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STONE IN CONTEXT

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TECHNICAL CONSERVATION, RESEARCH AND EDUCATION GROUP

HISTORIC SCOTLAND

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STONE IN CONTEXT

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TECHNICAL
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EDUCATION
GROUP

STONE IN CONTEXT
PROGRAMME – DAY ONE

14 November 2007

0830 – 0910	Registration & coffee

Morning Session chaired by Ingval Maxwell

0910 – 0920	Welcome Ingval Maxwell OBE, Historic Scotland
0920 – 0930	Opening address John Graham, Chief Executive, Historic Scotland

Session 1: Connections

0930 – 1000	From the Rolling Stones to Barbie – tourism experiences and futures Professor Ian Yeoman, VisitScotland
1000 – 1030	The scale of the previous use of stone and the current context Ingval Maxwell OBE, Historic Scotland
1030 – 1040	Q & A session
1040 – 1100	Coffee
1100 – 1130	Sustainability and embodied energy Tim Yates, Centre for Heritage, BRE

Session 2: Education & Training

1130 – 1200	Repair and maintenance links with new build Professor Tom Wilson, Glasgow Metropolitan College
1200 – 1230	Provision of masonry training in Scotland – overview of current developments David Mitchell, Historic Scotland
1230 – 1245	Q & A session
1245 – 1345	Lunch

PROGRAMME – DAY ONE

14 November 2007

Afternoon session chaired by Andrew McMillan

1345 – 1415	The digital documentation of the built environment Douglas Pritchard, Glasgow School of Art
1415 – 1445	The Masonry Standard Ian Walker, Historic Scotland

Session 3: Technical Update

1445 – 1515	Lime technology update Roz Artis-Young, Scottish Lime Centre
1515 – 1530	Q & A session
1530 – 1550	Coffee
1550 – 1620	Stone cleaning update Nicola Ashurst, Adriel Consultancy
1620 – 1650	What makes a good slate? Dr Joan Walsh, Stone Consultant
1650 – 1700	Q & A session

Evening reception

1715 – 1900	Drinks reception Exhibitors in the Café Bar

PROGRAMME – DAY TWO

15 November 2007

Morning session chaired by David Mitchell

0910 – 0920	Welcome David Mitchell, Historic Scotland

Session4: Procurement Pressures

0920 – 0950	Procurement pitfalls Colin Tennant, Scottish Stone Liaison Group
0950 – 1020	Quarry source locations Andrew McMillan, British Geological Survey
1020 – 1050	Stone matching: theory and practice Ewan Hyslop, British Geological Survey
1050 – 1100	Q & A session
1100 – 1120	Coffee
1120 – 1150	Operation of a Scottish sandstone quarry Marcus Paine, Hutton Stone Co Ltd
1150 – 1220	Planners roles and responsibilities Craig Frew, Scottish Lime Centre
1220 – 1250	Specifier roles and responsibilities Murdo MacLeod, The City of Edinburgh Council
1250 – 1300	Q & A session
1300 – 1400	Lunch

Afternoon session chaired by Colin Tennant

1400 – 1430	The conversion of Scottish traditional stone buildings Dennis Urquhart, Urquhart Consultancy Services
1430 – 1500	The effects of climate change on stone built structures Craig Kennedy, Historic Scotland
1500 – 1530	Production of standard stone units Peter Stewart, Tradstocks
1530 – 1540	Q & A session
1540 – 1600	Coffee

PROGRAMME – DAY TWO

15 November 2007

Session 5: Case Studies

1600 – 1615	Planning policy constraints on availability (sourcing Binny) Stuart Eydmann, West Lothian Council
1615 – 1630	Sourcing local stone: planning dilemmas Miriam Frier, Orkney Islands Council
1630 – 1645	The challenges of stone conservation Christa Gerdwilker, Historic Scotland Conservation Centre
1645 – 1700	The potential for natural stone in contemporary architecture Peter Wilson, Napier University
1700 – 1730	Conference discussion, chaired by Peter Wilson
1730	Close

SPEAKER BIOGRAPHIES

In order of appearance

John Graham was educated at Edinburgh Academy and studied classics and ancient history at Oxford University, graduating in 1972. He joined the Scottish Office, part of the UK Civil Service, as an administration trainee. In his early career in the Scottish Office, now the Scottish Executive, he worked on transport, housing, industrial development and energy.

He was private secretary to the Secretary of State for Scotland between 1983 and 1985. After that he was successively head of the town and country planning division, head of the central finance division, head of local government group and Finance Director, before becoming head of the Environment and Rural Affairs Department and a member of the top management team for the Executive in 1998.

Since September 2004 he has been the Chief Executive of Historic Scotland, the Agency of the Scottish Executive which cares for the historic environment.

Professor Ian Yeoman is VisitScotland's futurologist and stargazer responsible for futures related research, whether it is space travel or cycle tourism. Ian and his team provide a comprehensive scenario planning function incorporating trends analysis, scenario construction and economic commentary.

Ian has a PhD in Management Science from Napier University, holds an honorary Professorship in Tourism from Stirling University and is the author/editor of several books. His new book, *Tomorrows Tourist: Trends and Scenarios in 2030ish* will be published by Elsevier in 2008.

Ingval Maxwell OBE joined the Ancient Monuments Branch of Historic Scotland's predecessor Department, the Ministry of Public Building and Works, as an architect in 1969. After holding various positions he was appointed Director of Technical Conservation, Research and Education in 1993. He has since initiated a wide variety of technical conservation research projects and initiatives, and worked with a range of Scottish and UK standard setting, professional, education and training bodies. This activity has resulted in over 100 technical conservation publications being produced and published by TCRE Group.

His membership of a variety of conservation bodies has included Conservation Committees, Accreditation Panels, and the ICOMOS UK Executive and ICOMOS International Scientific Committee on Stone. To disseminate knowledge and appropriate understanding in building conservation issues he created and chairs, a number of Scottish conservation networks. These include the Scottish Conservation Forum in Training and Education, the Scottish Historic Buildings Fire Liaison Group and until recently, the Scottish Stone Liaison Group.

He represented the UK on the European Commission COST Action C5 programme "Urban Heritage, Building Maintenance" and has just concluded his Chairmanship of the European Science Foundation's COST Action C17 "Fire Loss to Historic Buildings". This 4 year long programme involved 20 European countries with corresponding member countries, including those around the Baltic Sea, Russia, Canada and the USA.

He was awarded an OBE in the 2003 Birthday Honours List for his lifetime work in building conservation in Scotland.

Dr Tim Yates has more than 30 years involvement in the built heritage. He started as a field archaeologist in Northampton and then moved through the analysis of materials, particularly medieval glass, through the geochemistry of recent carbonate deposits to the weathering of buildings. He has been at BRE since 1986, working initially on the effect of acid rain and air pollution on buildings and building materials, then looking at climate change and buildings, and many years of work on the drafting of British and European Standards for the construction industry.

He is currently responsible for projects relating to the long term performance of buildings including the selection and testing of stone and mortar for new and heritage buildings, the assessment of building defects, and the sustainable refurbishment of older houses.

Professor Tom Wilson OBE was appointed the first Principal of Glasgow Metropolitan College in 2004. He was Principal of Glasgow College of Building and Printing since 1989 after holding a number of posts in schools and further education. He has been a Professor of Glasgow Caledonian University since 1995.

His current commitments include membership of the Scottish Parliament's Cross Party Committee on Construction and the Scottish Construction Forum. He has been Chair of Learn Direct & Build since 2002 and an adviser to UNICEF (Scotland) since 2002.

His previous experience includes:

Chairman of Learning & Teaching Scotland from 2000

Chairman of the Scottish Council for Educational Technology

Member of the Digital Scotland Ministerial Task Group

Chairman Glasgow Colleges Group

Chairman Glasgow Telecolleges Network (shortlisted for the Bangemann Prize, Stockholm 1999)

Member of SFEFC/SHEFC working group to develop e-learning guidelines for colleges and universities

Member of Steering Group of Glasgow Digital Library, a project involving the three Universities in Glasgow and Glasgow City Council

Member of the Lifelong Learning Sub-committee of Glasgow City Council

Chairman Steering Group of REAL, a Glasgow-wide Lifelong Learning initiative (short listed for the 2002 Stockholm Challenge).

David Mitchell With an academic background in earth sciences and conservation, formerly managing director of Heritage Engineering in Glasgow for ten years, working on the conservation of industrial heritage.

Head of Division, Conservation Research and Resources within Historic Scotland's Technical Conservation Research and Education Group.

Leading a team of specialists providing technical advice, undertaking technical research and looking at craft skills and material supply issues across Scotland.

A founding Trustee of the Scottish Ironwork Foundation, ICOMOS ISCARSAH Committee on iron structures, Chair of the Scottish Industrial Heritage Society, and member of the National Heritage Training Group Executive.

Douglas Pritchard is the Head of Visualisation at the Glasgow School of Art, with a primary area of interest in the development of architectural and urban visualisation projects for heritage, design development, public consultation and urban planning.

He is a member of the City of Glasgow Urban Design Review Panel, recently appointed member of the Arts & Humanities Research Council Peer Review College and a member of the California-based CyArk Foundation.

For over the past two years he has been the Technical Director of Virtual City of Glasgow Project, a groundbreaking visualisation project (likely the most accurate and detailed urban model of its kind in Europe) for the Glasgow City Council.

Ian Walker has worked in the Construction industry for the last 25 years. He served his apprenticeship as a bricklayer and worked in various sectors of the construction industry including site management.

In 1996, Ian studied Architectural Conservation at the Glasgow College of Building & Printing, now Glasgow Met, and for the last 10 years he has project managed various construction training projects in Scotland & England.

Prior to joining Historic Scotland as Building Crafts Development Manager in August 2006 Ian worked for the City of Edinburgh Council.

Roz Artis-Young was appointed Director of SLCT in early 2005 after 10 years working with the Trust. As the first SLCT employee, Roz has contributed to, and managed, both consultancy and training.

As the SLCT's remit has grown, Roz has also been a committee member of the Building Limes Forum and is currently a Director of both the Scottish Stone Liaison Group and the Natural Stone Institute.

Nicola Ashurst is Principal of Adriel Consultancy, a practice which provides specialist technical advice on the cleaning and surface repair of historical masonry.

After training as an architect in Australia she studied overseas and worked for the Research and Technical Advisory Service of English Heritage. During that time she co-authored the "Practical Building Conservation" series. Nicola's two volume publication "Cleaning Historic Buildings" is in the process of rewriting. Adriel Consultancy has been in existence for 18 years and has been based in Scotland for the last 5 years (now Edinburgh).

Nicola is a great believer in understanding building and their materials in depth before work is done on them, analysis, detailed surveys and on-site trials forming important parts of pre contract investigations. She is keen to follow projects through on site; to ensure what needs to be done is done and no more. Nicola has specialised in the cleaning of historic buildings for over 20 years.

Dr Joan Walsh is a consultant geologist, specialising in natural stone used as roofing material. Her interest in slate began in 1995 when she was commissioned by Historic Scotland to carry out a survey of all the slate quarries in Scotland with a view to selecting one or two for more detailed study and possible re-opening. The procedures she developed to assess the quality of Scottish slate, have now been extended to encompass all types of slate used in Britain.

While at the University of Paisley, she managed the successful DTI 'Partners in Innovation' Project with the object of providing technical information on the durability of imported and indigenous roofing slates. The main focus of her current research is the development of procedures for the identification of used slates. She was Convenor of the Natural Stone Institute from 2004 to 2007 and continues to work with the Scottish Stone Liaison Group in its aim of procuring new supplies of Scottish slate.

Colin Tennant gained a post-graduate diploma with distinction in European Urban Conservation from Dundee University in 1997, after winning a scholarship from Tayside Building Preservation Trust. Colin continued to work for TBPT for six months before becoming Conservation Officer with Alnwick District Council in Northumberland.

Returning to Scotland in September 2000, Colin worked as Project Manager of the Stirling THI for Stirling Council before being seconded in 2004 to set-up and administer the Stirling City Heritage Trust. Colin became Chief Executive of the Scottish Stone Liaison Group in September 2006.

Andrew McMillan is a Principal Geologist at the British Geological Survey (BGS). He has over 30 years experience of mapping and researching the Palaeozoic to Quaternary rocks of northern Britain. He has also worked on aggregate resource assessment and urban environmental geology.

He is currently Project Leader for South of Scotland geological surveys and for Geomaterials of the Built Environment the latter focussing on UK building stone. He represents the BGS on the Scottish Stone Liaison Group and the GeoConservation Commission of the Geological Society (London).

He is a Director of the Natural Stone Institute. His interests in the built heritage were kindled during the mid-1980s when the Edinburgh Geological Society initiated a major study of Edinburgh's building stone. He is lead author of the 2nd edition (1999) of Building Stones of Edinburgh and of Historic Scotland TAN 12 Quarries of Scotland and a co-author of Stone in Scotland (published in 2006 by UNESCO, the IAEG, Historic Scotland & the BGS).

Ewan Hyslop is a mineralogist/petrologist with the British Geological Survey in Edinburgh. He has a PhD in Geology and an MSc in Architectural Conservation.

His main role is research and consultancy into stone decay and selection of stone, including the UK-wide BGS Stone Matching Service. He has completed various research projects and publications including 'Performance of Replacement Sandstone in the Edinburgh New Town'; 'Safeguarding Glasgow's Stone-built Heritage' (with SSLG), 'Stone in Scotland' published in 2006, and contributed to 'Stone Conservation: Principles and Practice' (published by Donhead in 2006).

Ewan lectures widely to professionals in building conservation, and has been part-time lecturer at the Scottish Centre for Conservation Studies, Edinburgh College of Art since 2004.

Marcus Paine Born is Swanage, Dorset in 1967, Marcus is the second son of a Purbeck limestone quarrier, with the family link to quarrying from County Durham through to Purbeck, stretching back 5 generations.

Marcus came to the Scottish Borders where his parents had bought a farm some years earlier and started Hutton Stone Co Ltd in 1994, cutting masonry and building stone in a disused barn. The company dealt initially in reclaimed stone and bought slab from other suppliers and in 2000 reopened Swinton Quarry, which historically supplied masonry throughout the Borders, North Northumberland and into Edinburgh. The company now employs 24 full

time staff quarrying block stone and rubble walling form Swinton Quarry and producing masonry and carving work from the yard at West Fishwick.

Craig Frew is Senior Buildings Consultant with Charlestown Consultants, part of the Scottish Lime Centre Trust. He was previously the Conservation Officer for Dundee City Council.

In addition to inspecting, surveying and investigating defects with traditional masonry buildings, Craig is also involved with Charlestown Workshops, the Lime Centre's traditional building skills training centre in Fife. He is an SQA approved trainer and assessor for the SVQ National Units in Conservation Masonry currently delivered by Charlestown Workshops.

Murdo MacLeod Joined CEC (then the City of Edinburgh District Council) Architects Department in 1977.

Worked on capital projects (housing, recreation etc) as a Quantity Surveyor.

Moved to Maintenance Section of the Council's Property Services Department and subsequently to the Property Conservation Section of the City Development Department.

Responsible for the management, procurement and administration of repairs to private property being carried out under Statutory Notice in default of joint owners. Staff also provide advice on repairs to traditional buildings to other Council Departments and external bodies.

Work programme currently valued at £32 million serviced by in-house surveying staff and external consultants; Conservation Architects, Building Surveyors and Structural Engineers. As Edinburgh has a substantial number of traditional buildings, a significant proportion of which are Listed or in Conservation areas, this involves close contact with Historic Scotland, the Scottish Lime Centre Trust and Edinburgh World Heritage.

Dennis Urquhart MBE was formerly a Reader and Director of the Masonry Conservation Group at the Robert Gordon University, Aberdeen. He is now the Principal of Urquhart Consultancy Services undertaking a range of work associated with the conservation of buildings and also undertakes consultancy in the field of higher education.

He is the author and co-author of many publications relating to stone and building conservation. He has authored a number of Technical Advice Notes and Guides for Practitioners for Historic Scotland, including the 'Conservation of Traditional Buildings'; a joint publication between Historic Scotland and the Scottish Building Standards Agency.

In 2007 he was awarded an MBE for services to conservation.

STONE IN CONTEXT
CONFERENCE OPENING ADDRESS

John Graham, Chief Executive, Historic Scotland

Historic Scotland

Historic Scotland is an Executive Agency of the Scottish Government and our corporate targets are set by Scottish Ministers. The Agency's mission is *"to safeguard the Nation's built heritage and promote its understanding and enjoyment"*. It is responsible for the upkeep of more than 340 historic properties across Scotland and provides statutory protection for buildings of historic or architectural importance, and monuments of national importance, by listing and scheduling, operating under separate legal arrangements. The work is guided by the following objectives:

- ***To protect and conserve Scotland's built heritage;***
- ***To encourage public appreciation and enjoyment of Scotland's built heritage;***
- ***To play an active role in the development and success of social, economic and environmental policies; and***
- ***To be effective and efficient in its work.***

Historic Scotland carries out and facilitates conservation of historic buildings and monuments of national importance through:

- ***Conservation and maintenance of properties in care;***
- ***Advice and grants to assist with conservation and management of ancient monuments;***
- ***Encouraging archaeological surveys and excavation at those sites threatened by natural forces or development where preservation is not possible;***
- ***Taking properties into State care;***
- ***Encouraging visitors to properties in Historic Scotland's care and ensuring that they enjoy and benefit from their visits;***
- ***Developing knowledge, appreciation and access to the built heritage across a wide audience;***
- ***Promoting the built heritage as an integral part of the Scottish cultural experience;***
- ***Researching and developing issues and skills related to the built heritage and raising the standard of conservation practice.***

Background

In our cities, towns, villages and country side, stone forms part of the Scottish identity. Numerous Scottish traditional buildings, from castles and mansions to blackhouses and farms, were built using locally available stone. All these buildings are a direct reflection of the ground upon which they sit. Scotland's legacy of traditional stone buildings has enormous value for the tourist industry and is intrinsically linked to the image of Scotland.

Whilst stone is a strong and durable material, it requires routine repair and maintenance if it is to remain sound and perform well. Of the construction industry sector turnover, almost 50% of activity is in repair and maintenance. However, there is no formal training provision for this. The shortage of a trained masonry workforce is a significant challenge to masonry conservation in Scotland today.

In 2006, the Scottish Stone Liaison Group's (SSLG) Glasgow Project was the first formal detailed study to identify how much work needed to be done, whilst identifying the shortage of trained personnel to do it, and the problems of sourcing the original stone supplies. The Construction Industry Council's 2006 *Falling Masonry Report* and the 2007 National Heritage Training Group's Scottish Skills Audit also identified the significant shortcomings of skills in this sector. In addition, in August 2006 the Historic Environment Advisory Council for Scotland (HEACS) also produced a series of recommendations on skills and materials for the Minister to consider in their *Report and recommendations on the availability and appropriate traditional materials and professional and craft skills to meet the needs of the built heritage document*.

The supply of stone in Scotland

The use of matching stone supplies is preferred to help ensure that the maintenance and repair of Scotland's traditional buildings can be carried out appropriately. Whilst the closure of many stone quarries has lead to challenges in the supply and procurement of stone, the reopening of Scottish quarries is limited by planning, mineral extraction licences, and urban capture issues. This raises a potential conflict with the perceived needs of the natural environment and other requirements.

Historic Scotland aims to promote a better understanding of the stone built heritage and financially helps to address some of the challenges facing the effective conservation of masonry in Scotland – in particular through the Scottish Stone Liaison Group (SSLG) and the Scottish Lime Centre Trust (SLCT). The SSLG works to support and assist efforts to facilitate indigenous supplies of Scottish stone and to promote research into matters relating to the Scottish stone industry. The SLCT provides specialist advice and training in the use of lime-based materials for the conservation and repair of Scotland's traditional buildings.

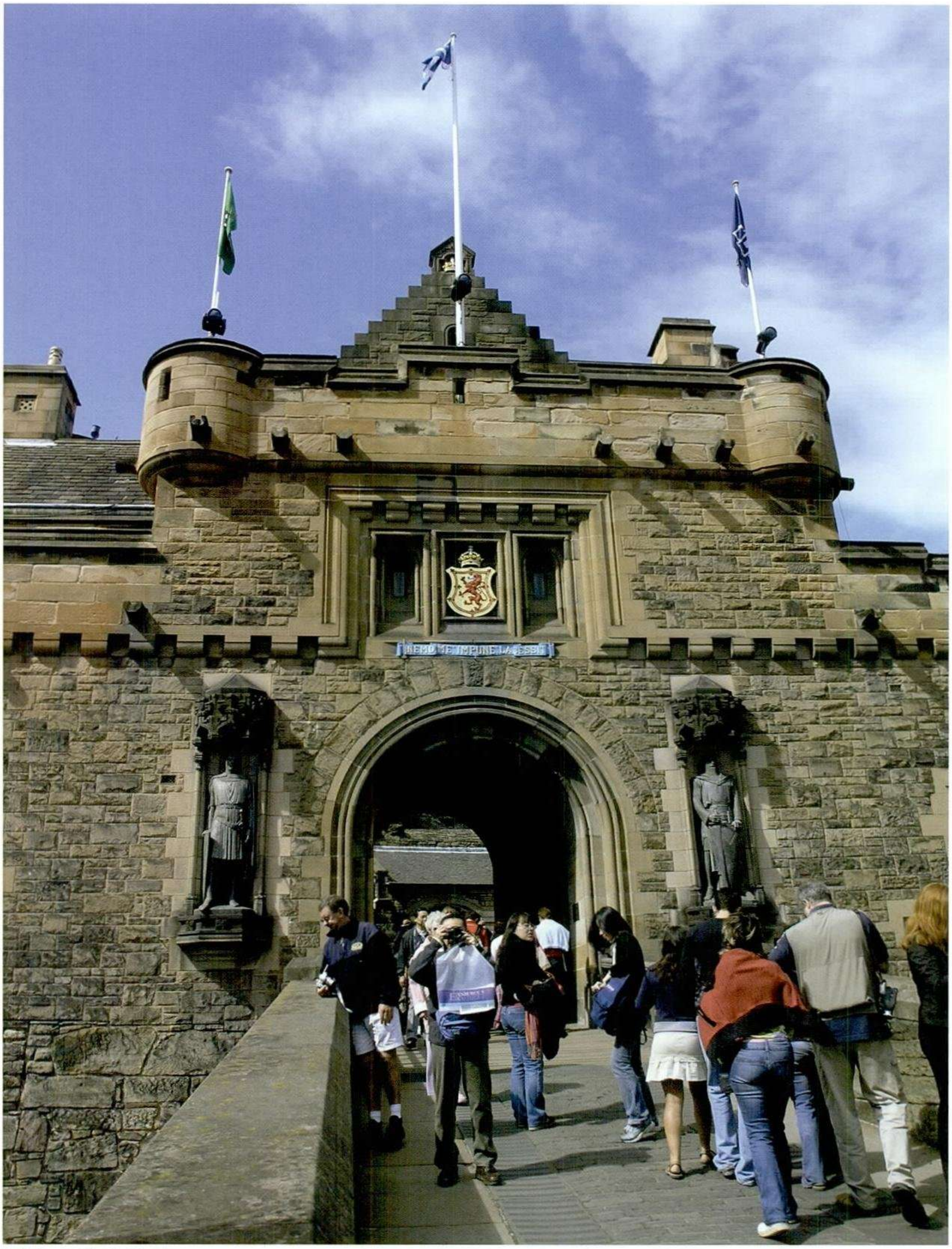
Technical literature

In support of this Historic Scotland's Technical Conservation, Research and Education Group (TCRE) has produced a comprehensive collection of technical literature over the past 15 years. These include a variety of Research Reports, 30 Technical Advice Notes, 8 Guides for Practitioners and (currently) 19 INFORM's, a number of which address the conservation needs of masonry in Scotland. TCRE continues to commission research publications which advance our understanding of the stone built heritage of Scotland. As an indication of this need, some 400,000 INFORMS and Short Guides downloaded from the Agency's web-site over the last 13 months.

National Progression Award in Masonry Conservation

TCRE also sees its role as brokering and enabling dialogue to pilot the creation of relevant qualifications to help alleviate the identified skills shortages, and this led to it taking the lead in devising the National Progression Award (NPA) in Masonry Conservation. The NPA, which was launched by Linda Fabiani MSP on 12 November 2007 is a specific qualification directed towards the repair and maintenance requirements of traditional stone buildings. Developed in Scotland to meet Scotland's needs, the Award is readily transferable to other parts of the UK. The aim of the Award is to provide additional training for those working in the sector as skilled practitioners, and also for those operating without a formal qualification. The NPA is also intended to support the Heritage Lottery Fund bursary training scheme in masonry conservation which is due to be delivered in Scotland and Northern Ireland over the next three years. I can therefore endorse the Ministers view that the Award is a major step forward in creating a properly skilled workforce to help deal with problems such as those identified in the SSLG Glasgow Project and other reports, and is to be commended

The Stone in Context Conference is aimed at those who are involved in and responsible for stone resources, specifications, care of buildings, and the education and training worlds. The intention is to present a comprehensive overview of inter-related issues with sessions addressing Educational and Training; Technical Update; Procurement Pressures and Case Studies, and I wish it every success in doing so.



Edinburgh Castle Gatehouse

"FROM THE ROLLING STONES TO BARBIE – TOURISM EXPERIENCES AND FUTURES"

Professor Ian Yeoman, Visit Scotland

Tourism is the fourth biggest industry in Scotland, currently worth £4.2 billion a year. It is estimated that by 2025 the industry will be worth £1.75 billion, with an extra 10 million people visiting Scotland each year. Heritage, including the built heritage, plays an important role in this industry. In a survey conducted by Visit Scotland, 18% of those questioned listed general sightseeing as their top attraction, and 14% listed houses, castles and gardens. Furthermore, 28% of all tourists in Scotland are from overseas, and are 20 times more likely to visit a historic property than go to a museum.

Looking at future consumer trends, heritage in Scotland is set to play an even bigger role. Rising affluence, increased education and an ever more networked society means that for the future consumer time to slow down, and to experience cultural attractions will become a luxury and therefore more likely to be an important deciding factor when choosing their holiday location and activities.

Urquhart Castle and Loch Ness

THE SCALE OF THE PREVIOUS USE OF STONE AND THE CURRENT CONTEXT

Ingval Maxwell, Director TCRE

All buildings are the product of man using, and integrating, materials have either been available on the surface of the ground or have been extracted from below it. Until relatively recently the predominant material used in the construction of Scottish buildings has been stone. From prehistoric times; through the introduction of religious influences; morphing the change from strong defensive castellated structures to more palatial accommodation in peaceful times' stone has been king. Through being set as rough rubble or dressed ashlar work its widespread adoption in the creation of cottages, farms, industrial complexes, villages, towns and cities has been universal.

The emergence and adoption of both science and engineering aided and abetted the development of the more formal masonry industry. The underlying link of how man and machine worked the locally available rock and the emerging architecture created a regional diversity in the appearance of buildings that truly reflected the underlying geology. Following centuries of development, the combined skills of quarrying, tooling, carving, and hewing, planing, turning, designing and exploiting stone reached its zenith during the 19th century.

In establishing this position, it is also useful to reflect on the development of architectural forms and features. This can reveal how human intuition, perception and capability utilised the quality of stone to create a wide range of structures and details. Plotting the structural development of a simple barrel vault through to the complexities of vaulting with cross and intersecting ribs with infill pieces, ably reveals the assurance, confidence and abilities that masons had in the past. These attributes are well revealed in the ability to think in the negative during the construction process - through having to work above temporary load-bearing supports with the finished structural entity only clearly seen for being the first time when the temporary scaffolding was removed.

St Magnus Cathedral, Kirkwall, Interior.

Similarly, the recognition that infill masonry tracery only needed to carry its own weight and resist any wind pressures against it enabled the craftsmen to create some remarkable "filigree" work on religious building. The use of the corbel also allowed the creation of some unique surface decoration. In addition, adopted in series, it worked as a structural device that enabled, in turn, significant changes in plan shape and dimension to occur. In the form of slates, stone has been used to roof innumerable structures whilst, in the shape of flagstones it provided hard wearing and functional ground paving. From prehistoric to relatively modern times a consistent pedigree in the use of local stone, and the structural and design features that it could create, has been at the heart of indigenous Scottish architecture and town-planning.

However, following its invention in the 1820's stone, in its manufactured form of cement, has persistently challenged the previously intuitive and traditional methods of building. Sadly, that adoption is increasingly going to be proven how ill-founded the use of this relatively modern material with traditional building construction has been.

Coupled with a lack of understanding on how to maintain and repair traditionally built stone structures, much of the quality of the counties traditionally constructed architecture is being steadily negated. Compounded by the adoption of ill-considered maintenance regimes, such as the inappropriate desire to clean buildings, especially those of sandstone, a considerable backlog of issues requiring urgent attention has built up over the past 50 years.

Whilst vestiges of appropriately qualified masonry craft skills remain, the findings of numerous recent studies reveals a significant discrepancy in the skills base now required to do the work. Likewise, whilst an awareness of the advantage of adopting the historically well-understood traditional lime technology is dawning, much remains to be done before the construction industry as a whole recognises the benefits of its use.

Perhaps the most challenging dilemma in present times is trying to gain access to sources of the original material from which the countries stone built heritage was constructed. Through conveniently providing ready-made locations to be unceremoniously packed with landfill waste; being disregarded in terms of twentieth-century urban development to become urban locked; and through not infrequently becoming designated as Sites of Special Scientific Interest, current and future access to original quarry sources of stone has all but been successfully prevented. In this process, little awareness was afforded to the need to look after our stone built heritage, and that this required appropriate skills and materials in equal measure to do the job properly.

In particular, as the repair needs of the 19th century stone-built heritage escalate, and demand increases, it would appear that much of its quality could be negated through the ill-considered decisions in the not too distant past. Inevitably, compromising decisions are currently having to be made, and will continue to be made, through the inevitable adoption and use of second-best materials. But, with a current projection that the skills base required to do the future masonry work is about to be enhanced, increasing attention needs to be given to where the various stone materials, upon which that work will be executed, are going to be obtained from.

THE SCALE OF THE PREVIOUS USE OF STONE AND THE CURRENT CONTEXT

Ingval Maxwell OBE DADun RIBA FRIAS AABC FSAScot

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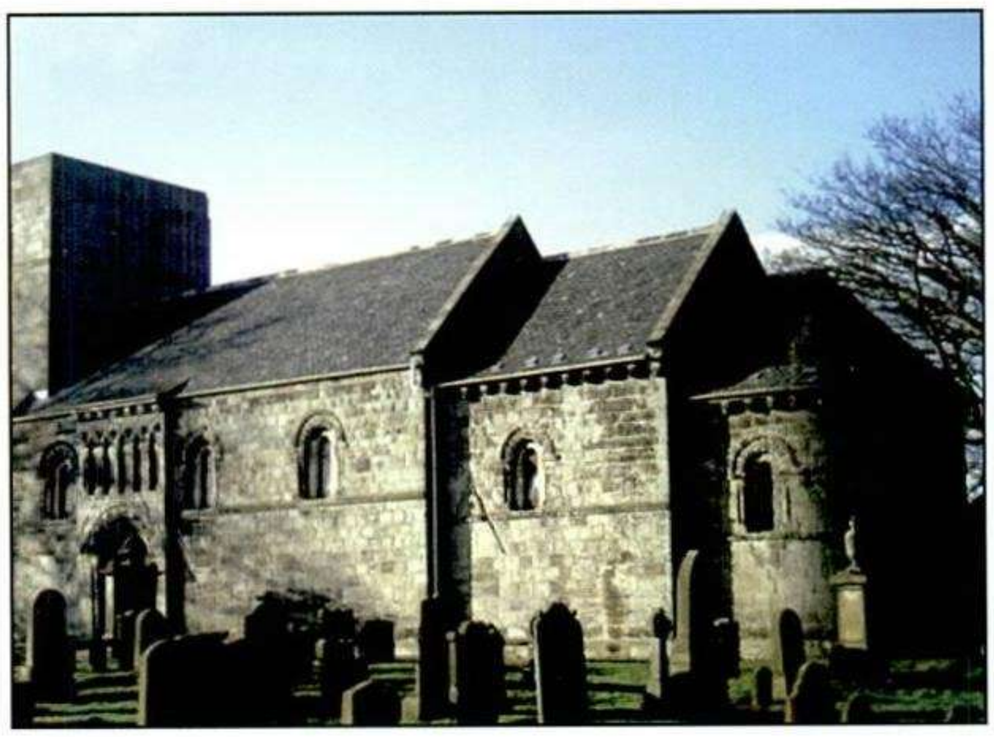

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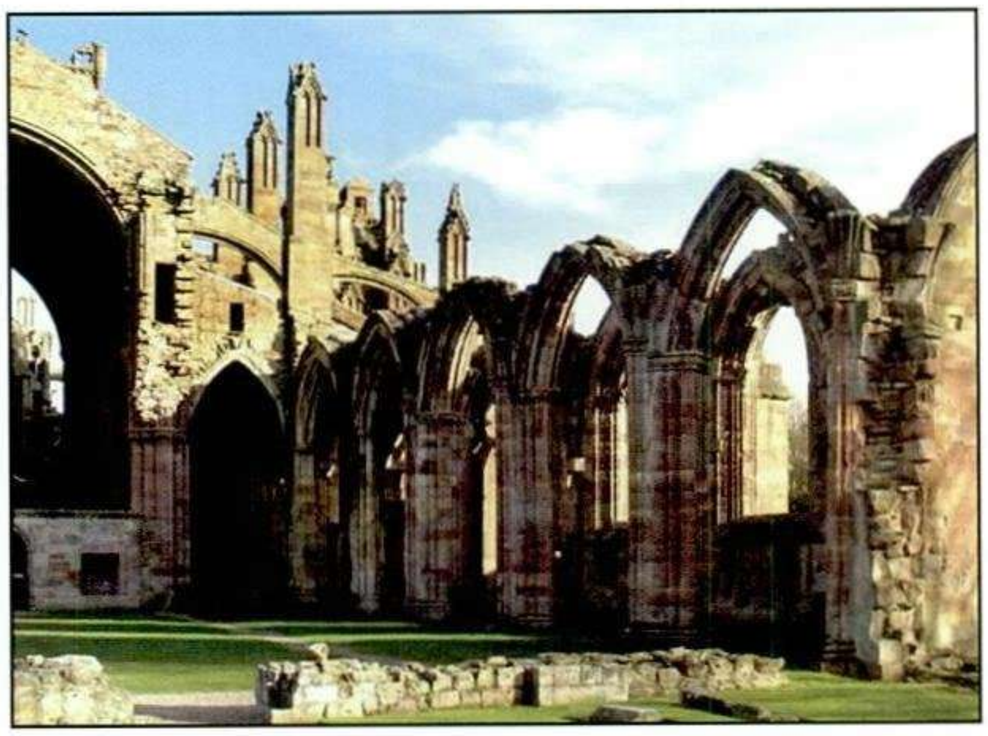

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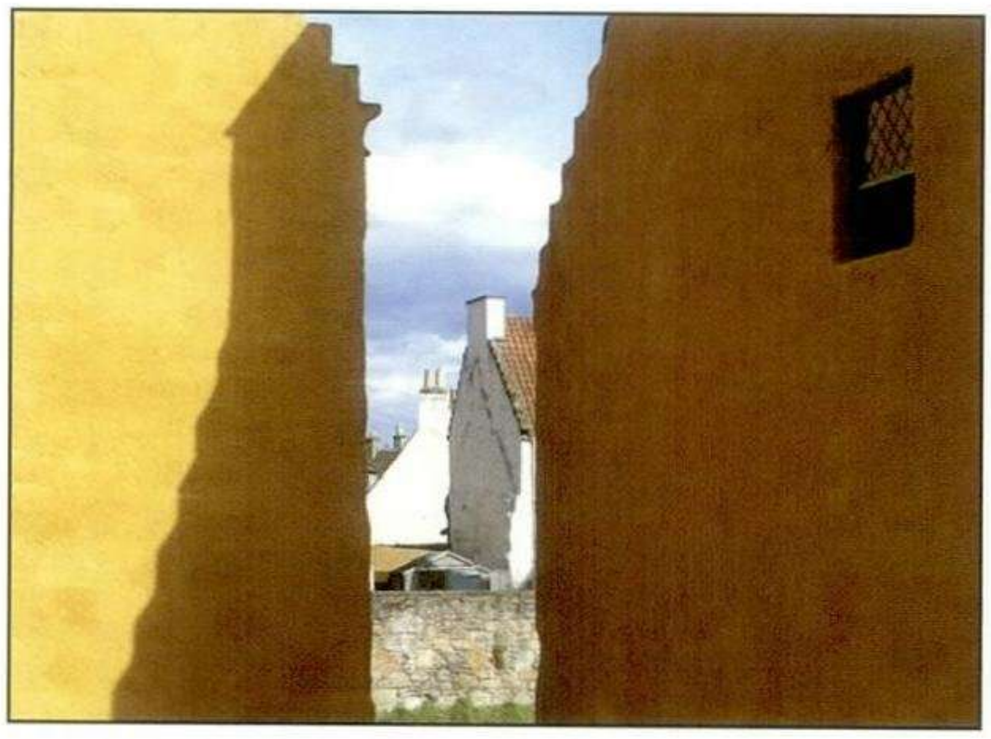

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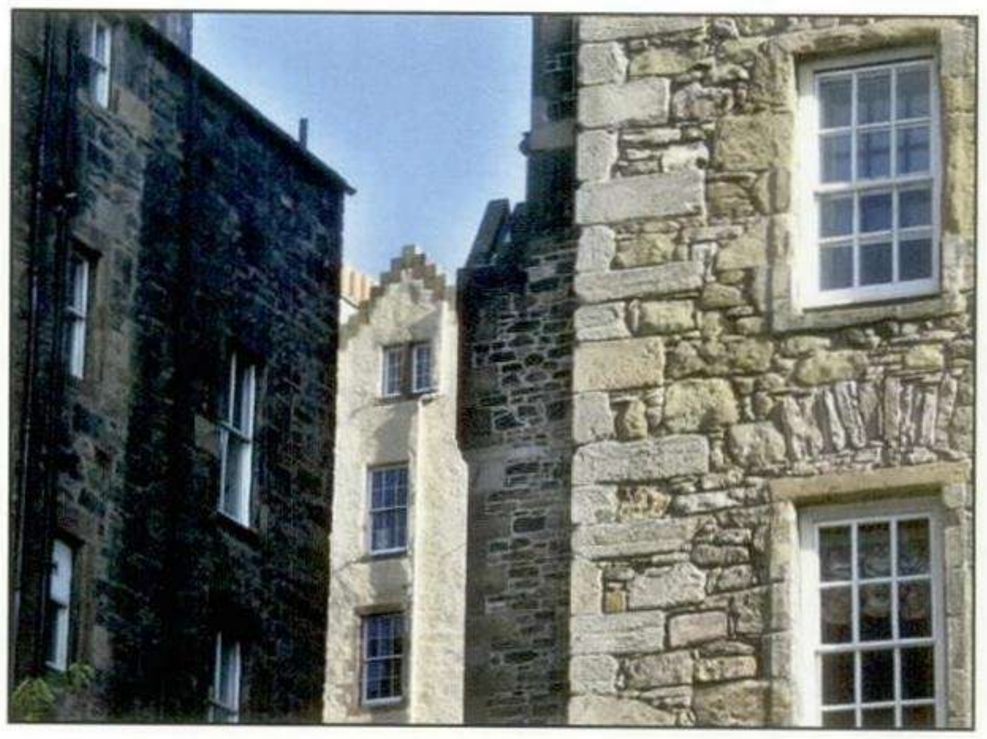

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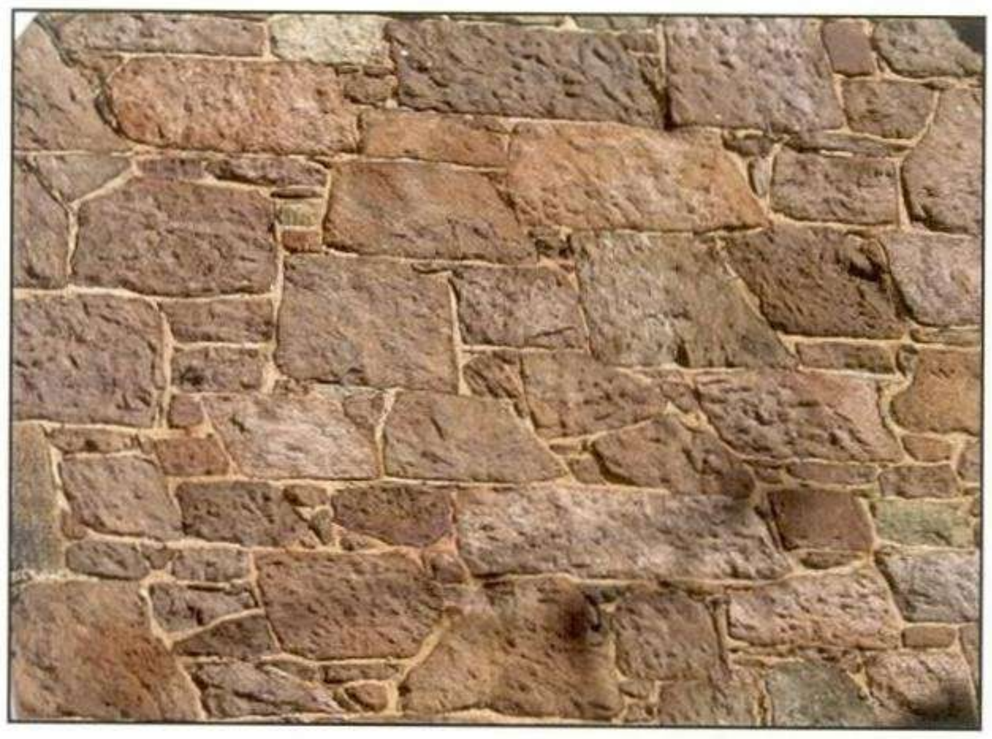

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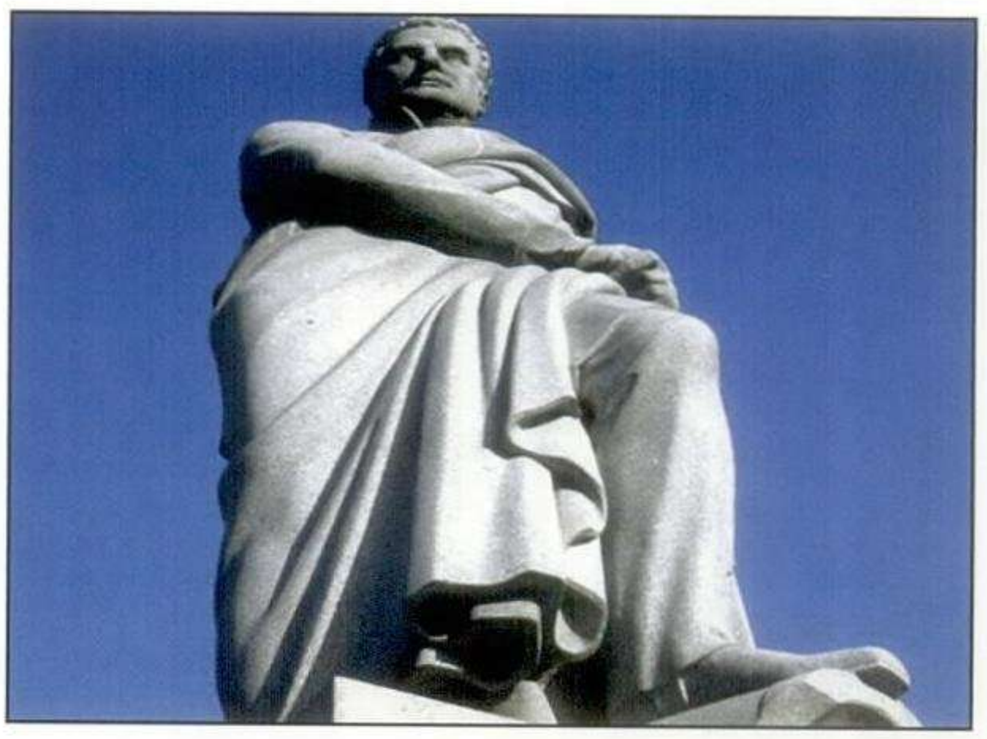

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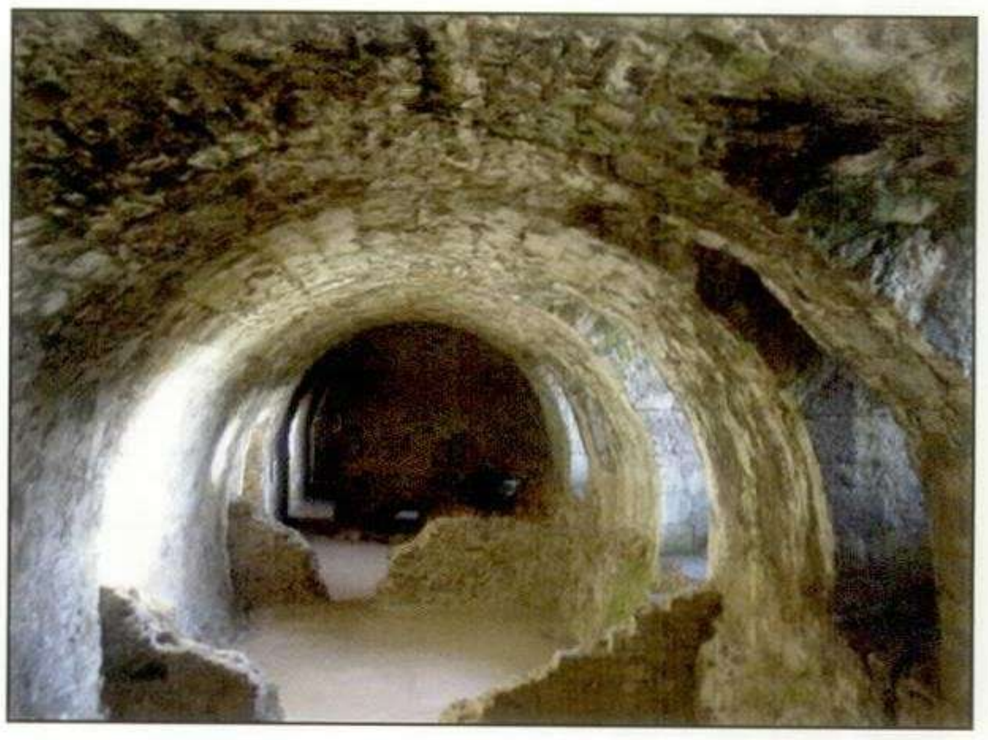

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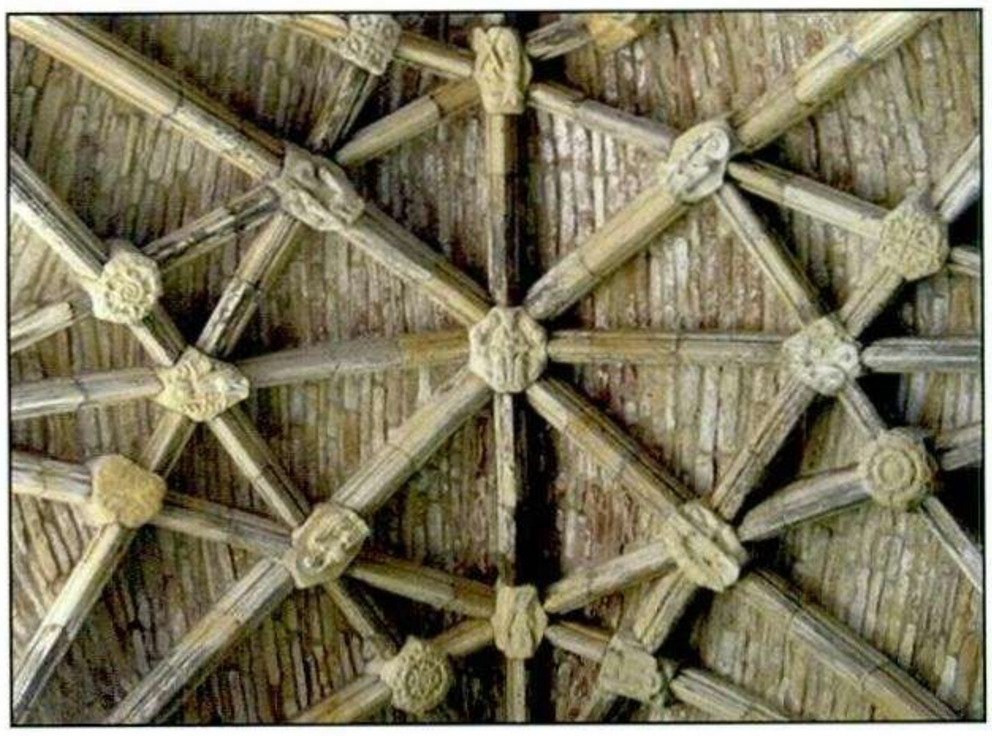

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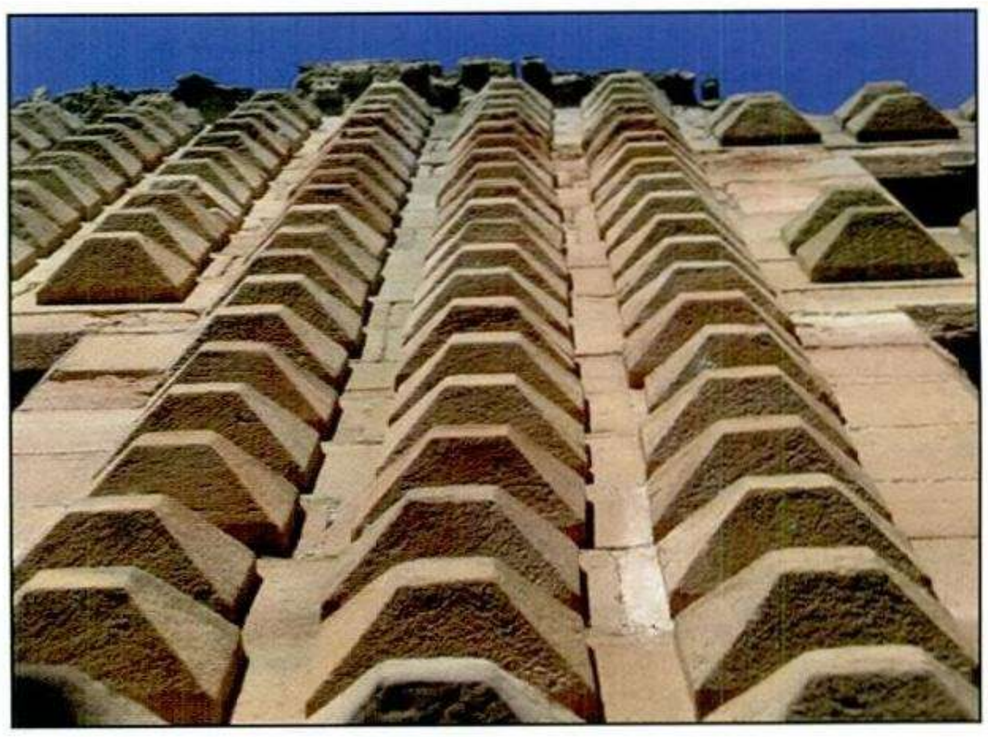

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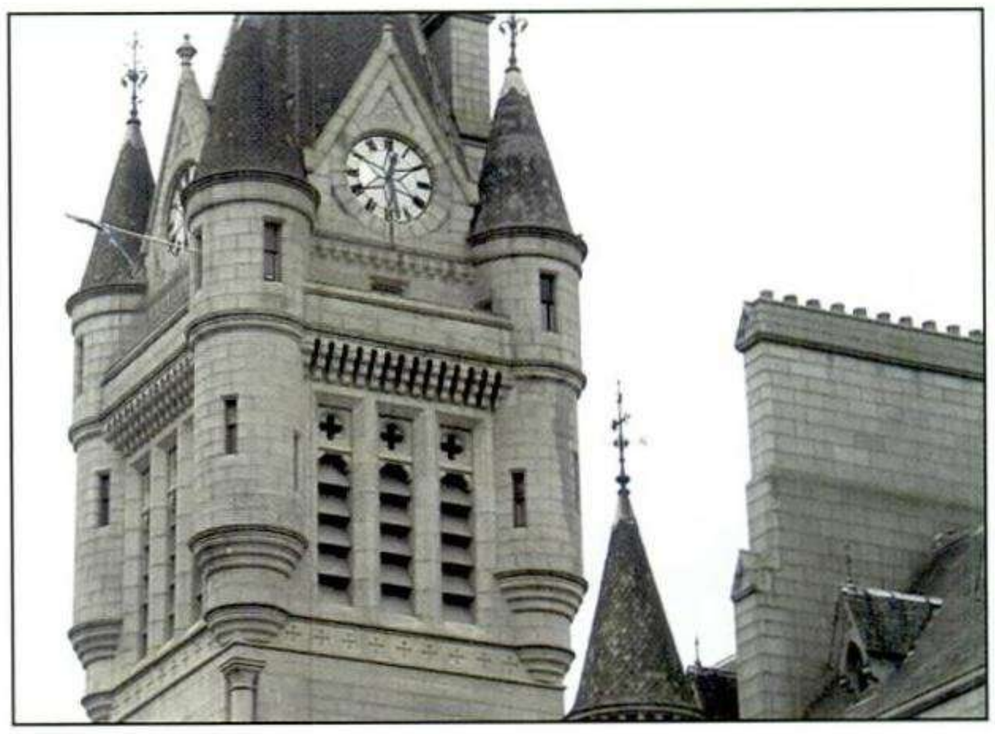

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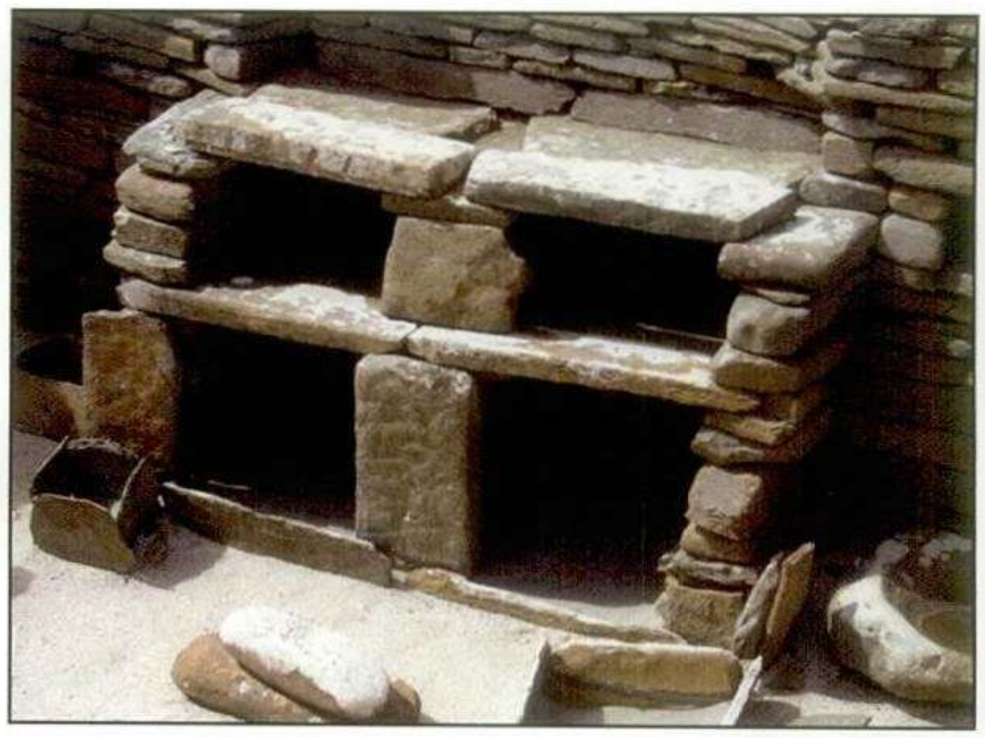

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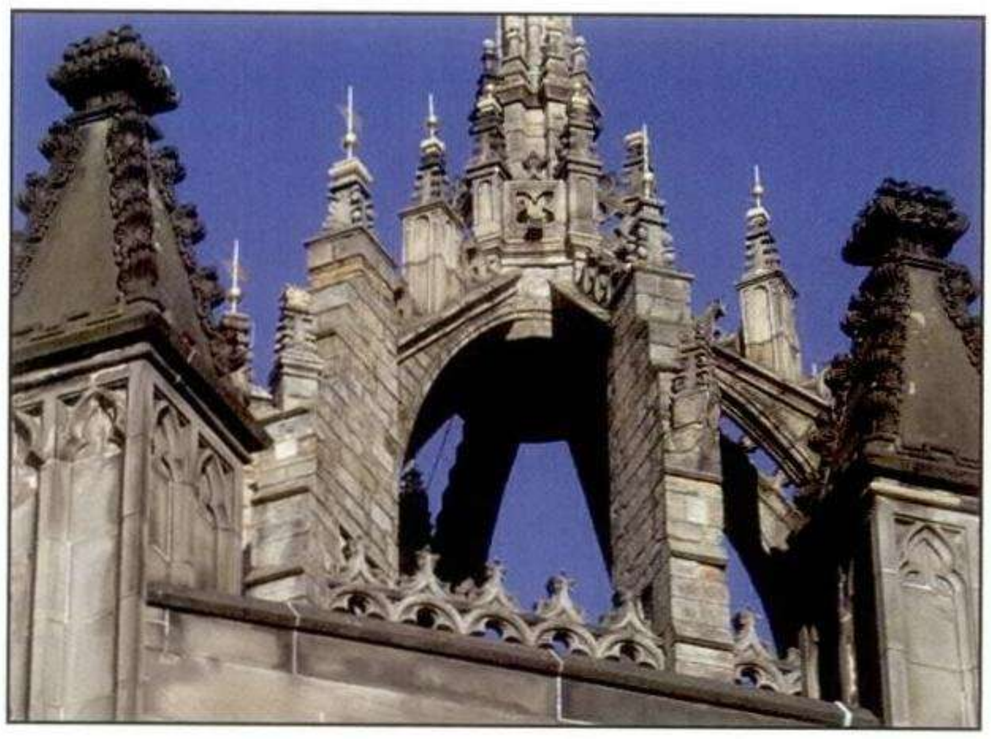

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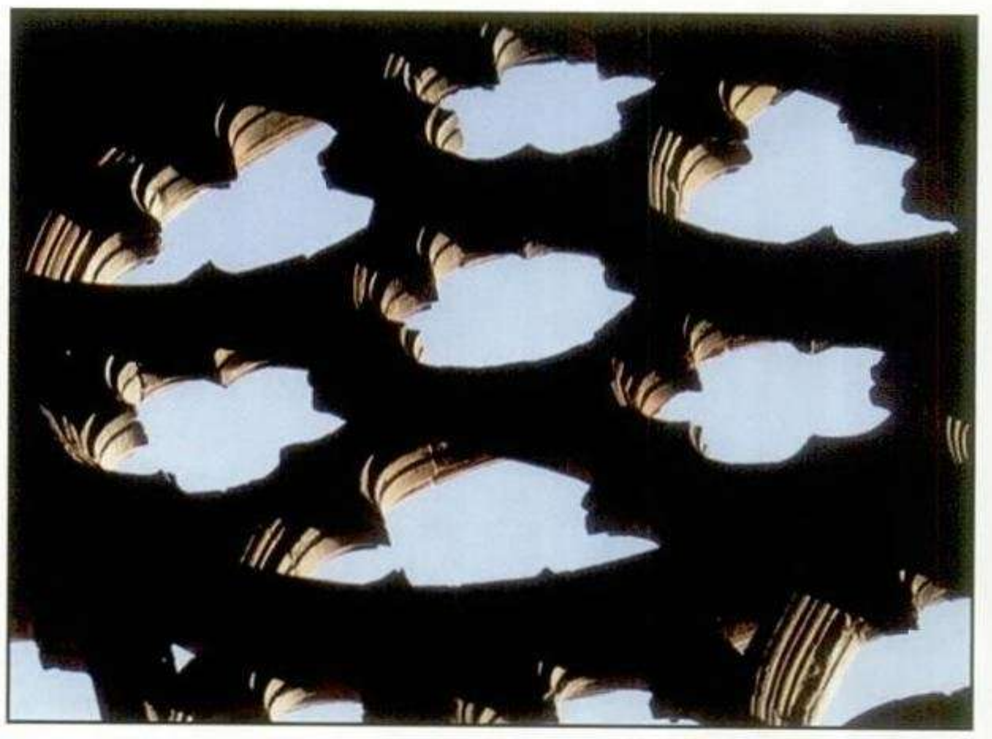

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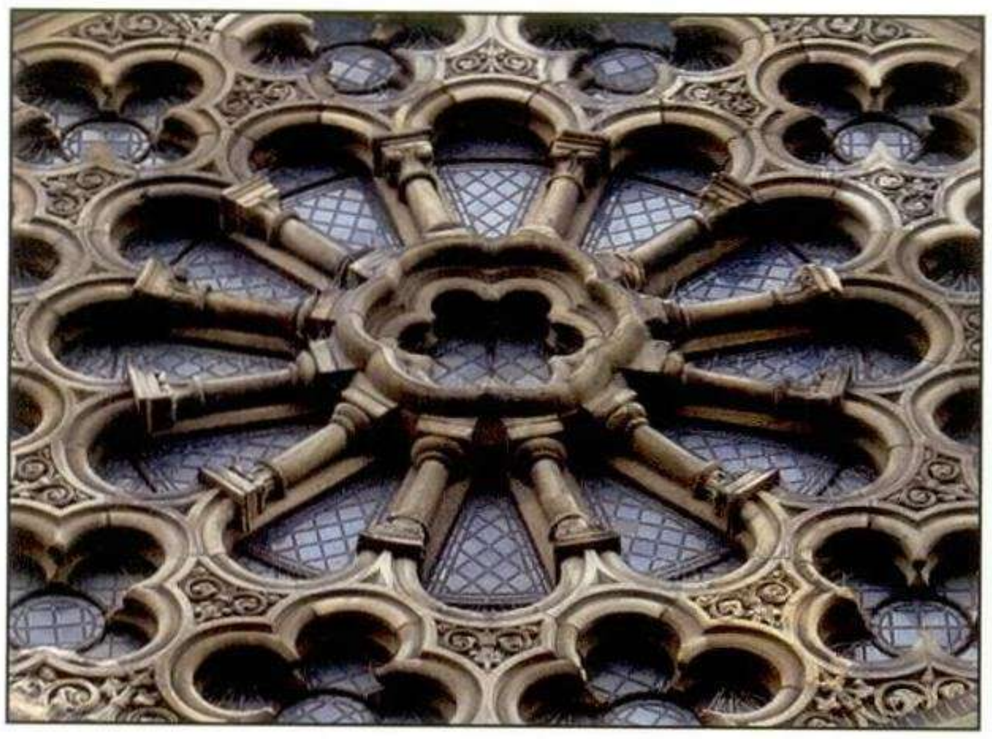

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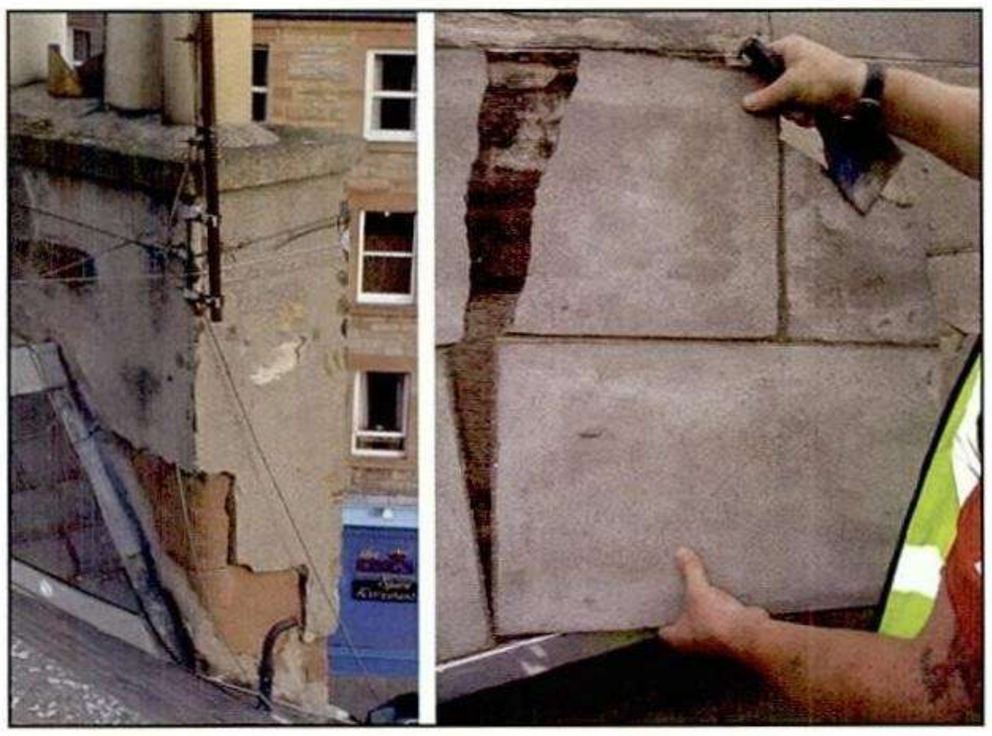

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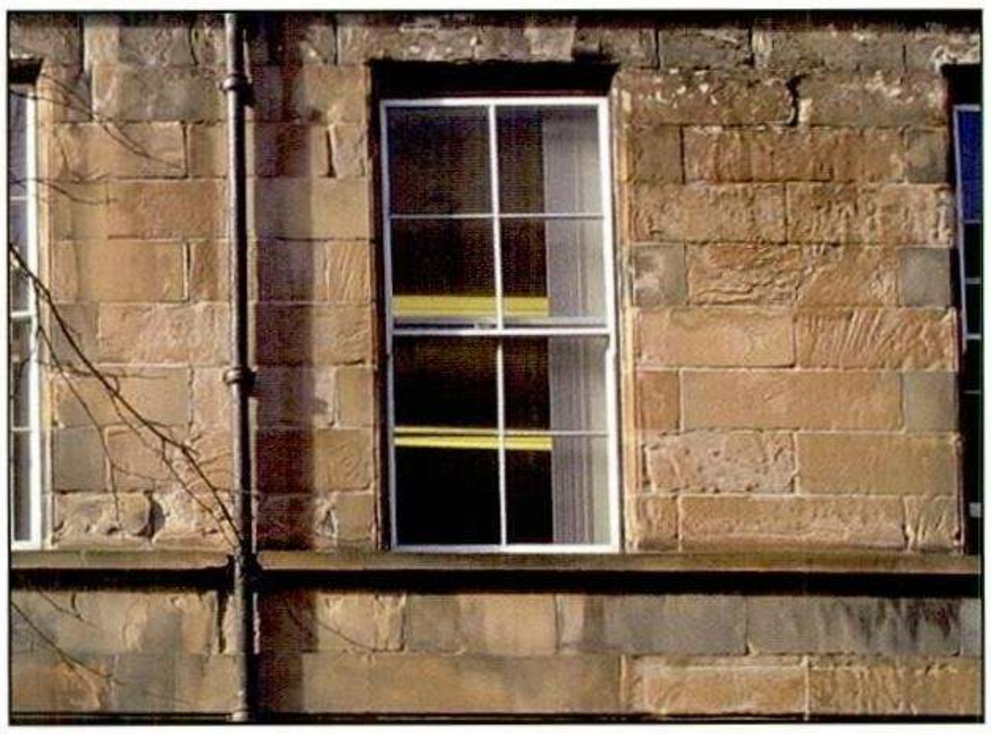

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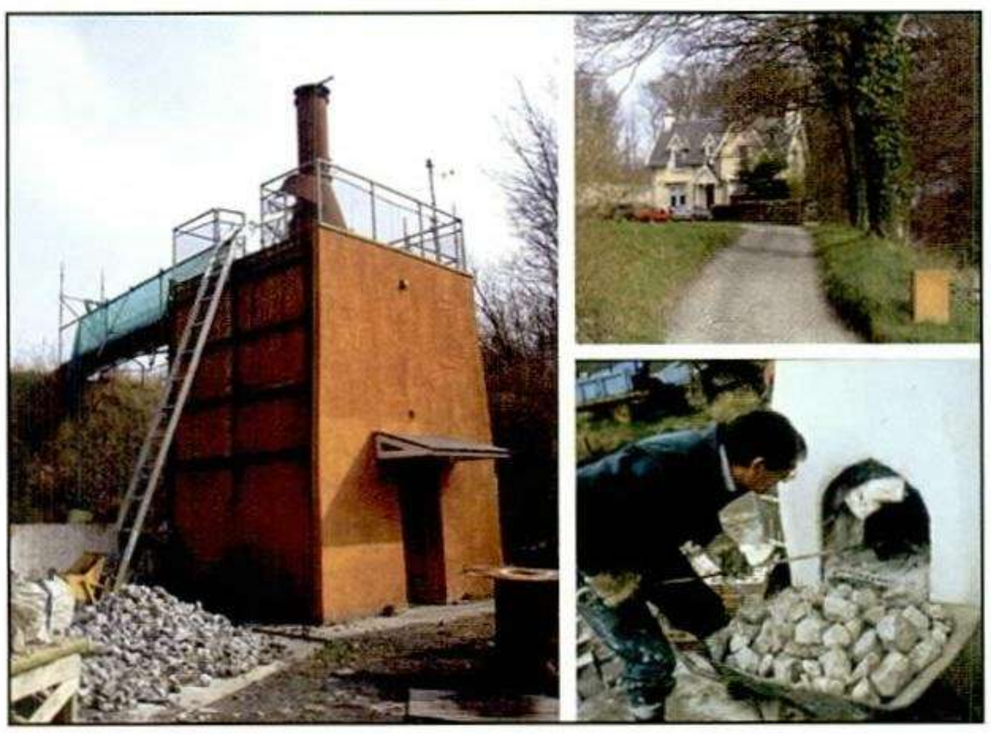

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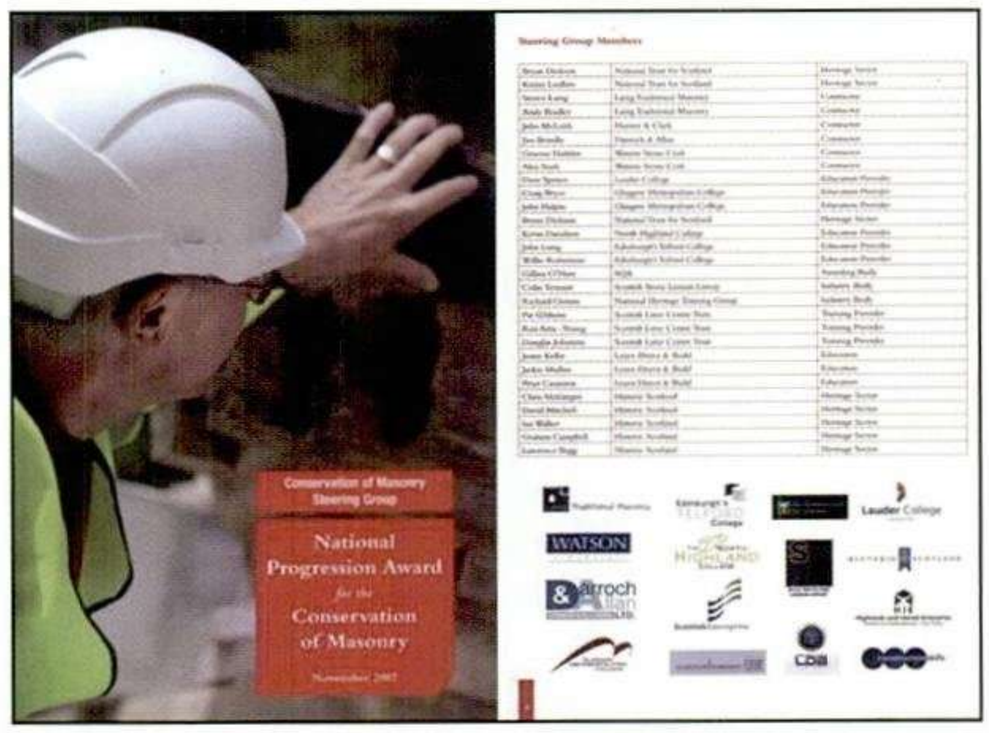

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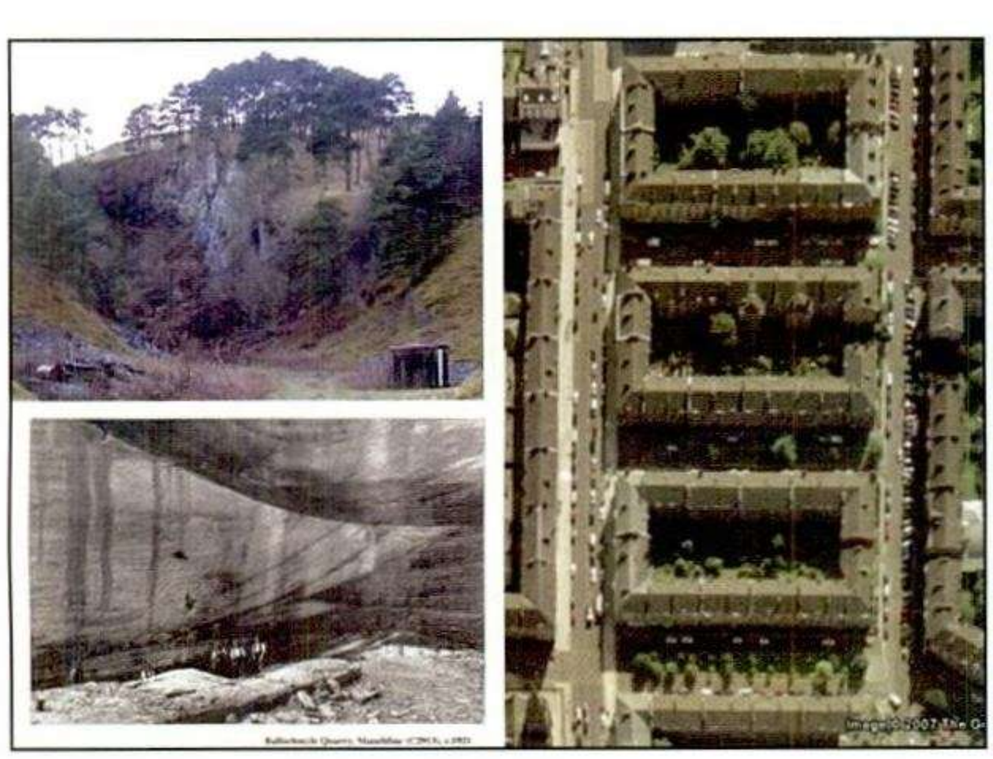

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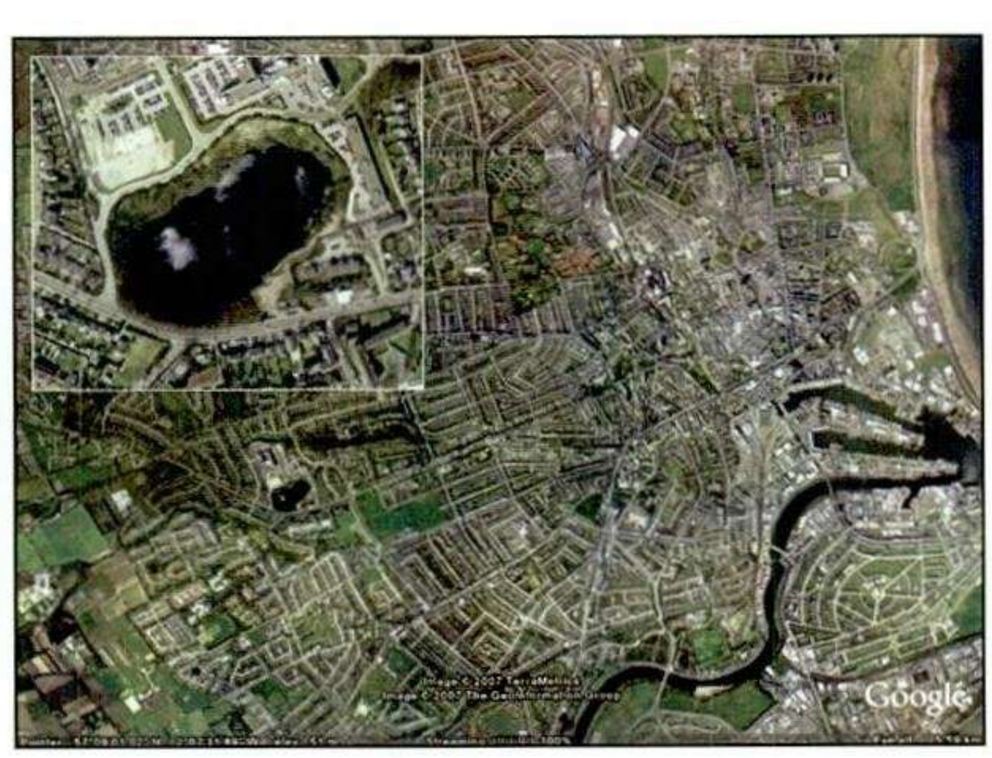

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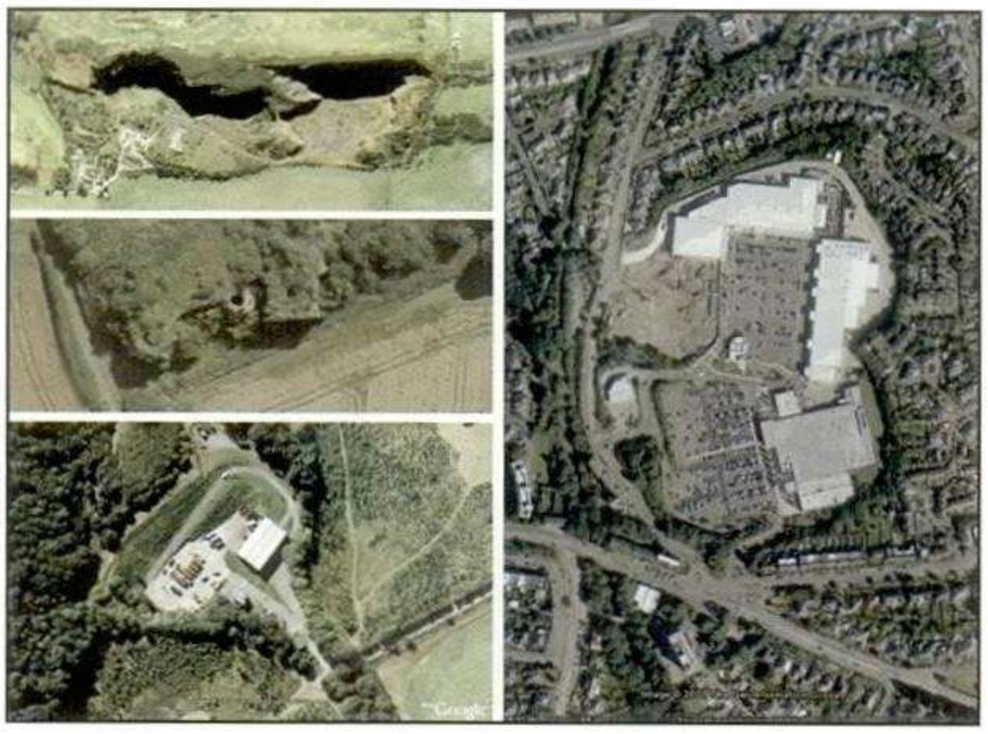

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SUSTAINABILITY AND EMBODIED ENERGY

Tim Yates, Centre for Heritage, BRE

Construction has a massive impact on the environment where all phases of the life cycle contribute. This includes mining of raw materials, manufacture, construction, operation, repair and maintenance, refurbishment, demolition and reuse. In a measure of UK carbon dioxide emission during 2000 it was found that 28% of emissions came from domestic buildings, 18% from people related transport and 15% from the commercial and public sector.

Life Cycle Assessment (LCA)

The life cycle begins when the raw materials are extracted from the earth, then continues, through stages of manufacture, to use, and finally to reuse, recycling or disposal. Life Cycle Assessment is a method used to measure and evaluate the environmental impacts associated with a product system or activity. It does so by describing and assessing the energy and materials used and released to the environment over the complete life cycle

Embodied Impacts

Embodied energy refers to the impact associated with construction, transportation of materials, disposal of waste materials, refurbishment and maintenance and demolition. The Life Cycle Assessment is used for measuring embodied impacts. Looking at the impact of houses and the construction industry in general, a medium to large terraced house dating to 1850-1899 of traditional construction (brick, timber floors) and excluding finishes, fixtures, fittings, services and landscaping has an embodied 32.75 tonnes of CO2. A new build construction of the same size and area has 40 tonnes of embodied CO2.

The UK construction industry consumes 6 tonnes of building material per person per year (approximately 350 million tonnes in total per year). The construction industry also accounts directly or indirectly for 30 to 40% of annual waste in the UK. However, 50% of construction waste is recycled although often as low-grade resources such as hardcore.

What is sustainable construction?

Sustainable construction must balance social, economic and environmental impacts. The environment ratings for different materials, whole life costs and performance assessments, and the physical, functional, environmental and economic performance, also need to be considered.

Whole Life Cost and Performance Assessment looks at the material's (initial and long term) physical, functional, environmental and economic performance and assesses whether competing alternatives provide satisfactory performance at a similar cost.

"It is a technique which enables comparative cost assessments to be made....over a specified period of time, taking into account all relevant economic factors....both in terms of initial capital costs and future operational costs" ISO Standard 15686 on Service Life Planning

It considers the construction, purchase, facilities, operations and disposal of materials.

So where does stone fit in?

Stone has a low energy consumption (compared to concrete), as dimensioned stone it has high wastage (compared to aggregates) but this is combined with a long service life and low maintenance needs (provided it is selected and used correctly).

SUSTAINABILITY AND EMBODIED ENERGY

Tim Yates, BRE

Sustainability and Embodied Energy

bre

Presentation to the 'Stone in Context' Conference
Tim Yates, BRE
14th November 2007

1

The Impact of Construction

- Construction has a massive impact on the environment.
- All phases of the life cycle contribute -
  - mining of raw materials
  - manufacture
  - construction
  - operation, repair & maintenance
  - refurbishment
  - demolition and reuse.

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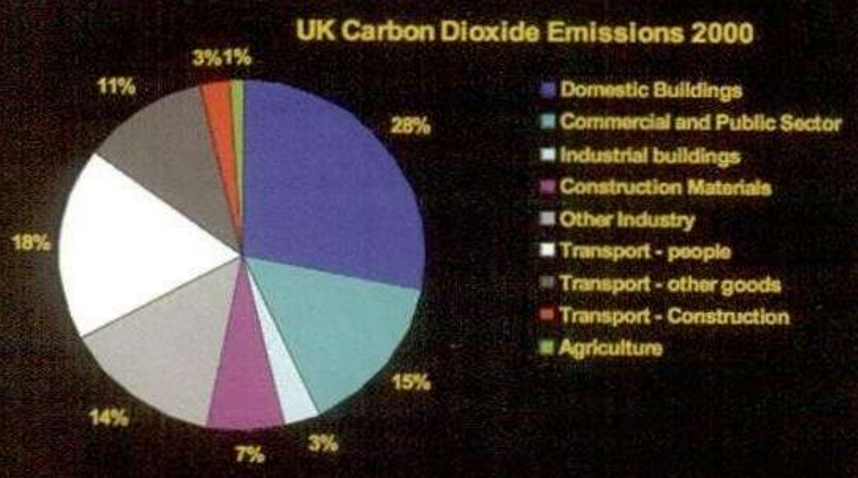
What are the impacts of buildings?



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Life Cycle Assessment (LCA)

- Life Cycle: The life cycle begins when the raw materials are extracted from the earth, then continues, through stages of manufacture, to use, and finally to reuse, recycling or disposal
- LCA: A method to measure and evaluate the environmental impacts associated with a product system or activity, by describing and assessing the energy and materials used and released to the environment over the life cycle

bre

4

Embodied Impacts

- Impacts associated with
  - Construction
  - Transport of Materials
  - Disposal of Waste Materials
  - Refurbishment and Maintenance
  - Demolition
- Embodied energy or Embodied CO_2 can be used as proxy
- Life Cycle Assessment for measurement

bre

5

Embodied Impact of Traditional Housing

- Medium to large terraced house, built 1850-1899
- Typical construction, brick, timber floors
- Overall floor area 117.7m²
- Excludes finishes, fixtures, fittings, services and landscaping
- Embodied Energy 520 GJ Embodied CO_2 32.75 tonnes
- New build construction of same area:
- Embodied Energy 520 GJ Embodied CO_2 40 tonnes

bre

6

Key facts

- UK construction industry consumes 6 tonnes of building material per person per annum (approx 350MTonnes / year)
- Construction accounts directly or indirectly for 30 – 40% of annual waste
- 50% of construction waste is recycled but often as low-grade resource such as hardcore

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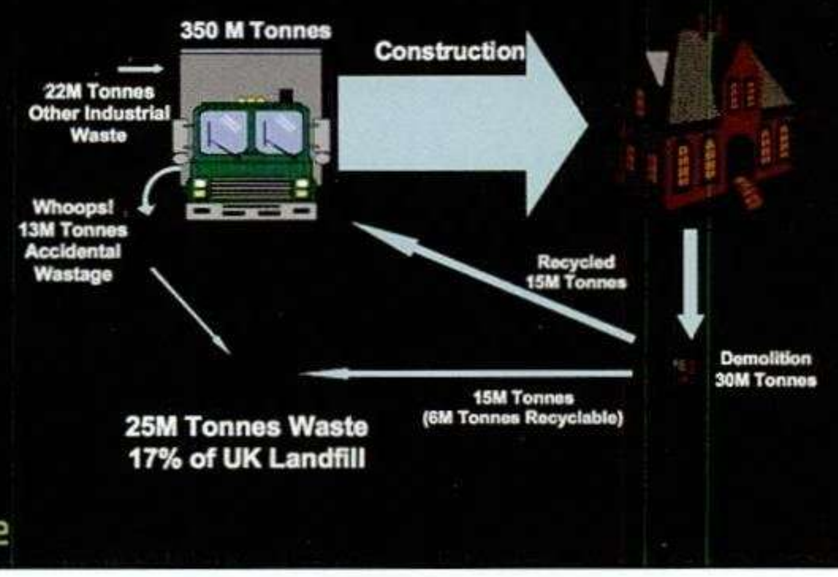
Construction and Waste



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What is Sustainable Construction?

- Balancing – a three legged stool
- Social Impacts
- Economic Impacts
- Environmental Impacts

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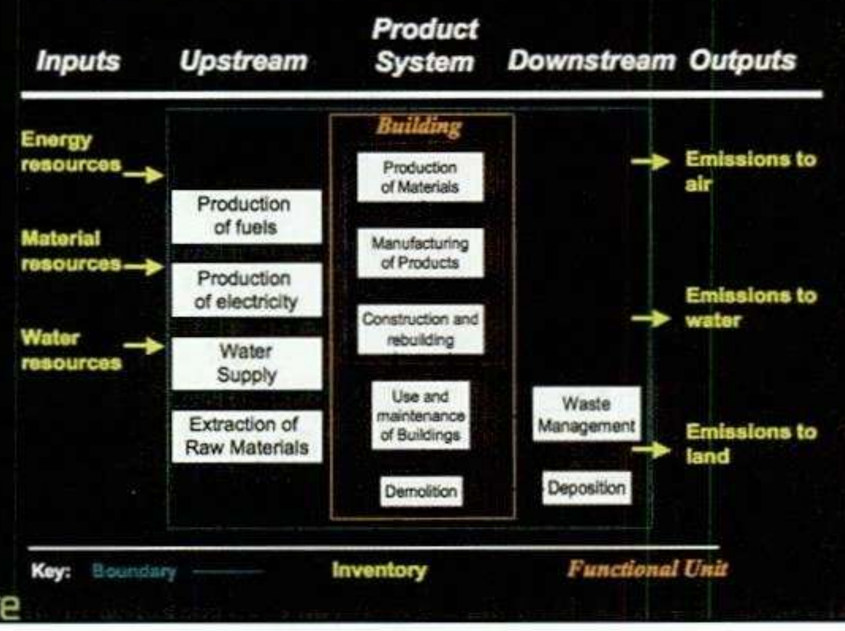
LCA for a Building



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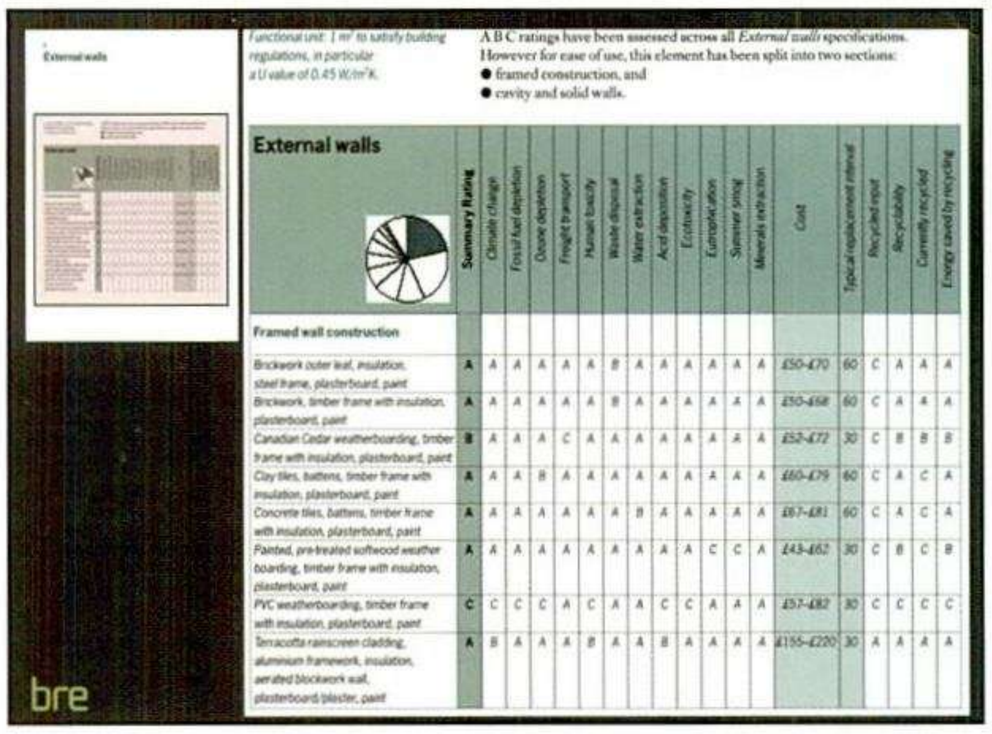

External walls

Functional unit: 1 m² to satisfy building regulations, in particular a U value of 0.45 W/m²K.

A B C ratings have been assessed across all *External walls* specifications. However for ease of use, this element has been split into two sections:
- framed construction, and
- cavity and solid walls.

External walls

	Summary Rating	Climate change	Fossil fuel depletion	Ozone depletion	Freight transport	Human toxicity	Waste disposal	Water extraction	Acid deposition	Ecotoxicity	Eutrophication	Summer smog	Mineral extraction	Cost	Typical replacement interval	Recycled input	Recyclability	Currently recycled	Energy saved by recycling
Framed wall construction																			
Brickwork outer leaf, insulation, steel frame, plasterboard, paint	A	A	A	A	A	A	B	A	A	A	A	A	A	£50–£70	60	C	A	A	A
Brickwork, timber frame with insulation, plasterboard, paint	A	A	A	A	A	A	B	A	A	A	A	A	A	£50–£68	60	C	A	A	A
Canadian Cedar weatherboarding, timber frame with insulation, plasterboard, paint	B	A	A	A	C	A	A	A	A	A	A	A	A	£52–£72	30	C	B	B	B
Clay tiles, battens, timber frame with insulation, plasterboard, paint	A	A	A	B	A	A	A	A	A	A	A	A	A	£60–£79	60	C	A	C	A
Concrete tiles, battens, timber frame with insulation, plasterboard, paint	A	A	A	A	A	A	A	B	A	A	A	A	A	£67–£81	60	C	A	C	A
Painted, pre-treated softwood weather boarding, timber frame with insulation, plasterboard, paint	A	A	A	A	A	A	A	A	A	A	C	C	A	£43–£62	30	C	B	C	B
PVC weatherboarding, timber frame with insulation, plasterboard, paint	C	C	C	C	A	C	A	A	C	C	A	A	A	£57–£82	30	C	C	C	C
Terracotta rainscreen cladding, aluminium framework, insulation, aerated blockwork wall, plasterboard/plaster, paint	A	B	A	A	A	B	A	A	B	A	A	A	A	£155–£220	30	A	A	A	A

bre

11

Whole Life Cost and Performance Assessment

This looks at the material's (initial and long term)
- Physical,
- Functional,
- Environmental,
- Economic performance

And assesses whether competing alternatives provide satisfactory performance at similar cost.

bre

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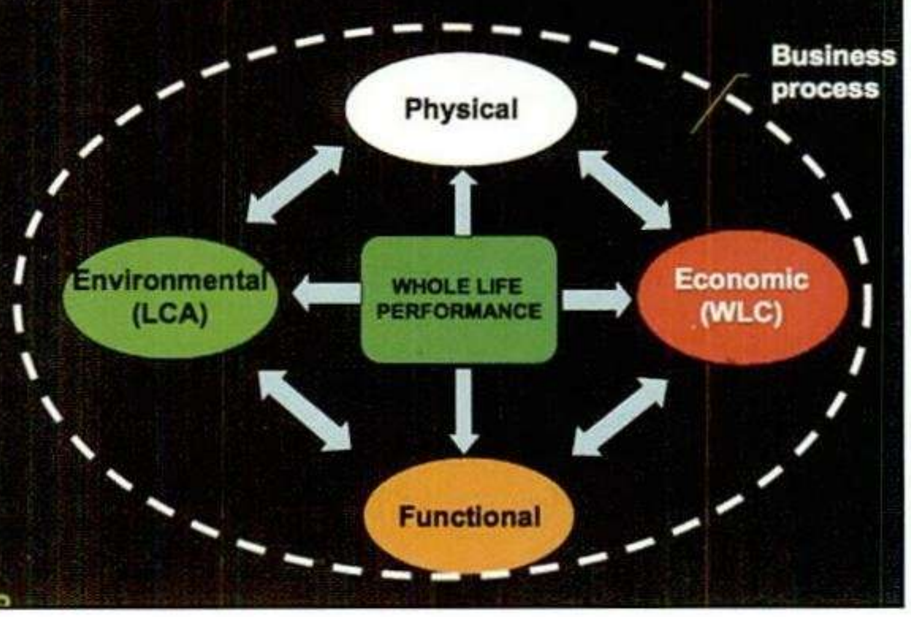
Whole life performance



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Whole Life Costing?

