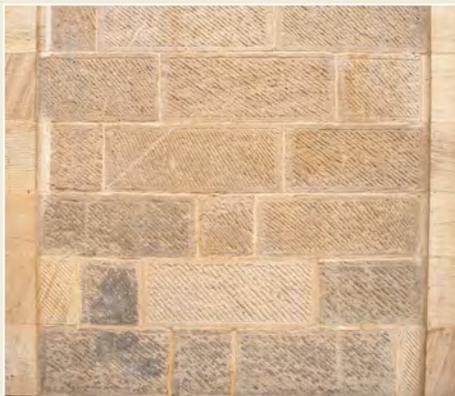


Fig. 6: Ashlar indents cut to fit and tooled to match existing masonry.

cutting, tooling and setting the indent without damaging the surrounding masonry, should be employed to do the work. The original construction needs to be studied and accurately measured to record the precise dimensions of any stone that needs to be replaced; scaffolding should be carefully designed and constructed around the original stonework and erected without damaging the existing masonry. Inspection and documentation of the existing masonry is necessary to ensure that the new stone fits exactly in the correct location and that the dimensions of the surrounding mortar joints do not alter in size (Fig. 6).

Care must be taken when cutting out the decayed stone to avoid chipping the edges of the remaining surrounding blocks (Fig. 7). A sufficient depth of stone needs to be removed to provide a 'bed' for the new stone (typically 100 mm deep), ensuring that it sits securely once inserted into the space previously occupied by the decayed stone.

To ensure that the indented stone blends effectively into the surrounding masonry, details of the



Fig. 7: Damage to existing masonry caused during indenting.

original surface tooling should be noted. Particular attention should be paid to the angle and depth of any chisel marks, the size of any borders, and the number of grooves that are incised into the face of the stone. Whilst failure to accurately replicate all of these features on the replacement stone will produce an unsatisfactory result, it may be impossible to achieve the required effect in the first place, if the 'wrong' stone is chosen (Fig. 8). This is likely to happen because of differences in the size of sand



Fig. 8: Variations in tooling due to differences in stone properties. It was not possible to tool the coarser grained replacement stone to the same fine detail as the original stone.



Fig. 9: Successful ashlar indents that are 'weathering down' and blending in with the original masonry.

grains between the two stones.

Occasionally, only a partial indent of a damaged ashlar block will be required. This approach requires additional attention to detail so that the surface tooling and edge border detailing accurately and closely match the remaining tooling. In addition, the joint between the two stones should be cut as finely as possible to help the indent tie in better. If properly chosen, newly indented stones will 'weather down' from a fresh appearance over time to acquire a surface patina similar to the original (Fig. 9). No attempt should be made to artificially weather or distress the finished surface of the replacement blocks; doing so can have a serious impact on the building's aesthetics (Fig. 10).

As the vertical joints are 'staggered' (off-set from one another) in original ashlar construction, it is good practice to maintain this original pattern when indenting multiple stones. In doing so, the structural strength of the wall, as well as its look, is maintained. Any voids behind the indent should be firmly packed with mortar and, in the final positioning of the indent, it



Fig. 10: Stone indents painted in an attempt to blend in to the adjacent masonry.

should be set so that the external face aligns evenly with the surrounding original face of the building. If wrongly positioned, the misalignment will not only look bad but can lead to the pooling of rainwater causing damp in the core of the wall and result in accelerated masonry deterioration.

Conclusion

The careful selection of stone for ashlar indenting is essential in ensuring compatibility between old and new. The skills of a specialist in the field of stone matching should be employed to assist in the selection of replacement stone. Choosing a suitable, compatible replacement stone will ensure the longevity of the indent and the surrounding existing masonry, by preventing accelerated masonry deterioration associated with the selection of incompatible materials. Any new work should replicate the dimensions and surface finish of the original stone and should be carried out by a suitably experienced and skilled masonry contractor.

Further reading

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Further information

HES Technical advice

T: 0131 668 8951
E: technicalresearch@hes.scot

HES Casework and designations

T: 0131 668 8716
E: hmenquiries@hes.scot

HES Grants

T: 0131 668 8801
E: grants@hes.scot

British Geological Survey (stone matching services)

T: 0131 67 1000
E: buildingstonesnorth@bgs.ac.uk
W: www.bgs.ac.uk



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Historic Environment Scotland
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Principal author: Dr Clare Torney
First published: 2007, revised: August 2020
Historic Environment Scotland, Longmore House
Salisbury Place, Edinburgh EH9 1SH Tel: 0131 668 8600

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