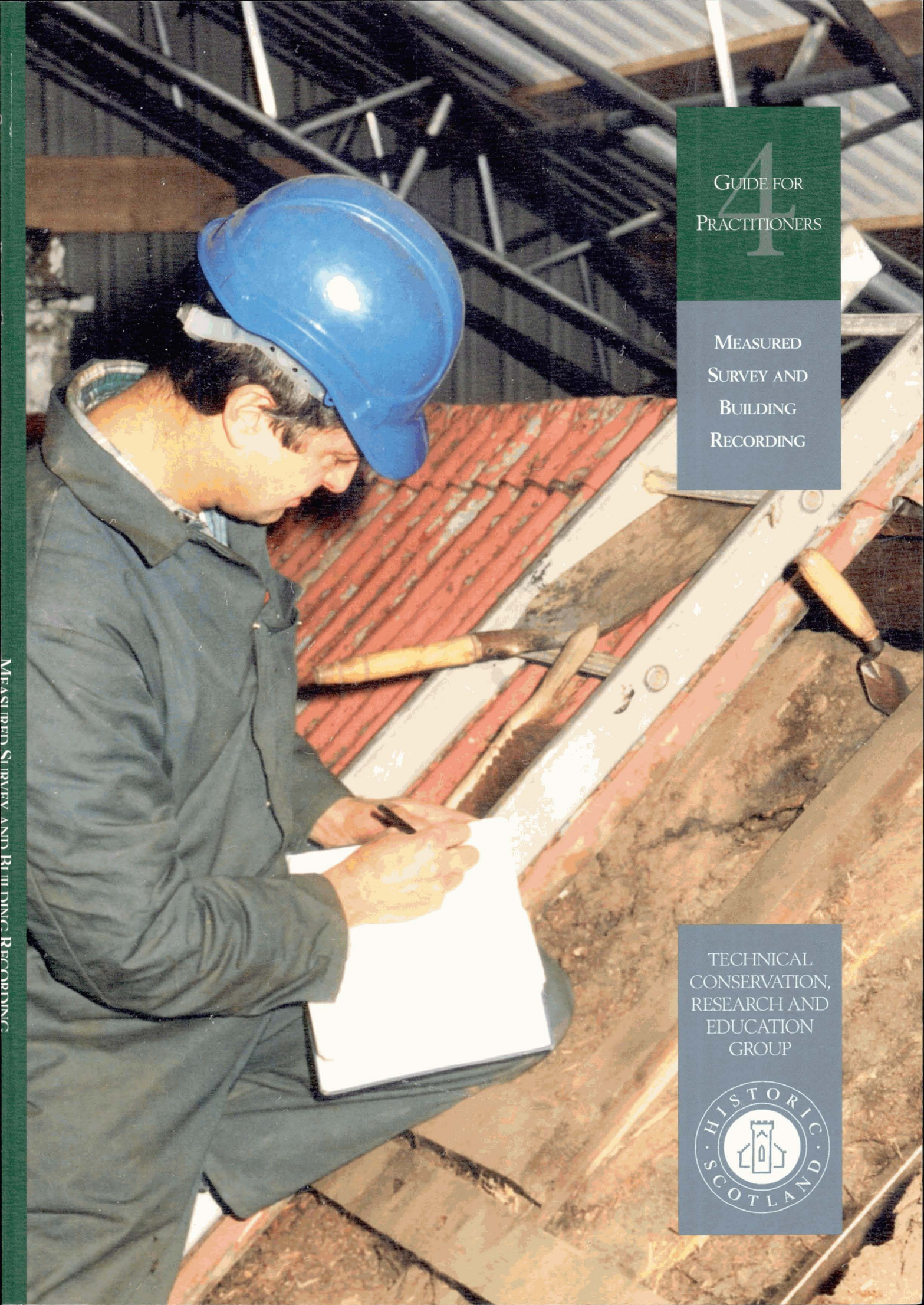


GUIDE FOR PRACTITIONERS 4

MEASURED SURVEY AND BUILDING RECORDING

TECHNICAL CONSERVATION, RESEARCH AND EDUCATION GROUP

HISTORIC SCOTLAND

MEASURED SURVEY AND BUILDING RECORDING

HISTORIC SCOTLAND TECHNICAL ADVICE NOTES

1 Preparation and Use of Lime Mortars (revised 1995)
2 Conservation of Plasterwork (revised 2002)
3 Performance Standards for Timber Sash and Case Windows (1994) (withdrawn)
4 Thatch & Thatching Techniques (1996)
5 The Hebridean Blackhouse (1996)
6 Earth Structures and Construction in Scotland (1996)
7 Access to the Built Heritage (1996)
8 Historic Scotland Guide to International Conservation Charters (1997)
9 Stonecleaning of Granite Buildings (1997)
10 Biological Growths on Sandstone Buildings: Control and Treatment (1997)
11 Fire Protection Measures in Scottish Historic Buildings (1997)
12 Quarries of Scotland (1997)
13 The Archaeology of Scottish Thatch (1998)
14 The Installation of Sprinkler Systems in Historic Buildings (1998)
15 External Lime Coatings on Traditional Buildings (2001)
16 Burrowing Animals and Archaeology (1999)
17 Bracken and Archaeology (1999)
18 The Treatment of Graffiti on Historic Surfaces (1999)
19 Scottish Aggregates for Building Conservation (1999)
20 Corrosion in Masonry Clad Early 20th Century Steel Framed Buildings (2000)
21 Scottish Slate Quarries (2000)
22 Fire Risk Management in Heritage Buildings (2001)
23 Non-Destructive Investigation of Standing Structures (2001)
24 The Environmental Control of Dry Rot (2002)
25 Maintenance and Repair of Cleaned Stone Buildings (2003)

GUIDES FOR PRACTITIONERS

Stone Cleaning – A Guide for Practitioners (1994)
Timber Decay in Buildings – The Conservation Approach to Treatment (1999)
1 Rural Buildings of the Lothians: Conservation and Conversion (1999)
2 Conservation of Historic Graveyards (2001)
3 The Conservation of Timber Sash and Case Windows

Available from:

Historic Scotland
Technical Conservation, Research and Education Division
Scottish Conservation Bureau
Longmore House
Salisbury Place
EDINBURGH
EH9 1SH
Tel 0131 668 8668
Fax 0131 668 8669
email hs.conservation.bureau@scotland.gov.uk

GUIDE FOR PRACTITIONERS

MEASURED SURVEY AND BUILDING RECORDING

for Historic Buildings and Structures

Editor
Ross Dallas

Published by
Historic Scotland

ISBN 1 903570 92 1

Commissioned by

TECHNICAL CONSERVATION, RESEARCH AND EDUCATION GROUP

LIST OF CONTRIBUTORS

Tom Addyman Addyman Associates
Ch 7 (all)

Fiona Allardyce Historic Scotland
Ch 6.4

David Bowler Scottish Urban Archaeological Trust Ltd (SUAT)
Ch 5 TF Clay building

Colin Briden Historic Buildings Archaeologist
Ch 6.7

Nick Bridgland Historic Scotland
Ch 8.5 (joint)

Stewart Brown Simpson & Brown Architects
Ch 3 TF Mansfield Place Church

Neil Cameron RCAHMS
Ch 5.8 and Ch 8.6 (with colleagues)

Krystyna Campbell Historic Scotland
Ch 5.7

Mike Cressey CFA Archaeology Ltd
Ch 8.5 (joint)

Anne Crone AOC (Scotland) Ltd
Ch 6.3

Ross Dallas Editor and Survey Consultant
Summary, Ch 4.1, Ch 4.5 and Ch 9 (except as noted), plus Editorial, other unattributed sections and Tables etc.

Caitlin Evans Glasgow University Archaeological Research Division (GUARD)
Ch 6.6

Gordon Ewart Kirkdale Archaeology
Ch 5.1, 2 & 3

Richard Fawcett Historic Scotland
Ch 2 (joint)

John Gordon Historic Scotland
Ch 4.2

Tim Holden Headland Archaeology Ltd
Ch 5.4, 5 & 6 and Ch 6.1

Olivia Lelong GUARD
Ch 6.5

Jim Loy Loy Surveys Ltd
Ch 4.3

Aonghus Mackechnie Historic Scotland
Ch 6.2

Alan Marshall Gray, Marshall & Associates Chartered Architects
Ch 3 (all)

Andrew Morris Mason Land Surveys Ltd
Ch 4.4

Ylva Player-Dahnsjö University of Dundee
Ch 9.11

Alison Plummer Oxford Archaeology North (formerly LUAU)
Ch 5.9 and Ch 8.1 (joint)

John Renshaw John Renshaw Architects
Ch 8.2 (joint)

Neil Ross Historic Scotland
Ch 8.1 (joint), Ch 8.4 and Ch 9.10 (joint)

Allan Rutherford Historic Scotland
Ch 2 (joint)

Gary Tompsett GUARD
Ch 4 TF Using RP, Ch 6.8 and Ch 8.3

Robin Turner National Trust for Scotland
Ch 1.5, Ch 1.6, Ch 1.9 and Ch 8.2 (joint)

Mark Watson Historic Scotland
Ch 1.8, Ch 9.8 and Ch 9.9

Jason Wood Heritage Consultancy Services
Ch 1.1, 2, 3 & 4 and Ch 9.6 (joint)

Cover page: Recording work in progress on the thatched roof of Sunnybrae Cottage, Perthshire, by Headland Archaeology Ltd, on behalf of Historic Scotland. see Chap 6.1.3. (Photo: Historic Scotland)

CONTENTS

ILLUSTRATIONS

ACKNOWLEDGEMENTS

The most important acknowledgments are naturally to the contributors, without whom this *Guide to Practitioners* could not have been written. The breadth of the subject is such that a wide number of disciplines are represented. All contributors are listed on page ii.

They have been drawn from a wide range of those involved in measured survey and building recording, mostly Scotland-based but not exclusively. As well, almost all contributors were 'interviewed', which provided much useful information. In a number of cases, members of a contributor's staff have also assisted, and I am grateful to them all.

From the contributors, I would in particular like to thank John Gordon HS, John Renshaw, Robin Turner NTS and Jason Wood for extra assistance. Neil Ross of TCRE was the main link to Historic Scotland and contributed to the Guide as an author. Others who have been very helpful in producing this work have been Lt Col David Anderson, David Connolly, Dr Sally Foster HS, Mark Hopton LD&N Architects, Gavin McCall NTS, Kate Pugh ICOMOS UK and Clare Sorensen RCAHMS.

In a work of this nature, there are many references to projects and many illustrations relating to sites. In Ch 3, I am very grateful to the National Archives of Scotland for agreeing to the use of several illustrations of General Register House; Edinburgh World Heritage Trust; George Heriot's School for the use of a photograph, and Barclay Church for the use of a floor plan. Material on Mansfield Place Church is by courtesy of the Scottish Council for Voluntary Organisations. In Ch 4.5, some material is used courtesy of the College of Estate Management.

In Ch 5.2, George McNeill of the Scottish Historic Buildings Trust was very helpful over the use of the Merchant's House. In Ch 5.4, information and illustrations are by permission of: Arnol Black House, Historic Scotland; Glencorse Church, Mr and Mrs H McCaig, and Ewingston Farm, Bankton Developments. Material on Castle Tioram is courtesy of Anta Estates. In Ch 6.5, the Geilston House example is by permission of the National Trust for Scotland.

In Ch 7, descriptions of Old Auchentroig, 26-31 Charlotte Square, Newhailes, Geilston and Ossian's Hall are by courtesy of the NTS, and Queensberry House is by permission of the Scottish Executive. For the Case Studies in Ch 8, the following are all acknowledged: Auchindrain, the Trustees of Auchindrain Township, Mr John McDonald and Historic Scotland; Newhailes, the NTS; Bowhouse Munitions Factory, the Scottish Prison Service; Fenton Tower Ltd and their architects, Nicholas Groves-Raines. The section on the RCAHMS was contributed by the following staff: John Borland, Neil Cameron, Alan Leith, Geoffrey Stell and Steve Wallace; edited by Neil Cameron.

I have tried to be as thorough as possible in correctly naming each site and acknowledging the client or organisation involved. By way of this note, full acknowledgment is given to all owners and clients whose site or material may be referred to in any way. If any have been missed in the text references, I take this opportunity to apologise. Where noted, the copyright of illustrations belongs to the named person, organisation or their client.

Where registered trademarks are used, full acknowledgment is made to the trademark owner. References to services and products are made in good faith, but the inclusion of any particular firm, individual or product does not imply endorsement by Historic Scotland of that service or product.

Finally, this project commenced with a 'Discussion Forum' held by Historic Scotland in June 2000. This was attended by over sixty practitioners. The stimulating debate helped greatly to focus the content of the Practitioner's Guide and I would like to thank all those who attended that meeting.

FOREWORD

Almost any works of intervention to a building of traditional construction require a thorough understanding and appreciation of what exists. The building or structure may be of significant architectural or historic interest, or of lower cultural importance yet having considerable value for the owner or occupier.

A full understanding of the historic building's development, fabric, components and materials can only be achieved by the careful recording of information gathered by inspection, documentary research and measured survey. This data can be obtained in a number of ways, and, increasingly, by the use of sophisticated recording and surveying techniques and equipment with which many of those who commission and use surveys and records may not always be familiar. Ideally, the repair or conversion of traditional buildings should only take place following an appropriate survey and recording exercise.

Of the estimated £6.6 billion spent annually in the Scottish building industry, almost half, £3.1 billion, is spent on repair and maintenance. Given this magnitude of cost, and with more operatives employed in construction than in the Scottish tourist and electronics industries combined there is clearly a need for appropriate guidance in all aspects of this important sector of the economy.

In June 2000 Historic Scotland's Technical Conservation, Research and Education Group invited a wide range of practitioners to a Discussion Forum to debate the need for technical advice on the surveying and recording of historic buildings and structures. It was recognised that the construction industry at large lacked sufficient information and guidance on the complexities of currently available surveying and recording approaches, and how to determine which techniques best suit differing needs. The discussion generated overwhelming support for such a venture and a ready willingness to participate in its preparation.

This *Guide for Practitioners* aims to address comprehensively the full range of measured survey and building recording methods likely to be encountered. It does not offer instruction to the professional building recorder or surveyor as such, but aims to assist all building professionals, property owners and managers to understand the potential of the different surveying and recording methodologies available for use during the repair, maintenance, alteration or conversion of buildings.

Although written from a Scottish perspective its findings have a wider international relevance. Hopefully, it will also emerge as a textbook from which a greater awareness of the value of recording of historic buildings will be recognised in the undergraduate schools and training colleges.

Ably co-ordinated by Ross Dallas as Managing Editor, a wide range of practitioners have willingly shared their professional experience and advice, supported by appropriate case studies. Our thanks are due to all who participated in the completion of this Guide.

Ingval Maxwell
Director TCRE Group
Edinburgh
November 2003

SUMMARY

Building recording? Measured surveys? Building analysis? What are these subjects, and of what importance are they to the owners and custodians of historic buildings?

Architectural history, and indeed the process of making a record of all or parts of a historic building, is not at all new. Numerous examples of this type of work exist from the C19 and indeed earlier.

APPROACHES TO CONSERVATION

What has changed? In the first place, the need for the conservation of the built heritage has become both a more widely accepted and a more acutely focussed field. Increasingly we are aware that, however carefully and sensitively buildings are conserved, the processes of time and decay are such that there will always be some loss to the originality of the fabric.

Furthermore, there are changes in approach and legislation taking place, which can influence attitudes to recording. For example, there is a much wider appreciation today of the need for full information on any building which is to be conserved, restored or altered, so that the specifier and owner are fully aware of what they are starting with.

The emergence of Conservation Plans (Ch 9.9) is a good case in point. This philosophy of bringing together an understanding of all the issues surrounding a historic building often requires building recording data to feed into the process.

Concurrently, building conservation has become a more scientifically-based process. Again, we are conscious that the most well-intentioned intervention in a building can have unintended and unforeseen consequences.

As an area of study, approaches to recording have also become the subject of considerable interest. Through the text, there are references to a number of recent books and documents on the subject. The UK has played a valued role in this process. ICOMOS UK were the producers of the 'Recording Principles' Resolution, adopted by ICOMOS in 1996 and reproduced as Appendix A.

Thus, making a record and having at hand the best quality of measured surveys is seen as a vital prerequisite for looking after historic buildings. Indeed, there can be few processes in the conservation and management of a historic building which will not benefit from the products and results of a building recording exercise.

NEW TECHNIQUES

Other factors have led to a greater current interest in this field. In the first place, techniques of archaeology are increasingly being applied to the recording and analysis of buildings.

The archaeologist's painstaking and systematic approach to recording, derived from principles of excavation where as a result loss of the site occurs, have been found to be invaluable in recording buildings. This is certainly not to belittle all the work that has gone before, but the new techniques have undoubtedly added depth and led to new insights in understanding historic buildings.

Furthermore, methods of measured survey and data capture have changed out of all recognition in the last two decades, largely as a result of the introduction of computers. New measured survey methods using, for example, total station theodolites and photogrammetry have raised the volume and quality of data capture. Presenting measured surveys in CAD (computer aided drafting) has transformed the functionality of this material for the user.

THE READERSHIP

Historic Scotland therefore considered it an appropriate time to produce this *Guide for Practitioners* to set out the principles and practice of building recording and how it has been changed and improved by these developments.

The Guide has been written primarily to inform all those involved and working with historic or older buildings, especially those who might not be aware of the many facets of recording and surveying work. This particularly includes owners and managers of historic properties, and those preparing to undertake works of conservation, repair or alteration to such buildings. It is not a textbook for the specialist provider of surveying and recording services who is already familiar with current methods and technology, nor is it intended to debate the niceties of this type of work.

Additionally, it will explain the benefits of having a thorough knowledge and understanding of a building. These range from the direct, practical value of using the information in the conservation process, to the importance of recording to a wider appreciation of the built heritage.

It should be noted that a Practitioner's Guide is not a policy document – it is a source of information and description of best practice. There is discussion on what can realistically be aimed for and achieved during the recording process, but the content is not intended to be prescriptive. Indeed, a theme that will emerge is that each situation will be somewhat different, and the recording response must be tailored to the circumstances.

This is the first edition of this Guide. As such, the content reflects current custom and practice, but as the Guide describes operational matters, there will be developments and changes in techniques over the years. Historic Scotland will welcome comment from the anticipated wide range of users on the usefulness of the Guide and indeed areas that should be developed or shortened.

In an ideal world, every historic or listed building would have available a complete record, but realistically this is probably not an achievable goal. It is therefore important that the owners or managers of a historic building should be in the position to make a judgement on the adequacy of their own records, providing a further reason for the description and evaluation of the many techniques.

SUBJECTS FOR RECORDING

The main emphasis in this Guide is on the survey and recording of historic buildings and structures. This is taken to include all forms of buildings, from domestic housing to castles to industrial buildings. Structures are considered as buildings no longer functioning or habitable, such as roofless ruins. Broadly speaking, the *techniques* will be applicable to all buildings and structures, although the *expertise* required will certainly vary.

Clearly, the whole field of interest of the built and indeed man-made environment is much wider than this – historic remains which can be recorded range for example from earthen hill forts to Pictish stones. However, these wider fields often require the use of specialist techniques outwith the range of those normally applied in building recording, and so are beyond the scope of the Guide.

Also, the Guide considers not just important buildings or even Listed Buildings and Scheduled Ancient Monuments. Scotland's built heritage, as with the whole United Kingdom, is made up of a very wide and diverse range of buildings. Many vernacular, non-domestic and later buildings are not statutorily protected, but they are still of much value in an appreciation of the built heritage.

It should also be noted that there are some areas closely related to building recording for which space was not available (Ch 1.11). For example, even with a building in use, archaeological excavation may be of great value – perhaps in elucidating where a former range or wing was located. The subject is covered briefly at various points in the Guide, but there is no extended description of excavation techniques.

Similarly, relating a historic building to its site is likely to be vitally important. In an Estate such as Newhailes, Edinburgh, for example (Ch 8.2) the relationship between the house and its estate is essential to an understanding of both. But considering the sites of historic buildings in detail opens up a whole new area of guidance. The field is discussed briefly in Ch 5.7.

DEFINITIONS

As used in this Guide, the expression **'building recording'** embraces in the widest sense the complete process - the provision of measured survey, the description of features, the photography, the analysis and the writing up to disseminate the accumulated information.

To date, this is not a universally accepted terminology. Many archaeologists for example, use the expressions **'buildings analysis'** or **'buildings archaeology'** to describe the process. Here, the first expression is used to define the 'thinking' part of the process – having observed the building, what has been learned? When and how was it built? Has it been altered, and so on?

The term **'buildings archaeology'** on the other hand has generally been avoided, as being too restrictive. That the archaeological input has been of great benefit to building recording is generally accepted, but a record of a building should be contributed to by many other specialists, experts and indeed non-professionals. When used, it is believed this term should be restricted to the understanding of the building when strictly developed through archaeological methods.

If this broad definition of building recording is accepted, strictly speaking **'measured survey'** - that is the preparation of the plans and elevation drawings – also sits within it. But, on many occasions, a measured survey alone may be the only product prepared or available. Measured surveys are also very important in their own right, as the 'building blocks' on which virtually every subsequent conservation, re-use and indeed recording process will be based. Hence special attention is paid to the products and preparation of measured surveys.

As will become evident, many persons can contribute to the record of a building – from the specialist in this field to the building professional to the amateur. To encapsulate all those who may contribute, the expression **'building recorder'** has been used throughout, even though their first discipline may be archaeology or architectural history or some other profession.

Again, the types of building and structures addressed in the Guide have been defined above. For convenience throughout the text, the expression **'historic building'** is generally used, but this should always be taken to mean any building or structure of interest to the recording process. This includes unlisted, vernacular and industrial buildings of great interest in building history terms, but perhaps not immediately recognisable as such by the public.

A term not widely used in the UK, but common elsewhere is **'documentation'**. This is widely used, for example, in ICOMOS literature to encapsulate the whole of the written or off site record of a building. It is a term worthy of much wider use in the UK. How much easier just to say 'the documentation of the building', and know that everyone will understand. The term **'historic building recording'** or 'HBR' might also be a useful encapsulation, although to the public, historic has rather a different connotation from many of the subjects recorded.

One other definition is relevant. In the conservation field, the word **'survey'** is a very overworked expression. Every type of activity seems to become a survey. The word should always be qualified by the type of survey – in this case measured survey. Given the specialist nature of the Guide, to avoid repetition wherever the word survey is used it may be read as measured survey.

THE CONTENT IN DETAIL

The Guide is a reference work, generally to be dipped into when the need arises. Hence much effort has gone into making the arrangement and layout as modular as possible, with many sub divisions and much cross-referencing. A small price to pay for this is that some subjects are referred to in more than one section.

Additionally, 'building recording' brings together many different techniques and methodologies. Inevitably, some of these will be well know already to some segments of the readership. For example, architects will be familiar with 'CAD', but building owners may not. Archaeologists will know all about 'contexts', but architects will most likely be unfamiliar with this component of recording. Hence, while not an instruction manual, in some areas methods are described in more detail than the minimum required, because they will almost certainly be new or unfamiliar to segments of the readership.

Chapter One provides a rapid overview of the whole field. Chapters Three to Six contain the descriptive heart of the book – here the sections describe in detail the many processes and uses of measured survey and building recording.

It is important to appreciate the underlying principles of recording, and the Guide approaches this in two ways. Chapter Two provides a formal review of the process, while Chapter Seven approaches recording from the point of view of skills, techniques and the wide range of knowledge which the building recorder might call on.

An appreciation of how building recording is applied is obviously vital. To describe this, Chapter Eight is given over to **Case Studies**. Here are described not only 'text book' examples but also the realistic approaches which, on occasion, have to be taken, and the sometimes piecemeal accumulation of knowledge of a historic building.

There are many practical and operational matters to consider in setting up and arranging measured surveys and recording projects. In Chapter Nine, these important issues are addressed.

References are consolidated into a Bibliography. There are quite a few references to the Reports prepared as a result of building recording exercises. Unfortunately, these are not often published in book form, as they are very specialist and specific to the individual building. Nevertheless, a number have been deposited in the National Monuments Record of Scotland (NMRS) and can be studied there. There is also a Glossary of terms and an Address and Website list.

THE CONTRIBUTORS

This Guide could not have been prepared without the contributors. A wide range of expertise has been consulted. Most sections have been specially written by appropriately qualified specialists. It has been necessary to try to make the texts balanced in length and as homogeneous as possible. This has involved quite a lot of editing and on occasion adding in some material not included elsewhere, so 'contributed by' is not quite the same as '100% written by'. The text does not comprise a series of invited chapters. The kindness of the contributors in having their text edited in this way is gratefully acknowledged.

CONCLUSION

'Building recording' is a broad church – the volume, the type and the date of collection of data will vary considerably – and the information will be used in a number of different ways.

While a counsel of the highest standards is preached, realistically a full building recording exercise, as described, is unlikely to be carried out on every historic building. Indeed, according to all the circumstances there will be occasions when just plans, sections or elevations are needed, or are all that can be afforded for the moment. A specific need for information may be met just from one of the 'recording' products, such as materials investigation or surface finishes.

Creating a record of a historic building should not just be the product of one individual investigation. Rarely can all the answers be obtained from one project. Records may often need to be built up over time. Documentary material may emerge from different sources at different times.

Lastly, as this Guide has been produced by Historic Scotland, most, but not all, of the writers are based in Scotland and all of the examples have been drawn from Scotland. Nevertheless, it is believed that the book has wider, indeed international, applicability. There are few countries in the world without some built heritage – the principles of building recording described should be applicable anywhere.

I hope that this *Guide for Practitioners* will reach a broad range of readers, and will provide them with an insight into what may be achieved in this field.

Ross Dallas, Managing Editor

1 INTRODUCTION

In this chapter, an overview of the field is provided. A brief explanation of the function and development of recording and its role in the conservation process is provided. References are given to the more detailed treatment of themes in later chapters.

1.1 THE PURPOSE OF MEASURED SURVEYS AND RECORDING

As with the whole of the United Kingdom, Scotland's built heritage includes historic buildings and structures of many periods, sizes and types, ranging from the humblest barn to the grandest palace.

This remarkable richness and variety reflects the distinctive aspects of the country's history and development. To appreciate and preserve this historical, architectural and archaeological significance requires successful conservation, sensitive management and interpretation, adequate protection, and on occasion sympathetic alteration and reuse of these historic buildings.

This can most effectively be achieved through a good understanding of the history, development, functions, materials and present condition of a country's built heritage. In turn, such understanding is reliant on an appropriate database of information on the built heritage. Cumulative documentation informs that process. The measured survey and recording of individual buildings contributes to that accumulation of knowledge.

1.1.1 Conservation, alteration and reuse

Survey and recording are essential aids in the planning and implementation of conservation and development projects for historic buildings. The use of material in this way is discussed in Chapter Two.

They can assist the preliminary stages of work, such as the formulation of proposals, obtaining consent and informing others in the conservation team. Thereafter, relevant parts of the data can form part of the contract documentation for the works and can be incorporated into the instructions to building contractors.

Such work may also assist the conservation team with a greater understanding of the structural and material performance of the fabric, thus helping to avoid damage and allowing for appropriate preservation. If fabric is to be lost through alteration or demolition, the record made will be all that is left.

There are also other ways in which surveys and records can bring worthwhile benefits to owners of historic buildings. They can increase an owner's awareness of a building's value, which may be important for loan security or insurance claims. Survey and records of the historic buildings may be of value as part of a disaster planning exercise.

1.1.2 Management, interpretation and protection

Survey and recording broaden our assessment and understanding of the significance of historic buildings, whether undertaken as part of a programme of works to the building, or in connection with the preparation of Conservation Plans and Management Plans (Ch 9.9), or for historical research.

This knowledge may assist the processes of statutory protection for the built heritage and help to inform strategic policies and record systems for the historic environment as a whole (Ch 9.8).

Surveys and records also have an educative and interpretative function. Such documentation may be required to explain and present information to the public and thereby help to generate popular interest in our cultural heritage (Ch 1.9).

1.2 HISTORICAL DEVELOPMENT

There is a long tradition of preparing measured surveys and records of historic buildings in Britain and specifically in Scotland. Involvement in such work has formed a significant part of historical, architectural and archaeological endeavour since at least the early C19, further discussed in Chapter 2.

The systematic investigations of this period applied standards of measurement, draughtsmanship and fabric analysis that permitted logical insights and conclusions to be drawn for the first time about dating, periodisation and typology.

Early workers like John Britton knew the value of demonstrating structural and phasing arguments through making proper records (Illus One). In the concluding volume of his *Cathedral Antiquities of*

Great Britain, referring to Canterbury Cathedral, Britton wrote:

"Many of its architectural features had never been published. The sections and elevations of its towers, nave, quire, transepts, and crypts, have not been previously offered to the public; and these are indispensably necessary to display its construction, and exemplify its history. Without sections and strict geometrical elevations we can never attain correct information as to the curvature and proportions of arches - the true contour of columns, capitals, and bases - with the relative projections and recesses of various other members in our ancient buildings. With them we are furnished with satisfactory data, either for practical imitation or for antiquarian reference" (Britton 1835 – quoted by Morris in Wood, 1994).

The need for measured surveys is still true. Today, the role of measured survey and recording of historic buildings has also been extended to assist the management of conservation and development works.

Our knowledge and use of modern survey and recording techniques continues to develop, and an interdisciplinary team approach is now required to ensure the success of major projects.

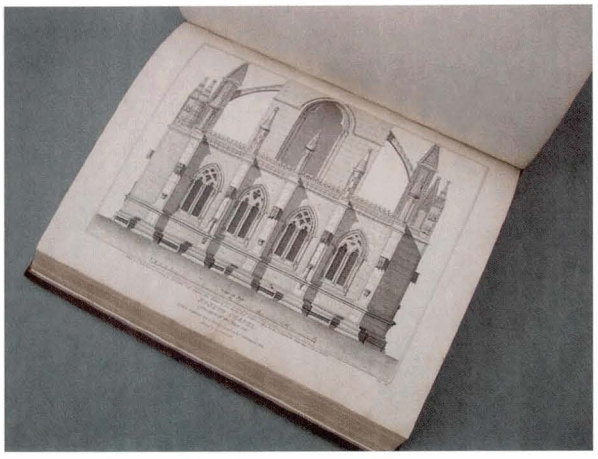
1.3 WHAT DOES 'RECORDING' COMPRISE?

In its most elemental form, 'recording' can be taken to mean the amassing of any fact or piece of information about a historic building. Again, in the widest sense, it does not really matter who gathered that fact or for that matter how inconsequential it may seem at the time. Whatever information is gathered will go forward to become part of the record of that building.

In practice, the approach to recording has been codified and refined over time. The emphasis in this Guide is on the methods that have evolved in recent years through a combination of archaeological techniques, improved methods of measured survey and photography, and the use of computers. It is believed that this approach can provide a more complete and logical body of information about a building.

As has been said in the Summary, this approach in no way undervalues the work which has gone on in the past, or the contributions to recording from other sources. For example the important work of the Royal Commission on the Ancient and Historical Monuments of Scotland (RCAHMS) (Ch 8.6) over nearly a century has led to a vast accumulation of records of Scottish buildings.

It is vitally important to recognise that the record of a building should not just be the product of one individual investigation. While a concentrated effort, such as described in several of the Case Studies (Ch 8), will provide a detailed record, records from before and after are also important. The establishment of a rolling programme of recording as part of a Management Plan should be considered (Ch 9.9). The introduction of a log book for a historic building will as well provide a location where all details of records may be held.



Illus 1 Typical of John Britton's extensive output was this survey of Rosslyn Chapel near Edinburgh, prepared for Britton's 'Architectural Antiquities of Great Britain' (Britton 1812). (Illustration: Courtesy of Janette Ray Bookseller, York.)

The chapters of the Guide will describe in detail how a record may be created. Generally, the basis of any recording exercise will first of all concern the intended purpose of the work, which in turn will guide the amount of and choice of survey and recording methodology. The amount of recorded data will determine the quality of analysis and overall value of the interpretation. The output from such work is normally in the form of written, drawn and photographic records.

Recording programmes should be carefully tailored to the particular circumstances of each project. Clearly not all buildings and structures need to be recorded in the same detail: different circumstances will demand different responses.

Moreover, the value of the desk-top assessment of documentary material (Ch 5.8) should not be underestimated, as such information can help anticipate or resolve problems throughout the process.

1.3.1 Scope of recording

The scope of recording might include an evaluation of a building's date and development, form and function, character and design, materials, construction techniques and related craft skills. A thorough assessment of the many components of the process which may be required is provided in Chapters Five and Six.

It may also be necessary to relate an individual structure to the built environment and the site (Ch 5.7) of which it forms a part, and to comprehend and communicate the relationship between that built environment and the historical, architectural, archaeological, topographical, technological, social, aesthetic and economic forces that created it.

1.3.2 How detailed should the recording be?

Levels of recording can be comprehensive, less intensive or selective. Comprehensive recording might be required for a complex building or major conservation or dismantling and re-erection project.

Less intensive recording might be appropriate for structures of more regular or repetitive build. Selective recording might concentrate on those elements where proposals entail alteration, concealment or loss of historic fabric or which are vulnerable for other reasons.

On some recording programmes it may be necessary to document the original state of the fabric being affected, the conservation or development process itself, and the finished result so that it is clear which elements are still original.

This is particularly important where a component or structure is dismantled, repaired and then reassembled. Where, for example, it is necessary to deconstruct the timber frame of a historic building to repair decay, or where partial demolition of masonry to remove rusting metal cramps cannot be avoided, it will be essential to prepare precise and accurate records. This process will involve the conservators of that fabric as much as specialist recorders.

In general, the extent and volume of recording will be dependent on a number of factors, including the type and complexity of the building, relevant Statutory or Planning policies, site logistics, the research agenda, the nature and scale of proposed works and any potential threats (Ch 2.4 and Ch 9).

1.4 SURVEYING AND RECORDING OUTPUTS

1.4.1 Measured Survey Products

In the Summary, it has been highlighted that whatever levels of recording and analysis may be carried out, the provision of plans, sections and elevations of a historic building should be a prerequisite in any case. To prepare a full record of a historic building, these products will be essential. Below, a quick review of the different types of survey requirements is provided (Ch 3 and Ch 5.4).

- **Plans** The requirement may include basement, ground and upper level floor plans, including plans of ceilings, vaults, roof structures, showing relevant external and internal detail and features. The location of all sections and elevations should be identified. Plans are the fundamental product to which all other material can be related.
- **Sections** The requirement may include sections corresponding to the bay divisions or axes through the relevant parts of a building. These should normally define the principal wall plane, and also include detail through adjacent openings and voids such as windows, doors, passageways and smaller features such as putlog holes or beam sockets, as well as roof and floor detail. The height locations of all plans should be identified.
- **Elevations** The requirement may include external and internal elevations of the relevant parts of a building, depicting architectural features with associated detail. Walls adjoining elevations should be depicted in section. The height locations of all plans should be identified.
- **Details** The requirement may include separate plans, sections and elevations of representative openings and architectural features, with exploded views to supplement the two-dimensional record where appropriate (eg, carpentry joints); and representative architectural, decorative and ornamental details, both loose and *in situ* (moulding profiles, inscriptions, setting-out lines, tooling, nail positions, masons' and carpenters' marks, graffiti etc).

1.4.2 Recording products

The recording process itself will produce a variety of records. Much of this information may be recorded or located on the primary plan documentation (Ch 5 and 6).

- **Analytical records** The requirement may include annotating the plans, sections and elevations to depict boundaries between different types of building material (stone, brick, slate, wood, metal, glass etc); surface finishes (mortar, harling, plaster, paint, etc); building periods, phases of construction and repair; constructional detail (wall alignments and thicknesses, blockings, butt joints, building lifts, fittings etc); occupational detail (wear marks, blackened timbers, industrial residues etc); and evidence for abandonment or demolition (robbing, salvaging, fire damage etc).
- **Interpretation records** The requirement may include plans, sections and elevations depicting outline reconstruction of the principal elements and features, for each of the periods identified. Three-dimensional projections may be used to facilitate greater comprehension of the sequence of development.

- **Intervention records** 'As-built' records, showing the extent of conservation or development works, should depict areas of rebuilding, rebedding, repointing, grouting, new fabric insertions etc.

1.5 RECORDING IN THE CONSERVATION PROCESS

The first step in the conservation process must be to know what it is we are trying to conserve. This should be done through a recording and analysis programme, which will lead to an understanding of the historic building and then to an appreciation of its significance. This may involve not only a specific recording project, but the input and observations of architects, engineers and others.

As a result of thorough recording and analysis, the received wisdom about a historic building may prove to be distorted or possibly incorrect. The provision of good records over the long term should therefore be the foundation of all subsequent conservation decisions, and is widely recognised as being an essential prerequisite at the beginning of the conservation process. A thorough and systematic drawn and written record, at a level appropriate to the importance of the building and the level of possible change, is essential to inform conservation decisions.

For example, the recording of 26 – 31 Charlotte Square, Edinburgh led to the identification of the construction sequence of these buildings. The phasing of construction of the façades of what is outwardly a completely unified Robert Adam design is shown in Illus 2.

The south side of Charlotte Square was a building site for many years in the first two decades of the C19, and the stratigraphic sequence was able to be discerned through close examination of the external fabric. This showed how different the six houses were, having been constructed in widely different ways over a period from 1805 to 1818, but all giving the illusion that Robert Adam's palatial façade was of a single build (Addyman 2001).

This information was in turn supplied to the conservation team, assisting them in understanding and appreciating differences between the series of houses. As this example indicates, recording can often be pro active in assisting with the conservation of a historic building.

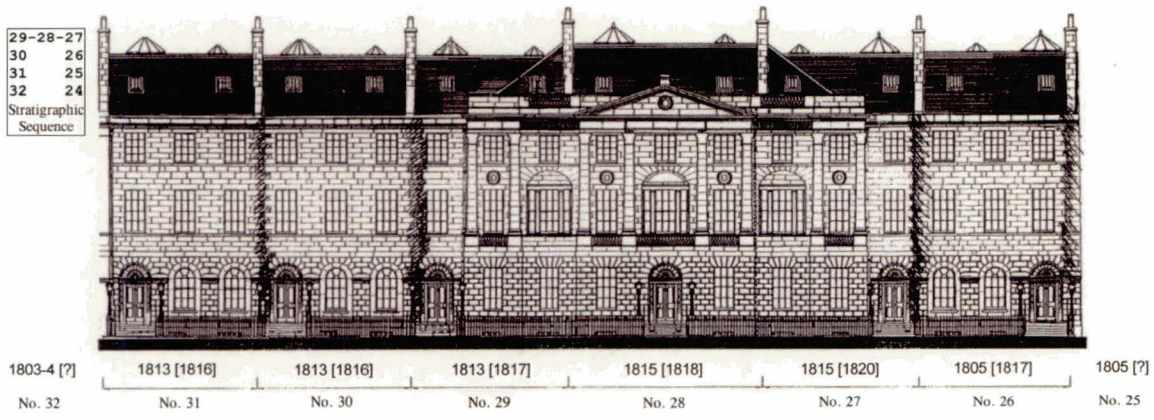
Recording is also necessary to note the existence of important features which might be compromised at a later date. Having been recorded, the existence of a feature can be flagged up in future should works be proposed in the area. It is also important that provision is made for continuing recording during the conservation or development process (Ch 6.6).

1.6 THE MULTI-DISCIPLINARY APPROACH

The most satisfactory recording exercises will be those which, from the earliest possible stage, work with and take into account the skills and experience of a wide variety of specialists. These may include archaeologists, architectural historians, interiors specialists, structural engineers, documentary historians, materials specialists and others.

While in this Guide the emphasis is on the most recent techniques, epitomised by archaeologically-led 'building recording' and modern techniques of measured survey, it is important to recognise this input from a range of specialists.

It is possible that studies which meet the needs of one discipline may be criticised for not meeting those of others. There is a delicate balance between involving as



Illus 2 Nos 26–31 Charlotte Square, Edinburgh. The dating was based on dates of land ownership changes, with first documented occupation dates in square brackets. (Drawing for the National Trust for Scotland by Simpson & Brown Architects, based on a photogrammetric original by W S Atkins, then annotated by Addyman Associates).

many areas of interest as possible, while still keeping a balanced view of what is important and indeed affordable.

For this reason, it is essential to make explicit in the project brief and/or specification the purposes of the recording exercise, and to include in the resultant Report suggestions for additional areas of work which could be carried out in the future, subject to funding.

In practice, no one person has all the skills that might be required to extract the maximum information during recording, so it is essential that the appropriate range of expertise is available. The project brief may explicitly ask for tenderers to demonstrate that they have brought together people with the right blend of experience for the job. This will often mean companies sub-contracting elements of the work to named individual specialists.

Although this can appear to raise the cost of the project, this is more than balanced by the enhanced quality of the results and ultimately represents better value for money. At Newhailes for example (Ch 8.2) more than a dozen different specialists were employed in the preparation of the documentation.

As time and money are often short, the temptation may be to try to cut corners by focusing on one recording strategy. The pitfalls of this are obvious and all-too common: using drawings made for development purposes, which do not have the accuracy or detail required to begin to understand the building; archaeologists trying to interpret only what they see, rather than investing some time in looking at documents that are often the key to understanding, and so on.

At the end of the day, it should be recognised that there are many different ways to look at historic buildings and their sites, and that each of these perspectives contributes to the overall understanding.

1.7 PRODUCERS OF RECORDS

All those involved with historic buildings should contribute to the record. The previous section on the multi-disciplinary approach has emphasised the importance of different specialisms. In this section, the likely sources of providing recording and surveying services and products are identified in brief.

- **Specialists** In the first place, there are the specialists who carry out programmes of recording work, as described in this Guide.
- **Building professionals** Professionals from various disciplines, such as architects and building surveyors may contribute. Craftsmen themselves may often make measurements, perhaps of mouldings, and take photographs.
- **Architectural historians** The overview of the architectural historian is vital in the analytical element of building recording.
- **RCAHMS** The Royal Commission on the Ancient and Historical Monuments of Scotland (and similar bodies in other parts of the UK) fulfils a unique role in the recording of Scotland's heritage of historic buildings and their sites.
- **Non-professional input** The invaluable contribution which the non-professional sector (and others not directly connected with the field) can make should also be noted (Illus 3).

In Ch 9.3, a more detailed resume of the differing roles is provided. In many countries, there will be a similar range of persons and organisations involved in building recording.

Illus 3 An example of an amateur photograph of value in recording the history of an historic building. Bennochy, Kirkcaldy, Fife, photographed circa 1950.(Photo: Anonymous)

1.8 CONSERVATION AND MANAGEMENT PLANS

Before any work on a historic building can commence, much thought should go into assessing the nature of the building, its use and the consequences of carrying out any work to that building or site. Thus the concept of the Conservation Plan has arguably existed for as long as conservation of historic buildings has been carried out.

However, the greater currency of the formal 'Conservation Plan' from the late 1990s owes much to the Burra Charter and Australian practitioners such as James Semple Kerr (Kerr 1996). The key to the Burra Charter is the emphasis on the concept of significance, and the capacity of the built fabric to demonstrate that significance, whether associational, aesthetic or otherwise. Chap 9.10 addresses the conservation plan in more detail.

The process has been given added consequence in Scotland and the UK through the Heritage Lottery Fund. The Fund has seen the conservation plan as an ideal vehicle to ensure that proposals are clearly thought through, achievable and based on an understanding of significance. This applies especially to larger projects.

This adoption of conservation plans has in turn often led to the requirement to carry out more measured survey and recording of historic buildings. These are often integral and vital in informing the preparation of the conservation plan.

Management Plans for historic buildings are similarly documents which relate to measured surveys and recording. While their content will vary according to the historic building and use, they may contain detailed descriptions and notes of condition, along with recommendations, schedules and costs etc. Measured surveys of the building may form an ideal framework for referencing and listing such information and also the results of associated building recording exercises.

1.9 USES IN INTERPRETATION AND EDUCATION

An interest in recording and understanding historic buildings should by no means be limited to building professionals. Once created, records of historic buildings have a multitude of uses.

At a simple level, display panels on historic buildings and sites often use plans, elevations and photographs. If these have already been prepared for the recording exercise, they can clearly be utilised (Illus 4).

Many visitor centres have been created in recent years, and these require much visual material. Again, the resource of the recording exercise can be drawn on to provide this information, often avoiding new and extra expenditure. At Moirlanich Longhouse, Killin, the Visitor Centre has drawn on such resources. Illus 5 shows an interpretive panel explaining the architecture and internal arrangement of the building, illustrated with a drawing based on the measured survey.

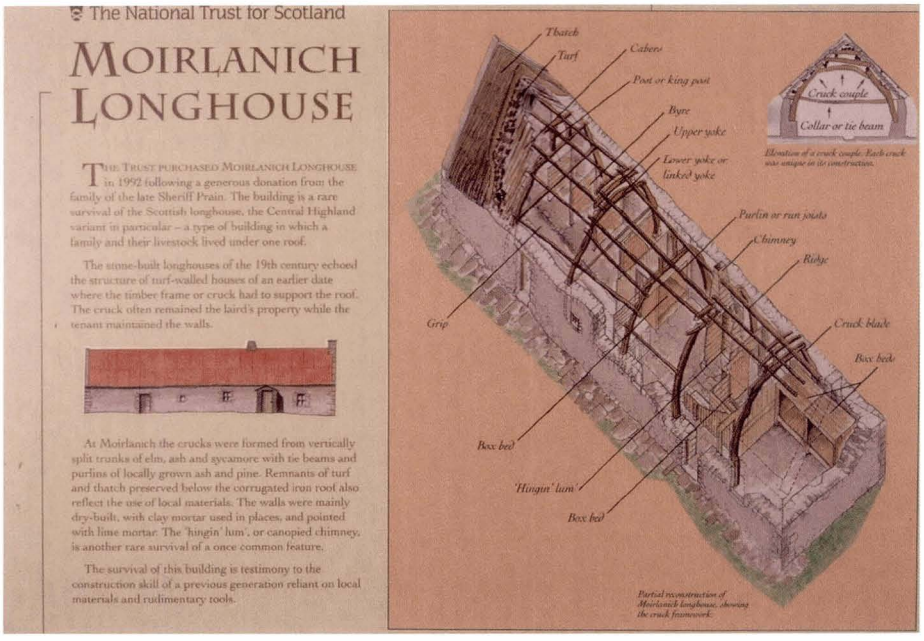
Illus 4 A signboard on a Historic Scotland site, showing a conjectural reconstruction, which will have been prepared by using floor plans and elevations of the buildings. (Photo: Ross Dallas)

The material can often be used to help visitors visualise sites which have changed, or for which the physical evidence is now concealed, for example beneath harling or plaster. A record made at Alloa Tower, Clackmannan, for instance was CAD-based (Ch 4.5) which made it relatively easy to translate into three dimensions. The resultant 3D computerised model was rendered and used for interpretive purposes, and could be used in the future for cut-aways, fly-throughs and other animations.

There are many ways in which other people from a variety of backgrounds can become involved with a building recording project. There are many amateur organisations with an interest in the heritage, whose resources can be focussed towards assisting with recording (Ch 9.3).

One option is for volunteers to help in the recording exercise itself, as was recently done at the ruins of Old Lawers Village on the north side of Loch Tay. Here, members of ACFA (Association of Certificated Field Archaeologists) created an impressive and comprehensive drawn and written record of the MoLRS site, reinforced by extensive documentary research (MacInnes and Alexander 1998)

The option for local people to help should also be explored - a process that inevitably will reveal the importance of a historic building to the local community, and thereby create a better chance of it being treated with care and respect. An exercise of this nature at the crofting township of Drumbui near Kyle of Lochalsh involved children from the local school in excavation and recording an old ruined barn before its replacement by a new one. This showed the children -



Illus 5 Display board in the NTS Visitor Centre at Moirlanich Longhouse, Killin, showing artistic reconstruction of interior based on measured survey drawings by Sam Scott. (Photo: Robin Turner)

and ultimately their teachers, parents and grandparents - that the old ruins scattered around the township are part of their heritage with which they can engage.

The above are only a small sample of the uses of recording material and of ways in which non-specialists may become involved. Although they may not principally have been commissioned for interpretive purposes, historic buildings records thus lend themselves ideally to a wide range of uses.

Where appropriate, this by-product should clearly be borne in mind when designing the recording methodology, and indeed in ensuring that matters such as copyright (Ch 9.10) are properly and clearly agreed in advance.

1.10 THE CASE STUDIES

The range of likely projects to be encountered in building recording is wide - and the *modus operandi* equally so.

For this reason, Chapter Eight concentrates on case studies, which describe a wide range of building types, and also a range of approaches taken to their recording. These range from the extremely thorough set-piece approach - appropriate and indeed necessary for a major project such as Newhailes – to the more expediency-driven example of Lion Chambers in Glasgow.

The recording of **Auchindrain Township, Argyll,** has been chosen as an example of recording fragile vernacular architecture. While Auchindrain is of course well protected, vernacular buildings are often most at risk of loss.

To move to the other extreme, **Newhailes House, East Lothian,** has been chosen to represent the category of the country house. There are many of these and in many forms throughout Scotland. But there have also been many losses (Strong *et al* 1974), regrettably still ongoing.

Industrial buildings are a category often rapidly and dramatically altered and lost, perhaps as they are often not perceived to be of particular aesthetic value. **Bowhouse Munitions Factory, Ayrshire,** has been totally removed from the landscape.

Commercial buildings are another category of buildings commonly altered or replaced, with generally little made in the way of record. **Lion Chambers, Glasgow,** is a very early example of the use of reinforced concrete in construction. The record here has not been a 'set piece' project, but rather has been built up slowly.

The Scottish tower house is a distinctive category of building. Many of these have been retrieved from a ruinous condition, which while valuable often means that the opportunity to record their construction and history is not possible. Hence the description of **Fenton Tower** describes how such a recording project may be carried out.

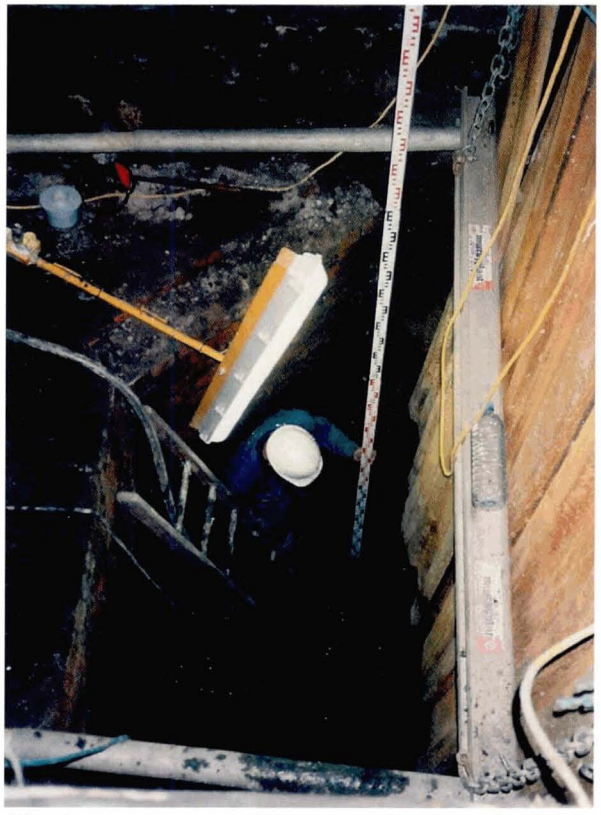
Finally, the unique contribution of the RCAHMS has been noted (Ch 9.3). The RCAHMS carry out a wide variety of work and three very different recording projects executed by them have been described, at **Aberdeen Tolbooth, Drumlanrig Castle** and **Glasgow Cathedral**.

It is not possible to describe every category of building and type of project, but it is hoped that these case studies will provide a sufficiently wide range to indicate what can be achieved.

1.11 TOPICS NOT COVERED

As will emerge throughout the Guide, recording is not a process with an absolute start and finish point. The process of recording can be contributed to by all those involved with a historic building. The dataset can as well be wide ranging.

In the Guide, however, it is necessary to have some cut-off points. Perhaps the most significant exclusion which has had to be made concerns **excavation archaeology** (Illus 6). As is shown for example with the case study of Fenton Tower (Ch 8.5), excavation archaeology may be important not just to inform the history, but to provide information on for example the form of the foundations.



Illus 6 Excavation or 'dig' archaeology may often be essential. Here, archaeologists are excavating the area of a new lift shaft, Scotland Street School, Glasgow. (Photo and work: GUARD)

The techniques of archaeological excavation are a very wide subject in themselves and there is much literature on the subject (see Hunter & Ralston 1993, for further references). Hence no description of excavation techniques is provided. As well, there are categories of buildings where excavation associated with recording the building would be of limited value. For example, it is unlikely in say studying the buildings of the New Town in Edinburgh that much information might be gained about the construction of the buildings. This is not to say that there might not be interesting archaeology under such buildings, but it may have little relevance to the current project.

The importance of such work should not be undervalued, and particularly in the case of categories of buildings such as castles and churches, exploration of the below ground archaeology may be essential and may well be tied into the above ground contract (Rodwell 1989). In setting this up, reference should be made to specialists in excavation archaeology.

The **site** of the historic building as will become evident is of considerable importance. Indeed, really no study of the historic building should take place without an associated study, no matter how cursory, of the surroundings of the building. This topic is covered in a limited way in the Guide (Ch 5.7), and is also referred to in the Newhailes Case Study (Ch 8.2). This coverage cannot do justice to the importance of the topic, but the constraints of space and other priorities prevent a more detailed approach to site assessment in this Guide.

Another field where it has not been possible to describe techniques in depth is that known as **non destructive investigation** (NDI). In part, this is because these methodologies tend more to be more directly used for the building's conservation. For example, if buried cramps are to be located behind stonework, it is more likely that the project manager will set this work up directly with NDI specialists, rather than route such work through the building recorders. As well, Historic Scotland have a separate Technical Advice Note on this subject (Historic Scotland 2001).

Another specialist subject deserving more through study in depth is that of *in situ* **painting**. Such painting is common in Scottish historic buildings, and can range from simple decorative schemes through to detailed topographic views painted directly onto surfaces. In Ch 6.4 the topic is addressed, but regrettably there is not space to give it the detailed treatment the subject deserves.

Indeed, virtually every topic covered in this Guide could be treated in more depth. Naturally, there is much more material available elsewhere, and where relevant references both to literature and websites has been given.

2.0 THE RATIONALE FOR RECORDING

2.1 WHY RECORD?

Understanding is at the heart of the conservation process. It is only by understanding a historic structure that its significance can be evaluated, and only then can the most appropriate conservation measures be determined.

The level of understanding that is required will differ from case to case, as will the techniques used to gain such an understanding. However, the most vital element in the process is the properly qualified conservation professional who becomes closely familiar with the historic structure in question, but who can also identify the occasions when his or her own knowledge is not sufficient and further help has to be sought.

Recording is an essential and integral part of the conservation process. It should not be seen as an isolated activity that is an end in itself, as it occupies a pivotal place in several areas of conservation:

- Repair, maintenance and modification – the requirements of architects and others involved in conserving historic buildings call for an understanding of the buildings they are working on with a need for plans, sections, elevations and other detailed records of the structures. In Ch 3, these uses of survey are further explored.
- Historical understanding – to locate a historic building in its context and to assess its significance, conservation professionals (conservation architects, building surveyors, cultural resource managers, archaeologists and architectural historians) require documentation, in which survey and record are an important part.
- Intervention – a thorough record of alterations to and interventions in a building, even when they have had minor physical impact, provides an invaluable long-term point of reference.
- Management and use – the assessment and determination of the most appropriate use of a historic structure, as when drawing up part of a Conservation Plan, for example, will be greatly enhanced by appropriate documentation and record.
- Archive – as a result of a wide range of processes, buildings are subject to continuing periodic loss, and we owe it to future generations to conserve our own knowledge of them through records deposited in accessible archives.

This chapter considers what recording is likely to involve and what the resultant records will be used for.

2.2 WHEN IS IT APPROPRIATE TO CARRY OUT RECORDING?

2.2.1 The historical background to recording buildings

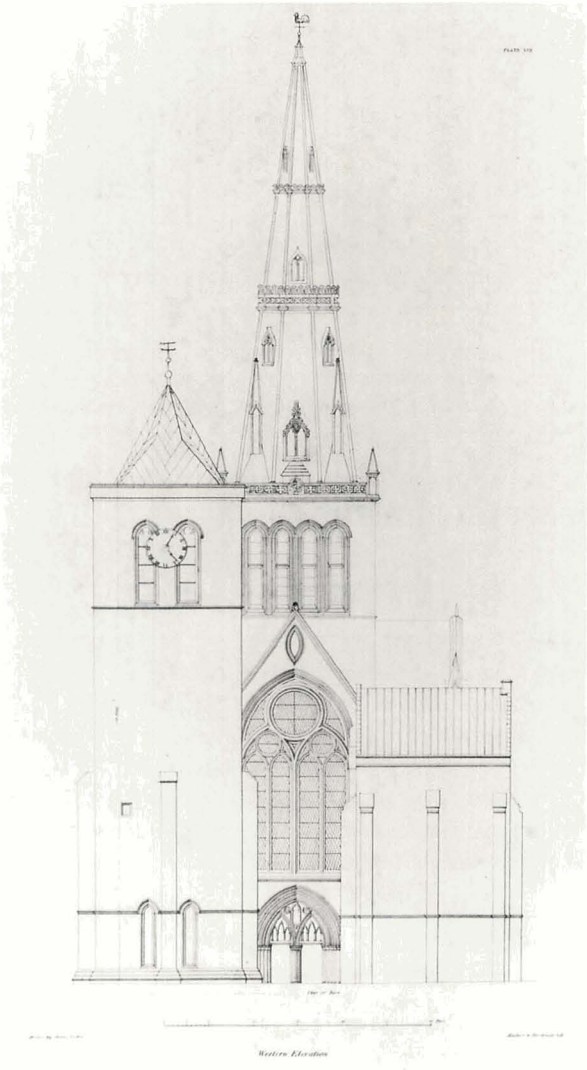
As long as people have been interested in the buildings they have created for themselves, they have made records of them. For example, buildings are carefully depicted in some Egyptian tomb paintings. As early as the C13 in medieval Europe, the French craftsman Villard de Honnecourt was travelling around drawing churches that particularly attracted his interest.

In Scotland, by the later C16 the map maker Timothy Pont was making tiny but accurate sketches of many of the major buildings in the areas he covered.

As architects became ever more aware of the need for a full understanding of the buildings they were asked to work upon, they increasingly prepared record drawings of their existing states, as well as of their proposals for modifications. There are, for example, many drawings of this type in the collections of the C18 architect Robert Adam (1728 – 92).

By the later C19, there was a growing interest in historic architecture for its own sake. Beautifully prepared folios of measured drawings of a number of important buildings were produced, such as that of Glasgow Cathedral published by James Collie in 1835 (Illus 7).

Perhaps the greatest landmark in this process in Scotland was the foundation of the National Art Survey in the early years of the C20, an ambitious project to publish measured drawings of all significant Scottish buildings. Only four volumes were ever published between 1921 and 1933 (Illus 8), though they established a standard for measured surveys that has been technically surpassed only relatively recently (Ross & Lorimer 1921-1933).



Illus 7 An elevation view of the west front of Glasgow Cathedral prior to the removal of the towers, measured and drawn by James Collie (Collie, 1835).

2.2.2 The range of needs for records

There are many reasons why a record of a historic building or structure might now be required. As has been noted in the Summary, 'historic building' should be taken to include all forms of building from the grandest country house to the simplest vernacular building - the process is of value whatever buildings are involved. In practical terms, most recording exercises on historic buildings tend to be carried out:

- When conservation works are being planned
- When consideration is being given to works that could involve significant changes to the fabric (although even minimal intervention can impact on the authenticity and significance of a structure)
- When there is the threat of some level of loss.

The need to adopt a fully integrated approach to proposed works at historic buildings is increasingly recognised. This is reflected in the growing acceptance of the need to prepare and implement Conservation Plans for historic buildings (Ch 9.9) and in the promulgation of concepts such as 'informed conservation'.

In *Informed Conservation*, the process of gaining understanding has been described as 'Conservation-Based Research and Analysis' or CoBRA (Clark/English Heritage 2001). This embraces the "research, analysis, survey and investigation necessary to understand the significance of a building and its landscape, and thus inform decisions about repair, alteration, use and management".

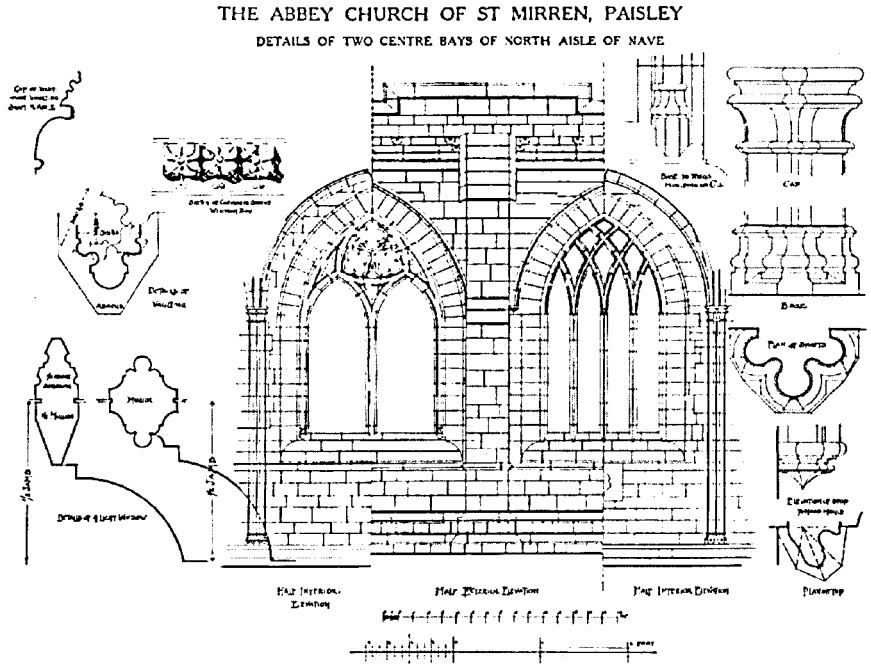
Historic Scotland endorses recording through such documents as the *Guide to the Preparation of Conservation Plans* (HS 2000), and the *Stirling Charter*, a document outlining the actions to be taken in respect of the conservation of Scotland's built heritage (HS 2000), as well as in *The Conservation of Architectural Ancient Monuments in Scotland: Guidance on Principles* (HS 2001).

Internationally, the need and value of recording has been extensively recognised by the International Council on Monuments and Sites (ICOMOS). Indeed, ICOMOS UK have contributed importantly to this field with the book, *Guide to Recording Historic Buildings* (ICOMOS UK 1990) and their resolution on *Principles of Recording* (ICOMOS UK 1996), ratified by the 11th ICOMOS General Assembly. The Resolution is reproduced as Appendix A.

A further very useful review of the philosophies underlying recording is contained in *Vernacular Buildings in a Changing World* (Pearson & Meeson eds 2001). While as the title suggests primarily concerned with vernacular buildings, the arguments discussed have more general applicability.

Recording may also be carried out even if there is no specific threat to drive the process, and this is enshrined in Historic Scotland's commitment to the need for historical understanding of the built environment. The work of the RCAHMS (Ch 8.6) is especially committed to this approach. But much recording and analysis of historic buildings is carried out by or for other bodies such as university departments and local authority archaeologists and conservation officers.

In cases of major or catastrophic loss, while it may be hoped that records will already have been made, what has survived needs to be recorded with particular thoroughness and care. Following the burning down of the country house, Uppark, Sussex, an extremely thorough survey and record was made of the remains (Rowell & Robinson 1996). Largely as a result of the thoroughness of this record, the National Trust was



Illus 8 National Art Survey, a typical page from the published work, showing architectural details of the Abbey Church of St Mirren, Paisley.

able to carry out a restoration of the building to a quite remarkable level of authenticity.

2.3 WHAT MAY BE INVOLVED IN RECORDING?

2.3.1 What is a building record?

In simple terms, the recording process should aim to provide an appropriate level of information on the state of a historic building or structure at the particular point in its history at which that recording exercise was carried out.

At the lowest level, a record may be no more than a series of photographs. At the other extreme, it may involve preparation of detailed plans, elevations, sections, axonometric views, large-scale studies of all details, topographical surveys, geological analyses, and specialist photography etc (Chs 4, 5 and 6). With modern techniques that allow a high level of accuracy, it should not be necessary to repeat such surveys for decades.

In cases of significant interventions it should be accompanied by analytical and documentary research, archaeological investigations and careful analysis of the evidence, so that the full significance of the building can be appreciated and understood.

Records are an essential tool in reaching decisions on the significance of the building and on works and uses that are deemed appropriate to preserve the structure. They are also invaluable for the information they provide for future generations on the state of the structures before that work was carried out. As such, the scale and thoroughness of the record may also be related to these factors.

In the process of commissioning a building record survey, initial decisions on the level of recording and choice of techniques will have a great impact on the outcome of the survey. These initial decisions will almost certainly be influenced by the perceived significance of the building, though it should be remembered that those perceptions are likely to change in the course of the work.

It should be accepted that the only strictly objective record of a structure is what is embodied within the structure itself. Any other form of record is inevitably a reflection of the decisions taken on the thoroughness of recording required, of the methods employed, and to some extent of the abilities of those making the record. But it must always be borne in mind that, if the fabric is altered or lost, the record may be the only source of knowledge, and the record should be planned accordingly.

In an ideal world, all historic buildings and structures of any significance should be recorded to a level adequate to inform conservation professionals involved in making decisions regarding the ongoing conservation of the structure.

Records should also be full enough to allow future generations to understand the appearance of the building at the date the record was made, together with its individual significance and inter-relationships with other buildings. They should also be complete enough to make it possible to understand the processes by

which the structure developed to its final form and the chronology of that process.

2.3.2 The reason for making records

Producing measured surveys of the existing state of a building, as part of the process of achieving a full understanding of it, is an essential starting point for any significant conservation work. Full coverage, including plans, sections and elevations of a building will be a long term investment of great benefit, and the material is likely to be frequently used for a wide range of purposes.

Similarly, the recording process can generate valuable information which may save time and trouble in both the short and long term. All those involved with historic buildings have experienced the frustrations, delays and increased costs resulting from trying to understand the nature and extent of previous interventions. With records to hand, these difficulties may be largely eliminated or at least minimised.

In practice, the exact level of recording carried out will be conditioned by a number of factors. Where alterations to Listed Buildings and Ancient Monuments are concerned, it may be a condition of Consent that a survey and record is carried out at a required level (Ch 9.8).

The provision of records has considerable benefits for those responsible for the maintenance and running of historic structures, and an aim of this Guide is to demonstrate the value of having such records whether or not their production has been required as part of the statutory processes.

2.3.3 Personnel

During the recording process, the competence and familiarity of the building recorders with the techniques they are using will be critical. It is essential that those carrying out the work are not only well qualified to deal with the types of building that they are recording, but that they can call upon expertise outside their own areas of knowledge should the need arise.

It should also be borne in mind that during the course of the recording exercise, and especially one in which building works may expose previously unsuspected aspects of the structure, day-to-day decisions will have to be made on what to record and at what level of detail (Ch 6.6). Because of this, it is particularly important that the recorders are able to recognise the potential significance of a wide range of features, even if they do not themselves have detailed expertise in those areas, and that they do not allow their own preconceptions to govern their responses.

2.3.4 Costs

The extent of recording will inevitably be conditioned to some extent by costs. However, the costs of the building recording and associated off-site work such as documentary research will usually represent no more than a relatively small proportion of the overall costs of a project (Ch 9.7). A disproportionate level of savings should not be sought in determining expenditure in these areas.

It is likely that assessments of the significance of a historic structure will have to be modified as more comes to be understood about it during the recording process. It is therefore important that the process of decision making on both the level of recording, and on the works to be carried out on the building, is sufficiently elastic for changes to be made in the light of the enhanced understanding of the building that emerges in the course of the recording.

Short-cuts taken in the course of recording may mean that insufficient evidence is available when critical decisions have to be taken. This in turn may result in delays to the work, as additional efforts have to be made to obtain the necessary information. Planning permissions and other consents may also have to be delayed if insufficiently thorough surveys and records are not available.

2.4 HOW MUCH RECORDING SHOULD BE DONE?

2.4.1 The level of recording

As every building and each intervention is different, it is not possible to be prescriptive about the level of recording. Essentially, the process of evaluating the building, which will almost certainly require elements of both recording and analysis, should be begun before any final decisions on repair and mitigation are made. The Guide describes the techniques to be used – how much work is called for will depend on circumstances.

Where recording is generated by building works, the level of recording should be in proportion to the extent of the works to be carried out on the building and the building's perceived significance.

For example, where the works are limited to replacement of decayed mortar, a clear photograph of the wall face to be treated may be adequate. Where the work involves some dismantling and reconstruction, a more detailed record is likely to be needed. This will have to be sufficiently detailed to allow the individual stones to be identified.

The masonry itself might be marked out with a grid in water-soluble paint, to help identification of the

location of stones (Illus 9). This may be sufficient to allow an experienced mason to work without any serious risk of modifying the historic character, while simultaneously providing a record of the masonry's appearance before the start of work.

Illus 9 A section of walling where minor dismantling and repointing was unavoidable. The numbered up stones plus photography ensure that reinstatement is exact. The paint is water washable. (Photo: Historic Scotland)

Moving on to works that have a higher potential impact on the historic fabric, when a great part of the structure is likely to be affected, a full record will almost certainly be required. Measured survey drawings of elevations, floor plans and cross-sections, together with records of all details including sections of mouldings will probably be called for.

In addition, the record should include context descriptions, good quality photographs, and other forms of record, as described in Chs 5 and 6. Only once the full range of available evidence has been taken into account can adequately reasoned decisions be made on the course that the proposed works should take, and on the means of achieving the desired ends.

Where building works result in the exposure of concealed fabric or fresh evidence of whatever form, the opportunity for recording should be taken even if the newly exposed evidence is not to be disturbed (Ch 6.6). For example, the removal and reinstatement of damaged harling is a common operation on historic buildings in Scotland, and in the course of such works significant fresh evidence for the underlying masonry can be revealed. Close integration with the building works is needed to take advantage of the window of opportunity afforded to record the revealed evidence.

It should also be mentioned here that it is not unusual for operational plans to change suddenly during building works. The programme of recording must be sufficiently alert and flexible, and have the power to require works to be temporarily halted, to enable additional recording that had not been anticipated to take place. As both these matters may have contractual implications, they should be considered in advance.

2.4.2 Interpretation and analysis

In most cases, the production of the physical record of a building will be just the first stage of a process of detailed interpretation and analysis. Indeed, recording is of limited or reduced value *unless* analysis leading to better understanding takes place, which in turn should inform decisions regarding repair, alteration and use.

This process of interpretation and analysis should seek to provide a narrative of the building's history and use. As with the recording itself, this must be undertaken by persons familiar with buildings of the periods and types that have been recorded. It should preferably be carried out by a person who was closely involved in the survey itself, since first-hand experience of the building is invaluable if the interpretation process is to be soundly based.

The written description of the surviving evidence accompanying the record should generally start with a systematically organised description of the building as a whole, followed by an area-by-area account of the constituent parts (Chap 5.3). The case studies in Ch 8 provide models of how this may be achieved.

In recent years, building recorders with an archaeological background have used stratigraphic techniques to demonstrate inter-relationships of phasing in complex buildings. Where appropriate, this system of interpretation should be built into the recording and subsequent analysis of the building (Davies 1993).

This process assigns a unique context number to every individual feature or building event, such as the main construction phases, the insertion, replacement and enlargement of doorway and window openings. A schematised Harris 'matrix' may then be developed to link the building events through time in a single interpretative scheme. This allows subtle relationships,

changes and developments to be revealed more clearly than with a simple phased diagram.

In addition to such techniques, it is also useful on occasion to carry out an analytical investigation of the planning of the building. This can be attempted purely on the basis of the plans and sections produced by the survey, though the analysis can go further by employing diagrammatic techniques of spatial analysis.

Examination of the inter-relationships of the spaces of which a building is composed may reveal complex subtleties in the architectural framework around which a building was developed. It can also demonstrate significant points of comparison between buildings which, on external evidence alone, might have appeared superficially dissimilar.

Techniques of this kind can be particularly valuable for the light they cast on how buildings were intended to meet the needs of their occupants and on how they were used or adapted by successive generations of their occupants.

All of this may be supported by comparisons with related buildings that will allow the building to be better understood within its broader architectural, artistic, historical, social and archaeological context. In the course of preparing the account, it may be found that buildings which initially appeared to provide a readily recognisable framework for ways of life that have continued down to our own times, in fact functioned quite differently from modern structures. Spaces and their inter-relationships, although possibly defined in similar terms as today, might have had very different uses and relative status.

2.4.3 Historical research

Whenever necessary the recording process should be supplemented by research into the documentary sources associated with the building (Ch 5.8), since buildings cannot be fully comprehended outside the historical context within which they were produced. Such research often clarifies the likely dates of construction and alterations. It may also indicate who was responsible for the building works, together with the motivation behind programmes of building.

In many cases, there will also be a need to investigate sources of pictorial evidence, which may reveal earlier forms of a building. In the case of ruined structures, it may indicate their appearance before the processes of ruination took hold, or, in the case of buildings restored from a ruined state, their appearance before restoration was carried out, as at for example Iona Abbey (Illus 10).

Illus 10 A view of Iona Abbey, Mull, from the south east, showing the Abbey before the late C19 and C20 additions, etched by Lord Cardross after Lilliman 1762.

The results of archaeological investigations, carried out either previously or as part of the programme of works, must also be taken into account. This is especially important if those investigations revealed buried features or evidence for missing structures that were once associated with the building.

Once the main body of physical, documentary and archaeological information has been brought together, it may then be helpful to combine this with the survey information to produce phased plans, elevations and sections as an aid to comprehension of the development of the building.

2.4.4 Reconstruction drawings

Where appropriate, it may also be considered helpful to use the survey data and the information gathered from the interpretative process to produce reconstruction drawings.

These can be an invaluable aid in developing an understanding of the stages by which a complex structure attained its final state or, in the case of ruined structures, of coming to terms with the evidence for missing features. They can also be of use in the process of drawing up proposals for the programme of works, especially if this involves any element of restoration to earlier states.

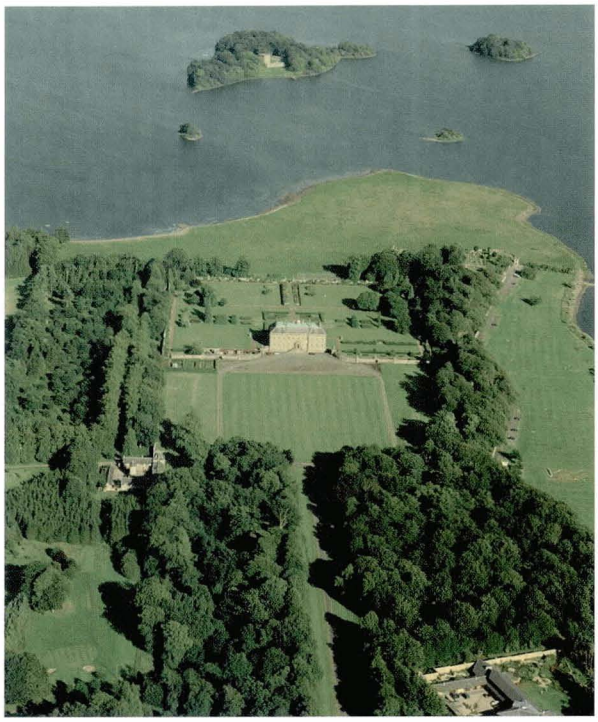
Such reconstruction drawings must, of course, always take into account all available forms of evidence, including the survey of the building, the interpretation of the standing masonry, the documentary and pictorial evidence, and all information recovered through archaeological investigation.

These studies need not stop at two-dimensional representations - for many centuries models have been used to demonstrate the forms and phasing of a structure in three dimensions, and they still have a wide range of applications. However, with the rapidly increasing availability of sophisticated digital techniques, computer-generated representations of buildings are becoming more widely used for analytical and interpretative purposes. These can allow the viewer direct interaction around and through the building.

2.4.5 Landscape and site

In planning a recording exercise, it is important that the building under consideration should not be considered in isolation. Each has its wider context and in many cases landscape analysis can help to provide information on the nature and use of the building throughout its history of use, as well as on its physical relationship with the wider setting. Often the setting of a building is an important factor in evaluating its significance (Ch 5.7).

One example of this is the planning and siting of Kinross House, Fife (Illus 11). Here, the views and alignments of the building are critical in an understanding of its layout and construction, and the significance of the house would be considerably diminished if the views to and from it were altered.



Illus 11 An aerial view of Kinross House, Fife, showing the important relationship between the House and its site. (Photo: Crown copyright RCAHMS)

2.4.6 Archaeology

If any form of ground disturbance has to be carried out as part of the work, and there is a possibility that archaeological remains will be disturbed in the process, an assessment of what archaeological investigation is required will be necessary. This assessment, which will probably be initially based upon a combination of geophysical survey and trial trenching, may recommend a number of options, varying from an archaeological watching brief to full excavation.

Under appropriate circumstances, geophysical survey techniques can be of value in allowing limited non-invasive investigation, and may point to underlying archaeological features associated with the building that were not picked up through a topographic survey.

Apart from giving information on associated structures and the wider context of a building, excavation planned as an integral part of the programme of works can provide information on aspects of the appearance of the building that may have been lost from the standing

fabric. These could include evidence for the roofing materials and the finish and details of dressed stonework or harling. Excavation can also provide evidence for fixtures and furnishing, such as doors, windows, partitions and floors.

It should be noted that excavation at Scheduled sites can only be undertaken with appropriate Planning consents. As well, there is a general presumption today that unessential archaeological excavation should be avoided.

2.4.7 Thematic studies

The most obvious benefit of recording is the detailed information it provides on individual buildings. Moving beyond that, when such recording is carried out at groups of related structures, it offers one of the most useful ways of coming to terms with the particular evidence provided by those structures both individually and as part of a class of structures. This may help to establish both the common ground and the range of variation between the buildings, and it can be an essential element in assessing the relative significance of a structure.

Comparisons between related buildings may also help to clarify the likely date range for a building, and may provide clues to cultural cross-influences, and perhaps even to the origins and later movements of workforces. For this reason, building recording is often an essential starting point for programmes of architectural and archaeological research into groups or types of buildings.

2.5 WHAT WILL BUILDING RECORDS BE USED FOR?

2.5.1 Preparation for building works

Where work is to be carried out on buildings, a record will be the main way of passing on to future generations information about the changes that have been made and the form of the building before those changes. This is particularly important if they are to be irreversibly modified or even destroyed. 'Preservation by record' is not a substitute for loss, but at least knowledge will be preserved.

On a practical level, however, records are most often needed to assist understanding of the existing structure, and to inform decisions on the planning of works varying from consolidation to wholesale remodelling for new use.

As has been noted, a record of a building can only be a poor second for the physical evidence embodied within the building itself. Every survey is to a greater or lesser extent partial, and is the result of a wide range of decisions taken by those commissioning the survey, as well as by those actually carrying out the work. Nevertheless, it provides an invaluable basis for reaching properly considered decisions on the best ways of dealing with the building, since it allows the building to be viewed and studied as a whole in a way that may not be possible on the ground.

Once the works have been planned and instigated, the building record in turn becomes an important source of reference in the process of the work, though it will probably have to be revised in the light of fresh evidence that may be periodically exposed.

It is often only by being provided with record information that statutory bodies, such as Local Authorities and Historic Scotland, can make informed decisions on whether to recommend consent for works (Ch 9.8). In turn, this needs to be at a level that allows the relative significance of a building and the evidence for the sequence of its historic states to be adequately assessed.

2.5.2 Records as a management tool

Once works have been completed, the record will become an essential tool in the building's management, particularly if it is made an integral part of a formal Management Plan (Ch 9.9).