- "a *technique* which enables *comparative cost assessments* to be made …
- over a *specified period of time*, taking into account *all* relevant *economic factors*…
- *both* in terms of *initial capital costs* and *future operational costs*"
- ISO Standard 15686 on Service Life Planning

bre

14

15

WLC - what is considered ?

Costs / Income

Construction	Purchase	Facilities	Operations	Disposal
•Site	•Price	•Rent/rates	•Rent	•Sale
•Design	•Adaptation	•Energy		
•Construction	•Commission	•Utilities	•Business	•Recycle
•Commission	•Fit out	•Maintenance	•Sub-let	
•Fit out		•Repair/Replace		
		•Refurbish	•Fiscal	
•Fees	•Fees	•Demolition		
•In-house	•In house	•Non-available		
•Finance	•Finance	•Management		

Capital Expenditure (CAPEX) Revenue Expenditure (REVEX)

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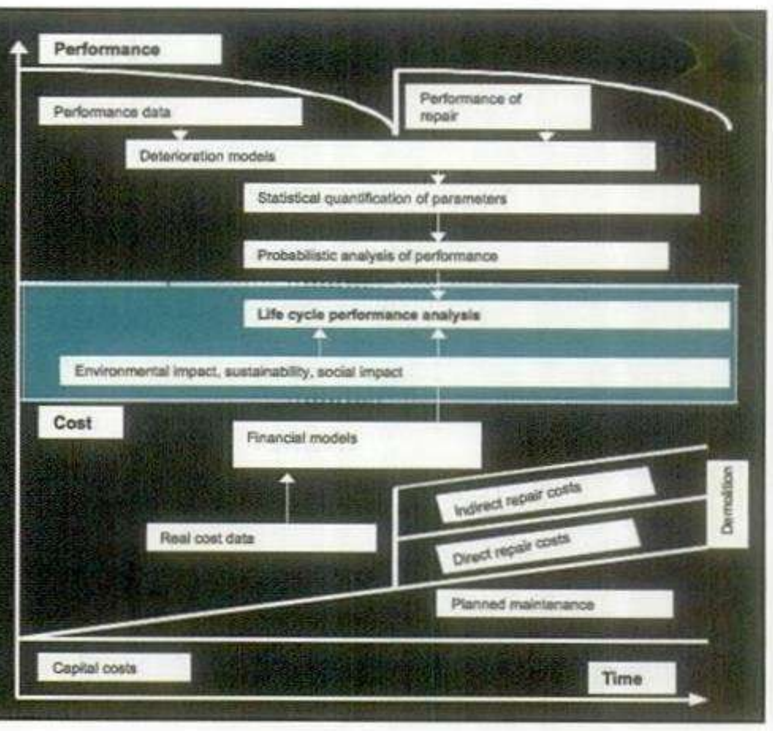
Critical Elements of Life Cycle Models



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Commonality: WLC & LCA

Stages in the Building Life Cycle

LCA

- Extraction of raw materials
- Production of building components
- Construction
- Use:
  - repair
  - maintenance
  - replacement
- Refurbishment
- Demolition
- Recycle

WLC

bre

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Where does stone fit in?

- Production and construction
- Impact in the context of the company/producer
- Reducing energy use

bre

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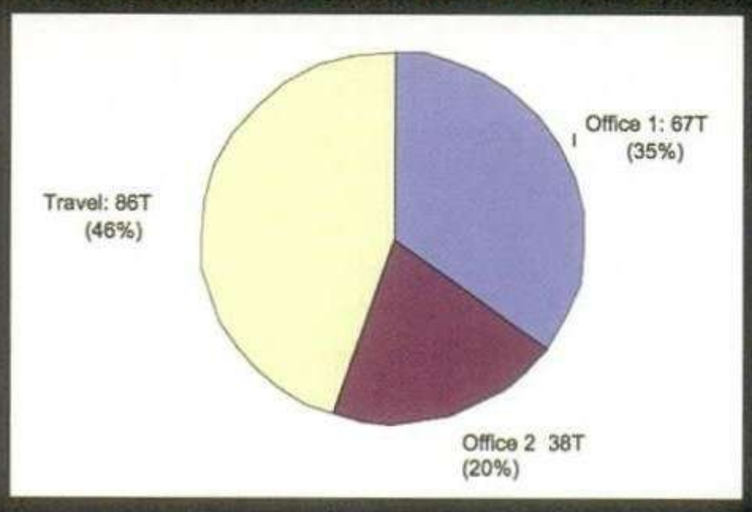
Total Emissions: 191 Tonnes CO2 per year



Approx 1.6 tonnes/person: Travel is nearly 50%

bre

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Where does stone fit in?

- Low energy consumption
  (compared to concrete)
- High wastage
  (compared to aggregates)
- Long service life
- Low maintenance
  (if selected correctly!)

bre

21

Where does stone fit in?

- Social impacts?
- Environmental impacts?
- Economic impacts?
- Urban Regeneration and Sustainable development

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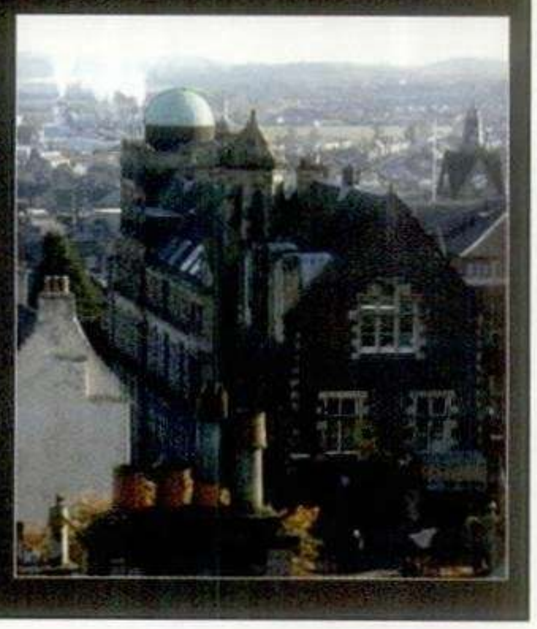
Conclusions

- Performance
- Whole Life Cost
- Life Cycle Analysis
- Sustainability

- Any Questions ?



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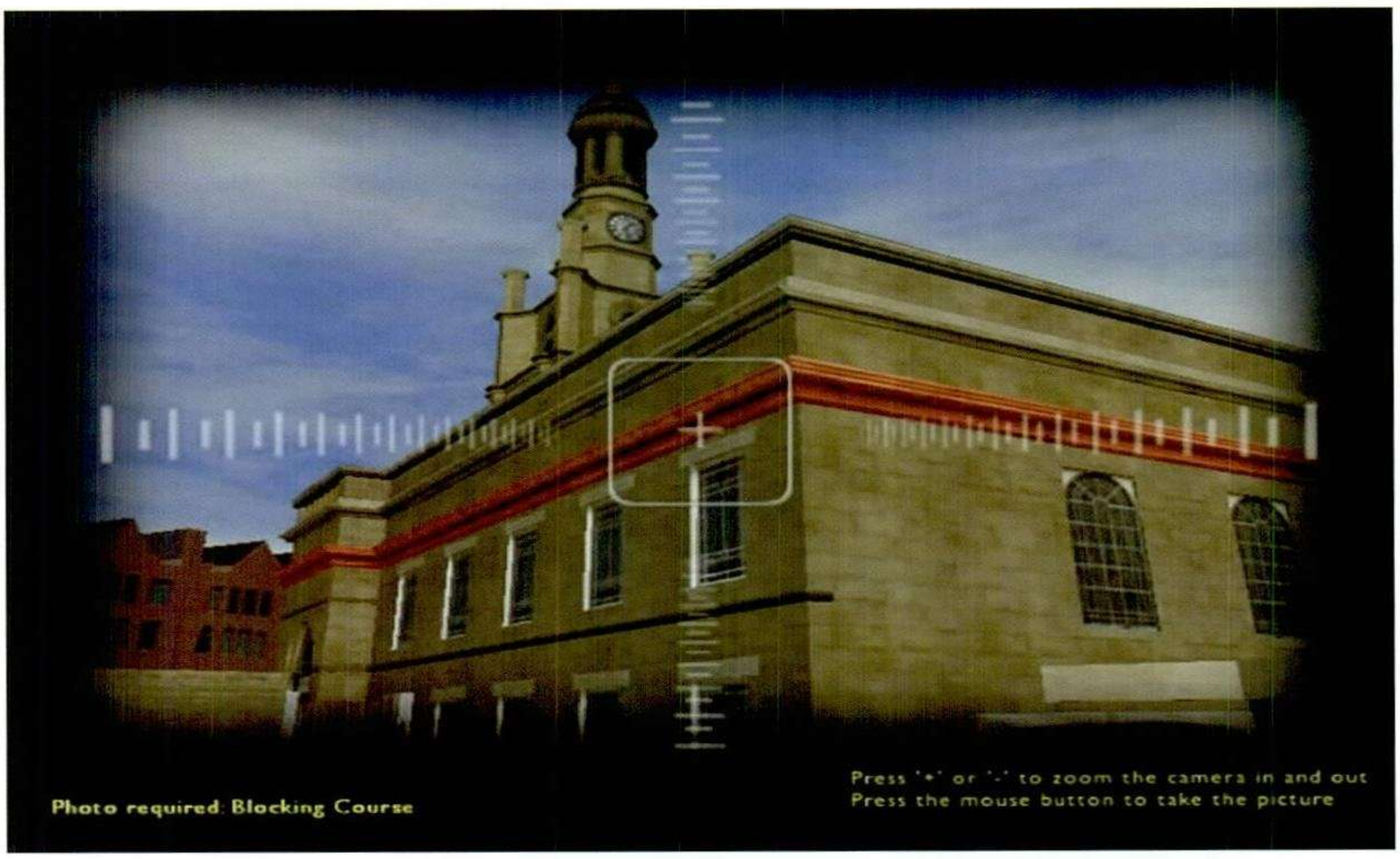
REPAIR AND MAINTENANCE LINKS WITH NEW BUILD

Professor Thomas B Wilson OBE,
Principal, Glasgow Metropolitan College and Chair, Learn Direct & Build.

On 15 March 2005, the Department for Education and Skills published its ambitious e-Strategy Harnessing Technology: Transforming learning and children's services. Among its purposes is the establishment of a baseline for the effective use of technology in learning, not just for children under 16 years of age but for "learners of all ages to meet their highest expectations". A similar statement of strategy is not available in Scotland. The purpose of this paper is to report on how the Learn Direct & Build (LDB) project has progressed its endeavours to establish a baseline for e learning in the field of Construction education and training. In particular the paper will note Learn Direct and Build's focus on conservation, repair and maintenance issues and the training of stone masons. Learn Direct & Build's strategy is ambitious: it seeks to use digital and interactive technologies to achieve a more personalised approach for the learner, to provide experiences relevant to the expectation of learners, and to unleash creativity and innovation within experienced lecturers and teachers. The application of technologies is not to replace the development of hand skills or as a substitute for face-to-face delivery by experienced lecturers.



Learn Direct & Build – building a partnership for innovation

The Learn Direct & Build project was established in 2003 at the instigation of learndirect Scotland and the Construction Industry Training Board. Initially three colleges were invited to contribute to its work: Edinburgh's Telford College, the then-Glasgow College of Building & Printing (now Glasgow Metropolitan College) and South Lanarkshire College. The partnership has been extended considerably since 2003.

LDB is, arguably, among the most effective and broadest partnerships active in e learning in Scotland. The consortium includes many key bodies charged with ensuring that the Built Environment Industry's workforce is trained to meet the Industry's demanding standards and well disposed to lifelong learning including continuing professional development. As well as learndirect Scotland and Construction Skills, LDB members include employers, federations, FE Colleges, Universities, Scottish Enterprise, Highlands and Islands Enterprise, Health and Safety Executive, Historic Scotland, Scottish Lime Centre, Scottish Stone Liaison Group, Scottish Funding Council and SQA. More recently York College and Cotswold Heritage Academy have forged links with LDB.

LDB ensures that its virtual learning provision:

- Involves all relevant partners including employers and the federations in the development stage and is available to learners, employers and FE colleges throughout Scotland as and when needed;
- Meets identified industry and learner and tutor/trainer needs including needs relating to migrant workers;
- Provides cost effective training solutions;
- Uses and develops appropriate and innovative pedagogical approaches including games technology;
- Transforms current built environment education and training, making it flexible, adaptable and sustainable whilst being attractive to and enjoyable for learners, tutors and trainers;
- Meets all relevant quality and technical standards to ensure SCORM compliance, interoperability between learning management systems and easy access for learners and trainers in university, college, training departments, workplace and home.

It is currently building partnerships across the UK, Europe and South Africa.

Learn Direct & Build – designing effective learning

The whole thrust of formal education over the last few years has been to move towards independent learning and individualised learning. This shift may not be primarily the result of advances in technology, but of the changes in society. On the one hand an understanding of communities has led to the realisation that investment in communities has to include an investment in learning; on the other hand there is the recognition that the individual has to accept a measure of responsibility for his/her own learning. An effective lifelong learning strategy requires both the investment of society and the commitment of the individual. The learning strategy must also embrace the principles of sound learning design.

Neurological research has also brought new approaches to learning design. Educational institutions are re-assessing their approaches to learning in the light of research findings into how the brain functions and how learners learn. Mayes notes: "By 1988, Ackerman was able to describe individual differences in learning in the following way:

- We no longer believe that intelligence is unitary: it is unlikely that a single learning ability exists;
- We no longer consider all types of learning to be alike;
- We no longer assume that intelligence and learning are different names for the same construct."

Consequently, the design stage demands much of the practitioner. First, the design should not restrict the learner's progress. Second, it must be suited to the skill or knowledge to be acquired. Third, it must recognise that several intelligences may be involved in a single task, and that the individual learner may not be equally developed in each. The design of learning should take into account the personalisation of learning if, for example, it is to provide for the learning style of the individual and his/her prior learning. If learning is well designed, technology has a part to play in offering, within the limitations of space, time and budget, opportunity for the individual's learning preferences to be met.

For LDB one other dimension of the design process is seen as important, viz. that the wider partnership should influence content and be supportive of the nature of the learning experience. The aims of the partnership were in place before the publication of the *Harnessing Technology* strategy mentioned above, but the two sets of aims are aligned. *Harnessing Technology* set out to achieve four overarching objectives:

- transforming teaching, learning and the individual's development;
- enabling learners of all ages to meet their highest expectations;
- connecting with hard to reach groups in new ways opening up education to partnerships with other organisations;
- moving to a new level of efficiency and effectiveness in delivery.

Learn Direct & Build is working with its partners to ensure that these four aims are realised wherever the education and training of those engaged in the Heritage Industry or the broader Construction industry.

Learn Direct & Build – recognising technology as part of a range of learning approaches

Technology has provided the tools to make major change happen in education but major change has not yet come, not because the cost of the technology is beyond the reach of the public purse but because in the main it is not considered desirable that learning be restricted to what technology can deliver. LDB has recognised from the outset the importance of hand skills at craft level. The use of technology does not reduce the importance of hand skills. However, appropriate use of technology in supporting studies can free additional time for the development of hand skills. More importantly, technology can also contribute directly to skills acquisition. Its ability to capture images can assist the learner in comparing his/her technique with that of the master craftsman/woman.

Learning is also a social activity, whether involving the craftsman/woman and the apprentice or the lecturer and his/her class. Social interaction is important to learners, as the House of Commons Education and Skills Committee Report on the UK e-University concluded:"(Learners) overwhelmingly requested a strategy that emphasises 'blended' approaches to learning and teaching—where e-learning via the web or other technologies is augmented by more traditional methods, including classroom sessions, and the use of books and other resources—rather than wholly computer based learning. In promoting blended learning, (learners) requested an approach that is not restricted to the use of technology and emphasised that e-learning is a process, not a product"[1]. Technology can create social interaction even when participants are geographically isolated, but it should be recognised that, for many learners, the use of technology to allow a geographically-scattered group to function may be a further hurdle to overcome. LDB is sensitive to the needs of younger learners to whom learning in a social grouping is important. In some parts of Scotland, however, the low population density does mean that it may not always be economic to meet the training needs of apprentices in a college or other centre. Some LDB products are designed for use on site or in a learndirect Scotland learning centre, thus reducing the length of time required at a distant college. For such learners the technology must provide both an alternative to elements of the course that would normally be delivered by a lecturer, and an experience that is engaging.

LDB acknowledges that technology is one approach to meeting the learner's needs, but by no means the only valuable approach to learning.

Learn Direct & Build – developing the lecturer's skills

Westminster Institute of Education, part of the Oxford Brookes University, warns that ICT "will not improve the students' learning experience unless the teaching methods are carefully developed" [2]. Few colleges would claim that every lecturer is equipped to support a learning environment in such a way that each individual's needs are catered for.

The Westminster report cited above draws attention to "the lack of thought given to the effects of multimedia methods on teaching and learning". It is not too much to suggest that until now many have accepted without empirical evidence that multimedia methods contribute positively to education attainment and that traditionally-trained tutors can attain positive outcomes without any additional professional development. Until colleges and the providers of teaching qualifications face up to the need to provide tutors with an enhanced range of skills the full potential of the technology will not be realised.

The lecturer's needs extend beyond skills development. The University of Edinburgh[3] in a review of school records notes "a preponderance of detail on pupils' behavioural and attitudinal aspects but little on their learning styles, capabilities and teaching needs". Unquestionably, the balance in record-keeping would need to shift significantly if the use of appropriate learning styles is to contribute to developing confident independent learners. Tutors need to see as vitally important the need to capture evidence pointing to a preferred learning styles, and so worthy of recording.

The range of skills required in staff would include:

- How to specify the objectives in a learning experience at a level of detail that enables the technologist to build a product to meet those objectives;
- How to choose approaches to suit the learning styles of users;
- How to assess a learner's preferred learning style;
- How to support learners within a managed learning environment.

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1 UK e-University Third Report. London: The Stationery Office Limited, 2005. www.parliament.uk/parliamentary_committees/education_and_skills_committee.cfm.

2 Times Educational Supplement 15 September 2000 FE Focus pp. 35-36.

3 Elizabeth Jordan, E/ Padfield, P. Evaluation of the SchoolsOutGlasgow.net project. Edinburgh: University of Edinburgh, 2004.

Learn Direct & Build – working with stone

The interest in a conference like this provides evidence of the importance of Scotland's heritage in stone and its conservation. Both Historic Scotland and the Scottish Stone Liaison Group have drawn attention to the scale of the task facing the nation. Investment is urgently needed in properties across Scotland. Equally urgent is the need to invest in people and their skills. Robert Gordon's University has drawn attention to a number of skills that literally are dying out as their practitioners retire. The purpose of the jointly published report of the SSLG and Scottish Enterprise Glasgow *Safeguarding Glasgow's Stone-built Heritage: Skills and Requirements* was to investigate the condition of Glasgow's stone-built heritage to enable an accurate prediction to be made of the craft skills and materials required to ensure the future viability of this heritage. The report concluded: "The stone heritage of Glasgow has survived reasonably well over the past 150 years but has now reached the stage where, from the evidence of the survey, 97% of all stone facades are in need of repair to some extent over 30% of facades require urgent maintenance to prevent further stone decay, this is an issue that must be addressed within any conservation strategy if the stone heritage is to be preserved." In the light of this report two areas requiring urgent and continued attention:

1. The development of craft skills throughout coming generations, and
2. Sourcing compatible materials, i.e. materials accurately matched to existing stone in terms of its petrographic characteristics.

"For Glasgow alone, and taking into account the existing provision, there is an estimated cumulative shortfall for 100% of repairs of around 4,715 stonemasons over the next 20 years (or 236 per year for the next 20 years) if the projected repair needs are to be met." LDB has been charged with assisting in the training of Scotland's stonemasons. Some changes in delivery patterns may be necessary to address the volume requirement. But the demands are about quality as well as quantity. As the report indicates, "an apparent disparity between the number of trainees entering training and the output of qualified masons is a concern that must be addressed by both the training organisations and employers." This issue employers and training providers must address.

Safeguarding Glasgow's Stone-built Heritage identifies several critically important issues. Some of those issues have implications for health and safety, some for ordinary families seeking to secure their most important investment – their home, others related to tourism, arguably Scotland's most lucrative industry. But there are other challenges for LDB's learning designers: the construction of three-dimensional "e buildings" exhibiting traditional features of stone

buildings, an "e workshop" meeting health and safety requirements, developing techniques for accurately capturing the stonemason's step by step approach to tasks. The designer must select the appropriate application from the available technologies in dealing with recognition and recall or planning.

At one end of the learning spectrum, LDB is also working with Historic Scotland and the Lime Centre to ensure that Technical Advice Notes are reflected in the learning experiences being developed. At the other end of the age range LDB is working with Historic Scotland,

Construction Skills and primary schools to stimulate an interest in, and some awareness of the importance of, Scotland's built heritage. The approaches adopted are markedly different. Computer games are a genre with which most children are acquainted and so adopted with younger learners.. Recently BBC and other media highlighted LDB's use of a computer game centred around Stirling Castle. Alongside others, LDB has a role to play in supporting all who work with stone, whether they be property owners or the rising generations or craftsmen and women or professional staff in the Heritage Industry. Learning packages for that segment of the market have to address technical knowledge transfer at least as effectively as traditional approaches.

Conclusion

LDB is working with its partners to address the training needs of those working in stone. Its approaches are informed by research into learning and by the experience and guidance of its partners. LDB is also working with others to ensure that young people understand the importance of conserving their stone-built heritage. Both tasks are of paramount importance.

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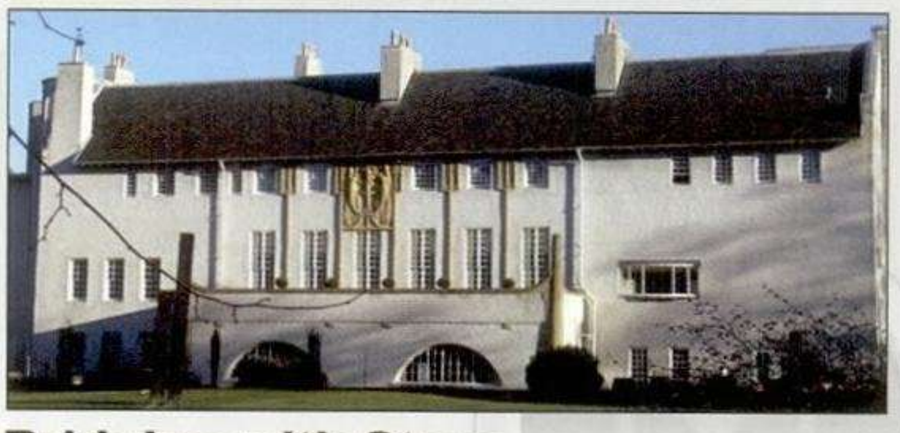
BRIDGING WITH STONE

Professor Tom Wilson

National Stone Conference

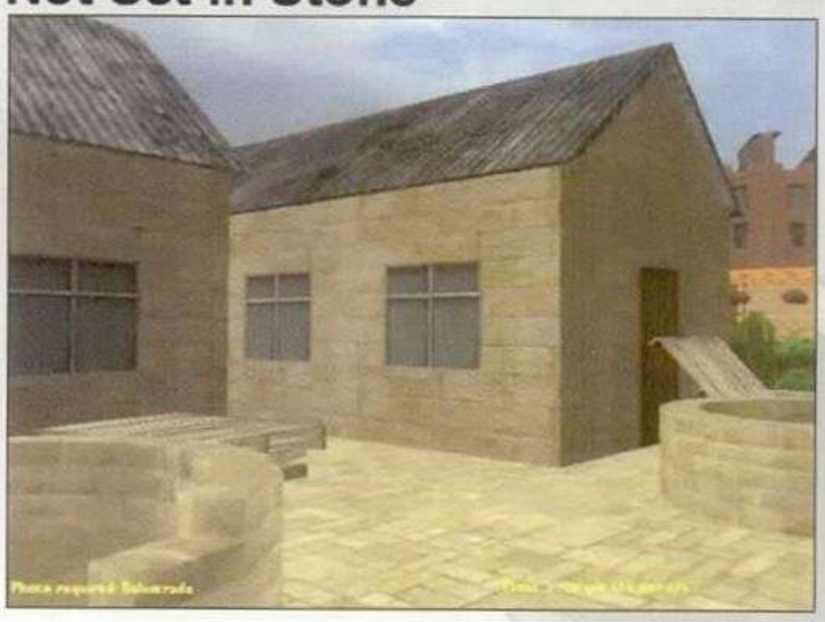


Bridging with Stone

Professor Tom Wilson

1

Not Set in Stone



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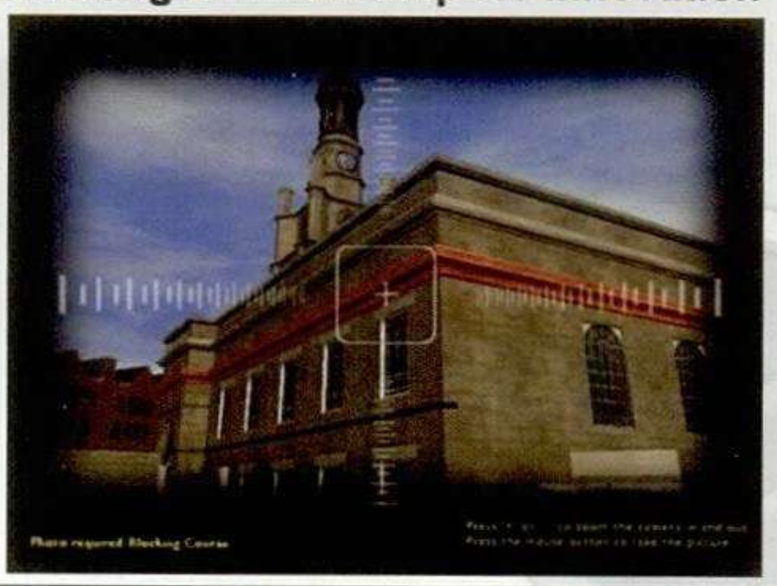
Learn Direct & Build

Building a Partnership for Innovation



3

Meeting Needs

4

Learn Direct & Build Partners

The Learn Direct & Build project was established in 2003 by learndirect Scotland and the Construction Industry Training Board, involving Edinburgh's Telford College, the then-Glasgow College of Building & Printing (now Glasgow Metropolitan College) and South Lanarkshire College.

The partnership has since been extended to include employers, federations, FE Colleges, Universities, Scottish Enterprise, Highlands and Islands Enterprise, Health and Safety Executive, Historic Scotland, Scottish Lime Centre, Scottish Stone Liaison Group, Scottish Funding Council, SQA and more recently York College and Cotswold Heritage Academy.

5

Learn Direct & Build will...

- Involve
- Meet
- Provide
- Address
- Comply
- Transform

6

Learn Direct & Build will...

- Involve: all partners and learners
- Meet: identified industry , learner and tutor/trainer needs
- Provide: cost effective training solutions
- Address: pedagogical issues
- Comply: with SCORM, interoperability standards etc.
- Transform: current built environment education and training

7

Designing Effective Learning

8

Research Findings

- We no longer believe that intelligence is unitary: it is unlikely that a single learning ability exists
- We no longer consider all types of learning to be alike
- We no longer assume intelligence and learning are different names for the same construct

(Ackerman, 1988)

9

Learning Design

- Not restrict the learner's progress
- Recognise that several intelligences may be involved
- Respect the user's preferred learning style
- Be responsive to the guidance of the wider partnership in respect of content and the nature of the learning experience

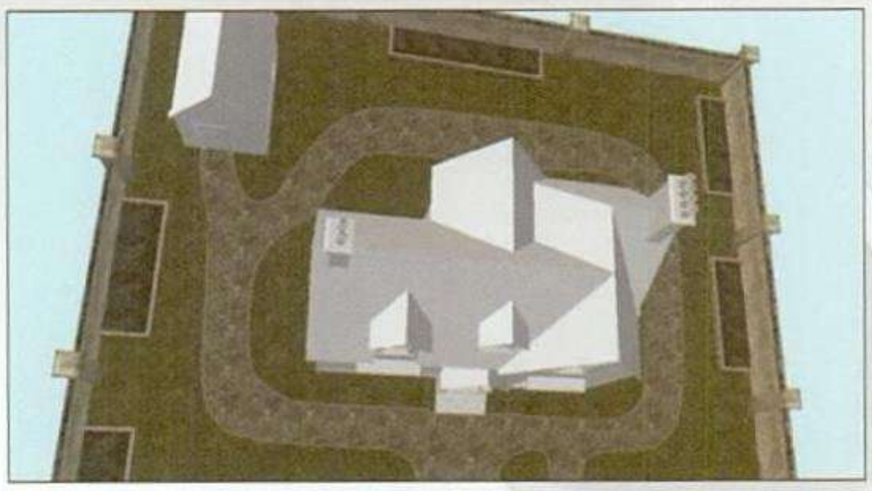
10

Aims

- Are compatible with *Harnessing Technology's* aims
- Transforming teaching, learning and the individual's development
- Enabling learners of all ages to meet their highest expectations
- Connecting with hard to reach groups in new ways opening up education to partnerships with other organisations
- Moving to a new level of efficiency in delivery

11

Recognising Technology as Part of a Range of Learning Approaches



12

Use of Technology

- Free additional time for development of hand skills
- Capture images can assist the learner in skills acquisition
- Reduce the hours of face to face tuition
- Promote blended learning where circumstances allow
- Assist the learner's skills acquisition

13

Developing the Lecturer's Skills

- To collaborate with the learning technologist
- To choose approaches that suit the learning styles of users
- To assess evidence pointing to a learner's preferred learning style
- To support learners within a managed learning environment

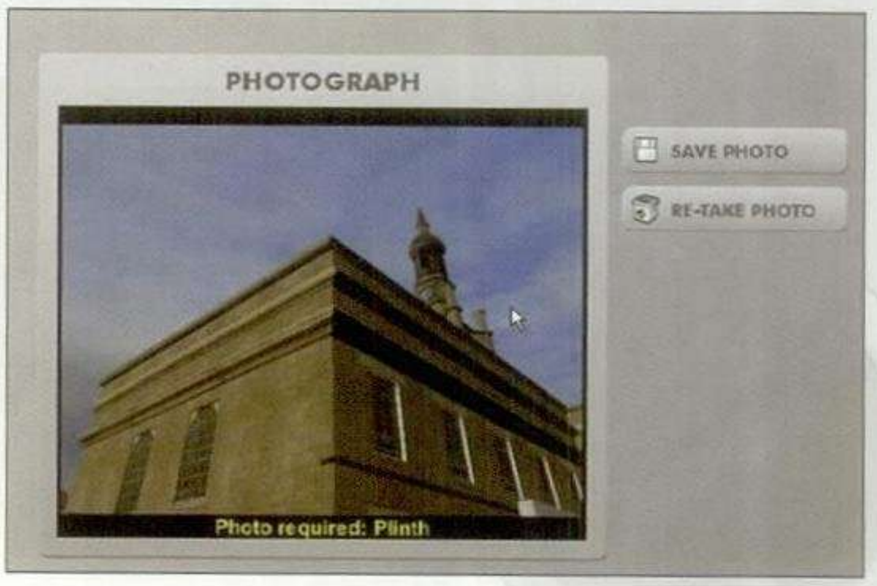
14

Recognising Needs

- Increases the volume of training
- Enhance the quality of training

15

Virtual Worlds and Tools



16

Virtual Worlds and Tools

17

Conclusion

- Working to address industry's training needs
- Raising young people's awareness of conservation issues

www.learndirectandbuild.com

18

PROVISION OF MASONRY TRAINING IN SCOTLAND – OVERVIEW OF CURRENT DEVELOPMENTS

David S Mitchell, Head of Division,
Conservation Research and Resources, Historic Scotland TCRE Group

Current stone masonry training in Scotland comprises a mix of formal vocational training via the modern apprenticeship, advanced craft and dry stone qualifications, informal training delivered by employers, and short term training courses provided by conservation – minded organisations. The Modern Apprenticeship (MA) in Stone Masonry is primarily delivered at Glasgow Metropolitan and Telford College. The MA is also provided at Historic Scotland's Elgin Training Facility – primarily for Historic Scotland Staff with small numbers of local contractors also. The bulk of Stonemasonry training therefore occurs in the Central Belt, and in low numbers. Established in 1994, the MA intake has slowly risen in the early years of the 21st Century but with insufficient output to meet the demand of industry.

In 2006 it was identified that conservation, repair and maintenance skills were increasingly in short supply to satisfactory levels, and that the MA did not sufficiently address this aspect of the sector, despite accounting for half of construction spend in Scotland. The National Progression Award was seen as a bolt on qualification to the MA and for those working in the sector without formal qualification. A steering group with client, education, industry and training interests was established and the National Progression Award in Masonry Conservation was launched by Linda Fabiani MSP Minister for Europe, External Affairs and Culture on 12 November 2007. A Professional Development Award is due to follow in Spring 2008, fully supported with educational resources produced by members of the Steering Group. This can be seen as potentially one of the most important training developments in the sector for decades. Delivery will be supported over the period 2008-12 with funding from Heritage Lottery Fund, Historic Scotland and Scottish Enterprise.

Employer comments suggest a range of difficulties in current provision – a feeling that 16 -17 years of age is too young for MA entrants, remnants of stigma about the construction industry (although this is improving), the gap between training delivery and employer needs on site, and the lack of training places.

Training providers can see the need for repair and maintenance training as well as new build, but resources for course development, and the specialist knowledge to develop these and deliver them are limited. The viability of potentially low volume courses with high overhead costs is an issue.

Clients seek an appropriately skilled workforce, yet can be unsure what this correlates to on – site. Consistency of training and standards from different training centres is an issue, although clients are increasingly aware of the potential to use procurement as a lever to raise standards.

With the introduction of two important conservation, repair and maintenance qualifications in masonry, it is time to progress towards a new masonry training framework in Scotland. A 'one size fits all' approach is outdated and does not meet the needs of trainers, clients or employers. A model for development is proposed. There is a strong desire for change and the NPA illustrates what can be achieved when clients, training providers and employers work together.

PROVISION OF MASONRY TRAINING IN SCOTLAND - CURRENT DEVELOPMENTS

Davis S Mitchell, Head of Division,
Conservation Reaearch and Resources, Historic Scotland TCRE Group

1

PROVISION OF MASONRY TRAINING IN SCOTLAND - CURRENT DEVELOPMENTS AND TOWARDS A NEW MASONRY TRAINING FRAMEWORK.

David S Mitchell
Head of Division, Conservation Research and Resources
HISTORIC SCOTLAND TCRE Group

2

AIMS

PROVIDE A SNAPSHOT OF CURRENT TRAINING PROVISION IN SCOTLAND.

UPDATE ON CURRENT INITIATIVES.

TO CONSIDER THE CURRENT CONTEXT FOR TRAINING.

PUT FORWARD ISSUES BEING RAISED BY EMPLOYERS, CLIENTS AND TRAINING PROVIDERS.

TO START A DISCUSSION ON THE DEVELOPMENT OF A NEW FRAMEWORK FOR MASONRY TRAINING IN SCOTLAND.

3

TYPES OF MASONRY TRAINING PROVISION

'FORMAL' TRAINING PROVISION WITHIN THE SCQF FRAMEWORK

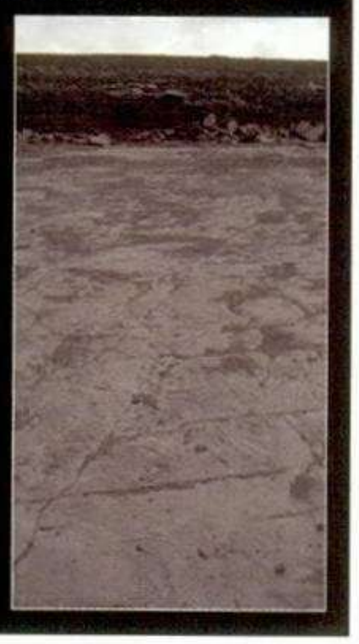
SVQ STONEMASONRY
STONEMASONRY ADVANCED CRAFT

DRY STONE WALLING LEVELS 1&2

SHORT TERM TRAINING COURSES - SLCT, FYVIE, NTS, SPAB, NORTH HIGHLAND COLLEGE AND OTHERS.

'INFORMAL' TRAINING BY EMPLOYERS AND EMPLOYEES.

OTHER MODELS - ST MARY'S CATHEDRAL WORKSHOP, SLCT MASONRY TRAINING SQUAD.



4

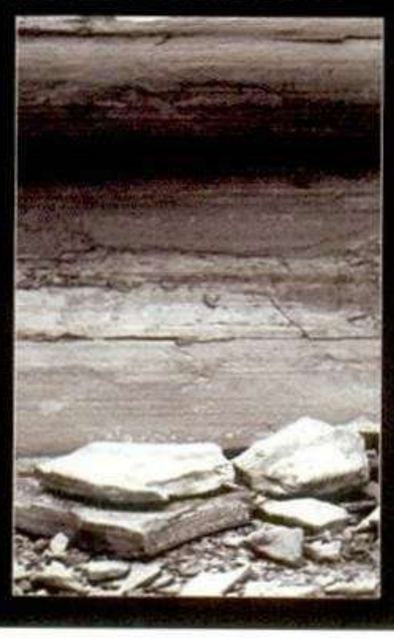
5

SVQ - MODERN APPRENTICESHIP DELIVERY

GLASGOW METROPOLITAN COLLEGE

TELFORD COLLEGE EDINBURGH

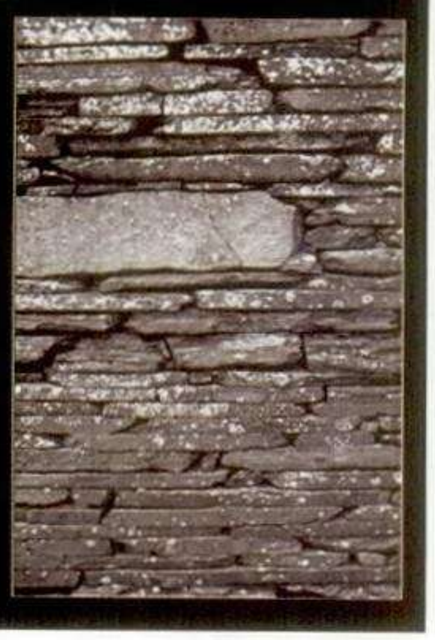
HS TRAINING CENTRE, ELGIN



6

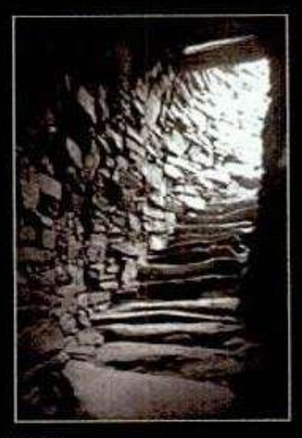
MODERN APPRENTICESHIP

- LAUNCHED IN 1994
- OPEN TO THOSE 16 +
- COMBINE WORK, ON THE JOB ASSESSMENT AND COLLEGE BASED LEARNING
- 'CORE SKILLS' OF COMMUNICATION, WORKING WITH OTHERS, NUMERACY, IT,
- PROBLEM SOLVING



MODERN APPRENTICESHIP

SVQ LEVEL 2 (7 UNITS)



- STORE RESOURCES FOR USE
- WORKING PLATFORMS
- EFFICIENT WORKING PRACTICES
- ERECT MASONRY STRUCTURES
- PREPARE STANDARD MASONRY COMPONENTS
- PREPARE TEMPLATES AND MOULDS

SVQ LEVEL 3 (9 UNITS)

- WORKINGPLATFORMS
- ORGANISE RESOURCES
- CO-ORDINATE AND SETTING OUT MASONRY
- BUILD, REPAIR AND MAINTAIN MASONRY STRUCTURES
- CO-ORDINATE AND FIX CLADDING
- ESTABLISHING THE OPERAIONAL AREA
- CONTRIBUE TO THE PROGRESS OF OPERATIONS
- HEALTH AND SAFETY TEST
- INTEGRATIVE ASSESSMENT IN THE CONSTRUCTION INDUSTRY

7

MODERN APPRENTICESHIP

Intake in Scottish Stonemasonry Training Centres 2002 – 2007

CENTRE	2002	2003	2004	2005	2006	2007
Glasgow Metropolitan	20	12	10	16	23	11
Edinburgh's Telford	10	12	17	16	18	31
Elgin Cathedral	7	9	6	5	6	6
Total	**37**	**33**	**33**	**37**	**47**	**48**

SOURCE : CONSTRUCTIONSKILLS NOV 2007

8

NATIONAL PROGRESSION AWARD & PERSONAL DEVELOPMENT AWARD

- FILLS IN THE CONSERVATION, REPAIR AND MAINTENANCE KNOWLEDGE AND TRAINING GAP
- A 'BOLT - ON' QUALIFICATION - NOT AN MA REPLACEMENT
- RECOGNITION OF THE 'HIDDEN' MASONRY WORKFORCE
- SCQF LEVELS 6-8, PROGRESSION ROUTE TO HND AND BEYOND
- THE MOST IMPORTANT DEVELOPMENT IN MASONRY TRAINING PROVISION FOR THE CONSERVATION, REPAIR AND MAINTENANCE SECTOR ?

9

NATIONAL PROGRESSION AWARD / PERSONAL DEVELOPMENT AWARD

Projected take up of NPA by individuals via HLF Bursary Scheme :

Delivery year	2008	2009	2010	2011	
Total output	**40**	**50**	**60**	**70**	**210**

(EXCLUDES ADDIIONAL DELIVERY BY APPROVED CENTRES)

10

CONTEXTUAL ISSUES

- DOES THE AVAILABLE TRAINING REFLECT THE WORK BEING DONE ?
- THIS SHOULD NOT BE A 'SHOW- DOWN' OF NEW vs OLD
- RECOGNITION OF THE 'HIDDEN' MASONRY WORKFORCE
- MA / SVQ LEVELS 2 & 3 ARE UP FOR REVIEW
- THE NPA AND PDA ARE COMING ONLINE WITH SIGNIFICANT EDUCATIONAL RESOURCES AND INCENTIVES
- WHAT ABOUT RELATED SKILLS - QUARRYING, PROCESSING, SPECIALIST AREAS - DRY STANE - MONUMENTAL MASONRY - GRAVEYARDS ?
- IS INDUSTRY TOO BUSY TO TRAIN ?

11

ISSUES FOR EMPLOYERS

- DOES THE TRAINING AVAILABLE MEET THEIR WORKING NEEDS ?
- IF PLACES ARE LIMITED - ARE WE USING THOSE PLACES EFFECTIVELY ?
- FEELING THAT 16-17YRS IS OFTEN TOO YOUNG
- DO LECTURERS HAVE THE REQUIRED SKILLS TO TEACH, AND ARE THEY IN TOUCH WITH INDUSTRY ?
- RECRUITMENT ISSUE IN TERMS OF QUALITY AND STIGMA
- THERE IS A NEED FOR A CLOSER WORKING RELATIONSHIP BETWEEN EMPLOYERS AND TRAINING PROVIDERS
- IS THERE A CLEAR BENEFIT TO TRAIN ?

12

ISSUES FOR TRAINING PROVIDERS

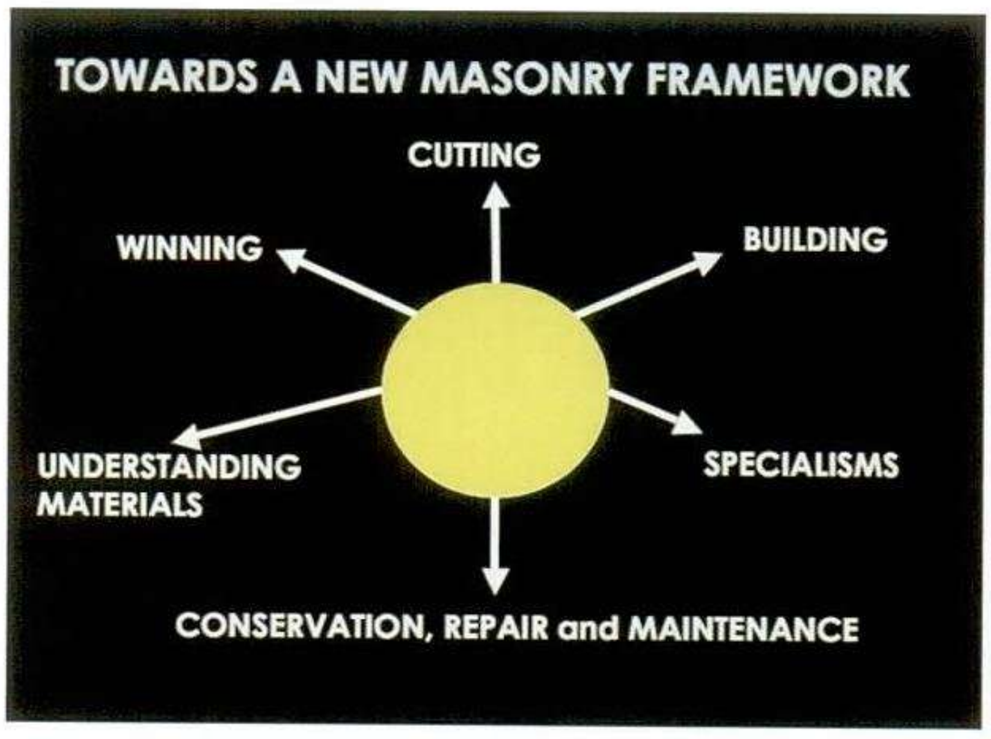
- RESOURCES TO DEVELOP AND DELIVER - FUNDING FRAMEWORK
- HOW BEST TO ENGAGE WITH EMPLOYERS ?
- HOW DO THEY 'TRAIN THE TRAINERS' ?
- VIABILITY OF LOW VOLUME COURSES
- TEACHING RESOURCES
- CAN THEY PLEASE ALL OF THE PEOPLE ALL OF THE TIME ???????

13

ISSUES FOR CLIENTS

- QUALIFICATIONS NEED TO BE COMPREHENSIVE AND CLEAR.
- DO QUALIFICATIONS RELATE TO STANDARDS ?
- CAN THEY USE PROCUREMENT AS A LEVER TO RAISE STANDARDS ?
- DO THEY KNOW WHAT GOOD WORKMANSHIP IS - AND HOW DO THEY GET IT ?
- TIMESCALES AND COSTS
- CONSISTENCY OF TRAINING AND STANDARDS

14


TOWARDS A NEW MASONRY FRAMEWORK
CUTTING
WINNING
BUILDING
UNDERSTANDING MATERIALS
SPECIALISMS
CONSERVATION, REPAIR and MAINTENANCE

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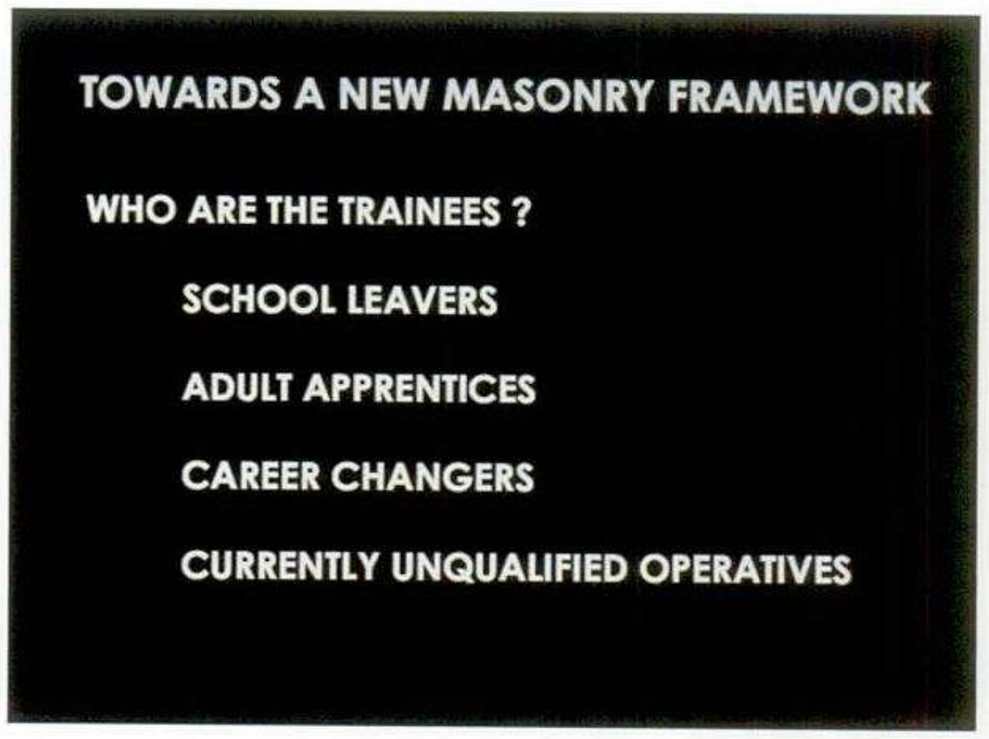
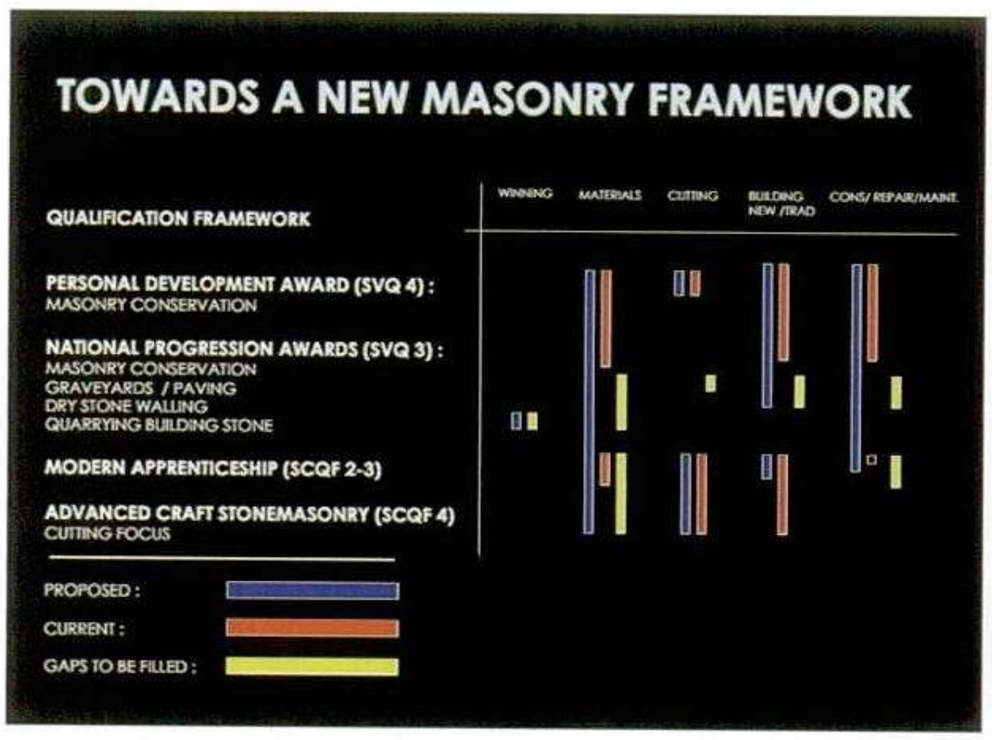
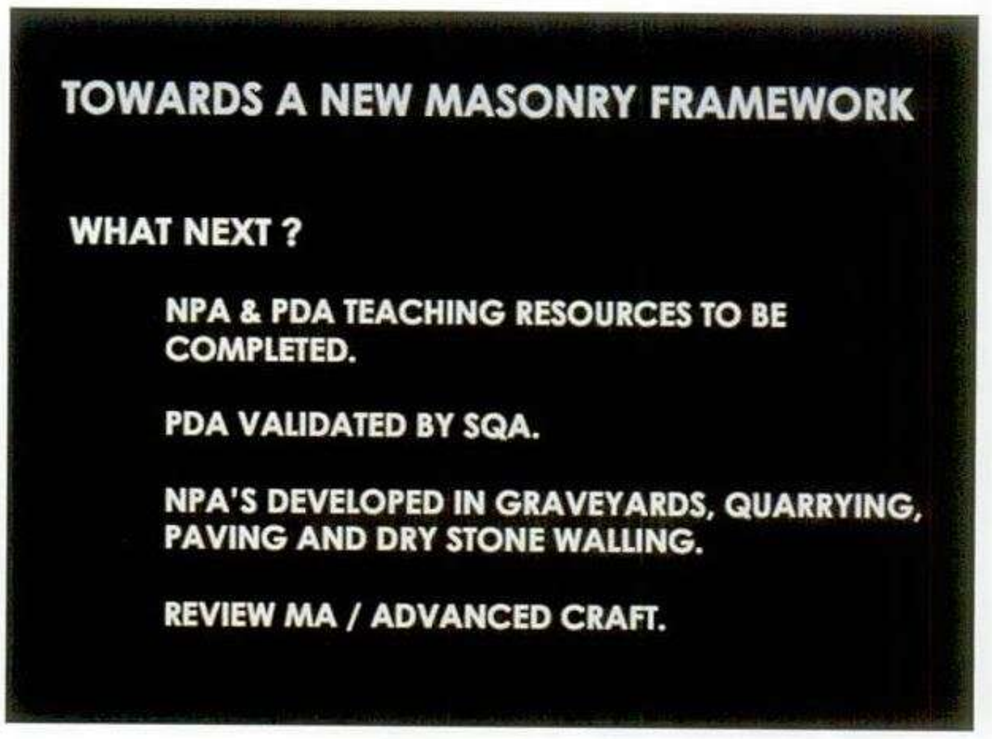

TOWARDS A NEW MASONRY FRAMEWORK
WHO ARE THE TRAINEES ?
SCHOOL LEAVERS
ADULT APPRENTICES
CAREER CHANGERS
CURRENTLY UNQUALIFIED OPERATIVES

16


TOWARDS A NEW MASONRY FRAMEWORK
QUALIFICATION FRAMEWORK
WINNING
MATERIALS
CUTTING
BUILDING NEW /TRAD
CONS/ REPAIR/MAINT.
PERSONAL DEVELOPMENT AWARD (SVQ 4) :
MASONRY CONSERVATION
NATIONAL PROGRESSION AWARDS (SVQ 3) :
MASONRY CONSERVATION
GRAVEYARDS / PAVING
DRY STONE WALLING
QUARRYING BUILDING STONE
MODERN APPRENTICESHIP (SCQF 2-3)
ADVANCED CRAFT STONEMASONRY (SCQF 4)
CUTTING FOCUS
PROPOSED :
CURRENT :
GAPS TO BE FILLED :

17


TOWARDS A NEW MASONRY FRAMEWORK
WHAT NEXT ?
NPA & PDA TEACHING RESOURCES TO BE COMPLETED.
PDA VALIDATED BY SQA.
NPA'S DEVELOPED IN GRAVEYARDS, QUARRYING, PAVING AND DRY STONE WALLING.
REVIEW MA / ADVANCED CRAFT.

18

DIGITAL DOCUMENTATION OF THE BUILT ENVIRONMENT

Douglas Pritchard, Glasgow School of Art

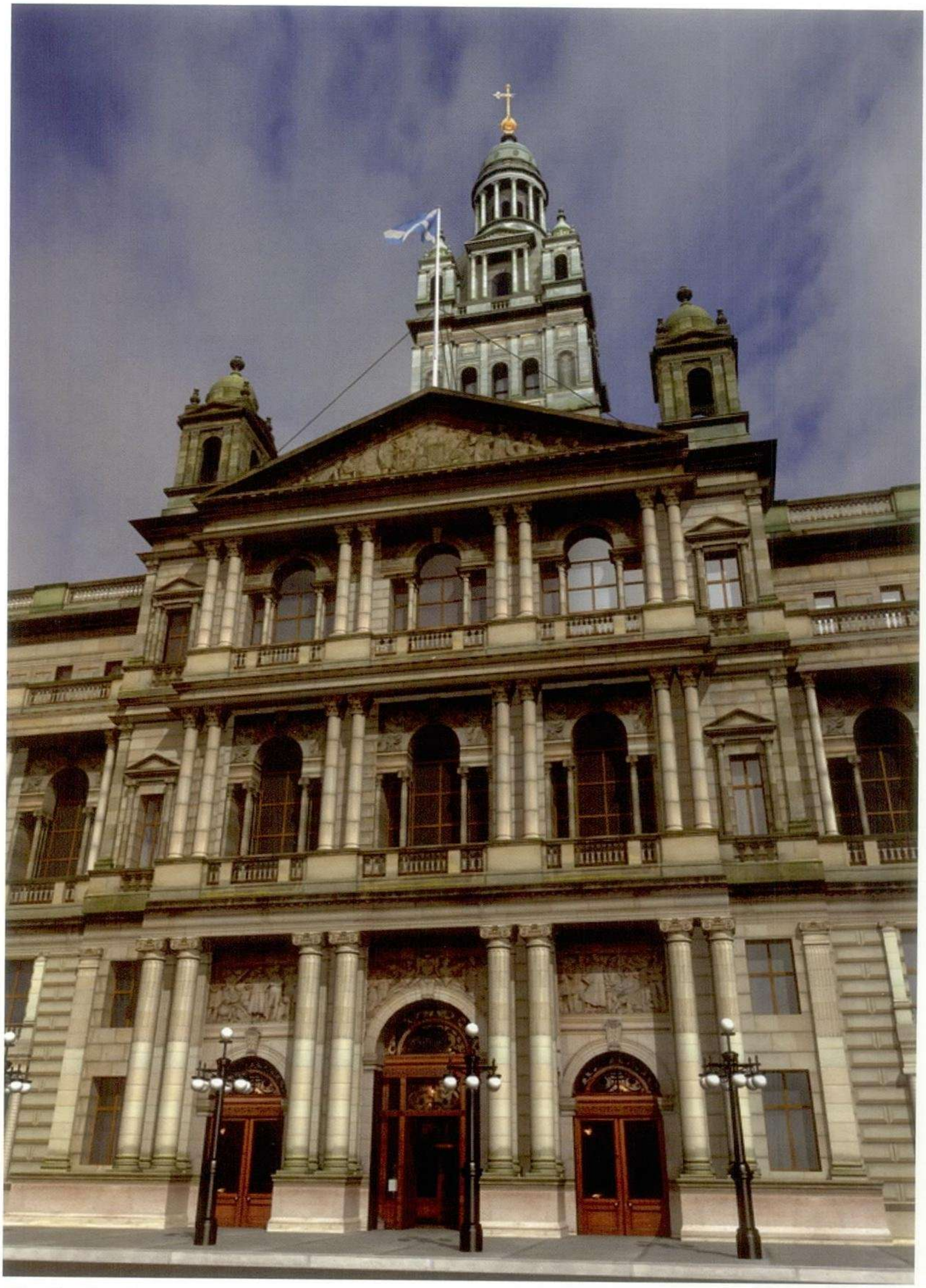
Recent developments in high-definition digital technology have enabled local governments to explore the use of detailed, dimensionally accurate 3D models for urban design and planning review as well as to encourage greater public access and understanding of the urban development process.

In April 2005 the City of Glasgow under the Access Glasgow Programme commissioned the Digital Design Studio, Glasgow School of Art to develop two 3D models of the city. The first is an interactive online model and the second is a highly detailed, highly accurate, photo-realistic model. Both versions were initiated in response to the Council and citizen's lack of easily accessible, accurate and understandable information in the design and planning of the city of Glasgow. The project was completed in October 2007.

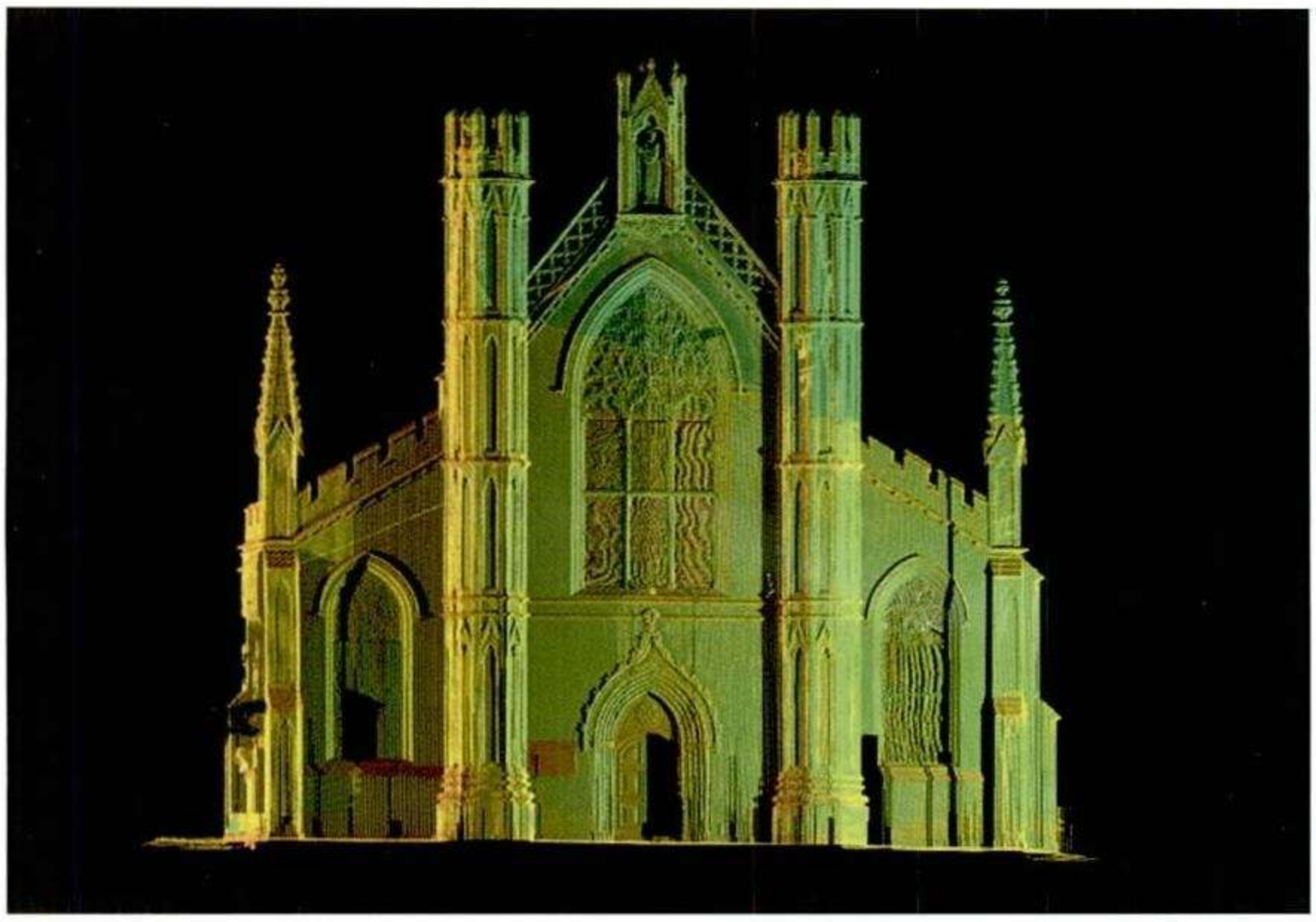
The process of acquiring accurate data was critical to the success of this visualisation project. The Glasgow City tender required the virtual representation of 23% of the City with a required 20 cm accuracy for building height and footprint as well as 20 cm building façade detail. Lidar provided a certain level of accuracy and context but could not effectively supply individual building façade details. 2D architectural drawings of existing buildings were proven surprisingly inaccurate, at times off by 1 or more meters. Computer photogrammetry was an inexpensive option, but the (computer operated) development process was time consuming and the technology found to be inaccurate at long distances.

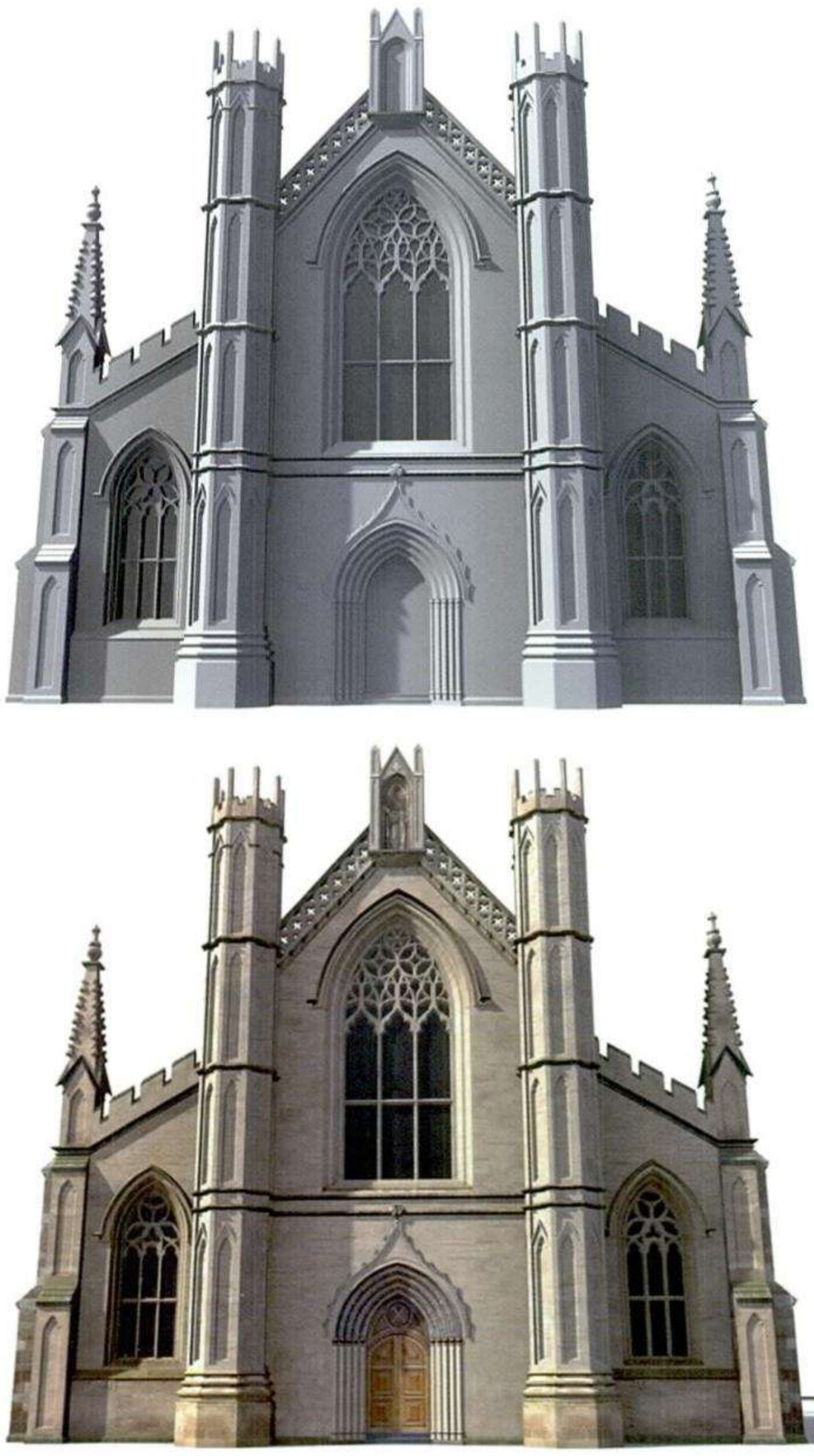
Onsite High Definition (HD) laser scanning hardware is expensive, but can provide fast, highly accurate results. The derived point-cloud information can be integrated with other forms of CAD, GIS and traditional survey information as well as other data such as high-resolution digital photographs (e.g. for textures).

HD scanning has the profound advantage of providing all the necessary information to derive the 3D urban model, therefore avoiding potentially troublesome IP issues by mixing other organizations data.



City Chambers, Glasgow: Rendered image





St Andrew's Cathedral, Glasgow: Rendered images

Bellahouston Exhibition: Reconstructed image

NATIONAL PROGRESSION AWARD (NPA) CONSERVATION OF MASONRY

Ian Walker, Building Crafts Development Manager, Historic Scotland TCRE.

The need to develop a new masonry qualification became clear after various recently published reports showed a clear need to develop the traditional craft skills in Scotland. The present SQA level 2, 3 and Advance Craft qualifications have little conservation, repair or maintenance content. A condition of the award of a HLF grant to Historic Scotland to develop masonry training in Scotland and Northern Ireland through a training bursary scheme required individuals to work towards a qualification in traditional skills and materials. However, as no suitable qualification was available one had to be devised – the National Progression Award (NPA) Conservation of Masonry. As such it was determined that the NPA should be provided as a bolt-on to the existing qualifications, not a replacement for them.

The process to create the NPA began by forming a Steering Group in October 2006. This wide ranging group of relevant partners was made up with representatives from Colleges, Training Providers, Contractors, Heritage Bodies, Industry Groups and Qualification Providers. From within this group, lead writers were charged with developing units in -

- Principles of Conservation in the Built Heritage
- Working with Traditional Mortars
- Masonry Materials & Performance
- Consolidation of Masonry Structures
- Masonry Repairs
- Surface Finishing to Masonry Walling

The NPA was launched on 12 November 2007 with an accompanying brochure setting out its intentions and its delivery is planned to take place at 3 or 4 key Delivery Centres throughout Scotland. Historic Scotland has committed to develop a full supporting teaching package including e-learning and paper based material. This material will be made freely available to colleges who have gained approval from SQA to deliver the NPA. This initiative is unique to qualifications within Scotland and the adopted approach will add to a consistency of delivery in appropriate standard of masonry skills throughout the country.

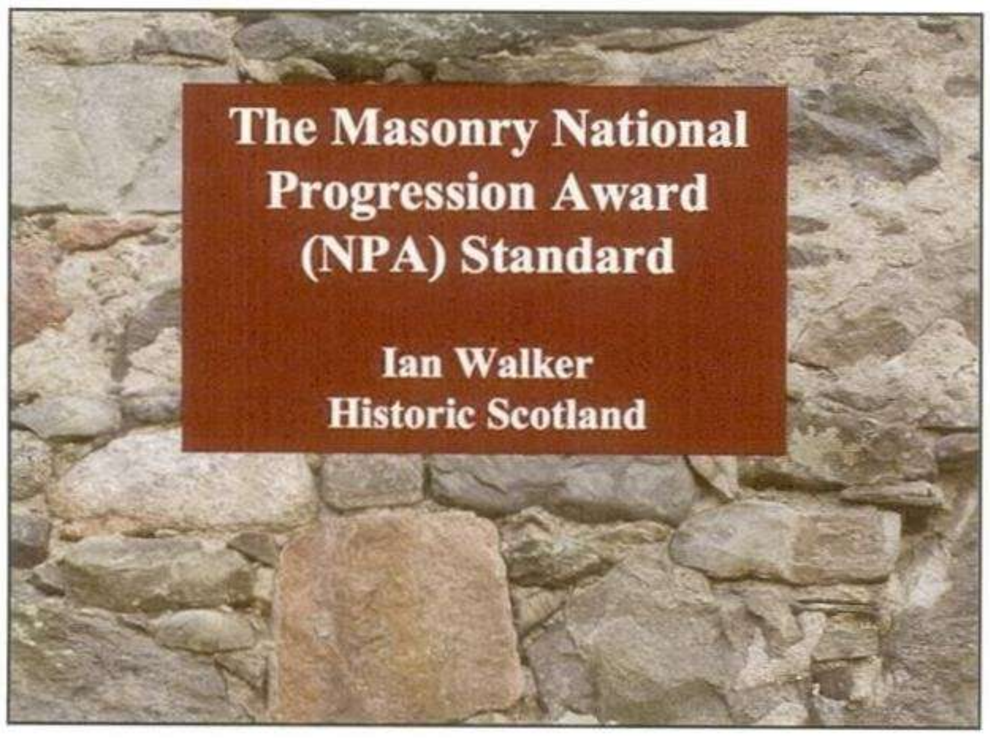
Combined with Heritage Lottery bursary funding some £2.3m is presently available to Historic Scotland to pursue this qualification over the next 3 years in the development of much needed masonry skills. The funding will allow the offer of 150 short term bursaries to recipients who work with contractors to achieve the NPA Conservation of Masonry award. 20 year-long bursary grants will also be awarded to others working towards achieving the NPA whilst gaining industry experience with masonry contractors. The project will be delivered in partnership with training providers across Scotland & Northern Ireland with a start date of November 2007.

Future developments include the production of a Professional Development Award (PDA) which will build on the skills that individuals will gain through the NPA. The PDA criteria will be validated early in 2008. The Professional Development Award Conservation of Masonry will be made up of the following units

- Principles of Conservation
- Indent &repair of stone masonry
- Repair of high level masonry
- Forming opening in mass masonry walling
- Structural Stabilisation
- Consolidation of roofless structures

THE MASONRY NATIONAL PROGRESSION AWARD (NPA) STANDARD

Ian Walker
Historic Scotland



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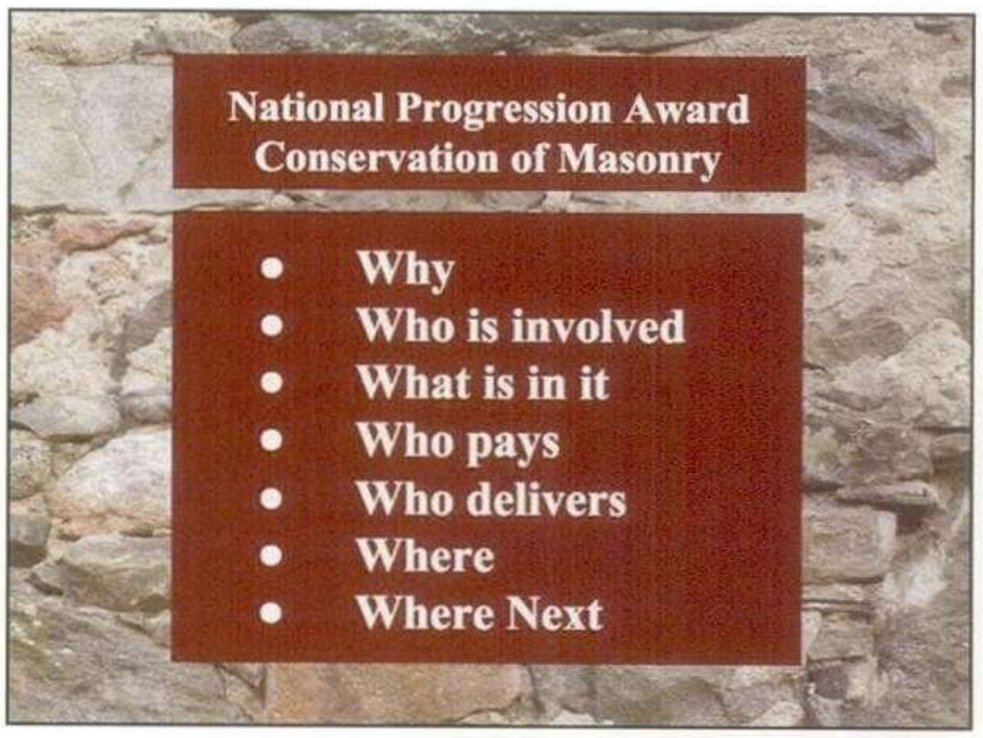

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Why Develop a New Masonry Qualification?

- The present masonry qualifications have little repair & maintenance content.
- The need to develop traditional craft skills to address the various report findings on skills & materials
- The HLF Bursary Scheme required a suitable qualification.
- The use of NPA standard as part of the Procurement process

3

Who has been involved?

- Scottish Lime Centre Trust
- National Trust for Scotland
- Glasgow Metropolitan College
- Lauder College
- Telford College
- North Highland College
- Scottish Qualification's Authority
- National Heritage Training Group
- Learn Direct & Build
- Scottish Stone Liaison Group
- Watson Stone Craft
- Hunter &Clark
- Darroch & Allan
- Laing Traditional Masonry
- Historic Scotland (TCRE)
- Historic Scotland (PIC)

4

National Progression Award Conservation of Masonry

- Principles of Conservation in the Built Heritage
- Working with Traditional Mortars
- Masonry Materials & Performance
- Consolidation of Masonry Structures
- Masonry Repairs
- Surface Finishing to Masonry Walling

5

Principles of Conservation in the Built Heritage

- Understand the principles of conservation
- Understand current legislation & guidance for historic buildings.
- Inspect buildings to identify repairs.
- Develop repair strategies.

6

Working with Traditional Mortars

- Site analysis of local lime stone
- Process the limestone to a useable condition
- Analyse local aggregates
- Mix mortars

7

Masonry Materials and Performance

- Exposure, environmental & seasonal effect on masonry
- Compatibility of materials
- Decay mechanisms

8

Consolidation of Masonry Structures

- Identify & treatment of organic growth
- Removal of defective pointing
- Traditional pointing
- Pointing of ashlar masonry

9

Masonry Repairs

- Strategy for masonry repairs
- Removal of defective masonry at roof level
- Replace defective masonry in line with repair strategy
- Surface repair of stonework

10

Surface Finishing to Masonry Walling

- Removal of defective materials
- Build in missing or defective masonry
- Apply surface finishes
- Lime wash

11

Delivery

- 3 or 4 key centres across Scotland
- Development of teaching materials
- Consistency of delivery

12

Heritage Lottery Fund Bursary Scheme

- Total Budget of £2.3million over the next 3 years.
- Offer 150+ short term bursary grants for people working towards the NPA.
- 20 Year long bursary grants will be awarded to people working towards the NPA and gaining industry experience with masonry contractors.
- Delivery of the project in partnership with training providers across Scotland & Northern Ireland.
- Start date November 07

13

Professional Development Award Conservation of Masonry

- Principles of Conservation
- Indent &repair of stone masonry
- Repair of high level masonry
- Forming opening in mass masonry walling
- Structural Stabilisation
- Consolidation of roofless structures

14

LIME TECHNOLOGY UPDATE

Roz Artis-Young
Director, Scottish Lime Centre Trust

As with the use of stone, lime is not a new building material. It has been around for thousands of years, applied to both new build and to the repair of historic buildings. Sadly, the use of lime, and much of the associated skills and knowledge, has been lost since the turn of the 20th Century. The revival of its use in the UK is relatively new, and its technological qualities have only recently been researched.

Over the past 14 years, The Scottish Lime Centre Trust (SLCT) has been heavily involved in the research of lime and in the provision of training. Although SLCT started outwith a specific focus on lime, it has developed in to far more than a lime centre. The SLCT is involved in-

- Promoting education, training and awareness for the repair and conservation of traditional buildings.
- Working with and listening to industry and stakeholders
- Recognising the need for the correct materials for the job on a performance basis: lime is not always the answer!
- Working to British Standards and Codes of Practice where appropriate.
- Making informed decisions based on proper analysis and holistic investigation.
- Developing cost-effective repair solutions to suit clients and their agents.

Typical masonry problems are primarily caused by a lack of maintenance. They may also be caused by poor original construction or built-in defects - historic buildings can be as badly built as new ones. Problems can be exacerbated by a misunderstanding of appropriate repair techniques.

In many respects the SLCT has succeeded in delivering its core aims and objectives, but in reality this has only just scratched the surface. There is a massive underpinning knowledge gap throughout the entire industry - especially at craft level - not just about lime, but about building conservation, restoration and repair. This underpinning knowledge gap becomes more apparent the more training we do.

In almost all instances, the SLCT are asked to provide a mortar analysis to match the existing mortar. There is merit in this for many projects. It can allow matching repairs to be carried out selectively where patching pointing is required. Part of the analysis process identifies the sand and aggregate type as well as binder type, and this can inform the colour matching, texture and finished look of the work.

However, the SLCT believes in focusing on best practice, rather than on lime, by taking a holistic view of buildings. Over the last 14 years or so the Trust has been trying to champion the intimate relationship between materials in a building and the skills necessary to specify them and use them. When assessing a building, it is essential to establish the root cause of problems rather than merely treating the symptoms. It is a fact that new gutters and down pipes are recommended more often than lime mortars.

Masonry varies in lots of ways; it has weathering characteristics that have to be understood before a repair strategy can be formulated. How a mortar binds or bonds to the masonry will be affected by a number of relevant performance characteristics of the materials, and by its location, exposure, environment and other, sometimes unforeseen or overlooked issues.

Lime mortars have a Standard and a Code of Practice, both British and European. This is covered under BS EN 459. The benchmark performance characteristic of all binders is the compressive strength at 28 days. Put very simplistically, CL90 is the definition of the weakest, purest Limes. NHL is the designation for Natural Hydraulic Limes. They come in three classifications: NHL 2 (what used to be known as feebly hydraulic lime), NHL 3.5 (moderately hydraulic lime) and NHL 5 (eminently hydraulic lime).

There is a significant different in strength between currently used materials that go into making a mortar on site, and materials that went into making mortars historically; a difference of over 5000% in fact. Compressive strength is not a pre-requisite for historic buildings as it is in current modern construction practice.

Nothing more than a material 28 day strength of 1-2 or 3 N/mm 2 even existed for the first 2000 years or so in Scotland.Virtually every masonry building dating to the 19th Century or before was built with lime or clay mortars and was within the very low compressive strength range.

The most common conditions we find on our advisory projects are cracked renders, permanently damp walls, cracked joints, moss or lichens growing at capillary breaks between masonry and mortar or step fracturing. All of these are easily recognisable problems, yet few people can say why they occur due to a lack of basic underpinning knowledge of materials.

As a rule of thumb, the weakest practicable lime mortar possible should be used so that the masonry will benefit from all the performance characteristics those weak materials offers, which are:

- Improved vapour permeability
- Improved Modulus of Elasticity (less brittle)

We can amend the working properties of the mortars to give us the balance we need to ensure the best performance characteristics, relative to the wide variety of issues that we have identified and considered. Lime technology has not moved on, it is actually only getting back to where it was, the only real difference is we are actually now understanding what in the past, was taken as the norm. We are not using new technology, we are using an ancient technology of animal fats, soaps, plant fibres, proteins - all the things our predecessors did regularly with a fuller knowledge of their effect and impact.

There is an abundance of understanding about lime technology available for any one who can relate the performance of one material to another in a holistic sense. It's the lack of joined up thinking that is the major barrier to the adoption and acceptance of the need for lime technology in the first place.

Lime slaking in progress

LIME TECHNOLOGY UPDATE?

Roz Artis-Young
Director Scottish Lime Centre Trust

CHARLESTOWN WORKSHOPS
CENTRE OF EXCELLENCE FOR TRADITIONAL BUILDING SKILLS

HOME OF THE SCOTTISH LIME CENTRE

Lime Technology Update?

Roz Artis-Young MA (Hons) MSc Dip.Bldg.Cons. (RICS)

1

Lime Technology Update ?

- Promoting education, training and awareness for the repair and conservation of traditional buildings.
- Working with and listening to industry and stakeholders
- Recognising the need for the correct materials for the job, on a performance basis: not always lime!
- Working to British Standards and Codes of Practice where appropriate.
- Making informed decisions based on proper analysis and holistic investigation.
- Developing cost-effective repair solutions to suit clients and their agents.
- Living in the real world and being pragmatic.

2

Lime Technology Update?

- We recognise that typical masonry problems are primarily caused by a lack of maintenance.
- We recognise they may also be caused by poor original construction or built-in defects: historic buildings can be as badly built as new ones.
- We recognise these problems are exacerbated by a misunderstanding of appropriate repair techniques.
- We believe in not focusing on lime, but in best practice.
- We start with the building, the materials, all of them, the details all of them and the problems of all of them.
- We recommend new gutters and down pipes more than we recommend lime mortars, more slate repairs, better drainage solutions and always work on the principle "If it ain't broke – don't fix it"

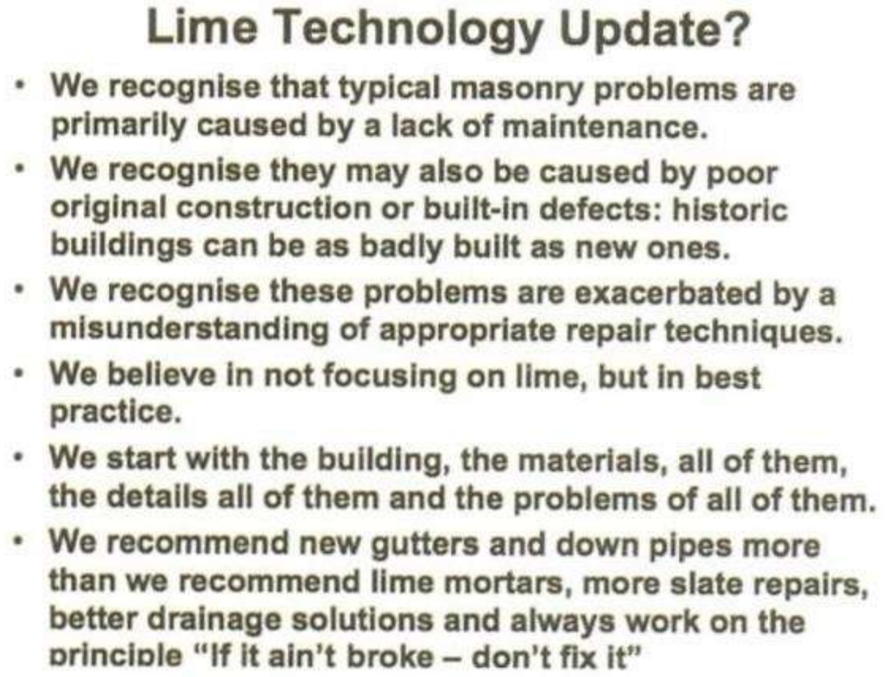
3

Lime Technology Update?

- Over seven thousand owners, architects, surveyors, stonemasons, brickies and plasterers have gained something from being on our training programmes.
- They have taken the time to come and learn something about improving the way they work with our traditional buildings.

4

Lime Technology Update?



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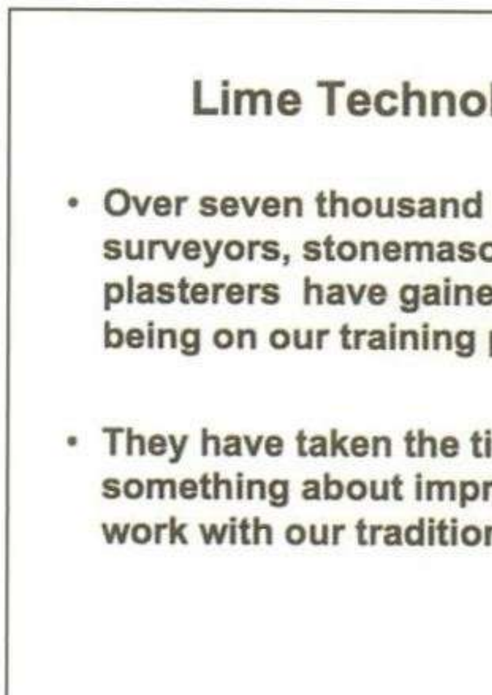


Lime Technology Update?

Match the original historic mortar

Consolidate the wall maintaining its structural integrity

Prevent wind driven rain penetrating the masonry

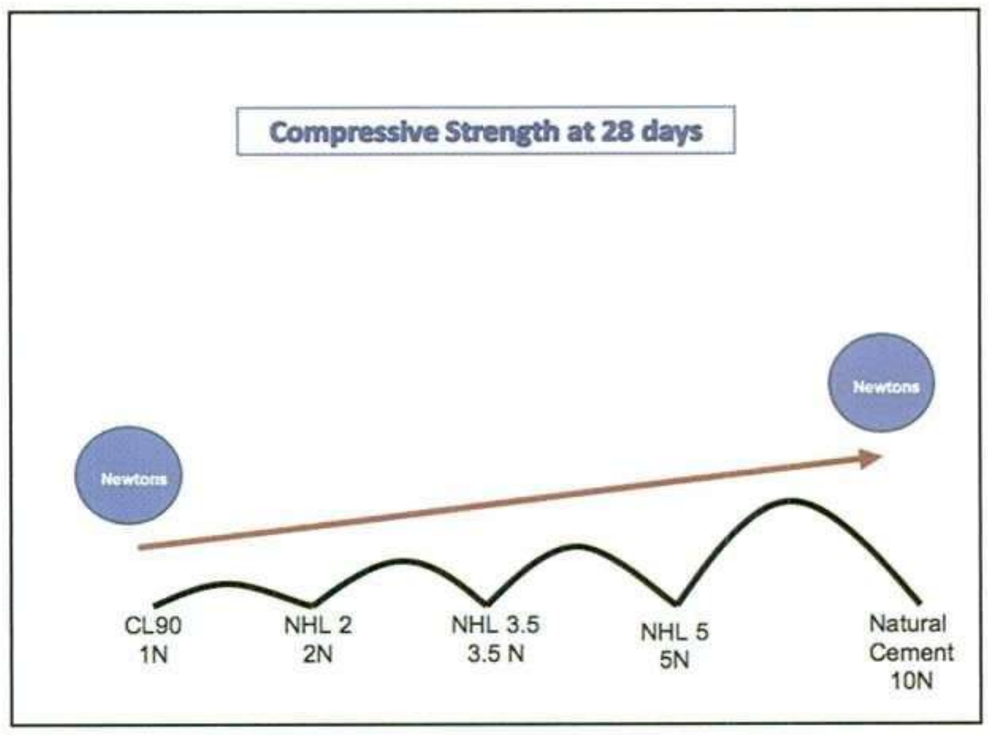
Keep the water out that cascades down the stairs

Look aesthetically pleasing

6

Lime Technology

7



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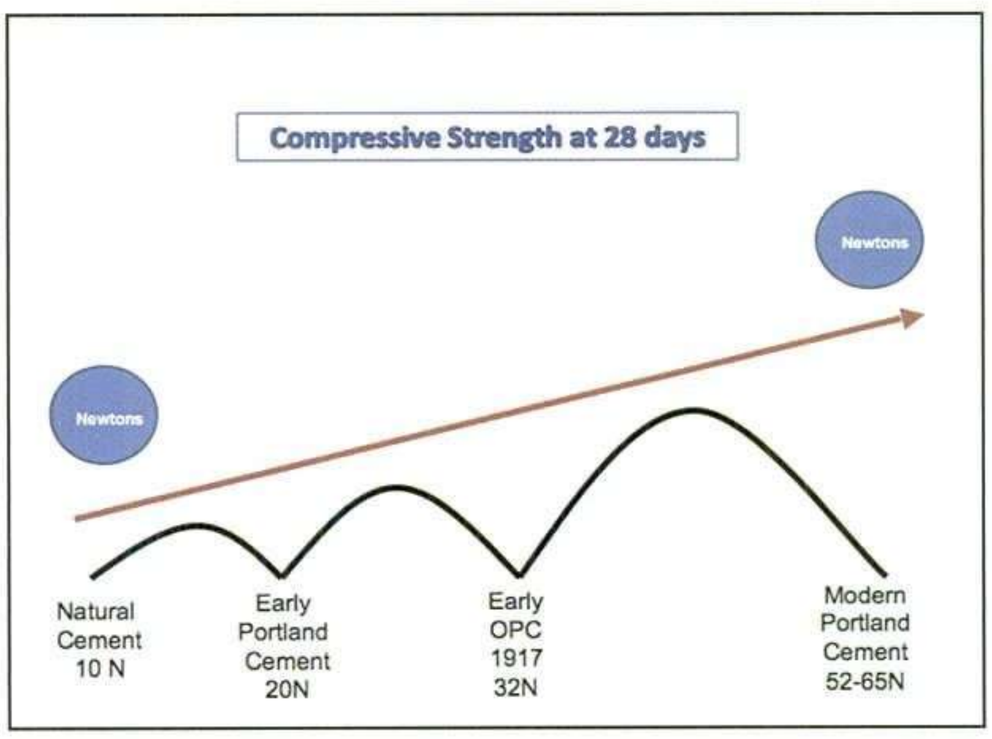

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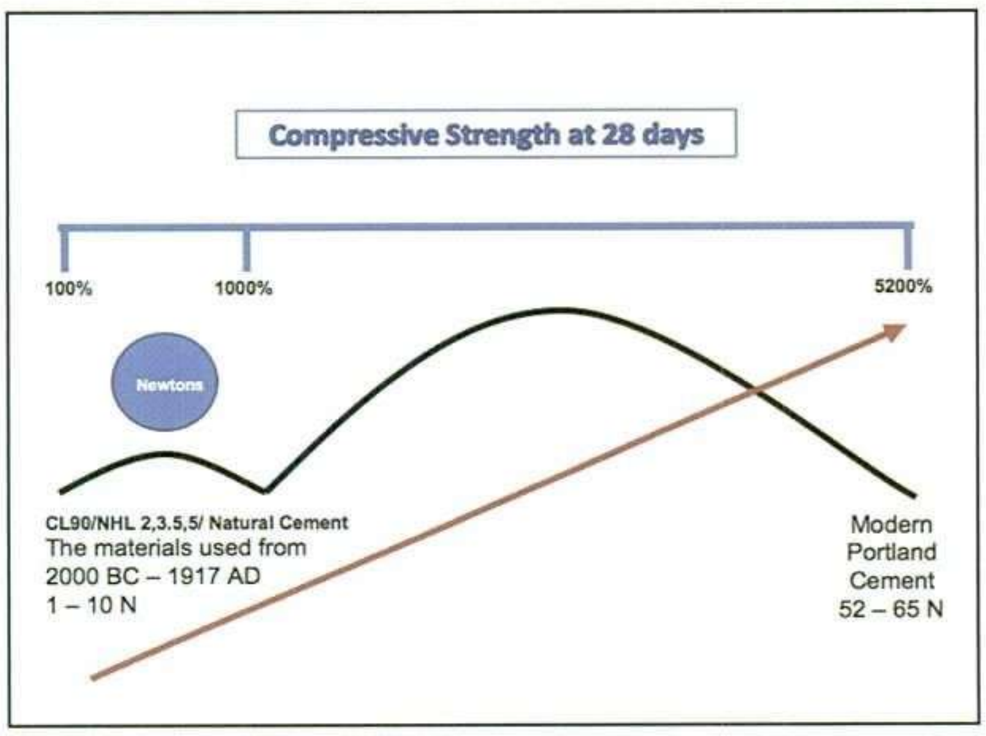

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Strength class

16

Standard	Ident	Class	Compressive strength, MPa			
			2 day	7 day	28 day	28 day
			min.	min.	min.	max.
BS EN 197-1	CEM	52,5 R	30		52.5	
	CEM	52,5 N	20		52.5	
	CEM	42,5 R	16		42.5	62.5
	CEM	42,5 N	10		42.5	62.5
	CEM	32,5 R	10		32.5	52.5
	CEM	32,5 N		16	32.5	52.5
BS EN 197-4	CEM	52,5 L	10		52.5	
	CEM	42,5 L		16	42.5	62.5
	CEM	32,5 L		12	32.5	52.5
BS EN 14216	VLH	22,5			22.5	42.5

Chris A Clear

BCA

11

Lime Technology Update?

