Guide for Practitioners 6

Conversion of Traditional Buildings

Application of the Scottish Building Standards

PART 1

Principles and Practice

TECHNICAL CONSERVATION, RESEARCH AND EDUCATION GROUP

Guide for Practitioners 6 Conversion of Traditional Buildings Application of the Scottish Building Standards PART 1

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Conversion of Traditional Buildings

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PART 1
Principles and Practice

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and Principal Author
Dennis Urquhart

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GUIDE FOR PRACTITIONERS
Conversion of Traditional Buildings
Application of the Building Standards

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* Refer to Acknowledgements for information on the designations of the contributing authors.

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Members of the Steering Group included: Ingval Maxwell OBE, Director of TCRE, Historic Scotland; Janet Kleboe, TCRE, Historic Scotland; Simon Montgomery, Inspector of Historic Buildings, Historic Scotland; Jane Robertson, Manager, Historic Scotland Conservation Bureau; Jeff Carter, Assistant Chief Executive, Scottish Building Standards Agency; Dennis Urquhart, Urquhart Consultancy Services and Mark Watson, Historic Scotland.

In addition to the Steering Group, an Advisory Panel met periodically to review and comment on work in progress. The Editor and contributing authors – many of whom were members of the panel – are extremely grateful for the time, effort and invaluable expertise given unstintingly by busy practitioners. In addition to members of the Steering Group, the following individuals also served on the Panel at some time: John Addison, Structural Engineer, Waterman Group; Mark Anderson, Building Control Manager, Midlothian Council; Stewart Brown, Simpson and Brown Architects; Iain Cram, Architect, Bell Ingram Design; Jocelyn Cunliffe, Conservation Architect, Gray, Marshall and Associates; John Duncan, Conservation Officer, Highland Council; Ian Gough, Fire Safety Consultant; Lyndall Leet, Architect (retd), The Leet Rodgers Practice; Stuart MacPherson, Principal, Irons Foulner Consulting Engineers; David Narro, Structural Engineer, David Narro Associates; Elaine Richardson, Midlothian Council; Andrew Wright, Historic Environment Advisory Council for Scotland; Ian Young, Conservation Officer, Midlothian Council.

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FOREWORD

The successful conversion of existing buildings is something to be celebrated. When it occurs it may bring a new lease of life to a depressed neighbourhood or the appropriate reuse for a redundant farm steading. From the first pioneer occupation of lofts in Manhattan, or for that matter in Glasgow's Merchant City, converted factories and warehouses spearheaded the renewal of districts. As a catalyst for change, the sensitive conversion of a building can be the first sign of recovery, indicating that an area has turned the corner and is looking forward to a new lease of life yet without rejecting its origins. The reuse of empty mills and warehouses, for example, can be a major element in delivering high-density urban living in a quality environment; a counter to suburban sprawl eating up the countryside. A reused church can continue to give a community meaning even if it is no longer a place of worship. The embodied energy that went into the original construction, using materials that would now be difficult to source make conversions inherently more sustainable than the equivalent built anew. Adaptive reuse is already delivering the sustainability agenda.

This Guide for Practitioners is specifically concerned with the conversion of Scotland's traditionally constructed built heritage. It has been prepared to provide those involved with its design, development and rehabilitation with relevant information on the application of the Building Standards.

The introduction of The Building (Scotland) Regulations 2004 is significant because, together with the supporting Technical Handbooks, they allow judgement to be made on how successfully an existing traditional building can be converted to meet the requirements of the new functional standards. Retaining the historic integrity of the existing built heritage and meeting the standards presents a challenge which frequently requires dialogue to resolve. It is intended that this Guide assists with that dialogue. It does this by outlining the construction, materials and performance of traditional buildings and, by addressing the relevant functional standards that are applicable, illustrates how their successful survival and reuse might be achieved. It also draws attention to the legislation governing traditional buildings.

As the attached formal letter from the Chief Executive of the Scottish Buildings Standards Agency intimates, this Guide legally sits alongside other documents that have been prepared for the purpose of providing practical guidance with respect to the building regulations.

The task of producing the Guide was overseen by a Steering Group consisting of officials from Historic Scotland and the Scottish Building Standards Agency, together with a range of practitioners well versed in the field.

The Managing Editor and lead author, Dennis Urquhart, with support from a number of contributing conservation practitioners, has brought together a wealth of understanding and good practice in this double volume. Part 1 of the Guide emerges as a platform for raising awareness on how the traditionally constructed built environment embodies the skills, energies and knowledge of our ancestors. Whilst Part 2 reveals how, with appropriate care and consideration, the relevant standards can be accommodated in a way that will permit the effective conversion of a traditional building so that it can be successfully retained for future use.

The presented information is the direct result of discussion and agreement between two government agencies; Historic Scotland and the Scottish Buildings Standards Agency. Historic Scotland has the over-arching responsibility for the protection of the built heritage in Scotland, whilst the Scottish Building Standards Agency has lead responsibility for the legislative functions relating to the building standards system. Both organisations have a remit which inevitably overlaps in places. Consequently there was an inescapable logic for both bodies to consider the production of a joint publication to offer a more integrated and comprehensive approach to practitioners involved in the conversion and adaptation of traditional buildings.

This guidance therefore draws together the responsibilities and legislative viewpoint of both Agencies. Its primary aim is to assist in the finding of sensitive and applicable reuses for a large part of Scotland's built heritage.

The authorship of this ambitious work was a considerable task as questions concerning conservation, relevant legislation and practice constantly needed to be balanced. As a result, bringing together the two seemingly opposing issues of retaining, conserving and repairing the historic environment with the need to address the mechanisms which often have to consider proposed radical changes to that same environment, has been successfully achieved. The result is a unique "text book" which "reinterprets" the Scottish Building Standards.

It is hoped that by being comprehensive, the Guide does not intimidate by its size and range of issues that are covered. It was written to be used as a "reference manual", rather than a technical publication to be read from cover to cover. It aspires to provide confidence to retain older fabric, and help create a sustained future for it, whilst meeting, as far as possible, present day needs.

In conjunction with other published technical material that has emanated from Historic Scotland's Technical Conservation, Research and Education Group over the years, the Guide aims to inform good practice and contribute to the awareness, understanding and appreciation of Scotland's traditionally constructed building stock and its adaptation to new uses.

Ingval Maxwell, OBE
Director TCRE
Edinburgh

12 March 2007

Chief Executives – Scottish Local Authorities

Copy to: Local Authority Building Standards Managers

SCOTTISH BUILDING STANDARDS AGENCY

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Our ref: QTO 2/4

12 March 2007

Dear Chief Executive

BUILDING (SCOTLAND) ACT 2003 – NOTICE UNDER SECTION 4(2) AND 4(4) RELATING TO GUIDANCE DOCUMENTS

Under the provisions of Section 4(1) of the Building (Scotland) Act 2003 (the Act), which came into force on 1 May 2005, Scottish Ministers may issue guidance documents for the purpose of providing practical guidance with respect to the requirements of any provision of building regulations and may issue revisions of the whole or any part of any guidance document.

Guidance documents issued under Section 4(1) of the Act take effect in accordance with a notice issued by Scottish Ministers under Section 4(2) of the Act. This letter, issued on behalf of Scottish Ministers, constitutes such a notice.

From 1 May 2007 the following document is added to the guidance documents for purpose of building regulations:

The Guide for Practitioners – Conversion of Traditional Buildings, issued by Historic Scotland.

The guidance documents are issued with respect to the provision of Regulations 1 to 15 of The Building (Scotland) Regulations 2004.

As provided for by Section 4(3) and 4(4) of the Act, this document will cease to have effect in relation to building warrant applications when notice is given by Scottish Ministers.

Yours sincerely

DR PAUL STOLLARD
Chief Executive

Scottish Building Standards Agency, Denholm House, Almondvale Business Park, Livingston EH54 6GA.
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PART I: PRINCIPLES AND PRACTICE

SUMMARY

Background

The Historic Environment has a key role to play in regeneration. Conserved historic buildings can provide important points of focus for wider regeneration schemes, adding character and preserving local distinctiveness and identity.† Through the conversion of buildings the historic environment can play a key role in Scotland's economic, social and cultural success.

Since the very beginnings of architecture, people have adapted the buildings they have inherited so as to meet contemporary purposes. A new use could be a way of asserting the primacy of a new religion or culture over the preceding one, or it could simply be a good way to utilise existing property without going to the trouble of starting all over again. With acceptance of the value of conservation in the later C19, and more so in the C20, has come a need to adapt buildings in ways that respect their character and that of their surroundings. The conversion of a building can be a catalyst for change: a converted factory will often be in the advance guard of regeneration in a run-down area. It can be a means of achieving development, such as rural housing in a former farm steading, that would otherwise be unwelcome. Conversion is also one of the triggers for the application of building standards that seek to achieve a number of social benefits, ranging from better disabled access and egress to a reduced carbon footprint across this small country.

This guide aims to provide advice to practitioners, developers, building owners and local authorities on issues surrounding the application of The Building (Scotland) Regulations 2004 to the conversion of traditional buildings. The 2004 Regulations are based upon expanded functional standards, which set out what the building must achieve when in use. They thus permit greater flexibility in satisfying the standards, and allow the needs of traditional (historic) buildings to be met in a sympathetic manner. While the book is focused on the application of the building standards within a Scottish context and to historic buildings, the underpinning principles may be applied to traditional buildings everywhere. It does not address, nor seek to constrain, the potential for creative interventions into historic buildings.

The guide is not intended to be a technical handbook covering all aspects of the building standards. Its function is to support the Technical Handbooks by identifying and resolving typical areas of difficulty that may be encountered during the conversion of a historic building. There is a risk, when attempting to satisfy the requirements of the standards, that the introduction of improvements (in terms of the standards) may affect adversely the historic character of the building. This guide therefore sets out the principles that underpin the conservation of traditional buildings. By utilising the concepts inherent in the functional nature of the building standards it provides practical advice that will help the practitioner to reach acceptable solutions to the often complex problems that may be encountered during the conversion of these buildings.

The book is divided into two parts. Part I is primarily devoted to the identification of the conservation issues that impinge on the conversion of traditional buildings. Part II addresses the requirements of the individual standards that are likely to have the greatest potential impact upon the historic character of a building and suggests solutions. There is an element of overlap between the two parts because it is appreciated that, in a book of this type, readers will tend to directly consult the standard or standards in question.

Part I. Principles

Part I sets out the rationale for the book.

The terms 'historic building, and 'traditional building' as they are applied here (see Section 1.1) define a building of traditional construction built before circa 1919 – **they include but are not confined to listed buildings or buildings within conservation areas.**

In Chapter 2 the important conservation principles are defined. Advice is given on what makes a building significant, and the identification of 'character'. The focus of the book is on the standards that most often apply in conversion. As it is often the case that repair and maintenance will be carried out at the same time, general advice on traditional approaches to the repair of historic buildings is included. This chapter also addresses the importance of building surveys, the need to assess cultural value and issues such as economic reuse and suggests further reading.

Chapters 3 to 6 concentrate on the performance of traditional buildings and give an overview of most issues likely to impact upon historic buildings as a result of

† *Scotland's Historic Environment: Scottish Historic Environment Policy 1*, Historic Scotland 2006.

conversion. The use of traditional materials and the dangers arising from the introduction of modern, non-compatible materials and construction methods are explained. As an example, the importance of windows and doors as a factor in determining the character of a historic building is discussed, including the difficult issue of achieving improvements to thermal insulation while retaining character.

The traditional building is an environmental system within which issues such as the control of moisture and water vapour can have a major impact on the performance of the building. A building can respond badly to the poorly informed use of modern moisture and vapour control systems, such as the insertion of damp proof courses and vapour barriers. The complex relationship between the need to achieve improvements to the thermal insulation of the building envelope and the protection of historic fabric is explored and the key problem areas identified. Upgrading of heating systems is another area of difficulty: the need for the adoption of a systematic and holistic approach to the design of systems is promoted.

Fire protection of all buildings and sound insulation of domestic buildings are important considerations in the design of conversions. However, the introduction of designs intended for use in new build, without recognising the special needs of historic buildings, can have serious consequences to both historic fabric and character. Achieving a satisfactory balance between these competing factors is an important consideration within these sections.

Lastly, key legislation that may have an impact on the conversion of historic buildings is covered, including issues such as statutory protection of historic buildings, the application of the Building Regulations to conversions, access (primarily the Disability Discrimination Act 1995) and health and safety legislation.

Part II. Application of the Building Standards

This part addresses the individual building standards that are most likely to have an impact on the character and fabric of the building. Schedule 6 of Regulation 12 governs the approach adopted, where the separation of the standards into those that are defined as *essential* standards and those where the conversion shall be improved to as close *as is reasonably practicable* inform the recommendations. However, each historic building is to an extent unique, or will at least contain unique features, which means that the use of model solutions must be treated with caution. Each situation must be carefully assessed so that the most appropriate solution, which meets the standard without compromising the historic character of the building, is achieved.

The arrangement of the sections within Part II reflects the arrangement of the sections in the Technical Handbook. Each of the standards is structured to a standardised format which includes the following elements:

- the text of the standard,
- classification into essential or reasonably practicable,
- a commentary on the potential influences of the standard on the conservation needs of historic buildings,
- a table that identifies the risks to the building from the application of the standard,
- recommended approaches to meeting the requirements of the standard and
- a list of other standards that may impact on the application of the standard in question.

1. INTRODUCTION

1.1 Scope of the Guide

The conversion of traditional buildings presents significant challenges for practitioners (that is architects, surveyors, engineers, project managers), developers, approved certifiers and local authorities who have to prepare or approve designs that will accommodate changes in the use and occupation of such buildings while respecting their cultural and historical significance. Not least of the problems faced is the need to meet the requirements of the building regulations, which prior to the Building (Scotland) Act 2003 did not recognise the specific needs of historic buildings other than by specific relaxations. The new system, however, acknowledges the fact that the conversion of existing buildings requires the building regulations to be sufficiently flexible to allow the adoption of a sensitive approach to traditional and historic buildings.

This guide aims to enable practitioners and building owners to apply The Building (Scotland) Regulations 2004 to traditional buildings. The imposition of contemporary standards, construction methods and materials on historic buildings has frequently resulted in conflict between the conservation needs of the building and modern regulatory and environmental regimes. The Guide provides examples of best practice in dealing with these complex issues. Practical examples that illustrate the satisfactory resolution of significant conflict-of-interest problems have been incorporated. These are not necessarily the only solutions in these scenarios but they illustrate a number of ways that meet the challenges and opportunities presented by adaptive reuse.

It is not the intention of this guide to act as a technical handbook for the building regulations. Rather, the focus is on the identification of typical areas of difficulty where the influence of the regulations is likely to have the greatest potential impact on historic fabric, namely:

- fire safety,
- condensation,
- noise,
- access and
- energy conservation.

Verifiers are expected to take this guidance into account when assessing historic buildings of traditional construction. More generally, the guidance may be relevant when assessing any traditionally constructed

Illus 1.1 Listed Category A Duff House was rescued from a disused state and converted into a country house gallery containing art works from the National Galleries of Scotland (Photo: D Urquhart).

building where the guidance in the Technical Handbooks is appropriate to the existing structure.

1.2 Definitions

Historic building. The definition of a historic building, as set out in the Procedural Handbook, is:

Box 1.1

'A building of architectural or historic interest or significance. The interest or significance may be local or national, and may be a consequence of, for example, the building's age, built form or location. It may result from its connection with a person or persons, or with local or national events or industry; or from a combination of these or other factors. A building does not have to be listed by Scottish Ministers or lie within a conservation area to have interest or significance.'

As the term is not restricted to buildings that have statutory designation on cultural grounds, such a definition anticipates a highly-developed awareness and understanding of historic buildings on owners, designers, developers and contractors. Many of these buildings will not benefit from the protection offered by listed building legislation. There may then be pressure to adopt solutions that, whilst offering the cheapest or least 'difficult' solution to satisfying the regulations, may compromise the interest the building may possess. If there is no specific or area designation in place, the advice in this guide may be recommended as best practice for the health of the building and the contribution it may make to the local scene.

Traditional Building: The advice in this guide is confined to buildings of traditional construction as it applies to Scotland. The term **'traditional building'** is therefore used to define a building of traditional construction built before circa 1919, **it is not confined to listed buildings or buildings within conservation areas**. It is estimated that there are around 500,000 such buildings. A defining characteristic is that their construction evolved over many years, adapting to the climate to promote the dissipation of water vapour. Their materials are breathable, and attempts to introduce modern standards of impermeability are likely to have unintended consequences. Much that is in this guide then applies to all buildings of traditional construction, whether or not they are considered to have special merit as defined above or as confirmed by statutory designation, such as listing. Where technical performance is discussed the text will usually refer to 'traditional buildings'.

The importance of traditional buildings to the nation's built environment, and therefore its identity, cannot be over-emphasised. The total stock of C18 and C19 buildings is continually being eroded, in a few limited cases through demolition. A larger and more pervasive problem is when poor alteration to these buildings may badly harm their character. The conversion of the existing building stock makes best viable use of this resource but must ensure that all that is significant is conserved and that good conservation practice is employed. Even where a traditional building has no specific interest that marks it out from others of the type, if it is traditionally constructed it makes sense to employ best conservation practice in the application of the standards.

Listed building. This and other statutory designations are covered in Section 7.2. It should be noted that, when a building is listed, listing covers both the interior and the exterior of a building, regardless of the category of listing. The term 'listed building' is here sometimes used where statutory permissions, known as listed building consent, for works affecting the character of listed buildings are discussed. These include works to interiors that do not require planning permission and which would not be required in the case of unlisted but 'historic buildings'. In Scotland there are around 47,000 listed buildings, representing less than one percent of the total building stock.

Illus. 1.2. An example of an unlisted former printing works that has been converted into apartments. Identically-sized windows have been installed in openings of variable dimensions below false ceilings fronted by an off-white infill. Fully-glazed openings might have been preferred, with false ceilings set back from these, or even given a dark reflective finish, had the building been listed and/or advice requested from Historic Scotland (Photo: Historic Scotland).

A larger number of unlisted buildings contribute to the character of conservation areas, and so do a few in designed landscapes, world heritage sites, national parks, areas of great landscape value and so on. There a case may be made for taking special care, as if they were listed in their own right, not to harm the character of buildings through zealous application of building standards. Buildings in conservation areas are considered in Section 7.2.

It should also be recognised that the term 'historic building' is not a simple definition of age. Some outstanding C20 buildings, built using contemporary materials and methods of construction, are listed: the youngest listed building in Scotland is around twenty years old. However, for the purposes of this guide, the advice will be confined to buildings of traditional construction that were built in Scotland up to the early C20.

1.3 The Building (Scotland) Act 2003 and its application to historic buildings

The new Act, together with the new Building (Scotland) Regulations 2004, has had a fundamental impact on the methods for setting and enforcing standards on building work in comparison to the previous Building (Scotland) Regulations 1990 and the Building Operations (Scotland) Regulation 1975. These changes were necessary to permit European harmonised standards to be used in Scotland, as required under the Construction Products Directive.

The 1990 Regulations could only be complied with by following the Technical Standards. It was this prescriptive approach that led to the conflict between meeting the standards and the needs of historic buildings. However, the 2004 Regulations are based upon the use of expanded functional standards that define what the building must achieve when in use. Functional standards, rather than prescriptive standards:

- permit greater flexibility for designers in achieving the minimum standards,
- cater more sympathetically to the needs of historic buildings undergoing conversion.

Within the 2004 Regulations, the term *'conversion'* has been given a specific meaning and is restricted to prescribed changes of intended use or occupation. After a conversion, the regulations require a building to comply with all the standards. However, there is an important qualification because few existing buildings can reasonably be expected to meet all aspects of the standards. Therefore, for specific identified standards the existing building is required to be improved *'to as close to the full requirements as is reasonably practicable'*. The Building Regulations define 'reasonably practicable' as *'…..having regard to all the circumstances including the expense involved in carrying out the building work.'* This means that an existing building will now have to be improved, even if meeting the full standard is not practically achievable.

Section 35 of the Act gives specific protection to certain historic buildings in relation to statutory notices. For purposes of enforcement under the Act, the following buildings are designated as historic buildings:

- those included in the schedule of monuments compiled under section 1 of the Ancient Monuments and Archaeological Areas Act 1970 (c46),
- listed buildings under section 1 of the Listed Buildings and Conservation Areas (Scotland) Act,
- buildings subject to Building Preservation Notices under Section 3 of the listed Building and Conservation Areas (Scotland) Act and
- those buildings in conservation areas subject to control of demolition under section 66 of the Listed Buildings and Conservation Areas (Scotland) Act.

In these cases, Scottish Ministers, the planning authority – or such other persons as the local authority think fit – must be consulted prior to the service of notices, such as a building warrant enforcement or a defective building notice.

The Procedural Handbook, in addition, notes that 'sympathetic consideration' may be given to a wider range of buildings as defined by the term 'historic building' in Section 1.2.

1.3.1 Conversions to which regulations apply

1. Changes in the occupation or use of a *building* to create a *dwelling or dwellings* or a part thereof.
2. Changes in the occupation or use of a *building* ancillary to a *dwelling* to increase the area of human occupation.
3. Changes in the occupation or use of a *building* which alters the number of *dwellings* in the *building.*
4. Changes in the occupation or use of a *domestic building* to any other type of building.
5. Changes in the occupation or use of a *residential building* to any other type of *building*.
6. Changes in the occupation or use of a *residential building* which involve a significant alteration of the characteristics of the persons who occupy, or who will occupy, the *building*, or which significantly increase the number of people occupying, or expected to occupy, the *building*.

7. Changes in the occupation or use of a *building* so that it becomes a *residential building*.
8. Changes in the occupation or use of an exempt *building* (in terms of Schedule 1) to a *building* which is not so exempt.
9. Changes in the occupation or use of a *building* to allow access by the public where previously there was none.
10. Changes in the occupation or use of a *building* to accommodate parts in *different occupation* where previously it was not so occupied.

Conversion can apply to part of a building as well as the whole building.

1.3.2 Alterations

Within the Building Regulations, the terms *alteration* and *conversion* must be clearly distinguished. Conversion, as defined in Section 1.3.1, is confined to situations where the building is subject to a change in occupation or use, and as such it falls within one of the classes in Schedule 2 of the Building Regulations.

Alterations refer to work carried out on an existing building where no change of occupation or use is involved. In this case there are no qualifications; alterations attract the full current standards *relevant to alteration work*. In addition, the whole building must not, as a result of the alteration, fail to comply with building regulations if it complied originally, or fail to a greater degree if it failed to comply originally. However, alterations to an existing building that are part of a conversion in terms of the Building (Scotland) Act 2003 are subject to a wider application of the regulations, so that the building being converted complies more fully.

1.3.3 Extensions

Extensions to existing buildings must be constructed in such a way that the extension complies with all the current standards that are relevant to the construction and use of the extension. However, where the extension is to a historic building that is being converted, the standards that apply to the building, other than the extension, remain those that apply to a conversion of a type set out in Schedule 2 of the Building Regulations (see section 3.8.1).

Illus 1.3 Former lodging house converted to apartments with new extension on the left (Photo: D Urquhart).

1.3.4 Ruined buildings

Some historic buildings are in a ruinous condition, but may still be proposed for conversion or alteration. It is possible that some ruined buildings being considered for conversion will be scheduled. Then, even if also listed, scheduled monument consent rather than listed building consent will be required. Consult Historic Scotland before carrying out work to a Scheduled Ancient Monument: even works of repair require consent.

When a ruin is being brought back into use, the way in which the building regulations will apply depends on the following circumstances:

a) If the past use of the building is known, then work on the ruin should be regarded as a conversion if it falls within one of the classes in Schedule 2 of the Building Regulations (1.3.1 above).

b) If the past use of the building is unknown, or is outside these classes, it should be regarded as an alteration. In this case, alterations attract the full current standards relevant to the alteration work. For further guidance refer to the Procedural Handbook that accompanies the Building Regulations.

