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2012

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# The Building Conservation Directory 2012

A guide to specialist suppliers, consultants and craftsmen in traditional building conservation, refurbishment and design

The many companies and specialist groups advertising in *The Building Conservation Directory* have been invited to participate on the basis of their established involvement in the field of building conservation and the suitability of some of their products and services for historic buildings. Some of the participants also supply products and services to other areas of the building market which have no application in the building conservation field. The inclusion of any company or individual in this publication should not necessarily be regarded as either a recommendation or an endorsement by the publishers. Although every effort has been made to ensure that information in this book is correct at the time of printing, responsibility for errors or omissions cannot be accepted by the publishers or any of the contributors.

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£16.95

ISBN 978-190091560-1



The paper used for *The Building Conservation Directory* is Satimat Silk from wood fibre originating from sustainably managed forests.

# The Building Conservation Directory

*The Building Conservation Directory* provides specifiers of works to historic buildings, their contents and surroundings a starting point in the search for appropriate products and services and expert advice. Approximately 1,000 different companies and organisations are represented in this edition.

The many technical editorial articles are written by leaders in this field and cover a wide range of important issues. The articles are not intended to be comprehensive but rather to raise awareness and stimulate dialogue amongst those involved with old buildings. Other reference information points the way on current legislation, continuing education and sources for further information and advice.

## HOW TO FIND WHAT YOU NEED

- ① The table of contents on page 4 together with the products and services index and the specialists index at the back should help you find the product, service or supplier you are looking for. Products/Services Selector tables, listing suppliers and their products and services head up each main section.
- ② Follow the index or Selector table page reference to the appropriate section or company and start the specification process. It may be helpful to contact more than one supplier. And please remember to tell each that you found them in *The Building Conservation Directory*.
- ③ If you still can't find what or who you need, don't despair. You can visit our industry leading website at [www.buildingconservation.com](http://www.buildingconservation.com) or ring us on 01747 871717 and we'll try to put you in touch with a supplier who can help.

All suppliers in the Directory pay a fee to be included and although Cathedral Communications does not formally approve or recommend them we do screen out inappropriate suppliers and products to maintain the established integrity of the Directory. This ensures that it remains a useful and credible forum in which appropriate suppliers can promote their businesses. Directory users should seek more detailed information and advice from suppliers before undertaking any sensitive project.

We are always looking for ideas to improve the Directory so please write to let us know if you have any suggestions for improvements to its content or presentation which will help you in your work with old buildings. And don't forget, our website at [www.buildingconservation.com](http://www.buildingconservation.com) is the primary Internet gateway to the building conservation and restoration industry and offers loads of supplier and technical information. And new for this edition, we've put the Directory in its entirety on the website as a flipping-page digital book, one more way to access the useful information it contains. Please see page 208 of this edition for more information on the website, or why not click in to have a look for yourself?

## Acknowledgements

Much like the successful hosting of the 2012 Olympics, *The Building Conservation Directory* this year has relied on the constructive teamwork of a wide range of individuals and organisations. For their contributions to this 19th edition of the Directory we would particularly like to thank the author of this year's foreword, Loyd Gissman of The Heritage Alliance, our advertisers for their continuing support, and our dedicated production team. Special mention goes also to all those who have contributed articles, illustrations or information; they include:

Anthony Beech, Anthony Beech ACR Furniture Conservation and Restoration  
Nigel Bryant, City of Bath College  
Robert Child, Historyonics  
Hugh Clark  
Nicholas Doggett, Asset Heritage Consulting Ltd  
Paul Drury, Drury McPherson Partnership  
Andrew Forecast, Trenton Fire Ltd  
John Gold, Oxford Brookes University  
Margaret Gold, London Metropolitan University  
Jonathan Goode, David Le Lay Architects  
Kelly Gunnell, Bat Conservation Trust  
Stephen Handforth, Victoria and Albert Museum  
Peter Holden, Acanthus Holden Architects  
Tim Hutton, Hutton + Rostron Environmental Investigations Limited  
Alan Jones, Pembrokeshire Thatch & Carpentry Services

Carole King  
Katie Laidlaw, National Trust  
Lindsay Lennie, Historic Shop Conservation  
Gerard Lynch  
Eleni Makri, Conservation PD  
Anna McPherson, Drury McPherson Partnership  
James Meek, Dyfed Archaeological Trust  
James Miller, Ramboll  
Ruth Nicholls, Astam  
David Pinniger  
Jo Reilly, Heritage Lottery Fund  
Caroline Rye, Archimetrics Ltd  
Mike Scott  
Charles Strang, Institute of Historic Building Conservation  
Heather Tetley, The Tetley Workshop  
Yanko Tihov  
Pat Waring  
Tim Yates, Building Research Establishment Ltd

# Foreword



*Historic environment conservation students from the Ironbridge Institute get to grips with metal conservation (Photo: Ironbridge Institute)*

**M**ILLIONS OF PEOPLE in this country actively support and hold a deep affection for our heritage, and investment in the historic environment has been shown to offer returns that are equal to, or higher than, other public sector investment. Yet, somehow, this powerful combination of passion and economic clout has not translated into political recognition.

2011 was a particularly tough year for the heritage sector, with cuts across the board, ever-increasing pressure to deliver more for less and a major shift in focus from the centre to local level. Far from this maelstrom diluting morale though, heritage professionals and volunteers up and down the country have so far risen to these challenges with the resilience, passion and commitment that characterises the sector.

One of the key tasks facing us all is how best to adapt to the localism agenda. Devastating cuts to local conservation services are a real concern and, as The Heritage Alliance has articulated to government on many occasions, volunteers cannot be expected to plug the gap in expert advice left in local areas. However, the 'Big Society' does present opportunities, and we must look at how the sector can pull together to make the most of these.

Many organisations represented by members of The Heritage Alliance – the umbrella body for 90 of England's non-government heritage bodies and the largest coalition of heritage interests in this country – have been blazing a trail in local, grassroots partnership-working for years. Their specialist knowledge and expertise, much of which is contributed on a voluntary basis for public

benefit, offers a valuable resource for local authorities to make more of in this new climate. Some of the new models that started in the voluntary heritage sector, such as heritage-led regeneration and asset transfer, are now mainstream, and the next few years will be a seedbed for future models. The expertise and passion of the hundreds of people listed in this directory will be vital to the success of these new approaches.

The next few years will be uncharted territory for all of us who love our heritage but by working together we can strengthen communities, keep costs low and ensure that future generations are able to use and enjoy what has so inspired us.

Loyd Grossman OBE FSA  
Chairman



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# CONSERVATION

## AN EVOLVING CONCEPT

PAUL DRURY

**B**UILDING CONSERVATION is distinctly different from the physical processes of repair and adaptation. It is an attitude of mind, a philosophical approach, that seeks first to understand what people value about a historic building or place beyond its practical utility and then to use that understanding to ensure that any work undertaken does as little harm as possible to the characteristics that hold or express those values. Conservation now needs to be explained in such terms, rather than by technical directives (that is to say, to be *operative* rather than *prescriptive*), because of the diversity of the buildings and places that people have come to value and wish to hand on to future generations.

Practising conservation involves judgement guided by professional ethics and public policy. It is based on an understanding of the relative importance of the heritage values attached to a building or structure, how they are represented in its fabric and the effects on them of different approaches to repair. The intellectual arguments for conservation originally put forward by antiquaries and critics, often prompted by the threatened destruction of valued buildings, have gradually developed into professional statements of ethics and good practice. The concept has evolved over a long time, but the language used to articulate it is changing. As conservation becomes a more complex and public activity, approaches to the conservation of buildings are seen as being closely linked not only to the conservation of objects but also to sustaining cultural values in the historic environment as a whole.

Throughout Europe, the cultural significance of historic buildings and places is now generally recognised as a public interest in property, regardless of who owns it, justifying the use of law, public policy and public investment to protect that interest. There are differences, however, about which buildings and areas are valued sufficiently to warrant legal protection, both quantitatively (the number of buildings and areas) and qualitatively (the values ascribed to them). Although the values of some places have long been recognised and tend to become more clearly established over time, attitudes to others (often of more recent date) may change, sometimes quite rapidly, within an evolving culture. Conservation thus requires



**Changing attitudes:** English Heritage oversaw the conservation and regeneration of derelict 18th-century houses that infill the ruins of the West Front, Bury St Edmunds Abbey, which the Ministry of Works had once proposed stripping away. (Photo: Fisher Hart Architectural and Interiors Photography)

an awareness of the mutability of heritage values. Policies and good practice about what should be conserved and how that should be done therefore represent a snapshot of contemporary understanding and approach, rather than a set of unchangeable truths.

### FROM MINIMUM INTERVENTION TO CONSERVATION PLANNING

The intellectual position of building conservation at the end of the 19th century was expressed with poetic force in William Morris' 1877 *Manifesto* of the Society for the Protection of Ancient Buildings. Its emphasis on the primary importance of sustaining inherited fabric and its opposition to restoration are still highly influential in British conservation. It is worth bearing in mind, however, that the manifesto's primary subject matter was medieval buildings, by then at least three centuries old. A huge expansion in the type, age range and number of buildings and

areas recognised as having cultural heritage value during the 20th century has made their conservation a much more complex activity, which now needs to take into account public as well as professional opinion.

Buildings of the 16th and 17th centuries, mostly still in everyday use, were included in the remit of the royal commissions established from 1908 to record them; the terminal date was soon extended to 1714. Statutory protection, effectively introduced in 1947<sup>1</sup> by the *Town and Country Planning Act* and *Town and Country Planning (Scotland) Act*, included Georgian buildings from the outset, soon adding a small number of Victorian buildings. While remaining highly selective of more recent buildings, inter-war and finally post-war buildings have been added to the lists. A '30-year rule' was set, and soon reduced to ten years for buildings deemed to be of 'outstanding' importance and under threat.

This closing of the gap between (present)



cultural value and (past) cultural heritage was perhaps an inevitable consequence of the emphasis from the outset (in the selection criteria for listing) on architectural rather than historic interest and thus on design value as well as fabric. The statutory lists now represent each nation's collection of architecture to which it attaches sufficient cultural value to wish to pass it on to future generations as part of their heritage. The incremental shift could not have been achieved without public support. Listing only began to be effective in protecting buildings during the late 1960s as public opinion moved against comprehensive redevelopment, a turning point being the introduction of conservation areas in 1967.

European Architectural Heritage Year (1975), a Council of Europe initiative, was a catalyst for thinking about how historic buildings, valued not only for their recollection of the past but also, and perhaps principally, for their contribution to the present and future, could be sustained in use. International statements of best professional practice, particularly *The Venice Charter* (1964), were still concerned primarily with monuments whose exceptional significance was evident at national, and often international, level and where ongoing use was desirable, but not essential, to survival. The Council of Europe *Convention on the Protection of the Architectural Heritage* (Granada, 1985) took a wider view. In the UK, pragmatic guidance became annexed to successive planning policy documents and supplemented by advice from national heritage agencies.

The idea of 'conservation planning' was pioneered by James Semple Kerr in Australia and underpinned (with *The Venice Charter*) *The Burra Charter*, which was adopted by ICOMOS Australia in 1979. While *The Venice Charter* and its precursors prescribed what was necessary to protect a relatively narrow range of heritage values, *The Burra Charter* set out a process for identifying the values people attach to places as the basis of managing change in ways that seek to retain 'all aspects of [their] cultural significance'. The heritage values of places were seen as often both multiple and mutable. Heritage practitioners therefore needed to become advocates and enablers as well as conservators, particularly in relation to the values attached to places by the communities that identify with them. The *European Framework Convention on the Value of Cultural Heritage for Society* (Faro, 2005; yet to be ratified by the UK) now places heritage in this wider political and social context.

Often promoted as a democratisation of heritage, addressing values beyond those of an expert elite, Kerr's work soon began to be referenced by practitioners in England and the 'conservation planning' approach was taken up by the Heritage Lottery Fund. The idea is a simple one: understand the range of values that people attach to a place and seek to manage the place to sustain as many of those values as reasonably possible. This idea, as well as established English conservation practice and public policy,

provided the background to the drafting of English Heritage's *Conservation Principles, Policies and Guidance for the Sustainable Management of the Historic Environment* (2008). This document attempted to domesticate the concepts of conservation planning and a values-based system of assessment, promoting an integrated approach to managing any and all valued elements of the historic environment.

The scope of designation and recognition of historic buildings and areas has widened to include those significant for their design or associations, rather than simply their age, and which are sustained by remaining in use. In parallel, there has been a de facto (but not universal) acceptance that 'minimum intervention' does not, of itself, necessarily provide an adequate response to the range of conservation issues faced by practitioners or regulatory authorities. This wider concept of heritage demands discrimination and a sense of proportion, to inform attempts to identify and balance conflicting public interests (the essential concern of public policy) in a methodical and transparent way.

#### EVOLVING POLICY

Public policy and professional practice have inevitably responded to changing concerns more rapidly than underlying legislation, complicating an integrated approach to managing cultural heritage values in the historic environment. In England, a draft heritage protection bill was published in 2008, but not taken forward, leaving integrated policy (*Planning Policy Statement 5: Planning for the Historic Environment*, 2010) informed by the ideas in the *Conservation Principles* but disconnected from the details and terminology of underlying legislation. At the time of writing, a high level *National Planning Policy Framework* seems likely to replace topic-based Planning Policy Statements, including PPS5. This is intended to leave good practice to be established through standards and guidance produced by professional bodies and organisations. More weight might then be attached to the revision, recently announced, of the British Standard (BS) *Guide to the principles of the conservation of historic buildings* (BS 7913:1998).

The Welsh Assembly Government has published its own *Conservation Principles for*

*the Sustainable Management of The Historic Environment in Wales* (2011), adapting the English version, and has announced its intention of bringing forward a Heritage (Wales) Bill. Scotland has high level policies applicable to all heritage assets,<sup>2</sup> including reference to conservation planning, but grounded in existing legislation, to which some amendments have been made.<sup>3</sup> Policy in Northern Ireland still follows a similar format to the recently-superseded English PPG15.<sup>4</sup>

#### KEY CONCEPTS IN CURRENT POLICY AND GUIDANCE

**Significance** is the starting point: it is the reason why, from a heritage perspective, the future of a place may be a matter of public interest. English Heritage's *Conservation Principles* defines it as 'the sum of the cultural and natural heritage values of a place, often set out in a statement of significance'. Breaking this down, a value is 'an aspect of worth or importance, here attached by people to qualities of places'. They are grouped under four broad headings, not intended as a checklist, but as a prompt to thought:

- evidential, deriving from the potential of a place to yield evidence about past human activity
- historical, deriving from the ways in which past people, events and aspects of life can be connected through a place to the present
- aesthetic, deriving from the ways in which people draw sensory and intellectual stimulation from a place
- communal, deriving from the meanings of a place for the people who relate to it, or for whom it figures in their collective experience or memory.

English public policy in PPS5 adopts a similar definition of significance, 'the value of a heritage asset to this and future generations because of its heritage interest', but limits it by the qualification 'that interest may be archaeological, architectural, artistic or historic'. This is the sum of the types of 'interest' included in the underlying legislation.<sup>5</sup> If one reads 'archaeological' for 'evidential', and accepts that architectural and artistic values fit within the broader concept of aesthetic values in the *Conservation Principles*, the main difference lies in the absence of the idea of communal values, although arguably they can be understood as a subset of historical values.

'Significance' can be considered as broadly equating, in terms of the *Planning (Listed Buildings and Conservation Areas) Act 1990*, with 'interest', as in 'special architectural or historic interest', but in an integrated approach to managing values, its scope tends to be wider, inclusive rather than specific. Works of alteration or extension for which listed building consent is required are those 'which would affect its character as a building of special architectural or historic interest'. In this context, 'character' (meaning 'distinctive nature, distinguishing quality or qualities') might be considered as the attributes that carry or express that special interest or significance.



**Changing values:** Once considered controversial, many post-war listings are now cultural icons: Leonard C Howitt's 1957 Hollings Building, Manchester, which was listed Grade II in 1998, now adorns a coffee cup. (Photo: www.peoplewillalwaysneedplates.co.uk)



**Evidential value:** *The atmospheric power-press room in a workshop in Vyse Street, in the heart of Birmingham's Jewellery Quarter, captures the emotive power of past human activity. It is above all a primary source of information about how jewellery and small metalwork were made. (Photo: English Heritage)*

**Heritage asset** is the portmanteau term used in PPS5 for 'a building, monument, site, place, area or landscape positively identified as having a degree of significance meriting consideration in planning decisions. Heritage assets are the valued components of the historic environment. They include designated heritage assets (as defined in this PPS) and assets identified by the local planning authority during the process of decision-making or through the plan-making process (including local listing). The English Heritage *Conservation Principles* prefers 'significant place', defined as 'a place which has heritage value(s)', while the Welsh *Principles* use 'historic asset', defined as 'an identifiable component of the historic environment. It may consist of or be a combination of an archaeological site, an historic building, or a parcel of historic landscape. Nationally important historic assets will normally be designated'. Scotland uses 'historic asset' and, less commonly, 'heritage asset'<sup>6</sup> as generic terms.

**Conservation** can be defined in many ways. The difference between prescriptive and operative definitions is evident from comparing the current BS 7913 (1998) with *Conservation Principles*. The BS definition is generic: 'action to secure the survival or preservation of buildings, cultural artefacts, natural resources, energy or any other thing of acknowledged value for the future'. But paragraph 7.1.2 goes on to state 'a conservative approach of minimal intervention and disturbance to the fabric of an historic building in which there is a presumption against restoration is fundamental to good conservation'. There are many buildings for which this is entirely true, but, arguably, others where a values-based approach would lead to a different conclusion.

The operative definition in the *Conservation Principles* is 'the process of managing change to a significant place in its setting in ways that will best sustain its heritage values, while recognising opportunities to reveal or reinforce those values for present and future generations'. It implicitly accepts that heritage values change over time, indeed that they can be changed by the process of conservation. The definition of conservation in PPS5, 'the process of maintaining and managing change to a heritage asset in a way that sustains and where appropriate enhances its significance', differs primarily in its assertion that significance can be enhanced through conservation. 'Enhance' presumably arises from the general application of a legislative provision relating to a specific type of heritage asset, namely conservation areas, whose character or appearance 'it is desirable to preserve or enhance'.

Other concepts tend to be confined to statements of principles or professional guidance, suggesting a boundary between public policy and conservation ethics.

**Authenticity** is defined in the *Conservation Principles* as 'those characteristics that most truthfully reflect and embody the cultural heritage values of a place, following the Nara Document on Authenticity (ICOMOS Japan, 1994)'. The process of conservation cannot sustain heritage values unless it has due regard for the authenticity of the place or building. This definition recognises that authenticity can be related to, for example, design (especially for recent buildings) and function (for example, a place of worship, or an engineering structure), as well as the evidential and historical values of inherited fabric, but nonetheless suggests that change should be detectable, at however subtle a level.

**Integrity** (literally 'wholeness, honesty') can apply, for example, to a structural system, a design concept, the way materials are used, the character of a place, artistic creation, or functionality. Decisions about recovering any aspect of integrity that has been compromised must, like authenticity, depend upon a comprehensive understanding of the values of the place, particularly the values of what might be lost in the process (*Conservation Principles*, para 94). Similarly, ascribing relative significance to parts of a building cannot justify interventions which cumulatively fragment the whole.

## REFLECTION

The concept of building conservation to sustain cultural heritage values, normally alongside utility value, has been evolving in the UK for more than three centuries. The past half-century has seen the most rapid developments, in scope, in thought about purpose and aims, and in technical skills, not least the rediscovery of traditional skills. There has been progress towards the integration of conservation philosophy and practice that has been developed by different professional groups under different legislative or policy frameworks, both within and outside official bodies.

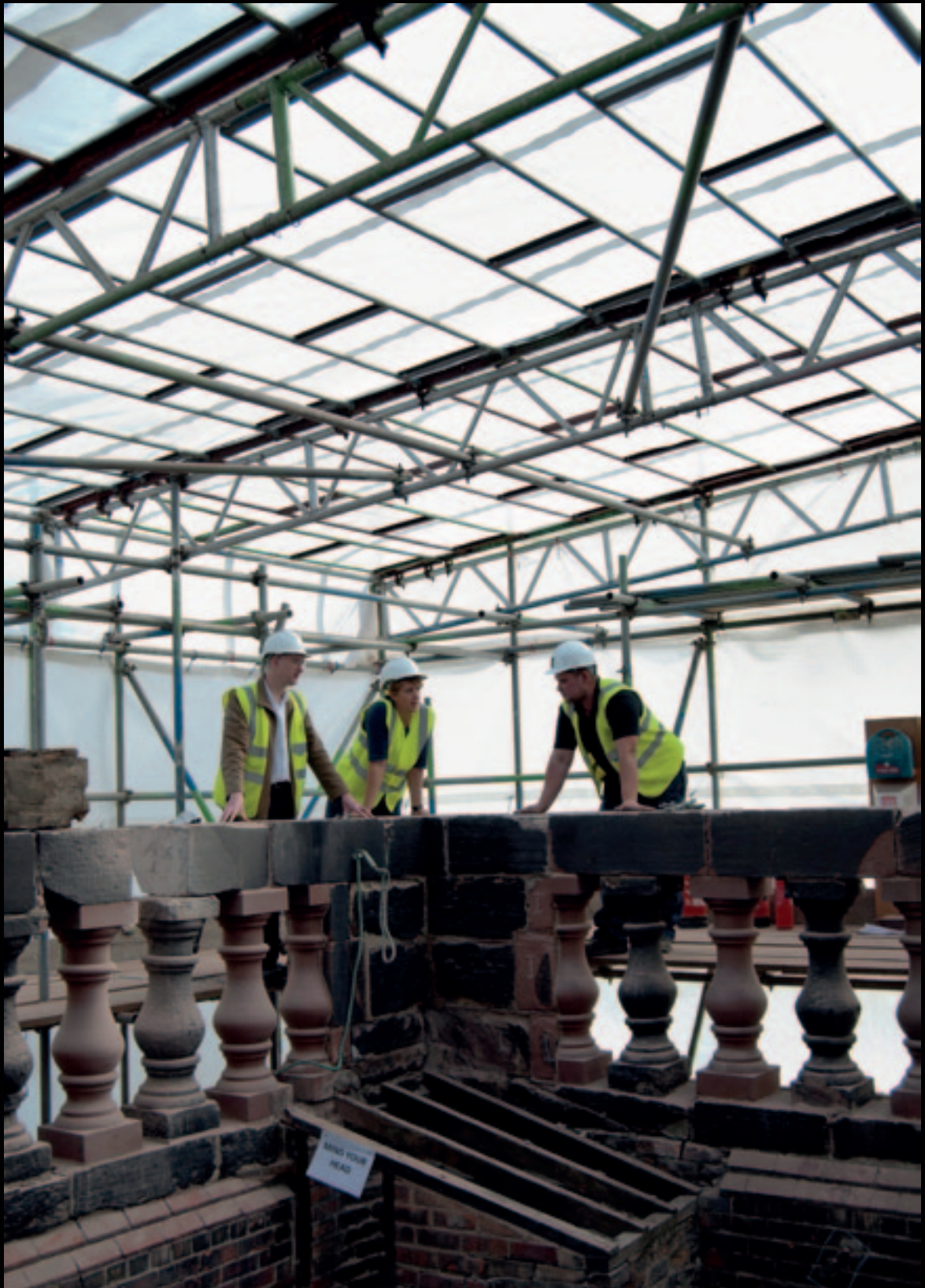
Ultimately, however, each of us has a conservation philosophy shaped by professional experience, personal value scales and sensibility. The importance of official and ethical guidance perhaps ultimately lies in providing common frameworks for consideration, assessment and debate about particular proposals.

**PAUL DRURY FSA MRICS IHBC is co-principal of the Drury McPherson Partnership (see page 39), which specialises in historic environment policy and practice. He is a former director of English Heritage's London Region and was the chair of the Council of Europe's Steering Committee for Cultural Heritage, 2003–4.**

This article draws on text written by the author for Chapter 1 of *Conservation Basics*, the first volume of the new edition of the English Heritage *Practical Building Conservation* series, due for publication early in 2012.

## Notes

- <sup>1</sup> Except in Northern Ireland, where listing was introduced in 1974
- <sup>2</sup> *Scottish Planning Policy* (2010); *Scottish Historic Environment Policy* (2008), esp 1.15
- <sup>3</sup> *Historic Environment (Amendment) Scotland Act 2011*
- <sup>4</sup> *Planning Policy Statement 6: Planning, Archaeology and the Built Heritage* (1999, as amended)
- <sup>5</sup> The term 'artistic' comes from the *Protection of Wrecks Act 1973*
- <sup>6</sup> *Scottish Planning Policy* (2010), para 110–111



Steve Welsh and Liz Jackson of architects Buttress Fuller Alsop Williams (left) discuss the repairs at St Anne's Church, Manchester with the contractor  
Photo: Jonathan Taylor

## Chapter 1

# Professional services

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A K S Ward Lister Beare	st	53								
A R P Anthony Richardson and Partners	ar qs	19								
A R P L Architects	ar cm po qs	19								
Aaron Evans Architects Ltd	ar cm hi ms pc ud ur	19				W	H			
Acanthus Clews Architects Ltd	ar cm id po su	19								
Acanthus Holden Architects	ar cm ms pc po	19								
Access Ecology Ltd	ei	141								
Adrian Cox Associates	st	53								
Alan Bishop & Associates	he	38								
Ambo Architects	ar id po	19								
Anderson & Glenn	ar ho la po	20								
Anthony Short and Partners	ar id ms su	20								
Antony Gibb Ltd	ar	20								
Archaeology South-East	ae hi ms po	16								
Architectural Archaeology	ae	12					H			
The Architectural History Practice Limited	hi po	16								
Arctic Surveys Ltd	aa ar ms su	16								
Arrol & Snell Ltd	ae ar he la ms po su	20								
Astam	ar be cm pc su	20				W				
Bailey Partnership	cm su	46								
Bare, Leaning & Bare	cm hs qs	49								
Barry Stow Architect Ltd	ar	20								
Bates Zambelli	ar id pc ud	20								
Beacon Planning	hi lg pc po ud ur	37								
Blackett-Ord Conservation Limited	ar hi su st	53								
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Brading Butt Chartered Quantity Surveyors	qs	50				W	H	L		
Brewer Jewel Chartered Architects	ar da	20								
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Buttress Fuller Alsop Williams	ar po ud	21								
Capstone Consulting Engineers Ltd	su st	53				E				
Carden & Godfrey Architects	ar id po	21								
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Carpenter Oak & Woodland Co Ltd	he ms	74								
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Clague LLP	ar cm ms pc po su	22								
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The Conservation Studio	hi pc po ud ur	39								
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Crane & Associates	ar	22					H			
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Devlin in Design	id	173								
Alan Dickinson	ae hi ms su	46						H		
Donald Insall Associates Ltd	ar cm fs hi id ms pc po ur	23								
Douglas Willis Associates Limited	da ms su	46				W	H	H		
Drury McPherson Partnership	pc po	39								
Ellis & Moore	st	53								
English Heritage (NMR)	hi ms ph	12								
Eura Conservation Ltd	cm po su	49								
Exegesis Spatial Data Management	ms ph	48								
F A S Heritage	ae hi ms ph po	16								
Feilden & Mawson LLP	ar cm hi id po su	23								
Ferguson Mann	ar	23								
The Floyd Consultancy	he ma su	46				W				
Franklin Ellis Architects	ar	24								
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Gibbon, Lawson, McKee Ltd	ar cm fs su	47								
Giles Quarrie & Associates	ar hi pc po su	24								
Gilmore Hankey Kirke Ltd	ar cm id la po	24								
Gray, Marshall & Associates	ar da po ur	25								
Greenwood Projects Ltd	cm hs qs	50								
Grosvenor, Meehan & Laing Associates Ltd	he ms	40								
Grover Lewis Associates Limited	lg pc po	37								
H O K Conservation and Cultural Heritage	ar hi id po ud	25								
Hall & Ensom, Chartered Building Surveyors	ar cm ms qs su	47				W	H	L		
Hawkes Edwards & Cave	ar	25								
Helen Hughes Historic Interiors Research & Conservation	hi po	175								
Heritage Surveys Limited	ar cm ms po su	47								
Heritage Testing Ltd	ma nd	49								
Hibbs and Walsh Associates	ar	25					H			
Hilary Taylor Landscape Associates Ltd	ed ei la po	141								
Hirst Conservation	ae ar ma po	49								
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Hockley & Dawson Consulting Engineers Ltd	po st	53							S	
Howl Associates Ltd	ar	25				W				
Huntley Cartwright	cm qs	50								
Hurst Peirce & Malcolm LLP	st	54								
Hutton + Rostron Environmental Investigations Limited	cm dn he nd su	49								
Ingarsby Conservation Ltd	cm	142								
Ingram Consultancy Limited	ar he ma po su	40								
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International Fire Consultants Limited	fs hs	163								
James Brennan Associates	ms ph su	16								
John C Goom Architects	ar	25								
John D Clarke Architects	ar	26								
John D Lynch Partnership	ar	26				E				
John McAslan + Partners	ar id la ud ur	26								
Johnston and Wright	ar cm hs id su ud	26								
Jonathan Rhind Architects	ar he id	26								
Julian Harrap Architects	ar hi id la su	26								
K A W Design	id	171								
K S P Consultancy LLP	cm hs qs	50								
Kathryn Sather & Associates	hi po	40								
Bernard Kelly	id	173							L	
Kingsland Surveyors Limited	ms pe ph	16								
Knox-McConnell Architects	ar	26		Y						
L U C (Land Use Consultants)	ed ei ho la pc po ud ur	37								
Lathams	ar ud ur	26								
Lee Evans Partnership LLP	ar	27								
Stuart Little	cm qs su	47								
M L M Consulting Engineers	be	163								
M R D A	ar he hi id po su	27						L		

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T C R MacMillan-Scott, Chartered Architect	ar	27					■	■	■	
John Malaiperuman, Conservation Architect	ar	28			W				■	
Mann Williams	hs su st	54	■	■	■	■	■	■	■	
Martin Ashley Architects	ar cm da he hi id po su	27					H	■		
Martin Thomas Associates	be fs	163	■	■	■	■	■	■	■	
McGregor Bowes	ar	28	■							
Mel Morris Conservation	hi pc po ur	40		W	■	■	h	■	s	
Michael Heaton Heritage Consultants	ae hi ms po	12							■	
Mildred, Howells & Co	qs	50			■	W			■	
The Morton Partnership Ltd	ar su st	54					■	L		
Nash Partnership	ar cm hi pc ud ur	28			■	■	■	■	■	■
Naturally Wild Consultants Ltd	ei	141	■	■	■	■	■	■	■	■
Nicholas Jacob Architects	ar	28	■	■	■	■	■	■	■	■
Nick Cox Architects	ar	28	■	■	■	■	■	■	■	■
Nimbus Conservation Limited	ph	101	■	■	■	■	■	■	■	■
Nye Saunders Chartered Architects	ar da	28							■	■
Odgers Conservation Consultants Ltd	cm he po	40	■	■	■	■	■	■	■	■
Oliver West and John Scott Architects Limited	ar	28					H	LH	■	
Owlsworth I J P	ar cm he ma	69	■	■	■	■	■	■	■	■
P D P Green Consulting	ar po st ud ur	28				■			■	
P W P Architects	ar cm pc	29		■	■	■	■	■	■	■
Paul Tanner Associates	st	54						H		
Michael Pearce	pc po	37					H	■	■	
Peregrine Bryant	ar	29			■	■	■	■	■	
Peter Codling Architects	ar su	29					■			
Press & Starkey	qs	50	■	■	■	■	■	■	■	■
Priory Heritage Ltd	cm he ms su	40					■	L		
Purcell Miller Tritton LLP	aa ar hi id pc su	29	■	■	■	■	■	■	■	■
R M A Heritage	la pc po ud	41	■	■	■	■	■	■	■	■
R P S Planning and Development	ae pc	12	■	■	■	■	■	■	■	■
R V M & Associates	cm pc qs	38						■		
Radley House Partnership	ar	29	■	■	■	■	■	■	■	■
Ramboll	ae be po st	54	■	■	■	■	■	■	■	■
Rees Bolter Architects	ar	29				E	■	■		
The Regeneration Practice	ar cm fd he hi hs po ud ur	29						L		
Reliable Effective Research	hi	16						■		
Resurgam	cm he nd po su	41	■	■	■	■	■	■	■	■
Richard Coles Builders Ltd	cm	70						H	S	
Richard Crooks Partnership	ar cm id	29		Y						
Rickards Conservation	he ms po su	47					■	■	■	
Robert Bloxham-Jones Associates Limited	be	163				W			■	
Robert Kilgour Architects Ltd	ar	30	■	■	■	■	■	■	■	■
Robert Seymour Conservation Architects	ar	30							■	
Robert Woodhead Ltd	cm	73		Y		E				
Robin Kent Architecture & Conservation	ar da hi po su	30	■	NY				L		
Rodney Melville & Partners	ar po	30	■	■	■	■	■	■	■	■
Roger Mears Architects	ar	30			■		■	■		
Ian Russell	nd su st	54						■	■	■
S F K Consulting	st	54							■	
Sandy & Co (Contractors) Limited	qs	70	■	■	■	■	■	■	■	■
Sawyer & Fisher	cm qs	50		WY		■	■	■	■	■
Sidell Gibson Architects	ar	31	■	■	■	■	■	■	■	■
Smiths Gore	aa ar cm hi id ms pc po su	31		■	■	■	■	■	■	■
Soul Architects	ar	31	■	■	■	■	■	■	■	■
St Ann's Gate Architects LLP	ar	31	■	■	■	■	■	■	■	■
Stone Edge Limited	ma	102	■	■	■	■	■	■	■	■
StoneCo Limited	he	153					H	■		
Stonewest Limited	ar he ma ms po	73					H	■		
Stow and Beale Conservation Architects LLP	ar	31	■	■	■	■	■	■	■	■
Stride Treglown PLC	ar	31	■	■	■	■	■	■	■	■
Stuart Page Architects	ar id po su	32						■	S	
Anthony Swaine Architect	ar he po	20							S	

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Szerelmey Restoration and Stonework	ms	153						■	■	
Tuffin Ferraby Taylor	cm da hi hs pc po su	48	■	■	■	■	■	■	■	
T R A D A Technology Ltd	he nd su	47	■	■	■	■	■	■	■	■
Thomas Ford & Partners	ar cm hs po su	32	■	■	■	■	■	■	■	
Timber Framing and Conservation	he hi	74				E				
Trenton Fire Ltd	fs	163	■	■	■	■	■	■	■	
Turley Associates	pc ud	41	■	■	■	■	■	■	■	■
U R S Ltd	ae cm hs pc su st	54	■	■	■	■	■	■	■	■
V A Conservation	ma po	165		■	■	■	■	■	■	■
Verity & Beverley	ar	32						L	■	
W C P (The Whitworth Co-Partnership LLP)	ar lg pc su	32					■	LH		
W R Dunn & Co Ltd	ar cm hs po su	48	■	■	■	■	■	■	■	■
Wallwalkers	he	82	■	■	■	■	■	■	■	■
Ward & Dale Smith Chartered Building Surveyors	pc su	48	■	■	■	■	■	■	■	■
John Wardle	st	54					H	■	S	
Watkinson & Cosgrave	cm su	48					■	LH		
Watson Bertram & Fell Ltd	ar su	32							■	
Weald and Downland Open Air Museum	hi	193	■	■	■	■	■	■	■	■
West Waddy ADP	ar cm hs lg pc po ud	32				■	H	■	■	
Wiles and Maguire Ltd	ar	32		WY	■					
Robin Wolley Chartered Architect	ar	32	■	■	■	■	■	■	■	■
Woodhall Planning and Conservation Ltd	ar hi pc po ud	37	■	■		■	■	■	■	
Andrew PK Wright	ar hi nd po	16	■							

## REGION CODES

North of England	N	Cumbria, Durham and counties to the north
	W	North West
	Y	Yorkshire and the Humber
Midlands	E	East Midlands
	W	West Midlands
East	E	East Anglia
	H	Northern Home Counties
South East	L	Greater London
	H	Southern Home Counties
South West	S	Berks, Hampshire and Oxfordshire
	W	Glos, Wilts, Dorset and counties to the west

## SERVICE CODES

aa	architectural technicians
ae	archaeologists
ar	architects
be	building services consulting engineers
cm	contract management
da	disabled access consultants
dn	dendrochronologists
ed	environmental consultants
ei	ecologists
em	estate management
fd	fundraising
fs	fire safety consultants
he	heritage science and technology
hi	historical researchers
ho	horticultural consultants
hs	health and safety consultants
id	interior designers and consultants
la	landscape architects
lg	legal services
ma	materials analysis
ms	measured surveys
nd	non-destructive investigations
pc	planning consultants
ph	photographic services
po	conservation plans and policy consultants
qs	quantity surveyors
st	structural engineers
su	surveyors
ud	urban design
ur	urban regeneration

# Informing Conservation



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ARCHAEOLOGISTS: See also: display entry in *Heritage Consultants* section, page 38 and profile entry in *Measured Surveys* section, page 16.

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Tel 01529 497449 Fax 01529 497518

ANALYSIS OF PLASTER AND PAINT LAYERS: See also: display entry on the inside front cover and profile entry in *Building Contractors* section, page 67.

### ■ INSTITUTE FOR ARCHAEOLOGISTS

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ARCHAEOLOGISTS: The IfA advances the practice of archaeology and allied disciplines by promoting professional standards and ethics for conserving, managing, understanding and promoting enjoyment of heritage. Cathedral Communications publishes the IfA yearbook, a useful working guide to the UK's archaeology profession including complete listings of IfA members along with essential industry contacts and a directory of specialist services.

### ■ MICHAEL HEATON HERITAGE CONSULTANTS

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ARCHAEOLOGICAL SERVICES AND PLANNING: See also: display entry in *Heritage Consultants* section, page 40.

# ROCH CASTLE, PEMBROKESHIRE

## A STUDY IN SIGNIFICANCE

PETER HOLDEN and JAMES MEEK



*Roch Castle photographed from the north-east just before completion of the project in 2011*

*If the intervention is to find its place, it must make us see what already exists in a new light* (Peter Zumthor, *Thinking Architecture*, 2006)

**CADW, THE WELSH** government's historic environment service, defines conservation as 'the careful management of change' in its *Conservation Principles* (2011). The same publication also states that 'to be sustainable, investment in the conservation of the historic environment should bring social and economic benefits'. With dwindling state aid, a sustainable future for historic buildings in Wales must be underpinned by economically viable use.

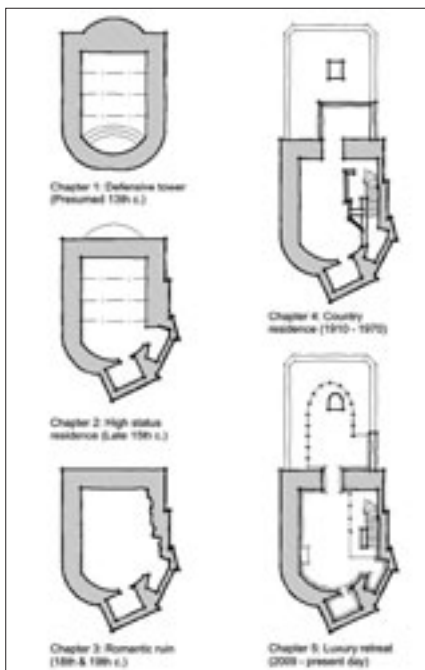
*Conservation Principles* goes on to describe the significance of a historic asset as embracing 'all of the cultural heritage values that people associate with it, or which prompt them to respond to it'. Assessing the significance of a place can involve subjective decisions based on emotional responses. To the client it may mean one thing, to the archaeologist or preservation group another. It often falls to the architect to assess conflicting evidence in order to evaluate significance.

Cadw's principles also state that new work or alteration to a significant place will normally only be acceptable if 'there is sufficient information comprehensively to understand the impact of the proposal on the significance of the asset' and

'the quality of design and execution add value to the existing asset'.

The conversion of a Grade I listed building to a new use can only be successfully achieved through a mutually respectful partnership between architect, archaeologist and conservation officer. This is especially true when the building in question is an early medieval castle like the one at Roch in west Pembrokeshire. The project benefited throughout from the support and positive input of the conservation department at the Pembrokeshire Coast National Park Authority.

As with all ancient buildings, the fabric records a story of change that reflects historical, political and social developments. The challenge at Roch Castle



Roch Castle: phases of use from the 13th century to the present day

was to understand the extent of the surviving medieval work and to evaluate the significance of the more recent alterations.

#### ROCH CASTLE – THE STORY SO FAR

Roch Castle was one of a number of defended sites along the 'Landsker line', the boundary between the English, Flemish and Norman settlers of southwest Pembrokeshire and the ousted native Welsh to the north and east. Originally a simple stone tower perched on an outcrop of igneous rock, its unusual D-shaped plan-form ('chapter 1' in the diagram on the facing page) was probably an engineering solution to the shape of the rock rather than a stylistic convention. It was constructed by the descendants of a powerful family of Flemish settlers in the 13th century, and the castle remained in the hands of the descendants of Godbert the Fleming (the de Rupe and de la Roche families) until the 15th century.

The square tower and stair extension on the south-east side of the castle were added when the defensive role of the castle diminished and it became a high status residence ('chapter 2'). By the latter part of the 15th century the castle was in a ruinous and deserted state. Between 1643 and 1645, during the English Civil War, it changed hands between the Royalist and Parliamentary forces four times and suffered cannon damage. It was not extensively repaired and by the 19th century ('chapter 3') it was a ruin.

The castle was purchased by Sir John Wynford Philipps (later Viscount St Davids) in 1899. He instigated extensive restoration works in the first two decades of the 20th century, including the addition of a three-storey extension on the northern side of the tower, and the installation of new floors, stairs and internal divisions ('chapter 4').

In 1954 the castle was purchased by John Whitfield and it was occupied by his father



Photograph of Roch Castle from the south-east taken before 1900 (Haverfordwest Records Office)

Lord Kenswood and his family until 1965. The castle was then sold to Hollis Baker, an American furniture manufacturer. The latter two owners, Kenswood and Baker, were responsible for the 'baronialisation' of the interiors. Photographs taken in the mid 1950s show a series of additions attributed to Kenswood. These include, significantly, black painted gothic doors with false strap hinges (by Baldwin's of America) and leaded light internal screens.

The last phase of alterations was carried out by David Berry who, between 1972 and 1985, closed off two stairways and reorganised partitions to facilitate separate holiday lettings of the annexe and tower.

#### ARCHAEOLOGICAL INVESTIGATION

At the start of the project an initial desk-based assessment and building appraisal was undertaken by Dyfed Archaeological Trust field services to support the planning and listed building consent applications. The aims of this work were to gain further information on the present state of preservation of the castle, provide an indication on the surviving medieval fabric of the building and make an assessment of its archaeological importance. Some research was undertaken into the castle's date, ownership and historical



Typical corrosion of floor slab reinforcement

development, and the subsequent report also provided further information on the known archaeological and historical character of the surrounding landscape.

Further works undertaken at the castle have included a scheme of detailed historic building recording, including survey and photography. This has been supplemented with information recorded during various archaeological watching briefs and a geophysical survey within the grounds.

The historic building recording work has established that the majority of the exterior castle walls is substantially of medieval fabric, although many of the internal and external wall facades were restored during the early 20th century. The recording work has confirmed that the original D-shaped tower had at least two upper floors and a basement area, which was partially occupied by the rocky outcrop. It is likely that this was first built in the early years of the 13th century by Adam de Rupe. Access to the original tower would have been at the first floor level on the north side. Originally, internal stairs were present within the thickness of the walls on the apsidal end of the building, although these were later modified when the square tower addition and stair extension were built on the south-east side of the castle. These extensions contained small bedchambers or solars (private sitting rooms) and guardrooms (latrines).

The medieval floor arrangements differed significantly from those inserted during the early 20th century works with the first floor hall having a much higher ceiling. By the 14th century, large windows had been inserted of which the stone corbelled arches survive, although the actual windows have been heavily modified and replaced. Similar arches over windows and doorways survive on the ground floor of the tower, although these are probably late medieval additions, modified in the early 20th century. The square tower is likely to have been added in the 14th century. The second storey of this tower retains an original rib-vaulted ceiling.

During the early 20th century works, new floors and room divisions were added. The circulation routes and stairs that exist in the building are a mix of medieval and early 20th century additions.

#### THE OWNER'S BRIEF

Roch Castle was purchased in 2009 by the Griffiths-Roch Foundation with the intention of repairing the building and converting it into one of a chain of retreats, all in historic buildings, operated by the Retreats Group Ltd.

Raised in St Davids, the owner (a commercial architect based in Hong Kong) knew the building well and was keen to preserve its history, architecture and importance to the landscape of the St Davids Peninsula. His plan was to introduce all the facilities associated with five star accommodation in the heart of the medieval building using careful design to protect and enhance its significance.

From the outset it was clear that there were potential conflicts and challenges



inherent in this approach, not least:

- introducing new functions and spaces without damaging the integrity of the old
- controlling damp ingress to an acceptable level without changing the aesthetic of the castle
- managing safe access and egress without introducing fire escapes
- accommodating new hidden services runs within and without
- minimising future maintenance, particularly at high level
- defining the junctions between new and old.

### CONSERVATION AND CONSTRUCTION ISSUES

The liberal use of concrete renders from the early 20th century restoration works has not aided the survival of the castle, which is recorded as having long-standing problems with water ingress and damp. These were serious enough to cause some occupiers to leave. The application of an asphalt coating to the flat roofs and parapet walks helped but, as with the use of cement-based pointing, it proved to be a short-term fix at best.

Encased in cement by Viscount St Davids and in glass fibre by later owners, permission was given at an early stage to allow the removal of linings, cement renders and pointing. This would allow a better understanding of the story of the development of the castle and its condition, prior to an application for listed building consent.

As work progressed, the extent of the damage caused to steel beams and unprotected reinforced concrete (RC) work became apparent. Roofs were formed from concrete cast in situ onto vaulted corrugated steel sheets between RSJs. The breakdown of the asphalt covering had severely damaged the corrugated steel and the top flange of the RSJs. The RC floor slabs had been built directly into the damp walls and had been cast with too little 'cover'. (Over the years, dissolved carbon dioxide from the atmosphere progressively reduces the alkalinity of the concrete which protects the steel reinforcement. The thickness of the concrete over the steel is therefore critical to its durability.) Concrete analysis showed that in all of the concrete floors, the depth of carbonation exceeded the concrete cover to the reinforcement, suggesting that all of the reinforcement was by this time liable to ongoing corrosion.

The engineer's report concluded that the extent of the damage to the reinforcement and the structural steel, and the degree to which it had been built into the masonry, meant that in situ repairs would be impractical.

On the other hand, the replacement of the floors and roofs would mean the loss of all the 1950s alterations and much of the Viscount St Davids restoration of 1910. There was a general consensus that the 1950s work was of little architectural or historical value.

The archaeologist had already concluded that the 1910 alterations had not adhered to any of the original floor levels or staircase



*View of the castle from the south-east*

locations and most of Viscount St Davids' architectural details had been lost during the later work. The significance of his involvement, certainly as far as the Society for the Protection of Ancient Buildings was concerned, revolved around what was perceived as an early use of in situ concrete work in west Wales.

Justification for removal rather than repair of the RC structure by the architect was based on:

- the identification of much better examples of early RC work in west Wales such as those at Caldey Island Monastery (1912) and the Towy Works, Carmarthen (1907–9)
- the long-term maintenance implications of not replacing the floors
- the likely effects of any collapse and the resulting damage to the medieval fabric should corrosion continue.

After a prolonged debate, consent was eventually granted. It was conditional on the specific testing of each slab and the development of a method statement for the removal of the floors (from the bottom up) aimed at preserving the integrity of the castle walls.

### INTERVENTION

Repairs and alterations were designed to ensure that the surviving medieval fabric was protected and consolidated, and new work was designed with reversibility in mind. Structural components such as roofs, for example, were attached to the structure, not built into it, so that if necessary the new components could be removed with minimum disruption to earlier fabric.

The external repair of the medieval fabric using matching Pennant sandstones and hydraulic lime mortars has been extensive and time consuming. Internally, the masonry walls have been plastered with hemp lime plaster.

Last repointed in sand and cement in the



*New lime render on the staircase walls*

early 20th century, all the pointing has now been renewed in hydraulic lime (NHL 3.5) and sand mortar. The main body of the medieval tower has been hacked out to an average depth of 60mm and pointed in three 'passes'. The final coat was trowled and brush finished over much of the rubble face work in what is locally known as a 'parged' finish. In addition the 15th-century square tower on the exposed south face has received two shelter coats of the same mix, brush applied. The roughly coursed masonry of the 20th-century annexe has been flush pointed in two passes.

To avoid confusing the history of the building, the internal fit-out is uncompromisingly modern, incorporating polished limestone floors, glass screens with aluminium frames and bespoke joinery. In the one location where the new interior extends outside, in the form of a structure which tops the annexe roof (see title illustration), the modern vocabulary is continued, although it interacts with the original fabric by reflecting the D-shaped form of the original tower.

This dialogue between new and old is continued internally through the use of hemp lime plasters for many of the new suspended ceilings and partitions.

Completed in the autumn of 2011, it is hoped that the quality of the repairs and alterations will sustain the next chapter in the life of this important building, both physically and economically.

**PETER HOLDEN RIBA AABC is managing director of Acanthus Holden Architects (see page 19) and was director in charge of the project with direct responsibility for the conservation of the medieval castle.**

**JAMES MEEK MifA is head of field services at Dyfed Archaeological Trust and was responsible for the archaeological research for the project.**

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# LISTED BUILDING CONSENT REQUIREMENTS FOR ALTERATIONS AND REPAIRS

NICHOLAS DOGGETT

**T**HE AIM of this article is to provide guidance on the need for listed building consent (LBC) for works to a listed building. After a short introduction to the legislative background, it focuses on the principles and practicalities of what constitutes an alteration and the circumstances in which LBC may also be required for repairs.

While much of what follows applies to all types of listed building, the focus here is on alterations and repairs to domestic dwellings in order to provide guidance for homeowners as well as for conservation and other professionals. In addition to the need for LBC, it is important to remember that planning permission will be needed for any extension (and some external alterations) to a listed building. Approval under the Building Regulations will also usually be required for both internal and external works.

The situation described here relates to England and Wales but not to Scotland and Northern Ireland, where slightly different circumstances pertain.

## THE LEGISLATIVE BACKGROUND AND THE NEED FOR LBC

The need for LBC is set out in Section 7 of the *Planning (Listed Buildings and Conservation Areas) Act 1990*, which states that 'no person shall execute or cause to be executed any works for the demolition of a listed building or for its alteration or extension in any manner which would *affect its character* [emphasis added] as a building of special architectural or historic interest, unless the works are authorised'.

The words 'affect its character' are critical. No distinction is made, in Section 7 or anywhere else in the act, between works which are considered beneficial and works which are considered harmful to the character of a listed building: *any* works which affect the building's character, whatever the nature of their impact, are included. The question of whether the works are considered to be beneficial or otherwise comes later in the determination of the application by the relevant decision-maker (usually the local authority but sometimes a planning inspector or the Secretary of State).

As Section 9(1) of the act makes clear, carrying out works which would affect the character of a listed building without



*A house in Aston Tirrold, Oxfordshire with old clay tile hanging, photographed in July 1992*

first obtaining LBC is a criminal offence, notwithstanding that Section 9(3)(a–d) offers a series of defences (relating to 'safety or health or for the preservation of the building') against that offence.

The maximum penalties for carrying out unauthorised works to a listed building are currently a fine of £20,000 or six months' imprisonment on summary conviction and an unlimited fine or two years' imprisonment on indictment.

## PRINCIPLES, PRACTICALITIES AND 'GREY AREAS'

In practice there is usually no argument that demolition, alteration or extension of any listed building will require LBC, and this will apply whether the works are internal or external. (The surprisingly common belief spread by some estate agents that a Grade II listing confers statutory protection on just the outside of the building or its facade is of course a myth.) However, there are a number of grey areas worth exploring.

Several issues are raised in connection with repairs. First, Section 7 of the act makes no reference to LBC being required for repairs to a listed building and it may be because of this that even today many local authority conservation



*The same building photographed in December 1992 with replacement tile hanging in new specially produced handmade clay tiles: whether this constitutes a repair or an alteration needing listed building consent is very much open to debate*

officers do not require LBC applications to be made for repairs, particularly if they are made on a like-for-like basis.

There is, however, considerable scope for interpretation here, not least over when repair becomes replacement. The *Shorter Oxford English Dictionary* defines repair as 'the act of restoring to a sound or

unimpaired condition' or the 'restoration of some material thing or structure by the renewal of decayed or worn out parts, by refixing what has become loose or detached'. While most if not all conservation officers would require LBC for the replacement of a decayed 19th-century single-glazed sash window by a double-glazed timber equivalent, some would also require LBC for its replacement by a single-glazed replica. It is unlikely, however, that many would insist on an application for LBC for repair of such a window, even though this could involve the loss of original material by cutting out decayed timber and splicing in new.

The situation would probably be different in the case of a 17th-century timber-mullioned window. Here, the replacement of a substantial section of timber with matching new timber might be considered to constitute a repair affecting the character of the listed building and would therefore need LBC.

The more extensive the work the clearer the situation becomes. Thus, in the case of a timber-framed listed building now rendered over (and rendered at the time of listing), no respectable conservation professional would dispute that replacing a section of decayed timber-frame with blockwork or brickwork and then re-rendering to the same specification would require LBC (and would almost certainly not obtain it).

But what would be the case if like-for-like materials were used? For example, would LBC be required to cut out a single decayed corner post made of elm in such a building, replacing it with a new one of exactly the same dimensions but in 'new' oak and then re-rendering the area affected? In the case of a Grade II listed building in Dorchester-in-Thames some years ago the answer was 'yes'. Would this also have been the case had it been possible to obtain a suitable section of elm to carry out the repair/replacement? Possibly not, but if the elm itself was 'new' would this actually be significantly different to using 'new' oak?

In this case the owner of the building was particularly conscious of his responsibilities as the guardian of what we must now call a 'heritage asset'. He was clearly anxious to do the right thing, but would a local authority have prosecuted or served an enforcement notice on him had he carried out this work without first obtaining LBC? This may seem to be entirely academic and surely any local authority would think hard before going down such a route. However, this question goes right to the heart of the matter, that is: does repair work that is completely compatible with the character of a listed building require LBC or could it instead be carried out following submission of a detailed specification of works to, and agreement in writing from, the local planning authority that the works are acceptable?

In the past this was often considered an appropriate method of proceeding. A written copy of the agreement and the details of the works would be placed on file as a record of what had been done. Today, matters are not always so simple. Many conservation officers now seem to take the view that an LBC

*51 High Street, Wallingford: the facade and return elevation of this already painted Grade II listed building were repainted without listed building consent*



application must be submitted for *any* work to a listed building, regardless of whether the work is a repair or an alteration. This is not, however, necessarily correct and while some conservation officers appear to think that PPS5 requires them to take this position, PPS5 does not advocate this at all. First, there is no specific policy in PPS5 covering repairs to a listed building, while paragraph 147 of the accompanying Practice Guide states that 'minor repairs [to a heritage asset] are unlikely to require planning permission or listed building consent (where relevant) if the works are carried out using the same materials and techniques and they do not affect the significance of the asset'. This is arguably little different in thrust to paragraph 3.2 of PPG15, which stated that 'Consent is not normally required for repairs, but, where repairs involve alterations which would affect the character of the listed building, consent is required'.

However, the Practice Guide does take a different and seemingly more robust attitude to restoration, a topic only obliquely referred to in PPG15 (in paragraph C.6 of Annex C). Paragraph 158 of the Practice Guide states that 'Restoration of a listed building requires its alteration and is almost always likely to need listed building consent and may require planning permission'. Intriguingly, though, the words 'almost always likely to' still leave some room for doubt.

Works of repair or restoration are not the only grey areas where LBC is concerned. Another, which has caused much controversy, is the subject of painting the exterior of a listed building. It is now commonly accepted that painting or rendering the surface of a wall that was originally intended to be left (and has remained) untreated is likely to be both physically and visually damaging. Such work is strongly discouraged and would require LBC, which it would almost certainly not obtain.

But what of a wall that is already painted and where the owner simply wishes to change the colour? PPG15 was relatively relaxed on this, stating in paragraph 3.2 and C.17 of Annex C that LBC would be required where the 'character' of the building would be affected but significantly softening this by adding: 'In many cases the colour of the

paint may be less important than the first application of an unsuitable covering which could be damaging to remove'. This sensible and pragmatic approach made it clear that conservation officers should not (as they are sometimes accused of doing) act as 'taste police', dictating which colours they feel are appropriate and which are not.

This was certainly the attitude South Oxfordshire District Council took to the repainting of the long-painted facade and return elevation of a prominently sited Grade II listed building in Wallingford some years ago (above left). The previous colour was a light green, the new colour (depending on one's view) was a vibrant or lurid dark pink. This was primarily a matter of personal taste. Certainly, there was no evidence to suggest that replacing one modern proprietary paint with another had in any way affected the character of the listed building and (to the dismay of some in the town who clearly disliked the colour) the council therefore declined to require that the owner submit an application for LBC.

Some 12 years on, the colour remains, probably to the chagrin of some but not, in my opinion, to the detriment of the building's character as a listed building.

Finally, and most importantly, it should be stressed that if an owner is in any doubt over whether the works they intend require LBC, the best advice is to ask his or her local conservation officer first and to ensure that a written response is received and retained. Under PPS5 this must extend even to paint colour in situations like that described above as paragraph 150 of the Practice Guide simply (but not particularly helpfully) comments that a change in external paint colour 'may' require LBC.

**NICHOLAS DOGGETT BA PhD Cert Archaeol IHBC MIFA is managing director of Asset Heritage Consulting Ltd, an Oxford-based heritage consultancy which works throughout the UK. From 1991 to 2002 he was principal conservation officer at South Oxfordshire District Council. Most of the cases referred to in this article are drawn from his experience there.**

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ARCHITECTS AND PLANNERS: Brock Carmichael Architects is an award-winning practice in the conservation, refurbishment, extension and adaptation of historic and listed buildings, and the appropriate and imaginative design and integration of new buildings within sensitive and historic sites. Operating on a wide geographical basis, a comprehensive range of services is provided including building surveys and analysis, feasibility studies, conservation plans, master planning, full architectural and planning services and interior design. Clients include English Heritage, the National Trust, local authorities, charitable trusts and public and private sector clients.

**ARCHITECTS** *continued***■ BUTLER HEGARTY ARCHITECTS LTD**

5 Rickthorne Road, London N19 4JS  
 Tel 020 7263 8933 Fax 020 7263 4477  
 Email [mail@butlerhegartyarchitects.co.uk](mailto:mail@butlerhegartyarchitects.co.uk)  
[www.butlerhegartyarchitects.co.uk](http://www.butlerhegartyarchitects.co.uk)

ARCHITECTS: Butler Hegarty Architects Ltd offers an unusual fusion of skills as sensitive contemporary designers and experienced conservation specialists. The practice specialises in extending and altering historic buildings to revitalise existing fabric. It prioritises careful consideration of clients' needs, and complements this with a thorough understanding of their buildings and the craft techniques used to create them. To all aspects of its varied work, the practice aims to bring a culturally informed and poetic resonance by inventing practical and beautiful solutions.

**■ BUTTRESS FULLER ALSOP WILLIAMS**

31-33 Princess Street, Manchester M2 4BF  
 Tel 0161 236 3303  
 Email [dts@bfaw.co.uk](mailto:dts@bfaw.co.uk)  
[www.bfaw.co.uk](http://www.bfaw.co.uk)

**■ CARDEN & GODFREY ARCHITECTS**

33 Clerkenwell Close, London EC1R 0AU  
 Tel 020 7490 0300 Fax 020 7490 0004  
 Partners Ian Stewart Dip Arch Dip Cons (AA) FSA RIBA  
 Richard Andrews MA Dip Arch FSA RIBA  
 Ian Angus Dip Arch RIBA  
 Email [mail@cardenandgodfrey.co.uk](mailto:mail@cardenandgodfrey.co.uk)  
[www.cardenandgodfrey.co.uk](http://www.cardenandgodfrey.co.uk)

ARCHITECTS: Specialists in all aspects of historic architecture: conservation, repairs, new buildings in sensitive sites, sympathetic alterations and additions, interior design and landscape design. Sound technical knowledge with a scholarly approach to historic detail and innovative design. Clients include the Parliamentary Estate, Historic Royal Palaces, Rochester Cathedral, National Trust, colleges, churches, developers and private clients, on projects ranging from small to large.

**■ CAROE AND PARTNERS ARCHITECTS**

18 Deane House Studios, 27 Greenwood Place, London NW5 1LB  
 Tel 020 7267 9348 Fax 020 7267 9344  
 Email [admin@london.caroe.co.uk](mailto:admin@london.caroe.co.uk)  
**■ Penniless Porch, Market Place, Wells, Somerset BA5 2RB**  
 Tel 01749 677561 Fax 01749 676207  
 Email [wells@caroe.co.uk](mailto:wells@caroe.co.uk)  
**■ 98 Cardiff Road, Llandaff, Cardiff CF5 2DT**  
 Tel 02920 577585 Fax 02920 555106  
 Email [llandaff@caroe.co.uk](mailto:llandaff@caroe.co.uk)  
**■ Sear House, Bye Street, Ledbury, Herefordshire HR8 2AA**  
 Tel 01531 634848 Fax 01531 633273  
 Email [ledbury@caroe.co.uk](mailto:ledbury@caroe.co.uk)  
[www.caroe.co.uk](http://www.caroe.co.uk)

CHARTERED ARCHITECTS: Caroe & Partners has nationally recognised expertise in the conservation of historic and listed buildings and the design of imaginative new buildings in sensitive sites, with a large portfolio of work on churches, cathedrals, National Trust and other charitable trust properties, major historic buildings and private houses. The company is passionate about preserving historic buildings and working closely with clients. Caroe's philosophy is to repair and conserve the fabric of a building, with minimum disturbance to the structure, whilst offering creative and sustainable proposals for alterations as required. The company also offers an archaeological service for analysis and recording of standing buildings. *See also: display entry on this page.*



Caroe &  
Partners  
Architects

Wells | London | Cardiff | Ledbury  
 Tel 01749 677561 | [info@caroe.co.uk](mailto:info@caroe.co.uk) | [www.caroe.co.uk](http://www.caroe.co.uk)

**■ CAROE ARCHITECTURE LTD**

Unit 8, 23-25 Gwydir Street, Cambridge CB1 2LG  
 Tel 01223 472237  
 Email [info@caroe.com](mailto:info@caroe.com)  
[www.caroe.com](http://www.caroe.com)

CONSERVATION ARCHITECTS AND HISTORIC BUILDING CONSULTANTS: Caroe Architecture Ltd is dedicated to the care and conservation of historical places and the creation of innovative new buildings, including complex urban, educational and healthcare environments. Oliver Caroe is Surveyor of the Fabric to St Paul's and Ripon cathedrals. Recent projects include major HLF-funded works for St Mary the Virgin, Oxford, the new narthex porch for Ripon Cathedral and a new archive for St John's College, Cambridge, within the 13th-century School of Pythagoras.

**■ CHARLES KNOWLES DESIGN**

80-82 Chiswick High Road, London W4 1SY  
 Tel 020 8742 8322 Fax 020 8742 8655  
 Email [ck@charlesknowles.com](mailto:ck@charlesknowles.com)  
[www.charlesknowles.com](http://www.charlesknowles.com)

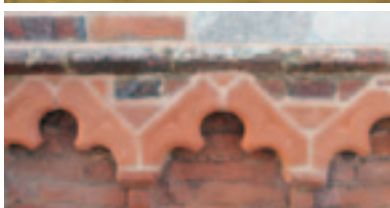
CHARTERED ARCHITECTS: Established in 1984. The practice has a reputation for high quality architectural design. From pure conservation, through refurbishment and additions to listed and historic properties, integrating contemporary design in an historical context. Philosophy: intelligent planning, good design, sound construction and the greatest attention to detail produce timeless solutions.

ARCHITECTS *continued*

## CRANE&amp;ASSOCIATES

Award winning architects and RIBA Specialist Conservation Architects accredited for work to Scheduled Monuments and Grade 1 and II Listed Buildings.

Projects range from alterations to Listed Buildings to major projects funded by the Heritage Lottery Fund.



Crane & Associates 01372 470524  
52 High Street Esher Surrey KT10 9QY  
admin@craneassociates.com  
www.craneassociates.com

## ■ CHEDBURN DUDLEY

**Bath Brewery, Toll Bridge Road, Bath BA1 7DE**

**Tel 01225 859999 Fax 01225 859343**

**Email chedburn@chedburn.com**

**www.chedburn.com**

ARCHITECTS: The conservation practice, Chedburn Dudley, aims to produce imaginative, sensitive and environmentally-aware design solutions, set within the historic built environment. The practice's work covers the conservation, restoration, alteration and refurbishment of historic buildings that require a specific set of skills and rigorous attention to detail. With over 40 years experience across a broad spectrum of projects, Chedburn Dudley offers an alternative to the larger practices in this field.

## ■ CHRISTOPHER RAYNER ARCHITECTS

**Apple Cross House, 52 The Rise, Sevenoaks, Kent TN13 1RN**

**Tel 01732 461806**

**Email info@raynerarchitects.co.uk**

**www.raynerarchitects.co.uk**

**Principal Christopher Rayner BA MArch(California) RIBA**

CHARTERED ARCHITECTS: Christopher Rayner Architects is a small architectural practice specialising in all aspects of work to churches and other historic buildings. Projects have included conservation, repairs and sympathetic alterations/extensions to Wealden hallhouses, post-medieval domestic buildings, barns, churches and buildings at risk.

## ■ CLAGUE LLP

**62 Burgate, Canterbury, Kent CT1 2BH**

**Tel 01227 762060 Fax 01227 762149**

■ **13 North Street, Ashford, Kent TN24 8LF**

**Tel 01233 624354 Fax 01233 610018**

■ **1 Kinsbourne Court, Luton Road, Harpenden, Hertfordshire AL5 3BL**

**Tel 01582 765102 Fax 01582 462149**

**Email andrewclague@clague.co.uk**

ARCHITECTS AND HISTORIC BUILDING CONSULTANTS: Founded in 1936 and established in three offices, Clague provides a full range of architectural and historic building services, including conservation repair and alterations, alternative uses for historic buildings, the preparation of conservation plans, the design of new buildings in sensitive historic settings, surveys and measured drawings and advice on building legislation and grant applications. Members of the practice are appointed to many parish churches, and act as Inspecting Architects in five Anglican dioceses. Clague specialises in the repair and alteration of churches, historic country houses, hotels, redundant farm buildings and military structures. Three members of the practice are accredited to the RIBA/AABC Register.

## ■ CODA CONSERVATION

**14 Springfield Court, Guiseley, Leeds LS20 8FD**

**Tel 01943 872567 Fax 01943 870824**

**Email coda@constructiondesign.co.uk**

CHARTERED ARCHITECTS AND ENGINEERS: The practice offers combined architect/engineer expertise in restoring and adapting redundant old buildings for new uses, and in designing new work in historic contexts, using traditional materials and skills.

## ■ CONSERVATION ARCHITECTURE &amp; PLANNING

**Wey House, Standford Lane, Headley, Hampshire GU35 8RH**

**Tel 01420 472830 Fax 01420 477346**

**Email jack@capstudios.co.uk**

**www.capstudios.co.uk**

**Contact Jack Warshaw BArch DipTP AADipCons ARB RIBA (SCA) RTPI IHBC FRSA RPUDG**

CHARTERED ARCHITECTS AND PLANNERS

## ■ CONSERVATION PD LTD

**151 Rosebery Avenue, London EC1R 4AB**

**Tel 020 7837 6393 Fax 020 7278 6645 Mobile 07789 988484**

**Email elenimakri@conservationpd.com**

**www.conservationpd.co.uk**

CONSERVATION PLANNING AND DESIGN: The practice offers comprehensive and accredited conservation architect expertise, which has achieved national awards. Services include the repair and re-use of listed buildings, sensitive designs in conservation areas, the appraisal, management and regeneration of the historic environment, energy saving measures, buildings at risk, grants, listed building consent applications and appeals. *See Wrought Iron and Steel Windows by Eleni Makri, page 119.*

## ■ DAVID GIBSON ARCHITECTS

**35 Britannia Row, London N1 8QH**

**Tel 020 7226 2207 Fax 020 7226 6946**

**Email mail@DGibArch.co.uk**

**www.DGibArch.co.uk**

ARCHITECTS: David Gibson Architects is a practice committed to the art of architecture and the design of good buildings. Specialising in work to listed buildings and buildings in conservation areas, it is guided by the philosophy of sympathetic interaction between good modern interventions and existing structures. The practice has an established reputation with the national and regional heritage bodies and amenity societies. The practice is able to advise on town planning, technical, space planning and aesthetic issues for listed and a wide range of building types.



**ARCHITECTS** continued**DAVID LE LAY ARCHITECTS****39 Old Church Street, Chelsea, London SW3 5BS****Tel 020 7351 5456 Fax 020 7351 7839****Email architects@davidlelay.co.uk****www.davidlelay.co.uk**

CHARTERED ARCHITECTS AND HISTORIC BUILDING CONSULTANTS:

David Le Lay Architects is a Chelsea based practice offering a range of specialist services for the conservation and refurbishment of historic buildings. The practice has a core philosophy rooted in traditional building methods, an intimate understanding of historic context and a belief in fostering skilled craftsmanship to execute high quality repairs and construction. The practice's experience of surveying, planning and construction puts it at the centre of the process, reviving and enhancing our built heritage. David Le Lay Architects has successfully provided listed building owners and occupiers with condition surveys, conservation repairs, refurbishments and extensions. See Copper Sheet Roofing by Jonathan Goode, page 77.

**DAVIES SUTTON ARCHITECTS****Penhevad Studios, Penhevad Street, Grangetown, Cardiff CF11 7LU****Tel 02920 664455 Fax 02920 664411****Email office@davies-sutton.co.uk****www.davies-sutton.co.uk**

CONSERVATION ARCHITECTS: Specialising in the care and conservation of historic buildings and churches to preserve their patina and character, Davies Sutton Architects aspires to being Wales' leading historic buildings practice, providing sensitive and practical conservation and new buildings on sensitive sites. The practice has a commitment to quality, attention to detail, good management and continuous learning. Members of the SPAB, providing a highly personal and dedicated service.