- Understanding Lime technology is directly linked to understanding masonry buildings as a whole, not components in isolation.
  - Background
  - Location
  - Environment
  - Exposure
  - Season

12

Lime Technology Update?

Intimate Bond

13

14

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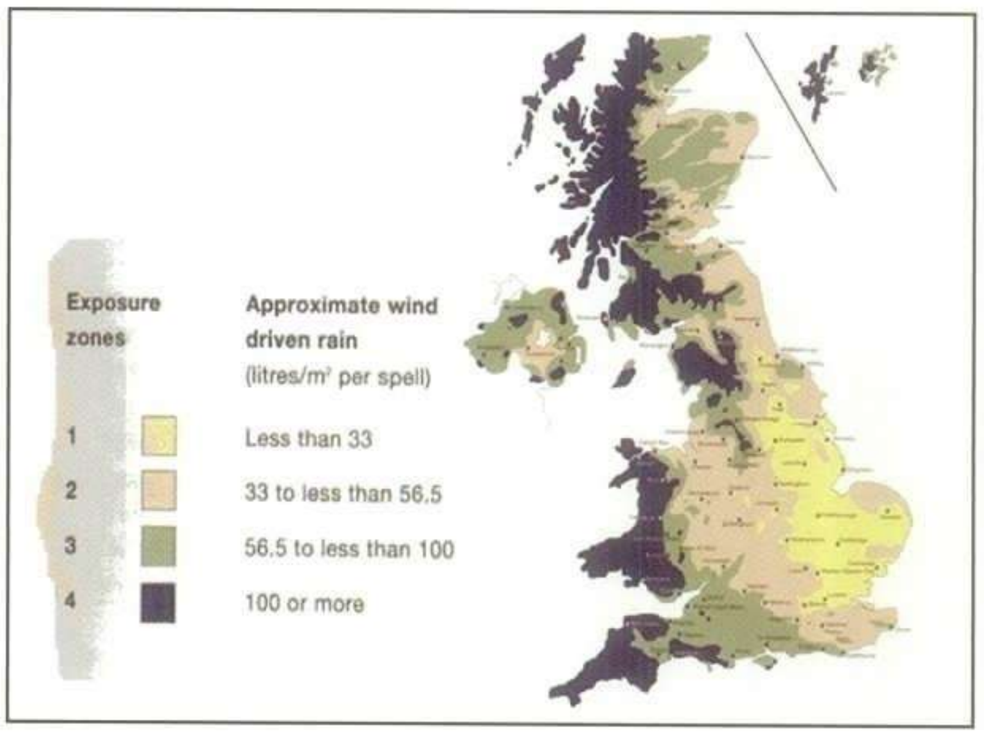

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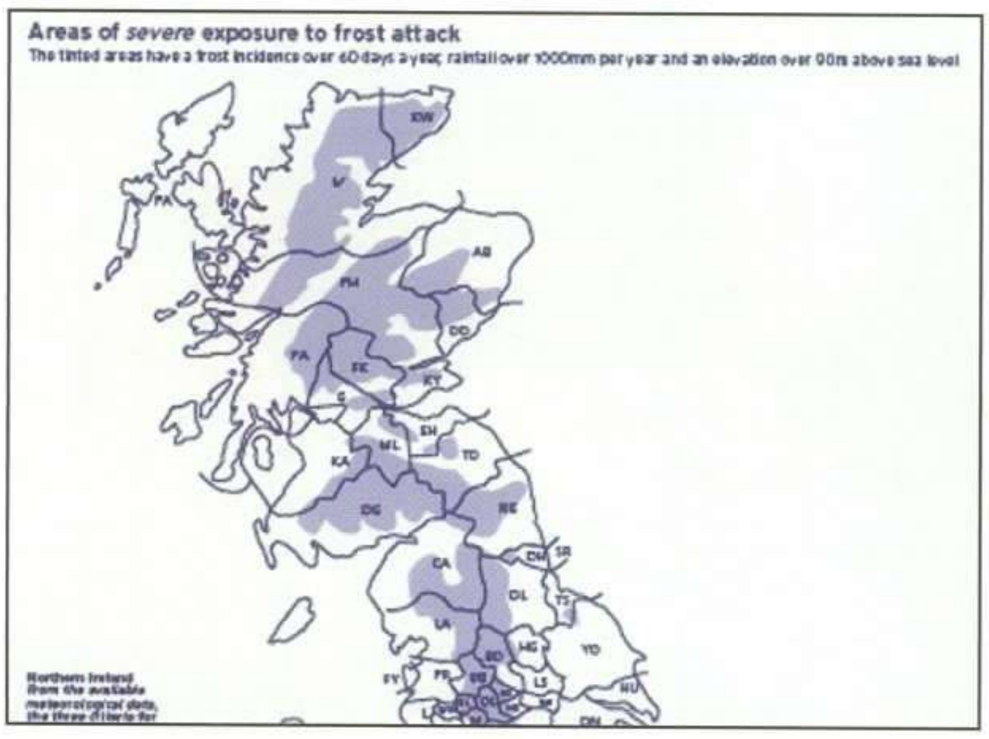

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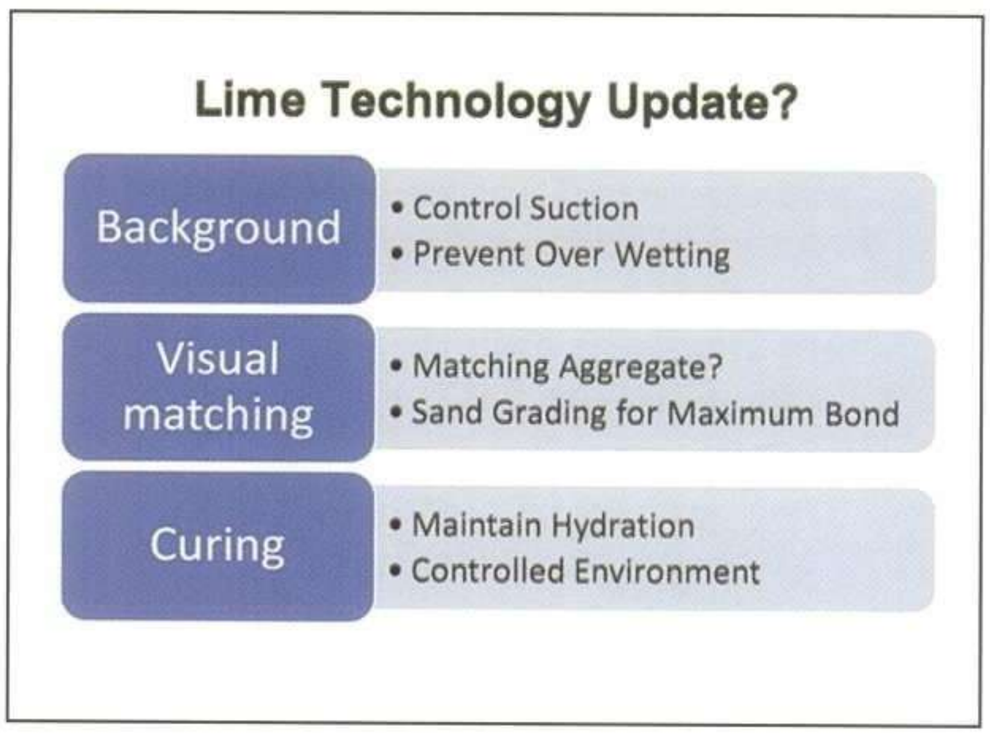

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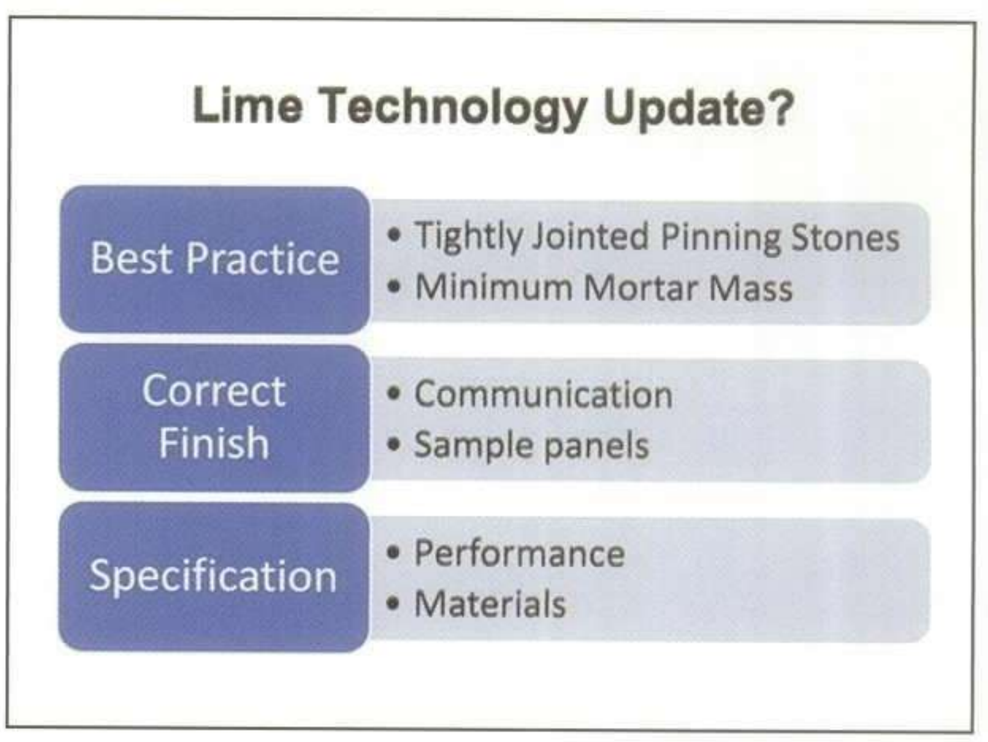

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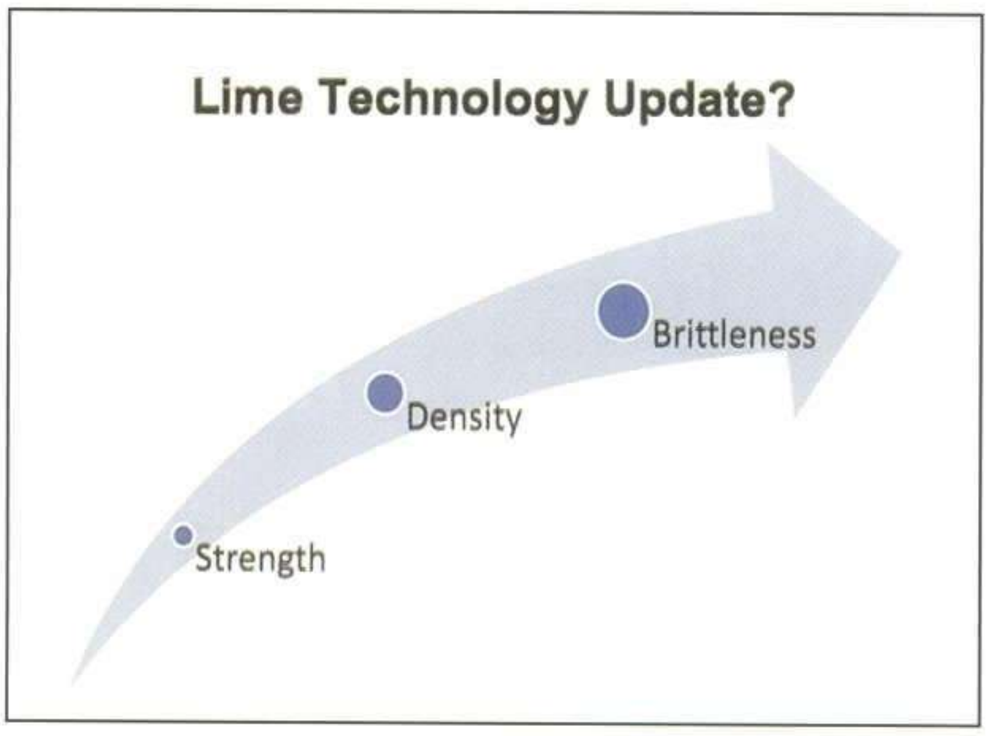

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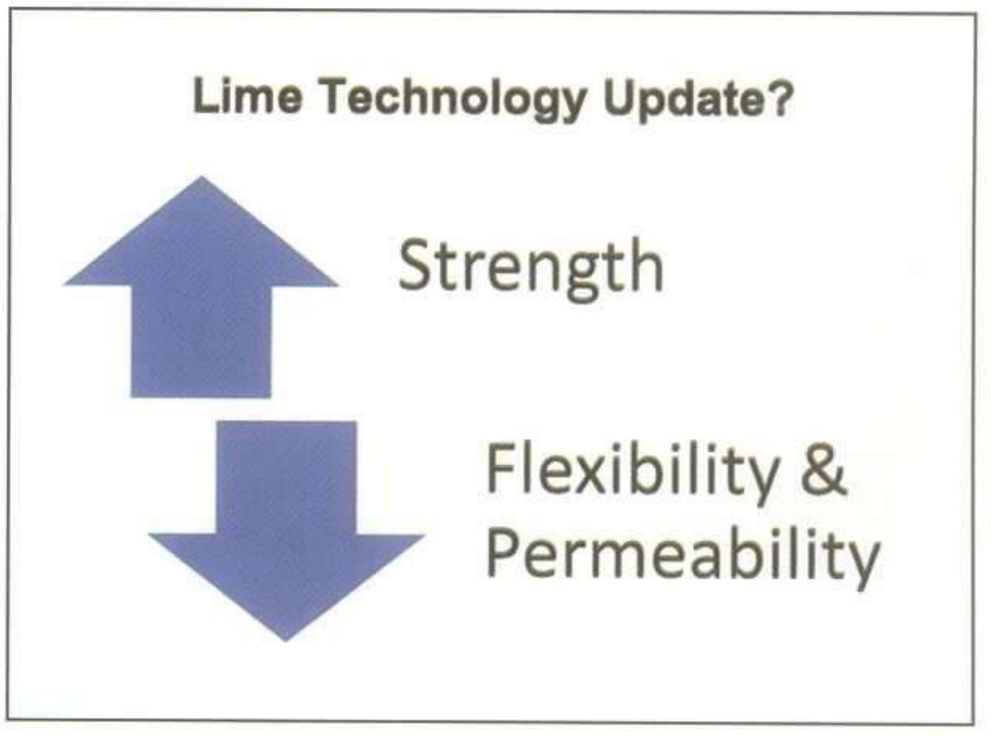

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Lime Technology Update?

Increased Capillarity

Lower strength

23

Lime Technology Update?

NHL 3.5	• 2 parts binder 5 parts sand • Additions
Additions	• Air entrained • Waterproofed
Performance	• Early freeze thaw • Reduction in strength • Reduced capillarity

24

Lime Technology Update?

Background	• Materials • Performance
Exposure	• Wind driven rain • Freeze thaw
Environment	• Pollution • Decay processes

25

Lime Technology Update?

26

....Lime Technology Update....

27

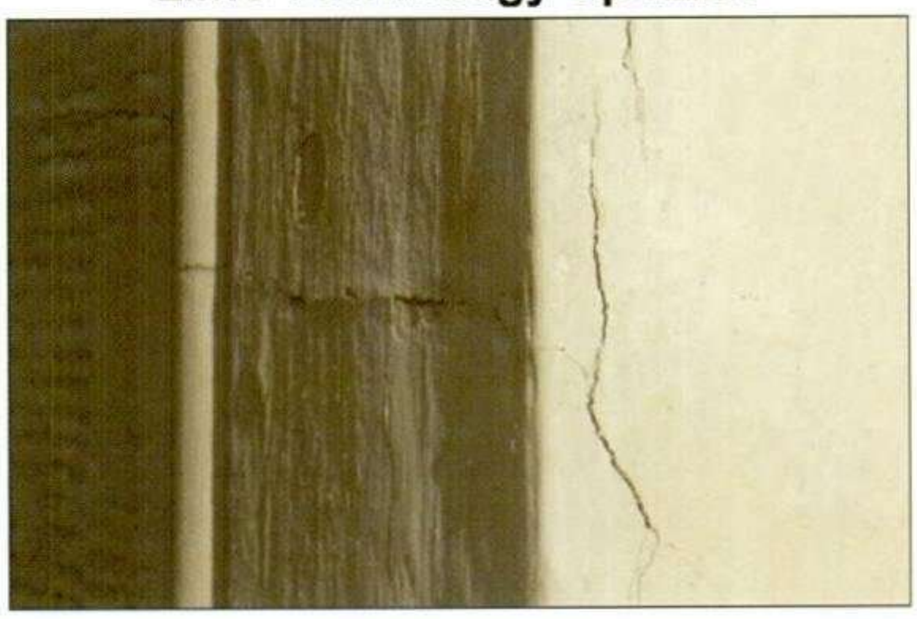
Lime Technology Update?

28

Lime Technology Update?

29

Lime Technology Update?



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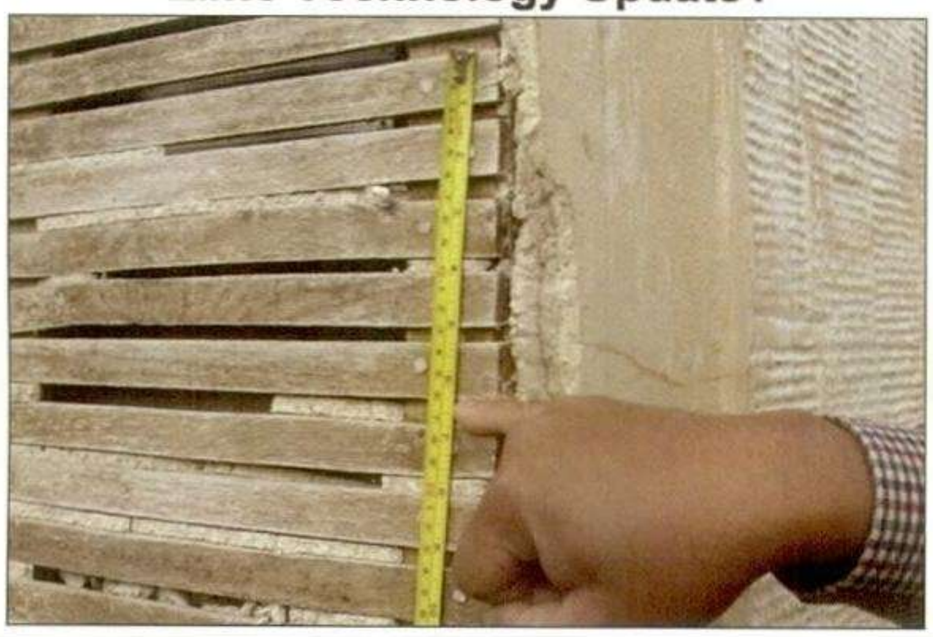
Lime Technology Update?



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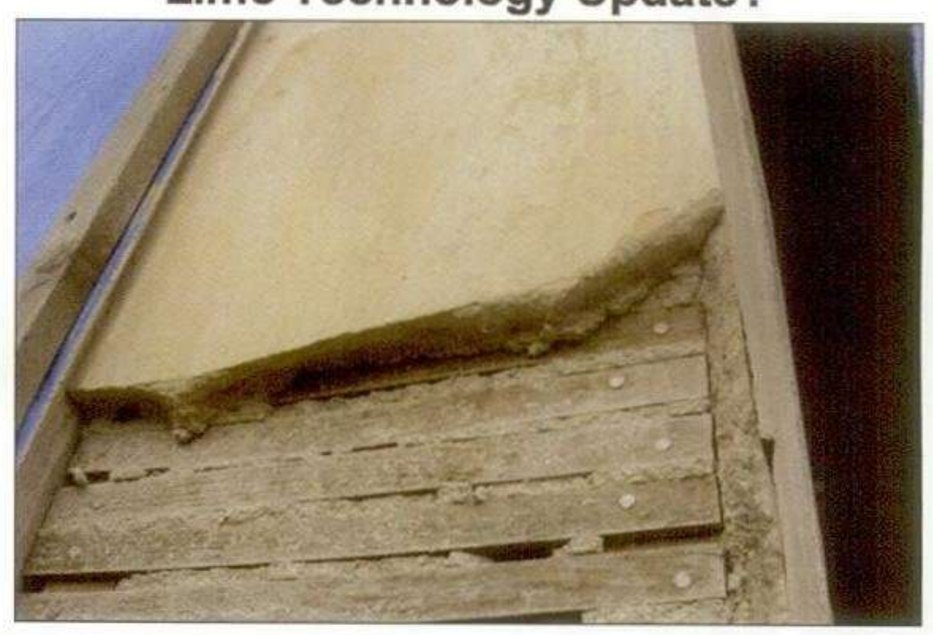
Lime Technology Update?



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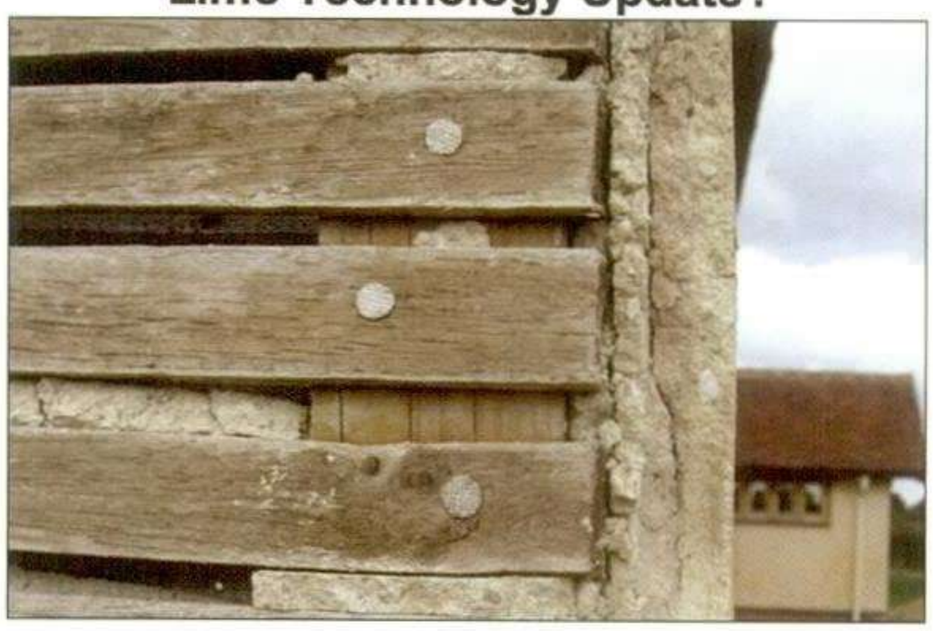

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Lime Technology Update?

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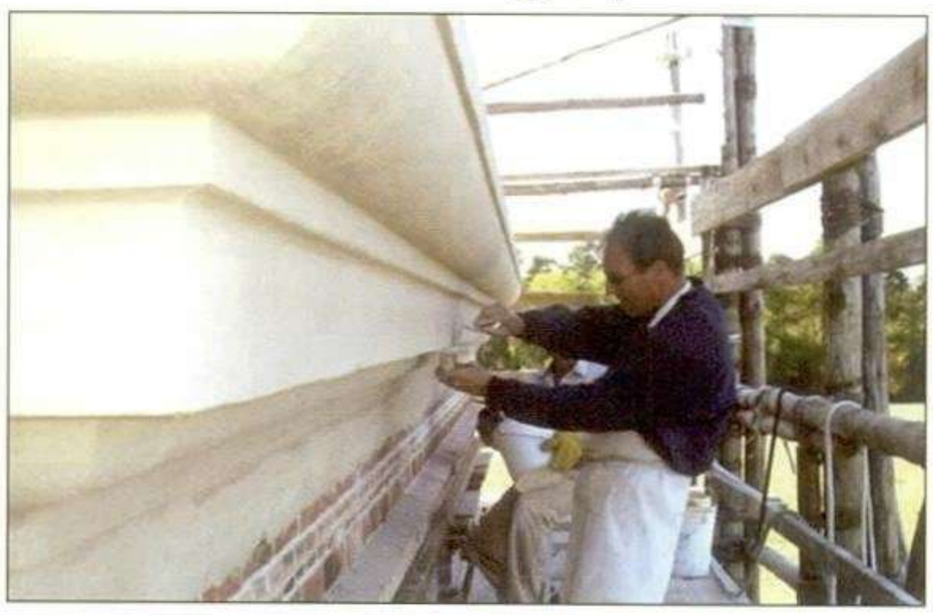
Lime Technology Update?



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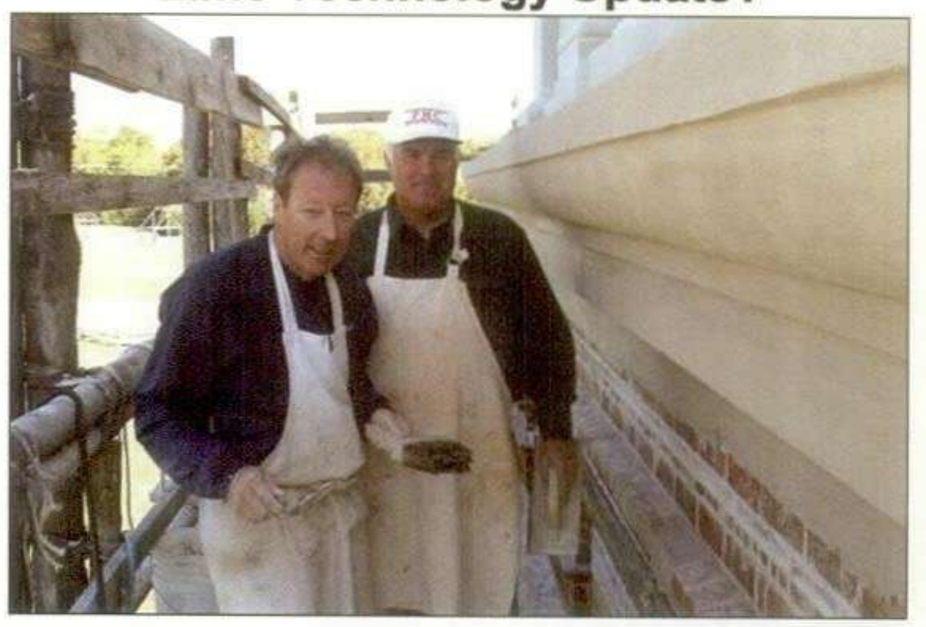
Lime Technology Update?



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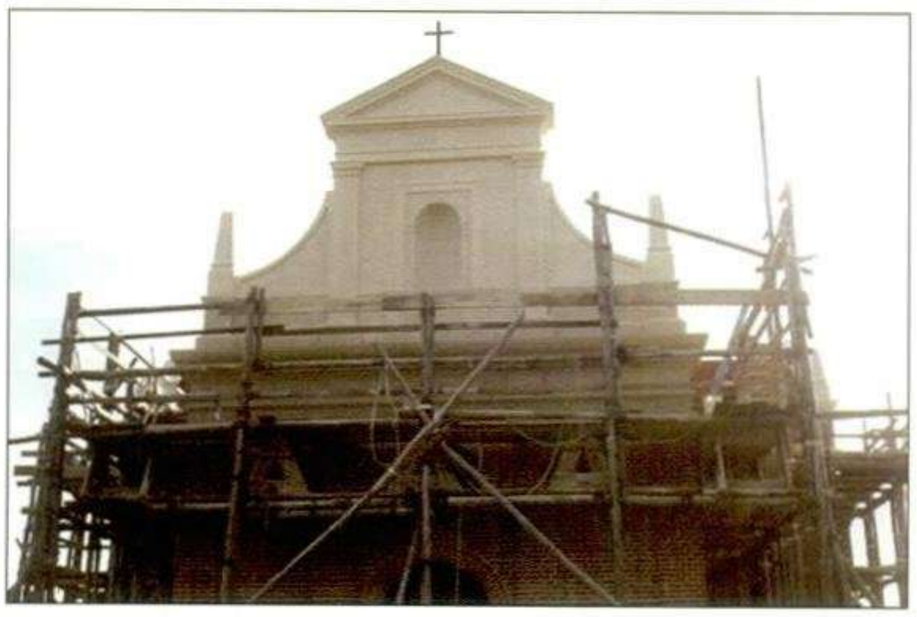
Lime Technology Update?



37

A CLEANING UPDATE

Nicola Ashurst

CAUTIOUS IS GOOD

It is always right to be cautious when deciding on any aspect of work to traditional and historical masonry. When we are not, incorrect, ill informed decisions are made and the building pays the price - permanently. This applies to all categories of intervention in historic masonry – conservation, repair and cleaning. Scotland had an outstanding amount of poor cleaning in the 1980's and it was right to make a public demonstration of calling a halt to this, to prevent further disasters. This reaction was to "bad" cleaning, not "good" cleaning. "Good" cleaning was taking place then, as now, but did not receive public attention as building surfaces were not changing colour and texture.

Cleaning external façades always has been and always will be a complicated process. The separation of soiling from masonry surfaces demands an understanding of both the soiling and the substrate and how cleaning processes affect both.

Good cleaning is achievable if the correct homework is done. The purpose of cleaning is to add value to historical and traditional masonry rather than detract from it.

Rutland Square, Edinburgh, is an often quoted example of bad cleaning which has caused permanent damage to many of the Square's stone façades. It could so easily have been a different story.

WHAT WILL CLEANING ACHIEVE?

The façade cleaning process needs to begin with an understanding of the soiling patterns on a building and what the removal of these will achieve. Consider the following examples.

- On an ornate Victorian façade soiling streaking can alter the appearance to the extent that architectural detail is either impossible to see or difficult to appreciate well beyond the positive contribution that some soiling can add to the "patina" or sense of age" of historic masonry. Cleaning of such façades does not necessarily remove all the patina of age but can restore the appreciation of the building's architecture.
- Some soiling is so deep-seated that it cannot be completely removed, safely. Soiling may have penetrated several sand grains deep. Weathering may have affected changes in stone ingredients which are irreversible. Cleaning will not remove these permanent changes.
- The cleaning of an individual building or façade must be evaluated in the wider content. How will it look when it is cleaned and its neighbours are not? Does its environment have a history of ongoing cleaning?

Above: A portion of this sandstone church in Birmingham has been protected by a family monument from decades of weathering and the subsurface changes that have developed elsewhere. The façade is "clean" despite its irregular appearance.

Left: The carved, moulded and plainer surfaces at high level on this Victorian building are made up of three types of limestone, and two types of granite. A wide range of thicknesses of soiling are also evident. These surfaces have not been cleaned before. This façade holds a lot of information relevant to its cleaning.

The existing soiling pattern of a building, if removed by cleaning, will redevelop over a period of time. The nature of soiling may alter to a degree, but from a distance the overall appearance will be very similar.

The existing soiling pattern on a façade may be partly due to the effects of previous cleaning, which are permanent and cannot be removed. Soiling may have masked these and its removal can re-emphasise previous damage and stains.

The Royal Exchange in London, seen here in 1989, is cleaned approximately every 20 years, as are many of the commercial and landmark buildings of Central London.

The Royal Exchange at the end of 2007, after cleaning with a combination of low volume water, steam, latex poultice and clay poultice. The stonework still holds evidence of previous abrasive cleaning.

Any evaluation of whether a building should be cleaned or not should assess the longevity of this and appearance of the building as it re-soils. The redevelopment of algal growth is a particular disappointment to owners of light coloured buildings particularly as cleaning may have served to increase the visual contrast between the masonry and the growths.

The chequer-board appearance of repaired but uncleaned buildings is not viewed positively in all parts of the UK particularly when it is known that, with the correct investigations, documentation and implementation, the remaining stonework could have been cleaned.

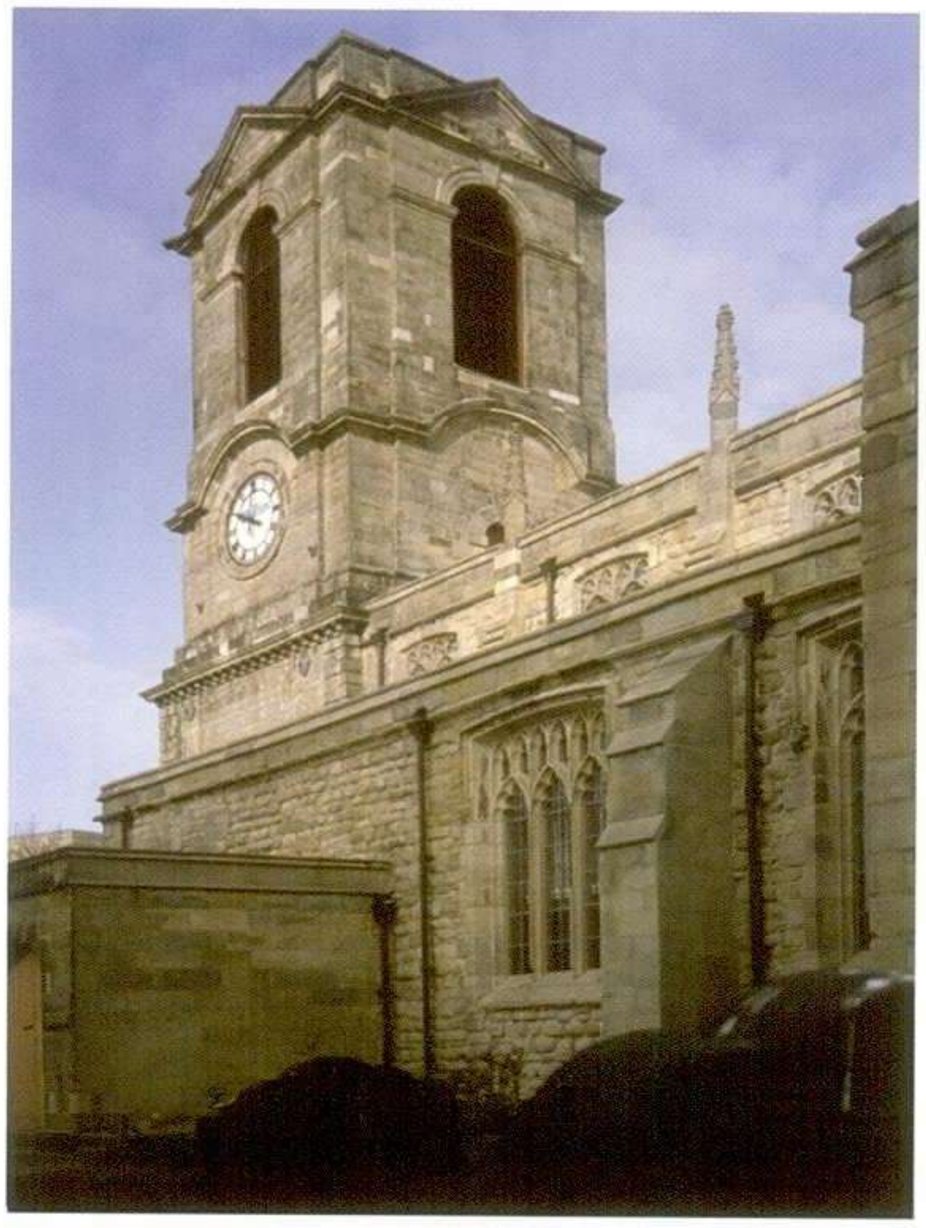
THE NATURE OF THE MASONRY SUBSTRATE

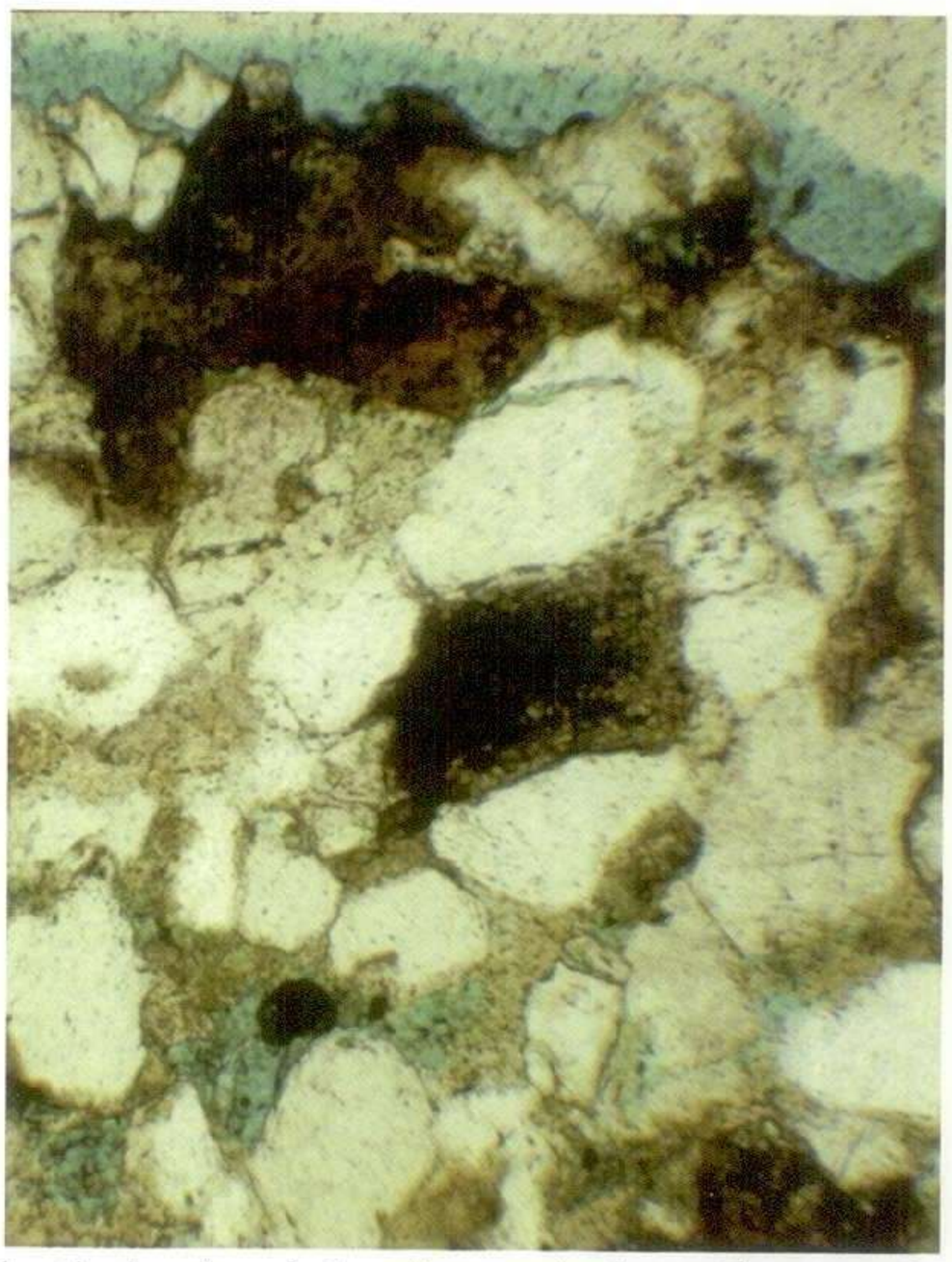
The first step of any cleaning programme is to understand in detail the nature of the masonry –its constituents, physical properties, condition, condition of its mortars and any other materials on the façade. The following descriptions are purposely simplistic, to make the point that the materials being dealt with are diverse and very different.

Sandstones are comprised of harder particles such as quartz, surrounded by a binding matrix. The ingredients of this matrix will vary, depending on which of the several hundred types of sandstone is being investigated. Both the "aggregate" and "binder" materials of sandstone can be inert or reactive to various chemical cleaning materials.

Sandstones are natural materials so there will be variations in their constituents and physical properties. Differences in porosity and hardness should be anticipated and catered for in a cleaning regime. Soiling on sandstone is largely insoluble in water. Consequently chemical or abrasive cleaning are the most commonly used of cleaning regimes.

The rate at which any cleaning liquids are absorbed and the ways with which they can be removed from a sandstone surface will again, vary. The proportion of binder to aggregate materials will affect sandstones' suitability to abrasive cleaning which bombards a surface with particulates. The effect of weathering, binder transfer or depletion will also be fundamental in determining whether a sandstone can be safely cleaned by an abrasive or a chemical process.





This church, on the southern bank of the River Tyne in Gateshead could not be cleaned any further without causing damage. The petrographic thin section (right) was fundamental to selecting the best cleaning regime and understanding the cleaned appearance of the church, which is now the local tourist information office.

Limestones, whilst composed primarily of calcareous ingredients will also have constituents such as iron and clay which need to be identified and taken into account, as do variations in surface texture, hardness, porosity and permeability.

Soiling on limestone is largely soluble in water. Consequently water-based cleaning systems are employed, with abrasive and chemical cleaning being used to remove more intransigent soiling.

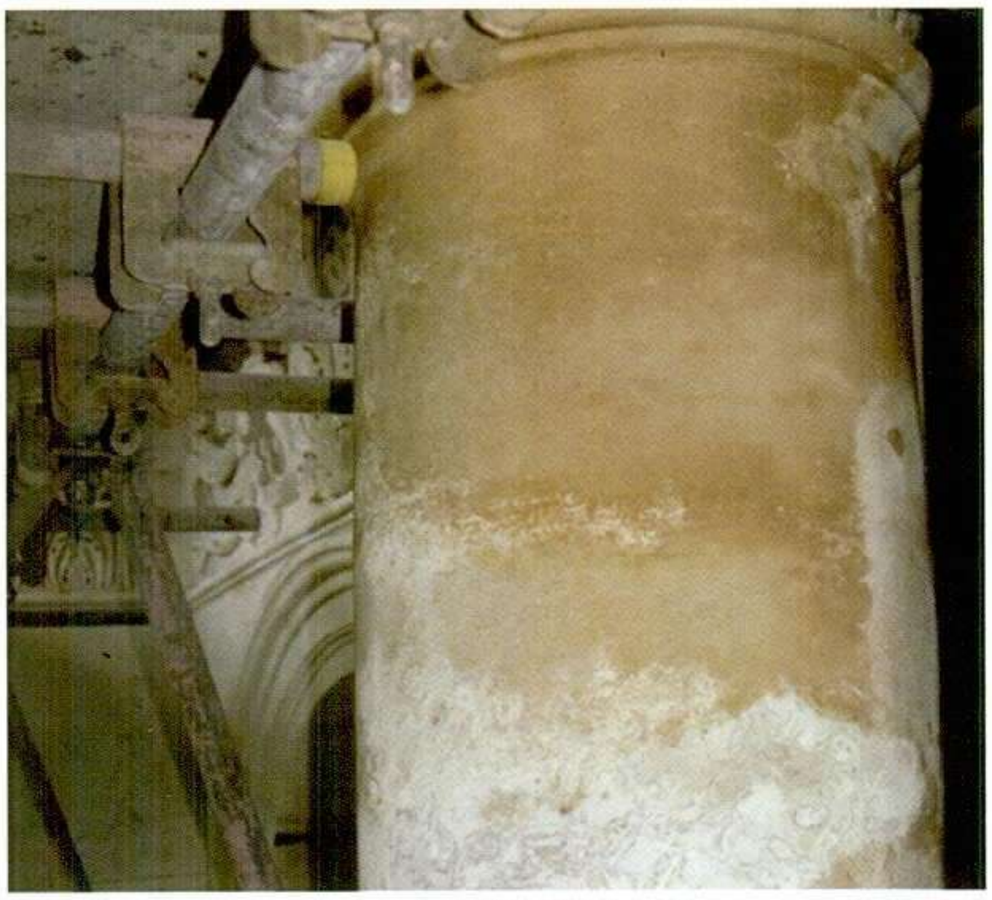
Varying degrees of soiling on Bath limestone surfaces and a similar variety of types of surface. Each type of limestone has its own properties and susceptibilities which need to be recognised when devising a cleaning regime.

Caen limestone surfaces before and after trial cleaning. The soiling has been softened and removed by the water-based cleaning and the sulphated skin remains intact. Previous repairs in grey mortar have been uncovered.

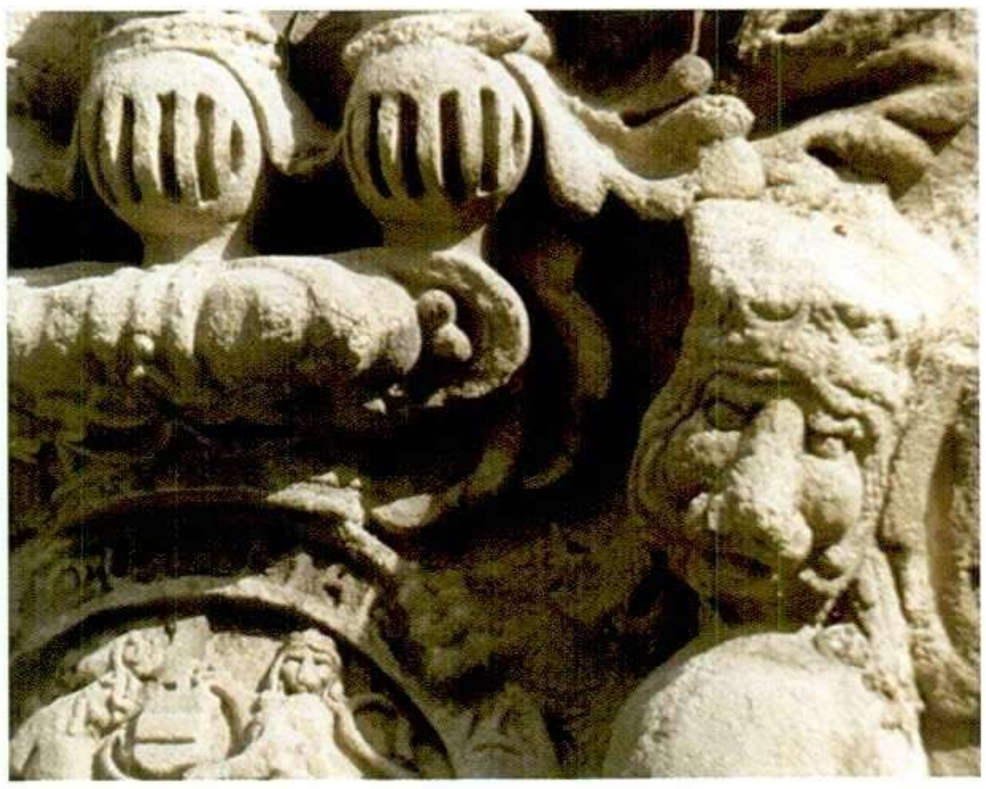
In areas of weathering limestone surfaces may be gradually eroded and appear more textured and lighter in colour than the more sulphated surfaces nearby. These colours and texture differences cannot be removed by cleaning. Some limestone e.g. Ham Hill, have extreme variations in hardness making them difficult to clean by abrasive. With others, alkali cleaning materials may react with iron constituents.

When the amount of water used needs to be controlled, nebulous spraying for short time periods and the use of water volume control nozzles are used.

Portland limestone buildings in London, which were once heavily soiled, can retain a "footprint" of embedded stain in areas once heavily soiled, which results in "browning out", the deposition of a rusty-brown surface stain as



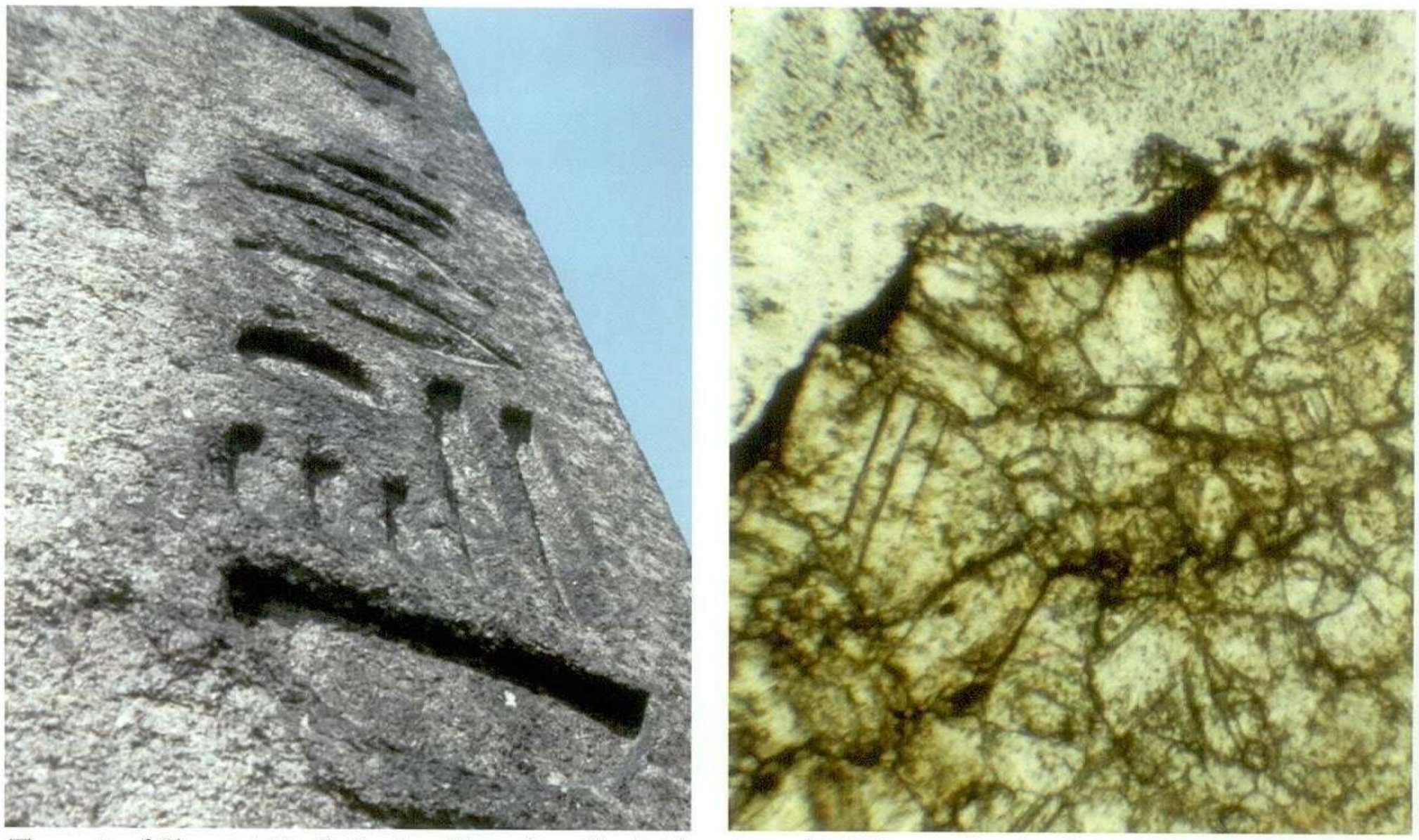
'Browning' out has developed on this Portland limestone column. This water based deposit was removed by a thin application of clay poultice.



Pressure water has damaged the carved surfaces of this limestone, operating more as an abrasive clean than as a water clean. The irregularities of hardness within the stone have added further to the roughening of the surfaces.

the water-cleaned surface dries out. Sometimes this can be avoided by reducing the amount of water used and the length of time it is applied to the surface. Other times the resultant stains disappear in the presence of sunlight whilst in others clay poultices are necessary to reactivate the stain, absorb it and remove it from the stone surface.

Granite is an igneous rock composed of quartz, feldspars and micas in varying proportions. Compared to sandstones and limestones they have low porosities. Micro fracturing to their surfaces can be present due to tooling of the original surface. These fractures will be important in designing the final cleaning regime. Mostly soiling to granite is superficial.



The granite of Cleopatra's Needle. London. The surface soiling is thin and superficial. This is confirmed in the petrographic thin section (Lithan Ltd for Adriel Consultancy). The thin section also shows the widespread micro fracturing of the granite, possibly due to the fires the obelisk was subjected to whilst still in Egypt.

Marbles are also very varied. External sculptures were often white Carrara marble which, is susceptible to surface dissolution in the presence of slightly acidic rainwater (i.e. most rainwater), and can also be of variable quality. The marble of the Waterloo Vase, in the gardens of Buckingham Place, was reportedly the largest piece of Carrara marble in 1815, selected for size and an indoor location rather than its current outdoor position.

The term **brickwork** describes fired clay units which have a bewildering variation of constituents and properties. These vary from "red rubbers" which can be carved with a finger nail, to highly fired and vitrified blue bricks and glazed bricks. Even within a single brick one should expect variations in surface texture which may prevent the safe use of abrasive cleaning or reduce the pressure of water jets. High absorbency may eliminate or stringently define the parameters of a chemical cleaning regime.

Soiling on brickwork is typically not soluble in water although water can soften it and assist its removal by other methods.

When chemicals are used, thorough pre-wetting and rinse regimes are fundamental to a successful clean without ongoing effects. It is very difficult to clean brickwork with abrasive methods, without damage.

Terracotta and its glazed counterpart, **faience** are large fired clay units which appear robust but which are brittle

There are many types of brick in historic façades. The properties of each must be identified for the selection of an appropriate cleaning regime. The common bricks seen here are highly porous, brittle, easily damaged by impact or abrasion and variable within each brick and from brick to brick.

and hence particularly sensitive to damage from abrasive cleaning. Soiling to these surfaces is typically not water soluble. They can be cleaned well using low strength alkali and hydrofluoric acid based ingredients, particularly when these are of thixotropic consistency and do not "run". Non-ionic detergents and EDTA based products can be successful at times.

The terracotta of the Doulton Fountain, Glasgow Green. Different colours of the material are principally due to different firing temperatures. The fractured neck of the torso shows the original colour of the fired clay body of the sculptures. As part of the recent restoration project the surfaces were cleaned with a mildly acidic gel, applied to a pre-wetted surface to a short dwell time, agitated throughout and thoroughly rinsed.

Joints are as important as the masonry units in a wall. They must not be damaged by the cleaning in the short term or long term.

The joints of masonry must be considered carefully, in as much detail as the brick work or stonework they surround, as their properties will be different to those of the masonry.

THE NATURE OF SOILING

The cleaning process should begin with detailed and close range inspections of the buildings surfaces to determine:

- The nature and degree of soiling
  - is it thick or thin?
  - superficial or ingrained?
- The types of soiling present. Options include:
  - atmospheric,
  - biological,
  - paint,
  - graffiti,
  - previous treatments,
  - previous building repair products
- The degrees of soiling present, and their distribution.
- The condition of the masonry, are surfaces sound or granulating?
- The effect of previous cleaning:
  - how has this affected the masonry units and the joints?
- And most importantly, the effect of weathering on stone.

Not all surface decay is due to previous cleaning. It is important that the effect of weathering is distinguished separately to the effect of previous cleaning.

ANALYSIS AND ON SITE TRIALS

The visual inspection using a hand lens may be sufficient for experiences specialist professionals to understand what has happened to a cleaned surface, but mostly coring and analysing of cleaned surfaces is necessary for complete understanding and confidence that short term and long term damage have been avoided.

The analysis of masonry cores by petrographic thin section (as a minimum) is immensely useful for determining in detail the properties and constituents of stonework, the effect that weathering has had on theses, for differentiating between the effects of weathering and the effects of previous cleaning, and for identifying the sensitivities a stone may have to water, abrasive chemical, latex or laser cleaning.

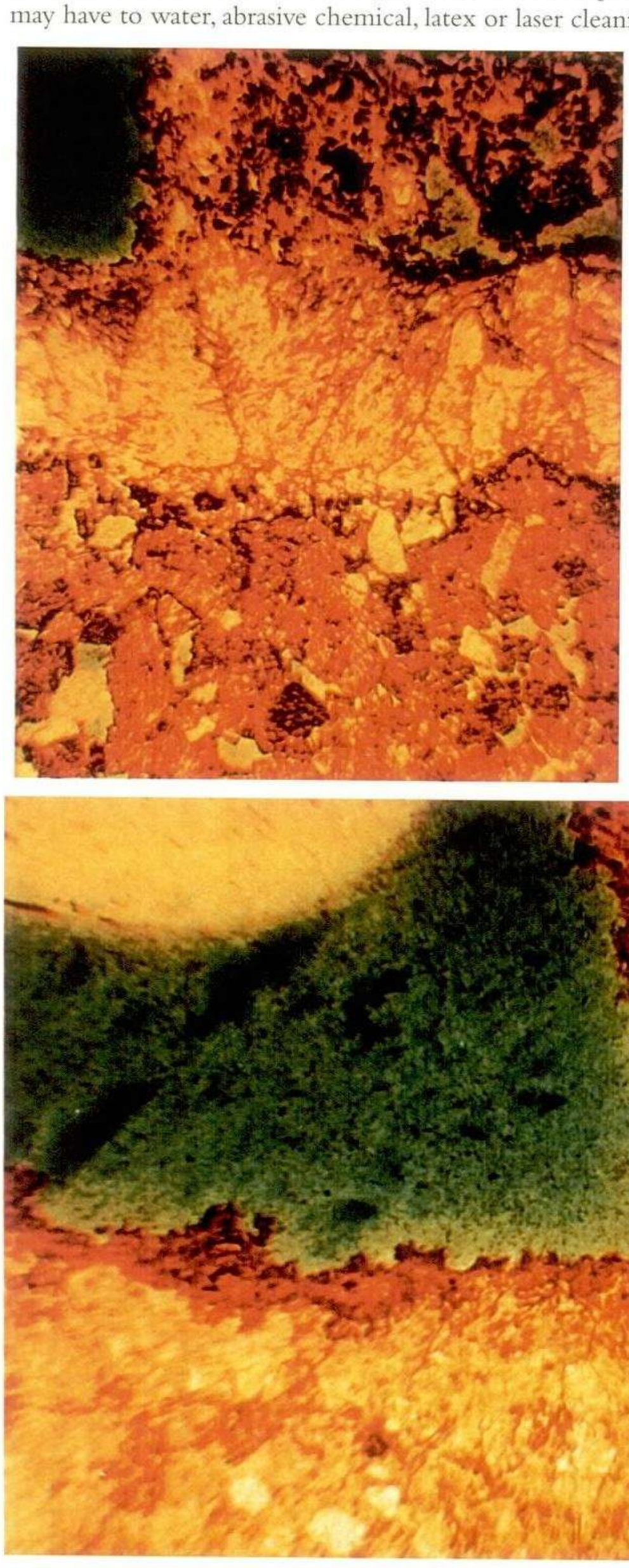


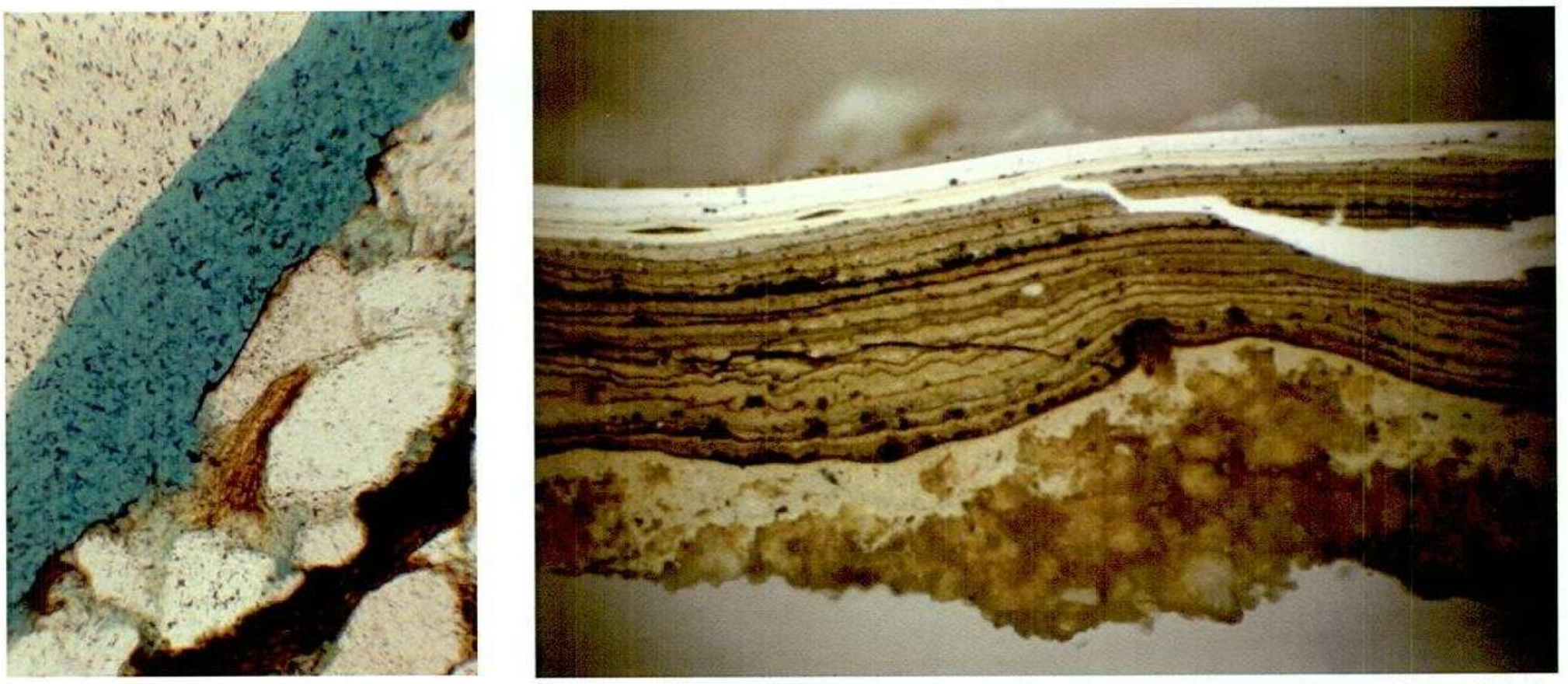
Plate 2. Details of surface features.

The photograph on the left, which has been stained and etched to emphasise the various surface features, shows the sharp, but irregular junction between the coarser-grained carbonate at the surface of the stone, and the unaltered dolomite in the lower half of the picture. Some lighter-coloured grains, similar to the coarse layer, are developing in the dolomite. The porosity in the dolomite, indicated by clear blue patches can also be seen. The gypsum contamination on the surface of the stone is visible at the top of the photograph.

500 μm

In the lower photograph, in which the gypsum has been stained and appears as a deep reddish-brown coloured material, the sulphate can be seen to occur as a thin layer on the surface of the stone (on the left of the picture) as well as in the form of a thick crust (on the right).

Thin section analysis of this magnesium limestone was necessary to understanding the alterations that had taken place within the stone and the fact there was no clear boundary between the soiling and the stone surface beneath.
(Jefferson Consulting for Adriel Consultancy)

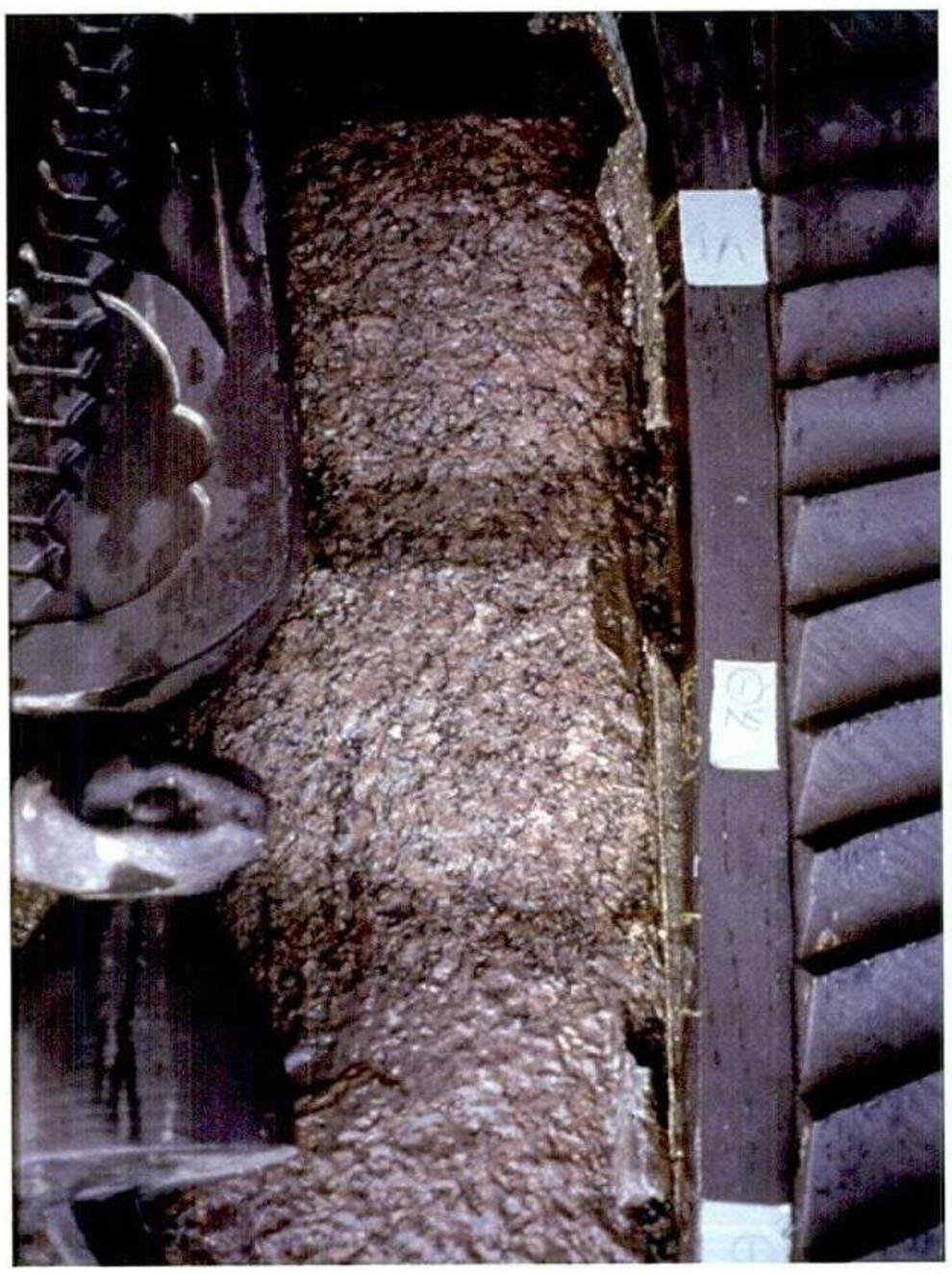


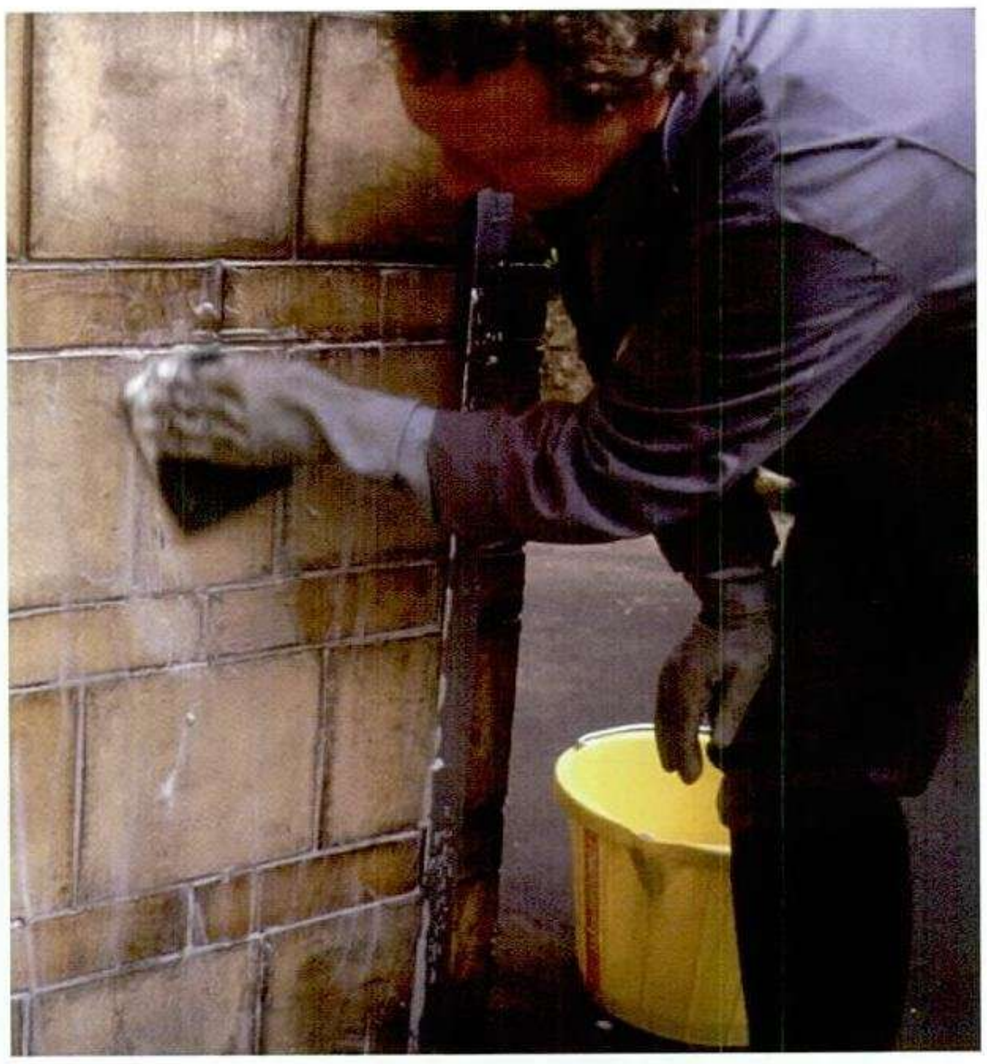
Thin section analysis was used to confirm remains of a linseed oil coating on the sandstone of Wellington's Church, Glasgow. (Lithan ltd. For Adriel Consultancy) Conventional sectioning (x25, Adriel Consultancy) was used to determine the types of paint present on this sandstone, the numbers and thickness of layers, and led to a well-informed series of paint removal trials.

Armed with this information an on site cleaning regime can be prepared and then implemented by an experienced specialist contractor. So much can be learned from seeing the cleaning trials happen rather than inspecting "before" and "after" that I would strongly recommend that the professional involved be in attendance throughout.

Cleaning tests should be on areas of heaviest soiling, even if ground level access is all that is available. Testing should start with the gentlest processes, with the more severe ones being evaluated when the less severe have proved unsuccessful. Spot trials should precede larger areas.

The purpose of the trials is to establish the different cleaning process that will be required to safely remove all types and degrees of soiling to all types and conditions of masonry. It should be expected that there will be more than one. Details of how each process is to be employed must also be established. This is essential for good and safe cleaning as well as a sound specification which can be accurately priced and programmed.





Non-ionic detergent was tested as part of the trial cleaning regimes at the Curator's Lodge, the Natural History Museum, London, and on the granite of Cleopatra's Needle, Embankment, London. It was successful on the granite but not on the terracotta.

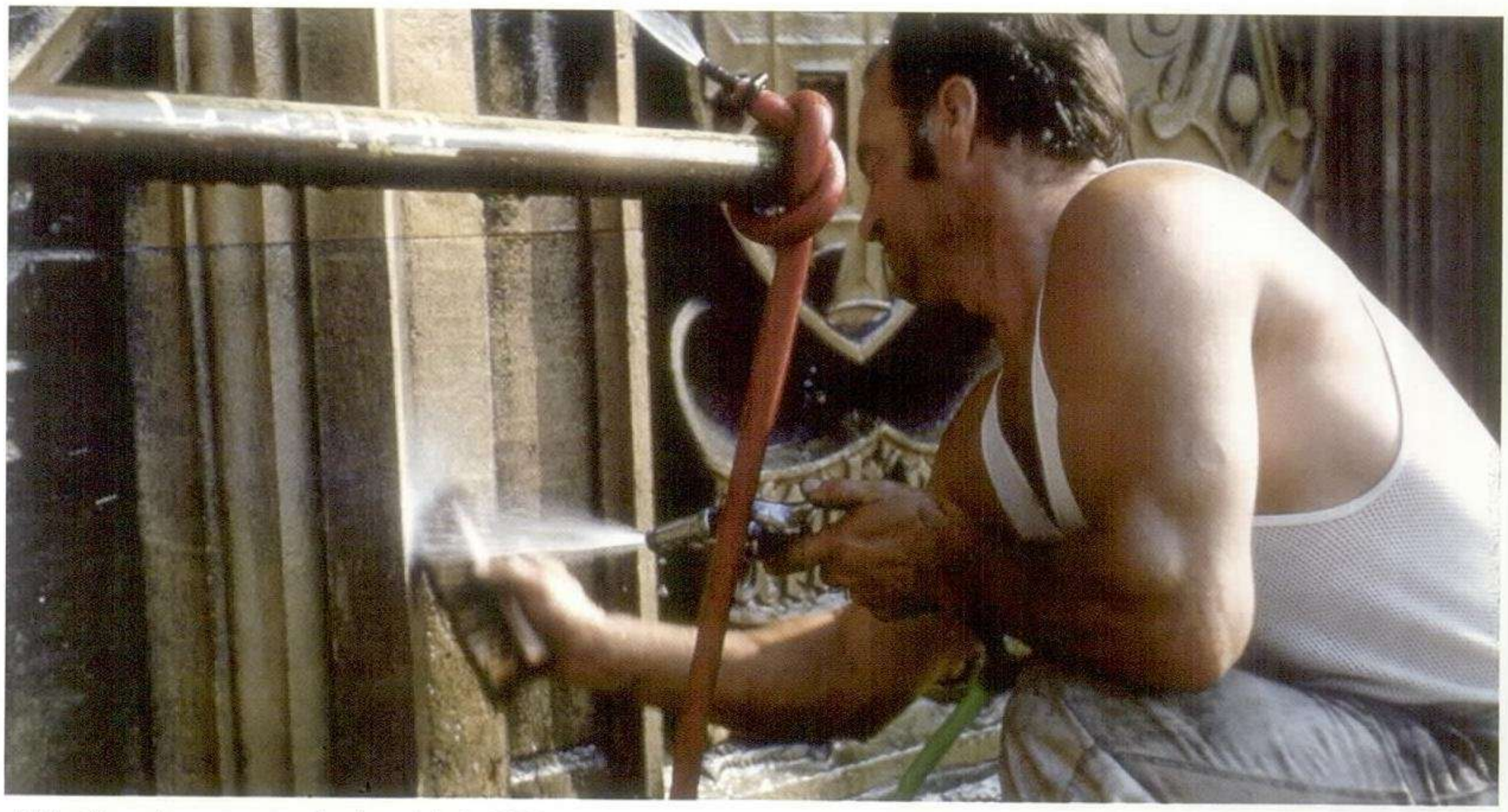
Cleaning trials on the sandstone of the College of Art, Birmingham, produced different results where the stone was protected and where it was exposed to the weather. It was important to understand this before the main cleaning began, so that realistic expectations were held by all parties to the project.

An appropriate cleaning regime must have a "margin of error."The upper and lower limits of operational procedures must be established so the specialist contractor knows the acceptable parameters which are to be worked within.

The trials can also be used to establish the level of clean that can be achieved without compromising the masonry. Clients need to understand this at an early stage and at times adjust their expectations.

The specification should set out all details of the cleaning processes. At the commencement of the main works, the specialist contractor appointed should be required to undertake sample areas of cleaning, to confirm the specification and to provide the standard for the remainder of the work. The need to adjust the cleaning regime as the work proceeds should be anticipated. Different levels on facades and different orientations will all serve to adjust the intensity and tenacity of soiling.

DEVELOPMENTS OF THE LAST DECADE



A blast from the past; water cleaning trials in 1971.

The last ten years have seen the following changes:

- More cleaning work is being undertaken by established, experienced firms. Professionals still need to be careful of the calibre of contractors they select. Cost, should not be the only factor which decides selection.

- Equipment and cleaning material suppliers are being more selective in who they supply, most requiring training of operatives as a prerequisite to registration as "approved applicators".
- The Stone Federation of Great Britain, Cleaning Section, has a training officer who runs cleaning courses for apprentices and experienced operatives at NVQ Level. 2
- BS6270:1982 "Cleaning and Surface Repair of Buildings" has been replaced with BS 8221: 2000 "Code of Practice for Cleaning and Surface Repair of Building". English Heritage and Historic Scotland were on the drafting committee for Part 1 "Cleaning of Natural Stones, Brick, Terracotta and Concrete". The document contains a basic, sound approach to cleaning.
- There has been increasing appreciation of the use of analysis, particularly petrographic thin sections to analyse stone and to test the effect of on site trials.
- There has been increasing awareness principally due to the use of analysis, of what the constituents of soiling are and the intimate relationship that often exists between soiling and the surfaces of stones.
- There has been more sophisticated usage of existing water-based, chemical and abrasive cleaning systems and wider use of combined systems.
- There has been more widespread use of laser cleaning, and its commercial viability is improving.
- The UK market has seen the use of latex cleaning on the interiors of St. Paul's Cathedral, London (Portland limestone) and the Kelvingrove Museum, Glasgow (terracotta)
- The implication of good health and safety measures for those undertaking cleaning others on the project, building users or passers by has become common place as a result of the risk assessment process.

But.....the search for a universal and magical cleaning system which provides perfect results without the need for understanding masonry surfaces or their soiling continues. Sophisticated marketing continues to promise this.

LATEX CLEANING – IS IT THE HOLY GRAIL?

This involves the painting on of a layer of latex containing EDTA (ethylene diamene tetraacetic acid). The EDTA bonds with the surface soiling as the latex cures and the layer can then be pulled away. It is a particularly attractive process for use in interiors which must remain operational and where any cleaning system which produces dust or water has impossible logistical implications. Several latex cleaners are available in the UK market employing various strengths of EDTA. Some contain ammonia and should be avoided.

The front and rear sides of a sheet of latex used to clean a coat of arms.

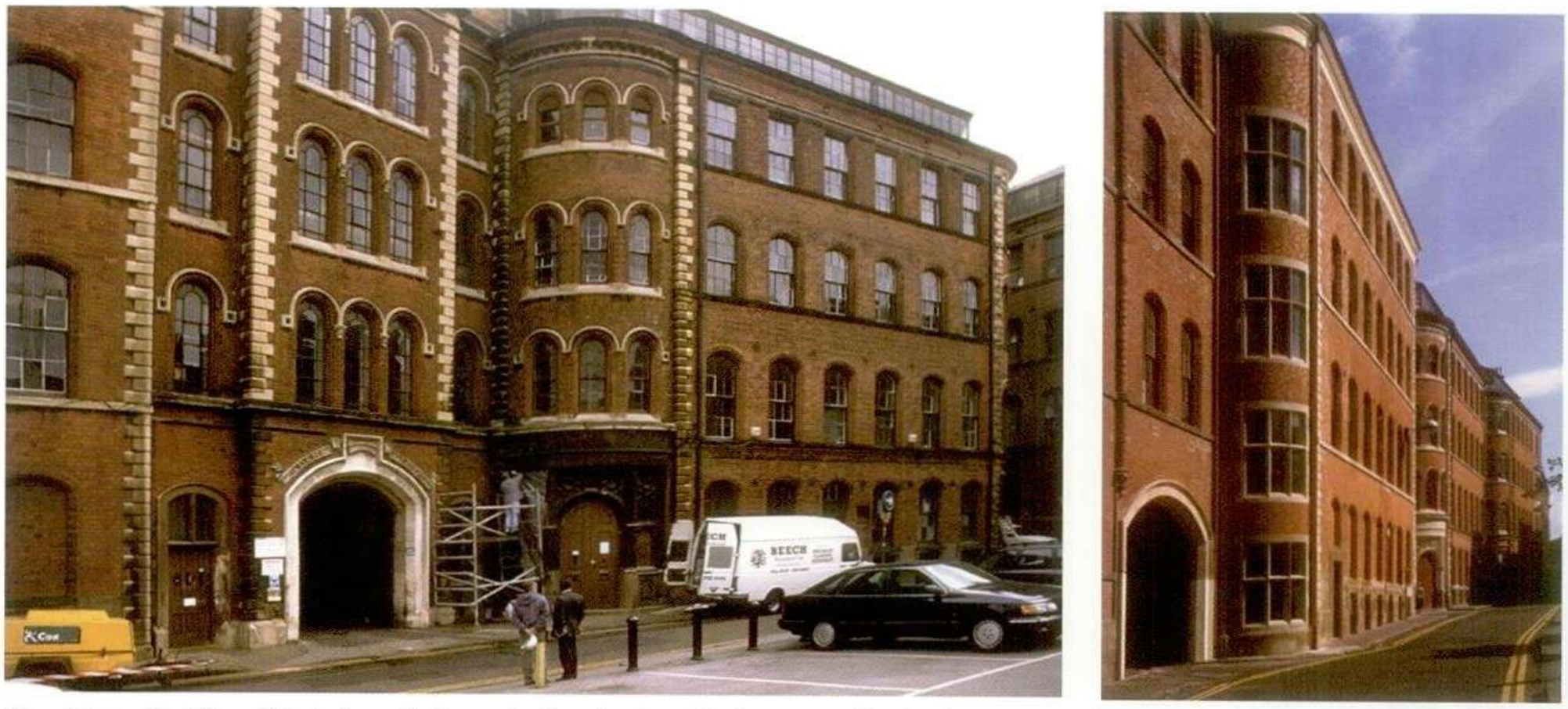
Latex cleaning is not a magical one-method-fits-all system. There are many masonry types and soiling types on which it is not suitable e.g. exterior soiling, complex internal soiling. Particularly where a textured surface is involved, latex cleaning can require the use of water to rinse off softened soiling residues from within pores, and is therefore not a water free process.

CONCLUSION

If cleaning is going to be done, it must be done well. We know how to do it well, but we must be prepared to pay for the full process of assessment and implementation.

Provided the necessary homework is done and the selected cleaning processes are implemented to a consistently high standard, there is no reason for a cleaning process to damage a building. Removing soiling does not change an historic building into a modern one. It does not dilute the historic value of an area.

We know what bad cleaning practice can achieve. We also know what good cleaning practice can achieve, so let's give good cleaning a chance.



The Adams Building, Nottingham, before and after cleaning. It's cleaning and redevelopment was key to the regeneration of the Lace Market Area.

WHAT MAKES A GOOD SLATE? REVIEW OF THE TESTING METHODS USED TO ASSESS QUALITY

Dr Joan Walsh, Stone Consultant

Introduction

Slate is a low-grade metamorphic mudstone comprised of quartz, and the phyllosilicates; chlorite and white mica. The phyllosilicates are platy minerals, which become aligned during metamorphism, along which the rock is capable of being split into thin slabs. It is this property that makes it ideally suitable as a roofing material. Other rock types, such as flagstones and mica schists, are also used as roofing material and are often incorrectly referred to as slate. In the 19th century, the use of slate as a roofing material depended on the local geology. It was sourced and quarried in Wales, Cumbria and Cornwall and several areas in Scotland. With improved transportation in the 20th century, British slate was used extensively in all of the major towns and cities, but as the century progressed, the British industry began to decline due to competition from imported slates and other roofing materials. In the 21st century only a handful of British quarries remain in operation, none of which is found in Scotland.

Assessing Quality

Some slates last hundreds of years while other fail after a few years of exposure on a roof. In the 19th century assessment of quality was primarily based on local knowledge, although some traditional methods based on the appearance, ring, absorbency and 'licking', were also used. With increased transportation in the 20th century, reputation no longer sufficed and more rigorous testing methods were required.

In the 1930's, several studies were carried out on different types of slate to establish their quality. Building Research Establishment (BRE) conducted a study to develop tests which correlate with the reputation of different slates. Their findings became the basis of the British Standard, BS680. The tests included; water absorption, cycles of wetting and drying and an acid test. The water absorption limit was set pragmatically to exclude poor quality slates, even though this had the effect of excluding slates of high quality .

At about the same time, a similar testing programme was carried out in the United States. This study assessed the properties of 343 new slates and 60 used samples some of which were more than 131 years old. As a result of their findings, a water absorption and a wetting and drying test, similar to the BS680 tests, were included in the America standard, although different compliance limits were set. It also included an acid test which is very different from the BS680 equivalent.

The European standard prEN12326, which recently replaced the British and other European standards, has a wide range of tests which can be categorised as follows (1) dimensional consistency, (2) physical properties, such as the bending, water absorption and freeze thaw and (3) chemical tests. The compliance requirements are more relaxed than the national standards it replaced so that inferior quality slates comply.

None of the standards, with the exception of the American, assesses the longevity of a slates. In the American standard, the estimate of longevity is based on the water absorption and the acid tests of new slate. However this research has found that there is poor correlation between the water absorbency of new slates and their longevity. Instead it has found that the rate of changes in the properties is a better measure of its durability. For example the water absorption of new slates may be high but is unaffected by weathering. Conversely, water absorption in some types of slate may start out low but increases rapidly with weathering.

Conclusion

The British BS680 is simple and cheap to perform, however the strict limits set for compliance often fails slates of known quality. In contrast, the European standard prEN12326 is complex and compliance limits are so relaxed so that only the poorest quality slates would fail. Neither of these standards addresses what should be the most important criterion when specifying a slate, namely its longevity.

WHAT MAKES GOOD SLATE?

Review of Testing Methods

Dr Joan Walsh, Stone Consultant

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What makes a good slate?

Review of testing methods

Joan Walsh

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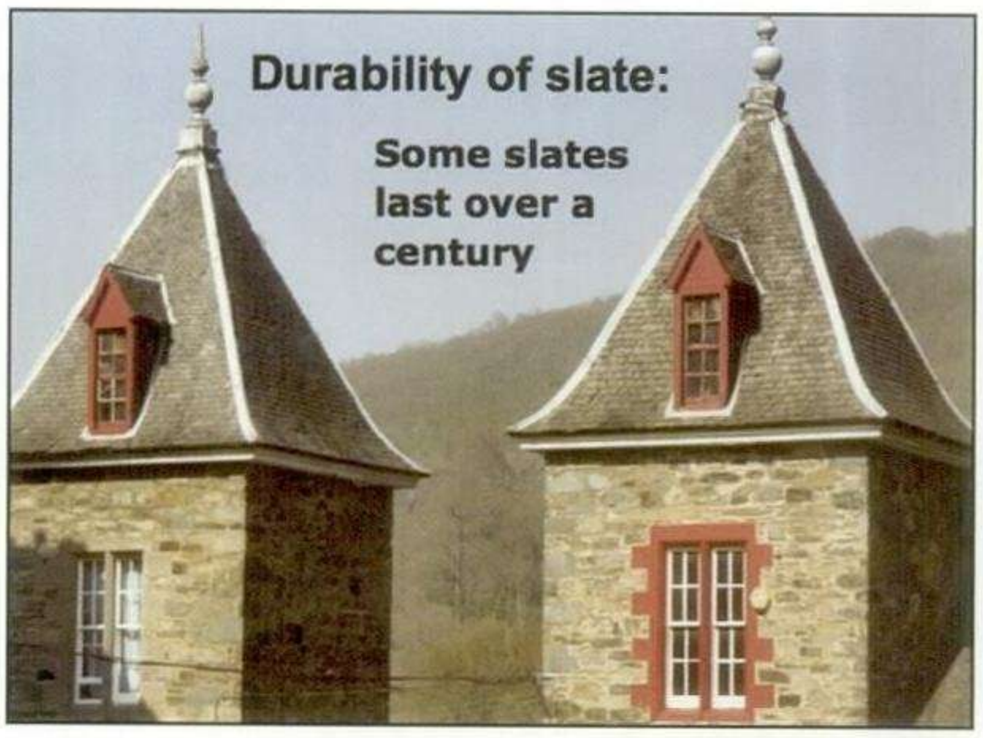

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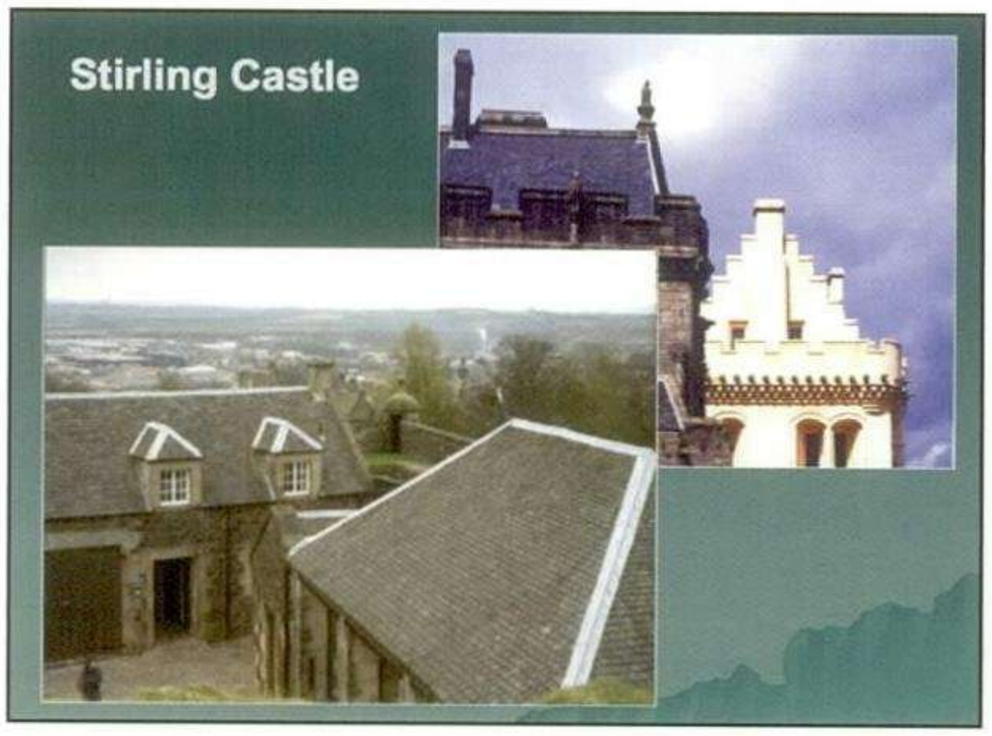

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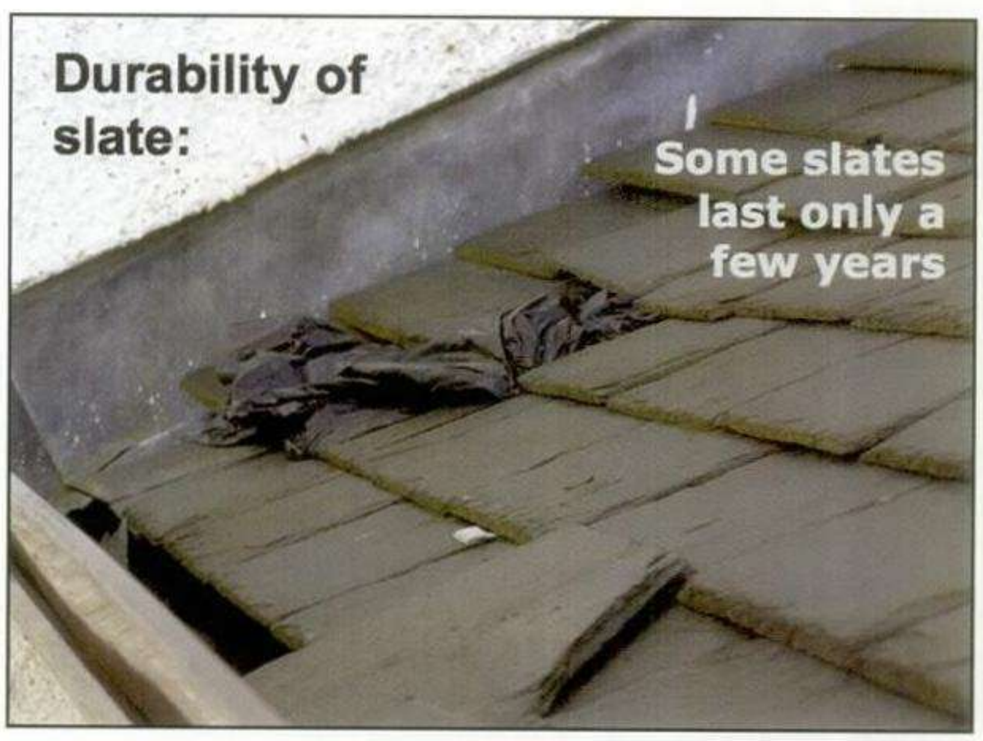

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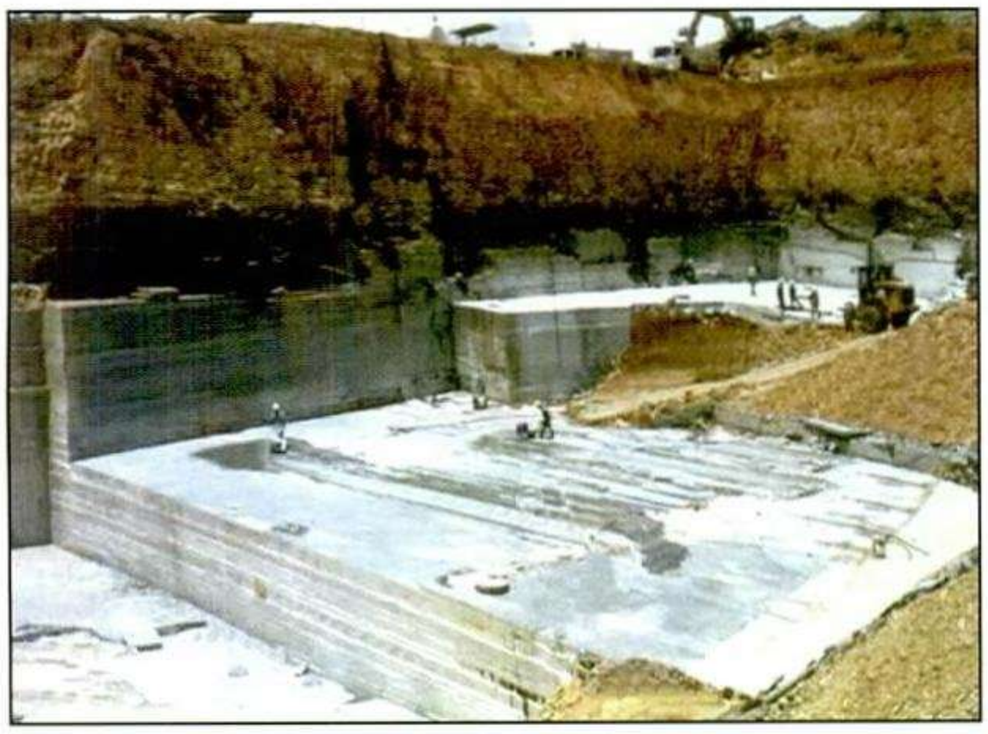
Summary

- Different types of natural stone used for roofing
- Historical sources
- Current sources
- Assessing quality
  - Reputation
  - Introduction of testing methods
  - New European standard
  - Other methods
- Conclusions

6

Types of natural stone roofs

- Flagstone
- Mica schist
- Slate



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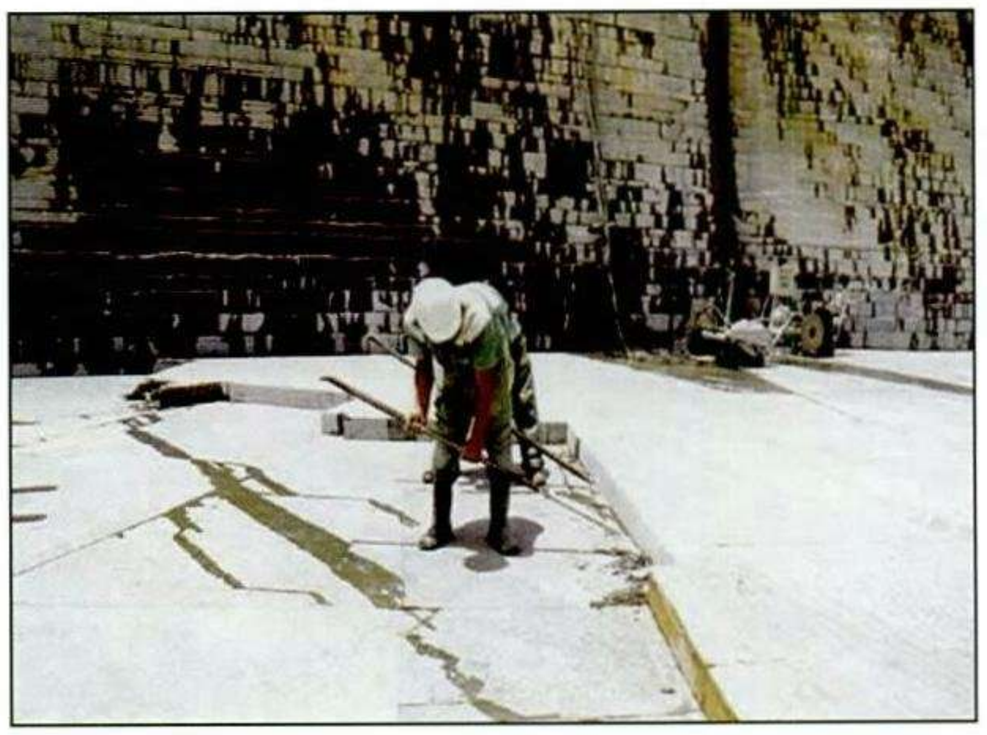

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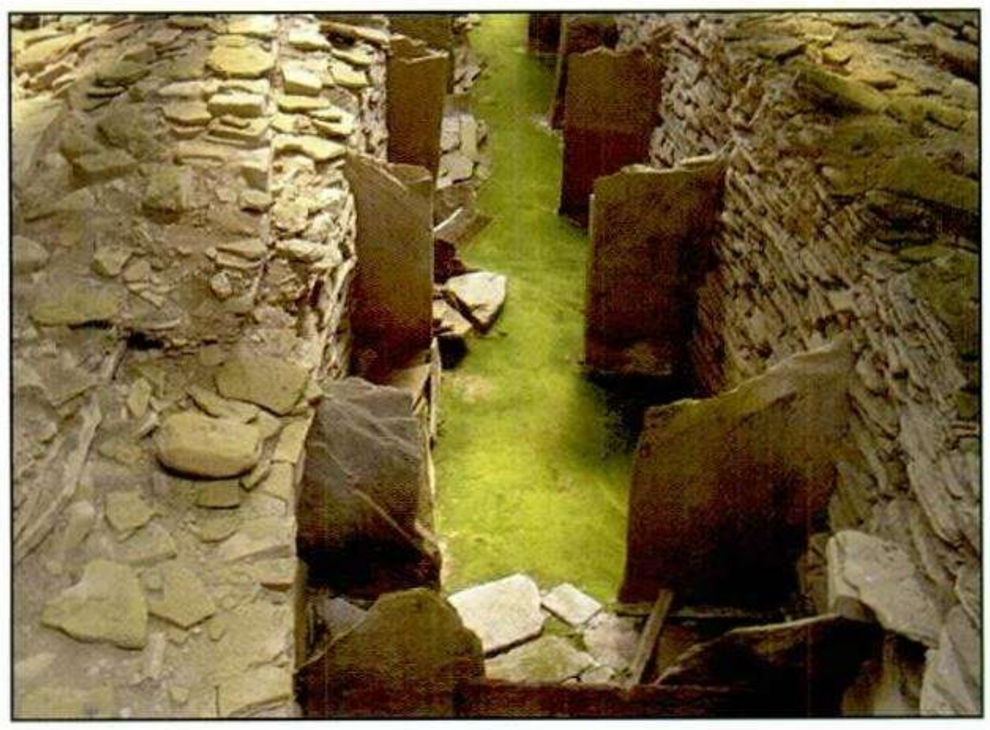

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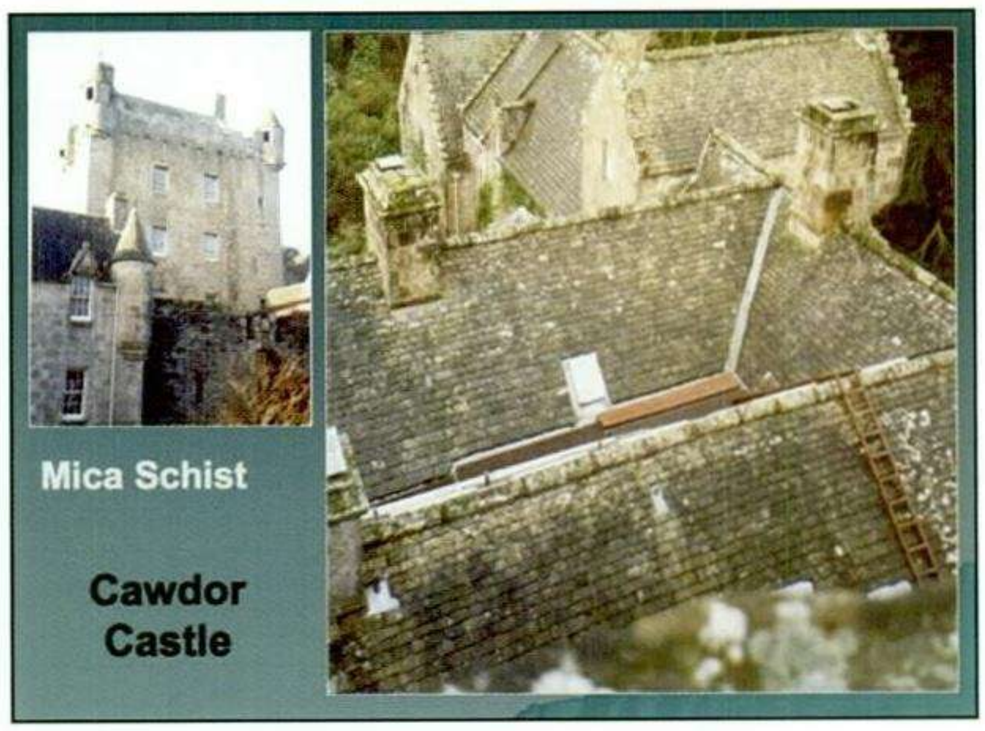

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What is slate?