1.4 Balancing conversion and conservation

A listed historic building may usually be converted provided that it does not compromise the character that is the special interest, significance or appearance of the building. Conversion of a building to change its occupation or use is often the only means of ensuring its retention and future viability. Achieving a proper balance between the development requirements of a conversion, the building regulations and the special needs of the historic building is a demanding task that requires specialist advice and negotiation with verifiers.

A flexible approach to the issues is required. A willingness to imaginatively use the spaces that exist, rather than attempt to alter them to impose standardised solutions, is an essential prerequisite to achieving a proper balance.

In a run-down area, the sympathetic conversion of a historic building may act as a catalyst to promote the regeneration of the area and encourage the movement of people and business back into the district. The skills and creativity needed to make this economically sustainable will be more demanding than replacing with new buildings, but can have greater long-term advantages socially, environmentally, culturally and economically (Civic Trust 2003).

Balancing the architectural and historic importance of a building, including where appropriate the internal fabric and fixtures, with the requirements of the regulations needs understanding of the way in which a traditional building performs, and careful application of regulatory requirements. While there is considerable flexibility in meeting the functional standards contained within the regulations, there are important issues where the interface between conservation and regulations can create uncertainty. In Section 0 of the Technical Handbook, Schedule 6 of Regulation 12 makes some allowance for historic buildings, where it states *'the classification of the building should influence the extent to which improvement is required, depending on whether the classification is for outside, the inside, all parts etc.'*

This requires interpretation. All of a listed building is listed, but on a case by case basis it may be established that certain internal or external works will not affect the character of that building and therefore improvements may have to be made to meet the standard. This can only be ascertained in consultation with the council's conservation officer, development control officer or Historic Scotland, as the case may be. The category of listing and the detail that a list description may happen to contain does not provide the necessary guidance.

If a building is unlisted, but may be within a conservation area, world heritage site, designed landscape, national scenic area, national park or other location in which more than the usual environmental care must be exercised, then it will be on the outside that special care must be taken.

Difficulties can arise where, in the conversion of a listed building into apartments for example, the resistance to sound transmission through a separating floor must be improved to meet the requirements of the standard. This is a case where the full standard must be met and will require skilful handling by the designer where historic fabric has to be retained. It may be that the character of the interior, say containing a C17 painted ceiling, is so important that it cannot be disrupted by conventional deadening between floor boards. Another method must be chosen or the layout of the subdivision reconsidered altogether.

In converting a historic building to a new use there may be an archaeological dimension to consider, even if it is not scheduled. Professional supervision may be required to investigate significant features both below ground level and within the upstanding fabric. Information extracted in this way should enhance understanding of the building and inform decisions regarding its development and future management. The local authority conservation officer or archaeological service may be able to advise on requirements.

1.5 Sustainable development

A new objective in the 2003 Building Act is concerned with furthering the achievement of sustainable development, responsibility for which, in terms of the regulations, rests with the owners of buildings.

Sustainable development is defined by the Brundtland Report 1987 as *'development that meets the needs of the present without compromising the ability of future generations to meet their own needs'*.

The conversion of an existing building, instead of creating a completely new building, takes advantage of the energy embodied in the fabric of that building. The energy expended in the manufacture of materials, transportation and construction of a new building is estimated to equal the energy necessary to heat, light and ventilate or condition the building for between five and ten years. Therefore sustainability favours the retention of the existing building stock, as the Sustainable Development Commission (2005) sets out:

> *Existing buildings provide a major opportunity in terms of creating sustainable communities. Existing communities must be sustained through repair and maintenance of existing homes as well as identification of appropriate infill sites for new homes. Improving and maximising use of existing stock is the cheapest and lowest-impact solution to the provision of housing.*

National Planning Policy Guideline: NPPG 18 emphasises the reuse of existing buildings where it states:

> *'Recycling existing buildings will minimise the consumption of materials and energy used in demolition and redevelopment. Traditional building materials and methods of construction are generally robust and can be more widely promoted on the basis that historic buildings normally have a life span well in excess of modern buildings.'*

The best viable use for a historic building should always be the main objective within a proposal to convert such a building. NPPG 18, when considering sustainable development, makes the key point.

Box 1.2 Best viable use of historic buildings (NPPG 18)

The best viable use may not necessarily be the most profitable use. The aim should be to find a new economic use that is viable over the long term with minimum impact upon the special architectural interest of the building or area. Achieving best viable use may require adaptation of the fabric. This should be undertaken carefully and sensitively, having regard to its architectural and historic interest, character and setting.

1.6 Constructive dialogue

Care must be taken in improving the existing stock, or sustainability becomes invalid. A balance should be struck between the extent of the work and the conservation needs of the building. Yates (2006) attempts to define the point when the conservation limit has been reached:

> *'At some point the extent of the work will mean that the conservation limit will have been reached. This is defined as the point beyond which conservation principles and good practice will become compromised if further changes are made to the building, for example the replacement of windows in a conservation area, the replacement of an historic roof with photo-voltaic panels, or the application of an external rendering system.'*

While the regulatory system is designed to reduce conflicts, there is nevertheless a vital need for constructive dialogue between all interested parties to ensure that the most appropriate balance is achieved. Such a balance should not compromise the historic character of the building nor increase the risk to its occupants. Understanding the performance of traditional buildings is the key to that balance.

Often it will be the case in listed buildings that listed building consent is first obtained and then has to be subsequently modified once the details of complying with the building standards are considered. Sometimes local authorities will grant listed building consent with multiple conditions anticipating that changes will later have to be made. To avoid this, early communication between owners, designers, certifiers of design, certifiers of construction and verifiers is recommended in order to achieve an acceptable solution.

An early dialogue between the designer of the conversion, the verifier and the conservation officer of the local authority is strongly recommended before applying for a building warrant. This discussion will also assist any approved certifier of design that may be used, who must be familiar with and sympathetic to the needs of historic buildings if maximum advantage is to be gained from the flexibility offered by the regulations. If, in future, the verifier is not an employee of the local authority, such a discussion will be essential. Information on the role of verifiers and certifiers is given in Section 7.3.2.

1.7 Risks to traditional and historic buildings

Historic buildings and their component parts are a finite resource, which once lost cannot be replaced. The process of converting a historic building to a new use, or a change in occupation, has the potential to cause irreversible damage to the building, through loss of character, of archaeological information and of historic fabric if careful attention is not paid to the risks involved in both the design and construction processes. Work that is not sympathetic to the nature of the building, can, for example, dramatically alter the moisture balance within the fabric of the building and increase the moisture content of vulnerable materials. There is a greater

attrition to historic buildings through dampness than through any other mechanism, including fire.

Practitioners responsible for conversions must not compromise the health and safety of the occupants or of the general public. The Technical Handbooks (Schedule 6 of Regulation 12), taking into account risk to occupants and users of the building, distinguish between regulations that must be met and those that shall be improved to as close to the requirement as possible. There are undoubtedly some historic buildings where any work involved in the process of alteration would cause damage to their character or special interest. However, most historic buildings will be able to be improved to satisfy the requirements of the regulations.

There is also some danger in the way products are changing, in part to accommodate the EU Construction Products Directive, which could lead to the use of materials and techniques that may not be appropriate to the character of the building (see 3.3.2 for further comment on this matter).

1.8 Broad principles

The broad principles for the conservation of historic buildings are set out in British Standard BS 7913; 1998, *Guide to the principles of the conservation of historic buildings.* In addition there are a range of international charters, conventions and recommendations that have a bearing on how conversion work must be planned and organised. Historic Scotland TAN 8 *Guide to International Conservation Charters* lists 76 charters from 1937 to 1996. This list does not of course include the more recent Stirling Charter, published by Historic Scotland in 2000, which derives from the corpus of earlier charters, and others that have emerged or have been updated.

Box 1.3 Selected extracts from the Stirling Charter

Article 1

Actions taken in respect of Scotland's built heritage should secure its conservation for the benefit and enjoyment of present and future generations.

Article 2

There should be a general presumption in favour of preservation: no element of the built heritage should be lost without adequate and careful consideration of its significance and of all the means available to conserve it.

Article 3

Scotland's built heritage should be managed in a sustainable way, recognising that it is an irreplaceable resource.

Article 4

Appropriate measures, which do not compromise cultural significance, should be taken, including through access, research, information and education, to assist all people to enjoy, appreciate, learn from and understand Scotland's built heritage.

Article 5

Conservation of Scotland's built heritage should:

- be carried out in accordance with a conservation plan.....
- incur only the minimum degree of intervention.....
- use appropriate materials, skills and methods of working.

Article 6

In relation to their respective roles, the relevant bodies and individuals should ensure that:

- full use is made of the statutory provision available to protect the heritage,
- appropriate and effective systems are established for monitoring and recording the condition of the built heritage,
- suitable knowledge, skills, materials and technologies are available.

1.8.1 Criteria for alteration work

The criteria given in Box 1.4 are from BS 7913, Section 7.4.3, give practical guidance appropriate to works of alteration, including conversion.

Box 1.4 Extract from BS 7913: 1998. *Guide to the Principles of the Conservation of Historic Buildings, 7.4.3*

Criteria for alteration work:

a) Sufficient survey, investigation, recording, documentary research and analysis should be undertaken in advance of design work to ensure that the building is as well understood as reasonably possible and that the risks of accidental damage, destruction, missed opportunities or unexpected discoveries are minimised.

b) Disturbance of significant existing fabric should be avoided and any unsound work retained and repaired in association with alteration work wherever possible. The need for alterations should not be used to justify avoidable damage or destruction. The level of intervention should be at the lowest appropriate level, and this should be capable of being substantiated.

c) Some buildings or parts of buildings are of such quality, importance or completeness that they should not be altered at all except in the most exceptional circumstances.

d) The need for alteration can, nevertheless, sometimes justify the removal of earlier work which, though part of the history of the building, is not of appropriate quality, is not well integrated architecturally, and manifestly detracts from the overall quality of the architecture.

e) The need for alteration can sometimes justify the restoration of the layout or of missing parts of the building according to an original or earlier design.

f) Even materials now regarded as hazardous can be of historical significance, and if so may best be left undisturbed.

g) New work in alterations should always be of appropriate quality, should not draw attention disproportionately, and should contribute to the architectural integrity of the altered building as a whole. In many circumstances it is appropriate for new work to be different and distinguishable from pre-existing work and to be in a natural contemporary manner. In other circumstances it may be appropriate for new work, even when it is not restoration according to an original or earlier design, to be carefully matched in materials, construction and details to existing work, subject to appropriate identification and records.

h) Consideration should always be given to the desirability of carrying out alterations in such a way that they could be reversed quite easily; that is, new work could be removed and the building reinstated to its previous state without further significant damage to the pre-existing fabric. This is particularly desirable in alterations like the installation of services, where the life of such services is likely to be short compared with that of the building as a whole.

1.9 Summary of investigations and assessments required for the conversion of historic buildings

The investigations and assessments identified below are those undertaken to properly inform the feasibility study for a conversion. Each is recommended at some point within the guide. Clearly the scale, complexity and historic value of the building and its site will influence the scope and costs of these essential elements. However, even conversions that are apparently simple

Illus 1.4 Category A listed Fort Augustus Abbey (1876) prior to its conversion into apartments (Photo: D Urquhart).

and straightforward may reveal, on further investigation, hidden features that are important for the sympathetic conversion of the building.

Before the feasibility study is finalised, it is strongly recommended that a conservation plan for the building (and the site) be completed so that the development proposal for the building is properly informed. Important features essential to the conservation of the building can thus be incorporated into the design brief and the cost implications of certain design approaches identified at an early stage.

Investigations and assessments may include:

- assessment of cultural significance (the first stage in a conservation plan),
- assessment of construction, materials, elements and features,
- investigation of existing defects in the building and assessment of repair needs,
- assessment of structure on the basis of past use and likely future use. In some circumstances load tests may be required,
- assessment of thermal performance,
- fire risk assessment,
- sound insulation assessment (dwellings) – sound testing is normally required,
- access audit,
- risk assessment for harmful and dangerous substances,
- archaeological evaluation and investigation (timed to give best results before and during the works).

It should be noted that, from May 2007, there will be changes to the wording of a number of the Building Standards. The detailed changes have not been available for incorporation into this guide. However, these changes are unlikely to have a significant effect on the arguments and advice set out in the Guide. Readers should refer to the notes included within the individual standards that are affected by these changes.

Illus 1.5 Conversion of a redundant spinning mill to a small Business Gateway by Scottish Borders Enterprise. A conservation plan guided the development (Photo: ©Crown Copyright, 2007, Historic Scotland Images).

Illus 1.6 Former brewery (1785), listed category B, converted to residential study centre. (Photo: D Urquhart).

Illus 1.7 New glazed opening formed below an existing window in this gothic sandstone rubble church hall (1898) listed Category C(S) converted to community play group facility. (Photo: D Urquhart).

2. CONSERVATION THROUGH CONVERSION

2.1 Assessment of significance

A statement of significance seeks to describe why a place is important. It explains the values and cultural significance of the place and their importance to the community, or to groups within the community. It may describe the aesthetic/architectural, technological, historic or social value of a place including features that offer intangible value. It is an essential first step in the development of a conservation plan (or conservation management plan) a document that sets out ways to protect the significance of the place. Setting out the significant values of a place is central to the process of protecting heritage, explaining how to manage it appropriately and helping to explain its significance to others.

2.1.1 Value of traditional construction

All historic buildings, large or small, complex or simple, make a contribution to our quality of life by informing us of our past and adding visual interest to the environment. Old buildings have historic interest because they reflect the lives and achievements of our predecessors. Tangible elements that embody significance by association with specific events or persons, both on the exterior and interior, should as far as possible be preserved.

Traditional buildings are constructed from locally-sourced materials that are rarely used in the majority of buildings constructed today. Although political, social and economic history has influenced the design, quality and layout of our built environment, the main distinction between historic buildings and new-build is derived from the fact that labour was comparatively cheap in the past and the transportation of materials difficult and expensive in comparison to today. Much of the practice of building in the past is now regarded as craftsmanship practised by relatively few specialist contractors. With the exception of large commercial and public projects, modern building practice is largely standardised in its use of materials, which are usually transported over large distances.

This difference between traditional and modern construction practice puts a value on all our historic buildings in terms of our cultural heritage, and as an irreplaceable resource. The continued use of this resource through repair and conversion is therefore clearly good practice in terms of sustainability.

The special architectural or historic interest of a small minority of Scotland's historic buildings is recognised by their inclusion in Historic Scotland's Statutory List. Although no count is possible of the number of traditional buildings in Scotland, it is thought that the 47,000 buildings in the Statutory List are likely to represent less than 1% of the country's entire building stock. Unlisted traditional buildings are important components of Scotland's 640 conservation areas, but the majority of the country's traditional building stock are not protected through statutory designation.

Many unlisted traditional buildings will have much in common with those which are identified as of special interest through their inclusion in the Statutory List. There will, for example, be C18 and early C19 buildings around the country where the stonework has been cut and polished by hand, or which retain their sash and case windows with crown glass, and yet are not included in the List.

In the second half of the C19 and early C20, Scotland experienced building on an unprecedented scale. Developments in technology increased the availability and choice of materials and economic prosperity and civic pride ensured that the quality of design and construction was maintained and improved. This period of expansion, which lasted until after the Great War (First World War), has left Scotland a rich heritage of good quality domestic and public buildings, most of which were built with traditional materials and techniques.

Because the majority of these buildings have much in common with those on the Statutory List, Historic Scotland's criteria for the listing of buildings of architectural or historic interest provides a useful starting point for assessing the significance of all historic buildings (refer to Section 7.2.1 for factors influencing listing).

2.2 Identification of character

The special architectural or historic interest of a listed building or conservation area is encapsulated in the term 'character'. The requirement in the Planning (Historic Buildings and Conservation Areas) (Scotland) Act (1997) to preserve the character of listed buildings and to preserve or enhance the character and appearance of conservation areas directs practitioners to base decisions on the special architectural or historic interest

of a building or settlement. Appendix 1 of Historic Scotland's *Memorandum of Guidance on Listed Buildings and Conservation Areas* (1998) sets out guidelines in the appraisal of applications to alter listed buildings, and may be considered best practice for unlisted buildings in conservation areas and other traditional buildings. It highlights the importance of understanding a building's character as the best way to inform sound decisions that will preserve that interest whilst meeting the changing needs of its occupiers.

The interest of the fabric may be that it is original, or that it reflects the alterations arising from changes in the circumstances of their occupants.

Appendix 1 of the Memorandum states that:

> *'Most buildings have been altered to some degree over the years to cater for the differing requirements of succeeding occupants, and much of their interest may result from the manner in which their present form and layout reflect changing architectural and social aspirations. As a general rule, therefore, buildings should be conserved as found. All original architectural detailing should be respected, as should later additions, embellishments or remodellings of definite quality'.*

The principle 'conserve as found' is not that a building should never move forward. It directs practitioners, wherever possible, to repair rather than alter back to some supposed previous form the surviving features and fabric of historic buildings. There are instances where change could be beneficial, such as the introduction of fire breaks, but restoration back to a notional previous appearance is not usually encouraged. Not all of the interest of a historic building may be immediately obvious:-

> *'It is worth remembering that many buildings are more interesting and valuable than they first appear to be, and much may be discovered in the course of alterations. Blocked door and window openings with chamfered or moulded arrises or surrounds may be found when old harl or render is stripped off and moulded fireplaces revealed when modern ones are removed. Timber panelling may survive beneath later wall coverings and good original ceilings lie hidden above later suspended ones. Particular care should always be taken with commercial premises as early shop fronts and interiors may be concealed beneath more recent work'.*

The Memorandum highlights the importance of understanding the character of a historic building prior to alteration. Further information about methods of determining the existence and nature of concealed features will be found in Historic Scotland Technical Advice Note *Non-Destructive Investigation of Standing Structures.* To understand a historic building's development, fabric, components and materials, careful inspection, research and survey are essential – for further guidance see Historic Scotland Guide for Practitioners 4 (2003).

The Memorandum provides detailed advice to inform appraisal of proposed alterations to listed buildings that may be summarised under the following headings:

Setting. A historic building may well be more significant in the context of its setting than it would be on its own. Similarities of design and materials should be noted where the building is part of a greater group such as a terrace, planned village or town. A building may have been conceived or altered in a manner that is different from its neighbours, reflecting a particular point in its history. This individuality should not be overlooked in preference to uniformity, even in cases of formal townscape. Buildings have a significant impact on Scotland's rural areas. The value of preserving the character and function of rural buildings will ensure that they continue to contribute positively to the wider area. A historic building may be surrounded by ancillary structures such as barns and boundary walls. It is important that the character of these is preserved as much as possible so that the merit of the principal building is not reduced.

Design. Whether a building was originally conceived by an architect or not, there is likely to be an overriding character to the design of its exterior. Many were deliberately built symmetrically or asymmetrically to reflect their status and/or inform of their function(s). Although some buildings may have distinctive elements such as a church's tower and spire, the main elements contributing to the design of a building are likely to be its walls and windows. The size and arrangement of window openings will usually be key elements in dating a building. Any alteration to the form of one or the other is bound to have a considerable impact upon the appearance of the building as a whole, and where inappropriate alteration work has been implemented much of the quality and character of the building may be lost. The interest of buildings whether or not designed by architects may be increased through being conceived in an architectural style. These buildings are very likely to have architectural features that are specific to that style and the building's status.

Materials. Materials, and the craftsmanship employed in their use, may well be the most interesting element in a historic building. However, the choice of materials and the way they are used in the construction of the building will provide an insight into the availability of materials locally, and/or the prosperity of the area at the time. Some materials and methods may be significant in demonstrating local traditions, whereas others may be of interest because they have been specially imported from elsewhere.

Illus 2.1 Traditional Scottish slated roof. The Scottish slates laid in diminishing courses are an important aspect of the character of the roof (Photo: D Urquhart).

Historic features. It is now widely accepted that the retention of a building's historic/architectural features is key to the preservation of its character and these should be retained in situ wherever possible. An assessment of the character of a building will inform whether features (such as fireplaces and chimneys), which may become redundant during conversion, should still be retained.

Interiors. The interior can, in some cases, make as great a contribution to the understanding of a building's history as its exterior. The interest and merit of each space, in whole or in part, must be carefully assessed to determine to what extent the character of the space may be affected. Importance may be attached to the completeness of features in a room, a suite of rooms, or their inter-relationship. By preserving past alterations as well as original internal features, the building will inform social and architectural history. The internal structural system of some buildings may contribute significantly to their interest. Iron columns and purlin roofs are examples of features to be preserved rather than removed or obscured during conversion. The practicality of maintaining the physical and visual presence of internal structural features should be considered at the earliest opportunity.

Plan form. Although often overlooked, the plan form of a building will usually make a significant contribution to a historic building's character, but there should be an attempt to identify the principal spaces in all buildings and ensure that these are protected wherever possible. Where the arrangement of the rooms has been altered, consideration could be given to the restoration of the original plan form. Functions will of course change in a conversion, but past uses should still be readable in the fabric.

Roof. The roof profile of historic buildings is also very important to their character. The pitch and eaves detailing can be key elements in dating a historic building. Plain roofs unencumbered by dormers may be a key part of the building's character, to be respected in any conversion.

2.3 Retention of historic fabric and architectural character

Respect for a building's character will inform decisions on the viability of conversion. It is accepted that the original use of a building is often the most appropriate one. It is therefore particularly important in cases where the new use of a building will be significantly different that the building's character, and possible risks to it, are identified at an early stage through a thorough assessment of the surviving fabric. It is possible that in some cases the loss of character would be so extensive that conversion to a certain function may not be appropriate.

Both the owner of a historic building and the planning authority that regulates works to it will seek the best viable re-use of a historic building. The viability of a conversion is commonly considered in terms of costings, but should always be considered in terms of the character of the building. In the case of historic buildings, careful attention should be paid to whether the works will have an *adverse effect* on the historic character of the building in order to meet the practical

needs of the conversion. If the works will have a significant adverse effect on the character, the proposals may be regarded as unacceptable.

Proposals for the alteration of a historic building are assessed on their own merits. Each building is different in terms of its location, form, and how well it has survived to the present day. Some historic buildings may have statutory protection, the effect of which will vary according to the importance of the building and its relationship with other designations. Each historic building is also likely to have an owner with aspirations that might be quite different from those of the owner of a similar building, and these may in turn be influenced by an advisor producing proposals for its alteration or conversion. Assessment of each case on its own merit ensures that the character of a building and the impact of proposals for its alteration are not unduly influenced by poor practice elsewhere.

If in doubt, owners or their agents should always check with the local authority whether a building is subject to such designations as statutory listing, inclusion in a conservation area, or by being sited within the curtilage of a listed building (see Section 7.2).

Where a historic building has been altered in the past, conversion may present the opportunity for enhancement such as the restoration of features or spaces. Restoration should always be based upon firm evidence of the original or historic appearance of the building. Photographic records in local museums and libraries and at the National Monuments Record for Scotland may provide the necessary information, as may old Dean of Guild plans and previous planning and warrant approvals.

2.4 Conservation plans

The conversion of a historic building would benefit from preparation of a conservation plan that identifies the cultural significance of the site and sets out policies that safeguard that significance. Such a plan will inform the design process for development of the building, and will assist in the effective management of the whole building and its setting, once the development has been completed. Clearly, a conservation plan should be tailored to the complexity of the site: the plan required for a Category C(s) listed residential property will be very different (and much shorter) document than that required for a large or complex building. The structure of a conservation plan is set out in *A guide to the preparation of Conservation Plans*, published by Historic Scotland.‡

The objectives of a conservation plan are:

a) to identify the cultural significance of the site, and

b) to set out a policy for the management of those attributes of the site that contribute to that significance.

The conservation plan should be prepared before, or at least in parallel with, plans for the development of the site. For some plans, further specialist reports and detailed research may be required; this should be built into both the cost and time required for the project work, or otherwise identified as a matter for subsequent further work.