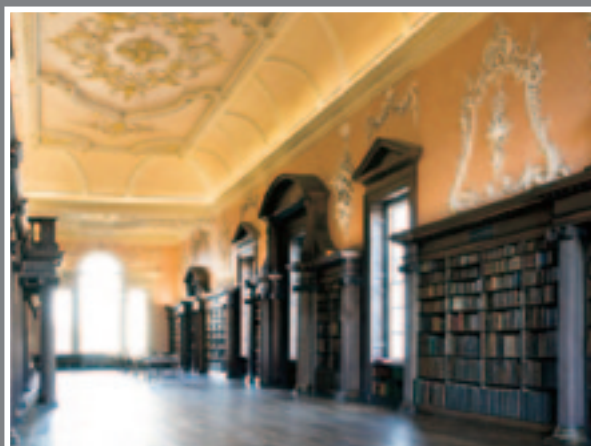
**DONALD INSALL ASSOCIATES LTD****19 West Eaton Place, Eaton Square, London SW1X 8LT****Tel 020 7245 9888 Fax 020 7235 4370****Email london@insall-architects.co.uk****www.insall-architects.co.uk**

ARCHITECTS AND PLANNING CONSULTANTS: See also: display entry on this page.

**FEILDEN + MAWSON LLP****21-27 Lambs Conduit Street, London WC1N 3NL****Tel 020 7841 1980 Fax 020 7841 1981****Email london@feildenandmawson.com****www.feildenandmawson.com**

ARCHITECTS, HISTORIC BUILDINGS CONSULTANTS, PROJECT MANAGERS:

Our existing built heritage is an invaluable national asset. Feilden + Mawson believes in the necessity of preserving the integrity of these buildings and sites, yet also of keeping them alive and relevant, balancing conservation issues with practical everyday requirements. The company's knowledge of historical construction methods and materials informs its work in like-for-like repairs and restoration. This technical expertise, combined with commercial acumen and experience in all statutory matters, underpins Feilden + Mawson's approach to adaptation and design of new build in historic sites. Key clients include the Ministry of Justice, the Cabinet Office, the Parliamentary Estate, Somerset House Trust, Portman Estate and Gray's Inn.

**DONALD INSALL ASSOCIATES**CHARTERED ARCHITECTS  
HISTORIC BUILDING & PLANNING CONSULTANTS

Upper Library, Christ Church, Oxford

Donald Insall Associates have over 50 years' experience of caring for Britain's Historic Buildings and Towns including both repair and adaptation, as well as in the design of new buildings in sensitive sites. With a head office in London and six branches, work is undertaken throughout the country, in Europe and beyond.

19 WEST EATON PLACE LONDON SW1X 8LT

Tel: 020 7245 9888 Email: london@insall-architects.co.uk

BATH BELFAST CAMBRIDGE CHESTER CONWY SHREWSBURY

**ferguson mann architects**

architecture conservation urban design

18 Great George Street, Bristol BS1 5RH  
T 0117 929 9293 F 0117 929 9296  
cb@fm-architects.co.uk www.fm-architects.co.uk  
conservation and refurbishment of St James Priory Street, 2011

# GILES QUARME & ASSOCIATES

ARCHITECTS and  
CONSERVATION SPECIALISTS

Award winning practice combines both art historical and design expertise with a commercial understanding of building regeneration and reuse.



Professional services include:

Architecture	Restoration, repairs and alterations Alternative uses and new buildings
Survey	Quinquennial inspections, measured drawings and conservation plans
Research	Historical research, materials analysis and authentication
Planning	Advice on listed building legislation Feasibility studies and expert witness

## GILES QUARME & ASSOCIATES

Winner of Civic Trust Commendations and the European Conservation Award: The Europa Nostra Order of Merit.

7 Bishops Terrace, London SE11 4UE  
Tel: 020 7582 0748 Fax: 020 7793 8807  
E-mail: [mail@quarme.com](mailto:mail@quarme.com)  
Website: [www.quarme.com](http://www.quarme.com)

### ■ FRANKLIN ELLIS ARCHITECTS

The Old Pumphouse, 5 The Ropewalk, Nottingham NG1 5DU  
Tel 0115 941 8475 Fax 0115 941 8675  
Email [enquiry@frankinellis.co.uk](mailto:enquiry@frankinellis.co.uk)  
[www.franklinellis.co.uk](http://www.franklinellis.co.uk)

ARCHITECTS: Franklin Ellis started life in Nottingham in 1993 and has grown considerably since its inception. It now employs around 40 staff and offers consultancy services in architectural, interior, project management, landscape, conservation and graphic design. With broad experience across most sectors of the building industry, the practice takes pride in the high quality of its design, acknowledged by numerous design awards, including CABE recognition. Franklin Ellis is committed to addressing sustainability and climate change issues and is regularly involved with conservation and listed building projects.

### ■ GIBBON, LAWSON, McKEE LTD

58 Castle Street, Edinburgh EH2 3LU  
Tel 0131 225 4235 Fax 0131 220 0499  
Email [david.gibbon@glmgilm.co.uk](mailto:david.gibbon@glmgilm.co.uk)  
[www.glmglm.co.uk](http://www.glmglm.co.uk)

ARCHITECTS: GLM's architects thrive on the challenge of working on Scotland's remarkable historic buildings: bringing light and breathing life into gloomy country houses and sensitively inserting modern facilities into exclusive private retreats. Working with in-house conservation building surveyors and specialist consultants, GLM provides a complete package: survey, repair, alteration and long-term maintenance. *See also: profile entry in Surveyors section, page 47.*

### ■ GILES QUARME & ASSOCIATES

7 Bishops Terrace, London SE11 4UE  
Tel 020 7582 0748 Fax 020 7793 8807  
Email [mail@quarme.com](mailto:mail@quarme.com)  
[www.quarme.com](http://www.quarme.com)

CONSERVATION ARCHITECTS AND PLANNING CONSULTANTS: The team is led by Giles Quarme AABC, Dr Archie Walls AABC and Julian Cripps who are architects, designers and historians with considerable planning experience. The practice has worked on a wide variety of historic buildings and prides itself on providing the same care and attention to the repair of small historic buildings as for large country mansions. It provides radical solutions combining innovation with traditional conservation methods. Responsible for the Princess Diana Museum at Althorp and advising Foster & Partners on the Great Court project at the British Museum, other projects include Chilham Castle, Hawksmoor's St Mary Woolnoth, Wren's St Edmund, King & Martyr, Royal Naval College Greenwich and Voysey's White Cottage. *See also: display entry on this page.*

### ■ GILMORE HANKEY KIRKE LTD (GHK ARCHITECTS)

528 Fulham Road, London SW6 5NR  
Tel 020 7471 8000 Fax 020 7736 0784  
Email [mail@ghkarchitects.co.uk](mailto:mail@ghkarchitects.co.uk)  
[www.ghkarchitects.co.uk](http://www.ghkarchitects.co.uk)

ARCHITECTS AND CONSERVATION SPECIALISTS: Established in 1973, GHK Architects has extensive experience in the conservation, repair, refurbishment and re-use of listed and historic properties as well as the design of new buildings for sensitive and historic sites both in the UK and abroad. Current work includes the conversion into luxury apartments of an historic warehouse building in Moscow; the refurbishment of barristers' chambers at the Temple, London; remodeling and extension of historic houses for private clients and work for Historic Royal Palaces. Awards include the RICS Conservation Award, which honours outstanding work in the conservation of a single building, awarded to Richard Young for his work on Lulworth Castle, Dorset.

**ARCHITECTS** continued**■ GRAY, MARSHALL & ASSOCIATES****23 Stafford Street, Edinburgh EH3 7BJ****Tel 0131 225 2123 Fax 0131 225 8345****Email mail@gray-marshall.co.uk****www.gray-marshall.co.uk**

CHARTERED ARCHITECTS: Established in 1972, the practice has a proven track record and particular interest in conservation work. Current and recent work includes General Register House, Royal Observatory and Calton Hill Monuments Edinburgh, Tower Mill, Hawick and Ettrick Mill, Selkirk. Working throughout Scotland, with clients from all sectors.

Gray, Marshall & Associates has considerable experience of listed buildings, including sympathetic adaptation and reuse, new buildings on sensitive sites, complex funding packages, phased restoration projects, church quinquennials, conservation plans and HLF Townscape Heritage Initiative appraisals.

**■ HAWKES EDWARDS & CAVE****1 Old Town, Stratford-upon-Avon, Warwickshire CV37 6BG****Tel 01789 298877 Fax 01789 204399****Email contact-us@hawkesedwards.com****www.hawkesedwards.com**

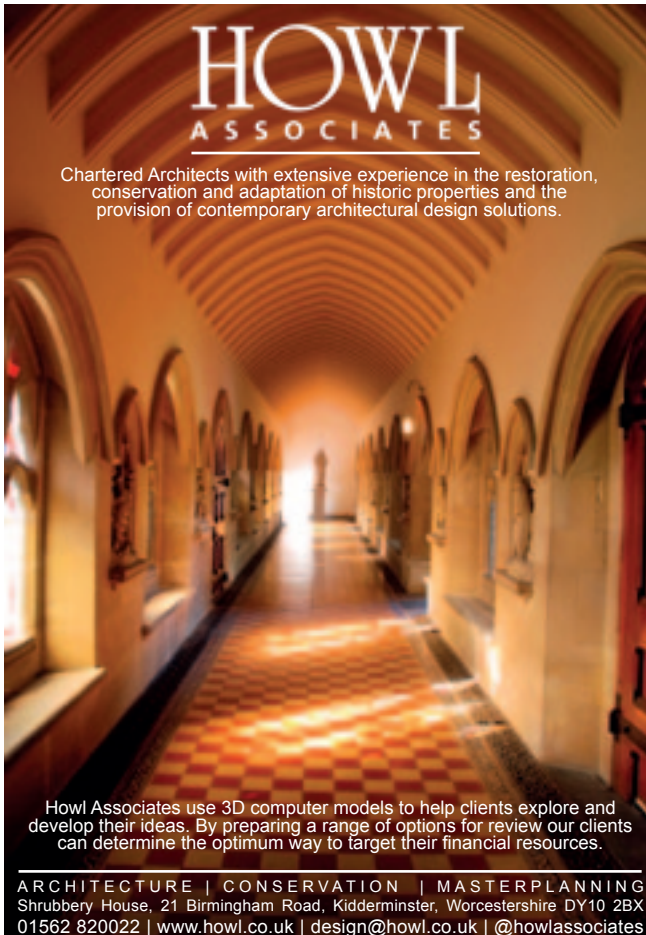
ARCHITECTS, HISTORIC BUILDING CONSULTANTS, SUSTAINABLE DESIGN, INTERIOR DESIGNERS: Established for over 50 years and winners of design and conservation awards. Projects range from conservation and church work, development and conversion for farmers and country estates, new houses, extensions and sustainable buildings. With experience in conservative repair and alterations of all kinds the practice is especially skilled in providing bespoke design solutions and handling sensitive and difficult planning and listed building consent applications.

**■ HIBBS AND WALSH ASSOCIATES****53 High Street, Saffron Walden, Essex CB10 1AR****Tel 01799 523660 Fax 01799 509940****Email office@hibbsandwalsh.co.uk****www.hibbsandwalsh.co.uk****Contact Mike Hibbs ARB, Janet Hayes ARB, Sebastian Walsh BSc Arch**

ARCHITECTS: Hibbs and Walsh Associates is an architects practice based in Saffron Walden, an area which has the highest percentage of listed buildings in Essex. Its work ranges from sensitive renovation and extension of the many 17th century timber framed houses in the area to the more unusual projects involving conservation and repair; amongst others a medieval dovecote, an Elizabethan hunting lodge and a locally listed 1960s church. Other work includes new projects in conservation areas, and advising on sustainability and the reuse of listed buildings.

**■ HOK CONSERVATION AND CULTURAL HERITAGE****HOK International****Qube, 90 Whitfield Street, London W1T 4EZ****Tel 020 7636 2006 Fax 020 7636 1987****Email neil.cooke@hok.com****www.hok.com**

ARCHITECTS: Recent projects include the Manchester Central Library and Town Hall extension, Percival David Collection, British Museum; Gardener's Lodge, Soho Square; Sir Richard Burton's Tomb, Mortlake; Palace of Westminster; Ashton Court, Bristol; Valentine's Mansion, Redbridge; British Medical Association, Tavistock Square; Cabinet Office 22-26 Whitehall; Geffrye Museum, Museum of London; Roman Bath Museum and Burlington House, Piccadilly. Awards include Churchill Museum and Cabinet War Rooms – European Council Museum for the year 2006; King's Library British Museum, 2004 RIBA Award, 2004 Crown Estate Conservation Award.



**HOWL ASSOCIATES**

Chartered Architects with extensive experience in the restoration, conservation and adaptation of historic properties and the provision of contemporary architectural design solutions.

Howl Associates use 3D computer models to help clients explore and develop their ideas. By preparing a range of options for review our clients can determine the optimum way to target their financial resources.

ARCHITECTURE | CONSERVATION | MASTERPLANNING  
Shrubbery House, 21 Birmingham Road, Kidderminster, Worcestershire DY10 2BX  
01562 820022 | www.howl.co.uk | design@howl.co.uk | @howlassociates

**■ HOWL ASSOCIATES LTD****Shrubbery House, 21 Birmingham Road, Kidderminster, Worcestershire DY10 2BX****Tel 01562 820022****Email phil@howl.co.uk****www.howl.co.uk**CHARTERED ARCHITECTS: *See also: display entry on this page.***■ JOHN C GOOM ARCHITECTS****108 High Street, Evesham, Worcestershire WR11 4EJ****Tel 01386 761224****Email info@johncgoom.co.uk****www.johncgoom.co.uk**

ARCHITECTS AND HISTORIC BUILDING CONSULTANTS: The practice is widely experienced in conservation, repair and adaptation of historic buildings and the sensitive design of new buildings in historic settings. John C Goom Architects has built a reputation for working in urban and rural environments with active projects throughout the Midlands and the South of England. Work ranges from conservation projects to small domestic works and includes repair and conservation of churches, country houses, adaptation and extension of many listed properties and redundant buildings as well as new buildings in historic settings. Please visit the website or telephone to discuss your project.

ARCHITECTS *continued***JOHN MCASLAN + PARTNERS**  
CONSERVATION AND REGENERATION

Our award-winning heritage team prides itself on offering an understanding of the significance and value of historic buildings and sites combined with an informed perception of their potential for change. Intellectual rigour, a strategic understanding and an all-embracing approach ensure that a building's special characteristics are retained and enhanced while future requirements, which may entail extensive interventions, are carefully and sensitively considered and developed.



King's Cross, London



Hallfield Estate, London



De La Warr Pavilion, Bexhill-On-Sea



Iron Market, Port-Au-Prince, Haiti

London  
Manchester  
Edinburgh

+44 (0)20 7313 6000  
mailbox@mcaslan.co.uk  
www.mcaslan.co.uk

**■ JOHN D CLARKE ARCHITECTS**

2 West Terrace, Eastbourne, East Sussex BN21 4QX

Tel 01323 411506 Fax 01323 410064

Email [admin@jdcarchitects.co.uk](mailto:admin@jdcarchitects.co.uk)

[www.jdcarchitects.co.uk](http://www.jdcarchitects.co.uk)

CHARTERED ARCHITECTS AND HISTORIC BUILDING CONSULTANTS: The practice was established in 1909 and one of the first projects was the restoration of the 13th Century Lamb Inn at Eastbourne following a fire. John D Clarke Architects has a reputation for sensitive conservation and repair of historic buildings as part of a portfolio which includes work for local authorities, pubs, shops, hotels and many churches of all denominations. The practice has received the Sussex Heritage and Civic Trust Awards. Other projects include alterations and extension of listed retail premises in a conservation area for Steamer Trading Cookshop; Harveys Brewery in Lewes, for which the practice received a Civic Trust Commendation for its Brewery Tower extension; and extensions and reordering of ecclesiastical buildings to give flexibility and extended use. The firm also works with English Heritage and other amenity societies.

**■ JOHN D LYNCH PARTNERSHIP**

28 Havelock Street, Spalding, Lincolnshire PE11 2YL

Tel/Fax 01775 724187

Email [johndlyncharch@aol.com](mailto:johndlyncharch@aol.com)

CHARTERED ARCHITECTS: This practice was formed in Spalding in the East Midlands in 1986 and is involved with projects in conservation of national monuments, historic buildings and churches across East Anglia and the East Midlands and new build throughout the East of England in health centres, schools, offices, commercial and residential. Specialist knowledge of historic buildings and methods of construction gained through apprenticeship to senior partner throughout the 1970s. Stone award received for specialist skills in natural stone conservation.

**■ JOHNSTON AND WRIGHT**

15 Castle Street, Carlisle, Cumbria CA3 8TD

Tel 01228 525161 Fax 01228 515559

Email [alastair.mcgregor@jwarchitects.co.uk](mailto:alastair.mcgregor@jwarchitects.co.uk)

[www.jwarchitects.co.uk](http://www.jwarchitects.co.uk)

CHARTERED ARCHITECTS: Founded in 1885, award-winning Johnston and Wright has an extensive track record in repair, restoration, conservation and alteration of historic buildings and their surroundings utilising practical experience of traditional building materials and innovative contemporary design. Conservation plans, feasibility studies, design proposals, maintenance, repair and development management. RIBA/AABC accredited.

**■ JONATHAN RHIND ARCHITECTS**

The Old Rectory, Shirwell, Barnstaple, Devon EX31 4JU

Tel 01271 850416 Fax 01271 850445

■ Coach House, Rumwell Hall, Taunton, Somerset TA4 1EL

Tel 01823 462300 Fax 01823 462301

Email [jonathan@jonathan-rhind.co.uk](mailto:jonathan@jonathan-rhind.co.uk)

[www.jonathan-rhind.co.uk](http://www.jonathan-rhind.co.uk)

CONSERVATION ARCHITECTS: Detailed local knowledge of English Heritage/conservation/planning issues and skilled/reliable builders. High quality design and imaginative solutions for the upgrade and re-use of all historic buildings. Advice on best conservation practice supported by continued professional education. Initial guidance on project planning and budget.

**■ JULIAN HARRAP ARCHITECTS**

95 Kingsland Road, London E2 8AG

Tel 020 7729 5111 Fax 020 7739 8306

Email [admin@julianharraparchitects.co.uk](mailto:admin@julianharraparchitects.co.uk)

[www.julianharraparchitects.co.uk](http://www.julianharraparchitects.co.uk)

DESIGN AND CONSERVATION ARCHITECTS: Julian Harrap Architects is a specialist practice offering a range of architectural services for the repair and restoration of historic buildings and for new buildings in an historic context. Established in 1975, the practice has a reputation for scholarly and innovative conservation with attention to fine detail. Clients include the Neues Museum, Berlin, the National Trust, English Heritage, the Royal Academy of Arts and Sir John Soane's Museum. The practice has received several national and international awards including nomination and success at the 2010 RIBA Stirling Awards for its projects at the Neues Museum, the Medieval Galleries at the V&A and The Monument, London.

**■ KNOX-McCONNELL ARCHITECTS**

9 Victoria Park, Saltaire, Bradford BD18 4RL

Tel 01274 773388

Email [info@knoxmcconnell.com](mailto:info@knoxmcconnell.com)

[www.knoxmcconnell.com](http://www.knoxmcconnell.com)

HISTORIC BUILDINGS AND CONSERVATION ARCHITECTS: Knox-McConnell Architects offers design expertise and vision that provides solutions to make sense of historic sites and make them work in the context of changing client requirements. The practice approaches problems laterally and innovatively, and designs new additions, alterations and repairs with sensitivity and care. (AABC registered).

**■ LATHAMS**

St Michael's, Queen Street, Derby DE1 3SU

Tel 01332 365777 Fax 01332 290314

Email [enquiries@lathamarchitects.co.uk](mailto:enquiries@lathamarchitects.co.uk)

[www.lathamarchitects.co.uk](http://www.lathamarchitects.co.uk)

ARCHITECTS: Lathams is a specialist in the repair, conservation and creative re-use of listed buildings, with an approach guided in equal measure by the demands of context and design. Services by AABC and SCA registered architects include research, surveys, conservation and maintenance plans, statements of significance, phasing and master plans, repair schedules/production information and grant applications.

## ARCHITECTS continued

MRDA ARCHITECTS  
3 King Street Cloisters, Clifton Walk, London, W6 0GY  
Tel: 020 8748 3755 Fax: 020 8748 3756  
Email: office@mrda.co.uk  
www.mrda.co.uk

ARCHITECTS AND CONSERVATION CONSULTANTS

■ **LEE EVANS PARTNERSHIP LLP**

St John's Lane, Canterbury, Kent CT1 2QQ

Tel 01227 784444 Fax 01227 819102

Email [architects@lee-evans.co.uk](mailto:architects@lee-evans.co.uk)

[www.lee-evans.co.uk](http://www.lee-evans.co.uk)

CONSERVATION ARCHITECTS AND HISTORIC BUILDING CONSULTANTS:

An award-winning practice operating throughout London and the South East with a reputation for balancing imaginative adaptations of historic buildings against the highest standards of conservation and restoration. With an extensive knowledge of the heritage grant system, DDA, planning and relevant legislation the Lee Evans Partnership offers clients value for money and a friendly service which includes ecclesiastical reordering, listed building alterations, repairs and extensions, as well as the design of new buildings within sensitive historic settings. RIBA registered conservation architect (SCA) and Managing Partner, Nick Lee Evans heads up the conservation team.

■ **T C R MacMILLAN-SCOTT, CHARTERED ARCHITECT**

11 Lansdowne Road, Alton, Hampshire GU34 2HB

Tel/Fax 01420 549233

Email [tom.macscott@btinternet.com](mailto:tom.macscott@btinternet.com)

**M** MARTIN ASHLEY  
ARCHITECTS  
MAA INTERIORS  
DESIGN AND CONSERVATION CONSULTANTS



*Phased external restoration of St. George's Chapel, Windsor Castle.  
RICS Regional Building Conservation Award 2010.  
Photograph by permission of The Dean & Canons of Windsor.*

Martin Ashley Architects are specialists in the field of conservation, repair and alteration to outstanding historic buildings and provide expertise in contemporary design for new buildings in historic contexts.

MAA Interiors augment and compliment historic buildings through high quality interior design schemes and furnishings of exceptional standard.

LAMB HOUSE, CHURCH STREET, CHISWICK, W4 2PD

Tel. 020 8948 7788 email: [enquiries@ma-arch.co.uk](mailto:enquiries@ma-arch.co.uk) [www.ma-arch.co.uk](http://www.ma-arch.co.uk)

When contacting companies listed here, please let them know that you found them through  
**The Building Conservation Directory**

ARCHITECTS *continued*

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23a Sydney Buildings Bath BA2 6BZ 01225 442424 www.nashpartnership.com

**■ JOHN MALAIPERUMAN, CONSERVATION ARCHITECT**

Lychgate, 2 Watery Lane, Nailsea, Bristol BS48 2AX  
 Tel 01275 852023

Email [malaiperuman@btinternet.com](mailto:malaiperuman@btinternet.com)

CONSERVATION ARCHITECT: John Malaiperuman BSc (Hons) Dip Arch (UCL) RIBA CA AABC specialises in the repair and adaptation of listed buildings. His portfolio includes Grade I and II listed churches, houses, offices, historic gardens, theatres, and an eco-barn conversion. Working from his base in north Somerset, he covers the South West of England and Wales, and is on the approved list of architects for the dioceses of Bristol and Salisbury, in which capacity he is able to carry out quinquennial inspections and reordering projects. Recent work has included the reordering of St Andrew's Church in Ansford and All Saints' Castle Cary.

**■ McGREGOR BOWES**

41 Learmonth Grove, Comely Bank, Edinburgh EH4 1BX  
 Tel 0131 332 7572 Mobile 07527 121131

Email [chrisb@mcgregorbowes.com](mailto:chrisb@mcgregorbowes.com)  
 www.mcgregorbowes.com

ARCHITECT AND CDM CO-ORDINATOR: Established in 2010 by Chris Bowes, a chartered architect and registered CDM co-ordinator, McGregor Bowes has experience with some of Scotland's most significant landmarks, including St Giles' Cathedral and Edinburgh Castle. McGregor Bowes' projects include: conservation architect for The Highlanders' Museum project at Fort George, a scheduled monument; architect for the fabric repairs of category A listed Scotsman Steps, and CDM co-ordinator and clerk of works for the artwork by Martin Creed; survey and fire risk assessment of category A listed building at 21 Abercromby Place, Edinburgh.

**■ NICHOLAS JACOB ARCHITECTS**

89 Berners Street, Ipswich, Suffolk IP1 3LN

Tel 01473 221150 Fax 01473 255550

Email [nicholas.jacob@njarchitects.co.uk](mailto:nicholas.jacob@njarchitects.co.uk)

www.njarchitects.co.uk

ARCHITECTS: The practice specialises in the repair, conservation and sensitive alterations or extension of ecclesiastical and secular historic buildings in East Anglia; imaginative design solutions for sensitive locations. The principal of the practice Nicholas Jacob is an Architect Accredited in Building Conservation.

**■ NICK COX ARCHITECTS**

77 Heyford Park, Upper Heyford, Oxfordshire OX25 5HD

Tel 01869 238092 Fax 01869 238093

Email [info@nickcoxarchitects.co.uk](mailto:info@nickcoxarchitects.co.uk)

www.nickcoxarchitects.co.uk

ARCHITECTS: Nick Cox Architects combines experience and expertise in conservation with an enthusiasm for new design. As well as working on new buildings in historic contexts, the practice advises on architectural matters for Blenheim Palace, Woburn Abbey, the National Trust and the Churches Conservation Trust. The practice adopts a creative approach to finding appropriate solutions to construction and design problems. Nick Cox has over 20 years experience working on historic buildings, developing an eye for design, detail and finish.

**■ NYE SAUNDERS CHARTERED ARCHITECTS**

3 Church Street, Godalming, Surrey GU7 1EQ

Tel 01483 418600 Fax 01483 418655

Email [info@nyesaunders.co.uk](mailto:info@nyesaunders.co.uk)

www.nyesaunders.co.uk

ARCHITECTS: Practice established for over 40 years with extensive experience in the conservation, repair, conversion and sympathetic extension of all types of historic buildings. Principal with RIBA Accredited Conservation Architect status. Nye Saunders now incorporates Brewer Jewel Chartered Architects. *See also: entry for Brewer Jewel Chartered Architects in this section, page 20.*

**■ OLIVER WEST AND JOHN SCOTT ARCHITECTS LIMITED**

The Studio, 3a Bath Road, Bedford Park, London W4 1LL

Tel 020 8995 4275

Email [westscot@dircon.co.uk](mailto:westscot@dircon.co.uk)

www.westscottarchitects.co.uk

ARCHITECTS: Architects experienced in sensitive repair and imaginative alteration of historic buildings and design of new buildings in sensitive locations. Clients include churches in the dioceses of London, Exeter, Bath and Wells and others, Church Commissioners and private clients. The restoration of landscape buildings and new café building at Hawkstone Park won a Civic Trust Award and Europa Nostra Diploma in 1995. Experienced in working with private clients on domestic projects and in communicating with English Heritage and conservation organisations. The firm is committed to providing a personal and practical approach, and high quality design. John Scott is an Architect Accredited in Building Conservation (AABC).

**■ P D P GREEN CONSULTING**

Unit 3 Calenick House, Truro Technology Park, Heron Way,

Newham, Truro, Cornwall TR1 2XN

Tel 01872 265400 Fax 01872 276356

Email [reception@pdpgreen.co.uk](mailto:reception@pdpgreen.co.uk)

www.pdpgreen.co.uk

CHARTERED DESIGN AND CONSERVATION ARCHITECTS: An integrated architectural and engineering firm, the practice is involved in all aspects of building conservation, including repairs, alterations, extensions, design of new buildings in the context of historic buildings, and conversions to new uses. In addition to design services, the practice also undertakes condition surveys and feasibility studies. Conservation projects are led by a director with an MA in architectural conservation, whose experience covers all grades of listed buildings together with scheduled ancient monuments. Clients include the National Trust, Cornwall Buildings Preservation Trust, MoD, local authorities and private individuals.

## ARCHITECTS *continued*

### ■ P W P ARCHITECTS

**Newnham House, 61 South Street, Havant, Hampshire PO9 1BZ**  
**Tel 023 9248 2494 Fax 023 9248 1152**  
**Email [design@pwp-architects.com](mailto:design@pwp-architects.com)**  
**Contact Jeremy Sayer**

ARCHITECTS AND PLANNING CONSULTANTS: Established in 1921 the practice handles the conservation, restoration and re-development of historic buildings in sites of special landscape interest, working with a broad range of conservators, landscape architects, archaeologists and environmentalists. PWP's clients use the firm repeatedly because it balances budget and time constraints against essential and urgent conservation needs. The practice has special expertise adapting and extending Grade I and Grade II buildings at risk, and negotiating viable new uses with English Heritage and the amenity societies. The practice carries out developments across the country and also undertakes feasibility studies and concept designs.

### ■ PEREGRINE BRYANT

**The Courtyard, Fulham Palace, Bishop's Avenue, London SW6 6EA**  
**Tel 020 7384 2111 Fax 020 7384 2112**  
**Email [peregrine@bryant.net](mailto:peregrine@bryant.net)**  
**[www.peregrine-bryant.co.uk](http://www.peregrine-bryant.co.uk)**

ARCHITECTURE AND BUILDING CONSERVATION: Peregrine Bryant specialises in building conservation, the repair and refurbishment of historic buildings, quinquennial reports and schedules of repairs, grant aided heritage work and high quality ecological new build. The practice offers full architectural services, collaborating with structural engineers and specialist surveyors whenever necessary. It also advises on interior fitting and landscape design, independently or in association with other design professionals. Clients have included the National Trust, Landmark Trust, Vivat Trust, Royal Hospital Chelsea, Crown Estate and Duchy of Cornwall, as well as London clubs and private owners of historic buildings.

### ■ PETER CODLING ARCHITECTS

**7 The Old Church, St Matthews Road, Norwich, Norfolk NR1 1SP**  
**Email [office@petercodlingarchitects.co.uk](mailto:office@petercodlingarchitects.co.uk)**  
**Tel 01603 660408 Fax 01603 630339**

ARCHITECTS: Church repairs, reordering and extensions; quinquennial reports. Repair and conversion of buildings of all ages and types. Housing for individual clients and special needs groups.

### ■ PURCELL MILLER TRITTON LLP

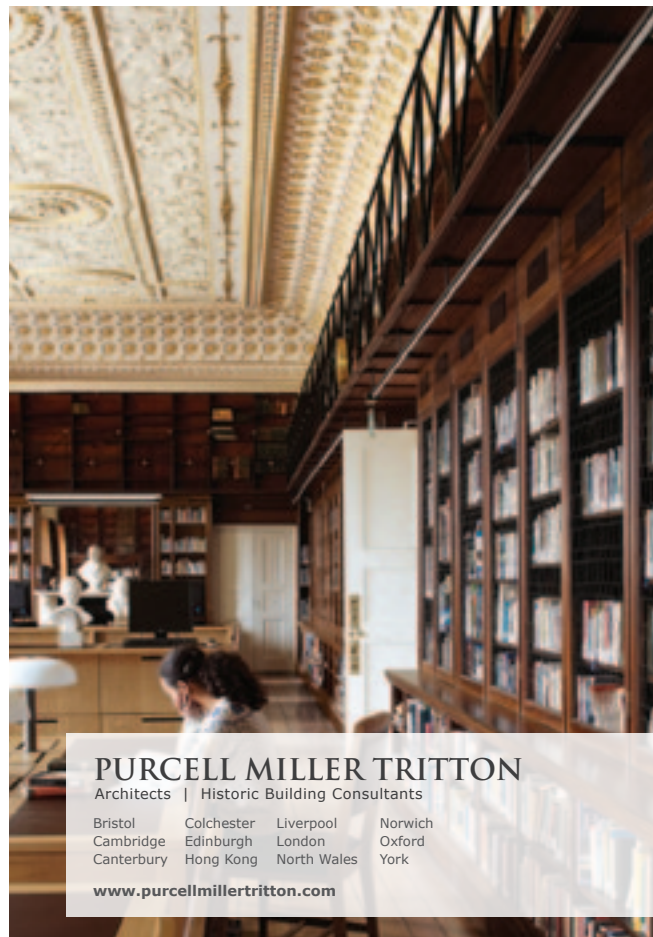
**15 Bermondsey Square, London SE1 3UN**  
**Tel 020 7397 7171 Fax 020 7397 7172**  
**Email [enquiries@pmt.co.uk](mailto:enquiries@pmt.co.uk)**  
**[www.purcellmillertriton.com](http://www.purcellmillertriton.com)**

ARCHITECTS AND HISTORIC BUILDINGS CONSULTANTS: Purcell Miller Tritton is a leading architectural practice with a 60 year track record of excellence. With expertise in conservation and contemporary design, the practice cares for some of the UK's finest monuments and delivers thoughtful new buildings in the most sensitive places: cathedral precincts, UNESCO World Heritage Sites and historic city centres. The team brings experience, commitment and flair to every project and has won numerous awards from the RIBA and the British Construction Industry among others. Purcell Miller Tritton is listed as one of the Sunday Times' Best Green Companies for 2010. *See also: display entry on this page.*

### ■ RADLEY HOUSE PARTNERSHIP

**Radley House, St Cross Road, Winchester, Hampshire SO23 9HX**  
**Tel 01962 842228 Fax 01962 842401**  
**Email [architects@radleyhouse.co.uk](mailto:architects@radleyhouse.co.uk)**  
**[www.radleyhouse.co.uk](http://www.radleyhouse.co.uk)**

CHARTERED ARCHITECTS AND HISTORIC BUILDING CONSULTANTS: AABC registered accredited architects. Founded in 1933. Expert in the conservation and adaptation of historic buildings, as well as new design in an historic context. Management plans. Clients include English Heritage, Historic Royal Palaces, local authorities, well-known country houses and their estates, churches and private clients.



### PURCELL MILLER TRITTON

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[www.purcellmillertriton.com](http://www.purcellmillertriton.com)

### ■ REES BOLTER ARCHITECTS

**New North House, 202 New North Road, London N1 7BJ**  
**Tel 020 7354 8347 Fax 020 7354 8366**  
**Email [mail@reesbolter.co.uk](mailto:mail@reesbolter.co.uk)**  
**[www.reesbolter.co.uk](http://www.reesbolter.co.uk)**

CONSERVATION ARCHITECTS: Founded in 1989 the practice specialises in the conservation, repair and sensitive alteration of historic buildings and buildings in historic settings. Clients include the Churches Conservation Trust, many Anglican churches, the National Trust and many of the London boroughs.

### ■ THE REGENERATION PRACTICE

**1 Huguenot Place, Heneage Street, Spitalfields, London E1 5LJ**  
**Tel 020 7247 6520 Fax 020 7377 5047**  
**Email [trp@regeneration.co.uk](mailto:trp@regeneration.co.uk)**  
**[www.regeneration.co.uk](http://www.regeneration.co.uk)**

ARCHITECTS: TRP is an RIBA/AABC accredited, award-winning firm of architects. The firm's philosophy is to conserve historic buildings through each stage of their development in order to create a strong sense of place while incorporating modern services so as not to distract from the story that the building has to tell.

### ■ RICHARD CROOKS PARTNERSHIP

**14 Calverley Lane, Horsforth, Leeds LS18 4DZ**  
**Tel 0113 281 8080 Fax 0113 258 4070**  
**Email [info@rcparchitects.net](mailto:info@rcparchitects.net)**  
**[www.rcparchitects.net](http://www.rcparchitects.net)**

CHARTERED ARCHITECTS: Historic buildings experience under the personal direction of Richard Crooks, AABC accredited in building conservation and member of EASA and SPAB. Current projects encompass repairs, reorderings, alterations, extensions and new use of redundant church buildings. Quinquennial inspections and guidance regarding the ongoing care of historic buildings.

ARCHITECTS *continued*

### Rodney Melville + Partners

CHARTERED ARCHITECTS  
HISTORIC BUILDING CONSULTANTS

Architects specialising in the repair, alteration and extension of historic buildings and the design of new buildings in historic settings.



We have considerable experience in compiling Conservation Plans, Heritage Impact Assessments and grant applications. We undertake access and fabric condition surveys and are actively involved in research into traditional building materials and techniques.



With offices in the Midlands and the West Country, we work throughout the UK.

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F 01926 451766	F 0117 316 9452
architects@rmpuk.com	
www.rmpuk.com	

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See also text entry.

2 Compton Terrace London N1 2UN  
tel 020 7359 8222 fax 020 7354 5208  
rma@rmears.co.uk www.rmears.co.uk

■ **ROBERT KILGOUR ARCHITECTS LTD**  
4 Park Lane, Bewdley, Worcestershire DY12 2EL  
Tel 01299 409040

Email office@robertkilgour.co.uk  
www.robertkilgour.co.uk

ARCHITECT: The practice specialises in the repair and conservation of historic buildings. Clients include the Dean and Chapter of Lichfield Cathedral, Hereford Cathedral and Derby Cathedral, the Churches Conservation Trust, churches in the diocese of Worcester and the National Trust, working at Powis Castle, Croft Castle, Hidcote Manor Gardens and Berrington Hall. (AABC registered.)

■ **ROBERT SEYMOUR CONSERVATION ARCHITECTS**  
The Merchants House, 10 High Street, Totnes, Devon TQ9 5RY  
Tel 01803 868568 Fax 01803 866937

Email info@robertseymour.co.uk  
www.robertseymour.co.uk

■ **Branch offices in London and Dartmouth**

CONSERVATION ARCHITECTS AND HISTORIC BUILDING CONSULTANTS:  
The practice has over 25 years experience carrying out sympathetic, appropriate repairs to a wide range of historic and listed buildings. It has strong links with English Heritage and SPAB, working with private clients, local authorities, charitable trusts, almshouse associations, churches and other groups. Detailed surveys, evaluations and repair programmes undertaken, often in sensitive urban conservation areas, throughout the South of England.

■ **ROBIN KENT ARCHITECTURE & CONSERVATION**  
Newtown Street, Duns, Scottish Borders TD11 3AS

Tel 01361 884401 Fax 01361 884402

Email rk@robinkent.com

www.robinkent.com

ARCHITECTS, BUILDINGS ARCHAEOLOGISTS AND HISTORIANS: Robin Kent Architecture & Conservation specialises in works to scheduled ancient monuments and listed buildings, including exciting new designs that enhance historic settings. The consultancy also prepares conservation plans, character appraisals, quinquennial/condition surveys and defects investigations, as well as carrying out recording and research. Robin Kent is conservation accredited in England and Scotland.

■ **RODNEY MELVILLE & PARTNERS**

10 Euston Place, Leamington Spa, Warwickshire CV32 4LJ

Tel 01926 881311 Fax 01926 451766

■ 7 Unity Street, Bristol BS1 5HH

Tel 0117 316 9451

Email architects@rmpuk.com

www.rmpuk.com

CONSERVATION ARCHITECTS: See also: display entry on this page.

■ **ROGER MEARS ARCHITECTS**

2 Compton Terrace, London N1 2UN

Tel 020 7359 8222 Fax 020 7354 5208

Email rma@rmears.co.uk

www.rmears.co.uk

CONSERVATION ARCHITECTS: Founded in 1980, the practice has built up a reputation for sensitive work to historic and domestic buildings, guided by the principles of the SPAB. Past work includes alterations, repairs and extensions to listed houses in London, Essex, Oxfordshire, Wiltshire and Dorset. Among them are Tudor House, Cheyne Walk, listed Grade II\* (formerly Rossetti's house and studio) and a terrace of Grade I listed houses in Newington Green dating from 1658. Current work includes alterations and repairs to a variety of houses and churches of different periods. See also: display entry on this page.



**ARCHITECTS** continued**■ SIDELL GIBSON ARCHITECTS**

**Sidell Gibson Partnership LLP**  
**Holford Mews, Cruikshank Street, London WC1X 9HW**  
**Tel 020 3179 9000 Fax 020 3179 9001**  
**Email richard.morton@sidellgibson.co.uk**  
**www.sidellgibson.co.uk**

ARCHITECTS: Founded in 1973 the practice, although principally working on new developments, has conservation experience notably at the Tower of London, St George's Hall Windsor Castle, Roedean School, Britannic House, the former Royal Army Veterinary Stables and Hospital in Aldershot and the former Patent Office Chancery Lane. The practice has also completed studies for disposal requirements set by Defence Estates such as the Royal Military Academy Woolwich. Sidell Gibson is currently working on conservation and heritage repairs at the Beane Institute in Canterbury, the Cedars in Chorleywood and the new Lycée Français in Camden.

**■ SMITHS GORE**

**Exchange House, Petworth, West Sussex GU28 0BF**  
**Tel 01798 345980 Fax 01798 345998**  
**Email jane.jones-warner@smithsgore.co.uk**  
**www.smithsgore.co.uk**

CONSERVATION AND DESIGN ARCHITECTS AND BUILDING SURVEYORS:  
 Offices throughout England and Scotland. Specialising in all aspects of works to historic buildings including Grade I buildings and scheduled ancient monuments. Works range from designing individual pieces of furniture for small county cottages to large scale conservation projects and new build projects in sensitive historic settings. Smiths Gore has carried out a considerable number of English Heritage grant aided repair projects to churches and is currently implementing a large project with grant aid to a privately owned house. It is able to offer additional services including planning and sustainability advice.

**■ STOW AND BEALE CONSERVATION ARCHITECTS LLP**


**1 Compton Road, London SW19 7QA**  
**Tel 020 8946 4141**  
**Email Barry.Stow@stowandbeale.com**  
**www.stowandbeale.com**

ARCHITECTS: Stow and Beale brings meticulous methodology and elegant design to the repair and development of listed buildings, ancient monuments, world heritage sites and historic landscapes. The practice has an established reputation for fine conservation and the imaginative adaptation of buildings in the UK and overseas, and has won many awards for design and for conservation projects. Recent projects include: the repair of Westminster Abbey Chapter House and Dover Castle for English Heritage; a master plan and redevelopment of buildings for Oriel College, Oxford; a master plan and four design projects for New College, Oxford; repairs to monuments and proposals for visitor centres at Great Windsor Park and the remodelling of three London churches.

**■ STRIDE TREGLOWN PLC**

**The Promenade, Promenade House, Clifton Down, Bristol BS8 3NE**  
**Tel 0117 974 3271 Fax 0117 974 5207**  
**www.stridetreglown.co.uk**

ARCHITECTS: Stride Treglown recognises that our national heritage is one of our most valuable assets. The practice takes a sensitive approach to the preservation and regeneration of our built environment and its experience extends to every type and scale of conservation work and to all listed grades. Stride Treglown is a top 15 multi-disciplinary practice of architects with nine offices throughout the UK and UAE. It provides award-winning, innovative and sustainable design and expertise to private and public sector clients, investing heavily in specialist services that react to the needs of its clients.



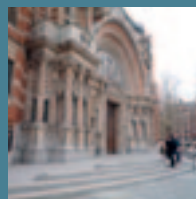
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**ST.ANN'S GATE ARCHITECTS****ARCHITECTS CONSERVATION DESIGN**

St Ann's Gate Architects has established a reputation over the past 30 years for award winning, imaginative design solutions within sensitive historic settings. The practice is responsible for the care of some of the country's most important historic buildings; existing clients include owners of listed properties, parish churches and cathedrals, the Churches Conservation Trust and the National Trust. Work includes conservation planning, management of long-term repair campaigns, access consultancy, adaptations and re-ordering of existing buildings, completely new design work and pure conservation and repair.

Conservation, sustainability and sensitive design for change within the historic context are the practice's hallmarks applied equally to all projects, large or small.

St Ann's Gate Architects LLP The Close Salisbury Wiltshire SP1 2EB  
 T: 01722 555200 F: 01722 555201  
 E: info@stannsgate.com W: www.stannsgate.com

## ARCHITECTS *continued*

### ■ STUART PAGE ARCHITECTS

Forge House, The Green, Langton Green, Tunbridge Wells,  
Kent TN3 0JB  
Tel 01892 862548 Fax 01892 863919  
Email [info@stuartpage.co.uk](mailto:info@stuartpage.co.uk)  
[www.stuartpage.co.uk](http://www.stuartpage.co.uk)

ARCHITECTS AND INTERIOR DESIGNERS: Historic buildings require economic and appropriate uses to ensure their survival. Stuart Page Architects undertakes architectural and interior design projects for new buildings and the conservation and repair of historic and listed buildings. The practice believes the architect's role to be especially important when working in conservation areas or with historic buildings to ensure sympathetic buildings integrated with their surroundings and which satisfy the client's brief. Projects include work for the National Trust, Historic Royal Palaces, English Heritage, local authorities and private owners of historic buildings.

### ■ THOMAS FORD & PARTNERS

177 Kirkdale, Sydenham, London SE26 4QH  
Tel 020 8659 3250 Fax 020 8659 3146  
Email [tfp@thomasford.co.uk](mailto:tfp@thomasford.co.uk)  
[www.thomasford.co.uk](http://www.thomasford.co.uk)

Partners Paul Sharrock BSc DipArch RIBA  
Daniel Golberg MPhil BArch RIBA AABC RMAFS FRSA  
Clive England BA Hons DipArch RIBA AABC  
Brian Lofthouse BA Hons RIBA  
John Bailey BA BArch RIBA AABC  
John Richards Dip Arch RIBA

CHARTERED ARCHITECTS AND SURVEYORS: Established in 1926 the practice has extensive experience of historic building projects up to £14 million including cathedrals, churches, country houses, museums, palaces, military buildings and other historic structures. Work includes feasibility studies, quinquennial inspections, conservation, repair, extensions, remodelling and new buildings in historic settings. The practice's portfolio includes many scheduled monuments, Grade I and Grade II\* buildings of national and international significance. Clients include English Heritage, National Trust, Palace of Westminster, Historic Royal Palaces Agency, Royal Household, Ministry of Defence, Landmark Trust, Historic Chapels Trust, National Museums, Essex University and Wakefield, Sheffield, Guildford and Birmingham cathedrals.

### ■ VERITY & BEVERLEY

55 Long Street, Tetbury, Gloucestershire GL8 8AA  
Tel 01666 503516  
Email [info@verity-beverley.co.uk](mailto:info@verity-beverley.co.uk)  
[www.verity-beverley.co.uk](http://www.verity-beverley.co.uk)

CHARTERED ARCHITECTS AND DESIGNERS: Established in 1871 the practice is experienced in the conservation, restoration and refurbishment of listed buildings, churches, modern structures within historic environments, and architectural interior design.

### ■ W C P (THE WHITWORTH CO-PARTNERSHIP LLP)

18 Hatter Street, Bury St Edmunds, Suffolk IP33 1NE  
Tel 01284 760421 Fax 01284 704734  
■ 1 The Close, Norwich NR1 4DH  
Tel 01603 626782  
Email [info@whitcp.co.uk](mailto:info@whitcp.co.uk)  
[www.wcp-architects.com](http://www.wcp-architects.com)  
Contact Matthew Stearn

CHARTERED ARCHITECTS AND SURVEYORS: Services include extensions and alterations to existing buildings, new build, surveys and defect analysis, conservation and repair of historic buildings, planning, party wall and expert witness appointments. Each project is approached with care and sensitivity, bringing together a range of expertise appropriate for the project. The partners, Philip Orchard (a Lethaby Scholar), Matthew Stearn and Mark Cleveland are chartered architects, and Tony Redman and Stephen Boniface are chartered surveyors. Philip Orchard, Tony Redman and Stephen Boniface are all conservation accredited.

### ■ W R DUNN & CO LTD

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Email [info@wrdunn.co.uk](mailto:info@wrdunn.co.uk)  
[www.wrdunn.co.uk](http://www.wrdunn.co.uk)

CHARTERED BUILDING SURVEYORS, ARCHITECTS AND HISTORIC BUILDINGS CONSULTANTS: *See also: profile entry in Surveyors section, page 48.*

### ■ WATSON BERTRAM & FELL LTD

5 Gay Street, Bath, Somerset BA1 2PH  
Tel 01225 337273 Fax 01225 448537  
Email [mail@wbf-bath.co.uk](mailto:mail@wbf-bath.co.uk)  
[www.wbf-bath.co.uk](http://www.wbf-bath.co.uk)

ARCHITECTS AND SURVEYORS: Watson Bertram & Fell has an enviable reputation in the restoration and alteration of listed buildings and the creation of new buildings in conservation areas. The practice has a fine design team led by Mark Watson, experienced in designing innovative and traditional extensions and alterations to important listed buildings and new houses in highly sensitive areas. It also has widespread conservation experience founded on sound ecological principles, specialising in works to numerous historic buildings, whether small rural dwellings or grand mansions.

### ■ WEST WADDY ADP

The Malthouse, 60 East St Helen Street, Abingdon,  
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# FLOODING

## RISK AND REMEDIATION

RUTH NICHOLLS

**F**REAK STORMS, often associated with Atlantic hurricanes, and the risk of flooding have been a threat to communities in the British Isles for centuries. However, climate change predictions suggest that changes in global temperatures will alter weather patterns, causing sea levels to rise and an increased frequency and intensity of extreme weather. The UK will be prone to prolonged and higher rainfall that will increase the likelihood of flooding. Historic buildings in areas so far unaffected by flooding may be poorly prepared to face this threat.

The last ten years have seen a number of floods in the UK that have caused serious damage and disruption. Many historic buildings have been affected. In 2004 Hurricane Alex caused storms over Cornwall with a flash flood in Boscastle where the river Jordan rose by 2m in one hour and tore through the village centre.

In 2007 towns and villages all down the Severn valley were flooded when the river burst its banks and in 2009 in Cumbria the rivers, streams and becks became raging torrents sweeping away bridges and causing widespread damage in many communities. In 2007 Gloucester was hit by both the rise in the Severn and its tributaries and by localised surface water and foul sewer flooding.

Images in the media of the Mythe Water Treatment Works at Tewkesbury and the electrical substation outside Gloucester surrounded by water were a reminder that many services and buildings are located on flood plains. The loss of water supply to the community and the narrowly averted catastrophic flooding of the substation made the threat of climate change seem more immediate and more serious.

In response to recent floods, English Heritage (EH) has prepared guidance for the custodians of historic buildings entitled 'Flooding and Historic Buildings' (EH, 2010). This article draws on EH guidance and on experience gained at the flood-damaged Church of St Andrew and St Bartholomew, Ashleworth, Gloucestershire, where the author is the church architect. The lessons learned at Ashleworth are relevant to other historic churches and to all old buildings at risk of flooding.



*The Church of St Andrew and St Bartholomew, Ashleworth, Gloucester and adjacent buildings in July 2007: the line of trees at top right marks the western bank of the River Severn (Photo: R Keene)*

### WATER AND FLOOD DAMAGE

The Environment Agency (EA) describes the risk of flooding as the chance that a location will flood in any one year and has developed comprehensive maps that illustrate the areas at risk. The EA defines the types of flooding as: river flooding, coastal flooding, surface water flooding, sewer flooding, groundwater flooding and reservoir flooding.

Water damage can be classified into three categories:

- clean water from internal water pipes
- grey water from internal wastes such as washing machines
- black water, which contains contaminants.

Contaminants vary depending on the surrounding environment and catchment areas. As the flood water recedes, mud, slurry, salts, raw sewage and other chemicals and matter are left behind. The effects on a building's fabric depend on its construction and the duration of exposure and saturation.

Water damage can be divided into primary and secondary damage:

**Primary damage** includes damage to the structure, expansion or shrinkage and staining. It will largely depend upon the

severity and velocity of the flood waters, how long the materials remain saturated and their absorbency. Contaminants can also cause damage: the salts in seawater are corrosive to some metals and some absorbent materials cannot be cleaned if they are stained by oils. Cleaning and drying out processes can also be damaging.

**Secondary damage** is caused by moisture travelling to other areas than those originally affected. Water vapour rising through a building can cause mould growth. Hygroscopic materials, which absorb moisture, will support mould growth because they maintain a high relative humidity at their surface. This can also occur on less absorbent materials if they provide a cool enough surface to elevate the humidity sufficiently. Introducing heat to dry the fabric of the building can make the situation worse if the vapour this produces cannot be removed.

### CLEANING AND DRYING

Many historic buildings are fairly flood-resilient and most construction materials can withstand the occasional brief saturation. However, perhaps the



*The Grade I listed Church of St Andrew and St Bartholomew, founded in the 12th century*

most problematic aspects of flooding are managing the drying out process and the effective removal of contaminants.

Where properties are insured, the insurer will often appoint a 'disaster-recovery contractor', who will first make a hazard and risk assessment. This assessment will cover a whole range of potential risks, including the stability of the building. They will also look at priorities for minimising any primary damage, and assess the potential for secondary damage and how this can be avoided. Some independent expert advice from an architect or other specialist may be necessary to agree the best way to save as much of the historic fabric as possible and to agree methods of opening up voids, removal of finishes and cleaning and drying out.

The clean-up operation should start as soon as the waters have receded, the flood risk has passed and access to the building is deemed safe. It is easier to remove mud when wet, and cleaning with plastic shovels, vacuum cleaners and soft-bristled brushes to gently remove the silty deposits is usually the best method. A neutral detergent and water solution should be used to clean floors and walls, which should then be rinsed with clean water, dried with cloths and then allowed to air dry before being sprayed with a sanitising mist to kill any remaining bacteria. Some materials will need to be sent to specialist cleaners for removal of contaminants.

The clean-up operation will be followed by a planned programme of drying out. Old buildings must not be dried out too quickly. As EH guidance points out: 'thin timber elements, including floors, doors and panelling, may warp, twist or split; salts will migrate through old stone and plasterwork, causing them to blister, powder and exfoliate; [and] many painted surfaces will peel and flake' if dried out too quickly ('Flooding and Historic Buildings', EH, 2010).

Temperatures above 18°C may also

encourage mould growth. Conversely, temperatures below 4°C allow the formation of ice crystals in moisture-laden materials, leading to spalling and de-lamination.

'Forced' drying of walls can produce a dry surface while the wall mass remains wet. This can lead to secondary damage, often appearing later as the repair works are completed. According to EH: 'the best general advice is to dry the building gently and slowly, first through natural ventilation, and then with the aid of dehumidifiers' (EH, 2010). Cross-ventilation is greatly aided by air movement, which can be natural or controlled through the use of fans.

Drying is a two-stage process: the first stage is drying by liquid transfer to the surface and the second is drying by vapour transfer. The first stage is fast and effective and governed by ambient conditions of evaporation, the second stage is much slower and almost independent of the ambient conditions.

Air temperature needs to be maintained, preferably below 20°C. The relative humidity should be monitored and maintained at 40–50 per cent. Dehumidifiers with humidity sensors can provide better controlled drying conditions.

Independent experts will give advice on drying and treating woodwork to prevent decay. They can carry out surveys to assess the potential risks of fungal and other infestations and they have the equipment to monitor the condition of inaccessible timbers over time.

Independent experts may also be required for advice on drying wall paintings and the use of chemical cleaners to remove oil contaminants.

#### **DAMAGE TO HISTORIC FABRIC**

Historic building materials typically require careful and specialist treatment during cleaning and drying out in order to prevent damage and it is important

to agree with the loss adjustors and emergency contractors on appropriate methods of cleaning and drying out.

As EH's guidance warns: 'organic materials such as timber swell and distort when wet, and suffer fungal and insect infestations if left damp. If dried too quickly and at temperatures that are too high, organic materials shrink and split, or twist if they are restrained in panels. Inorganic porous materials do not generally suffer directly from biological attack. However, enormous damage can be caused when inherent salt and water (frost) crystals, carried through the substrate, are released through inappropriate drying or very cold conditions' (EH, 2010).

Concealed cavities will also require cleaning out and drying, and in historic buildings it is important to agree how these areas are opened up. Water trapped behind panelling can be allowed to drain out by drilling tiny holes. It may then be possible to dry behind the panelling with 'injection drying', by pumping warm air into the voids. In some cases the panelling may need to be removed and dried properly by specialist joiners, who will number the panels and stack, turn and load them properly to counteract warping. The removal of historic lime plaster from a surface is rarely necessary, as the lime is very porous and helps underlying fabric to breathe.

Floorboards can buckle if they become saturated as a result of prolonged immersion in water and some may never regain their previous profile. Saving historic fabric should always be attempted first. Removing a number of intermediate boards can help to allow some expansion without causing permanent damage and buckled boards can be taken up and carefully stacked to allow them to dry slowly.

Wall and ceiling plaster finishes have different chemical and physical responses to water saturation. Modern gypsum-based plasters are hygroscopic and water-sensitive as the calcium sulphate in the plaster is partially soluble in cold water, so they are likely to need remedial treatment or replacement. Older lime-based plasters, on the other hand, may soften and swell when wet, but usually without collapsing, and they harden again once dry. De-bonding of lime plaster can occur if the underlying laths swell and then shrink, causing the plaster nibs to break, but they can usually be re-anchored using resins and screws.

Some metal objects which are subject to corrosion if temporarily immersed in water will not come to harm once dried. However, where water is retained around metal ties, cramps, pipes and conduits embedded in masonry walls or floors, ferrous metals can continue to corrode and expand leading to cracking and spalling of surfaces and to localised de-bonding. Serious structural problems can emerge, particularly in maritime environments. Signs of problems such as rust staining, cracks and movement may require investigation and invasive repairs.

Paint finishes and varnishes are vulnerable to staining, flaking, blooming and dissolution of binders. Permeable traditional paint finishes such as limewash

and distemper that allow moisture to evaporate through their surfaces from the substrate, can be cleaned, disinfected and left to air dry or repainted to match. Relatively impermeable modern paints such as alkyd oil-based paints or acrylic emulsions cannot be reapplied until completely dry and may require stripping off completely to allow the substrate to dry out effectively.

Historic painted decorations should be treated by a specialist conservator. Dehumidifiers and heaters should not be used in interiors that have historic wall paintings on plaster or timber. Slow drying supervised by a conservator is essential to avoid salt crystallisation, paint flaking and mould growth.

### REMEDIAL WORK AND REPAIRS

Debris that gets swept up by fast moving waters can cause mechanical damage. After the initial cleaning, decontamination and drying, a survey of the condition of the property will be required, including potential structural and material damage. The degree of moisture content of the various elements of the buildings will also need to be assessed including the condition of external walls, internal walls, floors, basements and cellars, and floor cavities, building services, appliances and fittings.

### FLOOD PLANNING

The Environment Agency has produced guidance on how to plan for and respond to a flood. Templates can be downloaded from the EA website and tailored to prepare a flood plan for a particular historic building. English Heritage's 'Flooding and Historic Buildings' also provides guidance on issues ranging from flood resistance measures to monitoring a flood-damaged building after remedial works have been completed.

### ST ANDREW'S AND ST BARTHOLOMEW'S CHURCH, ASHLEWORTH, GLOUCESTERSHIRE

The Grade I listed church of St Andrew and St Bartholomew was founded in the 12th century and lies alongside the river Severn below the level of the bank that has been built up as flood defence. The church is part of a group of 15th-century buildings including a tithe barn. The rest of the village is built on higher ground to the west.

At Ashleworth the river Severn is in its last stage in a wide flat valley through which it meanders down to the Severn estuary and out into the Bristol Channel. The tidal reach is a few miles downstream at Maisemore. According to the EA flood map, the church is at risk of extreme flooding described as a 1 in 1,000 chance of occurring each year. Without the river defences this risk would rise to 1 in 100.

Periodic flooding of the church includes significant floods in 1772, 1896 and 1897. Before 2007, the most recent significant flood was in 1947 and was recorded at 1,219mm above the floor level of the south aisle. The major flood of July 2007 was of similar proportions to that recorded in 1947.

Shortly before the church flooded in July 2007 the owners of a historic manor



*The church interior as the waters receded with the high water mark clearly visible on the wall*

house upstream from the church received an automated warning from the EA advising them of the risk of flooding, which they relayed to a churchwarden. A group of villagers moved the loose and soft furnishings to higher levels in the church.

Unlike previous floods, the July 2007 flood came up very quickly and entered the church sometime in the morning. As can be seen from the aerial photograph (see page 33), the water cut off the approach to the church. The churchwardens could not get in until a week later when the waters had receded.

### Cleaning and drying

As a result of periodic flooding the interior of the church was already reasonably flood resilient. When the 2007 floodwaters subsided it was found that the church had not sustained any structural damage. The major casualty was the organ, despite the fact that it was raised on a platform.

The clean-up was carried out by the emergency contractors and involved the following operations:

- muddy water and contaminants from the neighbouring farm's pig unit were removed. The only hidden cavity was behind some 19th-century and modern panelling in the base of the tower; the panelling was dismantled, cleaned and set aside for re-fixing
- loose furnishings such as the altar frontals and hassocks were saved from saturation but had to be sent to specialist cleaners
- all the furniture was decontaminated and removed, with only the font and the pulpit left in the church. The furniture and fittings were transported to a barn and left under cover. The barn was partly open which allowed plenty of air circulation. Security was a concern so a full inventory was made by the churchwardens (no losses were sustained)
- the organ was dismantled and

sent away for cleaning and repair by a specialist organ builder

- the under-pew heaters and low-level electrics, which were all damaged irretrievably, were removed
- the power was isolated and a temporary supply was arranged by the emergency contractors to allow them to use mechanical fans. Air circulation was improved by opening the doors to the south, west and south east. Assisted drying with extract fans took two months to reduce the moisture levels to acceptable levels that would provide an equilibrium of 10–15 per cent moisture content in the timber (anything above 15 per cent starts to enable rot and insect attack).

### Repair work

The flooding occurred early on Friday 20 July 2007 but the remedial works didn't begin until April 2008, after all the necessary approvals and tenders had been obtained.

Part of the approvals process included negotiation with the insurers as to how the insurance money would be spent. It was agreed that the value of like-for-like repairs could be used to carry out repairs and reordering, provided these alterations would improve the flood resilience of the building.

The parochial church council (PCC) was keen to carry out flood protection measures as part of the remedial works and it was agreed that the organ platform would be raised further and enlarged to fill the north transept.

All socket outlets were rewired and fixed 1,220mm above floor level. The under-pew heaters were replaced with high level quartz ray heaters to augment the existing radiant bar heaters.

Remaining sections of wall panel were removed and incorporated into the new front to the organ platform. The platform front was fixed so that it can easily be removed for future cleaning and drying.



The chancel with its new stone floor



The north transept with the refurbished and repositioned organ

The movement of loose furniture as the water entered the church caused some damage to the chancel floor. The thin floor screed, which had been made to resemble stone paving, was replaced with more robust stone paving on a limecrete base.

Some of the decayed oak kerbs around the pew platforms were replaced with part-seasoned oak. Open joints in the masonry were repointed and walls redecorated with limewash.

The furniture required more extensive repair and the redundant pews were salvaged to repair the rest of the pews. All furniture was cleaned and polished.

The bulk of the work was completed in October 2008 with the electrical and repair works the first to be finished. The furniture repairs were finally completed in 2009. The work had to be carried out in stages as the furniture restorer was in great demand from others affected by the same floods. The organ was finally rebuilt in mid 2009.

The clean up and remedial works were time consuming and involved complex logistics (especially the movement and storage of furniture) and a great deal of administrative work (from obtaining approvals for the works to negotiating costs with the insurance company). The church could not be used during this period but the end result is a more flood-resilient building. The organ setting is greatly improved and the east end of the nave is a more functional space. The interior of the church has been given a real lift as the cleaning and polishing of the pews and furnishings has harmonised what was a rather motley collection of furniture.

#### Flood planning

Following the 2007 flood, the church devised a flood strategy and is currently considering whether it should be on the EA's automated warning system (the floodwaters reached the east end of the church again in 2008, but fortunately did not enter). The flood strategy

will set out the sequence of actions to be taken in case of flood, including:

- agreeing a chain of command for raising the alarm
- mobilisation of and guidance for volunteers
- sandbagging, moving loose furnishings, unbolting the fixed pews to raise them on to the organ platform or removal to suitable temporary and storage
- keeping a record of emergency contact details (insurer, architect, etc)
- preparing an inventory of items and their condition
- creating a photographic record of the building and contents.

The document will be reviewed regularly at PCC meetings and passed to successive churchwardens to ensure continuity.

No emergency will go exactly to plan but if there is a plan for each of the key stages and a regularly updated checklist of necessary actions, the impact on the building and its contents can be mitigated. The burden of the recovery can also be distributed among those responsible for the building's care and management, reducing the risk of confusion and ensuring a faster and more effective response.

#### Recommended Reading

Association of British Insurers and the National Flood Forum, *Repairing your Home or Business after a Flood: How to Limit Damage and Disruption in the Future*, 2006

Cabinet Office, *The Pitt Review: Learning Lessons from the 2007 Summer Floods*, London, 2008

English Heritage, *Climate Change and the Historic Environment*, London, 2008

S Garvin et al, *Standards for the Repair of Buildings Following Flooding*, CIRIA, London, 2005

English Heritage, *Flooding and Historic Buildings*, 2nd edition, London, 2010

B Ridout, *Timber Decay in Buildings: The Conservation Approach to Treatment*, E and FN Spon in association with English Heritage and Historic Scotland, London, 2000

#### Useful Websites

The Environment Agency (includes interactive flood maps by postcode)  
[www.environment-agency.gov.uk](http://www.environment-agency.gov.uk)

The Met Office (forecast and archive data on weather, rainfall and temperature):  
[www.metoffice.gov.uk](http://www.metoffice.gov.uk)

The National Flood Forum (includes 'Beginner's Guide to Flooding' fact sheets):  
[www.floodforum.org.uk](http://www.floodforum.org.uk)

The UK Climate Impacts Programme (guidance on the impact of climate change):  
[www.ukcip.org.uk](http://www.ukcip.org.uk)

**RUTH NICHOLLS BSc(Hons) BArch (Bath) Grad Dipl Cons(AA) RIBA is an associate of Astam, a multidisciplinary practice with architects, engineers and project managers (see page 20). She is an architect and designer specialising in the conservation of historic buildings particularly churches and is church architect for a number of churches in the Gloucestershire Diocese.**

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# LASER SCANNING

## Surveying, recording and monitoring historic buildings

JAMES MILLER

**T**HE USE of laser scanning techniques for surveying is now commonplace. Ten years ago a measured survey would have been carried out using a computerised EDM (electronic distance measurement) device such as a total station and 'smart pole', together with hand-held tools, but today's surveyor is likely to be equipped with a tripod-mounted scanner.

Heritage professionals are likely to be more interested in having an accurate drawing on which to base their specification of works than in the process behind it. However, laser scanning is radically different from previous techniques, and it is well worth taking a moment to grasp the concepts, not only to take advantage of the new opportunities it offers, but also to avoid paying for unnecessary detail.

### LASER SCANNING TECHNIQUES

The technique requires a scanning head to be mounted on a surveyor's tripod. The scanner spins at very high speed while a low-energy laser fires a reflecting beam with extraordinary precision, recording up to 1 million points a second. The density of these is adjusted according to the purpose of the survey, with a typical spacing of 1–3mm. There might, for example, be 20 million points in a survey of the front facade of a modest Grade II listed cottage. The tolerance of the position of each point is typically 1–2mm. Together they effectively describe the surface and are known as the *point cloud*. Figure 1 shows a colour-mapped image of the point cloud for King Charles Tower on Chester's city walls.

Safety is a common concern for neighbours and bystanders. Lasers used for such work are of Class 3R or lower intensity in accordance with IEC standard 60625-1 and under normal use the beam is not harmful to the human eye. Legislation may require warning notices to be displayed while site work is carried out and the surveyor should have a method of work that mitigates exposure.

### SURVEY SET-UP

Obviously, the device does not have X-ray vision. To give a complete picture it must have sight of the features to be surveyed (as with the more traditional total station), so a number of different set-up positions will need to be adopted inside and outside the building. It may need to include roof voids and positions on or overlooking the roof itself if an accurate roof plan is required. Laser survey equipment has become lighter and can now be mounted on an extendable pole, although sway may result



Figure 1 Colour-mapped image of a point cloud of King Charles Tower on Chester City walls. (Image: Russell Geomatics/Donald Insall)

in error. Even so, it is often impossible to avoid areas of shadow on the point cloud where surfaces are hidden behind other fabric, and data is lost. In such cases some assumptions must be made later to fill in the gaps.

The set-up position does not need to be located over a survey 'station' (a nail head or pin), which is traditionally used to tie the survey together. Instead, the survey company will commonly use their own objects, typically spheres, to correlate the dataset from one location with that taken from another, as shown in Figure 2. Each piece of survey is then fitted together like a jigsaw so that the edges match to form a whole.

The scanning of motorways and railways is now undertaken from moving platforms, vehicles and even aircraft but, due to the lower tolerance on such data, this method is unsuitable for historic fabric.

### CURRENT SURVEYING PRACTICE

Survey companies have moved rapidly to embrace laser techniques because they reduce both the costs and the risks associated with site work. The time needed to record data can be as little as ten minutes per location. By reducing site activities and transferring them to the office, the influence of unpredictable factors such as bad weather are mitigated.

The benefits are significant when considering large building volumes and

spaces where detail at height is important, such as cathedrals, tall facades and historic civil engineering structures. There is usually no need to gain access at height in order to register their dimensions. The precise shape of a historic vault, a bulge in a wall or the irregular spacing of timbers across a ceiling can be measured from ground level.

Laser scanning therefore provides a new approach for the historic building specialist and a new way of visualising and exploring historic fabric. Its principal advantages over previous methods include:

- **Recording detail from a distance** The shape and condition of decorative stonework, corbels, lintels and other features can be reproduced by the surveyor at large scale (1:5 or even 1:2 if necessary) with a tolerance equal to or better than that obtained by close physical measurement.
- **Inspection in low light** The process is not dependent on the human eye so can be carried out at night when a building or site is unoccupied, or with very low levels of internal light.
- **Access to a complete computerised record** Conservation professionals have access to all the gathered data in scalable form on their own computer. They can jump from one survey position to another in a 3D environment, interrogating floor levels, lintel heights and other dimensions.



Figure 2 Typical survey equipment showing common objects mounted on tripods to correlated datasets taken from different locations – from either side of the river for example

### CHOICE OF SURVEYOR

Different surveyors specialise in different scales and types of work, so knowledge of the required outputs and attention to historic detail is essential. A mixed portfolio that includes small and medium sized projects and strong experience of historic fabric is usually a good clue to a surveyor's suitability.

### SPECIFICATION OF OUTPUT

Some time-consuming processing occurs after a laser survey is undertaken. It is therefore more important than with older survey methods for the professional to specify exactly what is required. A specification for conventional output of 2D drawings should include:

- a description of the purpose of the survey
- the physical extent of the work, including roofs and voids
- the point density and point tolerance
- the 2D drawing series of plans, elevations and details, if necessary using photographs or pre-existing survey records to help clarify the work
- parameters that describe the tolerance of detail on the drawings.

The tolerance of the detail can be described, for example, by the required scale of drawing (1:100 up to perhaps 1:5). Quoting this will help the surveyor to decide how much detail to include. Further guidance is given in sections 5 and 7 of English Heritage's *Metric Survey Specifications for Cultural Heritage* (see Recommended Reading).

It is important to define what project-specific detailed drawings may be required at the beginning of the survey, so that the surveyor can adjust the density of data collected and set-up points to focus on specific needs.

### FROM LASER SCAN TO DRAWINGS

The scan collects large volumes of data which are stored in compressed format on the device's hard drive. The data is then downloaded and processed to become the point cloud in a process known as registration, undertaken using software such as Cyclone™. During this process, spurious points are removed and the point data is converted to a standard transfer format. The point cloud might typically contain between one and ten billion points that describe the building surfaces inside and out.