The survey will additionally provide a benchmark against which to measure deterioration in the fabric of the building, utilised through for example condition surveys. It will also help in efforts to ensure that decisions on ongoing repairs and maintenance are carried out in the least damaging and most effective way.

3.0 USING PLANS, SECTIONS AND ELEVATIONS

3.1 PLANS FOR ALL PURPOSES

The preparation and use of measured surveys is a known and understood activity of relevance to most people dealing with historic buildings. Drawings produced as part of a measured survey serve to record and explain the building at a suitable level of detail, in a convention familiar to most people.

Measured surveys come within the wider activity of 'building recording'. However, for many persons and activities connected with historic buildings, plans and other measured surveys on their own may satisfy basic requirements. This particularly applies to the processes of use and management. Those involved in these processes may have everyday need of such documentation. When considering work beyond this, an appropriate level of survey and drawings is necessary to allow informed decisions to be made.

While as has been discussed extensively (Ch 2), it is to be hoped that a full record of a building will often be prepared, realistically the resources applied to that may be limited. Nevertheless, the architect and others will need measured survey drawings on a frequent basis. Hence the emphasis in this chapter is on the use of such documentation by the architect and others associated with the use and conservation of historic buildings.

3.2 SPECIFIC USES

The intended purpose of the measured survey may have a direct bearing on the way it is carried out and the level of detail that might be included. Measured surveys may be required for the following wide range of purposes in connection with the use of the historic building:

- A measured survey may be required to help evaluate and make decisions about the future of the building or structure, possibly as part of the process of preparing a Conservation Plan (Ch 9.9).
- Survey drawings may be required because some intervention to the historic building is required – this may be a matter of repair or maintenance or could be because some alterations, extensions or changes are being considered.
- Condition surveys of historic buildings are an important way of regularly monitoring the state of the building, and also may be carried out if third party activities may impinge on the building. For this purpose, plans are an important requisite.
- In some cases, the conservation strategy may involve removing later or unsympathetic additions, making accurate analysis essential.
- Alterations to listed buildings require Listed Building consent and possibly Planning consent (Ch 9.8). It is important that decisions are made on the basis of both accurate representation and sound understanding of the building.
- In many cases there is a need to analyse the fire risk from voids, fire paths or weak construction in order to develop a fire precautions strategy. Understanding the 3D geometry of the building is essential.
- The survey might be intended to provide as accurate a record as possible of a building or structure for academic or historical reasons, and as has been shown elsewhere, these findings should as well feed back into the building management process.

Whatever the intended purpose, the best possible measured surveys and resultant drawings will help all those involved gain the best understanding of the building or structure. As an aid in identifying requirements, a table, 'Table One: Measured survey types and their uses' is attached to this chapter.

3.3 INTERVENTION, UNDERSTANDING THE PLACE

When considering the conservation, repair or alteration of a historic building, great care is necessary to avoid loss or damage of authentic construction. A philosophy of minimal intervention is widely considered to be a fundamental starting point. Many buildings have been altered over their lifetime, sometimes to their advantage but sometimes inappropriately, with early authentic construction lost or concealed.

Before contemplating any change, it is essential to understand the history and construction of the building in physical terms. The best outcomes derive from the best understanding of the building. In most cases the history of the building, in terms of alterations, extensions and other changes will become clearer during the survey.

Proposals will generally involve careful conservation and repair, but could also on occasion involve the removal or alteration of some fabric. Because of this, it

is essential to have good documentation from the outset, to prepare a sound conservation strategy and inform decisions about the future of the building.

Measured surveys are in many cases carried out by architects as a preliminary to preparing proposals for the building. Indeed, the process of measuring and drawing a building leads to those involved gaining an invaluable knowledge and understanding of the building. The methods used by the architect in directly preparing surveys tend to concentrate on the 'hand survey' methods (Ch 4.2), and in this chapter the emphasis is very much on survey as carried out in this way.

For a number of reasons, the measured survey may have to be carried out by others, such as specialist land surveyors or building recorders (Ch 9.3). Where the survey is carried out separately from other investigation or design work, great care is needed to ensure close liaison between those carrying out different functions. Architects must brief the survey team well to ensure that features and details are measured and drawn in an appropriate and useful way.

3.4 PLANS, SECTIONS AND ELEVATIONS

Plans, sections and elevations are conventions that allow people to understand a three-dimensional building through the medium of two-dimensional drawings. Most commonly, drawings are prepared using *'orthogonal projection'*, where, essentially, each view is constructed at right angles to a principal plane of the building, such as the floor or the faces of elevations.

3.4.1 Floor plans

Floor plans are prepared by taking a hypothetical horizontal 'slice', or section, through the building, at a fixed distance above the floor (or chosen plane), then surveying and drawing everything seen below this plane. Generally, in architectural work, some flexibility is employed to show features such as windows and fireplaces, which might not all be cut by the same imaginary plane.

In most cases, surveys are non-intrusive, measuring only the exposed surfaces that can be seen. Indeed, conjecture has no place in measuring and recording. It can be positively unhelpful, as it could mislead those using drawings or preparing proposals at a later stage. Only that which can be seen, drawn and measured should appear on the drawing.

Preferably, plans should be of a sufficient scale to show detail essential to explaining the building, such as facings, pilasters, recesses and the like. They can also show details of anything 'seen' below the plane of the plan, such as patterns in floorboards or paving. In some situations hidden detail can also be indicated, for example cellars or ducts below the floor, provided these can be measured and related accurately to the plan.

Drawing conventions also allow indications of elements above the plane of the plan, for example ceiling layouts, beams and the like. Elements such as doors and windows are usually drawn in commonly accepted ways, often indicating the means of operation, such as door swings. Again, these tend to be shown diagrammatically rather than constructionally as much of the detail cannot be measured without disrupting the structure.

Exceptions include record drawings made as structure is opened up or exposed during investigation work, and archaeological surveys based on gradual uncovering of detail. Occasionally construction elements may be capable of being measured and drawn, if there are openings or gaps in the construction. A typical example involves showing shutter boxes.

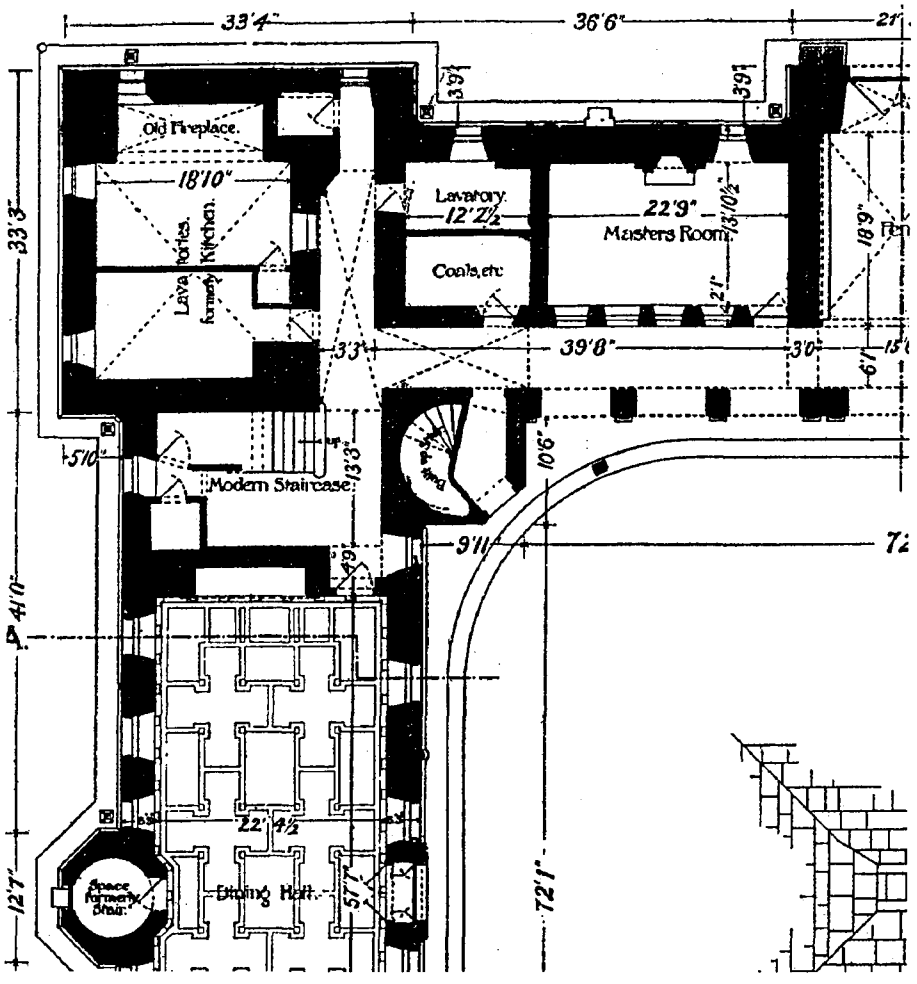
In some situations, it may not be possible to take all dimensions accurately and it is essential to clearly distinguish areas of less certainty and to be clear about the level of accuracy being achieved. For example, in measuring say an upper floor plan, external wall thicknesses may only be measurable at window openings.

Traditional drawing techniques may combine different aspects of detail within the same plan (Illus 12), particularly where the symmetry of the plan allows a clear understanding of the continuity of the pattern or element. Alternatively the different elements (floor, ceiling, etc) can be shown on separate plans. Commonly ceilings are shown as 'reflected ceiling plans' – ie each part of the plan is directly above its equivalent position on the floor, as if seen in a mirror placed on the floor.

3.4.2 Elevations

Elevation drawings are most commonly views of the outside surfaces of a building, drawn at right angles to the face of the building being observed, with all elements drawn to the same scale. Elements in front hide elements behind and usually little attempt is made at three dimensional representation (exceptions include rendering drawings or projecting shadows to indicate depth).

Particular problems can arise in drawing elevations where basement areas, perimeter walls, railings, steps and the like exist. In some cases, several drawings or part-drawings are required to record the different surfaces. Problems also arise when a building has deep returns or recessed bays. These may require additional



Illus 12 A traditional floor plan, also showing reflected ceiling patterns. Part of a measured survey of George Heriot's School, Edinburgh, by R Shekleton Balfour carried out around 1890 – 1900 (published in Blanc, c 1900).

part drawings or sectional drawings to record each plane.

Buildings which are not square present particular challenges. Mediaeval buildings, for example, are often quite irregular with curved or rounded features such as turrets. Often a drawing plane has to be chosen to best represent the view, which is then drawn as a projection at right angles to that plane.

Elements may then be at an angle to the drawing plane. In other words, the drawn elevation is a representation where the surfaces or areas drawn do not match the real size (at the chosen scale). An extreme form of this is a round building where the elevation can be drawn as an orthogonal view or alternatively as a developed surface.

3.4.3 Sections

Sections, or vertical 'slices' through the building, are generally drawn in the same manner and using the same conventions as plans and would normally show a matching level of detail. Imaginary slices are taken through relevant parts of the structure in a chosen vertical plane.

The pure section will generally be a slice through the centre of the room spaces, hence showing the thickness of structural elements such as walls and floors. The sectional elevation will as well include the projection of the wall face within the room(s), in one direction (Illus 13 and 14). Of course, elements can be combined or left off for illustration or clarity.

Sections can be a very useful way of explaining the building as the elevational detail seen beyond the plane of the section can be shown; thus doors, windows, panelling and the like can be measured and drawn. By contrast, sections can be used as a very important way of illustrating structural aspects of historic buildings.

3.5 OTHER TYPES OF DRAWING PROJECTION

3.5.1 Axonometric projection

This is a three dimensional representation based on a chosen plan. The plan is set at 45° and lines are then projected to represent vertical edges or elements.

These drawings are useful as a relatively simple way of explaining the building by a three dimensional

Illus 13 A sectional elevation through General Register House, Edinburgh, including the Main Dome and Historical Search Room. Note that the elevational detail is prominent in comparison to the structure of the building. (Drawing: Gray, Marshall & Associates and the National Archives of Scotland)

Illus 14 The Main Dome and Historical Search Room at General Register House. (Photo: Stewart Guthrie and the National Archives of Scotland)

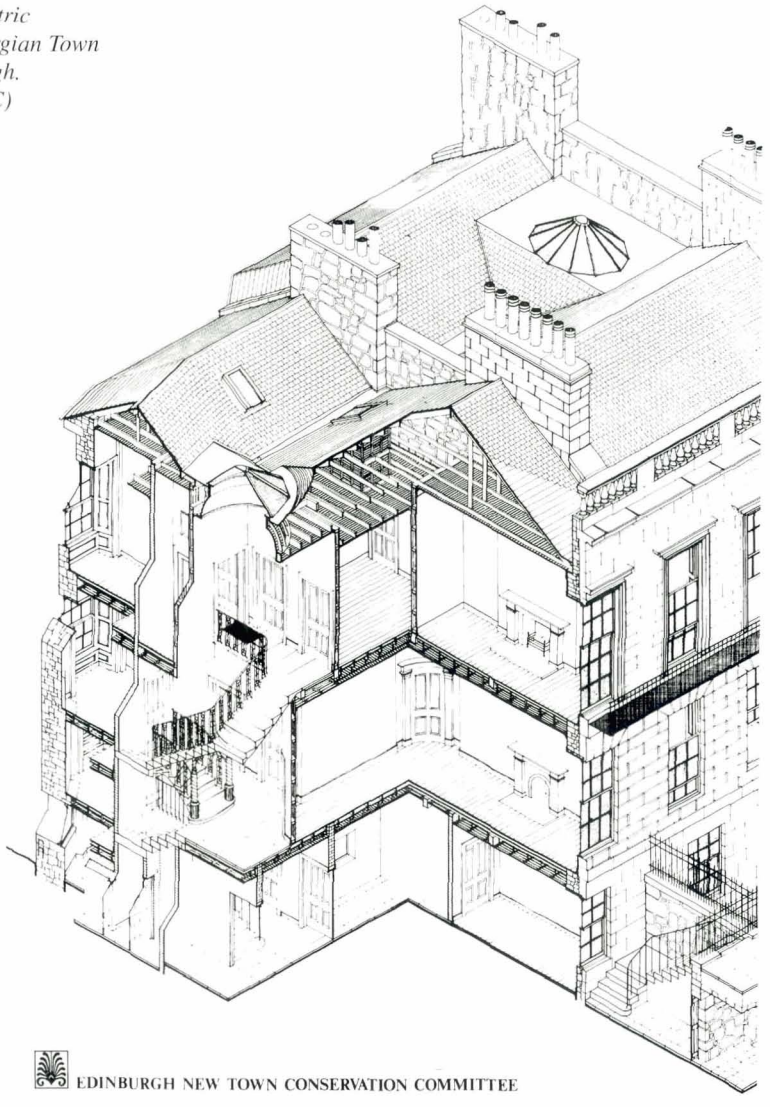
representation of the plan. The drawing can be constructed relatively easily, and to scale, but can be time consuming to prepare and can be limited in what can be shown. Sometimes axonometric drawings can be developed in a more complex way to show construction or multiple levels.

A further common use is to represent different floor levels, by displacing them vertically above their true position to allow a clear view of the levels below. This is known as an exploded axonometric. Because all parts of an axonometric drawing are drawn at the same scale, the drawing has no perspective. Particularly in large drawings, this gives a distorted appearance when compared with how the eye sees three-dimensional objects. Despite this, axonometric and 'exploded' axonometric drawings are useful ways of explaining the geometry or layout of a building in a way that is generally understandable to a wide audience. As a result, such drawings are more often prepared to explain general layout and proposals for construction, rather than as a tool in the process of measuring and recording.

3.5.2 Isometric projection

This is a similar projection to the axonometric, but is based on all parts of the drawing being to the same scale. The plane of projection is at equal angles to the three principal axes of the object shown.

Illus 15 An isometric drawing of a Georgian Town House in Edinburgh. (Drawing: ENTCC)



Illus 15 shows an isometric drawing of a Georgian town house, and demonstrates a well developed use of the technique. This illustration is from *The Care and Conservation of Georgian Houses*, based on the work of the Edinburgh New Town Conservation Committee (Davey *et al* & ENTCC 1980).

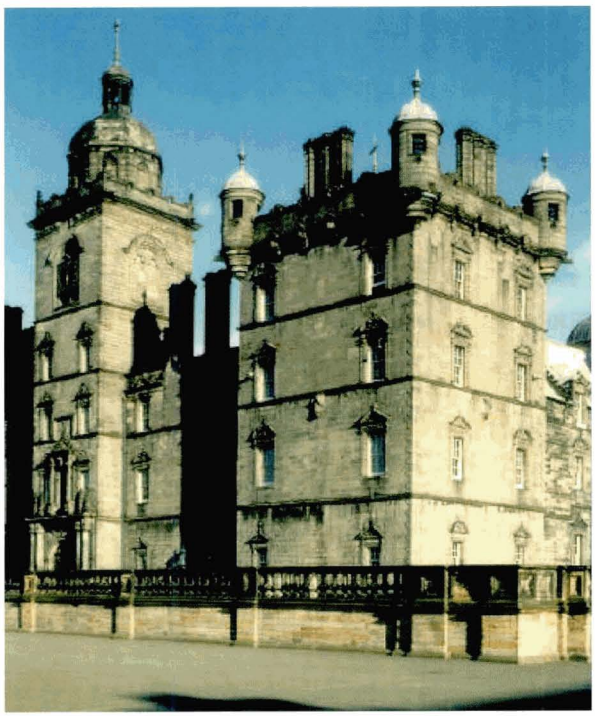
3.5.3 Perspective drawings

These are three dimensional drawings that most closely reflect the way an observer views a building from a given viewpoint. They can be constructed accurately but only from a single viewpoint. The process using conventional drawing methods is time consuming, often limiting the use of perspectives to one viewpoint chosen to best display the building. One advantage is that because they are taken from a hypothetical observer's viewpoint they can show detail above and below eye level.

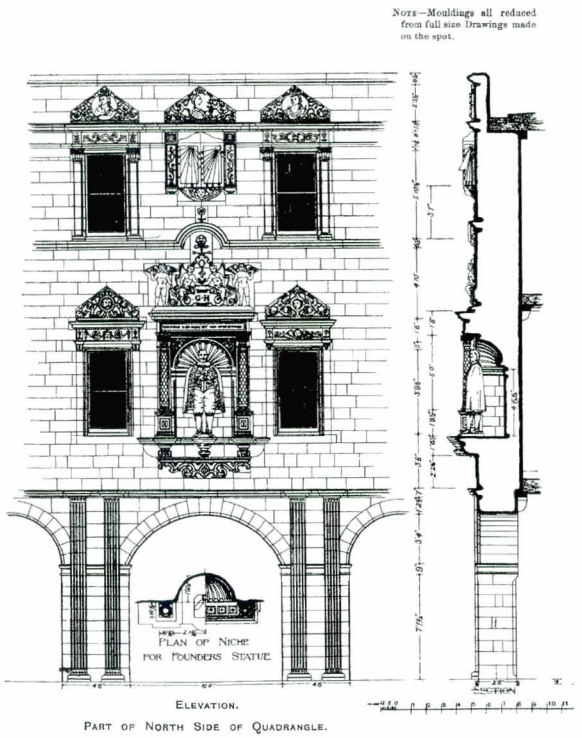
Well drawn perspectives can give realistic representations of interior and exterior views. Although they can be constructed accurately, different parts of the drawing are at different scales making their use for construction or accurate measurement limited. Because of this, and the time required in preparation, perspective drawings tend to be of more use for general explanation or display.

3.6 CONVENTIONAL DRAWING TECHNIQUES

Conventional techniques involve producing drawings on paper, usually in ink or pencil, or on drafting film, usually in ink (Ch 4.2). An example of a traditional type of elevation drawing is shown of George Heriot's



Illus 16 George Heriot's School, Edinburgh, from the north west, showing the architectural forms represented in Illus 17. (Photo: Stewart Guthrie and George Heriot's Trust)



Illus 17 A sample of a traditional elevation survey of George Heriot's School, part of the north side of the quadrangle, by Shekleton Balfour from Blanc op cit.

School in Illus 17, with Illus 16 showing a photograph of the building.

A constraint of this form of drafting is that the draftsperson must first choose a scale so that the drawing fits a useful size of drawing sheet/drawing board, normally the A1 size. To explain a building fully, this limitation may require a series of drawings to be produced at different scales. General arrangement plans may be required at smaller scales such as 1:50 or 1:100, with more detailed drawings involving drafting at a larger scale, for example 1:20, 1:10 or 1:5. Some components or structural elements may even be drawn at full size or half full size, ie 1:1 or 1:2.

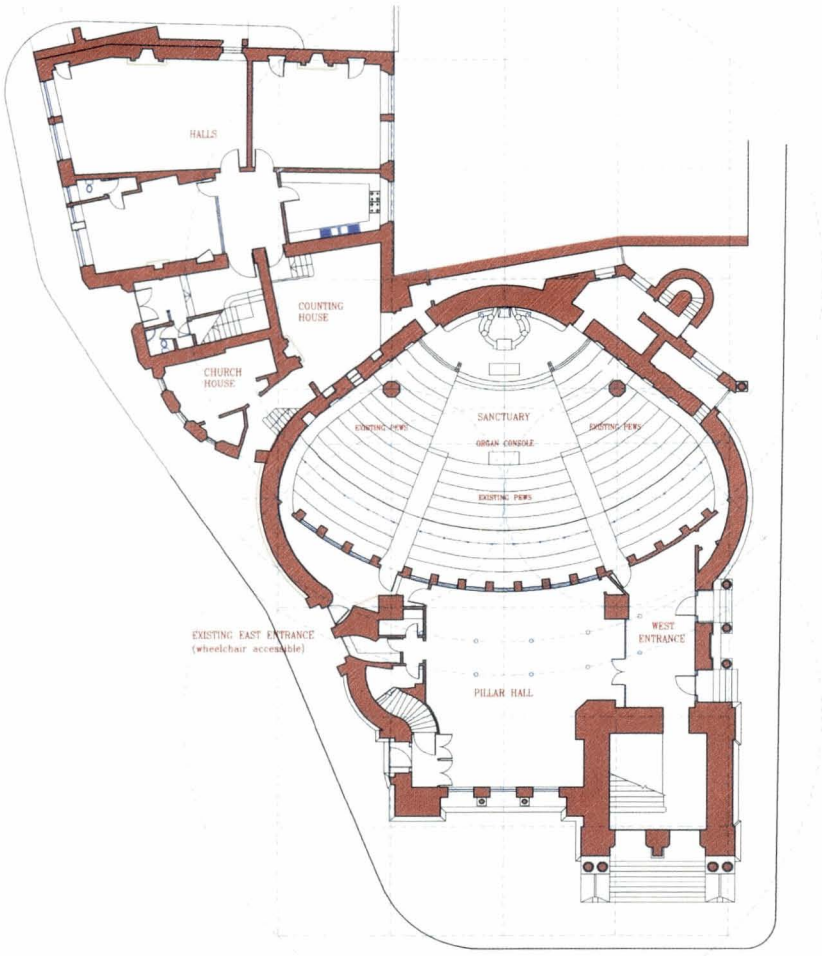
Alterations or additions to such drawings are difficult, and may involve 'scratching out' of detail, then redrafting over. Furthermore, changes in scale can only be achieved by mechanical methods.

3.7 USING COMPUTER AIDED DRAFTING (CAD)

Computer or CAD drawing is now widely used, and has quite significant implications for creating, using and revising drawings in historic building survey (see also Chap 4.5).

3.7.1 Attributes of CAD drawings

- At present, drawings are produced most commonly in two dimensions, ie plans, sections and elevations, in a similar way to conventional drawings (Illus 18). Increasingly programs may be based on, or include the creation of, virtual objects or solids which are more conducive to three-dimensional representation.
- Drawings tend to become cumulative; as more is measured or known about the building, this can be added to the drawing file in the computer. With historic buildings, this can be a distinct advantage as the more information becomes available the more the drawing can be added to and developed. The drawing can easily be edited (although this may be a danger).
- Computer drawings are usually constructed on a series of 'layers', which can be switched on and off allowing different elements to be shown for different purposes or can be coloured to help explain different elements. This allows quite complex levels of information to be recorded in a co-ordinated way. Particular advantages arise when proposals are under consideration, for example the co-ordination of services information with existing features and finishes.
- Printed output may look similar to conventional drawings, ie different drawings showing different levels of detail. However, the drawing method is often quite different. For example, multiple plan views at different scales are often based on a single computer drawing (or file).
- The drawing, being digital, can be easily copied, rescaled, printed or electronically transmitted or filed and can be used in a variety of ways, from printed copy to electronic projection.



Illus 18 A modern measured survey presented in CAD of Barclay Church, Edinburgh. (Drawing: Gray, Marshall & Associates)

3.7.2 Using 3D

Another way of constructing drawings in CAD is by three dimensional modelling where the drawing (or more correctly drawing file) is developed as a virtual model of the building. This allows as many different views of the building to be extracted as required. With advanced techniques of rendering and surface representation, quite realistic views can be achieved.

3D models allow perspectives to be generated by the computer relatively easily and when a series of these are joined together animated 'walk throughs' or 'fly-rounds' can be made. However, these are time consuming to create and tend to be the work of specialist computer draftspersons, some of whom may not have experience of historic building work. As with many 3D representations, the degree of accuracy and detail is to varying extents traded for a more general explanation of the building, so that the use of these techniques in measuring and recording is more limited than with conventional views.

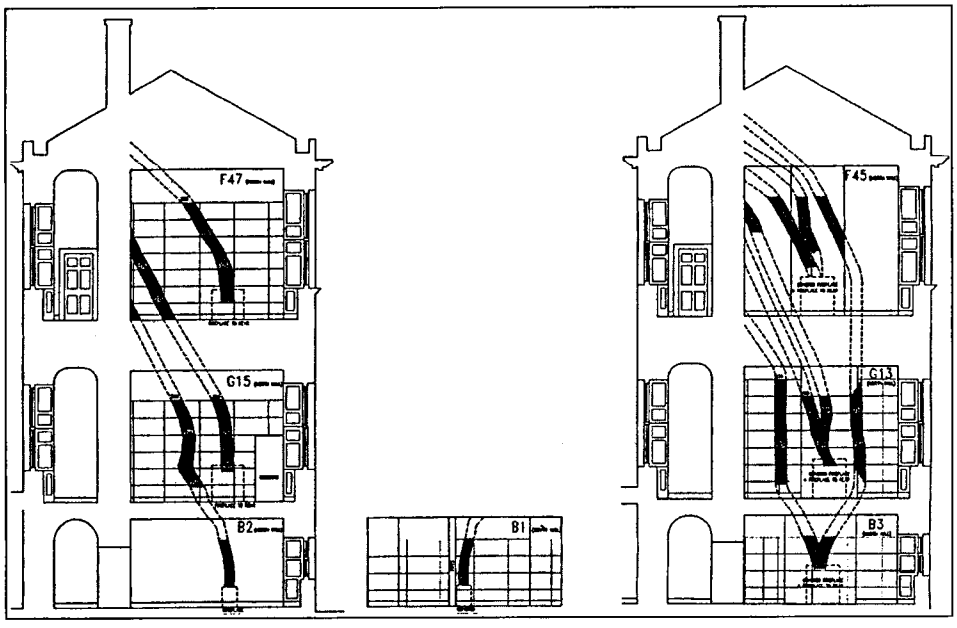
3.7.3 Accuracy in CAD

The degree of accuracy is an important issue with all survey drawings (Ch 4.1), but is of particular importance when computers are used. Printed output utilising CAD can appear very neatly drawn, but, as with all forms of measuring and recording, the drawing is *only as good as the accuracy of the survey information* and the skill of the draftsperson allows.

With conventional drawings, limited survey measurements may result in drawings that may be freehand or drawn in a way that is clearly in sketch or preliminary form. Preliminary CAD drawings, on the other hand, may *appear* convincingly neat and accurate but may be based on limited information. Before use (eg for construction) the degree of accuracy should be ascertained.

3.8 LEVEL OF INFORMATION RECORDED AND DRAWN

It is often the case today that the preparation of surveys is carried out by specialists. Advanced technical methods may be used (Ch 4.3 & 4.4). The use of advanced techniques and/or specialist contractors raises the question of what is being portrayed, why the information is needed and the degree of accuracy required. Techniques such as photography, photogrammetry, digital imaging, etc, are now readily



Illus 19 A radar survey of the internal walls through three floors of General Register House, which helped locate flues and define hidden voids within the building. (Drawing: GB Geotechnics Ltd and the National Archives of Scotland)

available and in many circumstances may be more appropriate as a means of recording information efficiently. There is a danger that the use of such techniques may be at the expense of good observational skills, which are essential to gaining a good understanding of the building.

Traditionally, measured survey work was often carried out in a very detailed and perceptive manner. The lack of photographic and specialist survey (such as described in Ch 4) meant that great reliance was placed on observation and accurate hand measured drawing work. Such work was considered fundamental to an architect's training until the latter part of the twentieth century.

Specialist surveying usually involves achieving the highest level of accuracy possible. On the other hand, with many projects of repair or intervention, where budgets have to be allocated, it may be as important for the architect and conservation team to spend time identifying correctly the location, extent and types of repair than to produce the most comprehensive measured survey drawing.

There may be wider issues of what sort of information is needed. Sometimes there are purposes in addition to obtaining conventional drawn information, for example it may be necessary to establish the presence and extent of voids, ducts or flues in order to understand possible routes for the spread of fire.

In such a case, a radar survey or other form of non destructive investigation (HS 2001) could be justified, producing information on hidden elements. Illus 19 shows a radar survey of the internal walls through three floors of General Register House, Edinburgh, which helped locate flues and define hidden voids within the building.

Historically important information may also come from sources other than the building itself, such as written records, original drawings, Dean of Guild records or other archive material (Ch 5.8). For example, at General Register House, Robert Adam and James Watt corresponded over a method of heating involving flues 'spiralling in the dome'. This record helped identify the presence of flues within the floor, confirmed by reference to a later drawing.

3.9 INVESTING IN THOROUGH MEASURED SURVEY

Good quality measured surveys are an essential part of understanding a building. Future planning and intervention should not be contemplated without an accurate survey of what exists at the outset. Building owners and project sponsors should recognise the essential nature of this work and should be prepared to invest in an appropriate level of measured survey work.

The principle of establishing clearly defined budgets for measured surveys should be fundamental to all projects where work to historic property is contemplated. Regrettably, current funding regimes often introduce an element of competition for the resources available. This creates pressure to reduce expenditure at the early stages of projects when funding may be less certain, yet it is at the early stages that accurate survey information can prove most helpful.

Local authority planning departments have a part to play in this, for example by ensuring that proper survey drawings are prepared as an essential part of Listed Building consent or grant applications. Public sector organisations can also promote best practice, for example by ensuring that adequate resources are devoted to the requisite measured survey at the outset.

TECHNICAL FOCUS A: MEASURED SURVEY REQUIREMENTS AT MANSFIELD PLACE CHURCH

An example of the requirement and use of measured surveys is provided by the project to repair, restore and alter Mansfield Place Church, Edinburgh. This Church, designed by Sir Robert Rowand Anderson in 1883 and unused since 1952, has been the subject of a £4 million scheme to provide modern offices for the Scottish Council of Voluntary Organisations (Illus 20). There will also be a multi-purpose performance and exhibition space in the original Nave, Chancel and side Chapels.

Illus 20 Mansfield Place Church from the west. (Photo: Simpson & Brown)

PLAN SURVEY AND INTERNAL ELEVATIONS

The original 1873 competition drawings were available but a full, up-to-date measured survey was required. A detailed brief was drawn up by the architects for the project, Simpson & Brown, and four land survey companies were asked to tender. The brief called for plans of the two floor levels of the building, plus internal sections and wall elevations (Illus 21). All information was to be provided in AutoCAD LT compatible format.

To limit the cost, it was accepted that the upper parts of the Nave and Chancel would not be surveyed, as this would have required expensive scaffolding or mobile access equipment. This information was drawn in by the architects by reference to the original survey drawings. The survey was prepared by Loy Surveys Ltd. The product supplied was used to form the basis of the architects' general arrangement drawings.

EXTERNAL ELEVATIONS

Much of the work to the exterior involved repairs and replacement of dressed, carved and rubble stone. It was not economically viable to scaffold the building pre-contract, nor was it possible due to site conditions to use an access platform to enable measured survey.

Therefore to provide the quantity surveyors with information for cost planning and to prepare contract drawings, black and white rectified photographs were taken of each elevation. These photographs were enlarged into A1 sheets and marked up to show which stones needed repair or replacement.

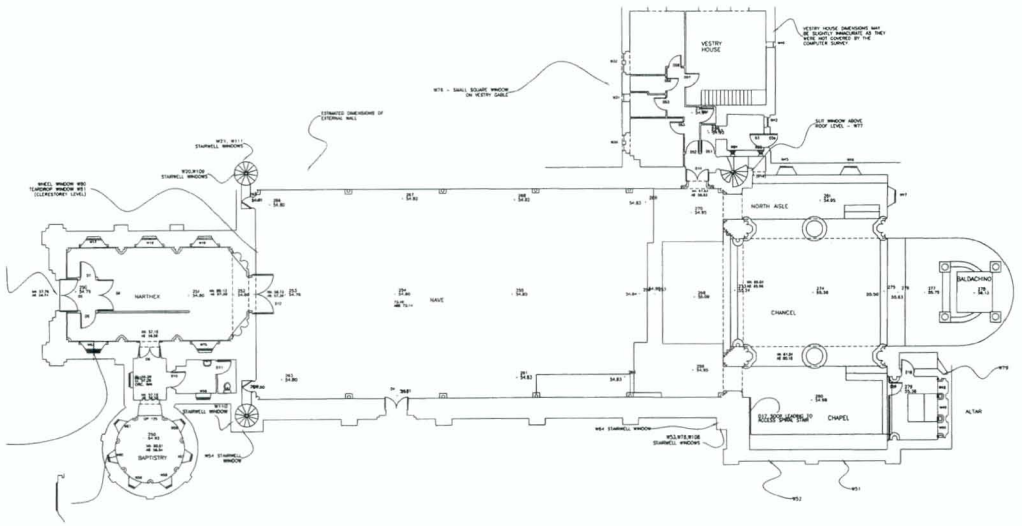
DETAILED MEASUREMENT

This worked well pre-contract and as a basis for tendering, but it was found that more accurate measured drawings were needed during the contract. This selective work was carried out by the project architects. This was possible, as the whole building was scaffolded early on in the contract.

Thus the basic digital survey was continually supplemented by the architects' own hand survey of individual features, spaces or openings. These were required to provide a high level of detail to allow the design of new elements.

PHOTOGRAPHIC SURVEY

A comprehensive colour photographic record was undertaken by the architects to record the pre-contract state of the building. As well, there was a requirement for the contractor to take colour photographs from pre-determined positions every month during the contract period.



Illus 21 Floor plan survey of the Church, prepared as digital data. (Drawing: Loy Surveys Ltd)

TABLE 1 MEASURED SURVEY TYPES AND THEIR USES

TYPE OF MEASURED SURVEY	USES	SCALE REQUIRED	MOST LIKELY METHOD OF PREPARATION
SITE PLAN			
Topographic or land survey of site, possibly with building 'footprint'	All	1:200 to 1:500	Instrument survey
PLANS			
Floor, roofspace, inverted ceiling, basement	Project planning	1:100 to 1:200	Hand or instrument
	Redevelopment	1:50 to 1:100	Instrument
	Conservation work	1:20 to 1:50	Instrument
	Historical analysis	1:50 to 1:200	Hand or instrument
ELEVATIONS			
External	Project planning	1:100 to 1:200	Laser scan
	Conservation work	1:20 to 1:50	RP or photogrammetry
	Historical analysis	1:50 to 1:200	Instrument, RP or photogrammetry
ELEVATIONS			
Internal	Conservation work	1:20 to 1:50	Hand, instrument or RP
	Historical analysis	1:50 to 1:200	Hand, instrument or RP
SECTIONS	Redevelopment	1:100 to 1:200	Instrument
	Conservation work	1:20 to 1:50	Instrument
	Historical analysis	1:50 to 1:200	Hand
DETAILS	Conservation work	1:1 to 1:10	Hand
	Historical analysis	1:5 to 1:20	Hand
3D REPRESENTATION	Project planning	1:100 to 1:200	Laser scan, Graphical or CAD
	Historical analysis	1:50 to 1:200	Graphical or CAD
	Presentation	1:50 to 1:200	Graphical or CAD

NOTES
1. The table must be used with caution, as different factors can affect the requirements.
2. See Chapter Four for definitions of the different methods of survey.
3. Also methods of survey are often COMBINED, eg instrument control with hand survey infill.
4. Photography of all types may be used to supplement information.

4.0 PREPARING PLANS, SECTIONS AND ELEVATIONS

4.1 OVERVIEW

The possession of plans, sections and elevations could be said to underpin not only building recording, but also all aspects of looking after buildings. In Chapter Three, this theme was more fully explored.

In this chapter, the methods of preparing such products will be discussed. In this respect, consideration is given not only to material for building recording, but also the preparation of plans, sections and elevations for all aspects of the care and maintenance of historic buildings and their sites.

The different products can in general be prepared by a wide range of measured survey techniques. In Table 2, the main methods of survey are listed, with notes on applications and use. As with most tables, there is an element of generalisation, so this listing should be used with caution. While there may be an optimum method of preparing a particular survey, in practice a wide range of other factors can influence the choice of method – for example, the time available, the access problems, the personnel and not least the funds available, will all influence matters.

Finally, the building manager or owner will rarely carry out any measured survey preparation themselves, apart from possibly some basic hand survey. Therefore, the purpose of the chapter is to provide information on the different methods. The section on hand survey does however include more 'how to do it' information than usual.

4.1.1 Personnel

Measured surveys can be prepared by a range of different professionals, whose contributions are more fully discussed in Ch 9.3. Broadly, survey is prepared by three main groups, noted here for reference.

It has been traditional for the **architect** (and building surveyor) to prepare surveys. In general, architects tend not to use more advanced survey instruments, but rely on the 'hand survey' techniques. As such, their surveys will often be of limited accuracy.

Nowadays, many survey products are prepared by **land surveyors**. Land surveyors have a training in the specialised methodologies of this field. While traditionally they have tended to work in the broader area of mapping survey, over the last decade, they have increasingly been involved in the measured survey of buildings.

In the building recording field, much measured survey is often carried out directly by **archaeologists**, when they are carrying out the recording. Often, this may be the appropriate and practical way of procuring the survey. For example, in vernacular building recording (Ch 8.1 Auchindrain) the subtlety of detail is such that it is often best to survey and record in one operation.

4.1.2 Methods of survey

The methods of survey can be broadly grouped into three categories, which then subdivide:

Hand survey
- Tapes only for 'dimensioned sketch' standard
- Tapes, levels, distance meters etc

Instrument survey
- Theodolite methods
- Laser scanning

Photographic survey
- Rectified photography
- Stereo photogrammetry
- Orthophotography

As will be seen, these are rather arbitrary divisions. The Table should be consulted as well. To a certain extent, presenting the information in this form does oversimplify. For example, today the hand surveyor will often be equipped with a hand held laser ranging device for measuring distances (see Ch 4.3), and will also present the hand survey as a CAD product. Nevertheless, the principle of hand survey remains different from the other approaches.

As well, on much survey work, different methods are combined. For example, with a photogrammetric survey, small areas are often obscured on the photography, and these must be completed by hand survey. Sections 2, 3 and 4 of this chapter provide detailed descriptions of how each method of survey is carried out, but this point about combining methods should be borne in mind.

It should be noted that no description is made of the methods of preparation of topographic or site surveys.

It is very common to have such a survey prepared, usually at 1:100 or 1:200 scale. This is often done simultaneously with the preparation particularly of a ground floor plan, so that both elements of survey will be in a common grid. Such survey is usually carried out with a total station theodolite. It should be specified in a similar manner to other plan surveys.

4.1.3 Choice of method and personnel

Clearly, deciding on the most appropriate method of survey and personnel to use is one of the most important decisions to be made at the commencement of the project. (Although this should not necessarily be decided by the client alone, but by discussion with the practitioners.) Equally, it is one of the most difficult about which to be categorical.

There are a number of technical factors which should determine the best method for the survey.

- Specification requirement for accuracy and content
- Type of building or feature
- Access restrictions
- Deliverables, ie digital data or paper

If plan surveys are required to high accuracy over a largish building, then instrument survey methods must be used, at the very least to control the survey. The nature of the detail to be recorded may also influence matters. If a large façade is to be recorded on a stone by stone basis, then photogrammetry will perhaps be the best option. But, if the same face has already been tightly scaffolded and sheeted, then hand survey may be the only option.

The choice can also be influenced by:

- The time slot available for the survey
- The personnel available (or not)
- The funding available

If a substantial survey package is wanted urgently, then land surveyors will generally be best placed to do this. If there are no in house personnel, then whatever is to be procured will require to be contracted out in any case. If cash is short, then optimum levels of accuracy and detail may have to be reduced, even if best practice would dictate that a higher level is required.

While general principles have been established and the range of possibilities is reasonably finite, each set of requirements must be judged locally and in accordance with circumstances prevailing at the time. The study of the following sections of the chapter and reference to other sections of the Guide should assist.

4.1.4 Accuracy of surveys

This note applies to all forms of measured survey. Most users of measured survey drawings tend to use the following terms rather loosely, but to land or geomatic surveyors they should be used quite specifically.

Accuracy strictly speaking is a measure of how close a measurement is to the true value, for example the exact shape of a room.

Precision is a measure of the consistency of the survey readings. This is an important concept for land surveyors, but an appreciation of this is not generally a matter of concern to users of surveys, so this expression has mostly been avoided.

Error also has a particular meaning for land surveyors. No matter how carefully a survey reading has been made, it will always have a small variation from the 'true' reading, caused by variations in the measuring device, care in reading etc. Again, apart from gross errors or blunders, the user of surveys should not normally be concerned with this area.

Detail is not a technical survey term, but it is important in telling the user how much information is recorded, and indeed can potentially be recorded, at a given scale.

The main matter of interest to the users of surveys is *locational accuracy*. That is, can the representation of say a room be taken to be a true representation of the shape of that room? There is a problem with this, as theoretically, the absolute true shape of the room cannot be found, as the survey will always be subject to the small variations contained within the 'errors'.

For the sake of example, if the shape of the room was measured with the greatest possible care and drawn out at 1:1 scale, this benchmark survey might be good to better than a millimetre. A practical, everyday, survey could not achieve this – lines will vary by at least several millimetres from this benchmark. To account for this, the land surveyor describes the survey as being within say ±10 millimetres of the true shape.

It must be understood that such a statement is a *theoretical* accuracy, based on the surveyor's belief that the techniques used and the precision of the instruments employed will ensure that the survey is accurate to within this tolerance.

There is another consideration, however, and that relates to the scale of the presented survey drawing. There is a convention in surveying that the 'line width' of the pen point or other drawing medium is normally considered to be 0.2mm wide – at say 1:50 scale this equates to 10 millimetres in reality. An 'accurate' survey drawing at 1:50 scale should therefore not have any measurable error.

With traditional drawn hardcopy drawings, this is quite straightforward. If such a drawing is enlarged up from 1:50 to 1:20, ie x2.5, the 0.2mm lines will become 0.5mm wide. The coarseness of these lines is immediately obvious. But this is a real problem with CAD, where drawings can be enlarged and viewed at any scale on screen, while the lines are still seen at the same width. (On some programs, the line width can be set proportionally, but this facility does not often seem to be used).

'Detail' is considered as the representation of the features present. A drawing could therefore be accurate but not show all detail present. In practice, such a drawing would be of little use for recording work. Nevertheless, there is no value in trying to survey detail that cannot be represented at a given scale. For example, at 1:50 scale, fine mouldings less than 10mm wide will simply not show. A larger local detail drawing should be prepared. Again, this is complicated today by the use of CAD, where such a detail drawing might be recorded at 1:1, but then 'shrunk' into a 1:50 drawing.

To sum up, when it is requested or stated that a survey is 'accurate', what is really being said is that there should be no measurable error at the specified scale. It is in this sense that the word is used in this Chapter, and indeed elsewhere in the Guide.

NOTE In the following sections, the inclusion of named products or suppliers does not imply endorsement by Historic Scotland. Examples are indicative of type only, and similar models or services may be available from other sources.

REFERENCES

There is quite a wide range of land survey or Geomatics text books available, aimed at all levels of experience, although texts directly concerning the measured survey of buildings are less common. The RICS Bookshop has a good selection, also available online through the RICS website. The Building Centre Bookshop, Store St, London also keeps a range of survey textbooks, also available on their website (see Useful Addresses).

TABLE 2: MEASURED SURVEY METHODS AND APPROPRIATE USES

METHOD	APPLICATION	MOST APPROPRIATE USE	UTILISED AT SCALE	DETAIL TO BE RECORDED	SKILL LEVEL TO PREPARE	COMMENT
(PHOTOGRAPHY) Chap 5 Sect 7	Not a survey method *per se*, but good for rapid record	All	1:20 to 1:100 (approx)	Medium to high	Low to high	Offers a different form of record
DIMENSIONED SKETCH Chap 4 Sect 1	Project planning Time shortage	Plan and elevation	1:50 to 1:200	Poor	Low	Best avoided, product has a habit of being accepted as survey
HAND SURVEY Chap 4 Sect 2	High interpretation Lack of time or other resource	All	1:10 to 1:50	Can be high	Low to high	To achieve a high standard requires great skill
INSTRUMENT SURVEY Chap 4 Sect 3	Plans and control Inaccessible subject	Plans Elevations	1:20 to 1:100	Low to medium	Medium	Good for low level of detail, rapid survey
LASER SCANNING Chap 4 Sect 3+TF	Rapid modelling	Elevations	1:20 to 1:100	Medium	Medium	New technique, still finding appropriate uses
RECTIFIED PHOTOGRAPHY Chap 4 Sect 4	Scaleable photographic image	Elevations	1:20 to 1:50	Medium to high	Medium to high	Good where irregular detail is to be recorded
PHOTOGRAM-METRY Chap 4 Sect 4	Records high detail level	Elevations	1:10 to 1:50	High	High	Good results, but complex process to apply
ORTHOPHOTO-GRAPHY Chap 4 Sect 4	Photographic image with dimensional accuracy	Elevations	1:20 to 1:50	Medium	High	Good for curved surfaces

Notes
1. These are considered the most appropriate choices and uses under average circumstances – but various factors can affect choices.
2. Survey methods can and often are combined – consult the text for details.
3. The indicated scales are generalisations. Accuracy would be assumed to be as good as possible within the specified scale.

4.2 HAND SURVEYING - METHODS & TECHNIQUES

4.2.1 Appropriate uses

The expression 'hand surveying' is used to describe the simplest approach to the measured survey of buildings or their parts. Normally, no great technology is involved other than tapes, plumb bobs, string and drawing materials. The work is literally 'hands on', with measurements made physically on the feature.

Having said that, the skills of hand survey should not be underestimated. Hand surveying efficiently, economically and quickly is a lot harder than it looks! As well, the equipment available has changed, strengthening the surveyor's hand greatly. Reference is made below to the use of laser rangers and laser levels. While most measurements are still made directly, these instruments help to establish an accurate framework.

Hand surveying is perhaps most useful where quite small areas of survey are involved, where line-width accuracy and detail is required locally but not necessarily overall and where some measurements are required quickly. As well, there are often situations on historic buildings where access is not practical for other methods of survey, for example due to the closeness of other façades, or when dense scaffolding and sheeting has been put in place.

Hand measurement can satisfy these requirements and can be the quickest and most cost effective method of measuring, depending on the size of the object and level of detail required. Until relatively recently, this was the traditionally accepted method of surveying buildings.

The level of detail to be recorded will depend on (a) the purpose for which the survey is required and (b) the scale at which the final information is to be drawn or plotted out. If the requirement is for a general record of the overall structure and the final plotted scale is 1:50, 1:100 or greater, then measurement need only be to the nearest ±10 millimetres. Detail finer than this will not be drawable on the survey. On the other hand, if the record is to show more detail, then more measurements are required in order to plot out at scales of 1:5, 1:2 or even 1:1 (see also 4.2.4).

4.2.2 Methods and techniques

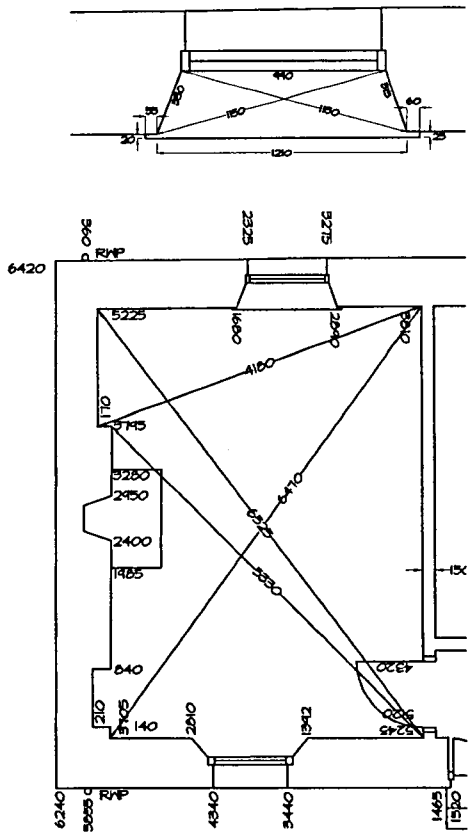
The nature and location of the building or site, together with the level of detail described above will determine the methods and techniques to be used. Regardless of the size of the survey to be carried out, the approach should be logical and methodical. Neat site sketches and notes will prove invaluable when deciphering information at a later date.

Site sketches should provide a proportionate representation of what is actually there, which will make it easier for noting site measurements. Running sizes, that is starting at a common datum point and measuring the position of all features from that point in turn, will be more reliable than individual measurements taken between features. To do this, two persons are usually required.

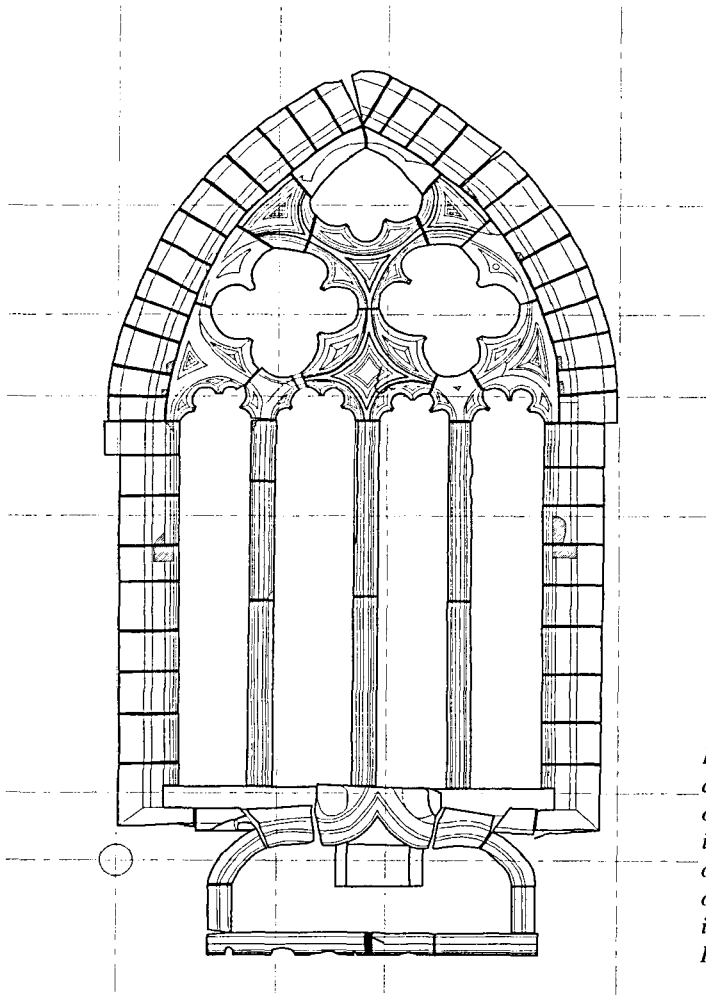
Each surveyor will have their own particular style and method of surveying but the following is offered as a general guide:

i) Floor plans Starting from a fixed point, say the corner of the room to the left on entering the door, measure all wall lengths in turn clockwise round the room, picking up the position of features with running measurements as one proceeds, ending up back at the start point. The majority of measuring tapes are designed to be read when measuring from left to right.

Diagonal dimensions from corner to corner should then be taken, as should diagonal tie sizes to any change in wall direction (Illus 22). These sizes are required in order to plot the angles of the walls, using the basic principles of geometric triangulation. This is very important, as it should not be assumed that walls are at right angles to each other especially in historic buildings.



Illus 22 Preparing a floor plan, by taking running dimensions along walls with diagonal checks. (Drawing: Historic Scotland)

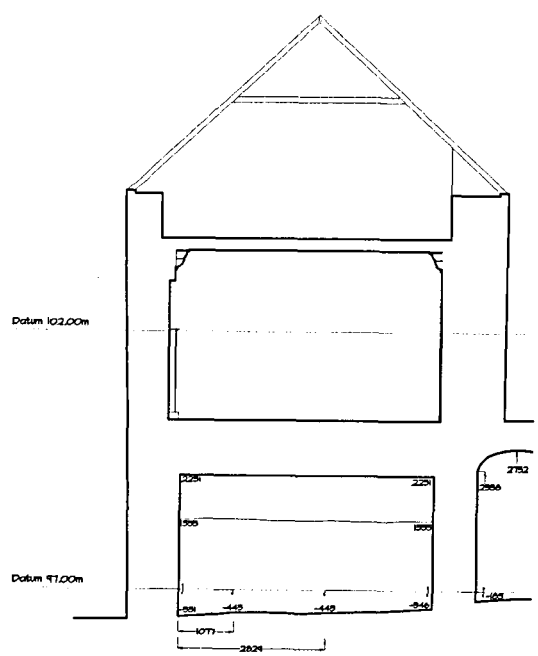


Illus 24 An example of a very detailed drawing of the type where hand surveying often excels. The surveyor's intimate involvement ensures that no detail is overlooked or misinterpreted. The position of the physical grid used to ensure accuracy is shown with the hatched lines. (Drawing: Historic Scotland)

Finally, all recesses or projections such as cupboards, windows, fireplaces and hearths etc should then be measured, again with diagonal tie sizes to determine the exact shape.

ii) Elevations and sections Vertical dimensions are required to locate the comparative level of features in relation to a common datum (Illus 23). If the floor is level then this will provide an ideal horizontal datum, if it is not or no floor exists, then an artificial datum has to be established. This can either be a temporary datum for the particular job or can be related back to an Ordnance Survey datum if this is practical.

In addition to the horizontal datum, vertical datums are required to establish the vertical alignment of window and doorjambs, wall faces etc. Measurements are taken perpendicular to the datum line to the feature to be recorded, upwards and downwards from horizontal lines or to each side of vertical lines. Sections can often be derived from measurements recorded on plans and elevations, but in some circumstances additional measurements are required in order to complete the section drawing. Again, these measurements should be related to an established datum.



Illus 23 A section through a building, showing datum lines established to ensure levels are correct. (Drawing: Historic Scotland)

Hand survey methods are often at their most useful when very detailed measurements are required, for example for cutting new stone. To accurately draw up a feature such as the window shown in Illus 24, normally a grid of strings or wires will need to be set up across the whole area.

4.2.3 Equipment and uses

Equipment required can be as basic or elaborate as finances permit. Digital or laser equipment can make the job easier and speed up the process - the more basic the equipment normally the longer it will take to do the work. In Illus 25, a range of equipment commonly used for hand survey work is shown.

i) Recording dimensions Pocket survey notebooks are easily carried but can be restrictive for larger surveys. A4 or A3 cartridge paper sketchpads offer greater flexibility. Cut paper or drawing film can be used on an appropriate size board, restrained with clips or rubber bands. Drawing film has the advantage of reducing smudging in damp conditions. Laptop computers, although expensive, are becoming more popular for use on site with a drawing software program loaded.

ii) Measurement Tapes come in a variety of forms for various purposes. Cased or open framed tapes made from steel or fibreglass range in length from 10m to 100m, the most common used is the 30m tape. These are used for all linear measurements, with steel being less prone to thermal movement or stretching.

Steel pocket tapes, with a variety of casings, vary in length from 3m to 10m and are useful for working in more enclosed areas or where a rigid tape is required for measuring across openings or for taking heights. Wooden 2m surveyors rods, single fold or multi-fold, are used for the same purpose, but are more rigid than pocket tapes. For greater precision in measuring fine detail, steel rules, 300mm long, can be used.

Telescopic measuring rods are available for heights from 3m to 10m and are most useful where heights etc are required above normal arm's reach and can avoid the need for ladder or scaffold access.

On flat surfaces, the archaeologist's one metre grid frame is another tool which can be especially useful in surveying elevations. This consists of a square frame marked off in 100mm or 200mm squares. Having established a datum, the frame can be moved a metre at a time to draw for example stonework detail.

Laser meters combine all the benefits of tapes and rods where they have a surface to act as a target. (see Ch 4.3, where such meters are illustrated). There is an additional advantage in that they can be used to measure across open voids such as floorless rooms, open wallheads, deep ditches and the like without the need for access at the other side of the void.

iii) Datums The traditional method of setting a horizontal datum is by water level which comprises of a length of hose with two graduated level tubes. Datum marks can be transferred throughout the site, including around corners. This process requires two people, although a single-user water level is available which has one level tube and a water reservoir.

Once datum marks have been established, continuous datum lines can be marked using a chalk line. This involves "pinging" a string line, coated with chalk dust, strung between two fixed points. Where the string hits the structure, it leaves a chalk line. Care should be taken only to pin into joints in historic masonry and never into the stone itself. Other methods of establishing horizontal datums are by surveyor's level and staff.

Illus 25 A range of equipment typically used for hand surveying. While the basic tools of tapes and rods are timeless, modern instruments such as the laser level (rear right) can be invaluable in establishing datums. (Photo: Historic Scotland)

Illus 26 Utilising a profile gauge to record stonework detail. The gauge is gently pressed in against the stonework until it takes up the profile. (Photo: Historic Scotland)

Illus 27 Transferring the profile to paper. The profile must be drawn off at 1:1, but this can then be digitised for transfer to a CAD program, when it can easily be rescaled. (Photo: Historic Scotland)

Vertical datums are traditionally set using plumb bobs and chalk lines. Plumb bobs are made from steel or brass and are suspended from a plumb line or chalk line. Chalk lines are transferred to the structure as above. It can be difficult to stop the plumb bob from swinging in the breeze and many methods have been tried to reduce this. The most common is to drop the plumb bob into a bucket of water, making sure that it does not rest on the bottom.

Laser levels and plumbs are quickly taking over from all the above methods for establishing horizontal and vertical datum lines. There is a large variety of instruments available, allowing the users the choice of fixed datum points, vertical, horizontal and at right angles in all directions. Rotating lasers giving a continuous line can be used vertically or horizontally, and have an oscillating facility which allows the beam to scan over a concentrated area. Fixed cross hair lasers show continuous horizontal and vertical lines at the same time.

iv) General Other items of equipment which can make life easier for the surveyor are the Abney level, inclinometer and digital inclinometer for measuring pitches of roofs, the angle of sloping masonry etc. A profile comb (or profile gauge) can be used for picking up detail of timber or stone mouldings. The plastic teeth models are preferred to ones with steel teeth, as the risk of damage to the fabric is greatly reduced (Illus 26 and 27).

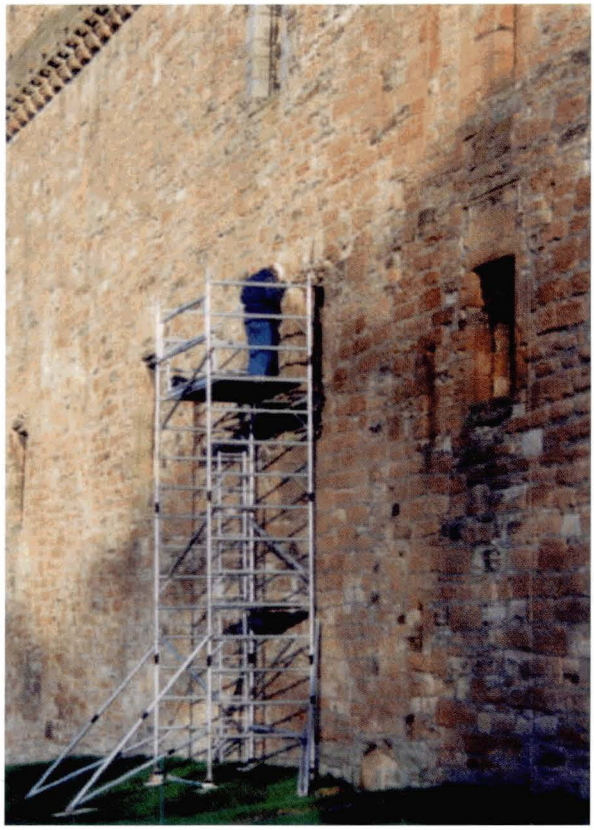
Cameras are an essential part of any survey kit, as site photographs can prove invaluable as an aide-memoire when working up record drawings, especially if on site drawing up is not undertaken. Polaroid instant photographs are useful, as the surveyor can check the contents of the photograph before leaving the site. Digital cameras are quickly taking over this process. A calibrated bar or rod, placed beside an object in a photograph, gives it scale. Due to perspective effects, measurements should not be taken off a standard photograph. (More complex uses of photography, such as rectified photography and photogrammetry are covered in Ch 4.4).

v) Access Ideally all survey work should be carried out from ground or main floor levels. If there are details to be recorded above these levels, then consideration will have to be given as to the best form of access. Telescopic rods or laser meters can be used from floor level. Ladders have the advantage that they are easily transported, but for safety reasons their use should be limited to access for localised measurements only.

Tower scaffolds provide a more secure working platform but still can be restrictive (Illus 28). Full lift scaffolding provides greater access, but the scaffold poles and boards can prove restrictive for measurement and careful planning of lift heights is required in order to access details. For quick access on external elevations, an aerial hydraulic access platform can be used. It should be noted that where scaffolding or hydraulic platforms are to be used, qualified erectors and operators would be required, see below.

vi) Health & Safety In order to determine what measures have to be taken to allow safe working conditions for carrying out surveys, a Risk Assessment

should be undertaken before commencement of any survey work (see Ch 9.5). It may be that there is no risk present, but normally the minimum precautions should be personal protective equipment of hardhat and site boots. If interiors are involved, a torch should *always* be carried. Particularly in unused buildings, suspended timber floors should be treated with the greatest of caution – dry rot may have invisibly weakened timbers.



Illus 28 One of the problems of hand surveying is physical access – often, work cannot be carried out without scaffolding. Here, a portable tower is being used to access a window opening. (Photo: Historic Scotland)

4.2.4 Drawing up the survey

Drawing up of the finished survey can be done on site or back in the office. On site drawing has the advantage of being able to take check sizes and carry out visual checks if required, which is particularly useful at remote sites. The office on the other hand has all drawing equipment readily available and provides a more comfortable working environment.

With traditional drawing board techniques, the surveyor requires a drawing board, T-square, set square, scale rule, compasses, pencils and rubber. Drawings on the board are drawn to a scale such as 1:50, where 1 drawn unit represents 50 units on the ground.

The first matter to decide on is the final output scale. Then, the final layout of the drawing must be considered. The overall size of the site or building to be drawn must be calculated, and this will in turn determine the size of paper required. A1 (840 x 594mm) and A2 (594 x 420mm) are the most commonly used paper sizes.

The actual techniques of drawing up will vary according to the project, the 'squareness' of the feature, the scales etc. There is not space in this brief description to describe any more than one basic technique. To draw up a room for example where the wall lengths and diagonals have been measured, first one wall length will be plotted out. Then, using compasses, arcs will be drawn for the other wall lengths and the diagonals. Where the arcs intersect will give the other corner points. The last wall length then provides a check dimension. Of course, this assumes that the wall lines are straight, and that there are no intervening obstructions.

The accuracy of the final survey drawing is dependant on output scale (Ch 4.1.4). The higher the requirement of the survey for dimensional accuracy and detail, then the larger the scale of drawing required. If information is required at different scales, then this has to be drawn from scratch.

4.2.5 Drawing up the survey in CAD

For drawing up hand survey, CAD has had a very significant effect on the methods used. Essentially, the processes used in hand drawing can be transferred to the computer screen. For example, the CAD program provides a virtual compass – from any fixed point, an arc can be created, and the drawing built up as with drawing board techniques.

In particular, CAD has brought to drafting for hand survey great flexibility and the ability to quickly change and adjust the drawing. The final layout and scale of the drawing can be left to last. The more sophisticated programs allow the operator to view the drawn model at various scales on the final layout sheet by the use of viewports.

A disadvantage of creating a drawing directly in CAD is that drawing is usually done at full size (1:1). Sometimes it can prove to be a problem working at full size, as 'screen' dimensions are apparently more exact than the field dimensions. An element of interpolation from the site recorded sizes will be required.

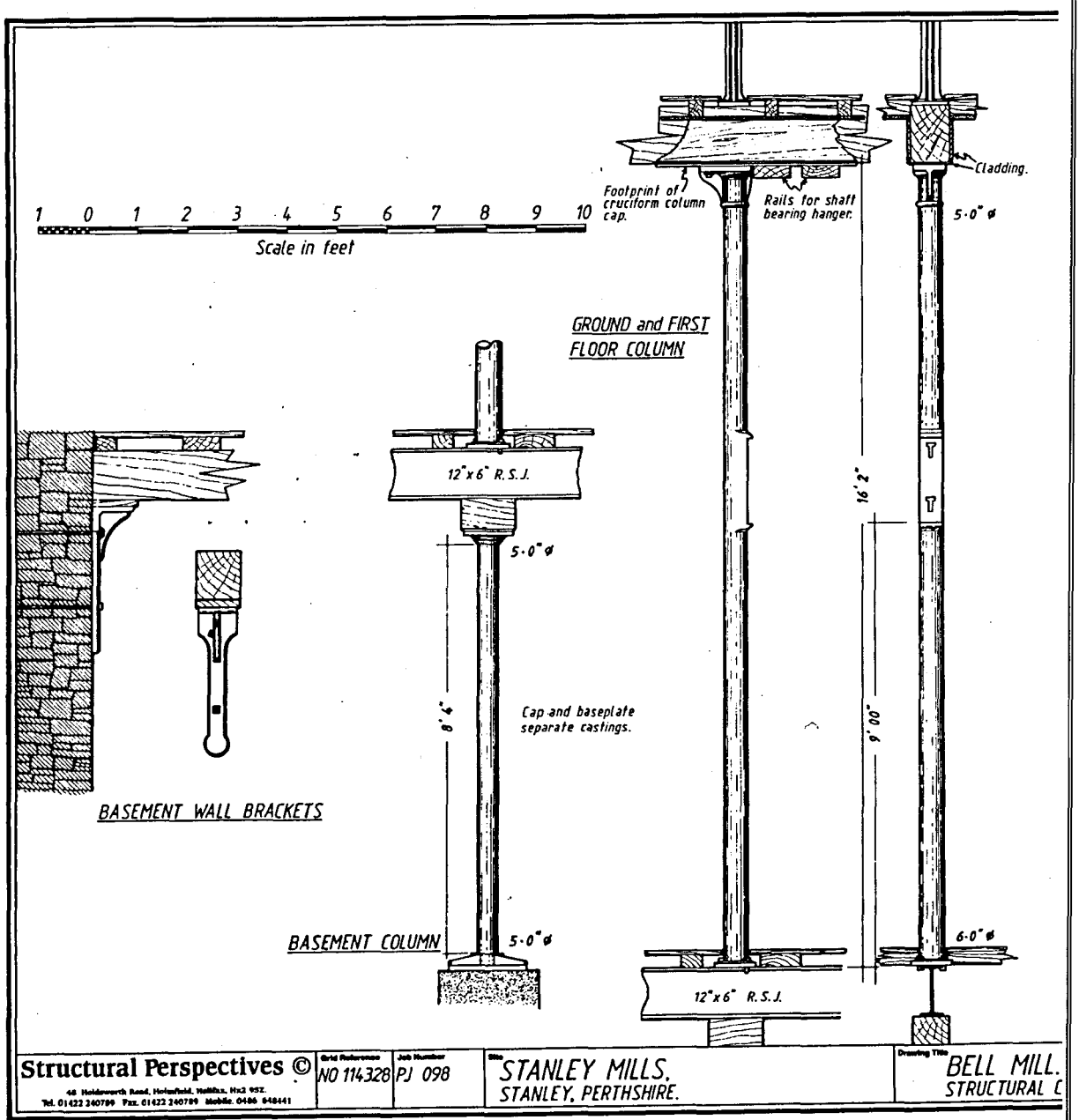
However it is produced, the completed drawing for adding to the archive should be clearly marked with the building name, brief title of recorded element, location plan, north point, date survey carried out, surveyor's name and scale. A graphic or bar scale should always be included, as copies of drawings may be issued either enlarged or reduced at a future time. Drawings should also carry an archive number relating to a catalogued index for easy retrieval.

TECHNICAL FOCUS B: MEASURING ARCHITECTURAL DETAIL

Hand survey techniques are normally used for measuring up relatively small items of architectural detail, such as windows and doors, and as shown in this page, cast iron details.

Hand survey is highly appropriate for such features, as they can be physically reached and touched. While overall dimensional checks do need to be made in the normal manner, at the same time the very design of such features intrinsically helps with the measurement. For example, the flanges at the top and bottom of the column will almost certainly have been designed to be at right angles.

Such features could be measured by other methods, such as photogrammetry or laser scanning. Generally, this is only appropriate if, say, a highly critical feature or surface has to be recorded. For most drawings at scales of from 1:1 to 1:10, hand survey (with photography) will be the best and most convenient option.

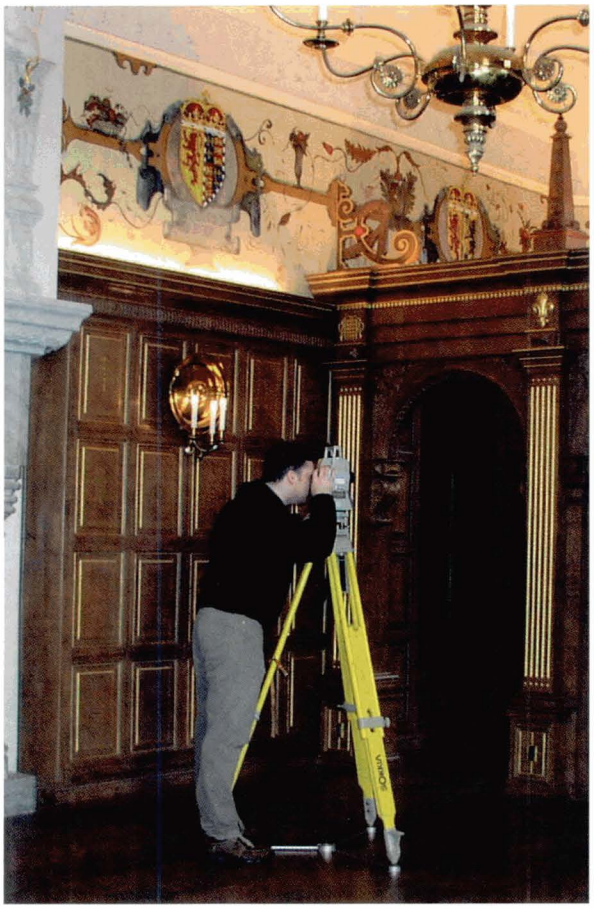


Illus 29 Detailed measured survey drawings of cast iron features in the Bell Mill, Stanley Mills, Perthshire, hand measured by Ron Fitzgerald. (Drawings: 'Structural Perspectives', courtesy Historic Scotland).

4.3 INSTRUMENT SURVEY TECHNIQUES

4.3.1 Providing the framework

At the start of this chapter, it was noted that the divisions by methodology were somewhat arbitrary. Nevertheless, they provide a useful framework, but it should be noted that these methods may well be combined.



Illus 30 A total station theodolite set up in a historic interior, the Laigh Hall at Edinburgh Castle. While essential for accurate survey control, great care must be taken when using instruments in these surroundings. The tripod 'spreader' to protect floor surfaces can be seen. (Photo: John Gordon/Historic Scotland)

Instrument survey techniques provide the framework for the most accurate survey work. Modern instruments are fast to use and economical to purchase. In general, instrument techniques will tend to be of most use for the preparation of plans of buildings. However, the new generation of reflectorless total station theodolites is also having a significant impact on the survey of elevations by instrument methods. These applications are described in more detail below.

Instrument survey, as typified by the use of the theodolite, has actually been around for a very long time – there are many designs of theodolites from the C18 and later. What has changed in recent years is the development of instruments such as the total station theodolite. At the heart of much of this change has been the application of computers - not just the familiar but relatively large 'desk top' PC computer, but embedded microchips in the theodolites and other instruments.

These have brought speed, reliability, computer power and new techniques to the instrument. As well, instrumentation has become relatively cheaper. Almost any practitioner involved in measured survey can today be expected to be equipped with total station theodolites.

4.3.2 Principles of survey

Modern instrumentation is making the job of survey easier, but it must be used in a systematic disciplined approach to achieve reliable results. Sound principles of survey always need to be followed. If the specification requires a fully controlled survey, then instrument survey will be essential to carry out the work. In this short description, there is not space to fully describe principles, but there are many textbooks on measured survey available (see Ch 4.1 References).

Good survey techniques produce work which is largely self-checking by recording measurements from a traverse of survey stations, which loop back to the start. The co-ordinates of the traverse can then be computed and an acceptable closing error will provide confidence in the work. The traverses as well as running around the exterior will normally carry through each floor of the building – the sight of a survey tripod and instrument (Illus 30) in a historic interior can be surprising.

Working from the primary control points provides a sound framework from which to measure the detail. This may be carried out wholly with the survey instrument, but equally the 'hand survey' methods previously described may be applicable at this point. There is no one answer as to the best technique. The approach will depend on the equipment available, the skills of the surveyor and the nature of the detail being surveyed.

Modern instrumentation also has applicability to the survey of elevations. With the REDM instrument described below, readings can be made directly off the surface. This works well where relatively limited measurements are needed. For example, in a very regular C19 façade, only outlines of the architectural detail may be needed (Illus 31). There may be no value in recording on a stone by stone basis. Conversely, in a very complex façade, every stone may require to be delineated individually. In this case, a photogrammetric technique may be necessary (Ch 4.4).

Illus 31 An example of a façade surveyed using a reflectorless EDM instrument. The instrument is set up perhaps 10 to 20 metres from the façade and readings are made directly off the surface. (Drawing: Loy Surveys)

4.3.3 Modern instrumentation

It is almost certain that some form of electronic measurement instrument will be more efficient than older non-electronic equipment. The use of optical theodolites has been replaced with electronic total station instruments, which measure distances as well as angles. Current versions incorporate non-contact or reflectorless (REDM) measurement, which does not require the use of a prism/target to record the measurement. This means measurements can be recorded to inaccessible points of a building by just pointing the instrument to the feature.

On occasion, tapes, optical measurement and hand drafting are likely to be used to support the primary instrument survey. There may be special circumstances where these methods are used, for example if the area is remote with no power available or it is dangerous to work with any battery-operated equipment.

4.3.4 Recording the data

Most modern electronic total stations come with built in memory to record measurements automatically and tag the measurement with a feature code for subsequent plotting. This data is then transferred to a computer for processing, using specialist software to graphically represent the information in CAD form.

Recent advances are moving the computing to the site, so the survey can be graphically displayed in real time as the work is being carried out. This allows the surveyor to see what has been measured as the work progresses. The laptop computer can also be used in conjunction with a handheld non-contact laser measuring device to infill areas.

4.3.5 Plotting the survey

Computer Aided Drafting is commonly used to process and plot the field measurements. The survey drawing is completed using the many commands in the CAD software to complete and enhance the drawings. Various features can be allocated to different CAD layers with appropriate pen settings to enhance final presentation on both screen and hard copy. The survey drawing can be generated in a fraction of the time taken in the past.

CAD allows the user to change scale easily and switch various layers on or off for different presentation (Illus 32 and 33). If appropriate, similar features can be surveyed in greater detail, then repeated using copy and paste commands – although with historic buildings this must be used with considerable caution. For example, apparently similar windows frequently turn out to have different dimensions.

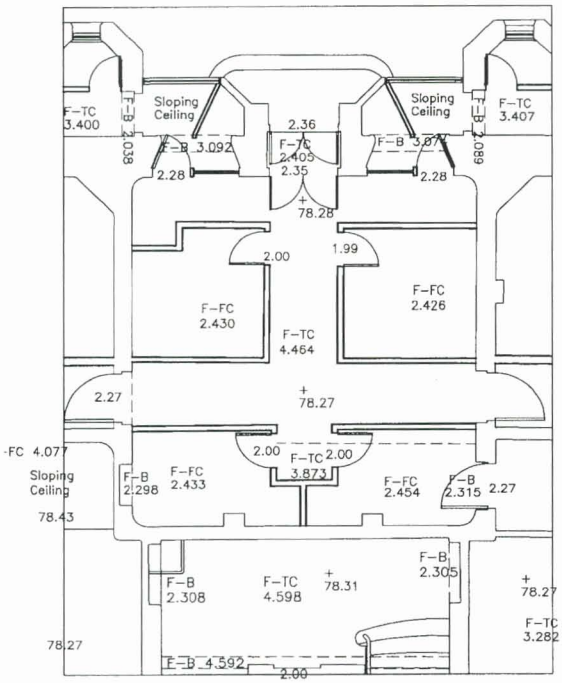
While much work is carried out nowadays directly on the computer screen, there is still usually a need for paper copies of drawings for taking on site. Modern printers are fast and efficient and can plot in colour if necessary.

4.3.6 Future advances

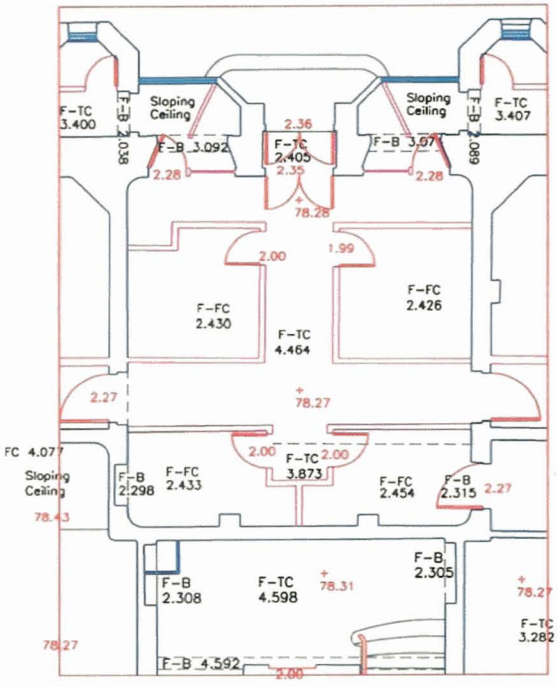
In general, survey instrumentation used in the historic building field has been transferred from the wider market. New equipment is constantly being developed which may have applicability in this field.

For example, in the past few years one of the most exciting technologies to emerge in the field of surveying is that of laser scanning (see Ch 4 Technical Focus – Laser Scanning). This technology is used to capture dimensional and surface data of any object. The data is then converted into a 3D model which can be used in CAD, or other systems for modelling, manipulation or simulation.

Described as simply as possible, the tripod-mounted laser scanner sends out hundreds of laser beams per second in order to automatically build up a 3D model of the defined area. The coordinates generated can provide dimensional accuracy to within a few centimetres or even millimetres. Often, the scanner generates millions of points in total. These 'point clouds' are processed using specialist software to form an image of the object.



Illus 32 A sample of a floor plan created wholly by instrument methods. A traverse has been run through the building, a framework created and then detail added using a Leica DISTO. (Drawing: Loy Surveys)



Illus 33 The same plan survey, printed in colour to show the layers incorporated in the CAD drawing. On computer, layers can be switched on or off to show differing amounts of detail etc. (Drawing: Loy Surveys)

The benefit of this method lies in the speed and efficiency with which vast amounts of measurement data can be acquired. Presently, substantial time is still required to interpret the data to provide the information in a format with which the end user is familiar. The potential of this method is still being explored. A possible application would be in the production of fully rendered 3D models, which could be inexpensive and invaluable for example for planning applications.