- **Slate is a low-grade metamorphic mudstone comprised of quartz, chlorite and white mica**

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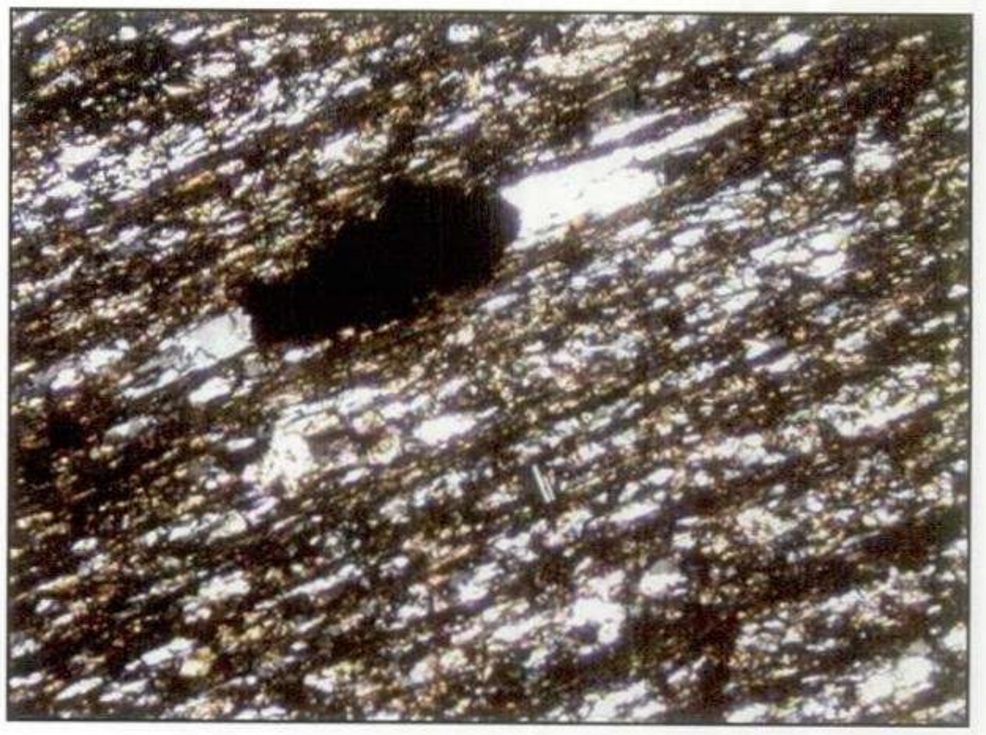

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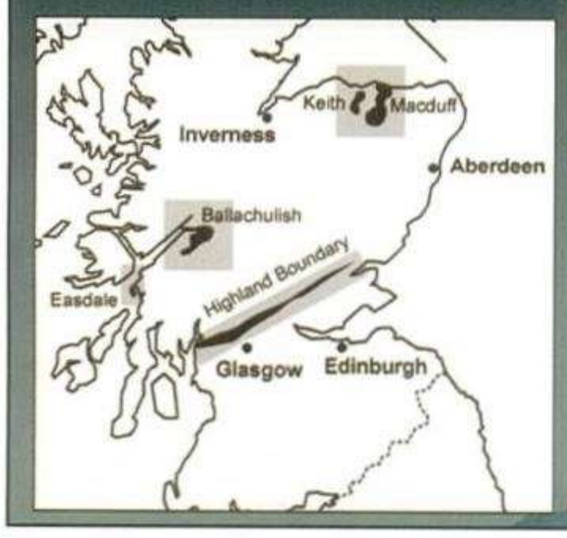
Sources of British slate



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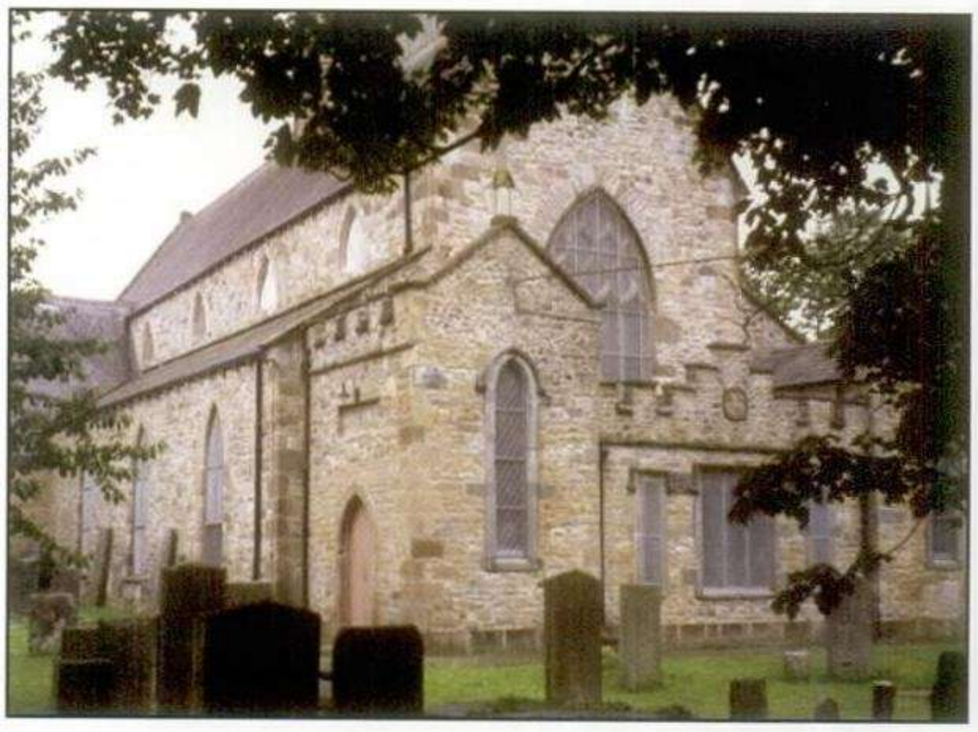

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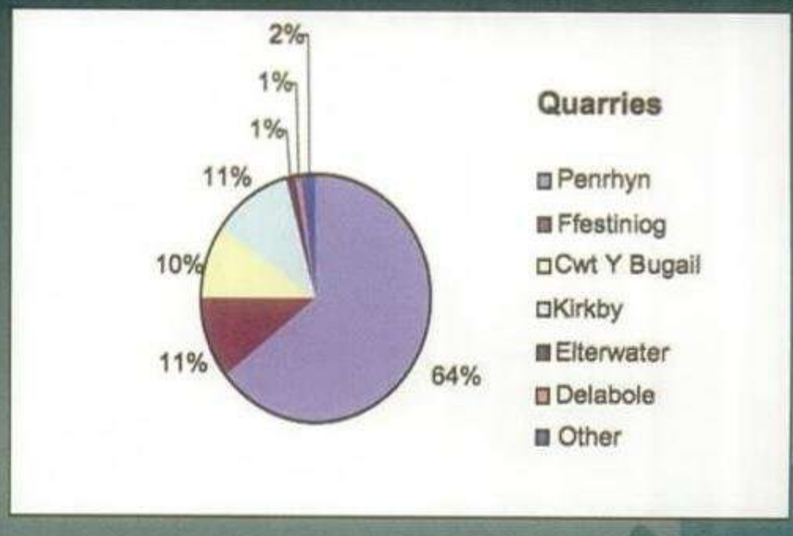
Domestic slate in the 21st century



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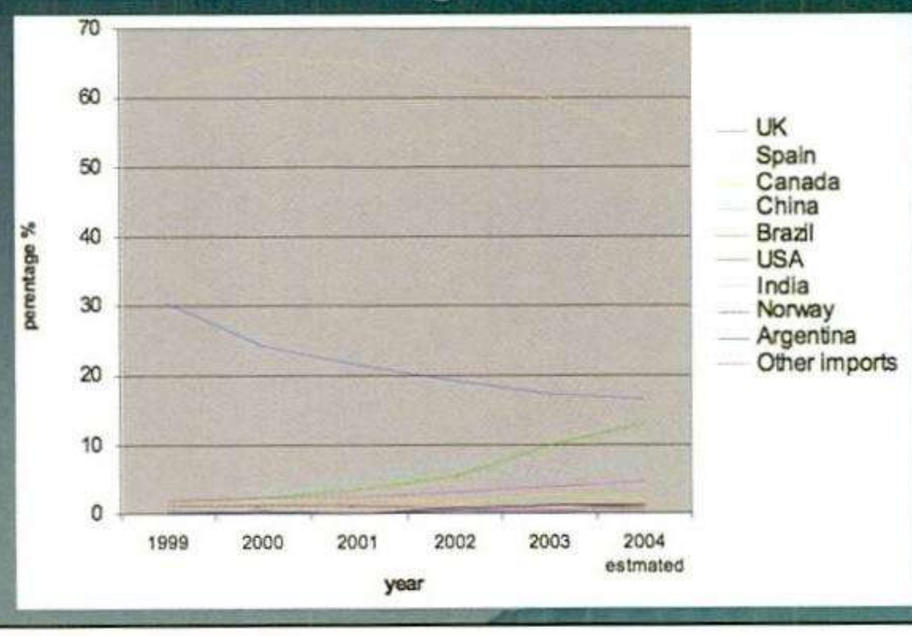
Source of roofing slates in Britain



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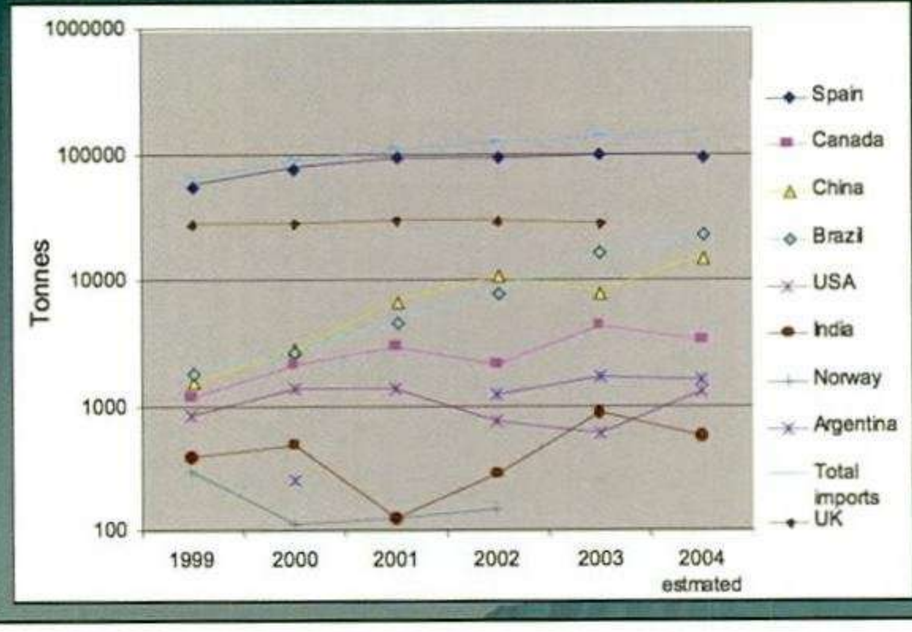
Source of roofing slates in Britain



24

Assessing quality

- Reputation
- Traditional methods
- Introduction of laboratory testing
- New European standard
- Other methods

25

Traditional methods

- Appearance
- Ring
- Licking
- Absorption of water

26

Introduction of laboratory testing of slates

BRE study in 1930s to develop tests which correlate with reputation

27

Reputation of selected slates

Source	Description	Quarry	Reputation
Welsh (Cambrian)	Blue purple	Dorothea,	Excellent
		Pen yr Orsedd	Excellent
		Penrhyn	Excellent
Welsh (Ordovician)	Blue-grey	Maen Offeren	Good
		Cwt y Bugail	Indifferent
Scottish	Dark grey, pyrites	Ballachulish	Good
Cumbrian	Dark green rough	Buttermere	Indifferent
Cornwall	Grey with pyrites	Delabole	Good
Norwegian	Silver grey	Vose grey	Good
Pennsylvanian	Grey	Bangor	Indifferent

28

Laboratory methods correlated with reputation -Watkins 1934

- Absorbency
- Permeability
- Effects of frost
- Transverse strength
- Chemical analyses
- Action of water
- Effect of acid

29

Laboratory methods - Watkins 1934

- Absorbency – Limit set at 0.3%
- Permeability – Negligible
- Effects of frost – No effect
- Transverse strength – No correlation with quality
- Chemical analyses – No correlation with quality
- Action of water – Good correlation

30

Laboratory Methods (Kessler and Sligh 1932)

- Properties of slates
  - –343 new slates
  - –60 used samples
- Laboratory simulation of weathering
  - –Loss of strength and increased absorbency
  - –Wetting and drying cycles

31

Laboratory Methods (Kessler and Sligh 1932)

- Absorbency – Limit set at 0.25%
- Permeability – Negligible
- Effects of frost – No effect
- Transverse strength – No correlation with quality
- Chemical analyses – No correlation with quality
- Action of water – Good correlation

32

Area	No of samples	Mean water absorption (%wt)	Reputation
Vermont-New York	154	0.13	Very durable
Pen Argyll Pa	648	0.30	Less durable
Bangor Pa	250	0.28	Less durable

33

European standard -prEN12326

- Dimensional (deviation from specifications)
  - length and width
  - straight edge
  - rectangularity
  - thickness
  - flatness
- Bending test
- Water absorption
- Freeze thaw
- Non-carbonate carbon
- Carbonate content
- Acid exposure
- Thermal cycle
- Petrographic examination

34

Test methods

Standard	Britain	France	Germany	Spain	Italy	USA	EU
Water absorption	✓	✓	✓	✓		✓	✓
Bending strength		✓	✓	✓	✓	✓	✓
Wetting and drying cycles	✓	✓	✓	✓			✓
Density		✓	✓	✓	✓		✓
Freeze thaw		✓	✓	✓	✓		✓
Acid	✓*		✓	✓*	✓	✓	✓

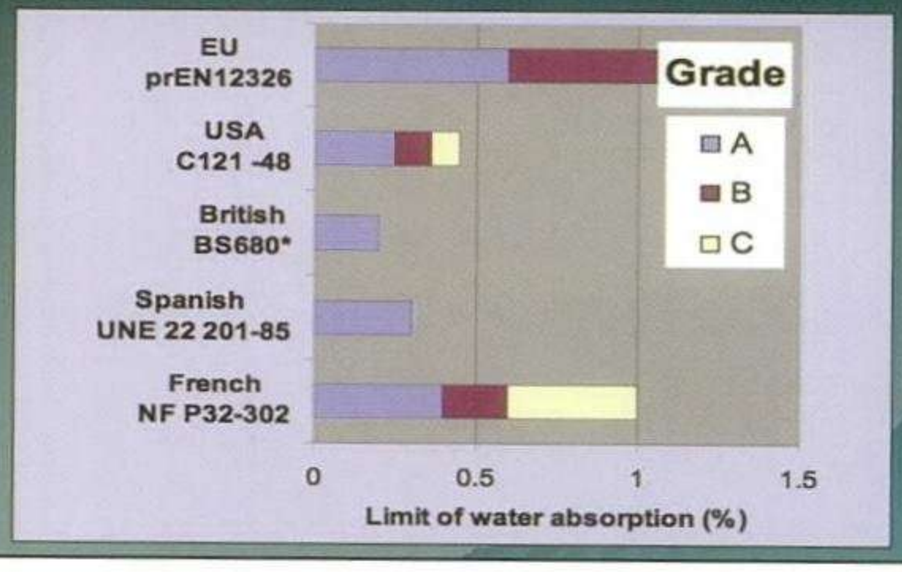
35

Water absorption limits (%wt)

Grade		A	B	C
Britain	Reflux for 48 hours	≤0.3		
France	Immersion	≤0.4	≤0.7	≤0.9
Spain	Immersion	≤0.3		
USA	Immersion	≤0.25	≤0.36	≤0.45
EU	Immersion	≤0.6	>0.6	

36

Limits of water absorbency set by different national standards



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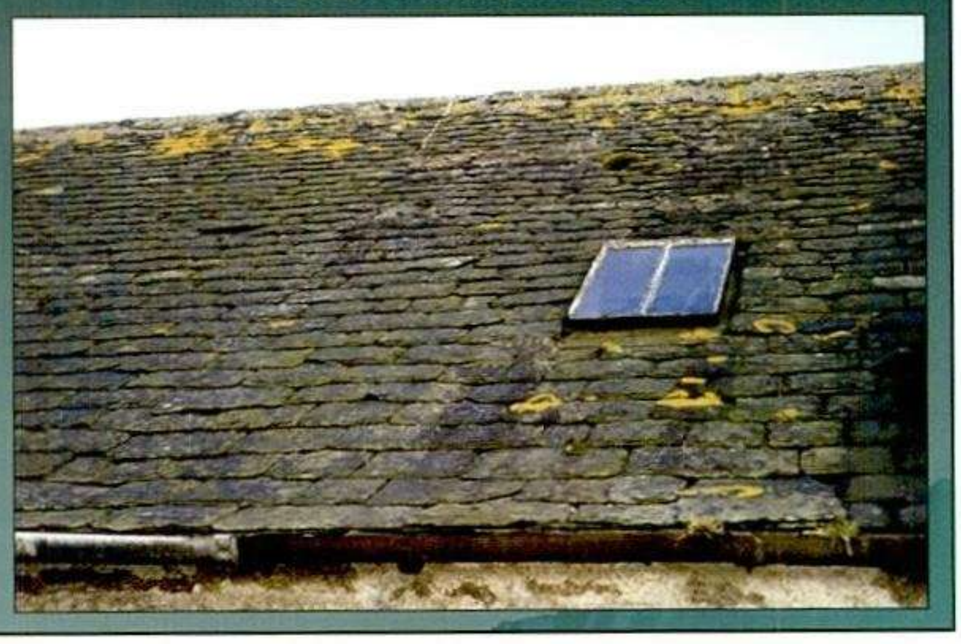
Modulus of rupture (MPa)

Grade		A	B	C
France	Dry	≥70	≥50	≥33
	Wet	≥40	≥33	≥24
Italy	Varies with thickness			
Spain	Dry	≥290Kg/cm^2		
USA		≥62	≥62	≥62
EU	As specified by the manufacturer			

38

Macduff: a failed slate!



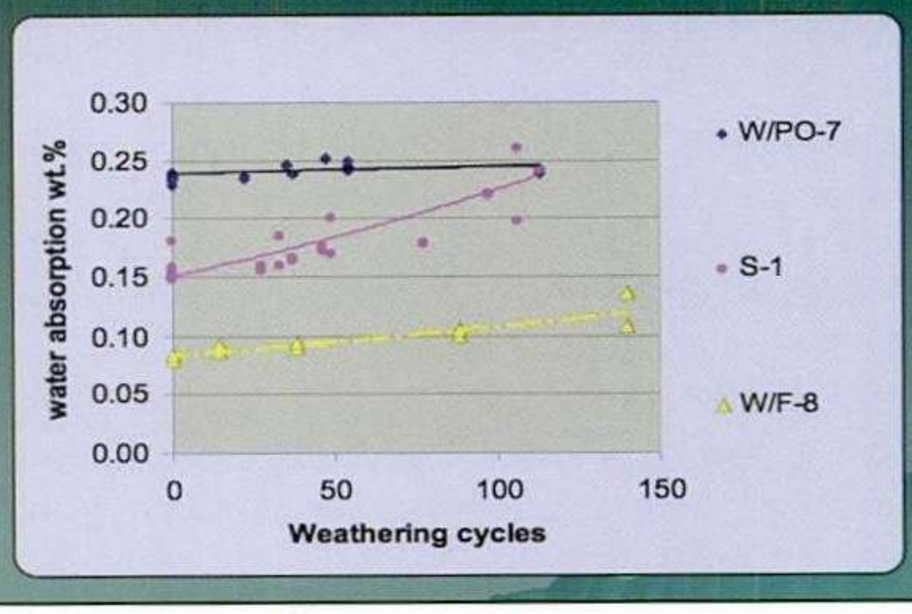
39

Methodology

- Determine the initial water absorption.
- Artificially weather the slate by repeated cycles of wetting and drying.
- Determine the rate of increase in permeability by repeating the water absorption test at intervals during the weathering regime.
- Compare the results with those of a standard slate of known reputation

40

Experimentally weathered slates



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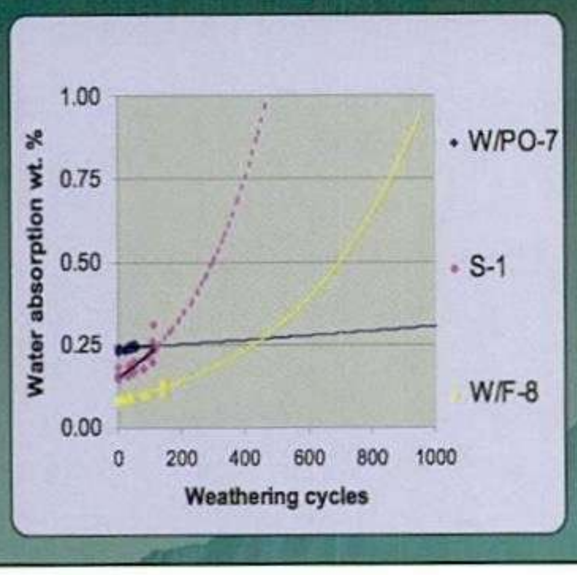
Extrapolation of water absorption data to limit of 1%

- Determine the number of cycles required to reach the limit.



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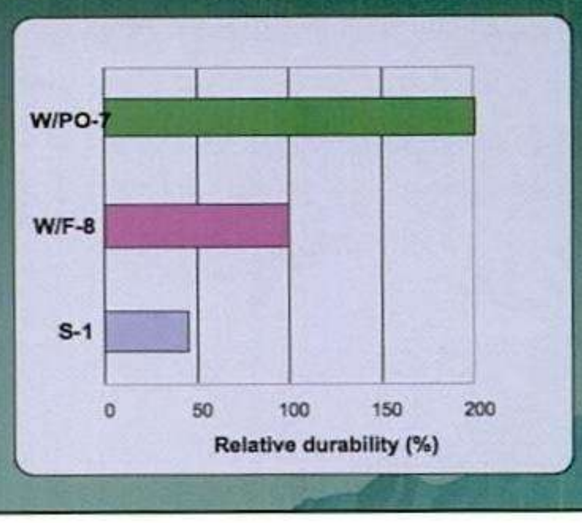
Durability relative to the standard W/F-8



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Conclusions

- What kind of information should a slate standard give the user?
  - Source
  - Dimensional consistency
  - Durability
- The life expectancy of a slate should be most important criterion when selecting a roofing material.

44

PROCUREMENT PITFALLS

Colin Tennant
Chief Executive, Scottish Stone Liaison Group

Scotland has a very rich and varied stone heritage, as can be seen in a city such as Stirling. It provides the material for our important ancient monuments, creates distinctive townscapes, provides housing and has been used to create retail areas that are vital to the economy of our country. Studies such as the Glasgow Project, by quantifying the skills and materials needs, have highlighted the scale of the problems the stone heritage of Scotland faces; shortages of thousands of tonnes of indigenous stone, the lack of hundreds of trained stonemasons and a deficit of millions of pounds of investment in repair and maintenance. It is recognised that these are common complaints across the whole of Scotland, as is illustrated by the images of various building defects from Stirling.

Part of the reason for these problems is lack of understanding of stone as a material and the processes of stone industry. This lack of understanding has the potential to have a massive impact on projects using stone, when they are not taken into account as part of the procurement process.

The restoration of Viewfield Place, Stirling, a Townscape Heritage Initiative Project, is used as a case study to illustrate these issues and how they impact on the quality of work undertake and result in poor decisions on procurement and design of stonework being made. Areas covered include lack of research into historic use of stone and lack of understanding of stone as a natural material. Contractual issues such as poor specification, lack of understanding of stonemasonry as a trade were also explored. Lack of knowledge and understanding by professionals both in terms of specification and construction were highlighted as key issues, with the need to take time to address this lack of knowledge through research and expert advice were suggested as a possible solution. The conflict between lowest cost and best value was also highlighted and it is suggested that greater understanding and appreciation of stone as a natural material and of stonemasonry as a skilled craft would lead to a better balance. This would enable better informed procurement decisions being made, resulting in better quality stonework being carried out in a more sustainable manner.

The presentation highlights the information and expertise that was available and looked at the policies that could be used to stimulate Scottish stone supply and demand; the work that is still required to improve our knowledge and understanding of this natural material; and the role of the SSLG in addressing these issues. The presentation concludes by illustrating that the raw material is still available and that we do still have the skills and expertise to win and use it to create an attractive and dynamic built environment. But, we need to invest in the use and development of those skills and expertise to ensure that we can continue to maintain and add to the stone built heritage that we have.

SEEKING TO SECURE THE SKILLS AND RESOURCES FOR THE FUTURE OF SCOTLAND'S BUILT HERITAGE

Colin Tennant
Chief Executive, Scottish Stone Liaison Group

SCOTTISH STONE LIAISON GROUP

Seeking to secure the skills and resources for the future of Scotland's built heritage

Colin Tennant

1

SCOTTISH STONE LIAISON GROUP

What is SSLG?

- Independent Company, limited by Guarantee
- Charitable Status
- Formed in May 2000
- Minute of Agreement with Historic Scotland
- Board of Directors
  - RICS, RIAS, BRE, Stone Federation, NFRC, Scottish Building, Scottish Lime Centre Trust, Hutton & Rostron, Scottish Landowners Federation
- Associate Members
  - British Geological Survey, CITB, NHTG
- Observers
  - RGU, HS, SEPA, Scottish Executive, SNH, Scottish Enterprise, Institute of Quarrying, Highland Council

2

SCOTTISH STONE LIAISON GROUP

Why?

Enhance availability, promote utilisation and advance knowledge and skills in design, specification and use of indigenous Scottish stone in existing and new build projects.

3

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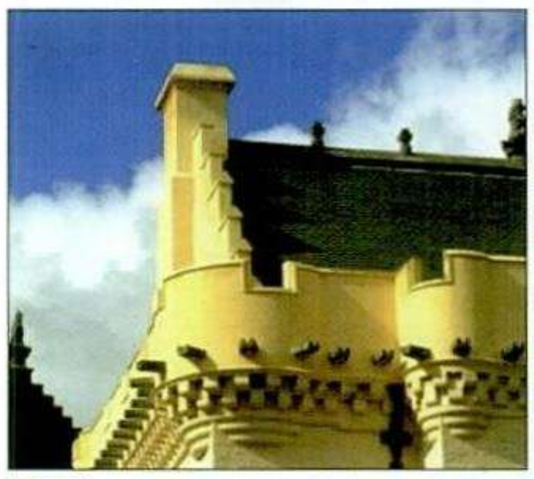

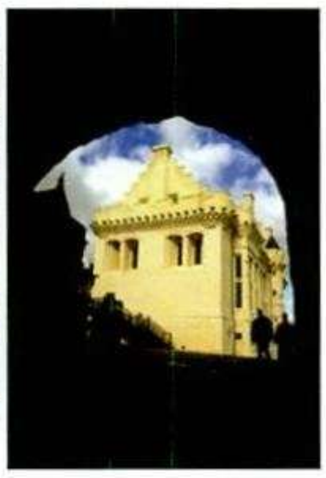

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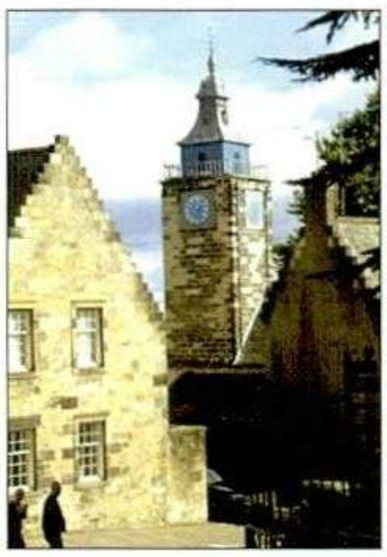

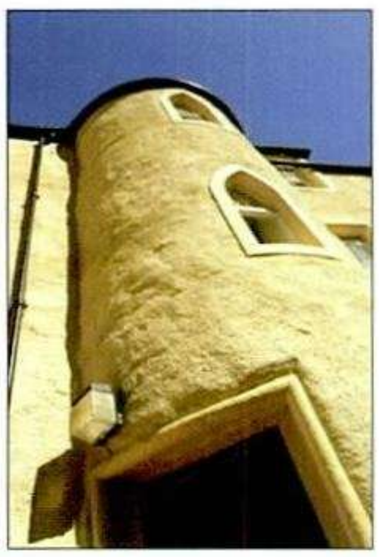

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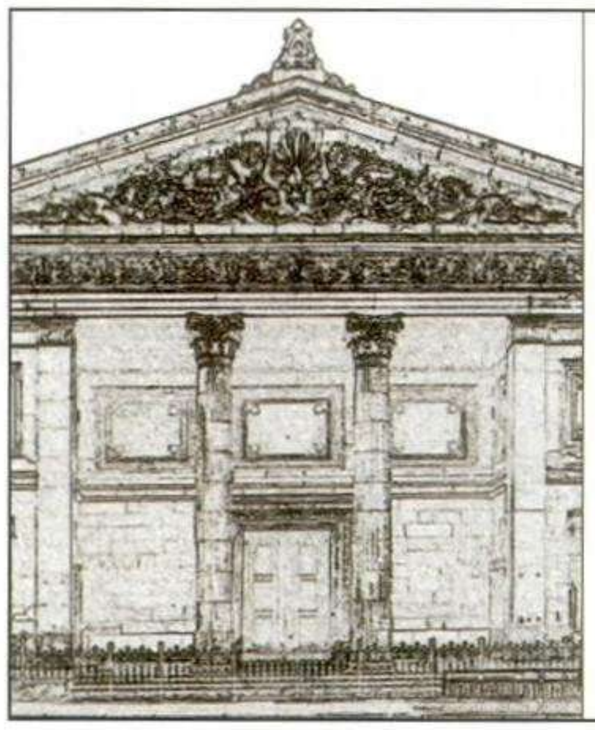

SAFEGUARDING GLASGOW'S STONE-BUILT HERITAGE

SKILLS AND MATERIALS REQUIREMENTS

SCOTTISH STONE LIAISON GROUP

British Geological Survey

Glasgow City Council

10

SCOTTISH STONE LIAISON GROUP

Why?

- Perception of risks
- Need for definitive data
- Construction Skills Action Plan for Glasgow
- Recruitment and training of stonemasons

11

SCOTTISH STONE LIAISON GROUP

Risks to Glasgow's stone built heritage

- Age of buildings
- Pollution
- Poor maintenance
- Lack of knowledge
- Inappropriate intervention
- Lack of funding
- Shortage of skills

12

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13

SCOTTISH STONE LIAISON GROUP

Project Aims

- Assess the condition of the stone heritage
- Assess the stone repairs required over next 20 years
- Determine the nature and volume of stone required
- Assess the skills required to implement repairs
- Identify future skills training needs

14

SCOTTISH STONE LIAISON GROUP

Key Findings

- 395,000 tonnes of stone required to repair Glasgow facades
- 149,000 (38%) is of a type not available in UK
- £585 million required to undertake repairs
- £24,000 per façade

15

SCOTTISH STONE LIAISON GROUP

Key Findings

- To repair all the buildings would require 1.4 million mason days
- 301 masons employed every year for the next 20 years
- Currently 7 stonemasons produced in Glasgow each year.

16

SCOTTISH STONE LIAISON GROUP

Key Findings

- 31% of facades need maintenance to halt further degradation
- If not carried out, another £180 m required
- 97% of buildings in need of repair
- 56% of buildings have 'plastic repairs' that will fail in the next 20 years

17

SCOTTISH STONE LIAISON GROUP

Key Conclusions

- Poor quality repairs and lack of maintenance
- Accurate matching of stone for repair
- Blonde sandstone more repair than red
- Stone suppliers unlikely to cope with demand
- Output of qualified stonemasons and training provision inadequate
- Min. of c.116 new stonemasons employed for 20 years to achieve 60% repairs
- Delay means more repairs and more cost

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SCOTTISH STONE LIAISON GROUP

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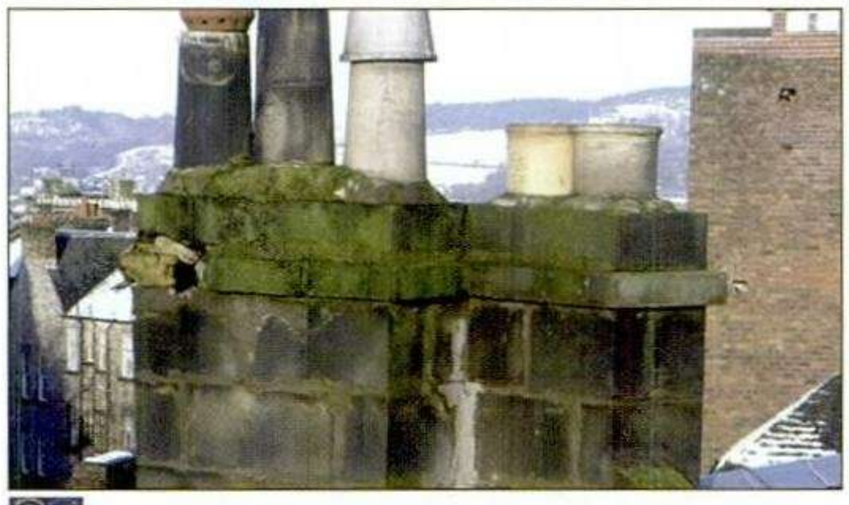

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22

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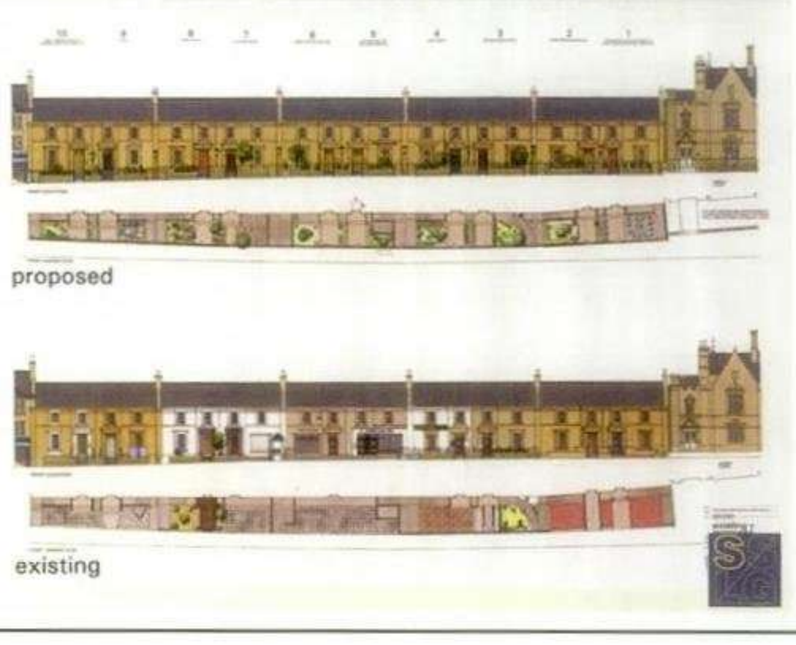
STIRLING TOWNSCAPE HERITAGE INITIATIVE

The Critical Project: 1-10 Viewfield Place

- **B Listed 2-storey & basement classical terrace**
- **Circa 1835, part of the early townhouse expansion outwith medieval core**
- **Important location on the edge of town centre**
- **Run down and badly altered over time**
- **Restore and revitalise the terrace**
- **Boost the stature of the area**

23

STIRLING TOWNSCAPE HERITAGE INITIATIVE



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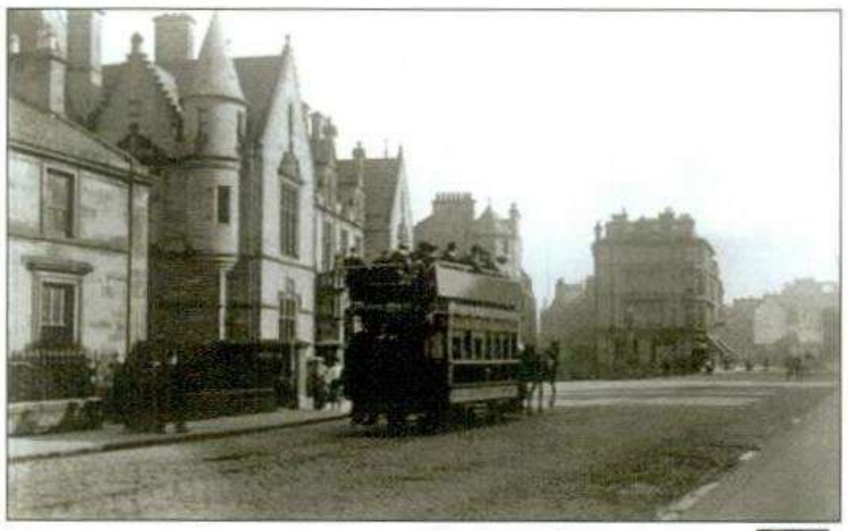
STIRLING TOWNSCAPE HERITAGE INITIATIVE



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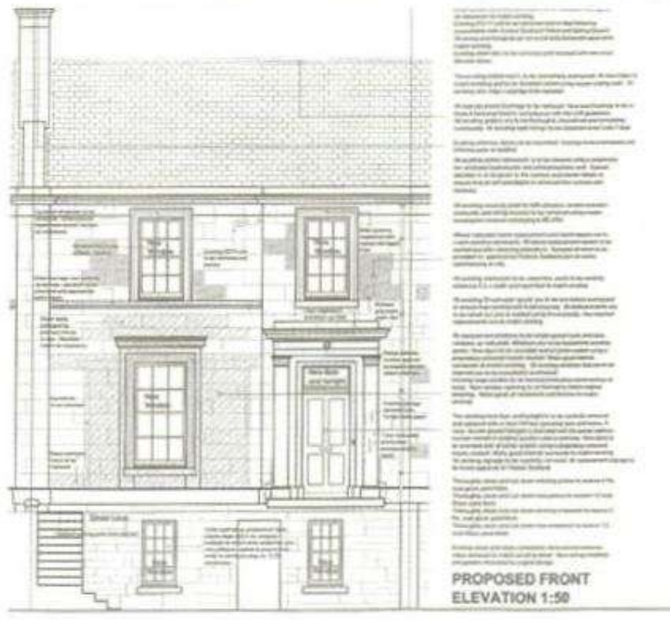
STIRLING TOWNSCAPE HERITAGE INITIATIVE



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STIRLING TOWNSCAPE HERITAGE INITIATIVE

Stone matched on basis of colour & texture

- **No historical research done on original source of stone**
- **No petrographic analysis to identify best match**
- **Decision made on one small sample of stone**

27

STIRLING TOWNSCAPE HERITAGE INITIATIVE

Stone as a natural material

- **No appreciation of how bed size in a quarry can impact on availability of stone**
- **No appreciation of natural marks that may appear, stone not a uniform product like artificial stone**
- **No appreciation of colour variations possible in one stone type, again not a uniform product**

28

STIRLING TOWNSCAPE HERITAGE INITIATIVE

29

STIRLING TOWNSCAPE HERITAGE INITIATIVE

Contractual issues

- **Due to tenders being well over estimates, specification weakened to lower costs and enable project to go ahead**
- **Main contractor had little experience of stone work, poor supervision**
- **Stone sub-contractor very busy, relatively small project, no consistency in terms of skills and workmanship**

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STIRLING TOWNSCAPE HERITAGE INITIATIVE

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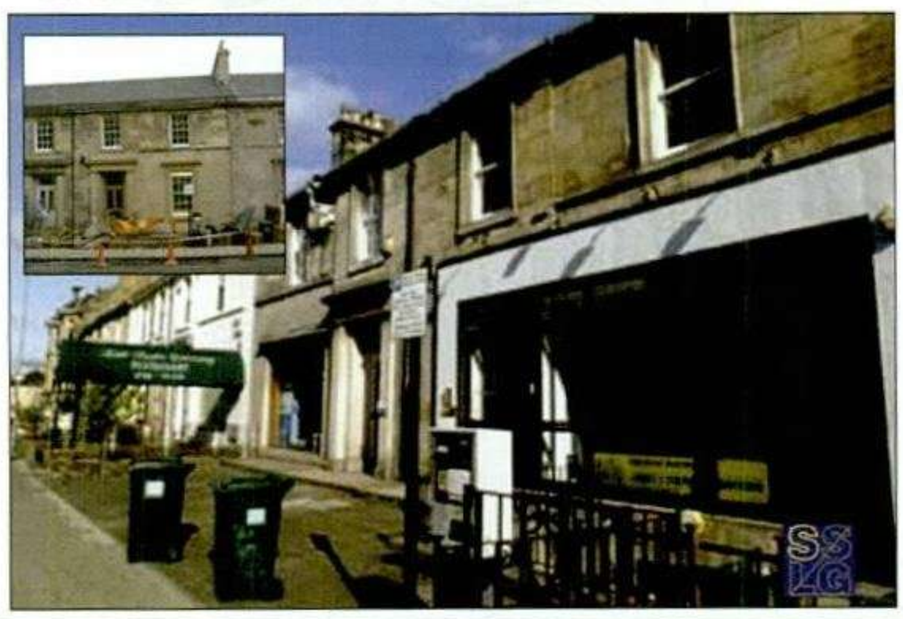
STIRLING TOWNSCAPE HERITAGE INITIATIVE



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STIRLING TOWNSCAPE HERITAGE INITIATIVE

34

STIRLING TOWNSCAPE HERITAGE INITIATIVE

Who was to blame?

- Architects/QS/Project Manager
- Heritage Lottery Fund, Historic Scotland
- Main contractor
- Sub-contractor

All to some extent !!

35

STIRLING TOWNSCAPE HERITAGE INITIATIVE

Why?

- Lack of technical knowledge by professionals
- Lack of respect for stone as a material
- Lack of understanding of the stone industry
- Commercial & time pressures
- Lack of locally available material
- Shortage of good skilled stonemasons

36

STIRLING TOWNSCAPE HERITAGE INITIATIVE

Consequences?

- Chance that new stone will have detrimental impact on original fabric
- Poor specification, supervision and lack of knowledge resulted in conflict between professional team, main contractor and sub-contractor
- Very little indigenous material used
- Restoration not as good as it could have been; technically or aesthetically

37

STIRLING TOWNSCAPE HERITAGE INITIATIVE

Lesson learned

- Take time to think & learn about materials and understand how they are produced and used
- Take (& pay for!) expert advice
- Take time to develop specification and investigate options
- Lowest price is not always the lowest cost

38

STIRLING TOWNSCAPE HERITAGE INITIATIVE

SCOTTISH STONE LIAISON GROUP

HEACS Report, Traditional materials and skills to meet the needs of the built heritage, September 2006.

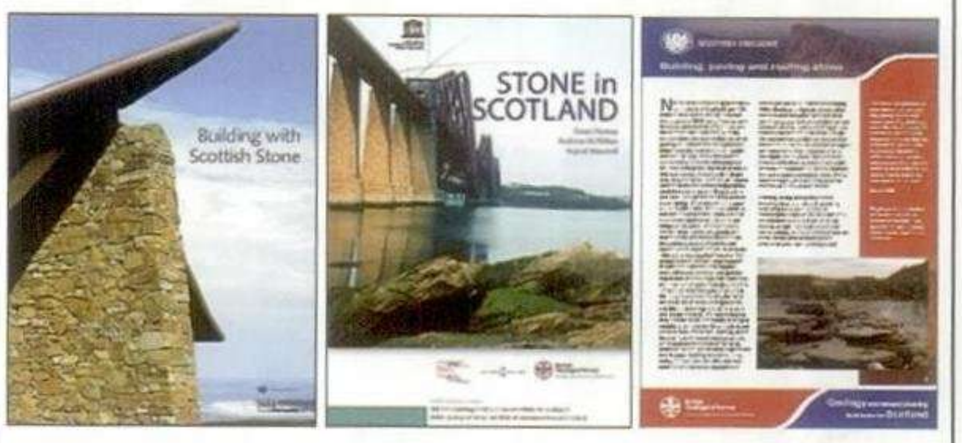
'Skills and materials audits similar to the Glasgow Project should be carried out in different areas, to provide comparative information.'

'The development of the Scottish stone quarrying industry, particularly dressed stone, should be taken forward as a priority.'

'Scottish Ministers must give a commitment to bring about new sources of supply of Scottish slate as a matter of urgency.'

39

SCOTTISH STONE LIAISON GROUP



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SCOTTISH STONE LIAISON GROUP

Scottish Planning Policy 4: Planning for Minerals
The demand for and scarcity of consented reserves of building stone requires additional reserves to be identified and safeguarded in development plans. Reopening dormant and securing active sites, supplemented by information held on workable reserves is important in providing for future supply.

Statement on Scotland's Architecture Policy 2007
Our existing building stock is a crucial contributor to local distinctiveness and identity. Reflecting local building materials and traditional construction, the existing built environment physically embodies the history and identity of communities. Large or small scale redevelopments can draw inspiration from our past in the creation of our future surroundings and can provide points of reference and cultural continuity for communities which may be affected by significant change.

41

SCOTTISH STONE LIAISON GROUP

STONE SUPPLY

- Identifying new sources of Scottish Stone + Slate
- Liaising between landowners, local authorities and operators
- Promoting the concept of 'snatch' quarrying
- Working with BGS and LECs to link supply of local stone with potential local demand

42

SCOTTISH STONE LIAISON GROUP

STONE DEMAND

- Local stone that matches in terms of petrographic composition that will give a long term, sustainable repair.
- Local slate that maintains the character of the local roofscape and provides a hard wearing and long-lasting roof covering.
- Work with Local Authorities to stimulate demand through planning conditions on proper repairs, sustainable design & grant schemes

43

SCOTTISH STONE LIAISON GROUP

44

SCOTTISH STONE LIAISON GROUP

INDIGENOUS MATERIALS ACTIVITY GROUP
Partnership with Local Authorities and National Parks in undertaking Building Stone & Built Heritage Audits, supported by the Scottish Government

- Identify sources of building stone and locations where it could currently be accessed

uantify stone needed for repair of existing buildings and potential use by new developments

uggest regulatory or financial measures that would stimulate the sustainable supply and demand of stone

reate a Scottish Building Stone Database, linking information on

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SCOTTISH STONE LIAISON GROUP

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SCOTTISH STONE LIAISON GROUP

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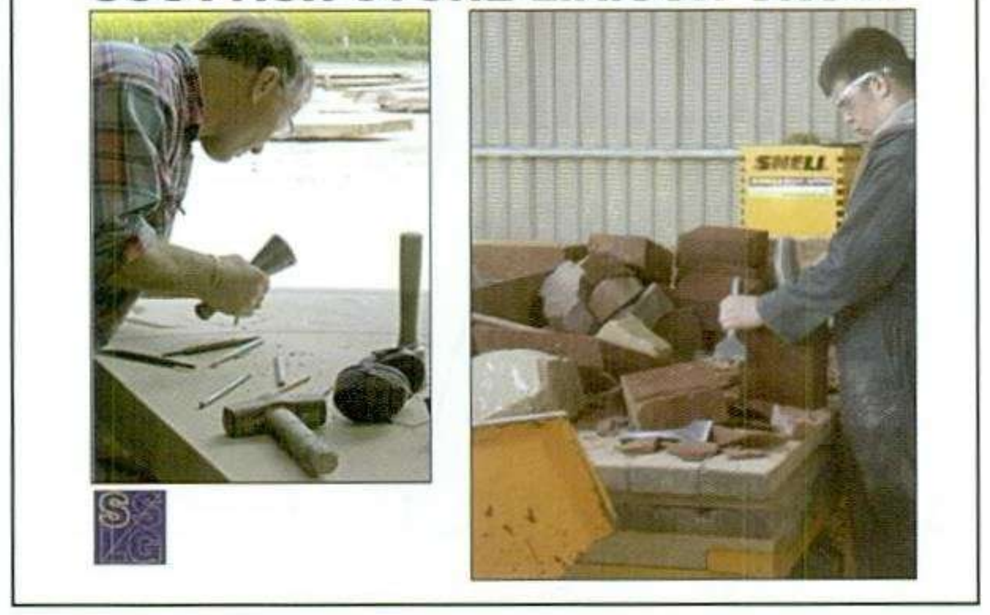
SCOTTISH STONE LIAISON GROUP
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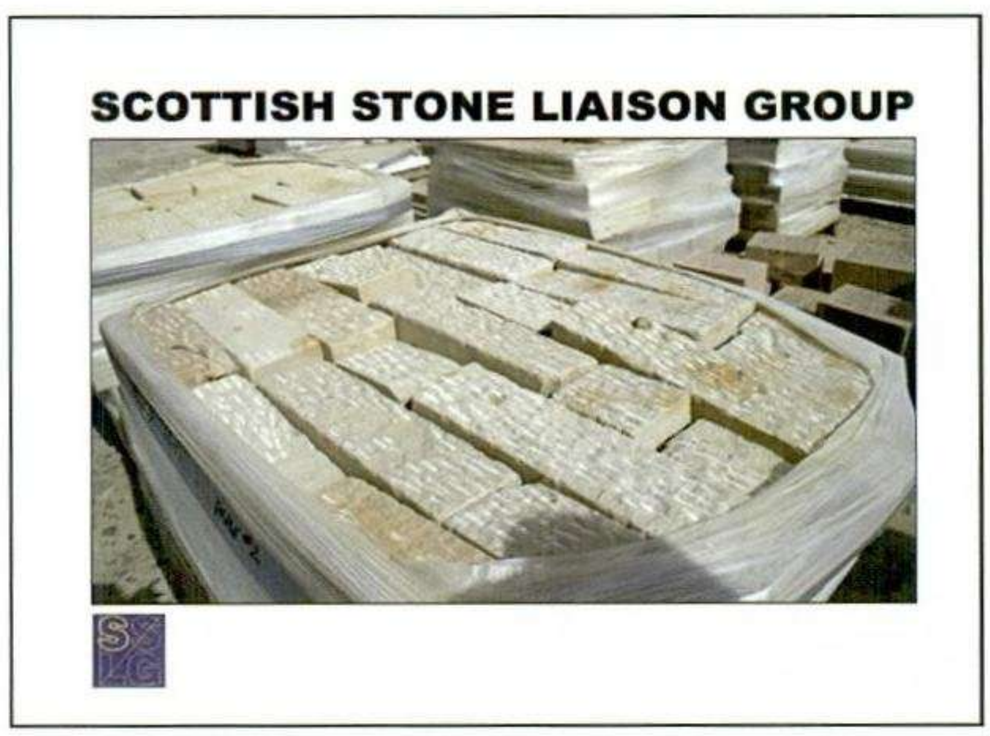
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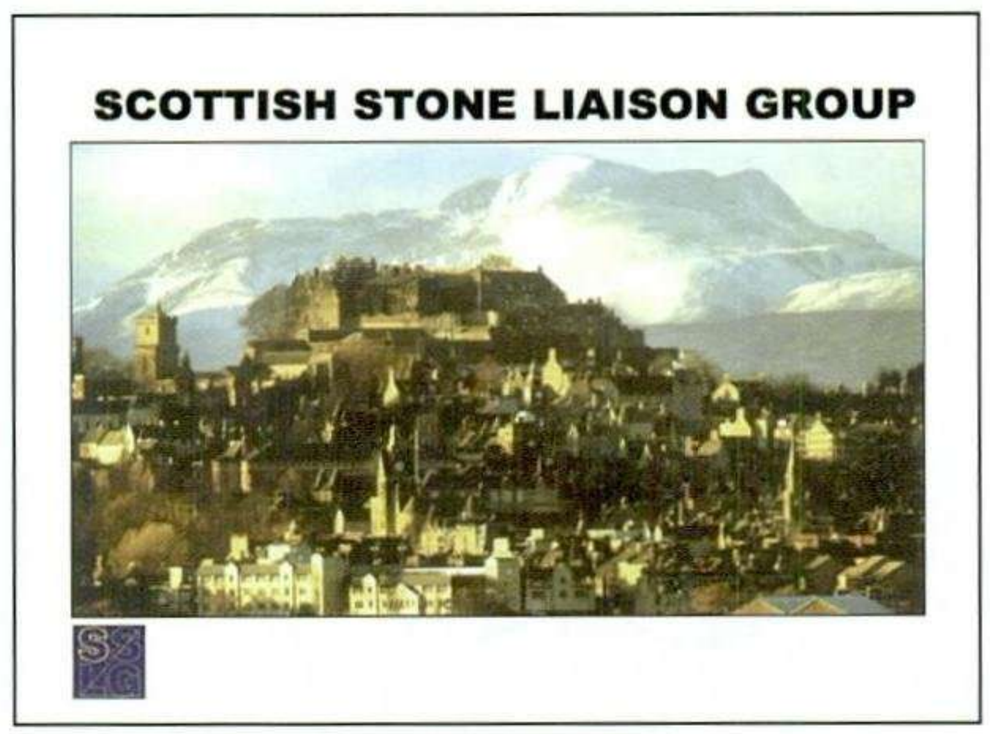
SCOTTISH STONE LIAISON GROUP

QUARRY SOURCE LOCATIONS

Andrew McMillan, British Geological Survey

Indigenous stone, defined by Scotland's varied geology has profoundly influenced the Scottish built heritage through its varied use and its effects on design and architectural style through the centuries. With the resurgence of interest in stone for repair, conservation and for new build in the 21st century, there are pressing needs both to understand the performance this complex material, to source supplies of indigenous stone and to ensure that these resources are used appropriately. Indigenous stone sourced from Scotland and northern England forms a major component of Scotland's pre-1919 building stock. Traditionally Scottish stone was also used for roofing, streets, pavements and bridges and all forms of walling. Today's global market has encouraged the importation of stone for new-build cladding and for new city streetscapes. Whilst this may positively influence public acceptance of the use of natural stone, consideration needs to be given to the use of 'like for like' indigenous materials for repairs and conservation work thus ensuring that the unique character of buildings constructed of Scottish-sourced stone is not lost for future generations.

The sourcing of indigenous stone is a crucial element of the safeguarding the resources for future use. The UK Government's response to the Rio Earth Summit on Sustainable Development (1992) notes '.... it will become increasingly important to have reliable information about the nature, quantity and location of mineral resources as workable reserves in environmentally acceptable areas become scarcer.'... Legislative planning for minerals working varies form country to country in the UK but Government minerals planning policy now makes specific reference to the identification of building stone resources (Department for Communities and Local Government, 2006; Scottish Executive, 2006).

As part of the ongoing research into quarry sources and supply of stone, the British Geological Survey (BGS) is validating information on historic Scottish quarries (McMillan et al, 2005). Some 16, 500 records collated in 1990s (not all unique quarry sites) have been amassed. Sources of information include: Geological Survey Economic memoirs, Wartime pamphlets, Geological Survey maps and memoirs, photographic collections, mineral and rock collections, Ordnance Survey Historical maps, books and scientific papers, building and quarrying trade magazines, articles and papers, together with quarry brochures and testimonials. The quarries range from national and regional significance to small workings for local use. As validation proceeds, the data are incorporated into the BGS Mines and Quarries Database BRITPITS which is used to publish Directories regularly (Cameron et al., 2005) and minerals planning factsheets (via http://www.bgs.ac.uk/mineralsuk/home.html). The information has been used for several index-publications on quarry sources and their locations such as the Building Stone Resources Map of Britain (British Geological Survey, 2001) and the UNESCO volume Stone in Scotland (Hyslop et al., 2006), and will serve the basis for future regional volumes to be published by Historic Scotland.

In the mid-1850s of the 674 significant building stone quarries listed by Hunt (1859), the majority lie within the Midland valley of Scotland and supplied sandstone to the major towns and cities. Studies of Edinburgh (McMillan et al., 1999; Hyslop, 2004) indicate that during the second half of the 19th century sources of supply were widespread and extended into England. Supplies of stone dwindled in the 20th century and by 1997 across Scotland there were only 10 quarries supplying building sandstone (McMillan, 1997). Ten years on the situation is largely similar, but the potential demand for indigenous stone is high. Based on research in Glasgow (Scottish Stone Liaison Group, 2006) and Edinburgh (Hyslop, 2004, Hyslop and McMillan, 2004) most stone for repair and for new construction is sourced from northern England. There is a pressing need to make accessible relevant resource information both via web portals (c.f. the Northern Ireland Natural Stone Database) and a range of publications. Follow-up regional field assessment is a prerequisite to establish currently available Scottish indigenous stone resources. Consideration should also be given to the technical and economic feasibility of winning more building stone from aggregate quarries.

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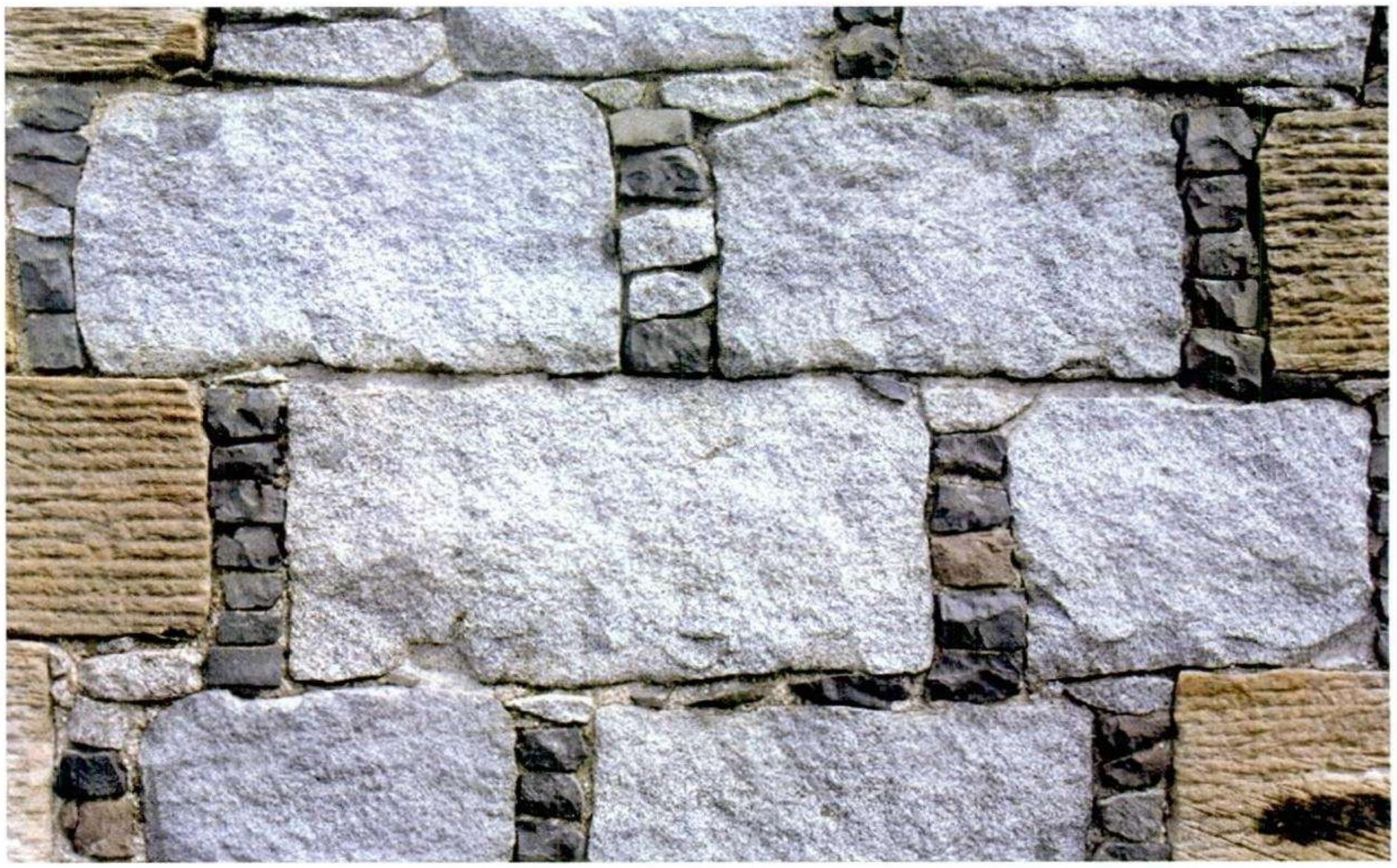


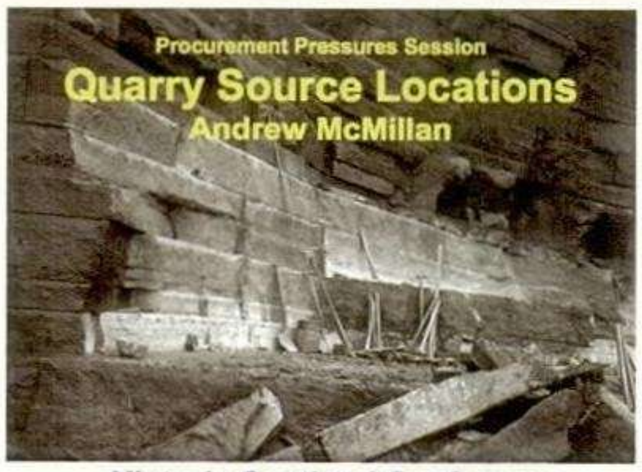
A variety of stone types can be found in buildings

QUARRY SOURCE LOCATIONS

Andrew McMillan
British Geological Survey

1

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL



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Historic Scotland Conference
'Stone in Context'
14 -15 November 2007, Tolbooth, Stirling

2

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

Sustainable Development: The UK Strategy.
The UK Government's response to the Rio Earth Summit.
'..... it will become increasingly important to have reliable information about the nature, quantity and location of mineral resources as workable reserves in environmentally acceptable areas become scarcer.'…

1997

Nov 2006

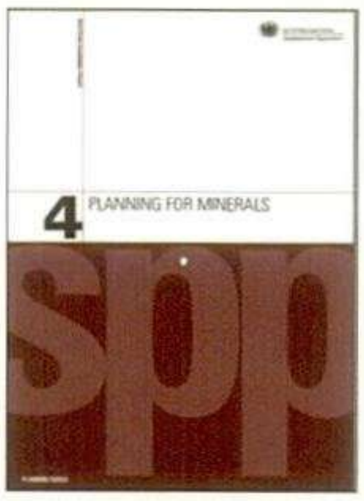
Minerals Planning Policy Statement 1: Planning and Minerals. Annex 3: Natural Building Stone and Roofing Stone (England)

'3. Policies for building and roofing stone provision
a) Safeguarding of building and roofing stone resources
3.1 Regional planning bodies (RPBs) and the Mayor of London should set out policies in their Regional Spatial Strategies (RSSs) or the Spatial Development Strategy in London, for safeguarding nationally, regionally and locally significant building stone resources.'

3

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

Towards a better planning system



- An efficient planning system is vital to the economy and protection of the environment
- The planning system has to balance the many different pressures on the use of land and between conservation and development
- Access to and interpretation of high quality data and information allows more informed debate and should lead to balanced judgements

Sept 2006

4

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SPP4: Planning for Minerals

- Recognises that minerals are vital to the economy and that they are the foundation of the built environment;
- recognises that minerals can only be worked where they are found;
- recognises that mineral working may have an impact on local communities and the environment;
- recognises the need for aggregate minerals landbank and the importance of safeguarding;
- promotes a positive and holistic approach to mineral planning.

5

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SPP4: Objectives for mineral working

- where possible, safeguard for future use;
- maintain steady and adequate supply to meet needs of society and economy;
- set high environmental standards for working and restoration;
- promote use of secondary and recycled material;
- protect designated areas from adverse impacts;
- minimise negative impacts on communities.

6

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SPP4: NON-AGGREGATE CONSTRUCTION MINERALS

47. **Dimension stone and slate are particularly important in repair and maintenance of existing buildings and as a bespoke material in new buildings**, contributing to the Executive's policy on the historic environment, improving housing conditions, sustainable development and 'Designing Places'.

The demand for and scarcity of consented reserves of building stone **requires additional reserves to be identified and safeguarded in development plans**. Reopening dormant and securing active sites, supplemented by information held on workable reserves is important in providing for future supply. **Reserves are often worked on small sites, in limited quantities and intermittently over a long period**.

Planning authorities should ensure that conditions do not impose undue restrictions on such operations. Operators should seek to conserve the resource and it may be necessary to enter into a planning agreement to ensure that materials are not used for lower grade purposes or that sites are not lost to other permanent uses. That policy does not apply to construction aggregates quarries where limited supplies of building stone may also be worked.

7

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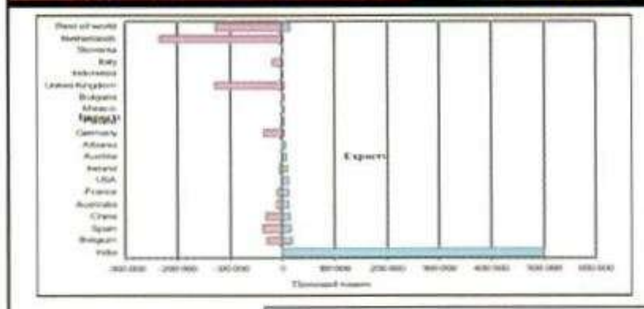
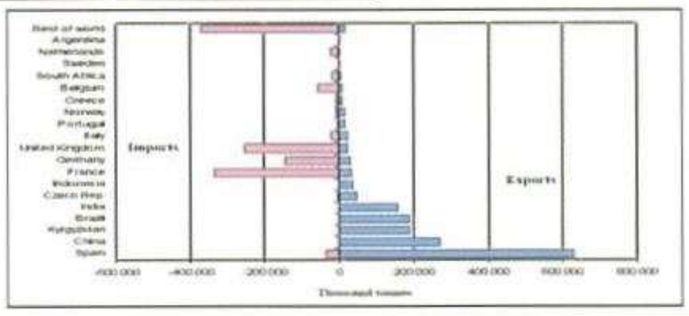


Major sandstone importing and exporting countries, 2005

From: BGS Mineral Profile 'Building and Roofing Stone' 2005 (data source UN Comtrade database)

Major roofing slate importing and exporting countries, 2005



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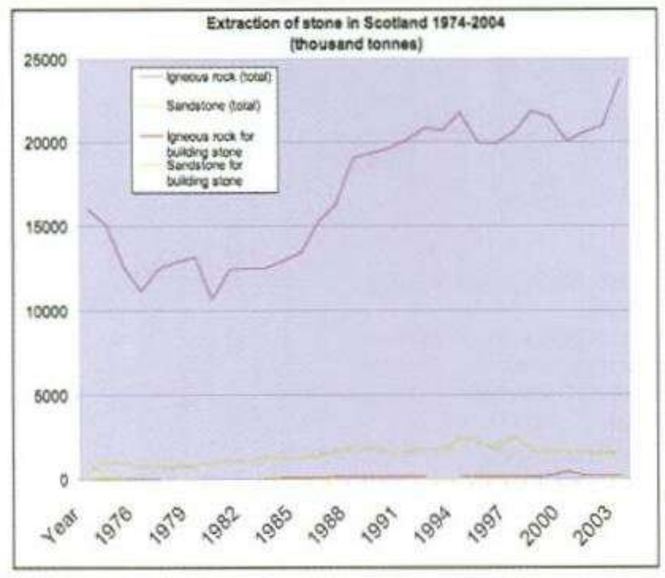
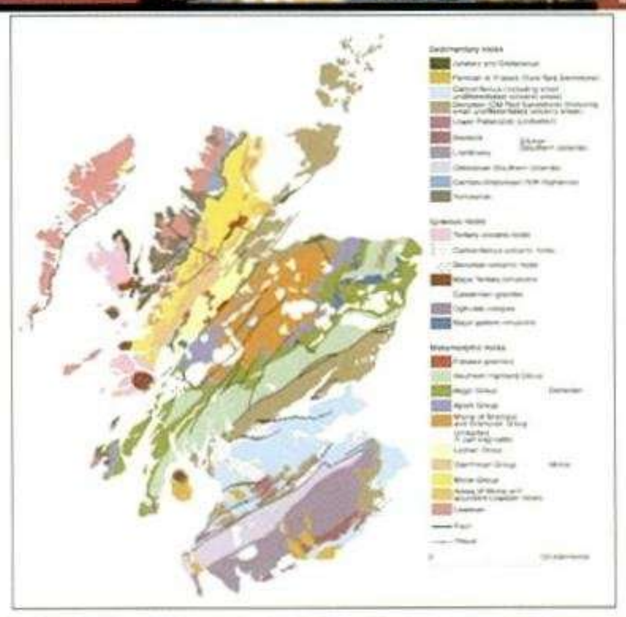


Data from Annual Minerals Raised Inquiry, Office of National Statistics

9

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

Bedrock geology of Scotland



10

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- 16,500 records collated in 1990's, but not all unique quarry sites
- sources of information: memoirs, survey and OS maps
- range of quarries: national and regional significance to small workings for local buildings, walls etc.
- most are historic abandoned quarries but database includes known active quarries
- unknown how many are sterilised through development, landfill etc.
- ongoing validation task using a geodatabase in ArcGIS
- validated data incorporated into BRITPITS (Mines and Quarries Database)

British Geological Survey

The BGS Scottish Building Stones Quarries Database Volume 1 of 2

11

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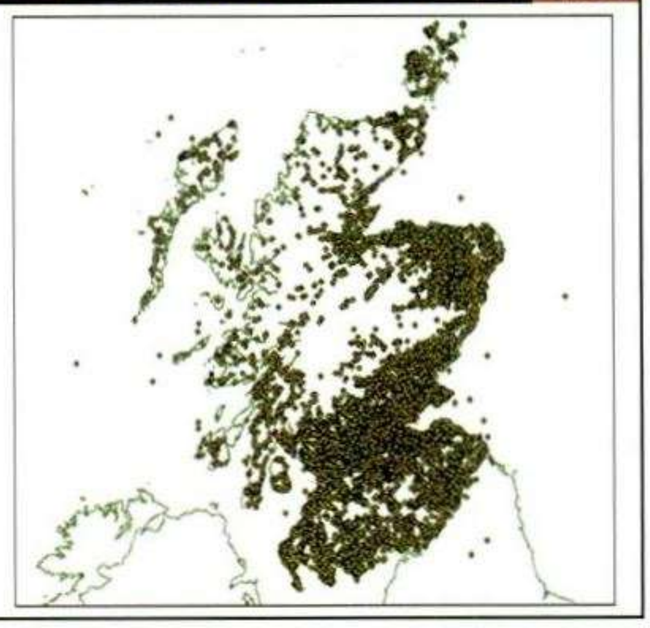
Location of some Historic quarries



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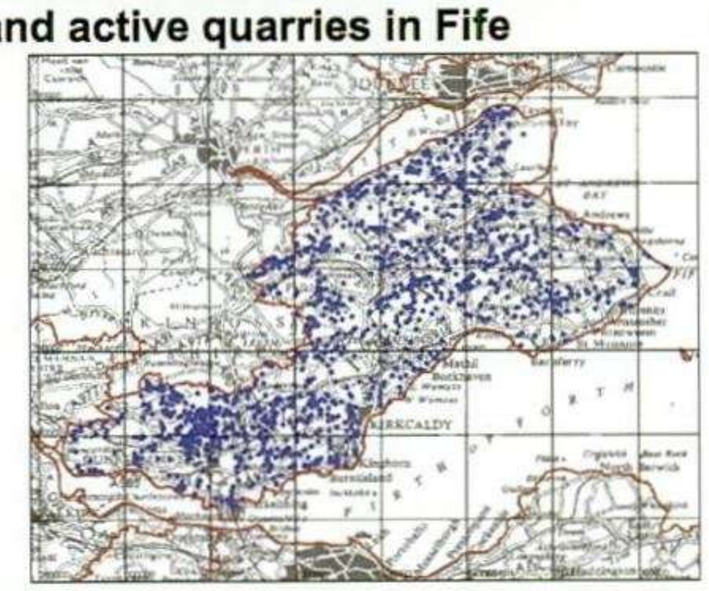
Historic and active quarries in Fife

1434 quarries of which 21 are currently active (source BRITPITS, 2007)



13

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Regionally significant quarries

14

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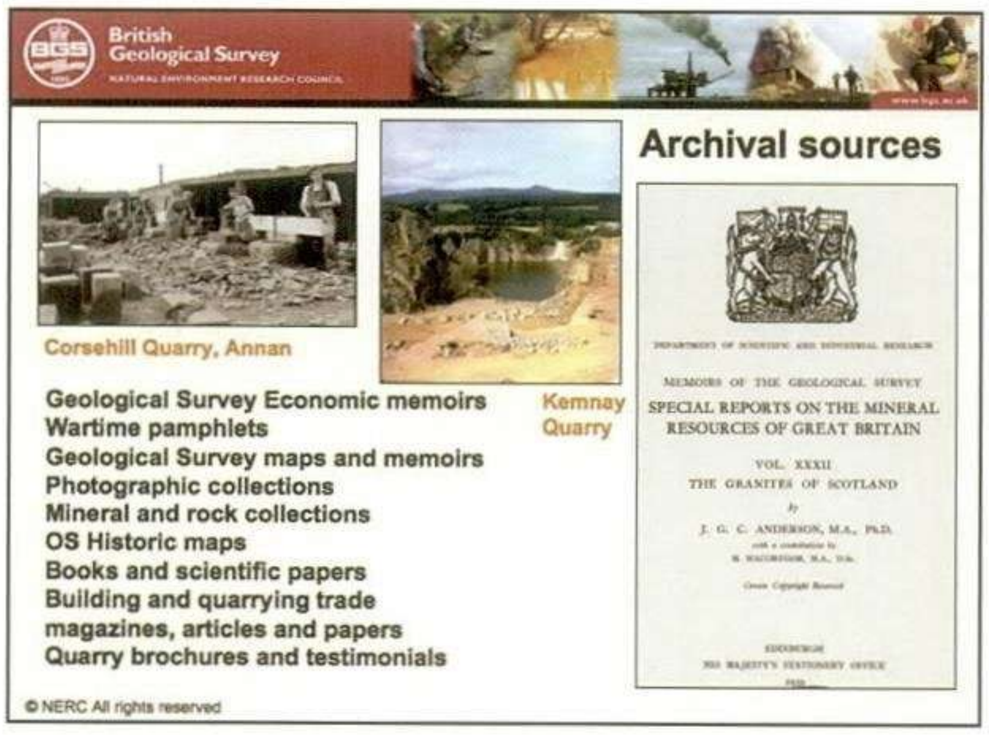
Regionally significant quarries

Active, 2006

15



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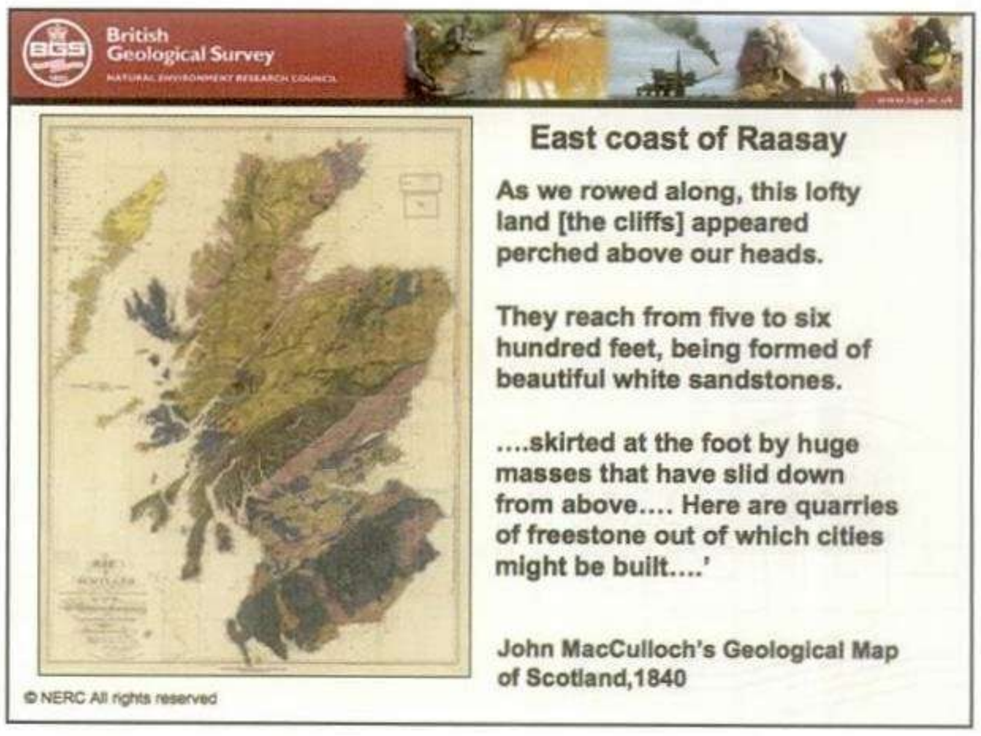

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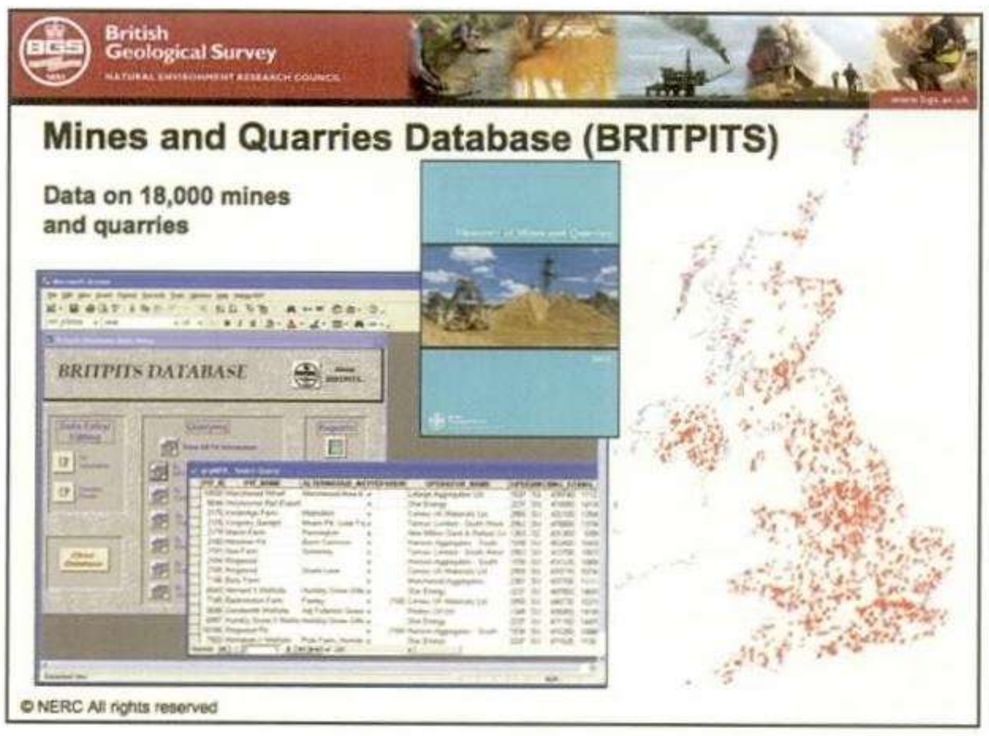

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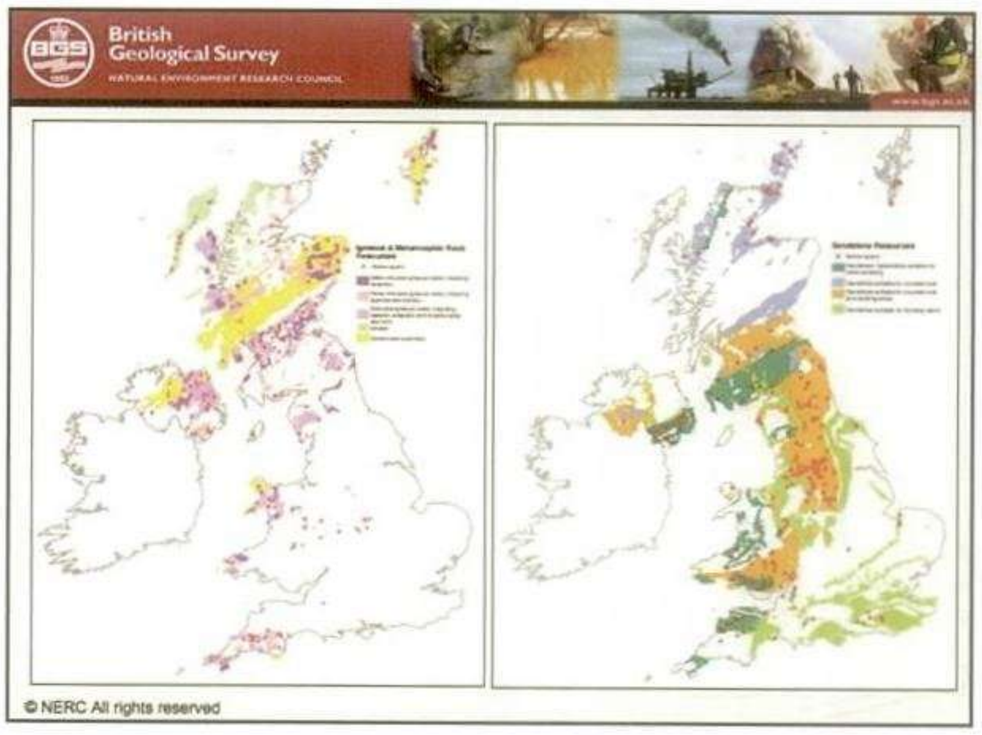

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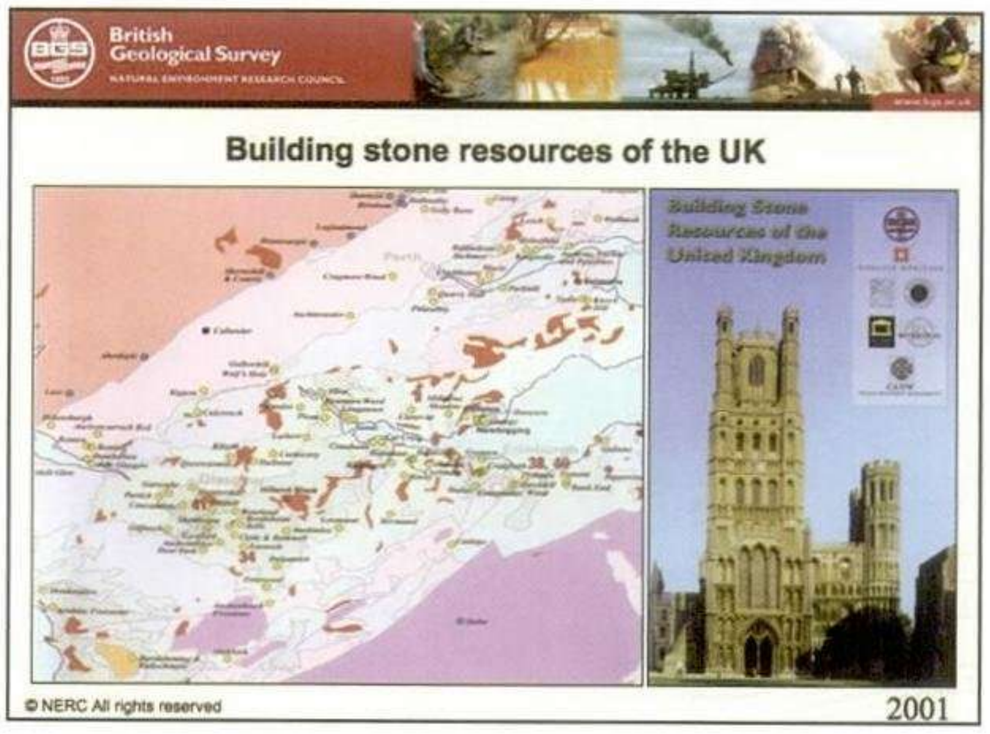

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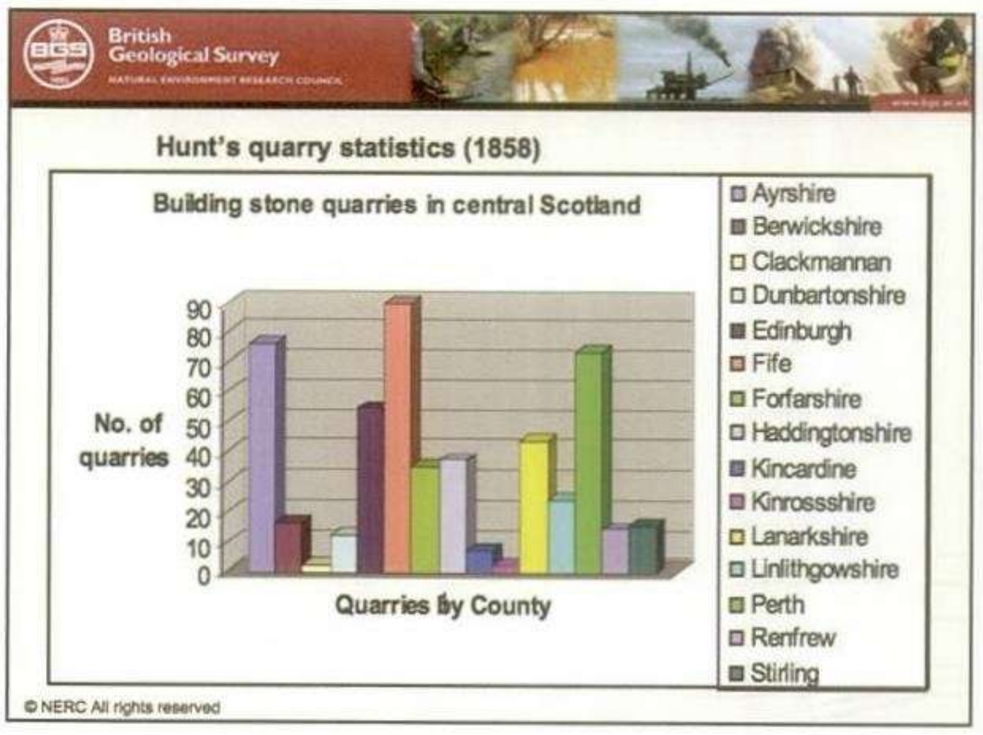

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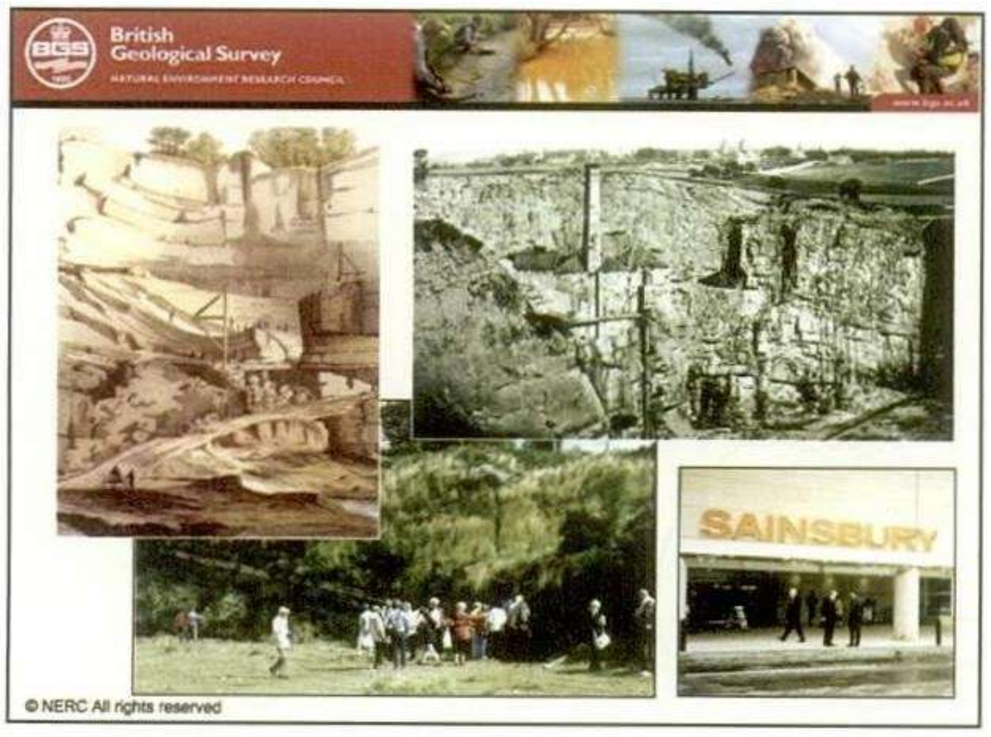

22

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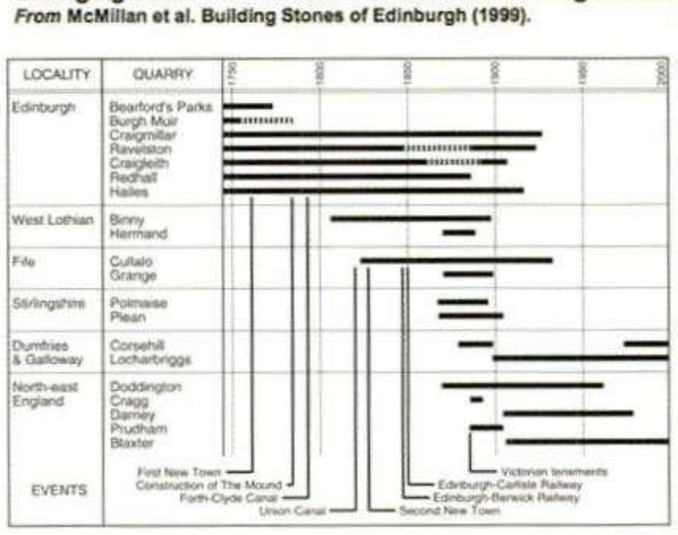
Changing sources of sandstone used in Edinburgh's buildings.