The process of reducing this to 2D drawings or 3D models usually involves thinning this to a lower density. In the case of 2D drafting, a cutting plane is defined and the data exported to form the drawing using proprietary software such as CloudWorx™. The process of creating the 2D image, known as vectorisation, is a simple but rather laborious process of join-the-dots. An enlarged detail is shown in Figure 3.

Clearly, the greater the accuracy required, the less thinning-out is undertaken and the more dots there are to join. So it is essential that the surveyor knows what resolution is required from the start. Quoting a drawing

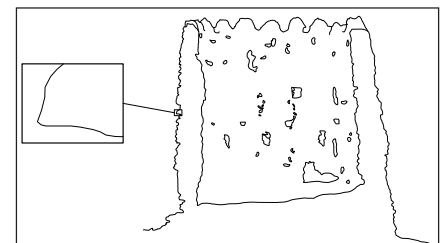


Figure 3 Detail of stonework drawn at 1:50 and enlarged to show discrete linework (Image: Greenhatch Group)

scale is still a good way of expressing this, even though CAD effectively functions at 1:1.

Scanning is particularly suited to recording highly irregular surfaces such as timber frames and medieval stonework, and their individual components can be clearly identified from the scan. However, it is often necessary to use photogrammetry in conjunction with laser scanning to trace more uniform areas of brick, terracotta or stonework. If this level of detail is required, for specifying repairs to individual stones for example, then this requirement should be stated at the outset for including in the pricing. The use should also be discussed in detail with the surveyor prior to site work.

### OWNERSHIP AND TRANSFER OF DATA

Normal principles of ownership and intellectual property usually apply to the output. The survey company retains this and the purchaser is typically given a royalty-free licence to use it for the purposes defined.

3D point cloud data is usually available to the purchaser if requested. However, the amount of data is large, sometimes running into terabytes, so an external hard drive is normally used to transfer it.

#### A SCALABLE IMAGE AND A 3D PHOTOGRAPH

There is nothing quite like having photographs to record and look back on a site visit, or explain the project. If photographs were scalable, we would be able to confirm dimensions and take levels that perhaps are not covered on our 2D drawings, however well specified.

The program TruView™ is a very powerful tool that does just that. Truview takes the scan data and effectively produces an image

of the building on an office PC. This can be rotated, enlarged and interrogated for dimensions and levels. It is a very useful application that provides good visualisation. Small architectural details can be enlarged for closer inspection. Structural defects such as cracks down to perhaps 1-2mm can be viewed, and sagging in beams and the bulge in walls can be read, even though the professional may be unable to see them on site.

The point cloud is not the only site data that can be recorded while on site. A 360° colour photographic image is often specified in conjunction with the scan. These photographs are not currently scalable, but by combining the digital photo with the scan image so that both are registered by the

computer program, the photo itself appears to be scalable. Scanning techniques are being developed to record the colour directly using the spinning laser, before registration.

#### COSTS

The cost of on-site laser scanning is now essentially hidden in the survey itself, so there is no cost premium. The whole process of 2D drawing production is no more expensive than by traditional total station techniques, assuming that normal drafting tolerances are specified.

The production of drawn output from the collected point cloud data will normally represent about 60-70 per cent of the cost of the overall survey, but this may rise to 90 per cent for detailed stonework, showing just how important it is to define the survey parameters.

Some consultants are tempted to produce the drawn output themselves from the point cloud. This can achieve good results but may prove more expensive. Direct use of the cloud by the consultant is more normally associated with surface and solid modelling.

Photographic colour imaging currently requires different equipment to be mounted to the tripod and so roughly doubles the time spent at each site set-up. It also adds to the registration process and will add 10-25 per cent to the overall cost of a survey.

3D modelling can be economical for basically rectilinear and recent fabric. The simple facade in Figure 4 was scanned and modelled, out-of-plumb and complete with bulges, for £1,350, ready for incorporation into the BIM model.

#### DRAFTING INTO 3D

The use of Building Information Modelling or Management (BIM) has been declared as a government objective in the procurement of design. Although capable of much greater sophistication, reduced to a minimum, BIM

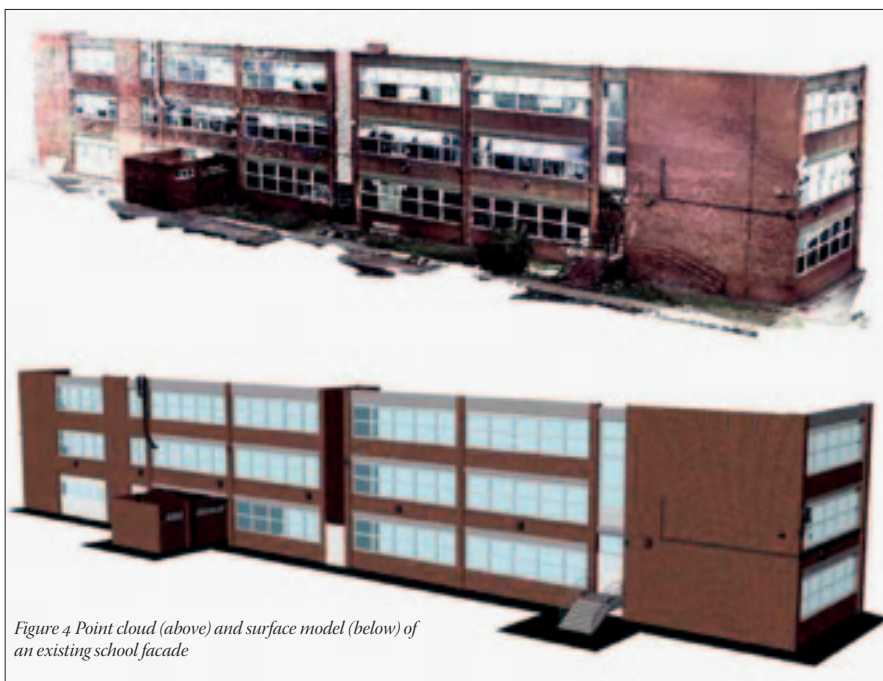


Figure 4 Point cloud (above) and surface model (below) of an existing school facade

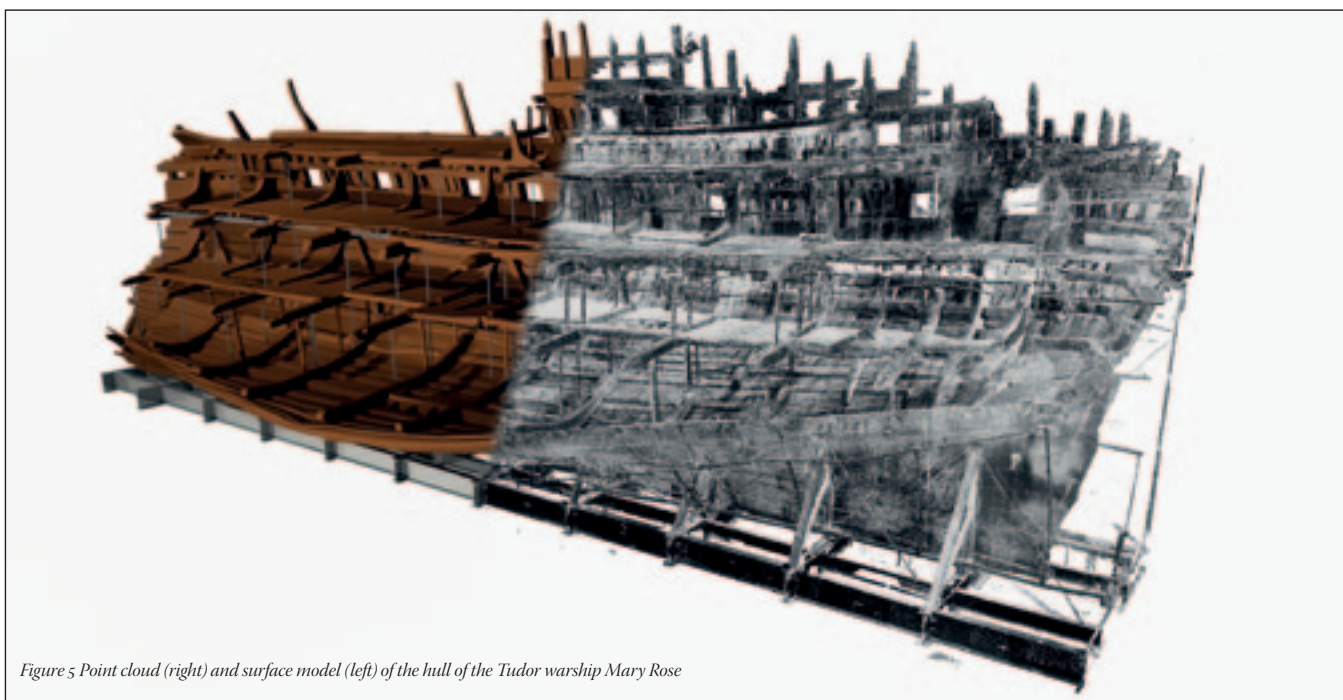


Figure 5 Point cloud (right) and surface model (left) of the hull of the Tudor warship Mary Rose

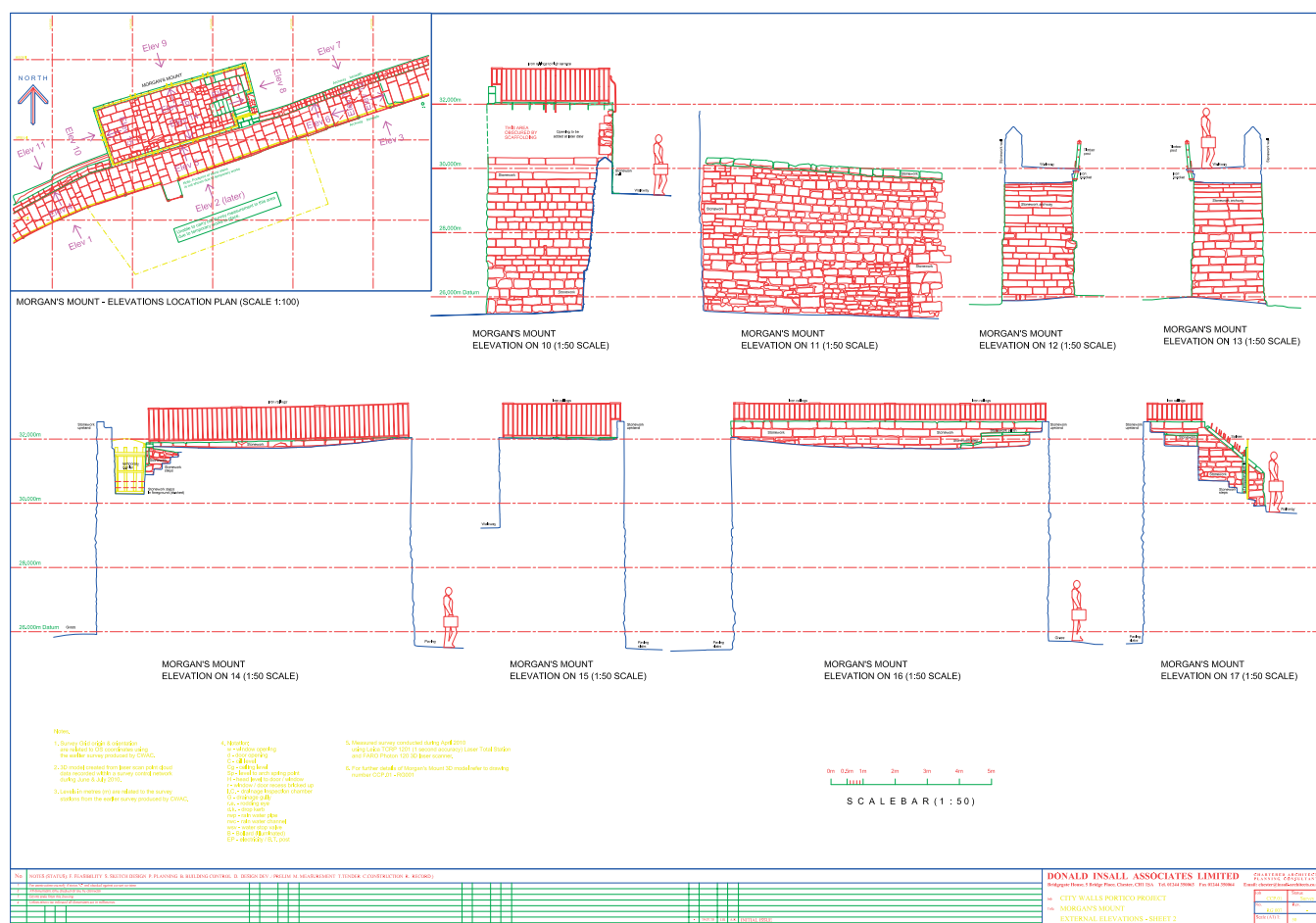


Figure 6 The final product: a working drawing showing a cross section of an archway through Chester city walls. Accurate, detailed drawings like this can be used for a wide variety of practical applications, from preparing specifications to monitoring and recording. (Image: Russell Geomatics/Donald Insall)

is effectively 3D drafting. When existing building fabric is to be repaired or modified, laser scanning provides the key by which survey data is pivoted into the model. By surface modelling from the point cloud, a historic building can reappear in reduced, filtered, and rendered form in the 3D drafting model, yielding very considerable benefits in terms of fit and visualisation.

This process requires experience and it is best to start simply. A number of survey companies will build a surface model from the point cloud, in the same way that they produce 2D drawings. The tolerances on a 3D surface model need to be carefully defined if the model is to be reliable and the deviations should be clearly understood (for example, permitting a 5mm or 10mm maximum deviation of the surface from the cloud).

The modelling process is much more expensive than creating 2D drawings. It may take a number of weeks to produce a model of a complex building or a structure like the Mary Rose (see Figure 5). Even so, some spaces are likely to escape survey and so cannot have surfaces fitted to them.

Drafting software such as Revit™ can now accept point clouds directly into the 3D model. The manipulation of the cloud by drafting platforms looks set to develop rapidly over the next few years, as it becomes easier to use scanned survey data for existing and historic buildings on office PCs.

### RECORDING HISTORIC FABRIC

The use of laser scanning for recording and archiving is now well established and English Heritage (EH) has produced good guidelines for the professional (see Recommended Reading). Concern has been expressed in the past over such methods because of the stability of the electronic archive, but this issue has been largely addressed by the National Monuments Record. EH has recently commissioned a comprehensive laser scan of Stonehenge and work at Ironbridge is due to commence shortly.

The choice of format in which the archived data is kept remains an issue because different manufacturers have different formats. The common choice remains the rather inefficient ASCII format which generates very large files for storage. The ASTM E57 format currently in development may provide an effective alternative.

### MONITORING MOVEMENT

Scanning provides a highly accurate contoured surface of buildings and structures. By repeating a scan a few months or perhaps a year later and overlaying one scan over the other, three dimensional movement in the surfaces can be detected. This provides a powerful tool for monitoring structural behaviour, given that it can be achieved without physical access to the walls. Contours (or 'isopachytes') can be produced using a

program such as Geomagic™ that shows the difference in movement.

This technique can be used at the sub-millimetre level to record the decay in surfaces such as brickwork or even decay in objects, using a more sensitive group of laser scanners that operate on the principle of triangulation, sited perhaps one metre from the object. A tolerance of 0.5mm is currently achievable.

### Recommended Reading

- D Andrew (ed), *Metric Survey Specifications for Cultural Heritage*, English Heritage, Swindon, 2009
- D Jones (ed), *3D Laser Scanning for Heritage*, English Heritage, Swindon, 2007
- RICS, *An Introduction to Terrestrial Laser Scanning*, London, 2006

### Acknowledgements

The author would like to thank colleague Daniel Niziolek, Andrew Dodson of Greenhatch and Paul Bryan of English Heritage for their assistance in the preparation of this article.

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HISTORIC BUILDING CONSULTANTS: Cube is a multi-disciplinary architectural and surveying practice, which offers advice on all aspects of historic and listed buildings including conversion, refurbishment, extension and adaptations. Working nationally, services include: feasibility studies; condition surveys; quinquennial surveys; detailed building design; interior design; contract administration; project management; cost consultancy and CDM co-ordination. The historic building consultancy is led by Stuart Prescott BSc DipBldgCons IHBC MRICS, who has experience working on world heritage sites, scheduled ancient monuments and listed buildings.

### ■ ALAN DICKINSON, MRICS GradDiplCons(AA)

1 The Grove, Rye, East Sussex TN31 7ND

Tel 01797 225139 Fax 01797 227956

[www.alandickinson.com](http://www.alandickinson.com)

CHARTERED BUILDING SURVEYOR, HISTORIC BUILDINGS CONSULTANT: Sussex and Kent-based practice specialising in building surveys and architectural services to period buildings backed by an understanding of historical development. Measured surveys, statements of significance and archaeological interpretive reports are also offered for planning, PPS5 and research purposes.

### ■ DOUGLAS WILLIS ASSOCIATES LIMITED

3 Cabot Close, Saltford, Bristol BS31 3LQ

Tel 01225 873854 Fax 01225 872682

Email [info@dwa-bristol.co.uk](mailto:info@dwa-bristol.co.uk) [www.dwa-bristol.co.uk](http://www.dwa-bristol.co.uk)

CHARTERED BUILDING SURVEYORS AND ARCHITECTURAL DESIGN SERVICES: Dealing with all aspects of listed buildings including measured and condition surveys, defect analysis, repair and maintenance planning, party wall matters, refurbishment, alteration and extension. Listed building, conservation area, planning and building regulation applications and advice. Preparation of drawings, specifications, tendering and contract administration.

### ■ THE FLOYD CONSULTANCY

14 Church Street, Hagley, Stourbridge, West Midlands DY9 0NA

Tel 01562 885806 Mobile 07762 614364

Email [info@thefloydconsultancy.co.uk](mailto:info@thefloydconsultancy.co.uk)

[www.thefloydconsultancy.co.uk](http://www.thefloydconsultancy.co.uk)

SCIENTIFIC ASSESSMENT OF HISTORIC BUILDINGS AND THEIR ENVIRONMENTS: Building condition or defect is assessed through: site investigation, analyses of materials/environments/bio-deterioration organisms and archival research, known colloquially as damp, timber decay and building fabric surveys. Structural assessment, strength grading of timber, installation of environmental monitoring systems and retrieval/analysis of data are also specialities. The principal is Timothy Floyd MSc (Architectural Materials Conservation) MRICS. See website for further details.



**SURVEYORS** *continued*

■ **GIBBON, LAWSON, McKEE LTD**  
 58 Castle Street, Edinburgh EH2 3LU  
 Tel 0131 225 4235 Fax 0131 220 0499  
 Email david.gibbon@glmglm.co.uk  
 www.glmglm.co.uk

CONSERVATION BUILDING SURVEYORS: A remarkable and unusual building surveying practice in Scotland specialising for over 20 years in building conservation and bringing to bear all the practical skills of building surveyors supported by in-house architects. The practice undertakes condition surveys, reports on maintenance and organises building projects to breathe new life into old buildings. *See also: profile entry in Architects section, page 24.*

■ **HALL & ENSOM, CHARTERED BUILDING SURVEYORS**  
 3 Meadow Court, High Street, Witney, Oxfordshire OX28 6ER  
 Tel 01993 774995 Fax 01993 700304  
 Email mail@hallandensom.co.uk  
 www.hallandensom.co.uk

Contact M C Hall FRICS IHBC PG Dip Conservation of Historic Buildings

CHARTERED BUILDING SURVEYORS, ARCHITECTURAL DESIGN SERVICES:

Listed buildings are a permanent feature of the practice workload and the directors, Martin Hall and David Ensom, have between them over 60 years experience, much of it in relation to historic buildings. Hall & Ensom's services include surveys, maintenance planning, repairs, alterations and major refurbishment projects. The practice has worked on all grades of protected buildings, from repairs to substantial refurbishment projects, and can provide a service tailored to the client's needs including quantity surveying and services engineering. Hall & Ensom provides a personal service throughout the Cotswolds and Thames Valley.

■ **HERITAGE SURVEYS LIMITED**  
 20 Hanover Square, London W1S 1JY  
 Tel 07944 927380

Email jon.evans@heritage-surveys.com  
 www.heritage-surveys.com

CHARTERED BUILDING SURVEYORS: Heritage Surveys Limited is a chartered building surveying practice which specialises in the care, conservation and restoration of historic buildings and ancient monuments. Services include: historic building consultancy, project management/contract administration, historic building surveys/condition surveys, quadrennial/quinquennial inspections, building defect investigations, planned preventive maintenance management, conservation plans/manuals, planning and listed building consent applications, significance statements under PPS5 and cost consultancy.

■ **HISTORIC BUILDING ADVISORY SERVICE**  
 PO Box 2140, Tisbury, Salisbury, Wiltshire SP2 2DW  
 Tel 01747 873803 Fax 01747 871919  
 Email info@historicbuilding.co.uk  
 www.historicbuilding.co.uk

INTERNET BASED CONSULTANCY: *See also: profile entry in Heritage Consultants section, page 39.*

■ **INGRAM CONSULTANCY LIMITED**  
 Holly Cottage, Lower Street, Upton Noble, Somerset BA4 6BB  
 Tel 01749 850900  
 Email enquiries@ingram-consultancy.co.uk  
 www.ingram-consultancy.co.uk

CONSULTANTS IN THE CONSERVATION AND REPAIR OF HISTORIC BUILDINGS, ANCIENT MONUMENTS AND THEIR SITES: *See also: profile entry in Heritage Consultants section, page 40.*

■ **PRIORY HERITAGE**  
 The Old Clay Works, Little Staughton, Bedfordshire MK44 2BX  
 Tel 01234 376866  
 Email davidllewelllyn@prioryheritage.co.uk  
 www.prioryheritage.co.uk

SURVEYORS AND HISTORIC BUILDING CONSULTANTS: *See also: profile entry in Heritage Consultants section, page 40.*

■ **RICKARDS CONSERVATION**  
 Hill House, Eynsford Rise, Eynsford, Kent DA4 0HR  
 Tel 01732 741677  
 Email rickardsconservation@mac.com

HISTORIC BUILDINGS CONSULTANCY: Rickards Conservation is an independent professional building conservation practice providing a comprehensive range of services to care for historic and listed buildings. The practice undertakes surveys, defects analysis, repair, adaptation and design; can provide conservation plans and sustainable solutions. Stephen Rickards GradDiplCons(AA) FRICS IHBC ARPS is a chartered building surveyor, RICS conservation accredited, and holds the Architectural Association postgraduate diploma in building conservation. He was responsible for conservation work praised by the Civic Trust in Chatham Historic Dockyard and a Conservation Award winner in 1999. Clients include English Heritage, National Trust, SPAB, dioceses and private owners.

■ **STRIDE TREGLOWN PLC**  
 The Promenade, Promenade House, Clifton Down,  
 Bristol BS8 3NE  
 Tel 0117 974 3271 Fax 0117 974 5207  
 www.stridetreglown.co.uk

SURVEYORS: *See also: profile entry in Architects section, page 31.*

■ **STUART LITTLE**  
 88 Abbots Road, Abbots Langley, Hertfordshire WD5 0BH  
 Tel 01923 260147  
 Email stuart@sjlittle.co.uk  
 www.sjlittle.co.uk

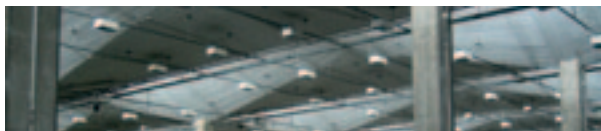
CHARTERED BUILDING SURVEYOR AND CHARTERED QUANTITY SURVEYOR: Specialising in building conservation. Services include historic building surveys, listed building surveys, repair of historic buildings, conservation works and advice, adaptive reuse and conversion, historic analysis and research, and advice on buildings at risk. Repairs are carried out using sustainable traditional materials and techniques, and where possible Stuart Little adopts the philosophy of the Society for the Protection of Ancient Buildings. Based in Hertfordshire the practice undertakes historic building consultancy work in all areas.

■ **T R A D A TECHNOLOGY LTD**  
 Chiltern House, Stocking Lane, Hughenden Valley,  
 High Wycombe, Buckinghamshire HP14 4ND  
 Tel 01494 569600 Fax 01494 565487  
 Email information@trada.co.uk  
 www.trada.co.uk

TIMBER CONSERVATORS: TRADA Technology's consultants offer a cost-effective holistic approach to conserving timber in historic buildings. TRADA Technology conducts in situ timber strength assessments using bespoke visual strength grading with engineering support where enhanced timber strength values are required. Timber surveys are undertaken using non-destructive techniques including decay detection drilling. Partnerships allow TRADA Technology to examine the condition of the full range of building materials. Where practicable the firm recommends drying down wood to control fungal decay. However, where remedial treatment or timber repairs are required, TRADA Technology can assist with preparing appropriate specifications, source repair specialists and oversee works. Clients include the National Trust and Cutty Sark Trust.

SURVEYORS *continued***TUFFIN FERRABY TAYLOR**

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jallen@tftconsultants.com 0203 479 7691  
www.tftconsultants.com

■ **WARD & DALE SMITH LIMITED, CHARTERED BUILDING SURVEYORS**

The Walker Hall, Market Square, Evesham,  
Worcestershire WR11 4RW  
Tel 01386 446623 Fax 01386 48215  
Email enquiries@wds.gb.com  
www.wds.gb.com

HISTORIC BUILDING CONSULTANCY INCLUDING CONDITION SURVEYS:  
Services include surveys, advice on damp and timber specifications, obtaining tenders and contract administration etc. Expert witness work.  
*See also: profile entry in Damp & Timber Decay section, page 149.*

■ **WATKINSON & COSGRAVE**

Linton House, 39–51 Highgate Road, London NW5 1RT  
Tel 020 7485 6016 Fax 020 7284 4058  
Email info@watcos.co.uk  
www.watcos.co.uk

CHARTERED BUILDING SURVEYORS AND STRUCTURAL ENGINEERS: Watkinson & Cosgrave has 50 years experience of repairing and restoring buildings, including initial appraisals, structural surveys, feasibility studies, design, specification, supervision of works and contract management.

■ **WATSON BERTRAM & FELL LTD**

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Tel 01225 337273 Fax 01225 448537  
Email mail@wbf-bath.co.uk  
www.wbf-bath.co.uk

ARCHITECTS AND SURVEYORS: *See also: profile entry in Architects section, page 32.*

■ **W C P (THE WHITWORTH CO-PARTNERSHIP LLP)**

22a North Street, Bishops Stortford, Hertfordshire CM23 2LW  
Tel 01279 507775

Email wcp.boniface@btinternet.com

www.wcp-surveyors.com

Contact Stephen Boniface

HISTORIC BUILDINGS CONSULTANCY: *See also: profile entry in Architects section, page 32.*

■ **W R DUNN & CO LTD**

27 Front Street, Acomb, York YO24 3BW

Tel 01904 784421 Fax 01904 784679

Email info@wrdunn.co.uk

www.wrdunn.co.uk

CHARTERED BUILDING SURVEYORS, ARCHITECTS AND HISTORIC BUILDING CONSULTANTS: Established in 1986, W R Dunn & Co Ltd undertakes commissions throughout the UK on behalf of English Heritage, the Home Office, the MoD, the Church of England Church Commissioners, the Archbishop of York, Harewood House Trust Ltd, several local authorities and councils and many private and commercial clients. The managing director is RICS accredited in building conservation. Past schemes include re-roofing a Grade I listed stately home, repairs/alterations to a Grade I listed stable block and repairs to castles, lodges, halls, monuments, walled gardens, dwellings and other structures.

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## MATERIALS ANALYSTS

### ■ CLIVEDEN CONSERVATION WORKSHOP LTD

South East, Head office – The Tennis Courts, Cliveden Estate, Taplow, Maidenhead, Berkshire SL6 0JA  
Tel 01628 604721 Fax 01628 660379

■ West, Bath office – Home Farm, Ammerdown Estate, Kilmersdon, Bath, Somerset BA3 5SN  
Tel 01761 420300 Fax 01761 420400

Email [info@clivedenconservation.com](mailto:info@clivedenconservation.com)

■ East and North, Houghton office – The Old Coach House, Houghton, Norfolk PE31 6TY

Tel 01485 528970 Fax 01485 529336

Email [enq.houghton@clivedenconservation.com](mailto:enq.houghton@clivedenconservation.com)

[www.clivedenconservation.com](http://www.clivedenconservation.com)

SCULPTURE, STONE AND WALL PAINTINGS CONSERVATION: *See also: profile entry in Stone section, page 98.*

### ■ HERITAGE TESTING LTD

Unit 43, The Old Brickworks, Plumpton Green, East Sussex BN7 3DF

Tel 01273 891785 Fax 01273 256545 Mobile 07714 006916

Email [consultant@heritagetesting.co.uk](mailto:consultant@heritagetesting.co.uk)

[www.heritagetesting.co.uk](http://www.heritagetesting.co.uk)

SPECIALISED CONSULTANCY AND LABORATORY TESTING SERVICE: In support of construction, conservation and preservation, restoration and remediation. Lime mortar, render and plaster analysis. Wattle and daub, cob, adobe and pise (rammed earth). Roman cement and early Portland cement concrete. Moisture and soluble salt testing. The company's portfolio ranges from unlisted vernacular/conservation area houses to listed historic churches, abbeys, castles, forts, industrial buildings and ruin consolidations. Projects include the Church of the Nativity, Westminster Palace, Syon House, Flaxley Abbey, St Mary Le Bow Church and The Royal Pavilion.

### ■ HIRST CONSERVATION

Laughton, Sleaford, Lincolnshire NG34 0HE

Tel 01529 497449 Fax 01529 497518

ANALYSIS OF PLASTER AND PAINT LAYERS: *See also: display entry on the inside front cover and profile entry in Building Contractors section, page 67.*

## MARINE ENGINEERS

### ■ EURA CONSERVATION LTD

Unit H2, Halesfield 19, Telford, Shropshire TF7 4QT

Tel 01952 680218 Fax 01952 585044

Email [enquiries@aura.co.uk](mailto:enquiries@aura.co.uk)

[www.aura.co.uk](http://www.aura.co.uk)

MARINE CONSERVATION: The team at Aura Conservation includes accredited conservators with experience of preserving, conserving and restoring metal and wooden maritime objects. Sole conservators of the 322 foot wrought iron hull of the ss Great Britain, its 104 foot iron main yard and its 16 tonne rudder. Aura has restored the National Maritime Museum's aluminium speedboat Miss Britain III, Gravesend Pier, canal boats and completed a survey and condition report for the 1789 yacht Peggy. Aura has extensive experience in the preparation of conservation management plans and applications for Heritage Lottery Funding and were Icon prize winners in 2010 for innovation. *See also: display entry in Metalwork section, page 133.*

## NON-DESTRUCTIVE INVESTIGATIONS

### ■ DEMAUS BUILDING DIAGNOSTICS LTD

Stagbatch Farm, Leominster, Herefordshire HR6 9DA

Tel 01568 615662

Email [info@demaus.co.uk](mailto:info@demaus.co.uk)

[www.demaus.co.uk](http://www.demaus.co.uk)

NON-DESTRUCTIVE INVESTIGATIONS, TIMBER TESTING, INFRARED THERMOGRAPHY, MICRODRILLING, ULTRASOUND AND ENDOSCOPY: Demaus Building Diagnostics Ltd specialises in the non-destructive investigation and assessment of historic structures using a wide range of advanced techniques which, combined with 30 years practical experience in building conservation, often lead to very significant cost savings. The company has particular expertise in the assessment and conservation of timber, including the preparation of specifications and methodologies for repair conservation. Thermographic surveys are essential to identify heat loss in old buildings, as well as locating concealed structure and defects. Regular clients include English Heritage, the National Trust, architects, engineers, surveyors and owners.

### ■ FUGRO APERIO LTD

Focal Point, Newmarket Road, Bottisham, Cambridge CB25 9BD

Tel 0870 600 8050 Fax 0870 600 8040

[www.fugro-aperio.com](http://www.fugro-aperio.com)

NON-DESTRUCTIVE INVESTIGATIONS: Specialists in non-destructive investigation of buildings, structures and monuments offering an experienced team using advanced techniques such as radar, thermography, ultrasonics, metal detection and endoscopy. Non-destructive investigations are conducted to determine structural condition and arrangement without damage to the fabric. With experience gained in the UK and overseas on buildings of national significance, the team combines investigation skills with an understanding of historic building methods. Recent commissions include Lambeth Palace, Sir John Soane's Museum, The British Museum, Hampton Court Palace and Buckingham Palace. Clients include consultants and private and public property owners including the National Trust and Historic Scotland.

### ■ HUTTON + ROSTRON ENVIRONMENTAL INVESTIGATIONS LIMITED

Netley House, Gomshall, Surrey GU5 9QA

Tel 01483 203221 Fax 01483 202911

Email [ei@handr.co.uk](mailto:ei@handr.co.uk)

[www.handr.co.uk](http://www.handr.co.uk)

CONSULTANTS ON BUILDING FAILURES AND ENVIRONMENTS: *See also: profile entry in Damp & Timber Decay section, page 149, and Resurgam profile entry in Heritage Consultants section, page 41.*

## QUANTITY SURVEYORS

### ■ BARE, LEANING & BARE

Part of the Synergy Group

2 Bath Street, Bath BA1 1SA

Tel 01225 461704

■ Exeter office – Tel 01392 272245

Email [g.evans@synergylp.com](mailto:g.evans@synergylp.com)

[www.synergylp.com](http://www.synergylp.com)

QUANTITY SURVEYORS: The partners and staff at Bath and Exeter have many years experience in the repair, alteration and conservation of listed buildings, churches and cathedrals throughout the UK. A full range of quantity surveying services is offered to clients for work being undertaken by contractors, conservators or direct labour. Applications for grant aid are prepared and cost advice given on maintenance programmes, quinquennial reports and VAT liability. Clients include English Heritage, National Trust, Landmark Trust, cathedrals, Anglican, Roman Catholic and non-conformist churches, preservation trusts, local authorities, and private owners.

When contacting companies listed here, please let them know that you found them through  
**The Building Conservation Directory**

## QUANTITY SURVEYORS *continued*

### ■ BRADING BUTT CHARTERED QUANTITY SURVEYORS

3 Meadow Court, High Street, Witney, Oxfordshire OX28 6ER  
Tel 01993 771974 Fax 01993 700304  
Email [mail@bradingbutt.co.uk](mailto:mail@bradingbutt.co.uk)  
[www.bradingbutt.co.uk](http://www.bradingbutt.co.uk)

Contact Andrew Bird MRICS MAPM, Rowland Butt MCIQB

QUANTITY SURVEYORS AND PROJECT MANAGERS: Listed buildings are a prominent feature of the practice workload and the directors, Andrew Bird and Rowland Butt, have over 60 years combined experience. The practice has worked on all grades of protected buildings with schemes ranging from small extensions to multi-million pound refurbishments of country houses. It is able to offer a full range of services including cost management, project management, design team co-ordination and contract administration, so can provide a service tailored to your requirements. From offices in Witney and Basingstoke the practice is able to provide a personal service throughout the southern half of the country.

### ■ BRUNDELL WOOLLEY

The Old Orchard, Walesby, Market Rasen, Lincolnshire LN8 3BZ  
Tel 01673 838000 Fax 01673 838111  
Email [info@brundellwoolley.co.uk](mailto:info@brundellwoolley.co.uk)  
[www.brundellwoolley.co.uk](http://www.brundellwoolley.co.uk)

Contact Richard Woolley BSc (Hons) MRICS

CHARTERED QUANTITY SURVEYORS: Based in the Lincolnshire Wolds Brundell Woolley specialises in the cost management of historic buildings, monuments and landscapes throughout the Midlands and the North. Each commission is handled with great enthusiasm and a high degree of client care. Clients include cathedrals, parochial church councils, private individuals and estates, preservation trusts and local authorities. The firm has provided services on numerous projects funded by English Heritage, the Heritage Lottery Fund and other grant aiding bodies and has much experience with the preparation of feasibility estimates for use with grant submissions.

### ■ GREENWOOD PROJECTS LTD

Oakwood House, Whittington Hurst, Lichfield, Staffordshire WS13 8QW  
Tel 01543 432266 Fax 01543 433619  
Email [office@greenwoodprojects.com](mailto:office@greenwoodprojects.com)  
[www.greenwoodprojects.com](http://www.greenwoodprojects.com)

CHARTERED QUANTITY SURVEYORS, PROJECT MANAGERS AND CDM CO-ORDINATORS: Greenwoods has been providing a range of consultancy services with particular expertise in heritage and restoration projects for over 25 years. The company helps clients ensure projects are completed within agreed budgets and timescales. Greenwood Projects understands heritage materials and construction techniques and the cost and time implications of using these in practice. The company is able to lead projects from options appraisal stage to completion and can also proactively assist clients in securing project funding, advising on availability of grants and business planning.

### ■ HUNTLEY CARTWRIGHT

Victoria House, Harestone Valley Road, Caterham, Surrey CR3 6HY  
Tel 01883 347004 Fax 01883 342607  
Email [geoffstallard@huntleycartwright.co.uk](mailto:geoffstallard@huntleycartwright.co.uk)  
[www.huntleycartwright.co.uk](http://www.huntleycartwright.co.uk)  
Contact Geoff Stallard MRICS

#### ■ Branch office in Maidstone, Kent

MULTI-DISCIPLINARY QUANTITY SURVEYORS: Huntley Cartwright offers quantity surveyor, cost consultancy, employer's agent, contract administrator, fund monitoring, project management, expert witness and CDM-coordinator services. The practice is renowned for its expertise in the conservation, repair, alteration and upgrading of listed buildings and structures, ecclesiastical buildings, scheduled ancient monuments and historic parks and gardens. Clients include The Royal Household, The Royal Collection, English Heritage, Historic Royal Palaces, The Royal Parks, Parliamentary Works Directorate, Crown Estate, Home Office and museums, ecclesiastical authorities, preservation trusts, private country homes and estates. A full range of services has been provided on projects ranging from £100,000 to £20 million in construction value.

### ■ K S P CONSULTANCY LLP

16 Little Park Farm Road, Segensworth West, Fareham, Hampshire PO15 5TD  
Tel 01489 578811 Fax 01489 577123  
Email [enquiries@ksp-fareham.co.uk](mailto:enquiries@ksp-fareham.co.uk)

QUANTITY SURVEYORS: Formerly King Sumners Partnership, founded in 1976 KSP operates from offices in Fareham and Winchester, and offers quantity surveying, project management, party wall surveyor services and CDM coordinator services throughout the southern half of the UK. Current appointments in Wales, Devon, and London indicate the current geographical range, and current clients include diocesan boards, churches and private estates. The practice philosophy is to provide a high quality, cost effective, value for money professional service to its clients, which is specifically tailored to suit the requirements of each individual project.

### ■ MILDRED, HOWELLS & CO

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Tel 0117 929 2894 Fax 0117 929 3655  
Email [bristol@mildredhowells.co.uk](mailto:bristol@mildredhowells.co.uk)  
[www.mildredhowells.co.uk](http://www.mildredhowells.co.uk)

CHARTERED QUANTITY SURVEYORS AND COST CONSULTANTS: Mildred, Howells & Co has many years experience in the repair, alteration and conservation of a wide variety of listed buildings, undertaking work from its Bristol, Swansea and Saltash offices. A full range of QS services is offered including cost advice, preparation of suitable tender documents, advice on procurement methods, assistance with grant applications, advice on VAT liability, maintenance programmes etc. Clients include English Heritage, the National Trust, churches, local authorities, preservation trusts and private owners.

### ■ PRESS & STARKEY

9-12 Stonehills House, Welwyn Garden City, Hertfordshire AL8 6NH  
Tel 01707 325408 Fax 01707 338333  
Email [trevorgroom@pressandstarkey.com](mailto:trevorgroom@pressandstarkey.com)  
[www.pressandstarkey.com](http://www.pressandstarkey.com)

CHARTERED QUANTITY SURVEYORS, HISTORIC CONSERVATION COST CONSULTANTS: Established in 1960 with offices in Welwyn Garden City and Maidstone, the practice serves clients in both the public and private sectors in all aspects of construction. A wealth of experience has been gained in the conservation, consolidation and presentation of historic buildings providing the full range of QS services and advice on the valuation for fire insurance, detailed costing of quinquennial and other maintenance plans and reports and Value Added Tax. Clients include Historic Royal Palaces, English Heritage, Cadw, National Trust, private estates, preservation trusts and churches. The practice provides a professional service tailored to the specific requirements of each client in compliance with BS/EN/ISO9002.

### ■ SAWYER & FISHER

Unit B, Aviary Court, 138 Miles Road, Epsom, Surrey KT19 9AB  
Tel 01372 742815 Fax 01372 729710  
Email [qs@sawyerfisher.co.uk](mailto:qs@sawyerfisher.co.uk)  
Contact Stephen Scammell BSc FRICS

CHARTERED QUANTITY SURVEYORS/CONSTRUCTION CONSULTANTS: Established in 1959 and based in Epsom for over 50 years, the practice provides a full range of professional services on all aspects of building work, both in the private and public sectors. It works with other members of the design team to provide sound advice on contract procurement and construction costs and to maintain financial control from project inception to completion. This includes developing feasibility studies and preparing applications for funding or grant aid. The practice has a great deal of experience in refurbishment particularly with high profile projects where continued public use of the buildings needs to be maintained. Clients include private individuals and organisations such as the National Trust, the Landmark Trust, local authorities and churches of various denominations.

# AFTER THE FIRE

TIM HUTTON

**FIRE IS** the most destructive and alarming thing that can happen to a historic building and has resulted in the destruction of many listed buildings, from terraces to palace apartments. Recent examples have been widely studied and well publicised. Based on this work, a number of useful observations can be made that should promote cost-effective early refurbishment of fire-damaged buildings with the maximum retention of original fabric.

## IMMEDIATE MEASURES AFTER FIRE

In the UK, fires brought under control by the local fire brigade may be treated as a potential crime scene. Access to the affected building may therefore be strictly controlled until the authorities have completed their work, but a number of measures can be taken.

Obviously the insurer should be contacted as a matter of urgency so that a loss adjuster can be appointed, but uncertainty over insurance cover can result in delays in this critical period, postponing refurbishment and re-occupancy, and resulting in further loss of historic fabric. It is therefore important for the building owner or manager to take all reasonable measures to mitigate these losses ahead of any final settlement. Consideration should be given to obtaining independent specialist advice as soon as possible, and the insurers should be advised of all measures being undertaken ahead of any settlement.

It is important to keep all key information on site, from the contact details of the fire brigade and local authorities, to the contacts with insurers or loss adjusters and the condition of structures and materials. Fortunately the general availability of digital cameras and email will help in this. Backup records should also be rigorously maintained and stored off site.

The factors to be considered in planning remedial measures include structural stability, safe access, electrical safety, contamination by hazardous materials such as asbestos, and water penetration. It is also important to contact the local planning and conservation authorities as soon as possible for advice. Keeping them informed will help to ease the process of obtaining listed building consent when necessary.

## WATER PENETRATION

Far more damage is caused to a historic building by water penetration into the building during and after a fire than is caused by the fire alone. Not only does this water cause physical and chemical damage to materials, it also provides the conditions for decay and mould growth during and



*The burnt out and saturated remains of the House of Reeves' furniture store in Croydon after the riots in August 2011, surrounded by the water from the fire hoses (Photo: Press Association Images)*

## MEASURES TO REDUCE WATER PENETRATION

- Establish effective ground and surface drainage, including checking and clearing existing drains
- clear surviving roof drains, including those of any adjoining structures, and provide effective temporary roofing and roof drainage as soon as possible
- disconnect and drain down any water pipes on site.

## MEASURES TO PROMOTE VENTILATION AND DRYING

- Remove saturated materials and contents from the building as soon as possible to prevent moisture migrating into other materials, including all damp furnishings, fittings, carpets, rubbish, damp infill and collapsed building materials (listed building consent may be required for this work)
- demolish or otherwise remove all parts of the structure not to be retained on refurbishment, including masonry masses and floor in-fills in particular (again, consent may be required)
- provide through-ventilation to all parts of the structure, including all structural cavities such as sub-floor voids, chimney stacks and wall cavities and fix all doors, windows, cupboards, etc in a partially open position
- identify all residual moisture in the structure using specialist moisture profiling of representative structures
- wherever possible, remove all impermeable finishes from structures containing residual moisture and strip all water and salt damaged plaster and finishes to expose structures behind
- detail refurbishment of the building to include moisture sinks such as through-ventilated dry-lining systems, permeable or microporous finishes and structural heating systems so as to allow continued drying during and after refurbishment (this will require specialist advice on detailing)
- if required, consider the installation of accelerated-drying machinery (the use of indirect heaters, high capacity desiccant dehumidifiers, tenting and fans is recommended but should be specified by an independent specialist); and consider the use of mechanical ventilation systems (the cost of both electrical power and the specialist on-site supervision required to accelerate drying successfully is always a limiting factor).

after refurbishment. The control of water penetration, the removal of damp materials and the drying out of the structure are therefore the most important factors in the cost-effective conservation, refurbishment and early re-occupancy of the building.

Unfortunately, most of the existing measures for controlling water penetration into buildings, roofs and roof drainage systems are destroyed or compromised by fire. Water penetration should therefore be controlled as a matter of urgency using the measures highlighted in the checklist (previous page).

#### HAZARDOUS MATERIALS

Fires can result in the production or exposure of hazardous materials, and a fire-damaged historic building may contain residues of asbestos, lead oxides, chromium, nickel and arsenic, as well as combustion products from more modern materials such as dioxins and isocyanates. These will form potentially hazardous dust particles and must be removed from the building and disposed of in accordance with current health and safety regulations, prior to any accelerated drying measures.

Independent specialist professional advice will be required to identify any significant hazards from materials such as these, as well as from hazardous spores and other metabolites introduced by mould growth. Failure to specify appropriate risk management measures can result in significant hazards to health during and after refurbishment, causing delays to the refurbishment programme and even affecting the capital value of the building.

#### VENTILATION AND DRYING

Many thousands of litres of water can penetrate into a building during and after a fire, and drying out the structure can create ideal conditions for mould growth and decay. The techniques to be used must therefore be carefully considered to ensure that the process is both cost-effective and efficient. It is particularly important to identify all areas of residual moisture in the building by taking moisture profiles through representative structures, and to provide through- and cross-ventilation into all affected areas and building voids.

Specialist accelerated drying measures such as the use of dehumidifiers provided by specialist sub-contractors are often used. However, the equipment is often poorly specified and improperly used, resulting in little or no accelerated drying and causing unnecessary delays.

If not properly managed, damp and decay problems can persist for many years after a fire, and fungal or mould growth can result in health hazards to occupants and/or the unnecessary loss of original fabric and structures. Conversely, appropriate measures as outlined in the prioritised checklist of drying measures, can allow refurbishment in less than six months, even after the most severe fires.

It should be noted that accelerated drying



*The floor of this fire damaged building was found to be constructed of reed and lime plaster. Failure to expose the underside had promoted mould growth, and further remedial treatment was required to promote drying prior to decontamination. (Photo: Hutton + Rostron)*

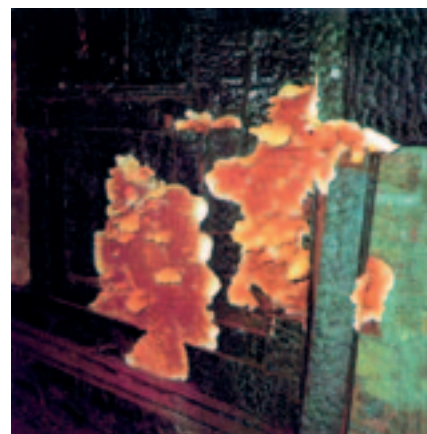
in the UK is more cost-effective in the winter and early spring and very much harder in the summer months due to the external air being relatively warm and moisture laden. Timely and appropriate advice can therefore make a difference of over six months in a refurbishment programme.

#### DRY ROT AND TIMBER DECAY

Water penetration during and after a fire can produce the ideal conditions for infection and decay by dry rot (*Serpula lacrymans*) or the related *Donkioipoira expansa*, which often decays oak. This is often the result of the reactivation of pre-existing infections beneath valley gutters or other vulnerable roof drainage details. No chemical remedial timber treatments or wall irrigations should be required. However, all timbers built in contact with damp or potentially damp structures should be investigated by an independent expert to determine their decay state and deep moisture content, in conjunction with the moisture profiling described above. Appropriate repairs and/or accelerated drying measures can then be undertaken. These may include the isolation of vulnerable materials from damp structures with damp-proof materials and/or through-ventilated air-gaps, so as to allow long-term drying after re-occupancy.

#### CONSERVATION AND REMEDIAL EXPOSURE

A policy of radical remedial exposure is often the most cost-effective way of conserving the maximum amount of historic material. For example the early lifting and removal of panelling, skirting and floor boards and the early removal of salt- and water-damaged plaster and pugging materials should be considered. This requires that the



*Dry rot fruiting bodies on fire damaged panelling: water penetration had reactivated an old infection and enabled it to spread. (Photo: Hutton + Rostron)*

conservation authorities are kept closely involved and that listed building consent is obtained as necessary. It is also important to employ appropriately skilled craftsmen, and to set up a robust and well managed system of recording and storage. An advantage of this approach is that valuable information on the history and archaeology of the building is often discovered, allowing previously unknown features to be conserved and incorporated into the refurbished building.

**TIM HUTTON MA MSc VetMB MRCVS is a building pathologist and environmental scientist, and the CEO and scientific director of Hutton + Rostron Environmental Investigations Limited (see page 149). H+R has provided specialist independent advice after fire to occupants and insurers of all types of buildings for over 30 years, including after the fires at Hampton Court Palace and Windsor Castle.**

## STRUCTURAL ENGINEERS

### ■ AKS WARD LISTER BEARE

**Manor Court, 26 Bancroft, Hitchin, Hertfordshire SG5 1JW**  
**Tel 01462 420668 Fax 01462 438630**  
**Email [consult@aksward.com](mailto:consult@aksward.com)**  
**[www.aksward.com](http://www.aksward.com)**

STRUCTURAL ENGINEERS: AKS Ward Lister Beare is a team of 80 engineers with wide experience of conservation, new build and refurbishment. The team includes two CARE-registered engineers and has been actively involved on many of the country's major buildings as well as numerous smaller projects. The practice aims to apply its knowledge of construction techniques to create innovative solutions that are sympathetic to the original. Offices in Hitchin, London, Oxford and Southampton.

### ■ ADRIAN COX ASSOCIATES

**The Studio, 3 Bayham Road, Sevenoaks, Kent TN13 3XA**  
**Tel 01732 462640 Fax 01732 740893**  
**Email [engs@adriancox.co.uk](mailto:engs@adriancox.co.uk)**  
**[www.adriancox.co.uk](http://www.adriancox.co.uk)**

STRUCTURAL ENGINEERS: As a small team of engineers experienced in historic structures the practice seeks to achieve the best solutions aided by extensive knowledge of traditional and modern repair techniques and use of the latest computer software where appropriate. Projects have included numerous historic structures including houses, museums, churches, schools and castles.

### ■ BLACKETT-ORD CONSERVATION LIMITED

**33 Chapel Street, Appleby-in-Westmorland, Cumbria CA16 6QR**  
**Tel/Fax 01768 352572**  
**Email [engineering@blackett-ordconservation.co.uk](mailto:engineering@blackett-ordconservation.co.uk)**  
**[www.blackett-ordconsulting.co.uk](http://www.blackett-ordconsulting.co.uk)**

#### Contact Charles Blackett-Ord CEng FICE FConsE

CIVIL AND STRUCTURAL ENGINEERS AND ARCHITECTS: The practice, accredited in conservation by CARE and AABC, works throughout the North of England and southern Scotland on repair and conservation of historic buildings and ancient monuments, including listed railway viaducts, 18th century grand houses, churches, medieval buildings and ruins. Projects have won RICS Conservation Awards and Ian Allan Railway Heritage and Civic Trust Awards. The use of traditional materials both in repairs and new work is encouraged and the practice has considerable expertise, particularly in the use of lime mortars and renders.

### ■ THE BUDGEN PARTNERSHIP

**56 Lisson Street, London NW1 5DF**  
**Tel 020 7224 8887 Fax 020 7224 8883**  
**Email [mail@budgenpartnership.com](mailto:mail@budgenpartnership.com)**  
**[www.budgenpartnership.com](http://www.budgenpartnership.com)**

STRUCTURAL ENGINEERING CONSULTANTS: Founded in 1959, The Budgen Partnership has earned a significant reputation for works to Grade I and II listed buildings. Important works include the Foreign Office, Royal Albert Hall, Parliament Hill Mansions, St Pancras Chambers, Armourers' Hall, an historical Park Lane property and many smaller projects. The partnership has received awards for design excellence in both new building and conservation work.

### ■ CAPSTONE CONSULTING ENGINEERS

**Home Farm, Hollinsclough, Buxton, Derbyshire SK17 0RH**  
**Tel 01298 83151**  
**Email [conservation@capstone-uk.com](mailto:conservation@capstone-uk.com)**  
**[www.capstone-uk.com](http://www.capstone-uk.com)**

**Contact John Ruddy BEng(Hons) MA(Conservation Studies York) CEng MICE MStructE Engineer Accredited in Conservation**

CONSERVATION ENGINEERS: From a small, friendly office, Capstone offers a flexible and professional service on a broad range of projects, large and small. Innovation and creativity play key roles in providing good quality conservation-led solutions. Recent work encompasses repair, adaptation and new build with ecclesiastical, domestic, civic, rural and historic park buildings and structures.

### ■ CONISBEE

**1-5 Offord Street, London N1 1DH**  
**Tel 020 7700 6666 Fax 020 7700 6686**  
**■ 9-10 Redwell Street, Norwich NR2 4SN**  
**Tel 01603 628074**  
**Email [design@conisbee.co.uk](mailto:design@conisbee.co.uk)**  
**[www.conisbee.co.uk](http://www.conisbee.co.uk)**

CIVIL AND STRUCTURAL ENGINEERS: Conisbee provides the full range of heritage engineering services including appraisals of structure and fabric, feasibility studies, expert witness, forensic engineering, conservation and repair assessment/design. Terry Girdler, Head of Heritage Engineering, joined Conisbee following 30 years with English Heritage and is accredited under the Conservation Accreditation Register for Engineers (CARE). Clients include English Heritage, the Royal Albert Hall, the British Museum, Royal Parks, Delfont Mackintosh Theatres Ltd, local authorities and private clients.

### ■ CURTINS CONSULTING ENGINEERS

**Curtins House, Columbus Quay, Riverside Drive, Liverpool L3 4DB**  
**Tel 0151 726 2000 Fax 0151 726 2001**  
**Email [info@curtins.com](mailto:info@curtins.com)**  
**[www.curtins.com](http://www.curtins.com)**

CONSERVATION STRUCTURAL ENGINEERS: Established over 50 years ago, Curtins Consulting Engineers is independently owned and works as one business from 11 strategically-chosen locations across the UK. CARE accredited, the firm provides specialist structural engineering advice on conservation and historic structures and monuments. The company's work covers large and small conservation projects including remodelling and extension works in historic settings and it has extensive experience in all traditional materials including masonry, iron and timber. Recent large projects include Liverpool Anglican Cathedral, John Rylands Library, Tate Gallery and Vaughan's Mansion in Shrewsbury. Other projects have included appraisal, monitoring and repair of churches, museums, mills, maritime structures, castles, forts, masonry bridges as well as domestic properties.

### ■ ELLIS & MOORE CONSULTING ENGINEERS

**9th Floor, Hill House, 17 Highgate Hill, London N19 5NA**  
**Tel 020 7281 4821 Fax 020 7263 6613**  
**Email [lachlan.mcdonald@ellisandmoore.com](mailto:lachlan.mcdonald@ellisandmoore.com)**  
**[www.ellisandmoore.com](http://www.ellisandmoore.com)**

CIVIL AND STRUCTURAL ENGINEERS: Ellis & Moore is an award-winning structural and civil engineering practice, established in 1977, that delivers enterprising and coherent design solutions. The practice is experienced in large and complex projects as well as working on intricate and delicate structures across the breadth of the historic environment.

### ■ HOCKLEY & DAWSON CONSULTING ENGINEERS LTD

**The Great Barn, Smithbrook Barns, Cranleigh, Surrey GU6 8LH**  
**Tel 01483 548784 Fax 01483 268765**  
**Email [admin@hockleyanddawson.co.uk](mailto:admin@hockleyanddawson.co.uk)**  
**[www.hockleyanddawson.co.uk](http://www.hockleyanddawson.co.uk)**

CONSULTING ENGINEERS: Hockley & Dawson is an award-winning practice providing specialist consultancy advice for the care and conservation of historic buildings and structures to ensure their stability and long-term use. The practice combines experience with innovation and traditional materials with modern techniques to ensure their design is sympathetic, proportionate and economic. This approach has resulted in long-term relationships with clients such as English Heritage, the National Trust, Historic Royal Palaces, The British Museum and many private owners. Hockley & Dawson's services include structural surveys, conservation and feasibility reports, design for repair, refurbishment and conservation, conversions and extensions.

## STRUCTURAL ENGINEERS *continued*

### ■ HURST PEIRCE & MALCOLM LLP

**Celtic House, 33 John's Mews, Holborn, London WC1N 2QL**  
**Tel 020 7242 3593 Fax 020 7405 5274**  
**Email enquiries@hurstpm.co.uk**  
**www.hurstpm.co.uk**

CHARTERED CIVIL AND STRUCTURAL ENGINEERS: Founded 1910, Hurst Peirce & Malcolm has extensive experience in the refurbishment and conservation of historic buildings and structures. Senior partner Andrew Dutton is one of the few engineers accredited under the Conservation Accreditation Register of Engineers (CARE), which is becoming a prerequisite for conservation work for clients such as English Heritage. Projects are undertaken in London, the South East, across the UK and internationally. Recent projects include the Nelson Monument, Trafalgar Square, The Palace of Westminster, Old George Inn, Salisbury, Althorpe House and many old but not listed properties.

### ■ MANN WILLIAMS

**7 Old King Street, Bath BA1 2JW**  
**Tel 01225 464419 Fax 01225 448651**  
**■ 53 Mount Stuart Square, Cardiff CF10 5LR**  
**Tel 02920 480333 Fax 02920 435920**  
**www.mannwilliams.co.uk**

CONSULTING STRUCTURAL AND CIVIL ENGINEERS: Working nationally on historic structures and ancient monuments since 1986. Mann Williams has built an impressive portfolio of clients in conservation. Projects range from work on cathedrals at Exeter, Winchester and St David's together with major works at Chatsworth, Sir John Soane's Museum, Strawberry Hill and Tyntesfield. Mann Williams has had a term commission with Cadw for several years working throughout Wales, and act for the NIEA in Northern Ireland. With offices in Bath and Cardiff, Mann Williams is able to provide effective consultancy throughout the UK.

### ■ THE MORTON PARTNERSHIP LTD

**Old Timber Yard House, 55 The Timber Yard, Drysdale Street, London N1 6ND**  
**Tel 020 7324 7270 Fax 020 7729 1196**  
**Email london@themortonpartnership.co.uk**  
**■ Leonardo House, 11 Market Place, Halesworth, Suffolk IP19 8BA**  
**Tel 01986 875651 Fax 01986 875085**  
**Email halesworth@themortonpartnership.co.uk**  
**www.themortonpartnership.co.uk**

STRUCTURAL AND CIVIL ENGINEERS: The Morton Partnership practice was founded in 1966. It is now almost completely involved in minimum repair solutions to preserve historic buildings. Current work includes: work to Canterbury Cathedral, repairs and restoration to the seriously fire damaged All Saints Church, West Dulwich, the new tower at Bury St Edmunds Cathedral, work to many parish churches, barns and domestic buildings, work for the Crown Estate in Regents Park, and National Trust properties. The practice carries out a considerable amount of work for local authorities, and is well known to all the national amenity groups. Work to small buildings is an important part of its work. Services include preliminary advice, structural surveys and presentation of the most cost effective solution to the proper repair of historic buildings and structures.

### ■ PAUL TANNER ASSOCIATES

**8 Upper High Street, Winchester, Hampshire SO23 8UT**  
**Tel 01962 859800 Fax 01962 856452**  
**Email reception@paultannerassociates.co.uk**  
**www.paultannerassociates.co.uk**  
**Contact Paul Tanner BSc CEng FStructE MICE**

STRUCTURAL AND CIVIL ENGINEERS: A practice providing private and public clients with a personal service on a variety of projects and which has CARE accredited engineers. Experienced in sensitive and innovative conservation and repair of all types of historic buildings and scheduled monuments in a wide range of materials. Services include structural design, surveys and appraisals. The practice works closely with clients, architects and others to develop appropriate solutions for historic and new-build projects in an historic setting. Projects include all grades of listed buildings, stately homes, town and country house adaptations, ecclesiastical work, rural conversions and historic park buildings.

### ■ RAMBOLL

**60 Newman Street, London W1T 3DA**  
**Tel 020 7631 5291 Fax 020 7323 4645**  
**Email historicenvironment@ramboll.co.uk**  
**www.ramboll.co.uk**

STRUCTURAL ENGINEERS: Gifford has now been acquired by Ramboll, creating a leading consultancy with award-winning specialists in conservation and structural engineering, mechanical and electrical services and archaeology. The company's inter-disciplinary approach allows it to deliver an integrated service to clients managing historic buildings and landscapes. Prestigious commissions include Westminster Hall, Chiswick House, Wells Cathedral and Whitehall for clients such as English Heritage, the National Trust, Parliamentary Estates and the Royal Household. With offices throughout the UK, specialisms include structural performance and laser scanning assessment, building fabric and energy conservation, environmental control, remedial geotechnical engineering, historic building recording and conservation management plans. *See Laser Scanning by James Miller, page 42.*

### ■ IAN RUSSELL CEng MICE MStructE

**Shulbrede Priory, Lynchmere, Haslemere, Surrey GU27 3NQ**  
**Tel 01428 653049 Fax 01428 645068**  
**Email ian@russellconsult.co.uk**

CONSULTANCY IN CIVIL/STRUCTURAL ENGINEERING AND BUILDING CONSERVATION: Compatible repairs and alterations to historic buildings and structures. Typical projects: roof repairs, Michelham Priory; Marlipins Museum extension, Shoreham; Lewes Castle repairs; Church spire repairs, Blendworth; modern extension to hall house, Haslemere; fort repairs, Shoreham; furnace pond bay wall stabilisation, Fernhurst and historic mill building repairs, Passfield. Party wall matters.

### ■ S F K CONSULTING

**Unit 24, Basepoint Enterprise Centre, Andersons Road, Southampton, Hampshire SO14 5FE**  
**Tel 02380 682460 Fax 02380 682461**  
**Email admin@sfkconsulting.co.uk**

CONSERVATION STRUCTURAL ENGINEERS: Specialising in structural engineering to historic buildings or new buildings in historic settings. Current clients include the Royal Household Property Section, the Dean and Canons of St George's Chapel, the National Trust, English Heritage and The Landmark Trust. Other clients include The Supreme Council of Antiquities in Egypt and UNESCO. Richard Swift, Richard Fewtrell and Mark Ketteringham are the three partners of the practice.

### ■ URS LTD

**6-8 Greencoat Place, Victoria, London SW1P 1PL**  
**Tel 020 7798 5000 Fax 020 7821 4178**  
**Email clive.richardson@scottwilson.com**

CONSERVATION ENGINEERS: Conservation accredited specialists in structural surveys, design of structural repairs, alterations and extensions and the design of new structures in historic settings. Assessment of cracks, distortions, subsidence, decay, damp, fire damage and floor loadings. Movement monitoring, forensic investigations, temporary works and scaffolding designs. Expert advice for planning inquiries and litigation. URS's national conservation service is known to English Heritage and led by Clive Richardson, Engineer to Westminster Abbey and visiting lecturer in building conservation at the Architectural Association, London. Offices throughout the UK and overseas.

### ■ JOHN WARDLE BSc CEng MStructE

**5 Lotus Road, Biggin Hill, Kent TN16 3JL**  
**Tel 01959 540696**  
**Email jwardlese@aol.com**  
**www.johnwardleltd.co.uk**

CONSULTANT STRUCTURAL ENGINEER: Experienced in conservation of older buildings and structures. Timber framed, stone or brick. Castles, churches, houses, barns and canal structures. Projects include: Howbury moated site (scheduled ancient monument), East London; Caledonian Canal, Scotland; the Jealous Wall, Southern Ireland and the Ivy Conduit (scheduled ancient monument), Kingstons.





Applying a hydraulic lime shelter coat under challenging access conditions at Roch Castle, Pembrokeshire (see article, page 13)  
Photo: Acanthus Holden Architects

## Chapter 2

# Building contractors

BUILDING CONTRACTORS	SERVICES	PAGE	SCOTLAND	NORTH	WALES	MIDLANDS	EAST	SOUTHEAST	SOUTH/SW	EUROPE
A C Wallbridge & Co Ltd	sj	82								
A K S Ward Lister Beare	bu	53								
A N Morgans (Wales) Ltd Builders and Stone Conservationists	bu	60								
A V V Solutions Limited	bu	60								
Anelays – William Anelay Ltd	bu tf	60								
Antique Buildings Limited	tf	74								
B Antoniw Joinery	tf	132								
Bakers of Danbury Ltd	bu	60								
Bennie Historic Conservation	bu	61								
Between Time (Conservation Builders) Ltd	bu rp tf	62								
Bonsers (Nottingham) Limited	bu	61		Y						
Bosence & Co	bu	46								
Boshers (Cholsey) Ltd	bu	61								
Bryan Williamson & Daughters	bu	62								
Bullen Conservation Ltd	bu	97								
Burrows Davies Limited	bu	97								
Busby's Builders	bu tf	62								
C & D Restoration Ltd	bu	97								
C E L Ltd	bu	62								
C R Crane & Son Ltd	bu tf	63								
Carpenter Oak & Woodland Co Ltd	ml tf	74								
Carrek Limited	bu	63								
Cathedral Works Organisation (Chichester) Limited	bu rp	63								
Charterbuild Ltd	bu rp	150								
Chiverton	bu	63								
Cintec International Limited	rp	150								
Collins & Curtis Masonry Ltd	bu	98								
Conservation Building Services Ltd	bu tf	63								
Country House Renovations Limited	bu	63								
D B R (London) Limited	bu	64								
Daedalus Conservation	bu rp tf	66								
Dunne and Co Ltd	bu rp tf	66								
Fisher Bullen	bu	64								
Grosvenor Construction Ltd	bu	64								
H K Askew & Son	bu	66								
Hall Construction Limited	bu	64								
Helifix Limited	rp	150								
Heritage Cob & Lime	bu	158								
Heritage Stone Access	bu ax sj	82								
Hirst Conservation	bu	67								
Inspire Conservation Ltd	bu	66								
Ivinghoe Building Services Ltd	bu	67								
J & W Kirby	bu tf	74		WY						
J P Ladell Ltd	bu	67								
J Rigg Construction Ltd	bu	68								
Kent Conservation and Restoration Ltd	bu	66								
Knowles & Son (Oxford) Ltd	bu	67								
Luard Conservation Limited	bu	172								
Magenta Building Repair Ltd	bu ml	68								
Mathias Restoration Ltd	bu	94								
Melcombe Regis Construction SW Ltd	bu	68								
Mike Wye & Associates Ltd	bu	158								
Millway Builders Ltd	bu tf	68								
Minerva Stone Conservation	bu sj tf	100								

BUILDING CONTRACTORS	SERVICES	PAGE	SCOTLAND	NORTH	WALES	MIDLANDS	EAST	SOUTHEAST	SOUTH/SW	EUROPE
Norman & Underwood Ltd	bu	68								
Oakwrights Limited	tf	74								
Owlsorth I J P	bu ml rp tf	69								
P Webb Roofing & Building Services Ltd	bu	82								
Paxton Restoration Ltd	bu	130								
Paye Stonework	bu rp	68								
Period Property Solutions Building Conservation Limited	bu tf	69								
Peter Cox Ltd	rp	71								
R J Smith & Co	bu	69								
R W Armstrong	bu	69								
Recclesia Ltd	bu tf	70								
Richard Coles Builders Ltd	bu tf	70								
S J Specialist Brickwork	rp	94								
Sandy & Co (Contractors) Ltd	bu tf	70								
Timothy J Shepherd Historic Brickwork Specialist	bu	94								
Simmonds of Wrotham	bu	70								
Splitlath Building Conservation Ltd	bu tf	72								
St Astier Ltd	bu df rp	70								
Stone Restoration Services Ltd	bu	102								
Stonewest Limited	bu rp	73								
Szerelmey	bu	70								
T Coleborn & Son Limited	bu	72								
T R A C Structural Ltd	ax rp	150								
Timber Framing and Conservation	rp tf	74								
Traditional Technologies LLP	bu	142								
Treasure & Son Ltd	bu rp tf	72								
Triton Conservation	bu	73								
Twyford Lime Products	bu rp	158								
V A Conservation	bu	103								
Valley Builders Ltd	bu rp tf	72								
W P D Productions	bu	173								
Wallwalkers	ax sj	82								
Weald and Downland Open Air Museum	tf	74								
William Taylor Stonemasons	bu	72								
Winterton Restoration	bu tf	132								
Woodhead Heritage	bu	73								

## REGION CODES

NORTH OF ENGLAND	N	Cumbria, Durham and counties to the north
	W	North West
	Y	Yorkshire and the Humber
MIDLANDS	E	East Midlands
	W	West Midlands
EAST	E	East Anglia
	H	Northern Home Counties
SOUTH EAST	L	Greater London
	H	Southern Home Counties
SOUTH WEST	S	Berks, Hants and Oxfordshire
	W	Glos, Wilts, Dorset and counties to the west

## SERVICE CODES

ax	aerial access
bu	building contractors
dc	deconstruction
ml	millwrights
rp	structural repair and stabilisation
sj	steeplejacks
tf	timber frame builders

# EARLY 20th CENTURY SHOPS

LINDSAY LENNIE



*Gill's of Crieff blends traditional design with 1930s style, as in its Vitrolite stall-risers.*

**W**HILE WE undoubtedly admire the beauty of Victorian and Georgian shopfronts, it is some of our 20th century examples which are architecturally the most daring and striking. Inter-war shopfronts offer a particularly rich addition to our townscapes but are sometimes unappreciated and their designs and materials not always understood.

## THE 1925 PARIS EXHIBITION

While many Edwardian shopfronts were beautifully constructed of exotic hardwoods and polished brass, they remained of an inherently similar design to their Victorian cousins. However, the 1925 Paris Exhibition was to be a watershed for 20th century shopfront design.

The *Exposition Internationale des Arts Décoratifs et Industriels Moderne* firmly established the Art Deco movement

while promoting revolutionary styles and new materials. Designs produced for the exhibition by French architects such as Louis-Pierre Sezille and Rene Prou were breathtaking in their bravery. The angular windows, daring signage and smooth frontages left visitors to the exhibition in no doubt about the radical new direction which retail architecture would take.