4.3.7 Instrument survey equipment

The following examples are provided to give the reader a better understanding of some of the equipment. Given the rapid pace of technology, it would be advisable to seek advice from a specialist regarding the appropriate employment of this equipment.

Illus 34 Handheld distance meters

As well, it should be noted in this section that the description of specific models is not an endorsement of that specific piece of equipment. In all cases, there is a wide range of alternative makes and models which should be considered.

The Leica DISTO measures using a visible red laser beam up to distances of 100 metres (Illus 34). The small laser spot allows measurement to small details, with special ease in cluttered environments. Fast, one-person measuring for both short and long distances is possible. There are other makes of these instruments which operate on the same principles.

The DISTO™ 'Classic' and 'Memo' models can measure with an accuracy within ± 3mm. The 'Memo' can store measurements for later transfer to a PC or can be connected to a PC online for instantaneous data transfer. A further model, the 'Pro' can also store and transfer measurements, but has a measurement accuracy of within ± 1.5mm and a large variety of calculation functions.

The Leica TCR300 series reflectorless total stations work with or without reflectors (Illus 35). This allows the measurement of difficult targets normally inaccessible. The object is sighted with the laser dot, the measurement is taken and the reading stored. The instrument has on-board memory, with an appropriate selection of either on-board or external PC applications programs. There is a very wide range of total station instruments available from many manufacturers.

Illus 35 Total Station Theodolite with REDM

	TCR303	TCR305	TCR307
Angle measurement	3", 1 mgon	5", 1.5 mgon	7", 2 mgon
Distance measurement	3000m (with reflector) 2mm + 2ppm 80m(w/o reflector) 3mm + 2ppm		
Measuring time	3 seconds without reflector up to 30m 1 second with reflector		
Built-in programs	Setout/Surveying/Free Station/ Area/Tie-distance		
Recording	Internal 4000 data records, RS232 interface for external connection		
Magnification	30 x		
Plummet	Laser: located in alidade, turning with the instrument, accuracy ± 0.8mm at 1.5m		

Leica Reflectorless total stations, appropriate for survey of historic buildings

The *Cyrax* is an example of a portable, 3D laser scanning system that captures, visualizes and models complex structures and sites with a combination of completeness, speed, accuracy and safety (Illus 36). There are other makes of laser scanner available, including hand held and short range models appropriate for scanning small objects such as sculptures.

The operator orientates the scanner toward the scene, selects the desired measurement area and measurement resolution, and then the auto-scan begins. As soon as the scanner has scanned a structure or site, software such as Cyra's *Cyclone* PC software allows the use of the 3D point clouds for a wide variety of applications, including those that require export to CAD and rendering software.

Currently, scanners are primarily used in engineering, construction work and maintenance activities in the manufacturing, plant and civil/survey markets. They have also been used for architectural, virtual reality, heritage preservation, forensic and other applications.

The potential for the survey of historic buildings is considerable, but the technology is still new and not all problems are solved. For example, faces may be hidden and deeply recessed features may be shadowed to some extent, necessitating several scans. This leads to very large data files. Also, if the scan is taken at an angle to worn architectural arrises, the reliability of the readings may be compromised, unless a very dense scan rate has been specified, possibly leading to errors or very large file sizes.

Illus 36 Laser Scanner (Photo: Ross Dallas)

The Cyrax laser scanning system specification

RANGE	
Maximum	up to 100m
Recommended operating	1.5m - 50m
SCAN RATE	1 column/sec @1,000 pts/column @ full FOV 2 column/sec @200 pts/column @ full FOV
Single point accuracy	±6 mm @ 1.5m - 50m range, 1 sigma
Modelled surface precision	±2 mm
SPOT SIZE	< 6 mm from 0 - 50 metres

Handheld or pen-computers let the surveyor see exactly what has been surveyed immediately. As data is captured, the survey builds up on the screen. The benefits are that missing areas or errors can be seen straightaway. The PenCentra 200 Windows CE H/PC Pro pen-computer from Fujitsu Personal Systems (FPSI) is an example (Illus 37). It weighs just one kilogram and has a rugged ergonomic design, long battery life and indoor/outdoor colour displays.

It was designed to specifically target the needs of mobile workers. The survey data captured through the total station theodolite can be viewed directly on screen in the field. Edits and additions can be made immediately, thus reducing the likelihood of interpretation errors.

4.3.8 Specialist software

As an example of specialist software appropriate to historic building surveying, 'TheoLT' is a software program that was initially developed by the English

Illus 37 Handheld field computer

Heritage Measured Survey Team. This was to provide a solution for architectural survey, using modern REDM survey instruments, against the limited functionality of AutoCAD LT in this circumstance.

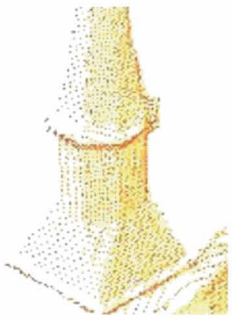
By providing an interface between the theodolite and the computer, it allows data to be drawn directly in CAD. Survey data can immediately be seen as a CAD-based drawing whilst it is being recorded, allowing full editing while still in the field. The program also allows control of the survey instrument, providing a point-and-click user-friendly system for an otherwise complex instrument. With the basic 3D data captured on a pen-computer in the field, any fine detailing can be inserted into the drawings by hand through the use of standard CAD features.

To many observers, seeing a drawing produced in real-time with a combination of the handheld computer and software such as TheoLT seems to remove much of the mystery of surveying. It allows the surveyor to feel more directly in control of the task they are carrying out, as they can rectify any mistakes straight away.

TECHNICAL FOCUS C: LASER SCANNING

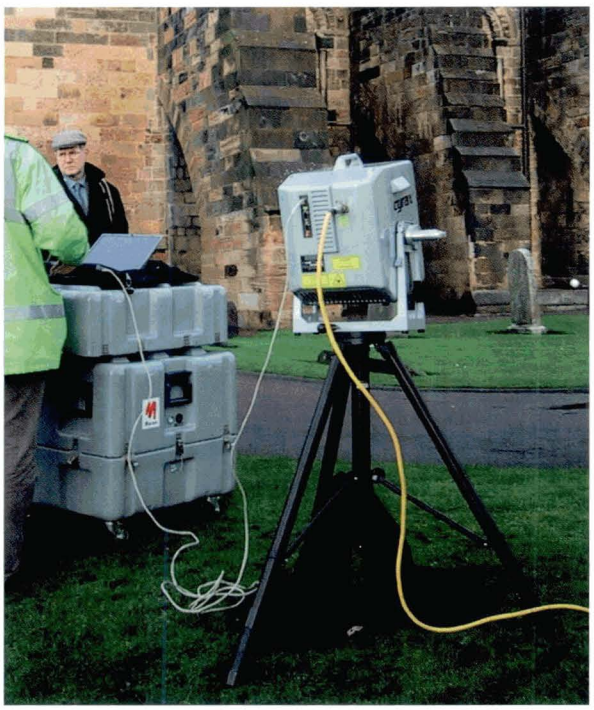
A new form of measured survey instrumentation may prove of value in the surveying of buildings. Laser scanners are in essence a development from REDM, and were briefly described in Ch 4.3 (Dallas & Morris 2002).

The difference between a laser scanner output and the traditional theodolite is that the scanner is programmed to make not just a discrete reading to a single point, but it scans the surface and takes many thousands of readings. Every reading is defined by angle and distance, producing a 3D coordinate for many points across the surface. Other readings such as reflectance value may also be recorded.



This leads to what is known as a 'point cloud' (Illus 38). The point cloud of 3D coordinates can then be treated in different ways. The most common is to triangulate between the points, to form a 'mesh'. The effect of this can be seen in Illus 39, which shows the south transept face of the New Church at Dunfermline Abbey.

Illus 38 A 'point cloud' of data, showing a small area from Illus 39. This is the raw product from the laser scanner. The information is not normally used in this way, but the illustration has been chosen to show how the data is made up. (Illustration: Mason Land Surveys Ltd, for Historic Scotland)

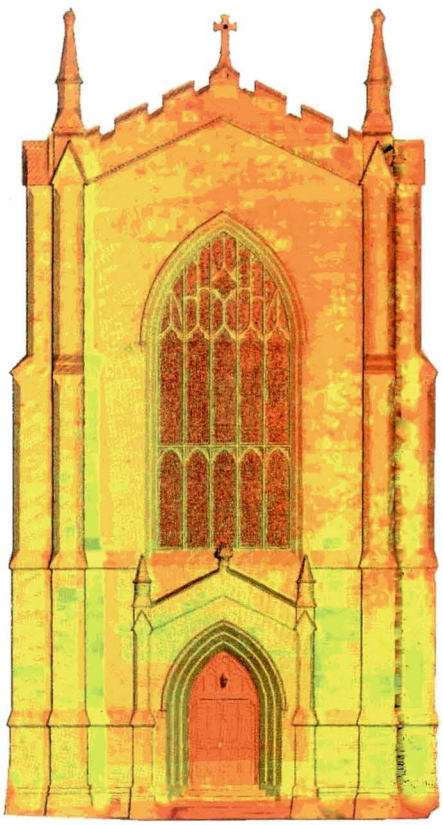


Illus 40 A typical laser scanner instrument, the Cyrax 2500 model, set up in front of part of Dunfermline Abbey. Typically, the instrument is set up between 10 and 20 metres from the façade. (Photo: Ross Dallas)

In use, the current range of instruments are utilised in quite a similar manner to theodolites, in that they are set up in front of a façade (Illus 40), then the scan takes place. Typically, the instruments are appropriate for recording whole façades. There are also more compact models appropriate for recording much smaller areas or features, such as sculptures.

What is completely different about these instruments is the way in which it is necessary to analyse the data. The elevation shown in Illus 39 recorded several hundred thousand points – with this volume of data, conventional processing methods would be of little value. Special programs have been written to handle this data and convert it into something approximating to a conventional drawing.

The instruments are seen to be particularly of value in recording façades. How effective will they be in supplying the type of data required for historic building work? They seem ideal for overall modelling. At the moment, producing stone by stone drawings of the type often required in building recording looks to be less successful. The greatest benefit may come from not trying to replace the conventional survey products, but from direct utilisation of the scan data. This will require quite a lot of development of the software.



Illus 39 A complete façade, developed from the point cloud. The image is based on creating a series of triangular planes between adjacent points. Then, a reflectance value, based on the returned signal strength provides a tonal value. (Illustration: Mason Land Surveys Ltd, for Historic Scotland)

4.4 PHOTOGRAPHIC SURVEY METHODS

4.4.1 Photography as a survey technique

Photography based methods are now widely used in the recording of historic buildings, both within the UK and overseas. The enhancement brought to the archival record of an historic building by good architectural or pictorial photography is clear (Buchanan 1983), but less well known is that photography can also be the basis for measured building surveys.

'Photogrammetry' is the term given to a range of technical approaches to providing measured survey products from photography. In surveying historic buildings, the field is usually referred to as *architectural photogrammetry*. There are two main methods:

- **Rectified Photography** - a single photograph approach providing a scaled image from which measurements and drawings can be obtained.
- **Stereo-Photogrammetry** - a multiple photograph approach allowing line drawings to be produced from a three-dimensional virtual model of the photographed object.

The choice of method will depend on the nature of the structure, the level of detail and the accuracy required, and the funding available for the recording exercise.

This section introduces the history of the use of the technique and explains the methodologies. Recording historic buildings was one of the earliest uses of photography. As early as the 1850's, a Frenchman called Laussedat developed a method to extract geographic information of Paris using photography taken from rooftops within the city. In architectural recording itself, the Prussian architect Albrect Meydenbauer adapted the techniques developed by Laussedat and commenced a programme of architectural recording of historic monuments (Carbonnell 1969).

In the UK, one of the first fully documented applications of photogrammetry as an aid to conservation occurred at Castle Howard in North Yorkshire (Thompson 1962). Some surveys of historic structures were undertaken in the late 1960's for the Ministry of Public Buildings and Works, including the exterior of Hampton Court Palace.

1968 saw the establishment by the Royal Commission on Historical Monuments England (RCHME) of a photogrammetric unit in the city of York, to record the fabric of York Minster, undergoing extensive conservation at the time. Since the 1960s commercial survey companies have carried out numerous photogrammetric surveys for clients in both the public and private sector, including much work in Scotland (Dallas 1996).

4.4.2 Rectified photography

One of the simplest photographic survey methods is rectified photography. It provides scaleable photographic images, which can be used as the source of data or from which a drawing can be obtained by tracing over the detail on the photograph. The approach involves photographing the structure, taking one or a series of photographs, normally with the camera focal plane set up parallel to the plane of the façade.

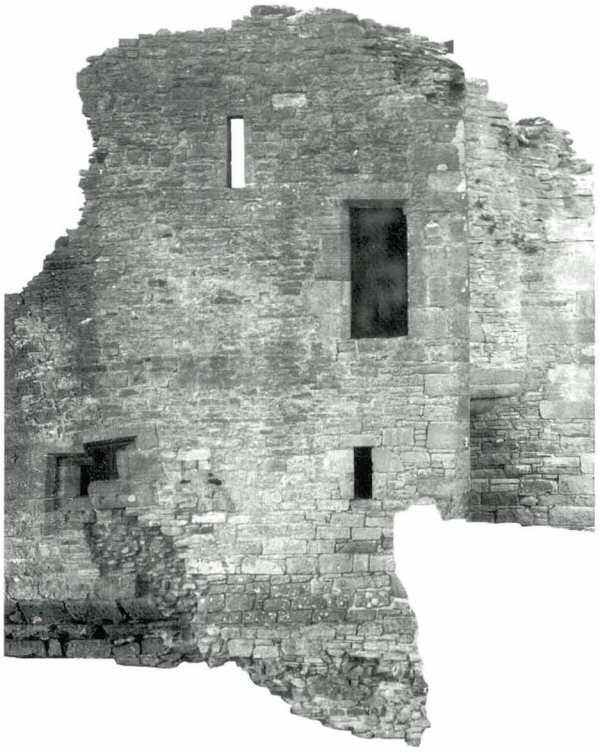
The specialist cameras needed for other photogrammetric methods are not required, but to obtain reasonable photographic quality, a medium or large format camera is preferred. In addition, where digital images are required, photographic negatives or positives can be scanned to a high resolution. Increasing use is being made of digital cameras and, again, the professional ranges are to be preferred where significant enlargement factors are to be applied.

This is not to say that small format cameras cannot be used, but to obtain suitable photographs for enlargement, a large number of photographs may be required of a façade. In turn, this will require more merging and mosaicing at a later stage (Ch 4 Technical Focus – Rectified Photography).

When initially enlarged, the photographic image will have no particular scale and, whilst this may be of use for simple interpretation, the image will not provide any measured survey or dimensional information. The presence of a scale bar in the photograph, perhaps held against the building, can enable overall dimensions to be extracted.

One problem with photography taken from ground level is that the camera must often be tilted upwards to accommodate the whole structure. This leads to converging verticals where parallel, vertical elements of the structure appear to converge on the printed image. Traditionally, this effect was removed by a photographic process using a rectifier-enlarger where the baseboard can be tilted until the converging verticals become parallel.

With digital or scanned images, software allows the effects of tilt to be much more easily removed. The most reliable and accurate result will be achieved by surveying a minimum of four points on the face of the structure to provide coordinate values. Using rectification software in association with a CAD program, the operator can digitise these control points. The software will then scale and tilt the image to fit the control points and show the quality of the fit (Illus 41).



Illus 41 Part of a rectified photograph survey of Duffus Castle, originally produced at 1:50 scale. This is formed of four images, scanned, rectified and mosaiced. Tone matching was carried out to highlight detail within the recessed areas affected by shadow and the whole image cropped to remove unwanted detail. (Survey: Mason Land Surveys Ltd, on behalf of Historic Scotland.)

4.4.3 Rectified photography - advantages and disadvantages

Rectified photography provides a relatively low cost solution to the requirement for a dimensioned drawing. The photograph will be produced to scale and will show all detail on the elevation within the resolution of the photograph.

Rectified photography can be an excellent aid to interpretation and can provide all the dimensioning necessary for certain applications. It is particularly valuable for interiors where positioning or ornamentation and paintings are important as well as structural details.

With the correct camera equipment and software, the non-specialist can produce rectified photography. If line drawings are required, detail can be traced off the photograph either onto drawing film or, more commonly by digitising over the architectural detail within a CAD system.

However, there are disadvantages to the rectified photography approach. Fundamentally, due to the many variable factors, it is difficult to prepare a product with a definable accuracy.

For example, the image is only true-to-scale in one plane. If the chosen control points are on the main vertical plane of the building then the detail on that plane will be true to scale, but all projecting and recessed elements, such as bay windows, will be at a smaller or larger, unknown scale.

Photography taken from ground level can limit cover, as noted above. To avoid this, use often has to be made of scaffold towers and aerial access platforms.

4.4.4 Stereo-photogrammetry

Stereo-photogrammetry is the most widely used photography based method for producing measured building surveys and is most often applied where fully detailed drawings are required.

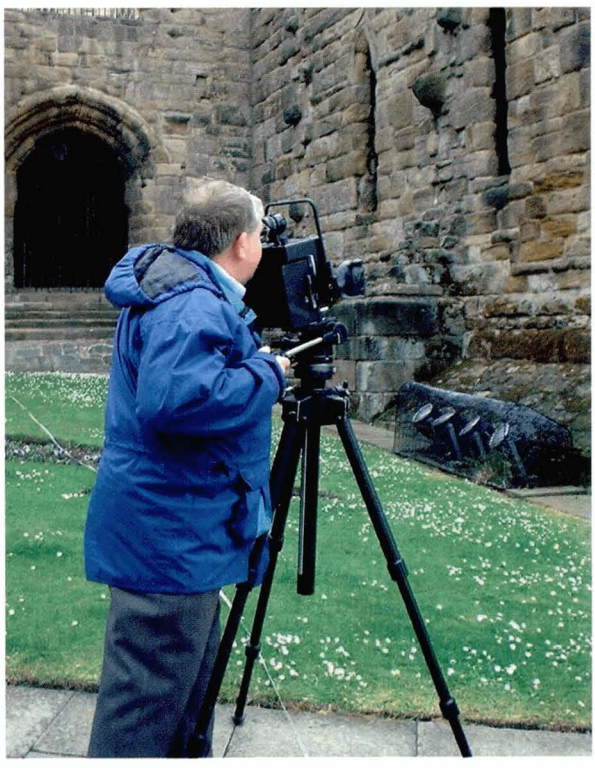
The process is best envisaged by reference to the Victorian stereoscope, where two images of an object, taken from slightly different positions, are viewed through a binocular system. By viewing the left image with the left eye and the right image with the right eye, the brain merges the two images to give the impression of viewing a single three-dimensional image. By viewing this stereomodel through a suitable instrument and introducing a measuring system, detailed scale drawings can be produced.

The use of stereo-photogrammetry can lead to the production of architectural drawings of high quality, detail and accuracy. Although the process is not low cost, the technique is highly efficient and has major advantages when compared to more traditional recording methods. Most stereo-photogrammetry is produced by commercial surveying companies, as the technique requires specialist cameras, stereo-plotting instruments and data collection software.

i) Cameras and set-up Unlike the cameras used for rectified photography, those required for stereo-photogrammetry are usually of a more specialised nature. Metric cameras - those produced specifically for stereo-photogrammetry - have lenses manufactured to show minimal lens distortion, commonly in the order of 0.01mm or less. Although true metric cameras are still in use, the costs of developing these cameras for a limited number of users has not warranted a continued investment by manufacturers. More use is now made of modified professional cameras fitted with calibrated lenses and reseaux plates, such as shown in Illus 42.

To obtain the required stereocover, the camera is set up in front of the façade. Then, the camera is moved along and a second photograph taken, the coverage of which overlaps with the first (Illus 43). The overlap area forms a stereopair.

Illus 42 A modern photogrammetric camera, the Linhof 'Metrika', which uses 4 x 5 inch film. This design is based on an existing camera. (Photo: Andrew Morris)



Illus 43 Obtaining stereo photography with the metric camera shown in Illus 42. Typically, the camera is set up 10 to 15 metres from the façade, and a series of photographs taken in a line parallel to the façade. (Photo: Andrew Morris)

ii) Data collection The overlapping or stereopair of images are viewed using a stereo-plotting instrument or digital stereo-viewing system, such as illustrated in Illus 44. Digital systems are increasingly being used either with scanned images from standard cameras or directly recorded digital images.

In the photogrammetric instrument, a measuring system, in the form of a dot or cross is superimposed onto the three dimensional model. The movement of this mark is related to a co-ordinate system so that x, y and z co-ordinates of any point on the object can be obtained.

The instrument operator places the measuring mark on the surface of the object at the point to be recorded, say a window corner, and collects a data point. Then, the measuring mark can be guided to carefully trace along the edge of the feature, collecting a succession of points in a continuous mode. In this way, the drawing is gradually built up, the digital data usually being recorded into a CAD program.

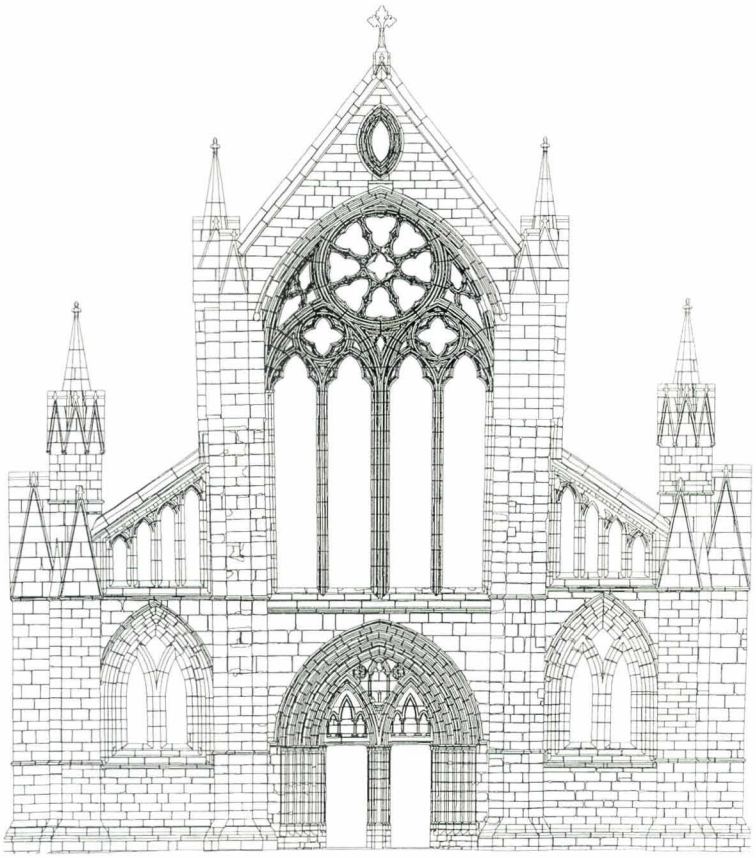
The process of producing a drawing from stereo-observations ensures that all objects within an elevation are presented true to scale, irrespective of their relative positions in depth. Recessed or projecting detail such as rooflines, cornices and porches are therefore all shown true to scale and in the correct position in relation to each other.

The amount of detail to be shown on a drawing can vary from simple outline drawings to fully detailed drawings showing all stone jointing, sculptural detail, architectural features and structural damage. Architectural detail can be recorded to a high level of thoroughness.

Elevation surveys are normally produced at a drawing scale of between 1:20 and 1:100 scale. Surveys of smaller structures, such as ornate doorways and coats of arms, may require the presentation of finer detail. Here, close-up photography can result in surveys at 1:10 or 1:5 being produced. Illus 45 and 46 show typical modern photogrammetric drawings.

4.4.5 Stereo-photogrammetry - advantages and disadvantages

Stereo-photogrammetry is the ideal technique for the production of highly detailed elevation drawings of large façades. Each feature is captured individually, showing even slight variations between apparently identical structures. Although repeat functions, to replicate identical features, are common tools in modern CAD packages, little use is made of these in recording historic buildings where minor variations are often of great importance.



Illus 45 An elevation drawing of part of Glasgow Cathedral, produced by photogrammetric methods. Photography was taken using a Zeiss UMK metric camera with colour transparency and with black and white film. Drawings were recorded at 1:20 scale. (Survey: Mason Land Surveys Ltd, on behalf of Historic Scotland.)

As with all photography-based methods, the time spent on site is relatively short and the non-contact nature of the process has obvious benefits.

The primary archival record from photogrammetric recording is not the drawing or digital data but the photography and survey control information from which it was derived. On some occasions, this may be the only product requested, as drawings or other dimensional information can be produced from the data at any time in the future should the need arise.

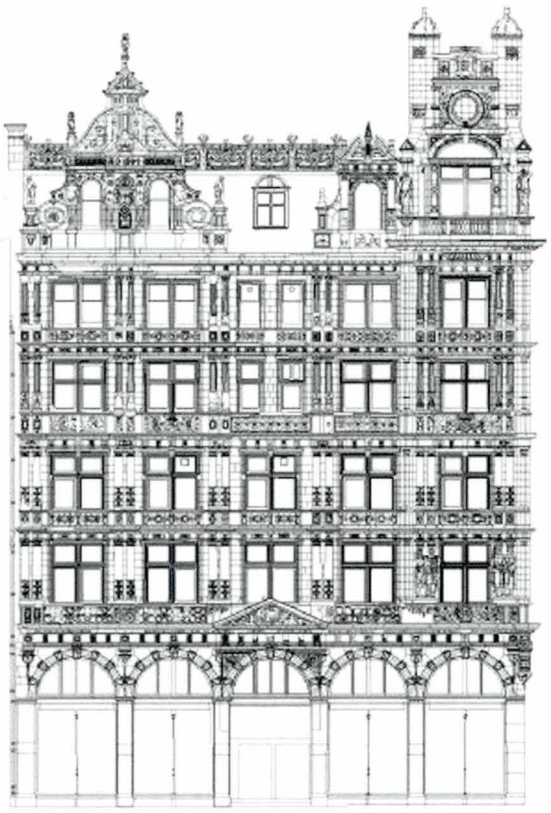
A valuable feature of stereo-photogrammetry is the fact that digital data is collected in three dimensions. Until recently this was only of limited use, as most users required only line drawings and CAD systems which offered the ability to manipulate data in three dimensions were not widely available. Today, most commonly used packages are able to make full use of the third dimension.

4.4.6 Related methods

The two photography-based techniques described above are those most often used for measured survey of historic buildings. Technological developments have taken place in both approaches allowing photography-based surveys to be carried out on standard desktop PCs and the increased use of digital imagery has widened the range of products available to the user.

i) Low cost photogrammetric software In addition to the specialist software and equipment from the major manufacturers and software developers, there are now low-cost packages available, which enable photogrammetry to be carried out on most desktop PC computers.

Illus 44 A photogrammetric plotter, the Leica SD2000. This instrument utilises conventional photography on film, but is computer driven. The newest generation of photogrammetric plotters utilise digital imagery. (Photo: Andrew Morris)



Illus 46 One of the many commercial buildings recorded by stereo-photogrammetry. The Jenners department store in Princes Street, Edinburgh was recorded in 1998 prior to conservation works. This example shows the wealth of detail that can be recorded. Photography and survey control of the whole building was completed over a two-day period without the need for any scaffolding. (Survey: Mason Land Surveys Ltd, by courtesy of Jenners Ltd.)

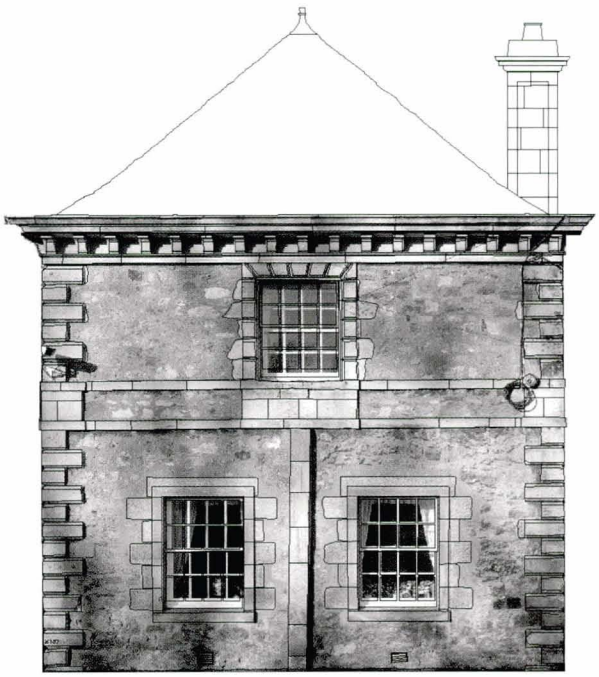
Drawings and dimensions can be obtained using photography taken with virtually any camera or images from a desktop scanner. These systems do not rely on creating a stereo view and so can use photography taken from any position and direction, providing that the area to be measured is covered by at least two photographs. At the recording stage, it is necessary to record the point to be measured on each single image and then join the points by a line. Although a simple process, the recording of detail can be much more time consuming, requiring more than twice as many operations as a stereo recording mode.

The low cost systems are most useful where simple 3D or outline recording is required, or where limited dimensions are more important than full detail drawings. For many modern commercial buildings, which are of simple construction, they are ideal, but for fully detailed recording of historic structures, the stereo-photogrammetric approach is still to be preferred.

ii) Composites The stereo-photogrammetric line drawing and rectified photography can be combined to give a composite product. This is particularly useful on elevations where details of the main structural features, roofline, cornices, door and window details, etc are required as a line drawing, but where the remaining elevational detail is too irregular or indistinct to justify or benefit from a full detail line drawing. This may be the case for example where the jointing has been heavily mortared and the actual joints are not visible. Line drawings showing the visible extent of the individual stonework would have little meaning.

The composite is produced by superimposing rectified imagery of each elevation on top of a photogrammetric line drawing. Illus 47 shows an example from a survey at Lennoxlove near Haddington.

The traditional approach of printing scaled photographic enlargements has been replaced by a digital approach, where all the processes are carried out by software with the images referenced to the line detail within a CAD package. Major savings in cost and time are achieved together with improvements in quality. As CAD software can now handle relatively large digital images, it is likely that this product will find increasing use.



Illus 47 A composite of rectified photography and a photogrammetric outline of part of the west elevation of Lennoxlove near Haddington. The survey was used to develop a stonework maintenance and repair programme. (Survey: Mason Land Surveys Ltd, by courtesy of The Duke of Hamilton.)

iii) Orthophotography A drawback of photography is that details projecting from or recessed into the plane of the elevation are not shown to scale. It is possible, by utilising stereo photography, to scale and reposition each part of the photographic image separately to produce a single photograph of an elevation which is true-to-scale over its area. This process is known as orthophotography.

An example where orthophotography has been employed to good effect is in the creation of digital rectified images of irregular rubble walls of Roman origin. Here the irregular face was projected onto a single plane by observing a regular grid of points showing the distance of the wall from the given plane. The resulting 'digital surface model' of the wall is applied to the digital imagery to scale each pixel of the image by the factor indicated by the surface model.

However, it is not always practical or cost effective to carry out this process on complex façades, as measurements of relative depth and the extent of projections will be needed for each element to be rectified. In such cases the provision of a fully detailed line drawing may be produced at less cost. The technique is well established in the production of orthophotomaps from vertical aerial photographs of the landscape and may find increased use for suitable measured surveys of buildings.

4.4.7 Conclusion

Photographic methods of recording are now a standard technique available to the architect and archaeologist for recording historic buildings and structures. The methods are well established, are of proven reliability and are widely adopted by agencies such as Historic Scotland.

Whilst the standard products - such as rectified photography or a line drawing - remain the main requirement of measured surveys, the possibilities provided by the increasing use of digital imagery is leading to an increase in the range of available products.

The reducing costs and increasing availability of computer software is bringing the ability to create rectified photographs and line drawings from photographs within the reach of practitioners with a PC computer. This may lead to a wider adoption and acceptance of the methods described above. But, users do need to be aware of the constraints and the need to apply rigorous standards, if the high level of accuracy and quality, traditionally associated with these methods, is to be maintained.

4.5 GRIDS, DIGITAL DATA AND 'CAD'

As has been noted at a number of points, the use of computers both for calculation and presentation has produced great changes in the methodology of measured survey. Several matters relating to this are drawn together in this section.

4.5.1 The survey grid

An important concept relating to modern measured survey is the co-ordinate or control grid. The survey grid actually long predates computers. Descartes (1596 - 1650) developed co-ordinate geometry on which most computation and surveying is based. The application of the same idea to a historic building and its site might seem unnecessary, were it not that essentially the same concept underlies the operation of Computer Aided Drafting or CAD programs.

For the non-specialist, a useful way to appreciate the idea of the grid is by comparison with the Ordnance Survey National Grid. On all Ordnance Survey maps, a grid with the appearance of graph paper is superimposed. To record a position on the map, an *Easting* value is read in one direction and a *Northing* value in the other. The point has now been given a co-ordinate reference. Although the third dimension of height is only shown on an OS map by number or contour, the grid itself can easily be considered as extending into three dimensions.

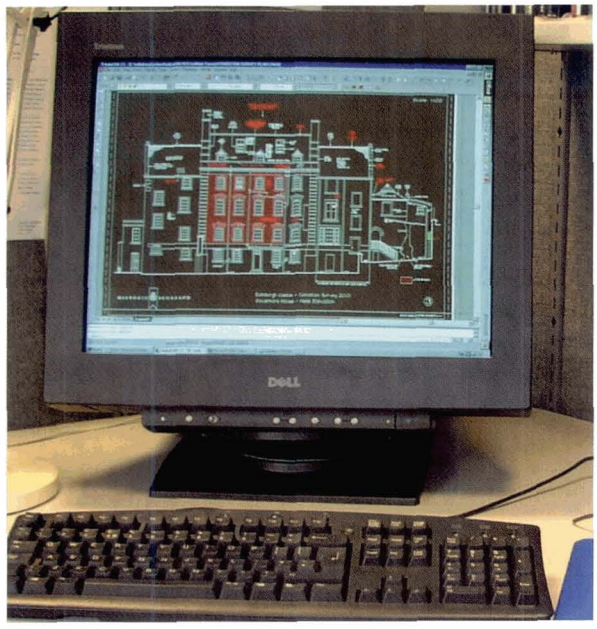
A similar 'grid' concept can be applied to any site or structure being surveyed. The land surveyor uses it in any case for the computations, but it can be adopted by the user of the plans. Particularly when data is being manipulated in a CAD or computer environment, this method can be very valuable.

This is especially so with a large building, or one on several floors, as it enables accurate location to ±10mm or better to be maintained throughout. If there are for example structural concerns, being able to compare dimensions to this accuracy is invaluable. As well, without the grid, relating elements of survey when working on CAD is not practicable. All instrument survey and photogrammetric work nowadays will be carried out in relation to a control grid.

For most small 'hand surveys', graphical methods of presentation may still be used. Using no more than cartridge paper, scale rules and compasses, the survey is built up on the sheet before inking in. For a small area of survey, this remains a method likely to be used (although the medium of drafting film should preferably be adopted). However, it is equally common nowadays to take measurements by hand survey methods, but to then draw up the survey in a CAD environment.

4.5.2 Computer Aided Drafting overview

A Computer Aided Drafting (CAD) system is a software 'package' which allows a drawing to be built up directly on the computer screen (Illus 48). The data which defines a line is held as a series of two or three-dimensional points, according to the type of program or how it is set up. A series of points are joined together in a string, called a *vector* line. Just as the text on a word processor can be so easily changed, the characteristics of each line or string can be easily altered.



Illus 48 The screen of a typical CAD computer set-up, showing an architectural drawing. The colours represent different layers of information. (Photo: John Gordon/HS)

The user does not see these coordinates as such, (except possibly in a window at the bottom of the computer screen), but they underlie the whole method. Lines can have their position moved, their form and thickness changed, then boundaries can be formed and the areas inside can be filled with symbols etc.

Where data is input from instrument or photogrammetric surveys, the CAD data in effect appears straightaway as a complete drawing. However, a CAD program can also emulate the techniques used graphically - a distance can be marked off, then an arc added and so on. When the drawing is complete, it can be output to a printer, in the same way that a word processor file is sent to the laser printer.

Another way in which data can be input is by digitising (Illus 49). Here, a cursor is used to follow round detail of a hand drawn or printed survey. This generates a string of coordinates. This method is quite commonly used where a hand survey is first drawn up manually. Also, if there is a good existing plan, it may be quite satisfactory to digitise it into a CAD format.

To sum up, CAD programs are an invaluable modern tool of surveying. A CAD program can do the following:

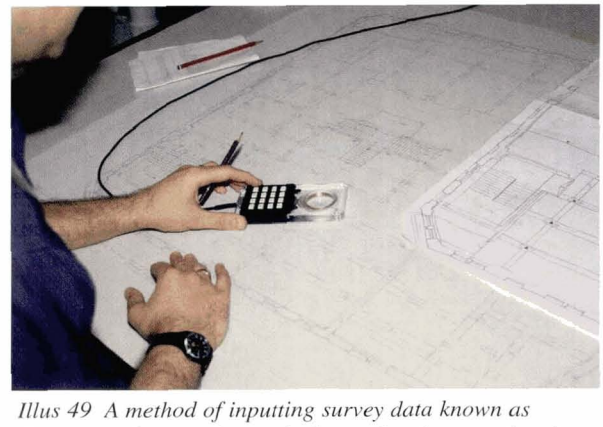
- scales can be changed
- corrections can be introduced
- line weights can be adjusted
- only a part of a drawing may be used or printed out at a time, by 'windowing' an area of interest.

But these are only the elementary features:

- if the data comes from a total station theodolite, it does not even have to be written down - it can be introduced directly into the program
- complex levels of data can be put into separate *layers* of information
- these can be merged or separated according to the use to which the drawing will be put.

Thus the survey data held in a CAD program is much more than the equivalent hard copy on paper or film.

CAD programs actually go back many years, almost to the earliest modern computers. What has changed in recent years is the cheapness of the programs, their 'user-friendliness' and the cheapness of the computers and plotters themselves. Nevertheless, programs such as the full 'AutoCAD' Releases and Intergraph/Bentley 'MicroStation' are still significant investments. However, there are many inexpensive CAD programs available. Current with the publication of this Guide, AutoCAD LT2002 is more than adequate for many tasks. Quite a few architects use 'Vectorworks' running on Apple Macs.



Illus 49 A method of inputting survey data known as digitising. This may be used where a hand survey drawing has been separately prepared, or a pre-existing graphical plan may be converted to digital format. (Photo: Ross Dallas, courtesy Sterling Surveys Ltd)

NOTE There are numerous CAD programs to choose from, and Historic Scotland make no specific recommendation as to any individual program. Nevertheless, it is important that they are compatible with the AutoCAD file types, because AutoCAD is the industry standard.

4.5.3 Limitations of CAD

For the effective use of CAD, a significant investment in equipment and software is needed. The surveyor requires a PC computer with a drawing software program and access to a plan plotter. Efficient systems of use have to be established and followed. For example, it is always necessary to keep a back-up of the work on disk, as there is a risk of losing all the information if the computer should crash.

An early criticism of CAD programs was that they produced very 'mechanical' looking drawings, with a very simplistic point-to-point appearance. This is really no longer valid. The appearance of the drawing is a function of how much survey data and detail has been introduced.

Examination of a high quality photogrammetric drawing, stored as CAD data, will show how the finest irregularity can be represented. Modern computer programs can hold far more data than the average project would ever generate. A simplistic-looking CAD drawing is produced by someone who has not fully got to grips with the technique.

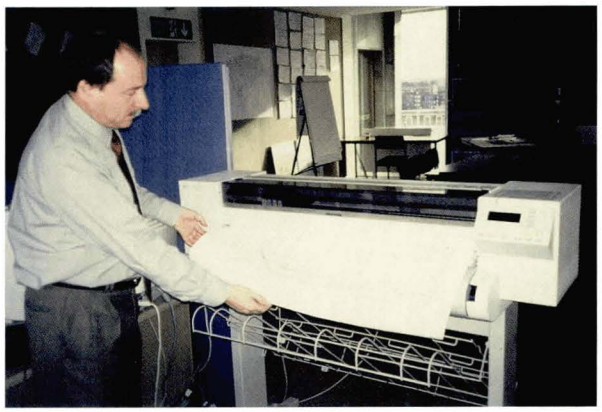
However, there are some concerns with the use of CAD. On the computer screen, the lines of the survey can be enlarged and viewed at any scale up to 1:1 or greater. If the image is greatly enlarged in this way, or a dimension is read by 'snapping' between two lines, the reading may show an astonishingly exact value say to three decimals, eg 7.503 metres. It is *extremely important* to appreciate that this is not a true measurement. The accuracy of CAD generated drawings can only be as good as the accuracy of the original measurements made on site (see 4.1.4).

4.5.4 Computer peripherals

In discussing the ways in which computers have altered methods of surveying, it is useful to note that it is not just the computer itself which has developed. The peripherals attached to the computer have been equally important. Even the computer screen or VDU/monitor has a part to play. It would be difficult to work with CAD were it not for the superb, sharp, large colour monitors now available.

As has been noted, the modern theodolite relies on a computer. New devices such as the laser measuring meter only exist because of the microprocessor. These are discussed in the earlier part of this chapter. The digitising tablet has been described above.

Even the print-out devices have been revolutionised by computers (Illus 50). Traditional devices for drawing out measured surveys, known as co-ordinatagraphs were hugely expensive. The modern printer in contrast is astonishingly inexpensive in relation to the quality, speed and accuracy of its output.



Illus 50 The peripheral devices associated with computers are in some ways as important as the computers themselves. A modern printer is fast, can be used in colour and is inexpensive. (Photo of Ross Dallas)

We are mostly familiar with the small scale scanner attached to PCs, which enables for example photographs to be scanned. In addition, there is a whole range of professional quality scanners able to scan in drawings up to A0 and larger. These allow large pre-existing survey drawings to be scanned in. The data is initially scanned as raster data, ie as a series of individual points. The image can be used as it is and imported for example into AutoCAD, where it is used as a 'raster backdrop'. Alternatively, there are ways of converting the image into vector lines.

TECHNICAL FOCUS D: USING RECTIFIED PHOTOGRAPHY

In this example, the practical use of rectified photography is described for recording elevations at Castle Tioram, Argyll. Drawings were required as part of the recording of the building. Rectified photography was chosen, as full stone by stone drawings were not considered necessary for this random stone walling. A further consideration was the need to use a method that would reduce site time at this remote location (Speller & Tompsett 1998).

Rectified photography can be used in a number of different ways (Ch 4.4). No one method is better than another – it depends on the nature of the project, the equipment (and software) available and the skills of the operatives.

In this case, the method was combined with observation with REDM theodolite. This was used to measure to key elements of the architecture and in particular to sharply defined features such as joist hole corners. This provided a framework of points for the later controlled rectification of the photographic images.

Photography was taken with a 35mm SLR camera on conventional film. While not carefully aligned, as far as possible the photography was taken 'square on' to sections of façade (Illus 51). Close liaison was needed between the photographer, the surveyor and the illustrator to ensure that the necessary imagery and control captured all faces.

In the office, the colour photographs that best portrayed the areas of interest were selected and enlarged. Colour usefully facilitates the differentiation of fabric types and vegetation. With the photographs secured to a calibrated digitising tablet, and with the 3D wireframe file in AutoCAD open, rectification could commence.

An essential step in AutoCAD was to identify a UCS (User Co-ordinate System) from the wireframe for each chosen elevation. In this way, detail taken from the tablet (photograph) was *transformed* into the same system as the UCS. Different transformations can be chosen (affine, orthogonal or projective) that best suit the nature of the original elevation, data or desired result. Residuals (misclosures) can be studied, and further rectifications made until the accuracy is within specification.

Illus 51 A view of the Tower House block, north face to courtyard. (Photo: GUARD)

Once these rectification set-up stages were complete, the CAD drawing could start, detail and features being traced off as appropriate. The drawing process used the basic AutoCAD functions in order to 'trace' the elements from the photograph to an agreed level of detail (Illus 52). Field notes were used to add extra information, such as context numbers.

Equipment Details

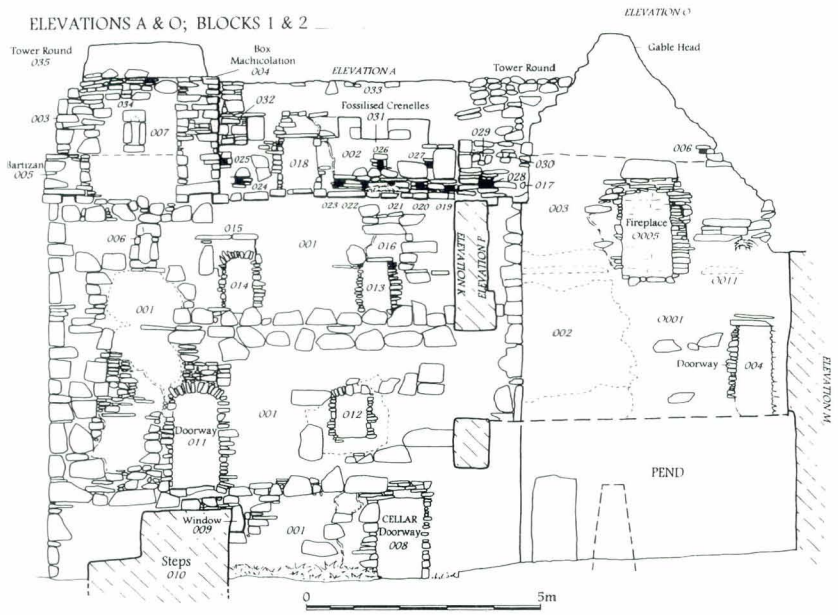
Leica Electronic Theodolite T460D

Leica Data Power 'Disto', mounted to the T460D

Kalidor Pen Computer, with 'PenMap' Software

AutoCAD Release 14

Summagraphics Digitising Tablet (Ch 4.5)



Illus 52 Example of elevation drawing produced from rectified photography, Tower House block, north face with context numbers. (Drawing: GUARD)

5.0 RECORDING – GENERAL TECHNIQUES

This chapter provides a description and overview of the broad methods and techniques used in recording, including documentation or 'desk top' assessment and the presentation of the findings.

5.1 EXAMINATION OF THE HISTORIC BUILDING

5.1.1 The scope of the project

When undertaking a programme of building recording, it is vital that the extent of the study, both physically and in terms of content, is clearly established. To this end, the study area should be assessed in terms of its historical importance, research potential and physical complexity. The successful completion of the programme of survey and recording will depend on a combination of practical and organisational solutions to achieve the required product.

It is therefore important that the site is assessed against a number of criteria, to ensure that a realistic balance between desired results and available resources is achieved. This will generate an effective and safe programme of fieldwork and analysis, sufficient to maximise the available 'window of opportunity' offered by the site.

The scale, scope and products of the programme of work should be clearly defined, identifying the architectural and archaeological potential and any specific research areas, to be illuminated by the fieldwork.

The building should be directly assessed during a preliminary site visit – preferably with the client and/or commissioning agent. This avoids any confusion arising at a later stage regarding the precise aims and desired end products of the agreed programme. As well, a Project Brief or other specification may well have been prepared (Ch 9.2) and if this is the case, the scope of the work should have been clearly established.

At this stage, the use of photography, video or audio recording is very useful to the contractor, both as an aid to conveying instructions to the personnel who will be undertaking the recording of the site, and to retain a record of any discussions and instructions from the client for future reference.

All strategies ultimately employed for both data retrieval and recording/analysis should be flexible enough to accommodate any unforeseen circumstances which may arise during the course of the work. It is unwise to rely implicitly on any standard methodology to achieve the best results.

In order to round off the necessary general site familiarisation process, the initial desk-based documentary research should be completed (Ch 5.8). This is to characterise the known history and morphology of the site and to provide an analytical frame of reference.

An assessment should also be made of any additional potential documentary records associated with the use and development of the site to the present time. All archive material associated with the site in the possession of the client/agent should be provided to the building recorders - particularly illustrative material.

5.1.2 Example - The Merchant's House, Kirkcaldy

An example of this approach is the survey undertaken at 'The Merchant's House', 339-343 High Street, Kirkcaldy, Fife, by Kirkdale Archaeology on behalf of the Scottish Historic Buildings Trust in 1996 (Kirkdale 1997). The building was seen to be of some complexity, and had already undergone partial but significant repairs (Illust 53).

The house lies at the east end of Kirkcaldy High Street and forms a part of the medieval town layout, close to the shore. The site has seen occupation from at least the C14, although the present house dates from the second half of the C16. It had as well seen considerable alteration up until its general decline from the late 1960's.

The present layout of the house was found to be based on a late C16 plan comprising ground, 1st and 2nd floors with no attic space, all within a basic rectangular footprint. The house underwent significant extension in the form of two new wings, primarily for accommodation, at the north side (rear) of the house. Further alterations to the upper floors took place in the C17 and C18, when the evidence suggests that large rooms were subdivided with stud partitions, new fireplaces were inserted and an attic space was created.

Illus 53 The front elevation of The Merchant's House, with survey in progress. An access platform or 'cherrypicker' is in use. (Photo: Andrew Hollinrake/Kirkdale)

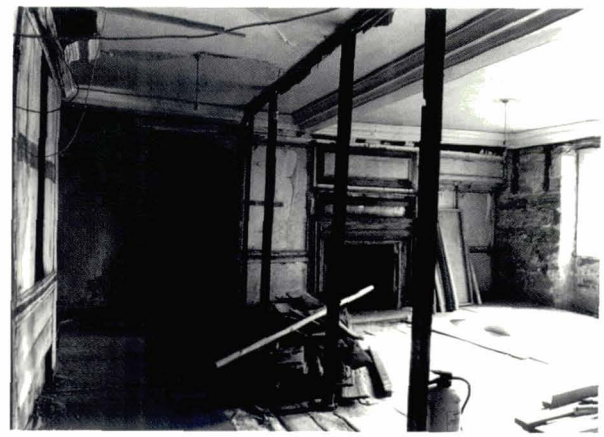
Illus 54 View of part of late C17 plastered ceiling, found on the first floor. (Photo: Andrew Hollinrake/Kirkdale)

In the same period, much of the interior was wood panelled and ornamental plaster ceilings were added. The house was further refined with the establishment of a formal garden at the rear of the property. At this time, much of the ground floor was given over to commercial use (mainly storage). Business use was a feature of all successive uses of the property.

During the C19 the property was subdivided for multi-occupancy, with consequent new access arrangements. By the C20, the ground floor comprised two separate shop premises, used latterly as a Post Office and a restaurant.

As part of an initial programme, the history of the house had been investigated, and repairs were carried out to the roof and to the main south façade. Here, new fenestration based on the C17 evidence was incorporated. This work stopped the deterioration of the property and flagged up some of the principal areas of interest within the structure. Many original decorative features and surfaces survived, or had been revealed by initial cleaning, including painted ceilings, woodwork and plasterwork of various periods (Illust 54).

Thanks to the roof repairs, the house at its upper levels was dry, but the interior was generally very dark for working in, as mains power had been cut off (Illust 55). At ground floor, the remains of the restaurant kitchen and toilet were extremely unpleasant - a condition not helped by regular flooding after heavy rain (Illustr 56). The once elaborate garden was a mass of weeds and self-seeding bushes over piles of rubbish and derelict sheds.



Illus 55 A general view of the second floor interior east face, as shown in the line drawing in Illus 58. The very dark conditions often experienced in unused buildings can be noted. (Photo: Andrew Hollinrake/Kirkdale)

Illus 56 Ground floor interior of the former restaurant area, note flooding experienced after heavy rain. (Photo: Andrew Hollinrake/Kirkdale)

The recording of the core structure interior of the property was undertaken by three draftsmen working independently at each level/floor, measuring all internal elevation detail. The architectural detail was carefully examined and context records were assembled by a further two person team. Temporary lights had to be installed for this internal work. Initial tasks also included the clearance of the garden (Illus 57) and the breaking out of the restaurant floor in advance of the archaeological excavation team.

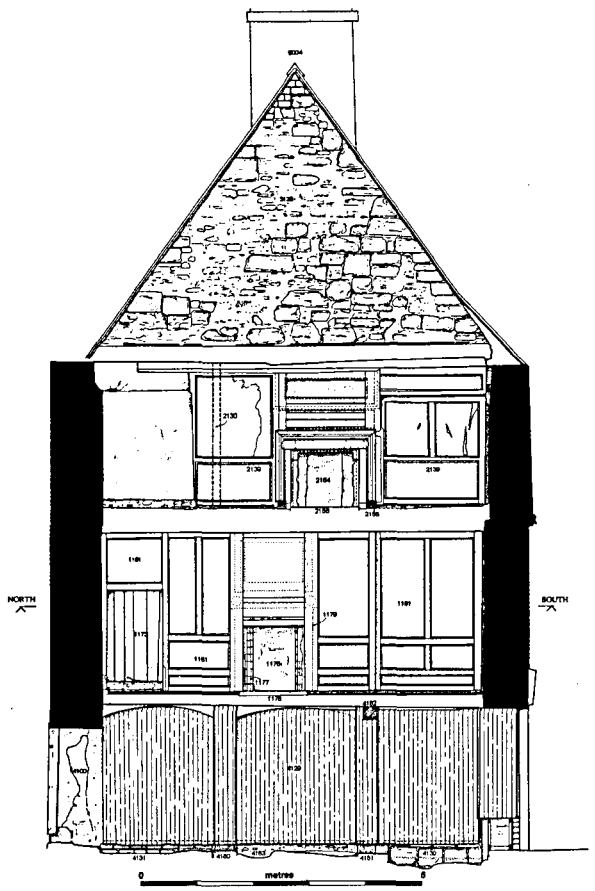
Access and low light levels proved to be the most awkward practical problems, along with a concern for site security. Generally, however, the site was readily accessible for survey and excavation, having been largely cleared out prior to the preceding building programme. The domestic scale of the interiors meant that access was relatively easy.

The recording programme generally benefited from the earlier work, but issues of data integration and interpretation were raised, as the records of features and surfaces prior to being reinstated had been collated under a different system. It was clear from the outset therefore that the critical task of cross-referencing various historic records applied to recent documentation, as well as that of the past.

A programme of survey, historical research and archaeological excavation was therefore devised, which would integrate new evidence alongside previous research (Ch 5.8). It was necessary to correlate the evidence gathered from the standing building along with various archaeological data, all under a single recording programme.

This programme was based on a combination of standard practice for feature notation, description and illustration, alongside digital manipulation of drawn elevations and plans. Illus 58 shows a typical internal elevation drawing, through three floors. The scale and complexity of both the archaeological excavation and the building surveying/recording by survey and photographic methods were delimited by available resources. Therefore, it was important to ensure that the procedures, and the resulting body of evidence, were structured to enable subsequent refinement/upgrading as required at any later date.

Illus 57 A rear view of The Merchant's House, showing the distinctive architecture of the building, and also the cluttered condition of the garden, all of which had to be cleared. (Photo: Andrew Hollinrake/Kirkdale)



Illus 58 The interior elevation of the east end of the property, combining separate drawings made at each floor level, external profiles and roof detail. (Drawing: Graham Douglas, John Wrothesly, David Connolly/Kirkdale)

The whole programme was ultimately able to define a structural sequence of the property. Further detailed documentary work developed the historical narrative, based on the sequence of owners from the C16 onwards.

As is so often the case with building recording, a number of specialisms were required. The grid and exterior elevations were completed by a team under Dr James Douglas, while the measured drawing and photography were undertaken by the Kirkdale Archaeology team. Historical research was by Dr Bill McQueen and textual context recording/databasing by Andrew Dunn. Specialist advice was given by Historic Scotland and the National Trust for Scotland.

5.2 BUILDINGS TO RECORD

Any type of historic building, from castles to churches to domestic houses, in part or in ruin, may be recorded by following building recording principles. For example, increasing public and academic interest in the buildings of WW2, industrial structures and agricultural buildings, all promote the merits of buildings which until fairly recently were often not deemed worthy of any detailed level of recording and analysis.

The significance of a given structure does not necessarily depend on its antiquity - rather its importance is based on its context and relative quality (see Ch 2). This can depend on local, regional and national criteria, and historical associations as well as architectural features.

The methodologies of building recording as devised from principles of archaeology can be applied to any type of structure of architectural and/or archaeological significance. This could include buildings/structures of any form, condition, period and location. A strength of the recent approach to building recording is that all sorts, types and ages of buildings have been examined, recorded and analysed (and should continue to be).

Buildings can be classified as part of a broad typological series, referring to function, context, date, and fabric (see Ch 7.2). By placing the building within such a typology, any specific requirements for specialist analysis (beyond the basic methodologies described in the following sections) will be more easily identified. This will help inform the necessary scope of the recording exercise, products, logistical requirements, research potential and costs.

The range of types of building found in Scotland is very wide, and spans a broad range of dates. *The Buildings of Scotland* series, produced by the Rutland Press under the aegis of the RIAS, well exemplifies the wide range of buildings and qualities which may be encountered (see Bibliography). It is also important to note that certain buildings may be of great interest and historical value through their associations. It may be that a given period or associations with certain personalities can be highlighted. This may be the case where the intrinsic merits of the building may seem quite low.

The range of skills and knowledge needed to record a diversity of building types is clearly extensive. However, as building recording has adopted a more established set of procedures, certain elements of the work have become quite standardised. For example, the preparation of floor plans, measurement of elevations, basic contexting and procedures such as photography can be undertaken by most personnel. Nevertheless, it is essential that according to the category of building types, specialist skills are brought in. This was shown with The Merchant's House (5.1.2), where a number of specialists were used at different stages.

5.3 DESCRIBING THE BUILDING

5.3.1 Identifying the component parts

The historic building or structure should be described in its present state, in terms of its existing layout, including all modifications and interventions, no matter how recent. Each element of the structure must be considered and described. This will include the walls and their construction, the flooring materials, the roof and all architectural items such as the doors, windows, fireplaces etc.

It may be possible to identify crucial evidence which defines the character and significance of the building. All structural evidence is relevant. For example, as at The Merchant's House, the use of late C17 mouldings in an early C18 ceiling suggested slightly unfashionable work for the time (Ch 5.1 Illus 54).

The level of recording will have to be site specific - and it may have to be accepted that it will not be feasible or even desirable - to record every single item within the structure. This is always one of the most difficult judgments to be made with a building recording exercise. It will arise both at the specification stage and during execution of the work, although careful assessment for the Project Brief should largely avoid problems.

The level of record of the feature may be influenced by a range of factors, from historic significance to funding available. Judgments may as well be based on the technical methods employed – on occasion, a measured survey may be appropriate (and of value to other disciplines), in another circumstance a photograph may be just as useful and possibly more meaningful.

The description should primarily be divided into interior and exterior. Even with a roofless ruin, a categorisation into what are believed to have been former interior and exterior walls should be made.

5.3.2 Interior

i) Components The site is initially defined by a numbered sequence of discrete spaces. These will be generally, but not necessarily, room spaces. These spaces form the core components or primary units within which additional detail can be located, as well as in associated groups. These spaces will be clearly separated from adjacent spaces.

They should be numbered in a coherent sequence, respecting the layout of the site if possible, for example per floor or storey, per wing, per orientation etc. If a pre-existing room/space numbering system is in existence, it should be adopted, for there is nothing worse than having more than one system of annotation in use. Whatever site-specific annotation regime is adopted, it should be consistent, based on the core components or units and be explicitly set out in the Report (see Ch 8 Technical Focus F).

ii) Features All relevant details should next be located by reference to the core components or room spaces, usually by reference to each elevation, ceiling and floor. It is important to reference these with a consistent system. A problem often arises when descriptive notes say the 'east face' of a room space. Is this the wall on the east side of the room, or the wall facing east? In itself, it is not too important, as long as a consistent annotation system is devised and kept to by all parties. Often, a numbering system may be safer.

All features will be described on pro-formas, each feature with a unique context number, prefixed by its component number (Ch 5.5). Complex features should be described in terms of their separate constituent parts, ie as combinations of discrete elements, each one of which is clearly defined and illustrated. All items should be clearly located in plan and elevation. Sufficient detail should be recorded to allow analysis of the construction and function of any given feature.

The illustration of features described in the text recording is the primary function of the drawn and photographic elements of the overall programme. With this in mind, illustrations should be annotated showing feature or context numbers where appropriate, along with any additional text to assist with the description and location.

Ideally, such feature numbers are allocated and shown on simple sketch plans of components, prior to the commencement of the drawn record. In this way, the illustrator can add the numbers to the survey drawing. This also facilitates the compilation of a more detailed photographic record. A list of photographs containing individual numbers can be prepared, rather than more general descriptions of what is shown in each photograph.

Any text added to the illustration should avoid over-diagnostic terms, and should adhere to a terminology consistent with other illustrators. All records should be of evidence and not opinion, the detailed analysis of the form and function of features being left to the next phase of the recording process.

5.3.3 Exterior

The exterior of the building or structure should be described in terms of discrete elevations, ideally following a systematic progression around the site. The recording of the exterior of the building should follow the same principles and procedures as outlined for the interior features.

All details will be described as discrete exterior features. Their correspondence with interior features will be established as part of the integration process of the interpretative account. Associations on whatever basis can then be presented as part of the refined database of contexts and illustrations.

Access arrangements for the examination and recording of exterior elevations are often an important issue. For example, where a building is surrounded by scaffolding, access is made easy for the illustration and close examination of the exterior but creates major problems for the photographic record. Ideally, the exterior of the building should be un-obscured, and access gained with the use of movable scaffolding or a hydraulic platform (Ch 5.1 Illus 53).

***

The programme of recording of the site must be obvious, rational, site specific, comprehensive and consistent. This policy must apply to the accompanying illustration programme, be it by survey drawing or photography. The primary products of the work, both account and illustration, should be suitable for project management, analysis and archive. All subsequent work can be assessed after completion of the primary product. This will include specialist input, refinement of illustrations and publication potential.

5.4 THE USE OF BUILDING FLOOR PLANS

5.4.1 Applications in recording

The preparation and utilisation of floor plans has various advantages for the understanding of buildings. The following are some of the main ones:

- Analysis of evidence that is not obvious from other sources
- Presentation of building recording data
- Comparative analysis of buildings
- Integration of architectural and archaeological evidence

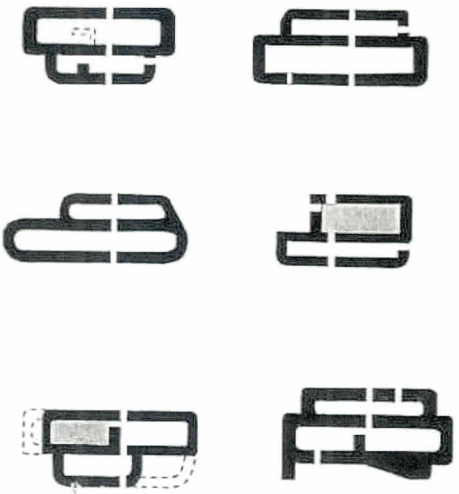
i) As a source of evidence

An accurate building floor plan survey can throw up evidence which may not have been noted in the field and only becomes apparent with the production of detailed plans. The true shape of rooms and buildings can be more fully appreciated through accurate plans.

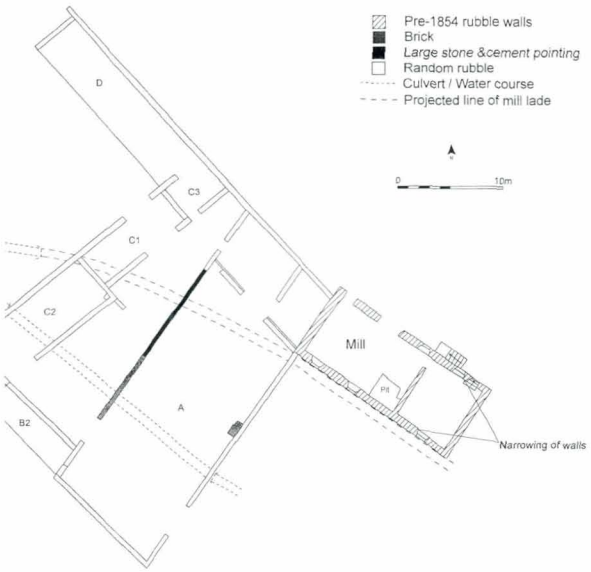
The alignment of buildings and the rooms within them - and their relationship with other topographical features such as roads, boundaries and other buildings - can also have a substantial bearing on the interpretation of structures. Remnants of different phases of building might be highlighted through varying alignments, these being a result of constraints specific to the period in which they were built. The shape of the building, how straight the walls are and how true the corners might also have a bearing on the date of structural elements.

While quite simple in terms of layout, the footprint of the blackhouses at Arnol, Isle of Lewis (Illus 59) clearly show how the plan can be used to interpret the history. Illus 60 shows a selection of blackhouse ground plans, with rounded and square end walls to buildings. The rounded end walls are, in all cases, the earlier in the sequence. As well, the older, multi-cellular buildings stand out clearly from the more recent croft house extensions, with their thinner walls and squared corners.

Illus 59 The remains of a typical Hebridean blackhouse, at Arnol, Isle of Lewis. (Photo: Headland Archaeology Ltd)



Illus 60 A sample of footprints of some of the blackhouses from Arnol reveal differences in form and phasing (Drawing: from Holden & Baker, in press)



Illus 61 Building alignments and straight line joints can be shown on plan, as at Ewingston Mill, Humbie, East Lothian. (Drawing: from Holden, Dalland & Morrison 2001)

Other evidence that can be seen from plans are variations in wall thickness and subtle changes in the plan of intramural features, such as window embrasures and hearths. These can all be used in the phasing of different parts of structures and are therefore invaluable to any interpretation.

ii) Presentation of survey data

Some forms of evidence, while being identified from elevations and other information, can best be illustrated in plan. For example, straight line joints identifying where masonry from two different phases of construction abut each other can most easily be shown as a line across adjoining walls in plan (Illus 61). Similarly, different classes of masonry and phasing can be shown (Illus 62 & 63), thereby providing a further useful interpretative device.

iii) Comparative analysis

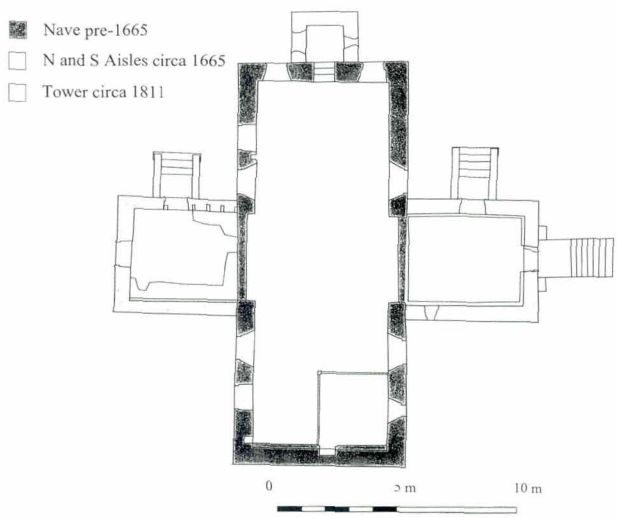
Simple plans of buildings enable rapid comparison of shape and form of different buildings within a group, drawing the eye to points of difference and similarity. These can have a bearing on both the date and function of buildings. This is well exemplified in the footprints of a series of collegiate Church plans (Illus 64), illustrated in *Scottish Architecture 1371 – 1560* (Fawcett 1994).

iv) Integration of architectural and archaeological evidence

On some projects, an analysis of the standing fabric of a building is accompanied by archaeological evaluation and excavation. In these cases, the plan offers an excellent medium to present the archaeological data in conjunction with the building plan (Illus 65). In this way, it is possible to build up a picture of the internal space of the building, with the two complementary forms of evidence throwing up patterns that were previously unresolved.

Archaeological floor surfaces might, for example, help to identify activity areas within structures. Patterns of postholes may elucidate former internal partitions, screens, galleries and the methods of support for upper

Illus 62 Glencorse Parish Church, Midlothian, view of the interior looking west. (Photo: Headland Archaeology Ltd)



Illus 63 The plan can be used to identify different phases of construction and wall thicknesses, as at Glencorse Parish Church. (Drawing: from Low & Dalland 2001)

floors. Conversely, masonry scars on the walls might help to explain truncated but possibly well-dated floor deposits. Features such as soot stains might provide information on secondary usage of buildings.

In all of the above, the value of the plan in its ability to show varying qualities of spatial information makes it an invaluable part of the building recording exercise.

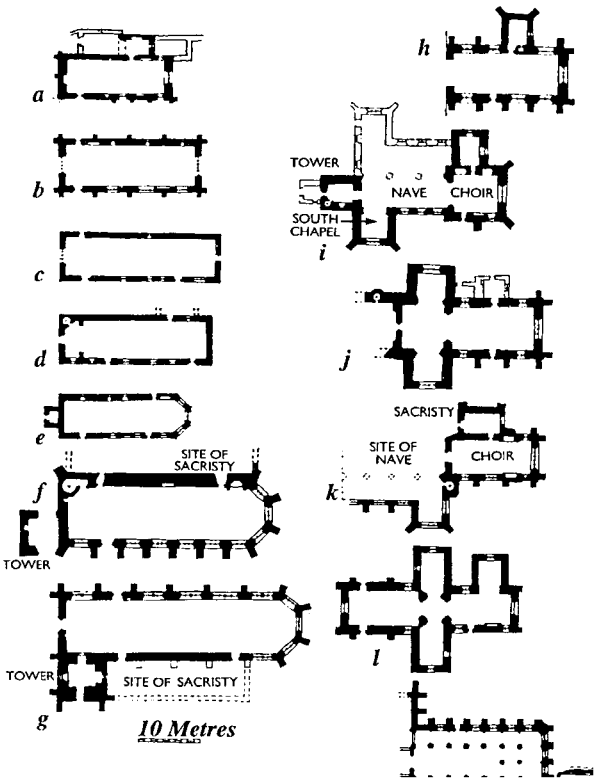
5.5 CONTEXTING

5.5.1 Application of the technique

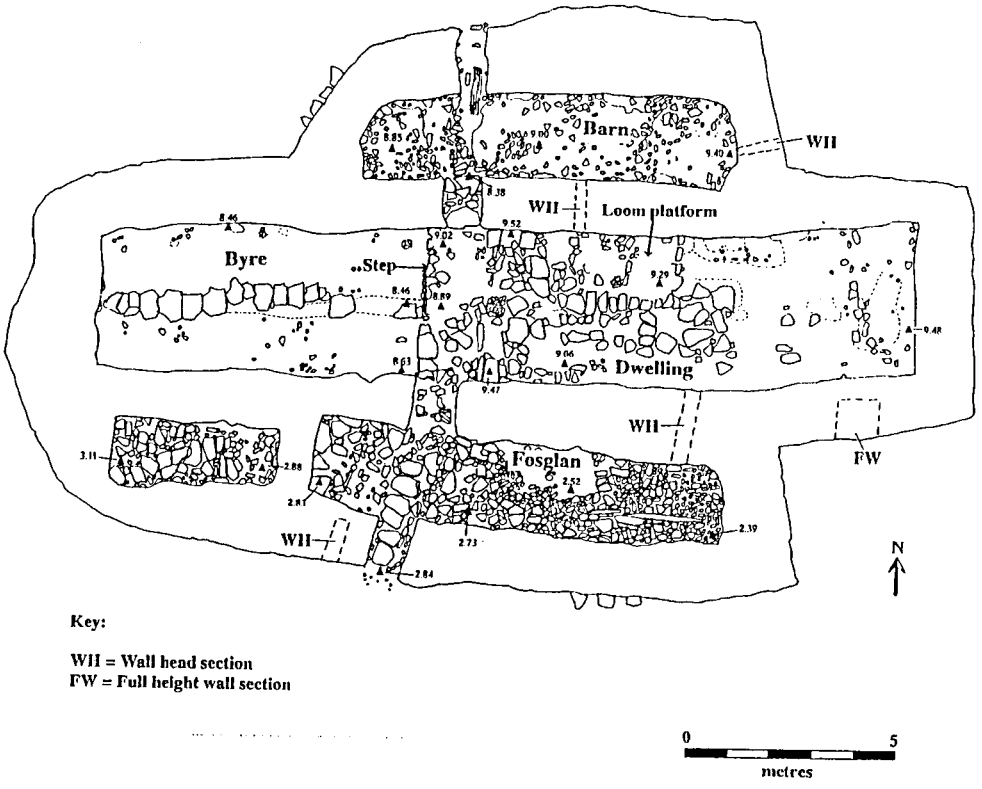
The allocation of context numbers to stratigraphic events is standard procedure on most archaeological excavations, and this in turn has become a tool of building recording. The principal reasons for doing this are:

- To provide a unique reference to deposits and interfaces which can then be described in detail.
- As a shorthand to identify deposits and interfaces and as a system of cross-referencing within the text of the Report or on illustrations (Ch 5.9).
- To facilitate the production of a matrix that can be used to group and phase features into useful units of interpretation (see as well the next section on stratigraphy).

In general, during the recording of standing buildings the same advantages can be gained from the identification of features, interfaces and the allocation of context numbers.



Illus 64 A series of footprints of Scottish collegiate churches, enabling comparisons to be made. (Drawing: from Fawcett 1994)



Illus 65 The architectural and archaeological data combined in plan at No. 39 Arnol, Isle of Lewis. (Drawing: from Holden et al in press)

In the example of Ewingston Old Farm House (Illus 66), as can be seen context numbers have been allocated to the principal features and areas. Further context numbers might well then be allocated to smaller features within these areas. An example of a typical context recording sheet is shown in Illus 67.

It is crucial from the outset of a project to determine the level of contexting and description that is appropriate to the objectives of the project. An inappropriate strategy could result in the collection of large quantities of detailed data that are superfluous to the objectives of the project and expensive to collect.

5.5.2 Examples of use

The density at which context numbers need to be allocated is also a matter of judgement and it is difficult to be prescriptive. The contrasting examples below offer some guidance as to the levels of recording required:

i) A medieval towerhouse - modified and refurbished over a period of 400 years, substantially gutted, little or no surviving timber. For a building of this type, the emphasis might be on the thorough recording of architectural details for the historical record and for the purpose of careful phasing.

Context numbers would generally be given to features such as windows, doorways, vaults, masonry types, masonry scars, quoins, areas of surviving render and to interfaces with insertions and additions. This would enable the construction of a detailed matrix if required.

In some cases it might be necessary to further discuss points of detail, such as features cut into the margins of a doorway that may have had a bearing on the way the door was hinged at different periods. Under such circumstances, it may be useful to give these smaller features individual context numbers that can be located on an illustration and discussed in the body of a Report. The case study on Fenton Tower (Ch 8.5) describes a building of this type.

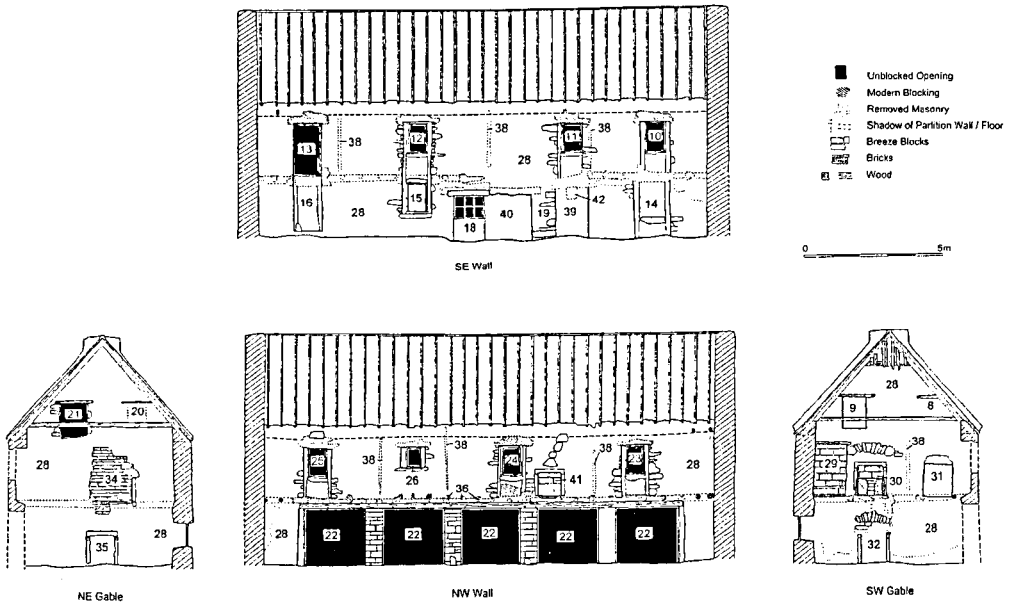
ii) A C19 industrial building – shell substantially unaltered, but with alterations to room usage. The priority within such buildings might be to record the broad historic fabric of the building, with special emphasis on details of features particularly relating to its design and use.

The principle should be followed of individual features being given context numbers and detailed descriptions being prepared. Many industrial buildings do exhibit complex changes and reorganisation in response to technological change over the last two centuries, which may be reflected in structural change.

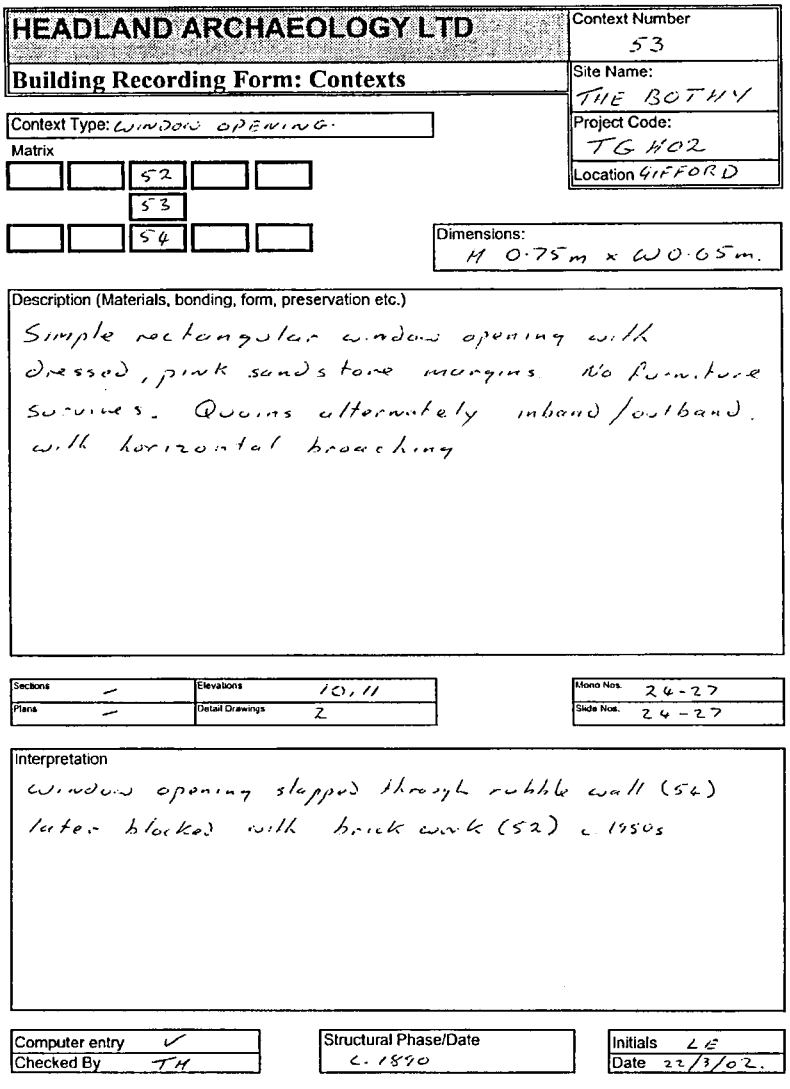
Nevertheless, industrial buildings may not show complicated stratigraphy and may have quite standardised fittings. Thus context numbers might only be assigned to features that were likely to be discussed in the Report text and the production of a very detailed matrix may not be justified. The case study on Bowhouse Munitions factory (Ch 8.3) describes recording an industrial building.