From McMillan et al. Building Stones of Edinburgh (1999).



23

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Sources of building sandstones used in Edinburgh

19th century

Data from 'Building Stones of Edinburgh 1999' and Historic Scotland Research Report 'Performance of replacement sandstone in the New Town of Edinburgh 2004'

24

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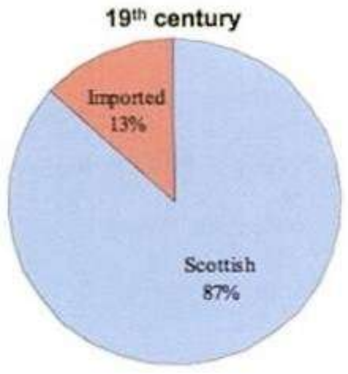
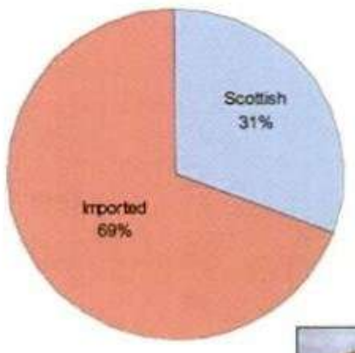
Sources of building sandstones used in Edinburgh

19th century



20th century



Data from 'Building Stones of Edinburgh 1999' and Historic Scotland Research Report 'Performance of replacement sandstone in the New Town of Edinburgh 2004'

25

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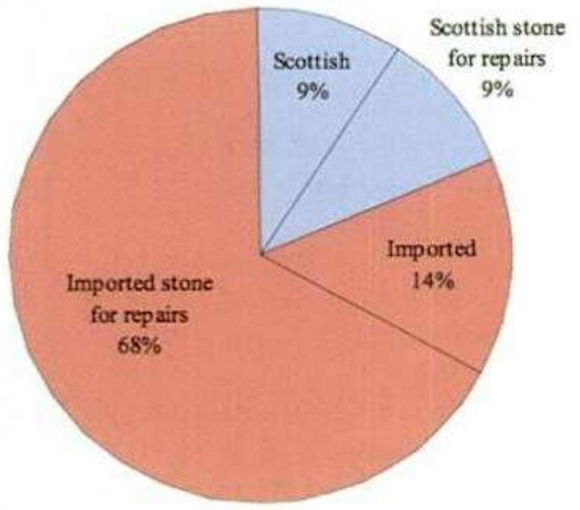
Sources of building sandstone used in Edinburgh between 1980 - 2000



Data from 'Building Stones of Edinburgh 1999' and Historic Scotland Research Report 'Performance of replacement sandstone in the New Town of Edinburgh 2004'

26

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Operating quarries -1997

Quarry Name	Location	National Grid ref.	Operator	Rock type	Age
Achavrole	Calder	NO098594	Scotstone Ltd	Sandstone	Devonian
Braxside	Reay	NC950639	G H Minter	Diorite	Reay Diorite
Clashach	Hopeman	NJ162701	Moray Stone Cutters	Sandstone	Permian
Cornoockie	Lochmaben	NY088870	Onyx Contractors	Sandstone	Permian
Corsehill	Annan	NY208700	Onyx Contractors	Sandstone	Triassic
Cruaday	Sandwick	HY247217	Orkney Builders Ltd	Sandstone	Devonian
Dunmore	Airth	NS860691	Scottish Natural Stones Ltd	Sandstone	Carboniferous
Easter Delfour	Kinoraig	NH843087	Alvie Trust	Granite	Monadhliath Granite
Gatelawbridge	Thornhill	NX902965	Scottish Natural Stones Ltd	Sandstone	Permian
Kemnay	Kemnay	NJ757170	John Fyfe Ltd	Granite	Kemnay Granite
Ledmore	Ledmore	NC253136	Anglo European - Ledmore Marble Ltd	Marble	Cambro-Ordovician
Locharbriggs	Dumfries	NX990805	Baird and Stevenson (Quarrymasters) Ltd	Sandstone	Permian
Newbigging	Burntisland	NT211864	Scottish Natural Stones Ltd	Sandstone	Carboniferous
Forest	Newcastleton	NY455840	Baird and Stevenson (Quarrymasters) Ltd	Sandstone	Carboniferous
Spittal No 1	Watten	ND172540	A. and D. Sutherland	Sandstone	Devonian
Spittal No 2	Watten	ND180545	Caithness Stone Ltd	Sandstone	Devonian
Spynie	Elgin	NJ220657	Moray Stone Cutters	Sandstone	Permian
Stonegunn	Castletown	ND157659	Caithness Stone Ltd	Sandstone	Devonian
Tormore	Ross of Mull	NM005230	Scottish Natural Stones Ltd	Granite	Ross of Mull Granite
Weydale	Thurso	ND153650	Caithness Flagstones Ltd	Sandstone	Devonian

27

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Active quarries – 2007 (BRITPITS)

Pit name	Location	British National Grid ref		
Achavrole	Calder	ND	309800	959400
Achscrabster	Halkirk	ND	307850	963300
Alvie	Kinoraig	NH	284300	808700
Ardchronie	Ardgay	NH	261675	888500
Ardownie	Dundee	NO	349250	734425
Avochie	Milton of Rothiemay	NJ	354175	847040
Balaldie	Fearn	NH	287200	879300
Balmullo	Balmullo	NO	341900	721400
Banniskirk	Banniskirk	ND	316785	956780
Blackhills	Cove	NJ	394800	800000
Bluehill	Charlestown of Aberlour	NJ	329155	843555
Bonawe	Loch Etive	NN	201500	733500
Cairdshill	Keith	NJ	344300	848300
Cairneyhill	Caldercruix	NS	284850	668295
Caysbrigga	Lossiemouth	NJ	324800	867100
Clashach	Hopeman	NJ	316255	870140
Corrennie	Tillyfourie	NJ	364150	811925
Corsehill	Annan	NY	320616	570271
Cove	Kirkpatrick Fleming	NY	325483	570985

28

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Craignair	Dalbeattie	NX	281925	560980
Cregan Loisgte	Reay	NC	294600	964700
Cruicks	Inverkeithing	NT	313300	681700
Cullalo	Cullaloe	NT	319175	688405
Cursiter	Finstown	HY	337650	1012470
Daviot	Inverness	NH	271900	839200
Duntilland	Shotts	NS	284300	663550
Furnace	Inveraray	NN	202855	700255
Gairsty A	Quoyloo	HY	325740	1020510
Gairsty B	Quoyloo	HY	325640	1020550
Hilton of Guthrie	Hilton of Guthrie	NO	355670	751925
Howley Park	Morley	SE	425525	426295
Innes Links	Lossiemouth	NJ	328435	867382
Knowehead	Locharbriggs	NX	298750	581350
Ledmore	Ledmore	NC	225630	913680
Locharbriggs	Dumfries	NX	299200	580780
Longhavan	Peterhead	NK	411500	839200
Lynemore Sand Pit	Dufftown	NJ	329400	836840
Newforres	Forres	NJ	308340	857740

29

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North Lasts	Peterculter	NJ	382500	804000
North Mains of Findon	Findon	NO	394300	798600
Ratchie	Exnaboe	HU	439800	1112800
Savoch	Longside	NK	406860	842510
Sconser	Skye	NG	154430	831710
Setter	Hill of Setter	HU	450360	1141840
Sheephill	Dumbarton	NS	243400	674700
Spittal No 1	Watten	ND	317415	954145
Spittal No 2	Watten	ND	316770	954425
Stirlinghill	Peterhead	NK	412300	841500
Swinton	Swinton	NT	385400	648600
Torlundy	Fort William	NN	218000	777590
Torrin	Torrin	NG	158395	820200

30

Working building stone quarries in Northumberland

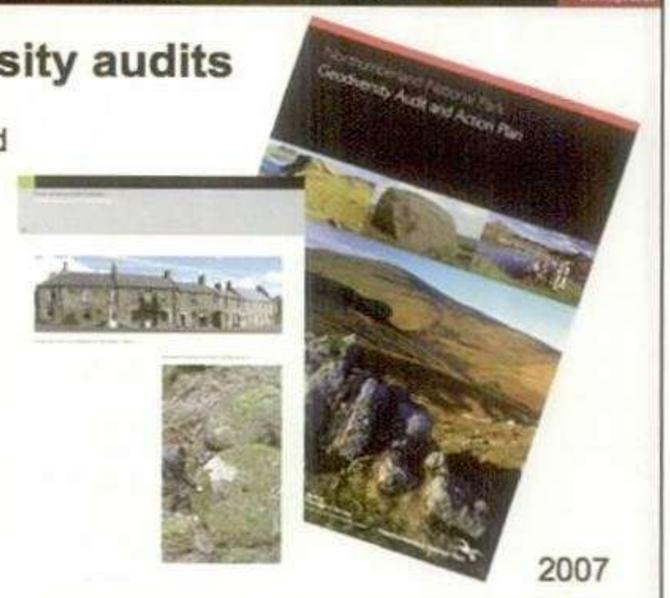
	Quarry	Location	National Grid Reference
Lower Coal Measures	Ladycross	Slaley	NY 952 555
Stainmore Group	Bearl	Ovington	NZ 053 641
	Black Pasture	Chollerford	NY 931 698
	Crag Bank	Belsay	NZ 089 773
	Cragg	West Woodburn	NY 887 857
	Darney	West Woodburn	NY 912 879
	Dodd End	Allenheads	NY 864 459
	High Nick	East Woodburn	NY 931 874
	Cop Cragg	Byrness	NY792 004
Fell Sandstone Group	Doddington	Wooler	NU 008 326
Lower Limestone Group	Blaxter	Otterburn	NY 932 903

Highley, D E, et.al. 2000. **Mineral Resource Information for Development Plans: Phase One Northumberland and Tyne & Wear (Northumberland, Northumberland National Park, Gateshead, Newcastle-upon-Tyne, North Tyneside, South Tyneside and Sunderland): Resources and Constraints**. *British Geological Survey Technical Report* WF/00/5

31

Geodiversity audits

- Northumberland National Park
- 32 regionally significant sandstone quarries
- 11 active



2007

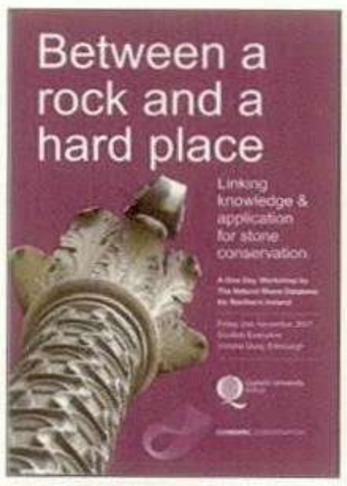
32

Historic quarries

- How many former quarries are sterilised by development ?
- How many are water-filled holes?
- How many have been partially or completely turned over to landfill?
- How many offer good resource prognosis on the basis of geological and technical specification?
- How many could be considered suitable for snatch-quarrying?
- How many offer potential for educational geodiversity after life?
- Do green-field sites offer an alternative?

33

Natural Stone Database for Northern Ireland



- surveying, sampling and analysis
- NI quarries survey
- Grade A and B Listed buildings
- c. 1800 buildings plus c. 260 monuments
- written and photographic record
- condition assessment of stone
- CD with ArcReader supplied to EHS and conservation architects
- Website www.stonesolutions.com goes live in Dec 2007

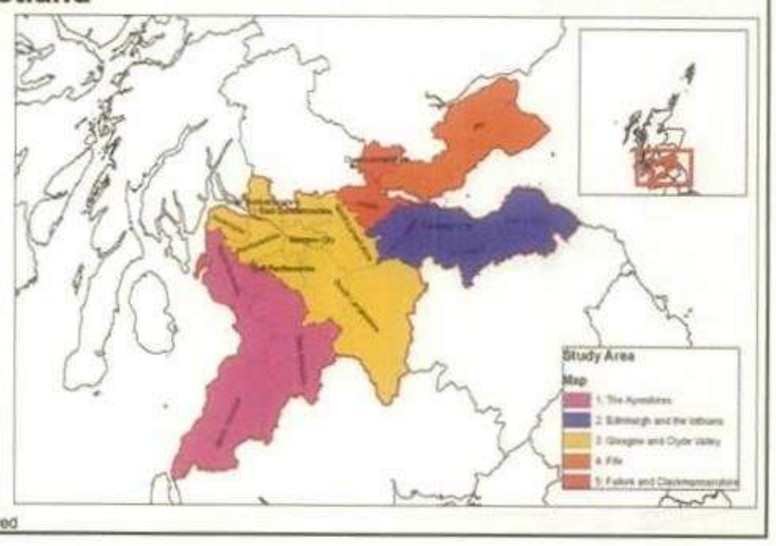
34

Mineral Resources for Sustainable Communities within Central Scotland: Background

- BGS compiled 'County' mineral resource maps for England - www.bgs.ac.uk/mineralsuk
- would like to apply similar approach to Scotland
- asked by Scottish Executive to bid for 2007-08 Aggregate Levy fund
- Central Scotland Mineral Information bid one of five projects to be funded

35

Mineral Resources for Sustainable Communities within Central Scotland



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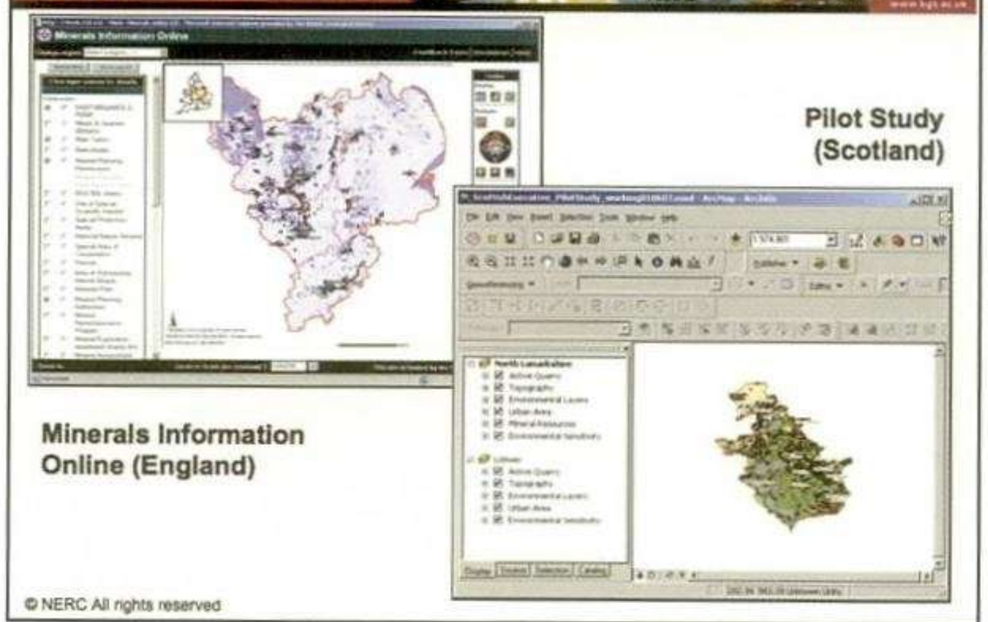
Minerals Information Online (England)

Pilot Study (Scotland)



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Minerals Information Online

38


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Mineral planning factsheets
Limestone
Construction aggregates
http://www.bgs.ac.uk/mineralsuk/free_downloads/home.html
http://www.scotland.gov.uk/Publications/Search/Q/Subject/467
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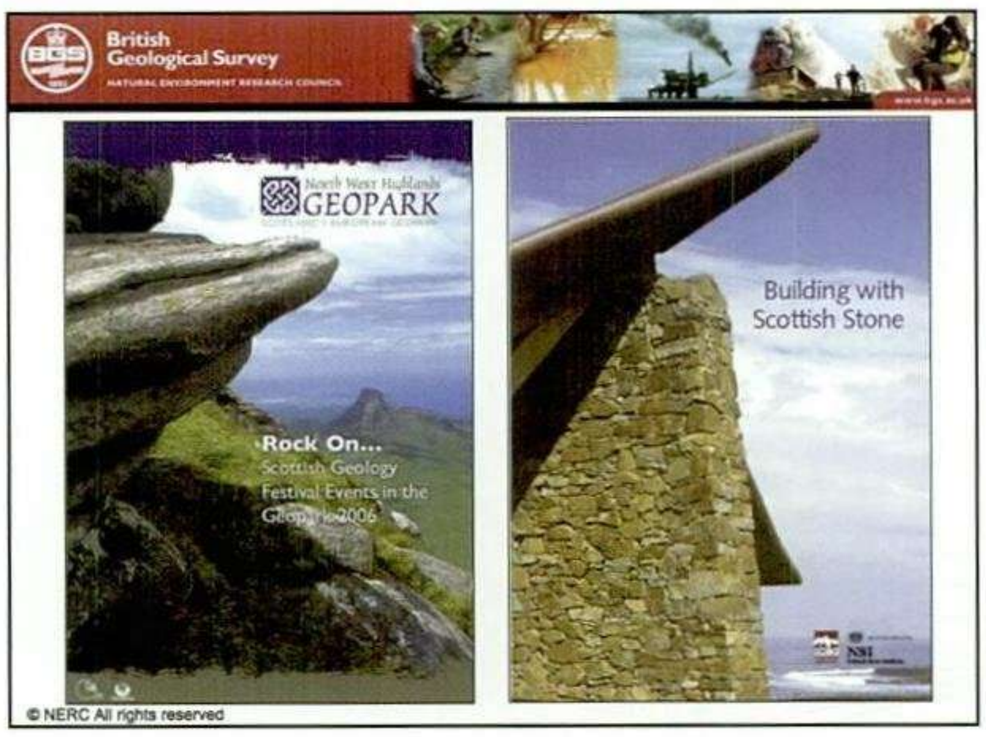
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North West Highlands GEOPARK
Rock On...
Scottish Geology
Festival Events in the
Geopark 2006
Building with
Scottish Stone
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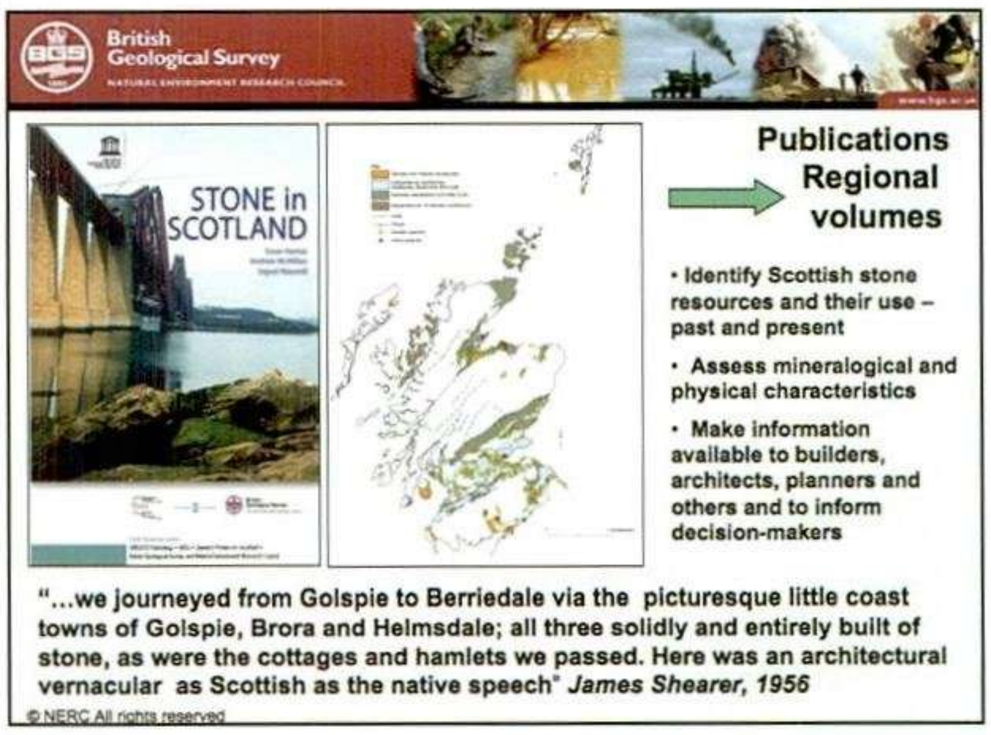
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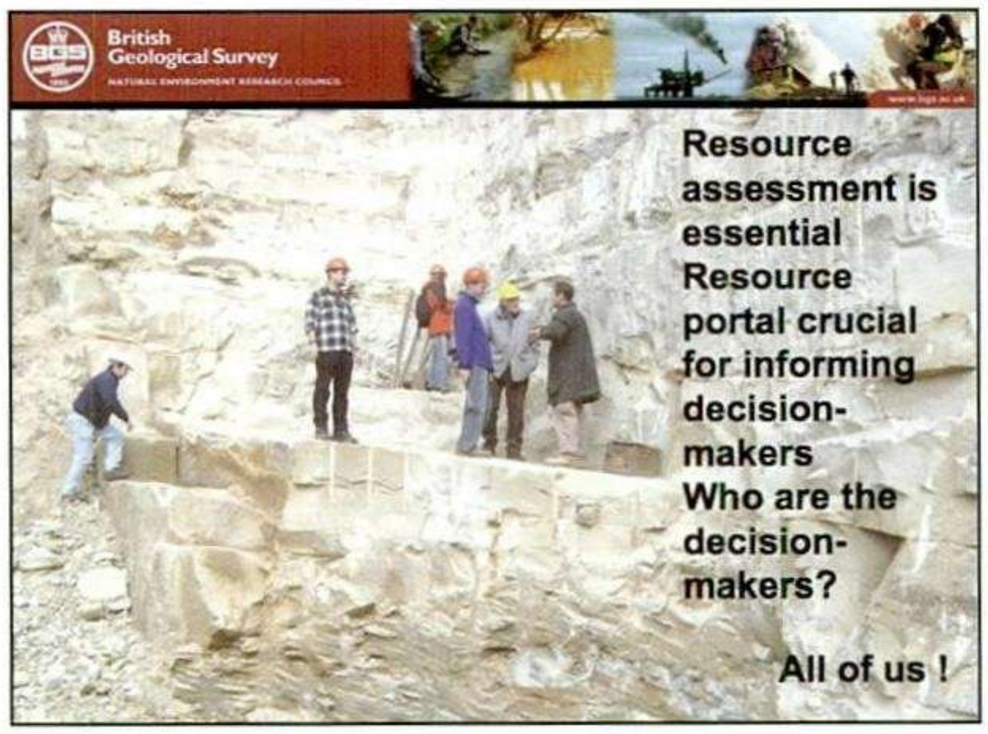
STONE in SCOTLAND
Publications
Regional
volumes
• Identify Scottish stone resources and their use – past and present
• Assess mineralogical and physical characteristics
• Make information available to builders, architects, planners and others and to inform decision-makers
"...we journeyed from Golspie to Berriedale via the picturesque little coast towns of Golspie, Brora and Helmsdale; all three solidly and entirely built of stone, as were the cottages and hamlets we passed. Here was an architectural vernacular as Scottish as the native speech" James Shearer, 1956
© NERC All rights reserved

41


British Geological Survey
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Resource assessment is essential
Resource portal crucial for informing decision-makers
Who are the decision-makers?
All of us !

42

STONE MATCHING: THEORY AND PRACTICE

Ewan Hyslop,
British Geological Survey

This presentation discusses the importance of stone matching for repairs, the factors that should influence the selection of stone, and the consequences of that selection.

Correct stone matching requires specialist input and it is important to build this process into the project programme at an early stage. Sampling is normally quick, cheap and easy to undertake. Care must be taken that the samples are representative of the entire building as many were constructed using more than one type of stone.

Characterisation and classification

Sandstones, like other stone types, can be complex and variable. Petrographic examination of samples under the microscope can determine the composition, grain size, density and porosity characteristics of different stone types. These and other factors allow an accurate identification of stone type and quarry origin, and can provide clues to their suitability for use and performance.

Analysis and testing

It is not always appropriate to choose the most durable, dense stone for repairs to historic structures. Instead, compatibility of factors such as composition, grainsize and texture may be more important. Porosity and permeability are particularly important in determining the compatibility of a stone type for use in repairs to an existing structure. The use of an incompatible stone, for example one which is much denser than the surrounding stone, can cause further and accelerated decay of the surrounding stone.

Sourcing stone

The vast majority of building stone quarries in Scotland are no longer in operation, which makes sourcing stone for repairs problematic. Nevertheless, with careful stone matching using the techniques described above it is usually possible to identify a suitable alternative matching stone type for repairs.

The Glasgow Project

Surveys of stone buildings in Glasgow has identified 6 varieties of blonde sandstone which were used to construct traditional buildings in the city. These came from numerous local quarries throughout West Central Scotland, none of which are open today. Although some of these stone types can be substituted using quarries in northern England, there are no quarries producing a number of key stone types necessary for future repairs to Glasgow's buildings.

Conclusions

There is a need to make better decisions in the selection of appropriate stone for repairs. By undertaking a series of building stone audits throughout Scotland, such as the Glasgow project, it will be possible to identify key stone types and their quarry sources. The reassessment of local sources of stone should lead to a network of quarries that are capable of supplying the key stone types required for the repair and maintenance of Scotland's stone built heritage.

STONE MATCHING: THEORY AND PRACTICE

Ewan Hyslop,
British Geological Survey

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

HISTORIC SCOTLAND
STONE IN CONTEXT
CONFERENCE
14-15th November 2007
Stirling Tolbooth

Stone Matching:
theory and practice

Ewan Hyslop
British Geological Survey
Edinburgh
ekh@bgs.ac.uk

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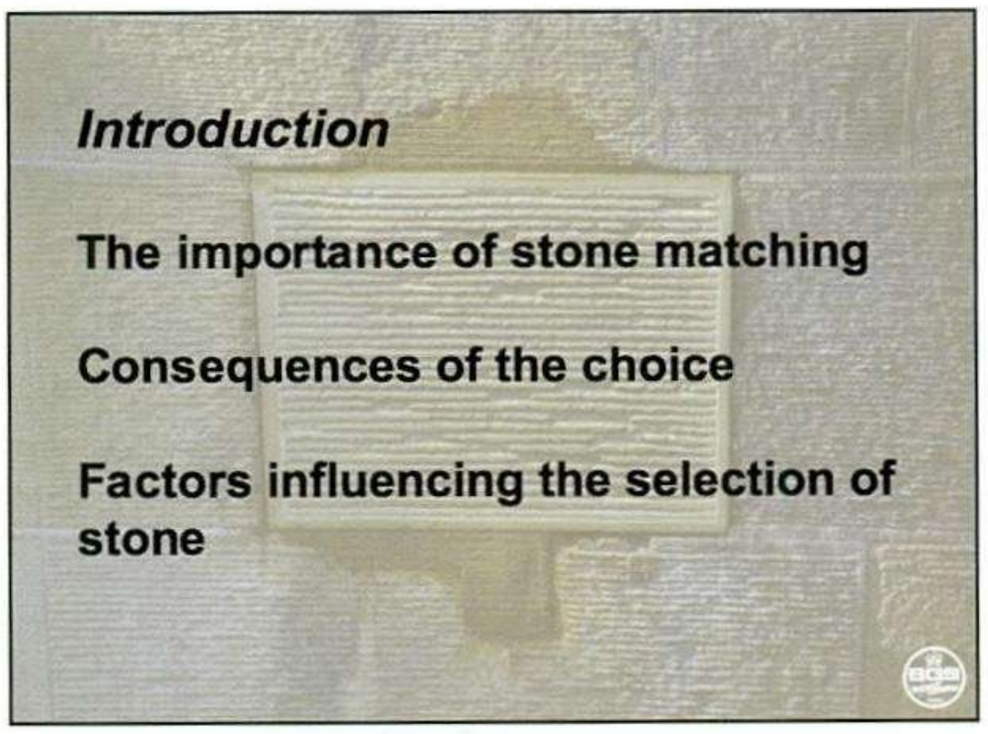

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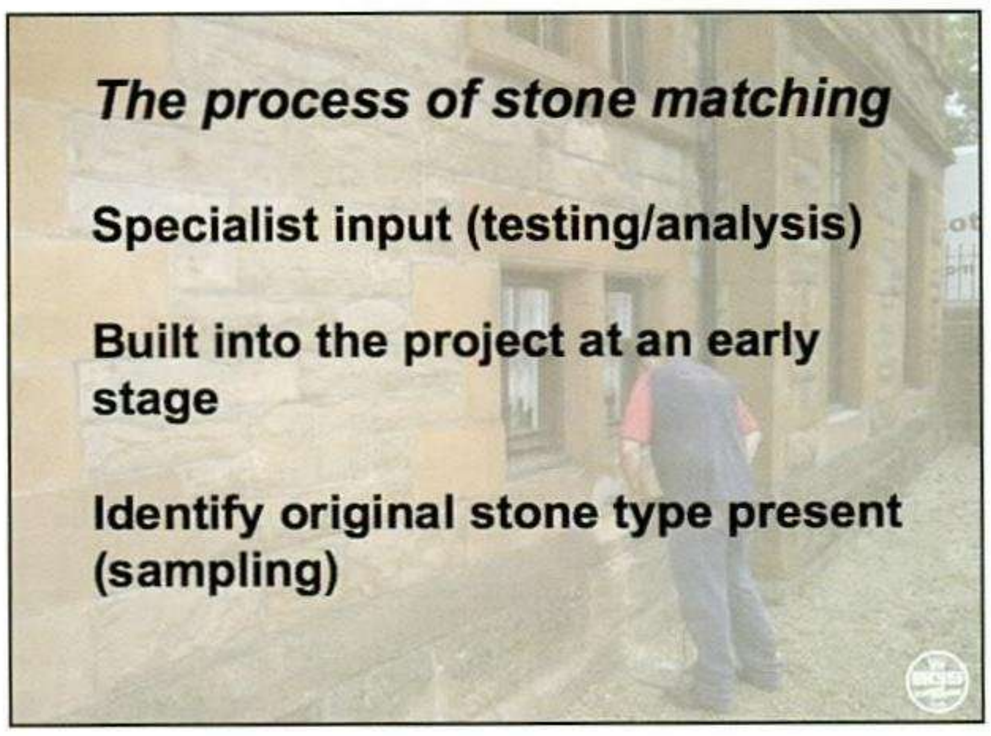

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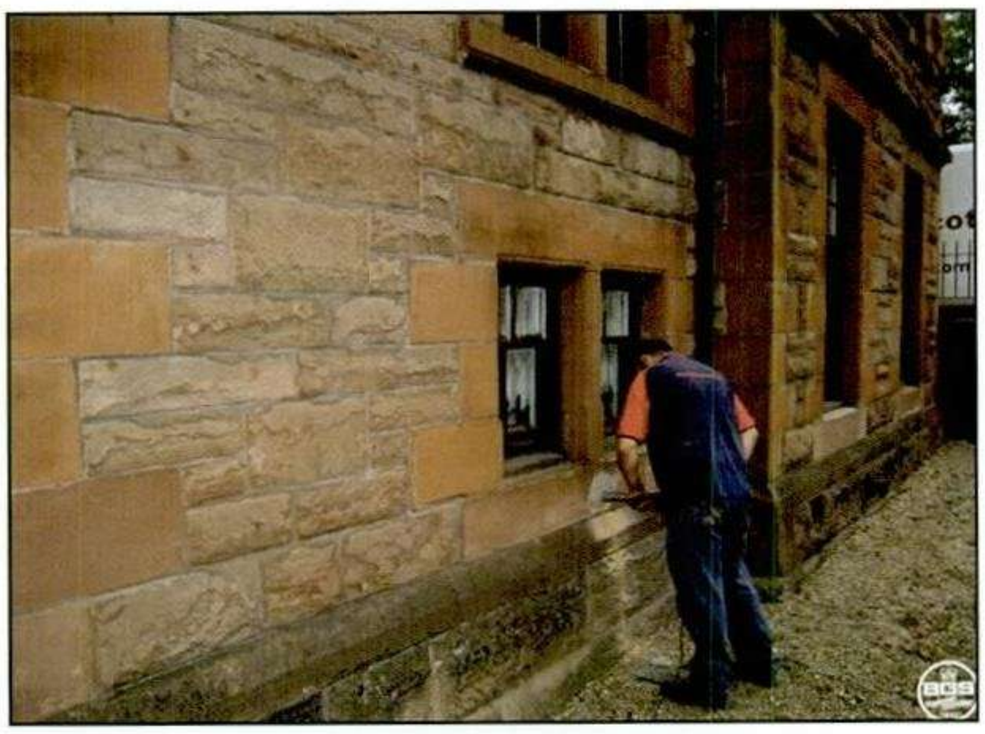

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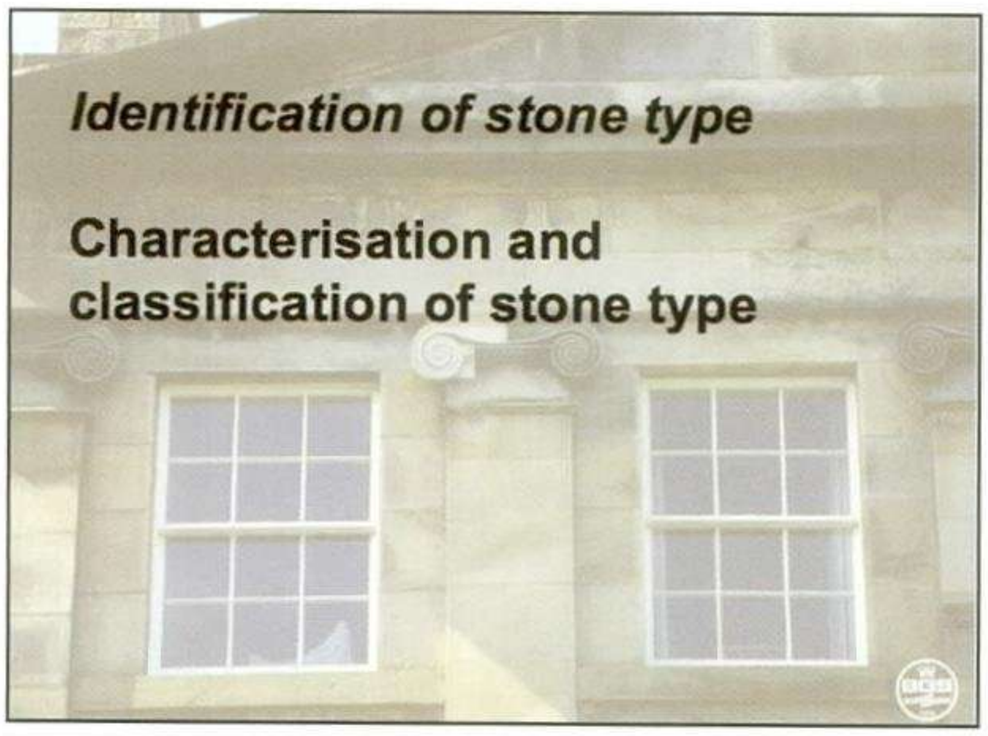

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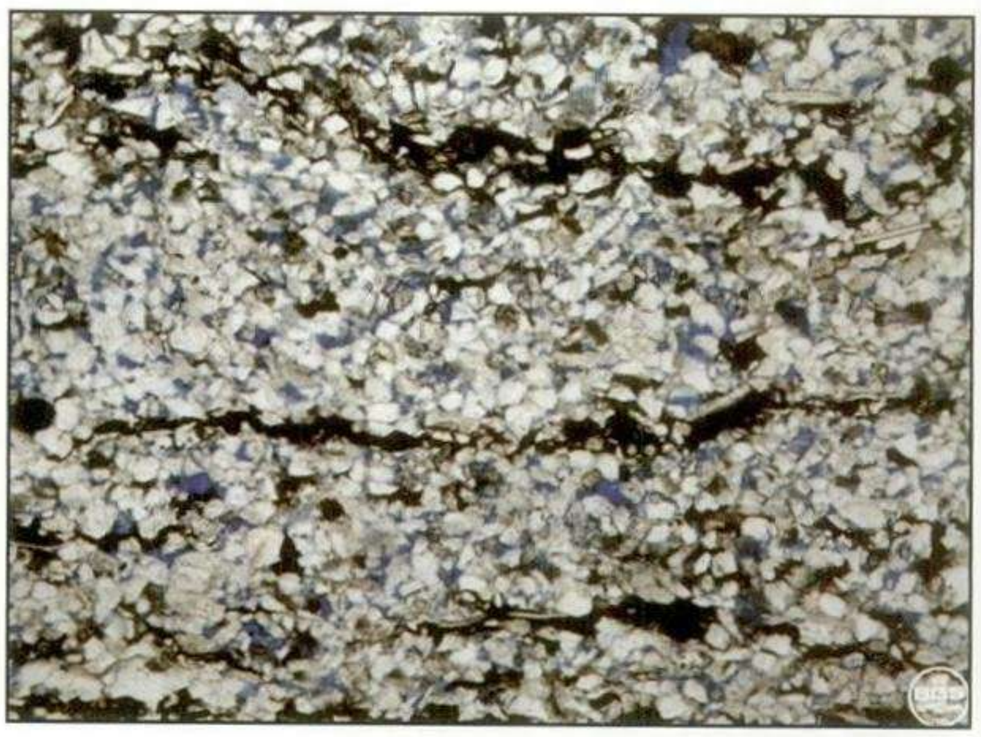

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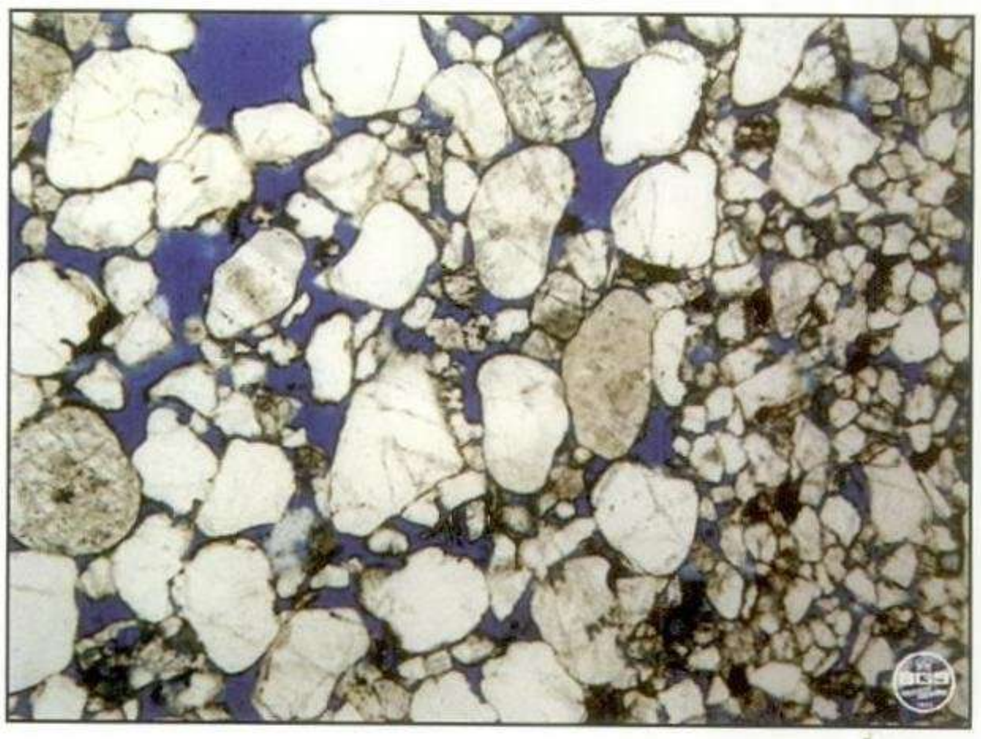

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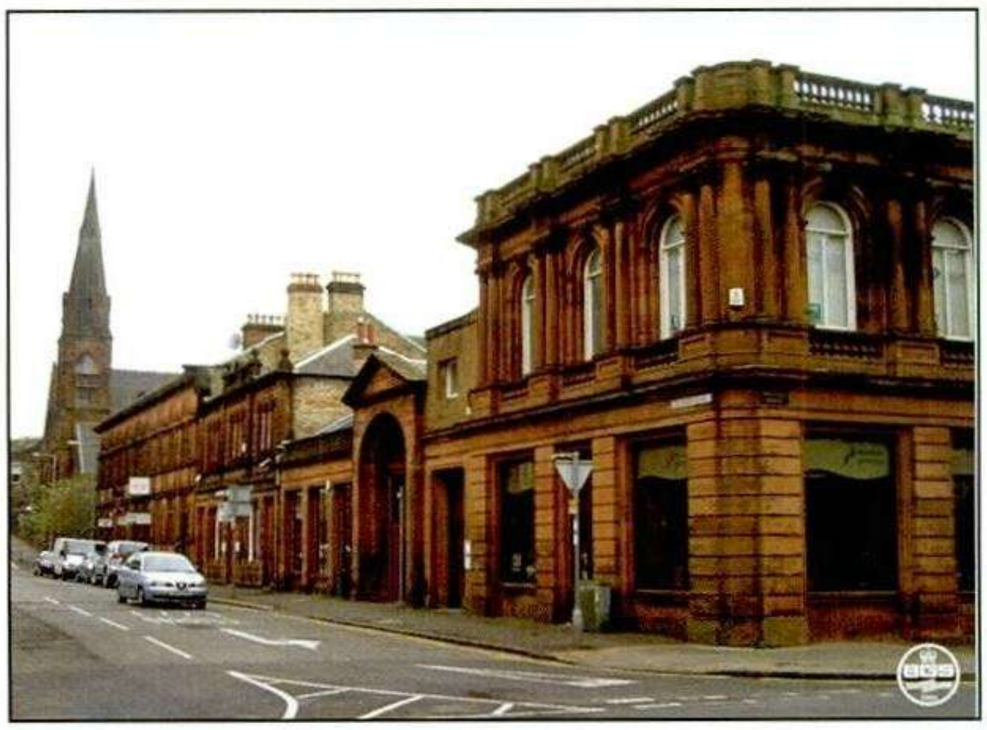

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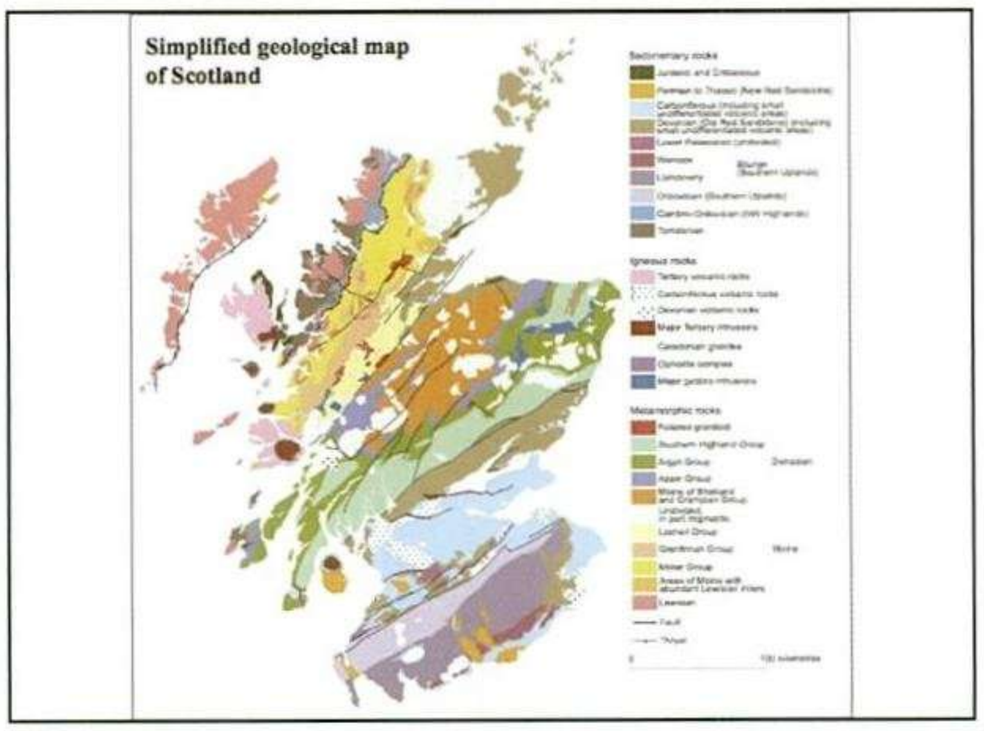

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Analysis and testing:

BS EN 1926 : 1999
compressive strength
BS EN 12372 : 1999
flexural strength under concentrated load (3-pt)
BS EN 13161 : 2001
flexural strength under constant moment (4-pt)
BS EN 13364 : 2002
breaking load at dowel hole
prEN 14580 FV
static elastic modulus
prEN 14146 FV
dynamic modules of elasticity
prEN 14158 FV
rupture energy
ASTM C 170-90 (19
compressive strength (lo 3000kN)
ASTM C 880-96 (19
flexural strength (loads f
ASTM C 99-87 (200
modulus of rupture (load kN)

BS EN 12407 : 2000
petrographic examination
BS EN 12440 : 2000
denomination criteria
BS EN 12670 : 2002
terminology
BS EN 13373 : 2003
geometric characteristics on units

BS EN 12370 : 1999
resistance to salt crystallisation
BS EN 12371 : 2001
frost resistance
BS EN 13919 : 2002
resistance to ageing by SO2 action in the presence of humidity
prEN 14147 FV
resistance to ageing by salt mist
BR141:1983
Crystallisation
BR141:1983
acid immersion
BS EN 14066 : 2003
resistance to ageing by thermal shock
prEN 14581 FV
thermal expansion c
prEN 14157 FV
abrasion resistance
ASTM C 241-90
abrasion resistance
BS EN 14231 : 2
slip resistance by me tester

BS EN 1925 : 1999
water absorption by capillary
BS EN 1936 : 1999
real/apparent density, total/open porosity
BS EN 13755 : 2002
water absorption at atmospheric pressure
BR141:1983
saturation coefficient and porosity
ASTM C 97-02
absorption and bulk specific gravity

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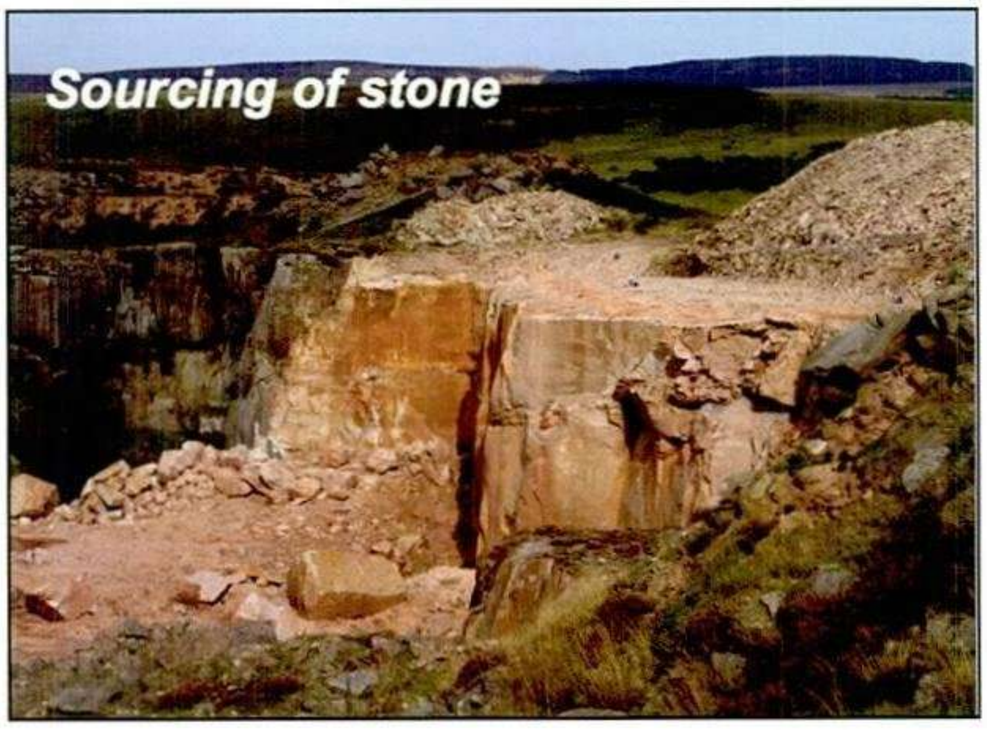

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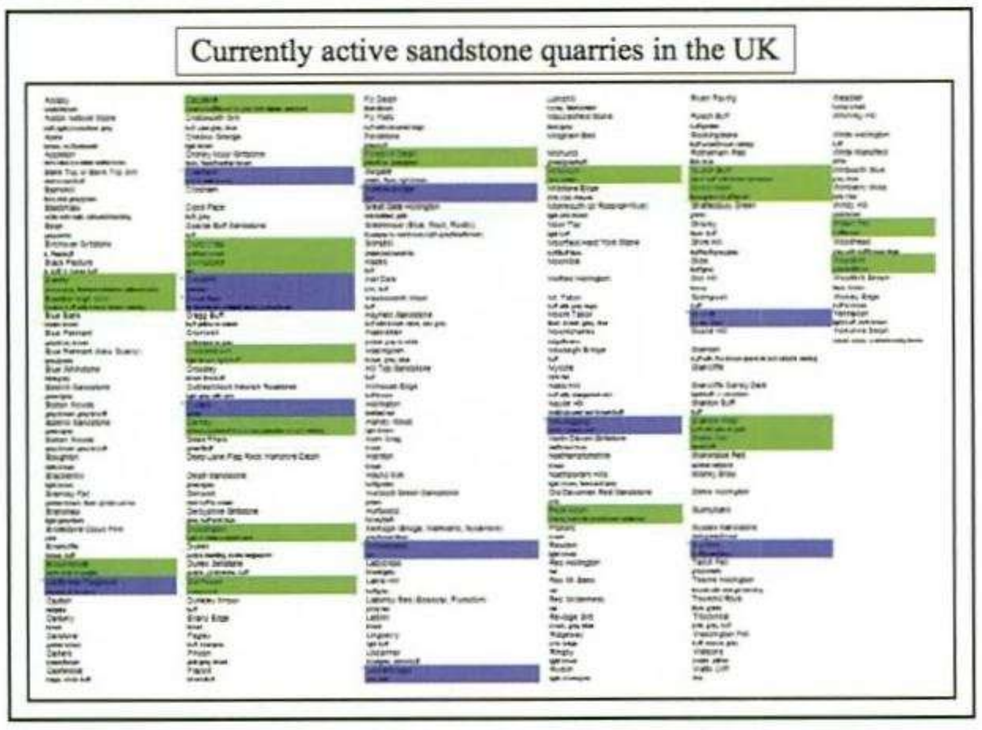

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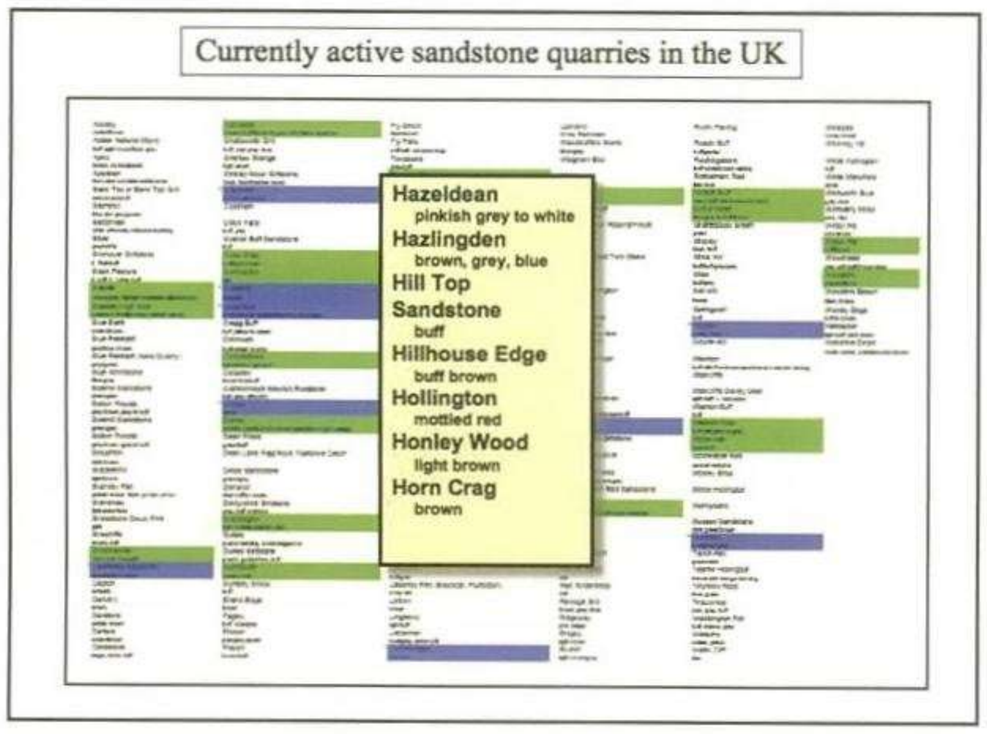

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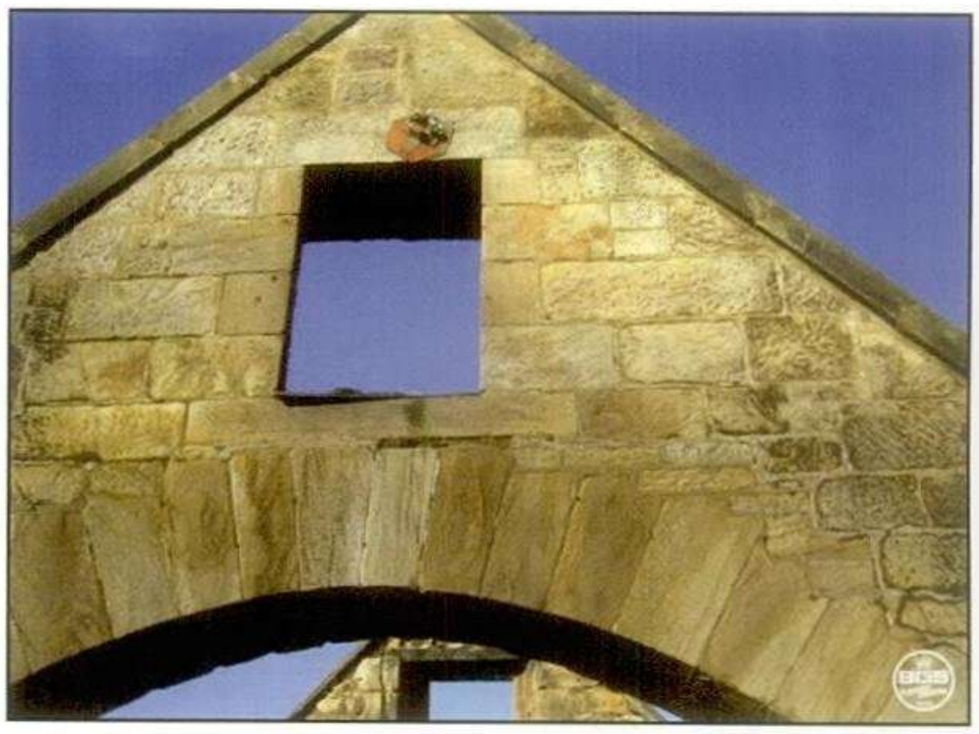

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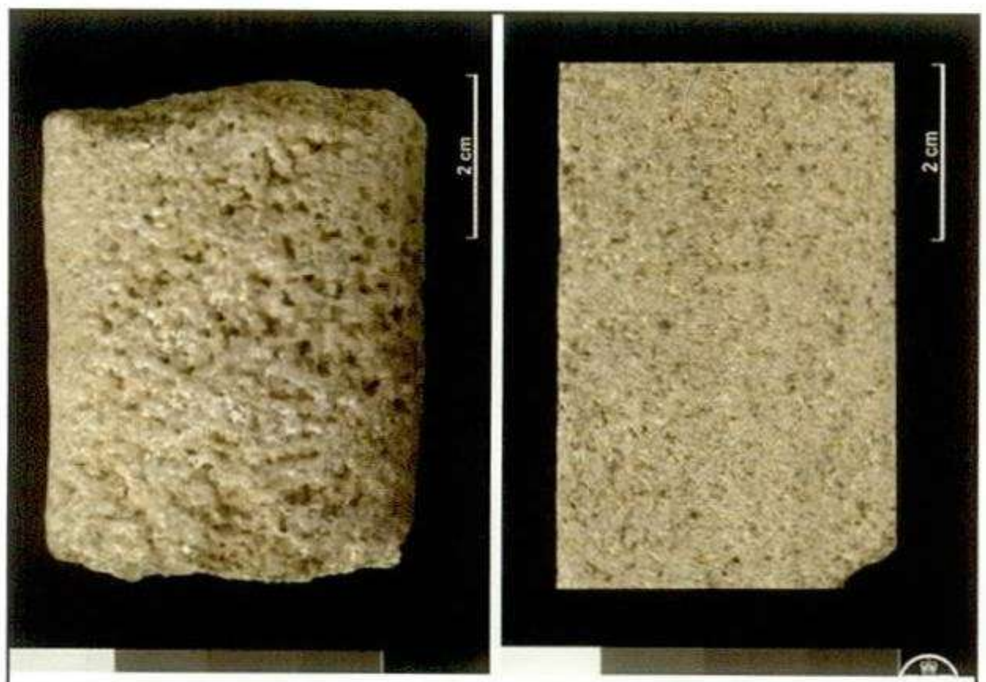

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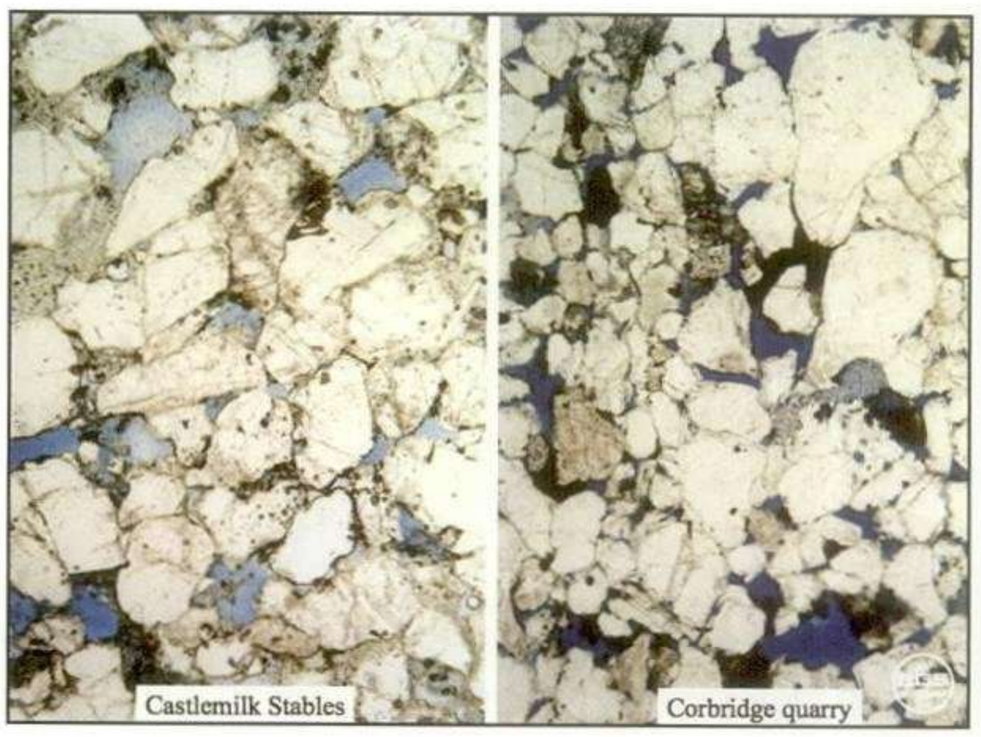

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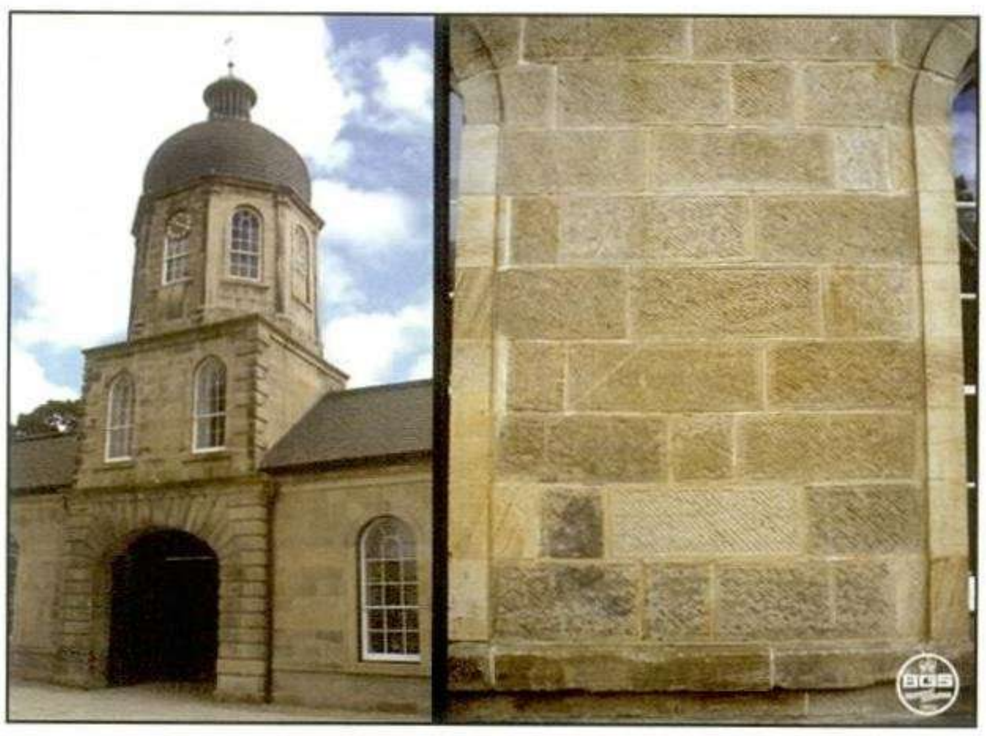

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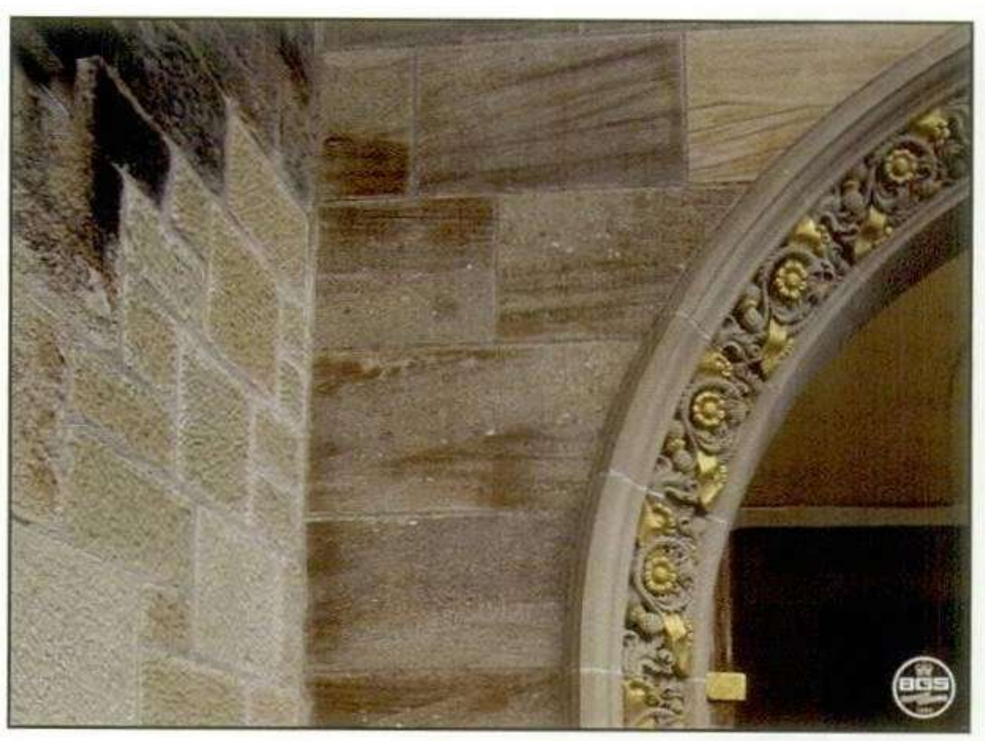

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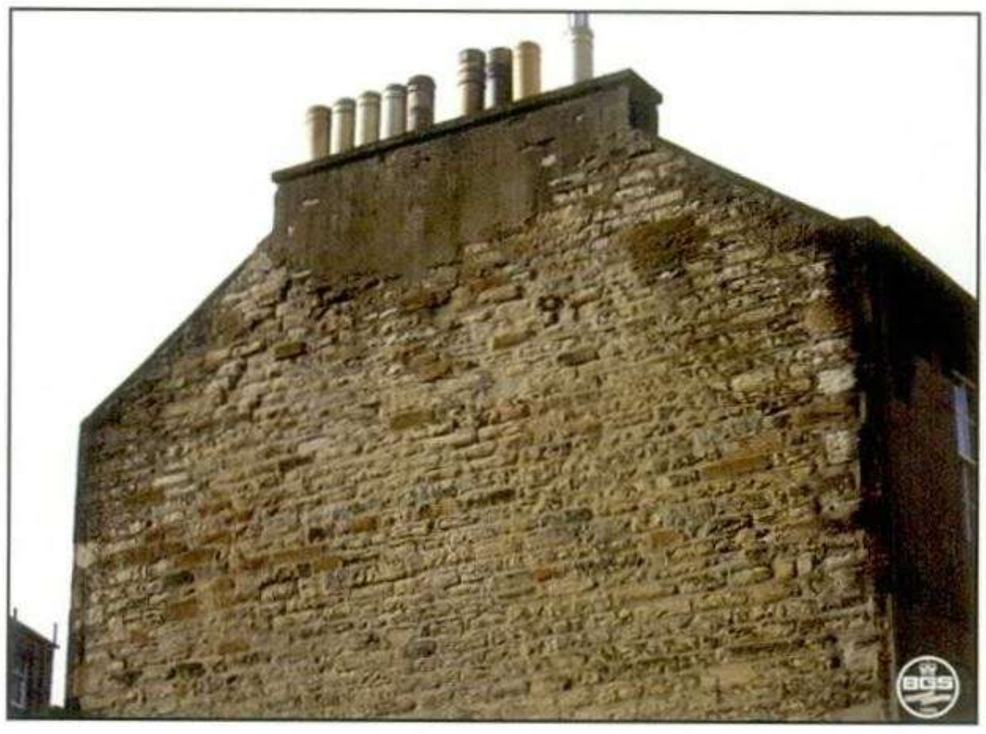

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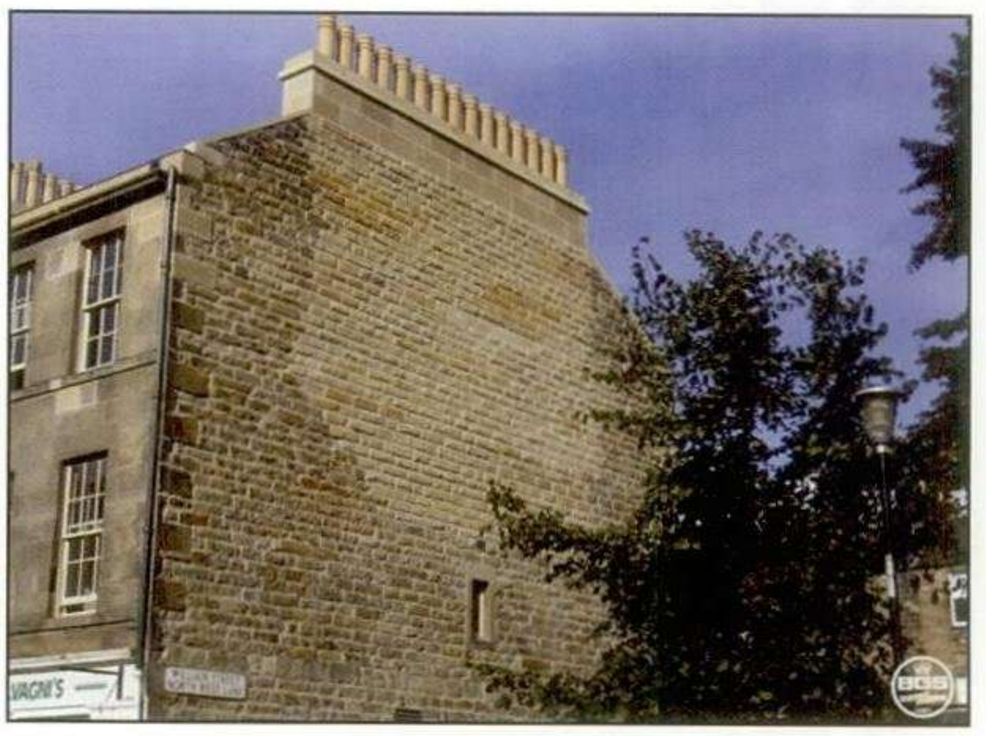

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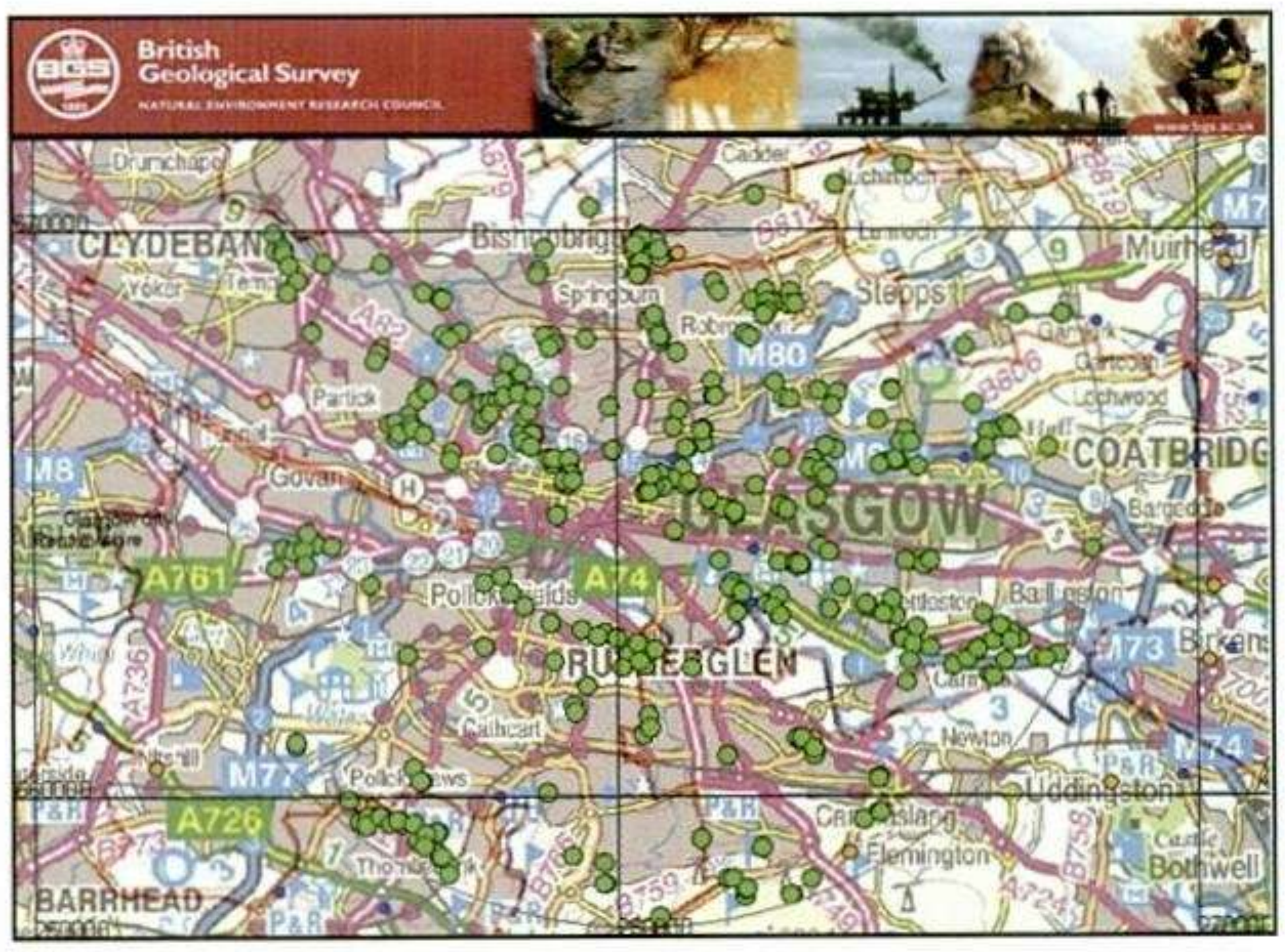
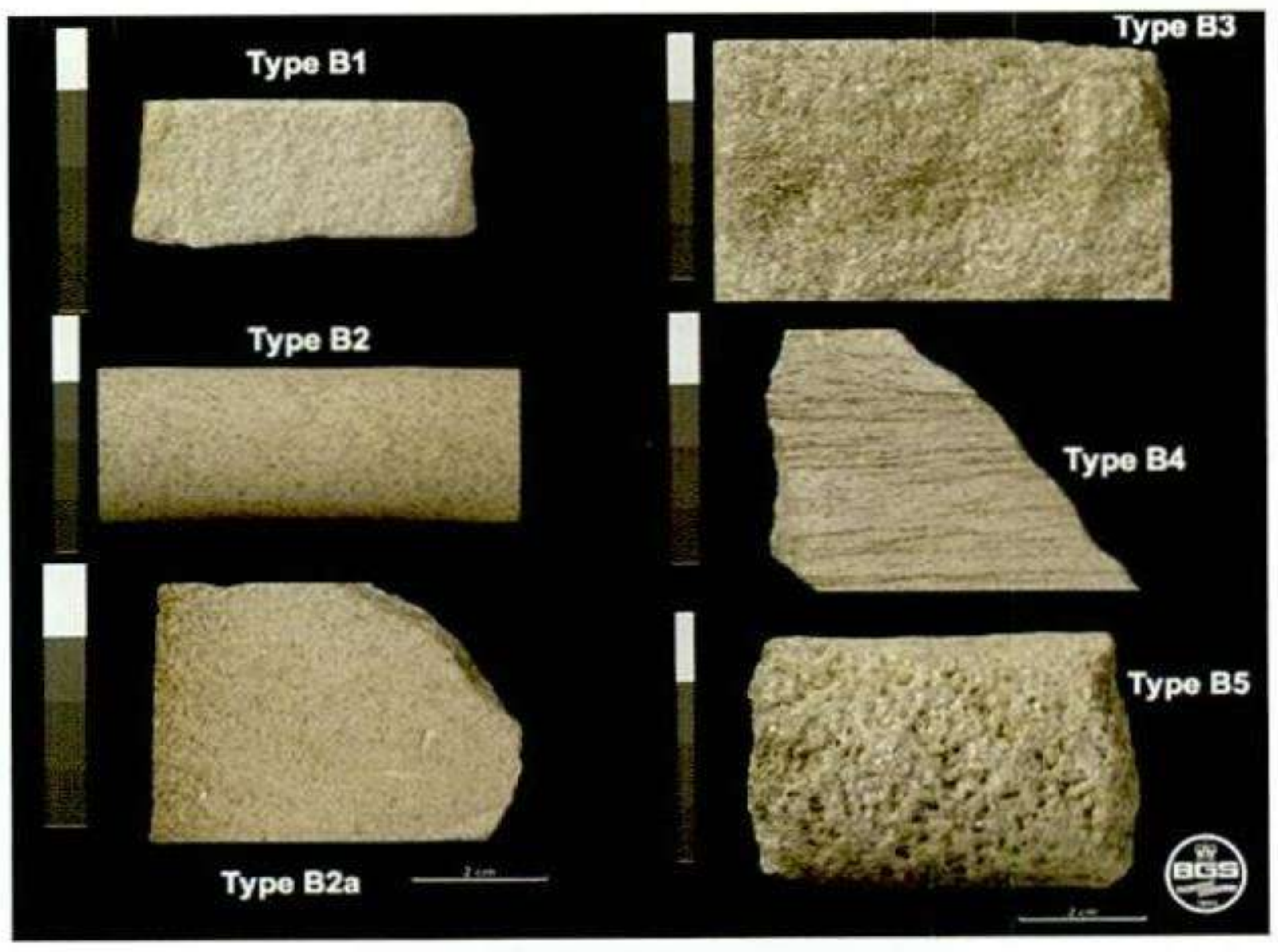
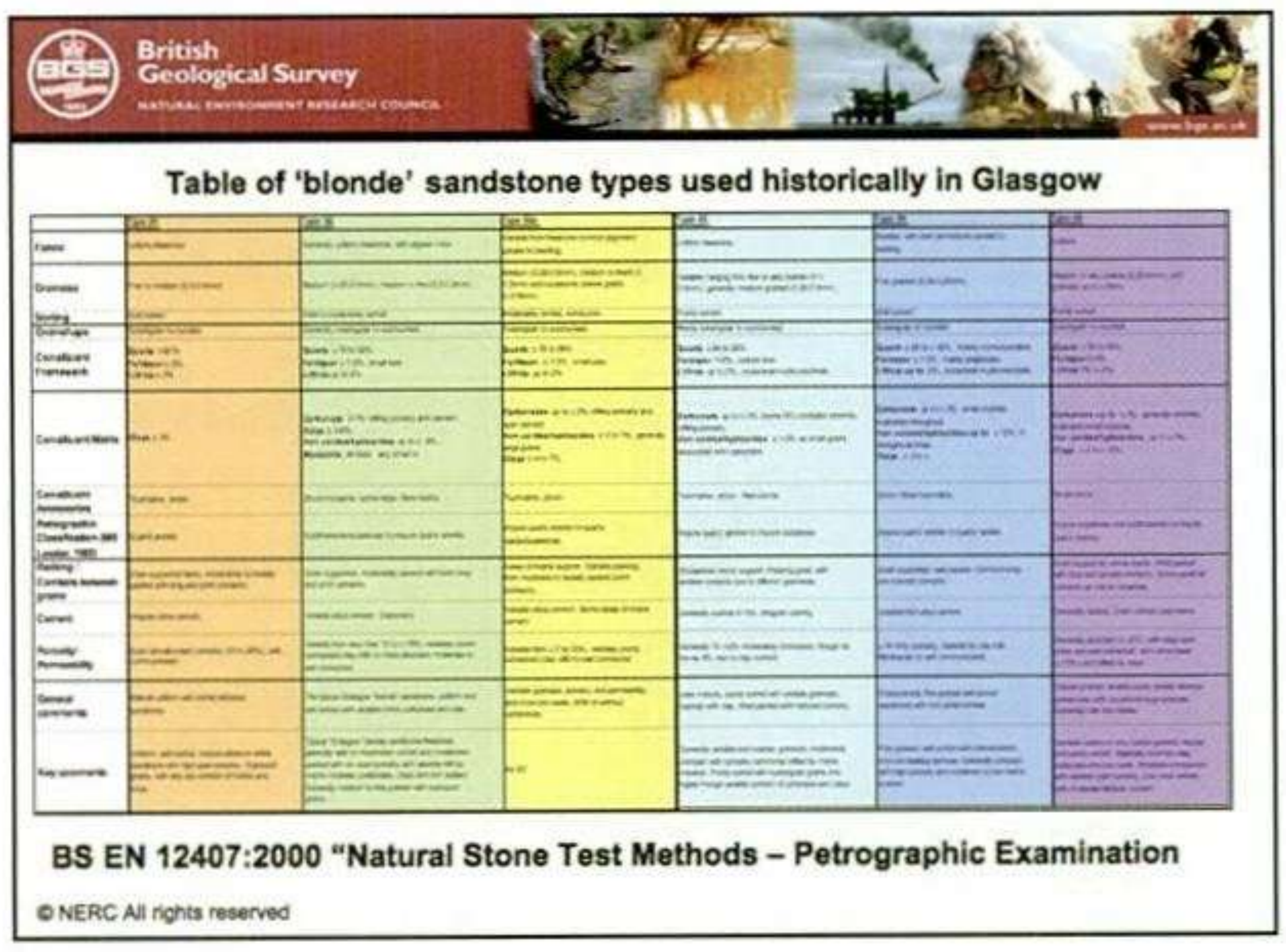
31 

 32

33 

Original (historic) quarry sources and substitute (current) quarries for Glasgow sandstones

BLONDE SANDSTONE	Type B1	Type B2	Type B2a	Type B3	Type B4	Type B5
Original (historic) quarries	Blochairn, Glasgow Craigash, Milngavie Craigleith, Midlothian Dunmore, Stirlingshire Humbie, West Lothian Lochcraigs, Glasgow Smithstone, Glasgow	Avenuehead, Glasgow Bishopbriggs quarries (including Huntershill, Glasgow Blochairn, Glasgow Germiston, Glasgow Giffnock quarries, Glasgow Hillhouse Muir, Glasgow Moskorriding, Kilwinning	Doghillock, Denny Kirkburn, Cambuslang Laverock Knowe, Airdrie Muirhouse Farm, Glasgow Plean, Falkirk Polmont, Glasgow Woodhall, Glasgow	Auchinlea, Motherwell Bushill, Shettleston Chatelherault, Hamilton Dalmuir, Glasgow	West side city centre Gilmorehill	Castlemilk and south of city
Substitute (current) quarries	Cullalo, Fife Clashach, Moray Huntlebine Denny	?	Blaxters High Nick Blaxter, Black Pasture, Dunhouse Buff, Stainton Witton Fell	Blaxter, Blaxter High Nick, Black Pasture Stainton Witton Fell, Coarse Buff Stanton Moor	?	Bearl, Catcastle, Mill Grit, Coarse Buff Peak Moor

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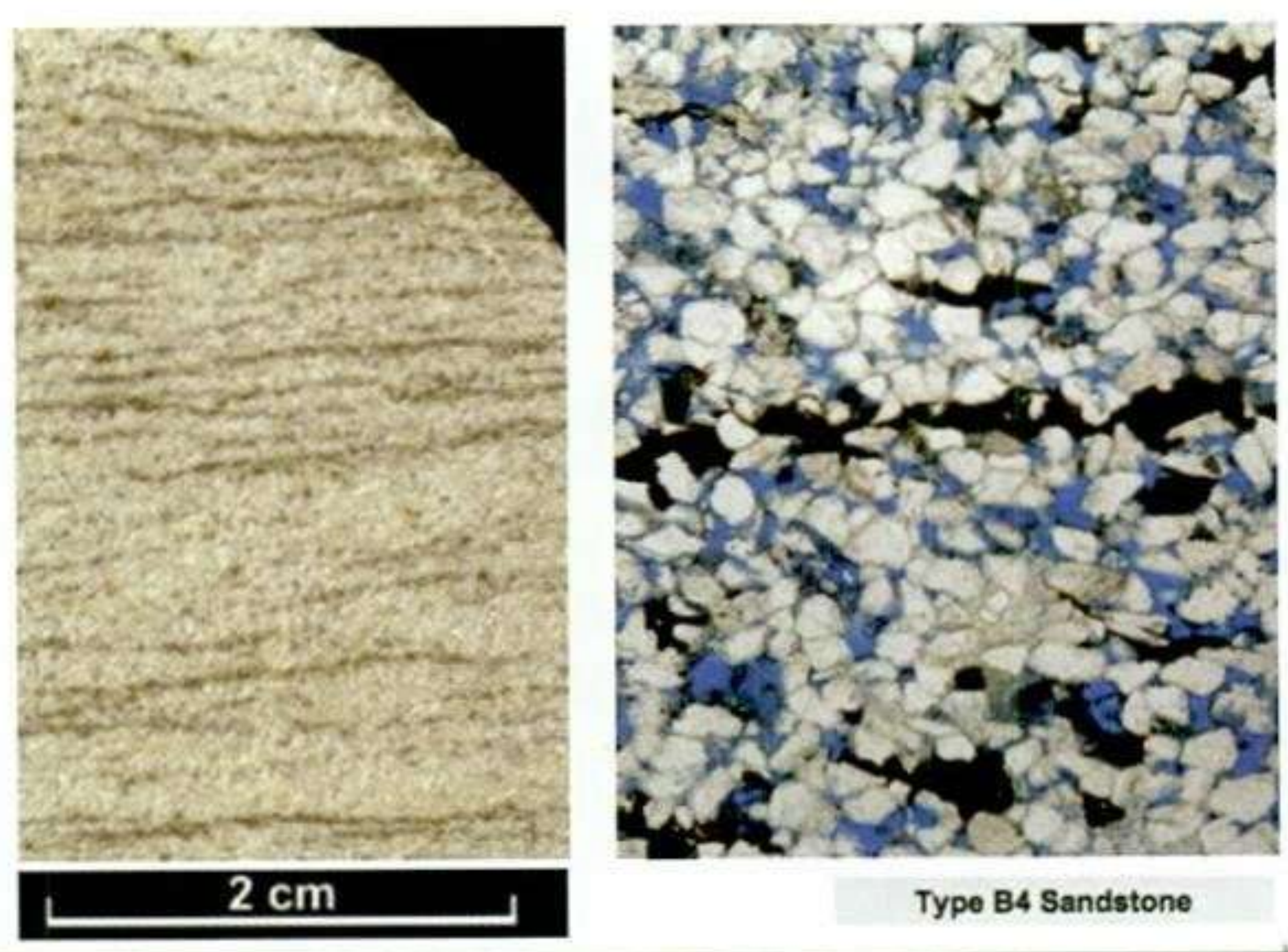 38

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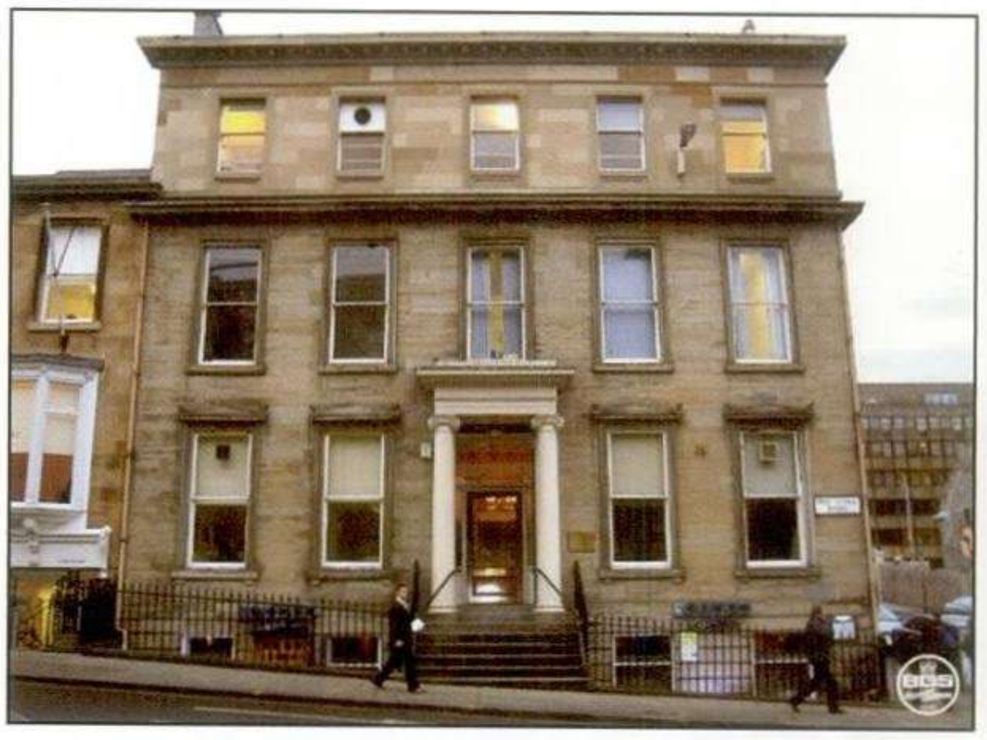

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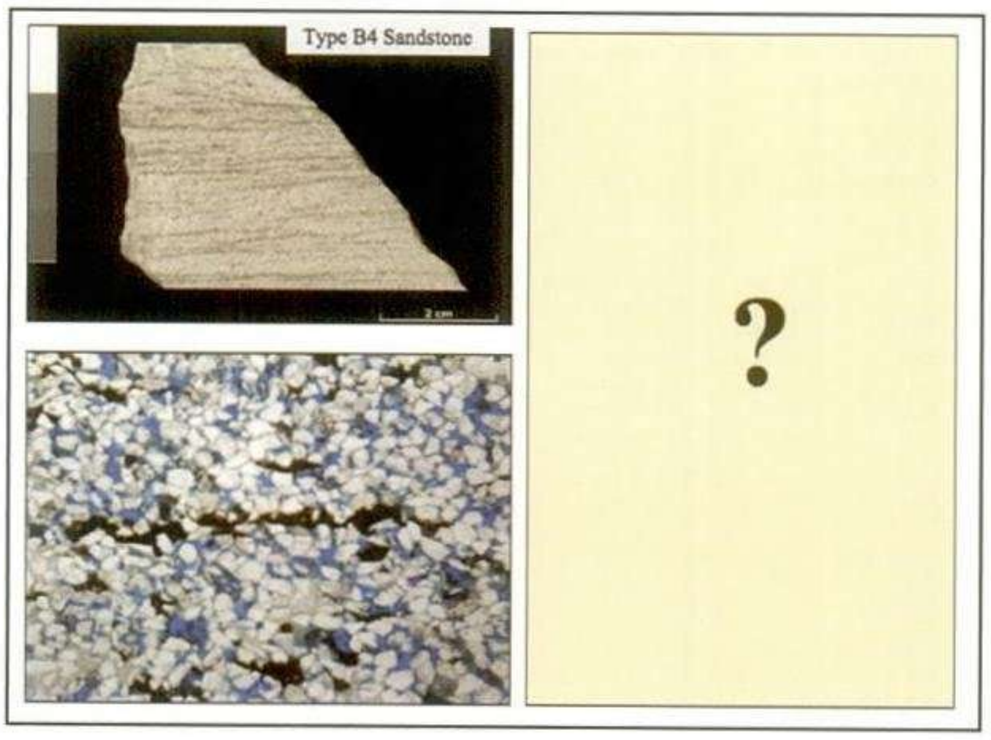

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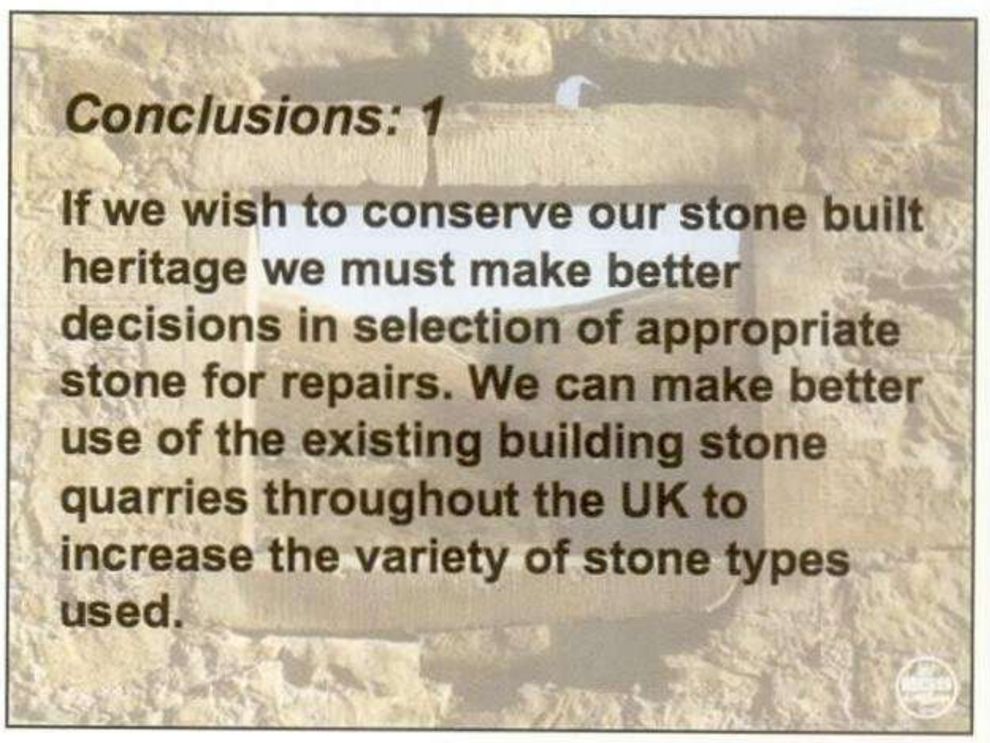