2.5 Principles of repair and alteration

The conversion of a historic building will almost inevitably lead to its alteration to some extent, and the need to satisfy the requirements of the building regulations will present additional challenges. For example, the conversion of a single-occupancy building into one of multiple occupancy will frequently require alterations to access, both to and within the building, and improvements to fire and sound insulation. Such alterations should be carried out in a way that prevents loss of cultural significance and historic fabric without increasing the risk to users and occupants. The maintenance of a building's fabric is essential, but so is protection of its cultural significance by conserving its physical elements in a way that does least damage to its important qualities. These broad values are set out above at section 1.8. Various conservation charters use the concept of 'integrity' in this respect (Bell 1997). Integrity may be grouped into five key components:

- structural and technological integrity,
- social integrity,
- spatial integrity,
- aesthetic integrity and
- contextual integrity.

During the process of conversion it is almost certainly the case that repairs to the building, where necessary, will be carried out at the same time. As with alterations, the repairs must recognise good conservation practice. Knight (1995) gives a helpful explanation of the purpose of repair (Box 2.1).

Box 2.1 The purpose of repair

The primary purpose of repair is to restrain the process of decay without damaging the character of the buildings or monuments, altering the features which give them their historic or architectural importance, or unnecessarily disturbing or destroying historic fabric.

‡ See also James Semple Kerr 1996, the *Conservation Plan*, and Kate Clark 2000, *Informed Conservation*.

The guiding conservation principles when undertaking a conversion of a historic building are similar to those used for repairs. These principles are set out in the conservation charters and are also identified in BS 7913, 1998. Works of repair should be the minimum necessary to stabilise the element or feature to ensure its long-term survival. In addition, the following points represent good conservation practice and should be built into any conversion project:

2.5.1 Proper assessment of the site.

There is a need to understand the previous history of the building if sympathetic repair or alteration is to be achieved. This can be a complex task in some situations and the time, effort and finance required should not be underestimated. The analysis of the site may require specialised architectural and archaeological investigations; through both on-site and documentary research (see below). Records of all elements of the site assessment should be retained.

2.5.2 Understanding the causes of defects and decay

To proceed with alterations, conversion or repairs without prior investigation of existing defects in the building can lead to abortive work and a recurrence of the problems. Moisture penetration, for example, is one of the most commonly misdiagnosed defects leading to inappropriate repairs that damage historic fabric, and may result in a recurrence of the problem. In this context it is advisable to adopt a holistic, environmental approach to the treatment of dampness and associated fungal decay of timber. The Historic Scotland publication, Palfreyman et al, TAN 24 (2002), *The Environmental Control of Dry Rot*, gives practical advice on this approach.

2.5.3 Unnecessary replacement and minimum intervention

A historic building will contain features that are original to it. There will almost certainly be later additions and alterations representing different periods in the life of the building. These later alterations and repairs may be important features of the building and are part of its history and character. Provided they do not seriously disrupt the architectural design and aesthetic value of the building, there will be a strong argument in favour of retaining these later alterations or additions. If, however, such work is considered for removal it should only be done after the most careful consideration of all implications, and the features to be removed and what lies behind should be fully recorded.

Replacement of historic fabric with alternative materials and components may adversely affect the appearance and authenticity of the building, and reduce its value as a source of historical information. A prime example is the replacement of original timber sash and case windows with modern PVCu frames. This entails a serious loss of authenticity, even when the replacement windows attempt to replicate the appearance of the original. Yet an honest repair of the original window could prolong its life for many years.

Over time all elements of the building fabric undergo decay, but the rate of deterioration will vary. Minimum intervention applied to repair means that historic fabric is replaced only where there has been a loss of function. Any intervention should show respect for the existing fabric and involve the least possible loss of that which is culturally significant.

Sometimes in altering or converting a building there can be justification for the removal of earlier work, which, though part of the history of the building, is not of appropriate quality, is not well integrated architecturally, and manifestly detracts from the overall quality of the architecture (BS 7913: 1998). If the building is listed prior advice should be obtained from the local planning authority, who may consult Historic Scotland.

2.5.4 Appropriate techniques and materials

Alterations and repairs should preserve the authenticity and historic integrity of the building. The techniques and materials used should match or be compatible with existing construction methods and materials.

Illus 2.2 Sandstone façade repaired with precast concrete synthetic stone instead of matching stone indents. Corrosion of steel reinforcement has caused spalling of the block. (Photo: D Urquhart).

Nevertheless, there will be pressure placed on designers and others to adopt modern materials and techniques because of a shortage of skills and expertise in the use of traditional materials, and a presumption that time or cost will be increased by their adoption. New materials, methods and techniques should be used only where they have:

- proved themselves over time,
- where traditional alternatives are no longer available or
- where the use of modern materials enables an important feature to be retained.

2.5.5 Hazardous materials

Some materials present in historic buildings may not be acceptable in modern usage for health and safety reasons but can be of historical significance. Many of these materials, for example lead paints, do not present a hazard unless disturbed and may be best left undisturbed. The same recommendation also applies when asbestos is encountered during the conversion on a historic building. The Health and Safety Executive's recommendation is that an asbestos-containing material (ACM) should not be removed if it is in good condition, but that steps should be taken to manage asbestos in buildings, which should include the following key stages:

- take all reasonable steps to determine the location and condition of materials likely to contain asbestos;
- presume that materials contain asbestos unless there is strong evidence that they do not;
- make and keep an up-to-date record of the location and condition of ACMs in the premises;
- assess the risk of the likelihood of anyone being exposed to fibres from these materials;
- prepare a plan setting out how the risks from the materials are to be managed;
- take the necessary steps to put the plan into action;
- review and monitor the plan periodically; and
- provide information on the location and condition of the materials to anyone who is liable to work on or disturb them, ie workers undertaking the conversion, or maintenance workers when the conversion has been completed.

Clearly, considerable responsibility is placed upon the persons involved in the survey of a historic building prior to conversion to ensure that all hazardous materials that may be present have been identified and recorded. Where the presence of hazardous materials is suspected, specialist advice should be sought.

2.5.6 Missing features

There will be occasions, in the conversion of a historic building, where it may be desirable to replace lost elements of a building. Typical elements are stone pinnacles, balustrades and timber structural members. The process of conversion may offer an opportunity to replace or reinstate the missing elements, provided that there is evidence for accurate replacement and appropriate consents have been obtained. It is sometimes the case that stone elements, including carved features, are replaced with replicas formed from non-traditional materials, such as precast concrete (synthetic stone), plastics and glass fibre materials, coloured to match the original elements. This approach is not normally accepted good practice for work on historic buildings.

Illus 2.3. An example of inappropriate replacement elements is illustrated on this B listed building. Stone brackets supporting the stone cornice have been replaced with reinforced precast concrete brackets. The reinforcement is corroding creating a risk of falling masonry. An original stone balustrade supported on the cornice has been removed. (Photo: D Urquhart).
Note: The sandstone façade has been subjected to inappropriate intervention (chemical cleaning and plastic repair) with resultant damage to the stone.

2.6 Importance of building surveys

While designers, surveyors and other professionals understand the need for detailed and accurate surveys of existing buildings when undertaking works of conversion or alteration, it is occasionally the case that surveys are conducted simply to record the physical dimensions and features of the buildings. Such an approach to surveys and recording may not be adequate for some historic buildings that can conceal surprises that should inform the design process.

The need for comprehensive investigation, survey and records to provide a complete picture of the cultural

value of the building, is a prerequisite to the development process. Clearly, the extent of any investigation of evidence will vary considerably depending on the cultural significance, age, history, size and complexity of the building. When trying to assess cultural value, the way in which the building has evolved informs the assessment of cultural value. Evolutionary factors to be considered are:

- construction,
- aesthetic,
- previous use and associations,
- context and
- present condition.

Conservation charters, identified by Bell above, and BS 7913 give guidance on this issue.

Box 2.2 Assessment of cultural value

1. **Charters**

a) Any work on a site must be preceded by professionally prepared studies of the physical, documentary and other evidence of cultural value, including where relevant an archaeological analysis of the ground.

b) Its condition should be assessed and all causes of decay and other defects should be diagnosed.

c) The gathering of information should not destroy any more evidence than is necessary for the protectional or scientific objectives of the investigation. Non-destructive techniques should be encouraged.

2. BS 7913: 1998: Criteria for alteration work

Sufficient survey, investigation, recording, documentary research and analysis should be taken in advance of design work, to ensure that the building is as well understood as is reasonably possible and the risks of accidental damage, destruction, missed opportunities or unexpected discoveries are minimised.

Many historic buildings are not entirely predictable in their form or construction. Rooms and spaces may not be symmetrical, wall thickness can vary, construction methods and materials can change with alterations to the building over time and parts of the building or historic features may be covered up. Large buildings and those that previously were or are currently in multiple occupancies, may have walls containing large numbers of flues. In addition, buildings of traditional construction are well ventilated and require the presence of ventilation pathways within the construction to remove moisture. These buildings may have other hidden voids, for example where redundant spaces have been covered up. These factors make the survey a more demanding exercise than in a more modern building. Identification of all hidden voids during the survey is of vital importance when a building is to change its use. The presence of undetected voids offer routes for the transfer of sound and spread of fire, or they may be inadvertently sealed up and thus limit the ability of the structure to remove moisture from the construction. The investigation of voids inaccessible to the naked eye can be carried out relatively simply by endoscopy, in which it is necessary to drill a small diameter hole (normally less than 12mm) to gain access.

All investigative methods used on historic buildings must respect the historic fabric and, as far as possible, avoid damage to the fabric. Some historic buildings may demand a survey that will be outside conventional skills and expertise of practitioners using traditional survey methods. The special demands of recording a historic building are explained in the Historic Scotland *Guide for Practitioners 4*. A number of non-invasive investigation and recording methods (TAN 23, 2001) can be grouped into three main categories:

- Electro-magnetic methods (impulse radar, thermography, metal detection, free electro-magnetic radiation),
- Nuclear methods (radiography),
- Mechanical methods (ultrasonic pulse velocity, impact-echo).

In most cases the investigations should be carried out by a specialist surveyor, with the assistance of an archaeologist experienced in the recording of standing buildings or an architectural historian who supports and interprets the results of the main building survey (Wood 1994), and may feed them into a conservation plan.

2.7 The economic reuse of existing buildings

Almost all buildings are capable of use that will be beneficial to society. Apart from buildings scheduled as ancient monuments, where their existence can be justified on cultural grounds alone, the existence of buildings depends on their economic value to society: they must 'earn their keep'. Perhaps inevitably, the judgement of the ability of a building to earn its keep is often too narrowly focused on the short-term return on invested capital. Whole-life cost of a historic building is rarely considered in a development to convert the building to another use.

One of the principal differences between a new building and the conversion of an existing one is that the selection of materials, constructional forms and techniques may be limited in the latter, whereas in new-build the choice is wide and limited mostly by cost. In conversion work, each project is unique and experience on one building, especially relating to cost data, can not always be transferred directly to another building. The room to manoeuvre may seem to be less than with new-build, as options relating to choice of materials or construction methods may be limited to those that will perform well in conjunction with existing fabric. A large part of the success or failure of a development may be attributed to initial decisions, but at each stage of the process it is necessary to consider what effect changes to the building will have on ultimate value, both financial and cultural.

When comparing the cost-in-use, the advantage of a modern well-insulated building in terms of heating costs might seem clear. While a converted building of traditional construction can be improved – indeed, will have to be improved to meet the new regulations – it is unlikely to match the energy efficiency of a new building. Yet this ignores the significant amount of embedded energy contained within the fabric of an existing building. It will usually be difficult to insulate an existing building to the same standard as a new building without adversely affecting historic fabric. However, most buildings of traditional construction are more easily maintained over long periods than their modern counterparts; major repairs to the external fabric are less likely. The occupancy cost of most converted buildings may exceed that of a purpose-built modern building due, for example, to more generous space standards such as ceiling heights and common landings presented by the existing building. On the other hand, these restrictions are often balanced by the prestige of the building and its environment. A large house divided into a number of smaller ones gives some of the newly created flats the opportunity to have extraordinary living rooms with proportions and finishes unimaginable in a newly built house of similar cost. They can, then, hold their value well.

It is sometimes thought that listed buildings can be more difficult to sell or lease, because it is perceived by prospective purchasers or developers that the fact that it is listed imposes a constraint. It may alternatively be argued that a listed building presents an unmatched opportunity to the right developer. There is also the poorly-founded argument that historic buildings are more difficult and expensive to maintain. This view tends to ignore the financial, social, cultural and environmental costs of frequent replacement of, usually, poor quality, short-life buildings.

Some historic buildings are in areas of economic and social decline. These areas tend to provide a high proportion of the buildings identified in buildings-at-risk registers[‡]. Local authorities and Historic Scotland will be keen to ensure that these become vehicles for regeneration. The rotation of buildings on the register serves in part as an indicator of economic health as well as of the energy devoted locally to regeneration through heritage.

For buildings within many conservation areas, there is a view among estate agents that the security provided by a conservation area may have the effect of increasing the value of an individual property. Being within a conservation area means that there is stability in the area. Development must enhance or preserve the character of that area, and the freedom of surrounding property owners to adversely change the quality of the built and natural environment is curtailed (PAN 71,2004 *Management of Conservation Areas*).

Historic buildings that are in good condition help to make the surrounding environment more secure. By reusing existing buildings and bringing them up to modern standards, the environment is improved and maintained, and economic activity stimulated. For office and retail premises, owners or occupiers may pay higher rents for buildings they perceive to be of high architectural merit and cultural significance.

The argument for reuse, as opposed to demolition followed by new build, is further reinforced by the use of appropriate traditional skills in conversion or rehabilitation. Conservation is generally labour-intensive and demands higher skills in using locally-sourced and sustainable materials. The use of traditional skills in such circumstances promotes local employment opportunities and encourages training.

2.8 Financial considerations: Value Added Tax

A factor that has a significant effect on the decision to convert a historic building is the additional cost of Value Added Tax (VAT). The current standard VAT rate of 17.5% is applied to most work to existing buildings, unless it can be charged at either a reduced rate of five percent or is 'zero-rated'. The legislation surrounding VAT is very complex, and developers should seek advice from HM Revenue and Customs before any work is undertaken regarding the position of each individual building with respect to the application of the reduced rate or the zero-rate of VAT. The VAT legislation, unfortunately, does not offer any general relief for historic and listed buildings. Any relief is dictated by the individual circumstances of each project.

The reduced five-percent rate applies to conversions carried out in the circumstances outlined in Box 2.3.

[‡] see http://www.buildingsatrisk.org.uk/

Box 2.3 Application of reduced rate VAT to conversions in the following circumstances;

1. Conversion of a dwelling resulting in a change in the number of dwellings.
2. Conversion of a dwelling into a multiple occupation dwelling.
3. Converting a non-residential property into a single household dwelling or number of dwellings.
4. Conversion of a dwelling or multiple occupation dwelling to a building intended for 'relevant residential purposes' (see definition below).

Relevant residential purpose: a home providing residential accommodation, student accommodation or personal care, including army accommodation, hospices or any institution which is the sole main residence of 90% of its residents.

For a building to be 'zero-rated' the following conditions must apply:

a) The work must be to a 'protected building', which includes listed buildings or scheduled monuments, and be identified as indicated in either (b) or (c).

b) It is an 'approved alteration'. Approved alterations are alterations that cannot be carried out without Listed Building Consent and have received such consent (these do not include repairs or 'incidental alteration', which are carried out as a result of the need to repair the structure of the building).

c) It is a 'substantial reconstruction'. A 'substantial reconstruction' is where no more than the external walls of the building remain, and/or the total cost of the approved alterations (excluding repairs) represents 60% or more of the total cost of the work.

In addition, the refurbished building must be used as either a dwelling for a 'relevant residential purpose' (see Box 2.3) or for a 'relevant charitable purpose'. A 'relevant charitable purpose' is use by a charity for non-business activities or to provide social or recreational activities for a local community.

2.9 Appropriate solutions in the conversion of historic buildings

To reach the most acceptable solution in the conversion of a historic building, due regard must be paid to the form, structure and internal arrangement of spaces. It therefore follows that, when a conversion is proposed, the building should be as well understood as possible so that the risks to the building are minimised and so that the work may actually enhance its character. BS 7913:1998 provides more detailed information on the criteria for alteration work. Some of the key points are identified below:

a) Some buildings or parts of buildings are of such quality, importance or completeness that they should not be altered, except in the most exceptional circumstances.

b) Consideration should be given to the desirability of being able to reverse changes to the building. That is, the ability for new work to be removed without damaging the pre-existing fabric. The building shown in Illus 2.4 is a former Category A listed spinning mill (circa 1793), within which the unique construction of flagstone floors on a grid of I-section cast-iron joists and beams has been preserved. New floors and ceilings formed for the conversion to apartments encase the historic floors, which, although hidden from view, are retained in place with all the original construction intact.

c) Disturbance to significant existing fabric should be avoided. The need for alterations should not justify the removal or destruction of material of architectural or cultural significance.

Illus 2.4 Former spinning mill (listed Category A) converted into apartments. An important issue in the conversion was the unique cast-iron structural system. The extension to the side with large glazed areas is a restaurant cut back from a bigger shed. The glass belvedere replaced a long-missing cupola for a water tank and bell (Photo: D Urquhart).

d) Where an addition to the building forms part of the development, the addition should be blended with existing work and not viewed in isolation. It should have architectural integrity as a whole and with its setting. In some cases this will mean it should match the existing. However, it is sometimes appropriate for an addition to be different and distinguishable from the existing building, but the new materials should be carefully matched.

Illus 2.5 This early C19 listed Category B, former bank building, has been disrupted internally to accommodate conversion into two-bedroom apartments (Photo: D Urquhart).

The identification of existing compartmentation within the building can inform the design process with respect to the provision of fire resistance. The creation of new spaces that result in the alteration of existing spaces and the destruction of fire resisting compartments may create added difficulties in achieving the necessary fire resistance. In addition, the creation of new spaces can have a destructive impact on the character of a historic interior.

It is sometimes the case that, to ensure the economic viability of a development, the developer will decide to convert a building to a use that will adversely affect internal spatial arrangements. Illustration 2.5 provides an example where a specific number of two-bedroom apartments were required by the development brief, which resulted in a major alteration of the existing spaces and consequent destruction of much of the internal finishes. A more flexible specification of accommodation provision may have been more sympathetic to the existing internal spaces, and avoided the loss of historic fabric such as internal lath and plaster, plaster cornicing and flooring.

Illus 2.6b Innovative conversion of a sandstone and iron-framed building (exterior view).

Illus 2.6a Innovative conversion of a sandstone and iron-framed building now part of a business and retail park (interior view). While the conversion of the building results in a modern, practical and economically viable development, the important historic features have been retained, as can be seen from the sandstone façade and the internal structural arrangement of columns, beams and floors. Historic columns and beams are retained behind a new façade cut across a very deep-plan yarn store. (Photographs ©Historic Scotland Photo Library).

3. PERFORMANCE OF TRADITIONAL BUILDINGS: MATERIALS AND COMPONENTS

3.1 Understanding Scottish traditional buildings*

Historic buildings, built using traditional materials and methods, form a significant proportion of the total building stock of Scotland and so should be familiar to all who work on them as either designers or as builders. Unfortunately, this assumed familiarity does not always hold good, as the skills necessary to fully understand such buildings, and to carry out repairs and alterations, no longer reside within the knowledge and experience of some generalists working in the construction industry. It has become an area for the specialist, whether designer or contractor. However, as existing traditional buildings form a large percentage of the total building stock, it is likely that practitioners who do not possess all the requisite knowledge and skills will be engaged to carry out works of conversion and rehabilitation. The development and expansion of the 'do-it-yourself' market poses a risk to historic buildings. Components and materials supplied to meet this demand are not generally compatible with existing historic materials and may compromise the historic character and long-term health of the building.

Box 3.1 Building warrant

A conversion will require a building warrant. Windows, doors and rooflights will be included as part of the insulation of the envelope, in which case the building envelope will be improved to as close to the standards as reasonably practicable.

3.1.1 Stone masonry construction

Traditional materials and methods of construction cover a vast range, but many materials and methods can be confined to specific geographical areas because they were sourced from their immediate locality. Distinctive buildings resulted from this diversity of methods. However, a common feature of most traditional buildings is that they contain soft, weak or permeable materials, such as lime mortars, plasters, renders and paints. The resulting building fabric is permeable to the passage of moisture and water vapour. The response of these buildings to environmental conditions and structural, thermal and moisture movement is quite different from that of more modern buildings that use hard, strong and often impervious materials and membranes.

There is a considerable diversity of materials and methods found in historic buildings. In addition to the most common forms of structures, where stone walls built in lime mortar with slate covered pitched roofs are seen as the principal Scottish building method, there are other forms of structures, including earth structures. Earth structures are quite common in Scotland where they can occur as houses (mainly cottages), agricultural buildings, civil engineering works and the like. More information on earth construction can be found in Walker et al *Technical Advice Note 6* (1996).

An example of tempered-earth construction is contained in the Category A listed Foulis Castle (Illus 3.1). The wall construction is timber standards with horizontal

Illus 3.1 Foulis Castle, Evanton, Ross and Cromarty (Photo: D Urquhart).

* Today, the term traditional building is misleadingly used to mean the techniques and materials employed to build concrete blockwork, apply cement rendering and erect plasterboard sheeting, for example. Applying this level of knowledge and experience to historic buildings can cause them additional stress leading to loss of authenticity, and often to accelerated decay.

Illus 3.2 Sympathetic conversion of former storage building at Foulis Castle into a family home with rubble walls lime harled, with sandstone facings to openings (Photo: D Urquhart).

Illus 3.3 Clay and bool cottages (C(S) Listed), Morayshire. Unfortunately, now rendered with a hard cement mortar Note: boulder base course and modern slated roof, which replaces the original traditional 'clay thatch'. (Photo: D Urquhart).

Illus 3.4 Example of a clay and bool wall, Morayshire (Photo: S Montgomery, Historic Scotland).

Illus 3.5 Despite its traditional appearance, this C(S) listed building (Waverley Buildings, Stornoway) is constructed from concrete. (Photo: Andrew Wright).

rails enclosed in a tempered-earth mortar (a blend of soil particles). Perhaps the key point is that the external appearance of the building is superficially similar to rendered rubble wall construction and, should any work be proposed to the building, the way in which an earth wall performs must be fully understood if permanent damage to the wall is to be avoided.

With the development of Portland cement in the early C19 came the introduction of mass concrete as a walling material; there was a proliferation of mass-concrete buildings in parts of Scotland in the 1870s, particularly in the Perth and Dundee areas. It is therefore important to understand the nature of the walling material, as the superficial appearance of these buildings may be not dissimilar to the more usual forms of masonry-wall construction (Illus 3.5).

Historic buildings are particularly susceptible to dampness when hard cement renders have been applied as an external finish, without a full understanding of the way in which such walls function. Hard external rendering, intended to keep the rain out, frequently has the opposite effect. The hard and relatively impervious mortar restricts the rate of evaporation from the wall and the wall remains wetter for longer. Also, hard mortars are prone to cracking, which directs rainwater run-off into the wall and traps the water behind the render.

3.1.2 Brickwork

Although the use of brick as a traditional construction material in Scotland dates back to at least the mid-C17, it was not in common use. The brick tended to be sourced from local brick and tile works where the main output was clay pipes for field drainage. These local bricks were sometimes soft and of poor quality for building work, and as a result would not always perform well in the Scottish climate. Many C18 granite buildings in the

Illus 3.6. Brick-built flax warehouse on a reinforced concrete frame, built in 1912, converted to up-market apartments. New rectangular windows have been cut through beside the original arched loading doorways that were accessed from external steel landings (Photo: D Urquhart).