5.5.3 Practical considerations

The context record should be recorded on a standard printed form or pro-forma to ensure consistency of recording (Illus 67). Basic details will be required for all contexts, such as context number, site name, project



Illus 66 Elevations at Ewingston Mill, Humbie, East Lothian, showing the assignment of context numbers on a moderately complex C18 farmhouse (Drawing: from Holden et al 2001)



HEADLAND ARCHAEOLOGY LTD

Building Recording Form: Contexts

Context Number: 53

Site Name: THE BOTHY

Project Code: TG 402

Location GIFFORD

Context Type: WINDOW OPENING

Matrix: 52 / 53 / 54

Dimensions: H 0·75m x W 0·65m.

Description (Materials, bonding, form, preservation etc.)

Simple rectangular window opening with dressed, pink sandstone margins. No furniture survives. Quoins alternately inband/outband. with horizontal broaching

Sections: – Plans: –

Elevations: 10, 11 Detail Drawings: 2

Mono Nos. 24-27 Slide Nos. 24-27

Interpretation

window opening slapped through rubble wall (54) later blocked with brick work (52) c. 1950s

Computer entry ✓ Checked By TH

Structural Phase/Date c. 1890

Initials LE Date 22/3/02.

Illus 67 An example of a typical context record sheet, as used for building recording work. (Headland Archaeology Ltd)

code, location and context type, together with detailed descriptions. Any notes on interpretation should be clearly separated out from factual evidence (see Ch 5.6 Stratigraphy, below). The individual context forms can be used in conjunction with additional forms relating to each building and room.

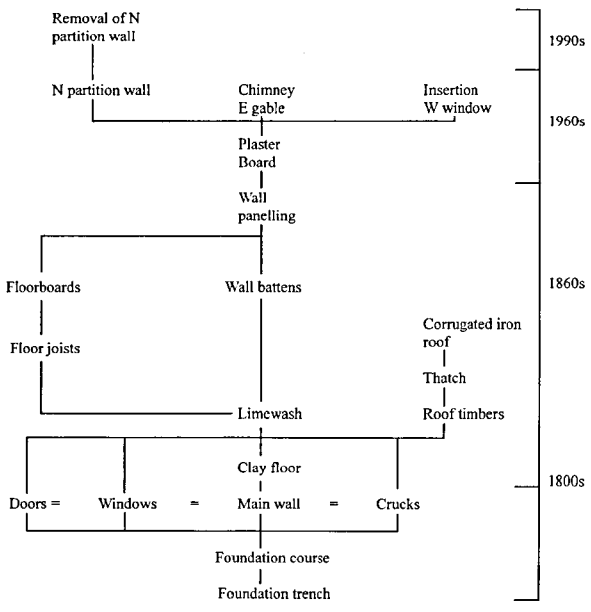
With repeating units, such as window frames or skirtings, it may be sufficient to illustrate and describe in detail just one example of each type. Of course all apparently similar examples must be examined most carefully. Any additional notes on the wall finishes, skirting/cornice types, exposed masonry and raggle lines would then be added as annotations to the drawings. Any annotations can then refer back to the type numbers and detailed descriptions. In graphics packages such as AutoCAD, annotations can be presented in separate layers.

The design of context record sheets is not prescriptive, but certain key information as above must naturally be recorded, such as the name of the site, the location, the recorder etc. For some sites and specific types of information, specialised pro-formas may have to be designed. With the increasing use of computers, data may be logged straight into a hand-held or laptop computer (Ch 6.8).

5.6 STRATIGRAPHY

The principles of stratigraphy, although deriving originally from geology, have been modified and developed for use with archaeology.

The most common system of recording and ordering the complex stratigraphic relationships found on some archaeological sites is by use of the Harris Matrix (Harris 1979). This relies on the allocation of context numbers to all deposits and also to interfaces between deposits that may represent specific events (eg, the cutting of a pit through earlier strata). One of the main benefits of the matrix is that it enables the organisation and presentation of vast amounts of contextual data.



Illus 68 A simple example of a matrix from a typical Highland cottage in Scotland. (Headland Archaeology Ltd)

A building, like an archaeological sequence, is the result of numerous processes resulting from human activity. These activities combine construction, destruction, repair, alteration and reinstatement. Thus the notions of stratigraphic deposition, disturbance and relationships can be applied (Davies 1993). Fabric can be overlain by later fabric and existing fabric can be cut and later fabric introduced. Illus 68 illustrates a simple series of stratigraphic relationships.

The concept of interfaces also applies to standing structures: a demolition or destruction interface is formed when fabric is removed and replaced by later materials. The insertion of a window or a repair to an unstable area would be examples of this. In some cases this interface is easily identified by the introduction of different materials, but where materials are re-used or are of commonly available types such evidence is difficult to identify.

The main aim of stratigraphic analysis is to determine the sequential development of a structure. Davies (1993) identifies seven categories of data relevant to the production of a building sequence.

- Stratigraphic relationships: whether an element is introduced before of after its adjoining elements.
- Building materials: the fabric of which an element is made; the sources from which it was obtained.
- Manufacturing technology of the building materials: the process by which the materials were made or transformed for use.
- Construction technology: the way elements fit together, including their methods of attachment, size and dimensions.
- Direct dates: date plaques, foundation dates, manufacturer's marks, graffiti.
- User wear patterns: the evidence of functions and extent of use.
- Style: architectural form, layout and design, and ornamental detailing.

Where possible, these should be recorded as part of the context descriptions and used along with evidence from comparative analysis, historical sources and archaeological evidence to flesh out the building sequence. Care must be taken over the separation of factual evidence from interpreted conclusions.

The point where building stratigraphy and archaeological stratigraphy tend to diverge is in the treatment of *under* and *over* relationships. In building stratigraphy, it is very common for elements that are physically *under* adjoining elements to be chronologically *later*. Examples might include such things as the insertion of a doorway at the base of an early wall or the addition of a mezzanine floor within a hall.

This type of relationship rarely occurs in archaeology. But in building recording, where evidence is sufficient, inserted features would be put above the chronologically earlier elements in the matrix. This enables the production of a sequence that should chart the development of the building and the order in which it occurred. Sometimes the matrix will identify inconsistencies in the sequence. Resolution of these may highlight observations that were initially missed in the field. For example, a feature such as a timber floor may have been incorrectly identified in the field as a single event. This would be highlighted in the matrix, with the floor occurring in two places in the matrix which is not possible.

Having produced the matrix based purely on the principles of stratigraphy, it is then possible to use historical sources and comparative analysis to groups of events between known dates. In this way the development of the building can be phased with confidence and based upon sound criteria.

TECHNICAL FOCUS E: RECORDING A CLAY BUILDING

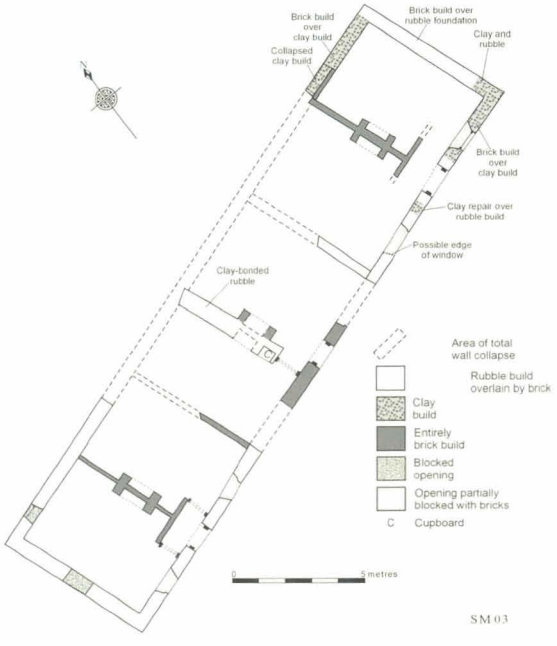
There is a local tradition of clay construction in the Carse of Gowrie, the low-lying clay lands along the north bank of the Tay between Perth and Dundee. A similar tradition exists in parts of Morayshire, Banffshire and Aberdeenshire. Many examples have been lost, but some have been preserved, some are hidden under later renders and roofs, and some remain as ruins, very vulnerable to weathering, erosion and rodent damage.

The remains of a row of clay cottages at Newlands in the parish of St Madoes were recorded in 2001, funded by Historic Scotland. The cottages appear on the 1866 Ordnance Survey, and perhaps on an 1855 survey of the Tay. According to the Valuation Rolls, they may have been converted from two houses to three, c 1889. When they were condemned and abandoned in 1959, they were still roofed with thatch, another local tradition. Some of the last tenants and their relations still live locally (Roy & Perry 2001).

Today the cottages are derelict, roofless, overgrown with vegetation, undermined by rats, cluttered with debris, and partly collapsed. They were surveyed to record the method of construction and to help in the recognition and interpretation of similar structures or traces seen in archaeological excavation.

The survey took two building recorders three days, including site clearance of vegetation. The buildings were measured by theodolite with taping of details (Illus 69) and photographed. The walls showed a great mixture of materials; clay, sandstone, whinstone rubble and brick (also a local tradition), obscured in places by a plaster render, especially inside. Some walls were panelled with boards, and some doorframes survived.

Illus 2 Plan of Newlands Cottages, St Madoes



Illus 69 A site plan of the cottages, with marking up of main materials . (Drawing: SUAT)

Illus 70 A typical view of an external wall, with the original clay construction built over with later materials. (Photo: SUAT)

Three phases were identified. The original building was constructed of clay and clay-bonded rubble, apparently on rubble foundations, probably in the early C19, when land in this area was reclaimed from the Tay (Illus 70). By the mid C19, much of the structure was of lime-bonded rubble, apparently divided into two cottages. This building incorporated the earlier clay walls to the east, and was also repaired to the east with clay. In about 1889 the cottages were re-divided into three, with new partitions, fireplaces and vestibules, mainly in brick. Various openings were blocked up, and walls were repaired in brick, but otherwise the cottages remained largely unchanged until their abandonment in 1959.

Although relatively modern, these buildings represent the final stage of a rapidly disappearing local tradition. They have decayed to the point where restoration would amount to total rebuild, and stabilisation as ruins is problematic with this 'water-soluble' building type.

The combination of historical research, including local oral history, and the very rapid, simple survey was able to record quite a full account of the buildings. This may prove useful in understanding and caring for other buildings in the area. If in time they collapse altogether, a record of their existence has been made.

5.7 TAKING THE SITE INTO ACCOUNT

5.7.1 The linking of building and site

The relationship of a historic building or structure to its site needs consideration from the start of any survey, recording or other appraisal.

A study of the building will inform knowledge of the development and uses of the land around it. Conversely, a study of the building's surroundings may inform the appreciation and knowledge of the building. Just as these are complementary, so are the various strands of information, evidence and skills which will assist in an understanding of the place. A multidisciplinary approach is essential.

Thus, consideration should be given to the site and its associated landscape in recording any historic building or structure. This applies as much to buildings in towns and cities, as to industrial buildings and other categories of buildings such as churches and castles.

The site may include a wide range of features – from archaeology to industrial monuments, rather than being of a single period. In addition, it is likely that site features may be completely unrelated to the building or structure that is the subject of study. For example, there could be previously unknown archaeology pre-dating the current site use, which would be threatened by any building extension or ancillary development.

The studies relevant to understanding a site are thus potentially wide and may involve different disciplines. This section focuses as exemplars on just two aspects – the relationship between the house or castle and its landscape and an industrial example.

5.7.2 Methods of study

Some study techniques are fundamental. Having an accurate and detailed topographic site survey is a major starting point in recording and analysing a site.

As the site is observed in the field, features can be identified and annotated. A measured survey is invaluable in understanding how a site has been modified. Examination of the contours will show whether there is any earth-modelling, connected either with the architectural layout and aesthetics of the site or to accommodate functional needs. Subtle features not readily noted on the ground may show up through the contours.

Early maps and photographs, if available, are invaluable. The collections held in the NMRS are a basic, useful starting point. The availability of some aerial surveys dates back nearly a hundred years, and aerial photographs can provide land-use information, not readily discovered from other sources (NAPLIB 1999). Early maps or photographs may, for example, show long lost buildings on the site.

Illus 71 Raasay House,Raasay, a painting of the landscape by C D'Oyly, 1823. (With the permission of Sabin Galleries, London)

For conservation purposes or for future site development, an analysis of the site is essential for ensuring that an informed range of options is considered. The study of the site may well have direct and practical value. For example, in redeveloping an industrial site, knowledge of long buried foundations may be vital in avoiding constructional problems.

Generally, any significant phase in the building or rebuilding of a property will have been followed by works to its immediate surroundings, gardens or policies. The layout of formal garden features, parterres, footpaths, the sites of garden buildings or walks can be detected using combinations of aerial photography, geophysical survey, parch-marks or field observation. Even traces of flowerbeds may survive.

Where appropriate, a tree survey is a valuable component, assisting in an understanding of the planting development. Both the species distribution and age structure of the planting will inform an understanding of how the landscape was laid out and how it was used. As well as being ornamental, amenity trees may be vital in providing shelter, as at Raasay described below.

Analysis of a tree survey may also indicate changes in the landscape layout, with remnants of earlier planting schemes superseded by deliberate change or change resulting from natural regeneration. Thus, consideration of the earth-modelling and planting structure in the Newhailes topographic survey clearly revealed the form of the early C18 walks and groves (see Ch 8.2).

5.7.3 Examples

A primary consideration should be an appreciation of the building's site and location, in terms of its topographical relationship to the surrounding landscape. Each building will exploit its site according to its design, function and needs, from the defensive position of a castle to the more subtle siting of a country house, taking advantage of a specific view or elevated position.

i) Raasay House, Skye

Of particular interest is the idea of a 'borrowed' landscape where a house may be sited to take advantage of its outer, surrounding landscape. A particularly spectacular and skilful use of this is at Raasay House, standing at the head of Churchton Bay, Raasay. From its south front, a superb panorama opens out onto the open sea, across the Narrows of Raasay to Sconser on Skye (Illus 71). This view is enclosed by the Cuillin Hills, their profile and range best appreciated from this distance. From the House itself, the open sea appears totally enclosed by the hills.

This dramatic landscape was amplified by being deliberately framed with flanking plantations, planted so as to splay slightly outwards to accentuate the perspective. The trees extended to the sea on either side of the front lawn framed by the surrounding hills. The idea of a borrowed landscape is not confined to rural sites. In towns, prominent civic buildings, churches and monuments are often used to terminate streets and vistas. Thus the setting of a building may be integral to its design, its history or our experience of it.

ii) Dunbeath Castle, Caithness

The manner in which a building was *approached* may reflect both its architectural style and relate to its development. Dunbeath Castle, dating from the C15, sits on a cliff-top promontory in Caithness (Illus 72). A defensive site was probably located here well before the existing castle.

While not systematically surveyed and researched, available map evidence indicates that, by the mid C18, the castle was set within a formal designed landscape. This was laid out to complement its dramatic situation and elaborate upon its defensive nature. A formal avenue was planted, cutting across a pre-existing field pattern, and laid out to focus on the north entrance front of the castle.

Illus 72 An aerial view of Dunbeath Castle from the sea, showing the alignment of the formal designed landscape with the Castle. (Photo Crown copyright: RCAHMS)

A doocot was built to terminate the northern end of the avenue, and two square enclosures were laid out to either side of this main approach, on the site of existing walled gardens (Roy, 1747-55). It was perhaps at this period that the Castle moat was filled, so as to connect the castle on its rock promontory with the mainland. When D & J Bryce came to remodel the building in c1881, it was given a symmetrical northeast front. This is unusual in Bryce's work and was probably influenced by the strong, axial, approach drive.

As noted, a prime phase of building or remodelling of a building will often be followed by a phase of landscaping. Sometimes where the re-orientation of the entrance front is concerned, there may be major changes. However there are instances where site-works associated with the layout of a landscape took place alongside the building, or even in advance. Documentary sources, estate plans and maps may all assist in knowledge of the sequence of events.

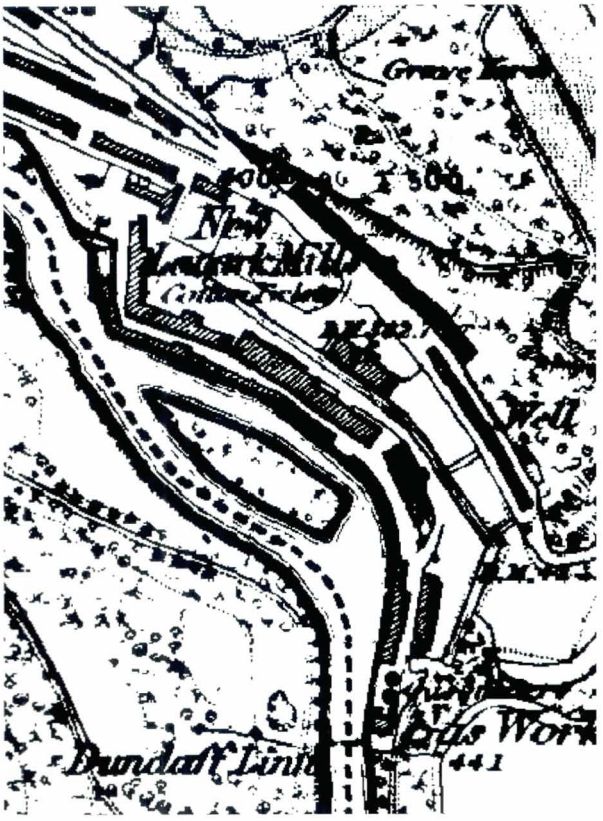
iii) New Lanark, Lanarkshire

The benefits of considering the site in relation to and as well as the building itself can be well illustrated by the study undertaken in the nomination and subsequent designation of the New Lanark World Heritage Site, a major industrial monument (Historic Scotland 2000).

The industrial model village, world famous for its innovative economic and social development, is reliant on its siting, finding its raison d'être in the tremendous waterpower to be harnessed from the River Clyde. In 1784, David Dale, the Glasgow textiles entrepreneur, and the industrial spinning pioneer, Richard Arkwright, identified the location as ideal for industrial development, due to the head of water provided by the Falls. The village is sited just below the Falls of Clyde and 130 metres below the level of the town of Lanark (Illus 73 and 74).

The linkage of the river to industrial mill buildings to workers' houses to schools and other communal buildings is vital to an appreciation of the site, for no one part of it can be properly considered without reference to another. The wider landscape in turn has a range of features, all linked to the exploitation of the Clyde waters. For example, immediately upstream of New Lanark, on the Bonnington estate, there are the remains of the earliest known building in Scotland specifically sited for the enjoyment of nature.

Illus 73 New Lanark mills and model village from the air. The source of the motive power, the River Clyde is seen on the left. (Photo Crown copyright: RCAHMS)



Illus 74 A plan of the New Lanark site from the C19, which can be compared to Illus 73.

5.8 DOCUMENTATION

5.8.1 The range of sources

The principal source of evidence in building analysis is always the structure itself, but crucial information can be provided by a variety of other sources.

These can include documents and other forms of primary evidence, the oral evidence of individuals with local knowledge, and pictorial evidence including maps, drawings, prints and photographs as well as architectural plans. Secondary evidence including previous descriptions and published analyses of a building should also, of course, be assessed where available.

In general, in conducting a detailed building analysis, all relevant forms of information about the building should be assessed in detail. In archaeological terminology, this study of material off site is often referred to as a 'desk top assessment'. The following description largely concerns sources of information in Scotland, but similar sources may be located elsewhere.

5.8.2 Documents

The detailed study of documents can often throw new light on the history and development of buildings, even those which are thought to have been subject to scholarly consensus. Ideally, skills in interpreting documents of varied periods may require knowledge of palaeography (the study of handwriting), and often languages in addition to English.

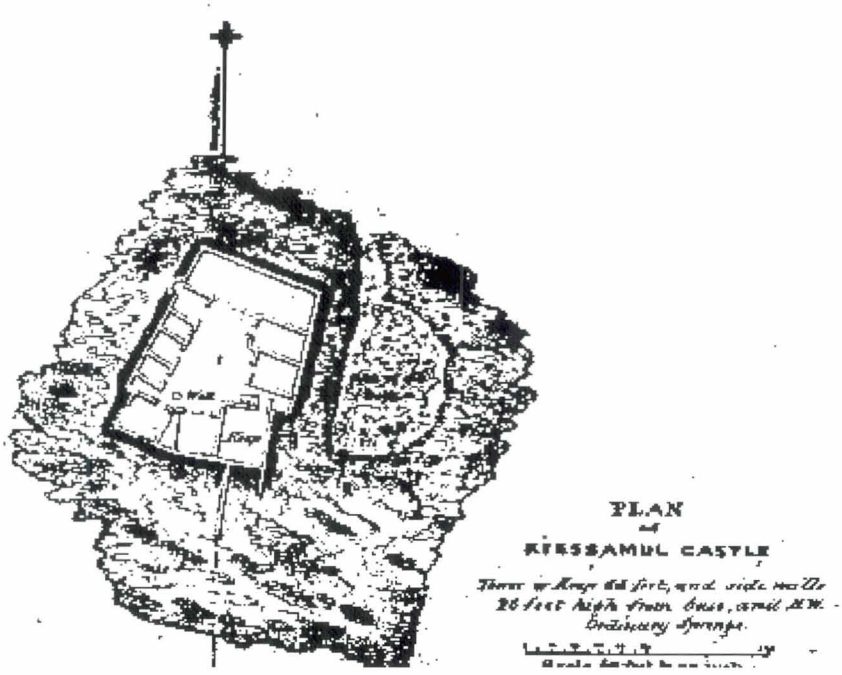
These include Latin and its non-standard variations (for the medieval and Renaissance periods) and Scots (for Renaissance and post-Renaissance buildings). For some specialist areas, such as documents relating to royal buildings of the C16, a knowledge of French, and the ability to understand non-standard conflations of different languages and common contractions, is a definite advantage.

Documentary evidence can take a variety of forms including building accounts, receipts, private journals, estate papers, letters and legal material such as title deeds. The last can sometimes provide a surprising amount of architectural information. This is often the case, for example, with some title deeds relating to properties in the New Town of Edinburgh.

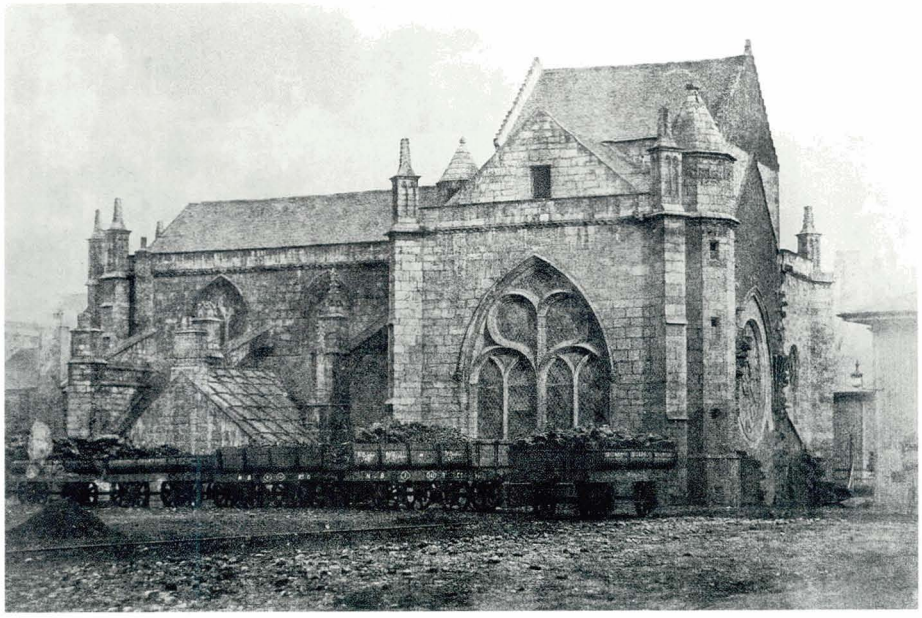
Sometimes archival material can shed light on the people for whom a building was constructed, or on the identity of its designer. This was the case, for example, with a recent survey of the Glenfinnan Monument. Investigation of a cache of documents in the National Archives of Scotland (previously the Scottish Record Office) by RCAHMS revealed detailed information about its patron, Alexander Macdonald of Glenalladale, as well as the name of its architect, James Gillespie Graham.

5.8.3 Plans

Original plans, where available, can usually help to clarify aspects of a building's origin or inception, intended primary form or later alteration. They are not always sufficient in detail and accuracy to be used as they stand in detailed structural analysis, but can form a basis for further investigation (Illus 75).



Illus 75 An early plan of Kisimul Castle, Barra, incorporated as a vignette in a larger map of the Western Isles. (Crown copyright: RCAHMS)



Illus 76 Trinity College Chapel, Edinburgh, demolished to make way for the railway. Indeed, railway wagons can be seen in the foreground. An extremely early photograph, c1849, known as a 'calotype'. (Photo: The Royal Archives © Her Majesty Queen Elizabeth II)

Owners of the building may hold plans, and they may also be found in collections such as the National Monuments Record of Scotland (NMRS). Dean of Guild plans may be held by Local Authorities and in county record offices. Amateur drawings and sketch plans, such as those drawn of various Scottish monuments by the Rev. John Sime in the early C19, which are now preserved in albums held in the NMRS, can provide useful information.

5.8.4 Photographs

Other forms of pictorial evidence should also be investigated. Photography is now over 150 years old, and photographs can often provide valuable evidence of the appearance of a building at an earlier period – or of a building which has been demolished.

An example of this is the magnificent C17 buildings of Old College, Glasgow, removed to make way for railway improvements. These are recorded in an extensive series of photographs taken in the later C19 and now held by the Courtauld Institute of Art in the University of London.

In the early days of photography, due to the long exposures required, static subjects such as buildings were often chosen. There are many highly informative architectural images from this period. Examples include the numerous calotypes of Edinburgh, taken by D O Hill and R Adamson in the second quarter of the C19. These show such subjects as Trinity College Chapel and Lady Glenorchy's Chapel, both demolished to make way for the railway (Illus 76).

5.8.5 Artists' images

It is also important to assess the value of any artists' images of a given building. These might be paintings, drawings or printed images, such as engravings or etchings. Although artists' images are not always accurate guides to visual appearance, where a number of different works showing the same building survive, they can provide corroboration of features now lost.

This was the case, for example, with a recent analysis of Falkland Palace, where a number of different artists' images of the building were 'pooled' and allowed lost features of the building to be determined. These images included engravings after R W Billings and J Slezer, both of whom produced numerous published prints that illustrate Scottish architecture (Illus 77 and 78).

In the case of Falkland, other diagnostic images included paintings and drawings in the collections of the Scottish National Portrait Gallery, Edinburgh, and in the British Museum, London, as well as engravings published in early local histories.

5.8.6 Secondary sources

Secondary published sources such as gazetteers (eg, the two series of *The Statistical Account of Scotland*), guidebooks, along with scholarly articles and books, should be consulted for relevant information and for opinions on matters such as dating and interpretation. A useful start point to investigate these sources is the online catalogue of the National Library of Scotland (NLS), which provides many references. The NMRS library should also be consulted.

Illus 77 Falkland Palace, as illustrated by John Slezer in his 'Theatrum Scotiae', published c1693 (Cavers 1993). (Crown copyright: RCAHMS)

Illus 78 A contemporary photograph of Falkland Palace, approximating to the same view, for comparison with Illus 77. (Photo: Crown copyright: RCAHMS)

Information may also be provided by the RCAHMS *Inventories of Monuments* and the RIAS *Buildings of Scotland* series. In addition, large-scale maps, especially the Ordnance Survey First and Second Edition maps produced in the second half of the C19, can provide useful information. These can be consulted on microfilm at the NMRS. The rough date of a building can sometimes be deduced from its inclusion or omission from a map of a given date.

Other useful published sources include two series of books published in the late C19 – one on ecclesiastical architecture and one on castellated and domestic architecture – by D MacGibbon and T Ross. Information on named architects may be found in H Colvin's *Dictionary of British Architects* and in the 'artists' catalogue held in the NMRS.

More specialist information may be found by consulting journals such as the *Proceedings of the Society of Antiquaries of Scotland, The Antiquaries' Journal, Archaeologia* and *Architectural History*. Local history and antiquarian journals, many of which are produced to a high standard, can also be a useful source of information on specific places or monuments.

5.8.7 Oral evidence

The oral evidence of individuals with local knowledge can also be useful, especially where no relevant written sources survive. Such evidence includes the oral testimony of people who were involved in the construction of a building, in its use, or who have particular knowledge, passed by word-of-mouth, about

its history or use. This can be particularly useful when researching rural properties such as crofts or farmsteads.

5.9 THE REPORT AND OTHER DELIVERABLES

5.9.1 Conveying the findings

What can the client or commissioning body expect to receive following the completion of a recording project, and in what format will the deliverables arrive?

This is largely dependent upon the specification for the project, the methodologies adopted and the nature of the historic building or structure itself. Assuming there has been a significant element of measured survey, corresponding to the building investigation, and a certain amount of documentary study, the client or commissioning body might expect to receive all or a number of the following elements.

Whatever the project, it is clearly essential that all information be properly and clearly presented in an accessible form. This is particularly important with building recording – with a building in use, access to the data should be as easy and flexible as possible.

5.9.2 The survey drawings

Drawings may be supplied at a variety of scales, usually ranging from 1:10 (details) to 1:200 (site plans, elevations). The measured survey drawings are today generally processed through a CAD package (Ch 4.5).

For a small project, it may be sufficient to include the site drawings (plans, sections, elevations, architectural detail etc) in the Report. For large scale projects (such as Auchindrain Township,Argyll, Ch 8.1) this may not be possible, and it may prove necessary to have separate bound volumes of the site drawings (Illus 79).

The digital supply of drawings and other data will be expected and CD ROM is the favoured format. For some projects the client may also prefer drawings to be produced onto stable plastic or Mylar-based drafting film. Hand drawn illustrations will be supplied on the medium specified, but thought should be given to the best method of reproducing such drawings from the chosen medium. For Auchindrain, hand drawn illustrations such as axonometric views were largely based upon the 3D CAD drawings.

5.9.3 Context records

The project database or context records comprises the collation of the field notes, often again presented in digital format and often in a database program such as Microsoft 'Access'. The record sheets are usually presented in an A4 pro-forma format, so they can easily be printed off (Ch 5.5).

The digital context records may have links to corresponding photographs. At Auchindrain, the link also allowed the site drawings to be accessed. In this instance, the link was initiated through the drawings, rather than through the context record sheet. The client was able to open a drawing, select a feature number, and via the link access the relevant record sheet.

5.9.4 Photographic material

All procured photographic material will normally be supplied. Following recent improvements in the resolution of digital cameras, there is a growing tendency for digital photography to be specified within the brief, and for the subsequent delivery of this to be in digital format. More traditional photography has however not been completely superseded, and 35mm format monochrome and colour transparencies are still a basic requirement of most projects.

Traditional photographic prints, especially in larger sizes such as A4, can be expensive. The client should always take care to specify when prints are required rather than contact sheets, the number of sets to be produced, or whether the film images should be scanned onto one of the photographic CD formats.

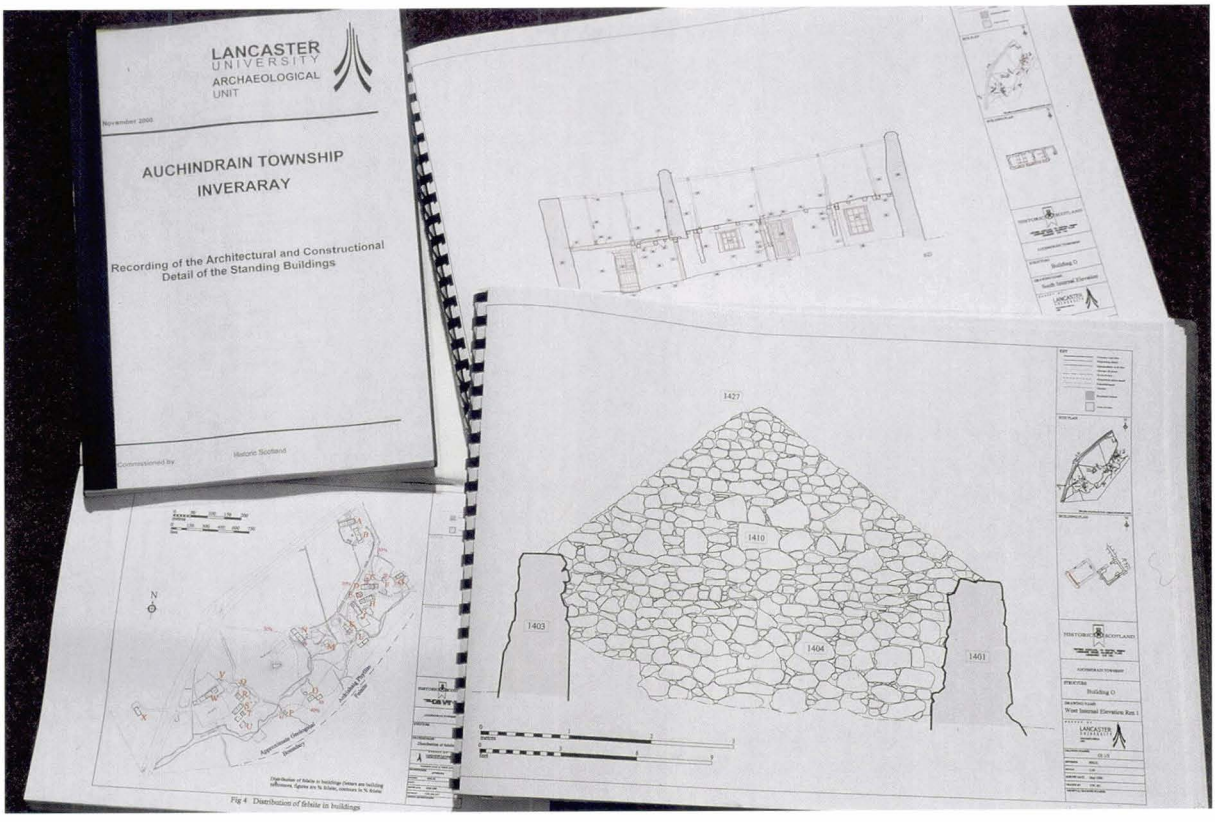
With digital storage, it is becoming common to have a small printout (approx 100mm x 70mm) of every image made, possibly in a separate volume. If more detail is required, the digital original can be consulted. The final choices will be influenced by the proposed function of the photographic record, for instance as a working aid or archive material.

5.9.5 The Report

The Report comprises the body of the results of the project, for example that prepared for Auchindrain Township (LUAU 2000) as described in Ch 8.1 Case Studies. It should contain relevant copies of photographs, illustrations, tables and technical appendices. It would normally be bound and divided into appropriate sections, as described below (Illus 79).

A digital copy is now usually submitted, to allow it to be reproduced at the client's convenience and to act as a back up. Today, this is most commonly on CD ROM, particularly if the survey comprised a large quantity of drawings and photographs. The use of Adobe 'Acrobat' PDF format can be very convenient, although it does not offer quite the flexibility of having the presentation in formats such as word processor files.

Unless the requirement is a purely photographic survey, the main component of most projects is likely



Illus 79 The Report and volumes of survey drawings generated by the Auchindrain Township project. As well as sections of text, the Report contains key photographs, selected survey drawings and listings of the documentation. While all survey drawings are available as digital data in AutoCAD, several hard copies at A3 format were prepared as shown. (Photo: Historic Scotland)

to be the Report. The contents of the Report will reflect the requirements of the project brief and design, and to some extent be influenced by the judgement of the author/contractor. There is a recognised number of elements that should be contained within a Report. The following are as prescribed by the Institute of Field Archaeologists (IFA 2001), and reproduced from that document with full acknowledgments:

Non-technical summary

This should outline in plain, non-technical language, the principal reason for the work, its aims and main results, and should include reference to authorship and commissioning body.

Introduction

This should include the scope of the project, circumstances and dates of fieldwork, acknowledgements and a brief archaeological, historical, topographical or technical background to the site.

Site description

Description of the structure, building or complex as found including archaeological interpretation of sequence, construction or function, use of materials. The description should use terminology appropriate to the architecture of the period. The results of any associated below-ground archaeological work should be incorporated into the site description.

Aims and objectives

These should reflect the aims of the brief, specification or project design.

Methodology

The methods used, including detail of any variation to the agreed project design or specification should be set out carefully, and explained as appropriate.

Documentary research

Presentation of map, pictorial, documentary or other research, setting out implications of source for understanding the archaeology of the site and its ability to inform.

Analysis and interpretation

Analysis and interpretation of the site, drawing together documentary, archaeological, technical, dating and other sources including a summary of specialist contributions in a description of the development and function of the site through time.

Development or other impact (if appropriate)

Implications for the archaeology of the site of any development, repair, demolition or management proposals.

Conclusions

A summary of the results of the work, placing the site in its context (local, regional, national, international, archaeological, historical or technical in terms of setting, origin, purpose, form, construction, design, materials or status). The section should include a statement on the reliability of the sources or any limitation imposed on the work. Recommendations on further work may also be required, but in most cases within the planning framework this will be the responsibility of the relevant planning archaeologist/ conservation officer or curator.

Appendices

These should consist of essential technical and other details to support the conclusions, and may include for example, a copy of the project design, a table of individual archaeological contexts (if used or gazetteer of site components), details of supporting technical or dating work, specialist contributions in full, summaries of sources, copies of documents, project archive catalogue, list of consultees, index to site codes.

Illustrations

Illustrations including modern location map, site survey, as-found drawings, detail drawings, interpretative drawings, analytical drawings, record photographs and copies of relevant historic sources (e.g. historic OS, tithe and estate maps, historic illustrations). These may be within text or at the end, or where needed for site purposes in an attached pocket. They should be clearly numbered and easily referenced.

Bibliography

A list of all primary and secondary sources, including maps and illustrations if not referenced elsewhere.

Other

Contents, disclaimers (IFA 2001).

5.9.6 The project archive

The final element of deliverables to be dealt with here is the project archive. This represents the collation and indexing of all the physical data and material gathered during the course of the project. This could include for example field survey drawings before fair drawing and hand written context sheets before being transcribed to digital format. As such, future researchers may wish to study this primary material.

Whenever possible, this is usually deposited with an appropriate repository, such as a county record office or the NMRS rather than the client (Ch 9.12). This makes it more available for future study and comparison with other similar buildings. The archive should be compiled to the standards laid down by Historic Scotland/RCAHMS (Historic Scotland 1996).

TABLE 3: CHECKLIST - CARRYING OUT A RECORDING PROJECT

The exact detail and procedure to be followed will naturally depend on the circumstances of the project and the availability of personnel etc. This table has been prepared to assist with scoping a recording project. **Please photocopy.**

REQUIREMENT	TASK COMPLETED/ SERVICE NEEDED	CHAPTER REFERENCE
Assessment of requirements:		
Inspection by Client project team or specialist		5.1
Define requirements in Project Brief		9.2
Prepare terms and conditions and specification		9.2
Inspect received Project Design(s)		
Appoint contractor		9.4
Items of recording required:		1.4, 5.0, 6.0
Measured survey products:		4.0
- Schedule of plans, sections, elevations		4.0, 5.4
- Topographic survey of site		
NB Will these be prepared in house or by survey company?		4.0
Feature contexting		5.5
Measured drawings of details, eg mouldings		6.5
Photography - in house/external		6.7
Materials sampling/analysis		6.1
Special records, eg surfaces, NDI		6.4
Define scope of documentary research		5.8
Define scope of analysis phase		5.6, 7.3
Site procedures:		
Assess access requirements		9.5
Consider interaction with other works on site		9.2
Assess safety requirements		9.5
Prepare Health & Safety statement		9.5
Prepare Risk Assessment statement		9.5
Prepare flowchart of programme		
Will outside experts be required:		
Materials		6.1
Documentary research		5.8
Others		
How are records to be made/prepared:		
Measured survey methods		4.0
CAD/digital data		3.7,4.2,4.5
Photography, conventional/digital		6.7
Context records, hand written/digital		5.5
NB Some of these matters may be specified		
Is a watching brief phase required:		6.6
Before/after main recording contract		6.6
Is the documentation correctly in place		6.6, 9.2
Are special safety precautions required		9.5
Deliverables required:		5.9
What formats, materials, numbers		
- Survey drawings		
- Photography		
- Context records		
- The Report		
- Other material, eg interpretative drawings		

6.0 RECORDING METHODS – DETAIL TECHNIQUES

This chapter continues the description of the methods and techniques used in recording, with an emphasis on more detailed and specialist techniques.

6.1 BUILDING MATERIALS

6.1.1 The range of materials

The range of materials found in buildings is surprisingly wide. Initially, one thinks of stone and bricks, but glass, slate, corrugated iron and traditional materials such as thatch and turf can be important building materials. In carrying out a building recording exercise, a record and analysis of the component materials of the building is one of the most important activities of all.

Indeed, the field is so wide that a whole volume could easily be devoted to just this topic. Rather, the purpose of this section is primarily to list the principal materials which may be encountered and to provide some notes on their significance in building recording and analysis. The materials used also exhibit significant regional differences, so the geography, geology, economy, available resources and culture can all affect the range used in any one building. References to texts which can be consulted are provided below.

With some materials, additional specialist input may be needed to provide information regarding the source of the material, its age and how it was made. A knowledge of the exact nature of a material, such as stone types, can often also be practically important to the architectural conservation work, which may be associated with the building recording exercise.

The following represent some of the main types of materials that might be encountered in Scotland.

6.1.2 Walling materials

The material used and the constructional form of walls will clearly be of the first importance. Many different materials have been used, but by the C19 stone was by far the most prevalent material (Illus 80). Immediately prior to this, particularly in rural locations, stone construction was restricted to prestige structures, such as religious buildings, castles and tower houses.

A large percentage of the population lived in timber-framed buildings and although the foundation courses may have been of stone, the upper parts of the wall were of turf, claywall and earth (Walker & McGregor 1996). In much of the Highlands, these were built over a framework of wickerwork and were known as creel houses. There are no known surviving examples of this type of building. They are known only from written accounts and from the outlines of their walls in abandoned clearance townships and other deserted settlements.

Illus 80 Random unmortared stone walling with corrugated iron above, used in the construction of a C19 barn at Auchindrain Township, Argyll. (Photo: Ross Dallas)

Examples of other types of earth structures do, however, survive within standing buildings. It is often possible to identify the source of the materials used and to identify, through their composition, the nature of the mixtures used. In view of the poor survival of earth structures and their importance in the past any examples are of considerable interest to building historians (Ch 5 Technical Focus – Recording a clay structure).

Given the ready availability of the raw material, the late adoption of stone into ordinary buildings is perhaps surprising. This is especially so when considering the expert dry-stone tradition seen in brochs, chambered tombs and at settlements such as Skara Brae, Orkney. In buildings such as the Lewis blackhouses, the drystone tradition gives all the appearance of antiquity with their battered stone walls and earthen core.

However, even here the universal use of stone appears to be a recent phenomenon instigated by the improving landlords.

It is only with the improvement of transport, land tenure agreements and the zeal of the improving landlords and town councils that improved masonry structures became more commonplace. Many ideas developed in the prestige buildings were copied in their more humble counterparts. Materials may also decline in use - as with the use of clay and later on lime mortar, timber frame construction declined.

Mortared masonry walls and newly-fashioned gables were fully able to bear the weight of the roof. Many masonry styles were employed, depending on the materials available. Squared, snecked and dressed stonework was all used, often of the highest quality (Illus 81). Rubble stonework was extremely common, especially in the less prestigious buildings or on their less visible parts (Illus 82). An analysis of the geology of the stone types used is often an important element in the recording exercise.

Illus 81 Ashlar stonework of the highest quality at Charlotte Square, Edinburgh (see Ch 1.8, for a drawing of this elevation). (Photo: Ross Dallas)

Illus 82 Random rubble walling at the rear of the same building in Charlotte Square. (Photo: Ross Dallas)

The finishing, or weathering coat, on these masonry walls can dramatically alter the character of a building. It is also remarkable how quickly the evidence can be removed over time by the elements. Limewashes, harls and renders have all been used with regional variations apparent (Scottish Lime Centre 1996; Whitfield 2000). For example, dressed stones at the window margins or quoins were sometimes left unharled, other times they were covered. On some buildings, colourants were added to the finish providing a dramatic effect.

Since the beginning of the C19, brick and corrugated iron were used more frequently. Structures such as schools and chapels, built primarily of corrugated iron and occasionally with stone gables, have become a distinctive feature of the landscape.

Scotland has relatively few brick buildings, at least externally, probably because of the readily available supply of stone. Brick is most common on industrial buildings, although some outhouses and rural buildings were constructed in the material. Brick farm chimneys are particularly common. Other walling materials such as railway sleepers are also familiar in places.

6.1.3 Roofing materials

Prior to the C19, the most common roofing material in both rural and urban locations was thatch. Numerous materials have been used for thatching, of which turf, heather, cereal straw, marram grass, bracken and broom are perhaps the most regularly encountered (Walker *et al* 1996). Sometimes clay and other additives were incorporated to improve water resistance or to act as fire retardants.

Most surviving thatched roofs are now preserved beneath corrugated iron (Illus 83 & 84), which took over as a relatively cheap and popular option for roofing (Ch 8.1 – Auchindrain). In cases where the thatch was left beneath the iron, this provided extra heat and sound insulation. This thatch is a unique archaeological resource that should not be overlooked (Holden 1998).

In places with good availability of flagstones - such as Caithness and Orkney - they were commonly used for roofing, sometimes in combination with thatch. Flagstones were also sometimes exported for use on higher status buildings. It is of interest that archaeological excavations at many ruined medieval and post medieval buildings frequently reveal no evidence of roofing materials. The poor survival of these materials must be because they were organic in nature and have since disappeared. Also, being more valuable and accessible, they may possibly have been re-used elsewhere. Thatch could have been used but a more plausible material might be wooden shingles or 'skalie'.

Illus 83 Sampling of a thatched roof, preserved under corrugated iron at Sunnybrae Cottage, Pitlochry. (Headland Archaeology Ltd, photo, Historic Scotland)

In more recent times, slate became the most widely used roofing material, with Scottish, Welsh and less frequently Westmorland slates all being used (Whitfield 2000). The use of pantiles flourished in the C18 and C19, providing a most distinctive roofing material in regions such as the Lothians.

Illus 84 Timber roof construction in a dwelling, now covered in corrugated iron, at Auchindrain Township, Argyll. (Photo: Ross Dallas)

The roofing materials were generally supported on a timber framework (Illus 84), although other materials such as whale bones and ironwork are also found. The nature of the materials used and the style vary considerable from region to region, depending on availability and status. In areas where good timber does not grow or was too expensive to transport, scrub and driftwood were employed. Elsewhere, cruck framed structures or elaborate timber frames might be constructed.

The basic framework should be recorded by the building recorders. In addition, notes should be made of such features as the type of joints used, whether the timber was sawn or hewn and the presence or absence of carved construction and other marks. The identification of species can be made and dendrochronological dating undertaken (Ch 6.3).

6.1.4 Flooring

As with the other elements, flooring materials vary from region to region and with status. Clay and beaten earth floors are common in many traditional buildings. In some places very little in the way of floor preparation seems to have been undertaken. Flagstones and cobbled surfaces were used, where available, with tiles and brick being restricted to higher status buildings (Illus 85).

Illus 85 Exposed local flags, revealed during an excavation of a croft house, Brotchie's steading, Dunnet, Caithness. (Photo: Headland Archaeology Ltd)

Dampness was a common problem in many Scottish buildings and both internal and external drains were required to combat this. In most later buildings, suspended wooden floors became the norm so providing an added level of comfort.

6.1.5 Recording the materials

In recording and analysing the constructional material used in a building, the building recorder will systematically note the position, extent and nature etc of the materials. This will be done using the various tools such as context pro-formas, photography etc, as described. The locations of the materials will be annotated onto the plans, sections and elevations of the building.

In this way, a picture is built up of how the building was constructed and indeed altered. The significance of the different materials used will play a part in the overall analysis of the structure. In addition, the building recorder's record and conclusions should feed back to the conservation process, to ensure for example that repair techniques and materials match carefully to original forms.

Of necessity, the above is only a brief review of the field. Because of the importance, indeed fundamental nature of the subject, a number of references are given below.

REFERENCES

There are a number of texts which provide details on materials used in Scottish construction. In the first instance, there are several books that can point the reader in the general direction, such as Fenton & Walker (1981), Maxwell (1996) and Naismith (1989). Riches & Stell (1992) contains a range of articles on many of the topics discussed. The Historic Scotland '*Guide for Practitioners*' on rural buildings of the Lothians (Whitfield 2000) contains much useful information. For more detailed research, the bibliographies (and other publications) of the Scottish Vernacular Buildings Working Group (see Useful Addresses) are excellent sources of information, for example Dunbar & Hay (1984) and Fraser (1987).

6.2 ARCHITECTURAL DETAILS

6.2.1 The significance of detail

In any recording exercise, an understanding and appreciation of the architectural forms and details encountered is of great importance. The starting point therefore is to appreciate that a building, no less than a paper or manuscript, is a primary historical document which holds the capacity to inform.

Architectural detail can constitute the key interpretative or diagnostic elements of a structure. Thus it is central to the interpretation and understanding of buildings, their place in cultural history and their demonstrating changing ideas over time.

In this necessarily brief section, it will not be possible to describe more than the broad processes or principles for addressing the potential of details as conveyors of evidence. The reader should therefore consult the general references, and also Ch 6.5 on fixtures and fittings.

6.2.2 General principles

A building might be a single period set piece or may have developed incrementally. In each case, consideration of architectural details can help provide fuller understanding of the building's uses and planning, and the provisions made to serve the functions which brought about its creation.

Broadly, for few but the newest buildings are alteration free, these two categories present different tasks. The first tends to require straightforward documentation of the existing form, whilst the latter demands construction of a chronological framework. That is, an analysis is required, combining external and internal inspection, examination of detail and study of documents and plans, with the aim of identifying a building's developmental history. In this short review, the emphasis will be upon this latter category. As it provides a valuable model, it will focus mostly upon the relatively early origin Scottish elite stone built house.

Crucial to the effectiveness of the process is the recorder's care to identify, analyse, date and then document *architectural detail,* as distinct from general views and plans. If the understanding of a building is to be maximised, the perhaps hidden complexities in its makeup may be decipherable only by analysis of successive layering of detail. Such detail may often be concealed by successive generations of owners or occupiers, whose interventions rendered obsolete previous phases of a building's existence, whilst retaining the building.

6.2.3 Walling - features

A start point is to consider the builders' intentions. Were additions intended to be explicit - or as at Dalkeith Palace where a south-facing mansion was made by scooping out the old and building a new show front - was the intention to conceal recycled walling from ready view?

Detailed wall analysis may only be possible on the occasion of removal of external harl or render and internal plaster in order to expose less evident features to view. Re-modelling or updating of buildings might have caused openings to be altered, perhaps blocked, or made smaller or larger.

Normally, dressed stonework gives a clue to date, if only by means of its surface tooling detail (Illus 86). For example, a light peck-marking was popular in the early C17; prominent horizontal droving from the late C18 until the mid C19, when stugged and snecked long and shallow stones became fashionable. (see References)

Where walling was heightened or extended horizontally, this is often decipherable through the evidence of details. Thus, use of stone from a different quarry, perhaps evident only by tonal change in colour, might, like a tide-mark, indicate heightening or other change. Vertical walling might retain 'frozen' quoin sequences, their returns normally carried inside as cross walls, with chimney gables retained maybe intact.

Illus 86 The form of surface tooling can be a guide to date, here horizontal droving in a detail from Edinburgh's New Town indicates a late C18 to mid C19 date. (Photo: Ross Dallas)

Rusticated quoins, popularised in England by Inigo Jones, became fashionable from the C17 onwards, but as with earlier tower houses into the C18, often only three frontal edges were cut square. Likewise, crow-steps and skewputts lost their place as high-status indicators from the C17, but remained popular in more provincial buildings, while moulded club skewputts were popular in the decades around 1800. Skews instead topped gable wallheads and formed the junction with the roof covering. All these, potentially, are indicators of date.

Chimneys were often corniced, perhaps with so called 'thack stanes' (said to denote a roof having been originally thatched) and sometimes enriched. Moulded strings, cornices and plinth courses were all popular from the medieval period until the C20, albeit in different forms.

With internal walling features, the processes are similar. The detailing at window and door ingoes may be intact and single phase, or else will illustrate different phases of intervention. A common occurrence is the situation where a door has become a window or vice versa. The presence or absence of window splays/square door ingoes may indicate a change made.

Brick was commonly used in internal and subordinate walling from the C18. It might in different areas be of varying type, size and finish. Factory-made brick often bears inscriptions such as makers' names, while the use of handmade brick was popular from possibly the mid-C18 (Douglas & Oglethorpe 1993). In south west Scotland, it was used too in this period as external walling.

6.2.4 Windows – openings and sashes

The detailing of window openings should be examined. Even in rubble walling, they were normally given ashlar rybats, sills and lintels. Sometimes on richer buildings they might have pediments or cornices, on occasion within architraved frames.

Such stonework would normally correspond with quoin stones in colour, quarry source, scale and tooling, or on ashlar walling of the main wall area. Deviation from this norm may indicate a difference in construction date, possibly with older walling re-used within a new build or more commonly a re-fenestration.

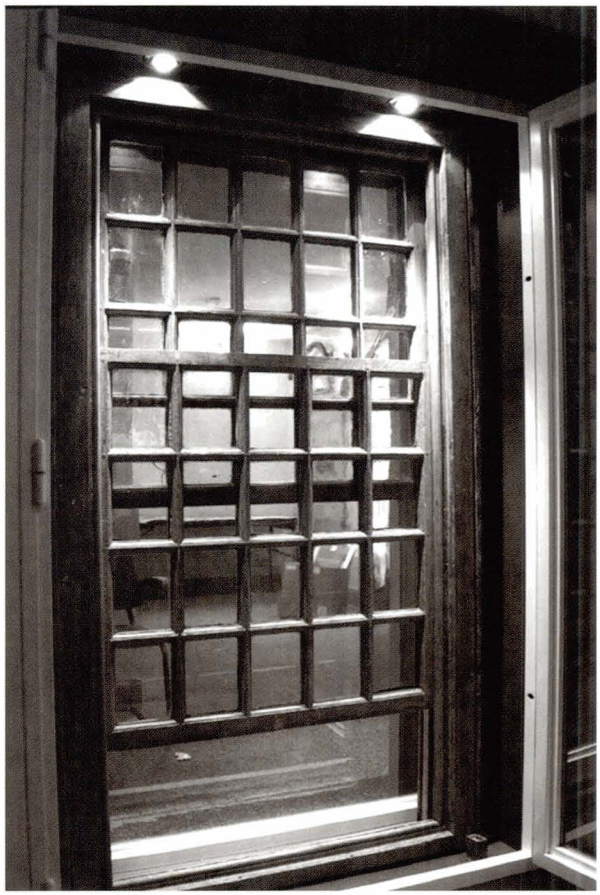
The obvious technical difficulty of keying in new dressed stonework for slappings or enlarged openings was often met at first by insertion of 'new' short-tailed rybats, contrasting therefore with any originals. With more commercialised quarrying from the mid-C19 decades, the problem was often instead resolved by insertion of monolithic vertical slab margins.

These changes are readable on the outside, while inside concealed rougher rubble ingoes would be expected. The reason for such alterations being made should be considered. Were they, perhaps, in light of internal changes and if so why? Sometimes, changes were essentially simply to follow fashion.

Sash and case windows (an invention of the English Royal works) were popularised from the 1670s onwards, particularly in Sir William Bruce's works (Roche 2001). Earlier examples were multi-paned, at least in 'middling' level elite buildings such as David Crawford's House in Hamilton, which is now Hamilton Museum (Illus 87). Astragals initially were thick, thinning during the course of the second half of the C18 to the slender characteristic of Edinburgh's New Town.

By the mid-C19 decades, there was more variety, including a horizontal glazing pattern or plate glass, with perhaps no astragals. But in revivalist works from the later C19, such as those by Sir Robert Lorimer, multi-paned, thick astragaled sashes returned. Distinction between the use of crown, spun or plate glass should be documented.

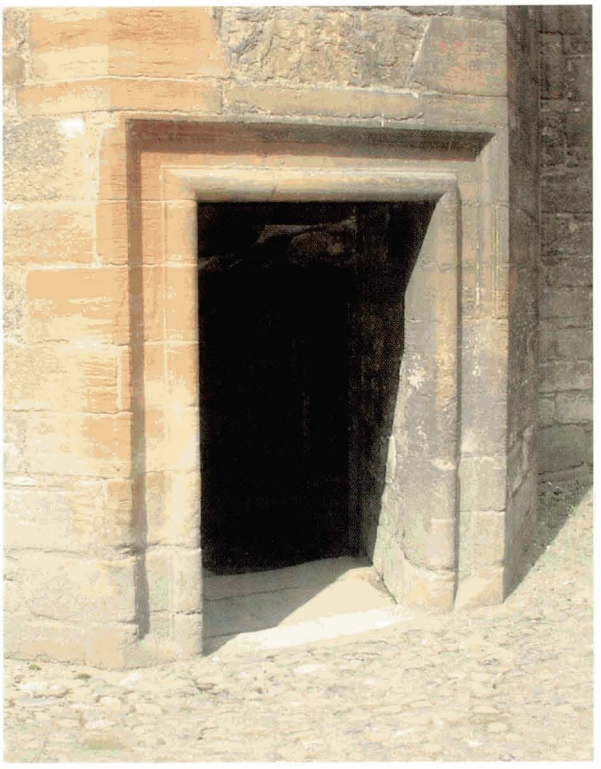
In Scotland, few early windows survive intact. Indeed, the only identified pre-Reformation stained glass is in Edinburgh's Magdalen Chapel (begun 1540s). The once common arrangement of windows bisected horizontally into fixed upper latticed lights and timber-shuttered ventilation openings below fell victim to the Age of Improvement. The few survivals are of doubtful date. Nonetheless, window ingoes – especially on long abandoned buildings – often indicate such an arrangement, with glazing checks together with recesses for timber framing.



Illus 87 The development of the sash window is a valuable identification and dating feature. This very early sash window from Hamilton Palace (demolished circa 1929) is now held in Hamilton Museum, Lanarkshire. (Photo: Historic Scotland, courtesy Hamilton Museum)

6.2.5 Doorways and doors

Treatment of a structure's portal or doorway was important even from prehistoric times, its presence typically emphasised in some way. In medieval to early modern buildings, a moulded frame might have sufficed, perhaps with overdoor sculpture or a heraldic panel. Such mouldings can be dateable. For instance, from the early C17 they might incorporate a flat recessed strip, as in the north quarter entrance (1618-20s) of Linlithgow Palace (Illus 88). In the decades around 1700, a bolection moulding was common, giving way to flat architraves.



Illus 88 Mouldings are often period specific. The early C17 flat recessed strip in this doorway on the north quarter of Linlithgow Palace, West Lothian, being typical. (Photo: John Gordon/Historic Scotland)

Lintels were sometimes inscribed, perhaps dated, with a couple's initials ('marriage lintel'). From the early C17, pilastered doorcases were being made. Manses or grander Improvement Period farmhouses might have doorcases or porticos, these often in a distinctive Doric and sometimes pedimented.

Entrance doors themselves were normally of timber, supplemented on tower houses by iron yetts. Few matched the vigour of that from Terregles (c.1600), with its sculptural imagery (RCAHMS 1967). From at least the C17 they were given classical detail and panelling. Fanlights became popular towards the close of the C18. By then, external doors were often flush panelled, but in the C19 they tended like their interior counterparts to be given heavier moulded panels.

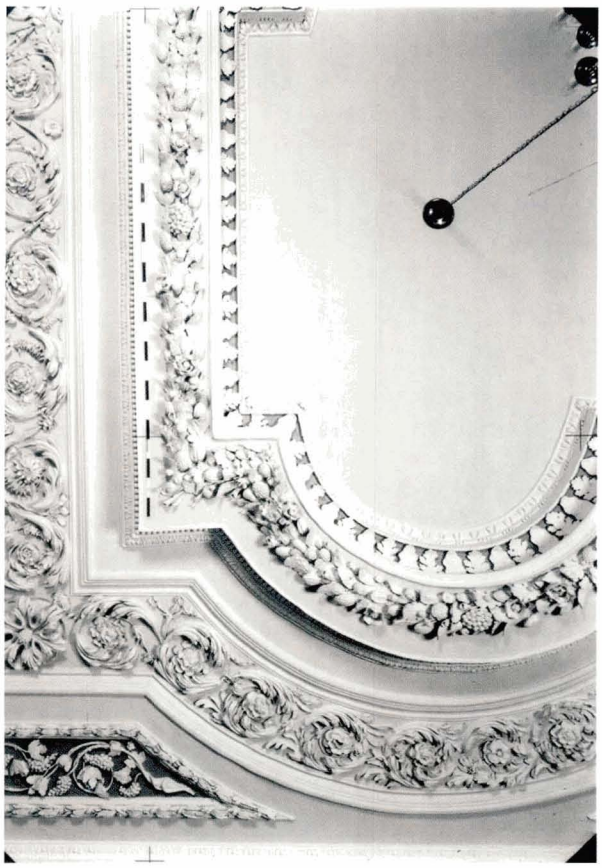
6.2.6 Interiors

Staircases (from especially the C16 onwards), fireplaces, plasterwork, stone or timber panelling, rails and flooring, and paintwork constitute the main architectural detail, but other details encountered may include, say, bellpulls, tilework, fire safety equipment, etc.

Thus, from the late medieval period onwards, domestic buildings such as towerhouses (Ch 8.5 Case Studies) might have moulded stone chimneypieces, which might admit a narrow date range. Stone window seats and tiled or flagstone flooring might exist, and even in ruinous buildings timber which might yield a dendrochronological date (Ch 6.3).

In the C16, ceilings (and often walls) were, like their French counterparts, sometimes decorated directly on the timbers, perhaps with religious or cultural themes as at Crathes Castle (Illus 89). From the second decade of the C17, ceiling plasterwork came instead to be fashionable, typically enriched by royal symbolism. With the employment from the 1670s of plasterers from the English Royal works, a new fashion was introduced with much heavier plaster decoration, as for instance at the Palace of Holyroodhouse (Illus 90).

Illus 89 Painted ceilings were fashionable in the C16, as exemplified by the Muses' Room ceiling at Crathes Castle, Aberdeenshire. (Photo: Ross Dallas, courtesy NTS)



Illus 90 Later in the C17, vigorous plaster ceilings became more common, this example being from the Palace of Holyroodhouse, Edinburgh. Note that this illustration is from a rectified photography survey of these ceilings (Ch 4.4). A scale strip can be seen. (Photo: W S Atkins for Historic Scotland, courtesy Royal Household)

By the mid-C18, this was replaced by a much lighter formula, but heavy, Italianate or coffered Grecian ceiling decoration made a comeback from the second quarter of the C19. In older buildings, it is important to consider the possibility of painted ornament surviving behind either plaster ceilings or walling (Apted 1966).

Features such as plank widths and depths, sawing techniques (hand or machine) and timber species may all help with the assessment of date and originality, besides indicating a likely source. Likewise, mouldings (eg, on fireplaces or staircases), masons' marks and surface tooling should be studied and recorded. Care must be taken with interpreting evidence of masons' marks, which can recur in successive generations.

Wall coverings also changed with fashion. In the early C16, for instance at Stirling Castle's Great Hall, wall hangings were used as ornament, the main walling being left as bare plaster (Fawcett 2001). By the early C17, walls were often timber panelled. The formula continued throughout most of the C18, giving way by the C19 to timber ornament being confined essentially to panelling, window shutters, skirting boards, picture and dado rails. Unusually, at the Dunfermline Aisle in St Bridget's Kirk, Dalgety Bay, the wall panelling and cornice above was cut in ashlar (Illus 91).

Staircases similarly underwent significant change. Even James I's precocious Palace at Linlithgow, begun in 1424, had to modern perceptions no 'grand' stair. Quite narrow forestairs and turnpikes were standard in prestigious buildings until the late C17. From the latter C16 decades, a straight staircase with a landing at the top, or a 'scale and platt' staircase, was optional. The richest known is that on the new wing at Crichton Castle (from 1581), enriched with stone mouldings and panelled ceiling ornament.

In the 1670s, square section stone balusters were employed on a cantilevered stair at Holyroodhouse, while decorative wrought iron balustrading became popular in the same period. The stair was developing to become an important, richly decorated interior feature of elite and middling houses, its purpose - besides enabling passage upwards to the principal apartments – being to project images of wealth.

The roof and its detail also requires examination, although here features must be treated with circumspection as repair and replacement are common. In the late medieval period, roof coverings were optionally of stone slabs, and stone slabs were used until the C20 in parts of the south west and Caithness. More typically, richer and certainly elite buildings for

Illus 91 Panelling is most commonly found as a feature in woodwork, but here at the Dunfermline Aisle, Dalgety Bay, Fife, the detail is worked in stone. The former ceiling vault scar on the gable can also be seen on the right. (Photo: Historic Scotland)

the last several centuries were slated and/or leaded. Lower status, industrial and agricultural buildings were often instead thatched, pantiled or shingle-roofed.

6.2.7 Conclusions

In this short review, it has been possible to highlight only some of the more obvious or significant architectural details requiring record, and the means by which they can be translated into sources of information.

Because most examples have been based on the 'old' elite house, entire classes of building such as churches, walled gardens, farms etc, are omitted, but it is suggested that the basic approach of careful visual analysis, appreciation and understanding of the building type, along with documentary research remains essentially the same.

REFERENCES

There are many books on Scottish architecture providing information on architectural detail, such as the RCAHMS *Inventories* (cf. text above) Glendinning *et al* (1996), Beaton (1997), Hay (1986) and Macaulay (1987). Pride's *Dictionary of Scottish Building* (1996) contains definitions of many traditional Scottish building terms, such as those used in this section, and an extensive Bibliography.

6.3 DENDROCHRONOLOGY

6.3.1 Value of dating timbers

Identifying the species and type of timber used in a building is an important aspect of its characterisation. Dendrochronological analysis of timbers contributes to this process.

It is primarily a technique undertaken to provide accurate dates for the construction of the historic building, but analysis of the tree-ring pattern can also provide information on the source and the quality of the timber, thus informing the social and economic context of the building. The process may also be of particular value when replacement materials are to be sought.

In Scotland, the technique has shown itself to be of most value in major or high-status buildings, where higher quality more substantial timbers of oak were used. In vernacular buildings, analysis is more problematic, as there is more diversity of species and generally smaller timber sizes are found. Very little use has as yet been made of the technique for C19 and later buildings.

6.3.2 Cross-matching, dating and interpretation

Three conditions are necessary to ensure the successful dating of the timbers in a building.

- The timber must be a species for which there are already dated chronologies (see below)
- Because cross-matching is a statistical process, a number of timbers are required, usually at least eight per building or phase
- The ring-patterns must be over a certain length, usually seventy rings

With these conditions observed it can be relatively straightforward to obtain a date for a timber. There is now an extensive database of calendrically dated chronologies throughout Britain and Europe, against which a tree-ring sequence can be compared and an exact calendar date obtained for the outermost ring of the sequence. However, the *interpretation* of that date in relation to the history of the building can be far from straightforward.

If the timber has been untrimmed and the bark or sub-bark surface is present, then the date of the outermost ring represents the exact year in which the tree was felled. However, building timber is commonly trimmed square and this removes the outermost rings, reducing the quality of the dating.

It may then be necessary to estimate how many rings have been trimmed. If some sapwood is still present, then it is possible to estimate a range *within* which the tree was felled. If the timber has been trimmed into the heartwood, it is only possible to give a date *after* which the tree was felled.

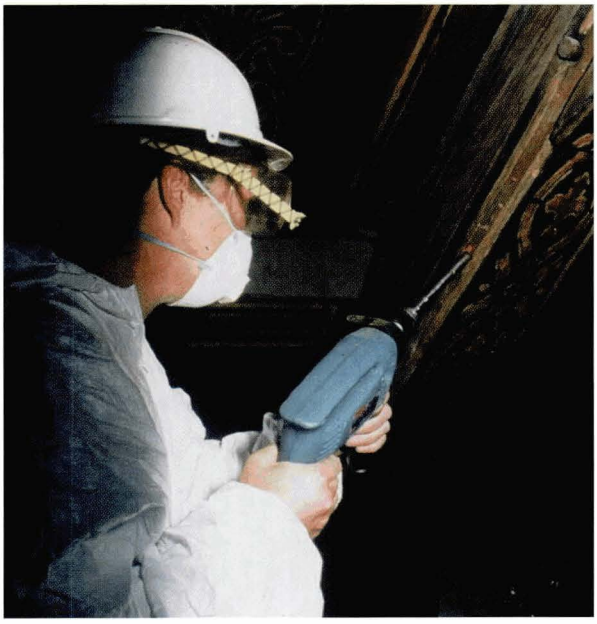
The year in which the tree was felled will also usually be the year in which the building or phase was erected, if the wood was worked while it was still green. However, timber could also be stockpiled, particularly if it was being imported (see below) and this must be considered when interpreting the date.

As well, timber was a valuable commodity and would have been re-used wherever possible. It is important to assess any evidence for re-use, such as redundant joints, duplicate carpenter's marks, etc before assigning a date for construction (Illus 92).

Illus 92 68 - 74 High St, Brechin. A group of oak timbers all felled in 1470 were found within the roof of this supposedly C17 house. They all bore redundant joints and duplicate carpenter's marks, indicating reuse. (Photo: AOC)

6.3.3 Sampling

In-situ timbers are usually sampled using a corer, which is attached to a power-driven drill and removes a core leaving a hole in the timber 10mm in diameter (Illus 93). The core must be aligned so that the maximum radius from pith to bark is sampled, thus ensuring the maximum number of growth-rings for analysis (see Illus 94). It is also important to select those timbers in the building which have retained as full a ring sequence as possible, ie those where the outermost rings have not been trimmed off or destroyed by woodworm.



Illus 93 Coring in progress in the Great Hall, Edinburgh Castle. The oak timber has been squared, but the sapwood and sub-bark surface survives on the edge of the timber. The timbers were felled in 1509/10 and came from either southern Sweden or Denmark. (Photo: AOC, courtesy Historic Scotland)

Coring is an intrusive method of sampling. In general, the benefits of being able to accurately date elements of the building are considered to outweigh the very small loss of material. Nevertheless, Listed Building or Ancient Monument consent may be required before the work can be carried out.

It is occasionally impossible to use this method, as in the case of painted ceilings and carved panels. In these cases, if the end-grain is exposed the ring sequence can be measured in situ using a hand lens. As well, silicone rubber casts can sometimes also be taken.

6.3.4 Timber species and sources - oak

Until the late mediaeval period, the primary building timber throughout the British Isles was oak. Consequently, most dendrochronological work is concerned with this species. In Scotland oak was used exclusively in high status buildings until the early C17.

However, supplies of good quality locally-grown oak began to diminish and from the C14 native supplies were increasingly supplemented by imported timber. The earliest examples came from the eastern Baltic, probably from Poland, but by the late C16 the bulk of the imported timber so far identified in Scotland was coming from Scandinavia.

For instance, analysis of floor joists of oak removed during the recording of Fenton Tower (Ch 8.5) showed that they were imported from Scandinavia. They were felled in 1572, thus confirming the late C16 date for the Tower (Crone 2002). Throughout this period, the eastern Baltic was the favoured source for the fine planking needed for painting and for carved panelling.

Illus 94 An oak core from Edinburgh Castle, mounted and prepared for measurement. The ring-pattern has been enhanced by rubbing chalk into the sanded surface. The outermost ring of this core was dated to 1509. (Photo: AOC, courtesy Historic Scotland)

6.3.5 Timber species and sources - pine

From the early C17 pine appears more frequently. The majority of the painted ceilings and roofs from that period are constructed entirely of pine, while oak is more rarely found.

The dendrochronological study of historic pine is in its infancy in the British Isles. As there are very few chronologies of locally-grown pine, it is difficult to identify native timber. It is likely that much of the pine was imported and as there are many European pine chronologies it is possible to identify and date this material. The only Scottish example to have been dated so far, C18 material from 42-44 Market St Haddington, probably came from eastern Sweden.

6.3.6 Dating in vernacular buildings

Vernacular buildings such as cruck-frame cottages display greater species diversity than the high status buildings, usually because they were built using whatever was to hand. Oak is very rarely found, while in the Highlands pine was commonly used.

The cruck-frames in the cottages at Moirlanich, Killin shown in Illus 95 and at Sunnybrae Cottage, Pitlochry were built primarily of ash, with a small amount of elm and sycamore in the former, and pine was used exclusively for the purlins. This composition reflects that of the local woodland. In theory it would be possible to date some of these species if a local chronology could be constructed. However, the timber used is often young and fast-grown which reduces the potential for dating.

Illus 95 The roof of the long house at Moirlanich, Killin. The young, untrimmed timbers characteristic of vernacular buildings are visible. (Photo: AOC, courtesy NTS)

REFERENCES

There is a considerable literature available on the subject of dendrochronology. General texts include Baillie (1995) and the 'English Heritage' guide (EH 1998). Several publications by Anne Crone provide more detailed reports (see Bibliography). The journal *Vernacular Architecture* provides an annual summary of results for standing buildings in England and Wales.

6.4 SURFACE FINISHES, INCLUDING PAINTINGS

6.4.1 Definition of surface finish

Within the context of this Guide, the term surface or decorative finish includes any surface treatment that has a historic or artistic decorative interest. On the whole, these finishes will be on internal surfaces, such as walls, ceilings and floors. However, external surface finishes should also be borne in mind, such as for example external renders, lime-washes and paints on wood or masonry (see Ch 7.3.7).

The term therefore covers a very wide range of finishes, from the simple and unambitious to the sophisticated and expensive. At the simpler end of the scale are:

- Early lime-washes
- Early lime plasters, whether painted or not
- Simple paint finishes which are original to the building or part of a later significant scheme, these for example could be distempers or flat oil paints
- Lath and plaster wall linings
- Evidence of a dado or skirting or plain run cornice.

More sophisticated finishes may include:

- Decorative plaster work, for example a modelled frieze or modelled plaster embellishments on a ceiling or cornice
- Elaborate paint work, such as a stencilled scheme or freehand wall or ceiling painting
- Timber panelling, which may be plain or elaborately carved, painted or gilded
- Wallpapers.

Tapestries as moveable items would not normally be considered, but evidence of their fixings should be noted. *In situ paintings* which form part of the fabric, such as door overmantels, may also be considered as part of the surface finish. Sometimes such features are attached to panels, at other times they are painted directly onto surfaces.

The content and nature of such in situ paintings is however very specialist. Normally expert painting conservators should be brought in to assess, and indeed record, such features. A normal building recording specialist should however be able to identify the significance of such a feature and recommend the appropriate route to obtain specialist input, for example from the Scottish Conservation Bureau.

6.4.2 Likelihood of unexpected discoveries

Although there are many notable exceptions, the interior spaces of public buildings are redecorated, on average, every 10 to 15 years, and domestic buildings about every 20 to 30 years, ie once each generation.

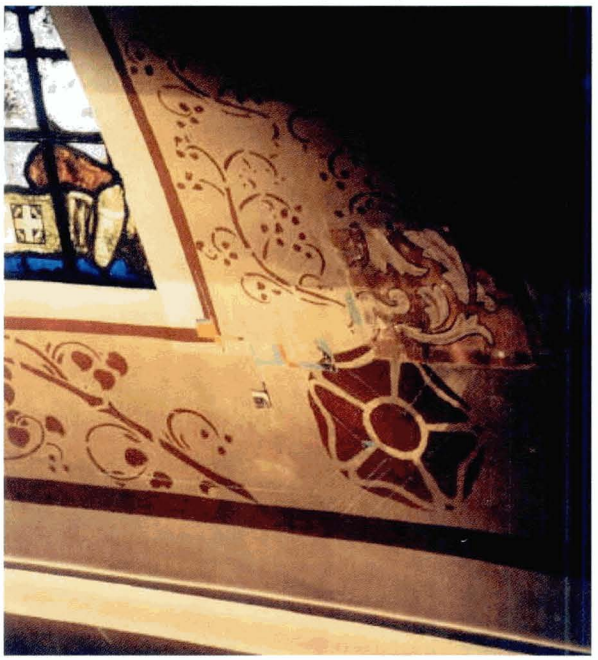
Often easily moveable decorative finishes, such as panelling or tapestries, will be removed once they become out of fashion or unwanted. But the less moveable finishes, such as paint and plaster, will just as frequently be simply covered over, and therefore survive beneath later decoration, awaiting discovery. Wallpapers fall between these two, but are frequently painted or papered over.

This means that a building which was built as recently as 15 to 20 years ago may already have been redecorated. In some cases there will be records relating to the alterations, but in others the observer may believe that he/she is looking at the original decoration when it has been at least partially concealed beneath a fresh layer of paint.

Thus, when looking at a historic building it is important to bear in mind that there is a very high chance that (a) it will have been redecorated at least once since it was built, and (b) at least some evidence of the earlier decoration(s) will survive beneath the most recent surface coatings.

C20 examples are the Rennie Mackintosh scheme at the Hill House, Helensburgh (Snowden 1992) and the Schaufelberg scheme at St Aloysius Church in Glasgow from the 1920s and 1930s. In both instances, the original paint-work had been covered over. In the case of St Aloysius, it had been redecorated twice within a period of about 20 years (Allardyce 1998).

In both instances, the original finishes survived to some extent beneath the later schemes, as for example shown in Illus 96. Clearly, if buildings completed as recently as these have been redecorated, older ones may well have been redecorated many times over.



Illus 96 A section of the internal ceiling dome of St Aloysius Church, Glasgow, showing remnants of three different paint layers/schemes. (Photo: Historic Scotland)

The other matter to bear in mind is that seemingly minor changes or redecorations may make a significant difference to the overall effect of a so-called 'original' interior. Because the scheme seems intact for the most part, it is possible to be misled into believing that a completely authentic interior is being viewed. This can lead to misinterpretations of a designer's style.

The drawing room of Skene House in Aberdeenshire, for instance, contains the original wallpapers and ceiling decoration, and at first glance would appear to be untouched. However a study of the shutters and woodwork (Allardyce 1997) revealed that all the woodwork had been repainted in a pale purple, when originally it was grained to imitate a beautiful honey-coloured satinwood. This enormous chromatic difference from purple to yellow completely alters the appearance of the room.

6.4.3 Fragility

The fragility of a decorative finish depends to some extent on the materials used. A water soluble distemper will be more fragile than an oil paint. Distempers were frequently applied as a first decoration over lime plasters, so that the plaster could 'cure'. They would then normally be followed by an oil scheme, for example the Cottier decoration of Dowanhill Church (Allardyce 1998). The distemper would be considered as a sacrificial layer, which was always intended to be temporary. Nevertheless, they are of interest in documenting the development of a scheme.

Normally, a far greater threat to the survival of a surface finish is poor or badly informed maintenance of the building. This may manifest itself as excessive damp due to building defects or fluctuations in Relative Humidity and excessive dryness due to overheating by modern heating systems.