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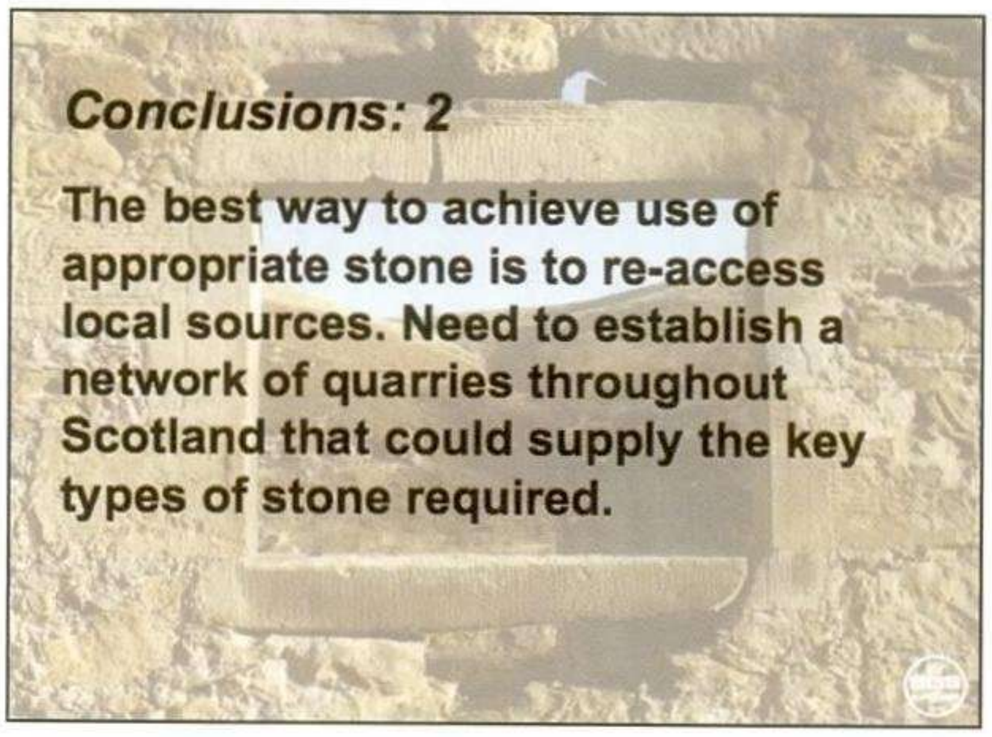

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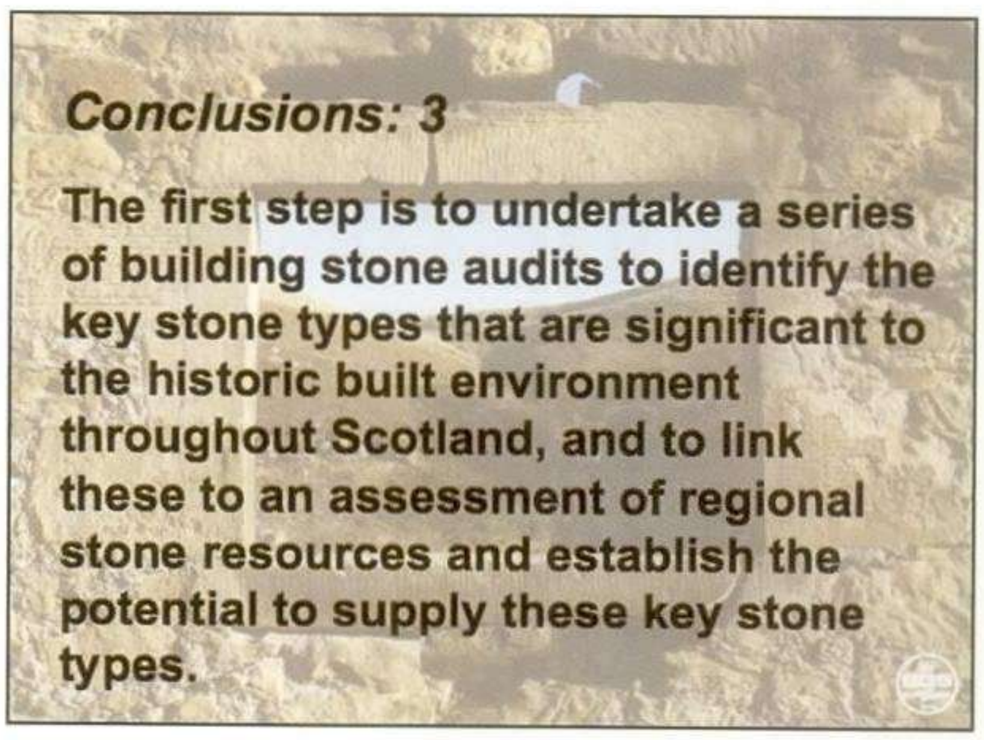

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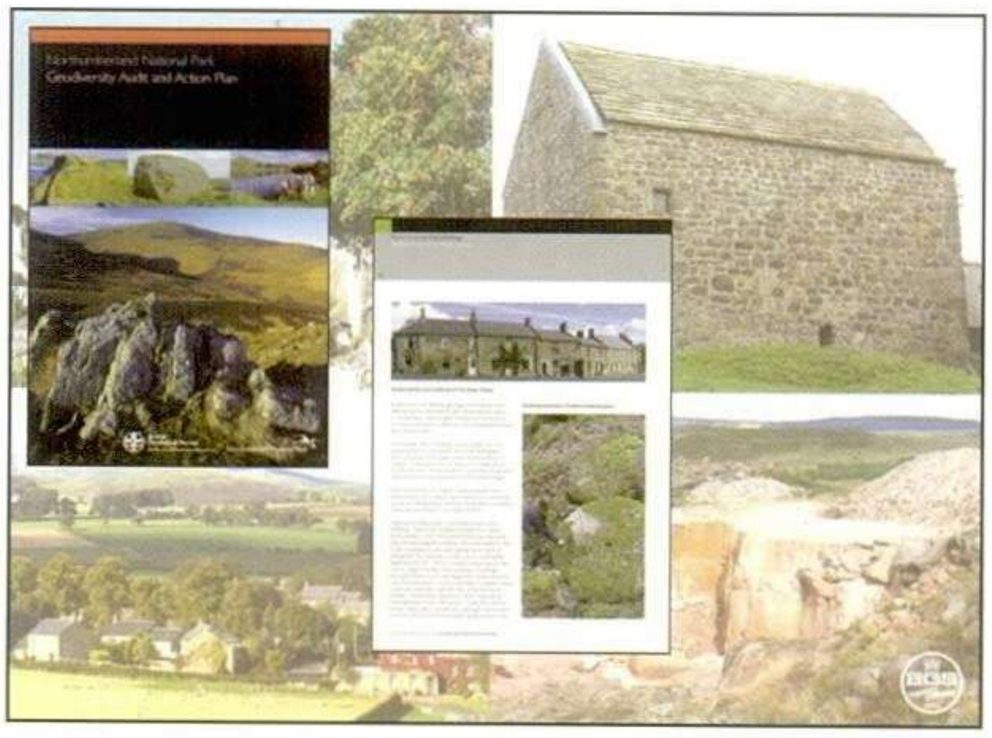

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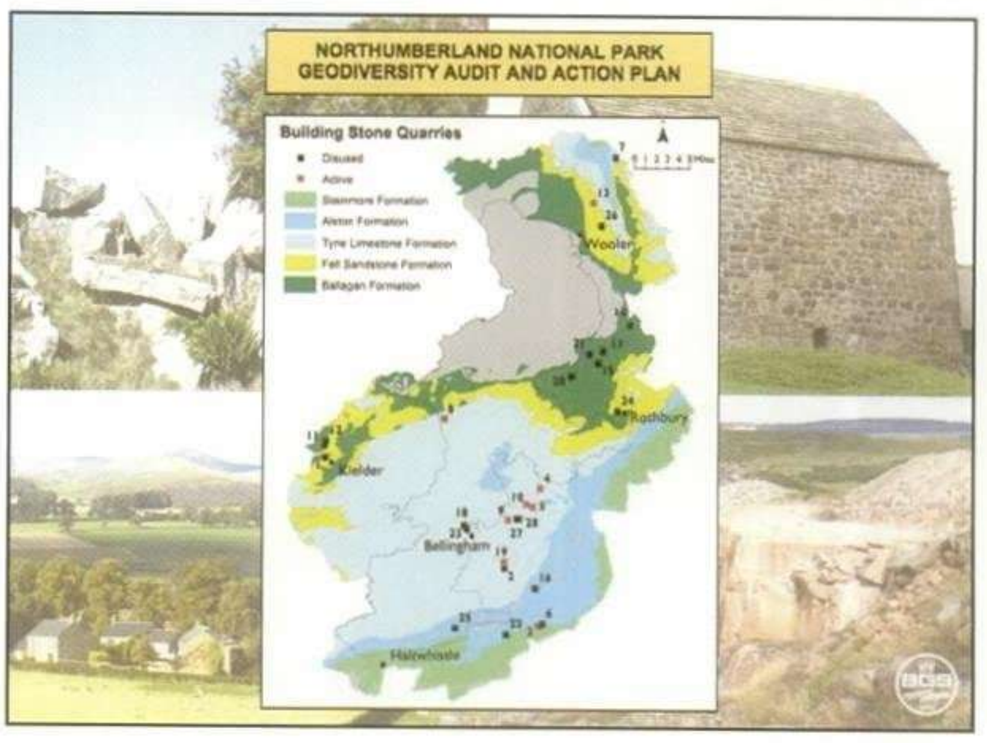

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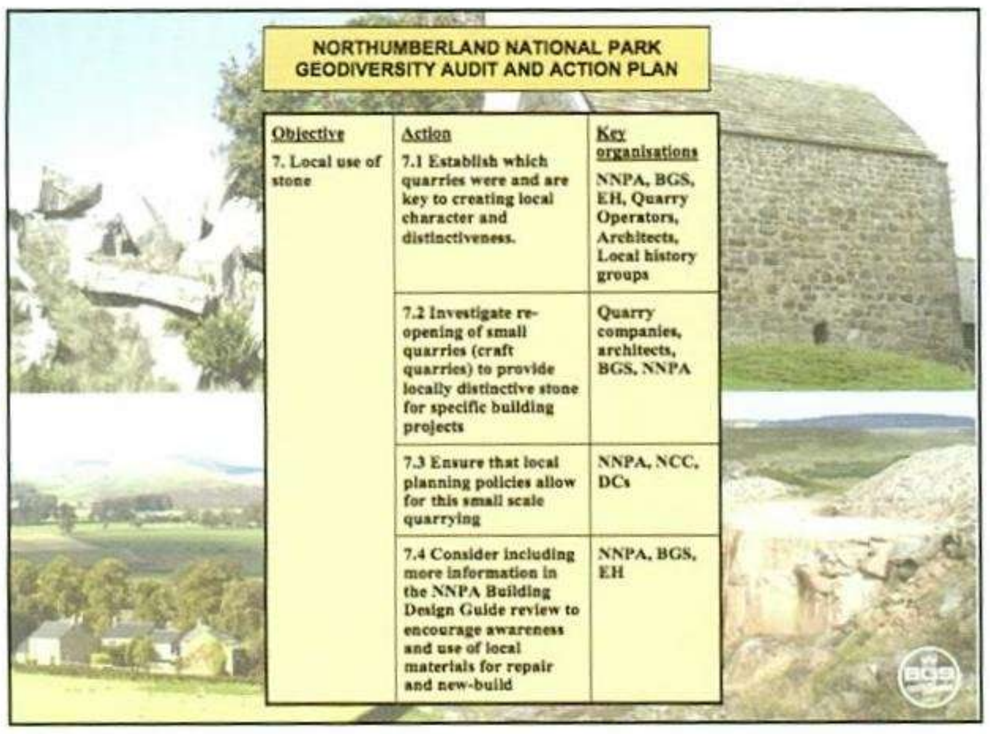
NORTHUMBERLAND NATIONAL PARK
GEODIVERSITY AUDIT AND ACTION PLAN
Objective
7. Local use of stone
Action
7.1 Establish which quarries were and are key to creating local character and distinctiveness.
Key organisations
NNPA, BGS, EH, Quarry Operators, Architects, Local history groups
7.2 Investigate re-opening of small quarries (craft quarries) to provide locally distinctive stone for specific building projects
Quarry companies, architects, BGS, NNPA
7.3 Ensure that local planning policies allow for this small scale quarrying
NNPA, NCC, DCs
7.4 Consider including more information in the NNPA Building Design Guide review to encourage awareness and use of local materials for repair and new-build
NNPA, BGS, EH

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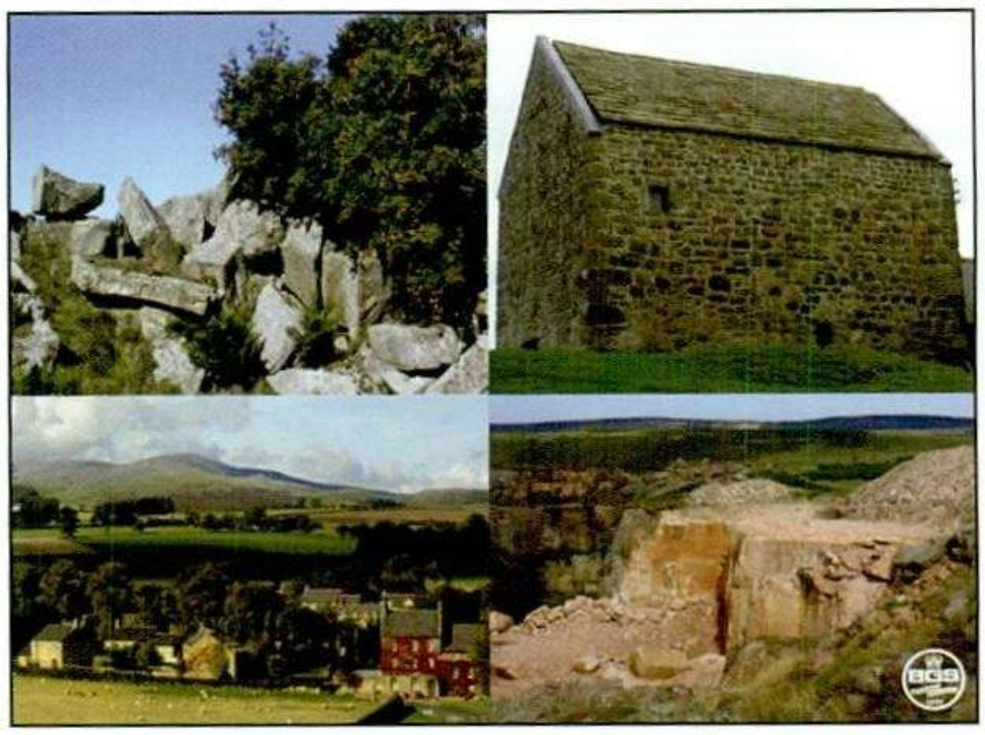


48

OPERATION OF A SCOTTISH SANDSTONE QUARRY

Marcus Paine, Hutton Stone Co Ltd

There is a long family tradition of quarrying in the Paine family. A number of years ago Marcus Paine reopened quarries in Swinton in Berwickshire and Hailes. Usually, a machine would be hired for 6 weeks in the summer to extract all of the stone which will be worked by hand for the rest of the year.

The type of stone quarried determines how it is tooled and used in architecture. The stone quarried in Swinton is largely used for random rubble walls. The type of stone will also determine how it is dressed – the Swinton stone is punched flat because it is possible to do so – many other types of stone are too hard to do this. However, masons would always aim to do the least possible dressing to stone – a punched face usually indicates that the stone did not split cleanly, therefore necessitating more dressing of the stone surface

Colour variation is common due to the practicalities of quarrying – different batches of stone vary according to which bed they have come from within the quarry. Usually, only high end buildings had a consistent single colour of stone as it would have been more difficult and time consuming (and consequently more expensive) to select a large amount of stone of the same colour.

An understanding of the quarry and its geology is important when specifying stone. Certain quarries can only produce certain dimensions of stone according to the stone type and how it has been laid down. Hailes quarry produced smaller scale stones for example.

Hailes quarry, which consists of carboniferous sandstone, was first registered in 1700. The architecture of the surrounding area is able to tell much about the quarry and what type of stone could be extracted. By looking at the more prestigious buildings in the area, it is possible to assume that bigger blocks might exist in the quarry.

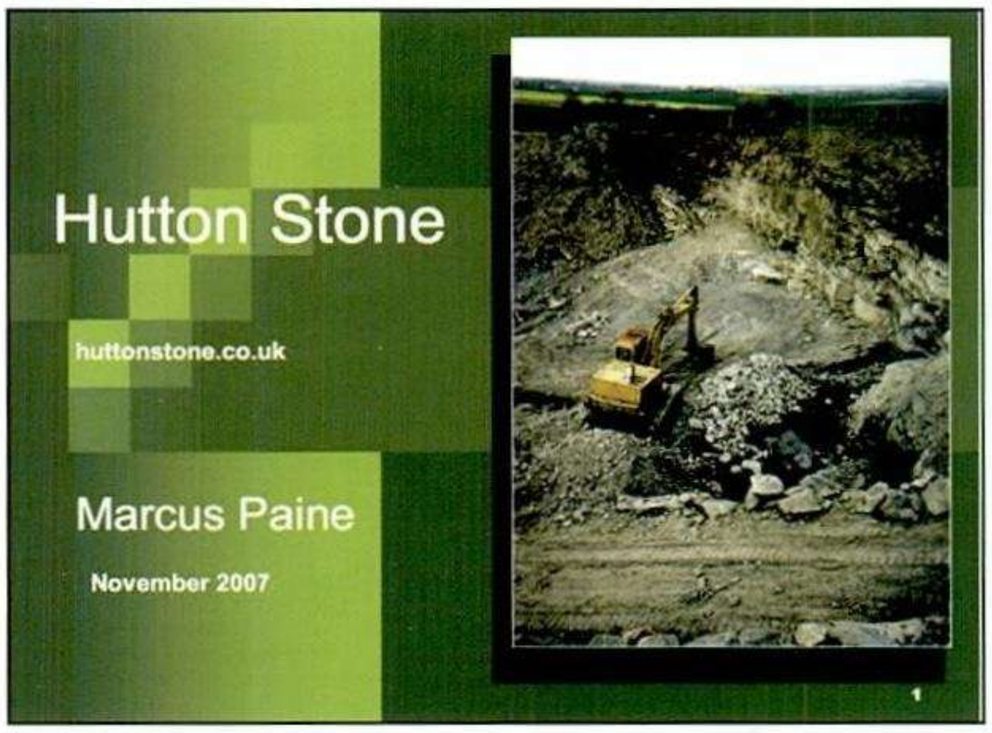
Quarries usually close for a reason, and often there is not much stone left that is easily accessible. Hailes quarry was in operation between 1700 and 1938, and then reopened briefly in 1952.

The way that stone is extracted from the quarry is important. When the quarry was reopened in 1952, dynamite was used to extract rock and this caused damage to the face. Today, machines are used to extract the rock. However, the machines are operated by quarrymen who have also extracted by hand. This means that they use the machine in an appropriate way.

There must be a market for the type of material produced by any quarry. Luckily, there is a market for the large amounts of rubble that the quarry produces. Generally, blocks sit at the quarry for about a month before going to the yard where the careful selection of block sizes is important.

OPERATION OF A SCOTTISH SANDSTONE QUARRY

Marcus Paine, Hutton Stone Co Ltd



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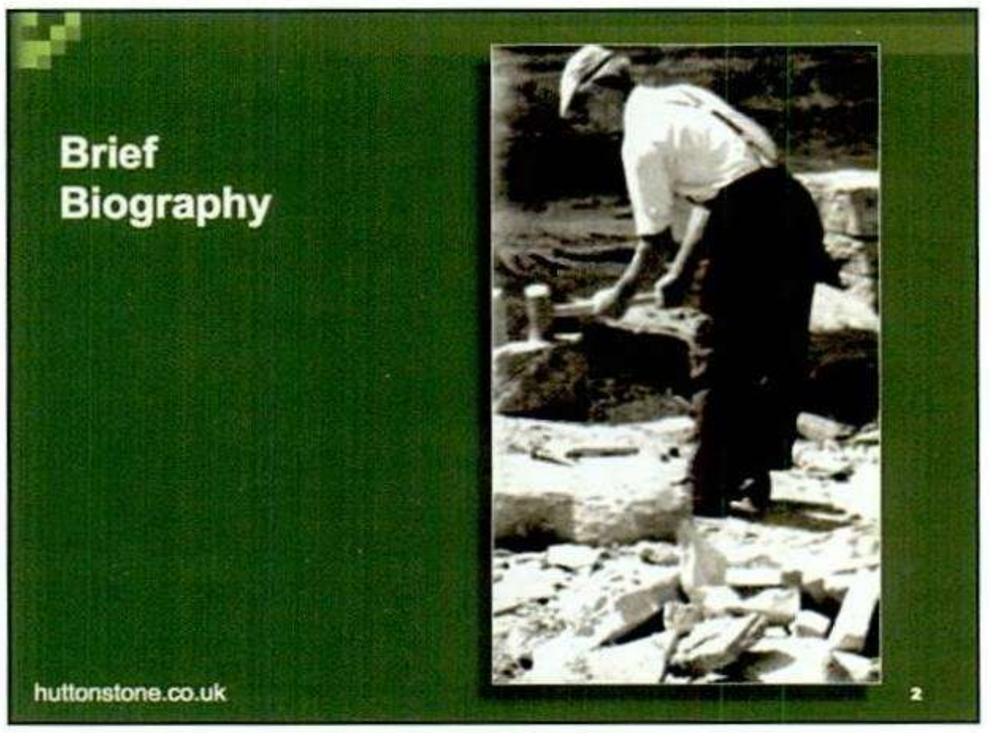

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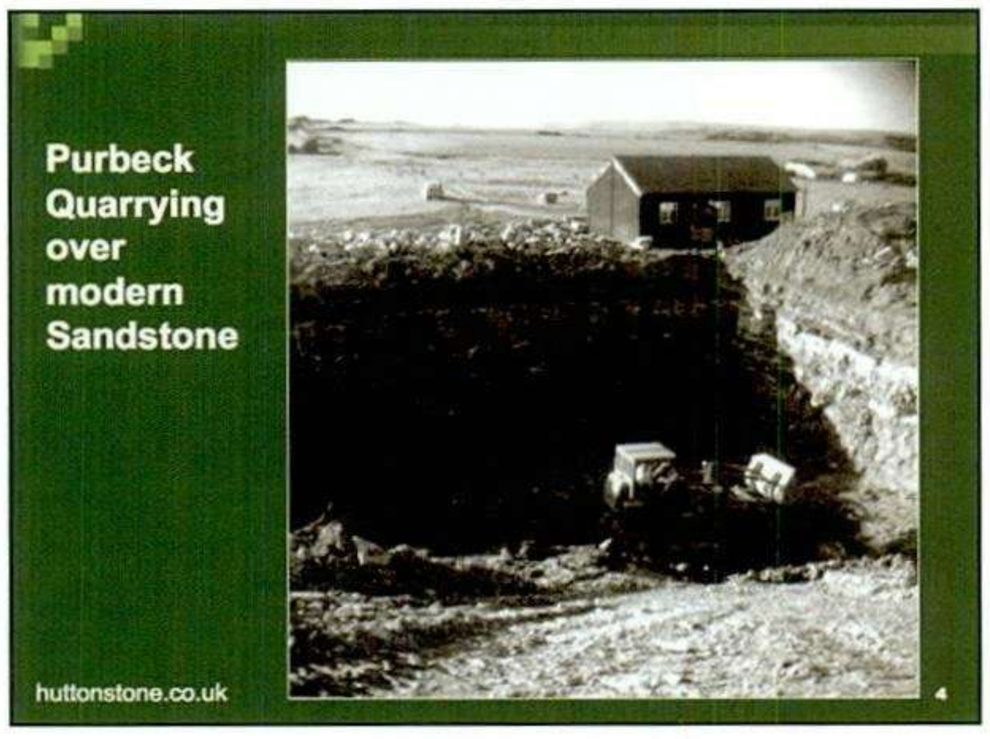

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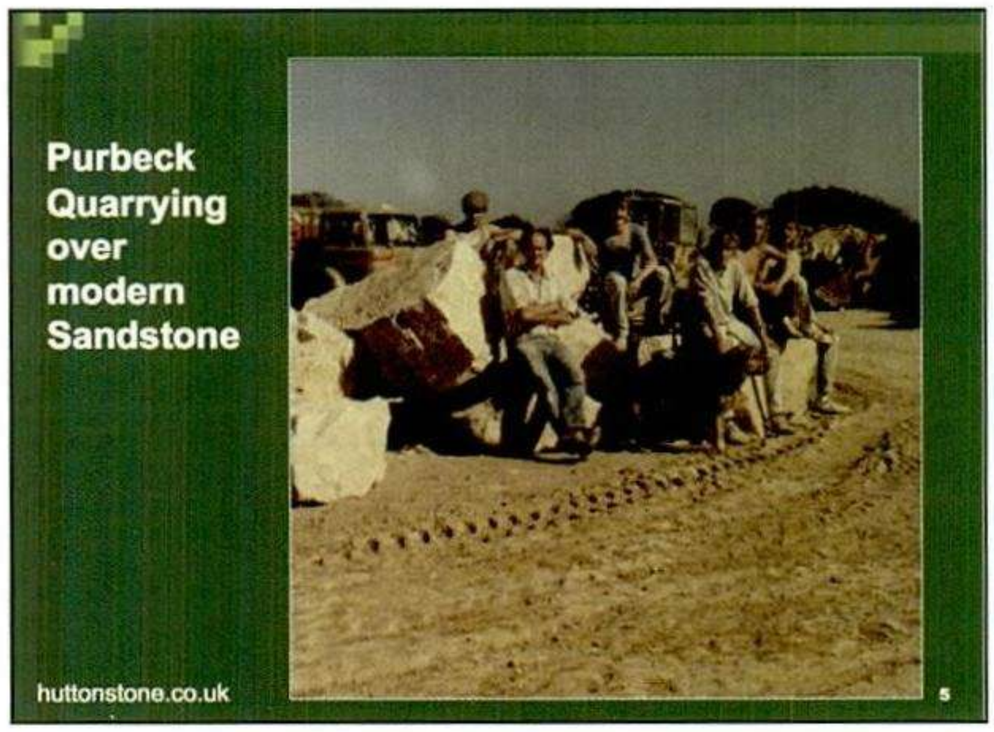

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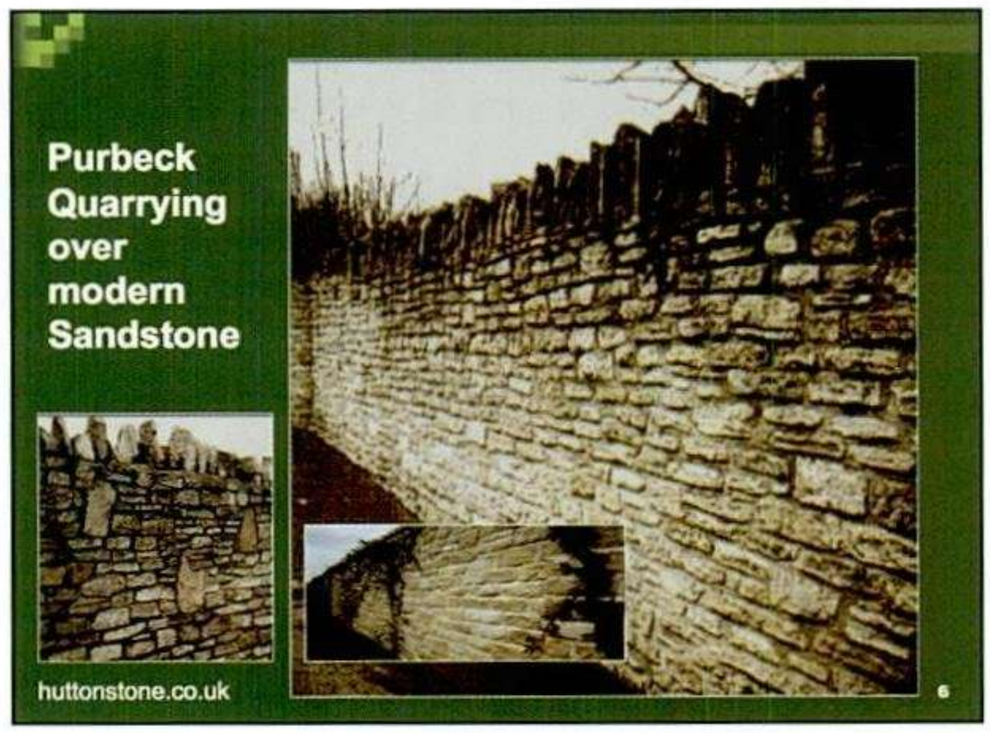

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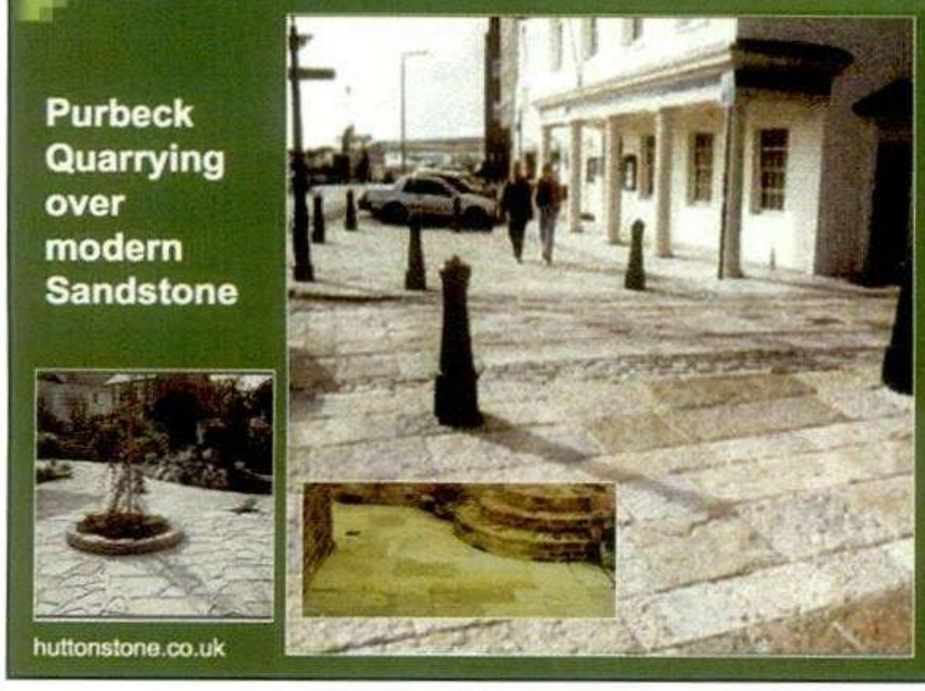
Purbeck Quarrying over modern Sandstone



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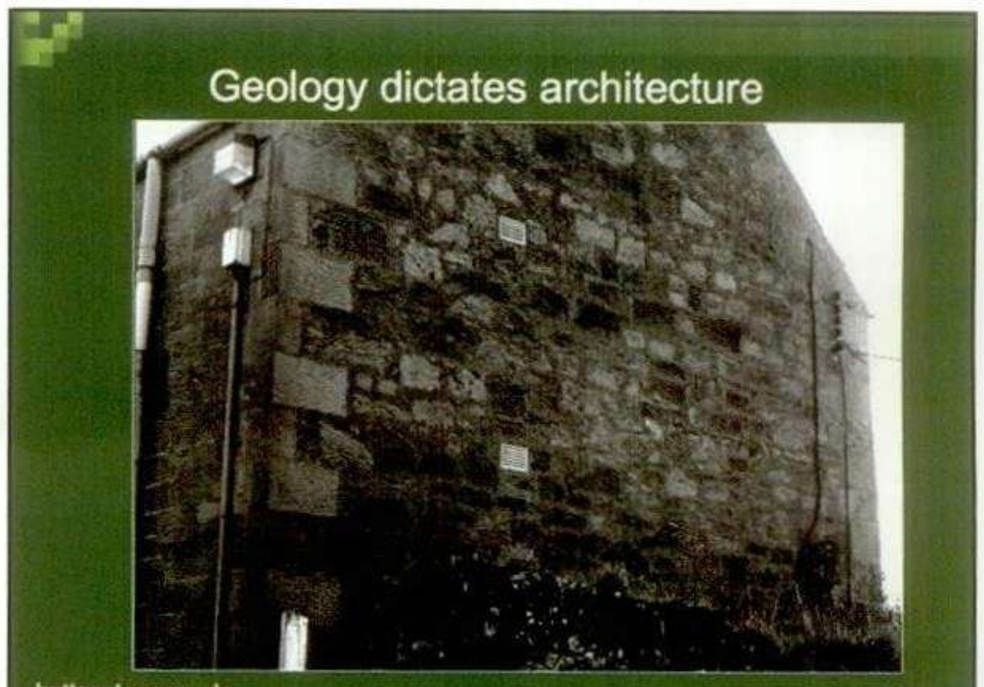

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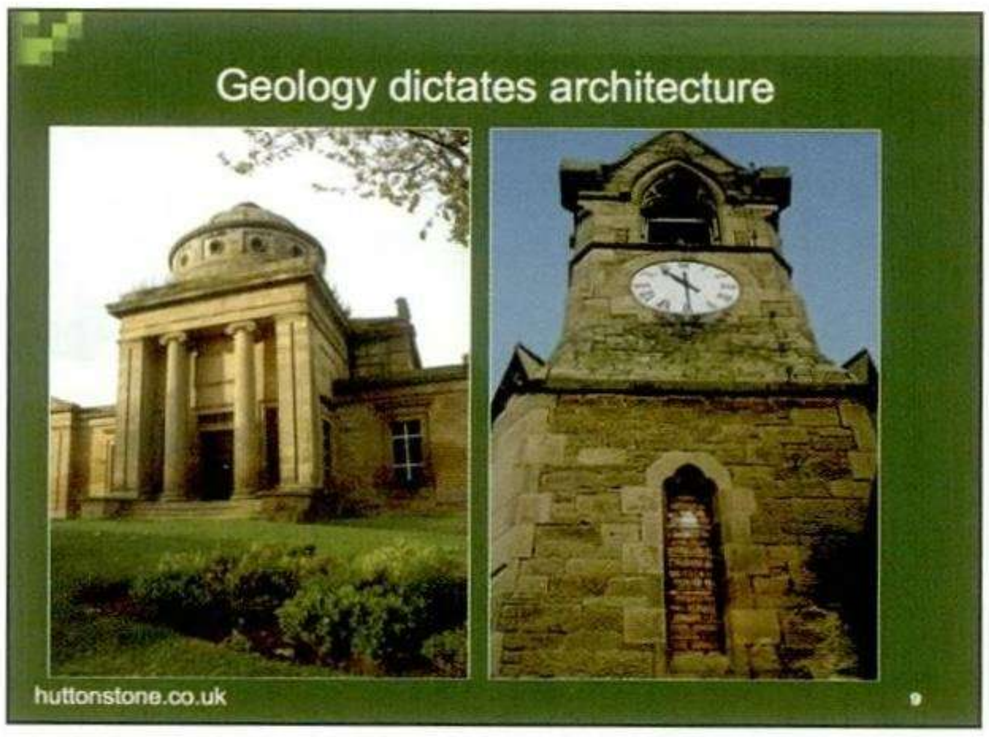

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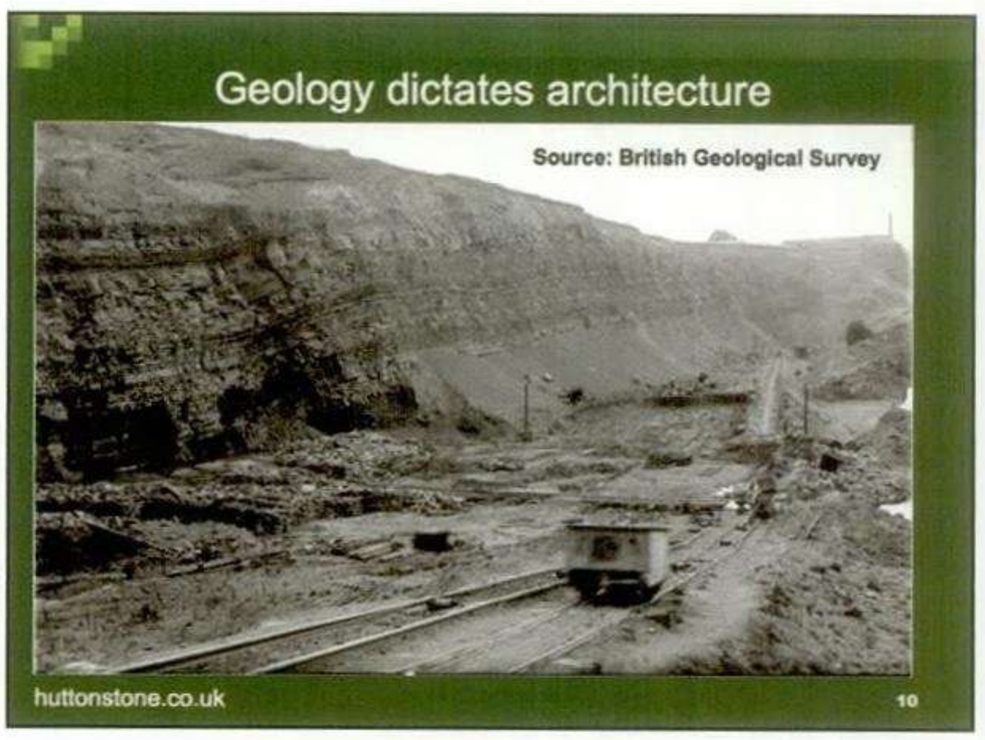

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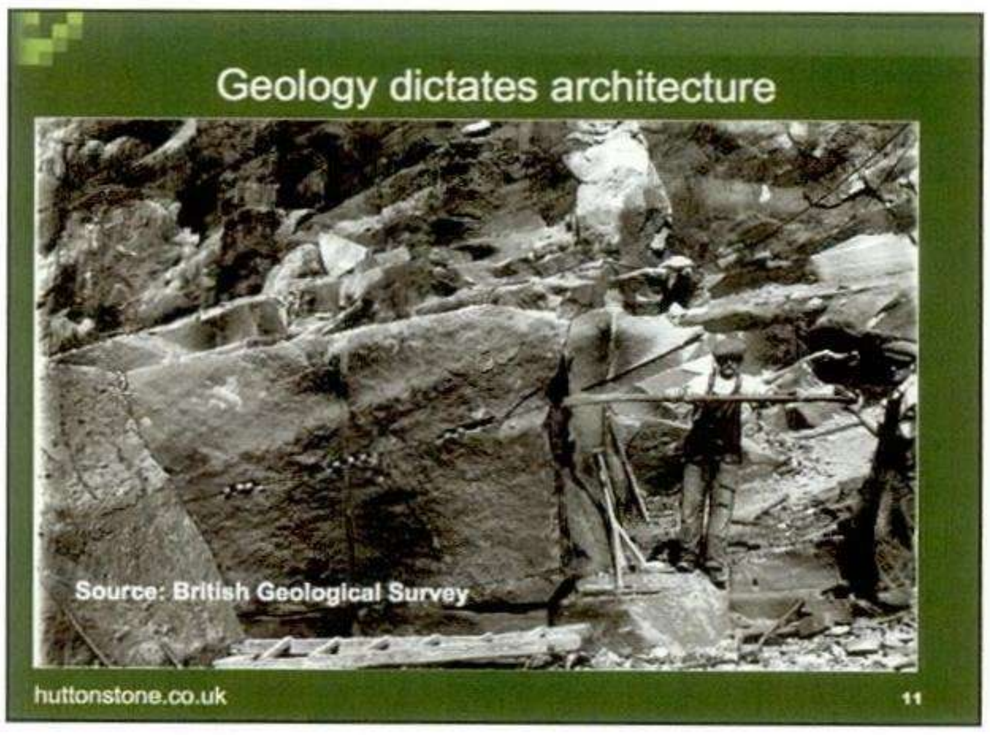

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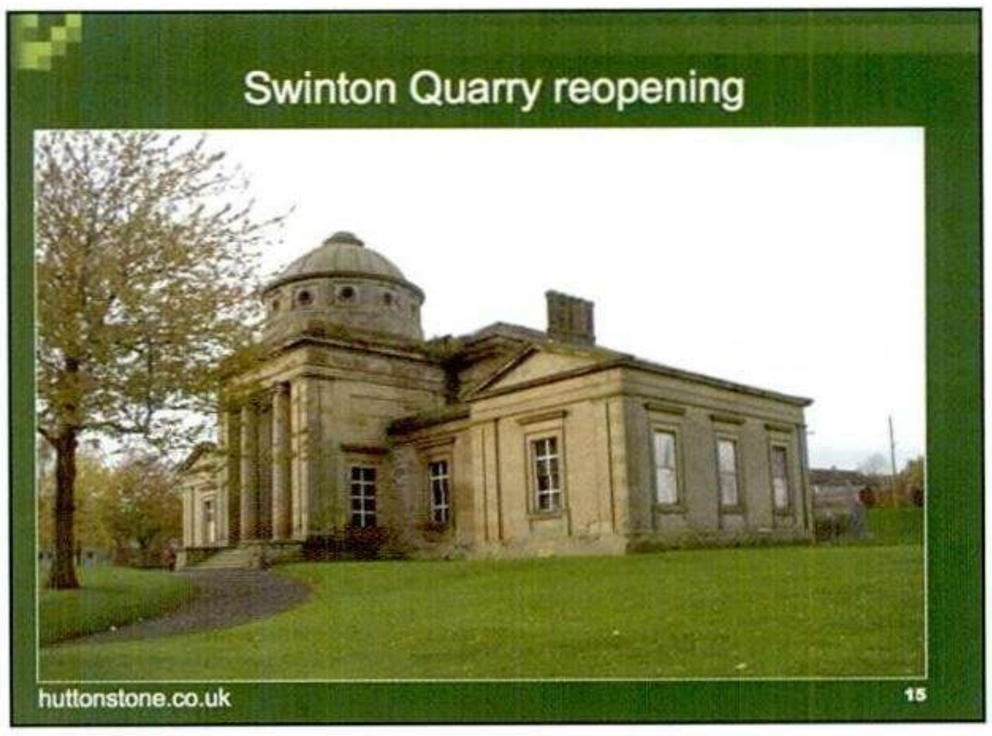

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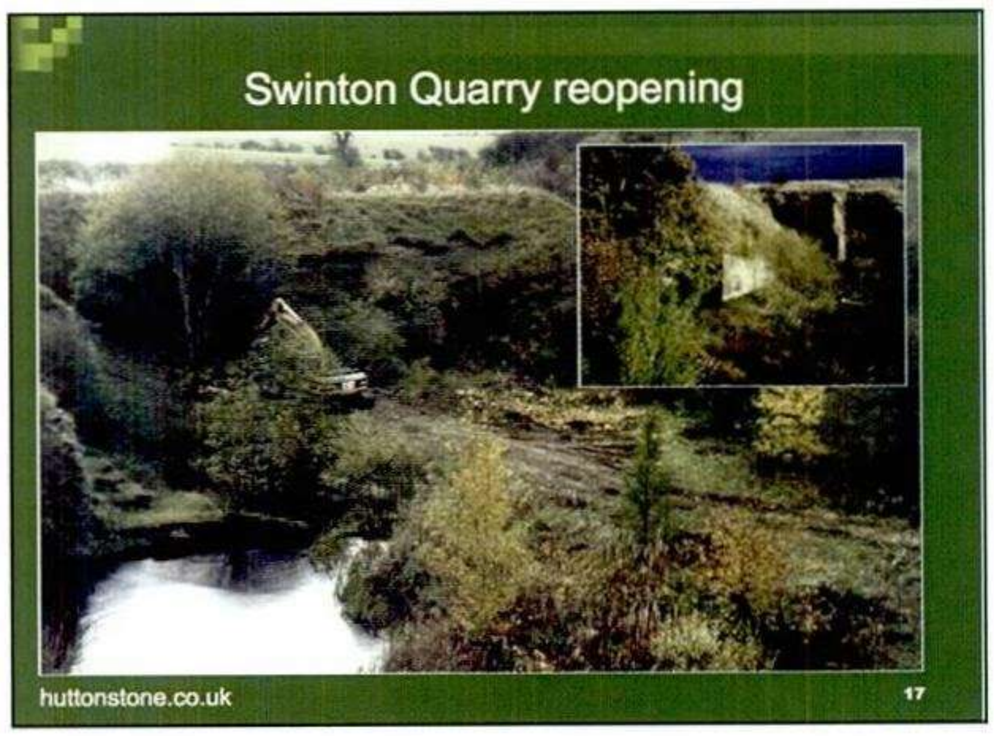

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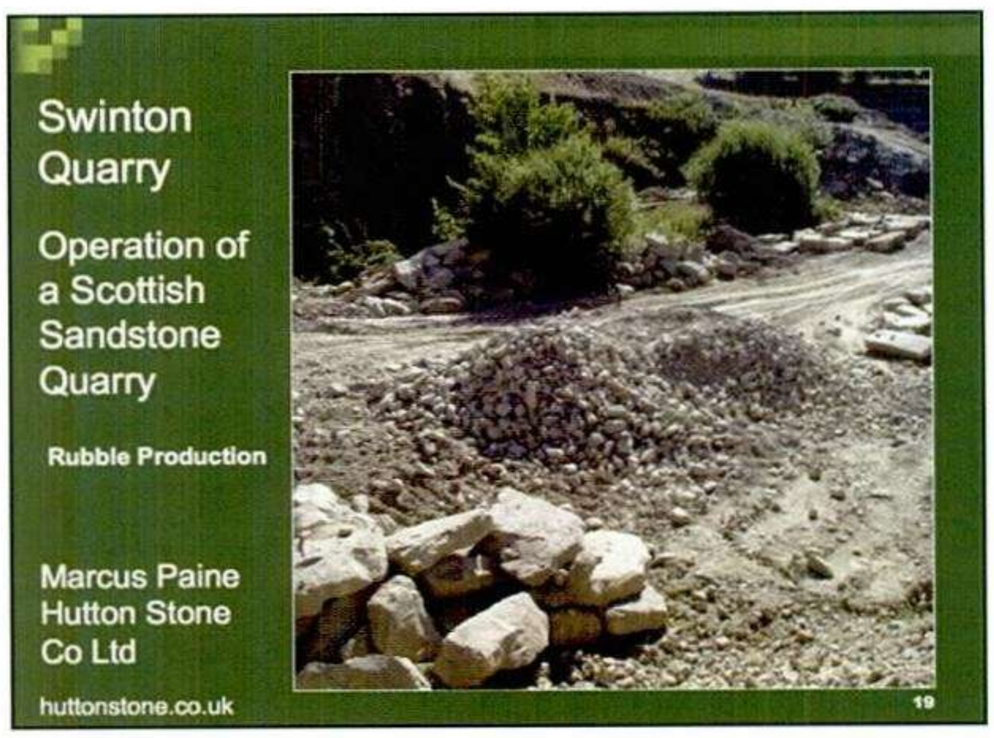

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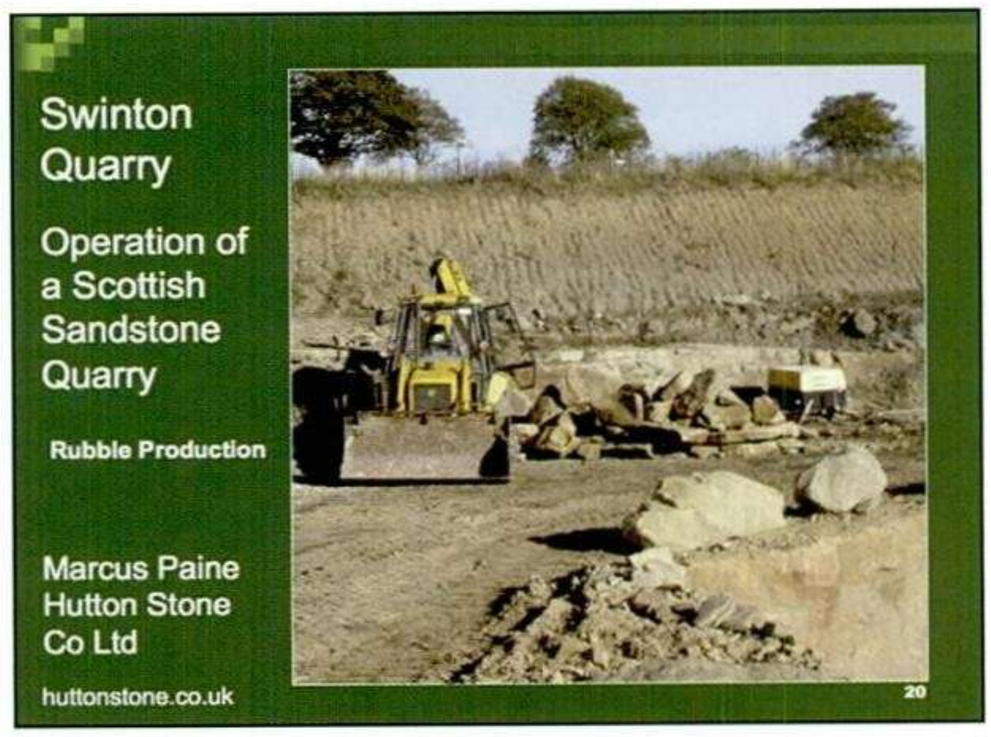

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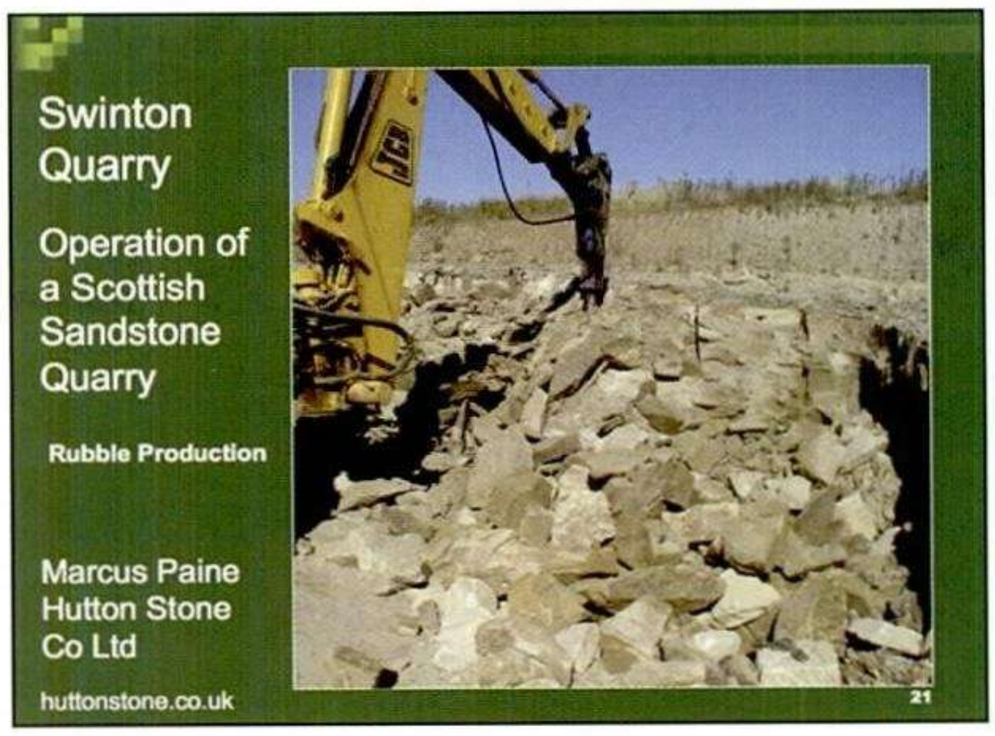

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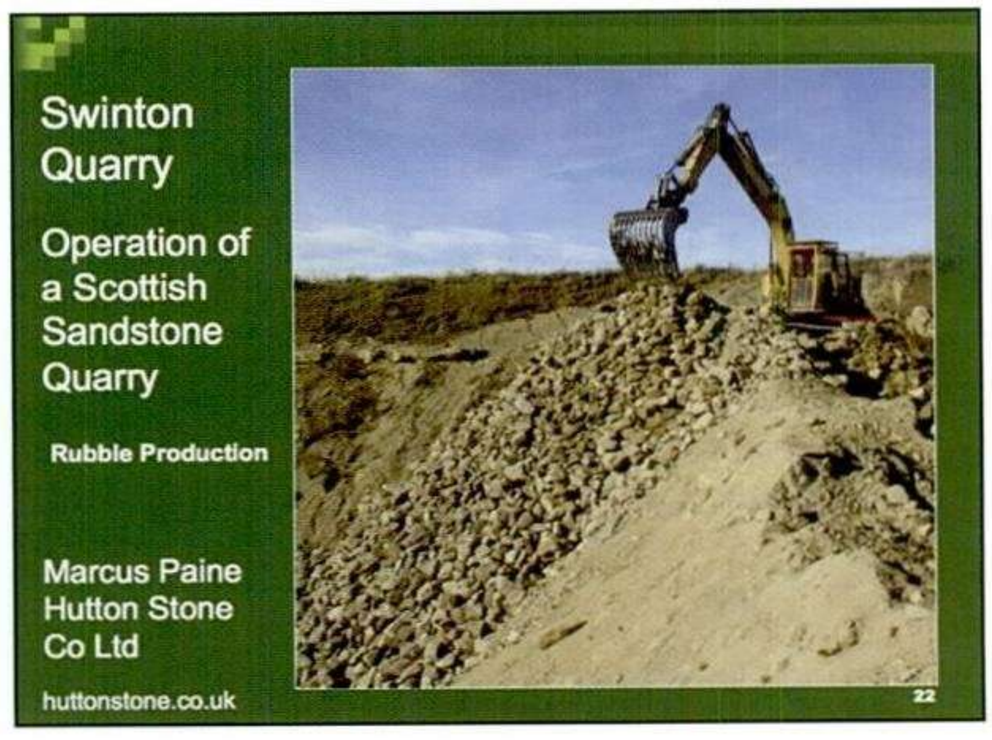

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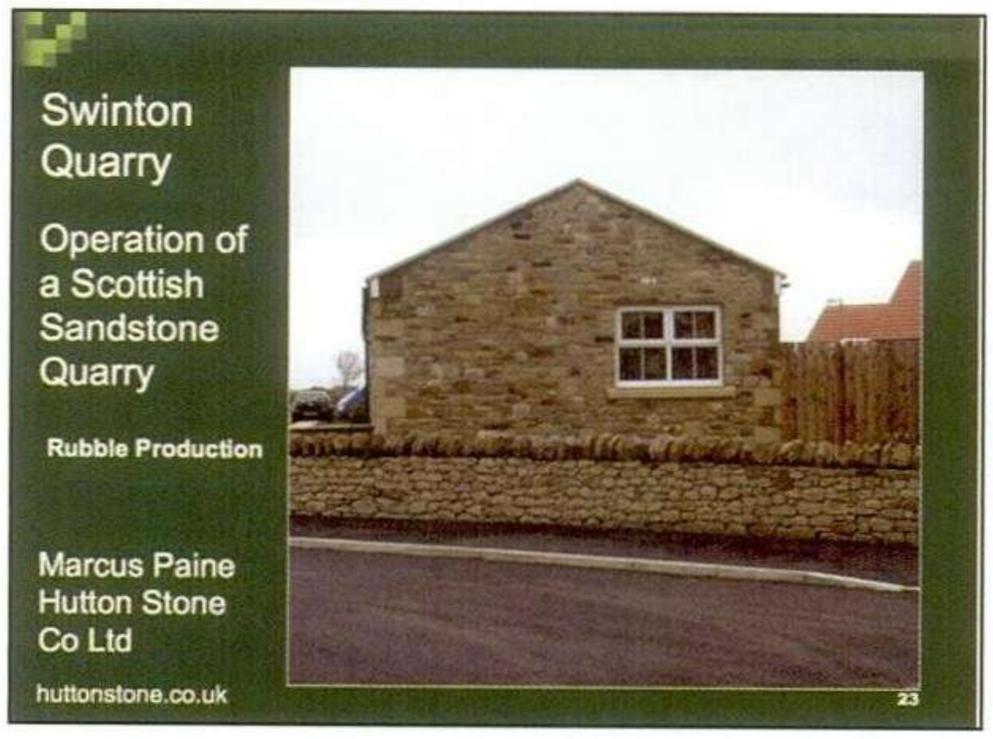

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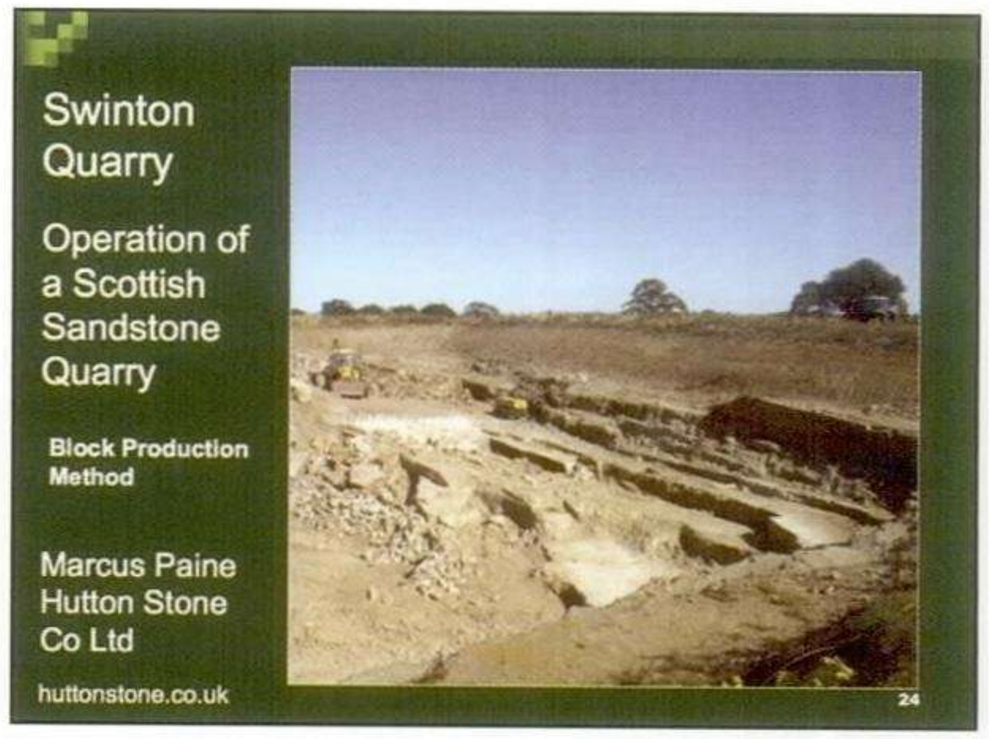

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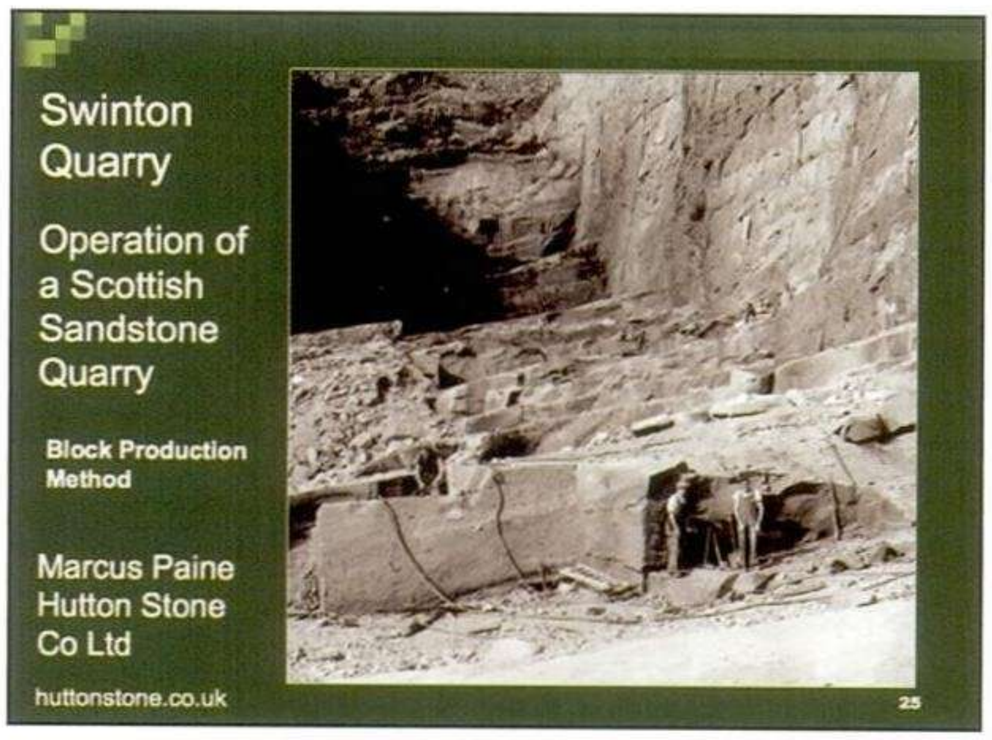

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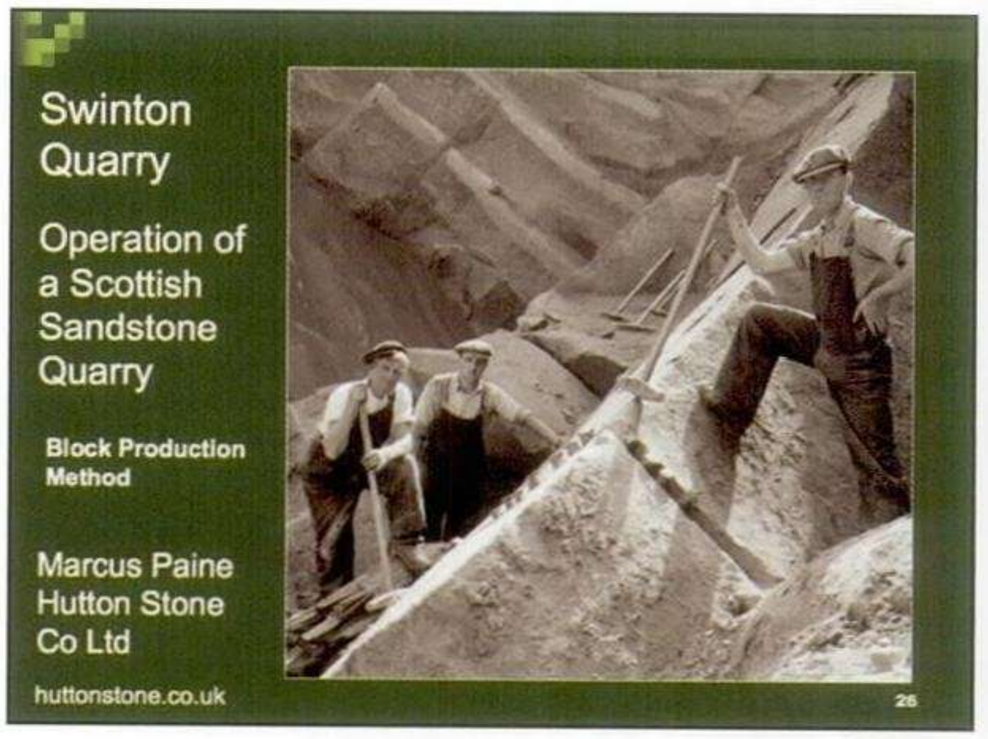

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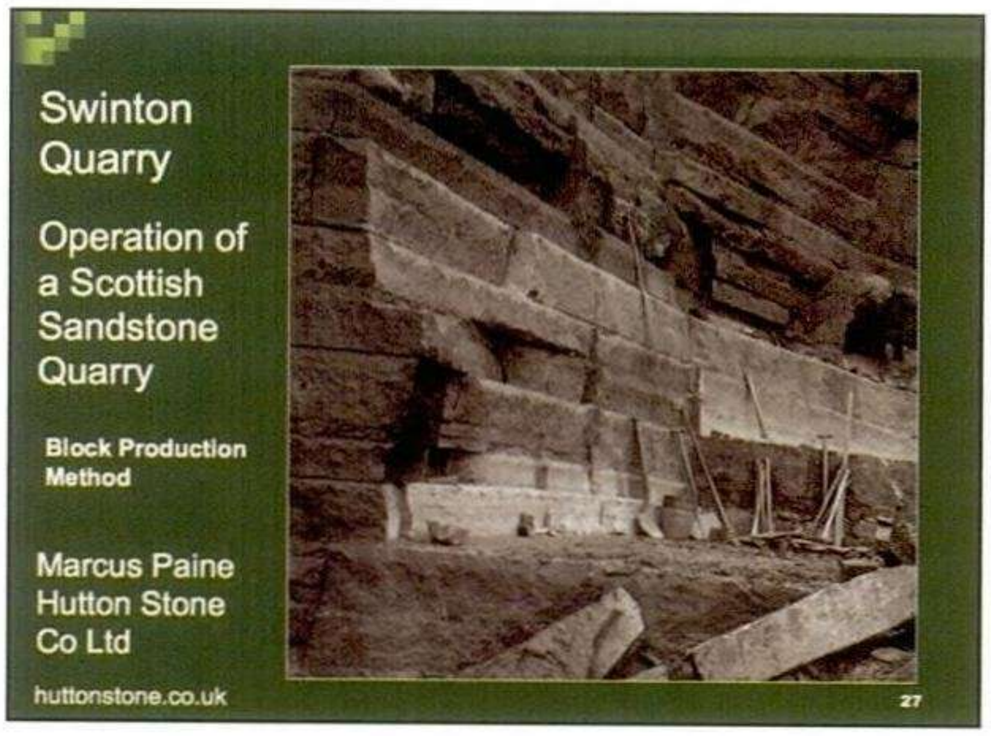

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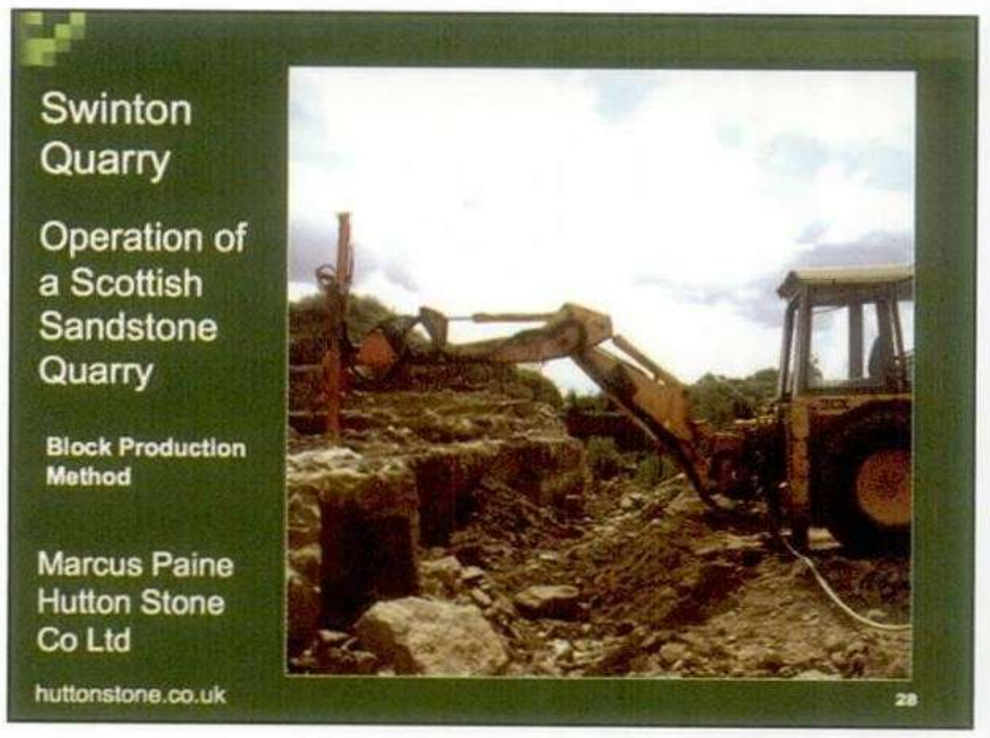

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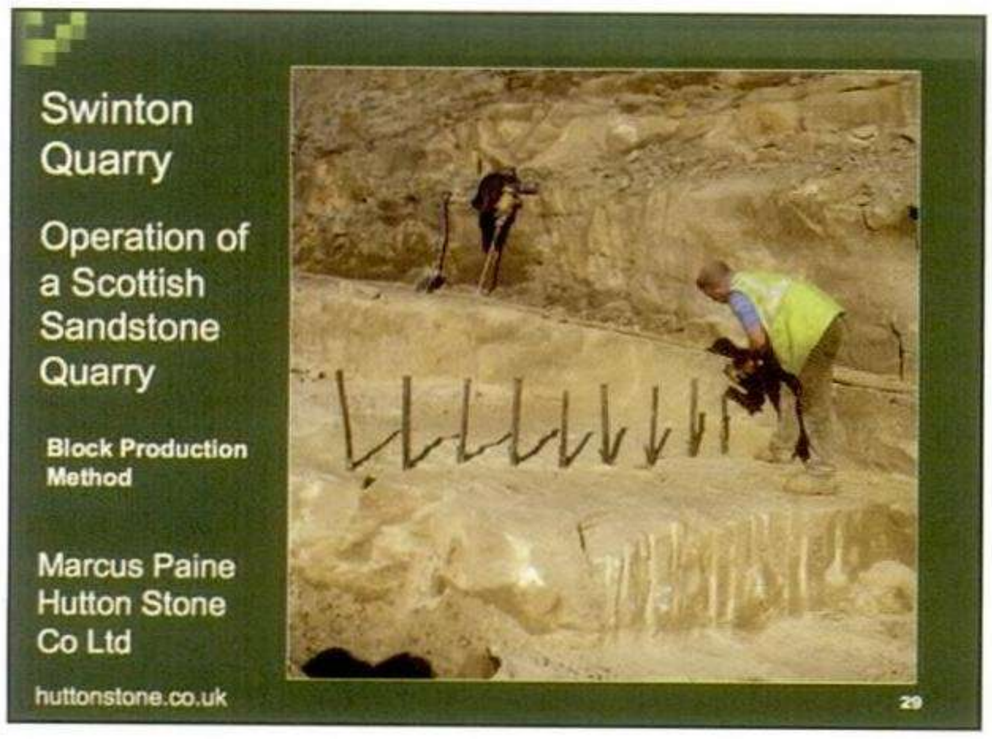

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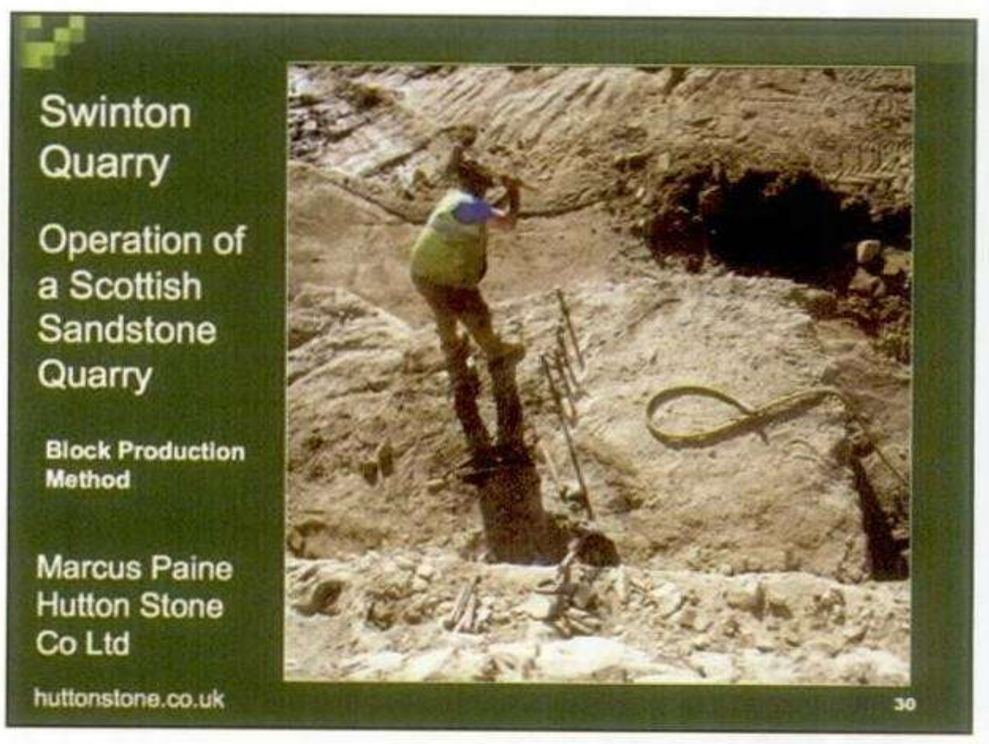

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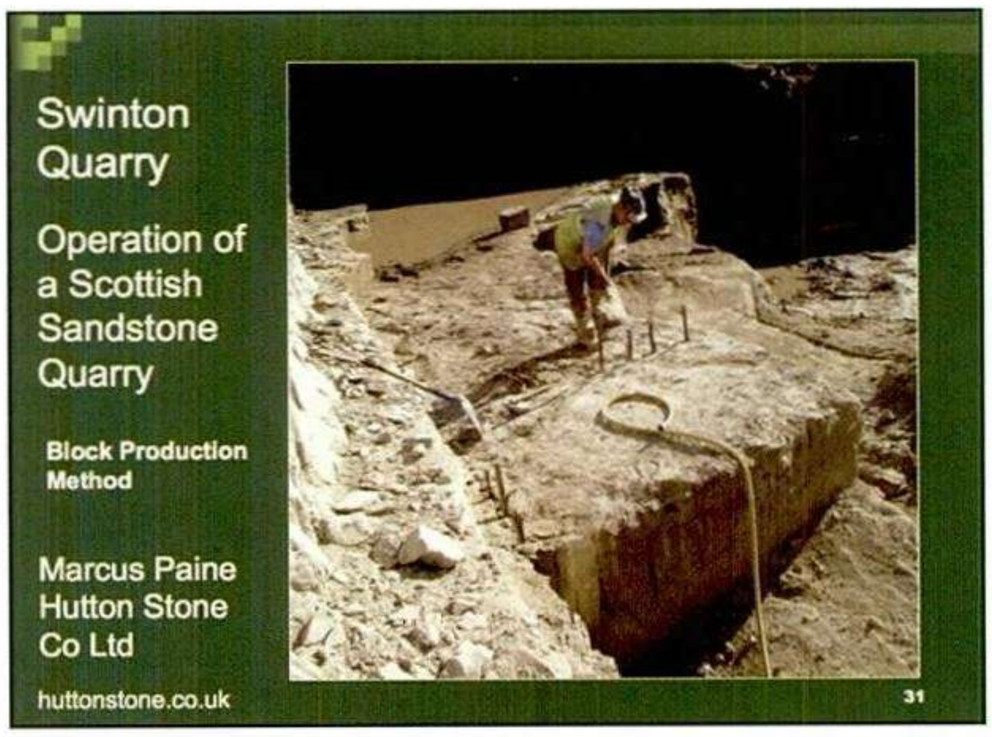

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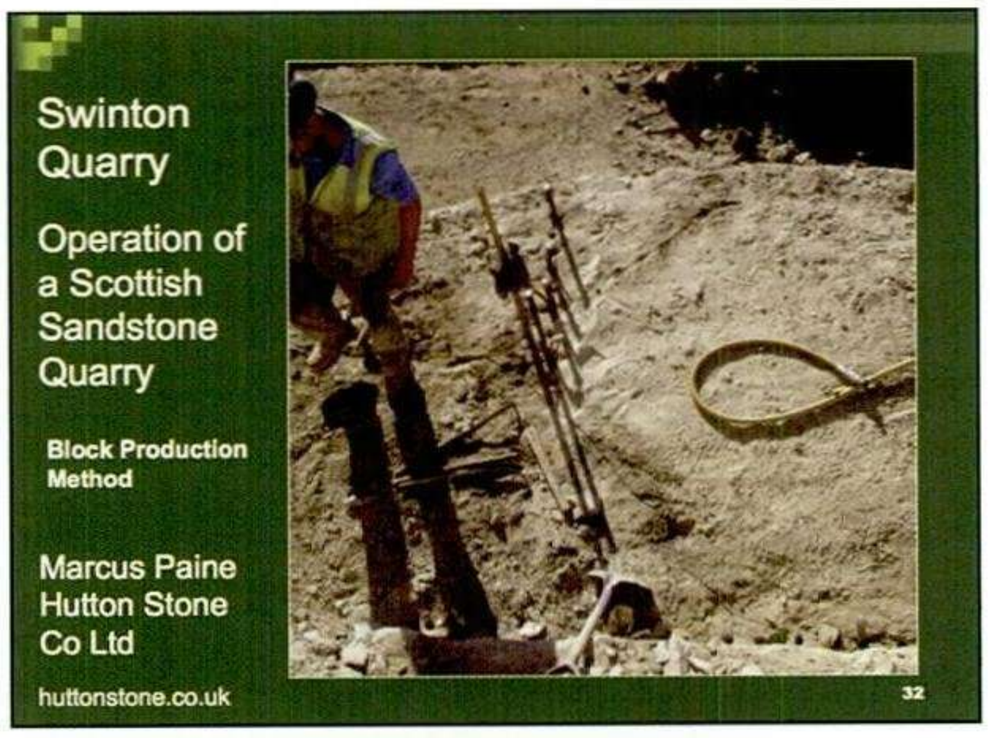

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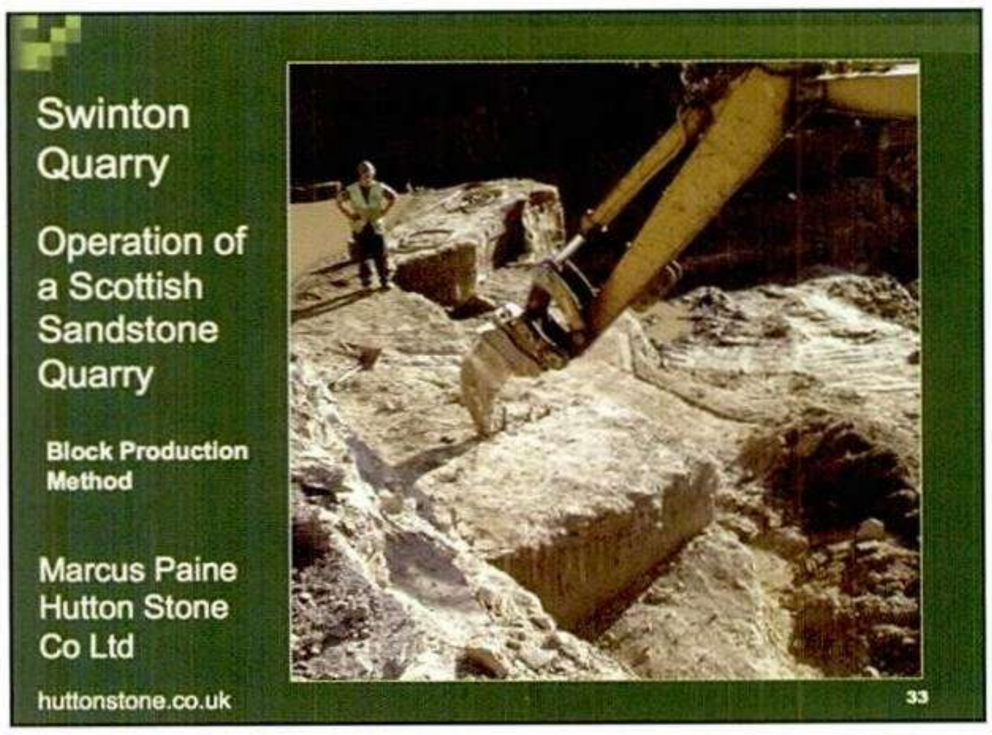

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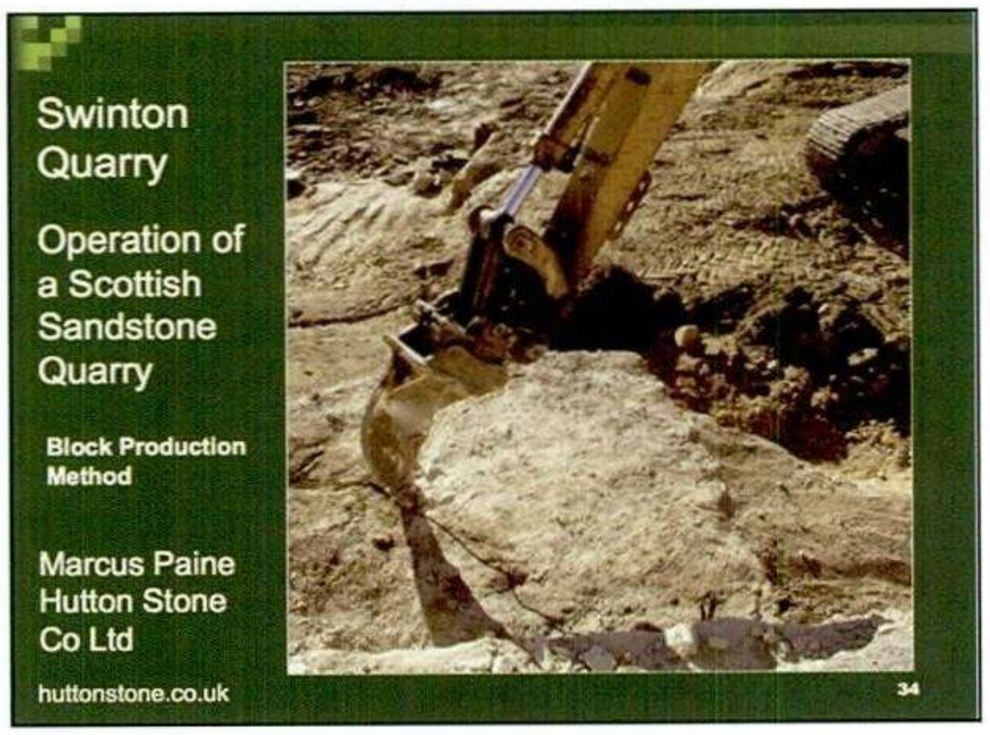

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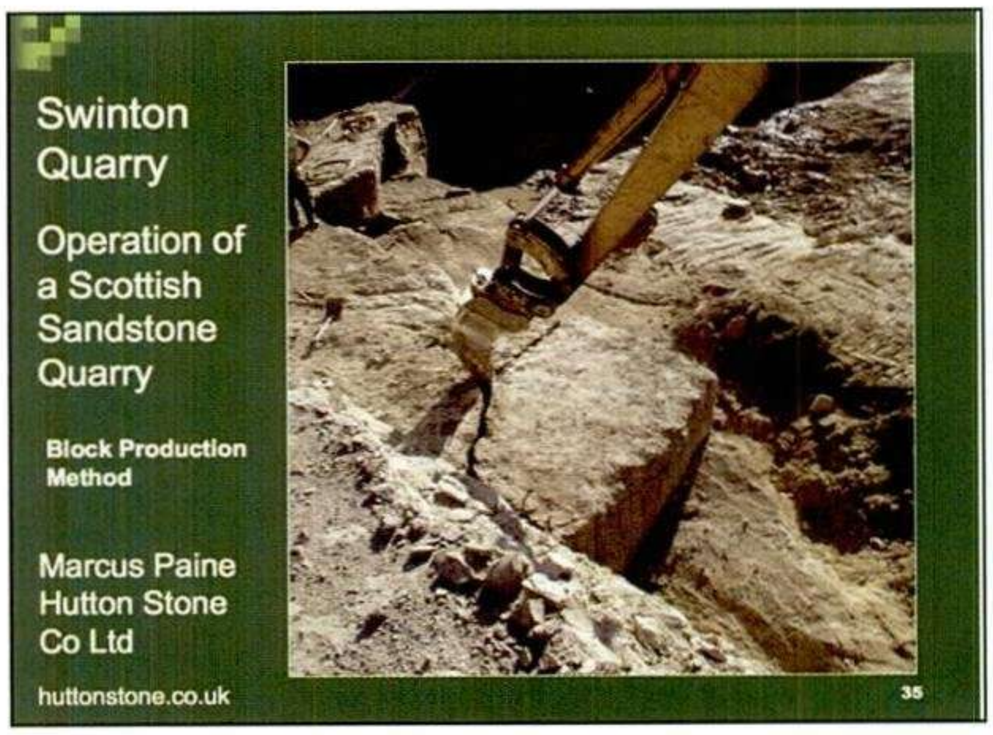

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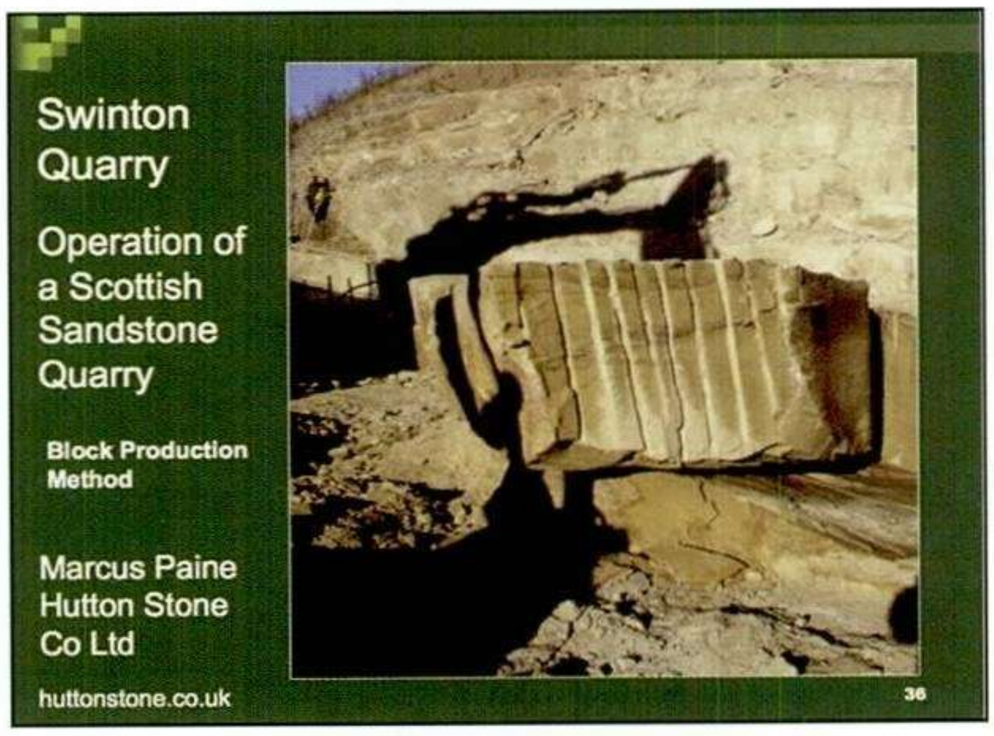

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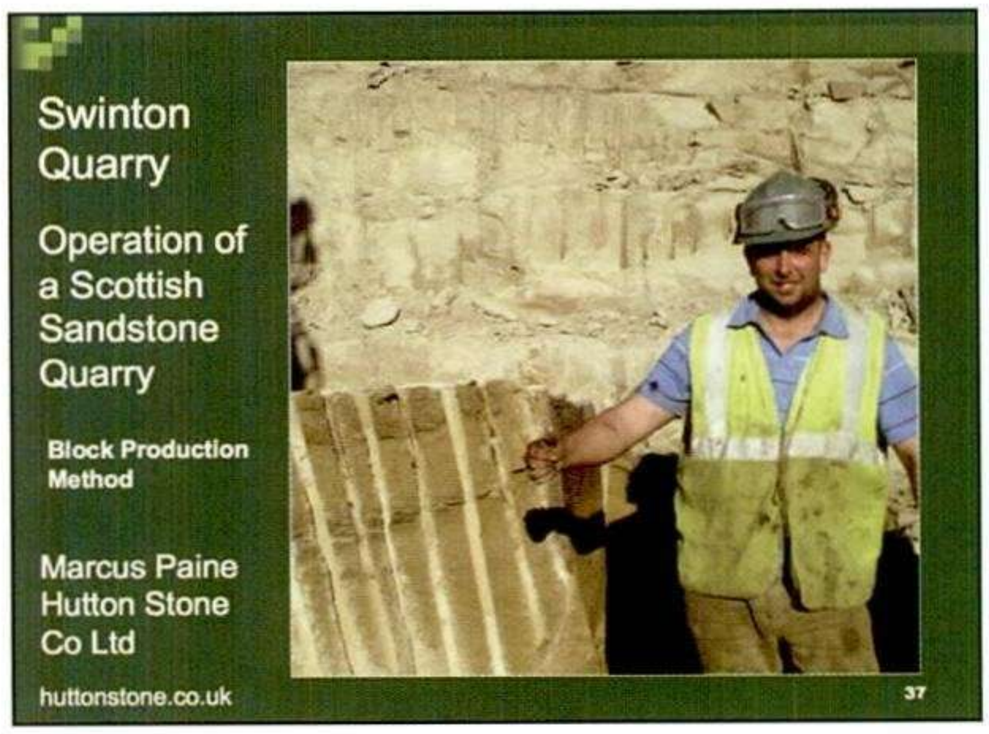

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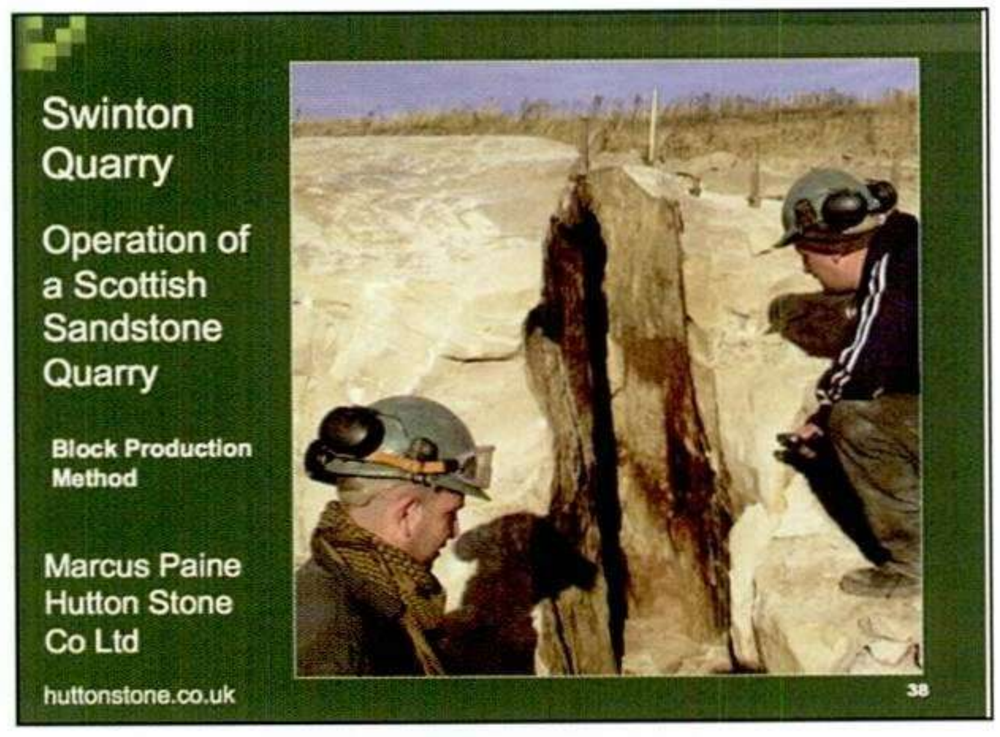

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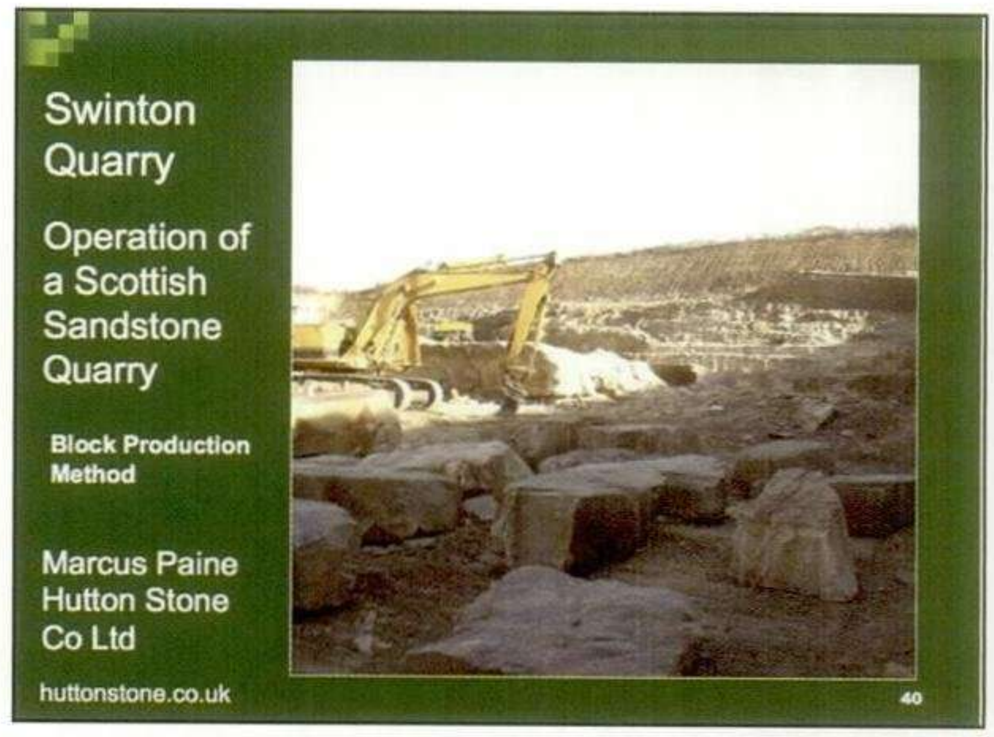

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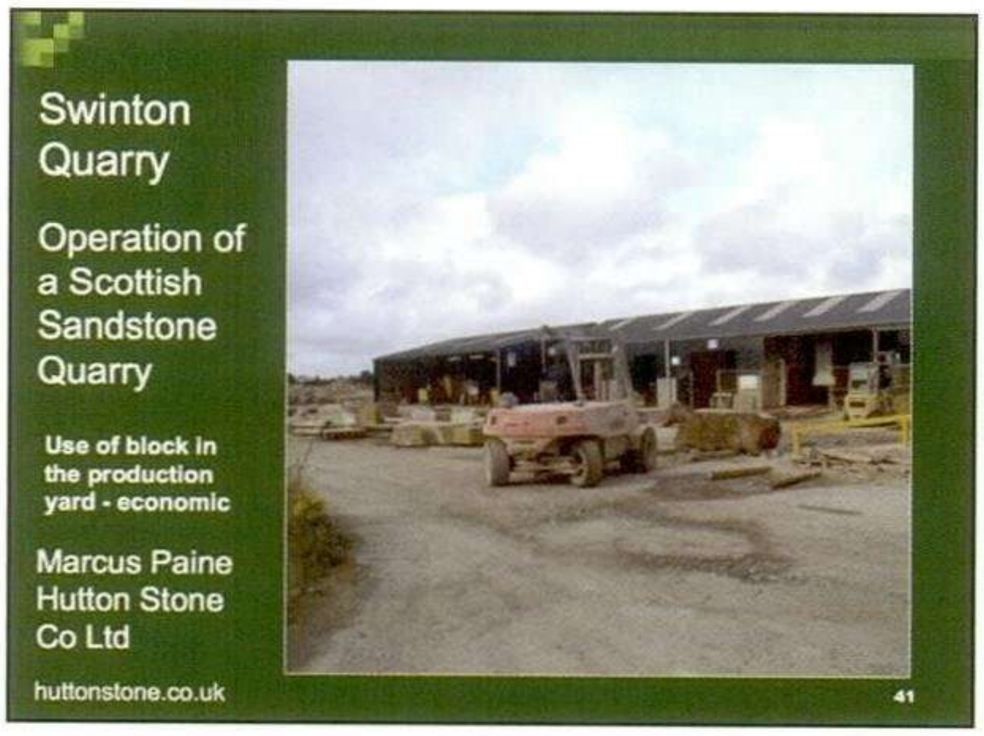