Aberdeen area have brick chimney flues and stacks, and brick is found in most parts of Scotland in C19 internal walls, rear and side elevations. Many urban stone-fronted commercial buildings employed brickwork on lesser elevations, such as the glazed brick used in lightwells. By the second half of the C19 the brick used was of a higher standard, and may be as robust as stone.

Most entirely brick buildings are built from 1860 or later, for industrial, commercial, agricultural and military purposes. A number of brick buildings might be suggested for conversion: usually large industrial or warehouse buildings, perhaps in polychrome brick. The classic example is Templeton's carpet factory in Glasgow Green, where the brick has weathered better than its stone details. After development as a business centre by the Scottish Development Agency in the 1980s, some of the buildings are now switching function to residential uses, demonstrating the versatility of the building type. An example of a conversion of a large brick-built flax warehouse is shown in Illus 3.6. This has non-traditional reinforced concrete floors, relatively early for its construction date, 1912.

The performance of buildings in brick is very similar to sandstone. Brick, like sandstone, is a porous material that is permeable to the passage of moisture, except where hard, dense engineering-quality bricks have been used. The normal rules that apply to the conservation of other masonry buildings apply to brick buildings.

3.1.3 Timber construction

Single-skin timber-framed buildings are also a traditional form of construction in Scotland. They mostly occur as houses, cottages, farm buildings, small railway stations, village halls and the like, which sometimes undergo conversion. Unfortunately, to reduce maintenance costs or occasionally to attract a mortgage from a bank or building society, such buildings were sometimes clad externally with brick or concrete block, or covered with a cement render on metal lathing in an attempt to make them look like conventional masonry buildings. These 'improvements', whilst destructive to the character and appearance of timber buildings, are also likely to be damaging to the timber structure, the timber cladding and also the interior finishes. Hard cement-based renders are unable to accommodate movement of the timber structure, and are likely to crack and admit rainwater into the structure. Moisture trapped in the structure cannot readily evaporate through the render, or any applied impervious paint films, and can lead to the rapid development of fungal decay in the timber.

However, when properly maintained, such buildings have a long life and are a valuable cultural resource; they should not be lost through ill-informed alterations.

Illus 3.7 Well-maintained, single-skin timber framed house (Photo: D Urquhart).

Illus 3.8 Category B listed former Victorian railway station converted to a variety of uses, including tearoom, shop and tourist information centre (Photo: D Urquhart).

3.1.4 Other structural systems

Other structural materials encountered in historic buildings are:

- cast-iron beams, commonly early to late C19,
- cast-iron columns, commonly late C18 to early C20,
- wrought iron, commonly mid to late C19,
- mild steel, late C19 onwards,
- filler-joist floors, late C19 to early C20,
- flitch beams combining timber and iron, late C18 to mid C19,
- reinforced concrete.

Many C20 buildings were constructed of reinforced concrete and a relatively small number of these are listed as of architectural or historic interest. Unfortunately, reinforcement corrosion is common, principally associated with carbonation, which causes substantial spalling of the concrete. Dealing with this problem is outside the scope of this book and specialist advice should be sought.

Most changes of use are from the more usual masonry-clad buildings constructed from loadbearing stone walls. They may be framed buildings with frames formed from cast iron, wrought iron, mild steel (or a combination of these) or reinforced concrete beneath a stone or brick cladding. These often respond well to changes of use in which non-traditional approaches to some elements may be appropriate (Swailes 2006).

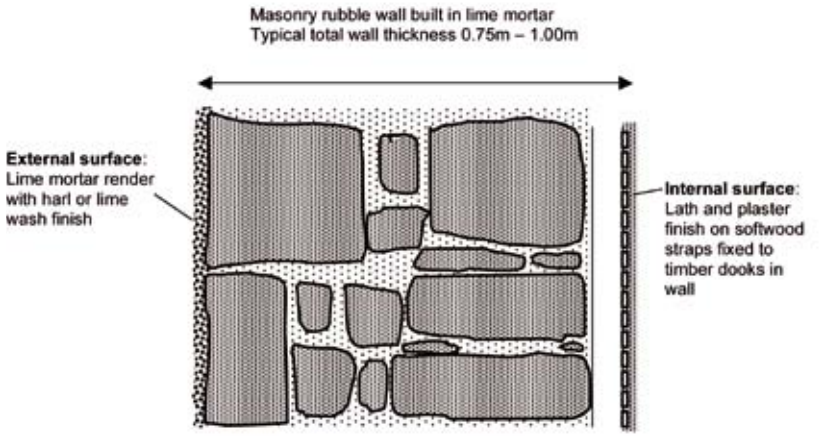
3.2 Traditional materials and components

3.2.1 Stone walls

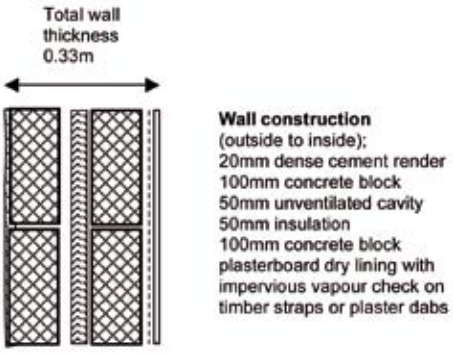
The traditional wall in Scotland is of rubble because it was the cheapest local material available for building masonry walls of all kinds. For more important buildings or façades, ashlar masonry was used, which may have a polished, stugged, droved or broached finish.

A comparison of typical traditional and modern wall construction methods is shown in Illus 3.10 and 3.11, and the principal differences are summarised in Table 1. Traditional construction in the table refers to sandstone and similar porous stones. Walls constructed from stones that are non-porous, such as granite and whinstone,

Illus 3.9 Traditional Scottish sandstone rubble wall. Conversion of former hemp works (Photo: D Urquhart).



Illus 3.10 Typical traditional Scottish masonry wall with internal dry lining.



Illus 3.11. Typical modern masonry wall construction.

are common in parts of Scotland. The stones have a significant impact on the ability of the wall to react to changes in moisture content. In a wall constructed of non-porous stone, moisture may not evaporate so quickly from the core of the wall as it will from a wall with more porous stones. Such a wall relies on the permeability of the mortar to effect evaporation, so that once the mortar becomes saturated it will remain wetter for longer.

A granite wall, with an ashlar facing and fine joints, can be highly water resistant when the pointing is in good condition: but when the joints are open – or even where there are fine cracks in the joints – the impervious nature of the stone encourages significant volumes of water to enter the wall through the joints, because no water is retained by the stone itself. Evaporation of moisture from the core of the wall can only take place towards the inside face where the mortar joints are much wider, and if air is stagnant at this face any timber that is in contact will be vulnerable to the dry rot fungus (*Serpula lacrymans*). During the conversion of these buildings it is important to assess fully the moisture condition of the walls and ensure that adequate ventilation of internal surfaces is maintained.

Table 1 Comparison of traditional masonry wall and modern masonry wall constructions.

Traditional masonry wall	Modern masonry wall
• Massive construction, thick walls	• Relatively slender construction
• Porous, highly permeable construction	• Porous materials but low permeability finishes
• Large volume of absorbent materials (porous stone and mortar)	• Limited ability to absorb moisture
• Moisture can penetrate into and evaporate easily from the wall. This helps stabilise moisture levels in rooms	• Moisture within the wall not easily evaporated
• Modern levels of insulation may not be achievable	• Insulation materials may be adversely affected by moisture
• Construction can absorb small thermal and moisture movements	• Well insulated construction • Prone to cracking due to hard, brittle materials • Cracks in external finishes permit water penetration into construction
• Air movement required behind dry lining to prevent raised moisture content of timbers	• Ventilation of cavities not required
• Damp-proof course not normally installed	• Damp-proof course essential
• No vapour checks or barriers	• Vapour checks integrated into construction

It will be clear from Table 1 that the traditional soft, porous finishes should not be replaced with harder and less permeable finishes used in modern construction. The use of strong, modern cements in place of lime mortar in renders and in stonework will adversely affect the performance and long-term health of the wall. If any alterations or repairs are required they should be carried out in materials that ultimately match the composition and strength of what exists already. New work should never be stronger or denser than the original, as this can promote deterioration of the original fabric. A wall of traditional construction is unlikely to be able to tolerate much change without affecting its moisture balance, or without the increased risk of decay of timber elements in contact with the wall.

A building warrant is not required for repairs, provided that *'the work, service, fitting or equipment is to a standard no worse than present.'* Further information on repairs and building warrant implications is contained in Section 3.4.

Where the stone in a façade is ashlar, past repairs to decayed stone frequently take the form of 'plastic' repairs, often in a cement-based mortar or proprietary mortar. If repairs to stone are needed as part of the conversion of the building, the opportunity should be taken to repair decayed stone with appropriate replacement stone indents. If past plastic repairs are accelerating decay of adjoining stone they should similarly be replaced by natural stone indents.

3.2.2 Plasterwork

Most historic buildings employed lime plaster as the internal finish. The earliest lime plaster was applied 'on the hard', that is it was applied directly to the masonry background of stone and lime mortar, usually in three coats, giving a total thickness of 11-13mm. Timber lath as a background material was introduced at the end of the C16, and allowed plaster to be applied to both walls and ceilings. This became the standard background for plasterwork until the 1930s. Hair was added to the mix to increase the tensile strength of the plaster, which had to be self-supporting between the timber laths. From the 1940s lime plasters were largely abandoned for new work, to be replaced by cement-gauged coarse stuff or by gypsum plasters or lime/gypsum plasters for all coats. More information on historic plasterwork is given in

Technical Advice Note 2 (Simpson and Brown 2002).

Historic plaster is vulnerable to damp conditions. The unwanted presence of moisture is the most common cause of problems. Dampness dissolves and mobilises salts that may be present in contaminants in the plaster or in adjoining construction. Where the salts are allowed to crystallise on the surface, they can be brushed off, but where they form behind an impervious paint film, for example, they can weaken the plaster by expansion of the crystals leading to spalling and surface breakdown. Only vapour-permeable paints and other surface treatments should be applied to traditional lime plasters.

3.2.3 External coatings and renders

A traditional masonry wall is porous: it has the ability to absorb and release (transpire) water and water vapour without deleterious consequences. Lime coatings were the traditional means of finishing walls, to provide both a decorative finish and a sacrificial coating as protection to the rubble wall. Clay, either on its own or in combination with lime, was also used on vernacular buildings. The development of Portland cement in the C19 also meant that some buildings were coated with early forms of cement, for which a number of recipes were patented. These early Portland cements and mortars do not have the strength of modern cements and are thus less damaging to historic fabric. A variety of lime coatings were used, and are described in Technical Advice Note 15 (The Scottish Lime Centre 2001), the most common being:

- lime harling,
- lime renders,
- modelled and decorative surfaces,
- sneck harling and
- coloured limewash.

Wherever possible, the original finish should be respected during the conversion of a historic building. Later coatings, using harder cement mortars, should be removed if causing harm to the character or fabric of the building, and the surface reinstated with an appropriate lime-mortar coating. It is common to find that historic

Illus 3.12(a) Recent lime coating showing exceptionally high moisture loading in the wall due to water penetration at roof level and to moisture from the ground. (Photo: D Urquhart).
Note: Prior reduction of moisture in the wall is required to ensure that new lime coatings will not fail. In this case repairs to skews and chimneys, a lower ground level and installation of drainage is recommended.

Illus 3.12(b) Good example of recent lime coating on a restored Category A listed building. (Photo: D Urquhart). Note the new DPC below the garden wall cope.

Illus 3.13 Typical failure of hard cement render on a soft mortar rubble wall. (Photo: D Urquhart).

buildings have been coated with incompatible materials during C20 repairs. All too often this has resulted in the decay of stone and lime mortar, due to entrapped moisture behind the render and differences in the permeability characteristics of the hard cement mortar and the stone. The common practice of removing traditional rendered finishes to leave exposed the rubble wall below, which is subsequently pointed up in hard cement mortar, reduces the weather-resisting properties of the wall and also adversely affects its character.

There are a number of C19 and early C20 rubble-built buildings where sometimes the whole of principal elevations may have been modelled in a smooth cement render, permanently achieving what could only be transient in lime. In Stornoway, dressed lintels and the like often prove to be of concrete. As this forms part of the architectural character of the building this should not be removed or tampered with unless proven to be damaging the structure.

3.2.4 Roof coverings

Pitched roofs are traditionally covered with slates, stone slates and flags, clay tiles (including pantiles), and thatch. In order to retain the patina and historic character that they possess, and to be sustainable, every effort should be made to retain as much of the original material as is possible during conversion or refurbishment. Sometimes a decision is made to replace the original slates on the basis that the roof has failed. However, failure of a slate

or tile roof is more often due to corrosion of the nails fixing the slates or tiles to sarking or battens, or to the decay of timber roof elements, than to deterioration of the slates or tiles themselves. These traditional materials are an essential feature of the character of the property and their replacement with modern, substitute roof coverings can lead to a permanent loss of that character. A careful assessment of the existing roof slates or tiles should be carried out before a decision is made to replace them.

Often there are insufficient existing slates to complete the work, so it may in some circumstances be acceptable to ensure that the existing sound slates are laid together on visible slopes, with new natural slates used on less prominent slopes. They should as far as possible match in terms of thickness, colour and surface texture, where appropriate graded at diminishing lengths and varying widths (as is normal practice with Scottish slates laid on sarking).

Other roof features, such as ridges, hips, verges and valleys, should, where necessary, be replaced in their original form. Features such as ornamental ridge tiles of clay, lead or iron are particularly valuable and are often capable of reuse. If they cannot be reused or repaired, they should be replaced with features of matching design and material.

These traditional roofs are to a large degree permeable: roof voids are well ventilated and slating felts or underlays are permeable to water vapour. The construction therefore helped to maintain the moisture balance within the building.

3.2.5 Windows

Windows play a vital role in determining the character of a building and, as a general rule, their design, materials and detail should not be altered as part of a building conversion. Where it is possible existing windows should be retained and repaired when necessary. Guide for Practitioners 3 (Newsom 2002) gives guidance on the conservation of timber sash and case windows. The traditional timber sash and case window, when properly maintained, is a long-lived asset and is capable of repair that will significantly prolong its life. Where new windows have to be installed, or existing windows replaced, the design of the original windows should be respected, and features such as the depth of reveal greatly affect the character of a building. New openings should therefore be designed to conform to the original design of openings so that the 'texture' and character can be maintained.

Metal windows are encountered in historic buildings, in industrial and institutional buildings, and in housing. The mass production of hot-rolled steel windows in the C20 provided the opportunity to introduce window frames that were strong, slim and non-combustible. Unfortunately, many such windows have been poorly maintained, are prone to condensation problems and suffer from corrosion. Nevertheless, such windows may be historically important to the character of the building and, wherever possible, should be preserved.

Illus 3.14 Early C20 listed Category B apartment building with steel windows. (Photo: Historic Scotland).

The most common reason given for window replacement during a conversion is to conserve energy by replacing single-glazed windows with double-glazed windows. It is frequently claimed that replacing timber windows with PVCu or anodised aluminium-framed windows will reduce maintenance costs, but this will not necessarily reduce the whole-life costs of windows when the short life of PVCu windows, for example, is considered. Listed buildings and buildings within a conservation area have some measure of protection through the need for listed building consent and planning permission. Unprotected historic or traditional buildings, however, are at very high risk of damage to their appearance from the installation of inappropriate windows. The new 2004 Regulations allow the whole building envelope to be considered as an insulating system, which requires that the building envelope be improved to as close to the requirement as reasonably practicable. The unique qualities of the historic windows may not need to be compromised as energy savings can be achieved elsewhere in the envelope, or by other measures.

Schedule 3 of the Building Regulations does not require a building warrant for the replacement of windows and doors when the replacement meets the standards; but where it is not a complete replacement, but a repair, the repaired window or door should be no worse than at present. However, a conversion requires a warrant, which will be required for the conversion and will include the windows and doors. For energy purposes the regulations require the insulation of the envelope (including windows and doors) to be improved to as close as is reasonably practicable, and in a way that is

Illus 3.15(a), (b) Replacement PVCu double glazed sash and case window (bottom window in exposed rubble wall). While resembling the timber sash and case window above, the wider frame and glazing bars detract from the character of this Category B listed building (1790) converted into apartments. (Photo: D Urquhart).

suitable for a historic building. Annex 6N3 of Section 3 of the Technical Handbooks, *Conversion of historic buildings,* offers considerable flexibility as to how this issue may be addressed. It is likely that the insulation of the window may not have to be improved to the level defined by current standards. However, other approaches to energy conservation should be incorporated within the building where these do not adversely affect the historic character of the building.

In the case of a conversion, windows, doors and rooflights will form part of the insulation envelope. For more detailed information on complying with the standard, reference should be made to Part II, Section 6.2.4 *Windows and doors.*

The energy efficiency of timber sash and case windows can be improved by draught-proofing, which will have a significant effect on air leakage and sound transmission and improve the perceived comfort of occupants. In well-made timber sash and case windows there will always be some degree of air penetration between the window elements, and this small amount of ventilation is beneficial to the fabric of traditional buildings. Care has to be taken, when draught-stripping is applied, that air leakage is not reduced to the extent that indoor air quality is affected, and the air supply to combustion appliances compromised.

Many historic buildings still retain their original timber shutters, which can be brought back into use to provide useful night-time thermal insulation. They also add an additional security dimension to a window. In many cases, roller blinds or heavy curtains can also provide significant reductions in night-time heat loss. Typical thermal transmittance values are shown in Box 3.2 (English Heritage 2002):

Box 3.2 Indicative U-values for vertical windows

Single-glazed window	U≈ 4.8 W/m²K
Double-glazed Low{ glass	U≈2.0 W/m²K
Secondary glazing	U≈2.9-3.4 W/m²K
Single-glazed plus curtains	U≈3.6 W/m²K
Single-glazed plus night shutters	U≈3.0 W/m²K

3.2.6 Dealing with replacement windows in historic buildings

During a conversion there may arise a situation where an existing component, such as a window or door, is itself a replacement for the original. The replacement may be a contemporary design constructed with new materials and, although complying with the building standards, may conflict with the original character of the building. In the case of a historic building, there will often be a desire, or indeed policy, to return the building to its historic appearance by removing discordant components and replacing them with ones that better respect the character of the building. Unless it is part of a conversion, a replacement component such as a window does not require a building warrant.

A typical example of this situation is where original single-glazed, timber sash and case windows have been replaced with modern PVCu or aluminium double-glazed units. If these are recent windows, a U-value of 2.0 W/m^{2}K or less is possible. Replacing the plastic windows with traditional single-glazed timber sash and case windows will result in windows that are of a lower thermal standard than was previously the case. Even with the benefits offered to historic buildings by the 2004 Building Regulations, this will, as a rule, result in a failure to meet Energy Standard 6.2. However, the installation of windows that do not exactly replicate the original will usually have a significant impact on historic character. Finding a suitable solution to this situation may involve compromise. The options that may be appropriate are:

1. Where the historic importance and character of the building is such that only the use of replacement single-glazed windows with narrow astragals (window bars of 18-22mm width) will protect this character, then improvements to the energy efficiency of the conversion must be achieved by other means. It is likely that this will apply to many listed buildings and buildings in conservation areas. Even in these cases, it will be required to ensure that the thermal performance of the window is improved. Recommended methods are:

- draughtproofing around window frames, while ensuring that ventilation is maintained and strength is not compromised;
- refurbishing and bringing back into use any existing wooden shutters, and installing insulating blinds for improved night-time thermal performance;
- secondary glazing (100mm air gap is recommended) will improve thermal and sound insulation and can be relatively unobtrusive, although narrow window cills and the presence of internal shutters may prohibit their use. See HS Practitioners' Guide 3, Chapter 5;
- loft insulation or other means of improving thermal efficiency of the building.

2. In cases where historically there were no astragals, or where the astragal is of more than 25mm thickness, the use of replacement windows, with double-glazed units and low-emissivity glass coatings, can meet the performance standard required. These are commonly described as 'one over one' or 'two over two'-paned windows. Even the best replacements may not exactly replicate the original windows due to the frame thickness required to accommodate the glazing unit and the additional spacer bar. Double-glazed timber sash and case windows will normally require a spiral balance system, rather than weights, due to the weight of the glass. They will still be expected to open in a traditional manner when fitted in listed buildings.

Further guidance on the importance of window details and the circumstances for evaluating proposed changes to windows is obtainable from the Memorandum of Guidance on Listed Buildings and Conservation Areas (1998), 1.2.4 - 1.2.11.

3.2.7 Doors

Doors and door openings, like windows, are key elements in defining the character of a historic building, and their replacement with doors of modern design or materials should be avoided (note the comments in Section 3.2.5, Windows, with respect to replacement doors and windows). Doors in historic buildings are predominately of timber construction, which means that most are capable of repair and refurbishment that will retain their historic value, and external doors can usually be draughtproofed with little difficulty. The two main regulatory requirements for doors that can create significant difficulties in compliance are access and fire protection. These issues are discussed in more detail in Chapter 6.

3.2.8 Environmental considerations

One of the primary objectives of the building regulations is to reduce the environmental impact of a building, including its construction and use, over its lifetime. A useful reference on this aspect is the *Green Guide to Housing Specification* (Anderson and Howard 2000), which gives the environmental rating to over 250 construction products. In the conversion of historic buildings, where insulation of the envelope may have to be improved in appropriate situations, the environmental impact of the insulation materials should be considered. For example, the use of materials associated with ozone depletion or climate change, such as hydrochlorofluorocarbons (HCFCs) and hydrofluorocarbons (HFCs) should be avoided. Renewable and recycled materials, including

Illus 3.16(a) The door on the left is an inappropriate modern replacement plastic door in this traditional 1914 building (Photo: D Urquhart).

Illus 3.16(b) The door on the right is an acceptable modern timber door in a building (circa 1904) converted to apartments and replaces a door that was not original to the building (Photo: D Urquhart).

recycled cellulose, cork, sheep's wool and low-density mineral and glass wool all score well in the Green Guide.

The environmental impact of windows and doors contributes 5 – 10% of the embodied environmental impact of a house. The Energy Saving Trust (2004) refers to the poor environmental rating of PVCu and aluminium when used for the manufacture of doors and windows. Timber windows and doors, which are normally more compatible with historic buildings, do not require much energy in their manufacture and score particularly well.

3.3 Use of modern materials and methods

3.3.1 Avoiding unnecessary damage

In many situations, the process of converting a historic building will require decisions to be made about the choice of materials and methods to be employed. Of course, the first priority is to preserve as much of the historic fabric as possible. Nevertheless, there will inevitably arise situations where new materials and components must be employed to meet the needs of the conversion.

Before any decision is made to replace existing materials and elements, it is essential to conduct a full appraisal of their condition, and structural capabilities where appropriate. Too often, the easy decision to replace existing with new is made because a lack of knowledge and understanding of historic materials has resulted in uncertainty about their capabilities. Proper investigation and appraisal may show that either the existing elements will meet the new requirements or, with a little ingenuity, can be sympathetically adapted or strengthened to meet the new situation. For example, existing timber joists or beams may be strengthened by the use of steel flitch plates, or by the insertion of additional timber members alongside the existing ones. Methods such as these may avoid the need to use deeper joists or additional supporting beams that will be destructive to existing finishes.

Where timber, or indeed any other traditional material, has to be repaired the repairs should be carried out using traditional materials and methods, ensuring that all sound material is retained, and replacing only what is essential to ensure proper function. The use of recycled materials; for example, second-hand slates, stone, timber and timber components will minimise the consumption of materials and energy required for demolition and redevelopment. However, the stripping out of historic materials from old buildings that are capable of viable reuse should be avoided. New natural materials are preferred to second-hand material of doubtful provenance.

Wherever possible, new materials should be matched to or be compatible with existing materials and methods of construction. The insertion of new materials and methods, which do not respect the original construction, can have an adverse effect on the appearance and integrity of a historic building. For example, in the division of a room into two compartments, the use of modern plasterboard with taped joints is unlikely to be compatible with the traditional finishes in the rest of the room. New methods should only be used where traditional alternatives cannot be identified or sourced, or where they enable traditional features to be retained.