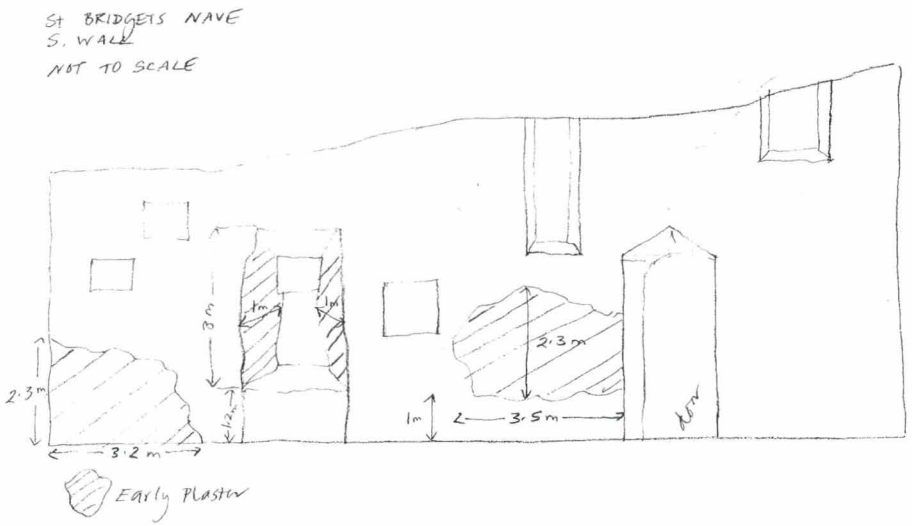
Finally, as has been pointed out above, decorative schemes are vulnerable to intentional damage as a result of changing taste. Changes in taste and fashion may be most easily accommodated, with least expense and disturbance to the inhabitants, by changing the interior decoration of a room. This makes surface finishes a very fragile and frequently altered part of the building.

It should be stated in favour of redecorating that in many instances covering over the earlier schemes has protected them from later damage. For example, the introduction of a lath and plaster wall over a wall that was previously plastered on the hard does not involve the total destruction of the original plaster. It will usually mean that some original material is lost where channels were cut through to fix the joists for the later lathing, but much original material may remain. In Strathleven House, Dumbarton (Allardyce 1999) this was noted, as shown in Illus 97.

Illus 97 A survival of an earlier decorative scheme in Strathleven House. A later lath and plaster wall has protected an earlier painted trompe l'oeil dado. (Photo: Historic Scotland)

6.4.4 Appropriate types of recording

With surface finishes, there is often no need to resort to complex and possibly expensive methods of recording. An accurate written description, with a sketch or diagram not necessarily to scale but preferably with principal measurements indicated (Illus 98) and good photography will together provide a great deal of information.



Illus 98 A rapid sketch may be an adequate first record, as long as this is supported by generous photography. (Historic Scotland)

Clearly, the more trained the specialist is in the study of surface finishes, the more detail will be observed. However, much valuable work can be contributed by the non-specialist, as long as he or she starts at a basic level. The principal questions to bear in mind are:

- Where is the surface finish? (eg, dining room S wall 2m from floor height 1m from E window).
- How large an area is covered? (eg, approximately 2x3m).
- What materials are used? (This may be hard to ascertain, however, an example would be lime plaster with hair).
- Does the decorative layer have a thickness, and if so what is it? (eg, lime plaster 40mm thick, made of two layers each 20mm thick. This last observation may require some knowledge of plasters, but if a section can be observed the overall thickness will be self-evident).
- Is the plaster pale or dark coloured, does it look coarse or quite smooth?
- Is there any evidence of a paint layer on the surface? What sort of colour is it? (Colour is a very subjective issue, and will be discussed below).
- Are the edges broken, or is there any evidence of tooling to finish off the edges?

A sketch/diagram may be quite basic, as long as it is supported by photography. A few crucial measurements and features are usually adequate to help with location. Photography is most important, and provides an immediately accessible record in support of the notes and diagrams. Care must be taken with photography to provide a high standard and to ensure neutral exposure (Ch 6.7). For example, photography taken while ordinary electric lighting (ie tungsten bulbs or fluorescent tubes) is still on can have its colour balance significantly altered.

If the building houses a more elaborate decoration, such as a stencilled scheme, a tracing of one repeat of the stencil could be made to accompany a photograph, but only if the condition of the paint allows this. Care of recording should apply equally to vernacular as well as to more sophisticated buildings.

If the decorative element is particularly noteworthy for any reason, a copy of the photograph may be offered to the RCAHMS/NMRS for their archive. It may be that they would wish to make their own photographic record following discussion. Historic Scotland may also be contacted for advice. Most importantly, if in any doubt about the value of a decorative finish and how best to record it, contact HS or RCAHMS.

The use of more sophisticated or advanced methods of surveying or recording may on occasion be appropriate. Alternatively, these may already have been provided, and surface finish annotation may be made onto them. These could include accurate measured drawings and/or rectified photography (Ch 4).

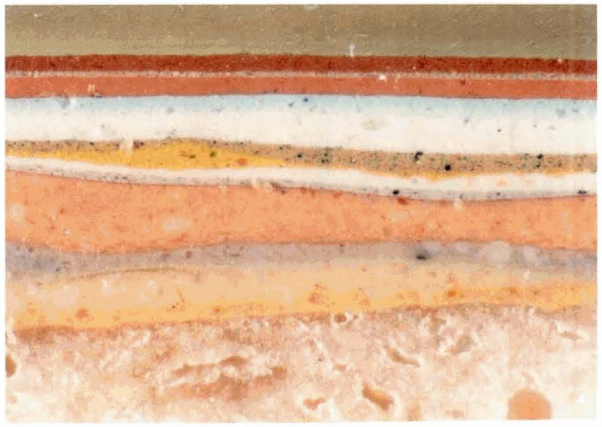
Such methods should be considered when dealing with a significant survival, for example a C15 ceiling painting. These methods need to be done by a specialist and are relatively expensive. The resultant document however provides an invaluable record for later generations and also a useful tool for conservation purposes. A written description and photographs are still necessary adjuncts for a good record.

6.4.5 Colour

Colour is very hard to record accurately. The way a colour is seen varies from one person to another and the shade is affected by light conditions.

In the first instance, a simple visual colour match is better than no record. A description of the colour may be given or the colour may be matched against a colour card, and the closest match provided. The most widely available and used cards are in the BS4800 range. A wider range, and the definitive standard for colour matching, is the Munsell colour cards. Although providing a more comprehensive range, the Munsell range is quite expensive to buy (approximately £200) and is less widely used. If the scheme is complicated, such as a stencil decoration, the colours should all be listed as accurately as possible.

A tool for accurately recording colour is a spectrophotometer. These cost several thousands of pounds and are used primarily by paint manufacturers. The problem of using such a device with historic paints is that in order for it to work properly there needs to be a sufficient area of paint in reasonably good condition. In addition, the spectrophotometer will only record the colour as it now appears. This is of some value, but it should be noted that the paint may have darkened, faded or yellowed considerably over time.



Illus 99 A paint sample cross-section, viewed through a microscope. This sample is from the nave of St Aloysius Church. (Photo: Historic Scotland)

Other more elaborate ways of recording colour involve taking small samples for scientific analysis (Illus 99). This needs to be done by an expert. It is a very useful tool, both in establishing how many decorative layers are present and also what pigments and binding media were used to make the paint. This information helps in judging the appearance of the original decoration.

REFERENCES

General references and further reading can be found in Apted (1966), Bristow (1996), Gow (1992) and Thornton (1984). The Historic Scotland Conservation Centre Reports mentioned in the text and listed in the Bibliography are all held in the HSCC file library and may be looked at on request.

6.5 FIXTURES AND FITTINGS

6.5.1 Keys to the past

Recording a habitable building, particularly one in use, can impose limitations on interpretation. When internal surfaces are plastered, papered and painted or harling covers the exterior, typical features such as butt joints, blocked windows and other indications of the building's structural history will largely be masked.

On the other hand, a habitable building will normally contain fixtures and fittings and service features, often lost in ruined structures. These can provide important clues as to how it was inhabited and altered over time. Establishing the dating and originality of these may also be important in a conservation scheme.

A good example of this is provided through Geilston House (Illus 100), a B-listed building near Cardross on the north shore of the Firth of Clyde (Lelong 1998). Always a relatively modest and little-known property, it was gifted to the National Trust for Scotland in 1997. A building recording exercise was commissioned by the NTS to establish the property's historical development and determine its cultural significance.

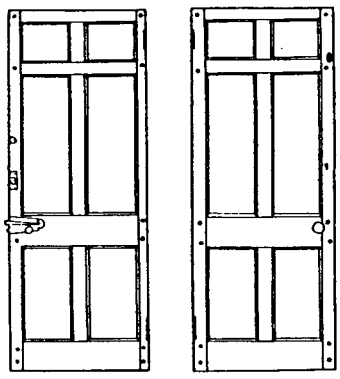
The survey found that the development of Geilston House mirrored the social and economic changes that took place along the Clyde from the late C16 to the early C20. It passed through the ownership of five families, from 'bonnet lairds' to members of the emerging merchant and gentlemen farmer classes to wealthy upper middle-class Glaswegians. As it did so, it developed from an increasingly genteel farmhouse to a country villa, including a *cottage ornée* wing used as a summer retreat from the city.

6.5.2 Recording the features

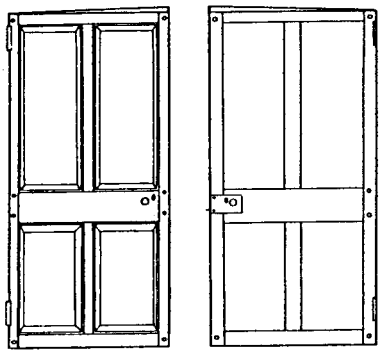
The building was surveyed to provide plans and sections of the exterior and interior. The bulk of the recording work, however, consisted of single context recording of individual features, including doorways and doors, window apertures and windows, shutters, fireplaces, wall fabrics, fixtures and fittings.

Illus 100 Geilston House (1998) showing the different range of wings added as the house developed. (Photo: GUARD, courtesy NTS)

Photographs and hand-measured drawings of selected internal features, such as the doors, were prepared (Illus 101).



Front Bathroom (West Wall) ***(976)***



Miss Hendry's Room ***(1198)***

Illus 101 Typical of the internal features recorded in detail were the doors. These ranged from fielded panel doors in public rooms to simple plank doors in attics. (Drawing: GUARD)

The character, dimensions and provisional dating of each feature was recorded on pro-forma sheets and the records transferred to a Microsoft 'Access' database, with each feature possessing a unique context number. The survey identified an enormous number of features – about 1,400 altogether – which itself illustrated the complexity of the building's development.

As the survey progressed, it became clear that the mouldings on doors, fireplaces, cornices, shutters, architraves and astragals throughout the house were excellent indicators of phases of construction or refurbishment.

Therefore, profiles were drawn of all the mouldings identified and a moulding typology was developed as a means of phasing different elements (Illus 102). Features such as door furniture also proved diagnostic in determining which parts of the house had been altered at different periods (Illus 103).

The process of recording and analysing these features was time-consuming and laborious, but it did prove its worth. It was only through the study of individual features, with equal and consistent attention and at the same level of detail throughout the house, that the building recorders began to recognise patterns and acquire an understanding of how Geilston House had developed.

6.5.3 Using the information

Ten broad phases of development were identified, including phases of re-fitting and gentrification of the interior in the mid C18 and late C19. As an example of the degree of complexity encountered, a window aperture might have been original to the C17 core of the house, been re-lined and re-fitted with a new sash and case in the C18, and in the C19 had a sash replaced, been given shutters re-used from elsewhere and furnished with new locking mechanisms.

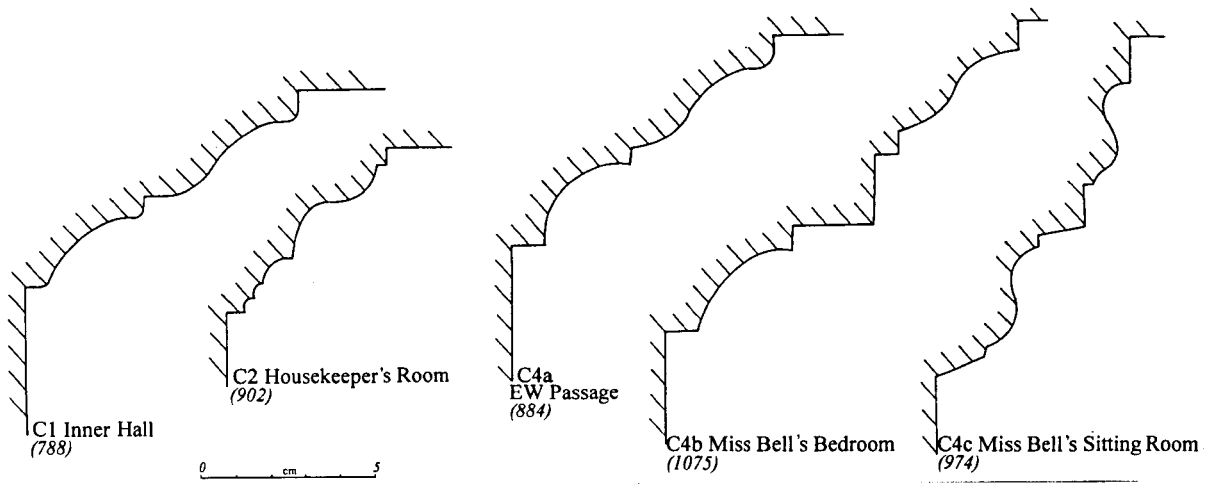
The process of interpretation was further complicated by the fact that Geilston's late C18 and early C20 owners, when adding a new west and north-west wing respectively, had attempted to maintain its stylistic consistency and provincial atmosphere, in some cases copying mouldings from earlier features elsewhere in the house.

Other fixtures and fittings were more readily attributable to particular phases. For example, a series of cast iron fire surrounds had been inserted in earlier fireplaces throughout the house in the Victorian period (Illus 104). Window astragals also proved particularly informative; surviving lamb's tongue astragals helped to date certain parts of the building to the middle to late C18 and broad fillet-and-ovolo astragals dated other parts to the late C18 to early C19.

Because of the extent to which the house had been altered piecemeal, with many small changes over a long period of time, careful attention had to be paid to detail that might indicate the re-fitting of a much older window aperture, as in the above example. Astragals in a Victorian gothic style were ubiquitous in phases of alteration dating to the mid to late C19 century. An early C20 phase of utilitarian modifications was represented by simple wooden shelves and large ceramic sinks in some of the service rooms. Modern stock astragals in some windows, brass light switches and service bell-pushes dated to the installation of electricity in the house.

6.5.4 Methodology

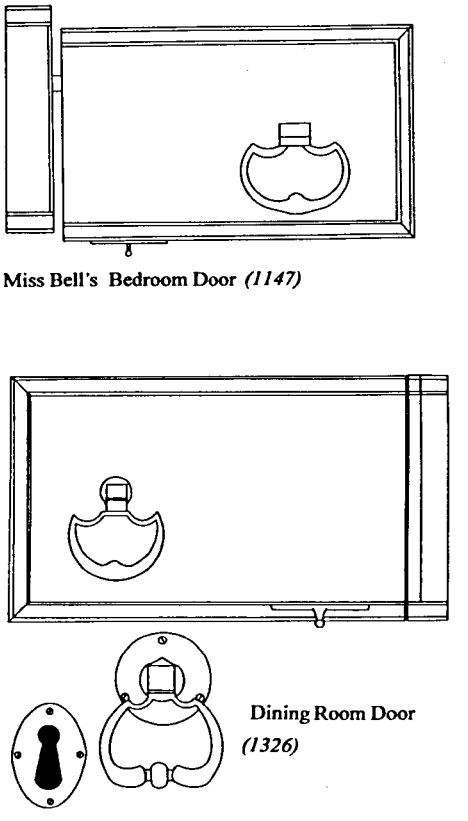
When undertaking the survey of a finished, habitable building, it may be best to begin with a general overview to familiarise the recording team with its fixtures and fittings, taking notes and making sketches



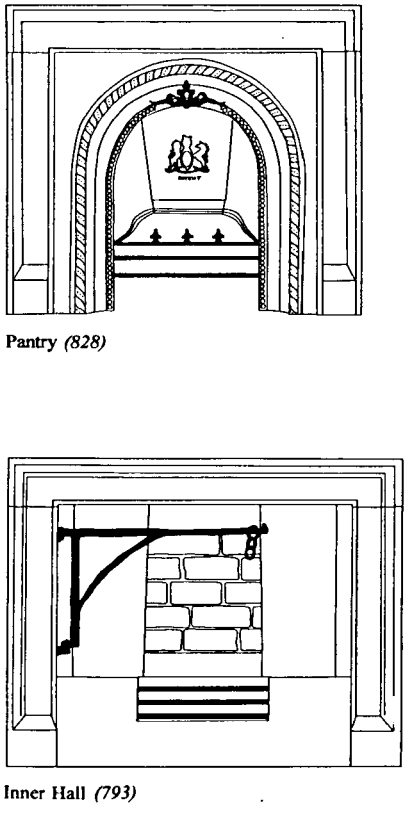
Illus 102 A typical range of moulding profiles found in the house, these from ceiling cornices. These were very important in dating different periods of build and/or refurbishment. (Drawing: GUARD)

of profiles and features, acquiring a sense of their character and identifying patterns in their occurrence. Access to record fixtures and fittings is generally straightforward, although recording ceiling detail may require for example a portable scaffold tower.

The use of pro-forma sheets for this detailed recording – directly onto a laptop computer if possible – is one way of ensuring consistently rigorous examination of the fixtures and fittings. Normally, a photograph will also be taken of each feature or of groups of features. A profile gauge, available from survey equipment suppliers, may be used to take moulding profiles (Ch 4.2). In general, the more minor and numerous the changes to a building's interior, the more detailed the



Illus 103 Door furniture proved important in dating features. Each lock was drawn and/or photographed and given a context number. (Drawing: GUARD)



Illus 104 A number of cast iron fireplaces were inserted in the building in the C19. (Drawing: GUARD)

approach required to understand how they illustrate its changing inhabitation.

Evidence for the history of services in a building can consist of extinct or current pipes, ventilation shafts, electricity conduits, service bells and so on. These should be recorded wherever possible, as they can tell much about the living conditions and economic standing of its former occupants. It should be noted that in many cases service features can only be partially observed and may only be visible during a watching brief on invasive works. At Geilston, no invasive work was carried out during the recording.

6.6 INVASIVE WORK – THE WATCHING BRIEF

6.6.1 A unique opportunity

The term *watching brief* describes the process of monitoring and recording associated with changes taking place to the fabric of a building or structure. Essentially, the work should be carried out following similar principles to a normal recording project, but there are a number of differences.

The circumstances of a watching brief phase can be very variable, but basically concern the situation where some disturbance to the fabric is taking place. This may range from essential repairs to the fabric, through opening up selected areas when say an extension is added, through in extremis to demolition.

In many cases, when invasive works are involved, the award of Planning consent is given with the stipulation that an appropriately qualified professional, usually an archaeologist, is retained by the client to monitor and record during interventions to the built fabric.

Unlike in excavation archaeology, the building recorder is not usually able except in a small way to carry out any dismantling by themselves (Illus 105). Either the building contractor or demolition contractors will normally carry out the work. Hence the building recorder needs to stand by ready to examine and record detail.

It is therefore important that the status of the building recorder is clearly established in advance. Contractual arrangements for such recording work need to be very clearly set out and agreed (Ch 9.2). This is particularly important in two respects. First, building works may be in progress on the site. If recorders are to be able to stop works for a period, to examine, measure and photograph, this must be contained in the *building contractor's* contract as well.

Illus 105 Demolition in progress!! This is emphatically what is not wanted – an uncontrolled demolition in this manner leads to the loss of a huge amount of invaluable historical evidence. (Photo: Ross Dallas)

Then, the time and duration of access etc, needs to be agreed. Making appropriate arrangements for recording under these circumstances is without doubt a thorny problem. Clients with building works in progress under industry standard contracts will not wish to experience delays, particularly if they are unexpected. On the other hand, under Planning conditions, they may have legally binding constraints on them.

The first step is to have carried out as much work and as thorough an examination (including of documentation) as possible before works commence. In this way, the likelihood of unexpected discoveries can be much reduced, and indeed the need for extra time can be anticipated.

As regards the contract period, it should be established during which periods it will be necessary to have a recorder on site. Opening up works could for example be blocked together into one phase. Then, the contractual arrangements should define where the recorder may be located and who will authorise safe inspection periods. The length of time during which works must be stopped to allow access for measurement is extremely difficult to predict. It would

not be sound to put a fixed time on this, but it is not unreasonable to expect the recorders in this circumstance to make more use of, for example, photography.

During any form of downtaking or demolition, the site is potentially dangerous. Health and Safety considerations become especially important and the contract must make clear the various responsibilities for H&S (Ch 9.5). H&S concerns must override recording interest. CDM regulations may well affect proceedings. The IFA *Standard and Guidance for an archaeological watching brief*, while primarily directed at excavation work, contains valuable guidance on all aspects of the procedures (IFA 2001).

If the building is particularly significant, a Conservation Plan may have been commissioned (Ch 9.9). This should highlight the most important areas of the building, any rare or unique features or best examples of type and therefore direct where every effort should be made to protect or record for posterity.

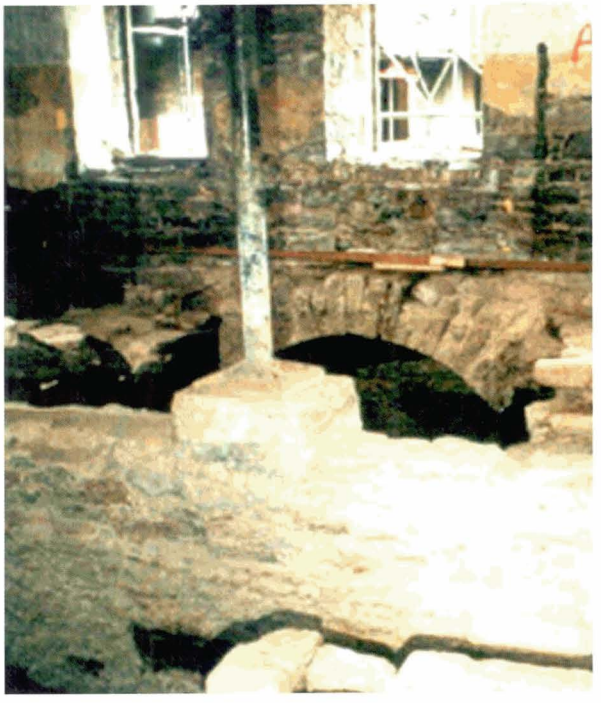
An unusual aspect of this work in comparison with normal recording is that the recorder should be prepared to provide information back to the conservation team while processes are taking place. Such is the nature of invasive works that new and often surprising information arises during the downtaking of parts of buildings.

Thus another issue which may have contractual implications is the preservation of discovered features. If assessed as highly significant, the newly found features may suggest a different scheme that leaves them intact and *in situ* (Illus 106). This will again very much depend on the nature of the building and works. The best mitigation for this is perhaps to plan the whole programme of works so that potentially sensitive areas can be left for some time without holding up overall progress.

If the watching brief takes place in an emergency – for example following an unexpected collapse or a fire – then no pre-examination of the site will have been possible, and the building recorder must make whatever records are possible under the circumstances. Nevertheless, a contract and H&S considerations must be put in place.

6.6.2 Procedures on site

The circumstances of a watching brief can range from a carefully planned and specified involvement to an emergency. As described, the building recorder may be overseeing invasive work for a number of reasons. The scale and nature of the invasive work will clearly dictate the level of activity.



Illus 106 Wheelpit at Stanley Mills, Perthshire. This historical feature had been lost to view. The watching brief ensured that its significance was recognised and noted, ensuring that a proposed modern feature was moved to avoid damage to the pit. (Photo: Historic Scotland)

Whatever, the building recorder must be on hand, fully equipped for measurement, photography and other forms of recording. Practical equipment such as drawing boards, torches, a tape recorder for speedy note taking and a compact camera for supplementary or emergency record photographs must be available.

The procedures to be followed will in general follow those already described in Ch 5 and 6, except that flexibility and speed many often be given more weight than normal. Safety is of paramount importance – the building recorder must never proceed without the instruction of the site manager.

6.6.3 Methodology

Whatever the circumstances which have lead to the invasive work and hence the watching brief, all information and samples obtained should be carefully written up and saved to the same standards as with normal recording work:

- **Descriptive records** Assigning unique context reference numbers to each feature is a useful tool for ensuring all features are noted before removal (Ch 5.5). Substantial downtaking and subsequent reinstatement of part of an important historic building with many original features may require that all fabric, associated coverings, fixtures and fittings are assigned unique numbers.

- **Annotate existing plans** The position of newly identified features and details should be added to existing plans.
- **Photography** Everything exposed during a watching brief should be photographed, including ceilings (these are often missed out). Consider using a video camera to record elements of the structure in relation to one another. As such work is often carried out under great pressure of time and access, photography is possibly more important than in other phases of building recording.
- **Survey measurements** All features exposed during the watching brief should be measured and drawn if possible. As the recorder will usually be up against a time deadline, the choice of feature to be drawn as against photographed will need assessment.

6.6.4 Information to record

When invasive work commences, written, drawn and photographic records of exposed features and those under threat during works should be made (Illus 107). With a watching brief, obtaining samples of materials is important, for it is possible that fabric will be totally lost. Samples should be taken where necessary as fabric is exposed. If practical, samples should be taken in advance, as there may not be the opportunity to do this once work starts.

Illus 107 Stripping out of an interior during refurbishment work may provide a good opportunity to record wall and sub floor structures. This shows an interior in Charlotte Square, as it had been left prior to purchase by the NTS. (Photo: Ross Dallas)

Features to be recorded and sampled include:

- **Wall surfaces**, including paint, plaster, paper, and panelling. Traces of historic wallpaper may survive behind later switch plates, fire surrounds and window casements.
- **Structural fabric** Dismantling may allow for close examination of the internal construction of walling features, not normally possible with a recording project.
- **Flooring** Again, there may be the opportunity to examine floor construction, as joists and plasterwork are removed.
- **Roof and ceiling materials** Lowered or false ceilings may conceal ornate plasterwork or medieval timber beams.
- **Windows** Constructional detail behind reveals may be accessible.
- **Fireplaces** Original or earlier openings may have been blocked, shortened or reduced in aperture or widened in height or width. Removing a recent fire surround may reveal blocking of an earlier or original aperture.

6.6.5 Example

While preservation of the fabric is of the first importance, demolition or dismantling may reveal information which would otherwise be unobtainable.

For example, during the demolition of a seemingly nondescript cottage in Grantown-on-Spey in 1995 (Illus 108), removal of the ceilings and internal walls revealed the timbers of a post and beam house (Atkinson 1996) of the C17. The bays between the posts had been filled with rubble and lime mortar, while the gables were constructed of external and internal timber scantlings, with the space between filled with sphagnum moss for insulation (Illus 109).

Illus 108 This apparently plain cottage in Grantown-on-Spey proved on investigation to have a post and beam structure dating to the C17. (Photo: GUARD)

Illus 109 Dismantling of the cottage revealed that the construction was of far earlier date than apparent. (Photo: GUARD)

All downtakings should be monitored most carefully, for with reference to this building, they may reveal surprising evidence of the past. For example, dating particular phases of the structure proved difficult. The phase one roof had been removed and replaced by a phase two roof in the late 1860's. The phase two roof was quite closely dated by a fragment of *The Penny Mechanic* newspaper, dated 21 March 1868 and adhering to the vertical scantling.

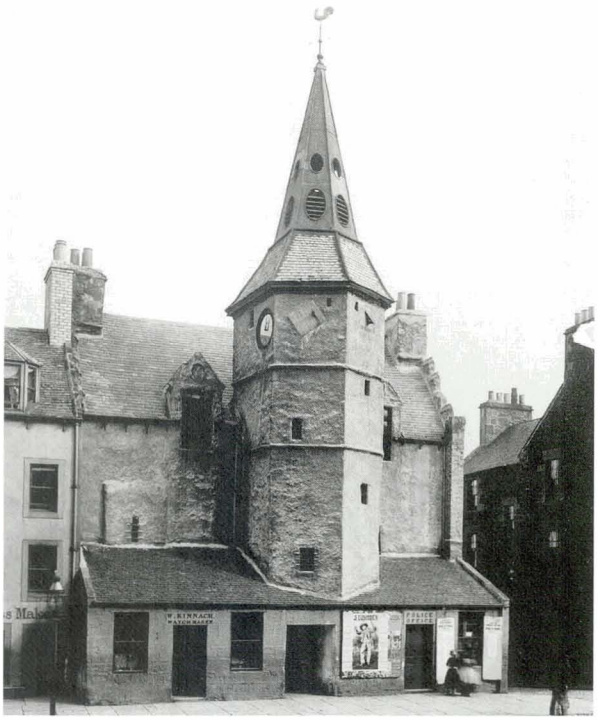
Demolition of the kitchen revealed a number of wallpaper catalogues used as insulation and dating from the period 1922 to 1933. It also revealed a newspaper *(The Daily Mail)* used as insulation and dated 10 April 1935, which almost certainly dated that particular phase of building work.

6.7 RECORD PHOTOGRAPHY

6.7.1 The recording requirement

Photography has long been recognised as a most important form of record where historic buildings are concerned. The vast collections of photography – many stretching back into the C19 (Illus 110) - held by the National Monuments Record for Scotland (NMRS) are a testament to this (see Ch 5.8).

Photography of historic buildings which will contribute to the record can be sourced from many places, and indeed may be taken by many different persons, from the owner through to the professional photographer. While all photographic images will be of value, it must be stressed that there is a considerable gulf between 'snapshot' photography taken with a small handheld 35mm compact camera and photography taken to professional standards with larger format cameras, tripods and lighting.



Illus 110 This historical photograph of the Town House, Dunbar dates from the 1880s, and was taken before the low buildings and harling were removed. (Photo: Crown copyright)

The emphasis in this section is on describing the standards which are needed for thorough building recording. The importance of careful specification is also emphasised.

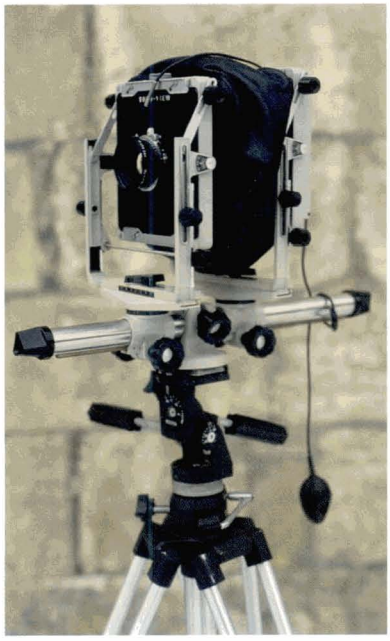
6.7.2 Equipment

Equipment for architectural photography should be as simple and robust as possible. It may have to be carried up scaffolding, manoeuvred through a derelict building, or carried for long distances over open countryside. There is no room for anything in the equipment which will not stand exposure to dust, minor impact, or the weather.

i) Film-based photography

In spite of the digital revolution, there is still a place for film-based photography, where the subject would benefit from the use of medium- or large-format cameras and where archival permanence of the images is regarded as particularly important.

Monorail cameras are simple to use and allow a full range of movements - a particularly important consideration where architectural photography is concerned (Illus 111). Medium-format cameras are more economical and generally offer an image quality not discernibly inferior in small enlargements. Cameras such as these offer very high resolution and should be loaded with film types designed to make the best of this characteristic. If processing is to be carried out by an independent laboratory, the need for image quality must be emphasised or the results may be disappointing. In both external and internal work, a tripod will be required, both to guarantee a sharp image and as it is much easier to carefully compose the photograph (Illus 112).



Illus 111 A modern monorail camera. While complicated at first sight, these cameras offer great flexibility in obtaining architectural photographs. (Photo: Ross Dallas)

Illus 112 Setting the camera up on a tripod. Use of a tripod will always improve the sharpness of photography and helps with the composition of the photograph. (Photo: Colin Briden)

The success or otherwise of the photographic record depends very much on the use of appropriate, well-planned, and revealing lighting. But illumination inside historic buildings is frequently problematical. Natural light often gives the best results, particularly where it can be combined with the discreet use of reflectors or infill artificial sources. Tungsten lighting requires either site power – not always available – or the use of a portable generator.

Controlled environments within curated buildings may prohibit the use of bright lights generating large amounts of heat. Indeed, it is strongly recommended that intense floodlights of the quartz-halogen type are ***never*** used in historic interiors where there is the slightest fire risk.

In this case, electronic flash – perhaps combined with modelling lamps so that the lighting effect may be judged before exposure – will have to be used. Techniques for using electronic flash are many and varied, but for good results at least two light sources will usually be required (Illus 113). This is best arranged either with slave units or by long exposures and a single mobile unit. If interiors flooded by daylight are to be photographed, thought should be given to the possibility of working at night under controlled lighting conditions.

There is no place in high-quality record photography for the compact 35mm camera with a built-in flash unit. These cameras can give, at best, only the most basic results. Although they are helpful for any form of rapid assessment work, they are not a replacement for high quality photography.

Illus 113 Lighting internal areas or features can be skilled work. In this example, two 'studio' flash heads are being used to provide even illumination of a feature. (Photo: Ross Dallas, courtesy Downland Partnership Ltd)

ii) Digital photography

Over the last few years, improvements in the technology of digital photography have taken place at breathtaking speed. As a result, it is now possible to obtain digital images which are comparable with those taken by medium-format cameras using film-based technology. The advantages of digital photography may be summarised as follows:

- No film is required, as the memory cards may be re-used indefinitely
- The video technology employed allows photography under difficult lighting conditions
- The use of a laptop computer on site allows the images to be checked and stored as the photography progresses (Illus 114)
- The process of data acquisition is speeded up greatly
- Individual images may be digitally manipulated to present the maximum amount of information.

While the following steps can be achieved by scanning photographs and converting them to digital images, the processes are much easier with straightforward transference from digital camera to digital image:

- The digital output may be stored and issued on CD and used for a variety of purposes at a later date
- Suitably compressed files may be transmitted electronically.

The difficulties with digital photography chiefly centre around the very large file sizes of images taken at maximum resolution: typically around 7 to 10 Mb. If a large number of photographs is anticipated, transfer to laptop computer on site will be necessary to ease memory problems. The longevity of digital images may also be a concern, discussed below under archiving of photography.

Illus 114 Recording with film and a digital camera. The digital camera image is being simultaneously downloaded onto a laptop computer. (Photo: Colin Briden)

iii) Other equipment

Metric scale bars of the appropriate length should be placed in all important photographs and should if possible be carefully plumbed and levelled. This may also aid any digital rectification of the image at a later date. Ranging poles can be obtained which will slot or screw together to make up any length.

A small chalkboard, or a plastic board bearing magnetic numbers and letters, should also be included in the photograph if it forms part of a series of very similar images – although care should be taken not to obscure significant detail. Spirit levels, or bubble levels that can be fitted directly to the camera or its tripod mount, are often useful.

An extending pole which will carry a camera into an inaccessible space can be made up - a digital camera mounted on the pole can be linked to a laptop computer or VDU to allow selection of the image before remote triggering. Spare cameras are often a good idea.

There is now a very wide range of sophisticated aerial access equipment available from plant hire companies. Particularly helpful are small self-drive hydraulic hoists which can be towed behind a car: these hoists are battery-operated and will normally reach a height of about 13 metres. So compact are some of these designs that they can be taken into interiors. The need for safe working practices with such equipment is evident (Ch 9.5).

iv) Image output

In most building recording work, there is still great demand for photographic images in hard copy form. Colour and/or black and white prints in albums will usually be required for at least one set of the record.

Similarly, all negatives must be carefully indexed and stored. It should always be remembered that the *negative* is the primary photographic record, and that all other forms of representation are derived from it.

However, where multiple copies of Reports are to be supplied, it is more common for these to contain inkjet, laser or photocopied images. This may be acceptable, *as long as an archival copy* is carefully deposited. Archival standard inks are available, which may be particularly appropriate to specify for inkjet printing, which is very impermanent.

In this respect, the possibilities of scanning and digitising photographs should not be neglected. Where possible, this is best done from the negatives or transparencies - in this case there will be very little loss of definition. Scanning in prints can be satisfactory where the output will be at the same scale, but is generally limited if higher enlargements are wanted.

Delivery of information in digital form is becoming increasingly common (Ch 6.8). The CD ROM disc can store a substantial number of images, and takes up very little space, although there are again archival considerations (see below). There are considerable advantages in having photographic images stored digitally, not the least that they can be easily and inexpensively disseminated.

6.7.3 The scope of the photographic record

It is impracticable here to list all the features which may need to be recorded; naturally this depends on the purpose of the work. This may range, for example, from the total record of a building facing demolition to a single photograph of a feature which is to be rebuilt or reproduced.

In all cases, the emphasis must be on the readability of the image: artistic effects are rarely informative. The extent of the survey would normally be described in the brief, but as a guiding principle the work should be carefully planned as a progression from the general to the particular. The most complete photographic record would therefore include:

- The setting of the building or structure
- All principal elevations, both external and internal (Illus 115)
- All significant structural and decorative features
- All dating evidence
- All evidence for the development of the building.

Illus 115 Photographic record of an exterior, presented as rectified photography, made up of a composite of several images. With digital input and modern computer programs, this type of product can easily be prepared. (Photo: Colin Briden)

Many such details can be difficult for the photographer to identify, let alone photograph. While there may apparently be more expense involved, it may be necessary for the photographer to be accompanied by the building recorder, at least initially to identify all required photographs. Any record of a building with a specialised function will need to offer a clear idea of the processes carried on within it. Here, also, specialist advice may be required.

6.7.4 Procurement

A requirement for a photographic survey of a building most often arises because:

- Photography is required as part of an assessment of the building which is designed to inform the conservation process
- A condition on a planning consent requires a photographic survey, which may as well include other forms of permanent record
- A photographic survey is a condition of grant aid of some form
- Record photography as part of say an academic study is less common. It differs from the above only in the more measured approach which can generally be taken in the absence of a statutory requirement.

In each case the photography will often be carried out by or on behalf of an approved building recorder or archaeological contractor responsible for other work on site. In all cases a detailed brief for the photographic work must be available to the photographer. The need for a watertight brief is always paramount. At its simplest, the brief should include a list of the areas of the building to be recorded, a list of specific details to be photographed, and technical data concerning the equipment and image processing methods which are to be used.

Floor plans of the building showing a room numbering system should be obtained for location purposes. Sketch plans are sufficient, although room *names*, being impermanent, are not normally recommended, or must be supplemented. Agreement to the brief will normally be obtained in writing from the client and from the authority concerned.

In some circumstances – where work is to be carried out in a dangerous structure, for example, or in an environment such as a factory or railway building – a method statement and/or Risk Assessment may also be required. This will describe access arrangements, health and safety considerations, and any other constraints on the work. A list of personnel may also be included for security reasons.

6.7.5 Archiving photographic material

Accurate descriptions must be kept if the photographic record survey is to have long-term value. These should be based on the room numbering scheme and floor plans. The photography file will also include details of the date and time of the site visit, equipment used, access arrangements and constraints on the extent of the work. An accompanying video record will help to place a detailed photographic survey in context (and indeed may form part of the record in its own right). Storage of film-based photographic materials is an important matter and expert advice may be required (Ch 9.11).

The archival permanence of digital images is currently causing some unease since it is suspected that CD ROMs may degrade, taking the stored information with them. It should be remembered that the permanent element is the **image file**, and that what matters is the ease of transference of the file from one medium to another and not the storage medium itself. At present, the life of CD ROMs is an unknown quantity since the medium has only been in use for a short time. The answer probably lies in alternative methods of storage currently under development. Improved data transfer methods – allowing the rapid copying of very large files on a regular basis – may also remove some concerns.

REFERENCES

There are so many books on photography that it is of limited value to identify particular titles. There are relatively few books on architectural photography, and even fewer on photographing historic buildings. Buchanan (1983) remains very useful and is particularly good on lighting techniques, but due to its date has no material on digital photography. For large format photography, Kodak (1998) is very useful. There are many books on digital photography, but it is such a new and fast-moving field that information quickly becomes out of date. A very useful primer is Lojkine (2001). Davies & Fernessy (2001) is a more advanced work.

6.8 COMPUTERS IN BUILDING RECORDING

6.8.1 The computer revolution

There can be few persons likely to be involved in building management in any way who are not familiar with computers. The ubiquitous desktop computer has become as commonplace as the office desk or the furniture. But it is easy to forget just how recent this innovation is, especially in comparison to the life of the historic buildings being discussed.

The purpose of this section is to take stock of how computers are used and influence current procedures - and to look a little at how they may affect processes in the longer term. Some use of computer or digital technology is often a requirement of the client, or is unavoidable due to the nature of the equipment that has been hired to do the work. It should be commented also that not everything about computers is positive – there are some difficulties in use and genuine problems with some equipment.

The personal computer or 'PC' is the device which has had the most influence on the field of recording and measurement. The PC allows the manipulation of often very large amounts of data quickly and accurately. It enables procedures to be carried out in real time. It enables large data sets to be analysed and exchanged quickly and easily.

However, it is important to note that a whole range of instruments, such as total station theodolites and digital cameras, only exist because they use a similar microprocessor chip to that which is central to the PC.

The computer has not only speeded up existing processes, but has allowed better, more advanced and more sophisticated solutions to be adopted. For example, creating data in 3D is with traditional methods very complicated (Ch 3.5), but with CAD it becomes straightforward. Processing colour images with a computer is no more expensive than black and white.

6.8.2 Recording and surveying utilising computers

i) Equipment

Most modern survey instrumentation is highly dependent on computer or microprocessor chips. As well as theodolites and levelling devices, the new laser scanners (Ch 4 - Technical Focus) utilise computers. For the inputting of text data, laptop computers are invaluable. Digital cameras are revolutionising photography and video.

In the office, the PC is obviously used in many ways, but the importance of the peripheral equipment which owes its existence to the chip needs to be noted as well. For example, even the modern photocopier is digital-scan based.

ii) Software

Many technical processes rely not only on the computer, but on the essential software 'package'. For example, a process such as photographic rectification (Ch 4 – Technical Focus) has been transformed out of all recognition by computers. Traditionally, this was a laborious mechanical process carried out with a photographic enlarger.

Nowadays, the image is scanned in and an appropriate computer program can tip, tilt, stretch, merge and scale an image. This can be used on any type of photograph, from the building elevation to that of an oblique aerial photograph. Detail can be transcribed in a number of ways (but it should be noted that the geometric principles underlying rectified photography are not altered).

Indeed, the whole area of image processing and handling is perhaps one where changes have been fastest and most profound. An image never needs now to touch the medium of film or paper. It can transfer from the digital camera to the computer, be viewed on the VDU screen, be stored on CD and be emailed to any other destination.

In the processing of data, the word processor perhaps has most applicability, but database programs are also important. The processing of context information can have greatly added depth, through the holding of the information in a database program, where information can be rapidly analysed and cross-referenced. With the level of computer literacy improving and broadening, formerly daunting computing tasks are more easily tackled.

Most computer operations deal with text, pixels (for raster/graphic images) or vectors (CAD drawing lines). These operations are sometimes enabled by the use of text codes or commands, but even these can be learned like any language, and training courses in various procedures or packages can be acquired by the non-specialist.

iii) Integration and combination of data

With continued development and even harmonisation of computer methods, there is the increasing desire to integrate data into one homogenous data set. This could be a combination of text and images, or a series of inter-linking packages that cross-reference the data.

An example of the holding of data completely in computer form comes from Kisimul Castle, Barra, a property recently taken into Guardianship by Historic Scotland (Brann *et al* 2001). Here, a thorough measured survey and building recording exercise has been wholly delivered in digital form and stored onto CD ROM (Illus 116).

- All measured survey data is in CAD format
- All context records are in Microsoft 'Access'
- All photography has been captured or scanned digitally
- Documentary material has been scanned
- The Report is in word processor format.

In addition, data can be cross-referenced within the digital data.

Illus 116 The database of information on Kisimul Castle is all available on CD ROM. The data is held on three CDs. Most of the CDs are used to hold high resolution photographic images, appropriate for printing. For everyday purposes of on screen viewing, the low resolution images are adequate. (Photo: Historic Scotland)

6.8.3 Some pitfalls of computers

But the use of computer data can also have a downside. To use computers and programs can still be surprisingly difficult - the learning curve can be very steep. Specialist software programs can be very expensive. Moving procedures onto computers can involve a whole system being set up. Without the right software and equipment, those wishing to study the data may be excluded.

The short and long term storage of computer data can be fraught with problems. In the short term, there is always the danger of the computer crash, where all information is wiped out. In the long term, the longevity and transfer of data is largely an unknown. The keeping of proper back-ups is no doubt the key to peace of mind, but the questions of long term storage certainly remain (Ch 9.11).

There are also some issues with the manipulation or enhancement of images and other data, in that images can easily be altered from the true conditions found when the primary record was made. While with traditional film processes, prints can certainly be altered, examination of original negatives is a fairly reliable procedure. With digital images, remarkable adjustments can be made and there is little way of establishing what is the true original.

6.8.4 The future

Computers are without hesitation here to stay, so some review of how the field of building recording may develop with computers is relevant. Undoubtedly the speed of computer operations and volumes of data will increase. This in turn will enable more data to be captured, and quickly too. Even with large datasets, accuracy and consistence of data should not be affected. Furthermore, miniaturisation and cost reductions will further encourage the use of various pieces of hardware.

Some areas where there will be great development will be with integration, analysis and access, and with data capture and recognition. For integration methods, there will be the continued combination of data sets within packages that enable informed access and analysis of the data, and in a very graphical way, often via the Internet or servers.

In the field, there will be more use of voice and character recognition to facilitate the human recorder to quickly transfer their visual observations and measurements into the PC. Central to these procedures will be metric digital photographic methods, the 3D modelling of buildings and the contextual application of text and observations.

We can imagine the not especially computer-literate field recorder looking at the façade of a building, talking into a PC microphone, taking some photographs with a digital camera and control measurements with a laser device – all then downloaded to a palm or laptop computer in real-time. Later, the recorder verifies the combined information during lunch-break, and then sends the graphic/CAD/text database via satellite email to upload to the Internet for perusal by the client later that day.

REFERENCES

With so much information available on computers and with the field developing and changing so rapidly, no specific references to computing techniques and equipment are provided.

7.0 UNDERSTANDING AND ANALYSIS

7.1 THE BREADTH OF BUILDING RECORDING

Much of this Practitioner's Guide has been concerned with the range of methods that can be applied to the recording of historic buildings. In Chapter Two, a broad analysis has been provided of the reasons for recording. In this chapter, the approach of the building recorder is explored in more depth.

What are we trying to learn about the building? How do we go about it? How is the information gained from the wide range of tools and techniques available synthesised into a meaningful understanding of the building? This chapter will endeavour to illuminate some of these questions.

But first, what drives the recorder? The excitement of unravelling a building's history is as good as a good detective novel. You approach, say, a modest country house. At first site, the façade looks to be bland. Then, a straight joint down through the masonry is noticed, then another some metres away. Closer inspection reveals that while all the surfaces have been retooled, in the area of the straight joints there is the clear pattern of the long and short work of quoins, unnecessary or unexpected in this location.

Later in the process, when the accurate floor plans have been prepared, it is found that the wall thicknesses in this part of the house are more or less double that of other areas. Then, documentary research from our historian reveals that during the extensive building work in the mid C18, the former tower house, long since believed to have been completely demolished, may not have been – the account books reveal an extra payment for 'making a doorway through *existing* masonry' (recorder's italics).

Into the roofspace, and on a wall apparently constructed to support chimneys, evidence is found of a narrow chamfered window dating to the early C16. It has been discovered that the current building actually incorporates a much earlier structure.

While this is not the time and place for an extended essay, a need to understand the past seems to be deep in our psyche. Studying and recording buildings has actually been going on for centuries, as referred to in Chapter Two. Similarly, the collecting of all sorts of artefacts, reflecting our forbears, is a long established practice. Of visitors to Scotland, 'heritage tourism', to give it its unfortunate sobriquet, is one of the main goals – Edinburgh Castle, the Palace of Holyroodhouse and many others are high on the list of tourist destinations.

Of course, there are the dark days. Working in the depths of winter in a damp, unheated basement recording a barrel vault is no one's cup of tea. But, when the story of a building's history is finally unravelled, there is huge satisfaction - both to the recorders, then in the knowledge that this information may in turn help with the conservation of the building, and equally in providing the wider public with a better understanding of a small part of their history.

Thus in this chapter, two main themes will be explored. Firstly, the processes of understanding, as gained by use of a range of techniques and tools. Then, the chapter will consider what can be learned about historic buildings by exploring a wide range of areas of study.

Some of these areas are described in detail in other sections of the Guide. Where appropriate, cross references to these sections and to the Case Studies (Ch 8) are given. It would not be possible to be wholly exhaustive in either or both of these areas, for as has been demonstrated elsewhere in the Guide, building recording and the approaches to it can encompass a wide range of techniques.

7.2 SKILLS, TOOLS AND TECHNIQUES

7.2.1 Overview

Beyond basic recording, one of the principal requirements of building recorders, be they archaeologists or architectural historians, is to provide *analysis*. This may simply involve establishing the general facts about a building - defining the building type, its evolution, its sequence of construction, breaking this into individual phases and dating those phases, and so on.

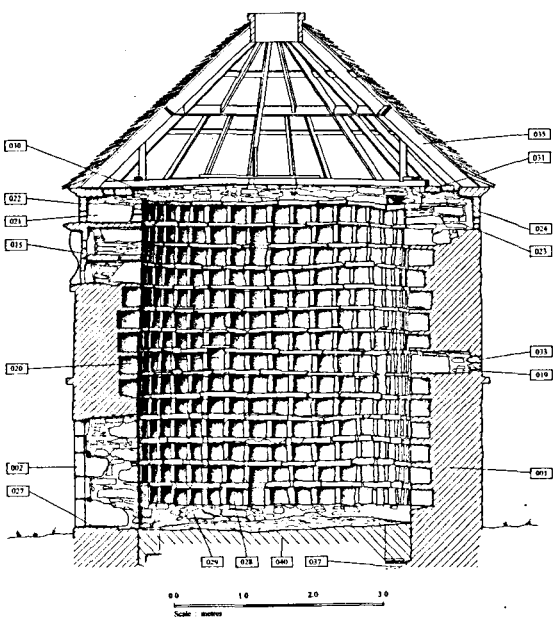
The building recorder draws upon a range of techniques and analytical tools that can help tease out the meaningful information that a building may contain. It is important to note that even a simple building could create a very large dataset. Recording is a process of sampling, which may be dictated by which research questions are being addressed.

In general terms, the building recorder combines the traditional methodologies of the archaeologist with the academic discipline of the architectural historian and the skills of the architectural draftsperson. This section explores why these various techniques are important and how they contribute to the understanding process. It also looks at the importance of being able to communicate this understanding effectively.

7.2.2 The discipline of drawing

In order to understand the fabric of a building, a proficiency in hand drawn survey is the most basic skill. The process of drawing forces the observer to cognitively unpick the elements of the building, to define boundaries, to express detail with clarity. It is thus one of the best means by which an understanding of construction can be developed.

The approach by which an archaeologically trained building recorder creates record drawings of buildings is in contrast to that of other professionals such as architects, surveyors and engineers, just as the reasons for doing so are different. The archaeological drawn record may be characterised as a process of *direct accumulation* of information (Illus 117). Thus in a hand drawn stone by stone survey of a given architectural feature the tendency will be to 'accumulate' the drawing, effectively building it up in individual pieces. The primary information is effectively delineated in its final form on site – measured and drawn directly by eye and to scale.



Illus 117 Boath Doocot, Auldearn, a hand surveyed sectional elevation. (Drawing: Addyman & Kay, courtesy NTS)

A further contrast is one of perception. The recorder with an archaeological background should approach a building without preconceived ideas of its nature. Rather than a designed concept, the building should be seen as an accumulation of parts which, when assembled in the form of a measured drawing, will then convey its wider meaning. In this way, the understanding of construction and design can be successively revealed as the survey progresses. Irregularities of the structure, often signifying very important analytical information, will be less likely to be evened out.

Clarity of thought and competence of draftsmanship are thus both fundamental skills. Each contributes to the clear definition of the information contained within a particular structure. It must be stated that by its nature such a record drawing will superimpose the observer's opinion as to the interpretation of the feature illustrated. Draftsmanship also inevitably involves some 'artistic licence' – choice of line thickness, shading, colour etc – which are employed to emphasise particular aspects of that information. The ability to communicate what is significant about a building is a skill acquired through experience. It follows that the success of a drawing is closely related to how effectively it communicates the information contained within it (this is also the case with photographic recording).

In practice, the buildings archaeologist often has to work with existing drawings, generally those prepared by the architects or building surveyors involved with the repair of a given building, or specially prepared by land surveyors. It is a common experience that such drawings are rarely produced for the purposes and to the standard required for detailed building recording.

Rather, they involve the design and contractual aspects of the project and are often inadequate in detail. They often omit the subtleties of a complex building, such as minor changes in wall alignment. It is often these details that tell the story of a building. All such plans need to be checked on site for accuracy and detail if they are to be used as a basis for recording.

7.2.3 Ordering information

In building recording, an archaeological background provides particular methodological advantages, characterised by a systematic approach to examination and recording of the subject.

i) Contexts and stratigraphic relationships

The methodologies of excavation archaeology are ones that are also now being applied to buildings (see Ch 5.5 & 5.6). Typically, each part of a building will be

allocated a unique context number. It is useful to consider each *context* as a 'single event' and a single deliberate act within the construction process (or indeed demolition), or within a phase.

Contexts can also be assigned to other types of information relating to a building. Where a feature has been lost but has left a scar or some other evidence *(negative evidence)* a context can be assigned under the guise 'evidence for X feature'. This would apply, for example, where a partition wall has been removed but its location is defined by paintwork or wallpaper that stops abruptly on either side.

In recording exercises where extensive analysis is possible, context numbers might also be assigned to features the evidence for which only exists in the documentary records, a simple case being an early photograph. A further category is conjectured or inferred features that no longer exist. All such *negative features* should be very clearly identified so as to avoid confusion within the record of the actual physical evidence, as observation of physical fact and assumptions must be clearly separated.

The architectural context should then be logically ordered in *stratigraphic* sequence, just as contexts for excavated layers are ordered. The most fundamental subdivision is the individual phase that defines a group of contexts. Once defined within each phase there must be a sequence of construction – literally the order in which the building was built.

Thus foundations must precede wall construction, which in turn must be in place before plaster and then paint are applied. Each step in the construction can therefore be defined physically, allocated a number and described, and then placed in their sequence of construction.

The great advantage of this approach is that it is both systematic and versatile. In many multi-phase buildings for example the most recent additions will be of less inherent significance than the 'historic fabric' that has necessitated the survey in the first place, although this must be a matter of judgement. In the context system, such parts of the building can be described by single context numbers rather than being broken down into individually numbered constituent elements. This is often a pragmatic approach where time or budget pressures are an issue.

At the most basic level, direct physical relationships are looked for – one part of the building had to be in place before the next part was built against it or over it. Typically one will look for different characteristics of construction and a physical boundary between these. For example in masonry construction, changes in mortar colour and make-up are often valuable guides to defining phases.

ii) Databases

For most buildings or projects the analytical data – the context record – will be arranged in the form of a computerised database. In some cases, particularly larger projects, this can also be an effective analytical tool where a substantial body of data can be rapidly questioned.

Databases can also be linked to digital images of buildings in programs such as AutoCAD or CorelDraw. By linking individual contexts or groups of common contexts to individual layers within the digital image, the image itself can be questioned and the analytical data can be manipulated by phase, by area, by type of feature and so on.

The recording of 26-31 Charlotte Square, Edinburgh, for the National Trust for Scotland is a good example of databasing. Some 2,500 contexts between 6 similar houses were recorded, allowing for detailed comparison and analysis to be made (Addyman 2001).

Another example is Queensberry House, Edinburgh, a large town mansion of the 1660s and 1690s (Illus 118). Here a system of layering was employed within the digitised images of the building (in AutoCAD and CorelDraw) which were related directly to the database. By filtering the information within the database the elements recorded within a particular phase could be expressed as a separate image (Illus 119).

Illus 118 Queensberry House, Edinburgh, in 1999, looking south. Note the test areas of harling which had been stripped. (Photo: Ross Dallas)

Illus 119 Queensberry House, a sectional elevation through one of the main staircases, with various periods and features recorded into separate CAD layers. ((Drawing: Addyman Associates, courtesy Scottish Executive)

Without the confusion of later modifications, it became easier to understand the surviving evidence for the original form of the structure. An additional digital layer was then applied to the drawing to represent the conjectural restoration of missing elements based on the surviving evidence.

iii) The Report

The written record is the final stage of the analytical process (Ch 5.9). It is incumbent on the practitioner effectively to distil the detailed information accumulated within the context record and to communicate this, in conjunction with suitable illustration, to the relevant audience.

This exercise forces the recorder to filter and put in a logical order the significant findings of the project work. This is most commonly done in chronological order and then by aspects of the building – exterior, internal planning, features by level and by room in a logical sequence. The account then typically addresses such issues as the wider architectural, cultural and landscape context, and significance.

7.2.4 Analytical tools

Fundamentally important for the understanding of historic buildings is the approach of the architectural historian, who relies upon the study of stylistic differences and the more clear-cut visible physical relationships between phases and the general characteristics of those phases. This information is contrasted with surviving documentation for the building, the study of which requires the historian's particular skills.

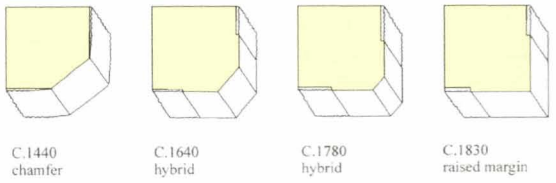
i) Typology

The *typology* is a basic tool for understanding historic buildings. In broad terms, as style changes, technology evolves and particular materials become available, so the planning and architectural details of buildings change over time.

This is one of the principal methods employed by architectural historians and one with which building recorders must be familiar when attempting to define dating, social status and function of a given building. The typological approach can be applied to many aspects of a building, such as its plan form, its individual decorative details such as masonry mouldings, and to its stage within technological evolution.

The creation of typologies of architectural features, particularly from buildings of known date, is done in the same way as archaeologists commonly categorise artefacts and can be expressed in tabular form. This is both a useful device for placing details in a particular building within a wider architectural context and as a means of recording within a single, multi-phase building. As with all tools, a cautionary note must be sounded, as typologies are 'works in progress', not definitive statements.

An example of this approach came from Geilston House, Dumbartonshire (see Ch 6.5). At Lochgoilhead Church, Argyll, architectural recording identified six individual phases of construction. Four of these were characterised by very particular but differing window surround details that provide an excellent if simplistic illustration of how architectural form evolves through time (Illus 120). Within this building, the late medieval chamfered *aris* was gradually superseded, via C17 and C18 hybrids, by the *raised margin* (Addyman 1997).

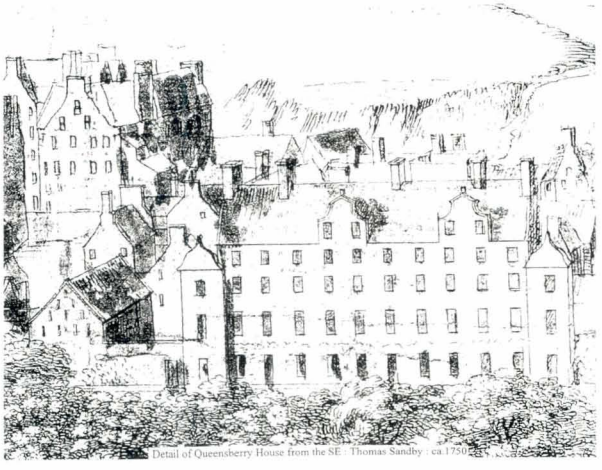


Illus 120 At Lochgoilhead Church, Argyll, differing window surround details illustrated how architectural form evolves through time. (Drawing: Addyman & Kay, courtesy Lochgoilhead Parish Church).

ii) Historical studies

Building recording work often relates closely to the study of archive source material (Chap 5.8). As the majority of buildings recorded will be of medieval and later date, the documentary study may be a more revealing activity than for example it could be in relation to excavation archaeology of earlier sites. Building accounts and inventories in particular often provide very detailed information that can be directly related to the structure.

For example, in searching for information on the C17 appearance of Queensberry House, Edinburgh, documentary records provided key pieces of evidence. These included a view of the building in the 1670's, a building account for 1681 for the building of the 'bartizan' or belvedere tower, early C18 room by room inventories of the interior furnishings and fittings, and a view from the south drawn in 1746 by Paul Sandby (Illus 121). The inventories named each room individually, including the Dutchess' (sic) china closet, the Duke's library and a long gallery (Lowrey 2000).



Illus 121 Queensberry House, a very early view of the house circa 1750, by Paul Sandby, extracted from a panorama of Edinburgh. (Courtesy: National Galleries of Scotland)

Another example comes from Ossian's Hall, Dunkeld (Addyman 2002). This small building has unusually extensive documentation that includes:

- Building accounts of the 1750's
- Accounts and shipping lists for the interior fittings for a reconstruction in 1782-3
- Numerous visitors accounts throughout its history, notably by Warren Hastings and the Wordsworths
- A plan and section sketched in 1806
- Various estate plans and Ordnance Survey maps
- A number of early photographs, including a stereopair that was taken after partial destruction in 1869
- Building accounts for programmes of repairs in the 1880s, 1950s and 1980s.

iii) Scientific techniques

There is now a wide variety of ways of analysing elements of building construction. Knowledge of the range of possibilities is necessary for the building recorder. Where suitable woodwork survives, dendrochronology may provide an important opportunity for absolute dating (Ch 6.3). Other potential dating techniques that are now being applied to buildings include thermo-luminescence (dating of bricks) and even radiocarbon dating (carbon kiln residues within mortars).

The analysis of the composition of building materials can generate important information. Thus visual characterisation under the microscope, chemical tests, even trace-element analysis, amongst others can be applied for understanding the composition of building materials such as paint pigments, mortars, plasters and glass. Mineralogical analysis of building stones is an important means of identifying quarry sources. Wood can be identified by species, and so on.

Such techniques are often only used in cases of particular significance, or where it is appropriate to achieve a correct match during the conservation of the building. Characterisation of historic mortars, for example, is now common practice and can yield important information – mortar types change through time. In all sampling programmes, great care must be taken to ensure that the origin of the sample is accurately recorded and can be assigned with certainty to an established phase of construction.

In Scotland, various bodies, particularly Historic Scotland, the National Museums of Scotland, the Scottish Lime Centre and some universities, also hold valuable comparative collections of traditional building materials, databases of stone types and so on.

7.2.5 Language

The language of architecture has enormous diversity and consequently presents a particular challenge that cannot be ignored – how does one describe a building and to what extent does one use traditional terminology?

This can be important, for a correct appreciation of traditional terms can provide a valuable understanding of processes. For example, in Gaelic-speaking areas the terminology can lead to insights into traditional building practice. Different types of beach sand have particular names according to their specific applications in construction, for example types of mortar, harl and so on.

As a starting point, many terms are in more or less universal use today, at least in Anglophone areas (thus excluding parts of the West Highlands and Hebrides). Terms such as *joist, slate, window* and *chimney* are for the most part uncontroversial. Beyond this there is a generally practiced *lingua franca* of terminology that has long been employed by bodies such as the RCAHMS.

For the practical need-to-know correct terminology, Glen Pride's *Dictionary of Scottish Building Terms* is an invaluable tool for understanding historic references to vernacular Scottish building traditions (Pride 1996). There are also numerous published works that introduce the Classical language of architecture, and the terminology of other specialized types such as industrial, garden, ecclesiastical and military buildings.

7.2.6 Experiencing the building process

It seems an obvious but nonetheless serious point that to develop an understanding of historic buildings one must become involved with them. Architects for example were traditionally trained by becoming familiar with the basics of construction on the building site, quarry and workshop. An intimate knowledge of building materials and a fundamental involvement in the construction process from first principles underpinned subsequent careers as designers of buildings and managers of projects.

Thus it is proposed that those concerned with the study of historic buildings should physically learn the fundamentals of traditional construction. Today, one can become at least familiar with the basics of traditional construction and knowledge of materials on a practical level by attending training courses provided by bodies such as Historic Scotland and the Scottish Lime Centre and by physical involvement on conservation projects.

There are numerous individual courses that can be attended – masonry construction, thatching, dry stane dyking, the varied uses of lime-based materials, folk museum reconstruction projects, and so on. On a more extended level, there are longer term (generally one or two years) buildings conservation degree courses.

However, there is no substitute for real involvement on the building site, that is working with the professionals undertaking the conservation works. Physical familiarity with traditional building materials and their application provides an invaluable understanding of building methods. Such direct experience will quickly dispel many misconceptions. Some of the best information about buildings is obtained from the tradesmen working on the site, who are intimately familiar with building construction.

7.3 AN INTRODUCTION TO THE ANALYSIS OF BUILDINGS

7.3.1 Variety and diversity

Buildings are wide in their variety. While they can be classed into types and categories, nevertheless they are very varied and a large amount of information can be found. They range in their appearance, materials, age, purpose, associations and cultural significance, both individually and as groups.

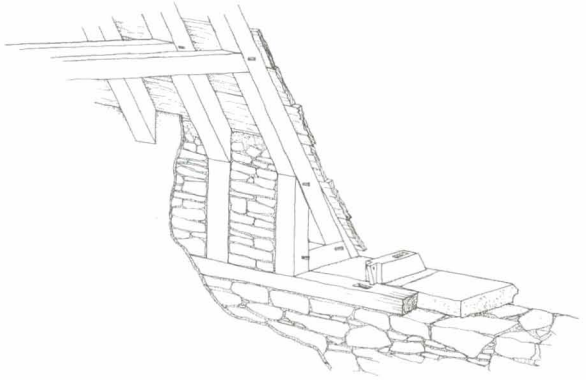
The following sections examine a number of themes and types of evidence that are commonly encountered in the study of historic buildings.

7.3.2 Construction processes

The understanding of the process of construction of a particular building or building type can be important for a number of reasons. If a system of construction can be explored, understood and recorded, this can be invaluable in informing the conservation process for the building itself. It also allows an understanding of how materials were manipulated by the craftspeople involved, the processes and order of construction, and the organisation of the building site itself.

Evidence of construction processes can take a variety of forms. An example that is often seen is blocked scaffolding holes or *putlogs*. Mason's marks relate to the organisation of labour on the site and the need to quantify an individual mason's work.

In the recording of 26 – 31 Charlotte Square referred to earlier, a mortar-mixing floor was discovered beneath the existing cellar floorboards at No.26. On the same project, temporary entrances were discovered between Nos. 27 and 28 – the two houses had been constructed simultaneously by the same speculative builder. The entrances had been infilled with brickwork at the completion of works. The similarities of the general construction and decorative details between these two



Illus 122 An understanding of roof construction comes from this detail drawing of part of Gylen Castle, near Oban. (Drawing: Addyman & Kay)

buildings were in notable contrast to those of the other four buildings that formed part of the study.

Buildings that are in a state of semi-decay (or undergoing extensive building work) are for the recorder often the best subjects for study, where many aspects of the construction are laid bare. As an example, the surviving evidence for parts of the roof structure at Gylen Castle, near Oban, were recorded on site, and a reconstruction drawing prepared based upon this evidence (Illus 122).

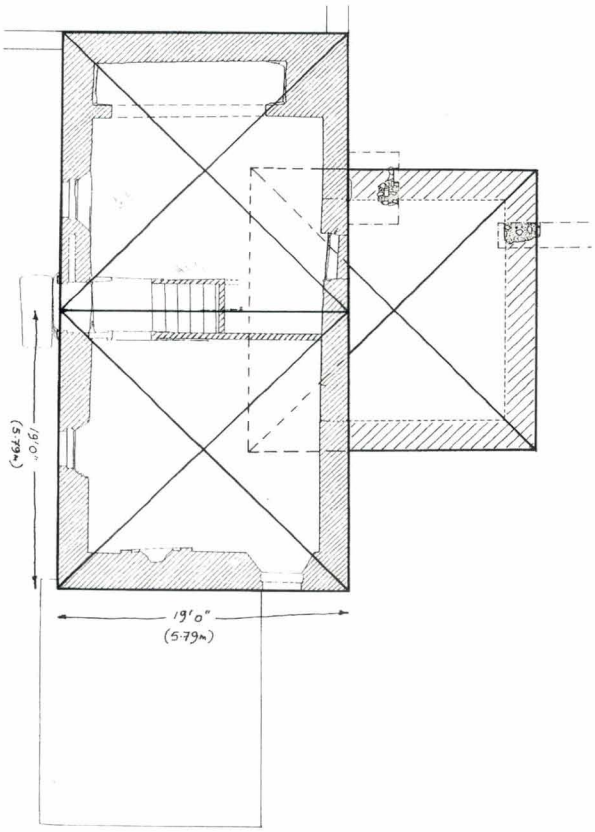
7.3.3 The design and planning of buildings

An important aspect of analysis will focus upon understanding the planning and design concepts involved in construction. In earlier periods, formal 'design' was generally confined to buildings of the highest status such as churches and castles. By the C17 and C18, this was beginning to extend to more humble buildings as the professional builder and architect increasingly replaced the local craftsman-builder.

An illuminating example of such a transitional building is Old Auchentroig (Illus 123), a minor laird's house in west Stirlingshire (Addyman 2002). Here, following accurate survey, it was possible to understand the planning of the structure, even of parts no longer extant such as the lost rear wing. Externally the plan had been based upon a series of 19 foot squares (Illus 124), while the internal space was governed by the 15 foot square unit and quarter subdivisions of this, that is 3'9". (The dimensions are here deliberately kept in imperial).

The latter measurement represented one version of the historic *ell*, at this length only in use in the later C17 up to the Act of Union, at which point it was abolished. Old Auchentroig, bearing a dated lintel of 1702, employed this measurement systematically as a tradesman's measure and all internal features of the plan were precisely related to it. The vertical internal space conformed to 2-*ell* units that even extended to parts of the roof structure.

Illus 123 Old Auchentroig, a minor laird's house in west Stirlingshire, photographed before the NTS began a programme of conservation. (Photo: Tom Addyman, courtesy NTS)



Illus 124 The importance of planning and design concepts is shown in this example of modular dimensioning from Old Auchentroig. (Drawing: Addyman & Kay, courtesy NTS)

7.3.4 Functional processes

An important aspect of traditional building, as with all construction, is the way in which it was designed to cope with environmental factors – the provision and distribution of heat and ventilation, insulation, water and wind proofing, drainage, the provision of light, and so on.

These may be termed the *functional systems* of a building. Differing solutions to such fundamental requirements were devised according to the period, locality (differing climatic factors and availability of different types of materials), different building traditions and the specific cultural requirements of the time.

By 1700 Queensberry House, Edinburgh, seems to have been heated by over 50 fireplaces, although many of these have long since been lost. However, the flues that served the fireplaces generally survived, forming a very extensive and intricate network. In one area, for example, a large chimney contained eight flues for which the remains of only two fireplaces still survived. By following the flues down, the location of each of the missing fireplaces could be conjectured and the arrangement of space with the corresponding rooms could be better understood.

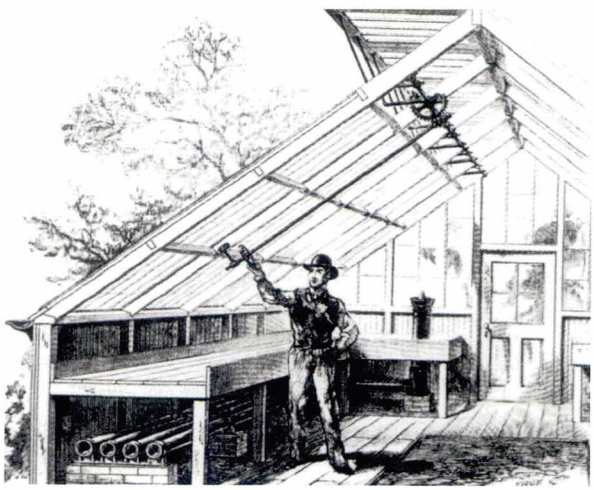
7.3.5 Evolution of technology

Buildings can be understood and studied according to various aspects of their technological evolution. This may simply be in terms of their method of construction, or more specifically, in terms of their particular function. An example of the former is the study of changing roof structure and carpentry details over time.

With the industrial revolution, technological evolution became increasingly rapid, with crafts and workshop-scale production rapidly superseded by sophisticated manufacturing operations that required purpose-built buildings of almost unlimited variety, the individual technology usually defining the appearance of the building itself.

In many instances the machinery of production is as much a part of the architecture of the building as the surrounding structure. This poses a particular issue for the building recorder, as much of the significance of the building resides in the machinery itself, which should be recorded accordingly.

A good exemplar of rapid technological evolution in construction is that of the heated glasshouse or *stove*, a building type typically found in walled gardens from the C18 to the early C20 (Illus 125). These structures were designed to provide clement conditions within which more tender or exotic plants might be propagated in less favourable climates. They underwent a bewilderingly complicated and rapid evolution, as new systems of heating, construction and cultivation were developed. The extraordinary variety of glass house architecture was demonstrated for example at the Duke of Queensberry's Dalkeith Palace walled kitchen garden, East Lothian, where by the late C19 at least fifteen different glasshouses stood.



Illus 125 Technological developments such as heating systems and the inexpensive manufacture of glass led to the rapid development of such features as glasshouses.

7.3.6 Specialised and idiosyncratic architecture

Even within the variety of buildings, there are extremes - categories that require specialist knowledge in their study. For example, the breadth of the industrial experience has produced a wide range of highly specialised structures, from the Bonawe iron furnace in Argyll, to the Douneray nuclear power station in Caithness. The study and record of such buildings is usually the preserve of the industrial historian and industrial archaeologist. Military buildings, again, can be highly specialised (Ch 8.3).

Another category apart is garden architecture. Encompassing a wide repertoire of forms and functions, garden buildings are characterised by their individuality, their ephemeral and often frivolous nature – subject to the vagaries of taste and whimsy – and their inherent beauty and literary associations. Such structures include obelisks, teahouses, grottos, sham ruins and follies, ornamental bridges and fountains as well as more integral landscape features such as the ha-ha.

An instructive example is the late C18 grotto-fronted shell house at Newhailes Estate, East Lothian (Addyman 2002 and Ch 8.2). Here a rectangular masonry pavilion was encrusted on its principal elevation with industrial waste so as to appear lava-like, with an extraordinarily rusticated entrance (Illus 126).

Within, the structure was wholly lined out with marine shells, some imported from the Far East, pressed into plaster. Interspersed with these was a wide variety of minerals including agates and crystals, pieces of broken mirror and fragments of fine wine glasses – anything that would sparkle. Chinese porcelain had been broken and fused with glass to create further colourful 'gems'. The floor was of polished sandstone with black marble insets (Illus 127).

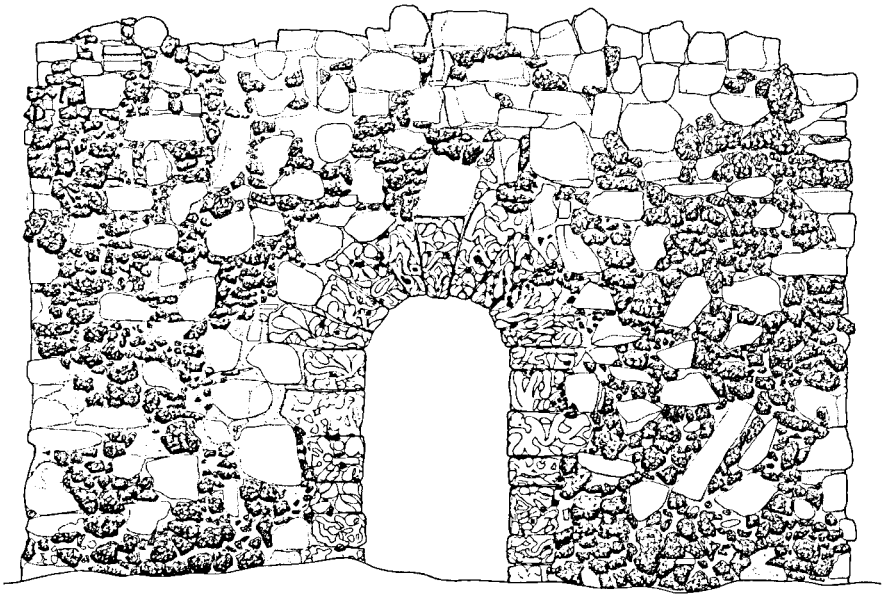
A system of intramural flues had been formed whose various external outlets may have been intended to generate smoke rather than to provide heating – the creation of an ethereal mist filtering through the woodland setting as one approached the building. A water cascade was created at the foot of the building, flowing down to a shaped pond. During the latter stages of construction, an ogee-headed window seems to have been unceremoniously punched through the side wall, altering the mood of the cave-like interior and the function of the structure, making it now more of a summer house.

7.3.7 Surfaces

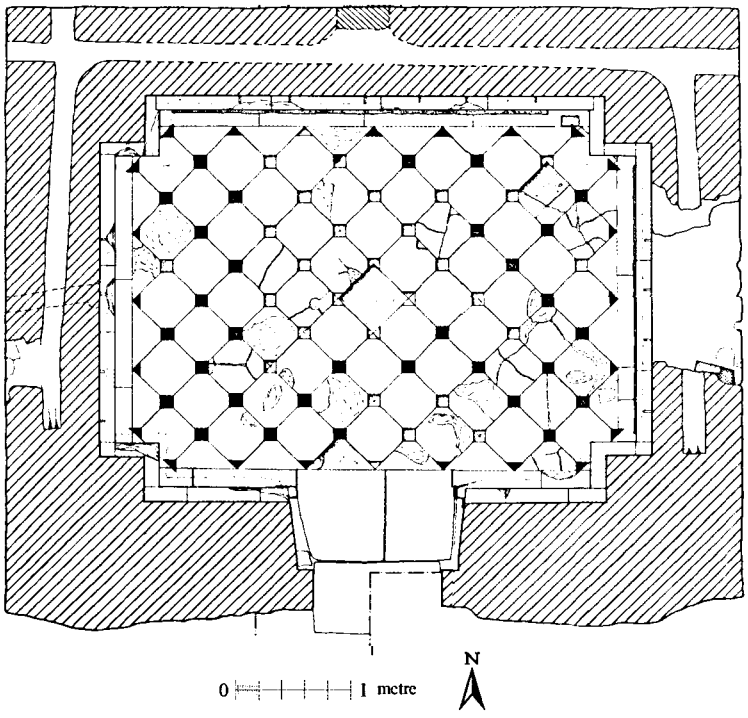
An area that is often overlooked by those who record buildings is that of historic surfaces (Ch 6.4). Remains of surfaces, both internally and externally, are critical for the understanding of a building, as they preserve the information as to how the structure was intended to be seen by the designer, craftsman and ultimately the client (Illus 128 to 132).

Historic surfaces – particularly those that are less spectacular – are often very vulnerable to even the best-intentioned conservation practice. For these reasons it is important to record and understand the remains of surfaces. This information may help to determine how a building will look at the end of the scheme of conservation.

The recording of decorative schemes is often the preserve of the specialist paint/wall paper conservator, and correctly so. But it is often the generalist recorder who is in the position to first recognise significant remains, and indeed may be the only one to have the



Illus 126 An elevation drawing of the grotto at Newhailes, East Lothian,displaying a remarkable variety of materials. (Drawing: Addyman Associates, courtesy NTS)



Illus 127 The floor plan of the Grotto, Newhailes, showing the elaborate floor and the intramural flue system. (Drawing: Addyman Associates, courtesy NTS)

opportunity to witness evidence revealed during repairs or demolition. It is important, therefore, that they are aware of what may be found within a building of a particular period and type.

7.3.8 Decorative and architectural details

Decorative features such as moulded plasterwork, carved woodwork and sculpted stone are clearly important details to include in a building record (Ch 6.2). Along with construction techniques and planning, they are the features most commonly employed as *signifiers*, or pointers to phasing, stylistic influences, social status and relative status of an individual part of a building. They are also significant in that they usually represent a proportionally greater investment of the craftsman's time and skill – the icing on the cake.

Carefully identified minor changes in decorative detail may help to unravel different phases of work. In the case of moulded detail such as a ceiling cornice, a profile will usually suffice as a record. Similarly for features such as a decorative window surround, an individual record of a single well-preserved example will usually suffice.