## DESIGNS AND DESIGNERS

From this embryonic beginning in Paris, the style spread rapidly and by the mid 1930s its use in Art Deco-inspired shopfronts was widespread throughout British towns. Undoubtedly the large cities had the greatest number, with Glasgow particularly favouring a Moderne style. Kenna (1985:4) describes this as 'consumer Art Deco which did much to brighten up the Depression-stricken city'. However, the

style is also evident in smaller towns, often associated with butchers and fishmongers.

Leading architects like Joseph Emberton (1889–1956) were inspired by visiting the Paris Exhibition and mapped the way forward with their exciting new designs. Some, like Erno Goldfinger (1902–1987) took the ideas to minimalist extremes. Architects recognised that shops offered a particular opportunity to bring Art Deco to the very centre of people's lives, to the main shopping streets of Europe.

By the end of the 1920s, two main types of shopfront style had emerged. The first was a very minimalist, undecorated design constructed of sleek and shiny materials. The second was of a more traditional style using curved glass entrances, leaded glass to the clerestory and marble or tiled entrance floors. There was therefore something of a reluctance to totally abandon the past. The use of stained glass to create sunrise motifs was popular for

both shops and domestic properties. Others adopted leaded glass, sometimes with mock bulls-eyes or tracery bars and margin lights to decorate otherwise plain glazing. Inevitably, styles merged, changed and adapted to create a myriad of variations within the streetscape.

Whether Moderne or more traditional in inspiration, common features included geometric detailing, integral blinds, decorative stall-riser vents and window screens. These screens were timber and glass which focused the view of the customer on the goods in the window but still allowed light into the shop.

Although it was architects who experimented with the first undecorated shops, it was shopfitters who brought these new designs to the mass market. Firms like Frederick Sage, E Pollard & Co and Harris & Sheldon were leading designers of exceptional shopfronts which broke the mould of traditional shop design and

construction. They re-fronted shops and offered specialist services such as showcases and interior fittings. They paid little heed to Victorian or Georgian parent buildings and were sometimes severe in their execution. The pursuit of a fashionable frontage surpassed any consideration of the surroundings.

Shopfitters were highly innovative and developed new products for their ever increasing client base. E Pollard & Co, for example, promoted a non-reflective glass in the 1930s. This was installed in the new black Vitrolite shopfront of T Fox & Co of London. Complete with a red neon sign, the shopfront was the height of fashion for this umbrella business which was established in 1868.

#### MATERIALS

During the early part of the 20th century the introduction of new materials like steel began to influence the construction of shopfronts.

Steel allowed even more possibilities than its 19th century predecessor, cast iron. The construction of Selfridges in 1909 with its innovative steel frame and exterior of Portland stone heralded a new approach to department store construction.

While structural considerations were clearly crucial, it was the exterior finishes which created the necessary look. The last two decades of the 19th century witnessed the mass production of decorative tiles for the first time. While these remained a popular material for shopfronts into the 20th century, other materials crept into the market and gradually usurped these decorative ceramics. Cladding in marble, terrazzo and Vitrolite became a quick and easy way to transform a shop from traditional Victorian to Moderne overnight.

A browse through Perry's 1933 *Modern Shopfront Construction* indicates the great breadth of materials available to shop designers in the 1930s. Travertine marble, black granite, Roman Stone (a form of artificial stone), bronze, embossed glass, walnut and stainless steel. Green marble proved to be particularly fashionable and was widely used. These materials were used in endless combinations to allow either a minimalist, Art Deco-inspired or more traditional style.

Of all of these, it was Vitrolite which became the iconic fashionable material of the 1930s. It is described in Pilkington's *Vitrolite Specifications* as:

*A Rolled Opal Glass ranging from semi-opacity to complete opacity. One surface is usually impressed with a pattern of narrow parallel ribs which provide a key for the mastic or other material with which the glass is fixed. The glass has a hard, brilliant, fire-finished surface.*

There were 16 colours available, ranging from the standards of black, white, green and turquoise to more exotic shell pink and walnut agate.

Although its origins were as a practical material for use in hospitals and also to clad the Mersey Tunnel, it was a particularly versatile material for re-fronting shops. Available in a range of sizes and thicknesses, the opportunity to use different colour combinations and to utilise it with other materials such as chrome allowed a mass produced material to offer significant individuality. While many shop owners opted for a simple, classy look of black Vitrolite, others were more daring, creating innovative and striking designs inspired by the geometric style of the Art Deco period.

Other fashionable glazing products included etched or sandblasted glass. The use of opaque glass was not new. In the Edwardian period the use of delicately etched glazing, often for entrance doors, offered an air of elegance and sophistication to shops. The name of the shop owner or their trade reinforced the advertising of the business. However, during the 1930s the use of decorative glass was particularly popular for the clerestory of the shopfront.



*Sunrise motif to shopfront clerestory, Falkirk: The design was popular in the 1930s and was widely used in shopfront design.*



*Tooth Factory, Forfar: A traditional shopfront with margin panes to the clerestory glazing, curved glass and black granite stall-riser (Photo: Historic Scotland)*

Geometric designs such as zigzags or wavy lines became an integral part of the shopfront design.

Faience and terrazzo also rose in popularity. These modest, unassuming ceramic materials provided a smooth finish and clean lines. Some retailers, like Montague Burton particularly favoured faience. His tailoring empire used white faience for its purpose-built inter-war shops designed by their Leeds architect, Harry Wilson. The gleaming white ceramic combined with Art Deco detailing to give a truly modern look for their shops. Chain stores like Burton's made an important contribution to the promotion of these new materials and styles and were often at the cutting edge of shop design.

### PROBLEMS

The great architectural success of these shopfronts was also perhaps their weakness. They were so modern and striking that their fashion was short-lived and by the time World War II had ended, the desire for this type of shop was waning. The 1950s saw a continuation of some of the themes born in the 1930s, but with less vigour and enthusiasm for the radical designs. Many shopfronts were replaced, making way for the designs which prevailed in the post-war decades including the rising use of aluminium.

Those which have survived face a number of issues. First, 1930s shops tend to be extremely sensitive to inappropriate alterations. Their minimalist style means that the overall architectural composition is surprisingly easily destroyed. Alterations to signage, entrances and windows can seriously detract from the designer's original intention. In contrast, Victorian shopfronts are often more robust and seem able to withstand a greater degree of intervention while retaining their integrity. For purpose-built shops such as those erected by Burton's, although the upper facades generally remain largely intact, the ground floor shops rarely survive, losing the overall design effect of the building.

Secondly, a lack of understanding of the rarity or significance of these shopfronts means that they are extremely vulnerable. Although there is a greater appreciation of them now and statutory measures offer some protection, many outstanding examples have already been lost. In cities like Glasgow, where the streets were once brimming with Art Deco shopfronts and gleaming Vitrolite, finding good surviving examples is a challenge. Effort needs to be focused on ensuring that any shopfronts which remain are suitably protected and conserved.

Undertaking conservation, however, can be a problem. Some of the materials, once mass produced and readily available, are no longer manufactured. Vitrolite has not been produced since the 1960s and although there are some limited salvage options it remains a very rare material. This is a significant issue when dealing with a product which is subject to breakages and cracking, particularly at stall-riser level and around entrances where impacts can easily damage the glass.



West Coast Fisheries, Ayr: 1936 black Vitrolite shopfront. Some damage is evident but overall the Vitrolite is in fair condition. The fascia signs are particularly good examples of their type (Photo: Historic Scotland)



Former Burton's store, Dumbaron: The ground floor shops have been altered and although the upper facade of white faience remains intact, the overall effect is lost (Photo: Historic Scotland)

Substitutes are rarely successful as they lack the depth of colour and distinctive finish which is characterised by Vitrolite. Shop owners have tended to resort to a mixture of unsatisfactory repair options including painted plywood, painted Perspex or glass and even polished slate. Damaged panels can allow water ingress, which may affect the stability of panels.

Options may include moving surviving panels to more visible locations and using a substitute material where the panels are less obtrusive. However, care needs to be taken in the removal of the panels to ensure further damage does not occur and that panels are made watertight when reinstated.

Other materials like faience and terrazzo are also subject to cracking and damage but they can, at least, be repaired more easily than Vitrolite. Similarly,

matches are possible where marble cladding has become damaged or lost.

### FUTURE CONSERVATION AND REPAIR

It is ironic that some of the more recent shopfronts cause the greatest conservation challenges. While repairs to Georgian joinery or Victorian cast iron shopfronts are relatively straightforward, the conservation of inter-war shops presents a much greater problem. The lack of expertise in dealing with them, together with the limited availability of certain materials means that shops frequently go unrepaired or are poorly repaired with inappropriate materials.

Recognising the significance and rarity of these shopfronts is a vital starting point in ensuring that their place in the architectural time-line of shops is secured. Statutory protection also has a vital role to play.



Bronze stall-riser vents set in green marble: These small details are important. Bronze vents varied in style but were always integral to the overall design. Damage to the marble is also evident.



Dean of Guild drawing for Dan Taylor's Hat Shop, Perth, 1932 showing etched glass and window screens (Photo: Perth & Kinross Council Archives)

The simplicity of inter-war shopfront design means that the special combination of integral blinds, door style, glazing pattern, stall-riser vents and fascia lettering should not be underestimated. Where features have been lost, reinstatement should be considered, where appropriate. Historic photographs and archive drawings can be particularly helpful in identifying the original features and design intentions.

Art Deco was a style which transcended localities and retailers. From tiny market towns to cities and from independents with a single shop to chain stores with hundreds of sites, the adoption of Art Deco as a style for shopfronts was unsurpassed. Despite the loss of many examples, the UK's high streets remain more interesting places as a result of the Vitrolite, faience and terrazzo shopfronts which still survive. Their role in the architectural history of our towns and cities deserves better recognition and wider appreciation.

#### Recommended Reading

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- F Hudd, 'Issues Surrounding the Conservation of Vitrolite Glass', *Journal of Architectural Conservation*, Vol 16, Issue 2, 2010
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- K Morrison, *English Shops and Shopping*, Yale University Press, London, 2004
- T Perry, *Modern Shopfront Construction*, The Technical Press Ltd, London, 1933
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- A Powers, *Shop Fronts*, Chatto & Windus, London, 1989
- The US National Park Heritage Preservation Services, *Preservation Brief 12: The Preservation of Historic Pigmented Structural Glass (Vitrolite and Carrara Glass)*, Technical Preservation Services, Washington DC, 1984

**LINDSAY LENNIE PhD MRICS IHBC is a chartered valuation surveyor, author and researcher. She has her own consultancy business, Historic Shop Conservation, which provides advice on the care and conservation of traditional shopfronts and their interiors – see [www.historicshopfronts.co.uk](http://www.historicshopfronts.co.uk).**

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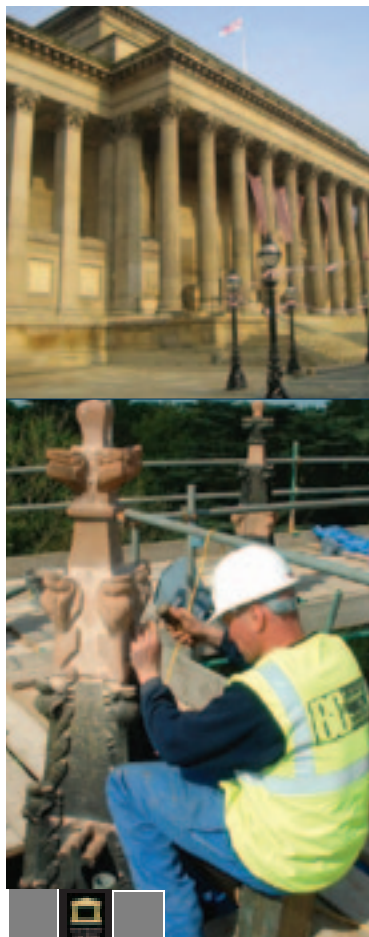
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PERIOD PROPERTY SPECIALIST: A long established company employing a large team of skilled craftspeople including masons, joiners, roofers and decorators specialising in the restoration and renovation of period and listed buildings, including churches, using traditional materials. Winner of an LABC award for building excellence. Mainly working in Berkshire, Oxfordshire and London.

### ■ H K ASKEW & SON

9 South View, Droxford, Hampshire SO32 3QS  
Tel 01489 877095 Mobile 07798 908628

BUILDING CONTRACTORS: H K Askew & Son uses traditional skills and a sympathetic approach in restoring properties dating up to 1912. Re-builds, repairs and extensions. Bespoke carpentry; wattle and daub; cob walls; lime brickwork/pointing; lime plastering; stucco ceilings; re-laying floors with reclaimed tiles; under-floor and ground source heating; oak flooring; roof repairs and sash window overhauls. Works include maintenance and restoration of Swanmore Park House, the Alfred Waterhouse designed 1880s mansion and complete restoration of circa 1540 four-bedroom cottage on a New Forest estate. Established 1962.

### ■ HALL CONSTRUCTION LIMITED

Units 2 & 4, Tannery Yard, Witney Street, Burford,  
Oxfordshire OX18 4DQ

Tel 01993 822110 Fax 01993 823880  
[www.hallconstruction.co.uk](http://www.hallconstruction.co.uk)

CHARTERED BUILDING COMPANY: See also: display entry in this section, page 64.

## BUILDING CONTRACTORS *continued*

### IVINGHOE BUILDING SERVICES

Listed Building Specialists



Ivinghoe Building Services sensitively cares for heritage buildings. Services include:

Lime mortar and render works  
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Recent refurbishment works include a project at Wallingford, filmed for BBC's *Original Features* programme.

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BUILDING CONTRACTORS

01865 249581    [www.knowlesandson.co.uk](http://www.knowlesandson.co.uk)    Established 1797




Knowles & Son, Oxford builders providing craftsmen since 1797, sympathetically renovating and restoring Historic Buildings




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### ■ HIRST CONSERVATION

Laughton, Sleaford, Lincolnshire NG34 0HE

Tel 01529 497449 Fax 01529 497518

Email [hirst@hirst-conservation.com](mailto:hirst@hirst-conservation.com)

[www.hirst-conservation.com](http://www.hirst-conservation.com)

SPECIALIST BUILDING AND ART CONSERVATORS: Consultancy and conservation work to painted and applied decoration on plaster, stone, canvas, wood and metal substrates. Restoration and recreation of historic decorative schemes. Also specialist building works including joinery, sculpture, marble, stonework, stone cleaning, stucco, pargetting, wall and floor plasters. Surveys, specifications and analysis services available. Hirst Conservation's policy is to provide a conservation service that is second to none. The company takes great pride in ensuring that it remains at the forefront of contemporary conservation ethics and thinking. The highly professional and dedicated team represents many different conservation skills and disciplines, and through its combined knowledge and experience is constantly striving to enhance current and develop future conservation practices. *See also: entry on the inside front cover.*


### ■ J P LADELL LTD

Green Sleeves, Swan Lane, Coney Weston, Bury St Edmunds, Suffolk IP31 1DW

Tel/Fax 01359 221424 Mobile 07710 906985

Email [jamesladell@live.co.uk](mailto:jamesladell@live.co.uk)

BUILDING CONTRACTORS: A small family-run firm, experienced in conservation and renovation of older buildings including listed buildings and churches. Working mainly in Suffolk, Norfolk and Cambridgeshire but work is also considered outside these areas. Experienced in using lime mortars and pointing, lime washes, oak timber frame repairs and new build, lead sheet work. In-house damp proofing and timber treatments with guarantees. The company can supply specialist joinery from its own workshop. All work is carried out to a very high standard with a personal service.



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Historic Building surveys  
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Lime Specialist  
New Construction

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Archival, geophysical, GIS map regression, GPS, photographic, photogrammetric, structural carpentry, total station, visual surveying  
Consultant: Dr R. Joadley BSc, MSc, PGCE PhD  
[www.geddevaarchitects.net](http://www.geddevaarchitects.net)

**MELCOMBE REGIS**  
**CONSTRUCTION**

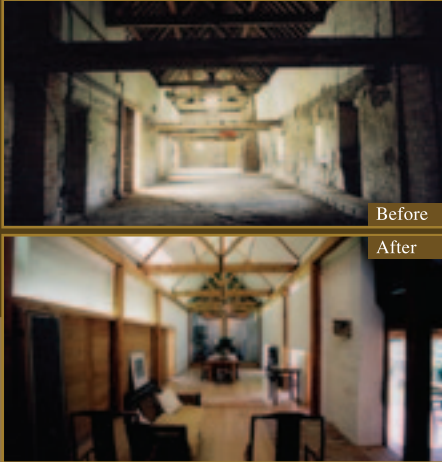
Tel. 01305 773239  
Fax: 01305 783238  
Email: [historicbuilders@dnorset.co.uk](mailto:historicbuilders@dnorset.co.uk)  
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**BUILDING CONTRACTORS** continued

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Leicester, Leicestershire LE3 1HP  
info@nandu.co.uk www.nandu.co.uk



### ■ J RIGG CONSTRUCTION LTD

Pry Lane, Cheltenham Road, Broadway,  
Worcestershire WR12 7LX

Tel 01386 858085 Fax 01386 858095

Email jrigg@jriggconstruction.co.uk

www.jriggconstruction.co.uk

**BUILDING CONTRACTORS:** A Cotswold based building company experienced in the restoration of substantial period and listed buildings using its own highly qualified team of directly employed craftsmen. Established in 1974, the company has carried out a considerable number of very successful projects in the Midlands, some of which can be viewed on the company's website.

### ■ MAGENTA BUILDING REPAIR LTD

Milton Mills, Milton Abbas, Blandford, Dorset DT11 0BQ

Tel 01258 880016 Fax 01258 881544

Email admin@magenta-repair.co.uk

www.magentabuildingrepair.co.uk

**BUILDING CONTRACTORS AND STONEMASONS:** Magenta Building Repair Limited specialises in the repair of historic and ecclesiastical buildings using traditional building methods and materials. Since the company's formation in 1995, Magenta has worked on many historic buildings and churches in the South of England. It works directly for English Heritage and the National Trust and regularly for a number of church architects. Magenta acts as a main contractor or specialist subcontractor in the following trades: stonemasonry, brickwork, lime plastering, conservation joinery and heavy oak carpentry, leadwork, millwrighting and engineering. IRATA rope access technicians. Magenta also carries out one-off new builds related to traditional construction.

### ■ MELCOMBE REGIS CONSTRUCTION SW LTD

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**BUILDING CONTRACTING AND HIGH QUALITY REFURBISHMENT, REPAIR AND RESTORATION:** A competitive and dynamic traditional building contractor offering a full range of restoration, repair, refurbishment and new construction services. An experienced and informed management with responsible, responsive construction teams. Melcombe Regis Construction delivers a high level of care and performance recognisable by results. Recent projects include: Whitcombe Manor, refurbishment of an 18th century church, restoration of a 19th century open air singing theatre at Larmer Tree Gardens (Rushmore Estates), a variety of works to Grade I and Grade II listed buildings and new construction of traditional stonework houses. Contact Melcombe Regis for a prompt service from drawings to completion including planning consents, if required. See also: display entry in this section, page 67.

### ■ PAYE STONEMARK

Stationmaster's House, Mottingham Station Approach,  
London SE9 4EL

Tel 020 8857 9111 Fax 020 8857 9222

Email rg@paye.net

www.paye.net

**MASONRY CONSTRUCTION AND REPAIR SPECIALIST:** See also: display entry in Stone section, page 101 and profile entry in Masonry Cleaning section, page 152.



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[www.owlsworthijp.co.uk](http://www.owlsworthijp.co.uk)



#### ■ R J SMITH & CO

Manor Court, Blosswood Lane, Whitchurch,  
Hampshire RG28 7BN

Tel 01256 892276 Fax 01256 893993

Email [email@rjsmith.co.uk](mailto:email@rjsmith.co.uk)

[www.rjsmith.co.uk](http://www.rjsmith.co.uk)

BUILDING CONTRACTORS: Specialists in the conservation of historic buildings.

#### ■ R W ARMSTRONG & SONS LIMITED

Armstrong House, Aldermaston Road, Sherborne St John,  
Basingstoke, Hampshire RG24 9JZ

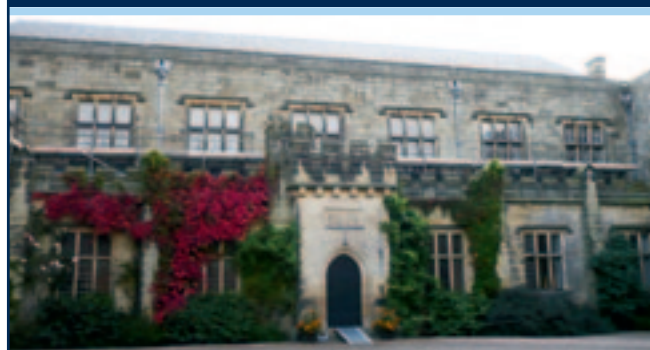
Tel 01256 850177 Fax 01256 851089

Email [info@rwarmstrong.co.uk](mailto:info@rwarmstrong.co.uk)

[www.rwarmstrong.co.uk](http://www.rwarmstrong.co.uk)

SPECIALIST IN THE RENOVATION, EXTENSION AND REFURBISHMENT OF PERIOD AND COUNTRY HOMES: Over the past 50 years R W Armstrong & Sons has established an enviable reputation as a traditional building company of the highest standard. The company has achieved this through the selection of prestige projects requiring a variety of services and the commitment of its large team of well-trained craftsmen and management. More recently, this reputation has resulted in the new build of several bespoke homes to one-off designs, often in the classical style. R W Armstrong & Sons also has long-term relationships with reliable subcontractors, and its workshops are highly regarded for producing joinery of the finest quality.

## PERIOD PROPERTY SOLUTIONS BUILDING CONSERVATION LTD



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## BUILDING CONTRACTORS *continued*



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**Email admin@recclesia.com**  
**www.recclesia.com**

**SPECIALISTS IN HISTORIC BUILDING CONSERVATION:** Recclesia specialises in the conservation and restoration of churches, historic buildings and ancient monuments. The award-winning management team has been at the helm of countless building conservation and restoration projects throughout the UK and France. The company has particular expertise in stonemasonry, lime work, stained glass and metalwork, making Recclesia a truly multi-disciplined contractor. Clients include English Heritage, Cadw, the National Trust, local building trusts, church councils and conservation architects and officers. The firm's reputation for delivering exemplary standards of workmanship and the ability to create a professional working environment on site is well regarded and its work has been used as the subject of a number of case studies. *See also: profile entry in Decorative & Stained Glass section, page 127.*

### ■ RICHARD COLES BUILDERS LTD

**The Briary, Plough Lane, Ewhurst, Surrey GU6 7SG**  
**Tel 01483 548856 Fax 01483 548458**  
**Mobile 07801 259949**  
**Email richard@rcoles.co.uk**  
**www.rcoles.co.uk**

**CHARTERED BUILDING COMPANY:** Richard Coles Builders Ltd is a small Chartered Building Company based in Surrey and working principally for private clients. The company specialises in high quality extensions, refurbishments and alterations to country houses, barn conversions, timber framed constructions and individual new homes. It aims to deliver a quality finish on time and to budget. Richard Coles, a corporate member of the Chartered Institute of Building, and his colleagues offer a personal service and recognise the importance of strong teamwork. Over the years the team has forged good working relationships with many architects, surveyors, engineers and other professionals involved in the creation of a sound built environment.

### ■ SANDY & CO (CONTRACTORS) LIMITED

**Grey Friars Place, Stafford ST16 2SD**  
**Tel 01785 258164 Fax 01785 256526**  
**Email info.sandy@sandy.co.uk**  
**www.sandy.co.uk**

**HISTORIC BUILDING CONTRACTORS:** Established in 1903, Sandy & Co is a well known firm of high quality building contractors which specialises in work on historic buildings and churches. Conservation, restoration and repair services are provided throughout the Midlands and across the United Kingdom for a wide variety of projects. Sandy & Co works with English Heritage, local government and private individuals, and has recently completed work for the National Trust at Hanbury Hall and Shugborough. The company has its own joinery workshop and painting and decorating division and its dedicated team of experienced craftsmen enjoys its contribution to conserving our heritage.

### ■ SIMMONDS OF WROTHAM

**Old House, West Street, Wrotham, Sevenoaks, Kent TN15 7AH**  
**Tel 01732 883079 Fax 01732 884055**  
**Email robert@whsimmonds.co.uk**  
**www.whsimmonds.co.uk**

**RESTORATION BUILDING CONTRACTORS:** Working throughout Kent, London and immediate areas. Specialists in old brickwork, stone and flint restoration. Simmonds regularly works on English Heritage projects. Recent works include renovations to medieval barns, several churches, brickwork and coping repairs and specialist decorating to a major listed house. Simmonds also provides expertise in carpentry and old plasterwork.

### ■ SPLITLATH LTD

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**Tel 01981 510611**  
**Email splitlath@btinternet.com**

**OAK FRAME REPAIRS:** *See also: display entry in this section, page 72.*

### ■ SZERELMEY RESTORATION AND STONEMARK

**369 Kennington Lane, Vauxhall, London SE11 5QY**  
**Tel 020 7735 9995 Fax 020 7793 9800**  
**Email info@szerelmey.com**  
**www.szerelmey.com**

**SPECIALIST RESTORATION CONTRACTORS:** *See also: display entry in Stone section, page 103 and profile entry in Masonry Cleaning section, page 153.*



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**Tel 023 9282 6662 Fax 023 9287 4201**

**Email office@tcsLtd.org**

BUILDING CONTRACTORS: Established since 1783 T Coleborn & Son Limited is a family-run company specialising in the sympathetic repair, refurbishment, alteration and restoration of historic properties in Hampshire and West Sussex. The highly skilled workforce has been very successful in carrying out an extensive list of conservation contracts on churches, forts, museums and many other public and private buildings and monuments. Many of these involved working alongside or sometimes directly for English Heritage; notably repairs and restoration to the majority of listed properties within the Portsmouth Historic Dockyard on behalf of the Portsmouth Naval Base Property Trust.

■ **TREASURE & SON LTD**

**Temeside, Ludlow, Shropshire SY8 1JW**

**Tel 01584 872161 Fax 01584 874876**

**Email mail@treasureandson.co.uk**

**www.treasureandson.co.uk**

CONSERVATION AND RESTORATION CONTRACTORS: Established in 1747 Treasure & Son is one of the region's leading specialists in the conservation and restoration of historic buildings and monuments. The firm has a wealth of experience and was awarded the Building of the Year for the Mappa Mundi Library in Hereford and a Wood Award for the admissions building at Kenilworth Castle. Recently completed works include the new restaurant at Hidcote Manor, major works to the roof of Hagley Hall, repointing at Chirk Castle, stone replacement works at Warwick Castle, repairs to St Mary's Church, Thornton Le Moor and refurbishment work on many private houses in the Midlands and border counties. The firm has its own in house joinery and stone masonry workshops.

■ **VALLEY BUILDERS LTD**

**The Old Granary, 214 London Road, East Grinstead,  
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**Tel 01342 311377 Fax 01342 300251**

**Email enquiries@valleybuildersLtd.co.uk**

**www.valleybuildersLtd.co.uk**

BUILDING CONSERVATION AND RESTORATION CONTRACTOR: Valley Builders has developed a range of quality services covering all aspects of building, especially the conservation and restoration of historic buildings. The use of sympathetic, traditional, specialist and modern construction techniques together with quality management skills has enabled the company to build an enviable reputation for the quality of its work and client service.

■ **WILLIAM TAYLOR STONEMASONS**

**Unit 2, Spencer Industrial Estate, Liverpool Road, Buckley,  
Flintshire CH7 3LY**

**Tel 01244 550118 Fax 01244 550119**

**Email william@taylormasonry.co.uk**

**www.taylormasonry.co.uk**

MASONRY RESTORATION AND CONSERVATION: William Taylor Stonemasons has experience in all aspects of architectural masonry, building, restoration and conservation and works on all types of ecclesiastical and historic building projects involving stone masonry, joinery and leadwork, decorative plasterwork and traditional roofing. It also offers JOS and DOFF cleaning systems.

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- Principal Contracting
- Cleaning & Restoration
- Conservation
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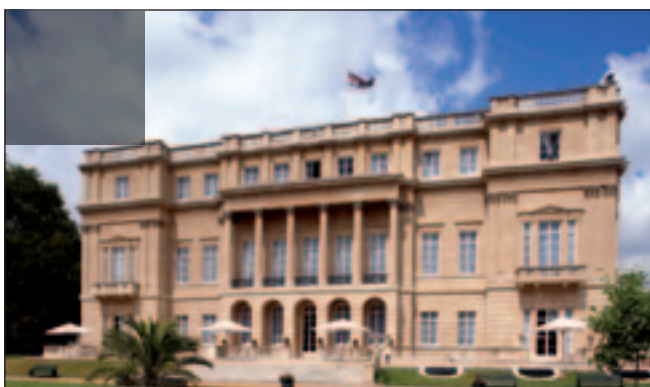
Cowdray Ruins, Midhurst

Lamberts Place, St James's Road, Croydon, Surrey CR9 2HX

E: [info@stonewest.co.uk](mailto:info@stonewest.co.uk) T: 020 8684 6646 W: [www.stonewest.co.uk](http://www.stonewest.co.uk)



Stonewest



Lancaster House conservation project, winner of the Georgian Group Architectural Award

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T: 020 8871 4048 F: 020 8871 4088  
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CONSERVATION TODAY



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HERITAGE

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SINCE 1999

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www.carpenteroakandwoodland.com  
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### ■ J & W KIRBY

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Tel 01924 862713  
www.jwkirby.co.uk

TIMBER FRAME CONSERVATION: Specialists in the conservation and repair of historic timber framed buildings, using in-depth knowledge and skills gained over 20 years. Working primarily on prestigious conservation and restoration projects for both private clients and professional organisations.

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Tel 01252 794325 Fax 01252 795947  
Email info@oakwrights.com  
www.oakwrights.com

TIMBER FRAME BUILDERS: Oakwrights is a team of craftsmen and a civil engineer specialising in design, construction and restoration of timber framed buildings. With combined in-house professional and technical skills Oakwrights provides cost-effective solutions avoiding the need for independent architects and engineers. Complex conservation and new-build projects are undertaken from planning through to completion. (Oakwrights also provides services in support of a main contractor or architect). Work carried out includes design and construction of new houses, extensions and outbuildings and repair of historic houses and barns.

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Email splitlath@btinternet.com

OAK FRAME REPAIRS: *See also: display entry in Building Contractors section, page 72.*

### ■ TIMBER FRAMING AND CONSERVATION

Manor Farm, Main Road, Nether Broughton,  
Leicestershire LE14 3HB  
Tel/Fax 01664 823209  
www.timberframing.org.uk

TIMBER FRAME CONSERVATION: A father and son business specialising in green oak framing and conservation of ancient timber frames offering 50 years combined experience blended with an enthusiasm for challenging new or conservation projects. This small team of experienced framers led by qualified staff relishes difficult building rescue work as well as traditional new frames. The company has facilities for detailed design and engineering, negotiations with planners and conservation officers, listed building applications as required and can work from clients' sketch ideas or together with architects to produce practical and cost effective solutions. SPAB members. CIOB, IHBC and MBEng qualified consultancy service.

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Email courses@wealddown.co.uk  
www.wealddown.co.uk

CONSERVATION SUPPLIES AND SERVICES: *See also: profile entry in Courses & Training section, page 193.*

www.[buildingconservation.com](http://buildingconservation.com)



Add [www.buildingconservation.com](http://www.buildingconservation.com) to your favourites list today

**Buildingconservation.com**, the UK's leading website for built heritage conservation, was established in 1994 by Cathedral Communications Limited, publisher of The Building Conservation Directory.

It's now used by over 4,000 unique visitors each day and receives over a million hits per month. It includes:

- 300 technical articles by the top experts
- 1,200 suppliers of specialist products and services
- 400 educational institutions and skills training providers
- links to all the industry's key organisations.

**Cathedral Communications Limited**  
01747 871717 [info@buildingconservation.com](mailto:info@buildingconservation.com)



Alan Jones stuff-thatching threshed long straw into a base coat of gorse at Llanon, Dyfed: this rare example of the west Wales vernacular is supported by a thick mat of twisted straw rope across the purlins, and includes a thatched chimney.  
Photo: Wilm Jones, Pembrokeshire Thatch & Carpentry Services

## Chapter 3

# Structure & fabric

ROOFING CONTRACTORS	PAGE	SERVICES			
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A L R Ltd	80			me	
Anelays – William Anelay Ltd	60	rc		me	
Bardsley & Brown	83				th
Between Time Ltd	62			me	
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Busby's Builders	62	rc		me	
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Chiverton	63	rc			
Country House Renovations Limited	63	rc			
D B R (Leadwork) Limited	81	rc		me	
Dunne and Co Building and Restoration	66	rc			
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Hall Construction Limited	66	rc			
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J P Ladell Ltd	67			me	
J Rigg Construction Ltd	80	rc		me	
John Williams & Co Ltd	81	rc		me	
Karl Terry Roofing Contractors Ltd	82	rc		me	
Lovell Purbeck Limited	99				
Barry Milne, Thatcher	83				th
Minerva Stone Conservation	100		sj		
Norman & Underwood Ltd	80	rc		me	
Northwest Lead Ltd	80			me	
P Webb Roofing and Building Services Ltd	82	rc			
Pembrokeshire Thatch & Carpentry Services	83				th
R Gilbertson	82	rc			
R W Armstrong	69	rc			
Simmonds of Wrotham	70	rc			
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T R A C Structural Ltd	150		ax		
Triton Building Conservation Ltd	73	rc			
Turners Ornamental Leadworks	116			me	
Twyford Lime Products	158	rc			
Wallwalkers	82		sj ax		
Weald and Downland Open Air Museum	193				th

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me	metal sheet roofing
rc	roofing contractors
sj	steeplejacks & lightning protection
sr	stone slate roofing
th	thatch

ROOFING PRODUCTS & MATERIALS	PAGE	TILES	LEAD	TIMBER	MISC
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Alumasc Exterior Building Products	85				rd
Anelays – William Anelay Ltd	80				rd
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Artisan Plastercraft Ltd	185			bt	
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Brickfind (UK)	90	as			
Bulmer Brick & Tile Co	89	rt			
C & D Restoration Ltd	97	sr			
C E L Ltd	62		ld		
Carpenter Oak & Woodland Co Ltd	74			bt os	
Castaway Cast Products & Woodware	112				rd
The Cast Iron Company	112				rd rl
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The Cleft Wood Company	83			bt	
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D B R (Leadwork) Limited	81				rd
Delta Membrane Systems Ltd	149		ld		
E G Swingler & Sons	82	rt rs		bt	
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Eura Conservation Ltd	113				wv
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os	oak shingles
pt	chimney pots
rd	roof drainage
rf	roof features
rl	roof lights & lantern lights
rs	roofing slates
rt	clay roof tiles
sr	stone roofing slates
wv	weathervanes

# COPPER SHEET ROOFING

JONATHAN GOODE

**W**ITH ITS natural tendency to form a protective green patina, copper roofing provides a prominent visual accent in our built environment. It is particularly distinctive against the occluded skies of our temperate climate. Copper is relatively expensive but it does have beneficial characteristics. This has meant that its use, historically, has typically been reserved for high profile buildings. During the 19th and 20th centuries the price of copper fluctuated dramatically, making it periodically available for use on a wider range of building types.

Large-scale use of copper roofing developed during the 19th century and examples or accounts of its use in England prior to this are rare. The use of copper as a roofing material became increasingly viable through increasing mechanisation and standardisation in the production of copper sheet. The use of copper in the first half of the 20th century fluctuated with its price, peaking around the 1920s and 1930s.

After the Second World War many churches were in poor condition. Some had suffered bomb damage and many more had been deprived of general repairs and maintenance because of the enforced postponement of such work between 1939 and 1949. Even then, shortages in materials, labour and funds, coupled with the need to obtain a Ministry of Works licence, hampered repair works. One of the worst cases was Chichester Cathedral where nearly all the roofs were in need of re-covering (illustrated overleaf).

## THE BENEFITS OF COPPER SHEET

The use of sheet metal in general as a roofing material allows a near continuous water-resistant covering with a minimum of joints between sheets. It enables roof slopes to be covered at lower pitches than would be possible using other roof coverings and it can be used to provide a smooth surface over curved architectural forms. In this respect copper is not unique and a number of alternatives are available including lead, zinc, tin, aluminium and galvanised and stainless steel. However, certain properties of copper provide benefits over these other metals.

The density of copper is less than that of



*The copper dome of West Register House, Charlotte Square, Edinburgh (Photo: Charles Strang)*



*Iron-staining caused by a steel overflow pipe to the heating system*

lead and it has much greater tensile strength. These characteristics combined mean that standard copper sheet is thinner and lighter than lead sheet, so it requires less structure to support it. The greater tensile strength reduces the likelihood of creep, making it better-suited to more steeply pitched roofs, such as domes and spires. Copper, with a much higher melting point than lead, also has greater fire resistance and was therefore considered suitable, historically, for use on important or valuable structures.

Corrosion of the outer surface of oxidised copper provides a protective coating over the metal beneath. This regulates the speed of corrosion through the metal so that copper sheet can last 100 years or more. The process of corrosion also produces a patina, which is predominantly green copper carbonate. It is this patination that gives most historic roof coverings their distinctive colour. Changing climatic conditions and air pollution affect the rate and colour of patination. The colder, dryer and less polluted the climate, the longer it takes for the patination layer to form.

#### INSTALLATION OF COPPER SHEET ROOFING

Until 1870 nearly all copper sheet roofing was laid in sheets, generally 2' by 6' in size, joined at the sides with vertical standing seams. Clips attached to the roof would be held between the sheets. The upstand would then be folded over either once or twice, to form the seam. Horizontal joints would be folded over flat to form welts. This is commonly known as the traditional method.

With the development of thin sheets of consistent thickness, a system of vertical joints using wood-core rolls was developed. A conical wood roll was fixed to the roof, then sheets with their edges turned up were placed on either side and welted together over the roll. This method developed to use an almost square batten with a strip laid over the top and welted to the adjacent sheets. This



*Chichester Cathedral: the wide bays used between vertical seams allow the sheet to deflect under wind-lift which can cause hardening of the metal and eventual cracking.*

later development made more allowance for thermal expansion of the bays, made it easier to form junctions and proved particularly preferable on shallow sloped pitches where footfall could damage standing seams.

Experimentation in methods of laying copper continued through the 1950s and 1960s, making use of the longer strips of copper then available for greater economy. The Broderick System was patented in 1953 and incorporated bay-width cleats held in place by dummy welts. Developments in Switzerland at the same time led to the Long Strip System, which was introduced in the UK in 1957 and is now used for most modern copper sheet roofing. This method uses long trays of copper sheet, 520mm wide and up to 8.5m long. It uses fewer clips and cross welts than the traditional method and the long standing seams are often machine-formed.

#### COMMON DEFECTS

Copper roofing can be affected by mechanical damage, corrosion and deterioration of the supporting structure. If the roof was laid in such a way that it cannot respond to the prevailing environmental conditions, then defects can arise through stresses applied to the sheets. Wind-lift can lead to drumming of the sheets. The copper hardens at the points of most stress and eventually tell-tale 'star' cracks form at the intersection of the lines along which the sheet has flexed. This is a particular problem at Chichester Cathedral where wider bays allow greater deflection of the sheets. Where thermal movement is restricted, fractures can occur. Accidental damage can produce punctures through the sheet or deformation of the seams, which prevent them from performing correctly.

Acid corrosion of the copper sheet either by acidic run-off or concentrated flue gasses will lead to thinning of the sheet. The acid solution removes the protective patination and oxide layers accelerating corrosion of the metal. Excessive thinning can lead to perforations developing in the metal.

Deterioration of the structure or underlay to the roofing can be caused by condensation if ventilation of the under-structure is inadequate. Deterioration may be due to earlier failure of the roofing as described above. In either case it is likely to lead to further mechanical failure. In this way defects in the under-structure or roof covering can lead to progressive failure of the roof if they are not dealt

with when they become apparent. The use of roofing felt and wood-wool underlay, introduced in the 1960s, has led to the premature failure of some roof coverings.

Staining is a common defect of copper roofs. It does not reduce the weathering capabilities of copper, but can significantly affect the visual appearance of the roof. Run-off from other metals, particularly those subject to oxidation, leaves metal oxide deposits in the patination layer, changing its colour. Run-off from steel or iron surfaces creates brown staining and run-off from lead surfaces creates grey staining. The only way to remove this discoloration is to dissolve the patination layer and then re-patinate it. The process for removing the oxide layer using a 5–10% solution of sulphuric acid is described in Ashurst and Ashurst's *Practical Building Conservation, Volume 4: Metals* (see Recommended Reading). The solution must be handled and applied very carefully as even diluted run-off can badly stain adjacent wood or stonework.

#### REPAIR METHODS

Recommended repair methods for copper roofs are described by Ashurst and Ashurst and in the Defence Estates' publication *Roofs: Metal Sheet and Asphalt* (see Recommended Reading).

In most roof coverings the sheets are held together through the use of welted joints. It is possible to re-open these joints and replace the defective sheets. Where necessary, the sheets can be replaced with sizes that are better suited to the mechanical forces which the roof covering is subject to.

Difficulties can arise from this method of repair because of the properties of copper. Hammering copper will harden the metal. Hardened copper sheets may fracture while the joints are being opened up or re-formed. Copper can be softened again with the application of heat, a process called annealing. Small areas of damage can be patched using soldering, brazing or welding, but all of these require the application of heat in some form. Consideration must be given to the potential hazards and the fire risk to the under-structure. The use of hot-work permits may be required. Where the risk is to a vulnerable or significant under-structure or building, the application of heat may be inappropriate.

It may be possible to replace a smaller area of roof covering, particularly if it can easily be jointed to the existing sheet without the risk of excessive hardening and without the application of heat to anneal it. Cutting back the retained sheet and using a batten joint at the seam, so reducing the amount of work applied to the existing copper, can avoid splitting the hardened copper. This method is often appropriate where damage has been caused to part of the roof by extreme weather, as at the Church of St Mary the Virgin in Dalham, Suffolk, which suffered storm damage in 1987 (see facing page, top right). Due to the relationship between patination and impurities in the air, new copper sheet may take longer to patinate than





Left: Lead-staining caused by run-off from a higher lead-covered roof. Right: The Church of St Mary the Virgin, Dalham, Suffolk: the roof was partially re-covered following storm damage. The new copper may never match the original colour because the development of patina on copper depends on climatic conditions and these have changed over time. (Photo: The Whitworth Co-Partnership LLP)

historic copper sheet and may not match retained elements. However, copper can be pre-patinated to match an existing colour.

Patching small areas may be all that is needed where the roof covering is generally sound. The small area repairs described by Ashurst and Ashurst in *Practical Building Conservation, Volume 4: Metals* involve hot-works. Understandably, current practice does not favour hot-works when working on listed buildings. A recent study of church repairs found the techniques suggested by Ashurst and Ashurst were rarely used despite the likelihood that they would provide a more durable fix.

Most small repairs are carried out using some form of adhesive material: gluing copper sheet with black mastic, self-adhesive flashing tape, mastic tape and mastic beads. None of these methods can be recommended due to their short life span. Repairs of this type are often applied without thoroughly understanding the underlying fault. However, the most common reason why these repairs fail is that they have been applied over the patination layer. This layer is porous so the weathering process continues unchecked, leading to the bond between the roof surface and the repair patch breaking down.

At St Mary's Church, Boxford, the architect has devised a successful cold repair method. The first stage is to remove the patination layer around the area of damage using a dilute acid solution in water. Then a triangular patch of copper sheet is adhered to the cleaned surface using acid-curing silicon. The triangular patch, pointing up the roof slope, allows water to be shed away. Although

this method has not yet been extensively trialled, repairs are currently reported to have lasted more than ten years.

#### CONSIDERING REPLACEMENT

A number of post-war repairs now need significant attention after only 50 years. This is commonly due to shortcomings in the supporting structure, original specification or the workmanship. It should be borne in mind that these repairs were carried out at a time when resources were limited and during a period of rapid expansion in the amount of repair and construction being undertaken by contractors and professionals who were unfamiliar with the material. This was also a time of technical development and experimentation in the method of laying copper.

If the cause of a defect relates to the laying or specification of the copper sheet, or relates to some defect in the under-structure, the problem will worsen unless it is addressed and removal and re-laying may be the only viable option. In these circumstances, to conserve historic methods of installation and appearance, the replacement works should be laid in a manner which best matches the original detail but overcomes any shortcomings in the method or specification originally used, rather than specifying the now ubiquitous long-strip method.

Well-laid and supported copper should reasonably last 80 years or more. The sustainability of copper as a roofing material is improved by suitable repair rather than replacement. The relatively high cost of copper can mean that other roofing materials are

used for replacement. This can result in a significant visual change to the building and the loss of copper as a historic roof covering.

#### Recommended Reading

- J Ashurst and N Ashurst, *Practical Building Conservation, Volume 4: Metals*, English Heritage Technical Handbook, Gower Technical Press, Aldershot, 1988
- The Guide to Copper in Architecture*, Copper Development Association, Hemel Hempstead, 2006
- Copper Roofing in Detail*, Copper Development Association, Hemel Hempstead, 2002
- Copper Through the Ages*, Copper Development Association, Radlett, Herts, 1955
- Historic Buildings Factsheet 3.02, *Roofs: Metal Sheet and Asphalt*, Defence Estates, HMSO, London
- F Röbber, *TECU Copper Planning, Designing and Processing*, KM Europa Metal AG, Osnabrück, Germany, 2000

This article is an abridged version of the author's dissertation *The Care and Conservation of Copper Roofing to Historic Buildings*, 2009. A digital copy is available on request.

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## METAL SHEET ROOFING

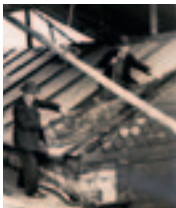


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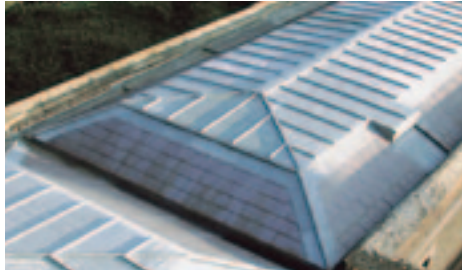


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CLAY TILES & ROOF FEATURES *continued*■ **BABYLON TILE WORKS**

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Tel 01622 843018 Fax 01622 843398

Email [info@babylontileworks.co.uk](mailto:info@babylontileworks.co.uk)

[www.babylontileworks.co.uk](http://www.babylontileworks.co.uk)

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Tel 01296 730930

Email [enquiries@cleftwood.com](mailto:enquiries@cleftwood.com)

[www.cleftwood.com](http://www.cleftwood.com)

**TILE PEGS, ROOFING BATTENS, CLEFT OAK GATES, CLEFT OAK POST AND RAIL AND PALING FENCING:** See also: profile entry in *Timber Suppliers* section, page 131.

■ **SANDTOFT ROOF TILES**

Sandtoft, Doncaster DN8 5SY

Tel 0844 9395 900 Fax 0844 9395 950

Email [heritage@sandtoft.co.uk](mailto:heritage@sandtoft.co.uk)

Contact Nigel Dyer

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Email [info@tudorrooftiles.co.uk](mailto:info@tudorrooftiles.co.uk)

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**ARCHITECTURAL CERAMICS:** See also: profile entry in *Terracotta* section, page 108.

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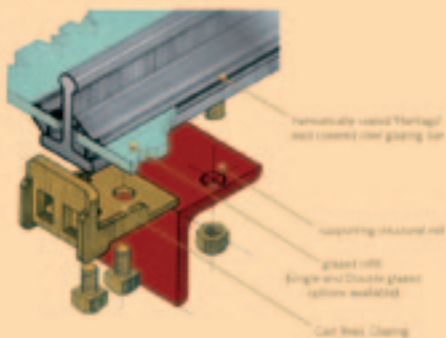
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A F Jones Stonemasons Ltd	95	sm	ss						
A N Morgans (Wales) Ltd	60	sm				br			pn
A S A P Brickwork	94					br			pn
A V V Solutions Ltd	95	sm			tc	br			pn sw
Alan Bishop & Associates	38		ss						
Anelays – William Anelay Ltd	94	sm			tc	br			
Aura Conservation	97	sm			tc				pn
Bakers of Danbury Ltd	95	sm	ss						
Bath Stone Group, The	96	sm							
Between Time Ltd	62			fk			ea		pn
Boden & Ward Stonemasons Ltd	96	sm	ss						pn
Bonsers (Nottingham) Limited	61	sm			tc	br			pn
Bosence	186				tc		ea		pn sw
Bosence & Co	46								pn
Boshers (Cholsey) Ltd	61	sm				br			
Brickfind (UK)	90					br			
Bullen Conservation Ltd	97	sm	ss		tc	br		cr	
Burrows Davies Limited	97	sm				br			pn
Busby's Builders	62	sm				br			
C & D Restoration Ltd	97	sm	ss	fk	tc	br		cr	pn
C E L Ltd	62	sm	ss						pn
C Ginn Building Restoration Limited	97	sm							
C R Crane & Son Ltd	63	sm							
Carrek Limited	98	sm				br			pn
Carthy Conservation Ltd	98	sm	ss		tc				
Cathedral Works Organisation Limited	63	sm	lr ss	fk	tc	br			pn
Charterbuild Ltd	150					br		cr	pn
Chiverton	63					br			
Claire Davies Conservation	98		ss						pn
Cliveden Conservation Workshop Ltd	98	sm	ss			br			pn sw
Coe Stone Ltd	98	sm	ss						
Collins and Curtis Masonry Ltd	98	sm							
Conservation Building Services Ltd	63	sm	ss						
Country House Renovations Limited	63	sm							
D B R (London) Limited	99	sm	ss		tc	br			
Eura Conservation Ltd	108		ss						
Fringe Workshop, The	99	sm	lr ss						
Grinshill Stone Quarry	99	sm	ss						
Haddonstone Limited	108	sm	ss						
Hall Construction Limited	64	sm				br			
Helifax Limited	150						ea	cr	
Heritage Stone Access	82	sm							
Herts Renovation	94			fk		br			pn
Hirst Conservation	108	sm	ss			br	ea		
Historic Brick Pointing Ltd	155					br			pn
Inspire Conservation Ltd	66	sm							pn
Kent Conservation & Restoration Ltd	94	sm				br			sw
Lambs Bricks & Arches	90					br			
Lime Centre, The	158						ea		
Gerard C J Lynch	94					br			
Magenta Building Repair Ltd	68	sm							pn
Mark Stafford Stonemasonry & Conservation Ltd	100	sm	lr ss						
Mather & Ellis Ltd	100	sm							pn
Mathias Restoration Ltd	94			fk		br			pn
McAllister Masonry Limited	100	sm							

MASONRY CONTRACTORS	PAGE	STONE	SCULPTURE	FLINT	TERRACOTTA	BRICK	COB	CONCRETE	MORTARS
Melcombe Regis Construction SW Ltd	68	sm				br			
Mike Wye & Associates Ltd	158						ea		pn
Milestone Lime Plastering	187						ea		
Millway Builders Ltd	68	sm							
Minerva Stone Conservation	100	sm	lr ss	fk			ea		pn
Nimbus Conservation Limited	101	sm	ss		tc	br			
Odgers Conservation Consultants Ltd	40		ss						
Owlsworth I J P	69	sm	ss	fk			ea		pn
Paye Stonework	101	sm	ss		tc				pn sw
Period Property Solutions Building Conservation Limited	69	sm							pn
Pierra Restoration Ltd	101	sm							
R J Smith & Co	69	sm				br			pn
R W Armstrong & Sons Ltd	69					br			
Recclesia Ltd	70	sm	ss						pn
Richard Rogers Conservation Limited	174		ss						
Roberson Stone Carving Ltd	101	sm	lr ss						
Rotafix	150							cr	
Rupert Harris Conservation	109		ss						
S J Specialist Brickwork	94			fk	tc	br			pn
Sandy & Co (Contractors) Limited	70					br			
Shaws of Darwen Limited	108				tc				
Timothy J Shepherd Historic Brickwork Specialist	94					br			
Simmonds of Wrotham	70	sm		fk		br			
Simon Swann Associates Ltd	109		ss		tc				
Splitlath Building Conservation Ltd	72	sm							
St Astier Ltd	70	sm						cr	
Stone Central (NW) Ltd	102	sm	lr ss		tc			cr	pn
Stone Edge Limited	102	sm							pn
Stone Restoration Services Ltd	102	sm				br			pn
StoneCo Limited	102	sm	ss		tc	br			
Stonest West Limited	73	sm			tc	br	ea		
Szerelmey	102	sm							pn
T E Tilley Ltd	102	sm							
T R A C Structural Limited	150							cr	
Taylor Pearce Restoration Services Limited	108		ss						
Traditional Technologies LLP	142						ea		pn
Triton Building Conservation Ltd	73	sm			tc	br			
Twyford Lime Products	158						ea		pn
Universal Stone Limited	103	sm							
V A Conservation	103	sm	lr ss		tc				pn
Valley Builders Ltd	72	sm				br			pn
Wallwalkers	82	sm							pn
Wells Masonry Services Ltd	102	sm							
Westland London	165		ss						
William Taylor Stonemasons	103	sm							pn

## SERVICE CODES

Stone	sm	stonemasonry
Sculpture	lr	stone letter cutting
	ss	sculpture & statuary
Flint	fk	flint knapping
Terracotta	tc	terracotta
Brick	br	brickwork
Cob	ea	cob & earth construction
Concrete	cr	concrete repairs
	pn	lime pointing
Mortars	sw	stucco

For Coade stone repairs see terracotta specialists  
For Pulhamite repairs see terracotta and stucco specialists

MASONRY PRODUCTS	PAGE	STONE	PAVING	CAST STONE	CLAY	EARTH	TOOLS
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Aldershaw Handmade Clay Tiles Ltd	83				at bk tn		
Antique Buildings Limited	142	as	as		as		
Aura Conservation	97			cs			
Baron UK Ltd	155						mt
The Bath Stone Group	96	sq	pv				
Best Demolition	142	as	as		as		
Boden & Ward Stonemasons Ltd	96	sq					
The Brick Development Association	90				bk		
Brickfind (UK)	90	as			as		
The Bulmer Brick & Tile Co	89				bk tn		
C & D Restoration Ltd	97	mg		cs			
C Ginn Building Restoration Limited	151	sq		cs	at bk		
Cathedral Works Organisation Ltd	63	ck kf sq	pv				
Coleford Brick & Tile Co Ltd	89				bk		
Cornish Lime Company Ltd	157					es	mt
D B R (London) Limited	64			cs			
Dunne and Co Building & Restoration	66	kf					
Grinshill Stone Quarry	99	sq					
H G Matthews	obc	kf			bk		
Haddonstone Limited	94			cs			
Heritage Cob & Lime	158					es	
Hirst Conservation Materials Ltd	158					es	
Ingarsby Conservation Ltd	142						mt
Lambs Bricks & Arches	90				bk		
Lambs Sussex Sandstone	99	sq	pv	cs			
Lambs Terracotta	108				at		
The Lime Centre	158						mt
Lovell Purbeck Limited	99	mg sq	cq pv				
Mike Wye & Associates Ltd	158					es	
Minerva Stone Conservation	100	ck kf mg sq					
The Mosaic Restoration Company Limited	180	mg					
Multi Marque Production Engineering Ltd	155						mt
Nostalgia	94	mg					
Recclesia Ltd	70	sq					
Shaws of Darwen Limited	107				at bk		
Smithbrook Building Products Limited	83				bk		
Stone Central (NW) Ltd	102	mg					
StoneCo Limited	102	sq					
Twyford Lime Products	158					es	
Wells Masonry Services Ltd	102	sq					
West Meon Pottery	108				at bk		
Westland London	165	as (mg)					
William Taylor Stonemasons	72	sq					
Womersley's Limited	158						mt
The York Handmade Brick Company Limited	90				bk		

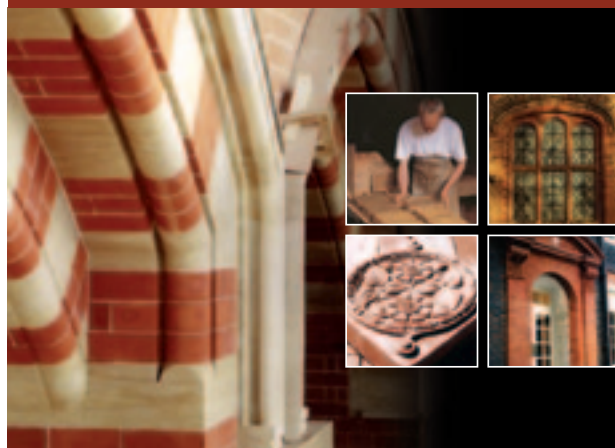
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	kf	knapped flint
	mg	marble & granite
	sq	stone (general)
Paving	cq	cobbles & setts
	pv	flagstone paving
Cast stone	cs	cast stone
Clay	at	terracotta
	bk	bricks
	tn	mathematical tiles
Earth	es	cob & earth materials
Tools	mt	masonry tools/equipment
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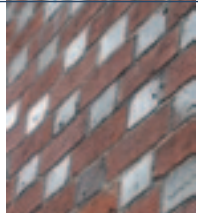
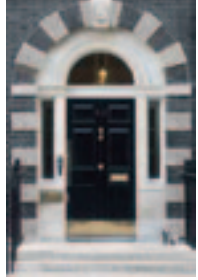
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*See display entry on the outside back cover.*

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# TUDOR BRICKWORK

GERARD LYNCH

**T**HE TUDOR period (1485–1603), which is often considered in the two broad phases ‘Early Tudor’ and ‘Elizabethan’, witnessed the decline of the Gothic style, symbolised in brickwork by the low-rise, ‘four-centred’ or ‘depressed’ arch. The Gothic was gradually displaced by Renaissance elements with a marked Classical influence.

A newly rich gentry, courtesy of land and assets taken from the Church after the Dissolution of the Monasteries (1536), instigated a frenetic period of secular building, creating fine mansions in brick. Brickwork was reserved for the privileged and received the royal seal of approval when Henry VIII took ownership of Hampton Court Palace (1514) from a disgraced Cardinal Wolsey in 1528.

## BRICKMAKING

Although commercial brickyards with permanent up-draught kilns existed, most bricks were made by itinerant brickmakers. They were hired by wealthy clients to locate suitable ‘topmost’ clay, frequently found on the site of the proposed building, and to excavate, mould, dry, fire and deliver bricks. Ideally, clay was excavated in the autumn and over-wintered to break it down and help remove soluble salts, ready for moulding from springtime onwards.

Preparing the clay for moulding resulted in clay with a high water content. This made it difficult to fully fill the mould, which is why Tudor bricks are shallow in gauge (height) with rounded arissses (the right-angled edges). Sizes are typically found to range from 210–250mm x 100–120mm x 40–50mm.

The mould was a simple frame, open top and bottom. The clay was thrown in, the excess struck off with a timber ‘strike’ and the frame lifted and removed. The best bricks would have been made at a bench, resulting in an even gauge. However, Tudor mansions demanded huge numbers of bricks, and judging by the irregular variation in dimensions between what should be parallel faces, it seems that some moulds may have been placed directly on the ground. Although unevenness of the ground might explain an undulating bedding face, the difference in gauge of some Tudor bricks is most likely to be because the mould moved or tipped when the excess clay was struck off. Essentially the same moulding process can still be seen in use today in developing countries such as Iran, Iraq, India and Pakistan, and in much of Africa.

Once moulded, the bricks were first laid out flat, on bed, to dry until strong enough to be placed on edge, being turned daily until fully dried and ready for firing.

Rather than using limited capacity kilns, bricks were usually fired in huge temporary open clamps that were capable of firing in excess of 100,000 bricks. Both clamps and kilns were designed with ‘fire-tunnels’ on the longest, opposing sides into which the fuel, mainly timber, was fed. Low-fired by modern standards, brick colours were dependent on clay mineralogy, ranging from pale pinks through to dark reds and buffs. The faces of the bricks that lined the fire-tunnels were exposed to the highest temperatures and the effects of hot flue gasses. These bricks were darkened or ‘flared’ in the process and were commonly used as headers for decorative effect (that is, they were laid at right-angles to the wall face). All fired bricks were graded for use within a structure with the best quality reserved for face work. Under-fired ‘semels’ (meaning ‘semi-fired’) were usually re-fired, although builders might, wrongly, use some, especially for internal walling, despite being forbidden to do so under the terms of their engagement.

## BRICKWORK

Tudor brickwork exudes confidence, being used for both utility and show. Bonding was mainly based on variations of English bond, with English cross-bond being particularly popular as it allowed the bricklayers to create regular quarter-bond offsets in every course that facilitated patterns, or diapers, utilising the flared headers to create a polychromatic effect.

Specially shaped bricks could be made by one of three methods. They could be cast using a suitably shaped mould or, less commonly, when three-parts dry, the ‘green’ clay could be cut to shape with a knife. However, with these two methods the resultant profile could distort during drying and firing. The most common method, therefore, was to ‘cut and rub’ the fired bricks to produce a wide variety of ornate shapes using a brick axe, a saw, a hammer and chisel, and various abrasives. Called ‘hewing’, this practice was introduced by Flemish craftsmen during the 15th century and required great skill. The results can be seen in cut-mouldings for plinths, reveals, tracery, label mouldings over openings and in the highly decorative chimney stacks which define the brickwork of the period.

Tudor brickwork is characterised by thick joints of lime-rich mortar that served as a flexible gasket. This was necessary for laying the typically irregular bricks to the line, level and overall gauge required to fit the dimensions of the architectural elements of a facade. The faces of the joints were finished, or ‘jointed’, using the trowel as work progressed to create either a flush face, or more usually



*The six-storey Tudor folly Freston Tower (c1550), which overlooks the estuary of the River Orwell in Suffolk (Photo: The Landmark Trust)*



*An example of Tudor polychromatic brickwork built of orange-red bricks laid in English Cross-bond to display ‘diapers’ of flared headers, at Farnham Castle, Surrey, c1508 (Photo: Gerard Lynch)*

a ‘struck’, or a ‘double-struck’ profile (see illustrations above).

To overcome the unavoidable variations in brick tones characteristic of up-draught firing, and to highlight the diapering, the predominantly red brick, premier, facades were usually colour-washed (not lime-washed). Washes were based on preparations primarily consisting of red ochre as the



Tudor brickwork at Chenies Manor, Buckinghamshire, dated 1520, jointed with a 'struck' profile, and displaying traces of the original red ochre colour wash and narrow 'pencil'.

(Photos and diagrams: Gerard Lynch)



An original example of Tudor 'Double-Struck' jointing from a wall in the great kitchens at Hampton Court Palace, c 1540. It was uncovered in the early 1980s below plaster applied soon after the wall was completed, when design alterations ordered by King Henry VIII, made the wall internal. The diagram shows the stages of execution: 1) bed joint from trowel, 2) joint 'struck' in a weathered fashion by trowel, 3) 1st stage completed, 4) joint struck by trowel, bottom up to middle line, 5) the finished profile.

pigment, glue size and 'small ale' (a readily available form of weak beer) to help it adhere to the masonry, and alum to 'fix' the colour. The wash was brush-applied over both bricks and joints once construction was completed. This finish also provided a small degree of protection to new brickwork laid in slow-setting lime-mortar.

Once the colour-wash had dried, the joints were selectively highlighted, but to a lesser scale, with regular narrow lines of white, or occasionally pigmented, distemper (a mix of glue size and crushed chalk, or 'whiting') using a thin paintbrush in a process termed 'pencil'ing'. These techniques added refinement to brickwork facades but some modern observers, used to a more weathered and rustic appearance, find the results garish.

### DECAY, CONSERVATION AND REPAIR

Before deciding on the most appropriate method of conserving or repairing historic brickwork, it is very important that a full assessment and accurate diagnosis of all failures is undertaken to correctly determine the causes.

Decay is often found to affect individual bricks and mortar joints in specific areas to varying degrees. Failures may be related to structural problems but they are often simply the result of the normal effects of exposure to the aggressive, cyclical weather-action of rain and frost. Water, in its different forms, is the main agent of decay and the original construction and detailing of the brickwork will largely determine its ability to minimise the impact of driving rain and reduce the potential of damaging saturation.

The measures taken to prevent damage associated with water – the maintenance of all rainwater goods, flashings, gullies, cills, copings and cappings, and ensuring good drainage – are at the heart of good brickwork conservation.

### INSPECTION AND SURVEY

Perhaps the most common indications of defective brickwork are:

- spalling (erosion or delamination of brick faces)
- surface staining from air-borne pollutants and organic growth
- excessive algae or uncontrolled plant growth

- eroded, soft, crumbling or loosened mortar
- crystallisation of soluble salts on or within bricks
- loosened or dislodged bricks
- bulges, misalignment or cracks in the brickwork
- poor bonding or inadequately tied-in corbelling
- failure of arches and lintels due to inadequate abutments or bearings
- leaning chimney stacks.

To determine the cause of the failure and specify the best method of conservative repair, it is essential to record accurate information on the defective materials or constructional elements. It is necessary to understand the building's history and original construction methods and materials used to develop a sympathetic repair strategy.

### CONSERVATIVE REPAIR

Everyone involved in the repair of historic brickwork should be aware of and strive to adhere to the philosophy of repair set out in the Society for the Protection Ancient Building's *Principles and Philosophy* and within relevant national guidance, such as English Heritage's *Principles of Repair*. These documents provide clear guidelines promoting respect for the historical integrity of a building by emphasising a minimum intervention approach.

It is beyond the scope of this article to deal with each and every problem or failure associated with Tudor brickwork. It is important, however, to briefly examine the main issues surrounding replacement bricks and mortars.

### REPLACEMENT BRICKS

When the faces of Tudor bricks have spalled sufficiently to warrant intervention to arrest decay, there are two main options:

- carefully cut out the full brick, clean it and the resultant indent of debris and reverse the brick so that the decayed face is placed to the rear
- where the decay is too severe, carefully cut out and remove the brick for replacement with another Tudor brick or an appropriate modern alternative.

All replacement bricks, whether reclaimed or modern, must match the original in size, shape, colour, texture, porosity and, as far as can be determined, durability.

### RECLAIMED BRICKS

Authentic 16th century bricks are understandably rare. In the unlikely event that a suitable supply is available for re-use, it is vital to establish their provenance both to ensure that they originate from a traceable source rather than from the unauthorised destruction of another historic building, and that they were originally used externally. It is sometimes possible to source replacement bricks from elsewhere within the structure or contemporary structures within the curtilage. However, an expert assessment should be sought on the various implications of this (including structural, ethical and legal issues) ahead of official authorisation.

Most reclamation companies do not accept liability for faults and, unlike new bricks, reclaimed do not have to meet test regulations to determine their performance. It is important, therefore, that all the reclaimed bricks are carefully inspected to ensure they are 'fit for purpose'. A pallet of reclaimed bricks may contain various grades, including bricks that were only ever intended for internal walling and which would quickly deteriorate if exposed to the weather. Here, the experience and judgement of a good craftsman is vital.

### MODERN REPLACEMENT BRICKS

If the decision is taken to use modern bricks to match Tudor originals, it is important to locate a traditional brickyard excavating similar topmost clays and a commitment, as far as is practical, to manufacturing the bricks required as closely as possible to the original methods. Unfortunately, replacement bricks are sometimes moulded too accurately so that their uniform texture and sharp arrises lack the all-important irregularities of the surrounding originals. The bricks produced by more efficient modern kilns and fuel types can also be too regular in colour, lacking the subtle tones and shades associated with up-draught kilns.

To produce the most authentic period bricks, it is necessary to mould with less precision and to recreate the historic method of firing by using the kind of kiln or open clamp that any Tudor brickmaker would recognise. Modern fuels achieve much higher temperatures than were possible in the 16th century so it is preferable to go back to timber

as the fuel. This has been undertaken at the Buckinghamshire brickyard of HG Matthews (see illustration) where the bricks lining the fire-tunnels naturally acquire the glossy grey 'potash' glaze that is commonly found on many of the bricks in a Tudor building. The effect, which is not achievable using coal as the fuel, is caused by the formation of chemicals as the timber burns. These probably act as a flux on the surface of the hottest bricks, allowing superficial vitrification, the fusing of mineral crystals to form a glaze, and binding some of the ash in the process.

Similar effects can be achieved by employing methods once traditionally used for the production of imitation flared 'headers' in brick tiles. These tiles, which are also called mathematical tiles, were sometimes used in the 18 and 19th centuries to face earlier buildings to mimic the fashionable appearance of contemporary brickwork. The 'header' tiles were coated with fluxes such as alkaline potash and then re-fired. Although less authentic than the effect of true wood firing, the technique has been successfully used to produce bricks for conservation work.

### MORTARS

A wide range of building limes is now available for mortars for use in the repair or re-pointing of Tudor brickwork. Lime is the product of firing some form of calcium carbonate ( $\text{CaCO}_3$ ) at around  $900^\circ\text{C}$  to drive off the carbon dioxide ( $\text{CO}_2$ ) to become calcium oxide ( $\text{CaO}$ ) or 'quicklime' which, with added water, is then hydrated to form either a powder (dry-hydrate) or, with an excess of water, to form putty. The material is now lime and it can be used as a binder with a filler (usually sand) to make mortar, plaster or render.

There are two basic types of building lime, both of which are covered by BS EN 459-1:

**Air lime** (sold as lime putty) is made from a limestone containing approximately 95 per cent pure calcium carbonate. This class of lime only hardens by carbonation, through re-absorbing carbon dioxide from the atmosphere to return to calcium carbonate (but now in the form of mortar not stone) in a process known as the 'lime cycle'. Air lime is incapable of hardening below water where it is removed from the effects of the atmosphere. Other craft names for it are 'high-calcium', 'fat' or 'rich' lime, and it is often referred to as 'non-hydraulic' lime or simply by the abbreviation CL – 'calcium lime'.

**Natural hydraulic lime (NHL)** is made from sources of calcium carbonate naturally containing varying amounts of silica and some alumina that, in firing, become reactive with calcite (crystalline calcium carbonate). The initial set that occurs arises from the combination of these compounds with water to form a new crystalline matrix. In addition, the lime follows the lime cycle, hardening as it carbonates. It is the first set which enables these mortars to set deep within a structure where there is little available carbon dioxide, and even under water (hence 'hydraulic'). The higher the silicate content the quicker and stronger the set. The natural hydraulic limes currently

utilised in conservation today are divided into three classes of ascending strength: NHL<sub>2</sub>, NHL<sub>3.5</sub> and NHL<sub>5</sub> (the numerals relate to the compressive strength in  $\text{N/mm}^2$  at 28 days). These are available as bagged dry-hydrates. The term 'natural' is significant as there are now two other designated classes of lime: hydraulic limes (HLs) which are permitted under BS EN 549-1 to contain up to 10 per cent undeclared content, including cement; and 'formulated lime' (FLs) which are blends of calcium hydroxide and a range of performance enhancing materials such as cements and pozzolana. Neither should be used in the repair of historic fabric.