Sometimes even the use of a traditional material can be a problem if its compatibility with the existing is not carefully considered. An example of this situation is where new sandstone has to be inserted into an existing façade. Matching stone has typically been selected on the basis of best colour match with the existing, but recent research (Hyslop 2004) has established that unless the stone has been matched using a wider range of petrographic and other physical and chemical characteristics, new stone that is incompatible with the existing can accelerate decay of the adjoining stone.

Clearly the economics of the development will be of considerable importance in arriving at the most appropriate materials and components to be used. A balance has to be struck between the economic viability of the development, the degree of benefit to the building in the future and the damage that may be caused to its historic character. In reaching a decision, the historic importance of the building must be taken into account. An unlisted building that is in a conservation area, where the external appearance is the most important feature, is unlikely to require the same degree of attention to internal features as a listed building where the interior forms part of the listing and may be a key element in its character.

3.3.2 Impact of the Construction Products Directive (CPD)

The Construction Products Directive (CPD) has an important influence on the materials available for use in the conversion of historic buildings. The purpose of the CPD is to remove the technical barriers to trade in the area of construction materials and products. The CPD replaces existing national standards (such as British Standards) with a single set of harmonised European Standards for construction products, including the testing methods to be applied. All products manufactured to these European standards may be given a CE Mark.

Member States are allowed, in their national building regulations, to choose 'levels and classes' of performance of products, in their national building regulations so as to reflect their particular geographic and climatic conditions, but must specify the requirements in the terms of the European Standards where these have been issued. The national standards, such as British Standards, must be withdrawn after a short period of co-existence. In the UK, all British Standards that are prefixed 'BS EN' are European standards. Box 3.3 identifies the application of the CPD.

Box 3.3 Application of the CPD

The CPD applies to products produced for incorporation in a permanent manner in works where:

- at least one of the 'essential requirements' must apply to the product in use, and
- the 'works' in which the product is intended to be used must be 'subject to regulations' (eg the building regulations).

Essential requirements are:

- mechanical resistance and stability,
- safety in case of fire,
- hygiene, health and environment,
- safety in use,
- protection against noise, and
- energy economy and heat retention.

Illus 3.17 New entrance to an upper floor apartment listed Category B former hotel. The new wall is in imported granite (as is the new building to the left) rather than the rock-faced Kemnay granite of the original wall. (Photo: D Urquhart).

It is then clear from the information in Box 3.3 that most materials available in future will be covered by the CPD. There are two important qualifications to this. First, some traditional materials are being excluded from the testing regimes, either where they are deemed to play a minor part with respect to health and safety and where it is considered that their qualities are well enough established, or by being accepted as meeting the requirements (eg fire tests) based on prior experience – for example if they are accepted as 'non combustible'. Second, while the Commission and most Member States consider the Directive means that any products or materials placed on the market must be CE marked, the United Kingdom and certain other states have never accepted this interpretation, and it remains possible for unmarked products to be sold in the UK. Thus specialist

Illus 3.18 View of the main entrance elevation of the conversion shown in Illus 3.17. (Photo: D Urquhart).

materials and products, produced in very small quantities to match the needs of historic fabric, and which full testing to EC standards might be uneconomic, should remain available while the UK position is maintained. Nevertheless, care must be taken in specifying materials by reference to standards, as changes in the make-up of products, to meet different tests, can be expected.

3.4 Repairs

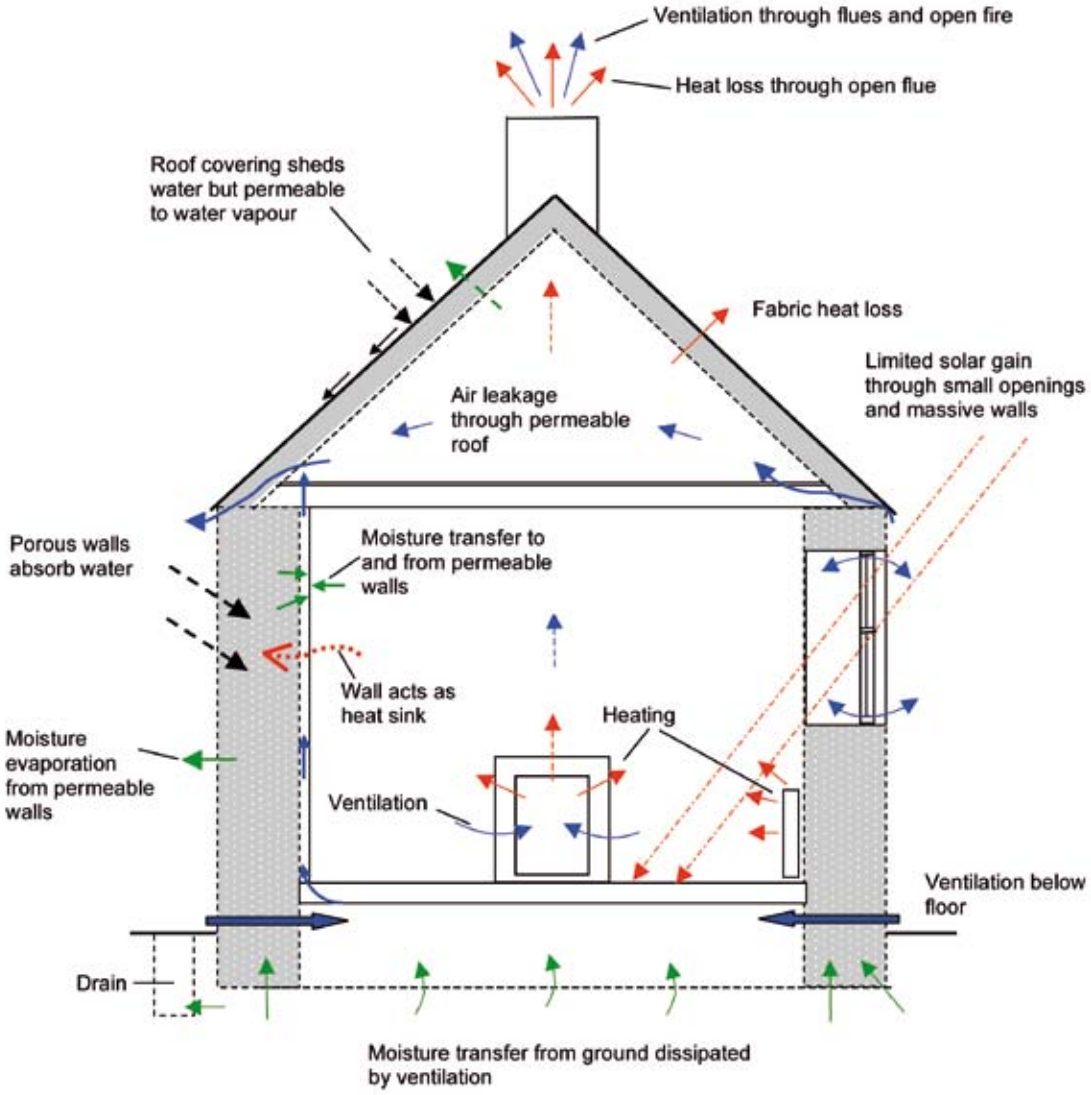
When dealing with repairs to buildings and the impact of the regulations, the reader is advised to note the implications of Schedule 3 of The Building (Scotland) Regulations 2004. In Schedule 3, no warrant is required for repairs, on condition that they in *'all respects and/or in the manner of their fitting meet any relevant requirements of the regulations'*. This includes a door, window or rooflight when the work includes replacing the frame. This implies that, when a window or door is replaced, the replacement must meet the insulation standards set out in the regulations; thus risking specification of unsuitable replacements, as far as conservation of the building is concerned. Part B of Schedule 3 does not except doors, windows and rooflights from the condition that *'the work is to a standard no worse than at present'*. However, any work to a window, door or rooflight, including glazing, which is less than a complete replacement of it and its frame, need only be to a standard no worse than at present.

4. PERFORMANCE OF TRADITIONAL BUILDINGS: THE BUILDING AS AN ENVIRONMENTAL SYSTEM

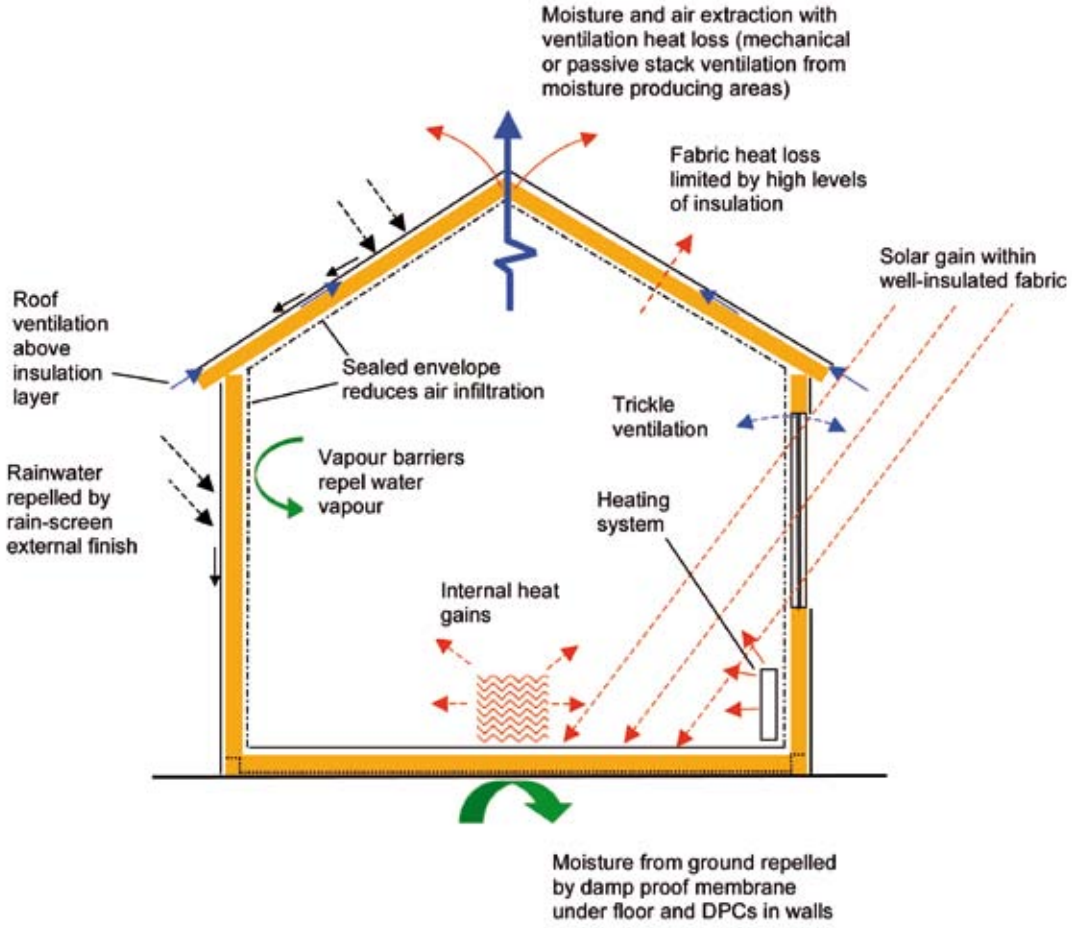
4.1 The systems approach

When converting a historic building, it is important to think of the building as an integrated environmental system and not as an amalgam of separate elements that operate independently of each other. The nature, mass, moisture-transfer characteristics and thermal performance of the fabric must be assessed to determine the most advantageous approach to heating, ventilation, insulation and energy efficiency. Thermal insulation, heating and ventilation must be considered together, since each is influenced by the other and they interact together. The BRE publication, *Thermal insulation: avoiding risks* (Stirling 2002), while primarily concerned with new-build, does offer guidance that is relevant to existing buildings.

Most available technical publications in relation to energy conservation issues, while recognising the problems associated with moisture production within traditional buildings, are aimed at new or modern construction methods. In many cases where historic buildings have



Illus 4.1(a) Moisture, air movement and thermal behaviour of a traditional building.



Illus 4.1(b) Moisture, air movement and thermal behaviour of a modern building.

been upgraded, applying modern standards of insulation and internal climate control has often proved to be detrimental to the fabric of the building. Historic buildings do not lend themselves to easy adoption of modern systems, and the difficulties in achieving modern standards are recognised within the new regulations.

The differences in the behaviour of buildings of traditional and of modern construction are shown in Illus 4.1. The essential difference is that the fabric of most traditional buildings is porous and permeable, which allows moisture and water vapour to transfer to and from the fabric with relative ease. High levels of ventilation are achieved through fortuitous air-leakage paths, which, in turn, maintain air movement within hidden voids and spaces to preserve the moisture balance of the fabric. Through this mechanism excessive levels of moisture in the fabric are prevented, unless there is a defect arising from inadequate repair and maintenance. In the case of a building of modern construction, the objective is to prevent moisture and water vapour penetrating into the fabric through the use of impermeable barriers (DPCs, rain screens, vapour barriers etc). Elimination of uncontrolled ventilation through gaps in the construction at floors, windows and other locations is a further objective. Thus the poorly-understood introduction of modern materials and techniques during work to a historic building may cause longer-term problems, promote moisture build-up and fabric deterioration. There is no predetermined formula that can be applied to a historic building to arrive at the most appropriate solutions. Each building and its requirements must be evaluated separately.

4.2 Air quality

The move towards ever increasing improvements in the insulation of the building envelope and the reduction in levels of ventilation through reduction in air leakage needs to be set against the potential to create an unhealthy indoor climate. The greatly reduced ventilation rates in modern buildings is thought to be a significant contributor to the dramatic increases in

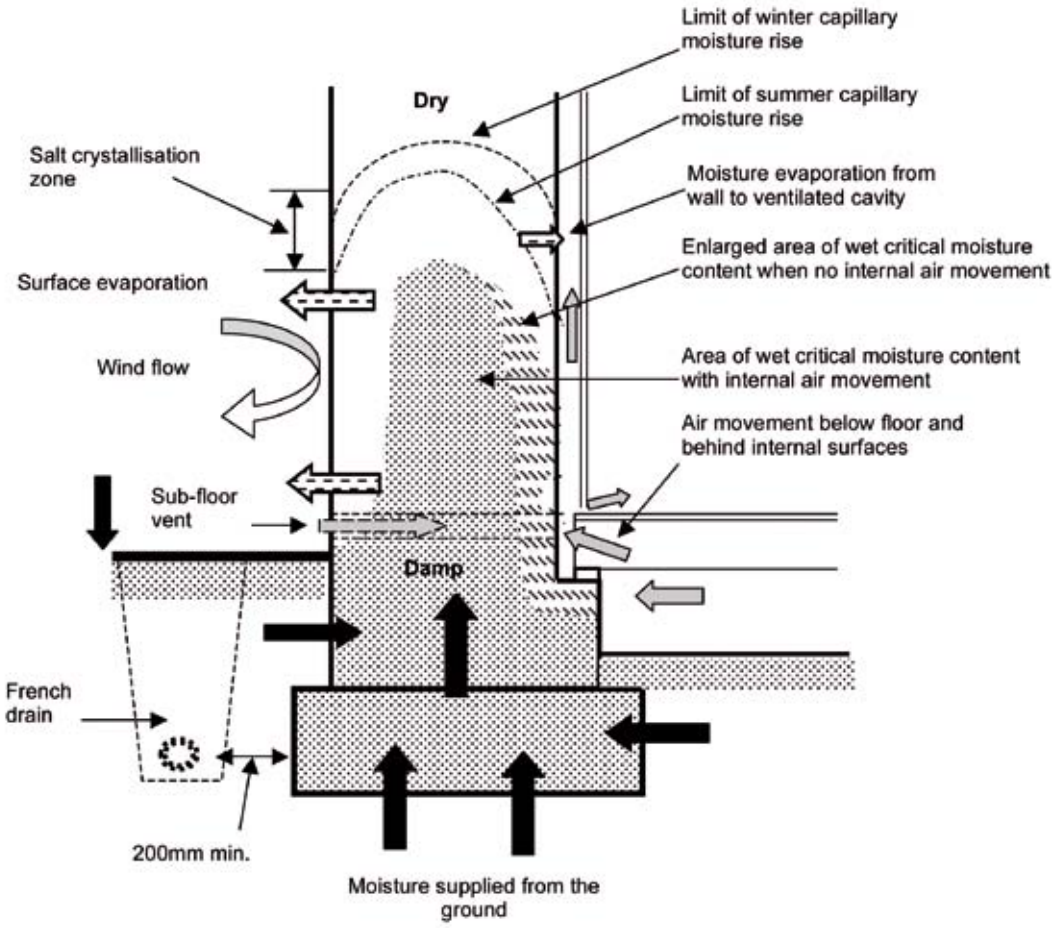
respiratory health problems, such as asthma, exacerbated by mould and chemical contaminants from modern materials and furnishings, and allergies brought on by airborne bacteria and chemical contamination. There are numerous papers reporting such evidence, for example Zock et al (2002). Well-ventilated buildings of traditional construction can, when sympathetically improved in terms of energy efficiency, provide a comfortable and healthy environment for occupants.

4.3 Moisture and water vapour

4.3.1 Moisture from the ground

Most historic buildings of masonry construction rely on the combination of mass of masonry and air movement to counteract the effects of moisture transfer from the ground. This transfer of moisture can be both vertical and horizontal. The ability of a wall to transport moisture depends on the pore size and structure of the material, which influences the capillary forces acting to draw moisture into the wall. Capillary forces drawing moisture upwards, gravitational forces acting downwards and the rate of evaporation from the wall govern the height of moisture movement. Equilibrium is reached when the transfer from the ground (and downward flow of rain water within the wall) is balanced by evaporation losses. Therefore, maintaining a flow of air across the surface will help to reduce the moisture content of the pores adjacent to the exposed surface. This is the principle underlying the need to provide ventilation of air spaces. Illus 4.2 represents the effects of air movement on the critical moisture content of a porous masonry wall.

Traditional masonry buildings are not generally constructed with damp-proof courses in walls or damp-proof membranes below ground floors; they rely on the mass of porous masonry to absorb moisture, control rising damp and disperse salts from the ground, together with adequate air movement to prevent deleterious effects on construction materials. In many cases, remedial action to prevent rising damp in thick masonry walls by the insertion of moisture barriers (DPCs, chemical injection, electro osmosis and the like) does not provide



Illus 4.2 Representation of the effects of air movement on the critical moisture content of a porous masonry wall. The installation of a French drain can reduce the moisture take-up by the wall. (Adapted from an illustration in TAN 24).

a satisfactory solution. The barriers may be ineffective and, by concentrating moisture and salts, can restrict moisture movement and hence drying, resulting in decay of porous stone and mortar. Illus 4.3 demonstrates this effect. Often it is a sufficient alternative to reduce external ground levels and install perimeter drainage to control the effects of rising damp.

In some situations, for example where a solid ground floor slab is in place, it may be difficult to ventilate spaces behind lath and plaster. Where this is the case, good building repair and maintenance must be rigorously enforced to ensure that walls are kept dry. Water from gutters and downpipes must not be allowed to enter the wall and joints and pointing should be maintained in sound condition. It is also likely that some fortuitous air leakage will occur at openings in the external wall, which will help to prevent stagnation in hidden voids.

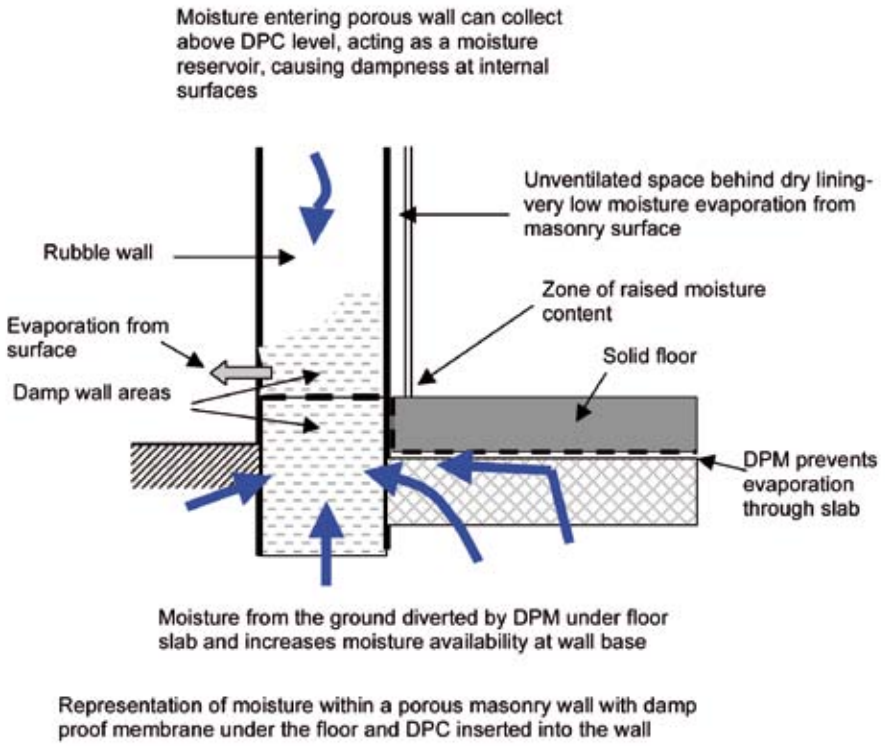
The installation of a damp-proof membrane below a new concrete floor in place of a suspended floor, or when a breathable stone-flag floor is lifted and re-laid, can actually increase levels of moisture within a wall. The new impermeable membrane below the floor allows moisture to accumulate below the slab, and encourages the migration of moisture to the sides of the slab and into the base of the wall (Illus 4.3).

In the case of earth walls, their strength is proportional to their moisture content and high moisture levels may result in collapse of the wall. Dealing with dampness in such walls is outside the scope of this book and specialist advice should be sought. However, it is always the case that where an earth wall has no brick or rubble footing walls, a damp-proof course, which provides a barrier, should not be used. A damp-proof course in this situation will stop drying of the part of the wall below the DPC by preventing moisture dissipation and evaporation from above, and thus may raise its moisture content above the critical level. Usually the most important action that can be taken in this case is by improving the land drainage around the building.

4.3.2 Ventilation and water vapour

As shown in Illus 4.1, the traditional building technology did not tightly seal buildings. High ventilation rates achieved through openable windows, gaps at skirtings, ill-fitting doors and open fireplaces with flues, mean there are usually only small differences between vapour pressure levels inside and outside the building. In general, the greater the difference between internal and external vapour pressures, the greater the potential for condensation to occur, both as surface and interstitial condensation.

Converting or rehabilitating a historic building to new use will often result in a reduction in overall ventilation rates as flues are sealed up and air leakage reduced.



Illus 4.3 Concentration of moisture and salts as a result of DPC and DPM installations in existing building.

Greater water-vapour production, which is a feature of modern living in dwellings, means that mechanical methods of humidity control must be considered to reduce internal vapour pressures. Failure to recognise and address the problem of increased vapour pressure can encourage interstitial condensation on masonry behind historic plaster finishes, raising the moisture content of adjacent timbers. Installing effective vapour barriers in historic surfaces is difficult and often results in the destruction of historic materials. In addition, high internal vapour pressures may cause increased condensation on single glazed windows, promoting decay of timber frames and corrosion of steel and iron elements, and cause dampness within soft plasters. Creating barriers to water vapour penetration in one place will simply encourage moisture migration to other vulnerable areas.

The introduction of vapour barriers as part of a programme of thermal insulation grants in Finland have proved to dramatically shorten the lives of the traditional timber buildings in which they were installed, introducing rot where previously the walls thawed and dried naturally (Panu Kaila 2000).