7.3.9 Regional diversity

Local distinctiveness is a major characteristic of vernacular building traditions and this extends as well into more polite construction - traditional building is inherently tied to its landscape. There are many reasons for variation between localities, but of these, the most significant are the availability of different types of resources, long-evolved local building traditions (see next section) and the difficulty of transporting bulk materials. Consideration of historic buildings should pay close attention to such factors.

In the study of historic buildings, knowledge of such local materials and resources is essential. The building recorder, in assessing a building, will seek to identify those local and regional traditions of construction. Such information may for example be important in the conservation process. Works such as *The Rural Architecture of Scotland* (Fenton & Walker 1981) provide much information on materials and regional variations.

7.3.10 Crafts tradition

It seems a statement of the obvious to say that historic buildings represent a substantial repository of crafts knowledge and traditional construction skills.

Local building traditions are very often the product of an extraordinarily long process of continuous experimentation, the evolution of strategies to best cope with a given environment and to most efficiently and effectively manipulate the available resources.

There has been a gradual loss of crafts tradition in architecture, as increasingly larger-scale economies developed in the building industry. By the end of the C19, it was only in the remotest areas of the country that vernacular traditions remained relatively unaffected by the supply of mass-produced materials and universal ideas of construction.

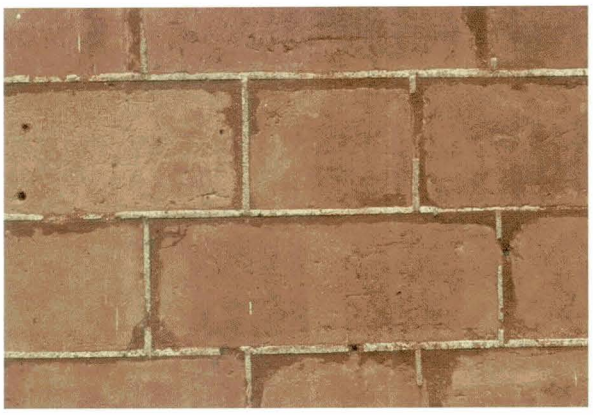
The processes by which new building traditions were introduced is in itself a fascinating study. The

THE IMPORTANCE OF HISTORIC SURFACES.

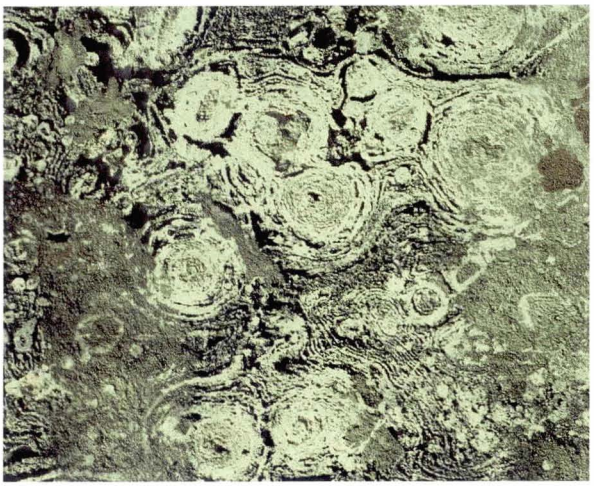
Illus 128 An area of historic harl of C18 date, where the individual casts from the harling trowel can be seen in the good cross-light.

Illus 129 A detail of the same, illustrating the build-up of layers of limewash. Both illustrate the high aesthetic quality of the surface texture.

Illus 130 An area of well-preserved exterior rubblework pointing, where the craftsman's individual trowel marks are clearly apparent.



Illus 131 An area of brickwork, where white mortar has been tuck-pointed over a red mortar base to provide an impression of a more expensive finish.



Illus 132 An area of eroded exterior plasterwork, the swirls relate to irregularities in the plaster mix. (Photos: Tom Addyman)

introduction of classical architecture involved Scottish aristocrats and architects travelling abroad, particularly to Italy, the circulation of treatises on classical architecture and the direct influence of foreign craftspeople. The development of the C18 Georgian cityscape saw the introduction of new building practices, notably speculators on a scale not previously seen.

Another area of considerable interest is how vernacular details were perpetuated in later periods. Scottish baronial architecture was largely defined by the reproduction of vernacular elements (often misunderstood) such as steep-pitched roofs, crow-stepped gables, bartizans (corner turrets) and moulded string courses. These traditional features, long evolved within a crafts tradition, were effectively hijacked and reworked as elements within a deliberate and self-conscious style. *Scottish baronial* became synonymous with 'Scottish-ness' in the C19 and as such was soon exported to all corners of the Empire.

7.3.11 The bias of the record

It is necessary to be aware that the sample of historic buildings that survives in both the urban and the rural context is inherently biased. In both areas, it is predominantly the better constructed and higher status buildings that have come down to us. A clear example is the large number of tower houses that still survive (Ch 8.5), whereas the standing remains of their associated settlements are extremely rare.

In Scotland almost no lower status rural buildings survive from before the C18 and very few within the C18 itself, although these housed the majority of the population. One would today be surprised at the extent to which turf and clay were employed in construction, now usually leaving very little physical trace. Only in the rarest instances, such as the remains on St Kilda, albeit of later date, does one gain an impression of what such settlements and structures may have looked like.

7.3.12 Cultural meaning

Buildings are far more than isolated physical objects. They are the complex products of the human experience and contain and convey meaning on many levels. In most cases this wider meaning can be recovered to some degree. Not only do buildings represent considerable investment of financial, human and physical resources, they embody the cultural influence of the time and, very often, the ideological, social, commercial or spiritual aspirations of the builder.

Church buildings contain many layers of meaning that are more or less apparent, and provide the most obvious example. They can be 'read' in terms of liturgy – architecture arranged to permit a certain form of service; their symbolism – at the most basic level the

Illus 133 Queensberry House, Edinburgh, a theoretical reconstruction of the late C17 interior space at entrance level, showing the room arrangement. (Drawing: Addyman Associates, courtesy Scottish Executive)

common cruciform plan and eastwards orientation; they are physical instruments that both embody and reinforce the social hierarchy; they serve to commemorate; they display – as an indication of devotion, success and the prestige of the community – the more sumptuous the better, or conversely, deliberate simplicity of detail and form to demonstrate asceticism.

The study of how buildings were organised and functioned socially is clearly important. The example of Queensberry House is again instructive. Here, combined historical research and building recording has permitted the theoretical reconstruction of the late C17 interior space (Illus 133).

At the entrance level this included the State Apartments of the Dukes of Queensberry, a sumptuously formal sequence of grand rooms arranged according to the principles of Baroque planning *en filade* ('in file') along the south frontage. Along this rigid east/west axis ran the state dining room, the withdrawing room and the state bedchamber. Beyond this to the east lay the Duchess' dressing room and china closet; to the west the Duke's chamber and library closet beyond.

The entire sequence of rooms was arranged so that the visitor would be permitted access to increasingly private areas on the basis of their rank. Intimates would achieve the innermost station, the state bedchamber where court would be held by the Duke residing in the state bed. According to the same rules of etiquette, persons of higher rank would be received in the chamber within the apartment that accorded with their status. Cultural meaning also evolves. Queensberry House was the town residence of the 'Union Duke' – 2nd Duke of Queensberry – and has significance as the place where much private discussion concerning the 1707 Act of Union may have taken place.

7.3.13 The wider context of the site

Although tangential to the purpose of this Guide, it should be observed that buildings cannot be understood in isolation and must be considered in relation to their site (Ch 5.7). This is obvious within the urban context, where the constraints of the town plan, city walls and increasingly stringent regulation of construction, influenced the appearance of buildings and the materials employed in building.

Equally in rural areas, the appearance and siting of buildings was much influenced by wider factors. These could be the location of resources such as favourable land and building materials, the proximity to means of communication, a defensible situation and so on.

An example where wider factors are linked to buildings is water supply, one of the most fundamental human requirements. Siting in proximity to a burn, spring or well, presented the most straightforward option. In many instances, this was not possible and elaborate systems of supply were developed. In the case of towns, water was increasingly piped. The sequence of stone conduit heads along the Royal Mile, Edinburgh, is part of one such system. For many military buildings, the advantages of a defensible location had to be weighed against the ability to supply water (essential in times of siege).

7.3.14 Settlement studies

The study of historic buildings within urban settlements is increasing in importance. While pioneering excavations were undertaken in Perth and Aberdeen some 20 years ago to examine medieval settlement remains, and the Scottish Burgh Survey series well established the study of urban morphology (Owen *et al* 2000), the equally important study of the evolution of standing buildings in the urban context has been remarkably lacking.

Individual projects such as the recording of The Merchant's House, Kirkcaldy (Ch 5.1) and 42-44 Market Street, Haddington, East Lothian are the exception. In each case, the complexity of town buildings was demonstrated, reflecting ever increasing intensity of occupation and characterised by changes in status.

Urban settlement patterns saw increasing change from the C18 onwards. Most dramatic are the planned towns that were often associated with the creation of aristocratic demesnes, at the expense of existing, long evolved settlements, such as at Inveraray and Huntly. With the *carte blanche* of a greenfield site, high principles of planning and architecture could be rigorously employed.

7.3.15 Above and below ground

Where a building can be related to buried remains, a greater depth of understanding can often be achieved, as was demonstrated by the integrated recording and excavation regime at The Merchant's House, Kirkcaldy referred to above. This topic is not covered in depth in the Guide (Ch 1.11), but its value should not be overlooked or underestimated.

At Market Street, Haddington, structural remains dating to the C12 or C13 could be closely related to the layout of its C16 successor, still standing (Addyman 1997). Original internal arrangements are often preserved below later floors, as are earlier floor levels themselves, the occupation deposits relating to the use of the building and construction deposits.

Construction deposits can often be particularly illuminating. For example building debris was commonly used as floor make-up, which in turn often conceals more direct evidence of the construction process. At 27 Charlotte Square, where the mortar-mixing floor was revealed below the basement floor level, it was possible to extract the individual ingredients of the mix – deposits of clean river sand and un-mixed lime.

7.3.16 Reused stone and other materials

The reuse of building materials was a fundamental tenet of most traditional construction. This reflected the fact that the majority of traditional materials were reusable in one form or another and that difficulty in procurement – quarrying, processing and transport – accorded greater inherent value to these materials. There was consequently a greater economy in construction and, conversely, actually no point in wastage.

Rubblework, for example, could be repeatedly broken down and re-formed. Wall plaster could be removed, crushed and re-mixed with new lime plaster as an aggregate. Even broken roofing materials saw common use as levelling stones for ashlar courses, packers between voussoirs of arches and pressed into mortar to make flush the wall face.

Stone chips, the residue of the dressing of cut blocks of sandstone were actually very valuable, indeed integral, to traditional construction in Scotland and many other parts of the world. They were used as *pinnings* – the small stones that are hammered between larger blocks to ensure the tightness of construction and the overall stability of masonry fabric.

The same economy, and indeed logic, dictated that in the majority of cases the reused material was as local as possible. These traditional building practices are of great value for the study of buildings, in that they preserve evidence for predecessor buildings, often ones of very considerable antiquity.

At Queensberry House, Edinburgh, numerous materials derived from earlier structures had been incorporated into the fabric. These included carved stones from a wide range of architectural features such as fireplaces, windows and entrance surrounds; reused wood, particularly rafters and floor joists, a piece of the latter retaining part of a decorative scheme; roofing materials such as slate, pantile and sandstone tile.

It was apparent that many of these materials derived from a number of tenement properties that had previously existed on the site, which were purchased and cleared for the erection of the mansion house. Stylistic details of these fragments were broadly datable to the C16 and early C17.

This project was unusual in that a major scheme of restoration was being undertaken, including reinstating its original external appearance. In this case the recording work had a significant bearing upon the project works, many lost details being reconstructed on the basis of fragmentary physical evidence.

7.3.17 Miscellaneous finds

Debris recovered from beneath floorboards and from other crevices are often a goldmine for building recorders, and can be given an 'archaeological' treatment. Wood offcuts and shavings and a whole range of miscellaneous building wastes are often deposited, whether on purpose as in the case of insulation, or incidentally.

Wallpaper scrapings and plaster fragments retain evidence of coloured schemes or moulded detail. At attic level, evidence of roofing materials are often preserved and other details such as sarking pegs. These are all common finds and can provide important information as to the construction and former appearance of a building.

7.4 SUMMARY

The study of historic buildings tells us about ourselves, our own story and background. Historic buildings are one of the most tangible reminders of our past and as products of our ancestors' endeavours deserve respect. They can also be beautiful, impressive, disturbing; they enrich the environment in which we live.

Building recording can be an enormously satisfying pursuit. It can also help to reconnect with a past that became unfashionable in the twentieth century. To an unprecedented degree in this century, the built environment became the victim of both war and, even more damagingly, subsequent planning and redevelopment. The record - and more importantly the study and understanding - of historic buildings has much to contribute in the modern world.

It seems clear that the conservation of the historic built environment is most successful when that environment is understood, when traditional materials and skills are revived and when the traditional scales of human interaction are respected. Beyond this, the study of traditional knowledge contained within historic buildings has much to contribute to other aspects of our surroundings – lessons of sustainability, management of resources, quality of construction and design, local diversity and the benefits of small-scale production.

8.0 CASE STUDIES

This chapter contains five individual case studies, covering a range of historic building types, and describes selected projects from the work of the RCAHMS. A resume of the chapter content is provided in Ch 1.10.

8.1 AUCHINDRAIN TOWNSHIP, ARGYLL

8.1.1 Recording a group of vernacular buildings

Auchindrain is a unique surviving example of a Scottish farming township, a once common form but now largely lost. It is comprised of a group of single-storey farmhouse dwellings, barns, byres and cart sheds (Illus 134). The earliest recorded occupancy of the site is 1534, by 1693 it had four tenants and increased in size during the late 1700s to a peak occupancy of about 38 tenant households in 1779.

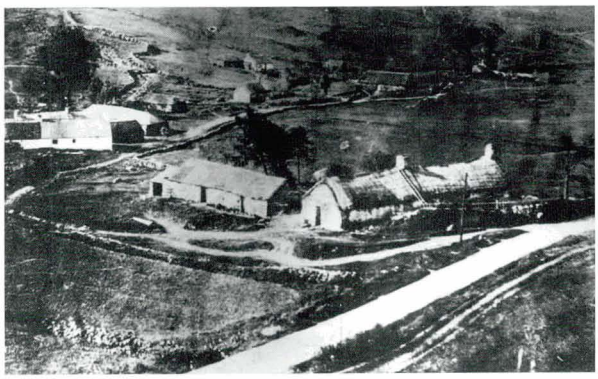
From about 1750, the amalgamation of holdings and improvements in agricultural methods led to the disappearance of many such small 'townships' although some survived into the C19. As enclosure of land and the introduction of sheep continued, more were eliminated. Auchindrain was one of few to survive, remaining as a multiple tenancy until 1935, with the last inhabitant leaving in 1962 (Illus 135). The Township then became a museum of country life with a Visitor Centre being opened in 1975. The buildings are managed by the Trustees of Auchindrain Township. The site lies 9km south-west of Inveraray, adjacent to the A83 road.

The Trustees commenced a programme of repair to various buildings on the site, with assistance from Historic Scotland. Restoration and repair work was carried out gradually over a number of years. Historic Scotland funded a rectified photography survey of the buildings in 1997/98, carried out by the HS Photographic Unit (Illus 136).

At a meeting with the Chairman of the Trustees in 1999, Historic Scotland recommended that the preparation of a Conservation Plan for the Township represented the most appropriate way to take forward a scheme of repairs for all the buildings which might be eligible for historic building repair grants.

Historic Scotland through their Technical Conservation Research and Education Division (TCRE) undertook to commission, as research projects, both the Conservation Plan and a measured survey and recording project. This would provide the Trustees with a comprehensive database on the site and buildings, on which future proposals for their conservation and repair could be founded.

Illus 134 Typical of the farmhouses in Auchindrain Township, this view shows the front elevation of House A. (Photo: Ross Dallas)



Illus 135 The Township in 1904. The buildings now described as houses A and B are in the foreground. Such early photography can provide invaluable information. For example, House A, then thatched, now has a corrugated iron roof. (Photo: Trustees of Auchindrain Township)

As with many historic sites, previous survey and recording work had been carried out. In particular, the Township was extensively surveyed (Illus 137) by the RCAHMS in the 1960s (RCAHMS 1992). However, while of the highest standard, the drawings produced in that survey were not as detailed as is now considered necessary for current conservation work. As well, Glasgow University Dept of Archaeology had worked a number of times on the site, but mostly in connection with the below ground archaeology.

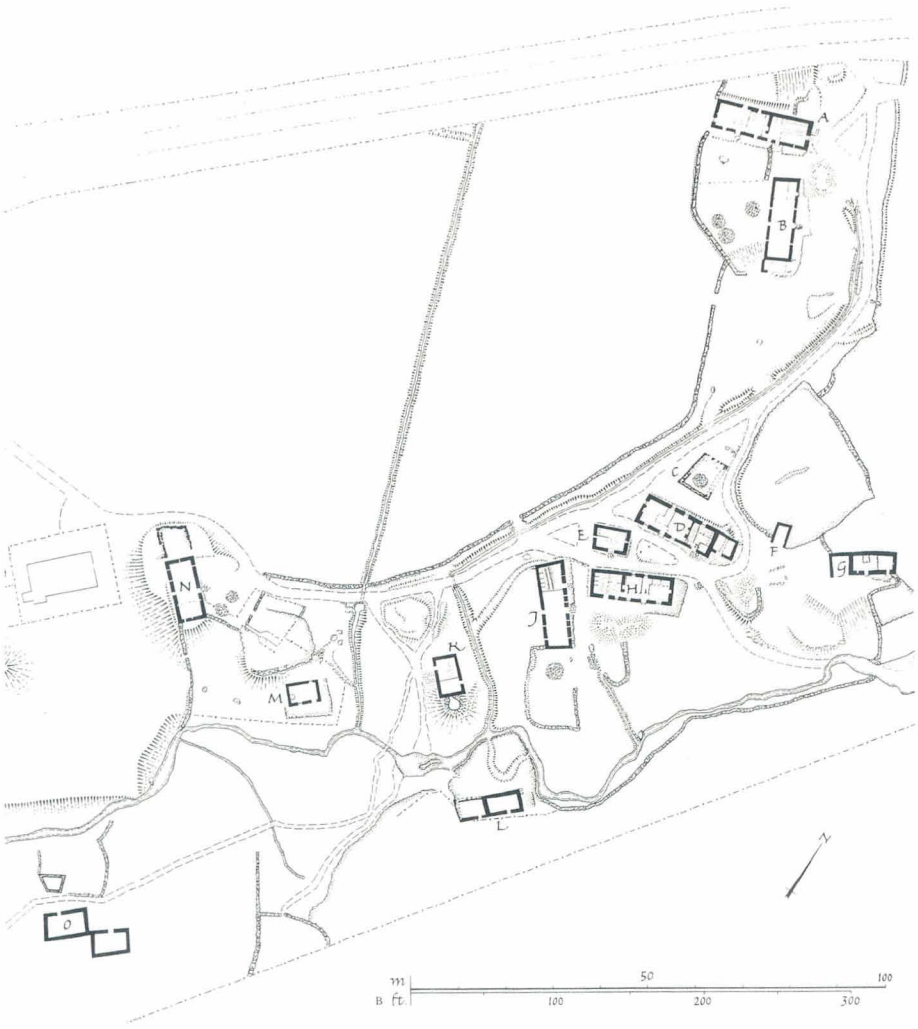
8.1.2 The recording programme

A programme for both projects was prepared and consultants appointed to take each section forward. RWA Dallas was appointed to manage the building recording contract on behalf of TCRE Division. The tender documentation consisted of a General Specification of Requirements, containing contract particulars, site and project management details, Health and Safety at Work requirements, the use of equipment, programme requirements and other terms and conditions.

In addition, a technical Specification for Recording, based upon specifications prepared by RWA Dallas and the Institute of Field Archaeologist's (IFA & Wood 1993) standard format, was adapted to Historic Scotland's requirements and the particular needs of the site. It set out the required outturns of the project in terms of recording the buildings and structures; preparation of drawings; photographic material; written accounts in the form of context sheets; a report on the site and its historical setting; and a complete archive of all survey and research material.

Tenders were invited from appropriately experienced and qualified archaeological survey units. It was considered that archaeologists would have the most relevant knowledge and understanding of the materials

Illus 136 Internal elevation, represented as rectified photography. This image is part of a systematic photographic record prepared of the whole Township, comprising over 500 images. (Photo: C Hutchison, Historic Scotland)



Illus 137 A part of the plan of the Township, prepared by the RCAHMS in the mid 1960s. (Crown copyright RCAHMS)

to be found and of surveying methods for buildings of this type. Following receipt of competitive tenders, Lancaster University Archaeological Unit (LUAU) were appointed to carry out the project in March 1999.

It was agreed that site work would be carried out over two seasons to take advantage of optimum weather conditions. The survey started in April 1999 and the first phase was completed in October of that year. Phase 2 commenced the following Spring and all site work was completed in October 2000. With the co-operation of the Curator of the Township, surveying continued throughout both summer visitor seasons with little disruption to either visitors or survey staff.

LUAU set up a temporary drawing office in existing site accommodation, from where survey data was electronically transferred for further development and preparation of drawings in Lancaster. Progress meetings with the contractor and the Curator were held on site at intervals throughout both phases. LUAU submitted initial drawings for discussion with the project manager and such matters as revisions to the drawing conventions were agreed. The Conservation Plan was taken forward as a separate, but parallel, exercise by an appointed consultant.

8.1.3 The fieldwork

The initial fieldwork task undertaken was the establishment of a survey traverse about the standing remains, thus enabling an accurate location of each building to be determined, and creating a footprint for the capture of detail for the individual structures. Additional survey stations were set up to capture architectural detail of the structures. This process was undertaken utilising a Zeiss 'Elta' conventional total station theodolite.

Following the establishment of the closed traverse, ground plans, joist plans and rafter plans were produced using a REDM theodolite (Illus 138). The survey data was captured using TheoLT software. This software facilitates the conversion of the survey data into CAD drawings in AutoCAD LT, as an ongoing process throughout the survey (Ch 4.3 & 4.5).

Illus 138 Survey work in progress. Chris Wild, in charge of the fieldwork, has the total station theodolite with REDM set up in the cow byre of one of the farmhouses. In front of him, the laptop computer shows the drawing being created as he works. (Photo: LUAU)

This enables the surveyor, via a laptop PC, to instantly observe survey data as drawn images, and further enables errors or inaccuracies to be corrected during the surveying process. Paper plots were produced of the survey data to which were attached draughtsman's film overlays (Illus 139 and 140). The indexed drawings were subsequently returned to site to allow additional detail to be added where necessary. In some instances, where the nature of the structures restricted the use of the REDM, hand survey methods were utilised and the CAD drawings enhanced appropriately.

A process of digitising/scanning from the rectified photographic record (see Illus 136) produced, where appropriate, external detail of the structures. The plotted drawings were corrected on site and the digital drawings enhanced with this information (Illus 141). For areas that were not suitably covered by photography or where the amount of additional detail was significant the REDM theodolite and TheoLT were utilised. The majority of the internal elevations were produced using the REDM and hand survey techniques.

Vertical sections were taken through the main elements of the structures rather than through cross walls and consisted of the principal wall plane, openings, voids, passageways, beam sockets, roof and floor timber components. Floor plans incorporated such detail as structural wall outlines, plinths, skirting, openings, windows, doors and structural timber. Normally drawn at a height of 0.50 metre above internal floor level, windows of sill height 0.75 to 1.25m were also represented. The outline of the plans was captured with a conventional total station, the data from which was downloaded into a portable PC for the production of drawings.

For the majority of the buildings, stone by stone detail was not required, as the walls were generally homogenous and a full photographic record was available. Detail recorded included constructional breaks, change in building material, damage and architectural/structural features such as windows, doorways, fireplaces, chimneys, constructional and timber detail, and architectural mouldings.

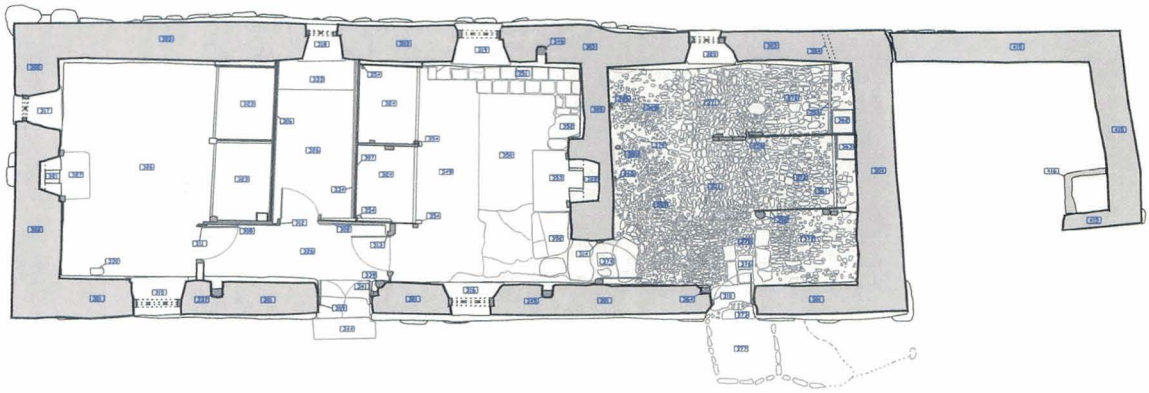
An appropriate CAD layering system was adopted to distinguish between differing categories of information such as building fabric. The use of the AutoCAD layering system allows the drawings to serve both as a presentation of the survey results and as an analytical tool. Emphasis was placed on the use of varying shades of grey rather than an excessive use of colour. For the same reasons a variety of line types were used. Drawings were at scales of 1:10, 1:20 or 1:50 as appropriate, and were supplied in AutoCAD Release 14 format stored onto CDs. Axonometric drawings were produced through a combination of 3D survey data and hand illustration techniques.

8.1.4 Analysis and interpretation

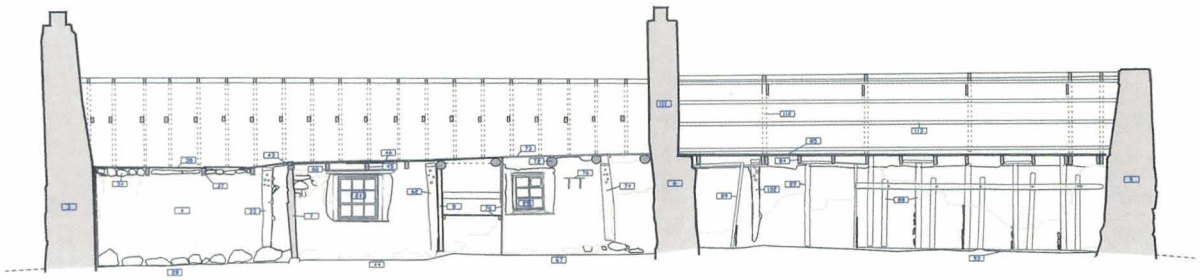
It was not the intention of the project that new documentary research into the site be undertaken, but rather to carry out an inspection and review of the relevant background material relating to the site and its environs, mostly as kept by the RCAHMS/NMRS.

This material included academic projects carried out by the University of Glasgow Archaeology Department. Interviews with the current and former Curators, the Trustees and other such local persons or experts who had worked on the site were conducted on an informal discussion type basis. The interviews served to provide a source of information into interventions and repairs to the buildings and structures.

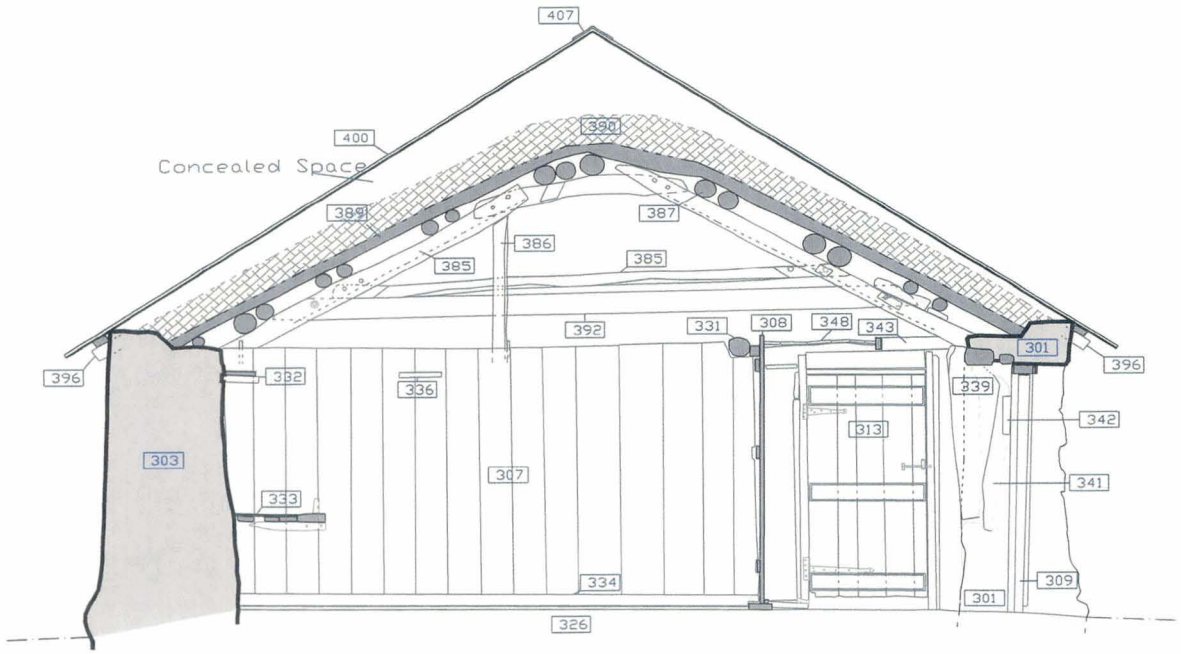
A descriptive record of the detail of each building/structure was compiled through the use of single context recording (Illus 142). Context numbers were allocated to every architectural and agricultural component within the structures. The contexts were extensive in type and number (in excess of two thousand), and included a range of features from principal walls to door hinges. Pro-forma record sheets were utilised and these were cross-referenced to photographic and drawing sheet numbers.



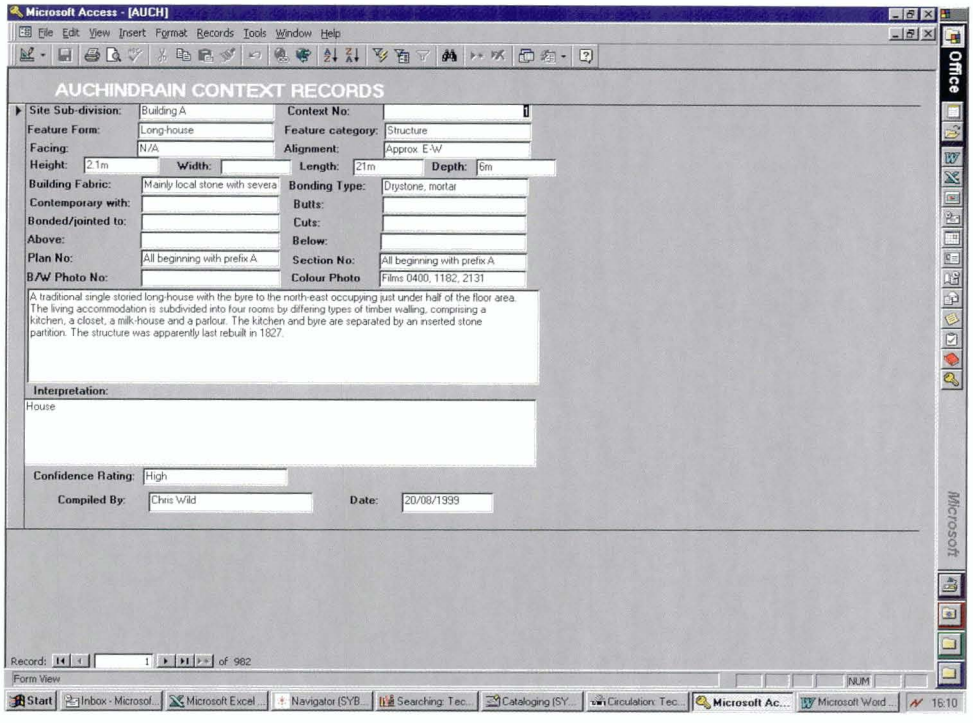
Illus 139 A typical example of a floor plan. All measured survey work was carried out to an accuracy and detail appropriate to 1:20 scale. (Drawing: LUAU)



Illus 140 A typical example of a sectional elevation drawing, prepared by a combination of theodolite observation, tracing off from rectified photography and hand survey. (Drawing: LUAU)



Illus 141 A cross section, where the thatched roof enclosed under later corrugated iron can be noted. (Drawing: LUAU)



Illus 142 Context record, presented as a screen shot from the Microsoft 'Access' database. The context record shots can also be printed off as reports on A4 sheets. (Photo: LUAU)

The resulting database allowed for a provisional phasing of each building to be compiled, along with an overall phasing of the site. The database was compiled within Microsoft 'Access' software and a digital link created between the database, digital photographs and the site drawings within AutoCAD Release 14. The level of recording for rebuilt structures was less detailed in nature than for areas of historic fabric.

A photographic record extending the originally supplied rectified photography record was maintained, incorporating both 35mm format colour negative and colour transparency. A digital camera was also used for the production of working/reference pictures.

A process of material analysis was undertaken for the building stone on site. All types of building stone found within the structures were identified and analysed. A layering system for typology was established within AutoCAD.

An interim Report was presented at the completion of the first phase of fieldwork. This contained the results of the documentary survey, interpretation and analysis of each building recorded during the first phase and of the site as a whole. The relevant site drawings were also included as figures. Following the completion of both season's work, the final Report (LUAU 2001) was issued and was accompanied by bound copies of the site drawings, the database and photographic archive. All elements of the survey were stored in digital format on CD ROM.

To summarise, the outturns of the project comprised:

- Drawings in hard copy and on AutoCAD of all elevations, floor plans, sections, roof plans and selected details of internal features
- Axonometric views of five buildings
- Context sheets, cross-referenced to the drawings
- Report
- Additional photography
- All archival material.

To this was added the previously procured rectified photography on CD ROM, in both high and low resolution formats. Copies of all the outturns were provided to the Trustees, and copies were retained by Historic Scotland. Drawings, context sheets and the Report were also lodged with the National Monuments Record for Scotland. While the material was primarily prepared for the preparation of scheme details for grant applications, it may also have utilisation for visitor presentation purposes at Auchindrain Township.

8.1.5 Summary

The experience gained from this project confirms a number of important issues:

- Care in the specifying of outturns is central to a successful conclusion. Specialists from different disciplines may have differing perceptions of presentation methods, and the commissioners of such work should ensure that their requirements are clearly established at the outset.

- Assessments of programme time must take into account the complexity of surveying in remote locations, within confined spaces, and in variable weather conditions. The local topography, ground conditions and vegetation around or over remnants of buildings will affect the ease, and therefore speed, of surveying.
- The effective management of site staff and procedures, particularly when remote from home base, is crucial to good progress of site work.
- Surveyors must establish effective links, both physical and philosophical, with their colleagues who will be responsible for transferring survey data to drawn or digitised formats.
- Consistency of approach to drawing techniques, and thorough cross-checking between drawings once completed, are essential for the accurate presentation of the final products.
- Written material must be factually accurate, be set out in a logical and readily comprehensible order, and be attractively designed, printed and bound to reflect the quality of the professional input and the project cost.

8.2 NEWHAILES HOUSE, EAST LOTHIAN

8.2.1 Recording an important country house

In 1686, the renowned Scottish architect James Smith built a house then called Whitehill on land that now lies between Edinburgh and Musselburgh. The house was subsequently modified in the early part of the C18 by the addition of two balancing wings (Illus 143). Thereafter, apart from minor alterations, received wisdom had it that the house was left virtually unchanged to the present day: it became known as the 'Sleeping Beauty'.

The house and surrounding estate were acquired in 1997 by the National Trust for Scotland (NTS), and the groundwork began towards the preparation of a Conservation Plan (Ch 9.9) to guide work on the property leading to its eventual opening to the public. The preparatory survey work for the Conservation Plan was part funded by a substantial award from the Heritage Lottery Fund.

Wherever possible in such circumstances, the NTS will commission a joint Historic Buildings and Landscape Survey (HB&L), to include a measured survey record of the buildings on the estate, as well as a detailed topographic survey and description of all the features of the landscape. A Project Outline for this work was produced in 1998, and the competitive tender for the work was won by a consortium led by John Renshaw Architects (JRA).

One of the problems in preparing a brief for a project like this is to make provision for the unknown. In some ways this means that parts of the brief will necessarily rely on the professional judgement of the successful team. In the case of Newhailes, the contractors were

" ...through a combination of documentary research, building recording, field prospection, topographical survey and vegetational survey, to establish clearly the location, nature and present condition of features, both extant and buried, significant to the historical development of the buildings and designed landscape or of intrinsic interest."

Illus 143 A general view of Newhailes House, south west front in 1998, before conservation works commenced. (Photo: JRA)

To take a standard archaeological approach - the systematic and consistent record of every feature - would have been unworkable at Newhailes, and the team had to have the discipline, in effect, to be apparently undisciplined in their approach. Their judgement would determine whether a door fitting in one room should be recorded whilst something similar in another part of the building should not, or should be recorded in less detail.

A second feature of the Newhailes project was that the building recording work had to sit within a whole suite of information-gathering exercises, all of which had to share information and bounce ideas off each other. Documentary research, for example, had already been commissioned, and would prove to add immensely to the results of the building survey. The recording work itself had to be carried out in close co-operation with project architects, Law & Dunbar-Nasmith (L&DN), whose measured survey drawings in CAD were prepared with better than normal accuracy so that they could be used by the building recording team.

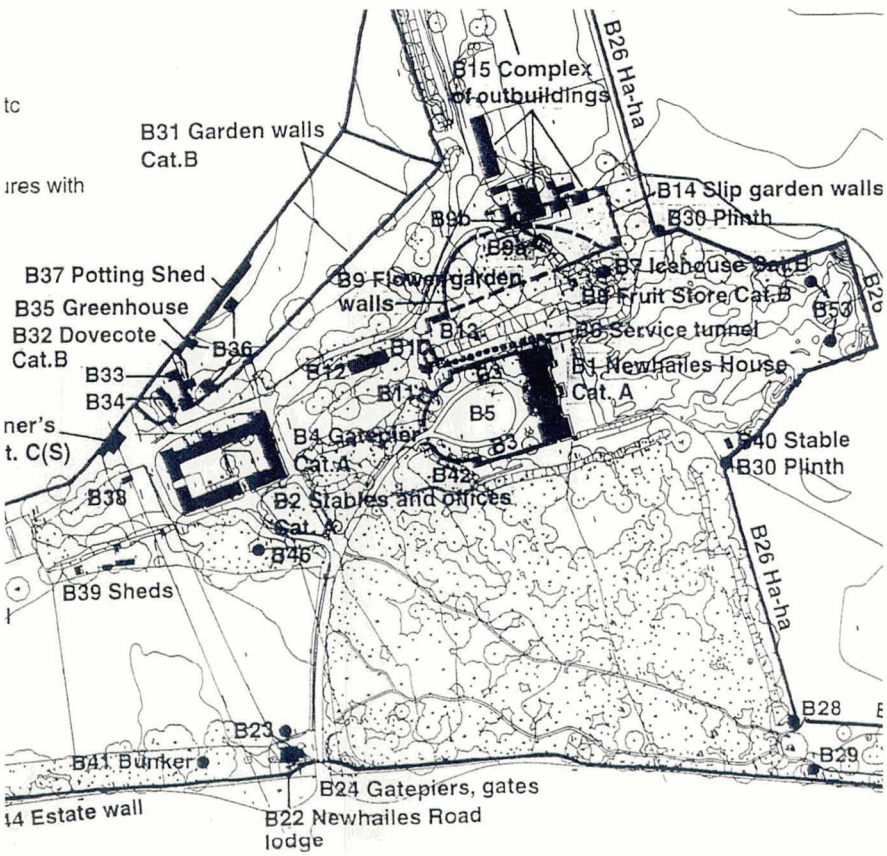
In sum, the Newhailes recording project has created a fascinating and critically important tool to assist with the conservation, restoration and management of this very special, very fragile place.

8.2.2 Details of the brief

Despite the special circumstances at Newhailes, the project outline or brief was in fact very similar to others that had been used successfully by the NTS on previous recording exercises. The standard project outline had developed as a methodology which gave the contractor sufficient leeway to use a good pinch of professional judgement in consultation with the Project Managers.

The area to be included in the building and landscape recording exercise included Newhailes House, the associated servants' quarters and tunnel, the stables and office court, garden buildings and surrounding land and features owned by NTS extending to some 35 hectares (Illus 144). Also to be included were any other land or features which were considered to have a bearing on the wider setting of the place and its cultural significance. The detailed objectives of the HB&L survey were:

- To enhance the knowledge and understanding of the origins and historical development of the place, its buildings and planned landscape and its/their cultural significance
- To collate, integrate and supplement the existing surveys of Newhailes House and estate to provide a detailed record of the place prior to the implementation of any further conservation or repairs



Illus 144 A modern plan of the estate (part), prepared in conjunction with the recording exercise, showing the principal built features (Survey: Sterling Surveys Ltd and JRA)

- To inform the development of the Conservation Plan and any subsequent conservation, repairs, maintenance or alterations to the place, and
- To provide the basis for further academic research.

The project outline and survey methodology was based on the ethical principles set out in the Australian ICOMOS *Burra Charter for the Conservation of Places of Cultural Significance* and was guided by James Semple Kerr's *The Conservation Plan* and the standards set out in the Institute of Field Archaeologists *Standards and Guidance for Building Recording* (see Bibliography).

The survey was commenced in May 1998 and was undertaken by a team comprising a historian, conservation architects, building recorders, a landscape architect and archaeologists. Measured survey plans were provided by L&DN and other contributions from various conservators and craftsmen were incorporated into the survey.

8.2.3 Documentary 'desk-top' research

The documentary research was intended to assemble and evaluate the available information on the architectural evolution, the development of the landscape, the archaeological remains and the social history of Newhailes House and Estate (Ch 5.8).

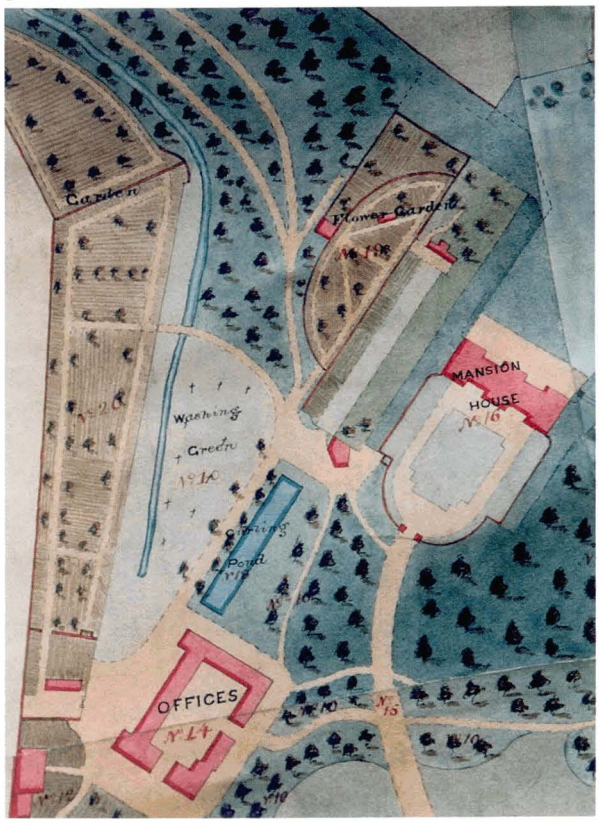
An initial historical research project had been completed during 1997 on behalf of the NTS by the National Library of Scotland, in order to collect the maximum amount of information about the evolution of the House and its Estate prior to the temporary closure. This research did not provide an analytical or interpretative historical account, but helped to identify relevant sources to be studied and helped to inform the interpretation of the buildings and site.

Further documentary research was undertaken in advance of the building recording work but after a number of visits to familiarise members of the project team with the site. This provided a better insight into the documentary sources, which were then used to guide and refine the buildings and landscape survey and recording strategies.

This research fell into four distinct categories:-

i) The analysis of **cartographic sources** including historical maps, Ordnance Survey maps and associated name book, thematic maps and specialist maps (Illus 145).

ii) A survey of primary **historical and modern papers**, secondary historical and other modern sources. The primary sources were inspected by Dr W B McQueen and included Entail Records in the Scottish Record Office (now National Archives of Scotland), the SRO on-line indexes, miscellaneous collections and the Register of Deeds re James Smith, together with a survey of the Fergusson of Kilkerran papers which were on temporary deposit with the SRO.



Illus 145 Documentary research revealed an early map of the Estate from 1883. This detail shows the area around the House. (From the Newhailes Papers, courtesy of The Trustees of the National Library of Scotland)

iii) A survey of **photographic** material including vertical aerial photographs and historical and modern photographs held by the NTS and RCAHMS/NMRS.

iv) The collection and review of **oral testimonies** collected by the NTS.

The study of the primary sources, which often had to be interpreted in the light of the surviving physical evidence, highlighted the inaccuracy of some of the modern secondary sources. This underlines the importance of referring back to primary source material wherever possible.

The research identified twelve main historical periods, including specific periods of individual ownership of the estate. During this time, there were eight major phases of sustained activity of building, alteration, improvement or repair to Newhailes House undertaken between c.1686 and the present.

These included

i) the original construction of the existing house to the design of James Smith, c.1686-1697

ii) the improvements to the house undertaken by Sir David Dalrymple, 1st Bart, between 1709 and 1718

iii) the construction of the Library wing between 1718 and 1722

iv) the construction and fitting out of the State Apartments c.1729-1745

v) the repair of the Library and main house roofs and other internal improvements, supervised by James Gillespie Graham 1815-28

vi) alterations within the house supervised by William Burn c.1839-1842

vii) a major programme of improvements undertaken prior to the lease of the house to Lord and Lady Shand between 1871-1873

viii) and finally, the repairs and alterations undertaken under the supervision of Law & Dunbar-Nasmith Architects during the 1970-90s.

The detailed accounts also confirmed that the House, the stables, the designed landscape and the garden buildings were continually undergoing repairs and minor changes during all of the periods of ownership.

8.2.4 Site surveys and gazetteer of features

The physical recording of the buildings and site included a visual survey of the landscape and archaeological features, a vegetation and habitat survey and visual survey of the buildings and structures, each undertaken by people with appropriate knowledge and experience. A topographical survey had been commissioned and completed prior to the HB&L Survey and this was used as a base map to locate and identify each of the features (Illus 144).

The landscape, archaeological and vegetational field surveys were commenced in May 1998 in advance of the buildings survey and prior to the completion of the documentary research, because the summer foliage was starting to obscure many of the buried archaeological features.

The field survey recorded all extant features of the landscape including: buildings and other built structures (Illus 146), archaeological features, drives, paths and bridges, water courses, field boundaries and land use, adapted natural features, landform and earthworks, planted features including woodlands and other planting. Relict or lost features were also included, together with modern additions to complete the survey as a record of the landscape as it existed. Each of these features was recorded on pro-forma sheets.

An Ecological Habitat survey, originally intended just to aid identification of previous planting and management areas, was extended to provide a fuller ecological survey. The range of habitats identified was quite limited, reflecting in part the restricted past land-use management. Standard NTS-design pro-forma sheets and species lists were provided for all records.

Illus 146 The Tea House, possibly dating from c1740, was one of the features of the landscape. (Photo: Ross Dallas)

8.2.5 Buildings record and survey

The survey of the House (Illus 147) and other buildings and structures was intended to provide written context descriptions in database form to assist in the architectural and archaeological analysis and interpretation of the buildings, and to provide the documentary basis for their future presentation, conservation and management. The measured survey drawings prepared by L&DN were used as the basis of the survey and to assist in the analysis of cornice and moulding types (Illus 148 and 149).

The building recording was undertaken between July and October 1998 and was limited to observable and accessible features without recourse to any invasive work. The features were recorded onto standard context or pro-forma record sheets, subsequently entered into a Microsoft 'Access' database. Each record included a unique unit number and description, including details of distinguishing characteristics, detailed description including physical dimensions where appropriate, condition and threats, context, associated finds, historical information, interpretation and phasing (Ch 5.3 & 5.5).

Illus 147 This interior view of the Library fireplace shows the rich architectural qualities of the House. (Photo: John Sheerin/NTS)

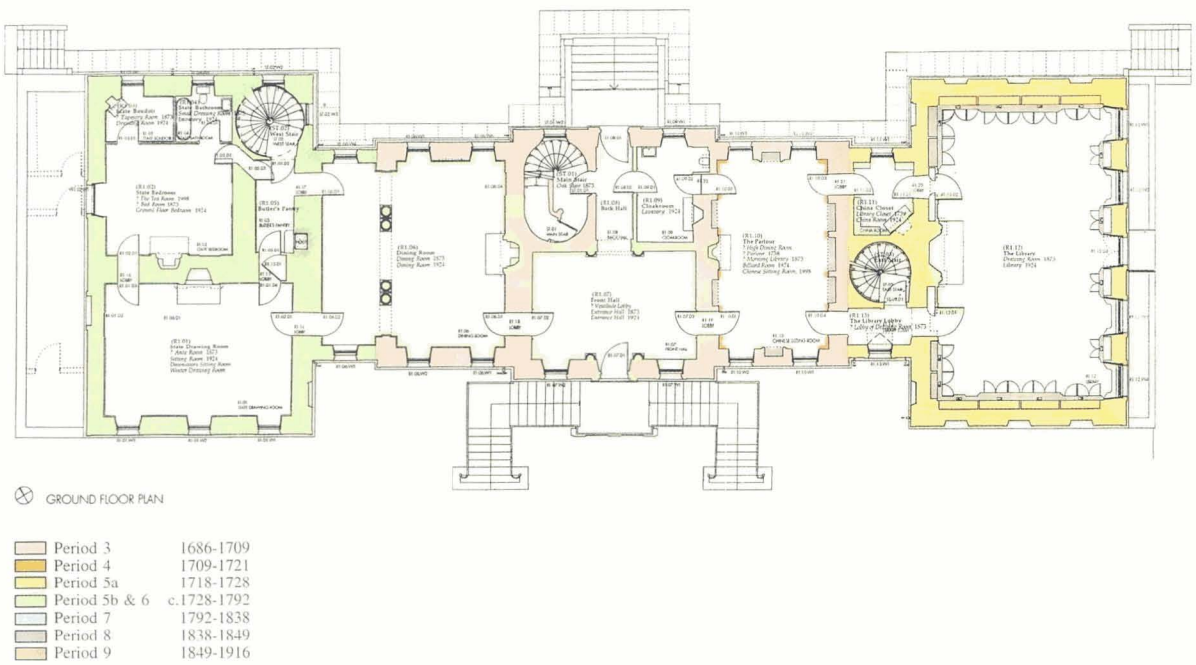
The thorny problem of deciding what to record was influenced by the sheer scale and complexity of the House and other buildings on the estate. It was physically impossible and probably undesirable to collect all data. The decisions on what to record were therefore based on the subjective and selective view of the project team. This approach is dependent on the recorder's ability to interpret and recognise features and in this case was influenced by the relative importance of each building or feature, the periods of development and anomalies identified by the documentary research. Nevertheless, something in the order of 1,000 separate context records were prepared (Illus 150).

The aim of the recording method was to produce as consistent and accurate a record as possible in a way that required decisions to be made about the interpretation of stratigraphic units on site; these could then be analysed and written up subsequently. Because of the need for selective recording, a transparent recording and numbering system was adopted which would accommodate different levels of information depending on the stratigraphy of each element and its significance. This would also provide for the addition of further information in the future, which may be identified by further research programmes or repair and maintenance work.

Due to the complexity of the Newhailes work, a very detailed referencing system was developed. This is described in TECHNICAL FOCUS F which follows this description.

8.2.6 Associated specialist studies

The recording project benefited greatly from a number of specialist surveys, which provided detailed information on some of the building materials, components and structure. Due to the size of the project, these were carried out by specialists directly contracted by the NTS. On a more normal sized recording project, the specialists would have been brought in as subcontractors to the lead recorders. These specialist surveys included:



Illus 148 The existing Ground Floor plan, annotated to illustrate the major phases of alteration, improvement and repair. (Survey by L&DN, overlays by JRA)

Illus 149 An internal elevation drawing of the Library, with the fireplace shown in Illus 147, annotated with context notes. (Survey: L&DN, notation JRA)

- A stone survey: the appearance and provenance of stone, its condition and detail
- A report on iron handrails: condition, dating and repairs
- A visual survey of glazing: types, condition, and window shutter and ironmongery details
- A structural condition report on the House and stables
- A condition report on the timber panelling and its decoration
- A condition assessment of the wallpaper
- An investigation of external render finishes
- A survey of brick structures
- A report on decorative schemes.

8.2.7 Presenting the results - the Report

The completed Report was presented in three volumes. The first volume contained an illustrated narrative summary of the historical documentary research, the site surveys of the standing buildings, landscape and archaeology and an analysis of their development.

The second volume contained the figures and appendices, including the project brief, inventories and selected extracts from the documentary archive, an inventory of the survey plans and photographs, summaries of relevant survey details and a bibliography.

A third volume provided a summary of the significance of the place and a summary of the evaluation and management implications. The third volume was not distributed widely. It was primarily for internal NTS use, to provide the Trust with the recorder's views on significance and management as a starting point to the development of NTS views on these matters.

The third volume also included a section where the recording team gave suggestions for further research. This was important because, even where so much had already been done at Newhailes, there was more that the NTS should aspire to do in the future, to further refine the understanding of the place. Additional material included all context records in a Microsoft 'Access' database, sets of marked up plans, and separate reports on the findings of the survey of primary sources.

The results of the Historic Buildings and Landscape Survey have proved invaluable during the conservation of the House and Estate, and in preparing the property to open to the public. The conservation approach will feature heavily in the interpretation of Newhailes, which opened to the public in June 2002.

NOTE: The consortium who carried out the work comprised John Renshaw Architects and Peter McGowan Associates. The historical research was undertaken by Dr W B McQueen. L&DN Architects prepared the measured surveys.

The National Trust for Scotland: Newhailes House - Historic Buildings and Landscape Record Form

No.	86	Building	B1	Room	R1.12	Element	T5	Sub Element	0
		Feature	0	Material		Date From	0	Date To	0

Description

Chimney piece, hearth, grate. 1a) large chimney piece 1830mm high x 2730mm wide overall, of fine quality and composed of several types of marble, giving a polychromatic effect: the architrave around heath opening is of yellow sienna marble against green Egyptian, the pilasters and frieze of red marble pieces mosaiced together to form a ground, the pilaster bases, impost and architrave and dentil-corniced mantle shelf of white/grey veined marble, plinth of grey-veined marble and mask and garland ornaments of white statuary marble; b) hearth stone 2623mm wide x 945mm deep of white/grey-veined marble with secondary inner stone a further 360mm deep; c) hearth opening 1525mm wide x 1216mm high x 420mm deep with inwardly tapering cheeks of dove grey/white-veined marble; 2; large steel grate and backplate of Renaissance/Gothic form, probably 19th C; 3) brass pelmet to upper margin of hearth opening.

Relationships

1a-c) all contemporary c. 1742-3
Seals wall R1.12.M4
Cuts into overmantle R1.12.T6
2a, b are secondary

Associated Features

Condition

Threats

Associated Finds

Illustrations

Cultural Significance

Analysis of Cultural Significance

Historical Information

Associated with overmantle by Clayton 1743, but no source given for its purchase/installation which seems to be contemporary with its surrounding overmantle.

Interpretation

Chimney piece associated with and contemporary with the overmantle of 1743. The gate and brass pelmet to hearth opening are probably second quarter of the nineteenth century.

Management Suggestions

Illus 150 A context record sheet, utilising the referencing system. This describes the fireplace shown in Illus 147 and 149. (JRA)

TECHNICAL FOCUS F: AN EXAMPLE OF A REFERENCING SYSTEM

Due to the size and complexity of Newhailes and the wish that the data could be interrogated in a computer database (Ch 6.8), a sophisticated referencing system was developed for this project (Illus 150).

A tiered numbering system had been devised by JRA on previous recording projects to allow the unique identification of large architectural elements, such as a wall with all its associated features down to small sub-elements, for example, individual stones. This coding system was adapted for Newhailes and also fitted to the numbering systems already adopted by L&DN. It is intended to provide a transparent numbering system which will also accommodate the future addition of any features which may be revealed during the process of conservation and repair.

The numbering system identifies each element with reference to the building, room, element, sub-element number and materials designation as follows:

Buildings
The buildings are identified by a unique building number as follows:

Prefix: B1 - Newhailes House
B2 - Stables
Etc -

Components (Rooms)

The numbering system for rooms and spaces within the house devised by L&DN was adopted and is identified by a prefix

R0 - (basement)

R1 - (ground floor)

R2 - (first floor)

R3 - (attic)

and a number .1, .2, .3, to n.

Elements
Elements are coded/numbered as follows:

M 00 – Walls, numbered 1 to n architectural units

L 00 - Wall Finishes, same number 1 to n wall behind

D 00 – Doors, numbered 1 to n architectural units, room by room, in accordance with L&DN numbering system

W 00 – Windows, numbered 1 to n architectural units, room by room, in accordance with L&DN numbering system

R 00 - Roofs, located by room number

F 00 - Floors, located by room number

C 00 - Ceilings, located by room number

S 00 - Staircases, located by number

T 00 – Fixtures and Fittings, numbered 1 to n discrete architectural units, room by room

Unit (feature) number
Each feature which can be recognised as a separate stratigraphic unit (eg an area of plasterwork) is uniquely numbered 1 to n.

Sub - unit number
The component parts of a unit (eg individual coats of plaster, laths, nails etc) can be uniquely lettered a to z.

Materials code:
The number includes a materials code, which is intended to facilitate database searches for specific materials:

ST - Stone
BR - Brick
MO - Mortar
PL - Plaster
CO - Concrete
GL - Glass
IR - Iron or steel
OM - Other metal
IM - Architectural ironmongery
WO - Wood
FC - Fired clay
TE - Textile
WP - Wallpaper
PA - Paint
XX - Negative feature (not applicable)

Database fields
The following database fields were selected and were used on the site context sheets (see Illus 150):

1) Building Number
2) Room Number
3) Element Number
4) Unit (feature) Number
5) Sub-unit Number
6) Component
7) Element
8) Period or date
9) Description
10) Associated Features
11) Condition
12) Threats
13) Associated finds
14) Historical Information
15) Interpretation
16) Level of Cultural Significance
17) Analysis of Cultural Significance
18) Management Suggestions
19) Illustrations
20) Layout and component survey drawings

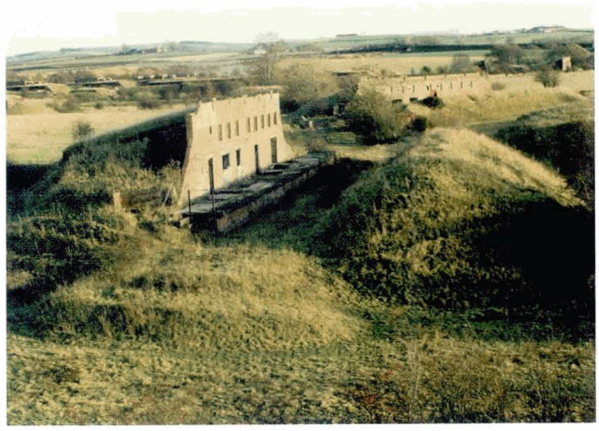
8.3 BOWHOUSE MUNITIONS FACTORY, AYRSHIRE

8.3.1 The background to the project

In 1939, a munitions factory was constructed on the site of Bowhouse Farm, near Kilmarnock, for the Air Ministry (Illus 151). It was built under the direction of ICI who acted as agents for the Ministry, with a contract to produce incendiary bombs, parachute flares and X bombs. This construction was part of a rapid programme of expansion during the second World War, from three to forty-four Royal Ordnance factories.

After the War ended in 1945, the factory was sterilised by ICI and was then used by the Ministry of Supply as an army surplus depot. In the 1950's, part of the site was utilised for the dismantling of surplus WWII incendiary bombs. Once this task was completed, all plant and equipment was removed. After various minor uses, the site had no further military purpose and fell into disuse.

The site was thus available for redevelopment as a large prison. East Ayrshire Council attached a condition to their Planning Consent, requiring a full record of the remains of the site to be made prior to their total removal in advance of development. The recording and survey was carried out in 1996 by Glasgow University Archaeological Research Division (GUARD). The work carried out was monitored by the West of Scotland Archaeology Service (WoSAS) on behalf of East Ayrshire Council.

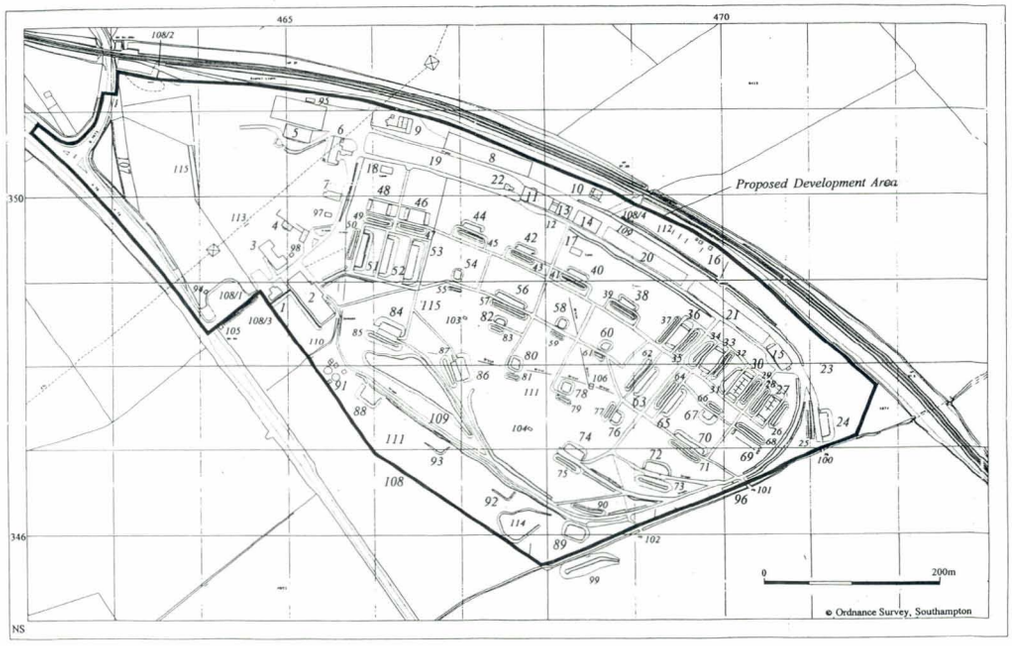


Illus 151 A general view of part of the site of Bowhouse Munitions factory, showing the spacious layout and bunds. (Photo: GUARD)

8.3.2 Location and design of the site

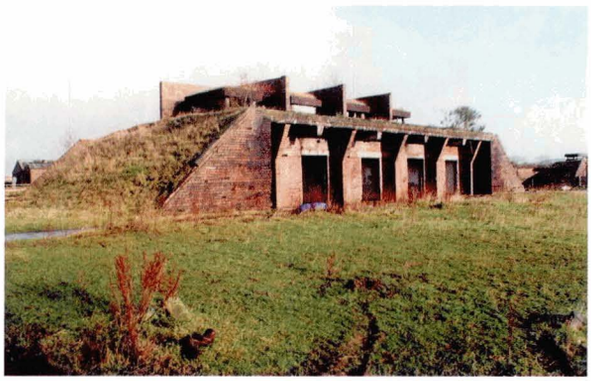
This site was located, in common with other incendiary and other explosive manufacturing plants throughout Scotland, away from major conurbations and near a railway (Illus 152). The railway was essential for the swift transportation of materials and products, while the rural site meant fewer people were at risk from the consequences of accidental explosion or enemy attack.

It was the possibility of industrial accident that heavily influenced both the design of individual buildings and the overall spacious layout of the site. This, coupled with the specific bomb products and production process, further dictated the layout of the site, making this a good example of industrial design and ergonomics.



Illus 152 A plan of the Bowhouse site, now lost through redevelopment. The extent of the site can be seen. The railway line to the north serviced the site. (Drawing: GUARD, developed from an Ordnance Survey © 1:10,000 plan)

The whole arrangement became an assembly line on a massive scale covering over 30 hectares, with over one hundred buildings carefully spaced out around the site. These assembly units were generally casemated (earth-covered) or surrounded by bunds (blast-banks), Illus 153 showing a typical structure. Some of the buildings contained air raid shelters. There were no underground features - all buildings were on the surface. They were connected by smooth asphalt trolley-ways, whereby rubber-wheeled trolleys, or bogeys, would be carefully pushed between buildings (and processes). Other ancillary buildings included magazines, rail sheds and packing and despatch buildings, related to internal railway sidings and stations.



Illus 153 A view of an Assembly House on the site. This building was of the casemated type, with earth banked against the walls. (Photo: GUARD)

8.3.3 The workforce and the products

Bowhouse was essentially a filling station, wherein materials produced and moulded elsewhere were assembled and packed. The workforce, mainly women, numbered 1,750 at full capacity (1943) and they rotated in three eight hour shifts per day. The working conditions were extremely hazardous, and there were many precautions to be taken to ensure safe working practices - any spark or flame could easily ignite the explosive materials or dusts.

This was reflected in the layout and design of the buildings and the site. A poignant aspect of building design was the way in which the workers operated in isolated cells, each with special roof vents. These would dissipate the blast upwards and away from adjacent cells, should there have been an accidental incendiary blast. There would probably have been little trace of the human operator.

8.3.4 Approach to the recording work

As noted above, the fixtures and fittings related to the munitions factory phase of use had been almost entirely removed from the site. Hence the recording programme focussed on the remaining architectural detail and the layout of the site. The history and operation of munitions factories is detailed in a recent book by Wayne Cocroft, *Dangerous Energy* (Cocroft 1999).

The fieldwork advanced in two distinct phases. The first phase required a general record to be developed and the second required a more detailed drawn record of individual elements of the site, which were either representative of a group of structures or unique in form or function.

The project brief called for the site to be thoroughly recorded, as it was to be completely demolished prior to being redeveloped. However, it would not have been economically feasible to compile architectural drawings of all the buildings. So, there had to be some informed stage of building selection before building recording could commence. A custom made pro-forma (Structure Summary Sheet) was developed, that would be used to record the attributes of every uniquely numbered building (Illus 154). Sketches and notes were made of any significant features and a general photographic and video record made.

An important and useful part of the record - and for the understanding of the site - were the numerous sections of text, such as building identifiers, notices and instructions still legible on the walls (Illus 155). These would be recorded by photography, video or by writing. When the text was entirely legible, the swiftest method was by verbal transcription to a pocket tape recorder.

					STRUCTURE SUMMARY SHEET									GUARD November 1996				
							Tick = Exist			Asterix = Best Example								
Attributes:			<	Fabric	>	<	Condition	>	<	Opening	>	<	Fixtures and Fittings			>		
Str No		**Rm No**	**Brick**	**Conc**	**Earth**	**Coment**	**Colaps**	**Burnt**	**Door**	**Windo**	**Vent**	**Power**	**Plant**	**Text**	**Mats**	**Other**		
1		g/f 1	y	y	n	f	n	n	1	6		y	n	n	n	fireplace		
1		2	y	y	n	f	n	n	3	2	2	y	n	n	cooker	see d/bk		
1		3	y	y	n	f	n	n	4	n	n	y	n	n	barrow	n	lobby	
1		4	y	y	n	p	n	n	1	4	n	y	n	n	storage	shelving	canteen	
1		5	y	y	n	f	n	n	1	n	n	y	n	n	drawers			
1		6	y	y	n	p	n	n	2	1	n	y	n	n	f&f	n	hall	
1		7	y	y	n	p	n	n	1	1	n	y	n	n	n	junk		
1		8	y	y	n	p	n	n	1	1	n	y	n	n	wc	n	toilet	
1		9	y	y	n	p	n	n	2	1	n	y	n	n	n	n		
1		10	y	y	n	p	n	n	1	2	n	y	n	n	f&f	storage		

Illus 154 With such a large number of buildings, many of them essentially similar, careful listing was essential. This shows a sample of one of the Structure Summary Sheets. (GUARD)

Illus 155 Many of the buildings still had signs and instructions on them, this safety notice being typical. (Photo: GUARD)

Once compiled, the resulting gazetteer was studied to reveal buildings of generic type. These similar buildings were then further studied to reveal 'best of type' qualities, unique and special features and function. Furthermore, there were a number of unique buildings and structures to be considered, such as offices, service buildings and railway related buildings.

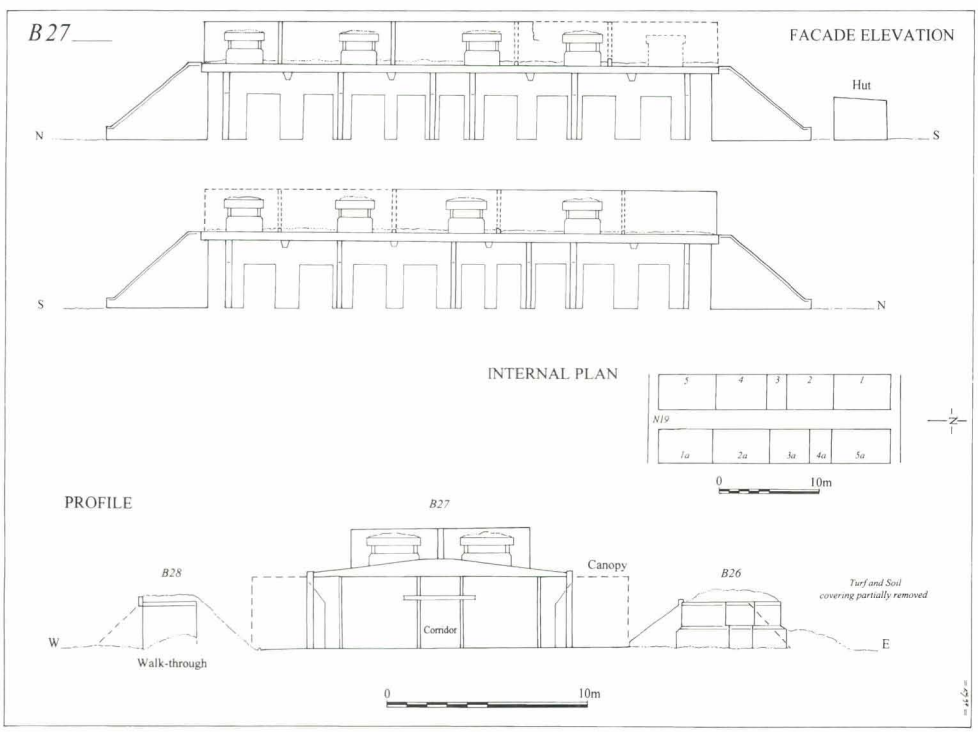
This study was augmented by desk-top research and oral testimonies. A war historian was employed to research the processes and people at the factory. Significantly, this lead to the WWII manager of the factory being invited back onto site. This emotional visit required sensitive handling, but the resultant information enabled an accurate understanding of the operating conditions and procedures of the day.

A short-list was then created. The resultant selection of buildings was to be recorded in more detail, including elevations, transverse profiles, room plans and detailed photography (Illus 156). In certain buildings, change of use phasing had occurred, particularly where the site function had switched from assembly to disassembly. This was initially more readily revealed in the palimpsest of room number stencils than by any changes to the brick and concrete fabric. In certain groups of buildings, further study showed how conveyor systems had been introduced in the 1950's to facilitate faster disassembly of the bombs.

8.3.5 The measurement of the buildings

With structures of this period being chiefly constructed of brick, concrete and steel, and with the standardisation that military design brings, the architectural recording process was very straightforward. The buildings exhibited regular features, were very 'square' and had many repetitive units of architecture within them. These attributes could be employed to advantage in the recording process.

Once the generic groups had been determined, a template was developed from a fully recorded exemplar building in each group - from then on, merely architectural *differences* could be recorded. This built 'regularity' enabled swift progress with recording, to the extent that some drawings started to look skeletal in appearance. However, coupled with the measured drawings made on earlier buildings, all the necessary information had still been recorded.



Illus 156 A typical set of drawings, showing facades, sections and plan of building B27, an Assembly House. (Drawing: GUARD)

On this project, the specifications for the accuracy and level of detail for the architectural recording enabled a workable solution by hand measurement methods alone (Ch 4.2). This was accompanied by drawing to scale in the field, onto a tracing sheet mounted over metric graph paper. Electronic or metric photographic recording methods would have been not only too accurate but difficult to apply, as most buildings were obscured by high bunds. The chosen drawing scale was typically 1:100, and this would be scaled down at a later stage for final Report illustration.

In practical terms, the measured drawing task had to be conducted by two people, one using the tape, with the other drawing. The value of efficient team working should not be underestimated. The measurer must understand what information (and in which order) the illustrator needs, and the illustrator must understand which measurements to ask of the measurer, and all this in order to construct the drawing in the most efficient way.

For elevations, the measurements themselves were comprised of horizontal distances taken from a chosen datum, with associated offsets taken vertically to tie in other features above ground level. In many cases, the building could be broken down into repetitive elements. Care had to be taken with cumulative error. Overall checks needed to be made occasionally over greater distances to ensure that there was no discrepancy between the drawn scale and the actual distance. If the misclosure was considered too large then re-measurement commenced.

Plans were constructed in a similar way, with particular care taken to calculate wall thicknesses. Profiles too, were measured using tapes, but care had to be taken when traversing the bunds to maintain accuracy from a level line or tape. The profiling was facilitated by measurements to exposed sections of buildings, where the protective earth had slumped.

All measurement was satisfactorily completed with various tapes, although today the measurement process could possibly be expedited using a laser tape measure (Ch 4.3), as the cost of these devices has come down greatly. For the type of measuring involved in this project, a broad (and hence stiff) five metre hand tape is essential and will provide most measurements. The broad tape enables a single operator to obtain measurements (vertically and horizontally) more easily, as the tape is self-supporting over longer distances. Additional to the hand tape, a 30 or 50 metre open frame fabric or steel tape was required for the longer measurements and checks.

8.3.6 Reporting

The project provided a valuable record of a type of industrial building which in recent years has disappeared very rapidly, as with so many military buildings (SAVE 1993). This factory was one of many related to the munitions industry, much of which was concentrated in Ayrshire at that time.

As industrial processes change with new technology, so do the buildings in which they are housed - to a certain degree this was evident at Bowhouse. With Bowhouse, regrettably the internal fixtures and fittings had almost totally been removed. Nevertheless, by recording the site and samples of the various buildings, an invaluable record has been preserved. A most interesting feature of this site was the way in which the geography of the layout was a true reflection of the handling of such a volatile product, and how the workers must have related to this environment in very physical terms.

After completion of the fieldwork, a written A4 format Report was produced, which included the following:

- A narrative report describing the results of the desk study and field study, illustrated by a site plan and other supporting figures as appropriate
- An archive report, in the form of a Gazetteer, recording the description and interpretation of individual structures and their components
- Plans, elevations and profiles of selected individual structures, typically at 1:200
- Appendices included; a building phasing list, room number changes, structure summary sheets, census information, production information, index to materials archived, photographic index and video index.

All material was deposited in the NMRS.

8.4 LION CHAMBERS, HOPE STREET, GLASGOW

8.4.1 A cumulative record

So far, the case studies have described work carried out as one project. As has been noted elsewhere, the accumulation of a record of any building must take time, but on the other hand many projects tend to focus on one specific recording exercise.

In the case of Lion Chambers, that has not really been the case – the record has in essence been built up cumulatively through a number of separate projects and reports. Indeed, those projects have not had recording *per se* as their end product. Nevertheless, through a series of architect's reports, engineer's reports, the preparation of measured surveys and academic articles, a substantial body of record has now been created.

Indeed, given the nature of the building, as described below, it could well be that the 'set piece' approach to recording would not be necessary and appropriate. In this respect, Lion Chambers has something in common with Case Study Three on the Bowhouse factory – the construction was essentially of one build and many of the earlier fixtures and fittings were long removed.

8.4.2 A commercial building

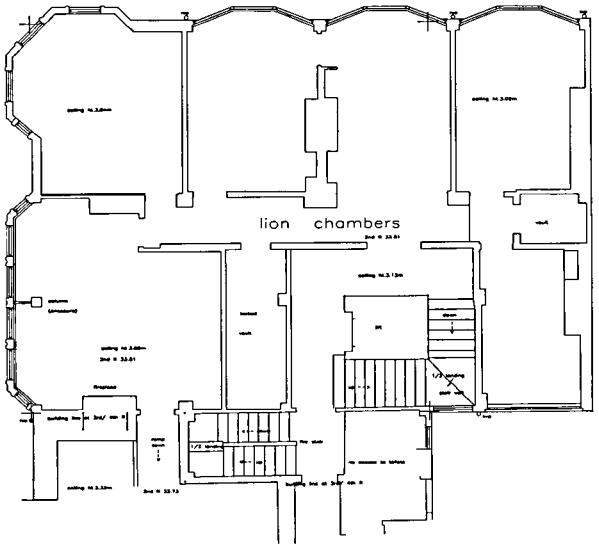
Lion Chambers, 170/172 Hope Street Glasgow, was designed by James Salmon and John Gaff Gillespie and built between 1904 and 1907 (Illus 157). It was the second building in Glasgow and amongst the first twenty in Britain to employ the patented 'Hennebique' system devised by the French engineer L G Mouchel, and built under licence by the Yorkshire Hennebique Company.

The ferro-concrete frame and panel construction supports slender internal columns, measuring only 330mm by 330mm (13 inches x 13 inches) in the basement, reducing to 200mm by 200mm (8 inches x 8 inches) at upper levels, and carrying fireproof *in situ* reinforced concrete floors and stairs. The single-skin uninsulated concrete wall panels were only 120mm (4.5 inches) thick, rendered externally with yellow stucco and plastered internally directly onto the panels.

Illus 157 A view of Lion Chambers, Glasgow, from the NW, taken in 1992, while the building was still fully occupied. The tall and narrow nature of the building can be appreciated and also the almost complete fenestration on the north face. (Photo: Crown copyright RCAHMS)

Illus 158 The west and north elevations of the building, which can be compared to Illus 157. (Survey drawings: Jevons Surveys Ltd)

Occupying a site just 10 metres by 14 metres this innovative building rises through eight storeys to a total height of some 27 metres. It originally accommodated a basement printing works, ground-floor shop, lawyers' offices on all the principal floors, and artists' studios at the top. Illus 158 and 159 show the front elevation and a typical floor plan.



Illus 159 A typical floor plan, the second floor. The small footprint can be noted. The floors are in general very similar in layout. (Survey drawing: Jevons Surveys Ltd)

The importance of Lion Chambers in the development of the structural design of commercial buildings on urban sites, and in its fusion of Art Nouveau influences with Scottish castellated forms, is recognised in its Category A Listed Building status. It stands as a symbol of the forward thinking prevalent in the heyday of Glasgow's industrial and commercial expansion in the early C20.

The building had a chequered career in recent years and was threatened with demolition in 1994. With the significant exception of the ground and basement floors, it lay unoccupied and the condition of the concrete structure deteriorated. Various feasibility studies were carried out from 1991 onwards to establish the repair needs and the viability of the building in the long term, including a report funded by Glasgow City Council and Historic Scotland in 1999 (GBPT 1999).

Any assessment of structural and fabric condition requires a detailed understanding of the physical arrangement of a building. To this end, a full measured survey and detailed inspection was initiated by the project co-ordinators, Glasgow Building Preservation Trust (GBPT). This along with previous work has provided a significant record of the building.