Generally, repair mortars should match the existing as closely as possible in mineral composition, texture and strength, except where attributes are linked to its failure. A preliminary analysis can be carried out as an on-site visual appraisal using knowledge of the local geology of historic building limes and sands to determine a suitable replacement. A better method is to send mortar samples for analysis by a reputable laboratory. The results can provide a vital tool in accurately determining data to aid specification, such as:

- class of binder
- aggregate type, size and grading
- ratio of binder to aggregate
- other inclusions.

Only complete sections of bed mortar (typically  $100 \times 150\text{mm}$ ) should be sent for analysis. These are first studied under a microscope before removing the lime binder using 'acid digestion'. The residue (principally mineral aggregates) is then washed, dried and graded within a stack of British Standard test sieves to determine the range of aggregates. The information revealed by these simple steps is usually sufficient for the specification of a replacement lime and sand mortar suitable for its intended purpose and compatible with the surrounding original. More sophisticated analyses such as electron-scanning microscopy and x-ray diffusion can also be successfully employed.

Although lime to sand ratios are often described as 1:3, analysis reveals that most historic mortars were far more lime-rich, with most ratios averaging between 1:1 and 1:2 (see the author's article, 'The Myth in the Mix: The 1:3 ratio of lime to sand' in *The Building Conservation Directory*, 2007 and online at [www.buildingconservation.com](http://www.buildingconservation.com)).

### RE-POINTING

Where Tudor brickwork is concerned, re-pointing should never be undertaken lightly. Re-pointing should only be considered if the depth of erosion is greater than the width of the joint, or if the joints are allowing sufficient water ingress to cause interior damp. As the thick joints on Tudor brickwork can constitute 25 per cent of the wall surface area, inappropriate and/or poorly applied re-pointing can seriously impact the aesthetics of the brickwork, over-emphasise the joints, and detract from the overall charm of the Tudor building.

If re-pointing is deemed necessary, joints



*A traditional open clamp at the brickworks of HG Matthews: bricks from an earlier firing, with their characteristic flared headers, are stacked in the foreground*

must be carefully cut back to a squared seating at least 2.5 times the width of the average bed joint thickness (38mm for a typical 15mm joint width). Joints are then brushed or vacuumed clean of debris and well dampened but not saturated. The choice of lime and sand for the mortar and mix ratio must be specified on a 'suitability of purpose' criterion. The joint profile is important too. It might be an exposed aggregate, finished just back from the face of the brick to match the appearance of the surrounding mortar. On a complete re-point of an elevation, however, an opportunity exists to consider sympathetically recreating the established original 'struck' or double-struck' profile.

Re-pointing must not be carried out if there is a risk of frost and, once completed, the re-pointed joints must be suitably protected until they have sufficiently cured to ensure that they are not damaged by the elements; and particularly the effects of driving rain.

All historic brickwork is important and deserves sympathetic treatment and careful repair by knowledgeable and skilled specialists. Tudor brickwork, however, is particularly rare and deserves the highest level of care, both for its character and its historical significance. Fortunately, brick is a highly durable material and if properly pointed and suitably repaired Tudor examples should last for many more centuries.

**GERARD LYNCH MA PhD, master brickmason and historic brickwork consultant (see page 94), and author, trained through the apprenticeship system and at Bedford College where he later became Head of Trowel Trades. He is internationally recognised for his extensive specialist knowledge and skills in the conservation, repair and re-pointing of traditional and historic brickwork.**

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HISTORIC BRICKWORK CONSULTANT: Gerard Lynch is an internationally acknowledged historic brickwork consultant and master bricklayer, offering a comprehensive consultancy and bespoke craft training courses in his workshop or on site as required. He lectures on historic brickwork and its conservation, and runs master classes embracing his extensive practical skills, covering historic, modern, gauged and decorative brickwork and traditional pointing methods. He is frequently relied on by heritage bodies, architectural practices and lay people to provide reports on brickwork, methods of sympathetic repair and conservation, and training for craftsmen. Author of *Gauged Brickwork a Technical Handbook*; *Brickwork: History, Technology and Practice* volumes 1 & 2 (Donhead) and *The History of Gauged Brickwork: Conservation, Restoration and Modern Applications*. *See also* Tudor Brickwork on page 91.

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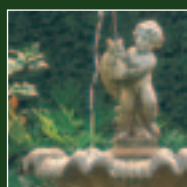
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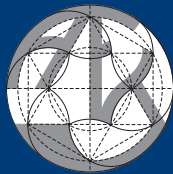
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STONE: *See also: display entry in Masonry Cleaning section, page 151.*

## STONE continued

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## STONE continued



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STONEMASONS: See also: display entry on this page.

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## STONE continued

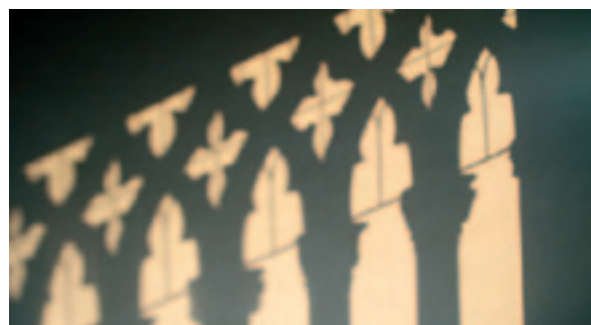


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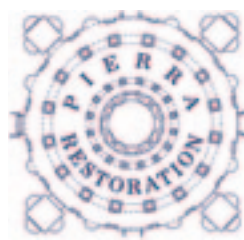
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Tel 07522 347543

Email [info@vaconservation.com](mailto:info@vaconservation.com)

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STONE: *See also: display entry in this section, page 103.*

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# GUIDANCE ON MATCHING TERRACOTTA

STEVEN HANDFORTH

**B**RITISH STANDARD 8221-2: 2000 makes clear that in conservation work replacement units must match the originals as closely as possible in terms of surface colour, texture and finish. This article explores the problems and potential resolutions associated with meeting this standard where architectural terracotta is concerned.

Replacing historic fabric is always a contentious issue and should be the last resort. When necessary, with naturally occurring vernacular materials such as wood or stone, accurate replacements can often be readily sourced and, although the difference in material will be noticeable, structural integrity will not have been compromised by the material. However, with the increasing standardisation of manufacture, difficulties in implementing this advice for man-made materials are far more complex.

## REPAIR OR REPLACE?

In England, statutory guidance advocates that 'original materials normally only need to be replaced when they have failed in their structural purpose' (*PPS5 Planning for the Historic Environment: Historic Environment Planning Practice Guide*, Section 6, para 149). Repair is always the preferred option but terracotta can be very difficult to repair adequately. Mortar repairs are often found on terracotta structures due to their relative ease of application. However, the surface texture will rarely match that of the smooth terracotta and although colour matches can be achieved, over a period of time this colour will be bleached through exposure to ultraviolet light and erosion. Another common 'repair' technique is the use of paint, which is often applied to obscure discoloured terracotta. This presents a homogenous appearance that is often conspicuous when compared to existing blocks. Newly developed filler materials and consolidants which include polymeric binders are becoming increasingly common, although their longevity is unproven.

There is a widespread misconception that once the fire-skin of a terracotta block has been eroded, either through natural weathering or insensitive cleaning, the integrity of the block beneath is compromised and it should be replaced. Although this is true for certain types of terracotta, such as the under-fired pink Doulton pieces, most Victorian and Edwardian terracotta was fired at such high temperatures and consistently enough that the removal of the skin has little effect on durability.



*A finial on the London Road Fire Station, a Grade II\* listed building in Manchester which is on the Buildings at Risk Register (Photo: Jonathan Taylor)*

Terracotta is susceptible to a multitude of failure mechanisms that stem from its method of manufacture and how it is fixed to a building. The problem with repairing terracotta units is that deficiencies in the wares are often internal, caused by

rusting cramps or dowels, expanding fills, freeze-thaw damage or salt crystallisation (cryptoflorescence) for example. Such problems can compromise the entire unit and often repairs cannot be carried out without damaging or destroying the originals.



Hand-pressed terracotta units often vary in depth because of the way they are formed.  
(All photos on this page: Steven Handforth)



Early replacement works often appear homogeneous with no colour variation between blocks.

For both aesthetic and structural reasons, terracotta units are often replaced in these circumstances. The question that must then be asked is: to what extent can they be accurately matched?

### CONSERVATION HISTORY

After the First World War architectural terracotta fell out of fashion and by the mid 20th century its manufacture had virtually ceased. The manufacturers that survived did so by branching out and making other architectural ceramics such as sanitary ware. Around the end of the 20th century the demand for terracotta increased as a result of the deterioration of existing architectural terracotta alongside the increasing recognition of the importance



'Authentic' under-fired pink terracottas are no longer produced due to their inherent weaknesses.

of Victorian and Edwardian architecture and demand for its conservation. During the mid to late 20th century a large number of terracotta structures were subjected to inappropriate remedial works. The first and most widespread of these was the use of inappropriate cleaning techniques including hydrofluoric acid cleaning and sandblasting. The former often caused surface streaking, while the latter led to the erosion of the fire-skin, leaving a pitted surface.

The new units employed during this period were far from adequate, reflecting the manufacturers' lack of experience. Due to the difficulty in matching existing terracotta units, replacement pieces often had a uniform layer of tinted clay (an 'engobe') applied to the surface resulting in a homogenous colour. In some cases a glaze was inappropriately applied resulting in an excessively glossy surface. A number of structures also had replacements made with other materials such as glass-reinforced plastic, although thankfully this practice now seems to be universally frowned upon.

Today, with ever-increasing demand for the material in conservation work and new-build alike, the quality of the new units is of a much higher standard. Despite this the conservation professional

must be aware of both the potential and the limitations of these new materials.

### MATCHING NEW TO OLD

The first problem is matching the plethora of different types of terracotta that were historically produced. The colours can range from dark reds, to browns, to buffs, to whites. Secondly, the variation of colour within each block can differ widely from the mottled appearance of the terracotta used for Edmund Sharpe's early 19th century 'pot' churches to the more homogenous appearance of the later Victorian wares. To add further confusion, the texture of the blocks can vary from smooth skins to undulating surfaces caused by vagaries in the manufacture and firing process. Finally, the original finish of the pieces could vary from smooth ashlar blocks to tooled or combed surfaces imitating stoneware.

In addition to provenance and manufacturing concerns, the conservation specialist may struggle to identify the original colour on first inspection due to heavy soiling or inappropriate cleaning. Surface deposits caused by pollutants often obscure the surface of terracotta, particularly in urban areas. On the other hand, the colour of blocks which have been cleaned may be difficult to identify due to streaking from insensitive acid cleaning, or a pitted surface from sandblasting, and some structures were so extensively cleaned that their colour has been completely bleached.

### CLAY SOURCING

According to modern conservation principles, replacement materials should be as authentic as possible, manufactured from the same clays and mixture of grogs (fired clay ground to a specified particle size and added to unfired clay to reduce shrinkage). They should also be modelled and moulded in the same way, and fired using the same methods as the original units.

Historically, clay sources would have been extensive thanks to the large number of manufacturers, which peaked in the mid to late 19th century. Today, due to the shortage of manufacturers, there are far fewer clay banks used for terracotta replacements than in the Victorian period. In addition, manufacturers use a limited number of clays as their tolerances and shrinkage rates are understood.

This is important because new blocks need to work to specific tolerances, compressive strengths and frost resistances in compliance with the *European Standard Specification for Clay Masonry Units* (EN 771-1). Although BS 8221-2:2000 highlights the significance and importance of using different clays, the imposition of standards such as EN 771-1 has actually resulted in suppliers using fewer clays. The requirement for durability has also had an impact on the production of authentic under-fired units such as early Victorian wares or pink Doulton products.

Visually this is not necessarily a problem, however, as extensive laboratory analysis is often used to identify oxides or colourants that can be added to the clay recipes to provide as accurate a match as possible. In any event,

the chances of obtaining the original clays and manipulating them in the same way are extremely low. Units produced using modern methods would almost certainly appear very different to the units they are trying to replicate. There is also evidence that chemical additives were used in the late 19th century, providing a precedent for their use today.

### MOULDING

Historically, methods of terracotta manufacture varied. Early 16th century wares were produced using timber moulds, while Victorian wares were often made using plaster casts. Modern manufacturers can replicate these techniques, with the clay being hand pressed into the moulds to a depth of approximately 25mm–50mm. Another modern technique is the slip casting method, where a liquidised clay mix (or 'slip') is poured into a porous mould and left to set, providing a uniform depth to the body. Of the two methods, slip casting is the most recent although its origins are over 100 years old. There are slight differences between the two processes with slip casting often giving a more smooth and sharp appearance. Other benefits of this method are that it creates a more uniform depth to the terracotta block and reduces the risk of air pockets, which are more common with hand-pressed wares and often lead to later laminations. It is therefore important for the conservation professional to sample the different types of ware to get an accurate match to existing units depending on their requirements. Undulations are also still possible in both techniques, often caused by slumping during the manufacturing process.

### FINISH

Matching the finish of terracotta is normally the most straightforward part of the process. In the early 19th century terracotta was used to imitate stone and would often incorporate tool marks on its surface. This can still be achieved through similar methods and is undertaken prior to firing.

### FIRING

Historically, terracottas would be fired in down-draught, muffle or Hoffman kilns, none of which produced particularly even firing temperatures. As the colour of natural clays changes substantially with firing temperature, the appearance of the wares would vary depending on their position in the kiln. However, modern demands for uniform, regular and reliable products have resulted in better kilns. The most common method of firing is now the shuttle kiln, which is an intermittent, low thermal mass, gas-fired structure. This creates a uniform heat removing any variations in the appearance of the terracotta blocks. To create a match for less evenly fired originals, in addition to using colourants, colour variation between batches can be achieved by using slightly different firing temperatures.

There are benefits to using these modern kilns in terms of the structural stability of the terracotta produced. The higher uniform firing temperatures dictated by EN 771-1 remove

all the sulphates from the clay, reducing the risk of efflorescence appearing on the surface of the ware. Higher firing temperatures also result in a denser body, which in turn makes the block more resilient to weathering and freeze-thaw damage. While in the Victorian period it might have been necessary to make two to three pieces of a unique unit in case of defects, modern manufacturers benefit from low wastage and high yields.

### THE BEST AVAILABLE SOLUTION

Although there are only a few manufacturers left, and despite their reliance on significantly different production processes, the modern architectural terracotta manufacturing industry has never had better conservation credentials. Its output in terms of matching is often of a high quality, with detailed research undertaken to ensure accuracy. Ironically, if original techniques were used, the chances of producing accurate replicas would be far slimmer because of the many variables that influence the appearance of Victorian and Edwardian terracotta. Modern regulations and production techniques may have ruled out the use of truly accurate replica materials, but they have enabled us to produce accurate visual matches using durable materials that are more resilient to weathering.

Although the process used in terracotta manufacture today is not in keeping with conservation best practice in terms of its sourcing and integrity, the products being made today are far superior to those of recent

decades. Problems with identifying the provenance of the unfired material combined with financial and regulatory constraints mean that the process currently employed is the best available.

### Recommended Reading

- J Ashurst and N Ashurst, *Practical Building Conservation, Volume 2: Brick, Terracotta and Earth*, Gower Technical Press, Aldershot, 1988
- British Standard 8221-2:2000, *Code of practice for cleaning and surface repair of buildings Part 2: Surface repair of natural stones, brick and terracotta*, 2000
- J Fidler, 'Fragile Remains: An International Review of Conservation Problems in the Decay and Treatment of Architectural Terracotta and Faience', in *Architectural Ceramics; Their History, Manufacture and Conservation*, James and James Ltd, London, 1996
- GR Hollis, 'Manufacturing Faience and Terracotta', in *Context*, Issue 52, 1996
- PPS5 *Planning for the Historic Environment: Historic Environment Planning Practice Guide*, EH/DCLG/DCMS, London, 2010
- M Stratton, *The Terracotta Revival*, Victor Gollancz, London, 1993

**STEVEN HANDFORTH MSc is estate manager of the Victoria and Albert Museum and oversees large-scale conservation projects at the museum along with day-to-day fabric issues. Email [steven.handforth@gmail.com](mailto:steven.handforth@gmail.com)**



*This modern slip-cast example shows natural imperfections in the block.*



*Mortar repairs often become unsightly as their pigments are bleached by exposure to ultraviolet light.*



*Sandblasting of terracotta units often leads to a pitted surface. Due to the temperature and duration of firing, the internal body of the block is still resilient to weathering. (All photos on this page: Steven Handforth)*

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2	wg	clear glass
	ef	etched or frosted glass
3	gp	glass protection/grilles

WINDOWS & DOORS	Page	1	2	3		
Bramah	116			lk	wf	
Britannia Architectural Metalwork Ltd	111		mw			
Bronzework	111			wf		
C J L Designs	126		mw	gp		
C R Crane & Son Ltd	128	td	tw			
C S C Window Films & Blinds	128			so	wf	
Calibre Metalwork Limited	111		mw			
Carpenter Oak & Woodland Co Ltd	74	td	tw			
The Cast Iron Company	136		mw	rl		
Castaway Cast Products and Woodware	112		mw			
Charles Collinge	117			wf		
Charles Lightfoot Ltd	126			gp		
Chiverton	63	tw				
Chris Topp & Co Ltd	112			wf		
The Cotswold Casement Co	124		mw			
Crittall Windows	124		mw	wf		
Fabco Sanctuary Ltd	128		mw	gp		
The Fine Iron Company	113		mw	gp	wf	
Glasgow Steel Nail Co Ltd	151			wf		
Hargreaves Foundry Ltd	84		mw			
Holdsworth Windows Ltd	124		mw	wf		
Ingarsby Conservation Ltd	142			wf		
Joseph Giles	117			wf		
Kierson Sash Window & Timber Restoration	128	tw				
Knowles & Son (Oxford) Ltd	67	td	tw			
Longden	129	td				
Lumen Rooflight	86			rl		
M B L	116			lk	wf	
Malbrook Conservatories	134	td	tw		rl	
Marsh Brothers Engineering Services Ltd	114		mw	rl		
Mike Honour Windows	125		mw	wf		
Mumford & Wood Ltd	129	td	tw			
Nick Bayliss (Architectural Glass) Ltd	126		mw			
Nigel Saunders Windows	125		mw	rl		
Norgrove Studios Ltd	118		mw	gp		
Orveta Products	142	td		wf		
Oxford Sash Window Co Limited	129	tw		dr		
Paxton Restoration Ltd	130	td	tw			
Peter S Neale Blacksmiths	115		mw	gp		
R W Armstrong	69	tw				
Recclesia Stained Glass	127		mw	gp	rl	sk
Reddiseals	117			dr	wf	
Refurb-A-Sash	128	tw		wf		
The Rooflight Company	87			rl		
Rundum Meir	125	td				
Sash Restoration Co	130	tw				
Sash Window Conservation Ltd	130	tw				
Selectaglaze Ltd	118			sk		
Steel Window Service and Supplies Ltd	125		mw	wf		
Steve Sherriff Stained Glass	127		mw	gp		
Vale Garden Houses	125		mw			
Walden Joinery	133	td	tw			
William J Gowar & Company Ltd	128			gp		

PRODUCT CODES		rl	roof lights
td	timber doors	lk	locksmiths
tw	timber windows	sk	secondary glazing
mw	metal windows	so	solar films & blinds
dr	draught proofing	wf	ironmongery
gp	glass protection		

TIMBER SUPPLIERS	Page	1	2	
Agrell Architectural Carving	133		tm	
Antique Bronze Ltd	109		tp	
Antique Buildings Limited	142	ti		
Artisan Plastercraft Ltd	185		bt	
Babylon Tile Works	83		bt	
Bosence & Co	46		bt	
Carpenter Oak & Woodland Co Ltd	74	ti	bt	tm

The Cleft Wood Co	131	ti	bt	
Clive Beardall Restorations Ltd	178		ve	
Cornish Lime Company Ltd	157		bt	
Coyle Timber Products	131	ti	bt	
E G Swingler & Sons	82		bt	
E I Flood & Sons	186		bt	
English Woodlands Timber Limited	131	ti	bt	tp
Ingarsby Conservation Ltd	142		bt	
Longden	129		tm	
Mike Wye & Associates Ltd	158		bt	
Minerva Stone Conservation	100		bt	
Milestone Lime Plastering	187		bt	
The Traditional Lime Co	159		bt	
Vastern Timber Co Ltd	131	ti		
Walden Joinery	133		tp	
Weald and Downland Open Air Museum	131	ti		
Weldon Contracts Limited	180	ti	tp	
Whippetree Hardwoods	131	ti	bt	tp
Womersley's Limited	157		bt	

PRODUCT CODES		
1	ti	timber suppliers
	bt	laths, battens & tile pegs
2	tm	timber mouldings
	tp	timber & parquet flooring
	ve	veneers

FINE JOINERY & CABINET MAKING	Page	1	2		
Agrell Architectural Carving Ltd	133		wc		
Anelays – William Anelay Ltd	132	jo			
Anthony Beech Furniture Conservation and Restoration	178		cb		
B Antoniw Carpenter & Joiner	132	jo			
Bakers of Danbury Ltd	60	jo			
Banisters of Bath	132	jo	bn	cb	wc
Between Time Ltd	62	jo	wc		
Boshers (Cholsey) Ltd	61	jo			
Busby's Builders	62	jo			
C R Crane & Son Ltd	132	jo	bn		
Carpenter Oak & Woodland Co Ltd	74		wc		
Carrek Limited	132	jo			
Carvers & Guilders Ltd	133		wc		
Charles Oldham Fine Woodcarving	133		cb	wc	
Chiverton	63	jo			
Clive Beardall Restorations Ltd	178		cb	jp	
Clough Harris Limited	172	jo			
Country House Renovations Limited	63	jo			
D B R (London) Limited	64	jo			
Dunne and Co Building & Restoration	66	jo			
Fisher Bullen	64	jo			
Foster & Pearson Limited	135	jo	cb		
Grosvenor Construction Ltd	64	jo			
H K Askew & Son	66	jo			
Hall Construction Limited	64	jo			
J & W Kirby	74	jo			
J P Ladell Ltd	67	jo			
Knowles & Son (Oxford) Ltd	67	jo	cb		
Longden	129	jo			
Luard Conservation Limited	172	jo	wc		
Melcombe Regis Construction SW Ltd	68	jo			
Mike Honour Windows	125	jo			
Millway Builders Ltd	68	jo			
Owlsworth I J P	69	jo	wc		
Paxton Restoration Ltd	130	jo			
Pembrokeshire Thatch & Carpentry Services	83	jo			
Period Property Solutions Building Conservation Limited	69	jo			
R J Smith & Co	69	jo			
R W Armstrong & Sons Limited	69	jo			
Romark Interiors	179		cb	jp	wc
Sandy & Co (Contractors) Limited	70	jo			
Sash Restoration Co	130		cb		
Simmonds of Wrotham	70	jo			
Stonewest Limited	73	jo	cb		
Treasure & Son Ltd	72	jo			
Triton Building Conservation Ltd	73	jo			
Walden Joinery	133	jo	bn		
Westland London	165		wc		
Winterton Restoration	132	jo			

SERVICE CODES		
1	jo	fine joinery
2	bn	banisters
	cb	cabinet making
	jp	timber panelling
	wc	wood carving



## METALWORK

### ■ ANWICK FORGE

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Email [info@anwickforge.co.uk](mailto:info@anwickforge.co.uk)  
[www.anwickforge.co.uk](http://www.anwickforge.co.uk)

TRADITIONAL SKILLS: Conservation, restoration and reinstatement of historical architectural and decorative wrought and cast ironwork using traditional skills. Consultancy and specification. Recent commissions include reinstatement of ironwork to listed town houses in Notting Hill and Primrose Hill and reinstatement/restoration of ironwork to a listed grammar school in Louth.

### ■ ARCHITECTURAL METAL DESIGNS LTD

224-227 Fielding Street, London SE17 3HE  
Tel 020 7703 6633 Fax 020 7703 2626  
Email [patricia.southwell@virgin.net](mailto:patricia.southwell@virgin.net)  
[www.architecturalmetaldesigns.co.uk](http://www.architecturalmetaldesigns.co.uk)

ARCHITECTURAL IRONWORK USING TRADITIONAL TECHNIQUES: Over the past 50 years Architectural Metal Designs has worked on some of the most prestigious historic buildings in London, manufacturing and site-fixing cast and wrought iron work to exactly replicate the original in all aspects. The company also specialises in renovating ironwork, natural stone plinths and brick walls using only traditional techniques. Contracts have included museums, garden squares and churches, in one instance dating back to the Norman period, as well as a wide range of listed private dwellings.

### ■ BARR & GROSVENOR LTD

Jenner Street, Wolverhampton, West Midlands WV2 2AE  
Tel 01902 352390 Fax 01902 871342  
[www.bng-ltd.co.uk](http://www.bng-ltd.co.uk)

ARCHITECTURAL CAST IRON: Barr & Grosvenor Ltd is one of the few remaining foundries with the skills and patience to produce complex items as used in Victorian times. The company is involved at all stages in restoration projects requiring castings, whether still existing or long since removed. Its services can help stabilise, restore or recreate castings for all purposes. Most of its work is made to order so that essential attention to detail is guaranteed. Specification advice, project management, pattern making, casting, machining, paint finishing and site fitting are all available. Group open days by appointment.

### ■ BRISTOL FOUNDRY

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Tel 0117 980 3360 Mobile 07796 067513  
Email [bristolfoundry@btinternet.com](mailto:bristolfoundry@btinternet.com)  
[www.bristolfoundry.com](http://www.bristolfoundry.com)

PRODUCERS OF ARCHITECTURAL AND DECORATIVE CASTINGS: Established in 2005, Bristol Foundry specialises in creating castings in ferrous and non-ferrous metals. The foundry can create castings from originals and can also supply patterns.

### ■ BRITANNIA ARCHITECTURAL METALWORK LTD

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Tel 01420 84427 Fax 01420 89056  
Email [info@britannia.uk.com](mailto:info@britannia.uk.com)  
[www.britannia.uk.com](http://www.britannia.uk.com)

ARCHITECTURAL CAST IRON AND METALWORK: Britannia's company of architectural metalworkers not only has its own green sand foundry but also offers a complete metalwork service for all aspects of conservation and repair; from the initial site visit to final installation. The company offers a design consultancy service and owns a large collection of original Georgian and Victorian patterns, ideal for projects requiring replica castings. *See also: display entry on this page.*

## Britannia Architectural Metalwork Ltd

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Phone 01420 84427 Fax 01420 89056 Website [www.britannia.uk.com](http://www.britannia.uk.com)



### ■ BRONZEWORX

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[www.bronzework.co.uk](http://www.bronzework.co.uk)

STRUCTURAL AND DECORATIVE WORK IN BRONZE: A division of Classic Marine, Bronzework specialises in the casting and fabrication of bronze and associated alloys. Design, patternwork, machining, fabrication and finishing are all undertaken in house to clients' specifications. Bronzework's pieces combine strength, attractiveness and longevity. The wide range of surface finishes available combined with natural or deliberate patination and/or plating, means that bronze can be formed and finished to suit your specific needs.

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[www.calibremetalwork.co.uk](http://www.calibremetalwork.co.uk)

METALWORK: Calibre Metalwork Limited is a new company specialising in metalwork restoration and conservation. With decades of practical experience, the Calibre Metalwork team delivers conservation and restoration works to the standards expected by English Heritage. The company also manufactures and fits bespoke, new-build installations where a high standard of traditional craftsmanship is required, particularly in listed buildings and conservation areas. A consultancy service assists project specifiers at an early stage with condition reports and budget pricing. The team prides itself on meeting deadlines and budgets. Enquiries are welcomed from local authorities, heritage organisations, main contractors and private clients.



## ARCHITECTURAL METALWORK

The Cast Iron Company offers a wide range of traditional metalwork designs produced by skilled craftsmen. We produce both standard and bespoke work, providing a complete turnkey solution from design through to erection. Our quality service accommodates the reproduction of individual items and the production of new designs and integrated schemes.

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Work is produced in cast iron, ductile iron, bronze, aluminium, mild steel and wrought iron. Design drawings, fully equipped workshops and on-site working and restoration services are all provided with the Cast Iron guarantee of quality.

### Expertise

The Cast Iron Company has impressive expertise in reproducing and conserving the built environment. The company regularly works with, and is specified by:

- ~ Cadw ~ English Heritage ~ Historic Scotland
- ~ as well as conservation officers from many local authorities.

We also offer a consultancy service which includes technical reports and recommendations on the conservation of all types of architectural metalwork.

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 Fax: 01483 229 088  
 e: [info@castiron.co.uk](mailto:info@castiron.co.uk)  
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### ■ CASTAWAY CAST PRODUCTS & WOODWARE

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**Tel/Fax 01469 588995**

**Email [castawaycastproducts@btinternet.com](mailto:castawaycastproducts@btinternet.com)**

CAST METAL PRODUCTS INCLUDING BESPOKE ITEMS: Supplying nationwide, Castaway undertakes any cast metalwork project using aluminium, bronze and gun metal, grey and nodular (SG) iron, carbon steels and stainless steels. Castings for historic buildings include gutter sections and other drainage ware, airbricks, wall retaining plates, brackets, gates and railings, signage, window frames and much more. Items can be made from drawings, photographs or from sight of originals – broken, corroded or intact. Items can be made from standard existing patterns or to your own designs in any quantities; from one upwards. In-house pattern making facilities are available if required. Contact John Wade to discuss your requirements in detail.

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**METALWORK** continued**WROUGHT IRON** RESTORATION**WROUGHT IRON** DESIGN

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ACCREDITED CONSERVATORS AND CONTRACTORS FOR ARTISTIC, ARCHITECTURAL AND MARINE METALWORK: Eura is highly experienced in the repair and restoration of leaded, iron and bronze windows. It also undertakes repairs to historic timber windows, matching profiles of existing mouldings. The company has conserved the Lutyens bronze windows at Castle Drogo, and repaired and made safe the 17th century wrought iron windows in the Monument to the Great Fire of London. Eura has a modern glass kiln where it can replicate antique glass effects to closely match missing or broken panes. It also undertakes in situ lead repairs on historic roofs, steeples and rain goods. *See also: display entry on this page.*

■ **THE FINE IRON COMPANY**

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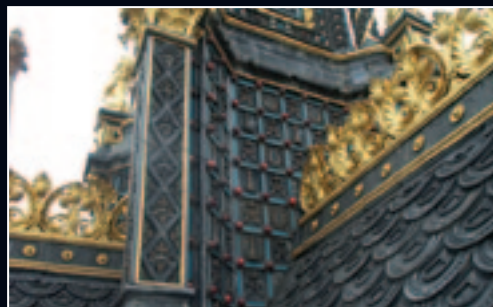
www.fineiron.co.uk

MANUFACTURE AND RESTORATION OF ARCHITECTURAL AND ORNAMENTAL WROUGHT IRON, CAST IRON AND NON FERROUS METALS: Fine Iron's team of experienced architectural blacksmiths offers a full design, drawing and sample service. Clients include local authorities, building contractors, developers, architects, conservation officers, interior designers, churches, museums, schools and other public buildings. *See also: display entry on this page.*

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**METALWORK** continued



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[www.blacksmiths-shop.co.uk](http://www.blacksmiths-shop.co.uk)

BLACKSMITHS: George James & Sons is a family business with considerable experience in the restoration of historic wrought and cast ironwork. It was established in 1841 and is still working from the same forge in Northamptonshire. The firm has a reputation for producing specialist ironwork of a high quality using traditional skills and materials and has successfully undertaken a wide range of unusual projects, please see the website for more details. Services offered include assessment and condition report writing of historic ironwork, planned programmes of maintenance, sympathetic restoration and conservation.

**■ GROSVENOR, MEEHAN & LAING ASSOCIATES LTD**

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[www.gml-associates.co.uk](http://www.gml-associates.co.uk)

HISTORIC METALWORK CONSULTANTS: See also: profile entry in *Heritage Consultants section, page 40.*

**■ HODGSONS FORGE DECORATIVE METALWORK & RESTORATION**

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[www.hodgsonsforgo.co.uk](http://www.hodgsonsforgo.co.uk)

HAND FORGED WROUGHT IRON SPECIALISTS: Master blacksmiths for five generations and now a partnership of Colin and Ian Hodgson, this family-run business is proud of the quality of its work and the service it provides. Its range of products covers all estate, domestic and industrial applications. All site work is undertaken including the dismantling and installation of ironwork. Hodgsons Forge can design or reproduce the most complex features including fine tracery work and wrought iron reproduction using traditional blacksmithing methods. Recent commissions include refurbishing ironwork Sandringham Estate, Norfolk.

**■ J H PORTER & SON LTD**

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Email [info@jhporter.co.uk](mailto:info@jhporter.co.uk)  
[www.jhporter.co.uk](http://www.jhporter.co.uk)

BLACKSMITHS: After 60 years in Kensington J H Porter & Son moved its forge to larger premises. The company manufactures, restores, reproduces and repairs gates, railings, balustrades, balconies and staircases, together with security grilles, antiques, indoor/outdoor furniture etc. It works to its own or to clients' traditional or modern designs. Commissions include work for antique restorers, architects, artists, builders, churches, designers, English Heritage, estate managers, London Transport, the National Trust, photographers, shop-fitters and the general public. A workforce of five blacksmiths produces ironwork to a very high standard.

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STRUCTURAL AND DECORATIVE CAST IRON: Marsh Bros provides a specialist service to restore decorative and structural cast iron components. The work undertaken includes staircases, railings, gates, windows and cast iron roof structures for lantern and atrium roofs. Also, restoration and repair of cast iron bridge parapets, facades and arch castings. Marsh Brothers provides a bespoke supply and design service to restore and manufacture identical replacement parts where loss or damage has occurred. The company covers all areas of the UK and principal customers include county councils, Crown Estates and major civil contractors.

## METALWORK continued



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IRON FOUNDER ARCHITECTURAL: Mather & Smith is probably the oldest established architectural iron founding and metal working specialist in the UK, dating back to 1675. Mather & Smith specialises in the conservation and restoration of all cast iron and wrought iron structures utilising its in house black smith, ferrous and non ferrous foundries. Recent works include the restoration of railings at a heritage castle, restoration and gold leafing of an astrolabe globe and iron works at a prominent cathedral. See also: *display entry in this section, page 114.*

■ **RICHARD ROGERS CONSERVATION LIMITED**

Unit 2, Mole Business Park, Randalls Road, Leatherhead,  
Surrey KT22 7BA

Tel 01372 805751 Fax 01372 388222

Email richard@rrconservation.co.uk

www.rrconservation.co.uk

CONSERVATION OF METALWORK AND FINE ART OBJECTS: See also: *profile entry in Fine Art Conservators section, page 174.*

■ **RUPERT HARRIS CONSERVATION**

Studio 5, No 1 Fawe Street, London E14 6PD

Tel 020 7515 2020 Fax 020 7987 7994


Email mail@rupertharris.com

www.rupertharris.com

CONSERVATORS OF FINE METALWORK AND SCULPTURE: Includes bronze, lead, zinc and electrotype, contemporary art, fine ironwork, casting, replication, security fixings and maintenance. Advisor to the National Trust since 1982. Other clients include museums, art galleries, architects and private collectors. Accredited member of Icon. See also: *display entry in Bronze Statuary section, page 109.*

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www.shepleyengineers.co.uk

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**METALWORK** continued■ **SHEPLEY ENGINEERS LIMITED**

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Email [engineers@shepley.vhe.co.uk](mailto:engineers@shepley.vhe.co.uk)

[www.shepleyengineers.co.uk](http://www.shepleyengineers.co.uk)

ARCHITECTURAL METALWORK RESTORERS AND CONSERVATORS: Shepley Engineers has been responsible for engineering faithful and innovative solutions for many major architectural restoration projects. The company offers a comprehensive range of services acting as consultant, designer, contractor or as principal contractor depending on the size and specific requirements of the scheme. Major projects completed or in progress include: Smithfield Market, London; The Curvilinear Range at the Botanical Gardens, Dublin; The Palm House at Sefton Park, Liverpool; The Paxton Pavilions, Sheffield Botanical Gardens; The Palm House, Botanical Gardens, Dublin, St Pancras Station, London, Kibble Palace, Glasgow and Westminster Palace. *See also: display entry in this section, page 115.*

■ **TURNERS ORNAMENTAL LEADWORKS**

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Tel 07930 377159


Email [info@turners-lead-collection.co.uk](mailto:info@turners-lead-collection.co.uk)

[www.turners-lead-collection.co.uk](http://www.turners-lead-collection.co.uk)


TRADITIONAL LEADWORK: Masters of the art of traditional leadwork, Turners Ornamental Leadwork joins together expertise, passion and creativity to bring even the most complex designs to life. Turners first won a Chelsea Gold Medal in 2001 and has gone on to win a total of seven consecutive Gold Medals for work with various garden designers. In addition to creating new pieces, the company also works with antique leadwork in need of restoration and repair. Brian Turner has the necessary qualifications and experience to tackle commercial and architectural leadwork projects, including complex ornamental roofing, cupolas, small domes and heritage restoration work.

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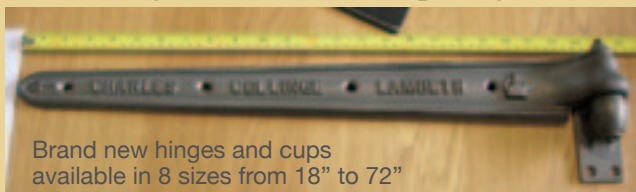
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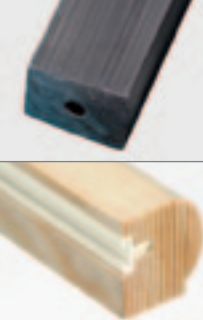
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# WROUGHT IRON and STEEL WINDOWS

ELENI MAKRI

**H**ISTORIC IRON window frames were produced in wrought iron, cast iron or mild steel. This article concentrates on wrought iron and mild steel windows and their conservation.

Wrought iron is the purest form of iron used in construction, containing between one and four per cent impurities and less than one per cent carbon. It is fibrous and malleable and can be welded. Mild steel is an iron-carbon alloy containing up to about two per cent carbon and has qualities similar to wrought iron.

Left unprotected, iron corrodes back to its original state (iron oxide). Wrought iron is the most resistant to this process and mild steel the most susceptible.

Wrought iron is either charcoal iron or its successor after 1784, puddled iron. Large scale production in the UK came to an end in 1973 with the closure of Thomas Walmsley's Atlas Forge in Bolton, Lancashire. Shortly afterwards the forge was rebuilt at Blists Hill Open Air Museum in Ironbridge where it resumed production for a few days a year.

Mild steel was a new iron-carbon alloy first produced in 1855 by Henry Bessemer in his Bessemer converter in an effort to reduce the production cost of wrought iron. Continuous advances in its production led to it replacing wrought iron and the establishment of the modern steel industry.

## HISTORICAL DEVELOPMENT

Wrought iron fenestration evolved from medieval window construction and from ecclesiastical stained-glass window construction in particular.

The 12-light Armada window of Sutton House, Hackney, London, dating from the early 16th century is a rare complete survival of early domestic fenestration. Typically for an early domestic window, all 12 lights are fixed.

The wrought iron opening casement appeared in the late 16th to early 17th century, initially as a single element which was less than the full height of the opening and set in predominantly fixed fenestration. In the next century both the number and size of opening casements increased and they now occupied the full height of the opening.

Changes in construction methods and materials (from timber-frame to masonry, brick or stone) saw the introduction in the early 17th century of the classical



*The Daily Express Building in Fleet Street, London (Ellis and Clarke, 1932), now occupied by Goldman Sachs International (Photo: Carole King)*



*Inward opening casement, mid 17th century  
(Brooking Collection)*



*17th-century wrought iron casement window with oak  
frame from vernacular farm building near Winchester,  
Hampshire (Brooking Collection)*



*Early factory-made window constructed from wrought  
iron sections and incorporating rubber draught-proofing  
(Brooking Collection)*

four-light cross-window. An example with wrought iron fenestration is a 1707 cross-window with three fixed lights and an opening wrought iron casement at a farmhouse in Pilning, Gloucestershire.

The late 17th century former manor house in Freckenham, Suffolk, retains original wrought iron casement windows with rectangular leaded lights. Some of the leaded lights contain crown glass, which became available in the late 17th century. While the counter-balanced timber sash window gradually became the fashionable standard for the houses of the wealthy following its use at Chatsworth in 1676, the wrought iron casement remained in use throughout the 18th century. In the 19th century wrought iron casements were sometimes used in attics and service rooms. In the late 19th and early 20th century, the wrought iron window became popular again through the Gothic Revival and in the work of Arts and Crafts architects such as Edwin Lutyens. However, in the 1850s wrought iron production was considered expensive and labour intensive and this gave rise to the production of metal windows (both sashes and casements) in cast iron.

By the late 19th century the development of the Bessemer process had enabled the production of sections from hot-rolled steel which were considerably cheaper than those made from wrought iron. At first, steel windows sought to replicate earlier wrought iron fenestration, as is evident from the early mild steel casements of Henry Hope & Sons Ltd and WF Crittall in the Brooking Collection at Cranleigh in Surrey. Among these, the 1891 casement by Hope is a new metal casement window in its own right. The 1909–10 example is encased in a thick timber frame and comprises a fixed light and an opening light very much in the tradition of the historic cross-casement.

Following the introduction of standard

window sections, often referred to as the 'universal suite', in 1918–20 by the newly formed Steel Windows Association (1918–23), the use of steel windows flourished. They were suitable for a range of architectural applications in the inter-war years and beyond, both in Britain and internationally. By 1954, Crittall was the biggest of the three main suppliers of steel windows, accounting for 40 per cent of production. The other two were Henry Hope & Sons and Williams & Williams, who jointly accounted for 25 per cent of production. This may explain why Crittall became synonymous with 20th century steel windows.

In revivalist examples of the inter-war period, such as at The Fox public house at Bix, Oxfordshire, universal suite steel sections were combined with timber frames and leaded glazing to produce strip and oriel neo-Tudor windows for a neo-Tudor architectural idiom. The fenestration of The Railway Tavern in Crouch End, London was constructed in a similar fashion. The possibilities for revivalist expression can be seen in the ground floor fenestration of Elizabeth House in Highgate, London (Richardson and Gill, 1930), and in particular in the Crittall French doors and combined fixed side lights, which all contribute to the building's neo-Georgian idiom.

Significantly, this is also the window of the Art Deco movement and its varied and widespread use can be seen in examples such as the Arnos Grove (1932–34) and Turnpike Lane (1932) Underground stations (both by Charles Holden), the Hoover Building (Wallace Gilbert and Partners, 1935) and many public swimming pools. These buildings demonstrate yet another trend associated with steel windows – the development of a new colour range for the 1930s.

The potential for architectural expression provided by the steel window is also seen in structures which used more advanced

building technologies such as the Boots D10 Factory in Nottingham (Sir E Owen Williams, 1931) and the Daily Express offices in London (Ellis and Clarke, 1932). Both of these buildings are clad concrete frames in which the envelope of the building, including the fenestration, is a lightweight system independent of the structural frame.

The steel window also became standard in the domestic buildings of the inter-war period, which otherwise continued to be built in the existing tradition of terraces, semi-detached houses and mansion flats. Notably, it was also Frank Lloyd Wright's window of choice at Fallingwater in the United States (1935–39), with the frames painted in Cherokee red.

#### **WROUGHT IRON WINDOW CONSERVATION**

The conservation of the wrought iron window may involve repairs to the sub-frame on which the casement hangs (if it is metal), repairs to the casement frame including the window furniture, or repairs to the leaded glazing.

When repairs are being considered, an informed decision should first be taken on whether surviving glazing (lead comes and glass quarries) can be adequately protected during the works or whether it should be removed until repairs are complete. If repairs are required to the casement, for example, it is unlikely that removal of the glazing can be avoided, whereas for repairs to the sub-frame alone, the casement can be removed and safely stored to be re-hung later. Any work involving leaded glazing, including its protection, is highly specialised and requires the right skills to avoid loss or damage.

If repairs are necessary, the surface of the wrought iron sections should be cleaned back to healthy metal, primed, repaired and finally painted in the following sequence of works:

**Degreasing** Oil or grease should be completely removed from the metal surface using scraping tools, washing with warm



Factory-made steel casement window in the Arts and Crafts tradition from a large house in East Sussex, c1895 (Brooking Collection)



Early 20th-century Crittall window from the 1904 alterations to Horton Priory House (1861), Monks Heath, Kent (Brooking Collection)



Small top-hung light with vent panel in lower light made by Henry Hope of Birmingham from the Midland Hotel, Morecambe, c1932–33 (Brooking Collection)

water and detergent, then rinsing off with warm water. Non-caustic degreasing agents such as white spirit followed by clean swabs can also be used.

**Surface preparation** Paint should be tested to determine whether it is lead-based. If so, appropriate precautions should be taken during its removal. It may also be important to establish and identify original paint layers, which can be done through carefully taken scrapes.

Removing paint and rust from wrought iron is best achieved by heating, which causes the metal to expand and breaks down the adhesion of the rust, allowing it to be removed with a wire brush. This method does not affect the mill scale – the outer surface of the iron formed in the forge. Evidence suggests that this is a protective surface and its removal may accelerate decay (grit blasting of wrought ironwork is therefore inappropriate). Heating can cause thin wrought iron sections (less than 2mm thick) to warp. Heat travelling horizontally is a fire hazard and if the flame is traversed too slowly, debris can become fused to the surface. All these problems can be avoided if the window is dismantled and repaired in the workshop.

Other means of surface preparation include acid pickling (off-site), preferably in warm diluted phosphoric acid which forms a protective layer of phosphates on the metal surface, followed by thorough rinsing. Cleaning with hand-held tools only removes around 30 per cent of rust but is useful for in situ work as a preparatory stage.

**Priming** Once cleaned, the material must be immediately protected from rust with an appropriate primer or rust inhibitor, which should delay the formation of rust for around 24 hours.

**Assessment** It is now possible to fully assess the extent of necessary repairs. This may involve cutting out the corroded section (often the bottom rail or associated jamb ends)

and welding in place a replacement section of the same material and profile.

**Repair** Welding wrought ironwork is also best done in the forge because of the laminated nature of the material. In situ gas welding (brazing) or arc welding is possible, but care should be taken that the welds extend to the full depth of the material to ensure all the laminated elements of the original are connected, as surface welds have no strength. Gas welding (brazing) is preferable as arc welding requires the use of a non-corrodible iron alloy wire or rod (mild steel is unsuitable as it will corrode).

Wrought iron is available for restoration work, primarily through the recycling of old material. Sources of charcoal iron are rather limited, but there are large quantities of 19th century puddled iron available from dismantled structures, which can be re-forged. Repairs to both charcoal and puddled iron can be made using reclaimed puddled iron as the two materials are quite similar.

While mild steel has been used for repairs to wrought iron, this is no longer considered good practice, partly because of the much greater susceptibility of steel to corrosion. It is also well-established that repairs are best carried out using original material and techniques. This is both possible and appropriate in the case of wrought iron fenestration.

**Painting** Because of wrought iron's natural corrosion-resistance it is sufficient to protect it with primer and paint. When choosing a protective paint system it is best to consult a reputable manufacturer who can advise on the compatibility of new and old paints and on the best system for the given conditions. Upgrading protection should be achieved by increasing the number of coats rather than using a more expensive system. Two coats of primer and four coats of air-drying paint should be adequate.

**Dismantling and re-housing** Dismantling

and removing the sub-frame to a workshop can disturb the surrounding masonry, although historically fixings were usually filled (or 'caulked') with molten lead. This can be removed by heating the lead until it melts. If dismantling is necessary, the frame should be removed with minimum disturbance to the housing and surrounding fabric.

Re-housing into masonry requires abrasive cleaning to completely remove all corrosion to fixing lugs prior to painting with epoxy paints and fixing or caulking with lead or lead wool packing. Severely corroded lugs can be replaced with new wrought iron sections.

### STEEL WINDOW CONSERVATION

Steel window conservation began with the listing of inter-war buildings in the 1970s and 80s. The resultant demand has given a tremendous boost to the steel window industry, which has witnessed the emergence of new manufacturers and suppliers in recent years who have been instrumental in establishing and implementing good conservation practice.

After the introduction of the 'universal suites' in 1918–20, most steel windows were made of sections that had the same technical specifications, regardless of manufacturer. However, these original inter-war sections are no longer in production so splicing repairs, while technically possible, are largely reliant on the availability of salvaged windows of the period. Another option is bespoke fabrication but this is expensive. The adjustment of currently produced sections is sometimes possible.

Produced before the introduction of galvanising in the 1950s, inter-war steel windows are prone to rust and their condition depends on how well they have been maintained. Rust is iron oxide formed by the reaction of iron with water and oxygen. Left unchecked, rust forming where paintwork



1930s terrace, Muswell Hill, London



Inter-war steel windows were used to imitate Tudor glazing at The Fox public house, Bix, Oxfordshire, 1936

has failed will spread beneath the paint by electrochemical reaction as the areas underneath the paint have less access to oxygen and are therefore differently charged.

The repair of inter-war steel windows may involve some or all of the following works:

#### **In situ repairs**

##### **Degreasing and removal of debris and dust**

This should be carried out as part of the regular maintenance of steel windows and in preparation for any repairs. Degreasing can be carried out using the same methods as for wrought iron windows (see above). The removal of debris and dust can be assisted by careful brushing and vacuum cleaning.

**Preparation** All hardware (except hinges) may have to be removed and glazing masked or temporarily removed, depending on condition.

**Surface preparation** In situ stripping back of paint and rust to healthy metal may

be carried out using a variety of tools such as needle guns, disc sanders, hand scrapers, wire brushes and sandpaper. Grit blasting is a more rigorous alternative but extra care should be taken as the blasting medium can collect in crevices where it holds moisture and can cause rust or distortion through build up. Health and safety considerations relevant to the removal of lead-based paint should be observed carefully. Paint samples should be taken to assist with the identification of the original colour scheme. The extent of stripping will depend on the condition of the window, sometimes it is enough to rub down, prime exposed metal and repaint.

**Priming** Stripped metal should be primed with a rust inhibitor immediately to avoid the re-formation of rust on exposed surfaces.

**Realignment** Once stripped of paint and/or cleaned of rust, window frames and casements can be realigned, adjusted and eased so that all operable windows are returned to good working order. Loss of alignment may be the result of rust behind the frames causing metal expansion and/or paint and debris build-up, both of which can cause distortion. Poor maintenance and user-pressure on uncooperative windows may be contributory factors.

**Assessment** Condition and the extent of necessary repairs are assessed at this stage and a decision made on whether to carry out in situ repairs or to remove the window for repairs at a workshop or to replace it. A detailed schedule of window repairs may include all three possibilities as the condition of individual windows in a building may vary.

**Metal repair** Even when metal frames appear to be in very poor condition, often

very little metal needs to be replaced. In situ repairs may involve the use of metal fillers. Piecing in of new metal is usually best carried out using brazing (rather than welding) because of its versatility and reduced fire risk. Replacing even small amounts of metal would require material from suitable reclaimed windows, or adjusting currently available steel window profiles.

**Hardware repair** Operators, hinges and locks should be cleaned using a fine wire wheel. Operators may have small lubrication holes and these are sometimes painted over. Mechanisms may have seized and can be repaired by flushing out the gears, then freeing the works by oiling. Missing or broken hardware and hinges should be replaced, perhaps using matching parts from salvaged windows. Alternatively, readily available parts can be adapted although this may necessitate filling existing screw holes with steel epoxy or plug welds and tapping in new screw holes. If the hardware is a highly significant element of the historic window, reproductions can be made.

##### **Re-glazing and weatherproofing**

Depending on the degree of distortion, de-glazing and re-glazing may be necessary. Cracked or broken glass and failing putty should be replaced. Re-placement putty should be appropriate to the use and be allowed to harden for approximately two weeks or longer before it is painted to match the colour of the fenestration. Silicone sealant is not aesthetically appropriate for conservation work. Weather-stripping using silicone beads can also be undertaken.

**Painting** Similar considerations to painting wrought iron apply (see above).

### Workshop repairs

In cases of severe deterioration, the window can be removed to the workshop. As noted above in relation to wrought iron windows, dismantling and re-housing will involve disturbing the surrounding fabric, although it may still be possible to repair sub-frames in situ.

Once in the workshop, removal of flaking paint and corrosion can be carried out in a chemical bath of phosphoric acid. Unevenly distributed rust may have to be grit blasted. Test areas should always be carried out to determine the correct air pressure and size of grit, starting at a pressure of 40psi with a fine grit (usually copper slag) and not exceed 60–70psi. It is important that BS standards for abrasive cleaning should be carefully interpreted before applying to historic steel sections.

As with in situ work the stripped metal should be primed with a rust inhibitor immediately to avoid the re-formation of rust on exposed surfaces. Then realignment can be carried out as necessary using heat and pressure. Any perished metal sections may then be cut out and replacement matching metal sections welded in. Replacement metal can either be taken from matching salvaged windows or suitably adjusted, currently available sections. Matching replacements can be specially fabricated but this will be more expensive.

Where appropriate, the repaired window can be powder-coated to the required colour over hot-dip galvanising, a zinc-coating process which improves rust and corrosion resistance reducing the requirement for regular maintenance.

### Repair versus replacement

In situ repairs, where possible, are likely to be the most economical option. When replacement is inevitable, the appearance of the steel window can be matched reasonably closely with currently available sections, which include SMW or F sections (both introduced in 1920) and W20 sections (introduced in 1956). Severely deteriorated windows are more expensive to repair than to replace so it may be appropriate to reserve repair in the workshop for the most significant windows.

Replacement windows have the advantage of hot-dip galvanising and powder-coated finishes which make them nearly maintenance free, whereas inter-war windows require regular maintenance and repainting to prevent rusting. It is possible to treat inter-war windows that are in the workshop for repair by powder-coating over hot-dip galvanising. However, the cost of this may not be justified given the lower performance specification of inter-war windows when compared to contemporary upgrades, which include double glazing and jamb linings that can partially design out an inherent problem of cold bridging.

Pre-1918 sections are unique to a particular manufacturer and so are exceptionally important. Hot-dip galvanising and powder-coating are not suitable for

these sections, which should be repaired and refinished as per the original window.

Finally, it should be noted that currently available steel sections provide an option which is both acceptable – in conservation terms and aesthetically – and financially realistic when it comes to the replacement of wrought iron and cast iron windows which are beyond repair.

### Acknowledgements

This article is based on research carried out for the chapter on metal windows in *Windows: History, Repair and Conservation* (see recommended reading). The author wishes to thank Charles Brooking for allowing her to photograph the collection at Cranleigh and for his assistance with the illustration captions, and Chris Topp for providing useful research documents on wrought iron.

### Recommended Reading

- E Makri and R Harris, 'Metal', in *Windows: History, Repair and Conservation*, Michael Tutton and Elizabeth Hirst (eds), Donhead, Shaftesbury, 2007  
 SC Park, 'The Repair and Thermal Upgrading of Historic Steel Windows', *Old House Journal*, Active Interest Media, Washington DC, 1984

**ELENI MAKRI** MArch BArch RIBA IHBC AABC is the founder and managing director of Conservation PD (Planning + Design) (see page 22). Her previous roles include head of the heritage team at the Halpern Partnership (now Formation Architects) and local authority conservation officer.



Neo-Georgian glazed metal doors at Elizabeth House



Elizabeth House, Highgate, London, Richardson and Gill, 1930

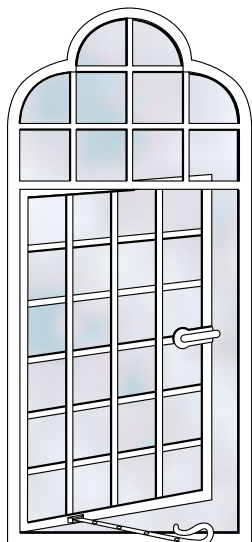
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### ■ JOHN CORLEY STAINED GLASS STUDIO

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Tel/Fax 01304 365160

Email [john.corley@btinternet.com](mailto:john.corley@btinternet.com)

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[www.recclesia.com/glass](http://www.recclesia.com/glass)

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**WINDOWS & DOORS** *continued*

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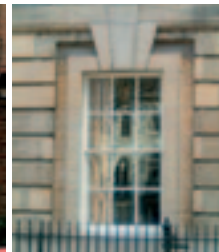
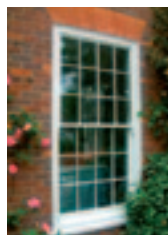
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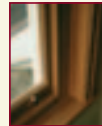
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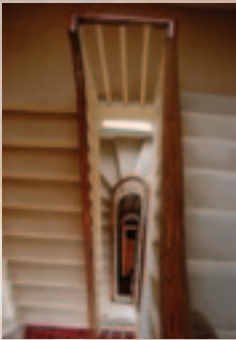
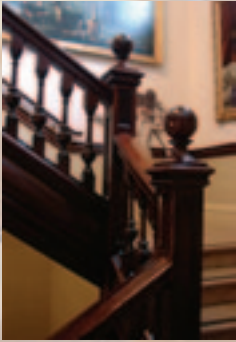
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BUILDING AND RESTORATION CONTRACTORS: See also: profile entry in  
Building Contractors section, page 60.

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in Building Contractors section, page 63.

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HISTORIC BUILDING REPAIRS: See also: profile entry in Building Contractors  
section, page 63.

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*The Human Touch*

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Aaron Evans Architects Ltd	19			ud
Access Ecology Ltd	141			ei
Alan Bishop & Associates	38		go ss	gd
Anderson & Glenn	20			ho la
Antique Bronze Ltd	109		mr ss	
Antique Buildings Limited	142	cq pv bp		
Architectural Metal Designs Limited	111	gt		
Arrol & Snell Ltd	20			la
Bakers of Danbury Ltd	60		ss	
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The Bath Stone Group	96	pv		
Best Demolition	142	cq pv		
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C E L Ltd	62		ss	
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Carpenter Oak & Woodland Co Ltd	74	cn gb		
Carthy Conservation Ltd	98		ss	
The Cast Iron Company	136	el gt sf si		
Castaway Cast Products & Woodware	112	gt si		
Cathedral Works Organisation Limited	63	pv sn	go ss	gd
Chris Topp & Co Ltd	112	gt		
Claire Davies Conservation	98		go ss	
The Cleft Wood Co	136	fe	go	
Cliveden Conservation Workshop Ltd	98		ss	
Coe Stone Ltd	98		ss	
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Conservation Building Services Ltd	63		ss	
The Conservation Studio	39			ud
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D B R (London) Limited	64		ss	
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Dunne and Co Building & Restoration	66			ln
English Woodlands Timber Limited	131	fe		
Eura Conservation Ltd	134	cn gt sn	mr ss	
Fabco Sanctuary Ltd	128	gt		
The Fine Iron Company	113	gt sf		
Foster & Pearson Limited	135	cn gn		
The Fringe Workshop	99		ss	
George James & Sons Blacksmiths	114	gt		
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Grinshill Stone Quarry	99		ss	
H O K Conservation and Cultural Heritage	25			ud
Haddonstone Limited	137	cn gb gt	go ss	
Hilary Taylor Landscape Associates Ltd	141			ed ei la
Hirst Conservation	67		ss	
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Hodgsons Forge Decorative Metalwork & Restoration	114	gt		
Ironart Ltd	114	gb gt sf		
J H Porter & Son Ltd	114	gt		
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Johnston and Wright	26			la
Julian Harrap Architects	141			la
L U C (Land Use Consultants)	141			ed ei gd ho la ud
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Lathams	26			ud
Lovell Purbeck Limited	99	cq pv		
Inspire Conservation Ltd	66		go	
Malbrook Conservatories	134	cn		
Mark Stafford Stonemasonry & Conservation Ltd	100		ss	
Marsh Brothers Engineering Services Ltd	114	gt		
Martin Ashley Architects	27			da
Mather & Smith Ltd	136	gt sf si		
Mathias Restoration Ltd	94			
McGregor Patterns	115	gt		
Melcombe Regis Construction SW Ltd	68	cn		
Minerva Stone Conservation	100		go ss	gd
Nash Partnership	28			ud
Roberson Stone Carving Ltd	101		go ss	
Naturally Wild	141			ed ei
Nimbus Conservation Limited	101		ss	
Nye Saunders Ltd	28			da
Odgers Conservation Consultants Ltd	40		ss	
Owlsworth J J P	69		ss	
P D P Green Consulting	28			ud
Paye Stonework	101		ss	
Peter S Neale Blacksmiths	115	gt sf		
Public Clocks Ltd	116	cl		

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R M A Heritage	41			la ud
Recclesia Ltd	70		ss	
The Regeneration Practice	29			ud
Richard Rogers Conservation Limited	174		ss	
Robin Kent Architecture & Conservation	30			da
Rupert Harris Conservation	109	gt	go mr ss	
Shepley Engineers Limited	116	gt		
Sidell Gibson Architects	31	cn		
Simon Swann Associates Ltd	109		ss	
The Standard Patent Glazing Co Limited	86	cn		
Stone Central (NW) Ltd	102		ss	
StoneCo Limited	102		ss	
Szerelmey	153			ln
Taylor Pearce Restoration Services Limited	108		go ss	
Thwaites & Reed	116	cl		
Tuffin Ferraby Taylor	48			da
Turley Associates	41			ud
Turners Ornamental Leadworks	116	sn	go mr	
V A Conservation	103		go ss	
Vale Garden Houses Ltd	135	cn		
West Waddy ADP	32			ud
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Products	Code	Description	Sculptors	Code	Description
	bp	brick pavers	go	mr	garden ornaments
	cl	clocks	mr	ss	metal sculpture
	cn	conservatories	ss	ss	sculpture & statuary
	cq	cobbles & setts	da	da	disabled access consultants
	el	exterior lights	ed	ed	environmental consultants
	fe	timber fencing	ei	ei	ecologists
	gb	garden buildings	gd	gd	garden design/restoration consultants
	gn	greenhouses	ho	ho	horticultural consultants
	gt	gates & railings	la	la	landscape architects
	pv	flagstone paving	ln	ln	landscaping
	sf	street & garden furniture	ud	ud	urban designers
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CONSERVATION AND RESTORATION OF GREENHOUSES: *See also: display entry in Metalwork section, page 113.*

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## CONSERVATORIES & GLASSHOUSES continued

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IRON FOUNDER ARCHITECTURAL: See also: *display and profile entries in Metalwork section, pages 114 and 115.*

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IRON FOUNDER ARCHITECTURAL: See also: *display and profile entries in Metalwork section, pages 114 and 115.*



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# CONSERVING BATS AND BUILDINGS

## A NATURAL SYNERGY

KELLY GUNNELL



*A pipistrelle bat in flight (Photo: Hugh Clark)*

**L**ONG ASSOCIATED in popular culture with horror and the supernatural, bats are in desperate need of a PR makeover. Contrary to popular opinion, bats are not mice with wings. They are, in fact, more closely related to humans than to rodents. These socially complex mammals usually have just one young per year and look after their offspring fastidiously, often forming crèches that allow the mothers to go out to forage while other females look after the pups.

Bats have long life-spans for their size. The record is 40 years for a ringed Brandt's bat. They do not make nests and they do not cause structural damage to buildings. Bats are not blind, they can see reasonably well but have evolved echolocation to help them with the difficult task of hunting tiny insects

in the dark. Bats are an important part of the UK's biodiversity, the 17 species of bat account for nearly one third of our national mammal species (globally there are over 1,000 bat species). All bats in the UK eat insects – a single pipistrelle bat can eat up to 3,000 midges in a single night. Bats are thus an important part of the ecosystem and their presence is an indication of a healthy and biodiverse landscape.

One stereotype does hold true, however: bats do like to roost in old buildings. In fact, bats and people have been sharing dwellings for thousands of years, making these unique creatures part of our cultural heritage as well as part of our natural heritage. Consequently, when conserving old buildings, there is a legal and moral imperative to preserve bat roosts.

### WHY DO BATS ROOST IN BUILDINGS?

About half of the bat species in the world use holes in trees for roosting. The other half use either caves or cavities. However, as 'natural' roosting sites have become scarce due to development and changing land-use, bats have adapted to use buildings, like barn owls or swifts, and are a building-reliant species. Buildings offer a range of possible roosting opportunities that mimic those found in the natural environment and are often cleaner, safer and warmer spaces than natural roosting sites. Crevice-like or tree cavity type spaces include those found in both modern and traditional houses such as behind fascia and barge boarding, spaces beneath roof tiles, wall coatings, hollow mortice joints, rain gutters and chimneys. Cave-like spaces include

attics and cellars that are dark, with stable temperatures and humidity. These spaces may be found in a range of structures including farm buildings, historic houses, castles, churches and terraced houses.

Bats are much smaller than people tend to think; some species only need a 15–20mm gap to access a roosting space. Most bat species cluster together tightly to generate heat and, given that it's possible to squeeze about 200 pipistrelle bats into a space the size of a shoe box, you can imagine how difficult it can be to find bats roosting in the dark corners of a building.

Bats do not make nests or chew electrical cables. The most obvious sign of their presence is bat droppings but even these can be hard to find, especially in a loft. Bat droppings are frequently mistaken for mouse droppings but can be identified by the 'crumble test'. Bat droppings consist largely of insect remains and crumble easily to a powder of semi-shiny fragments. Rodent droppings are smooth and plastic, quickly becoming hard. They cannot be crumbled. The droppings of UK bats do not present any known health hazards; they can be swept up safely and make an excellent garden fertiliser. Large accumulations may reflect use of the same roost over a number of years rather than large numbers of bats at any one time. Other signs to look for are grease marks on the rafters, urine splashes, cobweb-free corners, or insect remains from a feeding perch. If in doubt, contact your local bat group or a professional ecologist to conduct a survey.

Unfortunately for bats, even man-made roosts are now under threat. Demolition of old buildings, renovation, change of use, artificial lighting and the move towards airtight buildings, all have implications for the bat populations that use buildings. Combined with the loss of foraging habitat, this has meant that bat populations have suffered drastic losses in the last century. Bats are therefore afforded very strict legal protection which must be considered when carrying out any building work.

### SURVEYS, PLANNERS AND THE LAW

European and domestic legislation dictates that any structures or places which bats use for shelter are protected from damage or destruction, whether occupied by bats or not. This legislation means that planning authorities have an obligation to consider whether bats are likely to be affected by a proposed development. An application cannot be granted planning permission unless it includes all the information needed to make sure that bats will not be affected by building works.

It is for this reason that planning authorities will often ask for a bat survey to be carried out and the results submitted with the initial planning application. The survey will need to be undertaken by a licensed ecologist, who will inspect the site and building internally and externally to determine the likelihood of bats being present.

If the potential for the site to support bats is considered high, additional activity surveys will be carried out at dawn or dusk. These

### CASE STUDY 1: THE NEED FOR SURVEYING

A large aisled barn in East Lancashire, dating from 1605, was undergoing restoration.

The roof structure was in a poor condition and needed substantial repairs and refurbishment. The building comprised coursed sandstone rubble with quoins and a stone-slate roof. Bat roosting features included wall cavities and a very large number of mortice joints in the rafters, aisle posts and kingpost roof supports. Bat species found in the barn included common and soprano pipistrelle,

brown long-eared and Natterer's Bats. As part of the preparations for roof repairs, surveys were undertaken throughout the year in 2009, using a combination of building searches, remote detectors (every month) and manned surveys (throughout May to September). Bats were found to be active in all months of the year and the building supported roosting bats in every month. The information gained will be an essential part of the mitigation strategy.



(Photo: Pat Waring/Ecology Services UK Ltd)

### CASE STUDY 2: MITIGATION WITH A BAT BARN

A former textile mill, built in 1888 in a river valley in West Yorkshire, was proposed for development into a series of apartments. The surrounding landscape is ideal for bats and includes at least six species. Within the mill buildings, common and soprano pipistrelle bats have been recorded during spring and summer months, with at least one of the species hibernating in ground floor door lintels. The buildings also supported nesting swifts. As part of the preparation for development a dedicated bat barn was constructed in 2008 within 100m of the mill, adjacent to woodland and the river. Subsequent monitoring found bat droppings in the bat barn in 2010.



(Photo: Pat Waring/Ecology Services UK Ltd)

### CASE STUDY 3: MITIGATION IN A LISTED BUILDING

Clarkencombe Lodge is a Grade II\* listed gatehouse, which is part of the Ashton Court Estate in Bristol. The lodge was going to be refurbished to create residential living space but the refurbishment needed to allow for the five species of bat found on the site to continue to use the building and to enhance the maternity roost. The bat species included both greater and lesser horseshoe bats, brown long-eared, common pipistrelle and barbastelle bats.

Mitigation involved isolating the living accommodation from the designated bat areas, which included the full roof void. One tower of the gatehouse was also allocated for the bats, which created a route from the roof to the ground level single storey modern extension, which was modified to provide roosting ledges and a maternity environment. All windows and doors were removed from the extension and the building covered with planting. Its interior layout was designed by a bat consultant. Bespoke entrances and exits were created in the roof and tower. Canopy cover from the building to the adjacent woodland was ensured. A camera was installed for ongoing monitoring and this has shown a measured increase in the use of the building by bats and that the improved maternity roost is in use.



(Photo: CTT Sustainable Architect)

surveys aim to confirm the species present, the type of roost and identify any access points and commuting routes. Once this information has been collected, an assessment is made as to whether the planned works will impact the bats. If necessary, measures will then be suggested to reduce the impact to an acceptable level. In some instances where the impact is considered significant, an application for a European Protected Species (EPS) licence will be needed. The EPS licence will outline conditions to mitigate for the unavoidable impacts. This does not stop the work from going ahead, but tries to ensure that any work doesn't negatively impact the bats and is within the law.

The licensing process can take up to six weeks so it is always recommended that an ecologist is contacted as early on in the process as possible. This allows for any alterations to the scope and timing of works to be incorporated into schedules and prevents delays.

### STEPS TO TAKE IF BATS ARE DISCOVERED

When undertaking building or development work where bats may be present, the following steps should be taken:

- contract an ecological consultant for guidance throughout the project
- undertake a bat survey at the appropriate time of year
- if bats are present, compile a mitigation/compensation plan or method statement for everyone involved including architects and building contractors
- incorporate the bat survey report and mitigation plan/method statement into the planning application
- apply for planning permission
- if necessary, apply for an EPS licence (the planning permission will be needed as part of the licence application)
- if a licence is granted, carry out works with an ecologist's supervision
- carry out a compliance check to ensure that mitigation is being properly implemented
- monitor the site after the completion of the mitigation to gauge the response of the bat population.

### BAT ROOST MITIGATION

The main aim of bat roost mitigation is to allow for the conservation status of bats to be maintained or enhanced during and after the development. Bat roost mitigation comes in many forms. In most cases, mitigating for bats during building works involves changing the construction schedule to avoid sensitive breeding seasons and changing the scope of the work to maintain the bat entrances. Bat access points are created or maintained by making gaps either using existing materials or specially designed bat access tiles or bricks that allow bats to re-enter the roost once the work is finished.

