

# Conservation Guidelines

## Brickwork & Stonework

### Foreword

This series of booklets has been produced by the Department of the Environment to increase awareness of the value of our architectural heritage and to provide information on the basic principles and methods of conservation and restoration.

The titles in the series are listed on the back of each booklet.

These texts are not intended to be comprehensive technical or legal guides. The main aim is to assist architects, builders, owners and others, in understanding the guiding principles of conservation and restoration. They will facilitate the identification of the most common problems encountered in heritage buildings, and indicate the best solutions. It should be appreciated that specialised aspects of conservation and restoration will require professional expertise and more detailed information.

The Department acknowledges, with appreciation, the efforts of the authors of the individual booklets, the Irish Georgian Society who coordinated their production, the Conservation Advisory Panel established under the Operational Programme for Local Urban and Rural Development and all others involved.

### Summary of Conservation Principles

- Research prior to planning work
- Minimum intervention - repair rather than replace
- Respect the setting.

### Summary of Conservation Procedure

- Research and analyse history of building
- Survey building and identify original material
- Plan work according to conservation principles
- Use experts where necessary
- Record all work
- Install maintenance procedures.

## Introduction

Brick and stone are the two most important facing materials in the construction of 18th and 19th century buildings. These materials were used extensively in combination during this period. Brick was replaced by stone as a facing material for public buildings in the middle of the 18th century, and most significant public buildings in Ireland of this time are stone-faced. Much of the brick and stone which was used during this period was imported. There is a tradition of brick making in Ireland, and stone production and its associated skills are still an active industry.

## BRICKWORK

Historically, it is said that much of the brick which was used in 18th century construction was ship ballast and the quality of such brick was variable. This is demonstrated in the variety of colour and texture of brickwork in Georgian terraces. In an attempt to improve on its finished appearance, brickwork was often wiggled and tuck pointed to create a more uniform appearance. Whilst the brickwork of the 18th century is variable in colour and texture, in general, it is of uniform shape.

In the 19th century brickwork was often mass-produced, rather than hand made as had been the case previously, and, by the early 20th century, brick was available in a range of shapes and mouldings, dimensionally

precise and of uniform colour. Manufacture by this time had changed from clamp firing to kiln production. The colour of brick depends on its constituents and the temperature at which it was fired. Underburned brick is lighter in colour and softer whilst the overburned brick can be identified by its colour and hardness.

## Common Problems and Solutions

### 1. Deterioration

*Brick deteriorates for a variety of reasons, weathering being the most likely cause. Weathering is mainly the result of wind-driven rain. Buildings on exposed sites or with exposed upper levels are particularly vulnerable. The sound condition of brickwork in buildings at lower levels may not reflect the damage and deterioration in chimney stacks and on southerly and westerly elevations.*

*Pollutants and sulphation crusts can build up on the brickwork, interfering with the porosity of the brick, resulting in surface damage. Damage may also occur due to the formation of salt in brickwork which is often evident at lower levels where no adequate damp proof course exists and where the rising groundwater, containing salts, is causing surface damage.*

*Underburned or second quality brick with high levels of porosity may also exhibit signs of deterioration either in individual bricks spalling*

## Conservation Guidelines Brickwork & Stonework

*and disintegrating on the facade or the destruction and deterioration of boundary or garden walls where substandard brick was used in the construction.*



*Damaged brick work, caused by leaking pipe and over-dense pointing.*

Repair to brick walls may involve the removal and replacement of individual bricks or of substantial areas of brickwork in upper stories where the brick is exhibiting signs of major deterioration. The main problem encountered with the removal and repair of individual bricks is avoiding damage to the surrounding brickwork and the problems in matching colour, texture and dimensions. At the outset of repairs to brick walls, it is most important that the condition of the pointing be evaluated. If walls have been repointed in a dense cementitious mix it may be that the removal and replacement of individual bricks will result in extensive damage to the surrounding brickwork. If the pointing has eroded in areas where brick has deteriorated, the brick deterioration and

erosion of pointing may be interlinked. Consideration should be given to the complete repointing of the wall which will greatly assist in blending in new brickwork and avoid the risks of patching between existing weathered mortars and new mortars.

Repairs to brick walls may involve the total replacement of stretchers and partial replacement of headers with either new brick or matching secondhand brick. It may be possible to remove and reverse bricks providing the mortar is soft. They will blend into the wall. New bricks for repair must match the originals dimensionally and in colour and texture. Brick specials can be obtained from a number of specialist suppliers. An alternative to repairing brickwork with brick, is the use of plastic repairs, where the damaged bricks are repaired using specialised mortars. These works are of a specialised nature and very careful consideration should be given to the type of mortars proposed and the procedures involved. The method is not appropriate where extensive repairs are required.