4.4 Thermal insulation

Upgrading the thermal insulation value of construction during conversion of a building is common, however, introducing additional insulation can cause problems within the construction.

Box 4.1 Inappropriate construction techniques (Stirling 2002)

Increased levels of thermal insulation may lead to the inappropriate adaptation of traditional construction technology, eg multi-layer loft insulation leading to ineffective ventilation or thermal bridge at eaves.

In addressing the issue of thermal insulation it is necessary to consider the thermal transmission values of typical Scottish masonry wall constructions. Unfortunately, there is no definitive guidance on the values to be adopted: the information that is provided in the various guides and codes of practice refers mainly to new construction, modern brick or block cavity walls, solid brick (one brick) walls or timber-framed wall elements. The Energy Saving Trust (2004), in their publication series Energy Efficiency Best Practice in Housing, *Scotland: Assessing U-values of existing housing*, recommend a default value of 1.7 W/m^{2}K for pre-1919 traditional sandstone (or granite) dwellings with solid stone walls with thickness typically 600mm and an internal lath and plaster finish. However, no research information is available to provide measured values for traditional Scottish masonry walls. The above default value, which is also applied to most construction types up to 1975, may not fully recognise the composite nature of traditional stone walls with their high proportion of lime mortar (of lower density than stone) and thus underestimate the insulation value of the wall. However, based on the material density and thermal conductivity values that are available, it is possible to provide some additional guidance (Table 2) on typical thermal transmission values.

Table 2 Typical thermal transmission values for traditional Scottish masonry walls.

Assumptions:

- Total wall thickness 650mm
- 600mm composite stone and mortar, ashlar stone finish externally
- ventilated air space behind lath and plaster
- lined internally with 25mm lath and plaster
- moderate exposure

Wall type	μ value (W/m^{2}K)
Granite (density 2650 kg/m^3)	1.40
Sandstone (density 2400 kg/m^3)	1.33

Whether the default value or the calculated value is adopted, the thermal transmission values for traditional wall constructions therefore far exceed the standard specified in the Building Standards Amendment (Scotland) Regulations 2001, the latest regulations to precede the 2004 Regulations. In the 2001 Amendment Regulations, the maximum U-values for the solid area of an external wall is 0.30 W/m^{2}K where a gas or oil SEDBUK boiler is used, or 0.27 W/m^{2}K for other systems. These values are, of course, those expected in new-build walls. There is thus considerable pressure to try to improve the insulation value of a traditional wall and, as a result, historic finishes are sometimes removed to allow increased levels of insulation to be installed.

However, the purpose of the new regulations is not to force the destruction of historic fabric by undertaking unnecessary intervention. Upgrading is required only where this is reasonably practicable, and it is essential to balance the loss of existing fabric against any potential thermal efficiency gains. In the examples cited above, where the wall is in its original state, it is inappropriate to add insulation to either the external or internal surfaces, or to inject insulation into the spaces behind the lath and plaster. Under these circumstances an assessment of the construction and thermal performance of the whole building fabric should be undertaken. This will identify situations where it may be practicable to introduce some thermal upgrading, provided this does not introduce technical risks (see Box 4.1). For example,

it may be possible to add insulation at roof level and below suspended ground floors.

There are potential risks associated with the thermal upgrading of a historic building. The assessment of the building needs to adopt an integrated approach which looks at the building in a holistic way, as recommended in *Thermal Insulation: Avoiding risks* (Stirling 2002). However, even when this approach is adopted it is essential to recognise that, with some historic buildings, the recommendations may not be achievable for the following reasons:

a) Adding insulation may result in raised vapour pressures and increased condensation can result, for example, at window lintols and ingoes where thermal bridges may be present.

b) A historic building may have unheated or poorly heated rooms and hidden voids. These colder spaces will encourage vapour movement from heated spaces, again resulting in condensation.

c) Adequate ventilation of moisture-laden air by passive or mechanical means may be difficult to achieve, especially from hidden voids. In addition, the installation of mechanical ventilation systems may be destructive to historic fabric and, unlike modern buildings, the building itself may be a source of moisture.

d) Thermally upgrading a single-glazed window to a high-efficiency double-glazed window can virtually eliminate surface condensation on the glass, but creates an increased risk of transferring the condensation to hidden, less well-insulated areas of construction.

e) Introducing insulation at ceiling level, or increasing its thickness, significantly reduces the air temperature in the roof space. This, in turn, increases moisture-related problems in the roof space. However, the type of roof, and whether it incorporates ventilated or unventilated roof spaces, will influence the nature of the risk and possible solutions. Some potential solutions for introducing added insulation to the roofs of historic buildings are detailed in the English Heritage publication *Building Regulations and Historic Buildings* (2002).

4.5 Improving thermal insulation

There will occur situations where the existing finishes have been removed in previous alterations, or where complete replastering is required: especially in situations where little or nothing of the original historic fabric remains. In such cases it may be appropriate to upgrade the thermal insulation of the building envelope. Nevertheless, this is not the straightforward operation that is sometimes assumed:

a) The introduction of high levels of insulation, while improving internal comfort conditions, lowers the temperature of the original walls and therefore reduces their role in stabilising internal humidity conditions. The balancing effect of their high thermal capacity is lost to some degree.

b) Adding insulation to the internal surfaces of external walls will have a significant effect on the size of internal spaces, and may be unacceptable.

c) In adding insulation it is difficult to ensure that all thermal bridges have been eliminated, especially at window and door openings, junctions between floors and walls, and hidden internal voids.

d) Air movement within the construction may be eliminated or reduced, which can result in increased moisture.

e) Where existing features still survive, such as wooden window shutters, panelling, skirtings, dados, cornices and the like, the dimensional changes resulting from the added insulation may not be compatible with the retention of these historic features.

f) Adding insulation to the external surfaces of walls will destroy the historic character of the building.

4.6 Heating

4.6.1 Systematic approach

Traditional buildings were not generally designed to be heated to the temperatures that are recommended for modern buildings. Heating was either by open fires or by relatively inefficient low-pressure hot water central heating systems using cast iron radiators and piping. Today's occupiers will, however, expect modern standards of comfort. Heating historic buildings to currently accepted standards poses a risk to historic fabric. The fabric of traditional buildings has usually reached a stable moisture balance and moisture content that reflect the low level of heating normally encountered. When the heating system is upgraded and high output heat emitters installed, the fabric of the building, especially the finishes, adjusts quickly to the changed environment, resulting in a rapid loss of moisture from the porous materials (plaster, paint and timber). The resulting shrinkage and cracking can be very disruptive to finishes.

It is thus necessary for the designer of a conversion to fully consider how the internal climate of the building will be controlled, and the complexity of choices available means that a systematic approach is required. However, no matter what system is installed,

a change in internal environmental conditions will result. To accommodate this change the fabric must be allowed to heat up slowly, with a slow adjustment of its moisture content, to control the thermal and moisture movements that will occur. This change will influence how the historic materials in the building perform. It is desirable to set up a monitoring system that reports regularly on the effect on the fabric. Unfortunately, the pressures of modern development procedures mean that time is always at a premium and rapid completion of the project is of primary concern to developers, which does not allow the fabric time to adjust to changed conditions.

A systematic approach, such as that promoted by Park (1991), should consider the following points:

a) The use of the building (commercial, residential, assembly, retail or display – for example a museum) will influence the choice of system. Whether the building will be occupied continuously or intermittently will also have a major impact on the choice of system. New systems should be able to be installed with minimum damage to existing fabric and should be aesthetically compatible with the spaces in which they occur. A proposed use that will require a major alteration of the internal spaces may not be appropriate for a historic building.

b) The design and specification of the heating system, and other environmental control systems, should be the responsibility of persons familiar with the needs of historic buildings. They should be familiar with the principles of conservation, understand how historic fabric must be respected within the design, and be aware that some modern installations will be disruptive – physically, aesthetically and culturally – to internal historic spaces. The design of the new system should take account of any energy conservation measures that will be incorporated, such as roof insulation, draught stripping and use of night-time window shutters, so that the design capacity of the new system is kept to a minimum. The new system should be designed to work within the physical constraints of the building.

c) The condition of existing systems should be assessed: there may be a case for their integration into the new system.

d) The culturally and architecturally significant spaces should be identified, evaluated and prioritised so that existing important features, such as cast iron radiators, elaborate radiator covers and decorative grilles, are retained. It is also important to identify less significant spaces where larger items of equipment can be placed, and where pipes and ducts can be distributed horizontally and vertically without disruption to important historic fabric.

4.6.2 Alternative energy solutions

As it is unlikely that a historic building conversion will be able to be insulated to the full requirement of the standards, it is necessary to improve the energy efficiency of heating systems or use systems that have a zero carbon dioxide emission.

Currently, the most practical and economically viable of the alternative energy solutions tend to be wood chip or pellet-burning boilers serving a 'wet' central heating system (ie one with radiators and/or under-floor heating), with water heating assisted by solar panels. In a substantial building with a single owner such as an office or school, these techniques can be viable. This viability may be improved further if the building is in a rural location, where there is no access to natural gas but there is access to an economic and reliable source of biomass. There are however a number of practical considerations. These installations are typically more expensive than conventional installations, and they can also cost more to run. They require much more attendance and maintenance than simple oil or gas fired boiler installations. The flue arrangements for the boilers require careful design to ensure that they comply with legislation and the combustion products do not cause a nuisance to building occupiers or neighbours. Requirements for this are set out in Standards 3.19 and 3.20, and are generally more onerous for solid fuel appliances than for oil, which are in turn more onerous than those for gas.

In domestic installations, a wood burning stove with a back boiler serving radiators and domestic hot water heating can be a practical solution, but there can be difficulties with the detailed design of such installations due to the uncontrolled nature of the heat source. It is essential to consider features such as by-pass dampers to reduce the heat input to the back boiler when it is not needed, while a means of dissipating the excess heat from the back boiler is also required when there is little or no demand for space heating or water heating.

In general, it must be emphasised that installations incorporating biomass-burning boilers are not a 'low tech' solution. They require careful design by those with suitable qualifications and experience. Solid fuel systems have not been much used in the last 25 years and many of the skills associated with the effective design of these have been lost from the industry. There will be a period of re-learning before the majority of engineers are fully conversant with the design of such installations again. Users of such installations must also appreciate that features of oil and gas fired heating systems to which they have become accustomed will not be available from a typical solid fuel installation. For example, automatic frost protection cannot be provided by a heating system served by a wood-burning stove.

Wind power and photovoltaic cells, while rarely cost effective unless the capital cost of the equipment is heavily subsidised, do provide low carbon dioxide emission sources of power.

4.7 Thermal efficiency of historic buildings

The thermal efficiency of a historic building, even after its conversion, is unlikely to match that of a new building designed to current standards, even if the existing building were reduced to a shell and a new insulating skin inserted internally or externally. Essentially, this then becomes the creation of a new building that performs in a non-traditional way. Where it is necessary to preserve the character of a building, it may not be appropriate to try to bring the thermal efficiency of the converted building up to the standards that will be achieved by a new building.

In addition to upgrading insulation standards where appropriate, there are other steps that can be taken to improve the thermal performance of a historic building without adversely affecting the existing fabric and historic character of the building. These measures include:

- Draught stripping windows and doors and reducing excessive levels of air infiltration.
- Installing energy-efficient hot water systems in place of the sometimes sprawling, ad hoc systems found in large historic buildings. The opportunity should be taken to reduce lengths of pipe runs, improve levels of pipework insulation and install high-performance hot-water cylinders.
- Offsetting the limitations of the less efficient fabric by installing an energy-efficient heating system, correctly sized to meet the demands of space heating and, where appropriate, hot water supply. Over-sizing should be avoided as this will lead to inefficient operation. In a conversion to be used for housing this will almost certainly require the use of a new SEDBUK boiler efficiency of at least Bands A to C and ideally a condensing boiler.
- The effectiveness of radiators can be improved by placing a reflective insulant on the wall behind the radiator and by fitting temperature control valves (TRVs) to control the temperature of individual rooms.
- The heating of larger properties should be split into two or more zones, each with its own controls, which should recognise the impact of solar gains and other heat gain sources in the building.
- High-efficiency lighting can offer energy-saving opportunities, and are particularly suitable in high-usage areas such as living rooms, halls and community areas. Compact fluorescent lamps (CFLs) are available in a range of types and lighting outputs. However, the design of these fittings may not always be appropriate for use in historic spaces.

5. PERFORMANCE OF TRADITIONAL BUILDINGS: STRUCTURAL PERFORMANCE

Most buildings being considered for a change of use may be assumed to have been structurally suited to their previous use, though as a matter of course this should be confirmed. Changing the use of a building will require a thorough assessment of its structural configuration and condition in order to assess its ability to support the changes in loading that are likely to be imposed as a result of the proposed change of use. Reference to a structural engineer experienced in this type of work would be advised. Most buildings do not go through their life without alteration at some time. The quality of these alterations may not be of the standard set by the original building, or changes may not have recognised the original structural configuration. The building may have been adversely affected by the activities of subsequent builders, users or designers, their work then being concealed behind finishes or within floors.

When assessing a historic building's suitability for a new use, the structural form, the constructional elements (walls, foundations, framework, beams, lintels, floors, access stairs and roof structure) and the condition and suitability of materials must be assessed against the structural needs of the converted building. As part of the decision about the suitability for a new use for a building, a structural assessment will have a major influence on the project brief. The structural appraisal should highlight the limits of additional loadings (or changes in loading conditions) that can be imposed on a historic building before major structural intervention becomes necessary. A significantly increased loading, particularly to floors, will inevitably require structural enhancement, which may be both expensive and destructive to historic fabric. When major structural intervention is necessary to produce a building capable of accommodating its new use, the whole viability of the project and the suitability of the projected use for that historic building must be questioned. The fact that many structural elements may be hidden does not mean that they are not important to the special character and historic importance of the building. Where 'opening-up' of historic fabric, to inspect floors and other elements, is required for structural assessment purposes, it may be necessary to obtain advice from the Council's conservation officer. Comprehensive information on the structure of traditional buildings and how to deal with any structural interventions is provided by *CIRIA Report 111* (1986).

The first Code of Practice, *Structural recommendations for loadbearing walls*, was not published until 1948. Prior to this date, buildings were constructed with different degrees of understanding of structural design largely based on traditional rules of thumb. A common feature of traditional buildings is the large number of fireplaces, and resultant flues, in gable and cross-walls. When considering structural interventions it is necessary to ensure that any new openings or bearings introduced recognise the presence of existing voids and whether there is a need for viable flues. Failure to recognise the presence of flues can lead to instability of the walls. Another cause of instability is when floors have not been properly tied into walls, a structural concept that was not always properly addressed at the time of construction, and has sometimes been overlooked in the insertion of new stairs etc across floors that tie the building together. This is particularly relevant in C19 jack-arch floors where the load bearing capacity is dependent on both adjacent the horizontal structure and the deadweight of walls over for stability.

The structural issue that creates the greatest difficulty and has most potential to influence the viability of use of a historic building, is when a change of use imposes greater floor loadings; for example, where there is a change from domestic to office floor loadings. While the British Standard, BS 6399 Part 1: 1996, *Loading for buildings – Code of Practice for dead and imposed loads* provides recommended floor loads for various categories of occupation, very careful thought has to be given to how the spaces ***actually*** will be used. English Heritage (1994) has produced a useful guidance note on office loadings in Historic Buildings. For example, in the case of an office building, the recommended design floor loading of 5.0kN/m^2 for filing and storage spaces will represent the maximum loading in these areas. It may be unnecessary to strengthen the whole area of the floor to accommodate this loading as the designated design loading for general office use is half that figure (2.5kN/m^2). Should storage be required for heavy files and the like, the design of the conversion may be able to accommodate file storage at ground or basement level, where such a loading may be more easily dealt with without the need for structural strengthening of upper floors. It is important that the client is aware of these limitations that may be imposed in the design and, ideally, for the preservation of original material, the engineer should actively offer guidance on areas of the building where higher loadings can be appropriately accommodated.

Estimating the strength of a timber floor may not be a straightforward task as the strength and elastic modulus of old timbers are often greater than those specified in current codes of practice. Codes of practice and British standards have changed over the last 50 years, and it may be appropriate to consider the use of contemporaneous guidance to establish the original loading capacity. However, it is not simply the timber strengths, sizes, and spans that should be assessed, because a major weakness in an old floor may be the joints and connections between the timber members, and between other structural elements. It should also be noted that servicing requirements may have changed greatly since the building was originally constructed, and it is all too easy to notch and cut timbers to accommodate services, thereby introducing isolated weaknesses into the structural elements. CIRIA Report 111 recommends that the following information should be collected:

- identification of the species and quality of the timber (including the extent of any infestation or decay),
- determination of member sizes, and their overall geometrical relationship,
- examination of joints and connections and
- existing deformations.

If there is still doubt about the suitability of the floor to withstand the proposed floor loads, a load test may be required. Often a load test of an element of structure can show that, despite simple calculations to the contrary, the element is capable of sustaining the new loading conditions. Load testing should not be considered in isolation to provide a quick solution to prove suitability; the interaction of more complex structural elements may offer false security if the structural behaviour cannot be justified qualitatively.

There are other structural elements where it is almost impossible to determine their structural strength using design calculations. A particular example is when cantilevered or pencheck stairs are encountered. This particular form of stair, which is often circular, relies on its strength through stone, or sometimes timber, treads being built into a masonry wall and detailed to interact to form a series of cantilever or torsional beams. Alternatively, stair flights can be supported on projecting cantilevered landings. The quality and condition of the stone needs to be assessed, and a load test may be required to provide the necessary proof of structural strength for the proposed loads.

The installation of modern services into a historic building can be very intrusive and can have an adverse effect on the structural stability of the building. Frequently, little attention is paid to how services will be incorporated, and services drawings may show only a diagrammatic services layout of pipework, cables and ducts. Important decisions on the exact positions and how they will be installed within structural elements, such as floors, is often left to the discretion of the tradesperson on site. Usually the most serious impact on structural stability is when services are required to run within and across the joists in a timber floor. The increase in loading on the floor must be considered. The ill-considered cutting of notches for cables and pipes in joists and beams can significantly affect the performance of the floor. There is a tendency for holes and notches to be oversized to make installation easier. When dealing with the design of a conversion, it is recommended that detailed drawings are available that show clearly the location and maximum dimensions of all holes and notches that have to be formed to accommodate services, and to design them to run parallel to joists.

Illus 5.1 Structural support for this stair in Duff House would be difficult to determine using current design criteria (Photo: D Urquhart).

6. PERFORMANCE OF TRADITIONAL BUILDINGS: FIRE, SOUND AND ACCESS

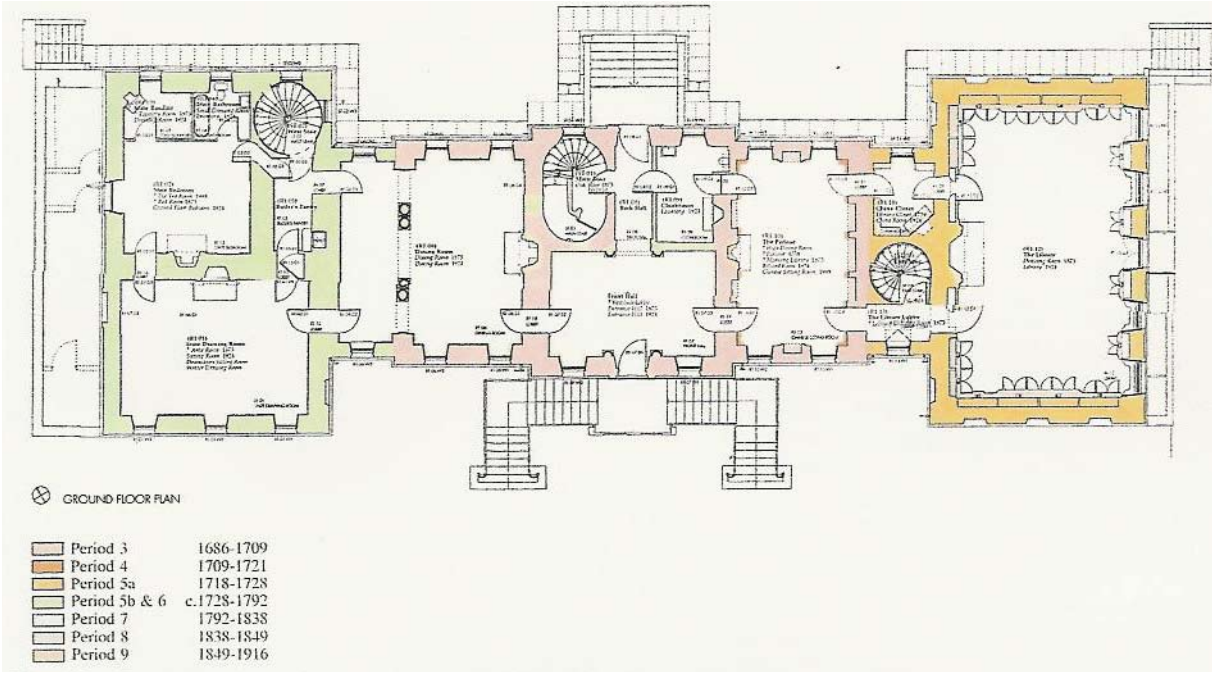
6.1 Performance in fire

6.1.1 Factors influencing fire risk

Each historic building is unique and its performance in fire, as with other performance criteria, cannot be compared directly with any other building: there are huge variations in the scale, complexity, construction, materials, fire load and fire risk between buildings. However, the construction technology of most historic buildings dictated that the spans of floors and beams were relatively small in relation to modern buildings. This, in turn, means that many of these buildings have a cellular floor plan arrangement, with thick masonry separating walls that can have a confining effect on fire spread. The advantage of a cellular plan arrangement is, however, offset by other features that increase the fire risk in historic buildings, such as:

- timber floors,
- timber staircases,
- walls lined with plaster on timber laths,
- timber-framed internal loadbearing partitions,
- timber built into masonry walls,
- presence of interconnected flues and voids within the construction that permit rapid spread of smoke and fire,
- combustible linings,
- large, interlinked roof voids,
- complex timber support structures to create vaults and domes,
- timber doors offering inadequate resistance to passage of fire and smoke,
- obsolete electrical wiring,
- unprotected iron and steel supporting structures.

An examination of almost every building will show it to have its own particular lines of compartmentation, which can be utilised in a conversion to provide separation elements that, with a little attention, are capable of providing at least thirty minutes of fire protection, and



Illus 6.1 Illustration of a typical cellular floor plan arrangement at Newhailes House. (Historic Scotland Guide for Practitioners 4: Survey by LD&N, overlays by JRA).

often provide an hour or more. An assessment of the existing compartments should thus form an important part of the fire protection strategy for the building. The design for a historic building conversion should respect these natural compartments, as their removal or alteration could have a serious impact on fire safety, development economics and, not least, historic fabric. It follows that, when deciding on a compartment strategy for the building, a full understanding of the location of all the hidden voids should be available to those responsible for the decisions.

In addition, the majority of historic buildings have been altered over their life, and these changes and additions may further increase the fire risk. Poorly executed work can create openings that will encourage the spread of fire, especially openings into hidden voids. This is particularly true as a result of the haphazard installation of services, where little attention has been paid to the resultant impact on fire risk. Classic examples of this phenomenon are the fires at Windsor Castle and Hampton Court Palace, which were spread more rapidly by the presence of hidden voids. The vulnerability of historic buildings to fire is explained more fully in Technical Advice Note 11 (Allwinkle et al, 1997) and in Technical Advice Note 28. (Kidd 2005).

6.1.2 Regulatory principles

The conversion of a historic building poses the most difficult of challenges to the designer, because the need to satisfy the fire safety requirements of the building regulations (and other legislation) has the greatest potential impact on historic fabric. The two fundamental issues that must be considered are the protection of persons, whether living, working or visiting the premises, and the protection of the building and its contents. The legislation is designed around the principle of protection of life and not the protection of property.