More complicated forms of mitigation involve replacing roosts within the building or creating purpose-built roosts such as bat houses or bat barns. Maintaining roosts in situ is always the preferred option. However, in some cases purpose-built bat houses may



*New bat access in one of the turrets of Clarkencombe Lodge, Bristol (see Case study 2, page 139)  
(Photo: CTT Sustainable Architect)*

be considered, as long as the risks of non-adoption by bats are minimised through careful design and site selection. In all cases, bat mitigation should aim to mimic or optimise the original roosting conditions, particularly thermal properties and access to favourable landscape features.

Below are some design principles for ex situ roost conservation:

- situate the replacement roost as close as possible to the roost to be lost
- match the replacement roost closely in terms of size, height and aspect
- situate the replacement roost close to existing flight-lines and have an entrance close to appropriate habitat to maximise chances of the bats finding and adopting it
- design the new roost to provide a suitable thermal regime for the target bat species
- provide a variety of roosting opportunities and thermal regimes
- make the building resistant to vandalism
- arrange for the long-term integrity and security of the replacement roost.

### ROOST WEBSITE

The frustration for homeowners and ecologists alike is that even the best thought-out and designed roost mitigation may not succeed. Bats can be fickle and our understanding of them is incomplete. Each species has its own unique preferences for temperature, roost size, access points and proximity to suitable landscape features and vegetation. These requirements can also change regionally and seasonally. Determining all these criteria and putting them together for a successful mitigation strategy is immensely challenging. Combine this with a lack of systematic follow-up and monitoring and you can see why the realm of bat roost mitigation has remained more of an art than a science. The licensing procedure has made it difficult for builders,

ecological consultants, architects and homeowners to keep track of the mitigation measures used in the past and whether they were successful.

To address this, the Bat Conservation Trust has developed a new web resource called Roost which enables users to upload information about roosts, mitigation strategies and explore case studies. Users can browse case studies using a number of criteria, make comments and access information on general design principles and resources for bat roost mitigation. The aim is that Roost will become a knowledge hub for anyone undertaking or involved in bat roost mitigation. In the long term, the collected information could provide a wealth of insight into what it takes to make a successful and attractive replacement roost.

It is hoped that by sharing information about effective mitigation, we can find new ways to enable bats to live happily alongside us for centuries to come.

Roost was launched in September 2011 (<http://roost.bats.org.uk>).

### Recommended Reading

- Bats and Buildings: Bats and the Built Environment Series Volume 1*, Bat Conservation Trust, 2010
- Bat Mitigation Guidelines*, Natural England, 2004
- Bats in Traditional Buildings*, English Heritage, National Trust and Natural England, 2009
- C Williams, *Biodiversity for Low and Zero Carbon Buildings: A Technical Guide for New Build*, RIBA Publishing, London, 2010

**KELLY GUNNELL is the built environment officer for the Bat Conservation Trust. The Built Environment Project aims to raise awareness and facilitate solutions for bat conservation in the construction and building sector.**

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LANDSCAPE ARCHITECTS: Award-winning historic landscape consultants with many years experience of the conservation, restoration and sensitive design development of nationally important parks and gardens of all grades. Services offered include conservation management plans, design development, project management and contract administration. HLF funded projects include Saltaire (World Heritage Site), Birkenhead Park, Wentworth Castle and Stainborough Park (Civic Trust Award 2008), Handsworth Park and Battersea Park (Civic Trust Award 2006). Conservation plans include Elvaston Estate, Shotover Park and Fountains Abbey. Clients include local authorities, private owners, National Trust and conservation trusts.

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[www.julianharraparchitects.co.uk](http://www.julianharraparchitects.co.uk)

DESIGN AND CONSERVATION ARCHITECTS: *See also: profile entry in Architects section, page 26.*

### ■ L U C (LAND USE CONSULTANTS)

43 Chalton Street, London NW1 1JD

Tel 020 7383 5784 Fax 020 7383 4798

■ 37 Otago Street, Glasgow G12 8JJ

Tel 0141 334 9595 Fax 0141 334 7789

■ 14 Great George Street, Bristol BS1 5RH

Tel 01179 291997 Fax 01179 291998

■ 28 Stafford Street, Edinburgh EH3 7BD

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Email [luc@landuse.co.uk](mailto:luc@landuse.co.uk)

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## ECOLOGISTS

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Tel 020 7383 5784 Fax 020 7383 4798

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Branch offices in Bristol, Edinburgh and Glasgow

ECOLOGISTS: *See also: profile entry in Landscape Architects section on this page.*

## ECOLOGISTS continued

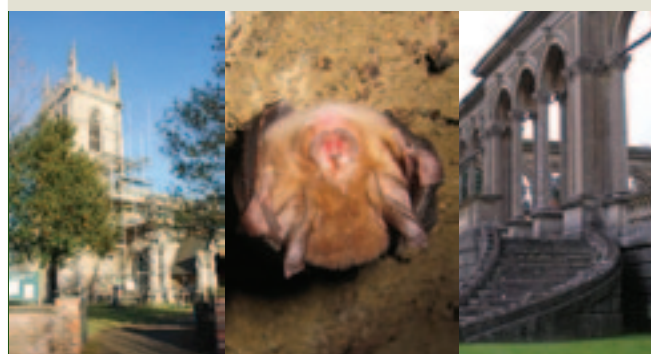
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GENERAL SUPPLIERS	Page		
Antique Buildings Limited	142	as	
Best Demolition	142	as	
Brickfind (UK)	89	as	
Carpenter Oak & Woodland Co Ltd	74		sp
Cornish Lime Company Ltd	157		sp
Coyle Timber Products	131		sp
Drummonds Architectural Antiques Limited	180	as	
Hirst Conservation	67		sp
Ingarsby Conservation Ltd	142		sp
Mike Wye & Associates Ltd	158		sp
Nostalgia	165	as	
Orveta Products	142		sp
Traditional Technologies LLP	142		sp
Weldon Contracts Limited	180	as	
Westland London	165	as	
Womersley's Limited	157		sp

#### PRODUCT CODES

as	architectural salvage
sp	builders merchants & specialist suppliers

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### ■ INGARSBY CONSERVATION LTD

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Email [info@ingarsbyconservation.co.uk](mailto:info@ingarsbyconservation.co.uk)

[www.ingarsbyconservation.co.uk](http://www.ingarsbyconservation.co.uk)

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### ■ ORVETA PRODUCTS

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Tel 01698 826941 Mobile 07776 149787

[www.orveta.com](http://www.orveta.com)

MANUFACTURER OF TRADITIONAL PRODUCTS: Orveta produces a unique range of high quality and historically accurate products for building conservation professionals. These products include many items that have recently been difficult to obtain, but were so familiar in years gone by, such as: mastics for rendering and jointing, stucco whitewash, bound and unbound distemper and lead-free driers and rosins. Other products include: traditional additives for mortar, render and plaster, plaster retardants and accelerants, glue, size, repair 'cements', putties, polishes and varnishes, selected hardwood tools, oak doors and door furniture. Orveta also produces insulated blankets for cold weather masonry work and statuary protection.

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Email [info@tradtech.net](mailto:info@tradtech.net)

[www.tradtech.net](http://www.tradtech.net)

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Nimbus Conservation conservators at Cabot Tower, Bristol: the heavily eroded mortar joints are being repointed with a hydraulic lime mortar coloured with coal dust to match the original.  
Photo: Jonathan Taylor

## Chapter 4

# Services & treatments

BIRD & PEST CONTROL	PAGE
Aura Conservation	145
Bonsers (Nottingham) Limited	61
Peter Cox Ltd	145
St Astier Ltd	70

DAMP & DECAY	Page		
A N Morgans (Wales) Ltd	60	dd	
Anthony Beech Furniture Conservation	178		ie
Bullen Conservation Ltd	149	dd	
Burrows Davies Ltd	97	dd	
C & D Restoration Ltd	97		er
Carpenter Oak & Woodland Co Ltd	74		er
Cathedral Works Organisation Ltd	63		er
Charterbuild Ltd	150		er
Delta Membrane Systems Ltd	149		dp
Demaus Building Diagnostics Ltd	149	dd	nd tt
George East, Master Thatcher	83		er
Fugro Aperio Ltd	49		nd
Helifix Limited	150		er
Heritage Testing Ltd	49		nd
Hutton + Rostrom Environmental Investigations Limited	149	dd	ec ie nd tt
International Fire Consultants Limited	163		tt
J P Ladell Ltd	67	dd	
Martin Ashley Architects	27		ec
Martin Thomas Associates	163		ec
Minerva Stone Conservation	100	dd	
Period Property Solutions Building Conservation Limited	69	dd	
Peter Cox Ltd	149	dd	er
Reddiseals	117		er
Rotafix	150		dp er
Ian Russell	54		nd
St Astier Ltd	70	dd	
Stone Central (NW) Ltd	102		er
Stonewest Limited	73		er
T R A C Structural Limited	150		er
The Floyd Consultancy	46		ec tt
Thermo Lignum UK Limited	145	dd	ie
Timber Framing and Conservation	74	dd	
T R A D A Technology Ltd	47		nd tt
Twyford Lime Products	158		er
U K Damp & Decay Control	149	dd	tt
Ward & Dale Smith Limited, Chartered Building Surveyors	149	dd	ie
William Taylor Stonemasons	72		er
Andrew P K Wright	16		nd

PRODUCT & SERVICE CODES	er	ie	nd	tt
dd	damp & decay treatment			
dp	damp & decay treatment products			
ec	environmental control			
		er	epoxy resin repairs	
		ie	insect & pest eradication	
		nd	non-destructive investigations	
		tt	structural timber testing	

FIXINGS & STRUCTURAL REPAIR	Page	PRODUCTS	SERVICES
Anelays - William Anelay Ltd	60		tb
Avon Stainless Fasteners Limited	151	fx	
B Antoniw Joinery	132		tb
Bakers of Danbury Ltd	60		tb
Between Time Ltd	62		rp tb
Boshers (Cholsey) Ltd	61		tb
Britannia Architectural Metalwork Ltd	111	zw	
Bronzework	111	zw zt	
Busby's Builders	62		tb
C & D Restoration Ltd	97		er
C E L Ltd	62		tb
Carpenter Oak & Woodland Co Ltd	74	fx zt	er
Carrek Limited	63		tb
Cathedral Works Organisation Ltd	63		rp er
Charterbuild Ltd	150	zw	rp er
Cintec International Limited	150		rp
Conservation Building Services Ltd	63		tb
Country House Renovations Limited	63		tb
D B R (London) Limited	64		tb
Dunne and Co Ltd	66		rp tb
George East, Master Thatcher	83		er
Fisher Bullen	64		tb
Glasgow Steel Nail Co Ltd	151	zt	
Grosvenor Construction Ltd	64		tb
H K Askew & Son	66		tb
Hall Construction Limited	64		tb
Helifix Limited	150	fx zw zr	rp er
Ingarsby Conservation Ltd	142	zt	
Ivinghoe Building Services Ltd	67		tb
J & J W Longbottom Ltd	84	zw	
J & W Kirby	74		tb
Kiersen Sash Window and Timber Restoration	128		tb
Mike Wye & Associates Ltd	158	zt	
Millway Builders Ltd	68		tb
Oakwrights Limited	74		tb
Owlsworth J J P	69		rp
Paye Stonework	101		rp
Period Property Solutions Building Conservation Limited	69		tb
Peter Cox Ltd	150		rp er tb
Peter S Neale Blacksmiths	115	zt	
R J Smith & Co	69		tb
Reddiseals	117		er
Richard Coles Builders Ltd	70		tb
Rotafix	150		er
S J Specialist Brickwork	94		rp
Sandy & Co (Contractors) Ltd	70		tb
Simmonds of Wrotham	70		tb
Splitlath Building Conservation Ltd	72		tb

St Astier Ltd	70		rp
Stone Central (NW) Ltd	102		er
Stonewest Limited	73		rp er
T R A C Structural Ltd	150	zw	rp er
Timber Framing and Conservation	74		rp tb
The Traditional Lime Co	159	zt	
Treasure & Son Ltd	72		rp
Twyford Lime Products	158		rp er
Valley Builders Ltd	72		rp tb
William Taylor Stonemasons	72		er
Winterton Restoration	132		tb

PRODUCT & SERVICE CODES	SERVICES	er	rp	tb
PRODUCTS	fx	nuts, bolts, screws & nails		
	zr	roof ties & plates		
	zt	traditional nails		
	zw	wall ties & plates		
		er	epoxy resin repairs	
		rp	structural repair & stabilisation	
		tb	timber repairs	

MORTARS AND RENDERS	Page	SERVICES	PRODUCTS
A N Morgans (Wales) Ltd	60	pn	
A S A P Brickwork	94	pn	
A V V Solutions Ltd	95	pn sw	
Andrew Doyle Past Plastering Services	185	pn sw	lm hy
Anglia Lime	157		lm hy
Aura Conservation	157	pn	
Bryan Williamson & Daughters	62	pn sw	
Baron UK Ltd	155		mt
Between Time Ltd	62	pn wd	lm hy
Boden & Ward Stonemasons Ltd	96	pn	
Bonsers (Nottingham) Limited	61	pn	
Bosence	186	pn sw	
Bosence & Co	46	pn	hy pz re
Boshers (Cholsey) Ltd	61		lm
The Bulmer Brick & Tile Co	89		lm hy pz
Burrows Davies Limited	97	pn	
C & D Restoration Ltd	97	pn	
C E L Ltd	62	pn	
Carrek Limited	157	pn	
Cathedral Works Organisation Ltd	63	pn	lm hy ag pz cp
Charterbuild Ltd	150	pn	
Claire Davies Conservation	98	pn	
Cliveden Conservation Workshop Ltd	98	pn	lm hy
Cornish Lime Company Ltd	157		lm hy ag pz re es mt
Coyle Timber Products	131	wd	lm
Crittall Windows Limited	124	sw	
D B R (London) Limited	64		cp
Dunne and Co Building and Restoration	66	pn	
E I Flood & Sons	186		lm hy pz re
George East, Master Thatcher	83	pn	
Garside Sands	154		lm ag
H J Chard & Sons	158		lm hy ag pz re
H K Askew & Son	66	wd	
Heritage Cob & Lime	158		lm
Herts Renovation	94	pn	
Hirst Conservation Materials Ltd	158		lm hy pz re es
Historic Brick Pointing Ltd	155	pn	
Ingarsby Conservation Ltd	142		lm hy mt
Ingram Consultancy Ltd	40		cp
Inspire Conservation Ltd	66	pn wd	hy cp
Keim Mineral Paints Ltd	156		cp
Kestell and Lewis Ltd	187	pn	
The Lime Centre	158		lm hy ag pz re mt
Lime Technology Ltd	158		lm hy
Magenta Building Repair Ltd	68	pn	
Mather & Ellis Ltd	100	pn	
Mather & Smith Ltd	115	pn	
Mathias Restoration Ltd	94	pn	
Mike Wye & Associates Ltd	158	pn wd	lm hy ag pz re es
Minerva Stone Conservation	100	pn wd	lm pz re cp
Multi Marque Production Engineering Ltd	155		lm mt
Milestone Lime	158		lm hy re
Milestone Lime Plastering	187	wd	lm
Ornate Interiors Limited	187	pn	
Orveta Products	142	sw	lm
Owlsworth J J P	69	pn wd	
Paye Stonework	152	pn sw	cp
Period Property Solutions Building Conservation Limited	69	pn	
R J Smith & Co	69	pn	
Recclesia Ltd	70	pn	
Rotafix	150		cp
S J Specialist Brickwork	94	pn	
St Astier Natural Hydraulic Limes	159		lm hy
Stone Central (NW) Ltd	102	pn	
Stone Edge Limited	102	pn	
Stone Restoration Services Ltd	102	pn	
Stonewest Limited	73	wd	
Strippers	154		lm hy
T Coleborn & Son Limited	72	pn	
The Traditional Lime Co	159		lm hy ag pz re
Traditional Technologies LLP	142	pn	lm
Twyford Lime Products	158	pn	lm es
V A Conservation	103	pn	
Valley Builders Ltd	72	pn	
W P D Productions	173	sw	
Whippletree Hardwoods	131		lm hy re
William Taylor Stonemasons	72	pn	hy
Womersley's Limited	158		lm hy pz re mt

PRODUCT & SERVICE CODES	mt	pn	pz	re	sw	wd
ag	aggregates					mortar tools & mixers
cp	stone consolidants					pointing with lime
es	earth renders					pozzolanic additives
hy	hydraulic lime					hair & fibre reinforcement
lm	non-hydraulic lime (lime putty)					renders & stucco
						wattle & daub

PAINT & DECORATIVE FINISHES	Page	PRODUCTS	SERVICES
Bennie Historic Conservation	60	lw	
Between Time (Conservation Builders) Ltd	62	lw	
Boshers (Cholsey) Ltd	61	lw	
C & D Restoration Ltd	97	lw	
Carthy Conservation Ltd	98		pa
Cathedral Works Organisation (Chichester) Limited	63	lw	
Conservation Building Services Ltd	63		pa
Cornish Lime Company Ltd	157	pd lw pg	
Crick Smith Conservation	175		pa
Dunne and Co Ltd	66	lw	
E I Flood & Sons	186	lw	
H J Chard & Sons	158	lw pg	
Hare & Humphreys Ltd	173		pa
Helen Hughes Historic Interiors Research & Conservation	175	pg	pa
Heritage Cob & Lime	158	lw	
Heritage Testing Ltd	49		pa
Hirst Conservation	157		pa
Hirst Conservation Materials Ltd	158	pd lw pg	
Holkham Linseed Paints	157	pd	
Ingarsby Conservation Ltd	142	pd	
Inspire Conservation Ltd	66	pd lw	
Keim Mineral Paints Ltd	156	pd	
The Lime Centre	158	lw pg	
Mike Wye & Associates Ltd	158	pd lw pg	
Lisa Oestreicher Architectural Paint Analysis	157		pa
Orveta Products	142	lw	
The Traditional Lime Co	159	lw pg	
Traditional Technologies LLP	142	pd	
Twyford Lime Products	158	lw	
V A Conservation	103	lw	pa
William Taylor Stonemasons	72	lw	
Womersley's Limited	157	pd lw pg	

PRODUCT & SERVICE CODES	
lw	limewash
pa	paint analysis
pd	paints & decorative finishes – general
pg	pigments

MASONRY CLEANING	Page	Products	Services
A F Jones Stonemasons Ltd	151		mc ac cc sc wt
A N Morgans (Wales) Ltd	60		mc
A V V Solutions Limited	151		mc ac cc gf
Anglia Lime Company	151	mp pp	mc cc gf pr
Aura Conservation	151		mc ac cc
Bryan Williamson & Daughters	62		mc
Bonsers (Nottingham) Limited	61		mc ac cc gf pr sc wt
Brickfind (UK)	89		mc
Bullen Conservation Ltd	151		mc cc sc wt
Burrows Davies Limited	97		mc
C & D Restoration Ltd	97	mp pp	mc ac cc ls pr sc wt
C Ginn Building Restoration Limited	151		mc ac
Campbell Smith & Co Ltd	173		pr
Carrek Limited	63		ac cc gf ls pr sc wt
Carthy Conservation Ltd	98		mc pr
Cathedral Works Organisation Ltd	63	mp pp	mc ac cc gf ls pr sc wt
Charterbuild Ltd	150		mc ac cc sc
Claire Davies Conservation	152		mc
Cliveden Conservation Workshop Ltd	98		mc ac cc gf ls pr sc wt
Coe Stone Ltd	98		mc
Conservation Building Services Ltd	63		mc ac cc pr sc wt
Crick Smith Conservation	175	pp	pr
D B R (London) Limited	64		mc ac cc gf pr sc wt
Hare & Humphreys Ltd	173		pr
Hirst Conservation	152		mc
Ingram Consultancy Limited	40		mc
Inspire Conservation Ltd	66		mc ac cc pr sc
Keim Mineral Paints Ltd	156	mp pp	
Mark Stafford Stonemasonry & Conservation Ltd	100		mc
McAllister Masonry Limited	152		mc ac sc
Minerva Stone Conservation	100	mp pp	mc ac cc ls pr sc wt
Nimbus Conservation Limited	152	pp	mc ac cc pr sc wt
O'Reilly Period Cornice Restoration & Cleaning	187		pr sc
Owlsworth I J P	69		mc
Paye Stonework	152	mp	mc ac cc gf pr sc wt
Peel Away	154	pp	gf pr
Pierra Restoration Ltd	101		mc
Recclesia Ltd	70		mc ac sc wt
Restorative Techniques	152		mc
S J Specialist Brickwork	94		mc
St Astier Ltd	70		mc
Stone Central (NW) Ltd	102		mc ac cc gf sc wt
Stone Edge Limited	102		mc ac cc gf pr sc wt
Stone Restoration Services Ltd	102		mc ac cc gf
StoneCo Limited	153		mc ac cc pr sc wt
Stonehealth Limited	153	mp pp	mc ac cc pr sc
Stonewest Limited	73		mc ac cc gf ls pr sc wt
Strippers Paint Removers	154	mp pp	mc cc gf pr
Szerelmey	153		mc ac cc sc wt
Taylor Pearce Restoration Services Limited	108		mc ac cc ls wt
Triton Building Conservation Ltd	73		mc
V A Conservation	153		mc cc ls pr sc wt
Wallwalkers	82		mc
Wells Masonry Services Ltd	102		mc
William Taylor Stonemasons	72		mc ac cc sc wt

PRODUCT & SERVICE CODES			
PRODUCTS	mp	masonry cleaning products & equipment	graffiti protection & removal
			ls laser cleaning
	pp	paint removal products & poultices	mc masonry cleaning (general)
			pr paint removal & poulticing
SERVICES	ac	air/water abrasive cleaning	sc steam cleaning
		chemical cleaning	wt low pressure water cleaning

## INSECT ERADICATION



### Ecological Insect Pest Eradication – Naturally

Sympathetic restoration requires a sensitive approach to the eradication of Woodborers, Moths, Carpet Beetles & other damage-causing Insects



Adult Woodworm



Carpet Beetle (larva)



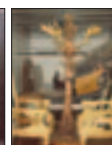
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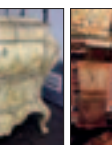
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[www.aurald.co.uk](http://www.aurald.co.uk)

RESTORATION OF LISTED/HISTORIC BUILDINGS AND CHURCHES: *See also: display entry in Stone section, page 97.*

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BIRD AND PEST CONTROL: *See also: display entry in Building Contractors section, page 71.*

## ENVIRONMENTAL MONITORING

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Email [ei@handr.co.uk](mailto:ei@handr.co.uk)

[www.handr.co.uk](http://www.handr.co.uk)

CONSULTANTS ON BUILDING FAILURES AND ENVIRONMENTS: *See also: profile entry in Damp & Timber Decay section, page 149, and Resurgam profile entry in Heritage Consultants section, page 41.*

# CARPET BEETLES and CLOTHES MOTHS

## What they are, what they eat and how to control them

ROBERT CHILD and DAVID PINNIGER

**T**HERE ARE two main types of insect which cause serious damage to textiles in the British Isles: clothes moths and carpet beetles. Although very different in appearance and habits, both are pests which eat animal fibres such as wool carpets and cashmere or mohair clothing.

### CLOTHES MOTHS

The common or webbing clothes moth (*Tineola bisselliella*) and the case-bearing or case-making clothes moth (*Tinea pellionella*) are the two main pest species. Both will attack and damage carpets, upholstery, clothing and animal specimens. The common or webbing clothes moth is now the most common species and has become a much more marked problem in recent years.

The adults of both species are small, dull, grey-fawn moths which are 58mm long and look quite similar. The common or webbing clothes moth (Figure 1) has more of a golden sheen, while the case-bearing clothes moth is more silvery-grey (Figure 5). They scuttle around or fly when it is warm and fold their wings along their backs at rest. Case-bearing clothes moths often come from birds' nests, particularly in unused chimneys, and can fly in through windows or open doors. One generation normally takes a year to develop, but webbing clothes moths can reproduce rapidly in heated buildings with two generations or more per year.

The adults avoid light and lay batches of up to 100 eggs in dark areas on fur, feathers, skin, wool or soiled silk. The larvae, which cause the damage, hatch from the eggs and spin silk webbing as they feed and grow.

#### The common or webbing clothes moth

The larvae of this species spin silk as tubes or sheets of webbing across the material they are eating (Figure 2). Damage is accompanied by copious webbing tubes which usually include large amounts of excreta known as frass (Figure 3).

**The case-bearing or case-making clothes moth** The larva spins a case or bag around itself, leaving the ends open so that it can use its jaws and legs (Figure 4). It then eats as it crosses the material carrying its case and leaving a trail of grazed textile or fur with fragments of excreta or frass. The larva moults within the case and when fully grown



Figure 1 Webbing clothes moth adult (All photos: David Pinniger/CSL/Collections Trust)

it pupates within the cocoon and eventually the adult moth emerges to mate and lay eggs. Infested material is often littered with empty silk bags or cases (Figure 6) which resemble grains of rice.

The pelleted excreta or frass produced by the larvae of clothes moths is frequently mistaken for moth eggs. However, while frass pellets are hard and opaque and the same

colour as the material being eaten, moth eggs are very small and translucent and vulnerable to physical damage. Contrary to popular opinion, clothes moth eggs will not remain dormant in textiles and then hatch many months later.

Textiles soiled with food, perspiration or urine are preferentially attacked and a stained area may be more damaged than an adjacent



Figure 2 Webbing clothes moth larvae



Figure 4 Case-bearing clothes moth larva in case

clean one. Damage is also more concentrated in dark and hidden areas so that in clothing, for example, it is likely to occur in crevices and creases, behind lapels, in pockets or where things are folded. In carpets, clothes moths will usually be found under heavy furniture or at the undisturbed edges. Clean, cotton materials are not normally at risk from attack by clothes moths but the larvae will eat holes in the cotton coverings of feather cushions if the fillings are infested.

#### OTHER MOTH SPECIES

Other common moth species which can be confused with the clothes moth are the white-



Figure 5 Case-bearing clothes moth adult

shouldered house moth (*Endrosis sarcitrella*) and the brown house moth (*Hofmannophila pseudospretella*). Both of these species are common in birds' nests and will only cause damage to materials stored in damp and dirty conditions. The Indian meal moth (*Plodia interpunctella*) is commonly found in domestic kitchens, but this species will only attack food such as cereals, nuts and dried pet foot.

#### CARPET BEETLES

The most damaging species of carpet beetle found in the British Isles is the varied carpet beetle (*Anthrenus verbasci*). Adult beetles are 2–3mm long and resemble small ladybirds. They are covered with grey and gold scales (Figure 8) and identification of the species is based on the pattern and shape of these scales. Adult beetles fly well in warm weather and may frequently be found on windowsills. In the British Isles they are found outside in later spring and early summer where they mate on flowers such as hogweed and *Spirea* before they return indoors to lay batches of eggs secreted in cracks and crevices.

The eggs hatch into short, fat, hairy larvae, often referred to as 'woolly bears' (Figure 9). When the larvae first hatch they are extremely small, less than 1mm long, and they can gain entry to cupboards and drawers through very small cracks. As the larvae grow,



Figure 3 Frass and damage caused by webbing clothes moth larvae

they leave empty hairy, cast skins or husks which are often the first sign of carpet beetle attack (Figure 7).

The larvae will grow to 5mm long and are voracious feeders which will rapidly make holes in woollen textiles, animal specimens, fur and feathers. They will also graze on animal glue in book bindings and picture frames. Clean cotton materials are not normally attacked although larvae may bore through them on their way out of a feather cushion. The damage is often mistaken for clothes moth larvae attack.

Carpet beetles are often found in natural situations such as birds' nests, wasps' nests and animal burrows and in some museums and houses they have a direct route into the premises from nests in attics and chimneys. Once established, they can be difficult to eradicate because the larvae can forage widely and may take some years to complete development. The normal life cycle is one to two years.

There are other species of *Anthrenus* which are similar in appearance and habits. The most important of these is the Guernsey carpet beetle (*Anthrenus sarnicus*). This is now well established in London and South East England and is causing increasing problems in the rest of the British Isles in houses and museum collections.

#### PREVENTION

Clothes moths and carpet beetles are frequently found in birds' nests and discarded animal-based textiles, such as old carpets and underlays in loft areas. The long-term solution to infestations is to make sure that birds' nests are removed from attics and particularly from disused chimneys. This should be done after any nesting period has been completed. Roof spaces should be cleared and cleaned and any suspect material removed and destroyed.

Good housekeeping, through regular cleaning, is the long term method of control of insect attack in buildings. Good design that allows inspection and cleaning of all areas is also to be encouraged. Regular vacuuming of carpets is essential, particularly along skirtings and under furniture. Wool-based clothing should be put into storage after being dry cleaned or warm washed as clothes moths prefer soiled material to clean.



Figure 6 Empty moth cases on upholstery



Figure 7 Cast skins of varied carpet beetle larvae

### MONITORING

Early detection of insect attack obviously helps minimise any damage and allows a swift response to the infestation. Insect traps can be valuable in catching flying and crawling insects, allowing them to be identified and the severity of the attack assessed. Sticky blunder traps are the most successful at catching a wide range of insect pests, as many insects such as clothes moths are not attracted to light or ultraviolet traps.

Where the insect species is known accurately, pheromone traps can be used. These are sticky traps which use the female sex pheromone of the species to attract males. They are commonly used for webbing clothes moth but are also available for case-bearing clothes moth and some carpet beetle species. Although very efficient, they should only be used as an enhanced trapping system, not a control measure.

### TREATMENTS

Where some form of insecticidal treatment is necessary, the problem needs to be assessed in terms of the efficacy of the treatment, possible adverse effects on the inhabitants of the property and possible damage to objects through staining, etc.

Recent changes in legislation through the Biocides Directive (*European Union Directive 98/8/EC*) are having an effect on the treatments and materials that can be used. Many traditional insecticides such as mothballs are now banned and others are likely to follow. Museums and historic houses are increasingly using non-toxic treatments such as deep freezing and heat. Sealing infested carpets or wool clothing in plastic bags and freezing them at  $-18^{\circ}\text{C}$  for two weeks will kill all stages of insect life. Heating objects to  $55^{\circ}\text{C}+$  will kill all insect stages in an hour but great caution must be taken to ensure the objects are not damaged by the very dry hot air. The Thermo Lignum heat process uses heat and controlled humidity in a chamber to avoid damaging objects.

Domestic treatments include the use of residual sprays containing insecticide such as permethrin around the edges of carpets, under furniture and in other vulnerable areas. Hanging sachets which give off an insecticidal vapour can be used in enclosed spaces such as drawers and wardrobes. Commercial



Figure 8 Adult varied carpet beetle

treatments can include the use of insecticidal smoke generators or 'fogging' with an ultra-low volume insecticide. Although these have value in killing adult moths, they do not penetrate into the textiles. Targeted use of Exosex, a pheromone-based system that disrupts moth mating, can be effective in reducing moth numbers in large, difficult to treat buildings.

### CONCLUSION

With fewer cold winters and more warm, centrally heated buildings, clothes moths and carpet beetles are becoming an increasing problem with faster breeding cycles. More insects per year are produced and the warmer conditions allow them to fly or crawl further and higher, spreading infestations into areas not previously attacked.

Prevent moths and beetles causing damage by:

- good housekeeping, particularly in dark and undisturbed areas
- regularly checking stored vulnerable materials



Figure 9 Varied carpet beetle larva or 'woolly bear'

- monitoring with insect traps
- ensuring pests are correctly identified
- using targeted treatments against insect infestations when they occur.

### Recommended Reading

DB Pinniger, *Pest Management in Museums, Archives and Historic Houses*, Archetype Publications, London, 2001

DB Pinniger, *Pest Management: A Practical Guide*, Collections Trust, London, 2008

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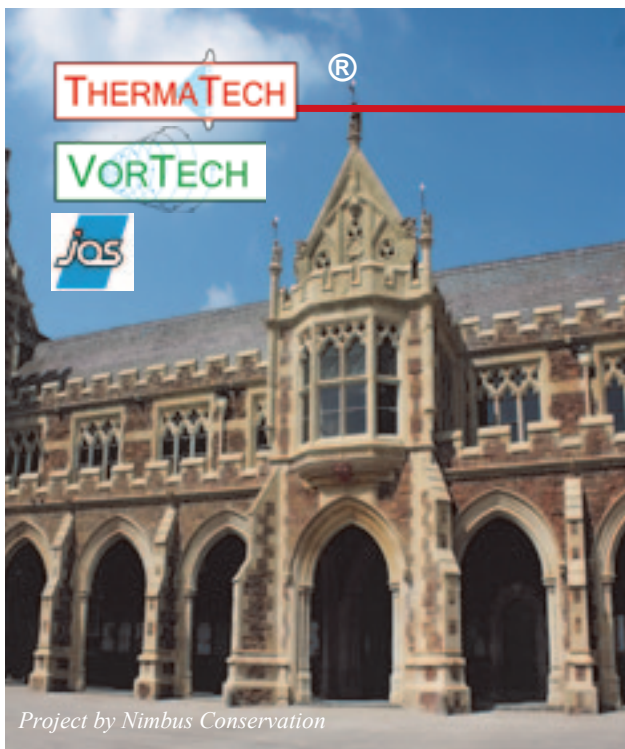
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Email [enquiries@nimbusconservation.com](mailto:enquiries@nimbusconservation.com)  
[www.nimbusconservation.com](http://www.nimbusconservation.com)

STONE CONSERVATION AND MASONRY: *See also: display entry and profile entry in Stone section, pages 100 and 101.*

■ **PAYE STONEMWORK**

Stationmaster's House, Mottingham Station Approach, London SE9 4EL

Tel 020 8857 9111 Fax 020 8857 9222

Email [rg@paye.net](mailto:rg@paye.net)  
[www.paye.net](http://www.paye.net)

MASONRY CONSTRUCTION AND REPAIR SPECIALIST: Specialising in the cleaning, conservation and repair of the built heritage, Paye Stonework is skilled in working with stone, faience, terracotta, stucco, brickwork, render and lime plaster. The company is able to act as principal contractor and manages specialist related trades such as stained glass, leadwork and decorations. It also has a division operating within the high specification internal flooring sector. *See also: display entry in Stone section, page 101.*

## MASONRY CLEANING *continued*

### ■ STONECO LIMITED

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Tel 0800 321 3381

Email [enquiries@stoneco.co.uk](mailto:enquiries@stoneco.co.uk)

[www.stoneco.co.uk](http://www.stoneco.co.uk)

MASONRY CLEANING: See also: display entry in Stone section, page 102.

### ■ SZERELMEY RESTORATION AND STONEMWORK

369 Kennington Lane, Vauxhall, London SE11 5QY

Tel 020 7735 9995 Fax 020 7793 9800

Email [info@szerelmey.com](mailto:info@szerelmey.com)

[www.szerelmey.com](http://www.szerelmey.com)

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### ■ V A CONSERVATION

Falcon House, 643 Stratford Road, Birmingham B11 4DY

Tel 07522 347543

Email [info@vaconservation.com](mailto:info@vaconservation.com)

[www.vaconservation.com](http://www.vaconservation.com)

STONE CLEANING, ARCHITECTURAL CONSERVATION AND RELATED SERVICES: See also: display entry in Stone section, page 103.

[www.buildingconservation.com](http://www.buildingconservation.com)



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## PAINT REMOVAL

## REFERENCES

The system has been used on the following buildings since 1981:  
 British Museum – cast iron railings  
 Greenwich Palace – ornate plaster ceilings  
 New Horticultural Hall, Westminster – painted concrete ceilings and walls  
 Charterhouse School – stonework and timber doors and panelling  
 Royal Hospital, Chelsea – carved woodwork

**The Peel Away® paint removal system has also been tested and approved by:**

The Paint Research Association, London  
 The National Preservation Institute, Washington,  
 Columbia University, Dept. of Architecture, New York,  
 The Auckland Institute and Museum, New Zealand

**The system has also been used for projects involving:**

English Heritage  
 National Trust  
 Building Conservation Trust

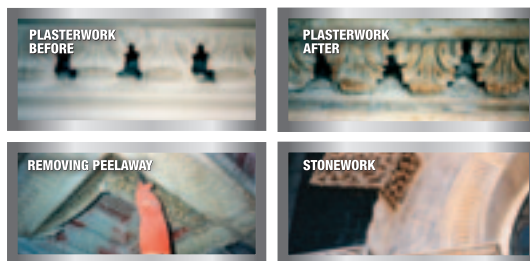


# The Poultrice Paint Removal System

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- The Peel Away® system is particularly suited to surfaces with carvings and mouldings, such as ornate plaster ceilings and stonework, carved or turned woodwork, or intricate ironwork where a reversed mould of the stripped surface can appear on the laminated cover.
- We've 30 years' experience of helping to restore fine surfaces with newer and safer formulations.
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For samples and to find the nearest Peel Away® suppliers, please contact our UK distributor Barrettine on: [sales@barrettine.co.uk](mailto:sales@barrettine.co.uk) or call 01179 600060.

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Tel 0161 442 9850 Email [enquiries@aurald.co.uk](mailto:enquiries@aurald.co.uk)

[www.aurald.co.uk](http://www.aurald.co.uk)

RESTORATION OF LISTED/HISTORIC BUILDINGS AND CHURCHES: See also: display entry in Stone section, page 97.

## ■ HIRST CONSERVATION

Laughton, Sleaford, Lincolnshire NG34 0HE

Tel 01529 497449 Fax 01529 497518

REMOVAL OF SPECIFIC PAINT LAYERS TO INTERIOR AND EXTERIOR SURFACES:

See also: display entry on the inside front cover and profile entry in Building Contractors section, page 67.

## ■ PAYE STONWORK

Stationmaster's House, Mottingham Station Approach,  
 London SE9 4EL

Tel 020 8857 9111 Fax 020 8857 9222 Email [rg@paye.net](mailto:rg@paye.net)

[www.paye.net](http://www.paye.net)

MASONRY CONSTRUCTION AND REPAIR SPECIALIST: See also: display entry in Stone section, page 101, and profile entry in Masonry Cleaning section, page 152.

## ■ STRIPPERS PAINT REMOVERS

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Tel 01787 371524 Fax 01787 313944

Email [info@stripperspaintremovers.com](mailto:info@stripperspaintremovers.com)

[www.stripperspaintremovers.com](http://www.stripperspaintremovers.com)

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## ■ SZERELMEY RESTORATION AND STONWORK

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[www.szerelmey.com](http://www.szerelmey.com)

SPECIALIST STONE CLEANING: See also: display entry in Stone section, page 103 and profile entry in Masonry Cleaning section, page 153.

## AGGREGATES

### ■ GARSIDE SANDS

Eastern Way, Heath & Reach, Leighton Buzzard,  
 Bedfordshire LU7 9LF

Tel 01525 237911 Fax 01525 237991

Email [garside.sands@aggregate.com](mailto:garside.sands@aggregate.com)

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[www.auraltld.co.uk](http://www.auraltld.co.uk)

RESTORATION OF LISTED/HISTORIC BUILDINGS AND CHURCHES: See also:  
*display entry in Stone section, page 97.*

### ■ HISTORIC BRICK POINTING LTD

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Email [info@historicbrickpointing.co.uk](mailto:info@historicbrickpointing.co.uk)

[www.historicbrickpointing.co.uk](http://www.historicbrickpointing.co.uk)

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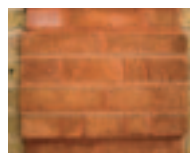
### ■ MATHER & ELLIS LTD

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STONEMASONS: See also: *display entry in Stone section, page 100.*



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Email: sales@cornishlime.co.uk



### ■ HIRST CONSERVATION MATERIALS LTD

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Tel 01529 497517 Fax 01529 497518

PAINTS AND RELATED PRODUCTS: See also: display entry on the inside front cover and profile entry in Mortars & Renders section, page 158.

### ■ HOLKHAM LINSEED PAINTS

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### ■ WOMERSLEY'S LIMITED

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Tel 01924 400651 Fax 01924 403489

Email markwomersley@aol.com  
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RESTORATION OF LISTED/HISTORIC BUILDINGS AND CHURCHES: See also: display entry in Stone section, page 97.

### ■ CARREK LTD

1 St Andrew Street, Wells Cathedral, Wells, Somerset BA5 2UN  
Tel 01749 689000 Fax 01749 689089

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HISTORIC BUILDING REPAIRS: See also: profile entry in Building Contractors section, page 63.

MORTARS & RENDERS *continued*


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■ **HIRST CONSERVATION MATERIALS LTD**

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**Email materials@hirst-conservation.com**  
**www.hirst-conservation.com**

CONSERVATION MATERIALS: The company produces lime putty, renders, daubs, grouts, limewashes, coatings and paints for historic building repair. A range of other conservation materials is also supplied. All products are supported by technical and practical guidance. Analysis and research services are available enabling historic materials to be closely matched where required. Supplies can be delivered anywhere in Europe. This company is a subsidiary of Hirst Conservation which can provide a team of specialists to apply the materials, giving a single source of responsibility. *See also: entry on the inside front cover.*

■ **THE LIME CENTRE**

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**Email info@thelimecentre.co.uk**  
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LIME PRODUCTS, ADVICE AND TRAINING: The Lime Centre at Winchester was opened in 1990 to provide information and training on the use of lime in historic building conservation. It advises on suitable products, specifications, application, mortar colour matching and analysis as well as an onsite consultancy service. The Lime Centre supplies St Astier Natural Hydraulic Lime, aggregates, lime putty, ready mixed mortars, plasters and renders, limewash, riven lath, animal hair and specialist tools. It supplies and delivers to south east England. Please telephone or visit The Lime Centre website for more information.

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A E L Heating	164	ra
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The Bath Stone Group	96	fi
Best Demolition	142	as fi
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li	light fittings: antique & decorative
ra	radiators & stoves

**ENVIRONMENT & BUILDING SERVICES: CONSULTANTS**

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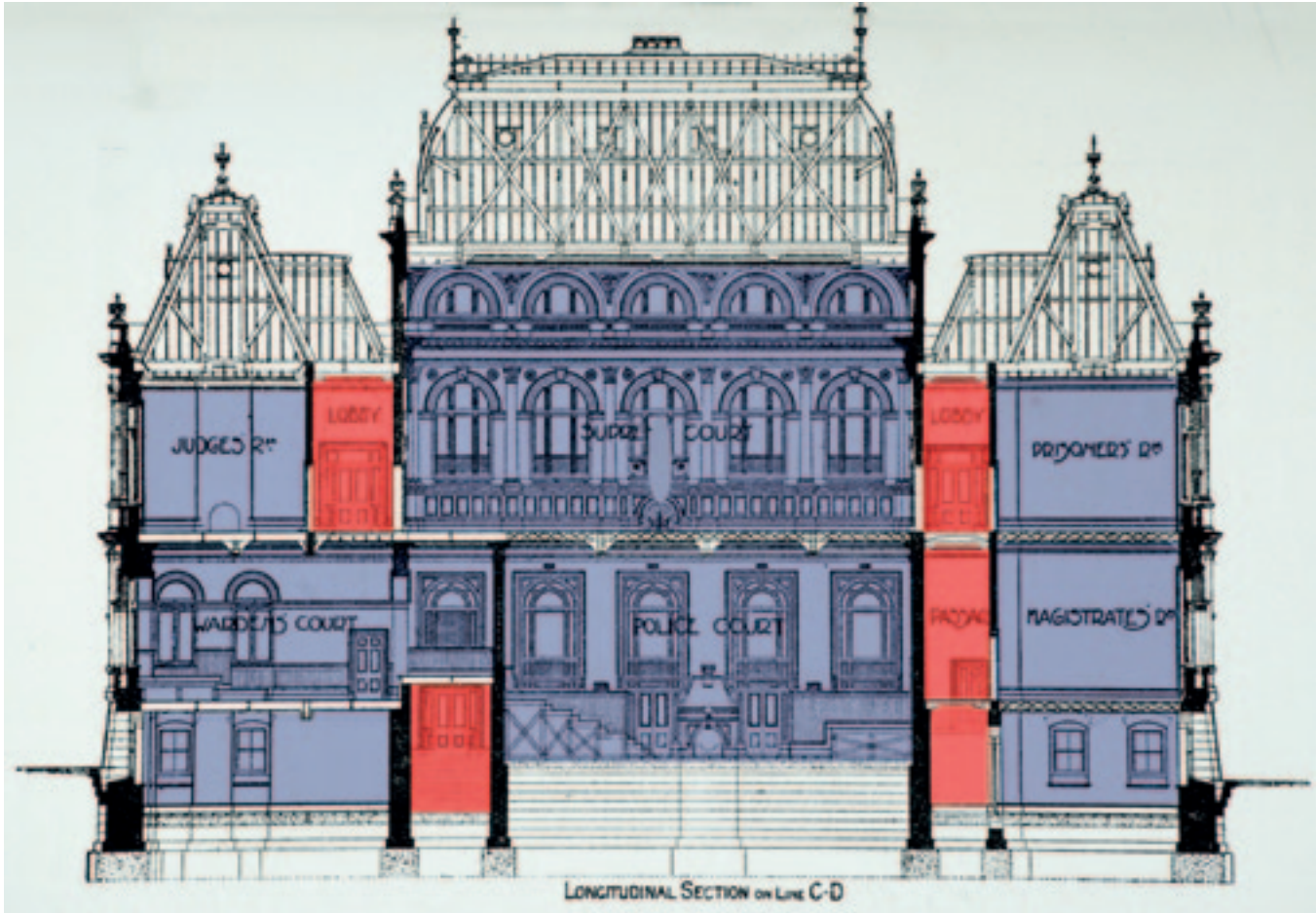
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# INTUMESCENT PRODUCTS

ANDREW FORECAST



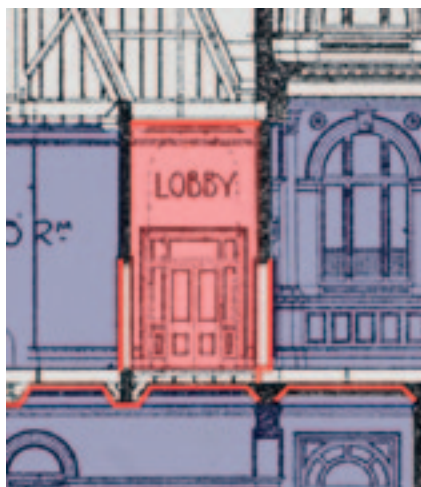
*Compartmentation: the diagram and the detail below illustrates the complexity of ensuring that fire cannot spread rapidly from one part or 'compartment' of a building to another. All openings must be taken into consideration, including those like underfloor spaces which can be permanently protected, and those like doorways, ducts and pipework which must be sealed in an emergency.*

**FIRE PROTECTION** within our built environment has always been of vital importance, not only for life safety but also for property and heritage protection, including business continuity. Fire protection, used for whatever reason, typically falls into two categories, active and passive.

**Active fire protection** generally means those installations that will actively respond to a fire event, including detection, sprinklers and smoke venting for example.

**Passive fire protection** refers to those products that remain robust enough to resist the passage of hot gases and fire for a given duration, and includes architectural elements such as doors, floors and walls as well as proprietary sealing systems such as collars, wraps and dampers.

Although the term passive might not be expected to apply to products which react to the application of heat, it is also used to describe elements which include intumescent materials. Such materials react to heat, usually by expanding, to



enhance the resistance of a component to the passage of heat, smoke and flame.

Active and passive methods of fire protection will typically be used in conjunction with one another to ensure that escape routes remain tenable for a duration

suitable for firstly effective evacuation (to comply with life safety requirements in *The Building Regulations*) and secondly for property protection (including salvage). The determination of where escape routes are needed and for what period they need to be protected, stems from the Building Regulations 2010. Recommendations on how to achieve those minimum expectations are given in the Communities and Local Government (CLG) guidance, Approved Document B (ADB).

## COMPARTMENTATION

Compartmentation is the vertical and horizontal division of the building into spaces and suites of spaces that can be isolated from each other in the event of a fire. In historic buildings, ensuring that fire cannot spread rapidly from one part or 'compartment' of the building to another can be complex since the integrity of walls and floors cannot always be relied on. Furthermore, during the life of the building its use may vary considerably, and even minor changes to the structure



*A typical Victorian panelled door in a house: upgrading to provide half-hour fire protection could be achieved by the use of intumescent perimeter seals and intumescent paper to the recesses of the panels with minimal impact on its character.*

and fabric may impact on the integrity of its compartmentation. Additional measures may be deemed necessary, particularly when a new use is proposed, or where its heritage value has been re-evaluated and better understood, or indeed simply to make the building function better.

Focusing on the need to maintain the compartmentation of a wall, doors are common passive fire elements that typically need to be maintained or upgraded. A door is seemingly a straightforward piece of joinery – it's a bit of wood that fills a hole! However, things are never quite that simple.

Although any closed door will have some delaying effect on the development and spread of a fire, for a door to be considered a fire door (whether it is original, old, upgraded or new), it must be proven to be capable of resisting the effects of a standard fire test (BS 476: Part 22 or BSEN 1634-1) for stipulated periods, usually 20, 30 or 60 minutes.

The requirements for fire doors are complex. While representative examples of intended fire door designs are required to be tested, this is generally not an option where existing door-sets are to be upgraded in situ. In most cases, regulatory authorities are willing to accept an assessment of likely performance in lieu of a direct test result, which will take account of performance evidence for upgrade materials when applied to the specific door-sets in question.

All building elements will of course have an inherent degree of fire resistance but without specific knowledge of products, construction and fire resistance testing procedures, the determination of such periods will be impossible. For example; will a door measuring 44mm thick provide 30 minutes fire resistance? The answer is possibly, but considering its thickness alone would not be enough to assess whether its performance will be adequate. It will also be necessary to consider other issues such as:

- What (if any) is the amount of bow and twist?
- Is there any leaf damage?
- Are there perimeter intumescent seals in place?
- Are there any intumescent gaskets to protect the ironmongery locations?
- If panelled, what are the panels made from and how are they retained?

Even if the above sample questions are suitably

answered, it does not determine the materials/methods required to enhance performance.

If it is found that upgrading the door may make it suitable for use as a fire door, the next step is to determine appropriate upgrade materials. For timber door-sets there are many, ranging from paints and varnishes to board materials and intumescent papers. The type to select depends very much on the end appearance and the door construction itself. Not all upgrading products are all encompassing. Consideration of 'reversibility' is also needed, particularly on historic door-sets in listed buildings.

#### PERIMETER SEALS

Intumescent perimeter seals are almost always needed on timber based fire-resisting door-sets. They sit, usually centrally, within suitable grooves in either the frame reveal or leaf edge and are typically encased in a PVC sleeve. Retro-fit seals are also available which adhere directly to the frame reveal. These seals tend to be wider, but as they are not encased they may only be 2mm thick.

The purpose of intumescent perimeter seals is to expand on heating not only to seal the opening gap and to provide a barrier to restrict charring of the local timber elements, but also to provide sufficient pressure between the frame and the edge of the door-leaf to help control leaf distortion, caused through dehydration and char. Performance is directly linked to the size of the edge gaps. Evidence suggests that once gaps exceed 4mm, the performance of the perimeter seals dramatically reduce; lowering the pressures produced to control distortion, decreasing the erosion resistance capabilities and limiting their efficiency at gap filling. The physical amount of intumescent seal used is also not set as the larger the door leaf (height and width), the larger is its propensity to distort and so the greater is the need for a larger perimeter seal. A perimeter seal alone is not sufficient to demonstrate suitable protection.

#### PANEL UPGRADES

Assuming that the edge conditions have been bottomed out, what of the panels? Depending on their thickness and their method of installation, panels can be one of the weakest part of a door construction. Upgrades are available in the guise of boards, papers and varnishes.

#### BOARDS

Over-sailing a thin timber panel with a board material of known fire resistance (gypsum or calcium silicate based) may well be considered appropriate by some people. However, screw-fixing the board over the panel on the room side (fire risk side) would not necessarily work if tested under the current fire resistance test standard. Many thin (6mm) fire rated boards will not offer insulation and so, if used on the fire side, radiant heat has the potential to burn the thin panel behind and cause it to spontaneously combust, thereby allowing fire to spread to the non-protected side. In this case, such boards may be best fixed to the non-risk side so that the panel burns away, but the fire cannot then penetrate the applied board (subject to suitable fixings of course). Additional questions arise from such upgrades, where there is the use of large boards on a single door. The door becomes unbalanced and so distortion characteristics may not be able to be controlled by the perimeter edge seals, causing the edge of the door to become exploited by the hot gases and flames. Boards can be, and are, successfully used to upgrade doors, but it is essential that the board's inherent performance is known, and that it has specific data to demonstrate its use as an upgrading medium on a comparable door construction.

The primary advantage of using board products is that, although the end appearance is not original, the upgrade is easily reversible subject to the minor infilling of screw fixings.

#### INTUMESCENT PAPERS

An alternative would be to upgrade panels using intumescent papers. These are thin (1-2mm) sheets of intumescent material, often coated on one side with a timber veneer to match the existing timber and grain pattern of the base door. Such sheets are typically applied to both sides of the panel. Their exact installation would be dictated by the manufacturer's test data but generally will require the removal of the perimeter beads in order for the intumescent to be inserted to the edge of the panel before re-applying either new or the existing beads. Some manufacturers have data which demonstrates that this is not required, but it would be advisable to check the evidence before installing. In this case, the intumescent material will expand many times its original thickness, to create a deep protective layer, which keeps the timber panel cool. The intumescent layer also tends to flow, helping to fill fissures within the burning timbers to prevent the entire mass (intumesced product and timber panel) from falling out prematurely.

If it is feasible to remove the existing panel, a replica could be inserted, which will provide enhanced fire performance. Replica panels would typically have an intumescent sheet (1-2mm thick) sandwiched between two thin timber faces of between 4-6mm each. The panel would then be replaced within the door structure using timber beads and pins. Specific evidence of performance of such a system would be needed.

With each of the above options for panel



*Intumescent paints are often used to enable the retention of structural elements such as these cast iron columns where industrial buildings are converted. The coating must ensure that structural integrity is maintained for long enough to evacuate the building.*

upgrades, size does matter. Test data will demonstrate performance but only for what was tested, which would include the specimen size. If a tested panel measured 350mm x 350mm, it would not necessarily work on a panel where one of the dimensions exceeded 350mm. In some instances, the self-weight of the large expanse of reacted intumescent is enough to pull it off the door it is protecting. Therefore, care should be taken to ensure that the test data supports the size (and thickness) of panel that is to be upgraded.

As with the board fixing option, panel upgrades that use intumescent papers are relatively easy to reverse, albeit requiring the potential remake of beads.

#### PAINTED COATINGS

Paints and varnishes are available which offer improvements to the fire performance of existing doors and panels. Their performance is based on a reactive coating that protects the underlying door/panel construction. The paints would require several coats, in thicknesses stipulated by the manufacturer, which would be applied to both sides of the door/panel. Their end appearance is varied depending on application and would be reversible if water based. However, their performance would again be linked to dimension and door/panel construction. Small tested specimens would not necessarily support the products use on a large expanse of panel due to increased heat experienced by the centre of large panels, which do not benefit from the shadowing of the perimeter beads and stiles and rails. Similarly the existing substrate would need to be identical to that tested in order to ensure good adhesion of the reactive coatings. This would certainly require the removal of any existing paint or varnish finish to the underlying door-set/panel.

#### WHOLE DOOR UPGRADES

If a door leaf is solid with no panels, but its thickness is not consistent with that expected for suitable integrity duration, can it be upgraded? The answer is 'possibly'.

#### Boards

Boards (plasterboards, calcium based boards etc) could be applied if they have correct test data to support their use as an upgrade to thin doors. But this is again dependent on the size of the door to be upgraded. Typically

test data will support fairly standard sized door-sets (1,982mm x 762mm) with an existing thickness of 35mm or more if used in single leaf configurations. In most instances, the full boards would be located on both sides of the door, either notched to go over the door stop or, the leaf re-hung and the door stop moved to accommodate the increased thickness. This is a robust and reversible method of upgrade but again, has size limitations.

#### Intumescent papers

Intumescent sheets are not really appropriate for such full size upgrades, and paints and varnishes have limitations in terms of base material (removing existing paints and ensuring similar timber base to test data) and of leaf size.

With all intumescent and board upgrades, it is essential to understand the test data and how it can ultimately limit the end application. A product seen to work in one instance on a pre-prepared specimen of limited dimensions will not necessarily work on a much larger scale. Care should be taken when reviewing test data. Always remember, test evidence is valid for exactly what was tested on the day of test. Its extrapolation to other uses (including size and material) can only be given by carrying out either many tests to cover the range, or by having an assessment produced by a reputable fire engineer.

#### IRONMONGERY PROTECTION

Intumescent materials are also used underneath items of ironmongery, more often for the higher integrity door-sets (60 minutes and above) but also for lower integrity door-sets when items are large and/or invasive to a door construction. Unusually large hinges blades, for example, which cross the frame reveal, act as a path for heat to be transferred past the perimeter intumescent seals (usually bisected at half-hour performance). This has the potential to char timber deep into the frame reveal and ignite the framing on the non-fire side.

Bedding hinge blades on an intumescent gasket helps in two ways, firstly the material will cool the blade by taking heat in order to react and secondly, to fill local fissures within the timber to help slow down the passage of hot gases. Bedding hinges on 'old' timber where grain patterns are prominent is also useful as a matter of course.

#### ALTERNATIVE APPROACH

The provisions above are driven by recommendations in ADB. However, ADB is a functional document which also enables fire engineering to be developed to demonstrate comparable conditions. Taking the geometry of the existing building into consideration, it may be possible for a qualified fire engineer to demonstrate that the instant flashover conditions of a BS476 (BSEN 1634) fire test would either not be reached or would be significantly delayed. If this is considered in conjunction with the speed for a fire to be detected and grow, it could be possible to demonstrate that a full 30 or 60 minutes fire resistance to the British Standard, is not needed. This provides the opportunity to reduce the extent of upgrades needed, with obvious benefits not only in terms of costs and timescales, but also by limiting the need for potentially damaging alterations to historic fabric.

#### SURFACE SPREAD OF FLAME

Notwithstanding fire resistance, escape routes, defined by either ADB or a prepared fire strategy, would be expected to have a certain level of performance to the wall linings. This does not relate to fire resistance (although most escape routes would also need fire resisting properties) but to the surface spread of flame. This relates to the speed at which fire will propagate and spread across the surface of a product. Typically escape routes would need to be classified to a National Class 1 (European Class C-s3, d2). Timber has a general surface spread of flame rating of National Class 3 (European Class D-s3, d2). The exposed surfaces may be treated to change the inherent classification, enhanced to meet the Class 1 needed. This may be achieved by the use of suitable paints and varnishes. There are many available and unlike the intumescent paints/varnishes, will not have a size restriction. It only becomes necessary to ensure that the base timber is suitable to receive the applied paint finish.

#### IN RETROSPECT

As with all fire rated products, be it for integrity or for surface spread of flame, test evidence is key, as is making sure that the product itself is sufficiently suitable and robust for the application in question. In historic buildings, demonstrating fire resistance retrospectively (that is to say, for pre-existing fabric) is therefore quite a complex issue, and should only really be confirmed by those with suitable experience who are able to take account of evidence from the product manufacturer and apply suitable determination.

**ANDREW FORECAST is Senior Fire Engineer at Trenton Fire Ltd (see page 163) and has worked in the Fire Engineering and Consultancy profession for over 16 years. His expertise has been derived from fire testing research through to the preparation of fire engineered strategies for a wide range of new build and heritage projects. He is an active member on the IFE Heritage Special Interest Group.**

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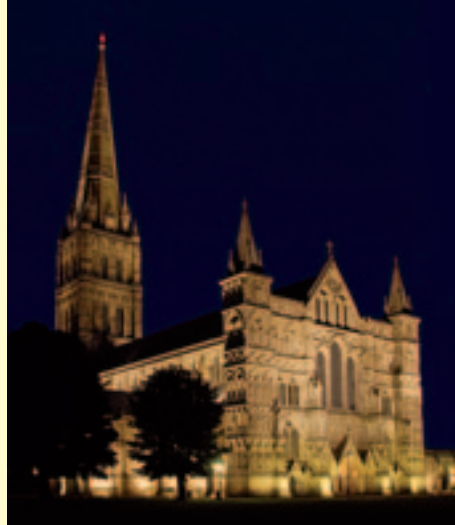
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# SOLID-WALL CONSTRUCTION

## MEASURING AND IMPROVING THERMAL PERFORMANCE

TIM YATES

**T**HE PRESSURE to address the threat of climate change by reducing the emission of greenhouse gases, particularly carbon dioxide, is growing steadily. The UK has committed to an 80 per cent reduction in CO<sub>2</sub> emissions by 2050. Early in discussions it was acknowledged that buildings are a major contributor to these emissions, so efforts to improve the energy efficiency of our existing buildings are intensifying. But for many people the interest in building refurbishment is also, and perhaps primarily, driven by a desire to improve the living conditions in older houses.

Most new buildings have cavity walls, but many pre-1919 buildings are constructed of solid natural stone or brick. These buildings present a particular challenge when it comes to improving thermal performance as any improvements are likely either to change the appearance of the building or reduce space inside. Nevertheless, because around 35 per cent of heat from dwellings is lost through solid external walls, improving the thermal performance of this type of wall is seen as key to reaching the challenging emissions target set by the government.

Research has shown that the potential for reducing emissions (and saving money) in older homes is considerable. Analysis of the latest English House Condition Survey data (2007) shows that 4.8 million dwellings in England (21.5% of English housing stock) were built before 1919 and the proportion in the rest of the UK is similar. The current average Standard Assessment Procedure (SAP) rating of the pre-1919 stock is 40 (a low energy efficiency or 'E' rating on the Energy Performance Certificate (EPC) scale). This is approximately ten SAP points below the stock average of 50, and 50 points below new-build which meets Code for Sustainable Homes Level 3 (a 'B' on the EPC scale).

### IMPROVING ENERGY EFFICIENCY

The key to improving energy efficiency is to take a 'whole-house' approach. This means considering the type of construction,



Figure 1 In situ measurement of thermal conductivity and interstitial moisture behaviour using heat flux monitors and in-wall gradient sensors (Photo: Caroline Rye/Archimetrics Ltd)



exploring all the appropriate energy-efficiency measures, examining the renewable energy options, and implementing water-saving and waste-reduction measures. Many simple improvements, such as draught-proofing, can be made but evidence shows that for solid-walled dwellings to achieve significant CO<sub>2</sub> savings, the thermal performance of the external walls must be improved.

Where traditional and historic buildings are concerned, careful consideration is needed if performance is to be improved without compromising their heritage value, damaging historic fabric or undermining the wellbeing of occupants by changing the way buildings breathe and respond to their internal and external environments.

### WALL INSULATION

Traditional solid-wall construction is probably the most difficult and often the least cost-effective building element to insulate. For listed buildings, any form of wall insulation is likely to require listed building consent and for the majority of buildings external insulation will usually require planning permission.

External insulation can be particularly difficult to incorporate into existing buildings as costly ancillary adaptations such as changes to the eaves and verges of roofs are often required. The potential benefits from installing internal or external insulation should be considered carefully, along with the planning constraints, the potential impact on the fabric of remedial works and the impact on internal conditions.

**Internal insulation** is usually applied directly to the inner face of the external wall, followed by a finish such as plaster. It is often necessary to relocate plumbing and electrical services and to adjust skirting boards, door architraves and fitted furniture. Cornices will also need to be modified which may result in the loss of original plasterwork.

Whatever insulation material is used, the improved wall will normally need to achieve a U-value of no more than 0.30 W/m<sup>2</sup>K, although a lower standard may be acceptable depending on the building. (U-value is a measure of heat transfer through a building element, so the lower the value the better.)

Thicker internal insulation systems may significantly alter the sizes of rooms, corridors, etc.

**External insulation** systems usually comprise an insulation layer fixed to the existing wall and a protective render or cladding installed on top to protect the insulation from the weather and mechanical damage. The increased depth of an external render or insulation system will require adaptation of roof and wall junctions, window and door openings and rainwater goods. Decorative details such as string courses and quoins may also be affected, and natural materials such as stone or brick will be hidden, effecting a significant change in character.

As most suitable external insulation systems will also need to be protected from rain and mechanical damage, they should normally be considered as a two-component

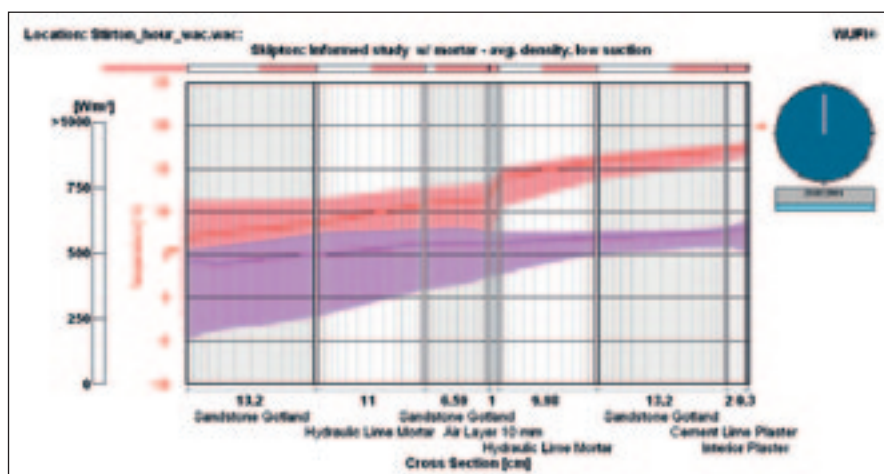


Figure 2 An example of a more complex model showing predicted temperature (red) and dew point (purple) changes through a sandstone rubble infill wall (Image: Dan Browne/SPAB Project)

system where all layers must work together. Materials are available which can be used as a single coat, such as insulating lime renders which contain expanded vermiculite, but these tend to give significantly lower insulating values. They can, however, sometimes be applied in circumstances where other types of external insulation would be unacceptably detrimental to the character of a historic building. Again, whatever insulation material is used, the improved wall will need to achieve a U-value of no more than 0.30 W/m<sup>2</sup>K.

### PREDICTING THE RISKS AND POTENTIAL BENEFITS

It is necessary to understand from the outset how the proposed changes are likely to alter the behaviour of the building. The biggest area for concern is moisture, both in the wall and in the building as a whole. The addition of insulation material to a wall is likely to alter the way moisture moves through it. For example, if non-breathable materials are added to an older porous wall, its ability to breathe and regulate moisture is compromised. Dampness, and even structural damage could result. Even if the walls are dry when the work is carried out, there may be evidence of past problems and a risk of them recurring. The main sources of external dampness will include run-off from gutters and downpipes, defects in the fabric such as roof flashings, and penetrating damp from driving rain. Rising damp may also be a problem, but only at the base of the wall. Internally, condensation is the mostly likely problem.

It is also necessary to consider the state of repair of the walls as dampness is often associated with salt crystallisation or efflorescence. Together, these processes can accelerate the deterioration of stone or brick surfaces, internally or externally.

The moisture content of a wall depends on the prevailing weather conditions, time of year and exposure of the site. If the wall is damp or in a poor condition, these problems need to be overcome before installing wall insulation. If there are any doubts about the condition of the existing walls, they should be professionally surveyed before any improvement works are considered.

Before any work is undertaken, it is also important to estimate the potential savings in terms of energy use, CO<sub>2</sub> emissions and reduced heating bills. The most common method of predicting the benefits is to model the performance of the building before and after improvements. The usual model is a SAP or RDSAP (Reduced Data Standard Assessment Procedure; further information on these procedures is available at [www.bre.co.uk](http://www.bre.co.uk)).

SAP uses a series of input values for the thermal conductivity of the different building elements, a series of accepted values and a set of equations that represent the environmental physics of the building. Accepted values are provided as part of the assessment method and these are used when specific performance information on the product or system is not available. However, when specific performance information is available for walls, floors, roofs and other elements, it should be used in preference to data from the tables.

### MOISTURE

Moisture movement and its measurement in walls has been studied for many years. Various measurement methods have been developed and tested but the most reliable seems to be to collect a small sample by drilling a hole and then weighing, drying and re-weighing the sample. This is a good way to determine the moisture content, but to start mapping moisture and to measure change over time requires too many drill holes to be practical.

However, advances in computing have allowed the development of complex models in 1 and 2 D, which can be validated by a limited programme of on-site intrusive measurements. The most frequently used model seems to be WUFI (*Wärme und Feuchte Instationär* or Transient Heat and Moisture), developed by IBP in Germany. This model is validated using data derived from outdoor and laboratory tests. It allows realistic calculation of the transient hygrothermal behaviour of multi-layer building components exposed to natural climate conditions by modelling the coupled heat and moisture transfer in building components.

There are a number of projects applying WUFI modelling to traditionally constructed

solid-walled buildings. One of these is the EU-funded SUSREF Project (Sustainable Refurbishment of Building Facades and External Walls). This project includes modelling of buildings in Wales by BRE Wales and Cardiff University to examine the distribution of moisture in a solid wall and the changes that occur when improvements are made to the wall's thermal performance.

Another project is being co-ordinated by the Society for the Protection of Ancient Buildings (SPAB). The results were reported at a meeting held in June 2011. An example of the equipment used is shown in Figure 1 and one of the outputs can be seen in Figure 2, which shows changes in temperature, water content and relative humidity.

Understanding the distribution of moisture and temperature in a wall is important if changes such as the addition of internal insulation are to be made to it. Such changes may alter the point at which interstitial condensation occurs or the minimum winter temperature. (Interstitial condensation occurs when relatively warm moisture-laden air diffuses into a vapour-permeable material – if it is relatively warm on one side and below the dew point temperature on the other, the moisture-laden air can reach 'dew point' within the material and deposit water there). These changes can affect the long term durability of the wall materials and of any timber or steel frame materials, which may be particularly vulnerable. The research undertaken by SPAB has also shown that moisture content can affect the measured U-value of the wall by between 10 and 40 per cent.

### THERMAL CONDUCTIVITY

Most thermal performance calculations rely on a series of assumed values, often based on measured values and then extrapolated to cover a wider range of building materials. In the case of natural stone the values used are often based on the density of the material and assume that the wall is solid stone whereas, of course, stone walls are rarely solid and include varying numbers of voids which may or may not be filled with rubble and/or mortar.

Two recent studies, *The SPAB Research Report 1: U-value Report* (2010) and *Historic Scotland's U-values and Traditional Buildings* (2011) have focused on U-values as an indicator of thermal performance and involved the comparison of in situ measurements with U-values calculated with software programs and often-used 'default' U-values. A key objective was to help construction professionals and building energy performance assessors make more informed and balanced decisions when assessing and improving the energy performance of traditional buildings.