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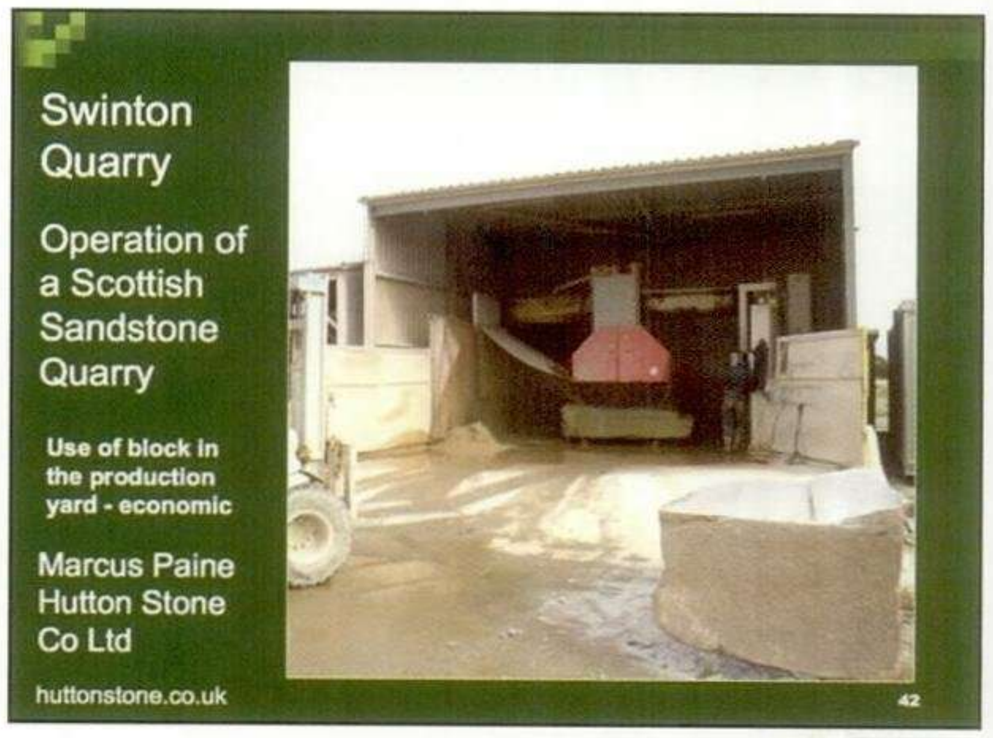

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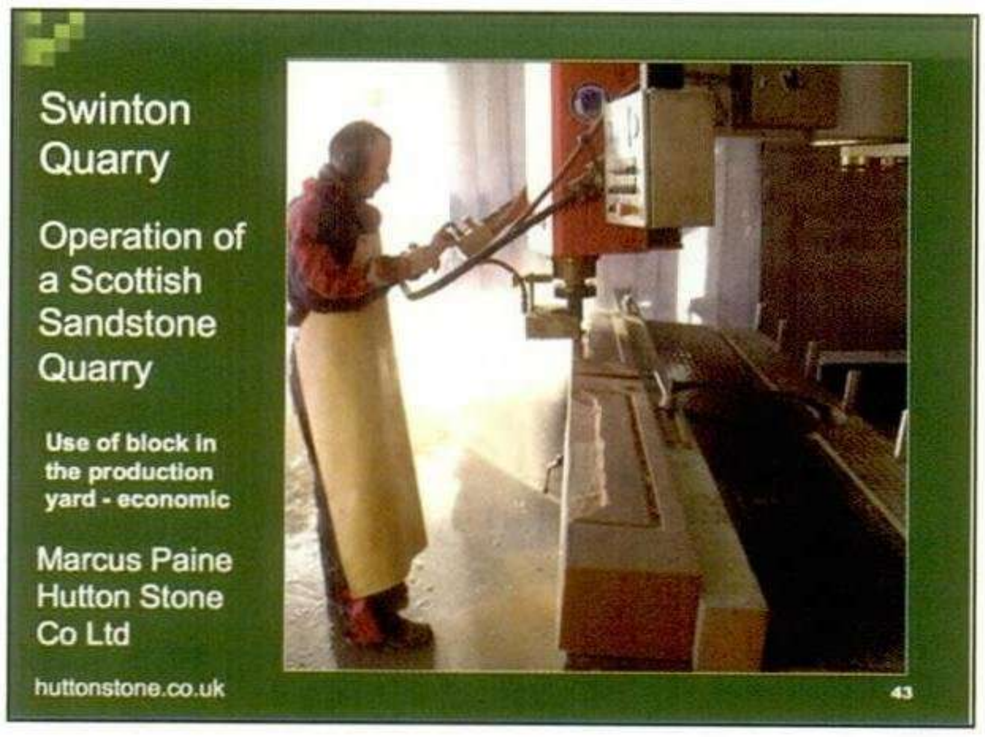

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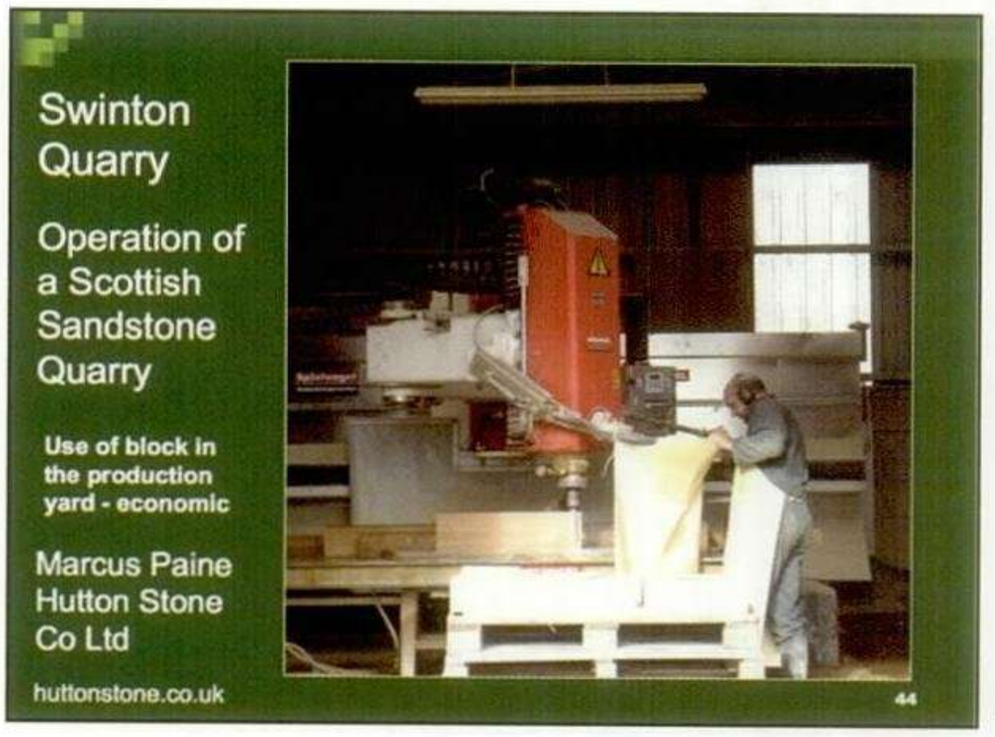

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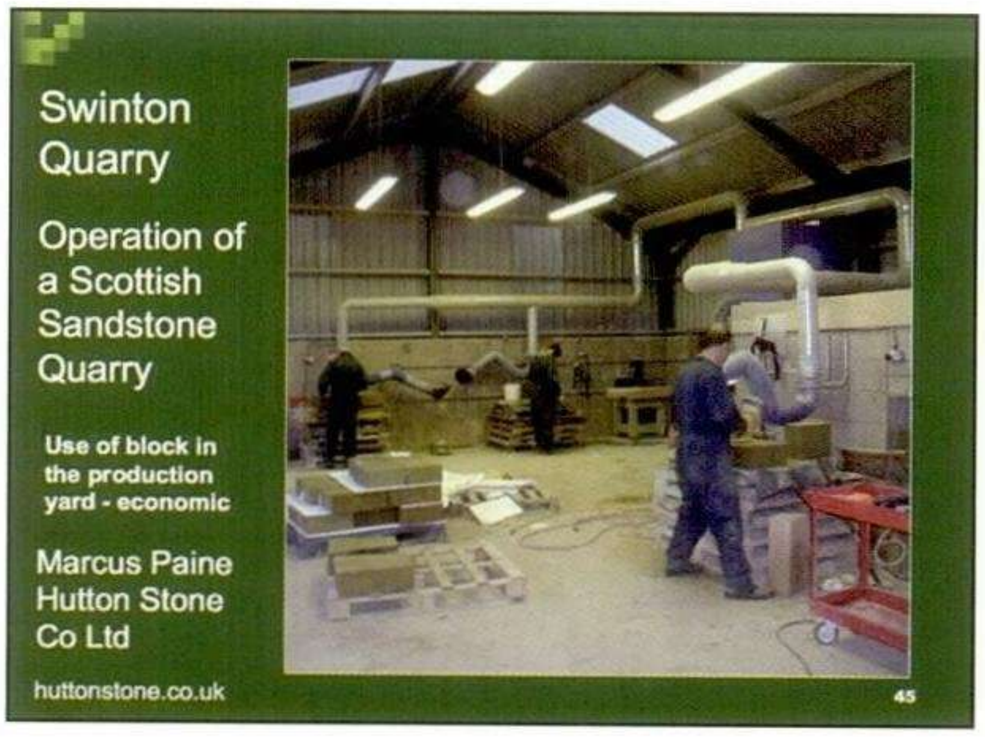

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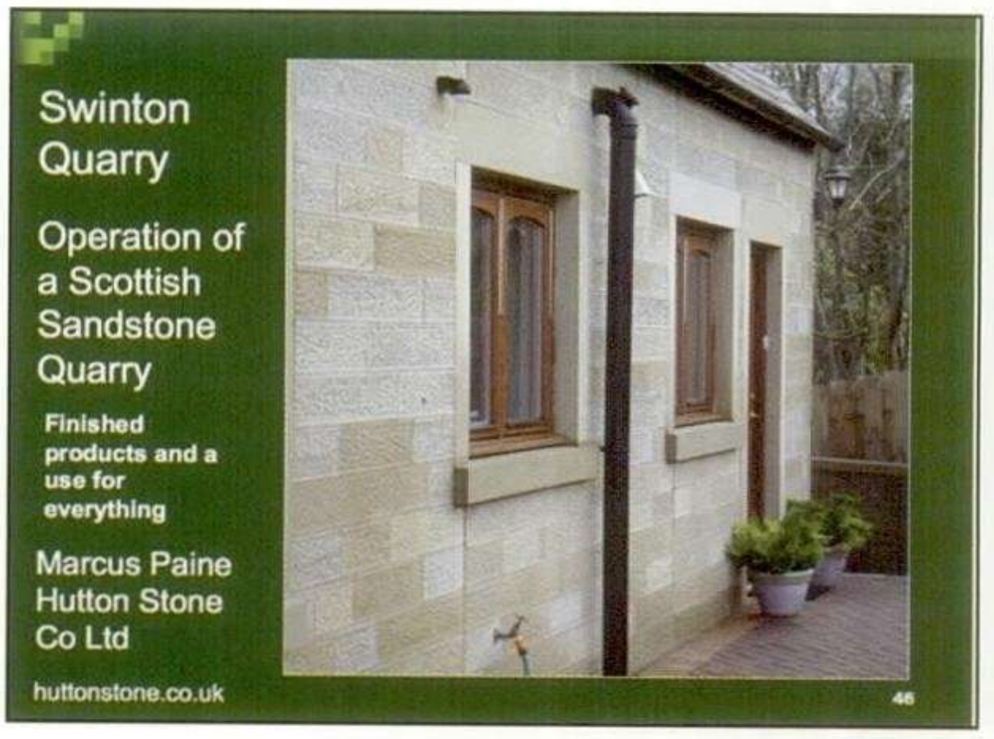

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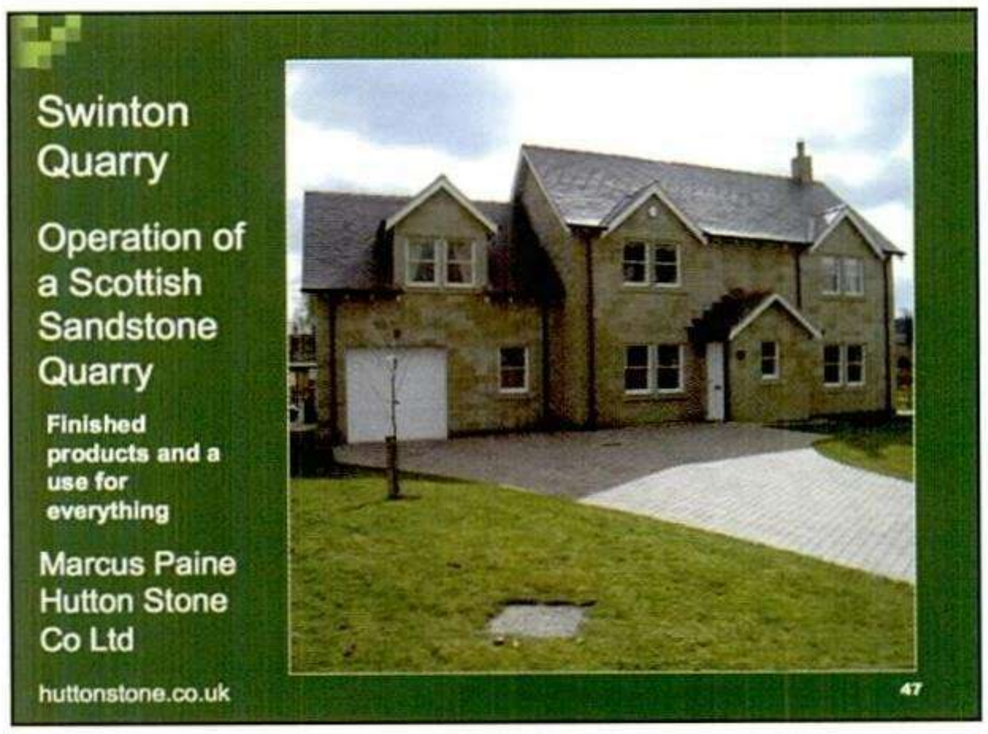

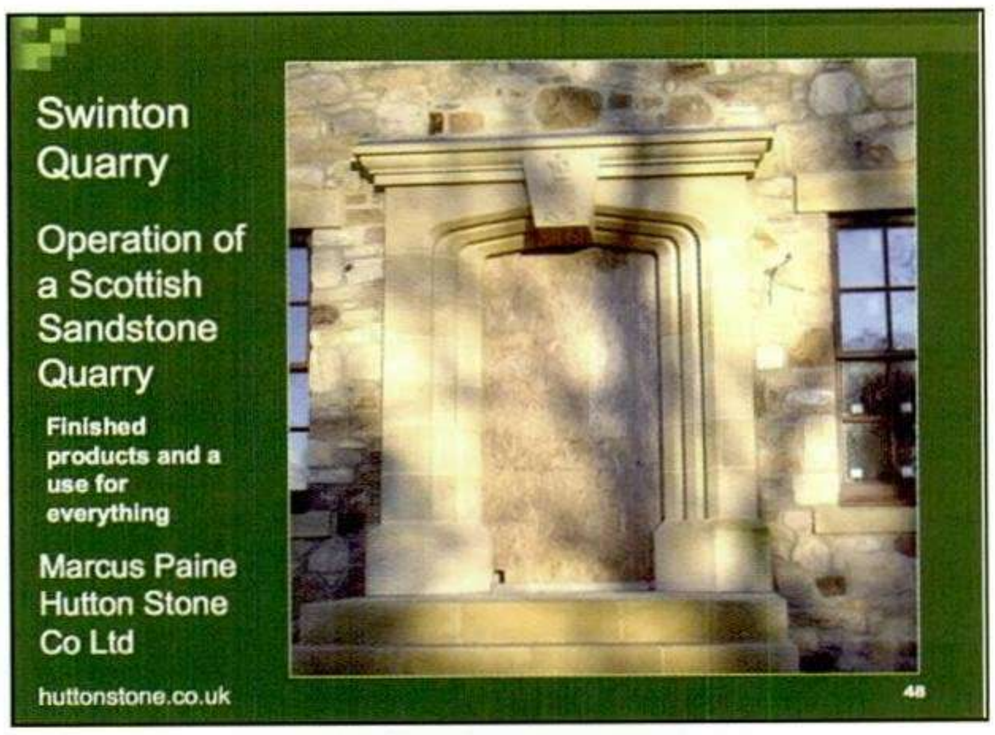

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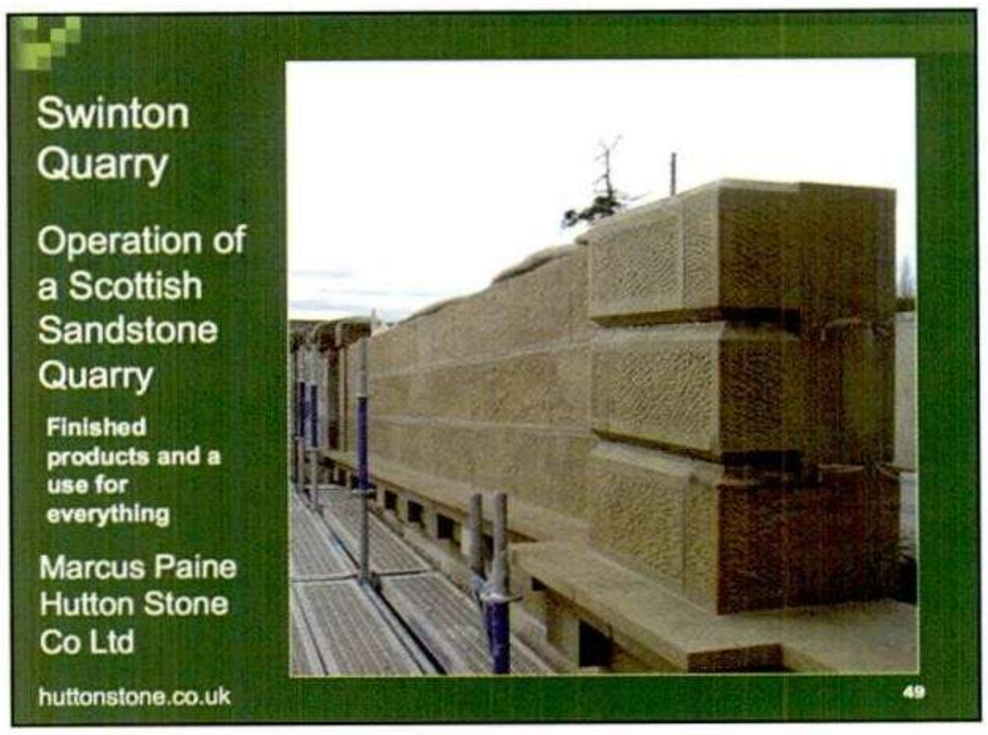

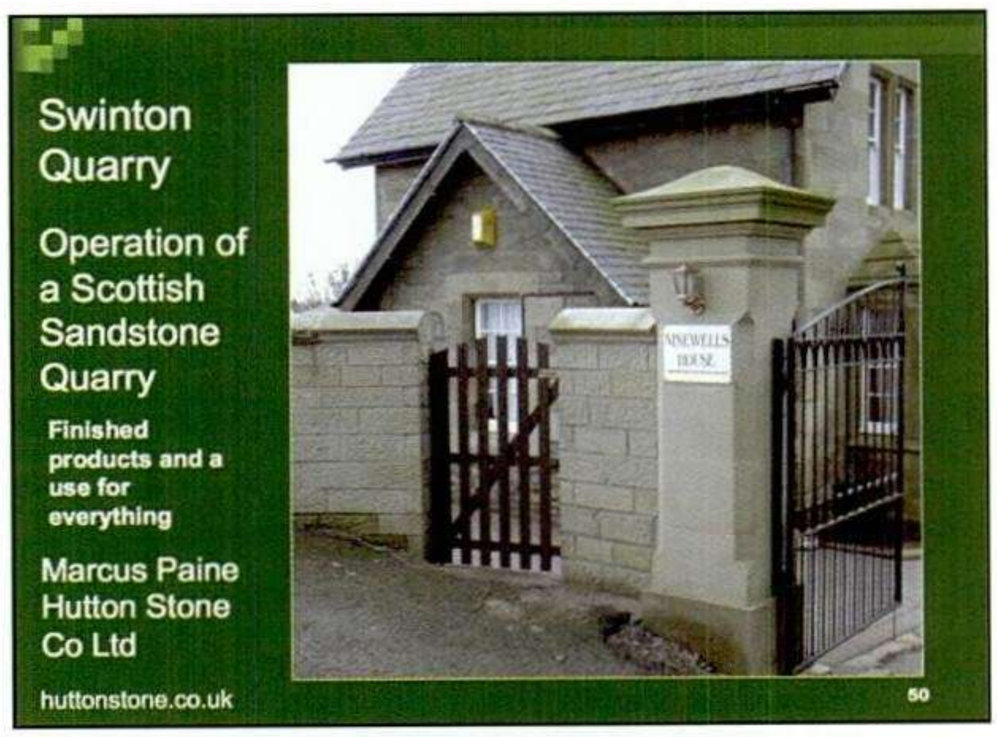

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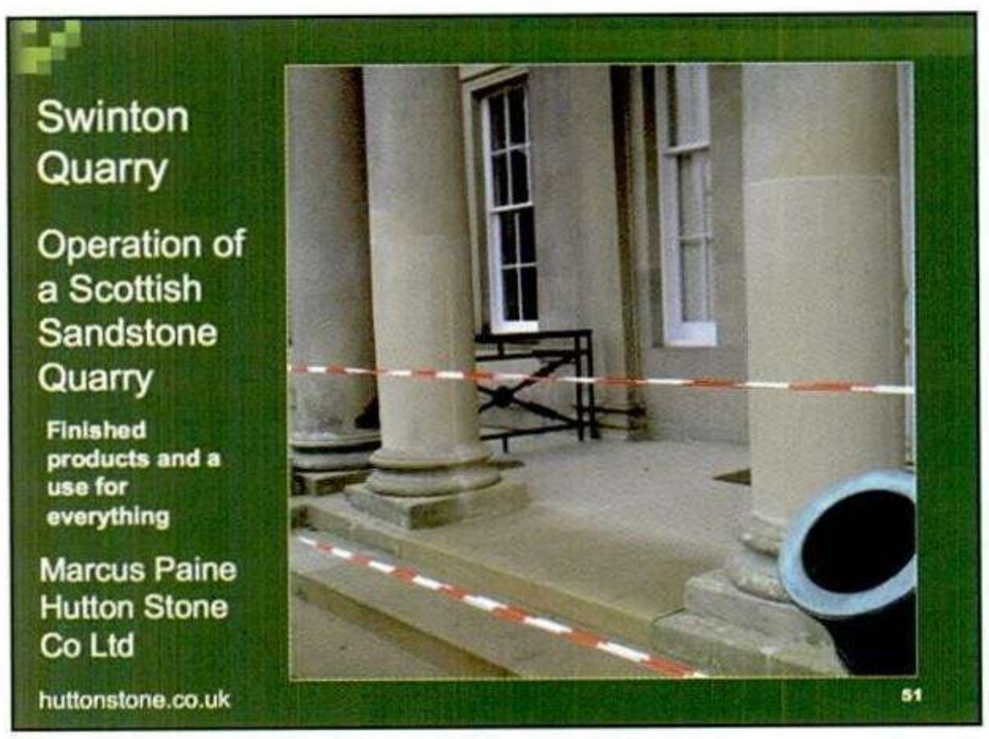

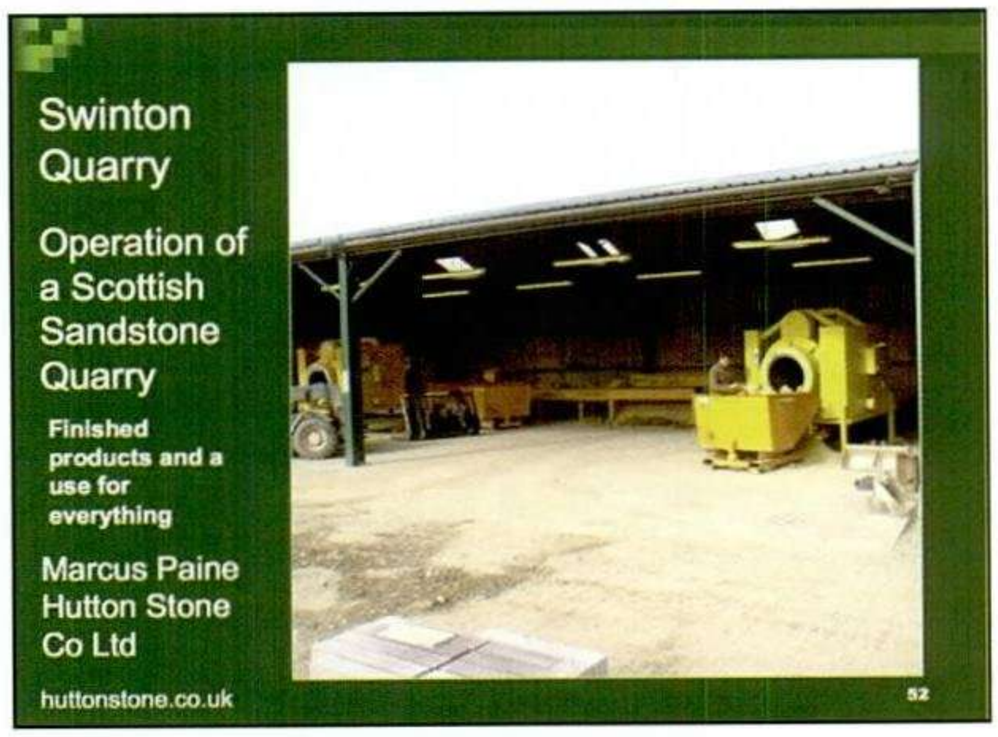

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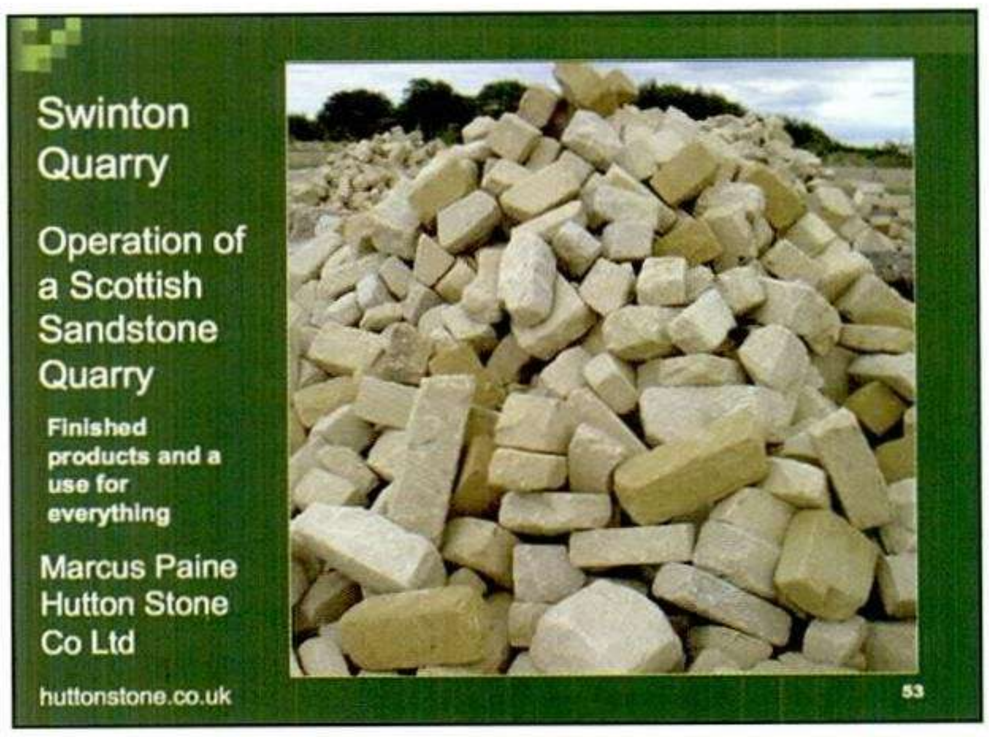

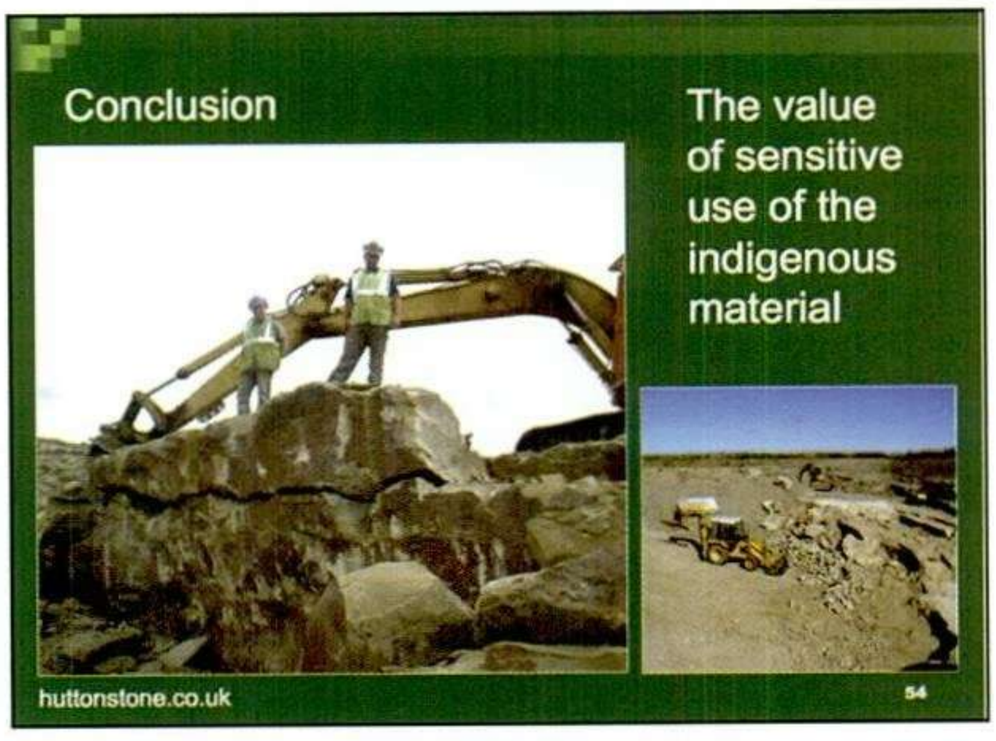

54

PLANNER'S ROLES AND RESPONSIBILITIES

Craig Frew, Scottish Lime Centre Trust

Firstly why is someone from the Scottish Lime Centre talking about planners?

1. Firstly, on a daily basis the SLCT deals with the clients trying to work in the black hole called the planning system.
2. On a daily basis SLCT is involved in decision making at project and site level as to what masonry repair work should and shouldn't be carried out.
3. SLCT regularly become involved in projects as a result of planning conditions (some good, some bad) and in LBC applications requiring specified details of the work to be approved by the planning authority prior to commencement of works.

Initially I trained as a planner with the benefit of studying some optional urban conservation modules, I then decided to pursue further education and subsequently a career in building conservation. In addition to my time with the SLCT, I have worked in planning as a Conservation Officer with Dundee City Council.

Some questions and responses

"Sample, or a full specification" – what one? In any case how does a planner determine what is an appropriate specification or an appropriate sample?

"Appropriateness for the purpose of strength, colour, grain and durability" – how can this be assessed?

"Drawings indicating coursing and tooling or surface finish to match" – this is very subjective – how can this be ensured?

There is a difficult reality of dealing with these issues on real buildings, in real locations, often coping with clients and applicants who think they understand conservation.

What is presented is my own personal experience and views, and not those of my employers – past or present! I'm sure there will be other planners and conservation officers in the audience who will have differing views on some of the issues that will be raised.

It is worth noting that the general conservation principles and philosophy should always apply to the conservation and repair of traditional buildings and structures. BS 7913 and the relevant conservation charters should be standard reading for anyone becoming involved in any decision making process related to such projects but, ultimately, good conservation is little more than well informed repair work.

Technical advice should come from a technical expert - someone who can stand by their advice but this can present a challenge. One particular local authority, for example, employs one full- time conservation officer covering a portfolio of nearly 1000 listed buildings and 16 conservation areas. This is not a criticism of planners or conservation officers – their training and professional development rarely incorporates any technical conservation aspects. The majority of planners (as with other building professionals) are trying their best to work within their remit. But there is a need to build up a local knowledge and skills base.

PLANNERS ROLE AND RESPONSIBILTIES
STONE REPAIR: AND REPLACEMENT: WHOSE JOB IS IT ANYWAY?

Craig Frew
Scottish Lime Centre Trust

Planners roles and responsibilities

Stone repair and replacement : whose job is it anyway?

Craig Frew MSc IHBC
Scottish Lime Centre Trust

CHARLESTOWN CONSULTANTS
Traditional Buildings Investigation, Analysis & Surveys

PART OF THE SCOTTISH LIME CENTRE

1

Stone repair and replacement:
Legislative context....

- When is listed building consent (LBC) required?
- Who makes decisions on LBC applications?
- What statutory guidance exists for planners?
- What non-statutory guidance exists?

2

Legislative context
When is LBC required?

- Primary legislation is provided under the Planning (Listed Buildings and Conservation Areas) (Scotland) Act 1997.
- Listed Building Consent (LBC) *is* required for demolition and any alteration or extension (inside and out) which affects the character or appearance of a listed building*.
- It is the role of the *planning authority* to determine whether or not listed building consent is required.

*Exclusions apply

3

Legislative context
When is LBC required?

- Planning authorities can use LBC as a mechanism for greater control over what, and how, works are carried out.
- Alternatively, there is scope for agreeing the nature and scope of 'minor' works, rather than asking for a full LBC application on the basis that the works constitute 'like for like' repair, rather than an alteration.
- There is no fee for submission of a LBC applications, unlike planning applications and building warrants.
- Therefore, LBC applications are dealt with at the planning authorities expense - is this why we have so few conservation officers?

4

Legislative context
When is LBC required?

Work which *may* require listed building consent;

- Stone cleaning
- Stone replacement/ indenting
- Pointing stonework
- Harling or rendering stonework
- 'Plastic' repairs to stonework
- Painting stonework facades

5

Legislative context
Who makes decisions on LBC applications?

- It is the responsibility of the *planning authority* to determine LBC applications.
- In the case of LBC applications for category A & B listed buildings, the planning authority have a duty to refer the application to Historic Scotland (HS) Buildings Inspectorate for comment, should they be minded to approve the application.
- HS do have 'call-in' powers should they disagree with the local authorities decision.
- In reality, most LBC applications will take approx 3 months to process for A or B listed buildings, and approx 2 months for a C listed buildings.

6

Legislative context

What statutory advice exists for planners?

- **NPPG 18: Planning and the Historic Environment**
  - ***"It is important that, as planning authorities, they adopt suitable policies in their development plans and implement them through development control decisions and other means."***
  - **primary source of guidance on the Scottish Governments interests and responsibilities in relation to listed buildings and conservation areas is provided in the *Memorandum*...**
- **HS Memorandum of Guidance on Listed Buildings and Conservation Areas 1998**

7

Legislative context

HS Memorandum of Guidance on Listed Buildings and Conservation Areas (1998)

HS Memorandum is generally seen as the planners 'Bible'. In relation to stone repairs....

"Stonework repairs are too often inadequately specified. If any questions remain unanswered the planning authority should not hesitate to ask the applicant to provide more information about exactly what is intended before considering consent. Samples, or a full specification, of new stone to be used for repair work should always be provided. This is to ensure that its appropriateness for the purpose in terms of strength, colour, grain and durability is accurately assessed. The submitted drawings should make clear that the coursing and tooling or surface finish will match the original work and that new stone will be correctly bedded according to its grain. All these matters can be dealt with by condition but it is invariably much wiser to resolve as many if not all of them before any consent is issued."

8

Legislative context

What non-statutory advice exists for planners?

- **Supplementary planning guidance/ advice notes.**
- **No requirement for local authorities to produce these...**
- **...but can be a useful tool to guide applicants on good practice , and ultimately what is expected from them as part of the planning process.**

9

Stone repair and replacement

What are the roles and responsibilities of planners?

- **To determine whether or not LBC (or planning permission) is required for certain works.**
- **If required, determine whether or not the submitted application(s) contain sufficient information on the works for which the consent is sought.**
- **To consult with the appropriate bodies taking into account their views.**
- **Make decisions on applications.**
- **Apply appropriate conditions to any LBC approval.**

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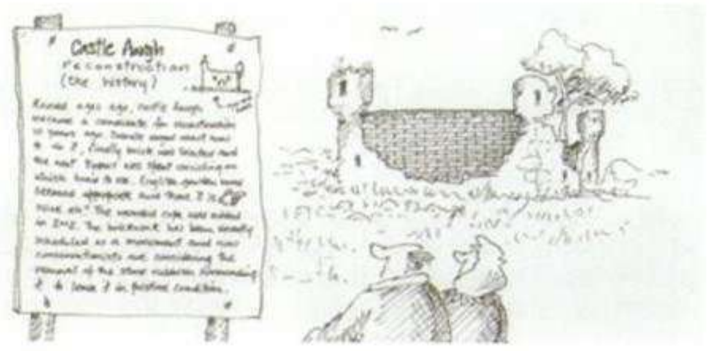
Stone repair and replacement: reality....

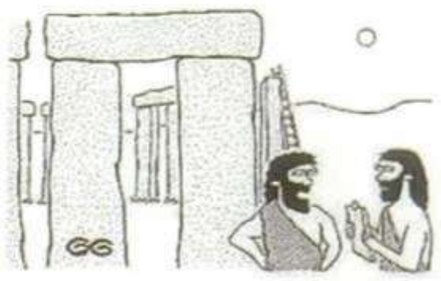


CASTLE AARGH reconstruction (the history):
"Ruined ages ago, Castle Aargh became a candidate for reconstruction 10 years ago. Debate raged about how to do it, finally brick was selected an the next 8 years was spent deciding which bond to use. English garden bond seemed appropriate and there it is – Nice eh? The rounded cope was added in 2002. The brickwork has been recently scheduled as a monument and now conservationists are considering the removal of the stone rubbish surrounding it to leave it in pristine condition."

11

Stone repair and replacement: reality....

- **The LBC application process.**
- **The consultation process.**
- **The decision making.**
- **What happens on site?**



"WHAT PLANNING PERMISSION?"

12

LBC application process:

(in the real world....)

Lets take a typical project involving stone indents and patch repointing work....

- **Is it a repair or an alteration? Does it need LBC? Well that depends on whether or not it changes the character or appearance of the building.**
- **Do the Council have any planning policies or guidance? If not, where else can I look for guidance?**
- **Is it in the Memorandum? Well there's some general guidance but it doesn't really tell me what to do - lets ask Historic Scotland....**

13

The consultation process:

(in the real world....)

- **Conservation/ Planning Officers seek pre-application and post-application advice on LBC applications from HS inspectors at various stages, as required. – not just as part of the formal referral process.**
- **Where Conservation/ Planning Officers require technical advice, they often rely on HS, where such advice is not readily available within the Council.**

"In order to speed up the system, I have my own personal member of the public to consult."

14

The decision making process:

(in the real world....)

- Policy led – if no policies exist, or are poorly drafted, then the extent of control can be limited.
- Dependant on the availability of suitable experienced and knowledgeable conservation staff.
- Good LBC 'conditions' are dependant on an understanding of what conditions are reasonable, necessary, precise and enforceable.
- They also rely on a proper appreciation of the relevant technical and practical issues of stone repair and replacement.

'I DON'T THINK THERE'S MUCH WE CAN DO ABOUT IT – HE'S ON THE PLANNING COMMITTEE.'

15

What happens on site:

(in the real world....)

- In most (but not all) cases, stone repair and replacement issues are dealt with through conditions , rather than considered as part of the application itself.
- Are the LBC conditions concise and clear enough to be executed in the required manner?
- Can they be complied with at reasonable expense and within a reasonable timescale to avoid delays to the project?
- Standard conditions which state 'like-for like' replacement are open to interpretation, are ultimately unhelpful to the applicant.

"Forget it lads - we've been refused listed building consent for the stone indents!"

16

So what are the problems:

(in the real world....)

- Whether a particular element of work does or does not require LBC is a subjective decision, most often based on the planners past experience and knowledge.
- Few local authorities publish guidance on stone repair and replacement – this appears to relate to the availability of suitably knowledgeable conservation staff.
- Even if available, advice is variable in terms of content and quality, much is out of date and some even promote repairs which are now known to cause damage and exacerbate problems in traditionally constructed masonry buildings.

17

So what are the problems:

(in the real world....)

- Planners and *some* Conservation Officers do not generally have the knowledge or experience to be able to provide technical guidance on stone repair or replacement issues.
- For most planners and conservation officers, the HS Memorandum of Guidance on Listed Buildings and Conservation Areas (1998)is their 'Bible' when dealing with LBC applications, yet this doesn't really cover the more technical aspects of dealing with such applications.
- Planners often rely on HS Inspectors for technical support and advice on LBC applications. The reality is that most HS Inspectors do not have this technical knowledge or experience (most are architectural historians, who are not taught construction technology).

18

Planners roles and responsibilities

Stone repair and replacement: whose job is it anyway?

- Planners should not be expected to be able to specify stone repair and replacement work – this is the job of the architect, engineer or surveyor.
- Planners should not be hesitant about seeking advice from relevant specialists – in our experience more should.
- Planners should however be able to ask the right questions and be confident in providing the applicant or their clients with the right advice on where to get the answers they are looking for.
- Planners should also be able to place conditions on LBC applications which are necessary and reasonable, in order to ensure the appropriate course of action is followed with regards to any stone repair or replacement.

19

Planners roles and responsibilities

how do we fix it?

- CPD for planners/ conservation officers.
- CPD for building professionals – the specifiers.
- Local training and skills upgrading for contractors which is ultimately sustainable in the longer term – can local authorities and/or planners encourage this?
- Ensure local authorities make provision for specialist conservation staff with appropriate knowledge and training.
- Planning training for HS's inspectors, with greater access to technical advice, support and information from within other departments of HS and other external organisations.
- National and local *planning* guidance on dealing with masonry repair issues *within the planning system*. Advice on best practice, what needs consent and what doesn't, determining applications, sample conditions etc.
- Streamline LBC requirements within the current system for 'minor' works such as minimal stone indenting, pointing, on the basis that we have experienced local authority conservation staff who can advise on and agree particular courses of action (based on best practice) negating any change to the character or appearance of the building and ultimately negating the requirement to apply for formal LBC.

20

SPECIFIER ROLES AND RESPONSIBILITIES

Murdo MacLeod, Property Convservation,
The City of Edinburgh Council

The Specifier

The Specifier is the person or organisation that is responsible for the project design, procurement, specification, site supervision and certification of works. The same person or organisation may not be responsible for each stage. Examples may include clients (both guided and informed) as well as construction professionals; Architects, Surveyors, Engineers and Builders. For the purpose of this exercise, let us assume an Architect or Building Surveyor led project to repair a traditional Scottish stone clad property.

The Estate

The City of Edinburgh Council covers 84,000 buildings, most of which are 100 or more years old. 82% of those are privately owned. Emergency works undertaken by the council include stone cladding falls, chimney falls, roof cladding and blocked drains. 5,000 requests for assistance are received, and 3,000 repairs are enforced each year.

Loose, precarious and falling masonry are an important concern for the council. This problem was highlighted after a fatal accident in Edinburgh caused by masonry falling from the roof of a building.

A cyclical approach should be taken to manage a masonry project

Direction – Collection – Collation - Delivery

Direction

This is the client's brief, which should include:

- Site boundaries/extent of responsibilities
- Current use
- End use
- Repair/renovation/conservation guidance
- Programme
- Budget
- Restrictions
- Special circumstances

Collection

Research prior to the commencement of works. This should include a desktop study which examines:

- Restrictions
- History – Drawings – Previous Repairs (pathology)
- Grant aiding bodies eligibility – requirements

Site specific research should include:

- Diagnose decay mechanisms
- Treat cause and effect
- Structural implications (programming etc)
- Schedule of works

Determining the cause and effect is crucial to effective repairs so that the underlying cause of the problem can be remedied, rather than just the symptoms.

Research should also be carried out on the stone and mortars. The original stone needs to be identified (by the British Geological Survey) so that a matching or compatible replacement can be sourced. Knowledge of the availability, delivery times, size availability and tooling is also essential. Mortar analysis and advice can be provided by the Scottish Lime Centre Trust. Other aspects to consider include the fixings (of individual stones and scaffolding) and grant aiding body requirements.

Collation

This incorporates contractor procurement and tender documentation. Contractor procurement should be based on site specific requirements and should look at the contractor's management & organisational ability, preliminaries, availability, skills (competency and verification), NPA etc, and previous examples of work.

Tender documentation should be based on site specific requirements. As much information as available should be included:

- Stone (quarry & type, finish)
- Sizes & Fixings
- Sequence of work
- Mortar specification
- Drawings
- Access / storage / restrictions
- Scaffolding (restrictions, design, loadings etc)

Delivery

Stone samples should be requested prior to ordering as well as samples of hand or machined tooling. It is important to constantly check work as it progresses and to make sure that the specification is being complied with.

Training

Training is also an important aspect of the delivery phase. The client should:

- Analyse knowledge gaps
- Research training availability
- CPD – Historic Scotland Advisory Publications
- Training Courses – Scottish Lime Centre Trust
- Partnership – sharing experience knowledge
- Linostone removal etc

SPECIFIER ROLES AND RESPONSIBILITIES

Murdo MacLeod, Property Conservation
The City of Edinburgh Council

Property Conservation

Specifier roles and responsibilities

Murdo Macleod
Group Leader, Property Conservation

Corporate Property & Contingency Planning

City Development

City of Edinburgh Council

·EDINBVRGH·
THE CITY OF EDINBURGH COUNCIL

1

Aim

Property Conservation

Specifier roles and responsibilities

- What is a Specifier?
- Background City of Edinburgh Council Experience
- Suggested approach:
  - Practical and deliverable
  - Suggestions / memory jogger
  - Examples
- Your job – seek guidance but take ownership

2

The Specifier

Property Conservation

The Specifier is the person or organisation that is responsible for the project design, procurement, specification, site supervision and certification of works. The same person or organisation may not be responsible for each stage.

Examples may include clients (both guided and informed) as well as construction professionals; Architects, Surveyors, Engineers and Builders.

For the purpose of this exercise, let us assume an Architect or Building Surveyor led project to repair a traditional Scottish stone clad property.

3

Background

Property Conservation

The estate
Buildings - 84,000: most 100 + years old
Privately owned – 82%
Emergency works:
- Stone cladding falls
- Chimney falls
- Roof cladding
- Blocked drains

Requests for assistance
- 5,000/year
- enforce 3,000/year

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Property Conservation

Failure of masonry structure

5

Property Conservation

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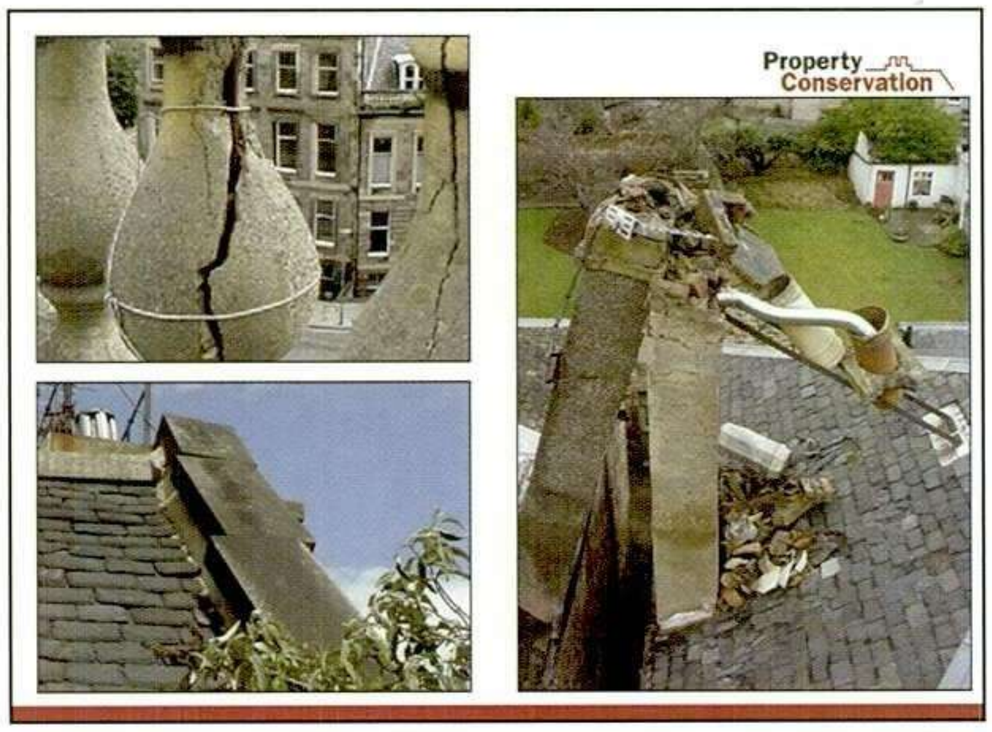

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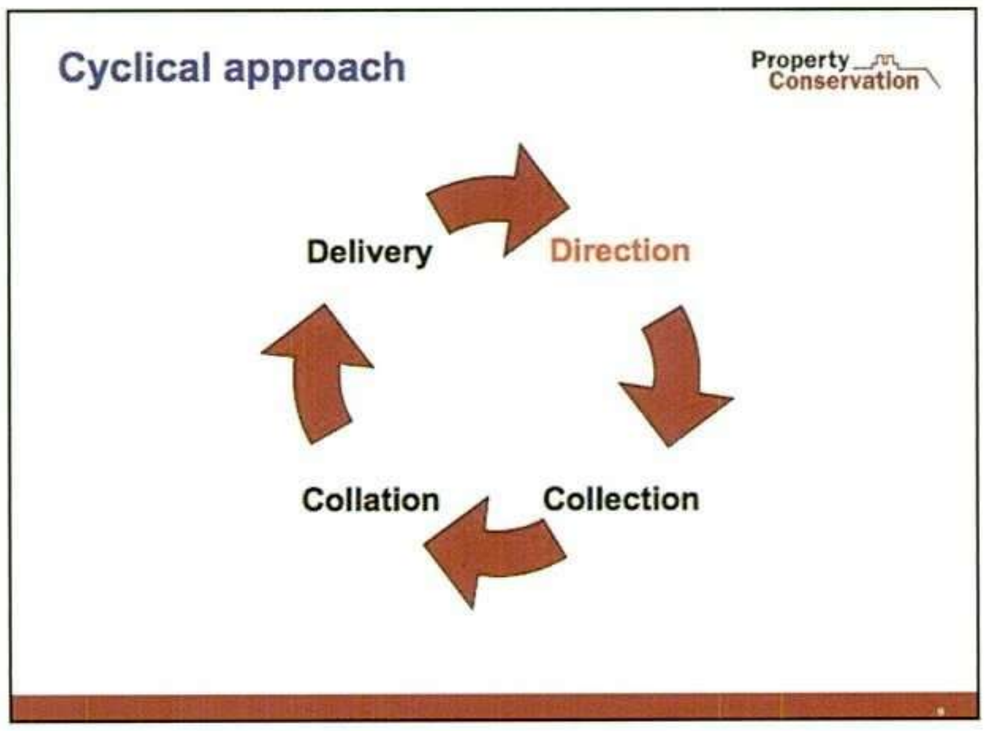

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Direction

Property Conservation

Client's brief:

- Site boundaries/extent of responsibilities
- Current use
- End use
- Repair/renovation/conservation guidance
- Programme
- Budget
- Restrictions
- Special circumstances

9

Collection

Property Conservation

Research:

- Desktop study:
  - Restrictions – check!
  - History – Drawings – Previous Repairs (pathology)
  - Grant aiding bodies eligibility - requirements
- Site specific:
  - Diagnose decay mechanisms (imperative!)
  - Treat cause and effect
  - Structural implications (programming etc)
  - Schedule of works

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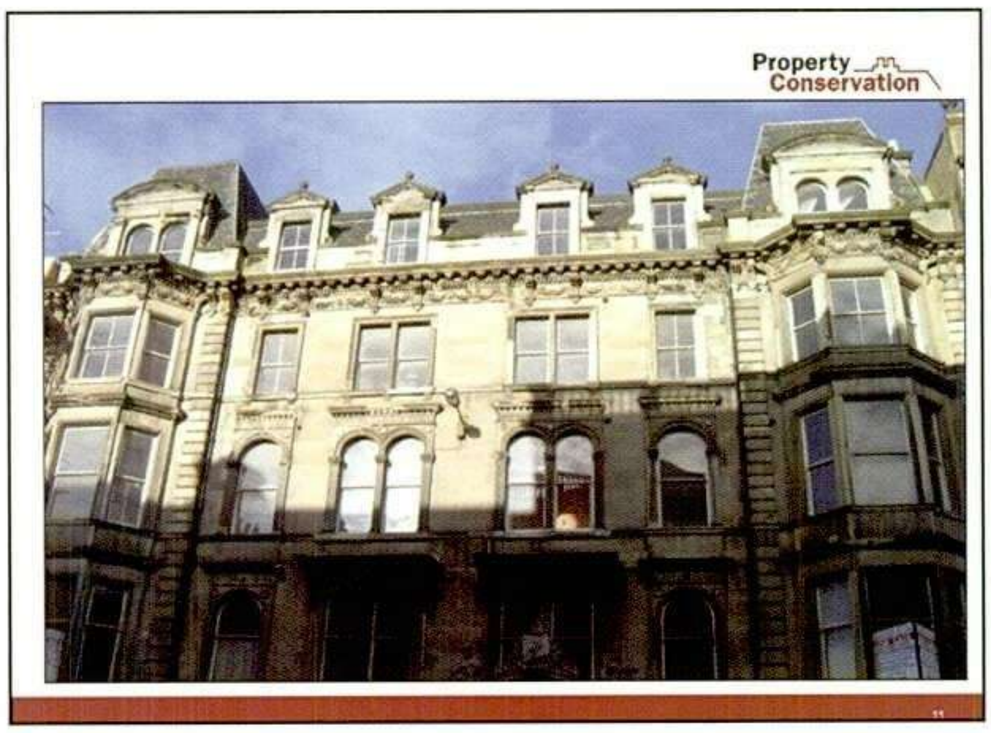

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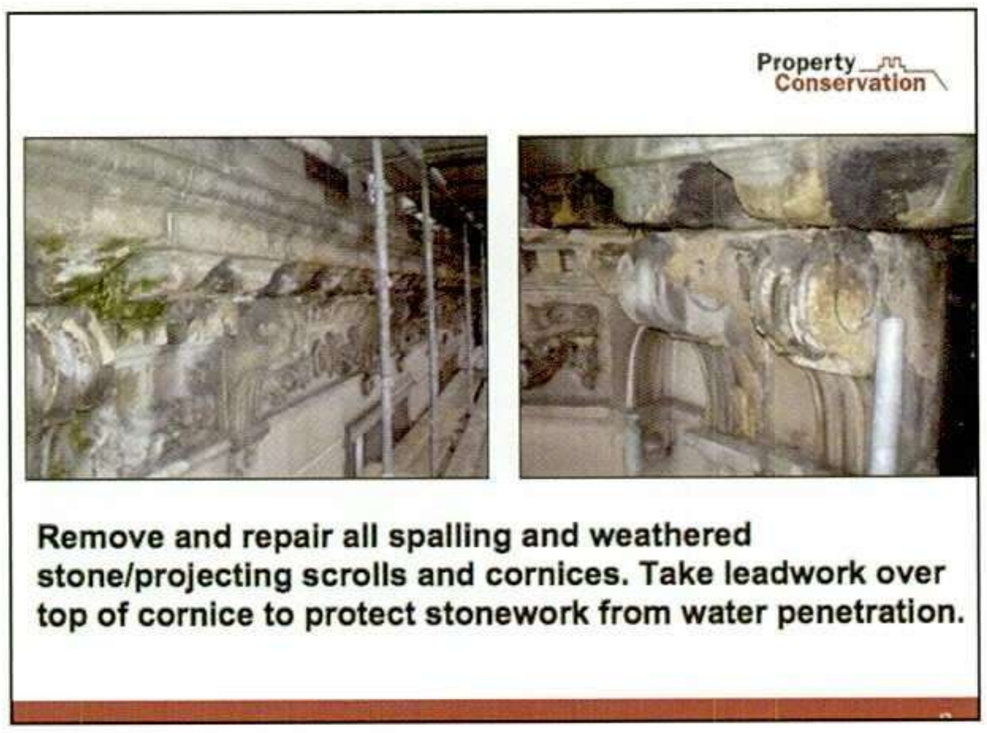

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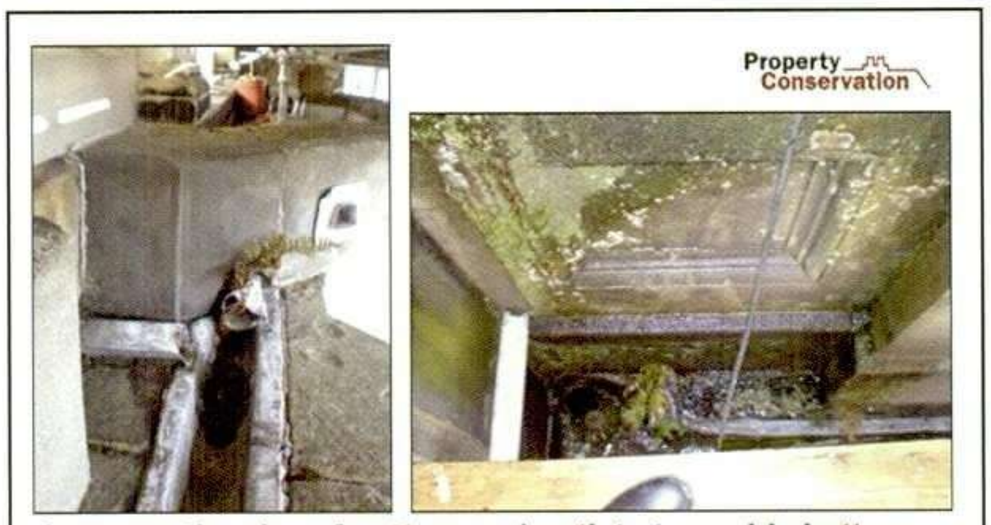

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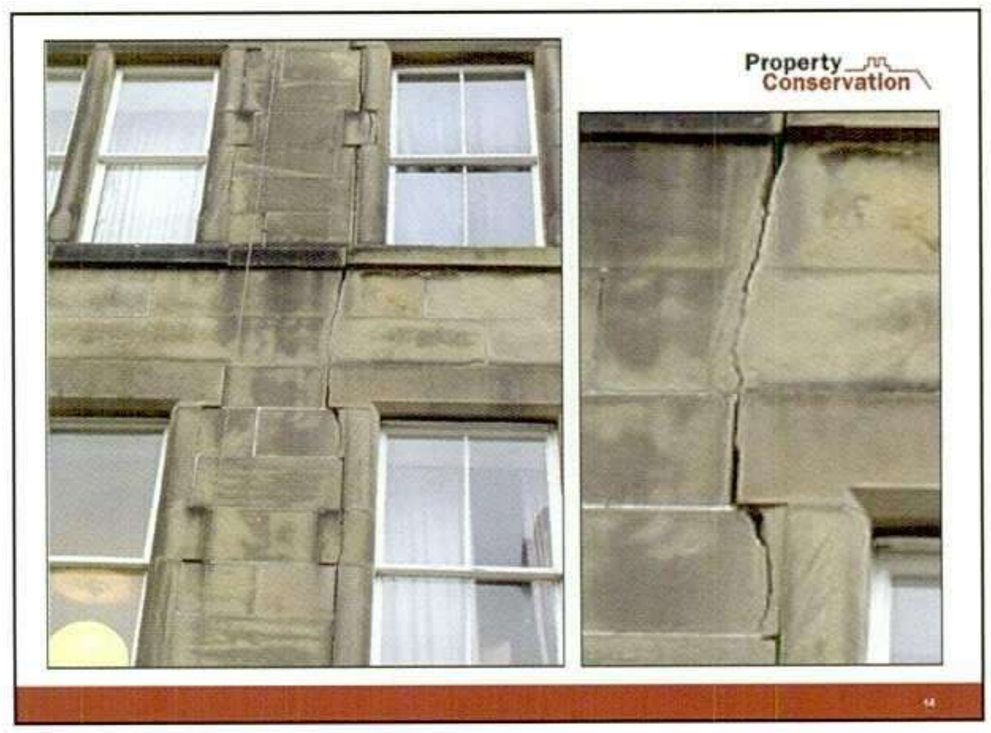

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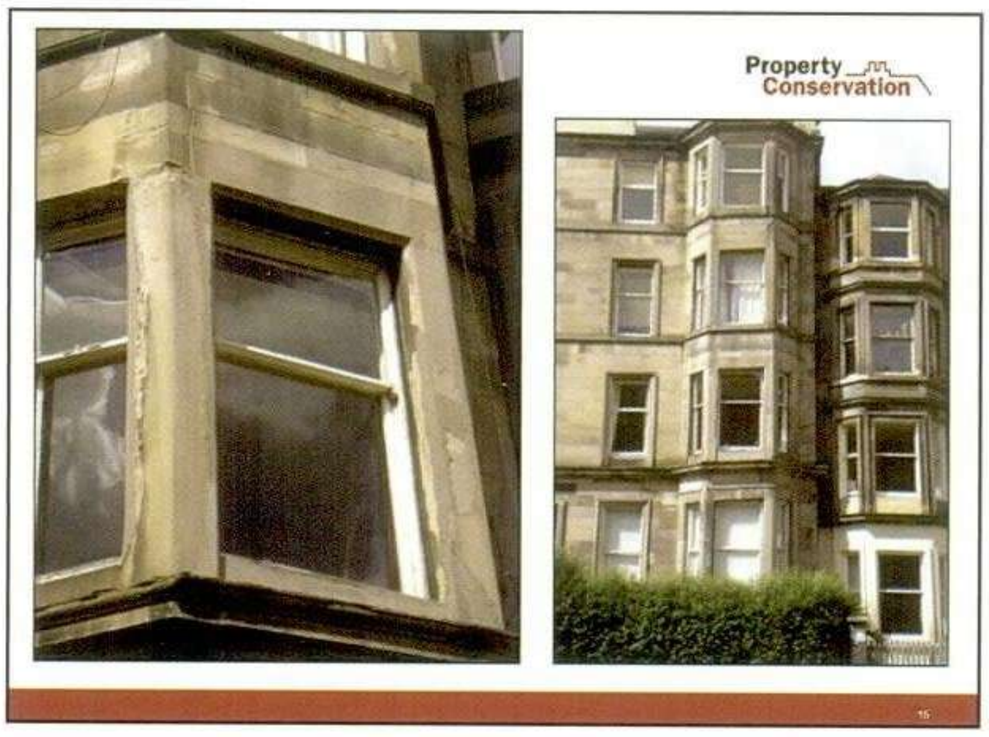

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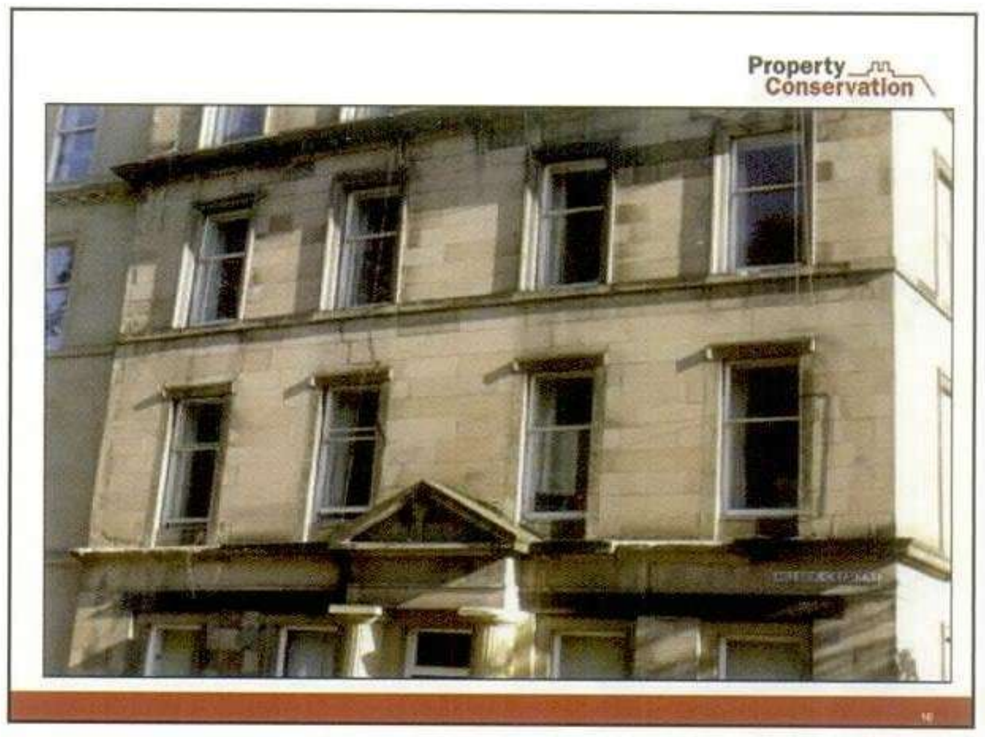

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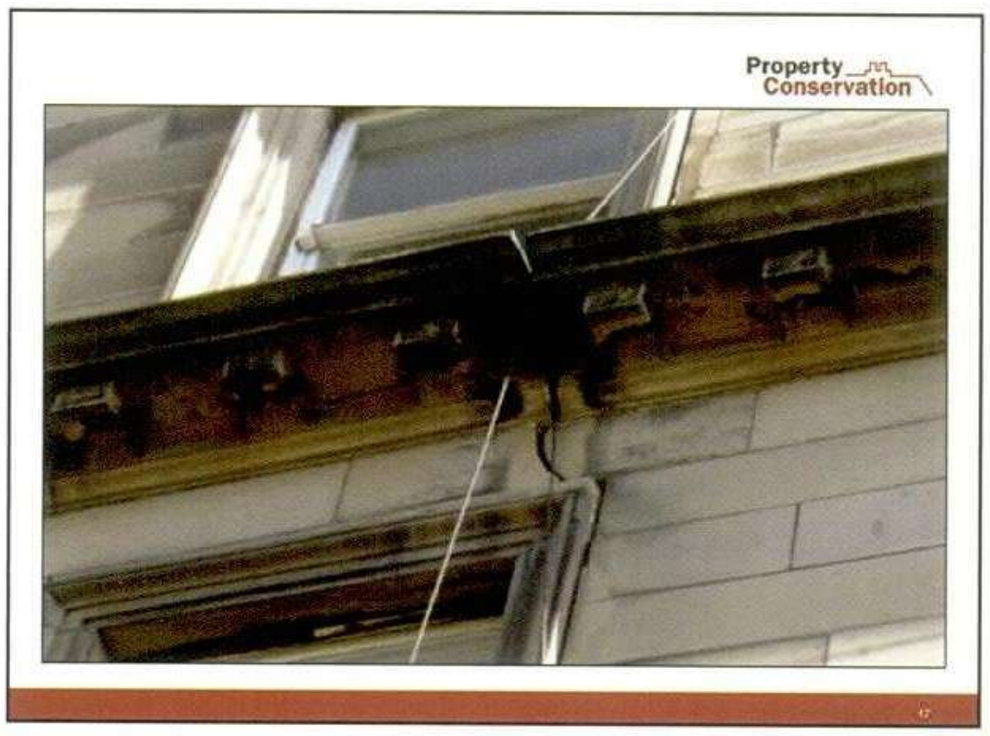

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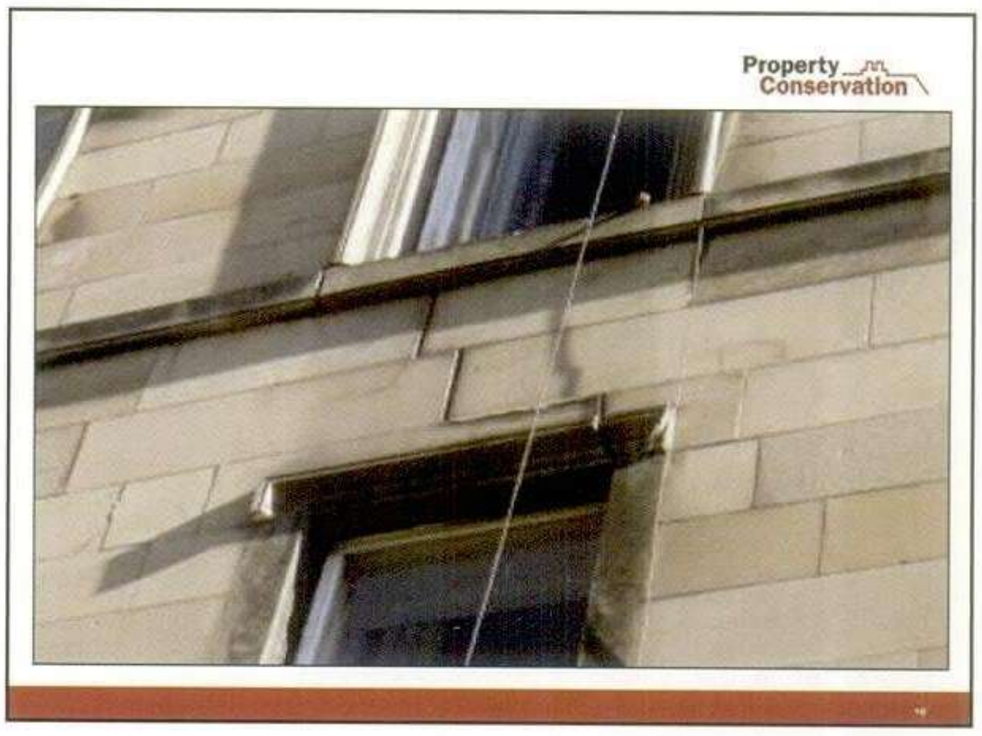

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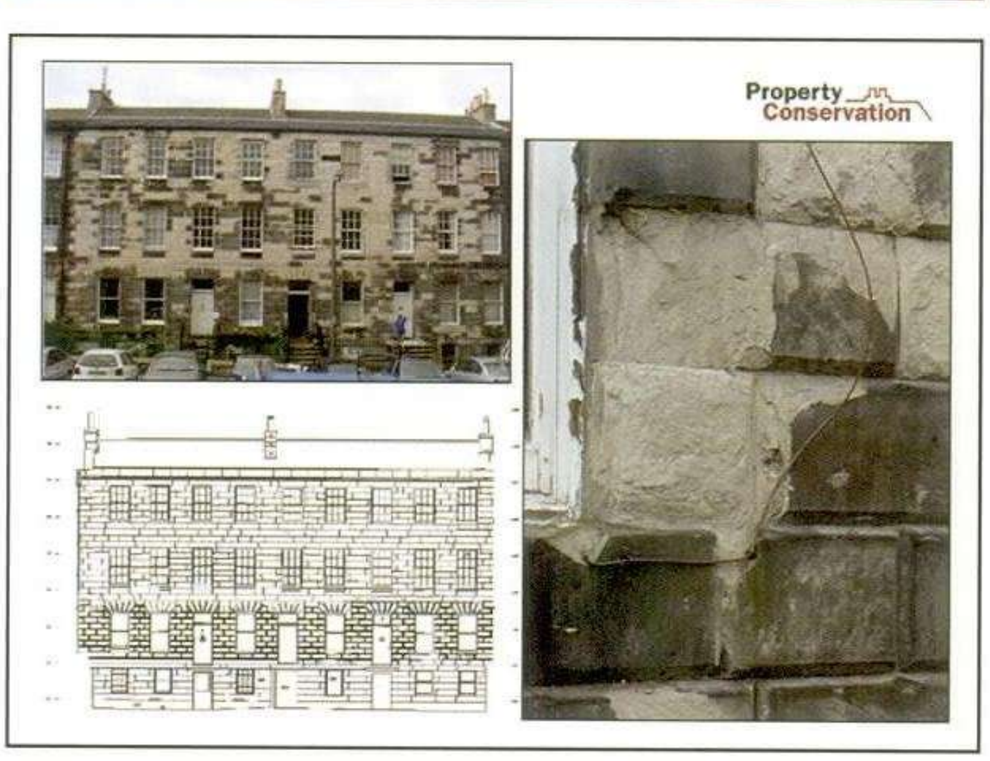

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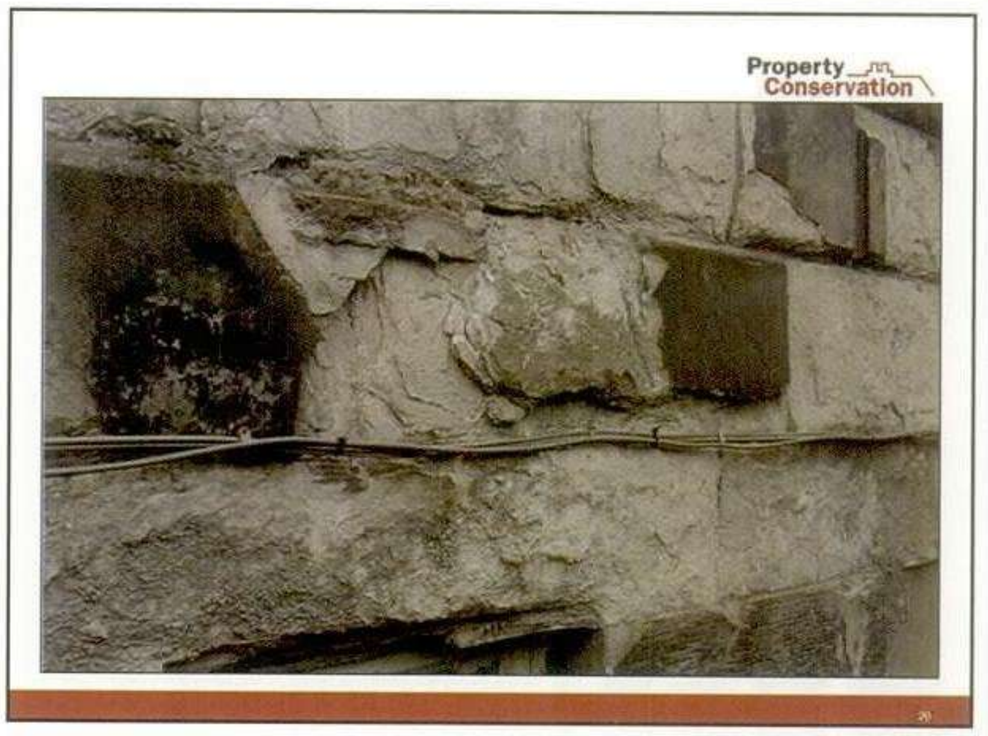

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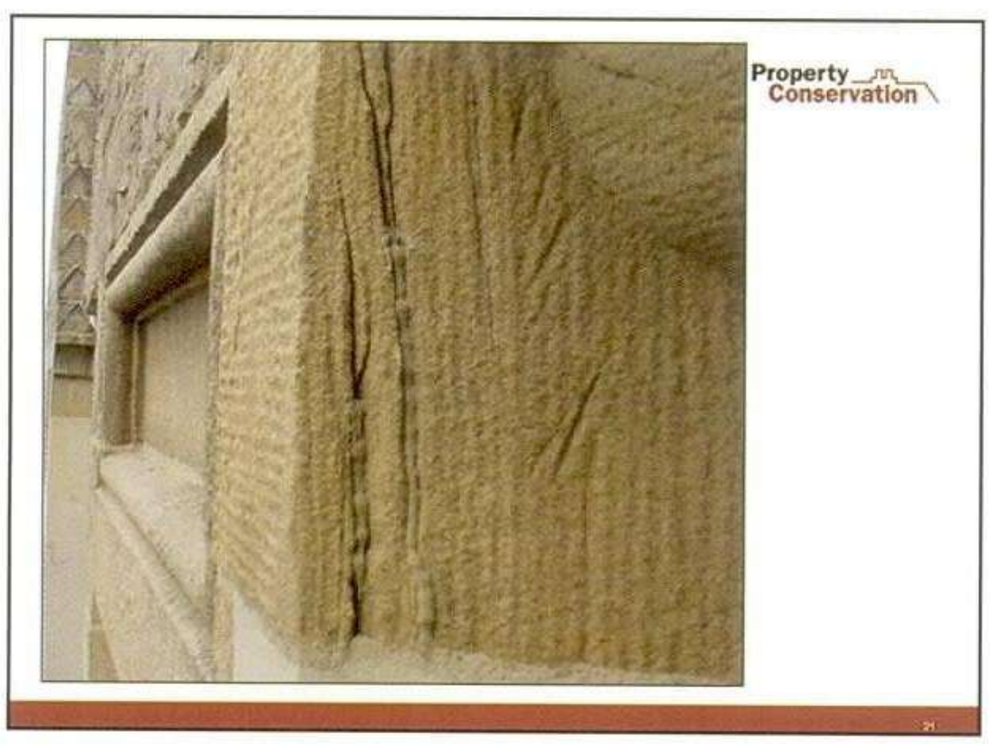

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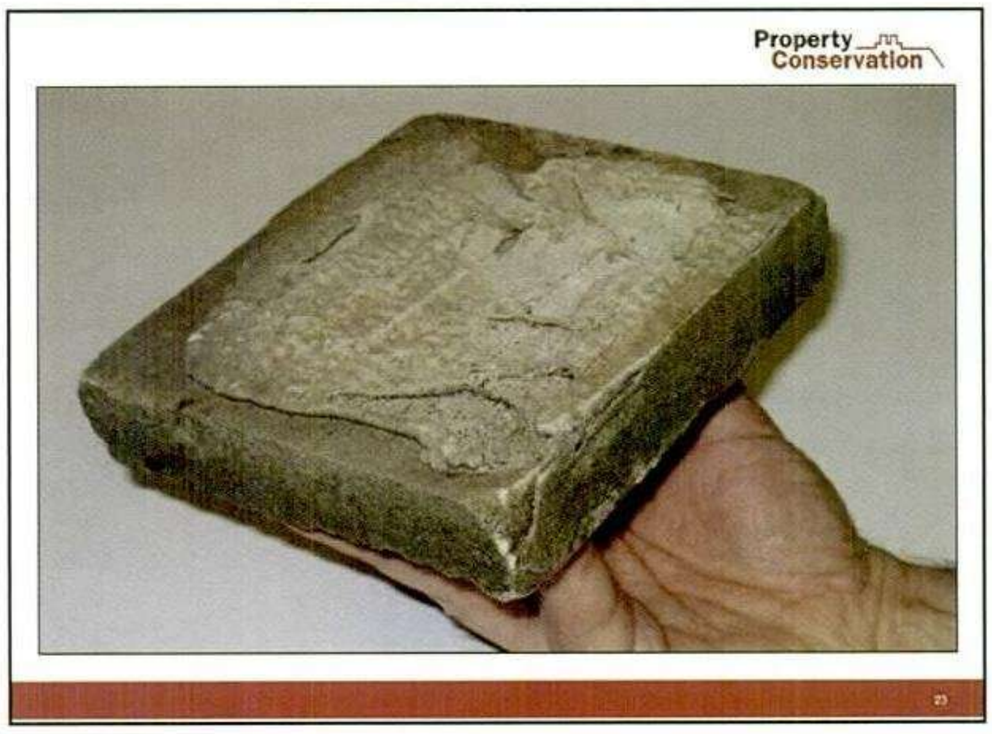

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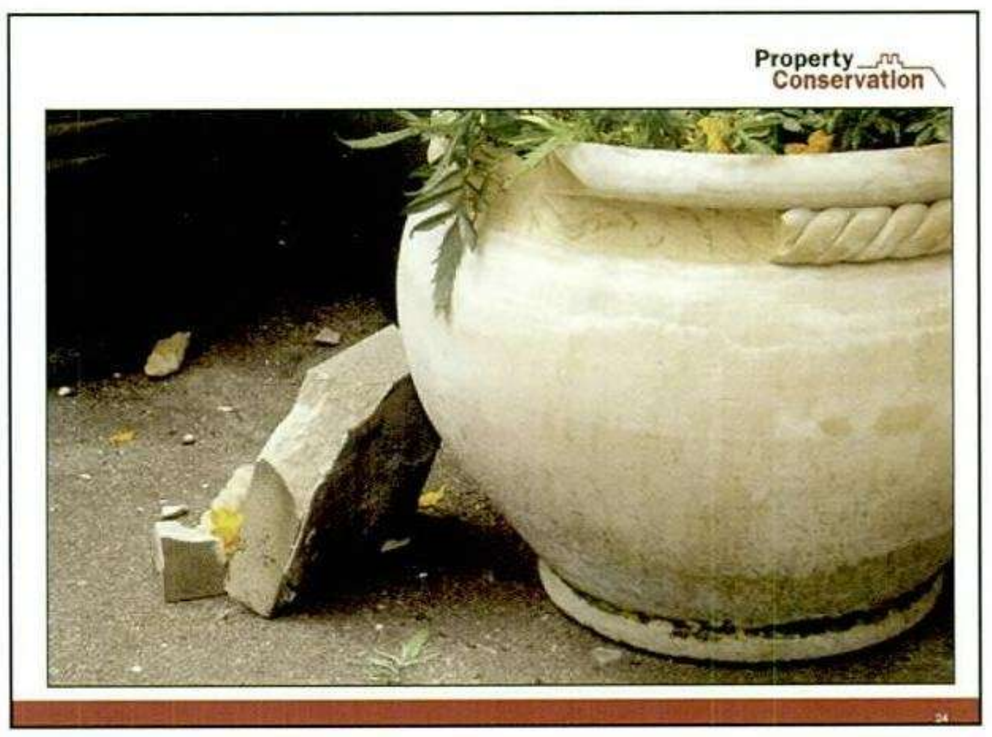

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Collection

Property Conservation

Research:

- Stone & mortars:
  - Stone matching (BGS)
  - Availability (Contractors / Quarry)
    - Delivery
    - Size availability
    - Tooling
  - Mortar analysis and advice (SLCT)
  - Fixings (of individual stones and scaffolding)
  - Grant aiding bodies - requirements

25

Collation

Property Conservation

Contractor procurement:

- Based on site specific requirements
  - Management & organisational ability
    - Preliminaries
    - Availability
  - Skills (competency and verification)
    - NPA etc
    - Previous examples of work

26

Collation

Property Conservation

Tender documentation

- Based on site specific requirements
- As much information as available:
  - Stone (quarry & type, finish)
  - Sizes & Fixings
  - Sequence of work
  - Mortar specification
  - Drawings
  - Access / storage / restrictions
  - Scaffolding (restrictions, design, loadings etc)

27

Delivery

Property Conservation

Stonework

- Samples prior to ordering
- Hand or machined tooling - samples
- Compliance with specification - be robust
- Constantly check as work progresses
- Again, Your job – seek guidance but take ownership

28

STONE

Property Conservation

Stone for Ashlar: Stone ..... shall be from the quarry and beds specified or as agreed with the Contract Administrator, prior to ordering of materials, and shall be free of vents, cracks, fissures, soft beds and veins or other defects liable to affect durability or structural soundness. Reasonable variations natural to the source in colour and texture may be acceptable within the range of samples supplied to and approved by the Contract Administrator. Materials delivered to site for fixing shall be subject to rejection by the CA if found to be outwith the scope of the above noted specification. Materials fixed without the CA being afforded an opportunity to inspect the stone shall be liable to rejection by the CA if found to be outwith the scope of the above noted specification. All materials rejected shall be replaced at the sole cost of the contractor.

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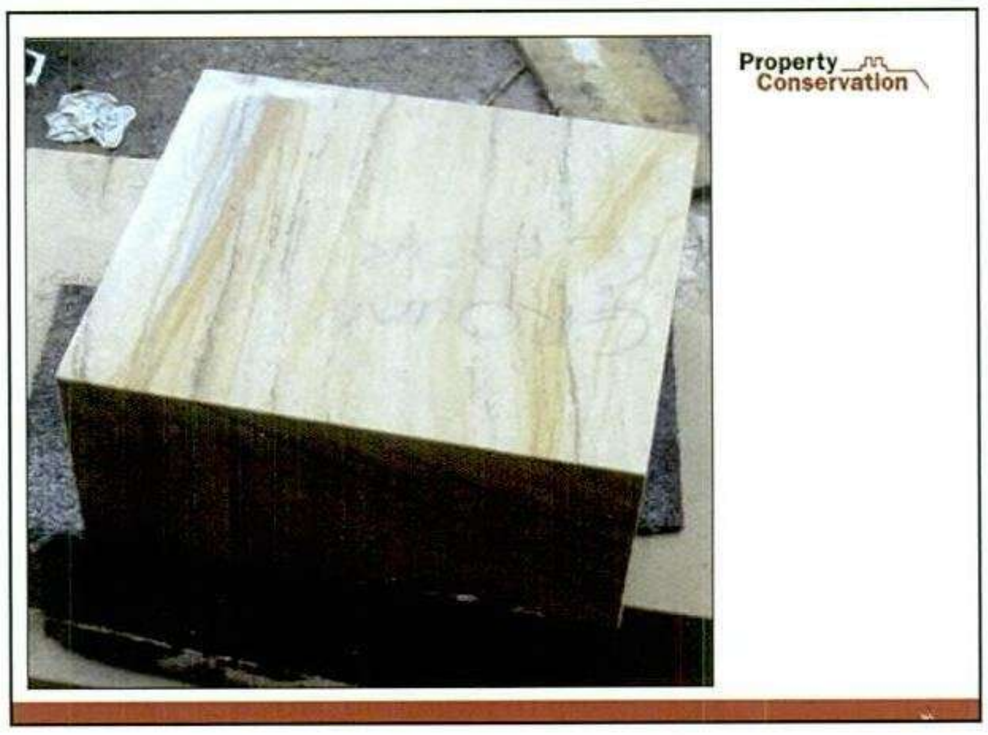

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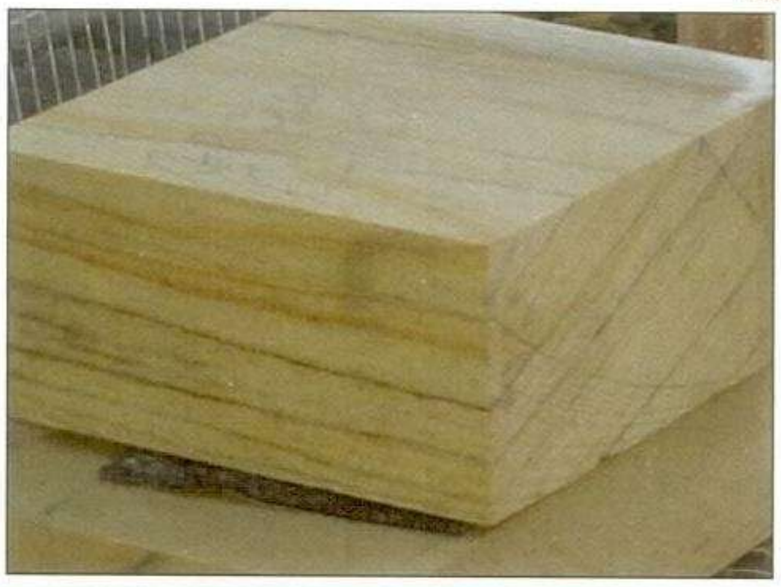
Property Conservation



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Delivery

Property Conservation

Training

- Analyse knowledge gaps
- Research training availability
- CPD – Historic Scotland Advisory Publications
- Training Courses – SLCT
- Partnership – sharing experience knowledge
  - Linostone removal etc

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Property Conservation

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Property Conservation

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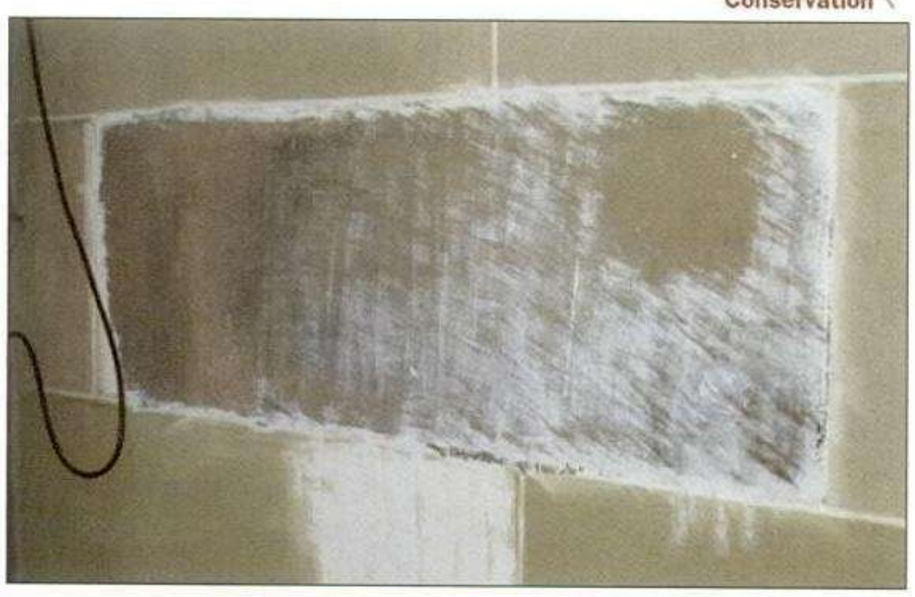
Property Conservation



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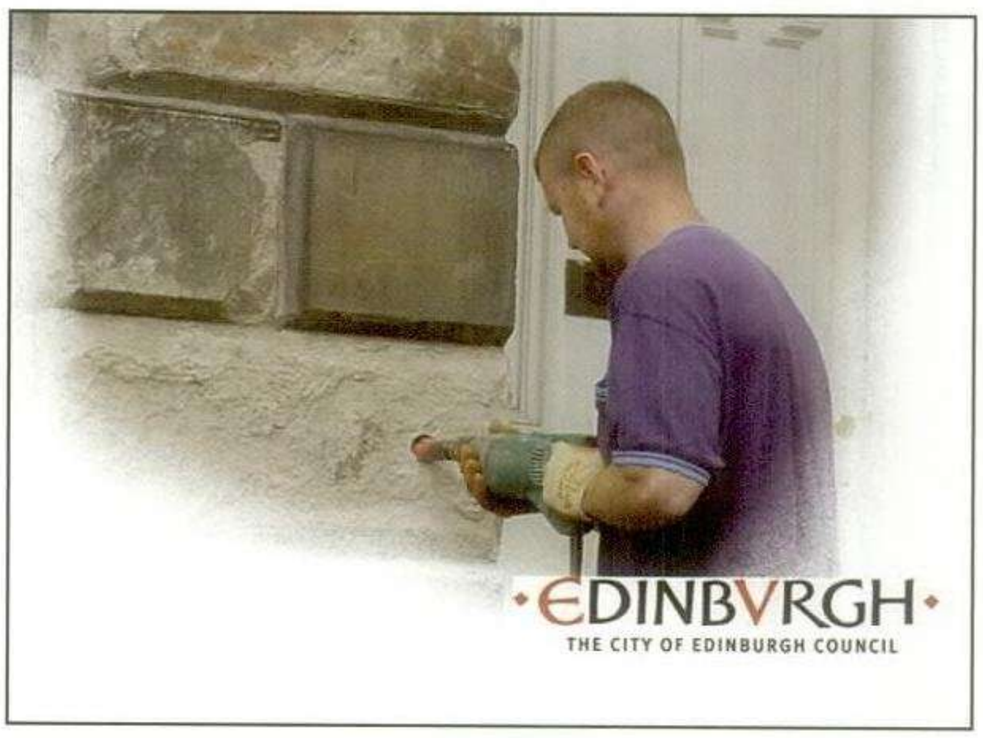


36

THE CONVERSION OF SCOTTISH TRADITIONAL STONE BUILDINGS

Dennis Urquhart, Urquhart Consultancy Services

This paper is based on the recently published Historic Scotland Guide for Practitioners, *Conversion of traditional buildings: The application of the Scottish Building Standards.* It deals with the way in which the new Scottish Building Standards are now able to accommodate the conversion of traditionally constructed pre 1919 buildings without compromising the character of the buildings. In contrast to the previous Standards, which were highly prescriptive, the new Building Regulations and associated standards are based on expanded functional standards. These set out what the building must achieve when in use and thus permit a greater degree of flexibility in how the standards can be satisfied.

Understanding how a traditionally constructed building performs is an essential prerequisite to the sympathetic design of a conversion that is capable of both meeting the Standards and retaining the important features of the building. This requires the adoption of a systems approach that looks at how the building functions as a whole and not as a number of unconnected elements. This approach is assisted by the use of functional standards because a shortfall in one area of the standards, such as wall insulation, can be compensated for by improvements elsewhere. That is, there is no prescribed method of meeting the standard. Recognition is given to the way in which changes to one element within a historic building can impact, sometimes adversely, on other parts of the building.