### **2. Soiled brickwork**

*Whilst the cleaning of brickwork can often enhance the overall appearance of a heavily soiled building, it is important to bear in mind that brick can suffer severe and irreversible*

## Conservation Guidelines Brickwork & Stonework

*damage through inappropriate cleaning methods. In the past many fine brick buildings were severely damaged through the use of inappropriate abrasive cleaning methods. Current procedures for cleaning brick involve water washing; chemical treatments and specialised systems of mildly abrasive cleaning.*



*Cleaning of brickwork in progress.*

Cleaning methodologies require careful specification and the skills and experience of trained operatives. Trials should always be carried out in advance. Water washing of bricks is unlikely to yield significant results. Alkali based cleaners yield fair results. The dwell time of these cleaning agents must be controlled and minimised otherwise bleaching and discolouration may occur from chemicals. Hydrofluoric acid-based materials yield good results. *These acids are very dangerous and must only be applied in controlled situations.*

Abrasive cleaning methods were used extensively in the past, often causing damage through inappropriate pressure blasting with coarse abrasives. Within the last few years

systems of abrasive cleaning developed for museum conservation purposes have been refined for use on buildings. These systems involve cleaning at very low pressures (10 p.s.i.) with abrasives, such as calcium carbonate or calcium chloride in dust form. The advantage is that it avoids the use of dangerous chemicals and no residual chemical is left on the brick.

### **3. Decayed pointing**

The raking out and repointing of brickwork has led in many instances to permanent and extensive damage to historic facades. Procedures for raking out must be carefully specified in order to minimise any damage to the brickwork. It should, if at all possible, avoid the use of mechanical saws or grinders and should be carried out manually using appropriately sized chisels. Repointing should involve the use of an appropriate mortar mix. These mortars should not be over dense. Weather struck jointing in many instances is totally inappropriate. Specialist firms are available to complete traditional wiggling and tuck pointing if required, and whilst the cost of this form of raking out and repointing may be more than other methods, it will restore the facade correctly and will enhance its appearance. For more details see booklet *No. 4 Mortars, pointing and renders*

In conclusion, the repair and cleaning of brickwork demands skilled and caring operatives utilising the appropriate materials and procedures.

# Conservation Guidelines

## Brickwork & Stonework



*Example of crude, inappropriate pointing.*

### Dos and Don'ts

- Do**
- locate and eliminate, if possible, the cause of deterioration
  - determine the condition of the pointing as well as the brickwork.
- Don't**
- use inappropriate abrasive cleaning systems
  - initiate cleaning procedures before carrying out trial tests
  - use dense impervious mortar for pointing.

### STONEMWORK

#### Introduction

Ireland has produced, and still produces, many fine types of stone for building. In general Irish limestones are durable. Early 18th century limestone will be found to have weathered well. However, the natural fissures or stylolites in the limestones will open due to weathering, and this can result in failure of profiled detail along these joints. Nineteenth century Cork limestones are particularly prone to this pattern of failure and, in particular, when used in ornament or column capitals. Black Dublin limestone, commonly referred

to as calp, can be found in very deteriorated condition where stone from substandard quarries has been used. This stone is prone to delamination and failure.

Eighteenth century granites, whilst appearing to be very robust, can undergo severe deterioration. This deterioration appears to relate to soft stones, possibly boulders which were worked in the 18th century and to high quarry stone dating from the same period. The deterioration of granite is more likely to occur in sheltered areas where the build up of pollutants on the stonework results in its damage and destruction. This pattern of damage can be found below cornices, cills and string courses and the extent of the damage in these areas may be very considerable.

In general, Portland limestone is a durable material. The problems associated with its deterioration relate to the methods of fixing rather than deterioration of the stone itself. This stone undergoes gradual erosion in areas of high exposure. In some instances, 19th century Portland stone can be found to have deteriorated more rapidly than the material used in the 18th century.

The red imported sandstone of the 19th century is inclined to high levels of decay and deterioration as is the 19th century yellow sandstone from Mountcharles, Co. Donegal. In the main, the pattern of weathering and deterioration specifically relates to exposure and driven rain or water runoff and the resulting damage may often be extensive.

# Conservation Guidelines

## Brickwork & Stonework

### Brief History

Stone was used extensively in 18th and 19th century buildings. It was used in brick houses and terraces where cills, steps, plinths, copings etc., are worked from granite. Many facades are constructed in finely dressed stonework or ashlar. The stone most commonly used was grey Irish limestone, as can be seen in many of the early to mid 18th century public buildings and churches, e.g. Leinster House (Kildare Street facade). Dublin calp is more commonly used in rubble walling than as facing material. Granites from a variety of sources, including quarried stone from Dublin and Wicklow, were usually used in areas of plain walling or rusticated ashlar e.g. the Bank of Ireland, College Green, Dublin. Granite is often used in combination with Portland stone, an imported limestone from the south of England. This soft creamy limestone is used in the carved detail in 18th and 19th century public buildings as columns, capitals and window linings. New supplies of all these stones are available for repair work.