U-values are normally calculated with computer programs developed with modern non-traditional construction in mind which follow the conventions set out in *BR 443: Conventions for U-value Calculations*. For the studies, in situ U-value measurements were carried out, mostly of uninsulated solid walls but, for comparison, some cavity

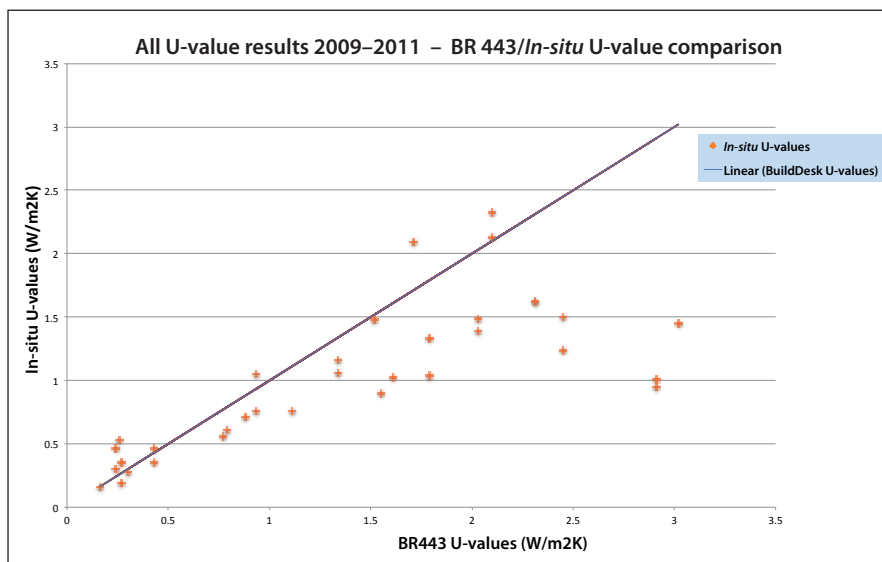


Figure 3 Plot of calculated U-values (using BR 443) versus measured U-values for a range of solid walls from The SPAB Research Report 1: U-value Report ('BR 443' refers to the Building Research Establishment document BR 443: Conventions for U-value Calculations, which describes the calculation methods for determining the U-values of building elements based on British Standards)

walls and building elements retrofitted with insulation were also measured. The non-invasive measurements were generally taken of building elements with their internal and external finishes intact.

The studies then compared the U-values measured in situ with their calculated equivalents using the software program BuildDesk U v3.4. SPAB's research suggests that 73 per cent of the traditionally built walls sampled (including timber, cob, limestone, slate and granite construction, 59 walls in total) actually performed better than expected (see Figure 3). A particular focus of the Historic Scotland comparison was the impact of the lime and stone core of a traditional solid stone wall on thermal performance.

This research is not a criticism of the calculation methodology or U-value modelling software, but it does highlight the difficulty of modelling and calculating the thermal performance of traditional walls using conventional techniques. These studies demonstrate that software programs for U-value calculations tend to overestimate the U-values of traditional building elements. In other words, traditional building elements tend to perform better thermally than would be expected from the U-value calculations. Furthermore, it is suggested that the in situ measurement of U-values is a useful tool which can aid in the assessment of the thermal performance of traditional building elements.

### POTENTIAL PITFALLS

Although historic buildings are often too precious to alter by adding solid wall insulation, it is suitable for many unlisted or converted pre-1919 buildings. In these cases it is important to first establish that the alteration will be of significant benefit and then to understand its probable impact.

Overall, the recent work on moisture and on thermal values has shown that in order to make good and reliable plans for the thermal improvement of solid walls we need to have a

good understand how the walls of a building are performing now: how the moisture is distributed, how and how much the walls are breathing, and how good the current thermal performance is. Only then is it possible to make good, low-risk plans for improving the thermal performance of walls, which will improve the building's thermal efficiency without threatening its fabric.

### Acknowledgements

This article draws on the work of many at BRE and in the wider research community. The author is very grateful for access to their work and their ideas on thermal improvements for solid-wall houses.

### Useful Information

Building Research Establishment  
[www.bre.co.uk](http://www.bre.co.uk)  
 Climate Change and Your Home (English Heritage)  
[www.climatechangeandyourhome.org.uk/live](http://www.climatechangeandyourhome.org.uk/live)  
 The Energy Saving Trust  
[www.energysavingtrust.org.uk](http://www.energysavingtrust.org.uk)  
 Historic Scotland technical papers  
[www.historic-scotland.gov.uk/technicalpapers](http://www.historic-scotland.gov.uk/technicalpapers)  
 The National Refurbishment Centre  
[www.rethinkingrefurbishment.com](http://www.rethinkingrefurbishment.com)  
 The Refurbishment Portal  
[www.rethinkingrefurbishment.com/portal](http://www.rethinkingrefurbishment.com/portal)  
 The Society for the Protection of Ancient Buildings research reports  
[www.spab.org.uk/advice/energy-efficiency](http://www.spab.org.uk/advice/energy-efficiency)  
 Sustainable Refurbishment of Building Facades and External Walls  
<http://cic.vtt.fi/susref>

**TIM YATES PhD is technical director of the Building Research Establishment Ltd (see page 38) with responsibility for projects on heritage buildings. He has been involved in the built heritage for more than 35 years and is currently chairman of the British Standards Committee on Cultural Heritage.**



Chris Cole of Banisters of Bath, repairing the cross-banded and French polished handrail of a late 18th century town house in Bath  
Photo: Jonathan Taylor

## Chapter 5 Interiors

INTERIOR CONSULTANTS & CONSERVATORS	Page	1	2	3	4
Ambo Architects	19	id			
A T Cronin Workshop	178			an	
Acanthus Clews Architects Ltd	19	id			
Agrell Architectural Carving Ltd	133			wc	
Anthony Beech Furniture Conservation and Restoration	178			an cb fr gi	
Anthony Short and Partners	20	id			
Antique Bronze Ltd	109				fa
Bryan Williamson & Daughters	62		ic		
Banisters of Bath	132			an bn cb wc	
Bates Zambelli	20	id			
Between Time Ltd	62		ic	wc	
The British Antique Furniture Restorers' Association	179			an	
C R Crane & Son Ltd	63			bn	
Campbell Smith & Co Ltd	173		ic	gi	wa
Carden & Godfrey Architects	21	id			
Carpenter Oak & Woodland Co Ltd	74			wc	
Carthy Conservation Ltd	98	pa	ic	gi	
Carvers & Gilders Ltd	188			an gi wc	
Charles Oldham Fine Woodcarving	179			an cb wc	
Christopher Rayner Architects	22	id			
Clive Beardall Restorations Ltd	178			an cb fr gi jp ve	
Cliveden Conservation Workshop Ltd	174				wa
Clough Harris Limited	172		ic		
Conservation Building Services Ltd	63	pa	ic		
Country House Renovations Limited	63		ic		
Crick Smith Conservation	175	pa		gi	wa
Devereux Decorators Ltd	172		ic		wa
Devlin in Design	173	id	ic		
Donald Insall Associates Ltd	23	id			
Francis W Downing	174				fa
E I Flood & Sons	186		ic		
Farthing & Gannon	188			gi	
Feilden & Mawson LLP	23	id			
The Fine Iron Company	113			gi	
Franklin Upholstery	171	id		an gi	
Gilmore Hankey Kirke Ltd (GHK Architects)	24	id			
Glasgow Steel Nail Co Ltd	151			an	
H O K Conservation and Cultural Heritage	25	id			
Hare & Humphreys Ltd	173	pa	ic	gi	
Helen Hughes Historic Interiors Research & Conservation	175	id	ic		
Heritage Testing Ltd	49	pa			
Heritage Tile Conservation Ltd	180		ic		
Hesp & Jones	172		ic	gi	
Hirst Conservation	174	pa	ic	gi	wa fa
Howell & Bellion	172		ic	gi	
Inspire Conservation Ltd	66		ic	gi	
John McAslan + Partners	26	id			
Johnston and Wright	26	id			
Jonathan Rhind Architects	26	id			
Julian Harrap Architects	26	id			
K A W Design	171	id			
Bernard Kelly	173	id	ic		
Knowles & Son (Oxford) Ltd	67		ic	cb	
Luard Conservation Limited	172		ic	wc	
M R D A	27	id			
Martin Ashley Architects	27	id			
Mather & Smith Ltd	136			gi	
Norgrove Studios Ltd	118			gc	
Lisa Oestreicher Architectural Paint Analysis	175	pa			
Ornate Interiors Limited	187		ic		
Owlsorth I J P	69		ic	wc	
The Perry Lithgow Partnership	175		ic	gi	wa fa
Peter S Neale Blacksmiths	115			gi	
Purcell Miller Tritton LLP	29	id			
Richard Crooks Partnership	29	id			
Richard Ireland Period Restoration	175		ic		wa
Richard Rogers Conservation Ltd	174		ic		fa
Romark Interiors	179			an cb fr jp wc	
Rupert Harris Conservation	174			an gi	fa
Sash Restoration Co	130			cb	
Smiths Gore	31	id			
Stonewest Limited	73		ic	an cb fr	
Stuart Page Architects	32	id			
T Coleborn & Son Limited	72		ic		
Thermo Lignum UK Limited	145			an	
Treasure & Son Ltd	72		ic		
Twyford Lime Products	158		ic		
V A Conservation	172	pa	ic	gi	wa fa
W P D Productions	173		ic		
Walden Joinery	133			bn	
The Wall Paintings Workshop	175		ic		wa fa
Westland London	165			wc	

SERVICE CODES	fr	French polishers
1 id	interior consultants & designers	
pa	paint analysis	
2 ic	interior conservators & decorators	
3 an	antique & furniture restoration	
bn	banisters	4
cb	cabinet makers	wa
		fr
		gi
		jp
		ve
		wc
		fa
		wa

INTERIOR FITTINGS & FURNISHINGS	Page	SOFT	MISC
A D Calvert Architectural Stone Supplies Ltd	95		fi
A T Cronin Workshop	171	tx	
A E L Heating	164		ra
Aldershaw Handmade Clay Tiles Ltd	83		fi
The Bath Stone Group	96		fi

Best Demolition	142		fi
Boden & Ward Stonemasons Ltd	96		fi
C S C Window Films & Blinds	128		so
Carvers & Gilders Ltd	133		fi
The Cast Iron Company	112		li lf
Cathedral Works Organisation Ltd	63		fi
Clive Beardall Restorations Ltd	178	le	
Cliveden Conservation Workshop Ltd	98		fi
Drummonds Architectural Antiques Limited	180		fi ra
Franklin Upholstery	171	ts tx	
Grinshill Stone Quarry	99		fi
Haddonstone Limited	137		fi
Nostalgia	165		fi
StoneCo Limited	102		fi
The Tetley Workshop	180	ca tx	
V A Conservation	103		fi
Westland London	165		li fi
William J Gowar & Company Ltd	128		ra

PRODUCT CODES	MISC	fi	fireplaces & surrounds
SOFT ca	carpet makers & conservators	lf	light fittings, display
le	leather conservation	li	light fittings: antique & decorative
ts	textile suppliers	ra	radiators & stoves
tx	textile conservators	so	solar protection

FLOOR & WALL TILES	Page	1	2
Aldershaw Handmade Clay Tiles Ltd	83		ft
Antique Bronze Ltd	109		mo
Antique Buildings Limited	142		ft
C & D Restoration Ltd	97		mg
Carthy Conservation Ltd	98		mo
Cathedral Works Organisation Ltd	63		ft
Cliveden Conservation Workshop Ltd	98		mo
Coleford Brick & Tile Co Ltd	90		ft
Crick Smith Conservation	175	ce	
Drummonds Architectural Antiques Limited	180		ft
Heritage Tile Conservation Ltd	180	ce	ft mo
The Jackfield Conservation Studio Ltd	180	ce	ft mo
Lovell Purbeck Limited	99		mg
Minerva Stone Conservation	100		mg
The Mosaic Restoration Company Limited	180		mo mg
Shaws of Darwen Limited	107		ft
Stone Central (NW) Ltd	102		mg
Stonewest Limited	73	ce	mo
Taylor Pearce Restoration Services Limited	108	ce	
Trevor Caley Associates Limited	180		mo
The Wall Paintings Workshop	175		mo
West Meon Pottery	108		ft
Westland London	165		mg
The York Handmade Brick Company Limited	90		ft

PRODUCT & SERVICE CODES	
1 SERVICES ce	ceramics conservators
2 PRODUCTS ft	floor & wall tiles
mg	marble & granite
mo	mosaics

TIMBER FLOORING	Page	1	2
Antique Bronze Ltd	109		tp
Antique Buildings Limited	142	ti	tp
Carpenter Oak & Woodland Co Ltd	74	ti	
The Cleft Wood Co	131	ti	
Coyle Timber Products	131	ti	
Drummonds Architectural Antiques Limited	180		tp
English Woodlands Timber Limited	131	ti	tp
Foster & Pearson Limited	135	ti	tp
Milestone Lime	158	ti	tp
Vastern Timber Co Ltd	131	ti	
Walden Joinery	133		tp
Weald and Downland Open Air Museum	193	ti	
Weldon Contracts Limited	180	ti	tp
Whippletree Hardwoods	180	ti	tp

PRODUCT CODES	
ti	timber suppliers
tp	parquet flooring

PLASTERWORK	Page	1	2	3
A D Holden Plastering	185	pf pl		
A V V Solutions Limited	95		sw	
Alba Plastercraft	185	pf pl		
Andrew Doyle Past Plastering Services	185	pf	sw sa	
Artisan Plastercraft Ltd	185	pf pl	mm	bt
Bryan Williamson & Daughters	62		sw	
Babylon Tile Works	83			bt
Bennie Historic Conservation	60	pf pl		
Between Time Ltd	62	pf pl		
Bosence	186	pf pl	sw	
Bosence & Co	46	pl		bt re

## TEXTILES &amp; UPHOLSTERY

Bullen Conservation Ltd	97		pm	
C R Crane & Son Ltd	63	pl		
C S Interiors	185	pf pl		
Carpenter Oak & Woodland Co Ltd	74			bt
Carthy Conservation Ltd	98	pf pl		
Classic Covings Ltd	186	pf pl		
The Cleft Wood Company	131			bt
Cliveden Conservation Workshop Ltd	186	pf pl		
Conservation Building Services Ltd	63	pf pl		
Cornish Lime Company Ltd	157			bt re
Coyle Timber Products Ltd	131			bt
Crittall Windows Ltd	124		sw	
Dunne and Co Ltd	66	pl		
E G Swingler & Sons	82			bt
E I Flood & Sons	186	pf pl		bt re
England's Ornamental Plastering	186	pf pl		
English Woodlands Timber Ltd	186	pl		bt
Farthing & Gannon	186	pf pl	pm sa	
Fine Art Mouldings	186	pf pl		
G Cook & Sons Ltd	186	pf pl		
H J Chard & Sons	158			re
Hayles and Howe Ltd Ornamental Plasterers	187	pf pl	sa	
Heritage Cob & Lime	158	pl		
Hirst Conservation	67	pl		
Hirst Conservation Materials Ltd	158			re
Historic Brick Pointing Ltd	155	pl		
Ingarsby Conservation Ltd	142			bt
Inspire Conservation Ltd	66	pf pl		
Ivinghoe Building Services Ltd	67	pl		
Kestell and Lewis Ltd	187	pf pl		
The Lime Centre	158			re
Luard Conservation Limited	172	pl		
Magenta Building Repair Ltd	68	pf pl		
McGregor Patterns	115		mm	
Melcombe Regis Construction SW Ltd	68	pl		
Mike Wye & Associates Ltd	158	pl		bt re
Minerva Stone Conservation	100	pf pl		bt re
Multi Marque Production Engineering Ltd	155	pf		
Nimbus Conservation Limited	101	pl		
Milestone Lime Plastering	187	pl		bt
O'Reilly Period Cornice Restoration & Cleaning	187	pf pl	mm	
Ornate Interiors Limited	187	pf pl		
Orveta Products	142		sw	
Owlsworth I J P	69	pf pl		
Paye Stonework	101		sw	
Period Property Solutions Building Conservation Limited	69	pl		
Plastercraft Interiors	188	pf pl		
Preston & Massa	187	pf pl		
Recclesia Ltd	70	pf pl		
Richard Ireland Period Restoration	188	pf pl	pm sa	
Sandy & Co (Contractors) Ltd	70	pl		
Simmonds of Wrotham	70	pl		
Simon Swann Associates Ltd	109	pf pl		
Stevensons of Norwich Limited	188	pf pl		
Stonewest Limited	73	pf pl		
T Coleborn & Son Limited	72	pl		
The Traditional Lime Co	159			bt re
Traditional Technologies LLP	142	pl		
Treasure & Son Ltd	72	pl		
Twyford Lime Products	158	pl		
V A Conservation	103		sa	
W P D Productions	173	pf pl	sw	
Sean Wheatley	188	pf pl		
Whippletree Hardwoods	131			bt re
Womersley's Limited	158	pl		bt re

PRODUCT & SERVICE CODES		sw	stucco
1	pf fibrous plasterwork	3	bt lath & battens
	pl lime plasterwork		re hair & fibre reinforcement
2	mm mould making	(See Mortars & Renders table on page 144 for lime suppliers)	
	pm papier-mâché		
	sa scagliola		

WALLPAPERS & PAINTS		Page	
Cornish Lime Company Ltd	157	pd	
Crick Smith Conservation	175	pd	wl
Devereux Decorators Ltd	172		wl
Hirst Conservation Materials Ltd	158	pd	
Holkham Linseed Paints	157	pd	
Ingarsby Conservation Ltd	142	pd	
Inspire Conservation Ltd	66	pd	
Keim Mineral Paints Ltd	156	pd	
Mike Wye & Associates Ltd	158	pd	
Lisa Oestreicher Architectural Paint Analysis	157	pd	
Traditional Technologies LLP	142	pd	
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PRODUCT & SERVICE CODES	
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## INTERIOR DESIGNERS

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Contact Kate Ainslie Williams BILD, MSc Historic Conservation, IHBC Associate Member

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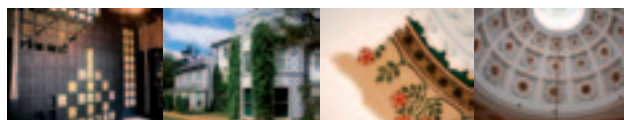
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# SHELLAC

ANTHONY BEECH

**M**ANY RESINS, oils and waxes have been used over the centuries to provide a glossy finish to fine timbers. One of the most important is shellac, a resin produced from a secretion of the lac beetle (*Laccifer lacca*), which feeds on tree sap. The insect's name is derived from the word *Lakh*, the Sanskrit word for the number 100,000, and relates to the number of insects found on infested trees. The tree branches become covered in the secreted material which, in its raw form, is called *sticklac*. It is harvested extensively in India and, to a lesser extent, in China, Burma and Thailand.

During the process of harvesting, branches are cut from the tree then crushed and washed to remove wood fibres and other contaminants, transforming the *sticklac* into a usable material called *seedlac*. Further refinement is achieved by heating the *seedlac* to its melting point and filtering it through a cloth onto a cool surface to form discs of *buttonlac*, which will be familiar to traditional polishers as a key ingredient of shellac.

The *seedlac* or *buttonlac* can then be dissolved in alcohol. This dissolved form of shellac is sold as French polish under trade names such as 'special pale polish' or 'button polish' depending on the exact preparation. The natural product contains a small quantity of wax produced by the lac beetle which is sometimes removed during production to create 'de-waxed' shellac. The weight of shellac dissolved is described as 'the cut'. This term refers to the ratio of shellac to alcohol in the preparation, so one pound of shellac dissolved in a gallon of alcohol is called a 'one-pound cut'. Most commercial preparations are a three-pound cut, which can then be further diluted as required or used neat for 'bodying up'.

Other off-the-shelf shellac preparations may have added ingredients to adapt the properties of the shellac, such as melamine to produce 'heat-resistant' polish. These modified shellacs have their place alongside modern cellulose and acrylic lacquers for finishing new cabinet work and furniture but are not generally suitable for period furniture or period architectural features because they are likely to be less reversible and less stable.

The exact nature of the shellac product varies depending on the species of tree which the lac beetle feeds on. This results in different colours and properties which were historically exploited to achieve different finishes ranging from deep brown



*English Japanned cabinet, 1690-1700: Japanning allowed European cabinet-makers to imitate oriental lacquer finishes. Shellac-based recipes for Japanning were published in 1688 in John Stalker and George Parker's A Treatise of Japanning and Varnishing. (Photo: Victoria and Albert Museum, London)*

to orange and amber tones. Use of the more opaque shellacs can be problematic as building a 'grain-filled' finish can require the application of so much shellac that the wood surface is partially obscured, resulting in an unsatisfactory, muddy finish. The finish can also become patchy during the 'cutting back' process (see 'Application' below).

Other issues arose historically with the grain-fillers used to prepare the wood for polishing. These were popular in the late 19th and early 20th centuries as a way of speeding up the polishing process. They

were often prepared using chalk and other materials which were coloured to match the wood surface. As a result, the finish on much Edwardian furniture displays white flecks in the grain where the grain-filler has been bleached by ultraviolet light.

## HISTORIC USE

Shellac has been used for wood finishing since at least the 13th century but it has had many other uses. Its most common early use was for fixing dye and it has been used in the food, pharmaceutical and cosmetic



French polished display case at the Sedgwick Museum of Earth Sciences, Cambridge



Rio rosewood table from the collection at Burghley House with original French polished finish (Reproduced by the kind permission of Burghley House Preservation Trust)

industries. Its thermoplastic properties also lent themselves to the production of cast material before the advent of modern plastic alternatives, including early gramophone records.

Early uses in cabinet-making include the creation of 'Japanned' finishes. References to the use of shellac appear in Stalker and Parker's *A Treatise of Japanning and Varnishing* published in 1688. This included recipes for the preparation of shellac-based varnishes and drawings of suitable oriental designs. The process of Japanning was an attempt by European craftsmen to replicate the appearance of Japanese and Chinese lacquerware, which was highly fashionable and was imported by wealthy collectors alongside oriental porcelain. Some confusion exists regarding the differences between oriental lacquer and shellac-based finishes. Oriental lacquer differs from shellac in its use of raw 'urushi' lacquer direct from the tree. It can only be used in its country of origin as it is difficult to store and cannot be transported in its raw form.

Around the time of Stalker and Parker's treatise, shellac was also being used to formulate varnishes which were applied by brush and created a finish for cabinet-work but which did not produce the completely flat and grain-filled surface typical of the later technique of French polishing. Many other varnish types were also then available. These were based on drying oils such as linseed oil, copal, sandarac and mastic, which were extracted directly from trees and plants.

Towards the end of the 18th century the technique of applying shellac using friction to achieve a grain-filled, bright, flat surface developed. This was well-suited to veneered surfaces which were often decorated with marquetry and inlay. Satinwood was one of the most fashionable veneers and responded particularly well to the bright finish of shellac, which enhanced the 'satin' patterns in the grain. This bright finish continued to grow in popularity into the Regency period when highly polished rosewood took over as the veneer of choice for fashionable furniture.

The eclectic nature of Victorian furniture later in the 19th century and the ease of trade with other parts of the world meant that mahogany, walnut and oak were all used by



Discs of buttonlac, a key ingredient of shellac (Photo: www.cornelissen.com)

cabinet-makers. The majority of this work received a shellac finish of some sort, ranging from opened grained oak to highly polished mahogany and walnut. Some of the best shellac finishes were produced at this time and many of them were sufficiently stable that they can be found in good order today.

Unfortunately, the Victorian period also saw a great deal of 17th and 18th-century furniture inappropriately given a shellac finish, often removing or covering earlier oil and wax finishes. Many late 19th-century interiors also boast excellent examples of French polished surfaces, staircases, panelling and display cabinets. These will often have original finishes which can be revived or uncovered from beneath later layers of opaque varnish or shellac.

#### APPLICATION

The familiar term 'French polish' refers not to the product itself, as is often thought, but to the technique of applying shellac in thin layers. The shellac is applied with a polishing 'fad' or rubber made by compressing polishers' wadding or cotton-wool into a covering of fine, lint-free cotton. The wadding is then saturated with liquid shellac and the sides are wound to tighten the cover, forming a firm pad which can be held between the thumb and forefingers. After building up a base-layer the surface is then worked in circular or figure-of-eight movements to push the soft shellac into the grain, then in straight lines to pull the surface flat and remove any circular 'whip' marks.

The surface is then allowed to dry before it is lightly 'cut back' with fine sand paper. Traditionally, pumice was sometimes used to assist the flattening process and fill the grain.

This is less common in modern polishing workshops as it can compromise the quality and stability of the shellac film. After cutting back to remove any ridges, the application process is repeated until the desired level of finish is achieved. Many traditional polishers used linseed oil to lubricate the fad so that more polish could be applied before the stickiness began to cause the fad to drag and damage the surface. This can be problematic, however, because if all the oil is not removed in the spiriting off or waxing back stages, it can spoil the finish by bleeding through or creating matt patches.

Once the desired full-grained surface has been achieved, the spiriting off or pulling over process begins. More alcohol is introduced into the mix to flatten and polish the surface of the shellac film to a bright finish with no lines or whips. This bright finish can then be 'burnished' with a liquid abrasive compound to produce a bright finish or matted back with wax and fine wire wool to achieve a softer, mellow finish which is well suited to late 18th-century furniture.

#### RESTORING AND CONSERVING SHELLAC-BASED FINISHES

Traditional shellac-based finishes remain semi-soluble in alcohol many years after application and can therefore be removed or reworked with alcohol. In many cases finishes with superficial damage can be reworked without the need to clean back and re-polish. If the shellac film is not heavily degraded it is preferable to repair the surface rather than re-polish. Minor damage and signs of wear can be carefully re-saturated with a weak shellac solution and a fine brush. This will often be sufficient to return the damaged area to its base colour, making the damage less visible. This approach is most effective on period pieces where evidence of use is recognised as part of the object's history and should be retained.

White 'bloom' or haze on shellac caused by water or heat damage can sometimes be 'burnished' out with a mild abrasive solution if it is limited to the surface of the shellac, or re-saturated with a weak shellac solution. The bloom is caused by tiny cracks in the surface and polishing with abrasive can bring back a good reflective finish. However, caution

must be exercised. Although less invasive than full re-polishing, this technique does remove some of the shellac surface and it is possible to burnish through. This will be indicated by a matt patch where the shellac has been removed to an earlier finish layer or to the bare wood surface. This will then require the polish to be re-built and may mean that the surface has to be completely re-polished to achieve an even finish. The other pitfall of this approach is that it can leave a brighter patch in the worked area compared to the surrounding aged surface. This can be avoided by working over the entire surface and then matting down to the desired level.

Apart from handling damage or water damage the most common reason for the failure of shellac finishes is exposure to unfiltered ultraviolet light, which gradually breaks down the finish until it reverts to a white powder on the surface. Infrared light can also cause damage by heating the surface until it becomes unstable. Unmodified shellac is sensitive to heat and can be damaged by hot cups and plates, which are responsible for a great deal of damage to shellac-finished side tables and dining tables. Alcohol in the form of wine or spirits will also soften shellac causing damage.

When it is necessary to re-polish because the shellac finish has broken down beyond repair, it is often possible to remove much of the damaged finish but retain the shellac which has filled the grain. This means that the subsequent re-polishing takes less time. This approach often allows the retention of much of the patina – the evidence of use and subtle surface colour-changes that make period polished wood so appealing.

The traditional method of removing shellac finishes was to saturate a pad of fine 'oooo' wire wool with a mix of methylated spirit and raw linseed oil, working this over the surface to soften and remove the shellac. The raw linseed is introduced to slow down the evaporation of the methylated spirit and lubricate the cut of the wire wool. The wire wool becomes clogged with shellac during use and must be replaced periodically. Finally, neat methylated spirit is used on a cotton wool pad to remove any remaining residue. This method has drawbacks, not least the potential risk of contaminating the wood surface with fibres from the wire wool. It is also rather uncontrolled and solvent gels or swabs provide a cleaner, more controlled method of removal.

It is important when carrying out tests on the polished surface to establish the nature of previous finishes and how they may change during cleaning and preparation for re-finishing. Many oxidised finishes which have degraded badly can be revived or repaired. Under no circumstances should 'sanding down' be considered as this can remove not only the shellac finish but also all surface patina and the hand-worked surface, which is of historical value. Marquetry-decorated and veneered objects have suffered heavily from this invasive approach and the thinning of the veneer often reaches the point where ground work is visible. The damage caused by sanding down period surfaces is irreversible and should never be considered for period furniture or historic interior woodwork.

Once the damaged layer has been cleaned back to a sound surface it is possible to rebuild a shellac finish using traditional techniques. The long-term reversibility and stability of unmodified shellac makes it suitable for use by conservators on historic wood surfaces which were originally shellac-finished and from which it can be removed again. Shellac is not suitable for the in-painting of shellac-bound finishes such as a Japanned or painted finishes because the method of removal for the new shellac would interfere with the original binding.

When re-finishing period furniture and interior woodwork it is important to try to achieve the correct finish for the period. The piece's place of origin should also be taken into account because a shellac finish may be appropriate for continental furniture from an earlier date than would be appropriate for British-made pieces. Thorough research should be the starting point for any project involving period wood finishing.

**ANTHONY BEECH ACR runs Anthony Beech ACR Furniture Conservation and Restoration (see entry on this page), an Icon-accredited workshop based at Burghley House, Lincolnshire. The company provides services ranging from the conservation and restoration of individual pieces to the ongoing conservation of complete collections and interiors.**

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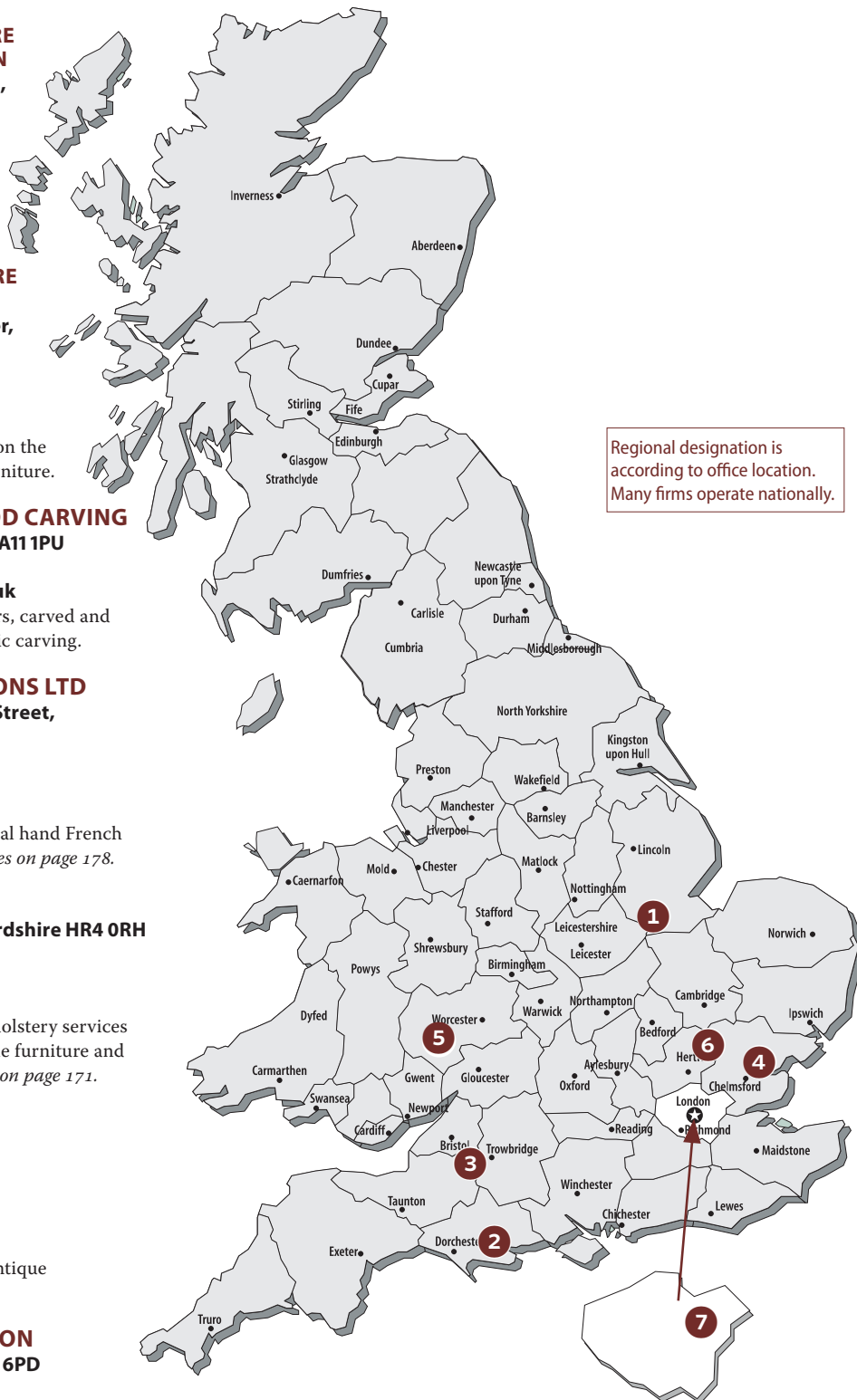
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# 18th CENTURY BRITISH FLOOR COVERINGS

HEATHER TETLEY

**L**OOKING AT the Georgian period, with its classical Palladian design, its light rooms, elegant furniture and glorious hand-knotted carpets, is rather like watching the sun emerge from storm clouds. The architectural and decorative ideals of plainness and structure are in such strong contrast to the previous century's dark colours and stylised decoration, which so neatly reflected its convoluted, intrigue-ridden politics.

In the new Palladian style of the early 18th century, exact proportions, smaller fireplaces and light colours give the general tone of the lifestyle. Although carpets with stylised and rather oriental designs were being woven in Britain in the late 16th and early 17th centuries, there is no record of hand-knotted carpets being made during the second half of the 17th century or the first half of the 18th. The only records of carpets made before around 1750 describe flat-woven 'Fote cloth' carpets, which were narrow strips of plainweave cloth made from coarse wool or plaited from rushes.

Depending on the homeowner's social status, floors were often limewashed in servants' quarters and in the houses of poorer folk. Painted floor cloths, which echoed the geometric designs of expensive Italian ceramic tiles, were popular in the houses of the moderately well-off and in many of the great houses of Britain and in Protestant America. The latter shared the British taste for the Palladian style rather than the very ornate high rococo or baroque decorative style of Catholic Europe.

Ingrain, or Scotch carpets, also known as Kidderminster carpets, were also popular. These were woven double sided and employed more colour and design, rather like a coarser version of the Welsh blankets of today.

As Britain's economy expanded, so the demand for carpets grew and new machines were invented to keep up with the demand. Foot-operated treadle looms were superseded by water-powered looms, which not only increased production but also allowed for more complex weaving techniques. Loop-pile Brussels and cut-velvet Wilton carpets began to be made in 1740. Their pile was created by adding extra backing material. The looping of the Brussels pile was formed by the use of a pile wire which was shot in with the weft (the yarns which are woven horizontally on the loom, passing through the vertical warp yarns)



*The 18th century Robert Adam carpet in the Music Room at Harewood House near Leeds (Reproduced by the kind permission of the Earl and Countess of Harewood and Trustees of the Harewood House Trust)*

before being drawn out to create the loop. Later, a small blade was added to the end of the pile wire to cut the looped pile when it was withdrawn, creating 'cut Wilton'.

There is plenty of documentation and many good illustrations of these early looms, but few surviving early power-loom carpets. However, examples of later 18th-century Brussels carpets and 19th-century ingrain carpets can be found at Audley End and there

are replica Brussels carpets at Kew Palace which were made for the bedrooms in 2006. Although the colours still apparent in the surface of the fragments and in the replication may not exactly represent the original strong palette, the construction and materials show the fine weaving of the early machines.

The development of the glorious hand-knotted British carpets relied on the foresight and creativity of a few men as well as the





*The Blue Drawing Room at Dumfries House, Ayrshire with its Axminster carpet of 1758 (Reproduced by the kind permission of The Great Steward of Scotland's Dumfries House Trust. Photo: Mike Scott)*



*Detail of the central medallion showing the deterioration of the black iron tannin mordant dye*

religious and political problems in Europe. The defection of Huguenots from the French textile weaving centres in the late 17th and early 18th centuries is now famous. They brought with them the sophisticated skills of 17th century silk weaving, but it was only in the mid 18th century that weaving hand-knotted carpets using the 'Turkish' or symmetrical knot was developed. Symmetrical knots had traditionally been used in Britain in the 16th and early 17th century in 'Turkey work', whereas the great French Savonnerie carpets were more usually woven with asymmetrical or 'Persian' knots.

In the 1750s carpet factories were set up by different weavers in Paddington, Moorefields, Fulham and later in Axminster, Exeter and Frome, all using slightly different techniques and materials. Although the original 18th century weavers came from France, fairly quickly English apprentices were trained and

the workforce became predominantly British. These carpets were the products of great skill. They were immaculately designed and woven, and showed an unparalleled sophistication of design and weaving. Incorporating complex mono-coloured field designs supporting an abundance of flowers, their designs rivalled the herbaceous borders of the great country houses, which were then being stocked with new plants introduced by botanist explorers.

A fine example is the Axminster carpet from the Blue Drawing Room at Dumfries House, made by Thomas Whitty in Axminster in 1759. It is a spectacular example of his early weaving. The design consists of four cornucopia, spilling flowers onto a brick chevron ground. The flowers, which include roses, daffodils, crown imperial, morning glory and tulips, are woven in a subtle palette and with an accuracy similar to the flower drawings and embroidery of the time

but executed in hand-knotted carpet with approximately 20 knots per square inch. Carpets of this quality were woven on woollen warps and linen wefts, while some of the lower grade carpets made later in the century were woven with both warps and wefts of linen and coarser wool. These lower grade carpets lack the high lustre of the famous 18th-century Axminster carpets found in The Royal Collection and at Harewood House, Dumfries House and such National Trust houses as Saltram, Wimpole, Attingham and Uppark.

Changes in architecture and interior design, structural advances and economic growth all affected the changes in the arrangement of furniture, and this was reflected in the style and scale of design of the carpets. It is noticeable that the designs of the carpets were governed by the size, shape and function of the room in which they were used. For example, in a large room such as the saloon at Saltram House, which would have been used for formal receptions, the furniture is arranged around the edge of the room. The central medallion of the carpet visually draws the room together, while the carpet's various geometrical forms prevent the size of the room from being overwhelming. This is in contrast to the intimacy of the flowing floral designs of parlour carpets, such as the one in the Blue Drawing Room at Dumfries House, or the overlapping circles of the Music Room carpet at Harewood.

Robert Adam often designed carpets and ceilings to reflect each other. The Adam carpet and ceiling at Saltram is a very fine example of this, as are the two Adam carpets at Harewood House. Creating mutually-complementary designs in these two very different mediums would have required a remarkable range of skills. Carpets needed a formal design structure, which was produced rather like a mosaic from the small squares of the knots. The stucco ceilings, meanwhile, had to conform to exact mathematical proportions to perfectly fit the space allowed.

#### **DETERIORATION AND CONSERVATION**

Many different factors contribute to the deterioration of historic carpets including wear, sunlight damage and other environmental problems. Textiles often suffer from the chemical deterioration of their constituent materials, which are made from biodegradable plant and animal fibres. Axminster carpets, for example, suffer from deteriorating linen wefts, a problem which may be caused by the acidity produced by ageing wool. Typically the wefts disintegrate and small splits grow into large broken areas leaving the woollen warp and knots intact but loose.

Conservation treatments for carpets in historic houses have been developed to meet ethical as well as practical needs. Treatments for textiles and other objects in use create special challenges for conservators. Unlike most valued historic objects, carpets in historic houses will usually continue to be used and exposed to wear after conservation. The problem of conserving carpets in historic houses, which have different needs from

those in museum collections, has driven the development of a range of treatments. Carpet treatments have been developed using the basic techniques of tapestry and textile conservation and certain of the less invasive treatments from restoration, for the cleaning and repair of carpets.

#### THE BLUE DRAWING ROOM CARPET, DUMFRIES HOUSE

The conservation treatment of the 1858 Axminster carpet in the Blue Drawing Room at Dumfries House was undertaken for most usual types of carpet damage, especially the deterioration of the black ground in the border and in the central medallion. It was relevant to note, after the carpet was re-laid and while the blinds were still open, that it was exactly in the path of the sunlight's journey across the room that the black areas (coloured by black iron tannin mordant dyes) had disintegrated to leave exposed warps and wefts.

This carpet also suffered from low pH and high conductivity due to a heavy impregnation of coal dust and soot. A wash solution was developed after testing that would remove acid pollution and grime while preventing dye run and leaving the piece at a pH that favoured both the wool and the cellulosic foundation and a conductivity that discouraged further

uptake of atmospheric pollutants. It was wet-cleaned in a shallow wash tank in three sections using a non-ionic detergent that works well with wool at low temperatures.

The damaged areas were supported onto large coarse linen (or 'linen holland') patches, which were sewn to the underside before the carpet was mounted on a large tapestry frame. In areas where the carpet was missing, the broken and fragile warps and wefts were couched to the linen. New warps and wefts were introduced and secured into the linen support fabric. These missing areas were infilled with new knots, where the surrounding pile was long and, where the surrounding pile was short, with a flat needlework stitch. Infill of this sort is undertaken for visual integrity, but more importantly to protect the carpet because even the lightest use, twice yearly vacuuming and daily opening of shutters, will gradually cause wear. Exposed areas, which are already weak, can suffer badly.

Conservation treatments for early power-loom carpets are slightly different. Because of their construction and the introduction of jute into carpet manufacture from the early 19th century, it is not advisable to fully immerse power-loom carpets. In general, where wet-cleaning is possible, it is preferable to use

conservation detergents through wet vacuum extraction machines and hand-held upholstery heads, which allow for good control of vacuum suction and quantity of water used.

Conservation treatment specifications are primarily to do with the safety of the carpet, its future use and current environment, as well as curatorial decisions as to the levels of intervention needed. A recent controversial treatment was undertaken to infill a large hole in a 15th-century rug with a photo replication canvas plug. This is very useful for museum display, but is unsuitable for historic houses or domestic use. Although dyed linen, even photo replication plugs, may work well on walls or beneath furniture where the carpet may be seen but not walked on, the fabrics available for infilling missing areas that are still in use not only wear badly but are visually intrusive.

Those responsible for historic houses and their contents face many challenges as they strive to balance the often conflicting requirements of access and preservation. Dealing with the problems caused by tens of thousands of visitors per year (or per week at Windsor Castle) while continuing to encourage visitor engagement, is an area in which conservators and curators are pushing the frontiers of preventive conservation and effective display. The process of conserving a historic carpet doesn't end once it has been re-laid; deciding how best to protect and care for it thereafter is very much a part of the process.



Conservators working on the Blue Drawing Room carpet from Dumfries House

#### Recommended Reading

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- V Habib, 'Scotch Carpets at Stirling: Thomas Gilfillan's Cash Book and Ledger 1764–1770', *Proceedings of the Society of Antiquaries of Scotland*, 130, 2000
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- B Jacobs, *The Story of British Carpets*, 2nd ed, Carpet Review, London, 1972
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- M Thompson, *Woven in Kidderminster: An Illustrated History of the Carpet Industry in the Kidderminster Area 1735–2000*, David Voice Associates, Kidderminster, 2002

**HEATHER TETLEY ACR is an accredited conservator with 25 years of conservation experience. She is the proprietor and a co-founder of carpet and tapestry conservation company The Tetley Workshop (see page 180), which has been granted a Royal Warrant for the conservation of carpets. Website [www.tetleyworkshop.co.uk](http://www.tetleyworkshop.co.uk)**

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*See also: profile entry in Wood Carvers section, page 133.*

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CONSERVATION AND RESTORATION OF SCAGLIOLA, HISTORIC

PLASTERWORK AND APPLIED ORNAMENT: *See also: profile entry in*

*Plasterwork section, page 186.*





The near-derelict former station at Laurencekirk, Aberdeenshire has been thoroughly restored and brought back into use as a working railway station. The Railway Heritage Trust joined other funders to provide a grant towards heritage features.

Photo: Railway Heritage Trust/Milepost 92½

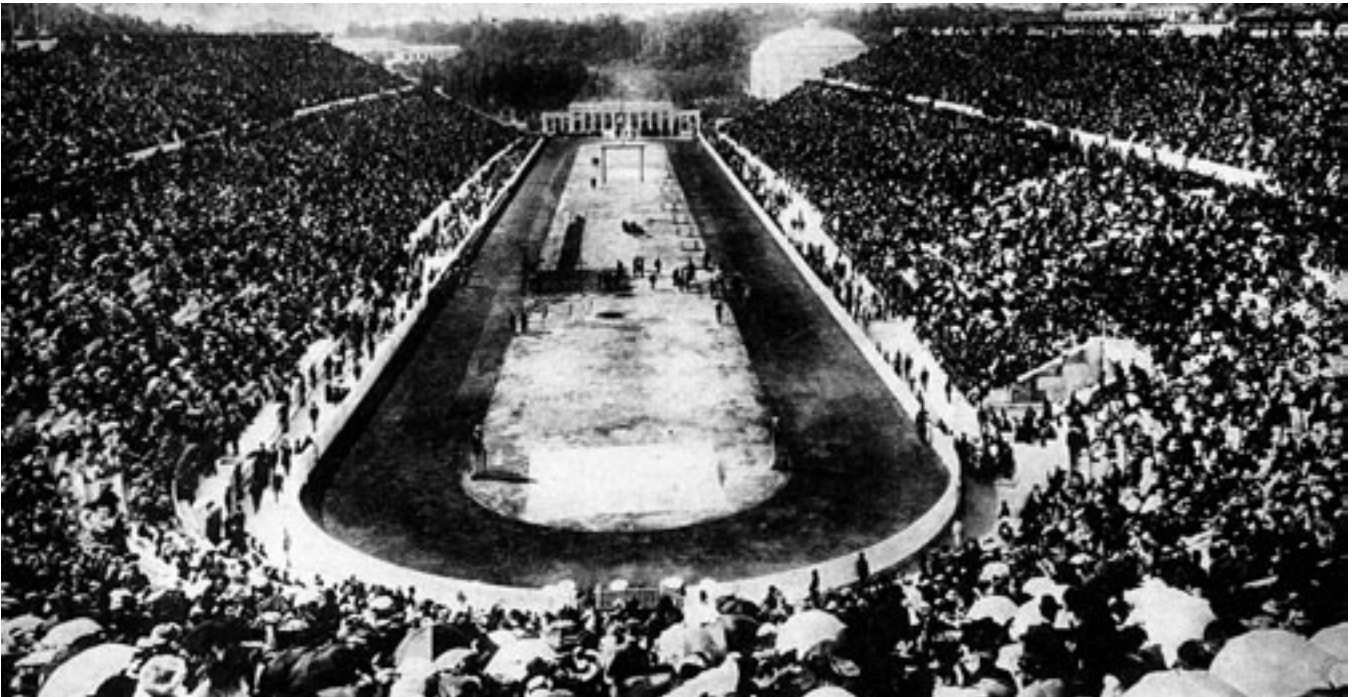
## Chapter 6

# Useful information

# AFTER THE GAMES

## OLYMPIC ARCHITECTURAL HERITAGE

JOHN GOLD and MARGARET GOLD



*The Panathenian Stadium, Athens during the 1896 Olympics*

**T**HERE IS a deep and abiding connection between the Olympics and their host cities. It started in the early 1890s when the nascent International Olympic Committee (IOC) decided that the modern Olympics would not follow the ancient pattern of having a permanent base, but would be an ambulatory event that was effectively franchised to the cities to which it was awarded. These 'Olympic cities', which in principle could be anywhere in the world, would supply the necessary sports venues and infrastructure in return for the right to stage the world's most venerable games.

For the first few Olympiads, organisers made use of existing facilities or constructed temporary structures to house participants and stage the sports competitions. The Olympics, however, quickly grew. The participation of many more nations brought far larger numbers of athletes and officials, who were housed in sizeable 'villages'. The addition of new events from sports as varied as cycling, gymnastics, shooting and

equestrianism led to a festival of increased complexity and diversity that needed purpose-built facilities.

Given the glare of publicity that the Games attract, the organisers and their architects understandably tend to treat the occasion as an opportunity to create iconic structures designed to impress visitors and the world's media – a strategy most recently illustrated at Beijing 2008 by buildings such as the 'Water Cube' Aquatics Centre, designed by a Chinese-Australian consortium and the 'Bird's Nest' National Stadium, built by Herzog and de Meuron to a creative concept by Ai Weiwei. Frequently seen as lasting advertisements for technical prowess and creative design, such structures are permanent features of the cityscape and often become heritage sites of considerable significance. Yet because the Olympics imposes demands that are quite different from most other sporting events, it is inevitable that host cities struggle to find alternative uses for such venues after the Games leave town.

### STADIA

Nowhere is this truer than for the main stadium. The IOC stipulates that there should be an open-air arena with around an 80,000 seat capacity that stages the opening and closing ceremonies and, in almost all cases, is also used for the athletics competitions. As the scene of many of the most memorable moments as well as being a prime focus for showpiece architecture, the Olympic stadium is emblematic of the Games.

There are few other occasions when these vast arenas are needed, however, and their shape and layout are poorly suited to the few mass spectator sports that might conceivably capitalise on their size. Football teams, for instance, complain about the lack of atmosphere, with the presence of the running track and the typically gentle rake of the seats of an athletics stadium making the action on the field feel distant for their spectators.

Without viable anchor tenants, their formidable maintenance costs cannot be borne without subsidy or by revenue from



TABLE 1 DETAILS OF SELECTED OLYMPIC STADIA			
CITY	YEAR	STADIUM DETAILS	POST-GAMES USE
ATHENS	1896	Panathenian Stadium built 4th century BC renovated 144AD excavated 1869/70 renovated for first 'modern' Olympic Games in 1896	music theatre celebrations and festivals heritage site archery and marathon events at 2004 Olympics
	2004	Spyros Louis Stadium built in 1982 for European Athletics Championships renovated and roof added 2002-04	athletics cultural events football (Panathinakos FC/AEK Athens)
BERLIN	1936	built in 1913 for 1916 Olympics rebuilt for 1936 Olympics listed in 1966 renovated for 1974 World Cup reconfigured and roofed for 2006 World Cup	mixed-use stadium athletics football (Hertha BSC)
LONDON	1908	White City Stadium built for 1908 Olympics as part of Franco-British White City Exhibition site at Shepherd's Bush	mixed-use stadium athletics football entertainment greyhound racing (core use 1926-1984) demolished 1985
	1948	Empire Stadium built for 1923 British Empire Exhibition and later renamed Wembley Stadium	national football stadium athletics cultural and sporting events demolished 2003
	2012	Olympic Stadium completed 2011 for 2012 Olympics	planned reconfiguration for dual use (football/ athletics)

tourist visits and occasional concerts, often leading to them becoming labelled the 'limping white elephants' of the Olympic movement (Mangan, 2010). The experiences of three host cities – each with a distinct story to tell – point to the problems and challenges encountered with Olympic stadia and their legacy (Table 1).

#### ATHENS

The city of Athens has hosted two Summer Games, more than a century apart. For the first, in 1896, the organisers used the recently-excavated Panathenian stadium (or Panathinaiko) to house the athletics events and stage the major ceremonies. This had the advantages of making valuable links with the Games' heritage and of successfully accommodating crowds of more than 50,000 at a modest cost – mainly incurred in renovating the seating and adding a modern running track.

Yet even then it was outmoded; its traditional elongated horseshoe shape with accentuated curves at each end hindered athletic performance and limited the nature of subsequent sporting uses. Such uses of the stadium, therefore, were largely retained for reasons of symbolic connection – most notably, hosting the archery competition and finish of the marathon races for the 2004 Summer



The Olympic Stadium, Maroussi, Athens, 2009

Games. Nevertheless, it has become a valued feature of modern Athens. Standing with its open end facing on to Vasileos Konstantinou Avenue, one of the city's main thoroughfares, its gleaming marble seating and memorial tablets to Olympic victors serve as a daily visual reminder of the ancient and contemporary significance of the Games for Greek society.

Rather less positive conclusions, however, might be reached about the Olympic stadium at Maroussi, a suburban district 9km north-east of the city centre, which was renovated for the 2004 Games. It originated as the Spyros Louis Stadium, a 75,000-seater venue built for the 1982 European Athletics Championships.

Wanting an 'architectural landmark of international recognition', the organisers approached the Spanish architect Santiago Calatrava in March 2001 to submit a redesign for the stadium. The key element of the project involved installing double-tied tubular steel arches, rising to a height of 72m, which support a 25,000m<sup>2</sup> laminated glass roof. Although functionally designed to protect spectators from the heat by reflecting up to 90 per cent of the fierce sunlight, the additions also served to supply a high-tech image for the stadium.

The 2004 Games, however, were notorious for a lack of forethought about their legacy. For strategic reasons linked to Greece's desire to be able to stage an Olympics at any time, the stadium will retain the capacity to host major athletics competitions. Nevertheless, other uses are sought to defray the costs. All three of Athens' major football teams (Olympiacos, Panathinaikos and AEK Athens) have played there at different times. Panathinaikos and AEK Athens continue to do so, but neither is entirely satisfied with using a stadium designed for athletics, with the former seeking to build its own ground and the latter complaining about poor gates.

Between football fixtures, the stadium is used for around 15–20 rock concerts per year and receives a trickle of visitors, although there are no visitor facilities or tours. The stadium might represent iconic architecture designed to portray the new Greece but it sits unseen in an Olympic park, far removed from the major circulation patterns of the city, that is deserted at most times of day.

#### BERLIN

Heritage issues of a more awkward form arise in relation to Berlin's Olympic stadium, which has never quite escaped its association with 'Hitler's Games' (Hart-Davies, 1986). Located in a peripheral area to the west of the city, the 1936 stadium grew from a predecessor constructed in 1913 for the never-staged 1916 Olympiad. Werner March's re-design of the 1913 stadium, originally designed by his father Otto, provided for a 110,000-seater stadium with a steel- and stone-clad structure that, in deference to Nazi ideology, was given a neo-classical facade with stone pillars and colonnades. Memorialised in Leni Riefenstahl's film *Olympia* and immediately familiar from television documentaries about Nazi Germany, the Olympic stadium lay at the heart of the Reichssportfeld – once the world's largest sports complex (below).



Aerial view of the Reichssportfeld, Berlin, 1936, with Olympic Stadium top right

It became a focus of attention throughout Germany in the period leading up to and including the 1936 Games for a regime that appreciated and mobilised the opportunity for powerful spectacle. After the Games, the city and state gained the infrastructural legacy of a sports complex and parade ground that could be used for military purposes and for future National Socialist celebrations.

Little damaged by the war, use of the stadium after 1945 was controlled by the occupying forces. A short phase of opening the grounds ended when the British Army requisitioned the Reichssportfeld. It then remained closed to the public until transferred to the city council (Magistrat) of Greater Berlin in June 1949. After languishing for some years, it was adopted as the home ground for Hertha Berlin Football Club and was listed for preservation as a historic structure in 1966.

While externally little changed, the stadium was renovated internally by the addition of spectator covering for the 1974 World Cup, with a partial roof designed by Friedrich Wilhelm Krahe. Complaints from international sports bodies and others about the stadium's dilapidated facilities and ailing structural condition led to a debate that included the possibility of demolition.

Its saviour was again a sporting mega-event. In 1998, Germany's gained the nomination for the 2006 World Cup, with the Olympic Stadium in Berlin accepted as its key venue. After appraisals and an architectural competition, the Hamburg-based architectural practice gmp (Architekten von Gerkan, Marg und Partner) won the contract to renovate the stadium at a cost of €242 million (Meyer, 2010). Only perhaps at this stage could the long-term future of the Olympiastadion be guaranteed.

## LONDON

The first of London's three Olympic stadia was less fortunate in this regard. The main venue for the 1908 Games was the White City, the first purpose-built Olympic stadium and also the largest sports venue of its day. Its enormous concrete bowl, designed by George Wimpey, enclosed athletics and cycle tracks, a 100m swimming pool, platforms for wrestling and gymnastics and even archery (above left). Called the White City after the gleaming white stucco rendering applied to the Franco-British Exhibition buildings (to which the Olympics were attached), its foundation stone was laid on 2 August 1907 and the stadium was inaugurated on the opening day of the adjoining exhibition (14 May 1908). It held 93,000 spectators, with 63,000 seated.

Although the Games themselves were regarded as successful, they left the less desirable physical legacy of a huge and largely unwanted stadium. Retained after 1908 despite an initial decision to demolish it, the White City was scarcely used for two decades before passing to the Greyhound Racing Association in 1926. It was then renovated, with its capacity reduced from 93,000 to 80,000, the cycle track removed and a greyhound track installed over the existing running track. In 1932, the reconfiguration of a running track to a new 440-yard circuit allowed the stadium's use for



*The White City Stadium, West London, 1908*

national and international athletics events.

On occasions, the White City did stage large-scale sporting festivals, such as the 1934 British Empire Games and the 1935 International Games for the Deaf, and provided a base for British athletics from 1933 onwards. However, when the athletics events moved to their new home at Crystal Palace in 1971, the stadium deteriorated. It continued to host greyhound racing until 1984 but became an increasingly forlorn structure that few mourned once it was demolished in 1985 to make way for offices for the British Broadcasting Corporation and housing.

Little needs to be said about the city's second Olympic stadium at Wembley, which was rarely regarded in the public mind as an Olympic Stadium. Held against a background of extreme austerity, the 1948 Games saw the organisers make full use of whatever was available. With custom-built stadia out of the question, they designated the Empire Stadium at Wembley, originally built for the 1924 British Empire Exhibition, as the Olympic stadium even though it had not staged an athletics competition for more than 20 years.

Once the 1948 Games were over, the stadium returned to its use as a greyhound racing venue (1927–1998), but more importantly as the national football stadium staging major domestic and international matches, as well as providing ideal facilities for pioneering outdoor arena rock concerts in the 1970s. It was demolished in 2002–3 and replaced by a purpose-built football stadium designed by Foster and Partners and HOK Sport. The lengthy delay before it could open in March 2007 was due more to indecision about its purpose than constructional problems, with attempts to combine athletics and football in a single stadium eventually scrapped in favour of a dedicated football stadium.

For the 2012 Olympic Games, London promised a utilitarian purpose-built athletics stadium which after the Games would become a multi-purpose venue that included athletics at its core (above right). Designed by Populous (formerly HOK Sport), the 2012 stadium addressed the 'white elephant' problem by combining a core structure that could find permanent usage with a temporary steel-and-concrete top tier for 55,000 spectators that would be removed after the Games. This would downsize the stadium to 25,000 seats, with the top tier, as originally hoped, possibly reused in a stadium elsewhere.

The visual impact of the stadium was to be provided by a fabric wrap which would



*The Olympic Stadium, London, June 2011*

be draped around the stadium. This fell victim to spending cuts at the end of 2010, but was reinstated after it seemed likely that the cost could be borne by sponsorship. Understandably, the success of this approach to stadium design rests on finding an anchor tenant that would allow the stadium to be used profitably while still permitting occasional athletics meetings. At the time of writing, however, the decision to retain the stadium in public hands as a mixed-use venue without having first found such a tenant means that, despite all endeavours, yet another main Olympic stadium seems destined to join its immediate predecessors as a white elephant.

## CONCLUSION

The stadia discussed here show in microcosm the challenges faced by all Olympic cities as they reconcile the demands of the Olympic movement, the desire to house the Games in a memorable fashion and the provision of a viable post-Games future for the facilities delivered. London has tried to pre-empt these future problems for its Olympic sites by engaging in the most comprehensive exercise in legacy planning yet attempted. However, the vagaries of post-Games market conditions will impact on these plans in ways that could well call into question the architectural heritage that will result from these Games.

## Recommended Reading

- D Hart Davis, *Hitler's Games: The 1936 Olympics*, Century, London, 1986  
 JA Mangan, 'Prologue: guarantees of global goodwill: post-Olympic legacies – too many limping white elephants', *International Journal of the History of Sport*, 25, 2010  
 M Meyer, 'Berlin 1936', in JR Gold and MM Gold (eds), *Olympic Cities: City Agendas, Planning, and the World's Games, 1896–2016*, 2nd edition, Routledge, London, 2011

**JOHN GOLD** is a professor of urban historical geography in the School of Social Sciences and Law at Oxford Brookes University.

**MARGARET GOLD** is a senior lecturer in arts and heritage management at London Metropolitan University and an associate of the university's Cities Institute. They have published extensively on the urban impact of the Olympic Games and are the editors of *Olympic Cities: City Agendas, Planning, and the World's Games, 1896–2016* (2010). Their most recent work is a four-volume set on *The Making of Olympic Cities* for Routledge's Major Works series (forthcoming).

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Conservation has been taught at Edinburgh College of Art since 1969. The Scottish Centre for Conservation Studies offers a one year Diploma/MSc course, available for full or part-time study, offering a thorough grounding in conservation principles and methods. Admittance is by a first degree in any area related to the built environment. Students proceed to the MSc (by dissertation) upon successful completion of the initial Diploma course. Core subjects (history, theory, building analysis, conservation technology, design intervention, planning law, and area conservation) are supplemented by options including conservation of world heritage and modern movement buildings.

### ■ OXFORD BROOKES UNIVERSITY AND UNIVERSITY OF OXFORD

c/o School of the Built Environment, Oxford Brookes University, Oxford OX3 0BP

Tel 01865 483684

Email [pgadmin.be@brookes.ac.uk](mailto:pgadmin.be@brookes.ac.uk)

[www.brookes.ac.uk/schools/planning](http://www.brookes.ac.uk/schools/planning)

HISTORIC CONSERVATION COURSE: Established in 1990, the course is the product of collaboration between the two major institutions of higher education in Oxford. The course aims to be not only relevant to the role of the conservation officer working within the planning system, but also to meet the needs of a wider range of professionals working within the public, private and voluntary sectors of the heritage industry. The modular construction of the course enables full or part-time study for a PG Diploma or an MSc in Historic Conservation, or part-time study for a Certificate in Historic Conservation. There are further opportunities for MPhil or PhD research.

### ■ WEALD AND DOWNLAND OPEN AIR MUSEUM

Singleton, Chichester, West Sussex PO18 0EU

Tel 01243 811464 Fax 01243 811475

Email [courses@wealddown.co.uk](mailto:courses@wealddown.co.uk)

[www.wealddown.co.uk](http://www.wealddown.co.uk)

CONSERVATION TRAINING, SERVICES AND SUPPLIES: The museum has an established reputation as a provider of specialist training/education in historic building conservation and the use of traditional building materials and processes. The 48 historic buildings reconstructed on its site give the museum an unrivalled teaching resource in this specialised field. Courses for surveyors, architects, conservation officers and craftspeople are eligible for CPD. MSc programmes in building conservation and in timber building conservation. Discounted course places may be available, please enquire. Exciting and innovative Downland Gridshell building provides workshop spaces and artefacts store, which inspire new courses. Research library designed for use by professionals. Specialist bookshop.



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For further information: Click: [www.anglia.ac.uk/conservation](http://www.anglia.ac.uk/conservation)  
Email: [answers@anglia.ac.uk](mailto:answers@anglia.ac.uk)  
Call: 0845 271 3333

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For an application form or further details, please view online at [www.aaschool.ac.uk/bc](http://www.aaschool.ac.uk/bc) or contact:

Admissions, Building Conservation  
Architectural Association School of Architecture  
36 Bedford Square, London WC1B 3ES  
Telephone 020 7887 4067 Fax 020 7414 0779  
Email [conservation@aaschool.ac.uk](mailto:conservation@aaschool.ac.uk)  
[www.aaschool.ac.uk/bc](http://www.aaschool.ac.uk/bc)

The School is run by the Architectural Association (Inc.), a Registered (Educational) Charity.

COURSES & TRAINING *continued*


**CEM** The College of Estate Management

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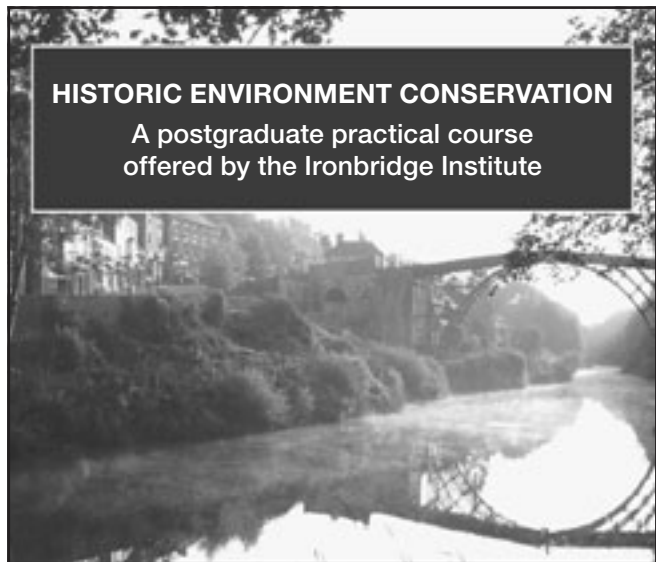
Established links with the National Trust, English Heritage and Prince's Foundation for Architecture and the Built Environment.

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**UK**

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**[archaeology@york.ac.uk](mailto:archaeology@york.ac.uk)**  
**[www.york.ac.uk/archaeology](http://www.york.ac.uk/archaeology)**



  
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A development of the former English Heritage Masterclass Programme

Training in technical and practical skills in the repair and maintenance of historic structures. These intensive short courses, which are validated by English Heritage, are designed and taught by leading practitioners in the field of building conservation.

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For more information on the 14 courses in the programme, contact:  
West Dean College, Chichester, West Sussex PO18 0QZ  
[cpd@westdean.org.uk](mailto:cpd@westdean.org.uk) 01243 818219 [www.westdean.org.uk](http://www.westdean.org.uk)

## COURSES & TRAINING continued

### ■ WEST DEAN COLLEGE

Chichester, West Sussex PO18 0QZ

Tel 01243 811301 Fax 01243 811343

Email [cpd@westdean.org.uk](mailto:cpd@westdean.org.uk)

[www.westdean.org.uk](http://www.westdean.org.uk)

**BUILDING CONSERVATION MASTERCLASSES:** A development of the former English Heritage Masterclass Programme. A series of intensive residential three-day courses combining lectures, demonstrations and practical exercises. The courses offer hands-on training and are designed for professionals and craftsmen. Professional development courses are also offered for conservators, as are MA and Postgraduate Diploma programmes in conservation of historic artefacts: books and library materials, ceramics and related materials, clocks, furniture and related objects and metalwork, and the Professional Development Diploma Conservation of Buildings, Interiors and Sites. *See also: display entry in this section, page 194.*

### ■ UNIVERSITY COLLEGE LONDON

Centre for Sustainable Heritage, Gower Street,

London WC1E 6BT

Tel 020 7679 8242

Email [shprojectsdirector@ucl.ac.uk](mailto:shprojectsdirector@ucl.ac.uk)

[www.ucl.ac.uk/sustainableheritage/msc.htm](http://www.ucl.ac.uk/sustainableheritage/msc.htm)

**MSc IN SUSTAINABLE HERITAGE:** An innovative interdisciplinary course for a new generation of heritage leaders. This course by the Centre for Sustainable Heritage provides today's professionals with the skills and mindset to deliver the heritage programmes and projects of the future. It brings together all aspects of cultural heritage combined with the best preventive conservation policies and practices to create leaders who apply the concepts of sustainability and sustainable development within cultural heritage projects. Students engage with leading international professionals and work on real case studies. The course is accredited by RICS.

### ■ UNIVERSITY OF BATH

Department of Architecture and Civil Engineering,  
Bath BA2 7AY

Tel 01225 386447/01225 386252

Email [fac-eng-pgt-admissions@lists.bath.ac.uk](mailto:fac-eng-pgt-admissions@lists.bath.ac.uk)

Contact Graduate School Admissions

**MASTERS DEGREE IN THE CONSERVATION OF HISTORIC BUILDINGS (MSc):** The course provides technical training within an academic framework including the teaching of classical architecture and the philosophy of conservation. Teaching units include: structural conservation; materials, construction and skills; history and theory; and the law relating to conservation and heritage management. Taking place within the world heritage city of Bath, the course may be taken over one year full time or two years part time. Architects, engineers, surveyors, conservation officers and suitably qualified candidates from other fields with first degree or equivalent are eligible.