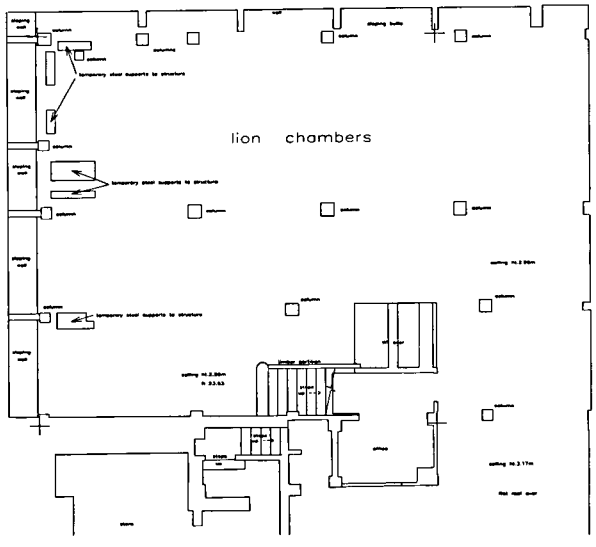
8.4.3 The record

In the first instance, documentary sources provided much valuable information. Articles and books contemporary with the building describe in detail the methods of construction (*The Builders Journal 1907*). More recently, the architectural history of the building was thoroughly reviewed in the journal, *Architectural History* (Cusack 1985 and 1986).

Various architects and structural engineers reports have been prepared since the late 1980s, as well as those associated with the GBPT report noted above. These earlier reports were collated by and are described or included in the GBPT Report.

An important part of the project was the preparation of measured surveys. These provided floor plans of all floors of the building and external elevation surveys of all faces. Sections through the building were not prepared at the time, but by the regular nature of the construction, these could be created from the plan and elevation survey with just a small number of extra measurements. The work was carried out at 1:50 scale. The level of detail shown in the surveys was not particularly high, but largely this was through the nature of the building – with its concrete construction and simple window frames etc, the amount of detail to be surveyed was limited in any case.

Nevertheless, accuracy was an important consideration, as the drawings would in turn be utilised by the structural engineers (Illus 160). Accuracy was achieved through the whole survey being total station theodolite controlled. Although this work was only carried out in 1997, even this is before the newest generation of REDM theodolites.



Illus 160 A plan of the basement, where the slender columns which support the entire building can be identified. (Survey drawing: Jevons Surveys Ltd)

Hence reflecting prisms were held to key points and 3D coordinates obtained in this way. A particular problem was that the principal elevations were shrouded in scaffolding, so external observation could only be made to points visible through the scaffold. From these points, direct hand measurement was made to infill detail. Internally, traverses were run to link to the external work. The whole was presented digitally in AutoCAD files. The work was carried out by Jevons Surveys Ltd.

Illus 161 An interior view of an office on the third floor, showing the north facing window wall. (Photo: Neil Ross/Historic Scotland)

As has been indicated, photography is a very important part of any record. Photography has been used in association with all studies of the building, for example the GBPT feasibility study in 1999 (*op cit*). The RCAHMS has taken a number of photographs in 1987 and 1992, held in the NMRS. Illus 161 shows an interior view of the third floor.

Perhaps the most obvious component of record which has not been undertaken so far is the preparation of individual context reports, that is the written descriptions of individual features. However, given the nature of the building, this may not be necessary as there is no complex history of changes to unravel.

Archival material which contributed to the record of the building is kept by Historic Scotland and the Glasgow Buildings Preservation Trust.

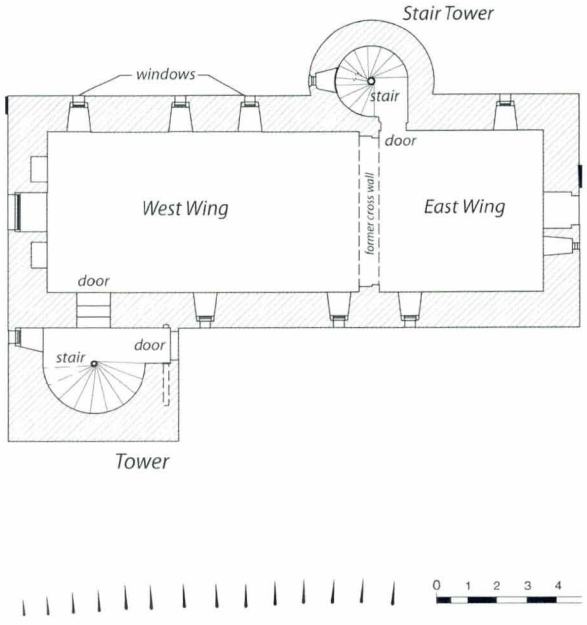
8.5 FENTON TOWER, EAST LOTHIAN

8.5.1 Recording prior to reconstruction

Fenton Tower is a late C16/early C17 towerhouse in agricultural land near North Berwick. It has been ruinous since at least the C19 and, as such, it is very typical of a wide range of similar structures in Scotland. It is also typical, inasmuch as the owners wished to reinstate the structure to use. As it was roofless and floorless, this meant that quite extensive works would be involved. In the interior, new wall finishes would conceal much of the wall faces from future study.

Fenton was originally a comfortable house. The planning of the rooms exhibits a level of sophistication, with the principal chamber on the first floor formed as an almost perfect square, with windows set in the centre of the north, south and east walls (Illus 162). Its ample provision of dry stool closets was also an innovation of the early C17.

During its occupied life, Fenton saw relatively minor alterations, essentially focussing on the windows and fireplaces. Following its abandonment, the ground floor cross wall and vault were removed. Little visible remains survived outwith the Tower, although there was a suspicion that parts of the neighbouring field dykes may have incorporated elements of a barmkin wall.



Illus 162 Fenton Tower, basement floor plan, showing the basic layout of this C17 L-plan Scottish tower house. (Drawing: CFA Ltd)

By the start of 2000, the masonry structure was in a poor condition and was liable to significant collapse (Illus 163). Reconstruction for occupation was considered the most suitable way of ensuring its long term future. The Tower was a Scheduled Ancient Monument and a Category A Listed Building. A condition of consent for the work - but with the support

Illus 163 The Tower exterior, south face, with the stair turret projecting forward. The largely complete nature of the structure can be seen, allowing for reconstruction of the Tower without significant conjecture. (Photo: CFA Ltd)

of the Architect and owners in any case - was that there should be an appropriate level of building recording and archaeological excavation for all aspects of the project.

The building recording/archaeological contractors, Centre for Field Archaeology Ltd (CFA), were an essential part of the project team, providing a record of the building which fed information back into the project. The archaeologists were needed both to record evidence which would be lost or concealed by the reconstruction and, in the absence of much in the way of documentary records, to gain a better understanding of the building. CFA provided this service, working with Nicholas Groves-Raines Architects on behalf of the owners.

Each stage of the reconstruction project was preceded by survey and investigation. While the purpose of this Guide is particularly to focus on recording of upstanding buildings, as has been noted an appreciation of the site is most important (Ch 5.7). At Fenton, although not described here in detail, this was integral to the process, with excavation being carried out within the Tower basement and around the site. This was a useful example where excavation combined with building recording provided additional information on the primary building phases, both within the interior and importantly for the surrounding site.

8.5.2 The recording

The recording programme consisted of:

i) Documentary research An initial, desk-based assessment of archive material, ranging from historic maps and aerial photographs to likely published sources, was carried out. The range of material available was fairly limited, and mostly secondary sources were consulted. For example, the RCAHMS recorded the Tower in 1924, this being written up in the East Lothian *Inventory* volume (RCAHMS 1924).

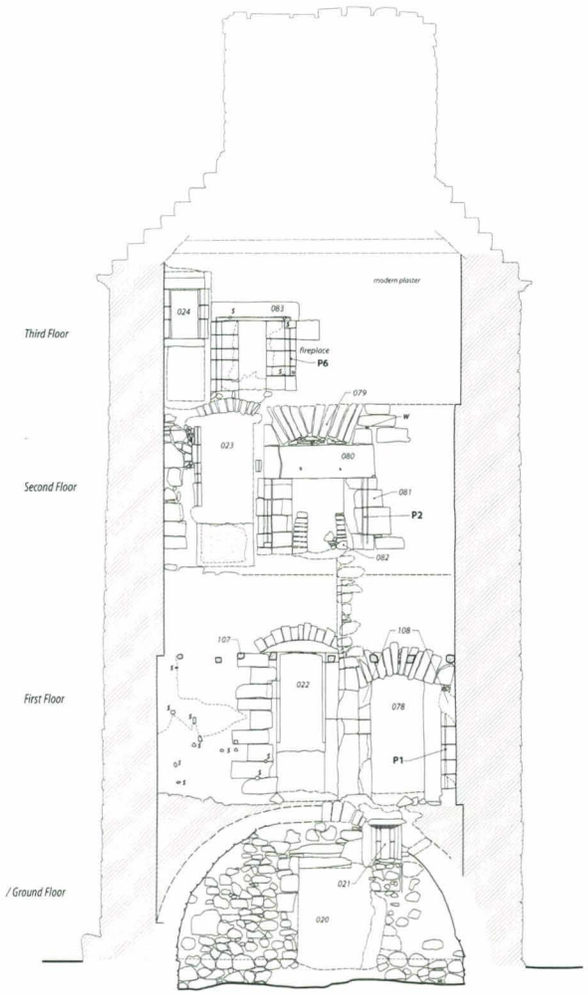
More extensive historical research could have been undertaken, but due to the relatively straightforward sequence of construction and adaptation, it was unlikely that this would have revealed much as an aid to further understanding of the built structure.

ii) Site survey A topographical survey of the site was carried out. This was needed both for the development work on the site and for identifying the archaeological features.

iii) Elevation survey As a roofless ruin of exposed stone construction, it was considered that the most information would be gained about the structure by preparing elevation drawings, both externally and internally (Illus 164). All architectural features and dressed stones were surveyed, but it was not considered necessary to record on a stone by stone basis, except in specific areas. This was because the walling was for the

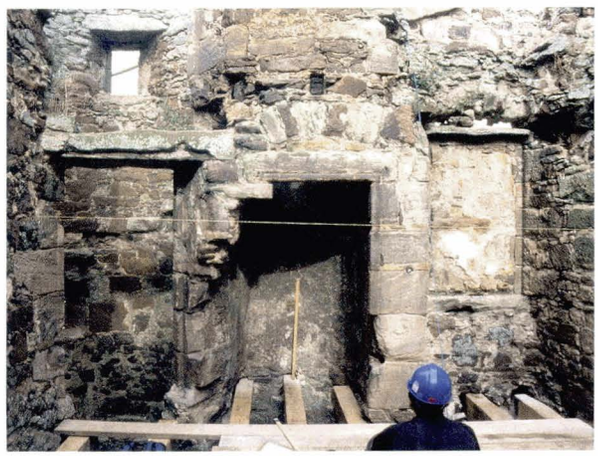
most part random rubble and had not been extensively altered.

Key points on the external elevations of the building were surveyed using a REDM total station theodolite. A full photographic record of the Tower was made of external and internal elevations and of architectural details. For the exterior, the data was then combined by rectifying the photography, utilising the BASP 'AirPhoto' program (see Note, page 139). These elevation drawings were subsequently checked and added to in the field.



Illus 164 An internal elevation, the east face, showing the scar of the former barrel vault and the alterations on the first floor. Context numbers for features can be noted. (Drawing: CFA Ltd)

This technique proved to be of limited success when dealing with the internal elevations, where photography suitable for rectification proved difficult because of oblique angles and since the elevations contained a number of planes. Hence the internal elevation drawings were made on a room by room basis, according to the availability of access as the floors were reinstated. Elevation drawings were undertaken essentially by hand survey methods at a scale of 1:20 using horizontal baselines and right-angle offsets (Illus 165). Reference points such as floor joists, window sills and window heads were used to enable the rooms to be linked to the floors above and below.



Illus 165 An internal elevation, with survey work in progress, east wing second floor. A horizontal datum line can be seen. Due to site conditions, much of the internal survey was carried out as the reconstruction work was in progress. New oak floor beams slotted into the original openings can be seen. (Photo: CFA Ltd)

As work progressed on the building, the recording team went ahead of the construction contractors to record the elevations prior to the works. The drawings were annotated to record features such as original plasterwork, voids or breaks in building work, insertion and re-used masonry and ornate moulding. The spiral stairwell walls could not initially be recorded to scale, owing to the difficulty of access at the time of the survey. After the reinstatement of the stairs, architectural details including original plasterwork and internal windows could be accessed and photographed.

8.5.3 Analysis

The survey and analysis of the structure revealed a fairly straightforward sequence of construction, adaptation and abandonment. It is possible to see the history, development and decline of the Tower in three major phases.

The first phase consisted of the original design and construction. The structure seems to be very much as found today, although it is likely that on the west side there may have been a contemporary wing, long since demolished. Evidence for this comes from some excavated wall stubs and a pitched roof raggle line which can be discerned on this elevation.

A second phase relates to various re-modellings, especially on the first floor at the east end where

windows were reduced in size and the ceiling lowered. The third phase can be seen as the Tower falling out of use and into a state of disrepair. For example, there is evidence that during the C19 the basement was used as a byre.

8.5.4 Archaeological excavation

As mentioned above, archaeological excavation was considered a necessary component of this particular project, principally because of the impact the works would have on any archaeological remains. As well, as with the information visible on the walls, reinstatement of the building to use would negate any future possibilities of investigation.

Internally, the whole of the basement floor was examined, both for the historical record and to inform the stability of the ground. This included excavating two trenches against the walls to depths of 500 millimetres (Illus 166), which revealed the construction of the foundations. This was preceded by a watching brief over the clearance of the floor of first modern debris and rubble, then remains of the removed ground floor vault (Ch 6.6).

Illus 166 Archaeological excavation in progress in the basement. The whole floor was surface cleared and selected trenches excavated. (Photo: CFA Ltd)

Externally, trial trenching was carried out to inform an appropriate response to ground clearance and the construction of a new service wing. While a small fragment of an early, related building on the site was discovered, the trial excavations showed that the archaeology of the site was particularly poorly preserved. This result of the trial trenching enabled an appropriate strategy to be formulated for mitigation of future ground disturbance.

8.5.5 The Report

The Report was prepared for the Architects and property owners (CFA 2001). This provided a written record of the investigations, a detailed description and an analysis of the features found. It was illustrated with plans, elevation drawings and photographs (Illus 167). As well, the project archive, comprising all record sheets, plans and reports was deposited with the NMRS on completion of the project.

APPENDIX 6 - ELEVATION DRAWINGS REGISTER

EVD No.	Sheet No	Scale	Date	BASEMENT
2	2	1:20	6/6/00	North wall, West end doorway and window
3	3	1:20	6/6/00	South wall and windows
4	4	1:20	6/6/00	South wall and window
5	5	1:20	6/6/00	North wall and windows
6	6	1:20	6/6/00	North wall, West end window
7	7	1:20	6/6/00	Doorway into basement from basement of tower
8	8	1:20	6/6/00	West doorway 020, blocked windows 093 and 094
9	9	1:20	6/6/00	East wall, window 021, door 020
10	10	1:20	6/6/00	North wall/West tower doorway
				FIRST FLOOR
11	11	1:20	13/12/00	Blocked window 023
12	12	1:20	18/10/00	Window 022, window 020, entrance 096
13	13	1:20	18/10/00	Entrance 098 to tower
14	13	1:20	13/12/00	South tower 1st floor W wall window
15	14	1:20	19/10/00	Great hall window 021
16	15	1:20	18/10/00	Broken fireplace 097, tower doorway 097
17	16	1:20	18/10/0	Window 022
18	17	1:20	29/9/00	Alcove-window, stairwell doorway
19	18	1:20	26/9/00	Window and fireplace 106
20	19	1:20	26/9/00	Window 015
21	20	1:20	29/9/00	Small window and door to great hall
			29/9/00	**SECOND FLOOR**
22	21	1:20	29/9/00	S wall window 017 and door into stairwell 111
23	22	1:20	11/12/00	E window
24	23	1:20	5/10/00	N window and wall
25	24	1:20	5/10/00	Blocked window 027, window 117 and door 118
26	25	1:20	12/12/00	Windows 024, fireplace 113 and door 114
27	26	1:20	20/10/00	Windows 114, 023 and 035
28	27	1:20	5/10/00	Small cupboard 11, entrance 116
29	28	1:20	20/10/00	Fireplace 080 and window 023
				THIRD FLOOR
30	29	1:20	12/12/00	Fireplace 124 and window 027
31	30	1:20	12/12/00	Window 020 and cross-wall
32	31	1:20	12/12/00	Window 036 and stairwell void
33	32	1:20	12/12/00	Fireplace 083 and window 024
				SOUTH TOWER
34	33	1:20	15/12/00	Basement door 060 and window 016
35	34	1:20	15/12/00	Door into basement 060

FENT/631/0/26/06/01 71 of 76 CFA

Illus 167 A listing of the survey elevation drawings, contained in the Report. Even on this relatively small building, some fifty three detail drawings were generated. (Table: CFA)

Following on the completion of the programme of recording, it was anticipated that further analysis of the results and finds would be carried out. The excavation and recording work identified a number of features and retrieved materials which deserved further analysis, such as the remains of a number of original retained timber scaffolding props, green glaze pottery (possibly medieval), post medieval glass, clay pipes and carved stones.

In particular, dendrochronological analysis was carried out on the oak floor joists (Crone 2002). The stubs of some twenty five joists were removed from socket holes on the first and second floors. This material

proved invaluable in investigating questions of dating and the sourcing of the building materials (Ch 6.3). The timber proved to be of Scandinavian origin and was accurately dated to having been felled in 1572, thus confirming the late C16 date for the Tower.

NOTE BASP 'AirPhoto' module This suite of programs, devised by Dr Irwin Scollar, is designed for extracting archaeological information from aerial photographs. The AirPhoto module has been successfully utilised for rectifying architectural photographs as well.

8.6 ROYAL COMMISSION ON THE ANCIENT AND HISTORICAL MONUMENTS OF SCOTLAND

8.6.1 Recording of buildings by the RCAHMS

Since the formation of RCAHMS in 1908, the analysis and recording of buildings has been a core element in its work. Building analysis, like all other aspects of recording, can be carried out to different levels. These vary from the provision of a broad assessment of a building's main periods to a detailed investigation into all aspects of its history, utilising all available sources of relevant information.

This latter is the traditional RCAHMS approach, with its emphasis on the understanding of how a building comes to take on a particular form, based on an appreciation of its history, development and cultural context. This approach should be distinguished from stone by stone analysis, generally undertaken for the purposes of conservation.

The primary source of evidence is always the structure of the building itself, but crucial information can be provided by a variety of other sources. These may include documents and other forms of written evidence, the oral evidence of individuals with local knowledge, and pictorial evidence including drawings, prints and photographs as well as architectural plans. Maps and published analyses of a building should also be assessed (Ch 5.8).

In the case of very detailed analysis of the kind published in some of the *Inventories* and other publications of RCAHMS (see Bibliography), structural investigation requires the provision of measured drawings as a key element in allowing such matters as wall thicknesses and wall alignments to be fully assessed.

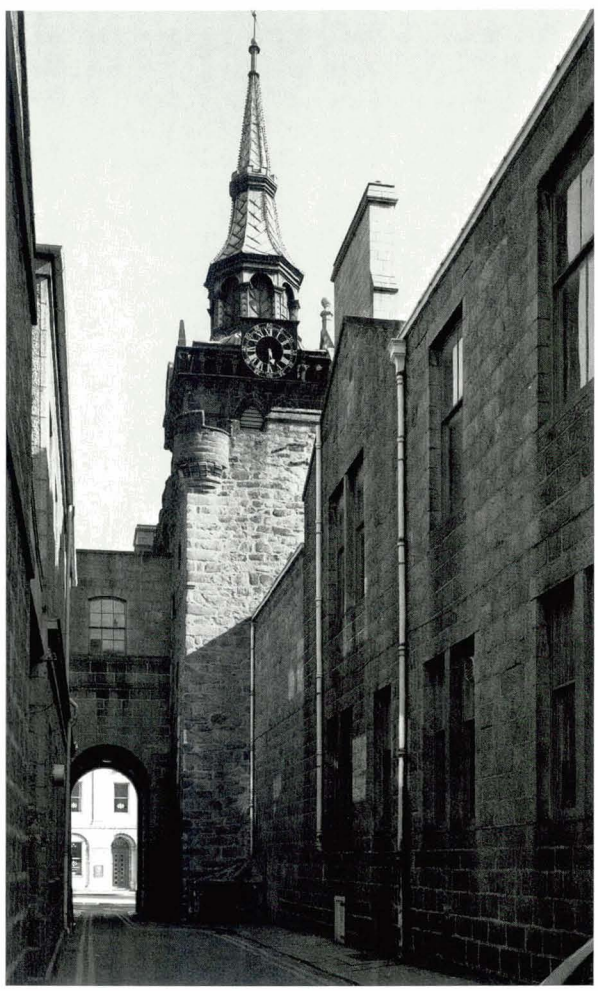
The results of detailed investigation normally take the form of a period-differentiated plan and a text (usually fully referenced), setting out matters of description and analysis in technical language and in an academic format. More information on RCAHMS approaches to recording can be found in the RCAHMS *Survey and Recording Policy* document (RCAHMS 1997).

The following three subjects have been chosen to illustrate different technical approaches to recording carried out by RCAHMS, including the use of reconstruction drawings and specialist photographic techniques. Aberdeen Tolbooth has been selected to demonstrate aspects of measured survey, Drumlanrig Castle is a case study involving both measured survey and photography, and Glasgow Cathedral here serves as an example of photography of a large and complex architectural subject.

8.6.2 Aberdeen Tolbooth

i) Measured survey

This compact but complex multi-period building (Illus 168) in the heart of Aberdeen was recorded as part of a thematic survey of Scottish civic architecture, published by RCAHMS as *Tolbooths and Town-houses: Civic Architecture in Scotland to 1833* (TSO 1996).



Illus 168 Aberdeen Tolbooth: view of tower from north showing restricted site (Photo: Crown Copyright RCAHMS)

The aim was therefore not only to produce a set of accurate measured drawings for the records of the National Monuments Record of Scotland (NMRS), but also to produce publication graphics to illustrate the development of the building, based on the analysis of the structure and on documentary and pictorial research.

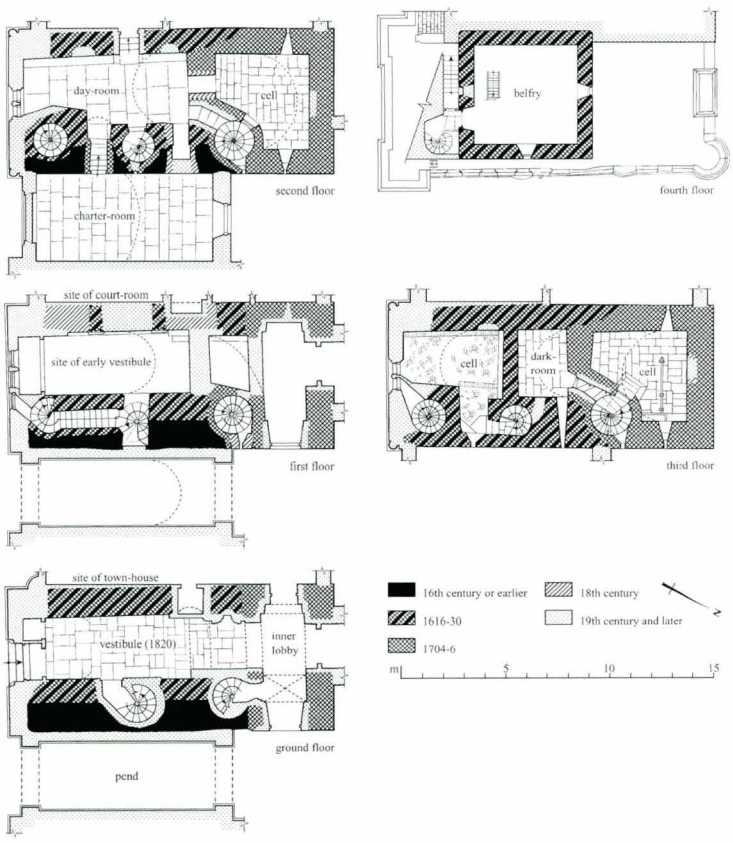
A complete set of floor plans was produced on site using simple alidade and triangulation, drawn at a scale of 1:100. Blocked features and changes in wall alignment and thickness were carefully observed and recorded. This process was complicated by the lack of interconnection on some levels, and by the presence of three mural turnpike stairs. From these survey drawings, a set of hatched plans was produced digitally for publication at 1:200 scale (Illus 169) to illustrate the building's complex period differentiations as clearly as possible.

A portion of arcading, a key element in understanding the early form of the building, was subject to detailed recording. During the production of the plans, small sections of what appeared to be pilasters and arches were noted (see Illus 169, first floor plan). Analysis showed these to be the truncated remains of an arcade that had once connected the early prison vestibule to the courtroom, and an elevation of this detail was drawn at 1:20 scale and published at 1:40 scale (Illus 170). A conjectural reconstruction was also produced.

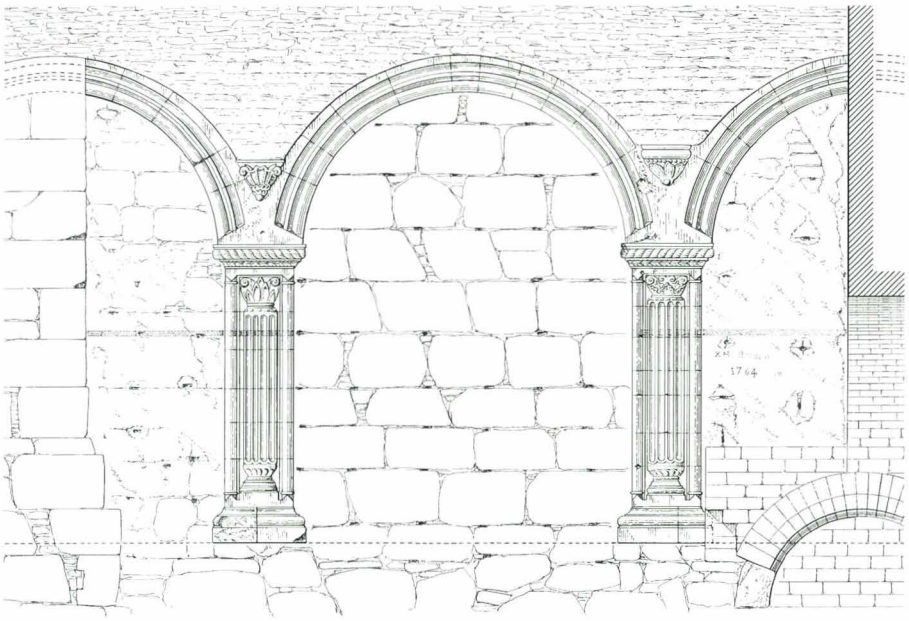
The aim of these drawings was to record accurately the form and nature of this important architectural detail and, with a reconstruction drawing, to put it into a spatial context. This provided a clear impression of what it may have looked like before it was partially dismantled and blocked, thereby enhancing understanding of the development of this major civic monument.

A conjectural reconstruction of the east elevation was also considered. Although now mostly obscured, parts of it could be accessed, measured and drawn. It was felt, however, that it could be difficult to differentiate sufficiently clearly between an actual measured elevation and one drawn to scale but with a large element of conjecture.

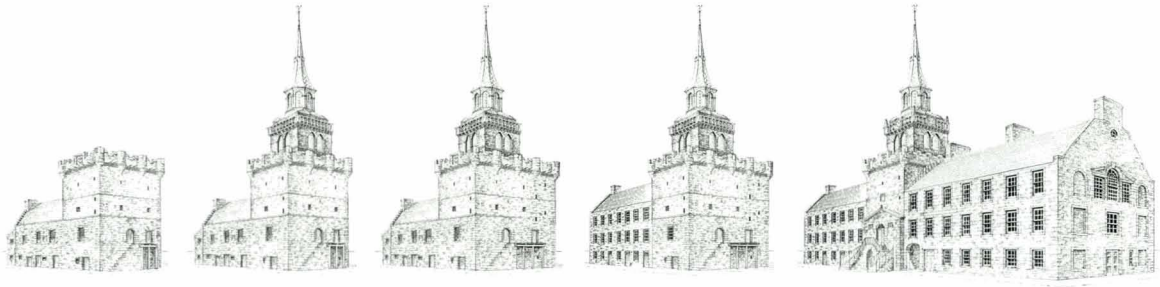
A solution to this problem was found by the production of not one, but a series of perspectival reconstructions (Illus 171) giving an impression of the overall form of the building at key stages in its development. These views complemented the set of hatched plans (see Illus 169) in a very graphic and accessible way, yet were identifiable as providing a quite different component in the RCAHMS account of the building's history. The production of these perspectival reconstructions was aided by the existence of numerous drawings, paintings, etchings and early photographs of the building.



Illus 169 Aberdeen Tolbooth: plans, prepared for publication, showing period hatching (Drawing: Crown Copyright RCAHMS)



Illus 170 Aberdeen Tolbooth: published elevation of arcade (Drawing: Crown Copyright RCAHMS)



Illus 171 Aberdeen Tolbooth: perspective views showing conjectural building development (Drawing: Crown Copyright RCAHMS)

8.6.3 Drumlanrig Castle

Drumlanrig Castle in Dumfriesshire, one the greatest houses of Scotland, is largely of C17 date and is laid out around a central courtyard (Illus 172). The survey of Drumlanrig was carried out as part of the RCAHMS Listed Buildings Recording Programme. This is an ongoing recording programme, devoted to providing detailed coverage and analysis of major historic buildings and sites of which RCAHMS has inadequate or out-of-date records. One main diagnostic purpose of the survey was to reassess the complex building history of the house.

This substantial survey was begun in 1998 and continued periodically over two fieldwork seasons, taking account of weather conditions and available light according to time of year. Although it is a private residence and is only open to the public in the summer months, helpfully out-of-season access was provided in order to conduct the survey.

i) Measured survey

All previously published plans of this massive quadrangular building show it as having been built on the square. It was generally thought to be the result of one main period of build, containing little or none of the fabric of an earlier castle that is known to have occupied the site.

A set of four floor plans was produced at a scale of 1:100 (Illus 173 illustrates one such plan at much reduced scale). Because of the size and nature of the building, EDM theodolite equipment was used to create an accurate control framework on which to construct the plans. Using three survey stations, a plot of the main points on the outside of the quadrangle was produced. A fourth station then took the control survey through the main entrance on the first floor of the north range and into the courtyard.

The fifth and final station then recorded the courtyard and the position of three of the four stair newels (the fourth was in an unavoidable blind spot and was subsequently plotted by triangulation). This framework clearly showed that the angle between the east and north ranges was acute and not a right angle as previous plans had shown.

As the courtyard exists only at first-floor level, having been filled in at ground floor level, none of the courtyard survey data (with the exception of the stair

Illus 172 Drumlanrig Castle, Dumfriesshire: north front (Photo: Crown Copyright RCAHMS)

newels) was of assistance in preparing the ground floor plan. Another control traverse was therefore laid out along the main corridors of the north, east, south and west ranges at this level, forming a right-angled grid from which to either triangulate or take offset measurements. From these control plots and grid, the plans were then produced using triangulation and offset.

Accurate planning of wall alignments and changes in wall thickness suggests that the east range is formed by a substantial pre C17 towerhouse surviving in some areas up to third-floor level. The position, alignment and thickness of other walls at ground and first floor level, along with details, such as the identification of part of an earlier newel and the stumps of stairs incorporated in the north-west stair, may help to confirm the survival of more of the pre-C17 structure.

ii) Photographic survey

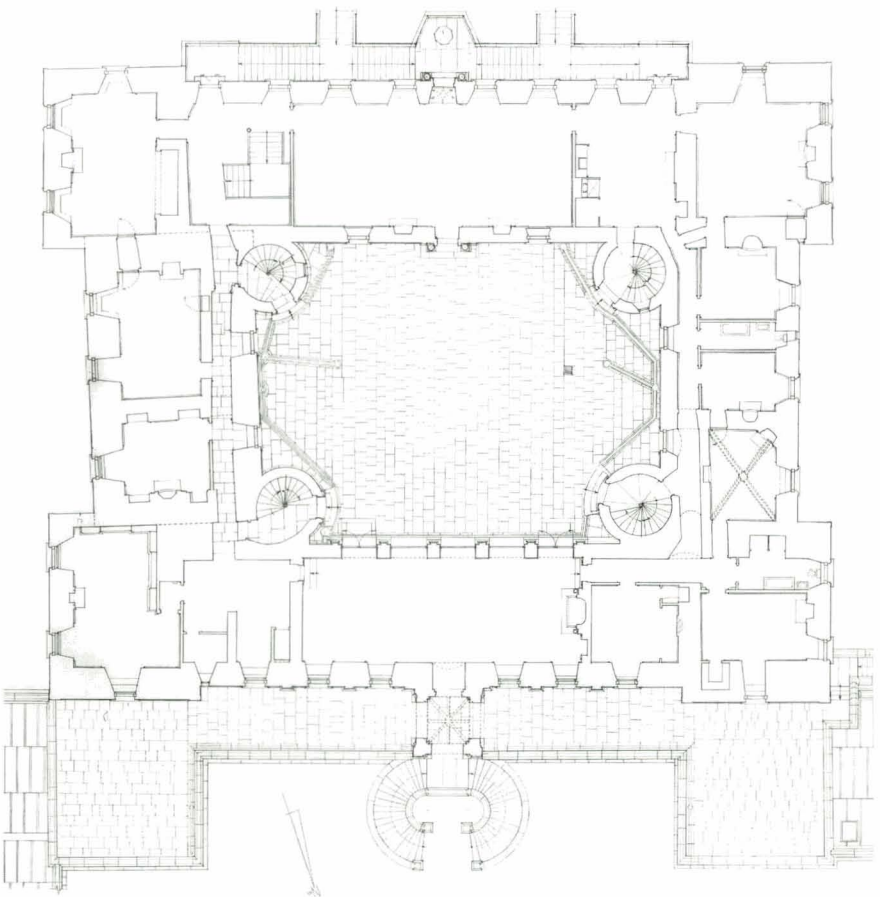
The first phase of the survey involved interior photography of the major rooms and public areas within the castle. All the photographs were taken in black and white, as well as in colour, and processed to archival standards for inclusion in the NMRS.

For the general interior views, a Corfield camera was used which features a fixed wide-angle lens with rising-front and produces 60mm x 70mm size negatives on 120 rollfilm. It also has a shutter that allows multiple flash exposures to be made onto one frame of film, an essential feature when lighting large and dimly lit interiors (Illus 174). In the drawing-room, a Hasselblad 120 camera with interchangeable lenses was used to take detailed views of the carved wooden panels above the fireplace and doorways, utilising a portable scaffolding tower.

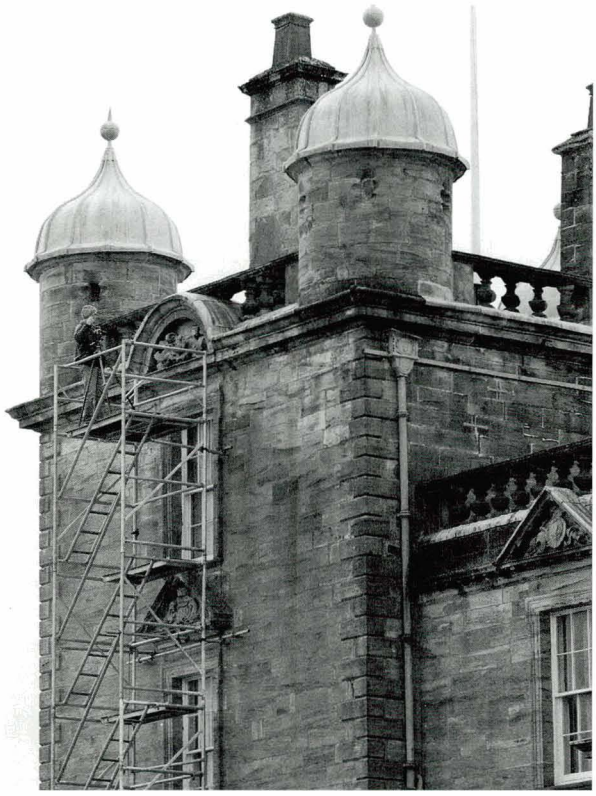
In 1999, the survey was continued with the main exterior views and interior photography of rooms that were not accessible on the previous visit. Also in 1999, a selection of estate buildings was recorded as well as the main north façade of the castle, taking maximum benefit from the strong sunlight of mid-summer for these exterior photographs.

As well as views of the castle itself, several were taken showing its estate setting, a crucial element in understanding the castle as an entity within a wider designed landscape. The main views of the north façade were taken in the evening, since this is the only

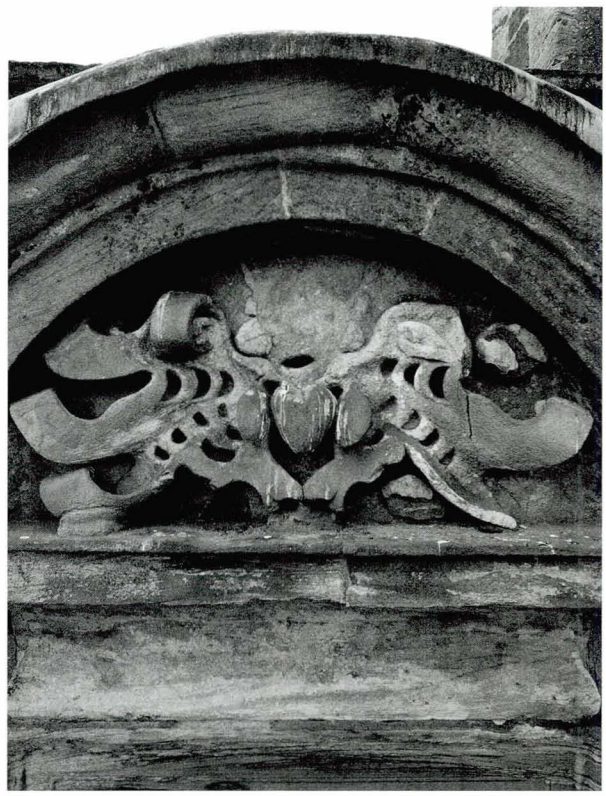
Illus 174 Drumlanrig Castle: first floor, drawing-room (Photo: Crown Copyright RCAHMS)



Illus 173 Drumlanrig Castle: survey plan of principal floor (Drawing: Crown Copyright RCAHMS)



Illus 175 Drumlanrig Castle: north front, recording of detailed features from scaffolding tower (Photo: Crown Copyright RCAHMS)



Illus 176 Drumlanrig Castle: north front, detail of a specimen tympanum (Photo: Crown Copyright RCAHMS)

time of day when this side of the building receives any direct sunlight.

Because of the considerable size of this building, the main exterior views were all taken on a 5" x 4" Sinar monorail camera. As the name suggests, this camera produces 5 inch by 4 inch negatives and can be used with a wide range of interchangeable lenses from extreme wide angle to telephoto. It is equipped with full movements to control depth-of-field and to correct converging verticals.

The final phase of the survey was carried out in June 2000 when the tympana on the north front were individually recorded. The inaccessible location of many of these highlighted the difficulties often experienced in preparing high quality photographic records. On this occasion, a scaffolding tower was supplied and erected by the estate and fixed to the castle wall for stability (Illus 175). The tower was moved and the platform height adjusted for each shot, with a wide-angle Hasselblad being used to ensure that the whole of each tympanum was included in each photograph (Illus 176). A bright overcast day provided ideal lighting for these north-facing features. As with all RCAHMS surveys, the resultant material has been deposited in the NMRS.

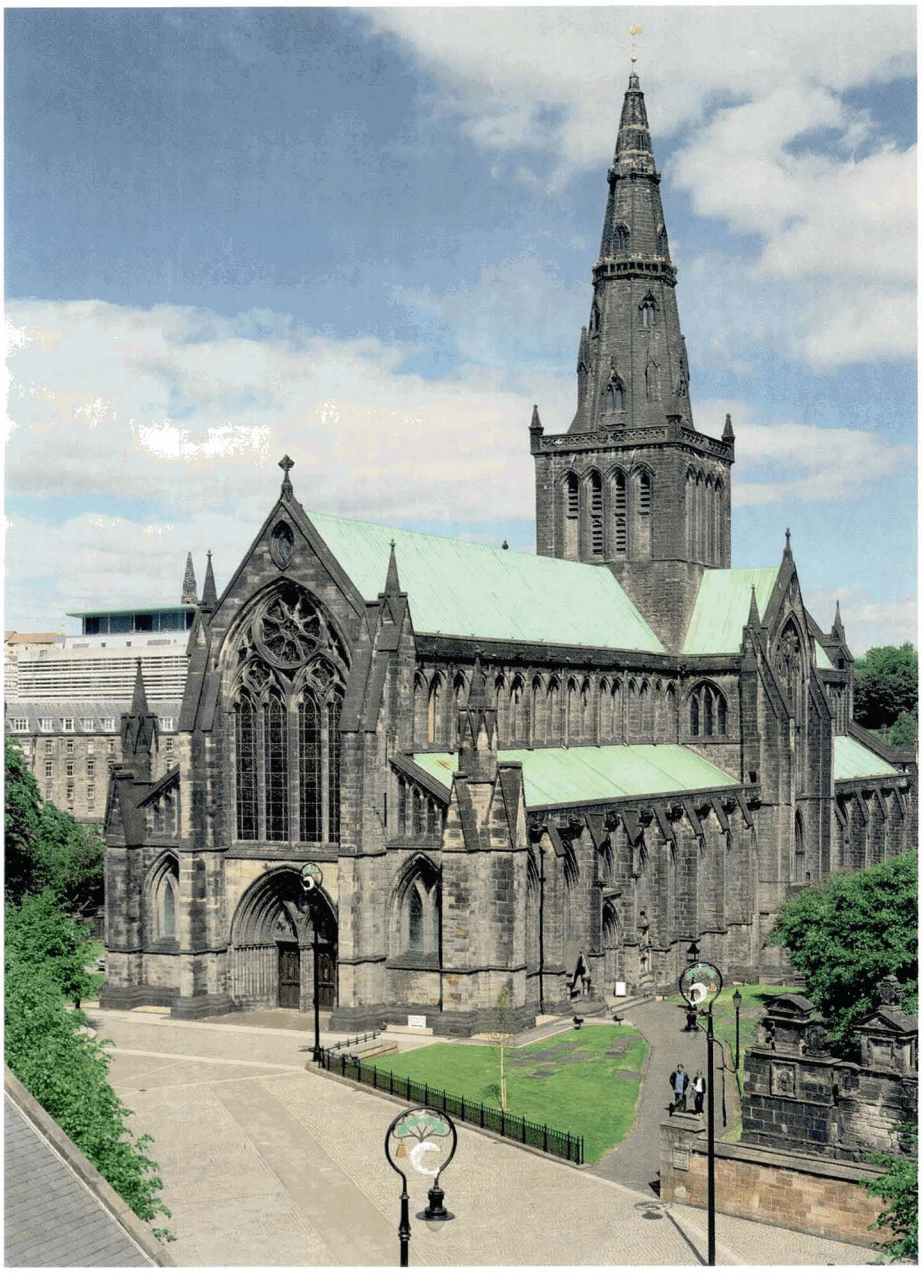
8.6.4 Glasgow Cathedral

i) Photographic survey

Glasgow Cathedral, which has been a key ecclesiastical centre since the early middle ages and possessed relics of St Mungo, is the best-preserved medieval cathedral in Scotland. Much of the fabric is of mid-to-late C13 date and includes a lower church which contained the shrine of St Mungo.

A comprehensive photographic survey of this great late medieval cathedral included a number of contextual exterior photographs, among which there were elevated views from the Necropolis to the south-east and from the Museum of Religion to the south-west (Illus 177). The Sinar camera was used for these general views because of the size of the building and the amount of complex visual information it provides.

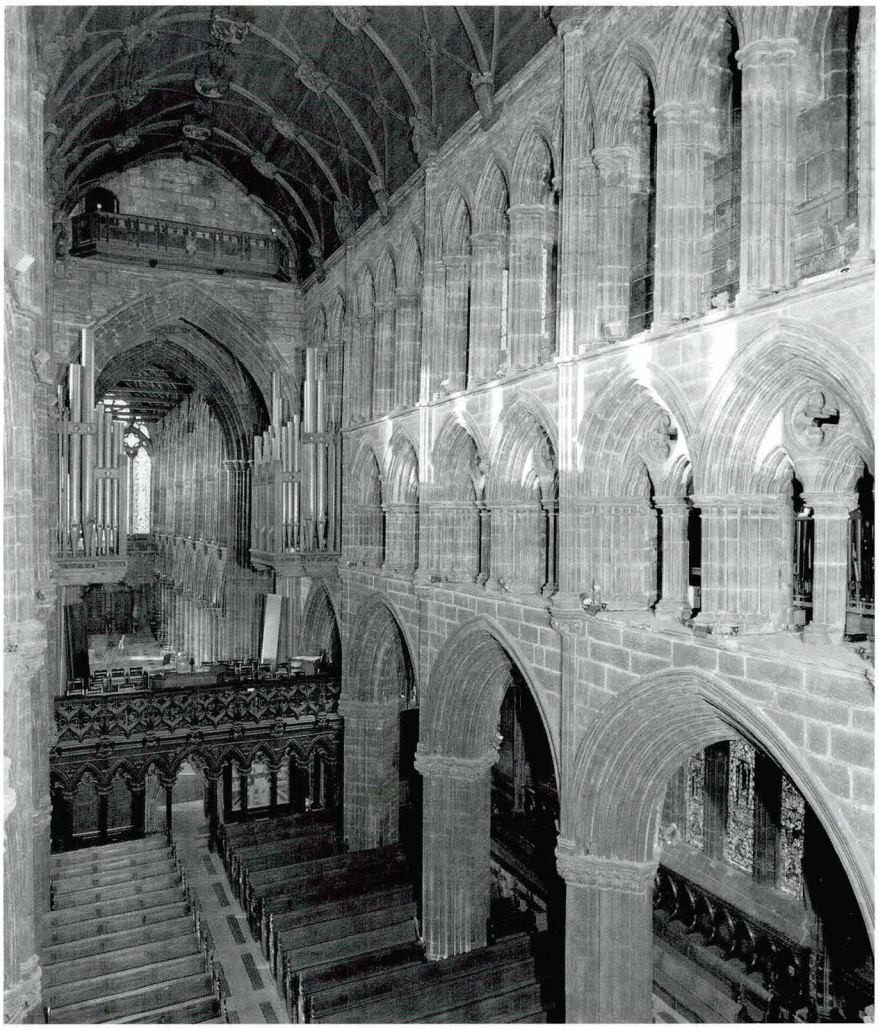
Interior photography included general views of the nave and choir of the Church (Illus 178), as well as the vaulted areas of the lower church. These were taken on the Corfield camera, using a multiple flash technique, where the camera shutter is fired, and a remote electronic flash gun triggered, using a slave cell held by a second photographer who moves around the subject between exposures.



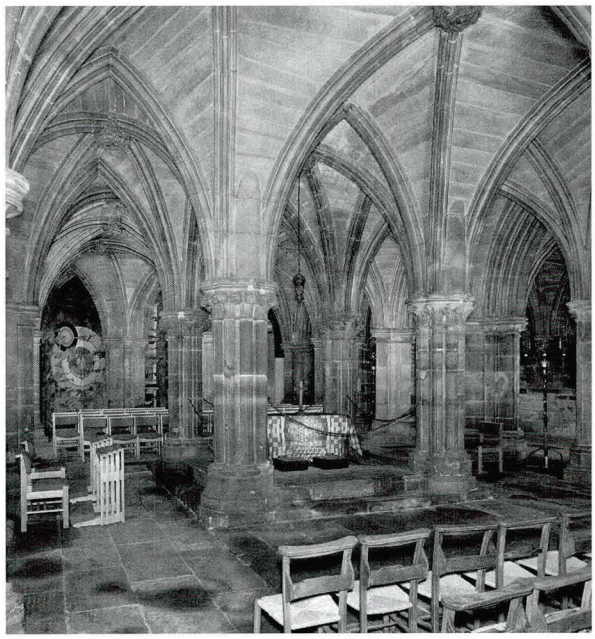
Illus 177 Glasgow Cathedral: high-level view from south-west (Photo: Crown Copyright RCAHMS)

This can be repeated up to some 25 times with the flash being carefully positioned behind piers, in window embrasures etc, lighting small areas of the subject individually until the overall image is correctly exposed. A very even and natural effect can be achieved using this technique, although it has to be executed carefully to create a feeling of consistency, especially in a vaulted space as complex as the lower church (Illus 179).

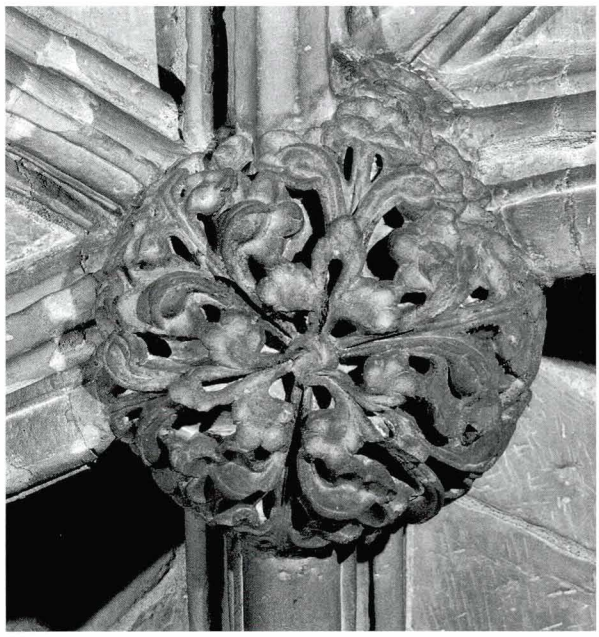
Very detailed recording of the carved stone bosses and column capitals in the lower church, and of the figures on the west side of the stone screen dividing the nave from the choir, was carried out using the Hasselblad 120 camera and two electronic flash heads to bring out the full character of the carved detail (Illus 180). The details were numbered and cross-referenced for identification to an annotated copy of a plan of the lower church.



Illus 178 Glasgow Cathedral: interior of the choir from south-east (Photo: Crown Copyright RCAHMS)



Illus 179 Glasgow Cathedral: lower church, vicinity of St Mungo's tomb, from south-east (Photo: Crown Copyright RCAHMS)



Illus 180 Glasgow Cathedral: lower church, detail of specimen carved boss (Photo: Crown Copyright RCAHMS)

9.0 OPERATIONAL MATTERS

In this chapter some of the practical and logistical aspects of carrying out measured survey and building recording exercises will be addressed.

9.1 WHEN TO CARRY OUT THE WORK

From what has gone before, it will be apparent that measured survey and building recording exercises can take a number of forms and range greatly in scope and size. The recording of Newhailes for example (Ch 8.2) was a substantial exercise.

Equally, it is of value for the record of a historic building if, when some floorboards are lifted, photographs and better still some measurements are made. In terms of new projects, for example if a historic building is to be put to a new use, the best advice is that recording and surveying should be built into the programme as early as possible.

These processes take time. For a medium size historic building, say of 20 to 30 rooms over three floors, the preparation of plans and sections might take four to six weeks. The procurement process also takes time, so adding to this a tendering process, three months is probably a reasonable allowance. The recording process might take a similar time. This would depend to a certain extent if the recorders were to be supplied with measured survey data in advance. If so, the recording work has to follow on.

As well, putting large numbers of staff on projects is not generally a satisfactory solution. In the first place, the number of specialists for this work is quite small. Then, having too many people on site can be counterproductive. While naturally the data presented will be homogenous, reconciling different inputs can take time. Hence providers of these services prefer to work with quite small teams.

Where some recording is to take place during work in progress or as a watching brief, clearly the timing will be coincident with the other aspects of the project. Even here, a reasonable time allowance must be made to allow staff to measure, photograph and otherwise record information.

9.2 SPECIFICATIONS AND PROJECT DESIGNS

9.2.1 Importance of specifications

It is axiomatic that all work related to historic buildings should be properly specified. In this respect, measured survey and building recording are no different from other activities.

In the first place, preparing the project brief or a specification helps define in the client's mind exactly what the requirements are for the survey. As well, the contract document should incorporate appropriate terms and conditions, ensuring that a proper contract exists between the client and the surveyor or recorder.

As a general principle, a 'performance' specification, as against a 'method' specification should be prepared. That is, the specification should set out the requirements of the work, then generally the contractor should have a choice of approach and method, as long as the work correctly fulfils the requirements. It should not generally be necessary to lay down very rigidly every aspect of how the recording is to be carried out. Occasionally, as with survey products, it may be in the client's interests to actually lay down the methods to be used, in order that the product is appropriate for other uses.

It may be useful to note some different terminology. From architecture and building surveying, the words 'specification' and 'method statement' tend to be used to describe contract documentation. From the archaeological world, the expression 'project outline' or 'project brief' describes the scope of the work, then 'project design' and 'specification' are used for the careful definition of the work. Note that the 'project design' is normally a document produced by the tenderer or contractor (see Glossary).

In public sector work, or where a significant proportion of the costs is being met by grant or Heritage Lottery funding, it is usual to procure work through competitive tender. It would be recommended that normally four, certainly a minimum of three, appropriate businesses be invited to tender.

Documentation for a competitive tender does require to be very thorough and clear – it becomes impractical and unfair if the terms and requirements are not very clearly set out. If invited Tenderers have to consult the client to clarify points, this can lead to confusion. The IFA *Standards and Guidance for the archaeological investigation and recording of standing buildings and structures* (IFA 2001), referred to below, provides a very comprehensive statement of the areas to be covered. Of course, clients may wish to develop their own documentation and it is not necessary to exclusively use archaeological terminology or for that matter contractors.

For small projects, costed at say under say £2,500 (in 2003), it is recommended that single tender negotiation be carried out. Any notional saving on competitive tender price will be more than swallowed up in the costs of preparing detailed specifications and other client staff time.

For the private client solely utilising their own funds, on a large project competitive tender would still be recommended. For a smaller project, direct negotiation with a company is probably easier and cheaper. While a specification must still be prepared, this can be done following site inspection and discussion with the proposed contractor. Generally in this case, the documentation can be less thorough than with the competitively tendered circumstance.

The following general content provides a quick checklist. However, it must be pointed out that neither individual writers nor Historic Scotland can be held liable in any way for omissions. As has been pointed out, each survey and recording project will be different, and following on from that, each one will have slightly varying requirements.

9.2.2 Terms and conditions

i) Content

The terms and conditions should constitute a legally binding document between the parties. Matters to be included should be:

Relationship between client and contractor

Tendering details (if relevant)

Surveying/recording services to be provided

Location of the work

Start dates and timing for the work

Consumables and equipment cost allocation

Need for Risk Assessment

Defining Health & Safety responsibilities

Insurances – both third party and professional

Delivery date arrangements

Procedures for proofing and delivering the data

Payment terms

Copyright and ownership

An extended discussion on a number of the above points is contained in the later sections of this chapter. Such a document can be as long or short as the circumstances dictate. On a small privately organised contract, it is difficult to be too precise, but the terms and conditions document might perhaps run to about two to three A4 pages.

Many organisations will already have standard documentation which may be tailored for use on survey and recording contracts. Indeed, particularly in the public sector, it may be mandatory to use standard documentation and add extra terms to cover a number of the topics above. Bodies such as the RIBA and the RIAS produce industry standard forms of contract documentation, such as the RIAS accredited SBCC forms of contract. In particular, where recording is carried out concurrent with a building project, this form of documentation may be essential. The contract with the building contractor should also contain statements concerning the recording work and define access arrangements, constraints etc.

ii) Insurance

One subject over which care must be taken is insurance. Normally, all those involved in this field will carry professional indemnity insurance, but it may be important to be sure of exactly what this covers. Land survey companies for example will carry such insurance against mistakes appearing in their work. If plans prepared by an archaeological business for interpretation are subsequently used for say engineering work, the cover held may not extend to that use. The likely use of material and the exact terms of insurance held should therefore be carefully investigated. All businesses should always be required to carry appropriate third party cover as well.

iii) Site safety

Linked to the matter of insurance is site safety. This matter is considered more fully later in this chapter (Ch 9.5). It is important that the terms and conditions properly define the requirements of health and safety and the possible requirement to prepare a risk assessment statement.

9.2.3 Specifying for measured survey

Considering the specification for measured survey work, this should include the following basic information:

Site of the project

Description of the item(s) of survey to be prepared, eg ground floor plan, west front elevation

A *careful statement* of the detail to be shown on each item

The scale of the survey

The accuracy required

The form of survey control

The form of presentation, eg hard copy, digital

If to hand, attaching samples which show the style and standard from previous surveys is a very useful way of ensuring that an appropriate product is obtained. If negotiating directly, previous examples of a business's survey product should be inspected. Reference to Chapter Four should be made for many of the practical details involved in preparing measured surveys.

Perhaps strangely, the *method* to be used to survey does not usually need to be defined, unless a particular product is wanted. For example, for floor plans, as long as the accuracy requirements are defined, then the client should not really need to define methodology. On the other hand, if detailed stonework drawings are required, it might be reasonable to specify, say that photogrammetric methods are to be used.

Publicly available specifications for measured survey work are not common. The RICS do produce a specification for large scale site and building work (RICS 1996) but it is rather limited in the amount of detail it contains and there is no special advice on historic building survey. Nevertheless, it provides a very useful framework.

English Heritage have produced a suite of specifications for various forms of measured survey work on historic buildings (EH 2000). However, these are essentially in-house documents, tailored very specifically to their needs. They are very prescriptive, method driven specifications, and as such it is not easy for the general practitioner to extract a straightforward and cogent specification from them. Nevertheless, they contain good examples and relevant clauses can be extracted.

Survey companies and specialist consultants will have their own specifications available (Dallas 1988), but these will normally just be available as part of a service provided by that company or consultant.

9.2.4 Specifying for building recording

In specifying for building recording work, much the same principles should be applied. As will have been evident from reading the Guide so far, defining what exactly will be needed in a building recording project is more complicated.

A different form of tendering is quite often used in this field. Recognising the specialist input which will be made, it is quite common for the client to more simply outline the overall requirements (the Project Brief or Outline), then invite Tenderers to provide their own statement of what they believe will be required (ie, a Project Design). On occasion, a fixed amount of cash will be stated, the work to be carried out inclusive of this. Then, the client must review these Project Designs to decide which most closely fits their perception of the work involved.

Of course, the more traditional form of lowest cost tendering may equally be used. In this case, the client will have to provide a detailed specification. While most matters can be prejudged, some latitude must be built into the specification to allow for the unexpected. The initial Project Brief will certainly have to define certain matters:

The site of the work

The scope to be covered

Then, the extent to which:

Measured survey products are to be prepared

Documentary research is to be carried out

What photography is to be taken

Extent of descriptive, ie context recording

Length of Report to be presented

Extent of analysis of the building

The form of presentation, eg hard copy, digital

Any specialist requirements:

Materials analysis

Special drawing presentations etc

Descriptions of what is involved in each of these areas are provided in the Guide, principally in Chs 5, 6 and 7. Where the work is tendered/priced by negotiation, these many areas will be discussed, then a Project Design or specification can be drawn up mutually between client and contractor to define the work.

As with measured surveys, there are few standard specification documents available in this field. The Institute of Field Archaeologists (IFA) is the main source. Their *'Standard and Guidance'* document for standing building recording (IFA 2001 *op cit*) is a very good and through document which covers all areas of terms and conditions and technical matters which have to be addressed.

However, it is a catch-all document and is not in a format which lends itself to direct adoption as a specification. While it can be downloaded from the Internet in PDF format, it will not be adequate simply to enclose this document as the specification. Detailed, site specific terms and conditions and technical requirements will have to be extensively added as appropriate. The IFA also produce a document focussing on contractual arrangements (IFA 2000) and one on archaeological watching briefs (IFA 2001), both of which are of value to consult.

Another source commonly used has been the former RCHME's *Descriptive Specification* or *'Levels'* document (RCHME 1996). So called from its four levels of recording, this actually contains very useful detail on specifying for recording, including graphical examples. The descriptions of the 'levels' are quite short, and could not be used in themselves as a specification. Nevertheless this document is often referred to.

Clients may of course develop their own specifications for work, especially if other professions are involved. RIBA and RICS standard contracts may provide necessary terms and conditions, but the recording work will still require to be defined. Again, archaeological units and companies and others in this field will have their own specifications available, but these will normally just be available as part of a service provided by that company or consultant.

9.2.5 Other specifications

As has been noted elsewhere, building recording may involve setting up a number of specialist sub-contracts, for example for documentary research or materials analysis. Generally, it will be best to have a lead contractor, with the terms and conditions defining this contractor's obligation to set up and procure such specialist services. Occasionally, on a very large contract, such specialist work will be arranged directly (see Chap 8.2 Newhailes).

Some areas on occasion might be set up directly. For example, if a **photographic record** (Ch 6.7) of a country house was wanted, this might be set up directly with a professional photographer. Apart from general terms, such a contract would require to define:

Areas to be photographed

Numbers of photographs, in total, in detail and by space

Format of photography

Film size

Conventional/digital/both

Proportion of colour/ black and white

Indexing method

Deliverables, eg prints, digital data etc

Another area requiring a special specification would be a **watching brief** (Ch 6.6). Generally, the requirements to be defined would be much as for a recording exercise, but with extra clauses related to access, timing and safety. The IFA *Standard and Guidance* on watching briefs (IFA 2001 *op cit*), while primarily for archeologically excavation, provides all information appropriate for most circumstances.

It is important here to define not only the recorder's work, but also the obligations of those around them. There will be limited point in setting up a watching brief if the building contractor, or *in extremis* the demolition contractor, is not required to take note of the building recorder's access and other requirements. The requirement to temporarily stop work at the request of the building recorder should be written into the standard building contract. Then, the building contractor can reasonably be expected to programme their work such that staff can be temporarily redeployed without penalty.

9.3 INPUT OF DIFFERENT PROFESSIONS

As described in this Guide, the person most likely to be carrying out or leading a building recording exercise will have an archaeological background. However, that is to conceal a more complex picture, where the input of architects, architectural historians, land surveyors and others will most likely be involved.

The modern development of the subject has it is fair to say been driven by the archaeological profession, but it should not be seen as the exclusive preserve of the archaeologist. Indeed, as has been discussed in the introductory Summary, the expression 'buildings archaeology' is rather misleading and puts the field in something of a straitjacket.

As well, in the broader context of the recording project, the building recorder does not and cannot operate in a vacuum. Whatever the nature of the project that requires recording, there will be other professionals involved. These will most commonly be the architect, but also structural engineers, quantity surveyors, representatives of the planning authorities, building contractors, conservation specialists and the clients themselves.

With the exception of the latter, each has a particular professional expertise that will be applied to a given building, and the building recorder will often know less than many of the specifically experienced professionals. Taking careful account of this

professional environment is no less a skill for the recorder than the recording itself. In this environment it is beholden upon the recorder to be as versatile as possible – beyond simple recording - and to be aware of the potential benefits to a project that the particular skills of other professionals can offer.

i) The Archaeologist The approach based on archaeology may be said to concentrate on unpicking the building, in a manner akin to archaeological excavation. That is, the detailed accumulation of individual facts goes together into the archaeologist's matrix of information. (This does not involve physically dismantling any part of the building, except with the watching brief, see Ch 6.6).

The strength of this approach is that no detail is left unnoted, no matter how insignificant it may appear at first. Thus piecing together the history of a building, or building up an accurate comparative database of types, becomes as objective an operation as can be. Another advantage of this approach is that a detailed archival record of a building is built up, with much more depth say than a rapid photographic record.

Against this, a building is not an archaeological site, thus on occasion the archaeological approach may be unnecessarily repetitive. However, a client setting up a building recording exercise as described in this Guide is most likely to utilise initially the services of an archaeological business.

Much measured survey is often carried out directly by archaeologists, when they are carrying out the recording. Often, this may be an appropriate and practical way of procuring the survey. For example, in vernacular building recording (Ch 8.1 Auchindrain) the subtlety of detail is such that it is often best to survey and record in one operation. Most archaeological businesses are today equipped with total station theodolites etc, and the larger businesses often now employ qualified land surveyors.

On the other hand, recorders tend to see their products as being a means to an end in the interpretation of the building. Products may not be available until well on in the project, and unless requested, survey drawings may often be heavily annotated or layered with other information, such as texturing of stones etc. As recorders like to prepare their own survey documents, they may utilise a mixture of methods which may not be optimal for other uses by the client. These points should be borne in mind, if for example survey drawings are wanted rapidly for project planning or to a specified accuracy for building works.

ii) Architectural historian As has been noted at several points, the debt owed to the subject of architectural history is fundamental. This field has a long and respected provenance. Generally academically based, the philosophy behind the study of architecture perhaps has a slightly different orientation and emphasis from the archaeology-based approach. It is perhaps more concerned with *comparisons of* historic buildings. A huge body of literature has been assembled on virtually every aspect of our built history.

While it is unwise to generalise, the architectural historian traditionally has tended to work by concentrating on stylistic comparison, dating and documentary research to reach their conclusions. While the architectural historian will make extensive use of floor plans of historic buildings, it is probably fair to say that the absolute accuracy of such material is not of prime concern.

iii) Building professionals As has been noted, a number of other professions may well contribute to the recording exercise, but it is unlikely that they will lead it. A number of architects and building surveyors do however offer services of building recording. They are perhaps more likely to assemble a team, or to subcontract parts of the work, but they will certainly also aim to deliver a final product much as described in the Guide.

Architects and building surveyors may also prepare measured surveys, usually by the 'hand survey' methods. For many purposes these will be quite adequate. Nevertheless, it should be recognised that such surveys will not meet the standards of accuracy of those prepared say by instrument methods. This is not to belittle these products at all, since as will be noted elsewhere (see Chs 3 & 7) the process of hand measuring brings an intimacy and understanding of the building and its parts.

The many other specialists who may be involved in building recording have been noted – the documentary historian, materials specialists such as geologists or metallurgists, the dendrochronologist and many others - all may contribute as part of the team.

iv) Land or Geomatics surveyors Building floor plans etc may be needed regardless of whether a more detailed building recording exercise takes place or not. Almost all land survey companies nowadays offer services for the measured survey of buildings. Naturally, this will be for any sort of building, from the factory to the office block to the historic building.

The strengths of the land surveyor lie in their appreciation of the specialised methodologies of surveying, accuracy and use of modern equipment. While traditionally they have tended to work in the broader area of mapping survey, over the last decade, they have increasingly been involved in the measured survey of buildings.

To this field, they bring rigour and accuracy, and tend to specialise in the more advanced instrument survey methods and techniques such as photogrammetry. They are less strong in an understanding of the significance of architectural detail. Land surveyors do not add interpretative material to their surveys. Rather, they see their job as providing a 'base map' on which other disciplines will annotate further information. Nevertheless, if on a medium to large historic building, full measured survey is required rapidly, land survey companies will be better able to provide these products than any others.

v) RCAHMS The Royal Commission on the Ancient and Historical Monuments of Scotland occupies a unique role in the recording and understanding of Scotland's heritage of historic buildings and their sites. The Commission is charged with the task of 'surveying and recording the man-made environment in Scotland' (Ch 8.6).

RCAHMS has been in existence since 1908 and its professional staff includes architectural historians, archaeologists, survey/graphics specialists and photographers. As well as its various programmes of recording, RCAHMS also has the important task of maintaining the National Monuments Record of Scotland (NMRS) (Ch 5.8). The huge body of material amassed by RCAHMS, both directly and indirectly, is well evidenced in its *Annual Reports* (RCAHMS 2000 and previous). In Scotland, before any new survey or recording work is commissioned, the archives of the NMRS should be consulted.

In some respects RCAHMS occupies slightly different ground from that of the building recorder as emphasised in this Guide. It does not have the resources available to carry out an in-depth survey and record of every building it investigates. The recording policies of RCAHMS are based more on strategic considerations – that is, to maintain an overview of historic building types and to record historically significant buildings which are inadequately recorded or are threatened with extensive alteration or demolition.

vi) Non-professional input The invaluable contribution which the non-professional sector can make is noted. Many historic buildings and their sites have been measured up and photographed by such persons. It is unlikely that the work will be as thorough as professional work, but as indicated in the introduction, all records of historic buildings have validity.

Many amateurs are actively involved through groups such as the Scottish Vernacular Buildings Working Group (SVBWG). Established in 1972, the Group provides an excellent forum for all those interested in this area (SVBWG 2000). Details and contact addresses for this and other specialist groups are contained in the 'Useful Addresses' section. Such groups tend to be open to both amateur and professional members.

Finally, contributions to building recording and history may be made quite unconsciously. In carrying out documentary research, researchers are often grateful for even early amateur snapshots of a building – the photograph may have been taken to show people, but the information in the background may be very revealing.

9.4 LOCATING EXPERTISE

The next matter which the potential client for a measured survey or building recording exercise faces is to locate appropriate businesses to carry out the work. Some aspects of the field are well catered for, others have quite limited resources. The following notes apply to the whole of the United Kingdom, not just Scotland. Where there are regional variations regarding Scotland these are described.

i) Measured surveys

Considering measured surveys first of all, as has been noted at various points, these will broadly be provided by land surveyors, recording units, architects or building surveyors practices. The choice of source has also been thoroughly explored, as have the relative merits of these different sources.

Architects and building surveyors practices are quite numerous, and while not all specialise in building conservation, the provision of survey through this source will not usually present any difficulty. Unless sub-contracted, such surveys will tend to be of the 'hand survey' type.

Land survey companies able to carry out measured surveys of historic buildings are also quite plentiful. Information can be obtained from The Survey Association, which represents some fifty plus accredited survey companies (Survey Association 2002) or the RICS (see Useful Addresses).

When it comes to more specialist services such as photogrammetry, this is a much more specialised field. There are only a relatively small number of companies working in this area. These are thinly spread around the country. On the other hand, the overhead of travel is not so significant, as the ratio of fieldwork to plotting is about 4 or 5 : 1. Most photogrammetric work is carried out by specialist sections within land survey companies, and appropriately qualified companies can be located through the above organisations.

ii) Building recording

Most building recording as described in the Guide tends to be carried out by archaeological businesses. These are quite numerous. Today, these tend to be mostly commercial businesses, but a number still are attached to Local or County Authorities or Universities. These businesses are mostly involved in excavation archaeology and field assessment work, but many now also list building recording as a specialism. Such businesses tend mostly to work regionally, but some offer a national service across the UK. They are best located through the IFA *Yearbook* or the IFA itself (IFA 2002). There are also a number of websites, including the IFA's, with information on archaeological services (see Useful Addresses).

Some architectural practices and building surveyors also carry out or manage building recording projects. Information would be available from the RIBA, the RIAS or the RICS (see Useful Addresses). For the more specialist services, such as documentary research, generally these will be best located or sub-contracted through the main contractor.

iii) The RCAHMS

The RCAHMS has been referred to and described in a number of places in the Guide, especially under Ch 8.6. While the RCAHMS carries out a substantial amount of recording, their services are not generally available to third parties on a contracted basis. The RCAHMS has a statutory right to record listed buildings being altered or demolished, and also has a statutory role in the Planning process. As well, any important or unusual but little recorded buildings will be of interest to the Commission. It will always be worthwhile to contact them (see Useful Addresses), not the least as the NMRS should be consulted to see what records may already be stored or listed. In England, the former RCHME, now part of English Heritage, works in a very similar way. Many other countries similarly have state organisations involved in recording historic buildings and sites.

SOURCES

The Survey Association 2001, *2001/2002 Membership Directory*, PV Publications, Stevenage.

Annual Directory, listing details of member survey companies, also web site, *www.tsa-uk.org.uk*

RICS No published list, but information can be obtained from the Information Service or the Geomatics Faculty, 020 7222 7000. The RICS also has a comprehensive website, *www.rics.org*

IFA 2002 *Institute of Field Archaeologists Yearbook and Directory 2002*, IFA, Reading.

Lists all individual members of the IFA and a Register of archaeological organisations, all with details of specialisms. IFA telephone number 0118 931 6446, website, *www.archaeologists.net*

9.5 SAFETY ON SITE

The safety of personnel working on historic building sites is always of vital concern. In particular, if the building has been the subject of neglect – and extremely has become a roofless ruin – then great caution and a planned safe approach must be adopted.

The site conditions in relation to recording projects may vary considerably. The subject may be a building in use. In this case, normal standards of care should be self-evident, although even here ladder work and entry into roof spaces may be necessary.

On the other hand, the building may be dilapidated (see Ch 5.1.3) or a dangerous ruin. If this is the case, it may not even be possible to commence surveying and recording until a structure is scaffolded and propped as necessary. In this case, the project's overall manager would be responsible in the first place for establishing safe working practices.

9.5.1 Legal requirements

All survey and recording fieldwork should be conducted in accordance with the *Health & Safety at Work Act (1974)* requirements. This enabling Act has been followed by the issue by the Health and Safety Executive of many further Regulations and Guidance notes etc. *The Management of Health and Safety at Work Regulations 1992 (the Management Regulations)* generally make more explicit what employers are required to do to manage health and safety under the Act. Like the Act, they apply to every work activity.

Health and safety legislation requires all those at work to take care for their own safety and for that of anyone else who could be affected by their acts or omissions. More specifically, where risks to which people could be exposed are significant, then *Risk Assessments* must be undertaken to identify any reasonably foreseeable potential hazards, quantify the degree of risk which they present to people, and determine suitable control measures. Where more than five people are employed by any one employer, this assessment must be recorded in writing. As well, if recording and surveying is taking place concurrent with construction work, the work may also be subject to the *Construction (Design & Management) Regulations (1994).*

A note of caution also concerns the use of volunteers, especially children (Ch 1.9). Although no payments may be made, it will still be the responsibility of the

organisers of a project to comply with the requirements of the Health and Safety Act and related legislation.

There is much information to be found on the Health and Safety Executive's websites (see Useful Addresses). The RICS publish a very useful booklet on site safety, called *Surveying Safely* (RICS 2002), which as well as containing much useful information has a good bibliography. It also has a very useful page on legal responsibilities.

9.5.2 Site conditions

A significant danger facing surveyors and recorders is that they may be going into areas not visited for many years. The unstable nature of a ruin may be self-evident, but even in a roofed building in use, floor areas of neglected rooms and roofspaces could be subject to woodworm infestation, wet rot or dry rot, possibly invisible to the eye. Clearly, great care must be taken in the initial recce of the site. One of the first priorities should be to establish a safe means of access and a means of escape.

Staff should always be equipped with essential equipment such as torch, gloves, overalls, safety helmet etc. The use of ladders is common in recording work, and great care should always be taken with these. Lone working is another hazard of the area of work. At best, it should be avoided, with a minimum of two persons always on site. At worst, if lone working is unavoidable for some reason, full and clear details including time of return MUST be left with a person able to respond.

A site inspection should ideally be undertaken with the client's representative and/or the author of the job specification, to respond to any issue arising from the proposed work. This inspection should include all potential areas of the recording programme (interior and exterior) and any unforeseen safety or logistical matters, identified and discussed on site.

The building may be unsound and there may be verminous infestations - typically pigeons. Any unexpected hazardous material encountered, for example pigeon droppings, asbestos, etc, should be immediately avoided and specialist advice sought before any work proceeds on site. Special care should be taken in derelict structures where light levels may be low.

On sites involving other contractors or visitors, such as demolition teams or other tradesmen, it is highly desirable that good communication is achieved between all interested parties from the outset. A clear chain of command for site access must be defined by the project manager. This will facilitate better integration of resources on site and promote site safety.

If any use is to be made on site of any form of aerial access platform or 'cherrypicker', safety considerations are especially important. These must only be operated by trained and competent authorised personnel. Personnel must ensure they are familiar with the safety procedures and safe system of work before making use of this type of equipment. With larger aerial platforms, these normally come with an operator, and the instructions of the operator must always be followed. Smaller platforms are often self-driven, but if so it is essential for the operator to have attended a safety course. Never operate this equipment unless you have received appropriate training.

9.6 REALISTIC TIMESCALES FOR SURVEY AND RECORDING

Timescales will be dependent on the scope and level of the recording project and the associated resource implications. It is not possible to generalise too much, as each project has its own requirements.

9.6.1 Programming the work

It is recommended that the best way to structure a typical recording project is to undertake as much of the investigation as possible, as far in advance of the commencement of site works as possible. Not only does this permit a 'clear shot' at the building, it will reduce the amount of time required for a site presence during works.

It is important as well to recognise how and when to involve building recorders and other specialists in the overall project. Timing may be crucial to maximise the potential and benefits of the work. It is desirable, for example, that the photogrammetric surveyor is given the opportunity to photograph a building prior to the erection of scaffolding, and that the recorder is given the maximum time possible to use scaffolding prior to works commencing.

An early record and interpretation can contribute positively to the proposals for the building. Information should be fed back to those involved with developing designs for the structure, for them to be made aware of findings or new interpretations. Findings should not be held until the final Report is available.

To meet these considerations, it is recommended that a member of the recording team be put on the project management team as early on in the project as possible. In this way, their knowledge, their requirements and finally the information gathered from the recording will be fed straight into the project. If the building recorders are appointed by competitive tender, they may not be available at the earliest stages of the project, but as soon as they are on board they should be invited to participate.

Land surveyors do not tend to be involved in the project management side of building works on historic buildings. The provision of their services tends to be discrete and relatively short in relation to the likely overall length of the project.

It is also relevant to consider matters from the client point of view. As a generalisation, the client would like all those involved in a project to be on site, complete their work and deliver the product as soon as possible. Land surveyors are used to working to short time scales, and typically they would expect to commence work and deliver measured survey products in weeks rather than months.

With the recording field, the work may take much longer. While fieldwork times will largely be driven by other factors, it is not unusual for the delivery of the Report and other material to take some months if not longer. If the building recorders are supplying plans and sections etc, the client should not leave themselves dependent on this unless very clear terms have been agreed for the delivery of these.

9.6.2 Time on site

The physical time that a recording project will take needs to be assessed on a project by project basis. Again, there are many factors to consider, such as the size of the building, its complexity, the scope of the brief and the staffing available.

There are two quite separate phases to the work of on site investigation and off site processing and analysis of the data. If possible, the site should still be available to the recorders during the off site processing phase, but it has to be recognised that this may not always be possible. On completion of the fieldwork phase (and indeed during it) the first priority of the recorders should be to ensure that survey measurements are accurate and that photographic material etc is developed. Then, if no further access to the site is possible, at least all data can be relied upon.

As has been stated, it is difficult to give times, but for even the very smallest project, a minimum window of opportunity of at least two weeks should be available. (This does not mean that other work, as long as it is not disruptive of fabric, cannot take place). For a larger historic building, say a house of 20 to 30 rooms on three floors, a very minimum of at least a month should be available for the fieldwork phase of recording, but preferably two months.

Again, these are very rounded figures, but for fieldwork duration of say two weeks, at least a further four weeks need to be allowed for delivery of information, applied *pro rata*. Specialist inputs might add to delivery of information times. Other work can proceed on the building after the recorders' site work is finished but before the Report and other deliverables are available. This is why it is important that findings, even if provisional, are fed to the project management team straightaway.

9.6.3 The watching brief

While given a short paragraph, the importance of programming this in is emphasised, as there will only be one opportunity for this work. It is important that records are made before partial or total loss of fabric through alteration, concealment or destruction. This should be set up as soon as possible, as arranging a competitive tender and allowing sufficient lead time for what are often quite small businesses cannot be done overnight.

9.7 WHAT WILL IT COST?

Providing indications of the likely cost of any work relating to buildings is notoriously difficult and potentially misleading. It is a truism, but every situation is different. It is not safe to illustrate say a measured survey drawing of an elevation and as this has cost '£x', therefore on another building which has four elevations the cost will be 4 x '£x'.

There are too many variable factors. The architectural detail can vary and the individual stonework may or may not need drawn out. Then, access to the site may vary. There may be scaffold in place paid for from a different budget, but a 'cherrypicker' may be specially needed.