With respect to the 2004 Regulations, the essential standards that must be met relate directly to life safety and adequate means of escape. Other standards, which require the building to be improved to as close to the standard as is reasonably practicable, include the inhibition of fire and smoke spread beyond the point of origin, and fire spread within concealed spaces. Prior to the introduction of the 2004 Regulations, the inflexible application of the Technical Standards to historic buildings sometimes meant either forcing disruptive changes to the fabric or seeking relaxations from the standards. The move away from prescriptive to performance-based standards in the new regulations means that a more flexible approach to fire safety can now be implemented, and the potential disruptive effect on historic fabric reduced. The need for relaxations, therefore, does not form part of the new standards.

6.1.3 Fire engineering approach

Previous approaches to fire safety relied heavily on prescriptive fire-safety standards, with an emphasis on passive means of protection. For escape routes, this entails the provision of fire doors in corridors, the enclosure of staircases and corridors, and the use of non-combustible materials. Upgrading a historic building to meet these requirements can mean significant cultural loss to the building.

To achieve a balance between the functional standards – where there may be a presumption that the only way to achieve the necessary standards of fire safety is by improving the passive resistance of the fabric – and the conservation of the building, a fire engineering approach can provide the optimum balance. A fire engineering approach will take the total fire safety needs of the building into account and will recognise the use, complexity and historic value of the building. It can provide a more holistic and economic solution than can be achieved by a more prescriptive approach. The principal stages in a fire safety engineering approach are provided in TAN 11(1997), and are summarised below:

- a qualitative assessment to produce a brief with design criteria specific to the building and the fire risks;
- a quantitative analysis, which provides the data to establish design criteria and suggests available options;
- recommendations arising from the analysis, which are assessed against the criteria; and
- the presentation of the analysis and recommendations to the decision-making group.

A fire engineering approach, when used within the context of fire-safety standards, permits the engineer to test the various components against each other, or in combination, which has significant advantages over a prescriptive and less structured assessment. The key element in a fire engineering approach is the risk assessment, where each risk can be assessed individually and each building treated as a unique entity. For example, for a building that is to be converted for the storage of important and irreplaceable artefacts, the protection of these artefacts will form an important feature of the fire strategy for the building.

It is common for inherent weaknesses in fire integrity to occur: compartments may be incomplete, boundaries between elements (such as floors and walls) may not be sealed and openings in compartment walls may have doors with less than 30 minutes of fire resistance capability. While it may be possible to improve the passive fire performance of specific elements, there is likely to be a point beyond which the conservation needs of the building are compromised. In such

situations, the use of an engineered approach can offer an effective compromise through the use of active fire protection measures, which can compensate for deficiencies in passive measures. Active measures should be part of the fire safety management system developed for the particular building, which will place emphasis on measures that will allow the occupants sufficient time to evacuate the building. These measures are:

a) Fire detection – the earlier a fire can be detected the more time there is available for evacuation and activities to suppress the fire. The choice of system should reflect the nature of the building and the risk posed to occupants, the value of historic fabric and contents. Automatic fire detection (AFD) can reduce the vital time between fire initiation and its detection. Installation should be in accordance with the recommendations of British Standard, BS 5839 2002: *Fire detection and alarm systems for buildings.*

b) Fire suppression – the use of systems designed to inhibit the growth of fire (refer to TAN 11). The systems can range from the use of hose reels and hand-operated or portable fire extinguishers (operated by properly trained personnel) to automatic suppression systems, such as sprinkler systems. However, the installation of pipework and sprinkler heads can be very disruptive to historic fabric; careful design, selection and installation of the system will be required to best suit individual circumstances.

c) Smoke control – this concerns the concept of smoke containment and release. Smoke control methods include containment by smoke filling, containment by construction, active pressurisation, natural-release ventilation, release cross-ventilation and fire suppression.

Should the design and nature of the historic building preclude the introduction of conventional fire safety features (see also Part II; Section 2.12.4), it will be necessary to manage the building in such a way that:

- it limits the number of occupants, either staff or members of the public, inside the building;
- limits activities in the building; and
- provides adequate supervision within the building.

6.1.4 Emergency Planning

An important consideration for many owners is the protection of valuable artefacts and paintings from the effects of fire. However, the efficient evacuation of all occupants takes precedence over procedures for limiting damage to property and contents. Salvage work should be limited to those parts of the building not directly affected by fire.

Fire wardens and others tasked with carrying out salvage work should have received formal training, adequate protection and be fully briefed about the health and safety risk assessment carried out to identify the dangers associated with this activity.

6.1.5 Performance of critical elements

Floors

Many floors in historic buildings are of timber construction, which can have a very variable period of fire resistance, ranging from slight resistance for a boarded floor without an applied ceiling to a separating floor with ash or sand pugging on boards and a lath and plaster ceiling, which can provide significant fire resistance. As with all historic elements, it is essential to assess the actual fire resistance of a floor. Timber floors are classified as combustible construction, and any upgraded floor must prevent fire from spreading from one floor to another. In essence, the protection offered by a floor to a fire from below depends on the plaster ceiling, as the age and condition of the plaster and the strength of its key to the plaster lath will greatly affect its ability to perform in fire.

Although timber is a combustible material, the structural timbers in many historic buildings tend to be generously sized in relation to the spans and imposed loads. The fire resistance of a timber section can be predicted and is based on the rate of charring: timber suffers no appreciable loss of strength until charring occurs. An oversized timber beam can achieve a significant level of fire protection, as charring of the outer surface will reduce air supply for combustion below the char layer and thus inhibit the rate of loss of strength of the beam. Treating the timber elements with an intumescent coating will increase further their fire resisting capabilities.

Upgrading the fire resistance of a floor can be a difficult task, which may result in some loss of historic fabric. A number of recognised methods of upgrading the fire resistance of floors is given in TAN 11 and reproduced here:

- consolidate any deficiencies in the original construction,
- introduce mineral fibre quilt supported between or below the joists,
- insert intumescent sheet material over or under existing surfaces,
- insert intumescent material at the perimeter of the floor to close the link with the wall cavities *in the event of a fire* [author's italics],
- apply intumescent coatings to ceilings,
- apply additional layers of fire resistant boards to ceilings.

Doors

Upgrading the fire resistance of doors is a substantial topic in its own right and the subject of extensive debate and advice. Doors that have gaps in their construction, or contain glazing, may allow fire to spread beyond the compartment of origin. As a result of recent research we now have a better understanding of the actual performance of doors in fire, which permits a more realistic assessment of historic doors in these situations, leading to solutions that can retain them in place. There are a number of techniques that can be employed to improve the fire resistance of a door, including:

- facing the door with non-combustible boards, which can be removed at a later date with minimum damage,
- sealing all cracks and gaps with an intumescent paste,
- fitting proprietary intumescent strips and flexible cold smoke seals.

Illus 6.2 Historic (secret) door with upgraded fire resistance, in listed Category A building.

Further information on improving the fire resistance of doors can be found in Technical Advice Note 11 (1997). There may be some situations where it is not practical to improve the fire resistance of a door, either because of its method of construction or because its intrinsic value makes alteration unacceptable. In the latter situation, the doors might be removed and placed in storage keeping the doors safely in a controlled environment to prevent damage or distortion, preferably in the building itself. Listed building consent may be required in the case of listed buildings, and it may be found that some alternative use, or the blocking of the side that is of lesser importance behind doors that are fixed shut, offer a more sustainable outcome.

Roof voids

Roof voids are an important feature of the fire resistance characteristics of any building, making their investigation an important aspect of the fire risk assessment. Many compartment walls do not continue up into the roof void, thus permitting the unhindered and rapid spread of fire along the roof space. Also, roof voids have a tendency to be used as storage space, which may pose an additional fire hazard due to the presence of combustible materials and debris. Compartmentation of the roof void is an essential element of upgrading the fire performance of the building, but installing fire-insulating barriers that do not line up with the compartment lines in the accommodation below will undermine the fire integrity of the structure.

6.2 Sound transmission

6.2.1 Impact of sound transmission on historic buildings

The impact on the fabric of a historic building by the introduction of noise reduction measures can be similar to that of fire: there is the potential to destroy important historic surfaces in order to achieve the optimum level of sound insulation. Unlike protection from fire, which has an impact on all types of buildings, the new building standards for sound transmission levels apply only to dwellings. Of course, this does not mean that the impact of sound on the design and construction of other types of conversion can be ignored, but it may be that solutions can be adopted that have a reduced potential to cause damage to historic fabric. Further information for buildings other than dwellings is provided in Planning and Advice Note, PAN 56: *Planning and Noise* 1999. Detailed guidance on improving the sound insulation of dwellings is provided in the Napier University report, Smith et al, 2005, *Improving sound insulation in dwellings.*

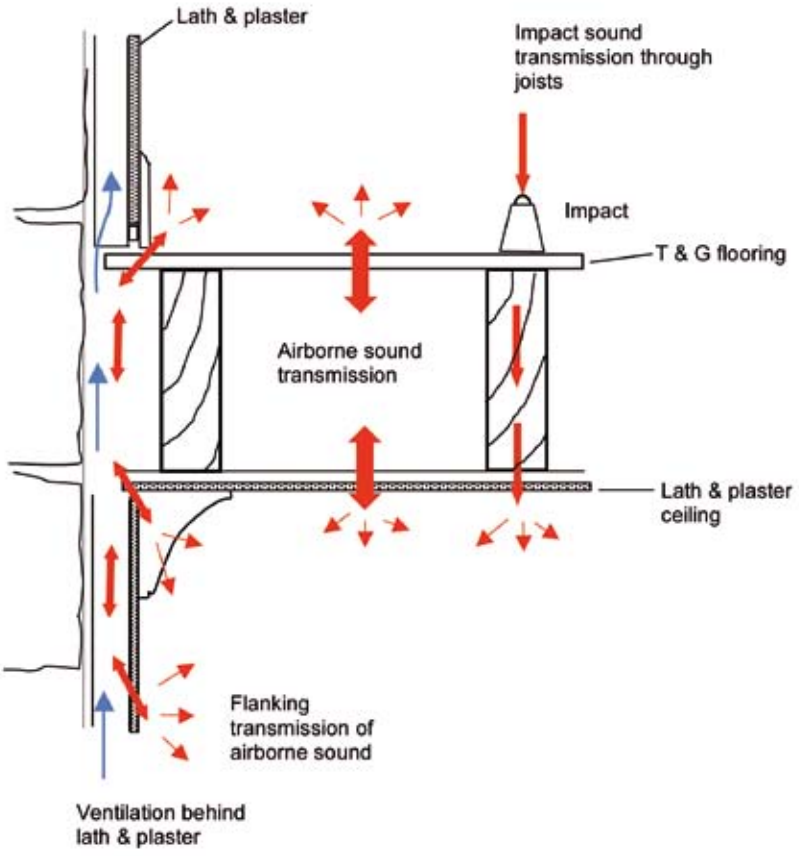
A large percentage of conversions of historic buildings involve a change of use to buildings in multiple occupancy incorporating dwellings, usually separate apartments on a number of floors. It is thus extremely difficult to assess the likely performance of a building, in its existing state, and to extrapolate this to the converted building, especially when a primary objective is to retain as much of the historic fabric as possible. Each

building is unique, which with its particular design and construction challenges the designer to arrive at solutions that provide the optimum sound insulation whilst preserving historic fabric.

6.2.2 Mandatory regulations

A building converted into multiple dwellings will require to be upgraded to ensure that the transmission of noise is contained within a level *that will not threaten the health of occupants or transmit noise that is not in excess of that from normal domestic activities (Building Regulations Standard 5.1)*. The conversion must also recognise that factors such as structure, fire and energy can have a significant impact on the performance of sound-resisting construction, and must be considered in a holistic way, along with sound transmission. The Technical Handbooks give guidance on three alternative approaches to the design of sound-resisting construction for separating floors and separating walls. These are:

a) *Specified construction* approaches are specifications that use common construction techniques and materials to achieve protection from sound transmission. This approach must be treated with caution when dealing with historic buildings because the adoption of these specified constructions will almost certainly mean the disturbance or loss of existing fabric. For example, in the case of a separating floor it may require the use of a new floor base that incorporates a floating layer. The floating layer may use the existing floor boards if these have been carefully dismantled – preserving the tongues and grooves – and re-laid on resilient strips on top of existing joists. This will mean raising the floor level with consequential disturbance to doors, skirtings and existing floors. The existing ceiling may also have



Notes

1. Sealing the gap at the floor perimeter to reduce sound transmission and for fire resistance will reduce ventilation of voids and may increase moisture related problems. Ventilation into the room is therefore recommended
2. Fire stopping may use intumescent materials that will still permit ventilation. However, venting is not appropriate for separating floors unless tests show that the minimum sound insulation requirements are met.

Illus 6.3 Sound transmission pathways in traditional timber floor construction.

to be upgraded, which could lead to the loss of original lath and plaster.

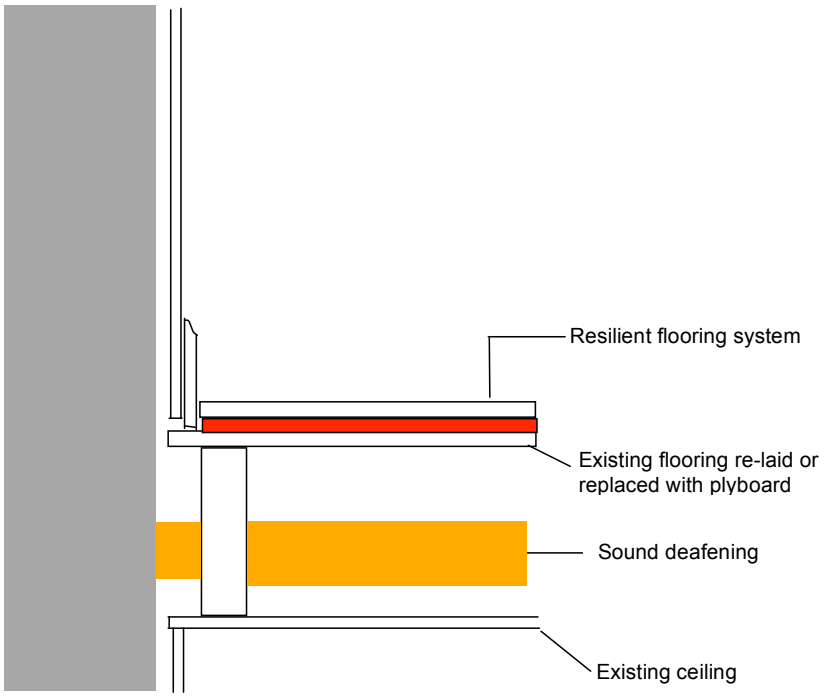
Unfortunately, implementing the recommendations contained within *specified construction* will usually mean loss or disruption of original features. It is therefore essential to have conducted a thorough assessment of these features and finishes as part of the conservation plan for the building, before the detail of the conversion is finalised. In this way the importance of the fabric, and the potential impact of the conversion on the fabric and on development costs, can be properly judged in the light of good conservation practice.

b) *Performance testing.* This sets out recommended minimum values for airborne and impact sound insulation that must be achieved after conversion. The performance testing approach is particularly suitable for conversions where flanking transmission may be significant. However, the fact that testing is retrospective to the conversion of the building means that, should the construction fail to meet the minimum values, it will be expensive and difficult (even impossible) to increase the levels of sound insulation. This means that a thorough assessment of the existing construction must be carried out before the development brief is finalised, so that the full implications of upgrading sound insulation on historic fabric are determined. It is therefore advisable to obtain advice from an acoustic consultant at the design stage.

c) *Scheme operated by Robust Details Ltd*. This scheme does not cover alterations or conversions.

6.2.3 Achieving balance between sound insulation and conservation

As with fire, it is necessary to assess the existing compartmentation of the building so that the design of the conversion makes best use of compartment divisions



Notes: Effects on existing construction are:

- Existing floor boards lifted and re-laid or replaced,
- Floor level raised, which affects:
  - Historic doors and architraves
  - Height of skirtings or panelling
  - Height to window cills
  - Floor to ceiling height
- Sound deafening at floor perimeter affects ventilation of voids behind lath and plaster

Illus 6.4 Implications of introducing a raised floor to improve sound insulation.

to achieve optimum sound insulation, with least damage to the building.

In the case of some conversions, it may not be feasible to improve the sound insulation to the recommended performance level without the loss of a number of the special characteristics of the historic building. Where it is not practically possible to improve sound insulation to the recommended level and where the health of the occupants of a dwelling is threatened or where the inconvenience is likely to be unacceptable, the proposed conversion of the building into dwellings may not be the most appropriate form of conversion. In arriving at an appropriate balance between conserving a historic building and improving sound insulation, it will be necessary to employ the services of an acoustic consultant and seek the advice of the local planning authority's conservation officer at an early stage in the design process. Smith, et al, (2005) recommend *'... that anyone considering converting an existing building to residential use, or sub-dividing a larger property, has the acoustic condition of the building assessed prior to commencing with the conversion. These sound insulation measurements are commonly termed "deterministic sound testing" or "pre-conversion sound testing"'*. By instructing such testing prior to the final design of the building, any problems inherent in the building will be identified at an early stage and will allow them to be dealt with during the design, rather than engaging in expensive remedial works after the construction has been completed. Also, testing at this early stage will determine whether the existing structure already meets the required standard and will thus not require expensive and potentially disruptive upgrading.

6.2.4 Summary of risks associated with improving sound insulation in historic buildings

Dealing with sound transmission and upgrading sound insulation in buildings where the internal fabric is of significant cultural value can result in either the direct loss or longer-term degradation of fabric due to changed environmental conditions. Some of the key factors that must be taken into consideration, and which may have an influence on the design of the conversion, are given below.

Floors

Raised floor levels to accommodate a resilient layer to reduce impact sound transmission, can result in:

- loss of floor finish, such as tongued and grooved boards and sometimes decorative floor finishes;
- unacceptable alterations to skirtings, architraves, dados and panelling;
- loss of original ceilings and associated decorative features;
- penetration of separating floors by vertical service soil pipes that are inadequately insulated;
- flanking sound transmission at wall-to-floor junctions can make the ventilation of voids behind wall linings much more difficult while, with some specifications, the use of dense pugging can overload existing joists, beams and connections.

Separating walls

Separating and flanking walls in traditional masonry construction will normally have sufficient mass to provide adequate sound insulating properties, but some features may cause problems:

- flues within walls acting as a sound transmission route,
- back-to-back fireplaces and built-in hearths having inadequate separating mass,
- the presence of recessed cupboards in a party wall, sometimes back-to-back,
- floor joists and beams built into separating walls,
- junction of party wall with thin flanking walls,
- position of window openings in flanking walls,
- walls that have been penetrated by previous alterations, such as the installation of service pipes and ducts, may not have been adequately sealed,
- breakdown of lath and plaster finish, eg due to occupants removing wallpaper and tiles,
- junction between a separating wall and roof within a ceiling or roof space may be difficult to insulate adequately (will also be necessary for fire resistance).

6.3 Access issues

Most historic buildings were not designed to be readily accessible to people with disabilities. Over the past few years the introduction of legislation, most notably the Disability Discrimination Act 1995 (DDA), now means that people with disabilities should be able to have dignified and easy access to and within historic buildings. Where the building is used to provide a service, the DDA has from October 2004 required service providers to assess obstacles to access and make reasonable adjustments to the physical features of their premises to overcome physical barriers to access. The Disability Discrimination Act, the new Building Regulations and other guidance, such as BS Code of Practice 8300: 2001, *Design of buildings and their approaches to meet the needs of disabled people*, underscore the complex issue of providing accessibility to historic properties.

Physical features are defined as:

- anything on the premises arising from a building's design or construction or from an approach to, exit from or access to a building;
- fixtures, fittings, furnishings, equipment or materials;
- any other physical element or quality of land in the premises.

The conversion of a historic building has to recognise that *'the building must be designed and constructed in such a way that all occupants and visitors are provided with safe, convenient and unassisted means of access to the building' (Building Standard 4.1).* Building Standard 4.2 requires that *'access within a dwelling should provide a "visitability standard", where persons with reduced mobility – be it through age, permanent disability or temporary incapacitation – may, if visiting a dwelling, make reasonable use of facilities within.'* As these standards are within the group where improvement of the existing building is expected where it is *reasonably practicable,* access will have to be improved even if meeting the full standard is not practically achievable. Often it is the distinguishing features of a historic building that pose barriers to disabled people, particularly those with ambulatory difficulties. Problem features, which may need to be improved, include:

- main access storey well above adjacent ground level, sometimes with a basement and light well that separates the pavement from the entrance,
- historically or architecturally important entrance steps and thresholds,
- narrow door openings in both external and internal walls,
- heavy doors,
- decorative and ornamental door furniture,
- narrow corridors,
- inaccessible toilet facilities,
- internal steps and stairs,
- missing or unsuitable handrails.

In addition to the requirements of the building regulations, other legislation, such as controlling the workplace and providing access to services for people with disabilities may impose further obligations.

As part of the information gathering process for the development of the design brief for the conversion, it will normally be necessary to conduct an access audit of the existing building, to be read in conjunction with the conservation plan. The access audit will identify all features of the building – not just physical features – that may need to be addressed to make the building accessible once it has been converted to its new use. The building regulations provide only a minimum standard of accessibility: they are not intended to meet the needs of individual disabled people. In the design of a conversion of a historic building it is good practice to anticipate the needs of disabled people, but where physical barriers cannot be overcome without destructive or damaging alterations to the building, alternative solutions that provide that service should be explored. The service may be able to be provided in a different way, or an alternative route into the building that is available to all users (not just disabled people) may be possible.

7. LEGISLATION

7.1 Introduction

The legislation identified in this section is not intended to be a complete list of all legislation that may apply to the conversion of a historic building. The aim is to draw attention to the key elements of legislation that support or are supplementary to the Building (Scotland) Regulations 2004, and which may have an impact on the cultural or historic importance of the building. Much of the legislation is, however, incorporated into the building standards, and where the standards have been satisfied the other legislation may have been also addressed. For example, obligations pertaining to means of fire detection and escape as set out in the Fire (Scotland) Act 2005 and Fire Safety (Scotland) Regulations 2006, may have been met during the conversion by the application of the building regulations in these areas, as these are essential standards. However, other legislation, such as the Disability Discrimination Act 1995 (DDA), may require more careful consideration by designers and developers because the building standards allow rather more flexibility in terms of access to buildings (these are standards that must be applied where it is reasonably practicable) than may be the case with the DDA.

7.2 Historic buildings and statutory protection

The Planning (Listed Buildings and Conservation Areas) (Scotland) Act 1997 requires Scottish Ministers to compile lists of buildings of special architectural or historic interest. The Act also directs councils as planning authorities to designate as conservation areas those parts of their district which are identified as having special architectural or historic interest.

7.2.1 Listed buildings

The buildings in the statutory list are chosen on the basis of a number of criteria‡ . These may be subject to change from time to time, but have included to date:

- planned streets, villages or burghs,
- buildings clearly associated with nationally famous people or events,
- special examples of buildings connected with social and industrial history and the development of communications,
- distinctive achievement or regional variations in design and use of materials,
- good examples within individual building types and
- technological innovation.

The term 'building' is broadly defined in the legislation and can include (for example) non-habitable structures such as walls, fountains, sundials, statues, bridges, bandstands and telephone boxes. The address of the property is the statutory element. The description attached helps to identify the building and some of its elements of special architectural or historic interest. It should be noted that this information is advisory, as the protection afforded by listing extends to the whole building at the address given, including both its interior and exterior.

In Scotland there are approximately 47,000 listed buildings (as at 2006), about 7.5% of which are listed at category, A, 56% at category B, and the remainder at category C(S). The category does not directly read across to levels of control that may be applied, and simply reflects approximate levels of importance.