When contacting companies listed here, please  
let them know that you found them through  
**The Building Conservation Directory**

## COURSE LISTINGS

### UNDERGRADUATE COURSES

Bishop Grosseteste University College, Lincoln Tel 01522 527347	BA (Hons) Heritage Studies	3 yrs FT
Buckinghamshire New University Tel 01494 522141	BA (Hons) Furniture Conservation and Restoration	1 yr FT (2 yrs PT)
Building Crafts College Tel 020 8522 1705	Foundation Degree Historic Building Conservation	2 yrs PT
University of Cambridge, Institute of Continuing Education Tel 01954 280399	CertHE Historic Building Conservation	PT (enrols every 2 yrs)
City and Guilds of London Art School Tel 020 7735 2306	BA (Hons) Conservation Studies	3 yrs FT
College of Estate Management Tel 0800 019 9697	BSc (Hons) Building Surveying	4 yrs PT
Herefordshire College of Technology Tel 0800 032 1986	BA (Hons) Artist Blacksmithing	3 yrs FT
Kingston University, London Tel 020 8417 4600	FdSc (Foundation) Historic Building Conservation BSc(Hons) Historic Building Conservation top-up	2 yrs FT 1 yr (2 yrs PT)
University of Lincoln Tel 01522 837171	BA (Hons) Conservation and Restoration	3 yrs FT
London Metropolitan University Tel 020 7133 4200	FdA (Foundation) Furniture Restoration BSc (Hons) Restoration and Conservation BA (Hons) Furniture Restoration	2 yrs FT (4 yrs PT) 3 yrs FT 1 yr (2 yrs PT)
Swansea Metropolitan University Tel 01792 481117	BA (Hons) Architectural Glass	3 yrs (<6 yrs PT)
Weymouth College, Construction Sector Tel 01305 764733	FdSc (Foundation) Applied Architectural Stonework and Conservation	2 yrs (3-4 yrs PT)

### POSTGRADUATE COURSES

Anglia Ruskin University Tel 0845 271 3333	MSc Conservation of Buildings	2 yrs + dissertation PT
Architectural Association, School of Architecture Tel 020 7887 4067	PGDip Conservation of Historic Buildings	2 yrs PT
University of Bath Tel 01225 386447	MSc Conservation of Historic Buildings MSc Conservation of Historic Gardens and Cultural Landscapes MPhil in Architectural History and Theory	1 yr (2 yrs PT) 1 yr (2 yrs PT) 1 yr (2 yrs PT)
University of Birmingham, Institute of Archaeology and Antiquity Tel 0121 414 5497	MA/PGDip in Landscape Archaeology, GIS and Virtual Environments	MA 1 year (2 yrs PT) PGDip 9 months (18 m PT)
University of Birmingham, Ironbridge Institute Tel 01952 432751	PGDip Heritage Management MA/PGDip Historic Environment Conservation MA Heritage Management MA/PGDip Heritage Management	2 yrs dist learning 2 yrs PT 2 yrs dist learning MA 1 yr FT PGDip 9 months FT
Bishop Grosseteste University College, Lincoln Tel 01522 527347	MA/PGDip/PGCert Heritage Education	15 months (3 yrs PT)
Camberwell College of Arts Tel 020 7514 6427	MA Conservation	2 yrs
University of Central Lancashire Tel 01772 893210	MSc/PGDip/PGCert Building Conservation and Regeneration	1 yr (2 yrs PT)
Centre for Sustainable Heritage, University College London Tel 020 7679 5965	MSc Sustainable Heritage	1 yr (2 yrs PT)
City and Guilds of London Art School Tel 020 7735 2306	PGDip Conservation PGDip Architectural Stone Carving PGDip Ornamental Wood Carving and Gilding	1 yr FT (2 yrs PT) 1-2 yrs FT 1-2 yrs FT
College of Estate Management Tel 0800 019 9697	PGDip/MSc in Conservation of the Historic Environment	PGDip 2 yrs PT MSc 3 yrs PT
Courtauld Institute of Art Tel 020 7848 2645	MA Conservation of Wall Paintings PGDip Conservation of Easel Paintings	3 yrs 3 yrs
University College Dublin Tel +353 1716 2771	Master of Urban and Building Conservation (MUBC)	1 yr (2-4 yrs PT)
Edinburgh College of Art, University of Edinburgh Tel 0131 221 6072	MSc/PGDip Architectural Conservation	9/12 months (24/36 ms PT)

## COURSE LISTINGS *continued*

University of Exeter, Department of Archaeology Tel 01392 725306	MA Landscape Archaeology MA Material Culture Studies	1 yr (2 yrs PT) 1 yr (2 yrs PT)
University of Greenwich, School of Architecture and Construction Tel 020 8331 9100	MA Garden History PGCert Garden History	1½ yrs (2½ yrs PT) 1½ yrs (flexible)
Hamilton Kerr Institute, University of Cambridge Tel 01223 832040	MSc Building Rehabilitation PGDip Conservation of Easel Paintings	1 yr (2 yrs PT) 3 yrs
Heriot Watt University Tel 0131 451 3866	MSc/PGDip Building Conservation (Technology and Management)	2–7 yrs dist learning
Institute of Archaeology, University College London Tel 020 7679 7499	MA Principles of Conservation MA Artefact Studies MA Cultural Heritage Studies	1 yr (2 yrs PT) 1 yr (2 yrs PT) 1 yr (2 yrs PT)
University of Leicester Tel 0116 252 2772	MA/PGDip Archaeology and Heritage PGCert Archaeology of Standing Buildings PGCert Critical Approaches to the Archaeological Heritage	2 yrs PT 8 months PT 8 months PT
University of Lincoln Tel 01522 837171	Graduate Dip in Conservation Studies MA Conservation of Historic Objects	1 yr (2 yrs PT) 1 yr (2 yrs PT)
University of Northumbria at Newcastle Tel 0191 243 7059	MA Conservation of Fine Art MA Preventive Conservation	2 yrs FT 1 yr (2 yrs PT)
Oxford University Tel 01865 270369	MSc Applied Landscape Archaeology PGCert Architectural History	2 yrs PT 1 yr PT
Oxford Brookes University Tel 01865 483684	MSc/PGDip Historic Conservation PGCert Historic Conservation	1 yr (2 yrs PT) 1 yr PT
University of Plymouth Tel 01752 585030	MA/PGDip Architectural Conservation	MA 1 yr (3 yrs PT) PGDip 2 terms (2 yrs PT)
The Prince's Foundation Tel 020 7613 8500	Graduate Fellowships in Sustainable Architecture and Urbanism	2 yrs (1st yr FT, 2nd yr PT)
University of Sheffield Tel 0114 222 0399	MA Conservation and Regeneration	1 yr (2 yrs PT)
University of Sunderland, Faculty of Arts, Design and Media Tel 0191 515 2190	MA Glass	1 yr (2 yrs PT)
Weald and Downland Open Air Museum Tel 01243 811464	MSc Building Conservation MSc Timber Building Conservation	2 yrs PT 2 yrs PT
West Dean College Tel 01243 811301	MA/PGDip in a range of conservation subjects PDD Conservation of Buildings, Interiors and Sites MA Conservation Studies	1 yr FT 1–5 yrs PT 46 wks FT
University of York Tel 01904 433963	MA Cultural Heritage Management MA Conservation Studies (Historic Buildings) MA Archaeology of Buildings	1 yr (2–3 yrs PT) 1 yr (2–3 yrs PT) 1 yr (2–3 yrs PT)



Trainee thatcher Dafydd Driver (right) at work with Alan Jones of Pembrokeshire Thatching Services: the 12 month placement was supported by HLF's Traditional Building Skills Bursary Scheme. (Photo: Wilm Jones)

## CRAFT TRAINING

City of Bath College Tel 01225 312191	Craft Dip Level 2 Stonemasonry or NVQ2 Stonemasonry  Craft Dip Level 3 Stonemasonry or NVQ3 Stonemasonry  NVQ3 Heritage Skills Architectural Stone Conservation	2 yrs FT inc 26 wk block rel  1 yr FT inc 12 wk block rel  36 wks FT
Building Crafts College Tel 020 8522 1705	C&G Advanced Stonemasonry Dip Range of stonemasonry courses (ICA, ACA, NVQ Levels 2 and 3) Range of joinery and shopfitting courses from NVQ to Advanced Modern Apprenticeship C&G Fine Woodwork Dip in Furniture Making	1 yr FT 1 yr FT (1–2 yrs PT) 1 yr FT (1–2 yrs PT) 2 yrs FT
The Chippendale International School of Furniture Tel 01620 810680	Furniture design, making and restoration course	30 wks
City and Guilds of London Art School Tel 020 7735 2306	Dip in Architectural Stone Carving Dip in Ornamental Wood Carving and Gilding	3 yrs FT 3 yrs FT
Craven College Centre for Construction & Heritage Skills Tel 01756 708934	NVQ3 Heritage Skills Plastering NVQ3 Heritage Skills Joinery NVQ3 Heritage Skills Bricklaying and Masonry	8 months 8 months 8 months
City of Glasgow College Tel 0141 566 6222	HNC/D Architectural Conservation  Stonemasonry (PDA Level 7) Advanced Cert Stonemasonry (PDA Level 6) SVQ2 and 3 Conservation of Masonry (NPA)	1–2 yrs  1 yr PT (block rel) 2 yrs PT (block rel) 6 wks FT (15 wks PT)
Herefordshire College of Technology Tel 01432 365314	Rural crafts NETS courses inc blacksmithing and welding Level 2 Dip Blacksmithing and Metalwork Level 3 Extended Dip Blacksmithing and Metalwork	2 yrs (block rel) 1 yr FT 2 yrs
Lambeth College Tel 020 7501 5000	Crafts training in most fields (NVQ 1–3) and Construction Dips levels 1–3	1 yr PT/FT per NVQ level
Lead Sheet Association Ltd Tel 01622 872432	C&G 6055 Leadworkers Cert (modules 1–4) NVQ3 Heritage Leadwork Advanced C&G Leadworkers Cert (module 5)	35 days 1 yr 15 days
Moulton College Tel 01604 491131	NVQ3 Apprenticeship Architectural Banker Masonry NVQ2 Apprenticeship Architectural Banker Masonry NVQ2 Architectural Banker Masonry  Level 2 Dip Architectural Banker Masonry	1 yr block rel (2 yrs day rel) 2 yrs (block rel) 2 yrs (block rel) 2 yrs FT
Oxford and Cherwell Valley College Tel 01865 550550	C&G Level 2 or 3 Making Furniture (restoration pathway)  C&G Level 3 Making and Repairing Furniture	L2 1 yr PT (1 day/wk) L3 1 yr (2 days/wk) 1 yr FT or flexible study
The Penicuik House Preservation Trust Tel 01383 872722	Building conservation and traditional building skills courses	1–5 days
The Prince's Foundation Tel 020 7613 8500	Building crafts apprenticeships	8 months
Scottish Lime Centre Trust Tel 01383 872722	Building conservation and traditional building skills courses	1–5 days
South Coast Roof Training Tel 0845 678 0065	NVQ3 Heritage Roofing SAP	30 days
Warwickshire College Tel 01926 318319	BTEC Blacksmithing and Metalworking	1 yr FT
Weymouth College, Construction Sector Tel 01305 208808	Level 3 Dip Stonemasonry Level 2 Dip Stonemasonry  NVQ2 Stonemasonry NVQ3 Stonemasonry	1 yr FT 1 yr + 1 term FT 2 yrs PT (block rel) 1 yr PT (block rel)
York College Tel 01904 770400	NVQ3 Stonemasonry (Conservation and Restoration) NVQ2–3 Stonemasonry (Banker Masons): Apprenticeships and Advanced Apprenticeships  NVQ2–3 Stonemasonry (Banker Masons)	8 wks (block rel) App 2 yrs (block rel) Adv App 1 yr (block rel) L2 48 wks PT L3 36 wks PT

## COURSE LISTINGS continued

### SHORT COURSES

Abey Smallcombe Tel 01647 281295	One-day practical cob courses	1 day
University of Birmingham, Ironbridge Institute Tel 01952 435969	Short CPD courses in building conservation, building recording, large object conservation and estate management – see events pages for details	2 days
The Brooking Collection Tel 020 8331 9312	Workshops built around the observation of original architectural features	1 day
Burngate Stone Centre Tel 01929 557336	Courses in stonemasonry, carving and letter cutting	Varies
Bursledon Brickworks Conservation Centre Tel 01489 576248	Various short courses in building conservation, traditional materials and trade techniques	1 day
Conservation Technologies, National Museums Liverpool Tel 0151 478 4916	An Introduction to Laser Cleaning in Conservation	2 days
Cornish Lime Company Ltd Tel 01208 79779	One-day introduction to lime courses and CPD sessions on suitable products for breathable buildings	1 day
Craven College Centre for Construction & Heritage Skills Tel 01756 708934	Various short courses in construction and heritage skills	Varies
Dorset Centre for Rural Skills Tel 01747 811099	Lime, cob and sustainable building technology courses	1, 2 or 5 days
Fleur Kelly Tel 01373 814651	Intensive short courses on fresco and panel-painting techniques, occasional two-week residential courses, tailor-made courses	5 days or 2 wks
The Flintman Company Tel 01273 502411	Flint-related courses	1 day or varies
The Green Wood Centre Tel 01952 432769	Professional short courses in woodland management and greenwood crafts	1–5 days
Historic Buildings & Conservation, Essex County Council Tel 01245 437672	Various short courses in traditional building skills including lime plaster, mortars, wattle and daub, brickwork, joinery, wrought iron and thatching – see events pages for details	1–3 days
House Mouse Tel 01284 830492	Short courses in repairing wattle and daub, and working with lime plaster using medieval materials, mixes and methods	1 day
Lambeth College Tel 020 7501 5478	Advanced craft skills courses in plastering, carpentry and joinery, decorating and stonemasonry	10 wks
Lead Sheet Association Ltd Tel 01622 872432	Introductory leadwork courses including basic welding and bossing Leadwork seminars for architects, surveyors and architectural technicians	3–5 days 1 day
The Lime Centre Tel 01962 713636	Bespoke courses on lime in traditional building	1–3 hours
Low-Impact Living Initiative Tel 01296 714184	Various craft courses including use of lime, hemp and cob	Varies
Memorial Arts Charity Tel 01728 688393	Short courses in letter carving (stone and wood)	1–5 days
Mike Wye & Associates Ltd Tel 01409 281644	Practical course in the use of traditional lime mortars in renovation Practical course in the use of Venetian polished plasters, tadelakt and marmorino	1 day 1 day
North of England Civic Trust Tel 0191 232 9279	Various practical heritage skills courses throughout the North East and Cumbria	½ day to 5 days
Old House Store Ltd Tel 0118 969 7711	Practical courses in building conservation	1 day
Orchard Barn Tel 01473 658193	Green oak timber-framing courses	Varies
The Orton Trust Tel 01536 711600	Practical stonemasonry courses	3 days
Oxford and Cherwell Valley College Tel 01865 550550	Introduction to restoration	5 wks
Oxford Brookes University Tel 01865 483560	Various short planning courses for professionals	Varies
The Portland Sculpture and Quarry Trust Tel 01305 826736	Introductory and advanced courses in stone carving, sculpture, architectural detail, letter-cutting and stonemasonry with individually tailored programmes for CPD and vocational training	Varies
The Prince's Foundation Tel 020 7613 8573	The Poundbury Series: lectures and tours exploring innovative urban thinking Executive education packages: tailored programmes on the built environment	1 day Up to 2 days
Rainbow Glass Ltd Tel 020 7249 0276	Day courses in stained glass and evening workshops	Varies

Scottish Lime Centre Trust Tel 01383 872722	Building conservation and traditional building skills courses	1–5 days
Shute Farm Studio Tel 01749 880746	Various short courses including stone and wood carving, bronze-casting and glass-blowing	1–5 days
The Society for the Protection of Ancient Buildings Tel 020 7456 0915	SPAB Technical Days/Afternoons: subjects vary – see events pages for details The Repair of Old Buildings: lectures and site visits for architects, contractors, and conservation and building professionals SPAB Homeowners' Weekend Course SPAB Faith in Maintenance: free courses for the volunteers who care for Britain's historic places of worship – see events pages for details	Up to 2 days 6 days (Spring and Autumn) 2 days 1 day
Steve Sherriff Stained Glass Tel 01202 882208	Short and long courses in stained glass for local authorities, colleges and private owners Tailor-made courses	Varies Varies
Sturge Conservation Studio Tel 01604 717929	Various courses including leather conservation techniques	1–3 days
Ty-Mawr Lime Ltd Tel 01874 658005	Various short courses in traditional building skills including lime plastering, natural paints, dry-stone walling and thatching; CPD seminars on the use of lime	Varies
Upkeep Tel 020 7256 7646	Short courses on building construction services, repairs and maintenance	Varies
Weald and Downland Open Air Museum Tel 01243 811464	Various short courses in building conservation and traditional crafts and skills – see events pages for details	1–5 days
West Dean College Tel 01243 811301	A range of building conservation masterclasses delivered in collaboration with English Heritage – see events pages for details	1–4 days FT
University of the West of England, Department of Planning and Architecture Tel 0117 328 3210	Heritage Assets: alterations and extensions to historic buildings Character Appraisal of Conservation Areas	1 day 1 day
Weymouth College, Construction Sector Tel 01305 208808	Stone-carving and letter-cutting	6 wks
Wheathills Tel 01332 824819	Antiques restoration study days Lime plastering	1 day 2 days
Womersley's Limited Tel 01924 400651	Various short courses in building conservation	1 day
Woodchester Mansion Trust Tel 01453 861541	Various short courses including dry stone walling and creative architectural drawing	Varies
University of York Tel 01904 433997	Various short courses in the conservation of historic buildings and places Various CPD courses	2–3 days Varies
Yorkshire Sculpture Park Tel 01924 832528	Various craft and sculpture courses	Varies

### MISCELLANEOUS COURSES

International Academic Projects Tel 020 7380 0800	Professional development courses in conservation, collections care, archaeology and museum studies	Usually 3–5 days
Planning Summer School Tel 01722 339811	Short courses in advanced town planning education held in September of each year	3 days
The Attingham Trust Tel 020 7253 905	The country house and its collections	Varies (residential)
The Society for the Protection of Ancient Buildings Tel 020 7456 0911	William Morris Craft Fellowship	3 blocks, 2 months FT each 9 months FT
The Traditional Building Bursary Scheme	SPAB Scholarship programme Building Crafts Bursary Placements (apply online at <a href="http://www.buildingbursaries.org.uk">www.buildingbursaries.org.uk</a> )	Varies

# PRACTICE MAKES PERFECT

## A new approach to skills training

JONATHAN TAYLOR



*The National Trust's restoration of the orangery at Tyntesfield is providing a unique training ground for students and members of the public*

**A**PPROXIMATELY ONE in five buildings in the UK predates 1914. Most of these buildings are traditionally constructed with solid walls built with lime-based mortars. As these structures are vulnerable to being damaged by modern repair techniques, it is vital for their survival that the workforce employed to repair them has the skills and expertise required. However, most construction colleges and training centres focus on the construction skills required for new buildings. The specialist skills required for stonemasonry and traditional brickwork are taught in only a handful of colleges, and many skills required for historic building work are unavailable through either the NVQ system or the new Qualifications and Credit Framework, which are geared to meet the needs of industry and large employment groups such as house builders.

The traditional method of teaching practical skills is through apprenticeships, an approach that lends itself well to teaching repair skills. It is difficult to teach a student in a classroom to 'read' the fabric of an old structure and, no matter how good the course, there is no substitute for on-site training. Appropriate repair techniques also vary widely from case to case according to condition and construction,

something that is best learned in the field.

The UK construction industry largely abandoned the apprenticeship training system in the 1970s and '80s. Some of the larger specialist conservation firms have continued to take on apprentices, who have either completed their college training or who are still in college but on a day-release programme. However, the numbers attaining the standards required by this route are limited, and the additional cost of carrying apprentices can make the best companies less competitive, particularly if the competitive tendering process focuses on price rather than on quality and value.

Much has been written recently about the decline in traditional craft skills, and research by the National Heritage Training Group (NHTG)<sup>1</sup> has given some insight into the scale of the problem in finding skilled craftspeople for the repair of historic buildings. It is clear that new initiatives are required if we are to continue to maintain our traditional building stock.

### THE TYNTESFIELD ORANGERY

A scheme piloted by the National Trust at Tyntesfield near Bristol is one of the most exciting training developments in recent years. Ten trainee stonemasons from City of Bath College are engaged in the



*Jackie Blackman, a student from City of Bath College preparing to insert a stainless steel rod to fix gable masonry at the Tyntesfield orangery for her NVQ level 3 (Photo: Nigel Bryant)*

conservation and repair of a fine Victorian orangery as part of their architectural stone conservation NVQ in Heritage Skills level 3. The orangery had been derelict for at least 20 years, with all the classic masonry problems associated with weathering and rusting metal cramps. Working alongside stone

<sup>1</sup> The NHTG has published a series of reports analysing demand, supply and training provision in traditional building craft skills for England, Scotland, Wales and Ireland: see [www.nhtg.org.uk/nhtginitiatives](http://www.nhtg.org.uk/nhtginitiatives).



conservators from Nimbus Conservation, the trainees are gaining hands-on experience in the practicalities of conservation.

The scheme was the idea of the National Trust. From the outset the aim was to integrate training into a programme of restoration and repair, and an education officer was appointed to see how this could be achieved. The orangery provided the ideal vehicle both for short courses aimed at the public, schools and, if possible, professional conservators too. By good fortune the proposal coincided with the development of a new course in masonry conservation at City of Bath College. Stonemasonry was already well established at the college with courses to NVQ level 3, and for the previous three years trainees on its courses had regularly worked with the Bath Building Preservation Trust to gain practical experience. The conservation course was a natural development, and the prospect of offering it in conjunction with work for the National Trust on a Grade II\* listed building was unprecedented.

When the National Trust invited tenders for the restoration of the orangery, conservation companies were required to allow for the provision of on-site training as part of their bid. Nimbus Conservation, a specialist stonemasonry company with a long track record of training its own masonry conservators, won the contract for the three-year programme of conservation, restoration and training.

The architectural stone conservation course commenced in September 2010 and is open to stonemasons with NVQ to level 2 or an equivalent qualification. The NVQ level 3 is awarded by the National Heritage Training Group. The syllabus is designed to provide the specialist skills and understanding required to work on historic masonry projects, and assessment is based on the ability of the trainees to demonstrate the key competencies covered by the course, including:

- conservation ethics
- lime technologies
- mortar repairs
- stone decay
- cleaning techniques
- stone carving and replacement
- taking details, model making and casting
- compiling and writing conservation reports
- health and safety.

The course includes areas not specifically required for the NVQ such as poulticing, lime shelter coats, and resin technology, including the use of resins for dot fixing broken fragments.

The course lasts 30 weeks, with one day each week spent at Tyntesfield and one day at the college, either in the workshop or attending seminars. The project was supported by the National Trust's on-site skills supervisor working closely with the building surveyor. Assessment is continuous, with on-site competencies judged by the three parties involved; the National Trust's surveyor for the project, Nimbus Conservation's site manager and the NVQ assessor.

The programme is the first of its kind in the UK and has successfully completed its first



*Adrian Wolfe, an NHIG student, flame cleaning a section of the Hampton Court screen to expose the condition of the underlying metalwork (Photo: Bethan Griffiths)*

year, with all but one of its students attaining their architectural stone conservation NVQ in Heritage Skills level 3. In October 2011 the programme won the first English Heritage Angel Award.

#### **NHIG AT HAMPTON COURT PALACE**

Eight trainee blacksmiths have been working on the conservation of one of the most famous examples of Baroque wrought ironwork in Britain, Tijou's screen in the gardens of Hampton Court Palace.

Like traditional masonry, historic wrought ironwork is quite unlike any modern equivalent, requiring a very distinct skill set for its conservation. In recent years the supply of skills has largely relied on one blacksmithing course, at Hereford College of Technology, which provides block release training and works closely with the few specialist firms with the resources to train their craftspeople. Chris Topp and Co for example has regularly sent trainees from its Yorkshire base to train in Hereford.

Despite the strategic importance of the block release course at Hereford to the maintenance of the craft skills required, funding for the course was withdrawn by the Skills Funding Agency in 2010 because the craft skill requirements had not been officially recognised by a 'national occupational standard'. Spurred by the imminent threat of closure, two key developments followed.

Firstly, working closely with the newly formed National Heritage Ironwork Group (NHIG), ConstructionSkills stepped in to help assess the skill requirements, paving the way for developing a Heritage Skills NVQ level 3 in blacksmithing.

Secondly, the NHIG set about the task of establishing a new course which would qualify for funding under the present regime. With the support of Historic Royal Palaces and Hereford College of Technology, NHIG submitted a bid to the Heritage Lottery Fund (HLF) under its Skills for the Future programme. The result was the Heritage Blacksmithing Bursary which commenced in May 2011 and is to run for two years.

The bursary enables eight trainee blacksmiths each year to broaden their skills and develop a better understanding of the philosophy and ethics of conservation. The programme provides one year of full time training and includes a five week block release

course at Hereford College of Technology and a series of work placements, the first of which is at Hampton Court Palace. Here they are gaining practical experience of ironwork conservation and holding repair work under the supervision of a specialist conservator from Hall Conservation. Further placements include working in museum environments and in selected blacksmiths' workshops.

On completion of the bursary programme, trainees who are able to demonstrate the competency standards required are awarded the NHIG Award for Blacksmithing Conservation. As the competencies are based on the 'national occupational standards' defined by ConstructionSkills for Heritage skills level 3 blacksmithing, the award represents a substantial proportion of the NVQ level 3 model.

Currently NHIG is working with other organisations to develop a sustainable funding model for work-based training at NVQ level 3 and above which will provide the traditional blacksmithing skills required.

#### **WHAT NEXT?**

The idea of using conservation projects as vehicles for specialist craft training is not new. What makes the Tyntesfield programme unique is that it is essentially an ordinary restoration project with a small but extremely effective training element. Each year, just 30 days are given over to training, and even then conservation work continues. Yet out of this small commitment, 10 stonemasons make the transition to specialists in conservation as a result of the liaison with Bath City College.

Many more specialists could benefit from this type of project. A quick leaf through the pages of *The Building Conservation Directory* illustrates the huge variety of specialist skills required for the conservation and repair of the UK's historic buildings. Specialist blacksmithing may have been plucked from the brink, but many other crafts are under threat.

Any conservation project which is likely to qualify for an HLF grant, and which involves significant elements of stone roofing, leaded light windows, or any type of earth walling for example, should be considered as potential training grounds for specialist trainees.

HLF's Skills for the Future programme is now closed, although its trustees have indicated they will make further strategic investment; meanwhile, the principal source of HLF assistance for the conservation of historic buildings is through Heritage Grants. To qualify for this type of assistance, proposals are required to 'help people to learn about their own and other people's heritage'. This is the only requirement applying to all proposals, and it is an extremely important one. Introducing a training element can satisfy this requirement and make a vital contribution to the survival of key skills.

**THE AUTHOR:** this article was prepared by the editor Jonathan Taylor with the help of Nigel Bryant of City of Bath College, Bethan Griffiths of the National Heritage Ironwork Group, Jo Reilly of the Heritage Lottery Fund, and the National Trust.

## EVENTS

## JANUARY

January 13–14

**Conservation Plans** How to write effective conservation management plans **Venue:** Ironbridge Institute  
**Contact:** Harriet Devlin, Ironbridge Institute (see below)

January 16–18

**Practice and Theory: Managing Change in Historic Buildings** Understanding current principles and practices in building conservation and improving communication between conservators and other heritage professionals **Venue:** West Dean College  
**Contact:** Liz Campbell, West Dean College (see below)

January 18

**International Issues** Part one of a course held on eight consecutive Wednesdays: the first half of the course explores key issues in conservation, the second half addresses project management of conservation projects **Venue:** University of York  
**Contact:** Pam Ward, University of York (see below)

January 19–20

**Vernacular Buildings: Earth and Thatch** Two-day course on vernacular buildings and their place in the history of architecture **Venue:** University of York  
**Contact:** Pam Ward, University of York (see below)

January 20–21

**Project Management and Urban Design** Introduction to project management (day one) and urban design workshop (day two) **Venue:** Ironbridge Institute  
**Contact:** Harriet Devlin, Ironbridge Institute (see below)

January 23–27

**Oak Timber Framing: Rafters** Students will fabricate a gable and a hip roof, lining out, cutting and fitting common, hip and jack rafters **Venue:** WDOAM **Contact:** Diana Rowsell, WDOAM (see below)

January 26–27

**Lime Plaster, Run Mouldings and Pargetting** Two-day course covering lime plastering, mouldings run in situ and pargetting **Venue:** Cressing Temple Barns  
**Contact:** Katie Seabright, Essex County Council (see below)

30 Jan–2 Feb

**Conservation and Repair of Architectural and Structural Metalwork** Conservation of structural metalwork, architectural features and statuary including both ferrous and non-ferrous metals **Venue:** West Dean College  
**Contact:** Liz Campbell, West Dean College (see below)

## FEBRUARY

February 2–3

**Vernacular Buildings: Brick, Tile and Timber** Two-day course on vernacular buildings and their place in the history of architecture **Venue:** University of York  
**Contact:** Pam Ward, University of York (see below)

February 3

**Conservation and Repair of Architectural and Structural Metalwork** Optional follow-on course (see 30 Jan-2 Feb) giving participants the opportunity to gain practical experience in metalwork conservation techniques in the college's traditional forge **Venue:** West Dean College  
**Contact:** Liz Campbell, West Dean College (see below)

February 3–4

**Understanding British Buildings** Two-day course exploring the buildings of Britain, from vernacular cottages to mansions, castles to churches, reinforced concrete to industrial warehouses **Venue:** Ironbridge Institute  
**Contact:** Harriet Devlin, Ironbridge Institute (see below)

February 9

**Structural Repairs to Historic Buildings: Some Case Studies** This seminar considers repairs to the structure of masonry and timber buildings and the philosophy behind them **Venue:** Cressing Temple Barns  
**Contact:** Katie Seabright, Essex County Council (see below)

February 11–13

**Repairing and Maintaining Leaded Glass Panels** Repair and care of leaded glass-work **Venue:** Bedale, North Yorkshire  
**Contact:** Tel 01677 422289 Email heritagecraftalliance@googlemail.com

February 13–16

**Mortars for Repair and Conservation** Detailed study of traditional mortars, including a brief history of their use, investigation and analysis, typical failures and appropriate repair techniques **Venue:** West Dean College  
**Contact:** Liz Campbell, West Dean College (see below)

February 16

**Conservation Solutions** The course runs for four days on consecutive Thursdays and introduces a range of issues in international heritage conservation **Venue:** The University of York  
**Contact:** Pam Ward, University of York (see below)

February 17

**Specifying Mortars for Repair, Restoration and New-build** The performance characteristics of building materials including causes of failure **Venue:** Penicuik House, Midlothian  
**Contact:** The Scottish Lime Centre (see below)

February 17–18

**Disaster Management and Heritage Management** Two-day course covering some of the essentials of disaster management in relation to historic buildings **Venue:** Ironbridge Institute  
**Contact:** Harriet Devlin, Ironbridge Institute (see below)

February 21–22

**Introduction to Masonry Repairs in Traditional Buildings** Introductory guide to the use of a range of mortars for the conservation and repair of traditional masonry buildings **Venue:** Penicuik House, Midlothian **Contact:** The Scottish Lime Centre (see below)

February 21–22

**Practical Flint Walling** Two-day course covering the sorting, selection, preparation and knapping of flints; different styles of flint-laying and the use of lime mortars **Venue:** WDOAM  
**Contact:** Diana Rowsell, WDOAM (see below)

February 25

**Introduction to Lime Pointing** One-day workshop for those who would like to undertake repointing works as part of a renovation project or as general maintenance to traditional masonry structures **Venue:** Penicuik House, Midlothian  
**Contact:** The Scottish Lime Centre (see below)

February 28–29

**Making and Using Traditional Mortars** This practical workshop will provide attendees with a strong understanding of lime technology, how to approach re-pointing work in traditional buildings and the correct materials to use **Venue:** Penicuik House, Midlothian **Contact:** The Scottish Lime Centre (see below)

February 29

**Energy Conservation in Traditional Buildings** The implications of improving energy efficiency for traditional buildings including a review of the relevant regulations **Venue:** WDOAM  
**Contact:** Diana Rowsell, WDOAM (see below)

## MARCH

March 5–7

**Introduction to Timber Repairs** Three-day practical workshop on in situ timber repairs **Venue:** WDOAM  
**Contact:** Diana Rowsell, WDOAM (see below)

March 5–8

**Conservation of Stone Surfaces and Detail** Aspects of stone conservation and repair relevant to ashlar and architectural detail **Venue:** West Dean College  
**Contact:** Liz Campbell, West Dean College (see below)

March 5–9

**Intensive Training and Assessment: C1, C2 and National Unit Assessment** Intensive week of training and assessment in conservation masonry **Venue:** Charlestown Workshops, Fife  
**Contact:** The Scottish Lime Centre (see below)

March 8

**Building Regulations and Historic Buildings** Two talks addressing the application of the Building Regulations to listed buildings, covering disabled access, insulation, fire and sound **Venue:** Cressing Temple Barns  
**Contact:** Katie Seabright, Essex County Council (see below)

March 8–9

**Practical Scarf Repairs** An introduction to the different types of scarfs and the tools and techniques used when scarfing new oak to old **Venue:** WDOAM  
**Contact:** Diana Rowsell, WDOAM (see below)

March 14–15

**Rendering with Lime** How to apply a variety of lime render finishes to a wide range of backgrounds including matching to existing finishes **Venue:** Charlestown Workshops, Fife  
**Contact:** The Scottish Lime Centre (see below)

March 16

**Mortar Analysis Explained** Understanding mortar analysis and using the results to create better specifications **Venue:** Penicuik House, Midlothian  
**Contact:** The Scottish Lime Centre (see below)

March 19

**Assessing Significance: Planning Policy and Conservation Plans** How to define the significance of a heritage asset, how to describe significance in proportion to the importance of the asset and how to use significance as the basis for conservation plans **Venue:** WDOAM **Contact:** Diana Rowsell, WDOAM (see below)

March 19–22

**Specifying Conservation Works** Including tailoring specifications to individual buildings, assessing the quality of the specified works, the role of the conservation contractor and preparing clear tender documents **Venue:** West Dean College  
**Contact:** Liz Campbell, West Dean College (see below)

March 20

**Sash and Case Window Repair for Contractors** Half-day course on repairs to traditional timber sash and case windows **Venue:** Charlestown Workshops, Fife  
**Contact:** The Scottish Lime Centre (see below)

March 20

**Traditional Timber-frame Construction** One-day course on traditional systems of timber framing **Venue:** WDOAM  
**Contact:** Diana Rowsell, WDOAM (see below)

March 21

**An Introduction to Dating Timber-framed Buildings** Dating timber-framed buildings based on stylistic evidence **Venue:** WDOAM **Contact:** Diana Rowsell, WDOAM (see below)

March 22

**Understanding Historic Timber Frame Design** Exploring the design of traditional timber-framed buildings **Venue:** WDOAM **Contact:** Diana Rowsell, WDOAM (see below)

March 21–23

**Masonry Building Conservation: Principles and Techniques** Three-day workshop on repair principles, materials and techniques for traditional masonry buildings including mortar manufacture, practical repair methods and aftercare of lime-based materials **Venue:** Penicuik House, Midlothian  
**Contact:** The Scottish Lime Centre (see below)

March 23

**Historic Timber Framing: Modern Engineering Solutions** Course for architects and carpenters considering the lessons from early timber-framed structures, new techniques and contractual arrangements for design and construction **Venue:** WDOAM **Contact:** Diana Rowsell, WDOAM (see below)

March 24

**Introduction to Maintaining Traditional Buildings** Traditional building techniques and the correct materials to use when undertaking repairs **Venue:** Charlestown Workshops, Fife  
**Contact:** The Scottish Lime Centre (see below)

March 26

**Wattle and Daub** Insights into the historic use of wattle and daub, and its repair and conservation **Venue:** WDOAM **Contact:** Diana Rowsell, WDOAM (see below)

March 26–28

**Introduction to Gauged Brickwork** Exploring the art of gauged brickwork **Venue:** WDOAM  
**Contact:** Diana Rowsell, WDOAM (see below)

March 27–28

**Making and Using Traditional Mortars** Practical workshop on lime technology, how to approach re-pointing work in traditional buildings and the use of appropriate materials **Venue:** Penicuik House, Midlothian  
**Contact:** The Scottish Lime Centre (see below)

March 28

**Timber: Identification of Species** Introduction to the identification of timber species through examination of anatomical features **Venue:** WDOAM  
**Contact:** Diana Rowsell, WDOAM (see below)

March 29

**Repair of Timber Framed Buildings** Day school including a lecture and a workshop session **Venue:** WDOAM **Contact:** Diana Rowsell, WDOAM (see below)

March 29

**Tour of Traditional Brickworks and Guided Walk** An opportunity to visit Bulmer Brick & Tile Company and Bury St Edmunds with one of the country's leading traditional brickmakers **Venue:** Bulmer Brick & Tile Company and Bury St Edmunds  
**Contact:** Katie Seabright, Essex County Council (see below)

## EVENTS continued

- March 29–30 **Reinventing Architecture and Interiors: The Past, the Present and the Future** International Conference on the re-use and re-design of buildings in contemporary settings  
**Venue:** Ravensbourne College, Greenwich  
**Contact:** Louise Fowler Tel 020 3040 3500 Email l.fowler@rave.ac.uk
- March 30 **In Situ Repairs to Historic Timber Structures** A step-by-step approach to the specification of remedial work to historic timber structures **Venue:** WDOAM  
**Contact:** Diana Rowsell, WDOAM (see below)
- March 30 **Grouting and Masonry Consolidation** How to prepare and apply lime-based grouts for a variety of situations including flat ashlar work, cornices and string courses  
**Venue:** Charlestown Workshops, Fife  
**Contact:** The Scottish Lime Centre (see below)
- March 30–31 **The Use of Lime in Historic Buildings** Essential skills for specifying mixes and applying mortars in the form of plastering, pointing and limewashing **Venue:** Ironbridge Institute  
**Contact:** Harriet Devlin, Ironbridge Institute (see below)
- APRIL**
- April 2–5 **Conservation and Repair of Plasters and Renders** History, documentation, condition survey, repair options, specifications, execution and quality control of remedial works to lime, gypsum and cement-based plasters and renders  
**Venue:** West Dean College  
**Contact:** Liz Campbell, West Dean College (see below)
- April 5 **Clay Plain Tiling** Details tbc  
**Venue:** WDOAM **Contact:** Diana Rowsell, WDOAM (see below)
- April 13–14 **The Conservation and Repair of Stone** A background to Britain's building stones, their qualities and availability as well as causes of decay and repair options **Venue:** Ironbridge Institute  
**Contact:** Harriet Devlin, Ironbridge Institute (see below)
- April 16 **Recording Vernacular Buildings Day 1: Observing and Sketching** Including improving the accuracy of rapid sketches, the geometry of construction and using string lines  
**Venue:** WDOAM **Contact:** Diana Rowsell, WDOAM (see below)
- April 16–18 **Traditional Masonry Repair** Three-day workshop covering rebuilding and repair of traditional masonry to match original work **Venue:** Penicuik House, Midlothian  
**Contact:** The Scottish Lime Centre (see below)
- April 16–20 **Oak Timber Framing: Jowl Posts** Students will frame up the principal timbers of a traditional Sussex timber-framed building **Venue:** WDOAM **Contact:** Diana Rowsell, WDOAM (see below)
- April 19 **Historic Roof Coverings** Details tbc **Venue:** WDOAM  
**Contact:** Diana Rowsell, WDOAM (see below)
- April 24 **Recording Vernacular Buildings Day 2: Imposing a Grid** Including setting up a plan grid, setting up levels and recording a structure **Venue:** WDOAM  
**Contact:** Diana Rowsell, WDOAM (see below)
- April 25 **Introduction to Leadwork for Specifiers and Installers** A foundation course for those with little or no experience of working with lead, concentrating on design and specification  
**Venue:** WDOAM **Contact:** Diana Rowsell, WDOAM (see below)
- April 26 **Practical Leadwork** Follows on from 'Introduction to Leadwork for Specifiers and Installers' (April 25) **Venue:** WDOAM  
**Contact:** Diana Rowsell, WDOAM (see below)
- April 26 **Natural Slating** Details tbc **Venue:** WDOAM  
**Contact:** Diana Rowsell, WDOAM (see below)
- April 27–28 **The Conservation of Structural Metals** The historical background of ferrous and non-ferrous metals, methods of production, causes of decay and appropriate conservation techniques **Venue:** Ironbridge Institute  
**Contact:** Harriet Devlin, Ironbridge Institute (see below)
- MAY**
- May 1 **Recording Vernacular Buildings Day 3: Studio Techniques** Basic equipment and materials, technical conventions, three-dimensional visualisation and drawing for publication  
**Venue:** WDOAM **Contact:** Diana Rowsell, WDOAM (see below)
- May 3 **Practical Thatching** A hands-on day thatching with straw on a model roof using traditional tools and techniques  
**Venue:** WDOAM **Contact:** Diana Rowsell, WDOAM (see below)
- May 8–11 **Conservation and Repair of Masonry Ruins** Assessment of the condition of masonry walls, identification of traditional materials, fault diagnosis, control of organic growth, treatment of wall-tops, specification of mortars and grouts, and preparation and placing of mortar **Venue:** West Dean College  
**Contact:** Liz Campbell, West Dean College (see below)
- May 9–10 **Tool Sharpening** Two-day course for students with little or no previous tool-sharpening experience  
**Venue:** WDOAM **Contact:** Diana Rowsell, WDOAM (see below)
- May 14–16 **Advanced Gauged Brickwork** A theoretical and practical course designed for those with some experience of gauged brickwork  
**Venue:** WDOAM **Contact:** Diana Rowsell, WDOAM (see below)
- May 14–17 **Conservation and Repair of Brick, Terracotta and Flint Masonry** Four-day conservation course  
**Venue:** West Dean College  
**Contact:** Liz Campbell, West Dean College (see below)
- May 15 **Limewash, Distemper and Linseed-based Paints** Learn how these traditional finishes were mixed and applied, with expert demonstrations and hands-on opportunities  
**Venue:** WDOAM **Contact:** Diana Rowsell, WDOAM (see below)
- May 18–19 **The Conservation of 20th-century Buildings** Two-day course based in Birmingham looking at innovations in 20th-century architecture and materials **Venue:** Ironbridge Institute  
**Contact:** Harriet Devlin, Ironbridge Institute (see below)
- May 21–25 **Oak Timber Framing: Braces and Studs** Students will line out, cut and fit the braces and studs of a traditional Sussex timber-framed building  
**Venue:** WDOAM **Contact:** Diana Rowsell, WDOAM (see below)
- May 25–26 **Ceramic Building Materials** Using the Jackfield Tile Museum and Blists Hill Victorian Town, this course will cover the background to and repair of brick, terracotta, faience and tiles  
**Venue:** Ironbridge Institute  
**Contact:** Harriet Devlin, Ironbridge Institute (see below)
- JUNE**
- June 6–8 **International Conference on Defence Sites: Heritage and Future 2012** Exploring the opportunities provided by redundant military sites to planners, developers, architects and local communities  
**Venue:** Best Western Royal Beach Hotel, Portsmouth  
**Contact:** Beverley Copland Tel 023 8029 3223  
Email bcopland@wessex.ac.uk
- June 11 **The Roofing Square** Students will use the square to carry out simple practical exercises, then to line out rafter pitch boards and rafter patterns **Venue:** WDOAM  
**Contact:** Diana Rowsell, WDOAM (see below)
- June 11–13 **Repair of Traditionally Constructed Brickwork** Includes principles of repair and causes of failure and decay  
**Venue:** WDOAM **Contact:** Diana Rowsell, WDOAM (see below)
- June 11–14 **Managing Wildlife on Historic Monuments** Course exploring the impact, both harmful and benign, of plants and animals on historic masonry and artefacts **Venue:** West Dean College  
**Contact:** Liz Campbell, West Dean College (see below)
- June 12 **Further Adventures with the Roofing Square** Follows on from 'The Roofing Square' (June 11) **Venue:** WDOAM  
**Contact:** Diana Rowsell, WDOAM (see below)
- June 14 **Lime Mortars for Traditional Brickwork** Lectures and practical demonstrations on the traditional preparation and uses of lime and lime mortars **Venue:** WDOAM  
**Contact:** Diana Rowsell, WDOAM (see below)
- June 15–16 **The Conservation of Timber in Buildings** Historic joinery (day one) and an analysis of repair techniques for timber framed buildings (day two) **Venue:** Ironbridge Institute  
**Contact:** Harriet Devlin, Ironbridge Institute (see below)
- June 18–21 **Masonry Cleaning** Comprehensive course for architects, surveyors and practitioners covering the aesthetic, technical and practical issues involved in cleaning masonry including brick and terracotta **Venue:** West Dean College  
**Contact:** Liz Campbell, West Dean College (see below)
- June 18–22 **Oak Timber Framing: Rafters** Students will fabricate a gable and a hip roof, lining out, cutting and fitting common, hip and jack rafters **Venue:** WDOAM  
**Contact:** Diana Rowsell, WDOAM (see below)
- June 21–23 **IHBC Annual School 2012** 'Significance', includes the IHBC day school **Venue:** Winchester, details tbc  
**Contact:** Email events@ihbc.org.uk
- June 25 **Basic Brickwork for Homeowners** A day of lectures and practical sessions for homeowners who need to understand more about bricks and bricklaying **Venue:** WDOAM  
**Contact:** Diana Rowsell, WDOAM (see below)
- JULY**
- July 3–4 **Historic Lime Plasters and Renders** Two-day course covering the fundamentals of lime plastering from simple renders to fine ornamental work **Venue:** WDOAM  
**Contact:** Diana Rowsell, WDOAM (see below)
- July 5 **Practical Lime Plastering** A practical day learning the basics of lime plastering  
**Venue:** tbc **Contact:** Diana Rowsell, WDOAM (see below)
- July 13–14 **The Conservation of Historic Interiors** Understanding and conserving the historic interior **Venue:** Ironbridge Institute  
**Contact:** Harriet Devlin, Ironbridge Institute (see below)
- July 27–28 **Introduction to Traditional Estates, Parks and Gardens** The history and management of historic parks and gardens including listing/scheduling and funding issues  
**Venue:** Ironbridge Institute  
**Contact:** Harriet Devlin, Ironbridge Institute (see below)
- July 29–30 **Recording Historic Buildings** Two-day practical course in recording techniques for standing buildings  
**Venue:** Ironbridge Institute  
**Contact:** Harriet Devlin, Ironbridge Institute (see below)
- SEPTEMBER**
- September 3–6 **Conservation and Repair of Stone Masonry** An overview of the issues involved in the conservation and repair of stone masonry with lectures, demonstrations, case studies and practical exercises  
**Venue:** West Dean College  
**Contact:** Liz Campbell, West Dean College (see below)
- September 10–13 **Conservation of Concrete** Course for architects, surveyors, engineers, contractors and conservators involved in the repair, conservation and maintenance of architecturally or historically significant concrete **Venue:** West Dean College  
**Contact:** Liz Campbell, West Dean College (see below)
- September 10–14 **Oak Timber Framing: Jowl Posts** Students will frame up the principal timbers of a traditional Sussex timber-framed building **Venue:** WDOAM **Contact:** Diana Rowsell, WDOAM (see below)
- September 17–18 **Jointing, Pointing and Re-pointing of Historic Brickwork** The historical development of jointing and pointing, and considerations for successful re-pointing  
**Venue:** WDOAM **Contact:** Diana Rowsell, WDOAM (see below)

EVENTS *continued*

- September 19 **English Brickwork: Tudor to Edwardian** The historical development of bricks, mortars and their uses in Tudor, Jacobean, Georgian, Victorian and Edwardian brickwork including causes of failure and conservative repairs  
**Venue:** WDOAM **Contact:** Diana Rowsell, WDOAM (see below)
- September 21–22 **The Use of Lime in Historic Buildings** Hands-on course based in a former lime-works including specifying mixes and applying mortars in the form of plastering, pointing and limewashing  
**Venue:** Ironbridge Institute  
**Contact:** Harriet Devlin, Ironbridge Institute (see below)
- September 24–27 **The Structural Repair of Historic Buildings** Applying engineering principles to the conservation of historic structures including inspection, monitoring and repair works ranging from pointing and grouting to tying and underpinning  
**Venue:** West Dean College  
**Contact:** Liz Campbell, West Dean College (see below)

## OCTOBER

- October 8–11 **Conservation and Repair of Timber** Intensive introduction to historic timber-framed structures delivered through a range of lectures, case studies, demonstrations and practical exercises addressing issues of construction, failure and repair  
**Venue:** West Dean College  
**Contact:** Liz Campbell, West Dean College (see below)
- October 10 **Timber Decay and its Treatment** The main causes of decay in hardwoods and softwoods, fungal and insect damage, conservative treatments and building monitoring  
**Venue:** WDOAM **Contact:** Diana Rowsell, WDOAM (see below)
- October 15 **Cottagers and Suburbanites: Colour and Décor for the Less-than-grand** A day of lectures on the use of colour and decoration from the Tudor to Victorian periods  
**Venue:** WDOAM **Contact:** Diana Rowsell, WDOAM (see below)
- October 19 **Homeowners' Day** Aimed at the owners and guardians of historic homes and including every day maintenance, relevant regulations, and sources of advice and training  
**Venue:** WDOAM **Contact:** Diana Rowsell, WDOAM (see below)
- October 22–26 **Oak Timber Framing: Braces and Studs** Students will line out, cut and fit the braces and studs of a traditional Sussex timber-framed building **Venue:** WDOAM  
**Contact:** Diana Rowsell, WDOAM (see below)

## NOVEMBER

- November 5–8 **Mortars for Repair and Conservation** Detailed study of traditional mortars, including a brief history of their use, investigation and analysis, typical failures and appropriate repair techniques, including mixing, placing and curing  
**Venue:** West Dean College  
**Contact:** Liz Campbell, West Dean College (see below)
- November 7–8 **Practical Flint Walling** Two-day course covering the sorting, selection, preparation and knapping of flints, different styles of flint-laying and the use of lime mortars  
**Venue:** WDOAM **Contact:** Diana Rowsell, WDOAM (see below)
- November 19–23 **Square Rule Timber Framing** Students will line out, cut and erect the timbers of a simple frame  
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Kent CT20 2RD  
www.englishstone.org.uk

### ENTRUST

Head Office, 60 Holly Walk,  
Royal Leamington Spa,  
Warwickshire CV32 4JE  
Tel 01926 488300  
www.entrust.org.uk

### EUROPA NOSTRA

Lange Voorhout 35,  
2514 EC The Hague, The Netherlands  
Tel +31 7030 24050  
www.europanostra.org

## USEFUL CONTACTS *continued*

### EUROPEAN CONFEDERATION OF CONSERVATOR-RESTORERS' ORGANISATIONS

70, Coudenberg, 1000 Brussels, Belgium  
www.ecco-eu.org

### THE FIRE PROTECTION ASSOCIATION

London Road, Moreton-in-Marsh, Gloucestershire GL56 0RH  
Tel 01608 812500  
www.thefpa.co.uk

### THE FOLLY FELLOWSHIP

36 Longfield Drive, Rodley, Leeds, West Yorkshire LS13 1JX  
www.follies.org.uk

### THE FOUNTAIN SOCIETY

High House, Bucknell, Shropshire SY7 0AA  
www.fountainsoc.org.uk

### FRIENDS OF FRIENDLESS CHURCHES

St Ann's Vestry Hall, 2 Church Entry, London EC4V 5HB  
Tel 020 7236 3934  
www.friendsoffriendlesschurches.org.uk

### FUNDS FOR HISTORIC BUILDINGS

The Architectural Heritage Fund, 9th Floor Alhambra House, 27-31 Charing Cross Road, London WC2H 0AU  
Tel 020 7925 0199  
www.ffhb.org.uk

### THE FURNITURE HISTORY SOCIETY

1 Mercedes Cottages, St John's Road, Haywards Heath, West Sussex RH16 4EH  
Tel 01444 413845  
www.furniturehistorysociety.org

### THE GARDEN HISTORY SOCIETY

70 Cowcross Street, London EC1M 6EJ  
Tel 020 7608 2409  
www.gardenhistorysociety.org

### THE GARDEN HISTORY SOCIETY IN SCOTLAND

The Glasite Meeting House, 33 Barony Street, Edinburgh EH3 6NX  
Tel 0776 0893954  
www.gardenhistorysociety.org

### GEFFRYE MUSEUM

136 Kingsland Road, London E2 8EA  
Tel 020 7739 9893  
www.geffrye-museum.org.uk

### THE GEORGIAN GROUP

6 Fitzroy Square, London W1T 5DX  
Tel 0871 750 2936  
www.georgiangroup.org.uk

### GLOBAL HERITAGE FUND

625 Emerson Street, Suite 200, Palo Alto, California CA 94301, USA  
Tel +1 650 325 7520  
www.globalheritagefund.org

### GREENSPACE

Caversham Court, Church Road, Reading RG4 7AD  
Tel 0118 946 9060  
www.green-space.org.uk

### THE GUILD OF ARCHITECTURAL IRONMONGERS

8 Stepney Green, London E1 3JU  
Tel 020 7790 3431  
www.gai.org.uk

### HERITAGE ALLIANCE

Clutha House, 10 Storeys Gate, London SW1P 3AY  
Tel 020 7233 0500  
www.theheritagealliance.org.uk

### HERITAGE CONSERVATION TRUST

2 Chester Street, London SW1X 7BB  
Tel 020 7259 5688  
www.hha.org.uk

### THE HERITAGE COUNCIL

Aras na hOidhreachta, Church Lane, Kilkenny, Irish Republic  
Tel +353 5677 70777  
www.heritagecouncil.ie

### THE HERITAGE CRAFTS ASSOCIATION

Thornleigh, Rowton Lane, Rowton, Chester CH3 6AT  
Tel 01244 335308  
www.heritagecrafts.org.uk

### THE HERITAGE EDUCATION TRUST

Bishop Grosseteste University College, Lincoln LN1 3DY  
Tel 01522 583695  
www.heritageeducationtrust.org.uk

### HERITAGE IRELAND

Office of Public Works, Unit 20, Lakeside Retail Park, Claremorris, Co Mayo, Irish Republic  
Tel +353 1647 6000  
www.heritageireland.ie

### HERITAGE LOTTERY FUND

7 Holbein Place, London SW1W 8NR  
Tel 020 7591 6000  
www.hlf.org.uk

### HISTORIC BUILDINGS ADVISORY COUNCIL FOR WALES

Plas Carew, Unit 5-7 Cefn Coed, Parc Nantgarw, Cardiff CF15 7QQ  
Tel 01443 336065  
www.cadw.wales.gov.uk

### HISTORIC BUILDINGS COUNCIL (NORTHERN IRELAND)

Room G-07, Waterman House, 5-33 Hill Street, Belfast BT1 2LA  
Tel 028 9054 3050  
www.hbcni.gov.uk

### HISTORIC CHAPELS TRUST

St George's German Lutheran Church, 55 Allie Street, London E1 8EB  
Tel 020 7481 0533  
www.hct.org.uk

### HISTORIC FARM BUILDINGS GROUP

129 Hoblands, Haywards Heath, West Sussex RH16 3SB  
www.hfbg.org.uk

### HISTORIC GARDENS FOUNDATION

34 River Court, Upper Ground, London SE1 9PE  
Tel 020 7633 9165  
www.historicgardens.org

### HISTORIC HOUSES ASSOCIATION

2 Chester Street, London SW1X 7BB  
Tel 020 7259 5688  
www.hha.org.uk

### HISTORIC ROYAL PALACES

Surveyor of the Fabric Department, Hampton Court Palace, Surrey KT8 9AU  
Tel 020 3166 6380  
www.hrp.org.uk

### HISTORIC SCOTLAND

Longmore House, Salisbury Place, Edinburgh EH9 1SH  
Tel 0131 668 8600  
www.historic-scotland.gov.uk

### HISTORIC TOWNS FORUM

PO Box 22, Bristol BS16 1RZ  
Tel 0117 975 0459  
www.historictownsforum.org

### HMSO - see THE OFFICE OF PUBLIC SECTOR INFORMATION

Homes and Communities Agency  
Maple House, 149 Tottenham Court Road, London W1T 7BN  
Tel 0300 1234 500  
www.homesandcommunities.co.uk

### ICCROM (International Centre for the Study of the Preservation and Restoration of Cultural Property, Rome)

Via de San Michele, 13, I-00153 Rome, Italy  
Tel +39 0658 5531  
www.iccrom.org

### INDUSTRIAL ROPE ACCESS TRADE ASSOCIATION

Kingsley House, Ganders Business Park, Kingsley, Bordon, Hampshire GU35 9LU  
Tel 01420 471619  
www.irata.org

### INSTITUTE FOR ARCHAEOLOGISTS

SHES, Whiteknights, The University of Reading, PO Box 227, Reading, Berkshire RG6 6AB  
Tel 0118 378 6446  
www.archaeologists.net

### THE INSTITUTE OF CONSERVATION

Unit 1.5 Lafone House, The Leathermarket, Weston Street, London SE1 3ER  
Tel 020 3142 6799  
www.icon.org.uk

### INSTITUTE OF HISTORIC BUILDING CONSERVATION

Jubilee House, High Street, Tisbury, Wiltshire SP3 6HA  
Tel 01747 873133  
www.ihbc.org.uk

### INSTITUTION OF CIVIL ENGINEERS/PANEL FOR HISTORICAL ENGINEERING WORKS

1 Great George Street, Westminster, London SW1P 3AA  
Tel 020 7665 2043  
www.ice.org.uk

### INSTITUTION OF STRUCTURAL ENGINEERS

11 Upper Belgrave Street, London SW1X 8BH  
Tel 020 7235 4535  
www.istructe.org.uk

### INTERNATIONAL COUNCIL ON MONUMENTS AND SITES UK

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Tel 020 7566 0031  
www.icomos-uk.org

### THE INTERNATIONAL INSTITUTE FOR CONSERVATION OF HISTORIC AND ARTISTIC WORKS

6 Buckingham Street, London WC2N 6BA  
Tel 020 7839 5975  
www.iiconservation.org

### INTERNATIONAL SOCIETY FOR THE BUILT ENVIRONMENT

29 The Nortons, Caldecotte, Milton Keynes MK7 8HQ  
Tel 01908 370887  
www.isbeltd.com

### IRISH GEORGIAN SOCIETY

74 Merrion Square, Dublin 2, Irish Republic  
Tel +353 1676 7053  
www.igs.ie

### JEWISH HERITAGE UK

Room 204 Ducie House, Ducie Street, Manchester M1 2JW  
Tel 0161 238 8621  
www.jewish-heritage-uk.org

### THE LANDMARK TRUST

Shottesbrooke, Maidenhead, Berkshire SL6 3SW  
Tel 01628 825920  
www.landmarktrust.org.uk

### THE LANDSCAPE INSTITUTE

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www.landscapeinstitute.org

### LEAD SHEET ASSOCIATION LTD

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www.leadsheet.co.uk

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www.londongardenstrust.org

### THE LONDON STAINED GLASS REPOSITORY

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Tel 020 7403 6652  
www.worshipfulglaziers.com

### MAINTAIN OUR HERITAGE

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Tel 01225 482228  
www.maintainourheritage.co.uk

### MASTER CARVERS ASSOCIATION

Unit 2, 15b Vandryke Road, Leighton Buzzard, Bedfordshire LU7 3HG  
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www.mastercarvers.co.uk

### MASTER LOCKSMITHS ASSOCIATION

5d Great Central Way, Woodford Halse, Daventry, Northamptonshire NN11 3PZ  
Tel 01327 262255  
www.locksmiths.co.uk

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Tel 01952 850269  
www.menofthestones.org.uk

### METAL ROOFING CONTRACTORS ASSOCIATION

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Tel 01293 614662  
www.mrca.org.uk

### THE MILESTONE SOCIETY

Hollywell House, Hollywell Lane, Clows Top, Kidderminster, Worcestershire DY14 9NR  
Tel 01299 832338  
www.milestonesociety.co.uk

### MONUMENTAL BRASS SOCIETY

Lowe Hill House, Stratford St Mary, Suffolk CO7 6JX  
www.mbs-brasses.co.uk

### THE MUSEUM OF DOMESTIC DESIGN AND ARCHITECTURE

Middlesex University, Cat Hill, Barnet, Middlesex EN4 8HT  
Tel 020 8411 5244  
www.moda.mdx.ac.uk

### MUSEUM OF GARDEN HISTORY

Lambeth Palace Road, London SE1 7LB  
Tel 020 7401 8865  
www.museumgardenhistory.org

### THE NATIONAL ARCHIVES

Kew, Richmond upon Thames, Surrey TW9 4DU  
Tel 020 8876 3444  
www.nationalarchives.gov.uk

### THE NATIONAL ASSEMBLY FOR WALES

Cardiff Bay, Cardiff CF99 1NA  
Tel 0845 010 3300 (English) or 0845 010 4400 (Welsh)  
www.assemblywales.org

### NATIONAL ASSOCIATION OF DECORATIVE AND FINE ARTS SOCIETIES

NADFAS House, 8 Guilford Street, London WC1N 1DA  
Tel 020 7430 0730  
www.nadfas.org.uk

### NATIONAL CHURCHES TRUST

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Tel 020 7600 6090  
www.nationalchurchestrust.org



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### NATIONAL COUNCIL FOR THE CONSERVATION OF PLANTS AND GARDENS (aka PLANT HERITAGE)

12 Home Farm, Loseley Park,  
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Tel 01483 447540  
www.plantheritage.com

### THE NATIONAL FEDERATION OF BUILDERS

3/5 Rough Hey Road, Grimsargh,  
Preston, Lancashire PR2 5AR  
Tel 08450 578160  
www.builders.org.uk

### NATIONAL FEDERATION OF ROOFING CONTRACTORS LTD

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London EC2A 2DY  
Tel 020 7638 7663  
www.nfrc.co.uk

### NATIONAL HERITAGE IRONWORK GROUP

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Albury, Guildford, Surrey GU5 9AG  
Tel 01483 202027  
www.nhig.org.uk

### NATIONAL HERITAGE MEMORIAL FUND

7 Holbein Place,  
London SW1W 8NR  
Tel 020 7591 6044  
www.nhmf.org.uk

### NATIONAL MONUMENTS RECORD

Kemble Drive, Swindon,  
Wiltshire SN2 2GZ  
Tel 01793 414700  
www.english-heritage.org.uk

### NATIONAL MONUMENTS RECORD OF WALES

Crown Building, Plas Crug,  
Aberystwyth, Ceredigion SY23 1NJ  
Tel 01970 621200  
www.rcahmw.gov.uk

### NATIONAL PIERS SOCIETY

Ridge Cottage, Stockland, Honiton,  
Devon EX14 9EN  
Tel 01404 831335  
www.piers.org.uk

### NATIONAL PRESERVATION OFFICE

The British Library, 96 Euston Road,  
London NW1 2DB  
Tel 020 7412 7612  
www.bl.uk/npo

### NATIONAL RECORDS OF SCOTLAND

HM General Register House,  
2 Princes Street, Edinburgh EH1 3YY  
Tel 0131 535 1314  
www.nrscotland.gov.uk

### NATIONAL SOCIETY OF MASTER THATCHERS

13 Parkers Hill, Tetsworth, Thame,  
Oxfordshire OX9 7AQ  
Tel 01844 281208  
www.nsmtd.co.uk

### THE NATIONAL TRUST

Heelis, Kemble Drive, Swindon,  
Wiltshire SN2 2NA  
Tel 01793 817400  
www.nationaltrust.org.uk

### THE NATIONAL TRUST FOR SCOTLAND

Wemyss House, 28 Charlotte Square,  
Edinburgh EH2 4ET  
Tel 0844 493 2100  
www.nts.org.uk

### NATURAL ENGLAND

1 East Parade, Sheffield S1 2ET  
Tel 0845 600 3078  
www.naturalengland.org.uk

### THE NEWCOMEN SOCIETY

The Science Museum,  
London SW7 2DD  
Tel 020 7371 4445  
www.newcomen.com

### NORTHERN IRELAND ASSEMBLY

Communications Office,  
Parliament Buildings,  
Ballymiscaw, Stormont,  
Belfast BT4 3XX  
Tel 028 9052 1333  
www.niassembly.gov.uk

### NORTHERN IRELAND ENVIRONMENT AGENCY - BUILT HERITAGE DIRECTORATE

Waterman House, 5-33 Hill Street,  
Belfast BT1 2LA  
Tel 028 9054 3095  
www.ni-environment.gov.uk

### THE OFFICE OF PUBLIC SECTOR INFORMATION

102 Petty France,  
London SW1H 9AJ  
Tel 020 8876 3444  
www.opsi.gov.uk

### OPEN SPACES SOCIETY

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Oxfordshire RG9 2BA  
Tel 01491 573535  
www.oss.org.uk

### THE ORTON TRUST

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Northamptonshire NN14 6DJ  
Tel 01536 711600  
www.ortontrust.org.uk

### PASSIVE FIRE PROTECTION FEDERATION

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Kingsley, Bordon, Hampshire GU35 9LU  
Tel 01420 471621  
www.pfpf.org

### PLANNING OFFICERS SOCIETY

PO Box 842, Aylesbury,  
Buckinghamshire HP20 9DY  
Tel 01296 422161  
www.planningofficers.org.uk

### THE PRINCE'S REGENERATION TRUST

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London W1W 7NT  
Tel 020 7462 6440  
www.princes-regeneration.org

### PROFESSIONAL ACCREDITATION OF CONSERVATOR-RESTORERS

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Unit 1.5 Lafone House,  
The Leathermarket, Weston Street,  
London SE1 3ER  
Tel 01626 824510  
www.icon.org.uk

### PUBLIC MONUMENTS AND SCULPTURE ASSOCIATION

70 Cowcross Street, London EC1M 6EJ  
Tel 020 7490 5001  
www.pmsa.org.uk

### RAILWAY HERITAGE TRUST

40 Melton Street,  
London NW1 2EE  
Tel 020 7557 8598  
www.railwayheritagetrust.co.uk

### REGIONAL DEVELOPMENT AGENCIES

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3 Priestley Wharf, Holt Street,  
Aston Science Park,  
Birmingham B7 4BN  
Tel 0121 380 3500  
www.advantagemw.co.uk

### EAST MIDLANDS

Apex Court, City Link,  
Nottingham NG2 4LA  
Tel 0115 988 8300  
www.emda.org.uk

### EAST OF ENGLAND

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### LONDON

London Development Agency,  
Palestra, 197 Blackfriars Road,  
London SE1 8AA  
Tel 020 7593 9000  
www.lda.gov.uk

### NORTH WEST

PO Box 37, Renaissance House,  
Centre Park, Warrington WA1 1QN  
Tel 01925 400100  
www.nwda.co.uk

### ONE NORTH EAST

Stella House, Goldcrest Way,  
Newburn Riverside,  
Newcastle upon Tyne NE15 8NY  
Tel 0191 229 6200  
www.onenortheast.co.uk

### SOUTH EAST

Cross Lanes, Guildford,  
Surrey GU1 1YA  
Tel 01483 484200  
www.seeda.co.uk

### SOUTH WEST

Sterling House, Dix's Field, Exeter,  
Devon EX1 1QA  
Tel 01392 214747  
www.southwestrda.org.uk

### YORKSHIRE FORWARD

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Leeds, West Yorkshire LS11 5AE  
Tel 0113 394 9600  
www.yorkshire-forward.com

### REGISTER OF ARCHITECTS ACCREDITED IN BUILDING CONSERVATION

No 5 The Parsonage,  
Manchester M3 2HS  
Tel 0161 832 0666  
www.aabc-register.co.uk

### ROYAL ARCHAEOLOGICAL INSTITUTE

c/o Society of Antiquaries of London,  
Burlington House, Piccadilly,  
London W1J 0BE  
www.royalarchaeolinst.org

### ROYAL COMMISSION ON THE ANCIENT AND HISTORICAL MONUMENTS OF SCOTLAND

John Sinclair House,  
16 Bernard Terrace,  
Edinburgh EH8 9NX  
Tel 0131 662 1456  
www.rcahms.gov.uk

### ROYAL COMMISSION ON THE ANCIENT AND HISTORICAL MONUMENTS OF WALES

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Tel 01970 621200  
www.rcahmw.org.uk

### ROYAL COMMISSION ON THE HISTORICAL MONUMENTS OF ENGLAND

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www.english-heritage.org.uk

### ROYAL HORTICULTURAL SOCIETY

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London SW1P 2PE  
Tel 0845 260 5000  
www.rhs.org.uk

### ROYAL INCORPORATION OF ARCHITECTS IN SCOTLAND

15 Rutland Square,  
Edinburgh EH1 2BE  
Tel 0131 229 7545  
www.rias.org.uk

## USEFUL CONTACTS *continued*

### ROYAL INSTITUTE OF BRITISH ARCHITECTS

66 Portland Place, London W1B 1AD  
Tel 020 7580 5533  
www.architecture.com

### ROYAL INSTITUTION OF CHARTERED SURVEYORS, BUILDING CONSERVATION FORUM

Professional Groups and Forums,  
12 Great George Street,  
Parliament Square, London SW1P 3AD  
Tel 0870 333 1600  
www.rics.org

### ROYAL SOCIETY OF ARCHITECTS IN WALES

4 Cathedral Road, Cardiff CF11 9LJ  
Tel 029 2022 8987  
www.architecture-wales.com

### ROYAL SOCIETY OF ULSTER ARCHITECTS

2 Mount Charles, Belfast BT7 1NZ  
Tel 028 9032 3760  
www.rsua.org.uk

### ROYAL TOWN PLANNING INSTITUTE

41 Botolph Lane, London EC3R 8DL  
Tel 020 7929 9494  
www.rtpl.org.uk

### SALVO

PO Box 4111, Bath BA1 0FL  
Tel 01225 422300  
www.salvo.co.uk

### SAVE BRITAIN'S HERITAGE

70 Cowcross Street, London EC1M 6EJ  
Tel 020 7253 3500  
www.savebritainsheritage.org

### THE SCOTTISH CIVIC TRUST

The Tobacco Merchant's House,  
42 Miller Street, Glasgow G1 1DT  
Tel 0141 221 1466  
www.scottishcivictrust.org.uk

### THE SCOTTISH GOVERNMENT – BUILT ENVIRONMENT DIRECTORATE

Planning Division, Victoria Quay,  
Edinburgh EH6 6QQ  
Tel 0131 244 7888  
www.scotland.gov.uk

### SCOTTISH IRONWORK FOUNDATION

42 Randolph Rd, Stirling FK8 2AR  
www.scottishironwork.org

### SCOTTISH LIME CENTRE TRUST

Charlestown Workshops, Rocks Road,  
Charlestown, Fife KY11 3EN  
Tel 01383 872722  
www.scotlime.org

### THE SCOTTISH REDUNDANT CHURCHES TRUST

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www.srct.org.uk

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### SIR JOHN SOANE'S MUSEUM

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Tel 020 7405 2107  
www.soane.org

### THE SOCIETY FOR THE PROTECTION OF ANCIENT BUILDINGS

37 Spital Square, London E1 6DY  
Tel 020 7377 1644  
www.spab.org.uk

### THE SOCIETY FOR THE PROTECTION OF ANCIENT BUILDINGS IN SCOTLAND

The Glasite Meeting House,  
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www.spab.org.uk/spab-in-scotland

### SOCIETY OF ARCHITECTURAL HISTORIANS OF GREAT BRITAIN

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Edinburgh EH8 9NX  
www.sahgb.org.uk

### SOCIETY OF ARCHITECTURAL ILLUSTRATION

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Tel 01892 852578  
www.sai.org.uk

### STAINED GLASS MUSEUM

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www.stainedglassmuseum.com

### STEEL WINDOW ASSOCIATION

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Staffordshire B79 7HJ  
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www.steel-window-association.co.uk

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Tel 01303 856123  
www.stone-federationgb.org.uk

### STONE ROOFING ASSOCIATION

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Tel 01286 650402  
www.stoneroof.org.uk

### STREET PRIDE

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The Tea Factory, Liverpool L1 4DQ  
Tel 0151 708 9920

### THE THEATRES TRUST

22 Charing Cross Road, London WC2H 0QL  
Tel 020 7836 8591  
www.theatrestrust.org.uk

### THE TILE ASSOCIATION

Forum Court, 83 Copers Cope Road,  
Beckenham, Kent BR3 1NR  
Tel 020 8663 0946  
www.tiles.org.uk

### TILES AND ARCHITECTURAL CERAMICS SOCIETY

The Potteries Museum and Art Gallery,  
Bethesda Street, Hanley,  
Stoke on Trent ST1 3DW  
www.tilesoc.org.uk

### TIMBER RESEARCH AND DEVELOPMENT ASSOCIATION

Stocking Lane, Hughenden Valley,  
High Wycombe,  
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Tel 01494 569600  
www.trada.co.uk

### THE TIMBER TRADE FEDERATION

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London WC1E 7BT  
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www.ttf.co.uk

### THE TOOLS AND TRADES HISTORY SOCIETY

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East Budleigh, Devon EX9 7DT  
www.taths.org.uk

### TOWN AND COUNTRY PLANNING ASSOCIATION

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www.tcpa.org.uk

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www.traditionalpaintforum.org.uk

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### UK ASSOCIATION OF PRESERVATION TRUSTS

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www.ukapt.org.uk

### UK CAST STONE ASSOCIATION

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Tel 01604 405666  
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### ULSTER ARCHITECTURAL HERITAGE SOCIETY

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