Similarly with the recording products, such as context records, the number of individual records needed can vary. On complex buildings such as at Auchindrain (Ch 8.1), literally dozens of context records per elevation were required. On industrialised buildings such as at Bowhouse (Ch 8.3), the context records could be tabulated, as so many components were common.

What can perhaps be said is that day rates for recording and measured survey work tend to be in the range of £200 to £250 per person per day plus taxes (2003). It would be rare for any building recording job to take less than a week's work, hence a very minimum for any project will perhaps be £1,000 to £1,250.

Another way of considering costing is as a percentage of the building or conservation works in progress. Again, this is a difficult, if not dangerous factor to apply. Projects can vary enormously, as can the status of the building. A small building project on a very important Grade A building might require very thorough recording, which might equate perhaps to 20% of the project.

On the other hand, a refurbishment project on the 20 to 30 room, over three floors, Grade B historic building might easily cost nowadays £1.5m. All measured survey and building recording might equate say to 50 person weeks, giving a rounded cost of say £50,000. This would equate to 3.3% of the total cost, which would not seem an unreasonable percentage.

It must be stressed that these figures should emphatically NOT be taken as either a guide or a rule. Nevertheless, the above may give some feel for what is involved.

9.8 STATUTORY REQUIREMENTS

9.8.1 Relevant legislation

In Scotland, as with the rest of the United Kingdom, there is legislation affecting proposals to alter any Listed Buildings and Scheduled Ancient Monuments. This legislation can have a bearing on the requirement for building recording and measured survey exercises.

It should be noted that there is no requirement on an owner to carry out any form of building recording *unless* work subject to statutory regulation is being envisaged. Nevertheless, many owners and managers of historic buildings do commission individual measured surveys and records to be made, for their own purposes of care and maintenance and proper stewardship.

NOTE Regulations in the rest of the United Kingdom and in other countries will differ.

9.8.2 Listed Buildings

In general, under the *Town and Country Planning (Scotland) Act 1997*, and related legislation such as the *Planning (Listed Buildings and Conservation Areas) (Scotland) Act 1997* and NPPG 18 (Scottish Office 1999), in order to obtain Planning Permission and/or Listed Building consent for various works to Listed Buildings, the provision of plans and other documentation is required.

While there is not a requirement *per se* to carry out a building recording exercise on a historic building, the regulations make it clear that the local authority must be provided with full and clear plans and documentation, as they and Scottish Ministers consider appropriate.

The following section from the *Memorandum of Guidance on Listed Buildings and Conservation Areas 1998* (Historic Scotland 1998), prepared by Historic Scotland on behalf of the (then) Scottish Office, is quoted in full. The italics have however been added to highlight specific references to survey and recording.

"Form of application for Listed Building consent

2.29 Application for listed building consent should be made in such form as the planning authority may require and should contain sufficient plans, drawings and particulars to identify the building and the works for which consent is sought. Scottish Ministers are empowered to make regulations regarding the manner in which applications for listed building consent are to be made.

2.30 Duly completed forms must be accompanied by 3 copies of *plans and drawings sufficient to identify the building and to provide full details of the proposed works,* and by such other relevant information as the planning authority may reasonably require.

The grant of outline listed building consent has never been and is not an option. Although it is now possible to grant listed building consent subject to subsequent approval of detail (see 2.83), this is intended to provide the necessary flexibility where the most practicable solution on a matter of detail is difficult to determine in advance of works beginning on site, not to encourage initial submission of sketch plans on which no proper decision can be reached.

Although planning authorities have discretion to prescribe the form of a listed building consent application, such an application must in all cases contain sufficient particulars to identify the building, *including a plan, and such other plans and drawings as are necessary to describe the proposed works.* Planning authorities are asked to be more rigorous in *rejecting inadequately detailed applications* in the early stages of their vetting procedures.

Planning authorities may, when prescribing a form, require information additional to that set out in the legislation. They may not, however, waive the statutory requirements. Accordingly, *they should insist on obtaining adequate plans*, and should, where necessary, also require *an applicant to provide such supplementary information as they consider necessary.*

2.31 Applications for listed building consent in respect of alterations, extensions or partial demolitions *should normally be accompanied by detailed drawings showing both the existing building, in the form of survey plans*, and the proposal. *Plans should be clear original prints and not merely photocopies of prints.* The drawings showing the proposed alterations should be coloured to show clearly what is old work and what is new work.

Existing architectural detail should be clearly shown and marked 'no change': failure to do so could be taken as an application for its removal or, subsequently, could be construed as implying consent to do so.

It would be helpful for demolition applications to be accompanied by photographs of all elevations, and for applications for alteration or extension to *be accompanied by photographs of the parts affected, including the interior.* Adequate photographs could reduce the visits which planning officers and the Historic Buildings Inspectorate require to make and could speed the decision-making process. The photographs need not be taken professionally, but should clearly show the architectural details of the building.

Applications for consent to demolish should be supported by evidence of the building's structural state of repair and wherever possible by evidence of attempted sale on the open market (see 2.13). Comparative costings for demolition and new build and repair to existing buildings should also be sought.

2.32 Clearly it is in the best interests of applicants *to provide such proper specifications and documentation:* its absence can lead to unnecessary enquiries and delay both at this stage and following notification of the case to Scottish Ministers. Planning authorities are particularly asked to note that Scottish Ministers will not be able to consider any application for which adequate detail is not available. Any such application will be referred directly back to the planning authority, and the initial 28 day period for consideration (see 2.48) will only start when an acceptable application accompanied by full details has been submitted.

2.33 An application for consent to vary or discharge conditions attached to a previous listed building consent shall be subject to the same procedure and requirements as would apply in the case of an application for listed building consent.

2.34 Planning authorities must also receive with an application a certificate either stating that the applicant owns the land or that necessary notification to owners has been carried out so far as reasonably possible. In this instance, listed building consent procedure exactly parallels the procedure for planning applications."

While reflecting the content of the *Memorandum of Guidance*, many requirements for building recording will in practice be arranged under the Planning process. *The Town and Country Planning (Scotland) Act*, led to the publishing of NPPG18 and various *Planning Advice Notes* (PANs). Direction under these documents will determine the bulk of building recording requirements.

Particularly for recording Grade B and C Listed Buildings, unlisted vernacular and industrial buildings, Local Authority Planning officers and their archaeological advisers will often write the Project Briefs. Local Government Planning and Conservation officers have an important role to play in the implementation of building recording projects. As always with listed building enquires, it is wise to consult verbally with the local planning officer in the first instance.

On making a decision on a Planning application regarding a listed building, the *Memorandum of Guidance* also recommends that the type of documentation described in the Guide be consulted. The following section is relevant (again, italics are to highlight relevant statements):

"8. Planning authority consideration of applications for Listed Building consent

2.39 In considering any application for listed building consent, and also any application for planning permission for development which affects a listed building or its setting (see 2.9), planning authorities are required to have special regard to the desirability of preserving the building or its setting or any features of special architectural or historic interest which it possesses.

In deciding applications for listed building consent, planning authorities should *refer to the photographic collections at local museums and libraries, and at the National Monuments Record for Scotland, John Sinclair House, Bernard Terrace, Edinburgh EH8 9NX, as these may contain very useful information on the original or former states of listed buildings and conservation areas.* Dean of Guild records or previous planning approvals may be a valuable record of the original design and/or later alterations.

The planning authority should also *draw upon the knowledge of national and local amenity, conservation and history societies where these exist. They are often familiar with, or can find, other documentary or photographic evidence* of which the planning officer may need to be aware and may find time consuming to search out, and they may, particularly in the case of older list descriptions, be able to supplement the brief information there provided. Etc"

9.8.3 Ancient Monuments

The situation with regard to Ancient Monuments is rather different (Fawcett 2001). In order to carry out works on buildings or structures categorised as Ancient Monuments, what is known as 'Scheduled Monument Consent' is required. Full details of the Act are contained in the *Ancient Monuments and Archaeological Areas Act 1979*, with some modifications by the Scottish Parliament, 1999. For a general summary and review of the Act, see also Breeze (1993).

Scheduled Monument Consent is granted by the Scottish Executive, acting through Historic Scotland, and states that *'the works are executed in accordance with the terms of the consent and of any conditions attached to the consent'*. In effect, Historic Scotland is empowered to require whatever conditions are deemed appropriate, which could include measured surveys and a building recording exercise.

In practice, Historic Scotland's Inspectors of Ancient Monuments will use their experience and discretion to ensure that the level of measured survey and recording is appropriate to the task in hand. For example if a tower house in a ruinous condition is to be restored to use (Ch 8.5, Fenton Tower) a full building record may be required. On the other hand, if alterations are minor and local, perhaps only plans to locate the changes and a photographic record will be needed.

It is most important to consult at the earliest stages of a project, to ensure that recording requirements are properly built into the programme.

9.9 CONSERVATION PLANS AND MANAGEMENT PLANS

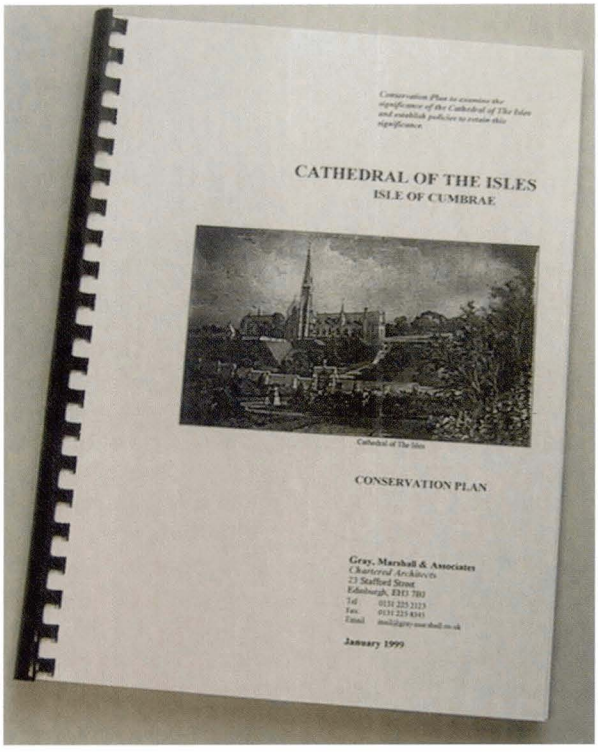
9.9.1 The link with surveying and recording

In Chapter One, it was noted that conservation plans, and to a lesser extent management plans, have increasingly acted as a trigger for the production of measured surveys and building recording exercises (Ch 1.6). While certainly not the only reason for carrying out surveying and recording, nevertheless there is an important link between these areas of activity. Conservation plans do not usually contain building recording reports, but often specify the need for one.

In this section, more detail is therefore provided of how such plans are carried out and at what stages measured survey and recording may require to be implemented. As well as the *Burra Charter* document (ICOMOS 1978) referred to earlier, Historic Scotland's leaflet on conservation plans may be consulted (HS 2000). As well, the recent English Heritage publication, *Informed Conservation* is of considerable value (Clark 2001).

The preparation of conservation plans is often put in the hands of consultants (Illus 181). These may be architects, building surveyors, town planners or other suitably qualified professionals. For convenience, producers of Plans are referred to below as the 'consultant'. An example of the preparation of a plan concerns Auchindrain Township (Ch 8.1). Here, a plan was prepared in advance of proposals to preserve the site but at the same time to improve the interest and educational value for visitors. The recording material was complementary to and was used in the plan.

Ideally, a conservation plan should be prepared in advance of any particular scheme. Gaps in knowledge will often be identified in the development of a conservation plan. This is one of the points at which the requirement for further measured surveys and building recording (including off site documentary research) may be identified by the consultant.



Illus 181 Conservation Plan prepared for the Cathedral of The Isles, Isle of Cumbrae. While the length of a conservation plan can vary greatly, typically the document might be 30 to 50 pages long. (Courtesy: Gray, Marshall & Associates Chartered Architects)

It is unlikely that the consultant preparing the plan will also prepare the measured surveys and building records. These are most likely to be carried out by others (Ch 9.5). Also, while documenting or recording a historic building, site or landscape may form part of the development of a conservation plan, the plan may not necessarily require the making of any new form of drawn record. In many cases, adequate drawings may already exist, even if not fully up to date. In other cases, significance may be well enough understood without further recording work.

Where a building is of more than usual complexity, where it has evolved in a number of phases and has performed a number of functions, then further measured survey and recording work may be amongst the policies recommended in the conservation plan, so as to better inform its future management or development.

9.9.2 Content of the Plan

The conservation plan must tie the historical significance of the site, and comparable sites, to an understanding of the physical fabric. The processes should be broadly common to any conservation plan:

- **Understand** the site by drawing together information about it, relating documents to physical evidence in order to present an overall account of the site through time, as well as a description of each of the components which make up the site.
- **Assess** the significance of the site generally and where appropriate in detail for each of the main components, making specific value judgements about historical, cultural, architectural, archaeological, technological, ecological, social, recreational and other types of significance. Consideration should be given to the impact past phases of alteration have on our ability to appreciate that significance, and the significance those alterations may have in their own right.
- **Define** the issues that affect the significance of the site or have the potential to do so in the future. These include physical condition, owners' objectives, uses, boundaries, location, available resources, external factors, existing information and the need for more information, past damage, community expectations, access, statutory implications and potential areas of conflict.
- **Develop** conservation policies that will retain the significance of the site in the future.

9.9.3 Developing the Plan

The consultant will draw together the readily available documentary evidence relating to the site, including copies of plans, maps, illustrations and photographs. The consultant will also draw on existing building recording and measured survey documentation. On occasion, it may be necessary to commission new documentation, without which the conservation plan could not be completed to the appropriate standard.

The aim of all this research is to cast light on the history of the construction, use of and alteration to, the building, structure or site. The consultant will piece together the main phases for the evolution of the site, drawing on architecture, archaeology, history and past management regimes. This analysis should be brought up to the present, including recent campaigns of repair and alteration.

Often chronology can best be illustrated by hatched plans or sketched reconstructions. The inclusion of graphic material will help to reduce the bulk of the text and aid comprehension of the plan, provided that it is relevant to the argument presented. Highly detailed record drawings would not normally be included in the plan. With complex sites, it is often useful to create a basic gazetteer in order to identify the date, function, significance and issues arising from key features. The gazetteer may be presented as a table or illustrated plan.

9.9.4 Identifying future requirements

The consultant will often note areas where further recording work may be needed as a project develops. It is most important that these are written into the conservation plan.

For example, the best time for recording of external elevations might be after removal of a cement render but prior to a re-harl. Clearly, this work will not be possible until well on into a programme of works. The information to be gained could, however, be vital in decoding the building's history. The conservation plan must write in *and cost* the provision of this recording work at this later stage.

If the project involves new building across part of the site, archaeological advice may be needed before development is directed towards a particular location. It should be indicated whether this should comprise a full-scale (possibly expensive and damaging) excavation or whether further documentary research or geophysical surveys will suffice. A conservation plan need not embark on this level of investigation, but should indicate where it will be needed if alteration were to be contemplated in the future.

Where potential changes to the fabric are noted, the plan might recommend the presence on site of a building recorder. The person carrying out this 'watching brief' should not be considered solely as mitigation in cases of assumed destruction. For example, the presence on site of building recorders during the exposure of the original (and unexpected) wheelpit at the East Mill, Stanley Mills ensured not only that it was recorded, but that a proposed modern lift was moved to avoid damage to the pit (Ch 6.6).

9.9.5 Management Plans

Much of what has been said about the relationship between conservation plans and recording and survey applies as well to management plans for historic buildings and sites.

There is an important difference inasmuch as the conservation plan is prepared in advance, while the management plan more concerns the ongoing use, repair and maintenance of the building. Written into the management plan could for example be proposals *and funding* to carry out specific measured surveys and recording exercises on a programmed basis or in connection with proposed works projects.

Too often, the provision of measured survey and recording is left to the last minute. With a management plan, the opportunity exists to properly write in these requirements in advance with an appropriate timescale, to identify the point at which survey and recording must be carried out (Ch 9.4).

9.10 COPYRIGHT AND OWNERSHIP OF MATERIAL

9.10.1 Importance of establishing copyright

The field of copyright is a difficult one. The rules of copyright in the United Kingdom are covered by the *Copyright, Designs and Patents Act 1988*. The full text of this can be purchased from HMSO (HMSO 1988), or can be accessed on the Internet. The Act has been amended, for example, Statutory Instrument No 3297 in 1996 introduced regulations which increased the duration of copyright in line with a European Union Directive.

The following must not be taken as a legal statement. Rather the intention is to make clear the matters which should be considered.

First of all, it is ESSENTIAL in all contracts relating to measured survey and building recording projects to ensure that the questions of copyright and ownership are properly addressed. It is unlikely that there will ever be much financial value involved, but many difficulties can arise over such matters as the right to reproduce photographic images and noting of appropriate attributions and credits etc.

9.10.2 Intentions of the Act

The intention of the Act is to protect property rights. It is a moot point as to whether some of the items prepared in surveying and recording work would fall within the definitions of the Act. Nevertheless, the Act within the category of "literary and artistic works" specifically mentions maps, plans and photographs, so the safe advice must be to write in appropriate terms as if all material was covered by copyright. Copyright in photographs and computer-generated images follows the general rule and belongs to the originator.

In most cases, copyright in the work rests with the author or person who creates the work. So, where an author or consultant is commissioned to carry out work, copyright rests with the author and NOT the commissioner, unless provision is made in advance for assignation of copyright to the client or commissioning body. The act of commissioning a work does not in itself automatically confer copyright ownership. It does not give the commissioning client an automatic right to reproduce or publish the work itself, unless such use is specifically agreed under the terms of the commissioning contract.

9.10.3 Who should hold copyright?

It would generally be recommended that the client requires the provider of the services to assign the copyright to the client, along with the right to use the material as required for the project, to reproduce any part of the work on a not-for-profit basis, all with the appropriate acknowledgment.

On the other hand, it is common with academic work for the client to allow the producer to retain the right of copyright. In this case, the contract must make it clear that the client has the unfettered right to make use of the material for all relevant purposes and that the producer may only use the material say for academic and reasonable publicity purposes.

In arranging archaeological works, Historic Scotland has optional clauses for both approaches (HS 1996), to be used as appropriate according to the nature and circumstances of the contract. Shared copyright should only be considered in rare circumstances.

It should be noted that where a "literary or artistic work" is made by an employee in the course of his or her employment then the employer is the first owner of any copyright in the work, subject to any agreement to the contrary. This in itself can be a grey area, especially nowadays when many people are employed on short-term contracts. The generally accepted definition would be that an employee is a person on a PAYE basis.

The duration of copyright protection under the Act is generally seventy years from the year of the originator's death, although there are some variations. The same rules generally apply when copyright is assigned as well.

9.10.4 Ownership of material

On the question of ownership of the physical material, the contract should state clearly that the ownership of all listed deliverable materials will become that of the client. This should be done, otherwise the producer of the material might conceivably claim the material back, claiming that it was only on loan. The position as regards site notes and other intermediate documents is less clear, probably it is reasonable to leave these with the producer.

It should be noted that in the event that the client loses material, for example computer discs, and the producer still has copies, whatever the copyright and ownership status, it is only reasonable that the client should pay some fees for providing new copies. Searching, unarchiving and possibly putting into a currently readable format all takes time.

Note: Finally, as was stated in the introduction to this section, neither the Editor not Historic Scotland can accept any liability whatsoever for the statements and advice given on matters of copyright. Both client and providers of material are strongly advised if necessary to obtain their own independent legal advice.

9.11 LOOKING AFTER RECORDS

9.11.1 Giving records a long life

In specifying for a building recording exercise, attention should be paid to the format of the deliverables (Ch 5.9). The products of the work will essentially comprise paper, photographic film and increasingly computer data. The range of shapes and sizes of materials can be very varied, and indeed the quantity can be large.

Historic Scotland, through the RCAHMS (HS 1996), has provided advice and information on the format of material for accession into the National Monuments Record for Scotland (NMRS). While specifically concerned with excavation, much of this information is relevant to building recording.

As has been noted before, records may comprise all material relating to a building, some of it of considerable age, and not just the products of one current project. This section provides advice and further reference on looking after a range of material.

9.11.2 Where to store the results

The essential principles are that data should be securely stored, but also be as widely available and as easily disseminated as possible (subject to copyright conditions etc). It would be anticipated that multiple copies of the Report will certainly be made, and these will be distributed to the property owner or manager, professionals involved such as the architect, but also should be deposited in libraries and in local record offices.

For the primary material, such as originals of survey plans, context sheets and photographic negatives, normally only one copy of these will be in existence (unless of course created or scanned into digital form, see below). In Scotland, the NMRS forms the most appropriate deposit for this material. It will accept primary record material, and provides the highest standards of archival storage. Of course, there may be circumstances where the original material may need to be deposited elsewhere, but at the least a copy of the Report should always be deposited with the NMRS.

As discussed, the increasing use of digital media, both for initial data capture and preparation and for storage of data, presents new problems. The wider debate on this is well known (Beagrie & Jones 2001). The simplest and safest advice at the moment is probably to ensure that data is recorded in the most widely used formats and that multiple copies are made and distributed. Nevertheless, building records are for the long term, and currently the likelihood of today's computer records being readable in fifty years time must be viewed with some disquiet.

Where a record has been built up on a piecemeal basis over time, it may be more difficult to bring together the components. (Indeed, for many buildings it could well be a valuable exercise in itself to locate and assemble all relevant record material). Often in these circumstances, material will be under different ownership, and individual owners for good reason may not wish to part with material. For example, early watercolours or drawings of a building could have considerable financial value. Wherever possible, photographs or digital scans should be obtained of such material, or at least a reference given to the location.

9.11.3 Looking after the material

Modern records take many forms, but their base remains either paper, plastics, metal or combinations thereof. Some combinations are more stable than others, and the life expectancy of all of them is directly affected by how they are handled and stored. Whatever the format, the aims of preservation are to ensure the survival of the record by:

- Making it and keeping it readily identifiable
- Keeping the data accessible
- Protecting it from mechanical damage and foreseeable disasters
- Preserving it from long-term chemical deterioration

i) Means

- Storing the record in the right format
- Storing the record in the best possible conditions
- Anticipating risks and minimising them
- Quick and informed action in the event of a disaster

Some thought on the part of the record creator – and especially by the use of archival materials – will pay dividends in the long term. It is worth considering at the outset whether it is important to preserve the medium itself, or the data only. If the original record will be frequently required for reproduction or display, it may be best to have a copy made for these purposes, to allow the original to be stored under optimum conditions.

ii) General notes on storage

Storage solutions for the record material need not be elaborate and high-tech, but by observing a few simple guidelines, the life of the records can be lengthened

considerably. Purpose built archives can be created, for example by following the advice of the Historical Manuscripts Commission (HMC 2001) or the British Standard, BS 5454:2000. The British Standard gives information about the design of archive storage. If possible, a purpose-built archival store should be considered, especially if a large quantity of records are to be stored. It must be said that a specialist archive store will generally be expensive and possibly not practical for the storage of relatively small quantities of data.

iii) Space

Stores should never be in basements, and ideally not in attic spaces, because of the risk of flooding in both cases. For the same reason nothing should be stored on a floor, even for a short time (Illus 182). The store should be checked for potential causes of trouble, eg drains, overhead water pipes, overflow pipes, fire hazards. It should also be as weather-, bird- and rodent-proof as possible, and regularly checked for signs of infestation and damage. Dirt and pollution should be excluded as far as possible, by general good housekeeping and if possible by filtering at fresh air intakes. Air circulation should be good, to prevent pockets of stagnant air which encourage mould growth and insects.

Illus 182 How not to store rolled drawings! Stored together and resting on the end of the roll, drawings will easily suffer mechanical damage. (Photo : Library Conservation Unit)

iv) Emergencies

There should be an inventory of the materials stored, and copies of the list kept in another location. If appropriate, a copy of the record itself should be deposited centrally, for example in the NMRS. There should also be a plan of action drawn up for use in case of an emergency, with:

- Simple details such as alternate safe locations to evacuate material to
- Contact details of local conservators and other service providers
- Companies which hire out pumps and de-humidifiers etc.

There are excellent disaster guides available free on the Internet. The golden rule is to keep the plans simple and relevant to the collection, and *to have studied them in advance!* For more details of disaster plans see References.

v) Conditions

Heat, light (especially natural light) and moisture are the enemies of all materials. The optimum conditions for storage of mixed archive materials is 15°C (or colder), total darkness, and a relative humidity (RH) of 55%. If a record is to be displayed, the light level should not exceed 50 lux (measured with a lux meter). Exceptionally, a higher light level (up to 200 lux) may be acceptable for a very short period of display. There should never be direct natural light on the object, or a source of heat nearby. Further details of the optimum storage conditions for archive material are found in British Standard 5454 (*op cit*).

9.11.4 Written and drawn records on paper

Without a doubt, good quality paper is still the most durable material for documents. However, it is affected by light, heat and contact with low-grade materials such as paper with a high wood content (eg newsprint, cheap files and boxes) and other materials which generate chemicals (fresh or untreated wood, most plastics and other materials which contain plasticisers, strongly acid or alkaline materials) and of course by water (Illus 183). Large formats frequently suffer mechanical damage (eg creases, tears and losses) because they are difficult to store and handle.

For long term storage, paper-based records such as context sheets should be stored in acid-free 'archival' or 'museum' standard envelopes, folders, boxes, rollers and wrappers (available from specialist suppliers). The only acceptable plastic storage material is clear polyester (Melinex grade O or Mylar grade D), without coatings or surface textures. All images should be kept away from direct light for the longest possible life. For survey drawings, flat storage is always preferable, but if rolling is unavoidable it is best done between sheets of Melinex which have been united at one end by sewing together without using self-adhesive tape (Illus 184)).

Illus 183 The type of cardboard boxes seen on the racking to the right should not be used for storage, as the material is highly acidic. (Photo : Library Conservation Unit)

Illus 184 The correct way to store rolled drawings. The original is sandwiched between a conservation grade film and lightly rolled. (Photo : Library Conservation Unit)

9.11.5 Photographic materials, photoreproductions and digital prints

Although produced by a variety of means, this group of records share a particular susceptibility to damage by light, moisture and contact with chemicals. All are constantly being developed and improved, but all are still fairly vulnerable media. The stability of the image is highly dependent on the quality of the image support (ie the paper, film etc), the pigments and dyes themselves, and the process of image production. That is, the material's life will be prolonged if the image has been properly fixed at the right temperature during the process of photocopying, or if the right balance of chemicals has been used to develop a photograph.

It is particularly important to store these records well, as the image may transfer to - or fuse with - some plastics (particularly PVC) or change colour due to the influence of chemicals leaching out of low grade storage materials and environments. Plastic and paper photographic prints, slides and negatives should ideally be stored in the neutral pH 'Silversafe' special photographic storage paper (from conservation suppliers) or in Melinex (useful if the photographs are to be frequently consulted).

9.11.6 Digital and electromagnetic material

These media share the obvious disadvantage of being 'machine readable' only, and are therefore wholly dependent on the availability of the relevant computer and software to deliver their message. The most immediate problem is therefore one of guaranteed obsolescence, coupled with the fact that the materials which make up and store the message are not very stable. Deterioration of the materials or the loss of data may not be obvious to the human eye without actually trying to access the information they store.

There is therefore a continual need to refresh or 'migrate' the data at regular intervals onto the newest appropriate medium available, and this must be done without loss of detail, especially metadata and format. It is extremely important that each version has clear details of how it was produced and which system is required to read the present version, together with a full history of what previous formats have been. It is wise to produce back-up copies in case a file is accidentally corrupted, and also wise to print out a hard paper copy. However, with some types of data such as CAD files, the digital data contains far more information than the printed version, so this is not an infallible solution.

9.11.7 Getting help

If in doubt, professional preservation advice should be sought. Prevention of damage is better (and cheaper) than cure. Accreditation by the relevant Professional

Body and inclusion in the Conservation Register of Practices are indicators of quality service providers, who are bound by a Code of Ethics.

SOURCES

Conservators and other professional help can be contacted through:

The Scottish Conservation Bureau (see Useful Addresses list) and the United Kingdom Institute of Conservation (UKIC), **www.ukic.org.uk**, who will supply names of specialist conservators and restorers from The Conservation Register.

PACR (Professional Accreditation for Conservator-Restorers) accreditation is awarded by the National Council for Conservation and Restoration (NCCR) following a rigorous assessment of professional practice.

The JISC/DNER website has a valuable section on the preservation of digital materials, at **www.jisc.ac.uk/dner/preservation**

Archival storage materials can be obtained from a number of sources, and again the Scottish Conservation Bureau can help with information.

DISASTERS

www.M25lib.ac.uk/M25dcp/home_t.htm

A complete Disaster Control Plan Template designed to be down loaded from the web, also includes a list of other web sites and links to them, and a good bibliography.

http://palimpsest.stanford.edu/bytopic/disasters/primer

A Primer on Disaster Preparedness, Management and Response: Paper-Based Materials

TECHNICAL FOCUS G: PREPARING MATERIAL FOR ARCHIVE

The following checklist should be consulted when preparing record material for archiving:

WRITTEN AND DRAWN RECORDS ON PAPER

Do not use:

- 'ordinary' (ie non-archival) plastic or paper envelopes, ring binders, file folders or boxes.

Why? They can cause yellowing of paper, fading or discolouration of pigments, and speed up the breakdown of the paper itself.

- 'Sellotape' or any self-adhesive tape - ever! (even if it calls itself 'archival').

Why? It can severely discolour the record in a short time. This may be irreversible.

Use archival envelopes or polyester pockets etc to keep fragmented or associated material together.

- metal paper clips, staples etc

Why? They rust and stain the paper - even at low humidity.

- 'Biro', ink or felt tip pens to number or annotate originals

Why? The colour can smudge and transfer to other surfaces, or work its way through to the other side of the record.

Some fade or change colour drastically over time.

Use a soft pencil instead, and if possible label the container rather than the record.

PHOTOGRAPHIC MATERIALS, PHOTOREPRODUCTIONS AND DIGITAL PRINTS

Do not:

- use ordinary photograph albums, sleeves, folders etc.
- use alkaline buffered papers, folders and files for storage

Why? Most archival storage materials are buffered (ie they have had an alkali added to them to raise the pH in order to ensure that the storage environment remains alkaline rather than acid). However, some photographic processes produce images which are sensitive to alkaline conditions. Therefore, the special photographic storage papers have a neutral pH, with a soft surface to avoid any kind of abrasion of the images. They are sold under the brand names of 'Silversafe' and 'pHoton'.

- touch the image with the hands

Why?: Dirt, oils and chemicals from the skin can transfer onto the image, and can locally speed up the deterioration of the image or its support material.

DIGITAL AND ELECTROMAGNETIC MATERIAL

Do not:

- place near strong magnetic or electromagnetic influences (eg electrical equipment and sockets, magnetised materials).

Why? danger of corruption of the data

- expose to temperatures lower than 10°C or higher than 60°C, and particularly not to sudden changes in temperature.

Why? Even a change of a few degrees over a short space of time can be sufficient to distort the material and corrupt the data.

This should be borne in mind when using cars for transport of such records - car boots and interiors can get very hot or cold quickly.

- remove from their protective casings.

Why? The materials used for discs etc, known as carrier films, are extremely sensitive to abrasion, leading to loss of data. Even CDs should be handled by their edges only, to avoid fingerprint marks, which could in the long term attack the surface.

- store vertically

Why? Unsupported carrier films may start to sag because of gravity. Always store them horizontally.

APPENDIX A

PRINCIPLES FOR THE RECORDING OF MONUMENTS, GROUPS OF BUILDINGS AND SITES

(Text prepared by the Research and Recording Committee of ICOMOS UK. Ratified by the 11th ICOMOS General Assembly as a Resolution and Declaration of ICOMOS, Sofia, Bulgaria, October 1996. Reproduced by permission of ICOMOS UK.)

As the cultural heritage is a unique expression of human achievement; and as this cultural heritage is continuously at risk; and as recording is one of the principal ways available to give meaning, understanding, definition and recognition of the values of the cultural heritage; and as the responsibility for conserving and maintaining the cultural heritage rests not only with the owners but also with conservation specialists and the professionals, managers, politicians and administrators working at all levels of government, and with the public; and as article 16 of the Charter of Venice requires, it is essential that responsible organisations and individuals record the nature of the cultural heritage.

The purpose of this document is therefore to set out the principal reasons, responsibilities, planning measures, contents, management and sharing considerations for the recording of the cultural heritage.

DEFINITIONS OF WORDS USED IN THIS DOCUMENT:

Cultural Heritage refers to monuments, groups of buildings and sites of heritage value, constituting the historic or built environment.

Recording is the capture of information which describes the physical configuration, condition and use of monuments, groups of buildings and sites, at points in time, and it is an essential part of the conservation process.

Records of monuments, groups of buildings and sites may include tangible as well as intangible evidence, and constitute a part of the documentation that can contribute to an understanding of the heritage and its related values.

THE REASONS FOR RECORDING

1. The recording of the cultural heritage is essential:

a) to acquire knowledge in order to advance the understanding of cultural heritage, its values and its evolution;

b) to promote the interest and involvement of the people in the preservation of the heritage through the dissemination of recorded information;

c) to permit informed management and control of construction works and of all change to the cultural heritage;

d) to ensure that the maintenance and conservation of the heritage is sensitive to its physical form, its materials, construction, and its historical and cultural significance.

2. Recording should be undertaken to an appropriate level of detail in order to:

a) provide information for the process of identification, understanding, interpretation and presentation of the heritage, and to promote the involvement of the public;

b) provide a permanent record of all monuments, groups of buildings and sites that are to be destroyed or altered in any way, or where at risk from natural events or human activities;

c) provide information for administrators and planners at national, regional or local levels to make sensitive planning and development control policies and decisions;

d) provide information upon which appropriate and sustainable use may be identified, and the effective research, management, maintenance programmes and construction works may be planned.

3. Recording of the cultural heritage should be seen as a priority, and should be undertaken especially:

a) when compiling a national, regional, or local inventory;

b) as a fully integrated part of research and conservation activity;

c) before, during and after any works of repair, alteration, or other intervention, and when evidence of its history is revealed during such works;

d) when total or partial demolition, destruction, abandonment or relocation is contemplated, or where the heritage is at risk of damage from human or natural external forces;

e) during or following accidental or unforeseen disturbance which damages the cultural heritage;

f) when change of use or responsibility for management or control occurs.

RESPONSIBILITY FOR RECORDING

1. The commitment at the national level to conserve the heritage requires an equal commitment towards the recording process.

2. The complexity of the recording and interpretation processes requires the deployment of individuals with adequate skill, knowledge and awareness for the associated tasks. It may be necessary to initiate training programmes to achieve this.

3. Typically the recording process may involve skilled individuals working in collaboration, such as specialist heritage recorders, surveyors, conservators, architects, engineers, researchers, architectural historians, archaeologists above and below ground, and other specialist advisors.

4. All managers of cultural heritage are responsible for ensuring the adequate recording, quality and updating of the records.

PLANNING FOR RECORDING

1. Before new records are prepared, existing sources of information should be found and examined for their adequacy.

a) the type of records containing such information should be searched for in surveys, drawings, photographs, published and unpublished accounts and descriptions, and related documents pertaining to the origins and history of the building, group of buildings or site. It is important to search out recent as well as old records;

b) existing records should be searched for in locations such as national and local public archives, in professional, institutional or private archives, inventories and collections, in libraries or museums;

c) records should be searched for through consultation with individuals and organisations who have owned, occupied, recorded, constructed, conserved, or carried out research into or who have knowledge of the building, group of buildings or site.

2. Arising out of the analysis above, selection of the appropriate scope, level and methods of recording requires that:

a) the methods of recording and type of documentation produced should be appropriate to the nature of the heritage, the purposes of the record, the cultural context, and the funding or other resources available. Limitations of such resources may require a phased approach to recording. Such methods might include written descriptions and analyses, photographs (aerial or terrestrial), rectified photography, photogrammetry, geophysical survey, maps, measured plans, drawings and sketches, replicas or other traditional and modern technologies;

b) recording methodologies should, wherever possible, use non- intrusive techniques, and should not cause damage to the object being recorded;

c) the rational for the intended scope and the recording method should be clearly stated;

d) the materials used for compiling the finished record must be archivally stable.

CONTENT OF RECORDS

1. Any record should be identified by:

a) the name of the building, group of buildings or site;

b) a unique reference number;

c) the date of compilation of the record;

d) the name of the recording organisation;

e) cross-references to related building records and reports, photographic, graphic, textual or bibliographic documentation, archaeological and environmental records.

2. The location and extent of the monument, group of buildings or site must be given accurately; this may be achieved by description, maps, plans or aerial photographs. In rural areas a map reference or triangulation to known points may be the only methods available. In urban areas an address or street reference may be sufficient.

3. New records should note the sources of all information not obtained directly from the monument, group of buildings or site itself.

4. Records should include some or all of the following information:

a) the type, form and dimensions of the building, monument or site;

b) the interior and exterior characteristics, as appropriate, of the monument, group of buildings or site;

c) the nature, quality, cultural, artistic and scientific significance of the heritage and its components and the cultural, artistic and scientific significance of:

- the materials, constituent parts and construction, decoration, ornament or inscriptions,

- services, fittings and machinery,
- ancillary structures, the gardens, landscape and the cultural, topographical and natural features of the site;

d) the traditional and modern technology and skills used in construction and maintenance;

e) evidence to establish the date of origin, authorship, ownership, the original design, extent, use and decoration;

f) evidence to establish the subsequent history of its uses, associated events, structural or decorative alterations, and the impact of human or natural external forces;

g) the history of management, maintenance and repairs;

h) representative elements or samples of construction or site materials;

i) an assessment of the current condition of the heritage;

j) an assessment of the visual and functional relationship between the heritage and its setting;

k) an assessment of the conflicts and risks from human or natural causes, and from environmental pollution or adjacent land uses.

5. In considering the different reasons for recording (see Section 1.2 above) different levels of detail will be required. All the above information, even if briefly stated, provides important data for local planning and building control and management. Information in greater detail is generally required for the site or building owner's, manager's or user's purposes for conservation, maintenance and use.

MANAGEMENT, DISSEMINATION AND SHARING OF RECORDS

1. The original records should be preserved in a safe archive, and the archive's environment must ensure permanence of the information and freedom from decay to recognised international standards.

2. A complete back-up copy of such records should be stored in a separate safe location.

3. Copies of such records should be accessible to the statutory authorities, to concerned professionals and to the public, where appropriate, for the purposes of research, development controls and other administrative and legal processes.

4. Up-dated records should be readily available, if possible on the site, for the purposes of research on the heritage, management, maintenance and disaster relief.

5. The format of the records should be standardised, and records should be indexed wherever possible to facilitate the exchange and retrieval of information at a local, national or international level.

6. The effective assembly, management and distribution of recorded information requires, wherever possible, the understanding and the appropriate use of up- to-date information technology.

7. The location of the records should be made public.

8. A report of the main results of any recording should be disseminated and published, when appropriate.

APPENDIX B

GLOSSARY

The definitions provided below relate to the specific use of these words in connection with building recording. Generally, architectural terms have been excluded, as there are many of these and it is better to consult specialist dictionaries.

Analysis Process of unravelling a building's construction history and alteration.

Ancient Monument In the United Kingdom, a legal term for a category of site, structure or building designated as such and protected in law.

Architectural history The academic subject of the study of the history of buildings.

Axonometric projection A form of three dimensional graphic representation (of a building) where all axis are set at 45°.

Blackhouse A unique category of domestic dwelling found in the Western Isles of Scotland, characterised by long, low construction.

Building accounts Early documentation specifically relating to the construction of a building.

Building recording The process of accumulation of knowledge of a building through observation assisted by the production of measured surveys, descriptive records, photography etc.

Buildings archaeology Alternative name for the *building recording* process, favoured where a very pure archaeological process is adopted.

Burra Charter A document which aids the process of assessing the significance of a particular historic building or site, prepared by ICOMOS Australia, see Bibliography.

CAD (computer aided drafting) Computer program for the preparation, manipulation and presentation of line drawing data.

CD ROM Currently the most commonly used form of storing of computer data generated in digital form.

Cherrypicker *Aerial access platform, aerial hydraulic lift*, all terms for access platforms.

Condition Survey Inspection of a building or other structure to assess its integrity and any requirements for repair and maintenance. Usually carried out on a regular basis, for example quinquennial inspections of Churches.

Conservation "Action to secure the survival or preservation of buildings, cultural artefacts, natural resources, energy or any other thing of acknowledged value for the future" (BS7913:1998).

Conservation Plan Document which identifies the cultural and historic significance of a site and sets out a policy for the management and conservation of the site.

Construction deposits Finds in an *excavation* which relate specifically to former building(s) on the site.

Context Term used to uniquely identify each build phase and/or feature identified within the historic building.

Co-ordinate or control grid Two or three dimensional framework which forms a geometric reference system for a building and/or site.

County Record Office Place of deposition of all forms of documents relating to that area.

Crafts knowledge The body of knowledge held by traditional craftsman on working practices within the building trade.

Database Usually, the holding in computer form of all context records and possibly related data, which can then be searched and queried using standard computer program procedures.

Datum Fixed height points to which all other levels can be related around the historic building or site.

Dendrochronology The science of establishing the age of timber.

Desk-top assessment Also, *documentary research*, phase of a building recording project where all pre-existing documentary evidence, both historical, secondary and modern, is located and assessed.

Digital photography Photography with a camera utilising direct capture of the image through a digital device, normally a CCD array. (The term should not be used when a conventional photographic image is converted to digital format by scanning a negative or print).

Dimensioned sketch Basic form of measured survey of plan or elevation etc, where no reliance can be placed on the overall accuracy, even if the detail shown is a good representation.

Documentation (1) as used in the Guide, generally to describe any specific records or other information on paper about the historic building.

Documentation (2) a valuable term to describe all the assembled record material on the historic building or site, widely used internationally but not commonly in the United Kingdom.

Documentary research *Desk-top assessment, qv.*

Drawing film Or *drafting film*, used to denote the dimensionally very stable and strong plastic or Mylar based mediums used for drawing out surveys, normally on large A1 or A0 sheets.

Drawings Or *survey drawings*, term very loosely used for the products of measured surveys.

Dry-stone Form of building construction where no mortar is used between stones.

Earth structures Form of building construction where earth, clay etc, is used for wall construction.

Electronic distance measurement Or *EDM*, device which allows accurate measurements of distance to be made in essence by reflecting a high frequency electromagnetic wave from the object.

Excavation archaeology Or *archaeological 'dig'*, the recognised process of exposing former habitation or other levels by careful removal and recording of the deposits.

Feature Term used in building recording to identify each discrete component or part of a historic building.

Fenestration The layout, arrangement and form of all windows to a building.

Functional systems The design elements of a building relating specifically to its operation, such as weather protection, drainage etc.

Geology Study of the rocks forming the earth, but used particularly in building recording to identify the stone types and sources used in a building.

Geomatics The modern definition of *land surveying qv*, but used to more broadly encompass the field.

Geophysical survey The processes used by archaeologists to investigate buried features of a site by non-contact methods and without resorting to excavation.

Hand survey The measured survey process for preparing plans etc, carried out by direct physical contact by the surveyor with the subject.

Harling Surface rendering over a building, very important in a Scottish context, as of historic interest in itself but simultaneously concealing important information about the build history.

Harris Matrix A system developed to relate all finds/contexts in an excavation, may also be applied to standing buildings.

Health & Safety at Work Government legislation concerning safe practices on building sites etc, principles of which are most important in building recording work, as *all* sites can potentially be dangerous.

Instrument survey The measured survey process for preparing plans etc, carried out by utilising theodolites and other similar survey instruments.

Intervention Any form of physical opening up in a building which disturbs the normally encountered surfaces.

Invasive work Used where the building recorder (or agent on their behalf) is responsible for the opening up of parts of the building.

Inventory Volumes produced by the RCAHMS and the RCHME which describe all buildings and sites within an area, usually a county, of historic interest.

Isometric projection A form of three dimensional graphic representation similar to an *axonometric*, but based on all parts of the drawing being to the same scale.

Land survey Or *topographic survey qv*, the measured survey of an area or site.

Land surveyor Person engaged in the preparation of measured surveys, historically applied just to *topographic survey* but nowadays applied to all forms of measurement where land survey principles are adopted, see also *Geomatics*.

Laser A beam of light focussed in a special manner such that it remains as a very concentrated narrow beam, the term is used very loosely for any device which relies on this.

Laser scanner Measured survey device which collects thousands of coordinate readings off a surface, also there are close range models not strictly survey instruments.

Layer Term used specifically in the CAD program 'AutoCAD', to describe the separate files of graphic information which go to make up a drawing, other CAD programs used different terms for the same purpose.

Listed Building In the United Kingdom, a legal term for a building or structure protected from alteration or demolition by law.

Management Plan Document drawn up to ensure that proper procedures are in place for the long term looking after of a historic building or site.

Materials Used in building recording to denote the constructional items such as stone, timber etc which make up the historic building.

Materials analysis Scientific processes of analysing the materials to decide on their nature, age and origin etc.

Matrix The relationship of all the components of the historic building, laid out in a graphical and interrelated manner, see also *Harris Matrix.*

Measured surveys The plans, sections and elevation drawings prepared of the historic building to defined standards of accuracy and content, also sometimes referred to as metric surveys.

Metric cameras The specialist cameras used specifically for photogrammetric work to acquire stereopairs, hence *non-metric* and *semi-metric* used for other cameras.

Metric surveys Alternative terms for *measured surveys qv.*

Mouldings The profiled or shaped decorative forms found usually on plasterwork, woodwork and on stone cornices and stringcourses, very important in stylistic and dating attributions.

Multi-phase building Historic building where particularly complicated sequences of change and alteration have taken place.

Non destructive investigation The methodologies of inspecting and monitoring by instrumentation the hidden internal structure of the historic building without the need for invasive or destructive inspection.

NPPG 'National Planning Policy Guideline', documents issued by the Scottish Executive. In England, PPG.

Oral testimony The spoken or verbal passing on of knowledge of the historic building by persons having a specific association with it.

Orthogonal projection The representation of a survey onto a plane parallel to the surveyed surface, eg a curved window bay becomes a flat surface, foreshortening the true dimensions.

Orthophotography A technique allied to photogrammetry which produces a true to scale photographic image, the product normally called an *orthophotograph.*

Outturns Materials to be delivered at the end of the contract.

PAN 'Planning Advice Note', issued in support of NPPGs by the Scottish Executive.

PDF format A commonly used method of presenting text and images, especially for internet use, utilising Adobe 'Acrobat' software.

Pen computer A form of laptop computer with a touch sensitive screen, where a pen or stylus can be run over the screen to record information or give instructions.

Perspective drawing A form of three dimensional graphic representation similar to the viewpoint seen by our eyesight.

Photogrammetry Or *stereo-photogrammetry*, the methodology of measurement through photography, strictly any form of such measurement but usually used in connection with the high accuracy application.

Photogrammetric plotter The instrument used for the production of photogrammetric drawings.

Photography The normal form of imaging with film or digital camera, usually with viewpoints oblique to the subject, sometimes called *pictorial photography* to differentiate from more specialist applications such as *rectified photography qv.*

Pictorial photography See *photography qv.*

Point cloud The large mass of 3D coordinates produced with *laser scanning qv.*

Post holes Form of archaeological evidence, where a former building was supported by posts in the ground, the wood having long vanished but the deposit indicating where the post had stood.

Pro-forma Standard printed forms used for recording features and their context numbers, often with pre-designed categories of information for easy assimilation into the *database qv.*

Profile comb Device used for recording the exact shape of mouldings.

Project archive The primary record material created through an building or archaeological recording exercise, ie site notes, context sheets, photographic negatives, plans etc.

Project Brief "is an outline of the circumstances to be addressed, with an indication of the scope of works that will be required (for a recording project). It does not provide sufficient detail to form the basis for a measurable standard (of work)". (Definition from IFA 2001).

Project Outline as per Project Brief, but this expression tends to be used in Scotland (IFA 2001).

Project Design "sets out a schedule of works in sufficient detail to be quantifiable, implemented and monitored. It may as well include contractual details. Projects Designs are normally produced by those undertaking the work, and can either be a response to the (Project) Brief/Outline or specification" (IFA 2001).

Radar survey Form of *non destructive investigation qv* which can detect voids in a structure.

Radiocarbon dating Scientific dating technique for organic remains such as wood, charcoal and bone.

Re-construction "Re-establishment of what occurred or what existed in the past, on the basis of documentary or physical evidence" (BS7913:1998).

Reconstruction drawing A drawing specially prepared to show the previous appearance at a point in time of a historic building or structure, may be in 2D or 3D, the important point is that it may contain conjectured information.

Rectified photography The process of preparing a photographic image taken in a parallel plane to a building façade and with some form of scale control, such that it has some of the properties of an elevation survey.

REDM Or *reflectorless* total station theodolite, variation on the instrument where the distance readings are obtained by direct reflectance off the surface.

Repair "Work beyond the scope of regular maintenance to remedy defects . . . the object of which is to return the building or artefact to good order, without alteration or restoration" (BS7913:1998).

Report The document which synthesises the results of a building recording exercise, bringing together descriptive information and analysis into a compact and easily read form.

Research Agenda Term used by the archaeological profession to define the aims and objectives of an excavation or building recording project, broadly focussing on the academic side of the work.

Restoration "Alteration of a building, part of a building or artefact which has decayed, been lost or damaged or is thought to have been inappropriately repaired or altered in the past, the objective of which is to make it conform again to its design or appearance at a previous date" (BS7913:1998).

Secondary published sources Information and evidence already published which may be of relevance to the building recording project.

Section Form of measured survey product which produces a 'cut' through a building or structure, strictly in one plane only.

Sectional elevation A section drawing which as well usually incorporates internal elevation surveys.

Settlement studies Historical research focussing particularly on the origins, forms and functions of settlements created by man.

Significance Term used extensively in *Conservation Plans qv* to assess the relative historical, cultural etc importance of the building or site.

Site As used in this Guide, specifically denotes the area around and associated with the historic building or structure, more generally often used to include the historic building itself.

Specification A document laying down binding terms and conditions and technical requirements for a building recording or measured survey project, see also *Project Brief* and *Project Design*. A specification "sets out a schedule of works in sufficient detail for it to be quantifiable, implemented and monitored" (IFA 2001).

Standing building Term used by archaeologists to differentiate between excavated remains of a building and a building still standing *in situ*.

Stereo photogrammetry See *photogrammetry qv*.

Stereomodel Photogrammetric term for the 3D image formed from overlapping pair or *stereopair* of photographs.

Stereoscope Device which enables stereopair of photographs to be viewed in 3D.

Stirling Charter Sets out the broad principles for the conservation of the built heritage in Scotland for the benefit and enjoyment of future generations, published by Historic Scotland.

Stratigraphy Or *stratigraphic relationship*, term used in archaeological sense to describe the relationship of the various features or components of the historic building or structure.

Surface or decorative finish Term used to encompass all applied finishes within and without the historic building, both plain and highly decorated.

Survey Wide ranging expression, frequently misused for all forms of evaluation to do with buildings, in the Guide used exclusively to describe *measured survey qv*.

Thermo-luminescence Scientific technique for the dating of materials such as pottery and brick.

Topographic survey Or *land survey qv*, the measured survey of an area of land, such as the site around a historic building.

Total station theodolite Modern version of the traditional theodolite, incorporating *EDM qv* and in which the readings for angle and distance are recorded digitally.

Tower-house Distinctive (though not uniquely) form of Scottish architecture.

Tree survey Or *vegetation survey*, common component of the recording of the site of a historic building, usually carried out by a specialist.

Triangulation A term from land surveying where the accurate framework of the survey is built up by creating a series of triangles, where values for angles and/or distances are known.

Typology As used by architectural historians, the method by which features are categorised by appearance, form and date, thus allowing comparison across buildings and locations.

Wall-thicknesses and wall-alignments Critical factors to be assessed in the analysis of the historic building, as determinants of building construction periods and change.

Watching brief The process of being on site during *invasive works qv* or demolition in order to note and record features which would not normally be exposed to view.

World Heritage Site Sites across the world which have been designated by UNESCO/ICOMOS for their special cultural and natural significance. The designation does not in itself accord legal protection.

APPENDIX C

BIBLIOGRAPHY

All text references have been brought together for convenience. These do not have notes or web site references found in the relevant section of text.

It should be noted that many building recording projects are unpublished or 'grey' reports, that is only a small number of copies, usually A4 format typescript and comb bound are prepared. In Scotland, copies are often deposited with the NMRS and/or Historic Scotland.

Addyman, T 1996 *A Record of some masonry features uncovered* at *the Church of The Three Holy Bretheren, Lochgoilhead, Argyll*, Addyman & Kay Ltd, Paisley. Unpublished report.

Addyman, T 1997 *42-44 Market Street, Haddington, East Lothian: Interim Report on Archaeological and Structural Recording*, Addyman & Kay Ltd, Paisley. Unpublished report.

Addyman, T 2001, 'Gladstone's Land, Lawnmarket', in Turner, R (ed) 2001, *Discovery and Excavation in Scotland 2000,* 35, Council for Scottish Archaeology, Edinburgh.

Addyman, T 2001, '26 – 31 Charlotte Square', in Turner, R (ed) 2001, *Discovery and Excavation in Scotland 2000*, 35, Council for Scottish Archaeology, Edinburgh.

Addyman, T 2002 *Ossian's Hall, The Hermitage, Dunkeld, Perthshire: Analytical assessment*, Addyman Associates, for the NTS, Edinburgh. Unpublished report.

Addyman, T 2002 *Old Auchentroig, Buchlyvie, Stirlingshire: Archaeological and Architectural Investigations*, Addyman & Kay Ltd, for the NTS (Little houses improvement scheme), Edinburgh. Unpublished report.

Addyman, T 2002 *Newhailes House and Estate, East Lothian: Archaeology, Report 5: The Shell House: Architectural Analysis and Archaeological Investigation*, Addyman & Kay Ltd, for the NTS, Edinburgh. Unpublished report.

Addyman et al *Queensberry House*, forthcoming volume, Historic Scotland, Edinburgh.

Alcock, N W & Hall, L (drawings by Linda Hall) 1994 *Fixtures and Fittings in Dated Houses 1567 – 1763* Practical handbook in Archaeology 11, CBA, York.

Allardyce, F 1997 *Skene House, Aberdeenshire*, unpublished report, HSCC, Edinburgh.

Allardyce, F 1997 and 1998 *St Aloysius Church, Garnethill, Glasgow*, two unpublished reports, HSCC, Edinburgh.

Allardyce, F 1998 *Dowanhill Church, Glasgow*, unpublished report, HSCC, Edinburgh.

Allardyce, F 1999 *Strathleven House, Dumbarton*, unpublished report, HSCC Edinburgh

Anon 1907 'Concrete and Steel Supplement' in *The Builders Journal*, January 1907.

Apted, M R 1966 *The Painted Ceilings of Scotland 1550* – 1650, HMSO, Edinburgh.

Atkinson, J A 1996 'Demolishing the past; saving our heritage', *Avenue No 19*, University of Glasgow, Glasgow.

Bailey, A, Insall, D & Kilshaw, P 1993 *Fire protection measures for the Royal Palaces*, Department of National Heritage/HMSO, London.

Baillie, M G L 1995 *A Slice Through Time - dendrochronology and precision dating*, Batsford, London.

Beagrie, N & Jones, M 2001 *Preservation Management of Digital Materials: A Handbook*, The British Library, London.

Beaton, E 1997 *Scotland's Traditional Houses – from cottage to tower-house*, HMSO/Historic Scotland, Edinburgh.

Blanc, HJ c1900 'George Heriot's Hospital – Described from an Architectural Standpoint', in Gunn, Blanc & Bedford *George Heriot's Hospital*, E & S Livingstone, Edinburgh.

Brann M, McNeill, T & Morrison, J 2001 *Report on the building survey of Kisimul Castle, Isle of Barra*, Historic Scotland/Headland Archaeology Ltd, Edinburgh. Unpublished report, may be inspected at Historic Scotland.

Breeze, D J 1993 *Ancient Monuments Legislation*, in Hunter & Ralston *op cit*, 44 - 55.

Bristow, I C 1996 *Architectural Colour in British Interiors 1615 – 1840*, Yale University Press, New Haven and London.

British Standards 7913:1998 *Guide to the principles of the conservation of historic buildings*, BSI, London.

British Standards 5454:2000 *Recommendations for the storage and display of archival documents*, BSI, London.

Britton, J 1812 *The Architectural Antiquities of Great Britain, Four Vols*, Longman, Hurst et al, London.

Britton, J 1814-35 *Cathedral Antiquities of Great Britain, Six Vols*, London.

Buchanan, T 1983 *Photographing Historic Buildings*, RCHME/HMSO, London.

Carbonnell, M 1969 'The history and the present situation of the application of photogrammetry to architecture', in *Proceedings of the conference on the application of photogrammetry to historic monuments*, Saint Mandé, France, 1968, ICOMOS, Paris, 43pp.

CCS 1989, *Gardens and Designed Landscapes: An owner's guide to Planning their Management and Conservation*, Countryside Commission for Scotland, Edinburgh.

CFA Archaeology Ltd, 2001 *Fenton Tower, North Berwick, East Lothian – Standing Building Survey and Archaeological Excavations Data Structure Report No 631* CFA Ltd, Musselborough, East Lothian. Unpublished report, copy may be consulted at NMRS.

Chitham, R 1980 *Measured Drawing for Architects*, Architectural Press, London.

Clark, K 2001 *Informed Conservation*, English Heritage, London.

Cocroft, W D (& others) 2000 *Dangerous Energy: the archaeology of gunpowder and military explosives manufacture*, English Heritage, London.

Collie, J 1835 *Plans, elevations ..... of the Cathedral of Glasgow*, (no publisher), London.

Colvin, HM 1995 *A Biographical Dictionary of British Architects, 1600 – 1840 (3rd Edition)*, Paul Mellon Centre/Yale University Press, London.

Crone, A & Fawcett, R 1998 'Dendrochronology, documents and the timber trade: new evidence for the building history of Stirling Castle, Scotland', *Medieval Archaeology* 42, 68-87.

Crone, A 2002 *Dendrochronological Analysis of Floor Joists from Fenton Tower, East Lothian*, AOC Archaeology Group, Edinburgh. Unpublished report.

Crone, B A & Mill, C M (in press) 'Seeing the wood and the trees; dendrochronological studies in Scotland', *Antiquity*.

Cusack, P 1985 'Lion Chambers: a Glasgow experiment', *Architectural History*, Volume 28, 1985, 198 – 206.

Cusack, P 1986 'Architects and the reinforced concrete specialist in Britain 1905-08', *Architectural History*, Volume 29, 1986, 184 – 196.

Dallas, RWA 1988 *A Specification for Architectural Photogrammetric Surveys of Historic Buildings and Monuments*. ISPRS, Commission V Archives, Kyoto, Japan.

Dallas, RWA 1996 'Architectural and archaeological applications', in Atkinson, KB (ed) *Close Range Photogrammetry and Machine Vision*, Whittles Publishing, Caithness, (Reprinted 2000), 283 – 302.

Dallas, R & Morris, A 2002 'Laser scanning: the potential for historic buildings', in *RICS Building Conservation Journal No 31*, RICS, London.

Davey, Heath, Hodges, Ketchin & Milne 1980 *The Care and Conservation of Georgian Houses*, published for Edinburgh New Town Conservation Committee by The Architectural Press, London.

Davies, A and Fernessy, P 2001 *Digital Imaging for Photographers*, Focal Press, Oxford.

Davies, M 1993 'The application of the Harris Matrix to the recording of standing structures', in *Practices of Archaeological Stratigraphy*, Academic Press, London.

Debois Landscape Survey Group 1997 *Review No 82, Designed landscapes in Scotland: notes on their planting and management*, Scottish Natural Heritage, Battleby.

Dingwall, C 1995 *Review No 54, Researching Historic Gardens in Scotland: a guide to information sources*, Scottish Natural Heritage, Battleby.

Douglas, G J & Oglethorpe, M K 1993 *Brick, Tile and Fireclay Industries in Scotland* HMSO/RCAHMS, Edinburgh.

Dunbar, J & Hay, G 1984 *Bibliography 1*, SVBWG, Edinburgh.

English Heritage 1991 *Management of Archaeological Projects*, EH, London.

English Heritage 1998 *Dendrochronology - Guidelines on producing and interpreting dendrochronological dates*, EH, London.

English Heritage 2000 *Metric Survey Specifications for English Heritage*, English Heritage, Swindon.

Fawcett, R (ed) 2001 *Stirling Castle: the restoration of the Great Hall*, CBA, York.

Fawcett, R 2001 *The Conservation of Architectural Ancient Monuments in Scotland – Guidance on Principles*, Historic Scotland, Edinburgh.

Fenton, A & Walker, B 1981 *The Rural Architecture of Scotland*, John Donald, Edinburgh.

Fraser, L et al. 1987 *Scottish Vernacular Building: Bibliography 2*, SVBWG, Edinburgh.

GB Geotechnics Ltd 2001 *TAN 23 Non-Destructive Investigation of Standing Structures*, Historic Scotland, Edinburgh.

GBPT 1999 *Lion Chambers – recovering a lost cause*, Glasgow Building Preservation Trust, Glasgow.

Glendinning, M, MacInnes, R & MacKechnie, A 1996 *A History of Scottish Architecture*, Edinburgh University Press, Edinburgh.

Gow, I 1992 *The Scottish Interior: Georgian and Victorian Decor*, Edinburgh University Press, Edinburgh.

Gray, Marshall & Associates 1999 *Cathedral of The Isles, Isle of Cumbrae, Conservation Plan*, Gray, Marshall & Associates, Chartered Architects, Edinburgh.

GUARD (Speller, K & French, C), 1997 *Bowhouse, Kilmarnock, GUARD Project 418*, Glasgow University, Glasgow. Unpublished report, may be consulted at University Library and NMRS.

Hay, G D 1986 *Monuments of Industry: an illustrated historical record*, HMSO/RCAHMS, Edinburgh.

Historic Scotland 1996 *Project Design, Implementation & Archiving Archaeological Procedure Paper 2*, Historic Scotland, Edinburgh.

Historic Scotland 1996 *Publication and Archiving of Archaeological Projects, Version 2.1*, Historic Scotland, Edinburgh.

Historic Scotland 1998 *Memorandum of Guidance on Listed Buildings and Conservation Areas 1998*, Historic Scotland, Edinburgh.

Historic Scotland 2000 *Conservation Plans – A Guide to the Preparation of Conservation Plans*, Historic Scotland, Edinburgh.

Historic Scotland 2000 *Nomination of New Lanark for inclusion in the Word Heritage List*, Historic Scotland, Edinburgh.

Historic Scotland 2000 *The Stirling Charter – Conserving Scotland's Built Heritage*, Historic Scotland, Edinburgh.

Historic Scotland/SNH 2002 *Inventory of Gardens and Designed Landscapes, Supplementary Volume: Highlands and Islands*, Historic Scotland/Scottish Natural Heritage, Edinburgh.

Historical Manuscripts Commission 2001 *HMC Standard for Record Repositories (3rd Edition)*, HMC, London.

HMSO 1997 *Town and Country Planning (Scotland)* Act, HMSO London.

HMSO 1998 *Copyright, Design and Patents Act 1988*, HMSO, London. (The full text of Acts can also be viewed on the web at www.hmso.gov.uk).

Holden, T G 1998 *The Archaeology of Scottish Thatch*, Historic Scotland, Technical Advice Note 13, Edinburgh.

Hunter, J & Ralston, I eds, 1993 (reprinted 2001) *Archaeological Resource Management in the UK*, Sutton Publishing/IFA, Stroud, Gloucester.

ICOMOS UK 1990 *Guide to Recording Historic Buildings*, Butterworth Architecture, London.

ICOMOS UK 1996 *Principles for the Recording of Monuments, Groups of Buildings and Sites: ICOMOS Resolution*, ICOMOS UK, London.

ICOMOS 1999 *Operational Guidelines for the Implementation of the World Heritage Convention*, ICOMOS, Paris.

ICOMOS Australia 1999 *Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance*, ICOMOS Australia, Melbourne.

IFA / Wood, J 1993 *Model Archaeological Brief and Specification for Recording Standing Historic Buildings and Ancient Monuments*, IFA, Reading. (Unpublished consultation document).

IFA 2000 (revised edition) *Code of approved practice for the regulation of contractual arrangements in field archaeology*, IFA, Reading.

IFA 2001 (revised edition) *Standard and Guidance for an archaeological watching brief*, IFA, Reading.

IFA 2001 (revised edition) *Standard and Guidance for the archaeological investigation and recording of standing buildings or structures*, IFA, Reading.
NOTE Several editions of these IFA documents have been published, and the most recent should be used.

IFA 2002 *Institute of Field Archaeologists Yearbook and Directory 2002*, IFA, Reading.

John Renshaw Architects et al 1999 *Newhailes House and Estate – Historic Building and Landscape Survey Three Volumes* JRA/NTS, Edinburgh. Unpublished document, can be consulted at the NTS and in the NMRS.

Kerr, J S 1996 *The Conservation Plan 4th Edition*, National Trust of Australia, Melbourne.

Kirkdale Archaeology 1997 *The Merchant's House, 339 – 343 High Street, Kirkcaldy: Archaeological Recording and Excavation*, Kirkdale Archaeology, Edinburgh. Unpublished report for the Scottish Historic Buildings Trust, may be inspected at the NMRS.

Kodak 1998 *Book of Large Format Photography* Kodak, Rochester, NY.

Lelong, O, and others 1998 *Geilston House and Garden, Cardross - Volume One & Volume Two*, GUARD, Glasgow, on behalf of the National Trust for Scotland.

Lojkine, M 2001. *A simple guide to Digital Cameras, Scanning and Using Images*, Pearson Education, Harlow, Essex.

Lowrey, J 2000 'The Furnishings of Queensberry House, 1700 – 25' *Regional Furniture Vol XIV*, 44 – 62.

LUAU 2000 *Auchindrain Township, Inveraray, Argyll*, LUAU, Lancaster. (LUAU now Oxford Archaeology North) Prepared by LUAU on behalf of Historic Scotland, unpublished but may be consulted at HS.

James Macaulay, 1987, *The Classical Country House in Scotland 1660 - 1800*, Faber & Faber, London.

MacInnes, D & Alexander, M 1998 *Report of a field survey of a deserted settlement at Milton of Lawers, North Lochtayside, Perth and Kinross*, Assoc. Certificated Field Archaeologists, Occasional Paper 21.

MacGibbon, D & Ross, T 1887-92 *The Castellated and Domestic Architecture of Scotland, from the twelfth to the eighteenth century (5 volumes)*, D Douglas, Edinburgh.

MacGibbon, D & Ross, T 1896-97 *The Ecclesiastical Architecture of Scotland, from the earliest Christian times to the seventeenth century (3 volumes)*, D Douglas, Edinburgh.

Maxwell, I 1996 *Building Materials of the Scottish Farmstead*, SVBWG, Edinburgh.

Montgomery-Massingberd, H & Sykes, CS 1997 *Great Houses of Scotland*, Lawrence King, London. (contains chapter on Newhailes)

Naismith, R J 1989 *Buildings of the Scottish Countryside*, Victor Gollancz, London.

NAPLIB 1999, *Directory of Aerial Photographic Collections in the British Isles, 2nd Edition*, National Association of Aerial Photographic Libraries, Dereham, England.

NTS 2000 *69th Annual Report and Accounts for 1998/99*, The National Trust for Scotland, Edinburgh.

Owen, O A, MacSween, A & Ritchie, M 2000 *The Future of the Scottish Burgh Survey: Research Report*, Historic Scotland, Edinburgh.

Pearson, S & Meeson, B (eds) 2001 *Vernacular Buildings in a Changing World*, CBA, York.

Peet, D 2001 'Surveying & recording the evidence' in Fawcett, R (ed) *op cit*, pp 77-86.

Pride, G L 1996 *Dictionary of Scottish Building*, The Rutland Press/Historic Scotland, Edinburgh. Contains excellent definitions of many traditional Scottish building terms, and an extensive Bibliography.

RCAHMS 1924 *Eighth Report, with Inventory of Monuments and constructions in the county of East Lothian*, HMSO/RCAHMS, Edinburgh.

RCAHMS 1967 *Peeblesshire: an inventory of the ancient monuments*, HMSO/RCAHMS, Edinburgh.

RCAHMS 1992 *Argyll: an Inventory of the Monuments Vol 7*, HMSO/RCAHMS, Edinburgh.

RCAHMS *Inventories* (various dates) As well as those noted, many Inventories have been prepared, normally on a county basis.

RCAHMS 1991 *National Monuments Record of Scotland Jubilee – A Guide to the Collections*, HMSO, Edinburgh.

RCHME 1996 *Recording Historic Buildings – A Descriptive Specification 3rd Edition*, Royal Commission on the Historical Monuments of England, Swindon. (now part of English Heritage).

RCAHMS 1997 *Survey and Recording* Policy, RCAHMS, Edinburgh.

RCAHMS 2000 *Monuments on Record – Annual Review 1999 – 2000*, and previous, RCAHMS, Edinburgh.

RIAS (various Authors/dates) *Buildings of Scotland* series, Rutland Press, Edinburgh.

Riches, A & Stell, G 1992 *Materials and Traditions in Scottish Building*, SVBWG, Edinburgh.

RICS 1996 *Surveys of Land, Buildings and Utility Services at Scales of 1:500 and Larger - Client Specification Guidelines 2nd Edition*, RICS, London.

RICS 2002 *Surveying Safely: A commitment to personal safety* RICS Construction Faculty, London.

Roche, N 2001 *TCRE Research Report: The Historical and Technical Development of the Sash Window in Scotland*, Historic Scotland, Edinburgh.

Rodwell, W 1989 (2nd edition) *Church Archaeology*, Batsford/ English Heritage, London.

Ross, T & Lorimer, L (eds) 1921-1933 *National Art Survey - Examples of Scottish Architecture from the 12th to the 17th Century, 3 Vols*, National Art Survey of Scotland, Edinburgh.

Rowell, C & Robinson, JM 1996 *Uppark Restored*, The National Trust, London.

Roy, R & Perry, DR 2001 *An Archaeological Standing Building Survey, Newlands Cottages near St Madoes, Perth and Kinross*, SUAT, Perth. Unpublished Report, deposited at HS and NMRS.

SAVE 1993 *Deserted Bastions – Historic Naval & Military Architecture*, SAVE, London.

Scottish Lime Centre 1996 *Case Studies of Traditional Lime Harling*, Historic Scotland, Edinburgh.

Scottish Office 1999 *NPPG 18: Planning and the Historic Environment*, Scottish Office (now Scottish Executive), Edinburgh.

Sinclair, Sir J 1791 – 99 *The Statistical Account of Scotland 1791 – 1799*, M Creech, Edinburgh. (reprinted by Wakefield EP Publishing, 1979)

and

Anon 1845 *The New Statistical Account of Scotland*, W Blackwood & Sons, Edinburgh.

Snowden, R 1992 *The Hill House, Helensburgh*, unpublished research into the interior decoration, HSCC, Edinburgh.

Speller, K & Tompsett, G 1998 *Castle Tioram, Topographical and Archaeological Survey of Eilean Tioram, GUARD Project 519, Part 2*, GUARD, Glasgow.

Strong, R, Binney, M & Harris, J 1974 *The Destruction of the Country House 1875 – 1975*, Thames & Hudson, London.

Survey Association 2001 *2001/2002 Membership Directory*, PV Publications, Stevenage.

SVBWG 2000 *Vernacular Building 24*, and previous, SVBWG, Edinburgh.

Thompson, EH 1962 'Photogrammetry in the restoration of Castle Howard', *Photogrammetric Record*, 4(20), 94 -119.

Thornton, P 1984 *Authentic Decor - The Domestic Interior 1620 – 1920*, Weidenfeld & Nicolson, London.

TSO 1996 *Tolbooths and Town-houses: Civic Architecture in Scotland to 1833* RCAHMS, Edinburgh.

Walker, B & McGregor, C 1996 *Earth Structures and Construction in Scotland: A guide to recognition and conservation of earth technology in Scottish Buildings*, Technical Advice Note 6, Historic Scotland, Edinburgh.

Walker, B, McGregor, C & Stark, G 1996 *Thatch and Thatching Techniques: A guide to conserving Scottish Thatching Traditions*, Technical Advice Note 4, Historic Scotland, Edinburgh.

Walker, K 1990 *Guidelines for the preparation of excavation archives for long-term storage*, UKIC Archaeology Section, London.

Whitfeld, E (ed) 2000 *Rural buildings of the Lothians: Conservation and Conversion*, Guide for Practitioners 1, Historic Scotland, Edinburgh.

Wood, J (ed) 1994 *Buildings Archaeology: Applications in Practice*, Oxbow Books, Oxford.

APPENDIX D

USEFUL ADDRESSES AND WEBSITES AS AT OCTOBER 2003

The list below is restricted to those organisations most directly involved in the field of building recording, or to primary sources of further information. Many websites have useful links to other websites/organisations.

There are many bodies in the conservation world who may have an interest in the field. A very useful list is published in *The Conservation Directory* and other publications of Cathedral Communications Ltd, listed below.

As well, there are the various commercial businesses involved in building recording and measured survey. Lists of appropriate businesses can be obtained from the relevant professional bodies, again listed below.

ARCHAEOLOGY DATA SERVICE
Department of Archaeology
University of York
The Kings Manor
YORK YO1 7EP
http://ads.ahds.ac.uk

ARCHITECTURAL HERITAGE SOCIETY OF SCOTLAND
The Glasite Meeting House
33 Barony Street
EDINBURGH EH3 6NX
www.ahss.org.uk

ASSOCIATION OF ARCHAEOLOGICAL ILLUSTRATORS AND SURVEYORS
c/o IFA University of Reading
2 Earley Gate
PO Box 239
READING RG6 6AU

THE BUILDING CONSERVATION DIRECTORY
Cathedral Communications Ltd
High Street, Tisbury
WILTSHIRE SP3 6HA
www.buildingconservation.com
Contains entries for recording and surveying

THE COUNCIL FOR BRITISH ARCHAEOLOGY (CBA)
Bowes Morrell House
111 Walmgate
YORK YO1 2UA
www.britarch.ac.uk

THE COUNCIL FOR SCOTTISH ARCHAEOLOGY
c/o National Museums of Scotland
Chambers Street
EDINBURGH EH1 1JF
www.britarch.ac.uk/csa
Has up-to-date list of archaeology businesses

CURRENT ARCHAEOLOGY
9 Nassington Road
LONDON NW3 2TX
www.archaeology.co.uk
Numerous links

EDINBURGH WORLD HERITAGE TRUST
5 Charlotte Square
EDINBURGH EH2 4DR
www.ewht.org.uk

GARDEN HISTORY SOCIETY (SCOTTISH BRANCH)
The Glasite Meeting House
33 Barony Street
EDINBURGH EH3 6NX

HEALTH AND SAFETY EXECUTIVE
www.hse.gov.uk
Website lists various regulations, a number of which can be downloaded.

HISTORIC BURGHS ASSOCIATION OF SCOTLAND
PO Box 1124
STIRLING KK9 4ZW

HISTORIC SCOTLAND
Also
HISTORIC SCOTLAND CONSERVATION CENTRE SCOTTISH CONSERVATION BUREAU TECHNICAL, CONSERVATION, RESEARCH AND EDUCATION GROUP (TCRE)
Longmore House, Salisbury Place
EDINBURGH EH9 1SH
www.historic-scotland.gov.uk

ICOMOS UK
(International Council of Monuments and Sites – UK National Committee)
10 Barley Mow Passage, Chiswick
LONDON W4 4PH
www.icomos.org/uk

INSTITUTE OF FIELD ARCHAEOLOGISTS (IFA)
The University of Reading
2 Earley Gate, PO Box 239
READING RG6 6AU
www.archaeologists.net

INSTITUTE OF HISTORIC BUILDING CONSERVATION (SCOTLAND)
The Glasite Meeting House
33 Barony Street
EDINBURGH EH3 6NX

INTERNATIONAL COMMITTEE FOR ARCHITECTURAL PHOTOGRAMMETRY (CIPA)
c/o ICOMOS, Paris.
http://cipa.icomos.org
Has a very useful website for up-to-date information on international recording and architectural photogrammetry.

INTERNATIONAL COUNCIL ON MONUMENTS AND SITES (ICOMOS)
49 – 51 rue de la Fédération
75015 PARIS
FRANCE
www.icomos.org

NATIONAL ARCHIVES OF SCOTLAND
HM General Register House
2 Princes Street
EDINBURGH EH1 3YY
www.nas.gov.uk

NATIONAL LIBRARY OF SCOTLAND
George IV Bridge
EDINBURGH EH1 1EW
www.nls.uk
Online publications catalogue

NATIONAL TRUST FOR SCOTLAND
28 Charlotte Square
EDINBURGH EH2 4ET
www.nts.org.uk

NATIONAL MONUMENTS RECORD OF SCOTLAND
(see also RCAHMS)
John Sinclair House
16 Bernard Terrace
EDINBURGH EH8 9NX
www.rcahms.gov.uk

ROYAL COMMISSION ON THE ANCIENT AND HISTORICAL MONUMENTS OF SCOTLAND (RCAHMS) (see also NMRS)
John Sinclair House
16 Bernard Terrace
EDINBURGH EH8 9NX
www.rcahms.gov.uk

ROYAL INCORPORATION OF ARCHITECTS IN SCOTLAND (RIAS)
15 Rutland Square
EDINBURGH EH1 2BE
www.rias.org.uk

ROYAL INSTITUTION OF CHARTERED SURVEYORS (RICS)
12 Great George St
Parliament Square
LONDON SW1P 3AD
www.rics.org.uk

RICS
Scottish Office
9 Manor Place
EDINBURGH EH3 7DN

SCOTTISH CIVIC TRUST
The Tobacco Merchant's House
42 Miller Street
GLASGOW G1 1DT

SCOTTISH CULTURAL RESOURCES ACCESS NETWORK (SCRAN)
www.scran.ac.uk

SCOTTISH SOCIETY FOR CONSERVATION AND RESTORATION
The Glasite Meeting House
33 Barony Street
EDINBURGH EH3 6NX

SCOTTISH INDUSTRIAL HERITAGE SOCIETY
Museum Stores and Workshop
7-11 Abbotsinch Road
Abbotsinch Industrial Estate
GRANGEMOUTH FK3 9UX

SCOTTISH VERNACULAR BUILDINGS WORKING GROUP
c/o N Smith
Monkswell House
Newburgh
FIFE KY14 6AF

SOCIETY OF ANTIQUARIES OF SCOTLAND
c/o National Museums of Scotland
Chambers Street
EDINBURGH EH1 1JF
www.socantscot.org

SOCIETY OF ARCHITECTURAL HISTORIANS OF GREAT BRITAIN
6 Fitzroy Square
LONDON W1T 6DX
www.sahgb.org.uk

SOCIETY FOR CHURCH ARCHAEOLOGY
c/o CBA
Bowes Morrell House
111 Walmgate
YORK YO1 2UA

SOCIETY FOR POST-MEDIEVAL ARCHAEOLOGY
c/o 267 Kells Lane
Low Fell
GATESHEAD NE9 5HU
www.spma.org.uk

SOCIETY FOR THE PROTECTION OF ANCIENT BUILDINGS IN SCOTLAND (SPABiS)
The Glasite Meeting House
33 Barony Street
EDINBURGH EH3 6NX
www.spab.org.uk/scotland
See also national society, SPAB

THE SURVEY ASSOCIATION
Meadlake Place
Thorpe Lea Road
Egham
SURREY TW20 8BF
www.tsa-uk.org.uk
List of land survey/geomatics member companies

UNITED KINGDOM INSTITUTE FOR CONSERVATION (UKIC)
109 The Chandlery
50 Westminster Bridge Road
LONDON SE1 7QY
www.ukic.org.uk

WEST OF SCOTLAND ARCHAEOLOGICAL SERVICE
Charing Cross Complex
20 India Street
GLASGOW G2 4PF
www.wosas.org.uk