Statutory protection may extend to structures within the curtilage of the main subject of listing. It is the responsibility of the planning authority to decide on the extent of curtilage and therefore whether a building or other structure is listed. Determination as to whether a particular building, structure or object lies within the curtilage of a listed building may ultimately rest with the Courts.

Alterations to the character of a listed building require listed building consent from the planning authority. The Act also directs planning authorities, in considering whether to grant planning permission for a development which affects a listed building or its setting, to have special regard to the desirability of preserving the building, or its setting, or any features of special architectural or historic interest which it possesses.

7.2.2 Conservation Areas

Planning authorities have a duty to identify and designate areas of historic or architectural interest and to ensure that development preserves or enhances the character of

‡ For current information see http://www.historic-scotland.gov.uk/index/historicbuildings.htm

those areas. Conservation areas are not only a means of applying increased levels of control to an area, but are one of the measures available to councils in raising the quality of the built environment. There are over 600 conservation areas in Scotland. These can cover historic land, battlefields, public parks or designed landscapes, but most contain groups of buildings extending over areas of a village, town or city.

Most works to the outside of a building or structure within a conservation area will require planning permission. The Act directs planning authorities, when considering applications for planning permission within those areas, to pay special attention to the desirability of preserving or enhancing the character or appearance of that area. Additional controls may be applied to changes within conservation areas where Article 4 Directions apply. These are promoted by the planning authority but usually require to be confirmed by Scottish Ministers. Conservation Area Consent is normally required in cases of demolition of unlisted buildings within a conservation area.

7.2.3 Scheduled Ancient Monuments

Where a building is a scheduled ancient monument, included under the Ancient Monuments and Archaeological Areas Act 1979, scheduled monument consent rather than listed building consent will be required for changes to it, including repairs. Once a monument is scheduled, it becomes an offence to carry out, without the prior written consent of Scottish Ministers any works which would have the effect of demolishing, destroying, damaging, removing, repairing, altering, adding to, flooding or covering up the monument. As the presumption is that a scheduled monument be preserved in the manner that it has come down to us, it is less likely to be converted to another use than would be a listed building. However, there have been instances where this has been permitted, in the best interests of the preservation of the monument. Should the conversion be to a residential or ecclesiastical use, the building would then be descheduled.

7.2.4 Government policy and guidance

Government policy on the built heritage is set out in National Planning Policy Guideline NPPG 18 *Planning and the Historic Environment* (1999). It sets out the policies for planning and development in the historic environment with a view to its continued protection, conservation and enhancement. It recognises the value of the historic environment, even where this does not have statutory protection through listing or inclusion in a conservation area. NPPG 18 advocates a positive approach and emphasises the need to find ways in which the active life of historic buildings and areas can be extended.

This NPPG also demonstrates how action to achieve conservation objectives can yield wider social, economic and environmental benefits and be consistent with the principles of sustainable development. This is now supplemented by a series of *Scottish Historic Environment Policy Statements* issued for consultation by Historic Scotland from 2006 onwards.

The primary source of guidance on Scottish Ministers interests and responsibilities in relation to listed buildings and conservation areas is provided in the *Memorandum of Guidance on Listed Buildings and Conservation Areas* (1998). The Memorandum sets out the duties of Scottish Ministers and planning authorities in respect of listed buildings, conservation areas and designed landscapes, and provides advice to assist planning authorities in their consideration of applications for conservation area and listed building consent.

Since it is possible that some buildings being converted will be scheduled monuments, scheduled monument consent rather than listed building consent will be required. Such consent is included within the Ancient Monuments and Archaeological Areas Act 1979.

7.3 Building regulations

7.3.1 Application to historic buildings

The intention of the building regulations is that there is no prescribed method of meeting the standards. The regulations, which are expressed in terms of 'functional standards', permit a variety of ways of complying. Comprehensive advice on the application of the Building (Scotland) Act 2003 and the Building (Scotland) Procedure Regulations 2004 is contained in the Procedural Handbook. This section will therefore summarise only some of the key points that relate to work on historic buildings.

Conversion of a building, if it is of a type set out in Schedule 2 of the Building (Scotland) Regulations 2004, requires that after conversion the building must comply with all the standards. However, few existing buildings can reasonably be altered to meet all aspects of current standards; therefore, for the standards identified in Schedule 6 of the Building Regulations, the requirement is for existing buildings to be improved *'to as close to the full requirement as is reasonably practicable'*. It will only be in exceptional circumstances that taking no action will be acceptable, although it is recognised that the full requirement will not be met for many of the identified standards.

For historic buildings (see 1.2 for the definitions), Schedule 6 has specific relevance. The particular matter that is significant or important should inform the application of the functional standards. In applying the

standards, rather than adopting the methods and materials promoted by the Technical Handbooks – which assume current materials and construction techniques – the construction and materials of the historic building must be recognised and retained where they are significant to the character or historic value of the building.

The change in occupation or use of a historic building, where this does not fall under the definition of conversion, does not attract application of the standards, unless there is alteration or extension to the building, in which case the full standards apply. However, in such cases, other legislation may have to be satisfied, which may itself have a potential impact on historic fabric, for example houses in multiple occupation and disability discrimination legislation.

7.3.2 Verifiers and Approved Certifiers

A major difference between the previous regulations and the Building (Scotland) Regulations 2004 is the change in the roles, duties and responsibilities of the various bodies charged with the implementation of the standards. The system is overseen by the Scottish Building Standards Agency, which is an integral part of the Scottish Executive. Enforcement of the regulations is by local authorities, but the responsibility for checking compliance, and certification of design and construction, rests with two new groups of people, verifiers and approved certifiers respectively.

Verifiers

While the Act provides for other bodies to act as verifiers, the only appointed verifiers to date are the Scottish local authorities, who will be responsible for their own areas. Verifiers are appointed by Scottish Ministers. It is the role of the verifier to protect the public interest by providing an independent check of applications for building warrants. The verifier will issue a building warrant.

Approved Certifiers

In the Act, two roles are established, certifiers of design and certifiers of construction. This permits suitably qualified people, businesses or other bodies – who have to be approved by Scottish Ministers – to certify that certain design or construction work complies with the building regulations. Detailed information on the appointment and role of verifiers and approved certifiers is found in the Procedural Handbook that accompanies the Building (Procedure) (Scotland) Regulations.

The certification of design is at the warrant application stage and allows certifiers of design to certify to verifiers that prescribed aspects of the design meet the requirements of the regulations. This replaces the process of self-certification of structures under the old regulations, and has the potential to permit other specialisms to be included as well. Approved certifiers of design may be responsible for either:

- specified aspects of the building design (such as the structure, energy design or fire safety), or
- specific parts of a building (such as a space heating system or a sprinkler system).

If the approved certifier is satisfied that the proposed design meets the relevant standard or standards, a certificate may be issued for submission with the application for building warrant. The certificate is taken as proof that the standards have been met for those aspects of the design that are relevant; the verifier will not check the design against these standards.

Approved certifiers of construction are responsible for the construction or installation of specified parts of a building, such as the structural frame, the electrical installation or a combustion appliance. As with the design certificate, the certificate of construction is taken as proof that the construction complies with the full range of relevant requirements. The verifier will not check the elements covered by the certificate of construction.

In the case of historic buildings, it is possible that an approved certifier may not have a full understanding or experience of design and construction associated with conversion of these buildings. Clients or their professional advisors are strongly advised to ensure that the approved certifiers, who are employed for design and construction certification purposes, have the necessary skills and experience to interpret and apply the standards sympathetically to historic buildings, and to recognise that what is appropriate for new build may be detrimental to the performance and historical integrity of a historic building.

For further information on the certification process, reference should be made to the SBSA website *(http://www.sbsa.gov.uk/current_standards/cert.htm)*, in particular the certification handbook.

7.4 Houses in multiple occupation

Under the terms of *The Civic Government (Scotland) Act 1982 (Licensing of Houses in Multiple Occupation) Order 2000,* all local authorities are required to introduce a licensing system for houses in multiple occupation (HMO). Houses in multiple occupation include shared flats and houses, bed-sits, lodgings, communal accommodation such as student residences and hostels. A property needs to be licensed if:

- it is the only or main home of three or more residents and
- the residents are members of more than two families.

The essential requirements, in so far as they affect the conversion of historic buildings, are identified below and listed under the main headings of the building standards. In most cases, compliance with the building standards will also ensure compliance with HMO standards. However, this cannot be guaranteed as, for a higher occupancy HMO, additional provision in some areas may be required. The requirement for listed building consent, where appropriate, will also apply to any works required to bring the property up to HMO standards. HMO legislation requires local authorities to be satisfied that the premises are suitable for use as an HMO. The HMO Benchmark Standards are set out in terms of guidance and it is stressed that these are reference points for an 'average' HMO, they should be applied flexibly in relation to the individual circumstances of each property, and consideration should be given to alternative approaches. This flexibility of approach should include recognition of the need to protect historic buildings, in the same way that the building regulations require a standard to be achieved to 'as close as is reasonably practicable'.

Box 7.1 Relationship (of HMOs) to compliance with the Building Regulations

Extract from *'Mandatory Licensing of Houses in Multiple Occupancy for Licensing Authorities' (2004).*

The Benchmark Standards included in this guidance cover a range of issues, many of which are also addressed by Building Regulations, with guidance given in the new Technical Handbooks. However, these apply only to new buildings, to existing buildings when they are altered or converted, and to extensions. Conversions include certain types of change of use, and significant alterations in the type and the number of expected occupants. Often, it would be impractical to apply the same level of requirements to older properties if they are not undertaking such alteration or conversion. The Benchmark Standards have therefore been compiled, in some cases from the requirements of Building Regulations, but also from existing practice in other areas such as Environmental Health.

Newly-built or converted HMOs must of course meet the level of requirements applicable under the Building Regulations. However, even buildings that meet the Building Regulations requirements may require additional work to make the property suitable for use as an HMO rather than, for example, a family home. In many cases, a building warrant will be required for such work, or if a warrant is not required, the work may still have to meet Building Regulations. Advice should be sought from building standards officers.

7.4.1 Fire safety

The fire safety regime in the Fire (Scotland) Act 2005 applies to HMOs that require a licence and therefore fire safety will no longer be addressed as part of the licensing process. It is, however, expected that the Fire and Rescue Authorities will continue to co-ordinate their work with licensing authorities and to use the Benchmark standards as a guide to appropriate fire safety measures in HMOs.

An important aspect of fire safety is the protection of escape routes, and self-closing doors will often be recommended. Traditional timber panelled doors are not considered capable of providing thirty minutes of fire resistance without upgrading (refer to section 6.1.4). The advice offered by local authorities may be that when the fire resistance of doors has to be improved, a tested and proven proprietary system should be selected. However, the use of an approved proprietary door in place of a door that forms part of the character of a listed building is unlikely to be acceptable in such circumstances. Agreement will have to be reached regarding the most appropriate method of achieving the necessary period of fire resistance, while maintaining the historic character of the door.

7.4.2 Environment

The building standards do not specify the minimum floor areas for apartments, but do stipulate the minimum space requirements for activities and furniture. However, the HMO guidance gives advice in the Benchmark Standards for space in bedrooms and communal living rooms, expressed in terms of square metres. Designers should crosscheck room sizes against the minimum requirements for HMOs, as, for example, the HMO requirements for sanitary facilities may impose a need for more toilets and baths or showers than would be necessary to satisfy the building standards and should be accommodated when possible.

Fully meeting the relevant minimum building standards will satisfy the lighting and ventilation requirements for HMOs. As with the building standards, there is flexibility in the HMO requirements and thus the need to increase the glazed areas of windows in historic buildings may be relaxed where the character of the historic building would be adversely affected.

7.4.3 Safety

In a conversion, the common area between HMO guidance and the building standards concerns electrical safety. In this respect, a conversion that complies with the building standards will also satisfy HMO standards for electrical safety and the minimum requirement for socket outlets.

7.4.4 Noise

Many HMOs are in flatted buildings, and a key concern of the licensing regime is to minimise disturbance to neighbours resulting from increased occupancy. Licensing authorities will therefore seek to ensure that flooring, door closer systems, extract fans and other items reduce noise as far as possible. Again a balance may need to be struck between licensing requirements and maintaining the historic character of the property.

7.4.5 Energy

HMO legislation is not concerned with energy related problems.

7.5 Fire

As a result of architectural and archaeological considerations, work to improve the fire safety of historic buildings needs to be carried out with sensitivity so as not to damage the building's historic interest. Alternative means of improving safety (where it is necessary to do so), without making structural changes to the building or by keeping changes to an absolute minimum, should be implemented.

The application of the building standards will incorporate those elements which also sit within the fire legislation and that may require changes to the fabric and fittings of the building. Other aspects of the fire legislation, such as those relating to fire safety risk assessment, preventing fires, maintenance, management, staff training and use of the premises are, of course, outwith the scope of the building regulations.

7.5.1 Fire (Scotland) Act 2005

The legislation currently in force is the Fire (Scotland) Act 2005 and its related legislation, the Fire Safety (Scotland) Regulations 2006. This legislation supersedes the Fire Precautions Act 1971 and the Fire Precautions (Workplace) Regulations 1997/1999. However, as with the previous legislation, the impact of the new act is not likely to impose significant additional requirements to those that are required by the building standards in connection with the design and specification of the conversion of a historic building.

Part 3 of the Act introduces a fire safety regime for non-domestic premises, based on the principles of risk assessment. Dutyholders who may be employers, owners, occupiers, tenants, contractors and any other person who has control of non-domestic premises, are requires to carry out a fire safety risk assessment and take such fire safety measures as are necessary to ensure the safety of persons in, or in the immediate vicinity of premises. For the purposes of the regime, HMOs are not considered to be domestic premises.

Fire safety measures are measures in premises for:

- reducing the risk of fire and the spread of fire,
- means of escape,
- ensuring that means of escape can be safely and effectively used,
- fighting fires,
- detecting fires and giving warning in the event of fire,
- action to be taken in the event of fire (including measures for the instruction and training of employees and for the mitigation of the effects of fire) and
- such other measures in relation to premises as may be prescribed by regulations.

Further information on the fire safety regime is available at *www.infoscotland.com/firelaw*, including guidance on dutyholder's responsibilities and fire safety measures.

7.5.2 The Fire Safety (Scotland) Regulations 2006

The Fire Safety (Scotland) Regulations 2006 state the requirements for means of fighting fire, means of giving warning in the event of fire and also means of escape. These aspects of the regulations impose requirements that may impact on the fabric of the building, such as emergency exits and routes and emergency-route doors. A conversion that satisfies the building standards will also meet the requirements of the fire regulations. However, the fire regulations impose a responsibility on the person with duties under Section 53 or 54 of the Act to ensure that a suitable system of maintenance of facilities, equipment and devices is in place and that they are maintained in an efficient state, in efficient working order and in good repair.

These regulations are a fundamental part of the fire safety regime and must be considered along with the general fire safety duties contained in Part 3 of the Fire (Scotland) Act 2005. Whereby the act contains general fire safety requirements, the regulations contain more specific requirements in terms of fire safety measures for non-domestic premises.

The regulations also contain a provision that extends to domestic premises. Facilities and fittings provided in the communal parts of domestic premises, by virtue of an enactment (this includes building regulations), for the use or protection of fire-fighters, require to be maintained in efficient working order and in good repair.

The 2005 Act and the 2006 Regulations place a considerable burden of duty on the employer with

regard to the safety of employees and the fire precaution measures in their place of work. Under the previous Fire Precautions (Workplace) Regulations, all building owners were required to undertake a fire risk assessment of their buildings and to maintain them in an efficient manner – even where a Fire Certificate exists for the building. In October 2006 the new Fire Safety Regulatory Reform Order (RRO) became law. Under this Order, Fire Certificates for a building will no longer be issued and the 'Responsible Person' will be personally accountable for fire safety. It is therefore important that the work of conversion of a historic building includes a fire safety manual, with supporting drawings, to allow the 'Responsible Person' to undertake a fire risk assessment.

7.6 Access

In addition to the building regulations, the key legislation concerning access is the Disability Discrimination Act 1995 (DDA), which applies generally, with some limited exclusions, to all non-domestic buildings. There are many different parts of the Act but the most important, as far as their impact on historic buildings is concerned, are Parts III and IV. Part III imposes specific duties on service providers and may compel owners and service providers to make physical changes to their buildings to make them accessible to disabled people. Part IV of the Act applies to places of education.

- from October 1999, service providers have had to make 'reasonable adjustments' such as providing extra help or making changes in the way they provide services;
- from October 2004, service providers also have to 'make reasonable adjustments' to the physical features of their premises to overcome physical barriers to access.

The Secondary Education Needs and Disability Act 2001 (SEDA), which also includes historic buildings used for higher education, has been incorporated into Part IV of the DDA.

It is not the intention here to discuss the detailed content and application of the DDA, as such information is available elsewhere. However, in the design and development of a conversion to a historic building, a physical feature is defined by the Act as including:

- any feature arising from the design or construction of a building on the premises occupied by a service provider;
- any feature on those premises of any approach to, exit from or access to such a building;
- any fixture, fittings, furnishings, furniture, equipment or materials on such premises;
- any fixtures, fittings, furnishings, furniture, equipment or materials brought onto the premises (other than those occupied by or on behalf of the service provider) in the course of (and for the purpose of) providing services to the public;
- any other physical element or quality of land comprised in the premises occupied by the service provider.

While the building standards encompass the concept of an accessible environment, designers, clients and developers should be aware that the DDA might impose additional requirements on the design of access to, and within, the conversion. The building standards relating to access to and within buildings are standards that have to be met as closely as is reasonably practicable. Part III of the Act requires service providers to make 'reasonable adjustments' in relation to their premises to overcome physical barriers to access. Unfortunately, the Act does not give guidance on what might constitute 'reasonable adjustments' to physical features. No specific allowance is made for historic buildings. It is recommended that reference is made to the *Code of Practice: Rights of Access: Goods, Facilities, Services and Premises (1999*).

Where a physical feature places a disabled person at a disadvantage, the Act imposes a duty to take all reasonable steps to remedy the situation. Amongst the options to consider would be the alteration or removal of such physical features. However, these may not be realistic options where alteration or removal would have an adverse effect on a historic building. The requirement of the building standards to have a clear opening width for an entrance door to a non-domestic building of 800mm would not be universally achievable in all historic building conversions. What is reasonable depends on a number of factors, in particular the size and resources of the organisation; for example, where the conversion is to form a large retail development this will have different requirements to a small shop conversion. Installing a lift or new toilets may be inappropriate for the small shop but essential for the large development.

When considering the requirements of the DDA, it is desirable to conduct an access audit[‡] of the building that is to be converted and to link this to the conservation plan. The audit should identify all the areas in the building where it may not meet the aim of providing independent access for most disabled people. This will then inform the design of the conversion and ensure that the needs of both disabled persons and the historic building are met. A properly qualified and experienced consultant, who is, ideally, a member of the National

[‡] The Planning Bill proposes that a statement on ways that issues relating to access for the disabled have been dealt with shall be included with certain Listed Building Consent and Planning application. The access audit and conservation plan would be a way to achieve this.

Register of Access Consultants, should carry out an access audit of the whole building. Disability organisations and local authority access officers can also offer valuable advice. Clearly, it is much easier to deal with a problem at the early design stage than at a later date when the building is brought into use, when alternative solutions may not be so easily implemented. Experience indicates that most buildings can be successfully and effectively altered, but to do this successfully requires a sound understanding of both the needs of disabled persons and historic building conservation.

7.7 Health and safety

7.7.1 Construction (Design and Management) Regulations 1994

The Construction (Design and Management) Regulations 1994 (the CDM Regulations) impose duties on clients (except domestic clients where no developer has been appointed), developers and designers as regards good design and good safety management of construction projects. The regulations apply to building and construction work including:

- new building and installation of new services;
- alteration, maintenance and renovation of a building, including services;
- site clearance;
- demolition and dismantling of structures;
- temporary works.

Under these regulations, clients must appoint a competent Planning Supervisor for their construction project and ensure they are competent and have sufficient information relevant to the health and safety of the project.

The regulations also apply to all design work carried out for construction. With respect to the conversion of historic buildings, additional responsibilities and specific duties to those imposed by the Building (Scotland) Regulations 2004 are placed directly on designers, developers and owners. These duties can influence the choice of materials to be used in the conversion and might, as a result, affect the character of the historic building if the CDM Regulations are not sympathetically applied. CDM does not require the elimination of attractive or historic features that are important to the building, such as cupolas, nor does it require designers to take into account unforeseeable hazards.

CDM, however, does place certain specific duties directly on designers (*CDM – Dos and Don'ts,* Health and Safety Executive, *http://www.hse.gov.uk/construction/designers/do.htm*), namely:

- to eliminate hazards where feasible (eg if specifying rooflights, specify non-fragile materials);
- to reduce risks from those hazards that cannot be eliminated (eg specify designs and coatings for materials that reduce the need/frequency for replacement, cleaning and re-painting);
- to provide information on residual risks if they are significant (eg if a set sequence of assembly or demolition is necessary to maintain stability).

Detailed guidance for designers is to be found in the Health and Safety Executive's publication *'Designing for health and safety in construction'*.

The CDM regulations are due to change in April 2007. The regulations described above will be substituted by a set of key construction regulations, mainly revising, simplifying and consolidating the Construction (Design & Management) (CDM) Regulations 1994 and the Construction (Health, Safety & Welfare) (CHSW) Regulations 1996.

7.7.2 Other safety legislation

Other legislation that may influence the design and development of the conversion of a historic building include:

Management of Health and Safety at Work Regulations 1998

These make explicit what is required of employers under the Health and Safety at Work Act 1974, and place duties on employers, employees and the self-employed to carry out risk assessments and implement risk controls, as well as setting out a framework for ensuring health and safety is managed in a systematic and organised way.

Workplace (Health, Safety and Welfare) Regulations 1992

The Workplace (Health, Safety and Welfare) Regulations 1992 cover the key issues for inspection and enforcement by local authorities on matters relating to the physical characteristics of the workplace such as temperature, lighting, cleanliness and sanitary conveniences. In addition, these regulations have been amended by the insertion of Regulation 4A. Regulation 4A imposes a duty on an employer to ensure that the stability and solidity of the workplace, where it is in a building, are appropriate to the nature and use of the workplace.

Control of Work at Height Regulations 2005

These require risks from all work at height (any distance where a person could fall and be injured) to be assessed and, where practical, eliminated by working from the ground or using barriers to prevent falls. Where temporary or permanent safety barriers cannot be

installed, a safe system of work to minimise the risks is needed.

Control of Substances Hazardous to Health Regulations 2002

Sets out the eight basic measures which employers must take to assess the risks from, and implement measures to control, exposure to hazardous substances. Wherever possible exposure to hazardous substances should be eliminated; for example by the use of a safer substance, or by enclosing the process. Precautions will need to be in place and maintained if significant risks remain.

Control of Lead at Work Regulations 2002

These require employers to assess and control the risks to staff from exposure to lead, and where this is potentially significant to apply specific controls as detailed by the regulations.

Control of Asbestos at Work Regulations 2002

These require employers and those responsible for the maintenance of non-domestic premises to manage the risks to their staff, contractors or others arising from that asbestos. Where work with asbestos is carried out by contractors they must be licensed under the Asbestos (Licencing) Regulations 1983.

The Electrical Safety, Quality and Continuity Regulations 2002

The Electrical Safety, Quality and Continuity Regulations 2002 defines the duties of any party supplying electricity to the premises with regard to matters such as supply, equipment, protection and provision of earthing.

The Electricity at Work Regulations 1989

The Electricity at Work Regulations 1989 defines the duties of an employer to ensure and maintain a safe working environment with respect to any electrical installation within a building.

The Gas Safety (Installation and Use) Regulations 1998

The Gas Safety (Installation and Use) Regulations 1998 require that any person who installs, services, maintains, or repairs gas fittings must be competent. It covers not only materials, workmanship, safety precautions and testing of gas fittings but also the safe installation of all aspects of gas-fired combustion appliance installations.

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