In the 19th and early 20th centuries sandstones were used in public buildings. Red sandstones were mainly imported from the north of England and Scotland. Yellow sandstones were quarried in Mountcharles.

### Common Problems and Solutions

#### 1. Damaged stone

Repair of stonework may be both costly and complex. When a building is found to be constructed in a substandard stone it may be

a matter of attempting to isolate repairs to areas where maximum damage and destruction have occurred. Repairs to stonework, such as granite or Portland limestone will involve obtaining matching material which blends in both in colour and texture with its surroundings. In the case of granite it will require careful selection of stonework from particular areas. The specification should indicate the location of both quarry and bed. Clean stone with minimal shell content is required where Portland stonework is to be used in intricate carving or in the replacement of detail.



*Damaged granite, caused by inappropriate pointing.*

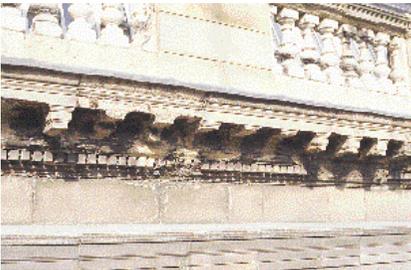


*Repairing stonework.*

# Conservation Guidelines

## Brickwork & Stonework

The replacement of sandstones creates problems as the replacement material may weather and decay within a short period. As an alternative to using stone for repair in sandstone buildings it may be more realistic to consider the use of specialised mortars for plastic repair. These mortars again must be carefully selected from a range of materials which provide similar porosities and appropriate strength to the original stone. In many instances over dense cementitious repairs have resulted in further damage and disfigurement. It is important in attempting mortar repairs, that the appropriate materials and methodologies are applied.



*Sandstone detail before repair*



*Sandstone detail after repair with specialist mortar*

Replacement of stone may involve the indenting or grafting of pieces into damaged stones or the removal and replacement of complete stones. In all instances the overall structural stability of the building must be first considered. There is no value in attempting to complete repairs to a building which is structurally unstable.

### **2. Metal fixings**

In many instances, damage to stonework results from the use of ferrous metal fixings. It is important to attempt to locate these fixings as they will require replacement in either stainless steel or phosphor bronze. Such a process may be destructive, and great care should be exercised in removing the fixings, so as to minimise the damage as much as possible.

### **3. Soiled stonework**

There are many methodologies for the cleaning of stonework. It is important to bear in mind that chemical cleaning, using acids, can result in very severe damage to limestone while being successful in cleaning granite. The use of alkali cleaners on stone can yield good results and is unlikely to damage Portland stone. New systems of abrasive cleaning using very low pressures and very fine abrasives can yield good results. In all cases, as with brick, skilled and trained operatives are required to complete these works, as the cleaning of both brick and stonework can result in both permanent and

# Conservation Guidelines

## Brickwork & Stonework

irreversible damage if appropriate methodologies are not applied.

The use of poultices on limestone is becoming more commonplace and such methodologies minimise the migration of chemicals into the stone.

### 4. *Decayed pointing*

As with brick, the raking out and repointing of stonework requires care to avoid damage and should be completed wherever possible by hand rather than by mechanical means. Mixes in repointing stone should not be over dense or over rich in cement but should involve the use, where necessary, of lime and crushed sand. For further detail see booklet *No. 4 Mortars, pointing and renders*.

### Dos and Don'ts

- Do*
- ascertain type of stone and source matching material for repairs
  - use stainless steel or phosphar bronze when replacing ferrous metal fixings
  - carry out trials prior to cleaning.
- Don't*
- commence extensive repairs before ascertaining structural stability of building
  - use inappropriate abrasive cleaning methods
  - use dense impervious mortar for pointing.

### Select Bibliography

Ashurst, John and Nicola. *Practical Building Conservation, Vol.1: Stone Masonry* (English Heritage). Aldershot, 1988.

Ashurst, John and Nicola. *Practical Building Conservation, Vol.2: Terracotta, Brick and Earth* (English Heritage). Aldershot, 1988.

Ashurst, John and Nicola. *Cleaning Stone and Brick*. (Society for the Protection of Ancient Buildings Technical Pamphlet 4). London, 1977.

Lloyd, Nathaniel. *A History of English Brickwork*. London, 1983.

Nash, W.G.. *Care and Conservation of Georgian Houses: Brickwork Repair and Restoration*. Eastbourne, 1985.