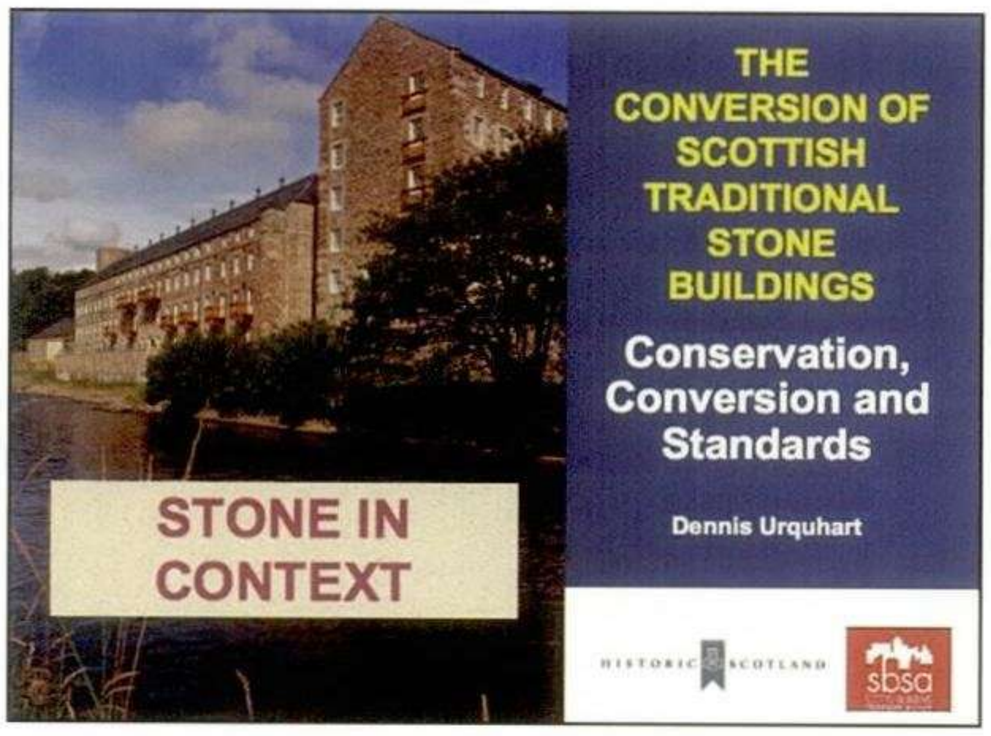
A comparison of the performance of traditional stone walls with that of walls of modern design and materials is provided. Issues, including moisture, air movement and thermal behaviour are explored. This includes a description of how moisture and water vapour moves into and transpires from a traditional wall and the dangers associated with the introduction of DPCs. In a conversion, improving the thermal performance of the building is one of the key objectives but doing so can have adverse and unintended consequences for the building. The risks to the building by applying insulation to the internal wall surfaces are identified.

A full understanding of the performance of a historic building will therefore require an investigation and assessment of the building before any detailed design of a conversion takes place. The extent of this will be influenced by the scale and cost of the project, and an outline of the factors that should be investigated is provided, which also includes an assessment of the features that contribute to its cultural significance.

Finally, the need to understand that there is now no prescribed method of meeting the standards is explained and as a result there are no 'deemed to satisfy' specifications and no relaxations of the Standards. For conversions, individual standards are classified as either essential of reasonably practicable (i.e. they must be met as close as is reasonably practicable), which provides a degree of flexibility in their application. Tables outlining the significance of this division of application are provided.

THE CONVERSION OF SCOTTISH TRADITIONAL STONE BUILDINGS: CONSERVATION, CONVERSION AND STANDARDS

Dennis Urquhart, Urquhart Consultancy Services



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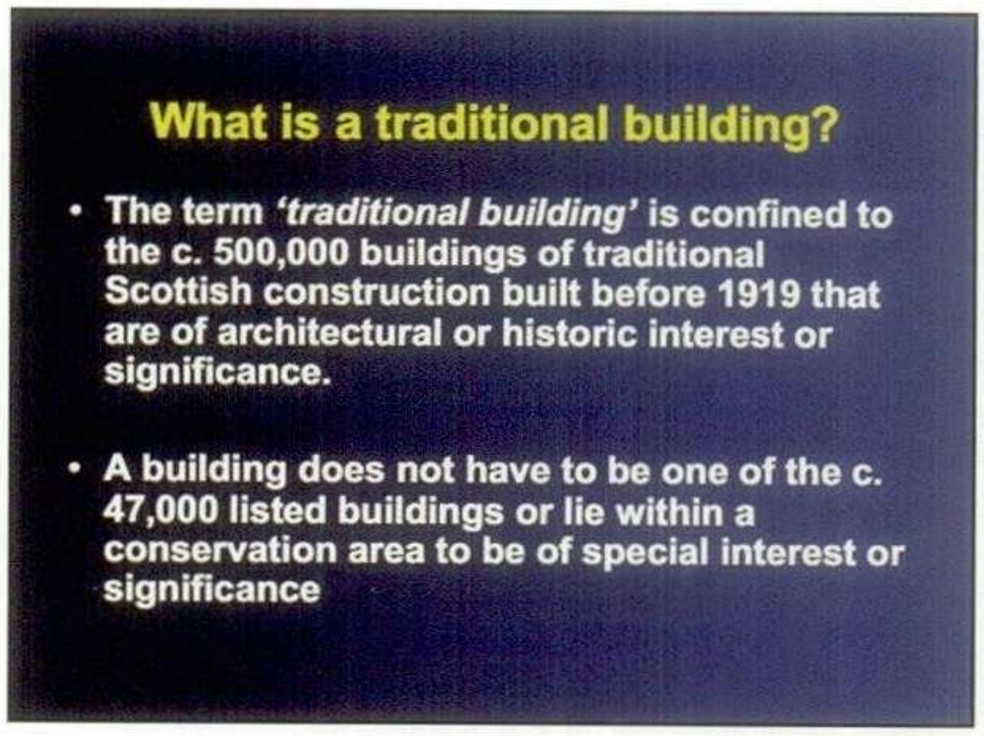

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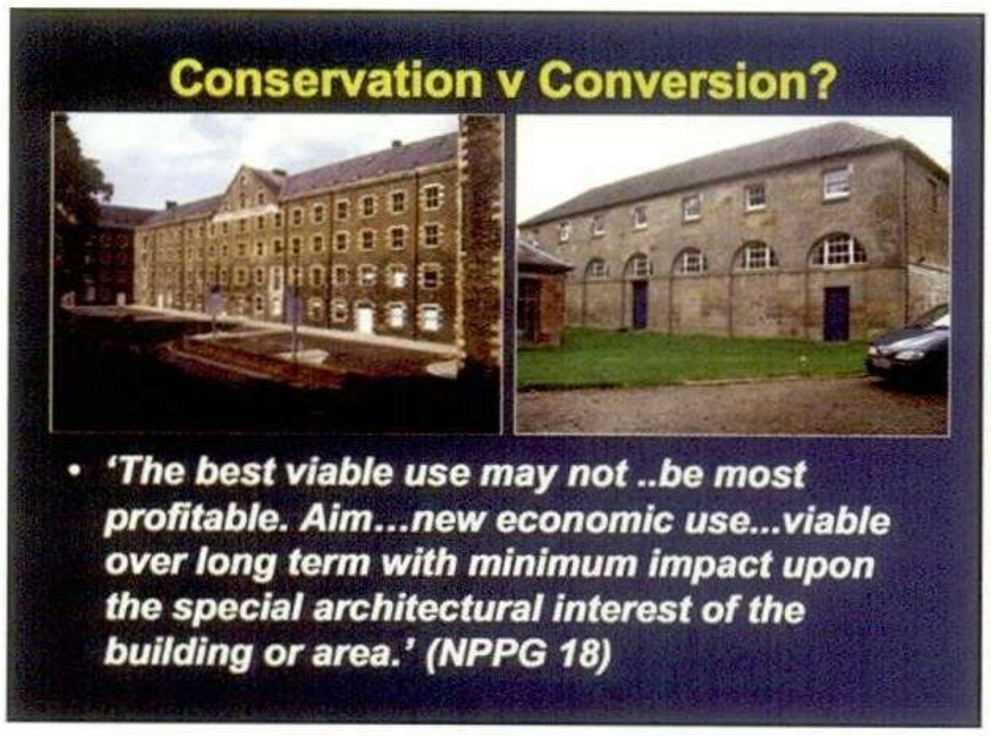

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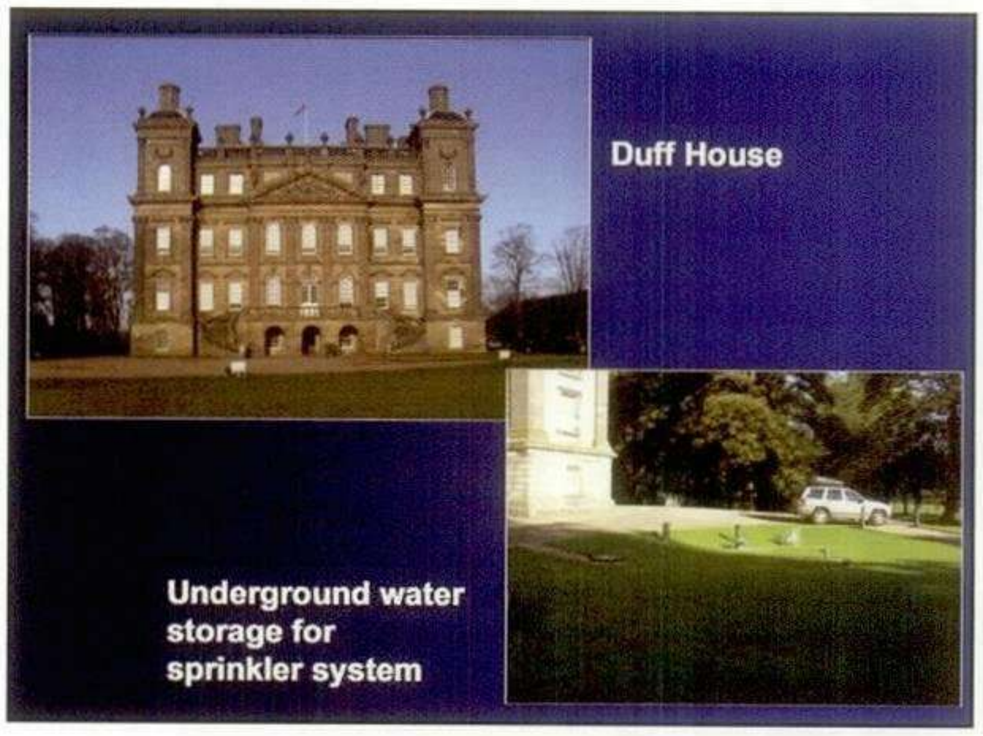

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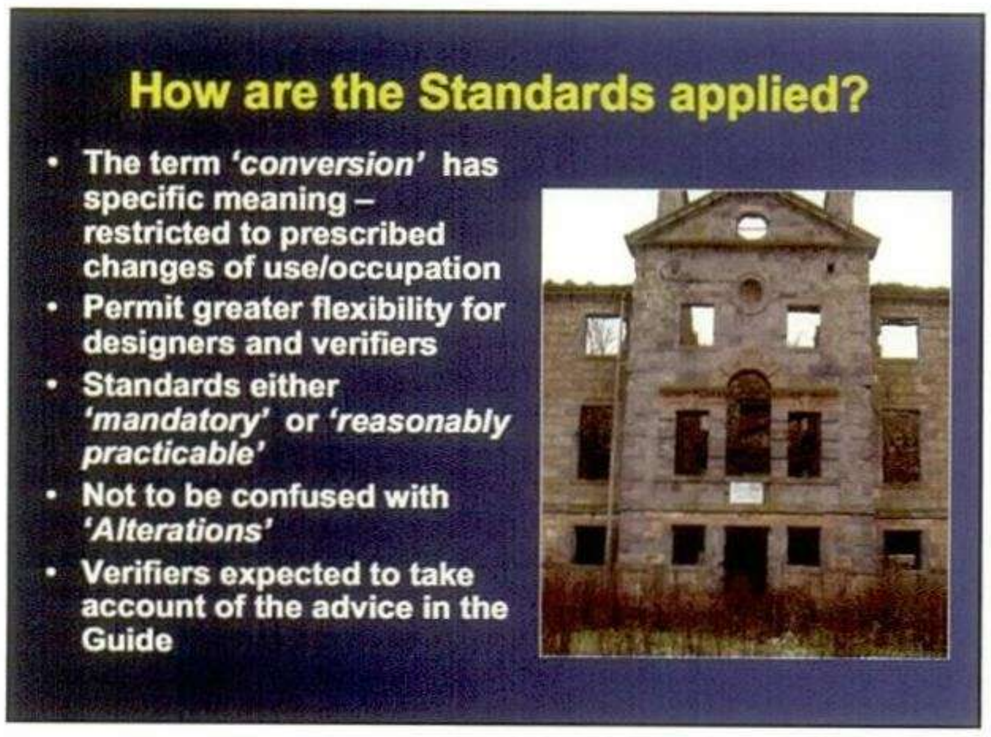

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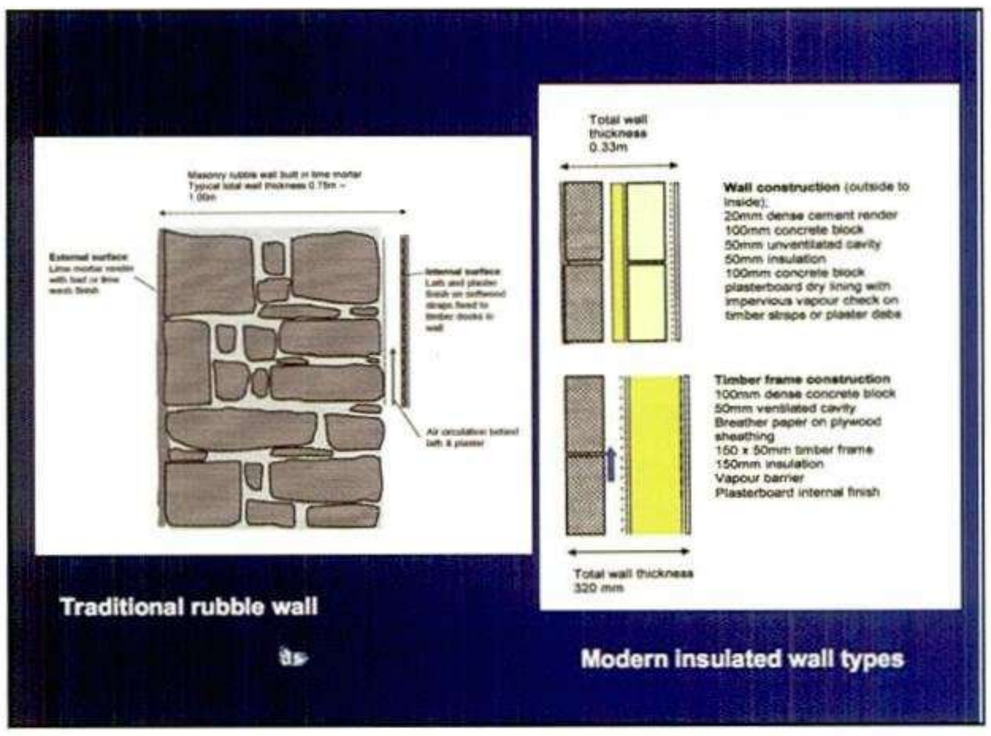

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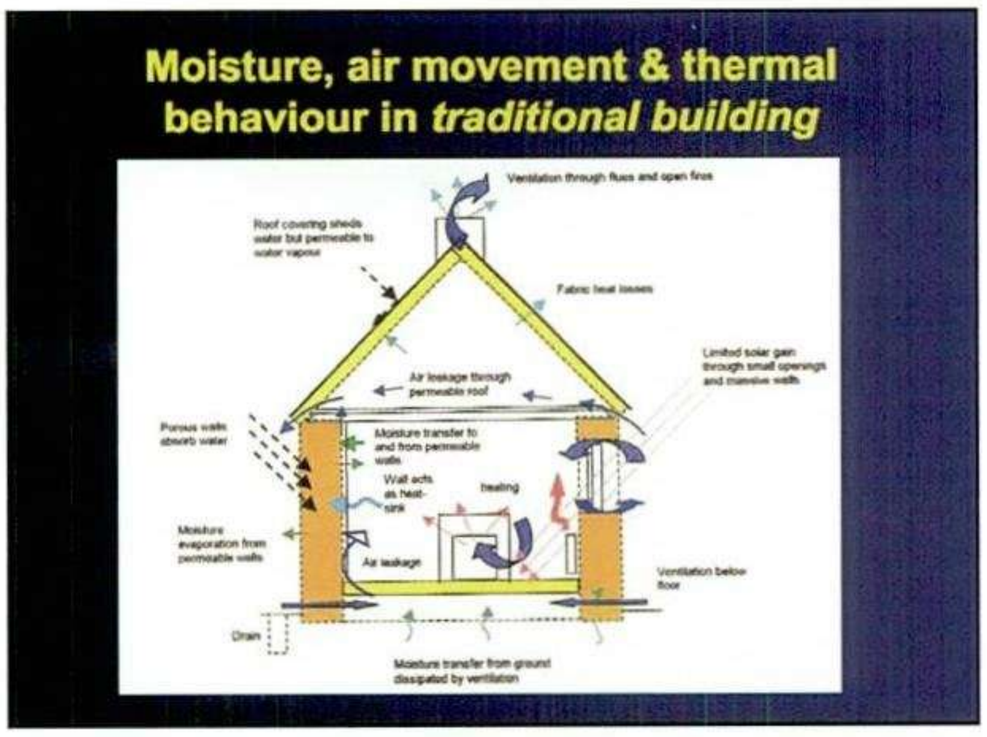

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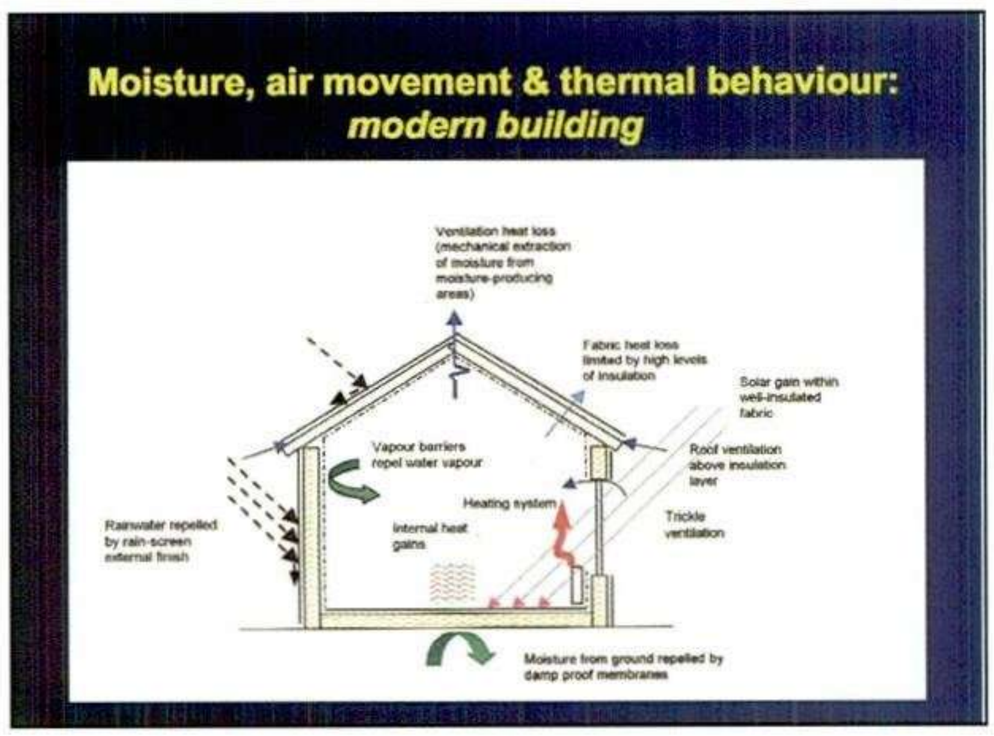

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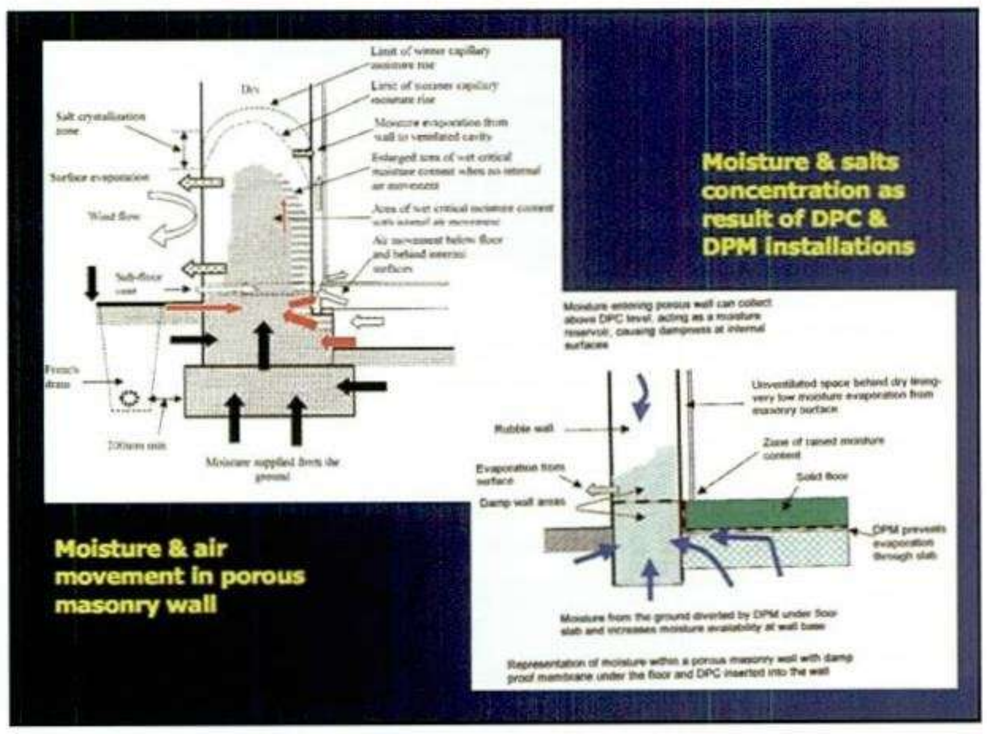

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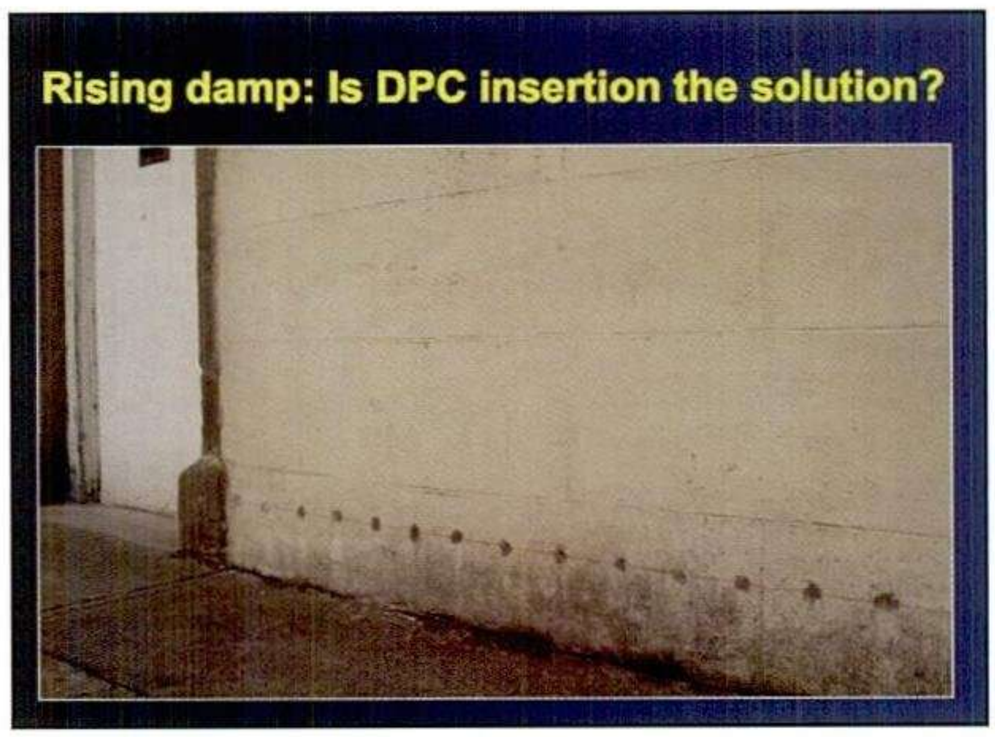

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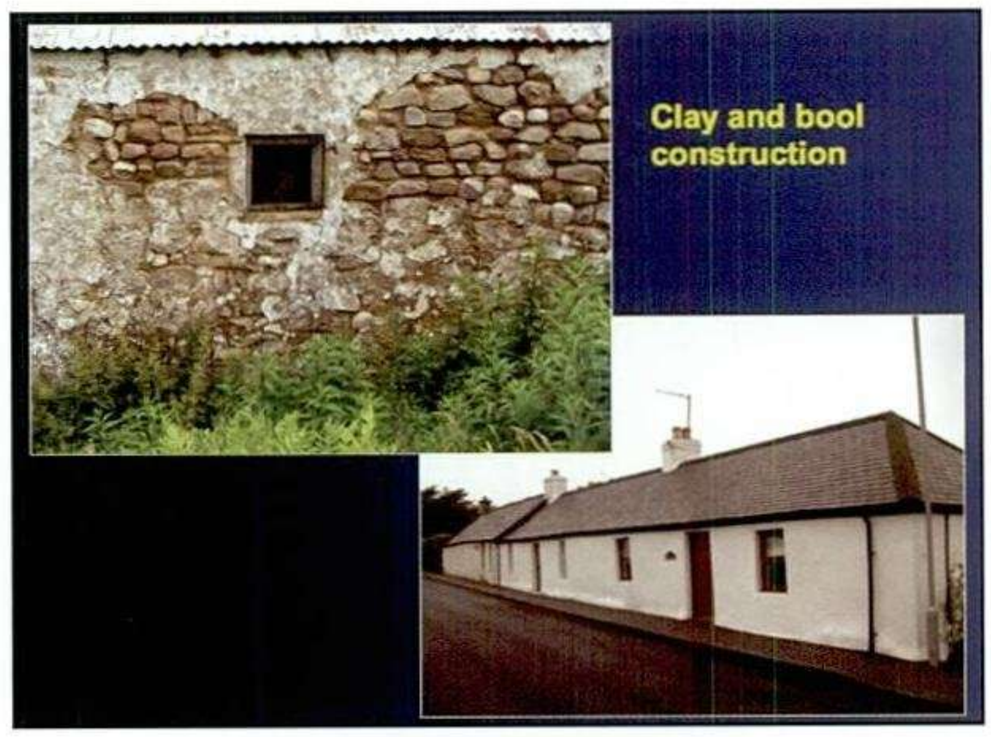

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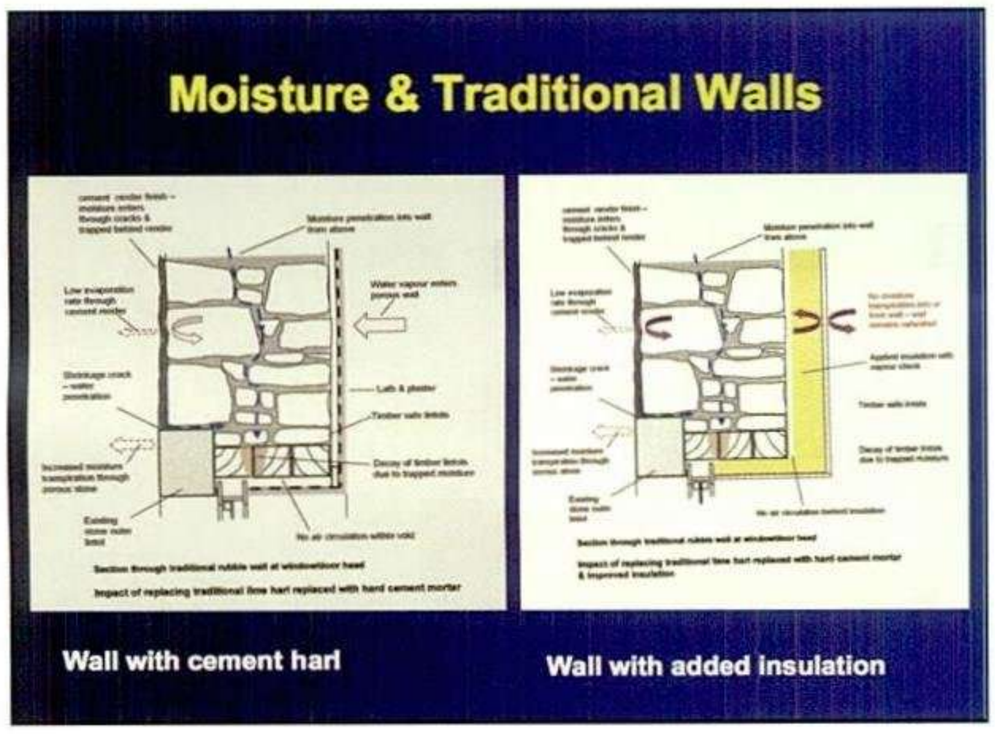

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Investigation and assessment

- Assessment of historic character and cultural value
- Assessment of construction, materials, elements & features
- Investigation of existing defects & assessment of repair needs
- Assessment of structure
- Assessment of thermal performance
- Fire risk assessment
- Sound insulation assessment
- Access audit
- Investigation for harmful/dangerous substances
- Archaeological investigation and assessment

14

Windows

15

Improving thermal efficiency of traditional windows

- Retain traditional windows
- Draught proofing
- Refurbishing existing shutters
- Insulating blinds
- Secondary glazing (100mm gap recommended)
- Improving thermal insulation elsewhere

16

Application of Regulations to conversion of historic buildings

- No prescribed method of meeting the standards
- System of Verifiers and Approved Certifiers
- *'...establish with the verifier where meeting the standards in full is not reasonably practicable...'*
- *'For historic buildings the classification of the building should influence the extent to which improvement is required...'*
- *Schedule 6 defines standards for conversions*
  - *which shall meet the requirements and those which shall be improved as close as is reasonable practicable*

17

Classification of standards 2. Fire Safety

Essential standards					Reasonably practicable standards				
No	Standard	H	M	L	No	Standard	H	M	L
2.1	Compartmentation	✓			2.2	Separation	✓		
2.3	Structural protection	✓			2.4	Cavities	✓		
2.5	Internal linings	✓			2.6	*Spread to neighbouring buildings*			X
2.9	Means of escape	✓			2.7	*Spread on external walls*			X
2.10	Escape lighting		✓		2.8	*Spread from neighbouring buildings*			X
2.11	Communication		✓		2.12	Fire service access	✓		
2.13	Fire service water supply (non-dwellings)		✓						
2.14	Fire service facilities		✓						
2.15	Life safety fire suppression systems	✓							

18

Classification of standards 6. Energy

Essential standards					Reasonably practicable standards				
No	Standard	H	M	L	No	Standard	H	M	L
6.1	Policy	✓			6.2	Building Envelope insulation	✓		
6.7	*Commissioning building services*			X	6.3	Heating system		✓	
6.8	*Written information*			X	6.4	Insulation of pipes, ducts and vessels	✓		
					6.5	Artificial display lighting (non-domestic)		✓	
					6.6	Mechanical ventilation & air conditioning (non-domestic)	✓		

19

Last word:

There need not be conflict between the Building Standards and the conversion of a traditional stone building but this needs:

knowledge & understanding

20

THE EFFECTS OF CLIMATE CHANGE ON STONE BUILT STRUCTURES

Craig Kennedy, Head of Science, Historic Scotland, TCRE

Since the Industrial age, greenhouse gas levels have risen sharply. Levels of the greenhouse gas carbon dioxide (CO_2) have been measured directly from the atmosphere at Mauna Loa, Hawaii, since 1960. In that time CO_2 levels have risen steadily from 315 ppm to 380 ppm. Historical evaluations of atmospheric CO_2 levels are carried out using ice cores, allowing levels dating back up to 800,000 years to be measured using gas analysis. During this time CO_2 levels cycled from 180 ppm to 300 ppm, lower than current levels.

The rise in greenhouse gases in the atmosphere has led to a process of climate change. The effects of climate change on the UK weather system have been analysed by the Tyndall Centre, giving localised predictions for the trends of weather patterns in future. In terms of Scotland, this means an average increase in temperatures, wetter winters and drier summers. This will have an impact on buildings and other stone built structures in a number of ways.

The most striking example of the effects of climate change is the increased levels of flooding, brought about by increased winter precipitation and rising sea levels. When a stone structure is saturated with water and then dried, lasting problems such as damp, microbiological growth and loss of aesthetic and structural qualities become evident.

More immediately, damage to structures in the wake of a disaster such as flooding is often man-made, as efforts to make a building useable in as short a space of time as possible mean that care and attention is often not taken with respect to the building fabric. Bad workmanship, knocking through walls, etc. contributes to the longer term detriment of the stone structures. Flood repairs can take from 6-12 months, and costs typically range from £15,000-£30,000 (Association of British Insurers).

The current condition of buildings is also a factor in seeing the effects of climate change on stone built structures. Poorly maintained buildings will be less able to cope with the pressures of extreme events such as storms or floods relative to those that have been well preserved.

The way in which stone interacts with its environment will change also in future. As the winters become warmer, the number of freeze-thaw cycles per year is expected to decrease. This means that one cause of damage to stone will become less evident. However, the annual saturation cycle caused by the wet winters and dry summers is expected to increase the rate of salt crystallisation in stone over time.

The changing environment is also likely to alter the types of biological species that interact with stone structures. Masonry bees were found in Edinburgh for the first time in 2007, attracted north by a changed climate system. This will likely be repeated with microbiological species in future.

References

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THE EFFECTS OF C LIMATE CHANGE ON STONE BUILT STRUCTURES

Craig Kennedy, Head of Science, Historic Scotland, TCRE

The effects of climate change on stone built structures

Dr. Craig Kennedy

Head of Science
Technical Conservation, Research & Education Group
Historic Scotland

HISTORIC SCOTLAND

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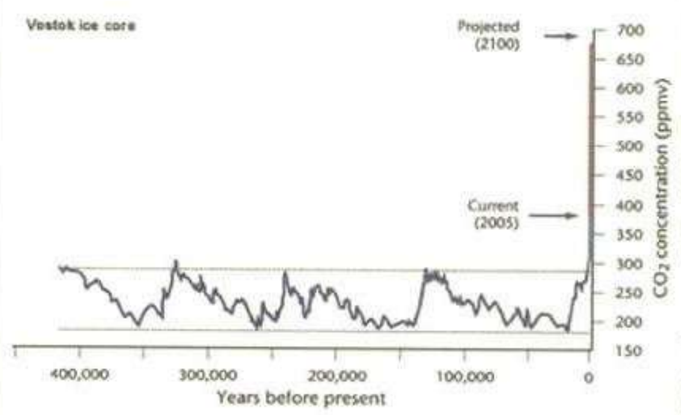

Since the Industrial Age, greenhouse gas levels have risen.

CO2 levels are at their highest in 430,000 years – and are expected to keep rising.

The greenhouse effect means that the climate is changing as a consequence of this.

HISTORIC SCOTLAND

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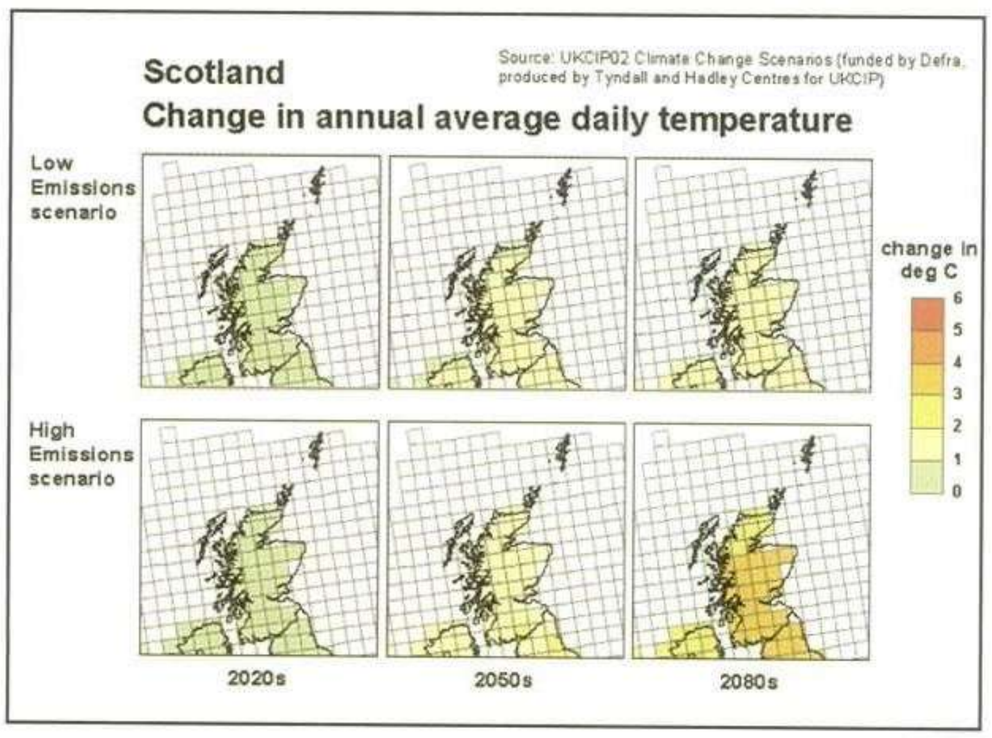

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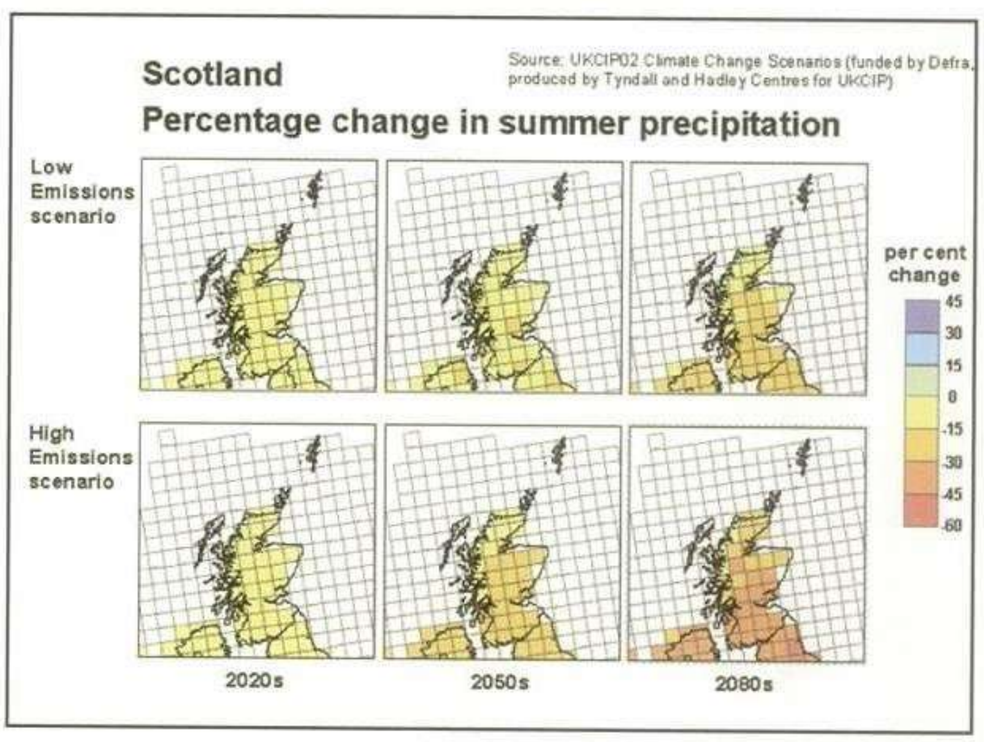

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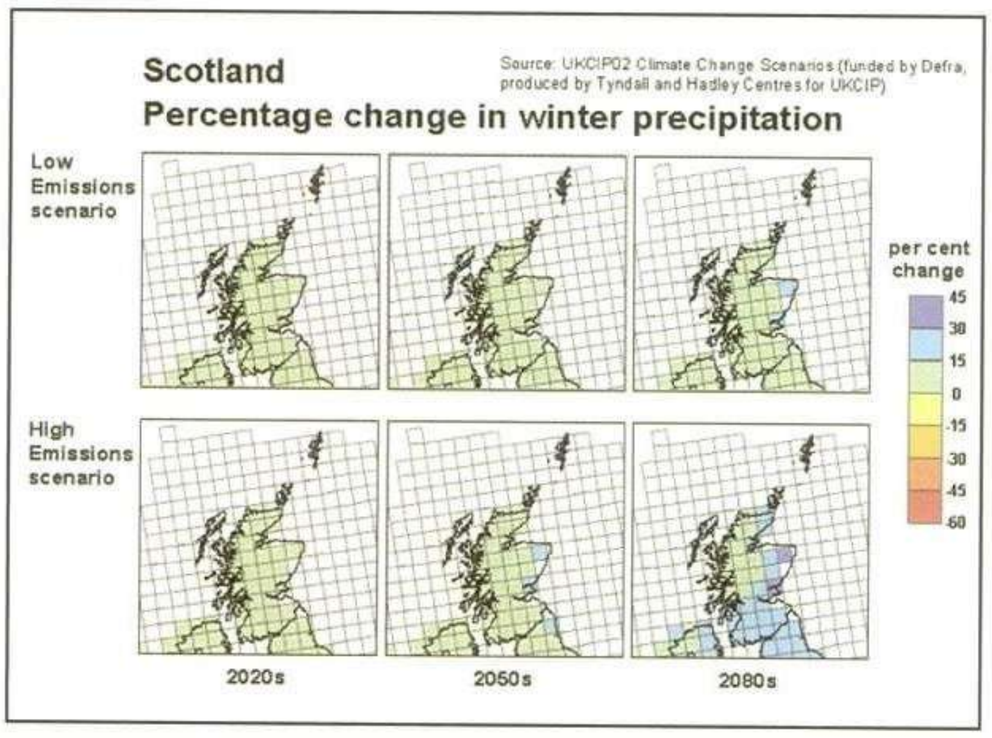

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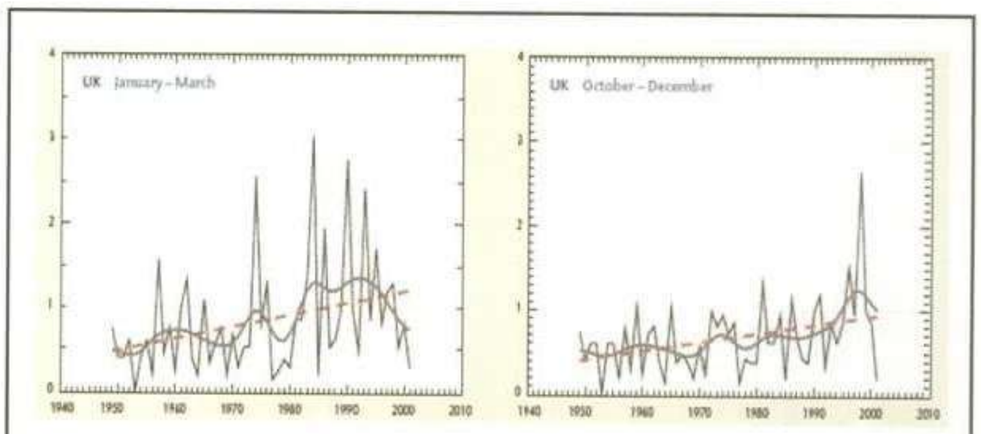


The number of storms per observation station over the United Kingdom during (left) January to March and (right) October to December.

HISTORIC SCOTLAND

6

Storm surge – Great Yarmouth: 9 November 2007

7

UCL report "Climate Change and the Historic Environment" (2005) listed 9 major climate changes that are set to impact the historic environment.

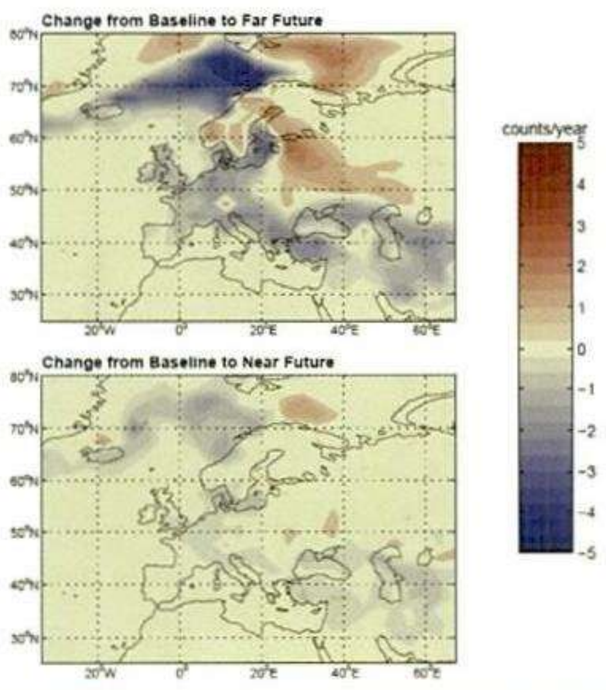
Climate change poses a great threat to built heritage due to:

- **Extreme weather events (storms, floods) becoming more frequent**
- **Changing weather cycles (wet-dry)**
- **Sea level rises**

European research has attempted to show the effects of climate change on heritage structures

HISTORIC SCOTLAND

8



EU project Noah's Ark:

predicted climate change impacts on historic environment.

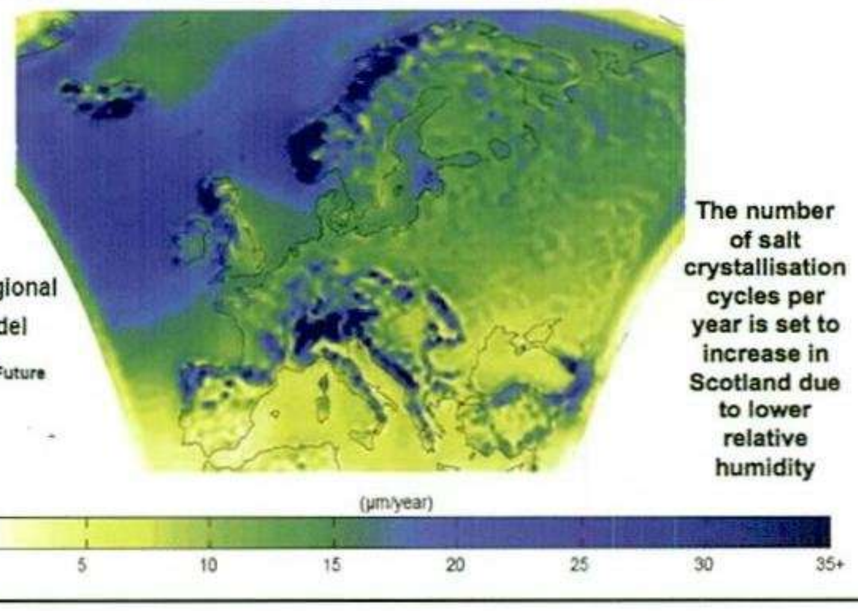
http://noahsark.isac.cnr.it/

The number of freeze-thaw cycles per year will fall in Scotland and Western Europe, but increase in the East

9

EU project Noah's Ark –

predicted climate change impacts on historic environment.

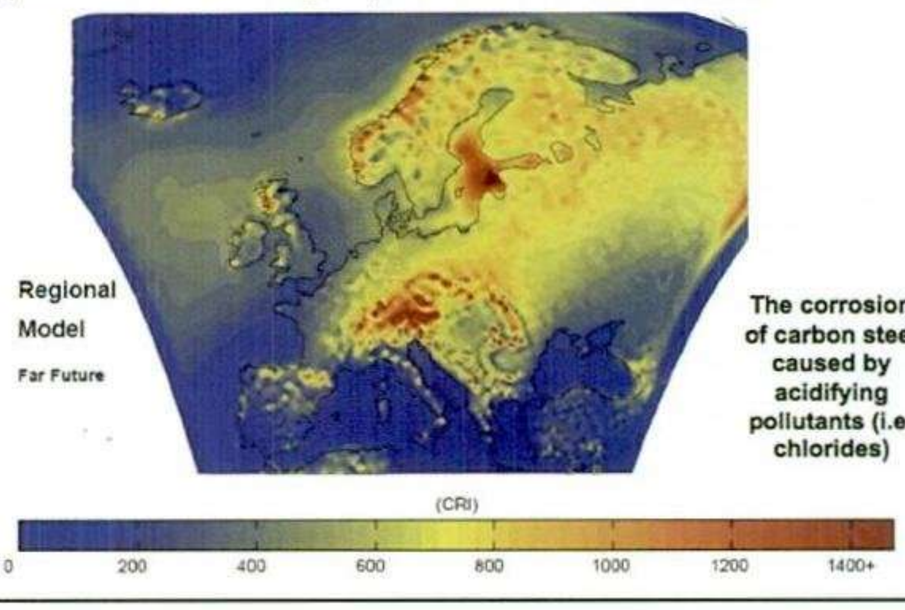


The number of salt crystallisation cycles per year is set to increase in Scotland due to lower relative humidity

10

EU project Noah's Ark –

predicted climate change impacts on historic environment.



The corrosion of carbon steel caused by acidifying pollutants (i.e. chlorides)

11

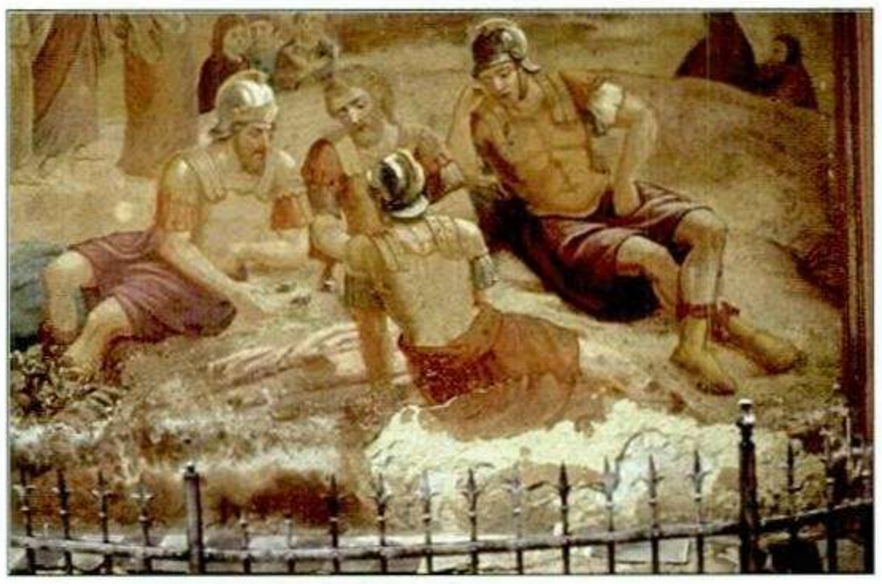
How will climate change affect stone built structures? : Flooding

Troja: Prague floods, 2002

12

HISTORIC SCOTLAND

13



HISTORIC SCOTLAND **Damage to a wall painting Klodzko, Poland, by action of salts and moisture, result of the flood of 1997**

14

HISTORIC SCOTLAND

Flooding followed by drying can lead to problems for masonry and increased biological growth.

15

HISTORIC SCOTLAND

Brodick Castle: spread of algae on west wall: (left) July 2004; (right) May 2006: Engineering Historic Futures project

16

Flood repairs can take 6-12 months to complete due to drying requirements and the extensive work necessary. Costs are typically £15,000 - £30,000 but many rise as high as £60,000. (Association of British Insurers)

The main cause of anxiety to victims of the Carlisle flood of 2005 were contractors damaging buildings and belongings.

HISTORIC SCOTLAND

17

Storm Damage

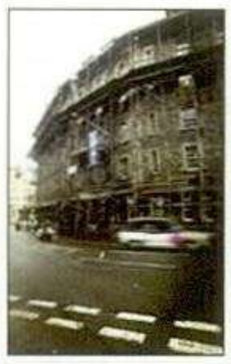
Attic wall of the Cloth Hall, a landmark of Cracow, Poland, World Heritage Site, destroyed by a storm in 2002.

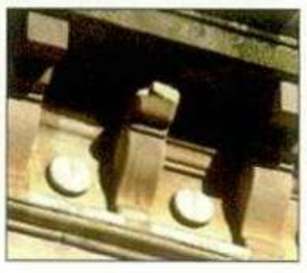
HISTORIC SCOTLAND

18

Dangers of falling masonry

An average of 50 reported cases of falling masonry per month in Scotland (2005-07)





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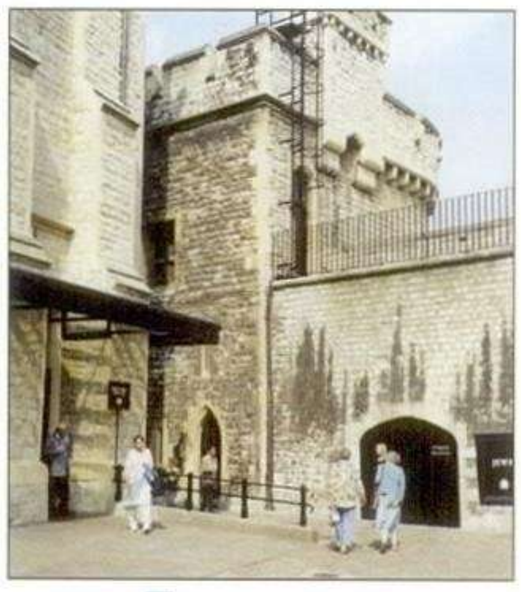


HISTORIC SCOTLAND

Air pollution

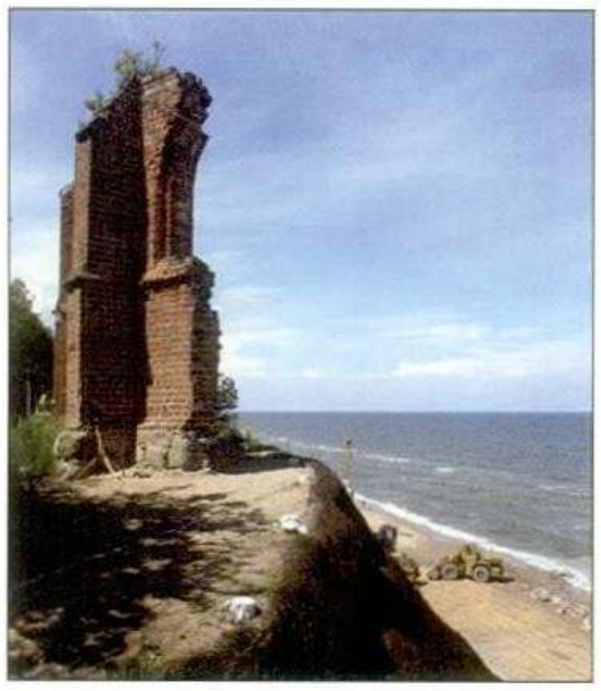
Tower of London – affected by air pollution showing increased blackening

20

Impact of coastal erosion:

Ruins of the medieval church in Trzesacz, at the Baltic Sea, Poland, destroyed by the shift of the coastline

HISTORIC SCOTLAND



21

How will stone deteriorate under new climate conditions?

Different **Biological attack**

- **Masonry Bees (Osmia Rufa)**
- **Bacteria**
- **Algae**
- **Moss**
- **Lichens**

Reduced freeze-thaw cycles

Annual saturation and drying; salt crystallisation

All related to water – precise mechanisms not fully explored

HISTORIC SCOTLAND

22

UK Research in to climate change induced stone decay

NERC CASE PhD studentship: "The impact of climate change on weathering in urban environments: prediction and mitigation"

Glasgow University, British Geological Survey, Historic Scotland

Collaborative PhD studentship: "Current mechanisms and future patterns of stone decay in cleaned sandstone and granite buildings "

Paisley University, British Geological Survey, The Robert Gordon University, Historic Scotland

Leverhulme Trust Research Project: "Climate change, moisture regimes and deterioration of stone monoliths"

Edinburgh University, University of Oxford

HISTORIC SCOTLAND

23

Take home message: Repair & Maintenance

A properly working building will be better prepared to withstand extreme weather events

- Make sure downpipes and gutters are clear
- Ensure roofing does not leak
- Investigate sources of water ingress and damp
- Keep pointing appropriate and up to date

- There are no technical "quick fixes"

HISTORIC SCOTLAND

24

PRODUCTION OF STANDARD STONE UNITS

Peter Stewart, Tradstocks

Tradstocks have an available range of 14 stone types. They supply ashlar, walling, window Surrounds, door surrounds, quoins, plinths, steps, paving, setts and kerbs, copes, balustrades, gate pillars, finials etc. Some stone is salvaged from demolished buildings. There is an infinite variety of components, styles and stone types.

It is impossible to standardise stone units therefore most items are bespoke. However, it is possible to standardise stone production methods.

Design issues for a new build house:

Natural stone can greatly enhance a new build house and will offer good performance if chosen correctly. There are a number of design issues which will affect the supply of stone for new build houses however. All too often, client requirements and planning conditions are vague and lack understanding. Whether the building will be timber kit or traditional, or the architectural specification is conventional or contemporary are also factors to be considered.

The geographical location is important when selecting the stone type, but it is important to note that stone matching should not be done by colour alone – other properties such as the density and porosity of the stone also need to be considered. The client's budget of course plays a major part in the selection of natural stone or precast stone – natural stone will cost 2 or 3 times more than precast for instance. The method and ease of construction, for example the size of stone units required, will also impact on the design.

Production issues:

- Off-site manufacturing can be difficult – accurate information is key to success
- The format in which the client supplies that information can have a significant impact, for example whether they provide a CAD Drawing, a rough sketch or numbers over the phone
- The type of stone required is also a factor for consideration – this will be affected by current availability and the relationship with the supplier
- The stone performance – assessed by test results, by choosing a proven material, and by experience
- Raw material cost - £40 - £160 per tonne plus the cost of haulage to the yard
- Ease of production – will it be a block shape, diamond segment or can a CNC router be used
- What surface finish is required?
- The commercial realities are an important factor for Tradstocks, such as payment terms, bad debt and liquidations.

Ideally, the client would be well informed, and willing to pay the market price for a good quality product which is appropriate and available. A competent architect or designer should provide dimensioned CAD drawings showing well proportioned, appropriate stone units. A production schedule including construction would be included, and the stone cut and shaped by a skilled, happy workforce. The stone should be delivered and paid for on time, and the building would be well built, enhancing the local environment for at least 100 years.

Conclusion

It is possible to produce standard items relatively quickly. Chronic planning weaknesses and a general lack of understanding means that there is a real need for Standards to be developed. It is vital that the way new buildings look and fit their surroundings improves but this change must be consumer driven.

PRODUCTION OF STANDARD STONE UNITS

Peter Stewart, Tradstocks

HISTORIC SCOTLAND
Stone in Context

Production of Standard Stone Units

Peter Stewart

1

Introduction

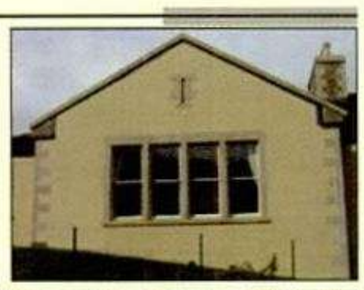
- Name: Peter Stewart
- Company: Tradstocks Ltd
- Main Activities: Natural Stone sales, Processing and Quarrying
- Location: Thornhill, Stirling
- Established: 1992
- Employees: 25
- Primary Saws: 3
- Secondary Saws: 6 (inc 5 axis CNC)
- Delivery Vehicles: 4
- Source and supply throughout UK
- Stone Types: 14
- Output: Cut Masonry 15-20m3/week (50t)
  Walling -200m2/week (75 -100t)

2

Typical 'Standard' Items we supply

- Ashlar - Various finishes
- Walling - Random ~ Coursed
- Window Surrounds - Plain ~ Moulded
- Door Surrounds
- Quoins – Plain ~Tooled
- Plinth – Chamfered ~ Moulded
- Steps, Stairs
- Paving, Setts, Kerbs
- Copes, Balustrades
- Gate Pillars, Finials
- Etc Etc

- Infinite variety of components, styles and stone types.
- Impossible, wrong to standardise stone units. Most items are bespoke.
- It is possible to standardise stone production methods.



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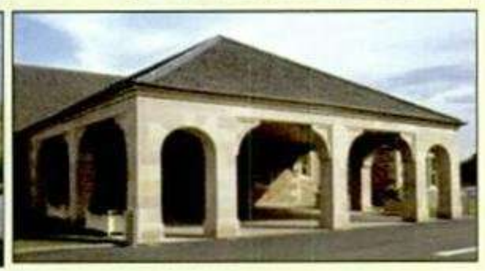
Further Examples – New Build



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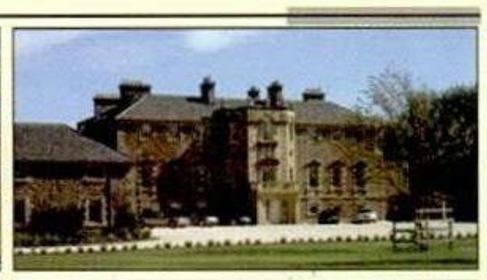
Historic Examples



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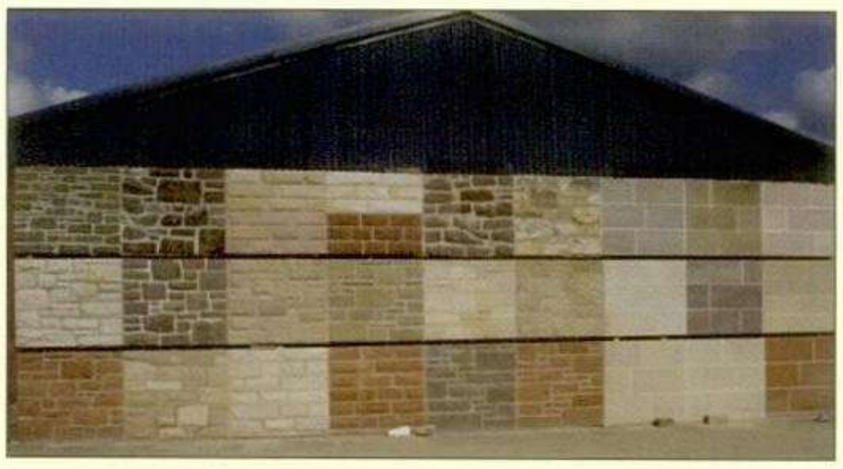
Design Issues – New Build House

- Client Requirements – Specific/Vague – General lack of understanding
- Planning Conditions – Often vague and non specific.
- Timber Kit or Traditional – Same units suit both.
- Architect Specification – Conventional/Contemporary – Avoid precast spec (215mm coursing, complicated cill design etc).
- Geographical Location of Project – eg Bearsden or Skye.
- Cost - Natural stone will cost 2 or 3 times precast/pretend stone.
- Match Existing – Stone type, not always colour.
- Stone Type – Best fit for locality, local stone!
- Method/Ease of construction – Size of stone units, size of window openings etc.
- Compromise? – Not always as understanding grows and more indigenous stone becomes available.

6

Sample Panel Wall



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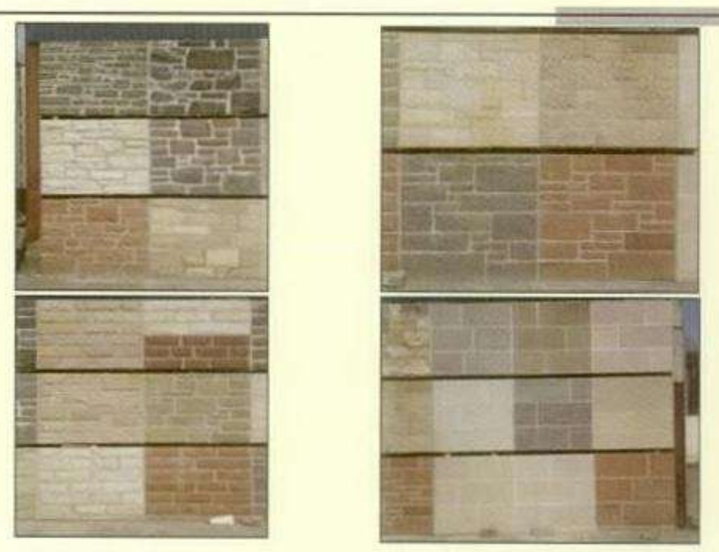
Rubble ~ Ashlar

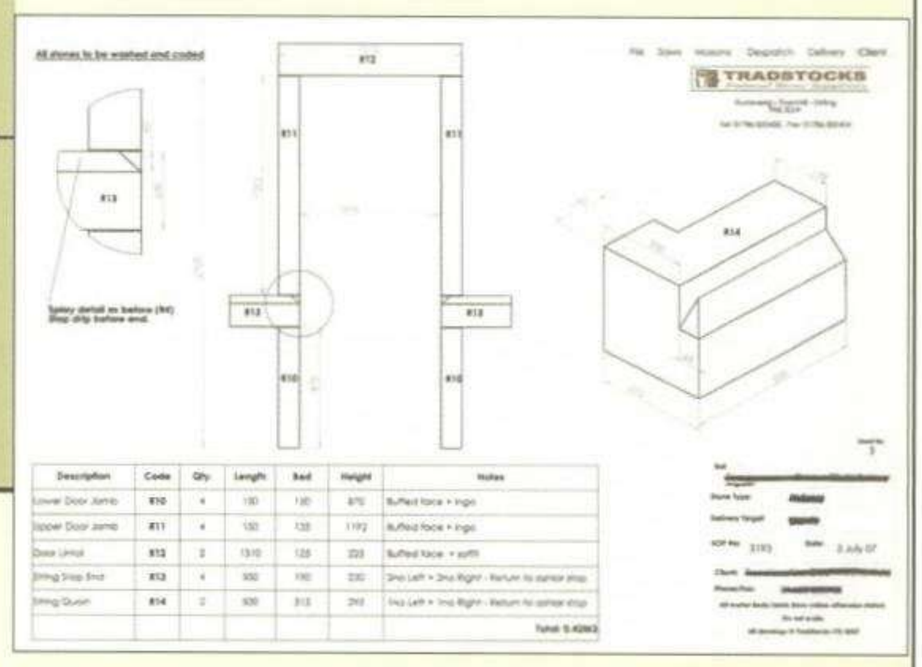


8

Production Issues

- Off site manufacturing is fraught – Accurate information is key.
- Format of Client Requirements – Occasionally CAD drawing with concise stone schedule ~ More often rough sketch, or just some numbers given over the phone!
- Stone Types – Current availability, relationship with supplier.
- Stone Performance – Test results, proven material, experience.
- Raw Material cost - £40 ~ £160/tonne + haulage to yard
- Ease of production – Block shape, diamond segment required - CNC
- Surface Finish – HAVS etc.
- Commercial Realities – Payment terms, bad debt, liquidations etc.
- Compromise? – Try to provide best all round solution/package for client.

9



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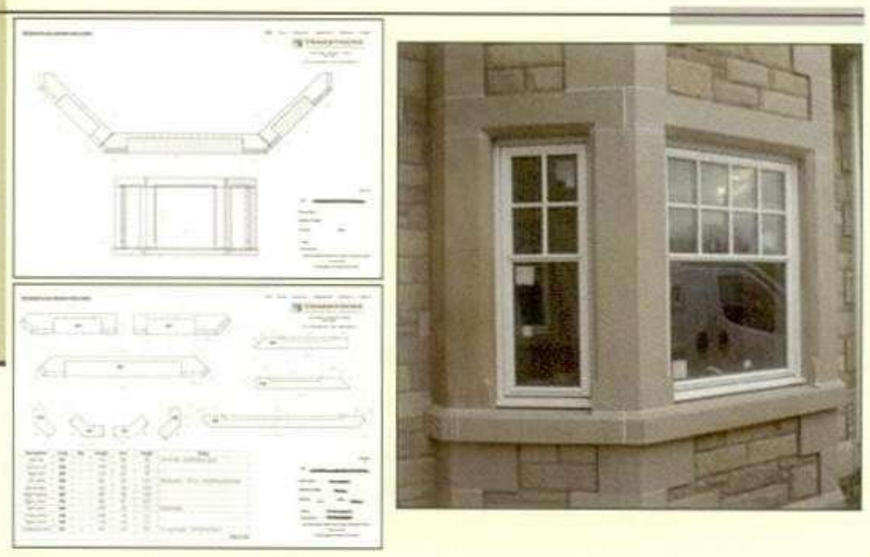

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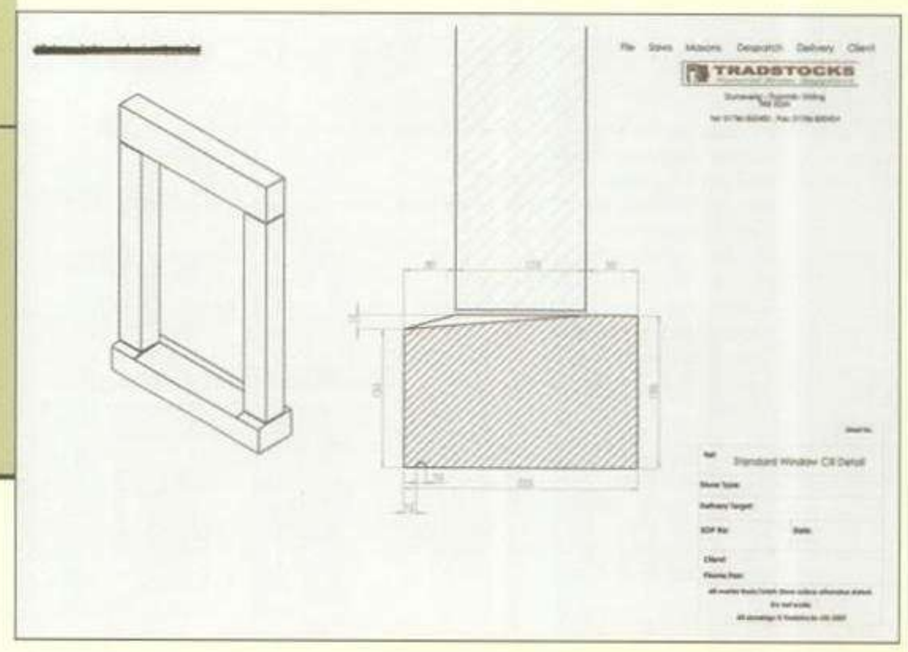

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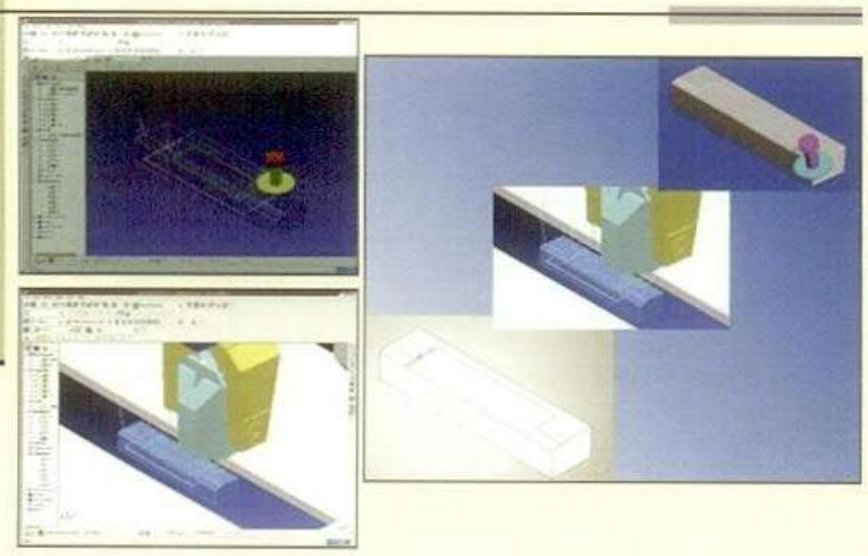
CAM - CNC Production



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14

Ideal Scenario……

- Informed Client – Desiring a quality product, while accepting market cost is good value.
- Competent Architect/Designer – Dimensioned CAD drawings, well proportioned stone units with conventional coursing (295mm – 125mm ingoes – 150mm Bands).
- Select most appropriate, available stone type.
- Production schedule, including construction information.
- Stone cut and shaped by skilled, happy workforce.
- Delivered and paid for on time.
- Built well.
- The quality material we supplied enhances the building and local environment for at least 100 years!

15

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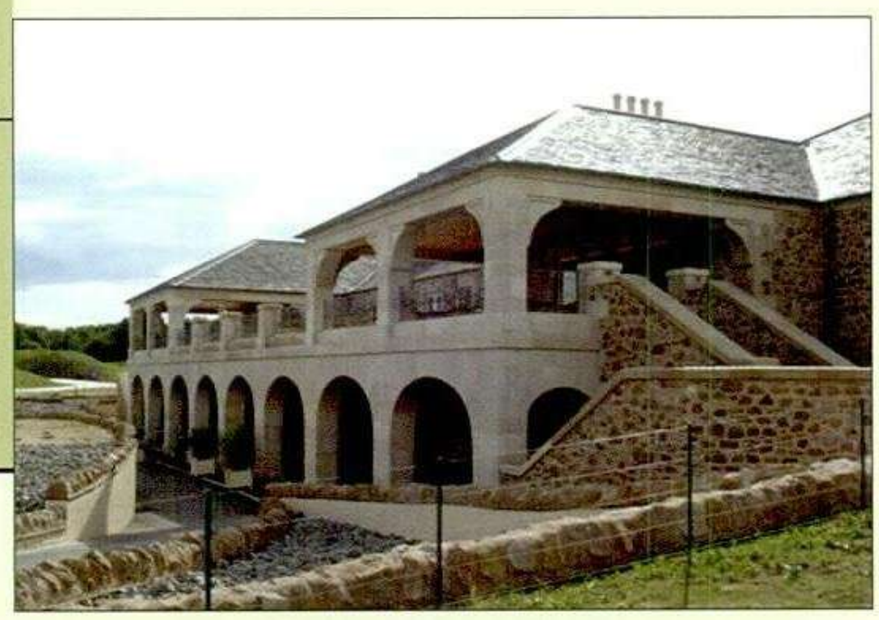

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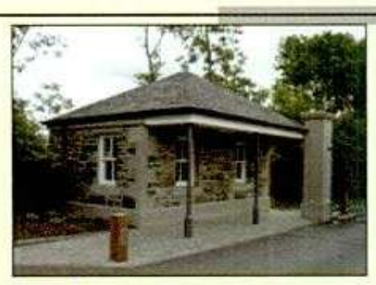

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Conclusion

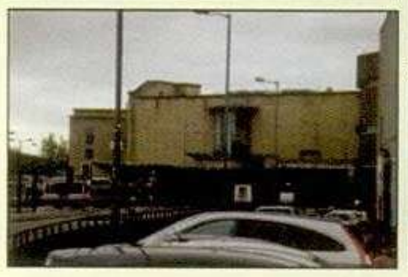
- Standard items can be produced relatively easily.
- Is it Standards not standard required?
- Chronic planning weaknesses - ignorance.
- Consumer driven change.
- Must start improving how new buildings, particularly homes, look and fit surroundings.

24

Reality……

25

Stirling's latest…..



26

Thoughts for today…….

- Stone is expensive compared to what? Coloured concrete!
- Natural stone v precast/pretend – double initial cost, lasts longer, difference as % of overall build cost less than 5% which developer can add to sale price.
- No logical reason to allow imitation stone: we have to prevent the ruin of our built environment.
- Current future historic, iconic buildings?
- Our generations legacy :currently embarrassing.
- We are judged as a nation on what we build and allow to build.
- What do tourists and visitors think of these buildings?
- Really difficult to find an unspoilt town.
- Nothing better than a building fitting it's setting. Local materials are key.
- Cost of locally produced materials not important as long as good value: money remains in local economy.
- Situation is so bad that many consumers don't know the difference between natural and man-made.
- Educational opportunity– instil understanding and pride in young people. Then they will then demand better quality.
- Affordable housing not cheap looking housing.
- Relatively rich nation. currently being polluted with low quality buildings: driven by developers greed.

27

Solutions?

- Scottish Government be bold and dynamic……set higher standards for building materials and regulate, empower planning authorities to insist on quality.
- Take example from areas of England!
- Need a Jamie Oliver……expose the problem, raise profile through media. Get people thinking and talking about it. Develop national pride in what we build and are prepared to live in/look at.
- Encourage dimensional stone quarrying…..there are plenty of stone and slate reserves in Scotland.
- Export potential……premium Scottish product to China!
- If the demand and encouragement is there, the Scottish Stone industry will respond and provide required quality 'standard' units.

28

PLANNING POLICY CONSTRAINTS ON AVAILABILITY (SOURCING BINNY)

Stuart Eydmann, West Lothian Council

The re-opening of original quarries can be difficult, with a presumption amongst locals against mineral extraction borne out of the legacy of large scale coal, shale, open-cast, sand and gravel extractions in the past. Policies have evolved in response to theses, but have not been designed for building stone, or with the longer term in mind. This situation is further compounded by reluctance amongst rural locals to suffer to serve city needs, a situation made more difficult because resources tend to be found in interesting sites.

West Lothian Planning Policy is concerned with:

- Scottish Planning Policy 4,
- Planning Advice Note 50 and its annexes
- The impact of quarrying on residential properties,
- Traffic generation and the quality of restoration
- Compromise of designated and locally important landscape features and areas
- The impact on ecological sensitivity areas and long-term biodiversity
- Impact on sites of cultural heritage
- Impact on peat habitats
- Visual intrusion, even after mitigation
- Potential contribution to cumulative adverse impacts
- Impact on existing businesses or industry
- Extensive community concern which cannot otherwise be offset

Ways forward

Raising consciousness of geodiversity and local liaison could highlight the local benefits of opening quarries; however it is a national issue that needs to be addressed by the Scottish Government with specific, well worded policies are needed. Mineral maps are needed to recognise the resources of Scotland.

Re-opening the Binny quarry

Binny sandstone was quarried since 1794 in West Lothian. The stone is a pale yellowish brown, medium grained rock and comes from the Lower Carboniferous period. The Scott Monument and "The Dome" are two prominent Edinburgh buildings that have been built using this stone. The site is situated within an area of Great Landscape Value, close to listed buildings, and 150 m away from the nearest houses. The site encompassed 0.1 ha of grazing land and a golf course.

A request was lodged in 1997 to reopen the Binny quarry for repairs to the Scott Monument and a small extraction area was proposed to supply the 75 cubic metres of stone needed. The project would last 9 weeks, including 4 weeks of extraction. It was agreed that there would be a maximum of 3 to 4 return lorry movements per day for 10 days between 8am and 5pm, after which time the land would be reinstated to grazing.

Local liaison was crucial. Consultation was held with local residents and community councils and the applicant's agent met with local representatives. This was a successful approach and the project received only 2 letters of objection.

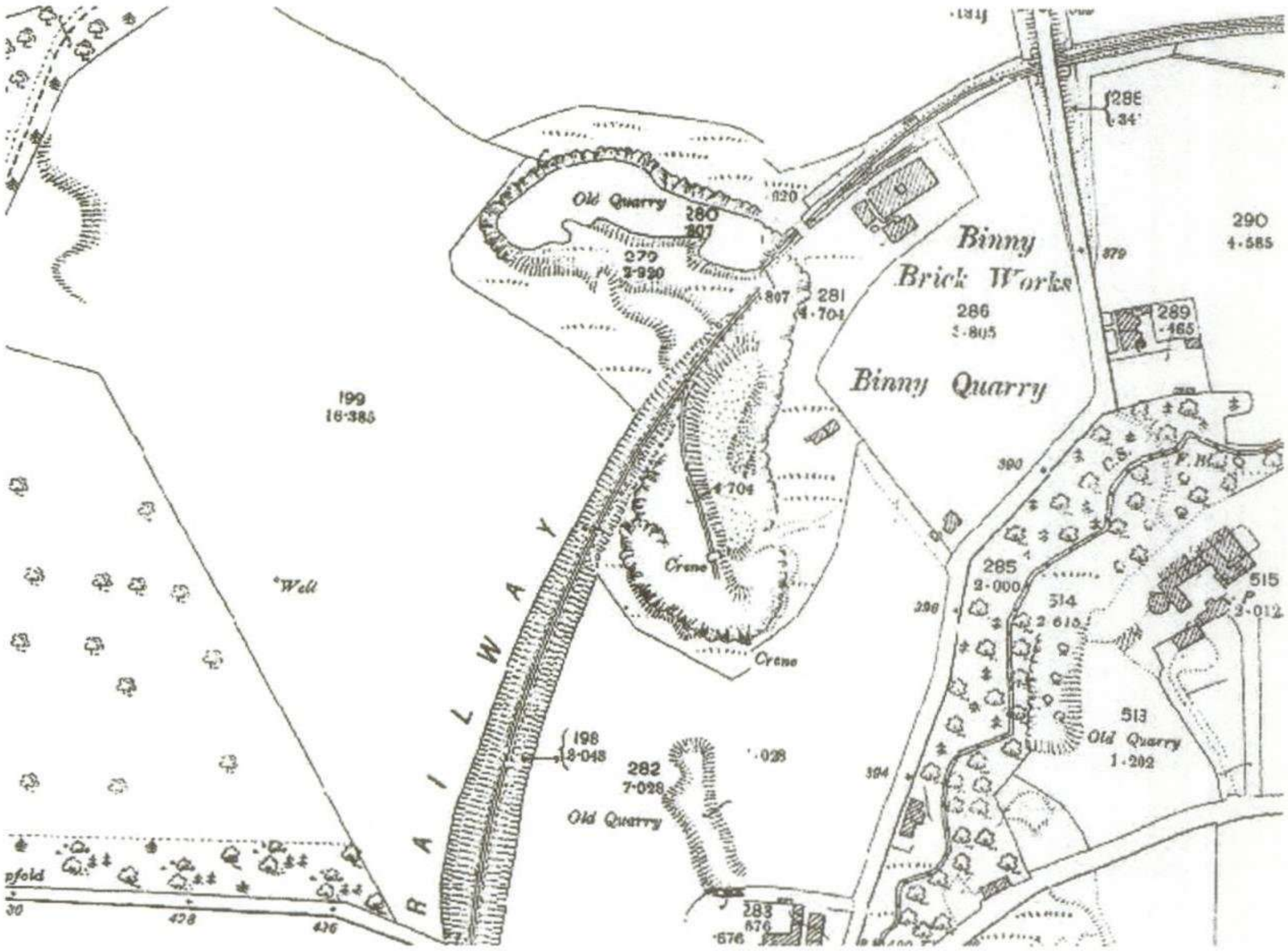
Following the consultations and an Environmental Health analysis of predicted noise levels, it was confirmed that it was unlikely to be intrusive and that vibration would not occur as blasting would not take place. Dust extractors were to be used on drills which would be used in a location unlikely to cause dust. The applicant also agreed to meet the expense of any damage to the roads.

Policy considerations

Policy normally would not agree, but in this case made an exception due a number of factors including; the limited and temporary nature of the project; local acceptance; Highways and Environmental Health, Historic Scotland and Heritage Lottery Fund requirement and support.

The project was also subject to a Section 75 legal agreement which agreed on various limitations and requirements. The project was also subject to planning conditions relating to the duration, hours of working, control of noise and dust and other factors.

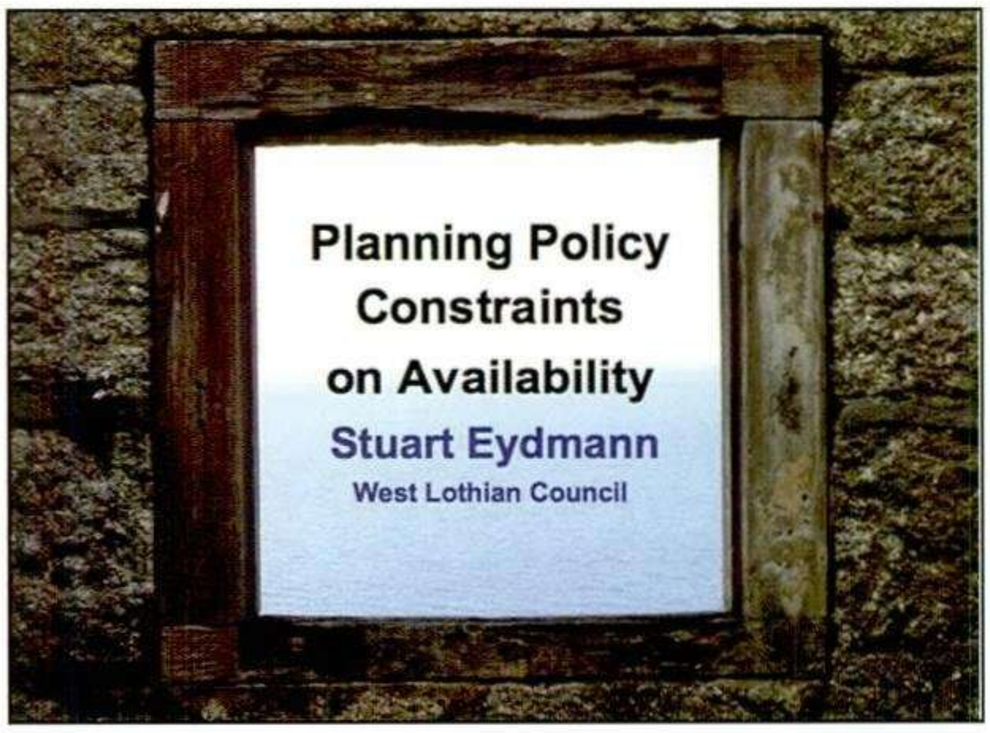
Thanks to a thorough system of consultation, local liaison and planning liaison, it was possible to successfully extract the stone required for the Scott Monument restoration project with great success.



Binny Quarry, West Lothian c1890

PLANNING POLICY CONSTRAINTS ON AVAILABILITY (SOURCING BINNY)

Stuart Eydmann, West Lothian Council



1

Legacy

- Presumption against mineral extraction
- Local experience and legacy of coal, shale, open-cast, sand and gravel…
- Policies evolved in response
- Policies not designed for building stone
- Policies evolved to deal with longer term
- Why suffer locally to serve city needs?
- Resources tend to be in interesting sites

2

West Lothian Planning Policy
is concerned with:

- Scottish Planning Policy 4
- Impact on residential properties
- Planning Advice Note 50 and its annexes
- Traffic generation
- Quality of restoration
- Compromise of designated and locally important landscape features and areas
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West Lothian Planning Policy
is concerned with:

- Impact on sites of cultural heritage
- Impact on peat habitats
- Visual intrusion, even after mitigation
- Potential contribution to cumulative adverse impacts
- Impact on existing businesses or industry
- Extensive community concern which cannot otherwise be offset

4

Compliance

"The council will normally require the operators of a site for mineral working to finance the appointment, by the council, of a compliance officer to monitor the site during the currency of the planning permission"

5

Local Liaison

"The council will encourage and support the establishment of a local liaison committee as part of any permission for mineral working and the group shall meet at a frequency determined by the planning committee during the period of extraction, restoration and aftercare"

6

Restoration and Aftercare Bonds

"The council will require either the developer or landowner of a mineral site to lodge a bond to cover restoration and aftercare. The developer must appoint an independent assessor, agreed by the council to advise the council at set stages during the lifetime of the development of the estimate of outstanding liabilities at the site, and the amount of finance to be secured for the sole use of the council. The developer will be required to provide the necessary financial security to address the outstanding liabilities"

7

Community Benefit

"Following the approval of a planning permission, having regard to the development plan and other material considerations, the council will encourage developers to discuss community benefit projects"

8

Building Stone

"Proposals for the development of a quarry to extract building stone must be accompanied by support for the proposal from Historic Scotland, indicating that the mineral is significant for the conservation of the built heritage and that, where there is a potential conflict with other policies, there is no alternative suitable site in the market area with less environmental impact"

9

Development Control Criteria

Where potentially acceptable the council will consider:

- The extent, screening capability, topographical containment and maturity of existing and advance woodland planting
- The extent of comprehensive mineral working proposals for the area taking into account the presence of contiguous and recoverable deposits
- The duration of the operations
- Provision and adequacy of supporting information on mineral quality, reserves, tonnage, extraction or tipping rates, alternatives available and the market

10

Development Control Criteria

Where potentially acceptable the council will consider:

- The implications for haulage, including road safety, road cleanliness and the need to minimise nuisance to communities around the site and on the preferred haul routes
- The impact on ground and surface water regimes, the adequacy of site drainage and the treatment of site water to avoid pollution of water courses or ground water
- Protection of infrastructure such as roads, pipelines, cables and drains
- The maintenance or diversion of rights of way and other established footpaths

11

Development Control Criteria

Where potentially acceptable the council will consider:

- The protection of landscape features
- The environmental impact of traffic and any cumulative impact from other similar sites on other road users and communities
- An investigation of the scope to use rail transport or to route lorry traffic on to the strategic road network, so avoiding communities, shall be carried out and the results, including mitigating measures, submitted as part of the application
- Methods of working, which should minimise visual intrusion using existing landforms where appropriate
- The acceptability of ancillary mining development in terms of location, appearance and performance in relation to environmental standards

12

Development Control Criteria

Where potentially acceptable the council will consider:

- Stripping and storage of soils so that proper restoration can take place
- A requirement for archaeological recording and investigation
- Safety of the public and farm stock
- The steps to be taken to prevent nuisance or environmental deterioration generally, including an assessment of existing and introduced noise, air quality, dust deposition and ground vibration

13

Development Control Criteria

Where potentially acceptable the council will consider:

- The adequacy of the proposed working method to enable the progressive restoration of the site to take place at the earliest opportunity
- The restoration to profiles reflecting the landscape character of the site.
- The suitability of after-use and aftercare arrangements
- Contingency measures, including details of treatment proposals to deal with any ferruginous outbreaks should this occur after restoration is complete

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Ways Forward

- Specific, well worded policies - flexibility
- National guidance and lead – NPPG / HS
- A national issue - Scottish Government
- Recognise the resources - minerals maps
- Consciousness raising - geodiversity
- Local liaison – local benefits
- Share understanding through case studies

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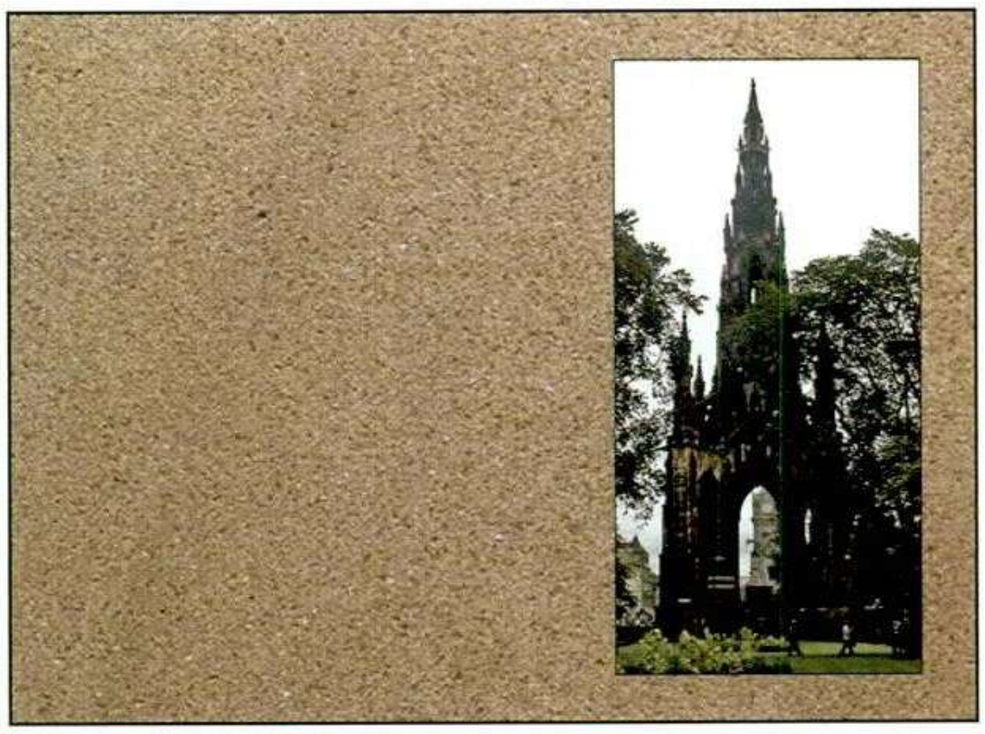

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Binny Sandstone

Quarried since 1794

Transported to Edinburgh from 1822 by the Union Canal, and by railway from 1842

Pale yellowish brown, medium grained rock and comes from the Lower Carboniferous period

Edinburgh buildings: the former General Post Office, Donaldson's School for the Deaf, Queen Victoria on the Royal Scottish Academy, "The Dome"

"a very nice material, probably not quite so durable as Craigleith but less costly to work and of better colour; for ornamental carving it is particularly good"

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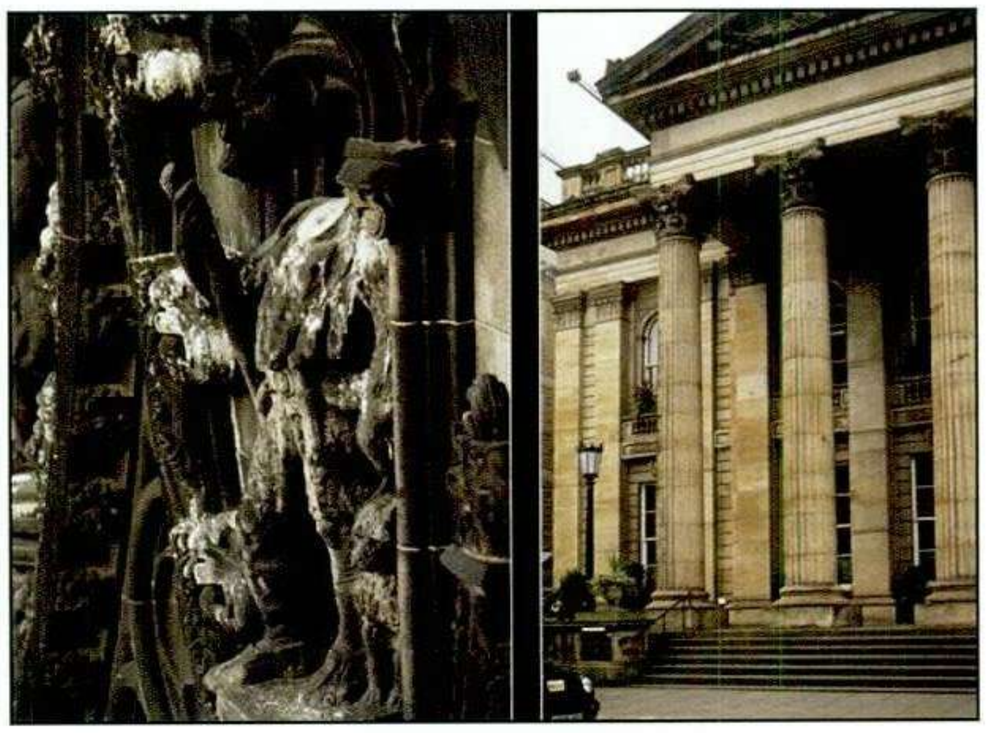

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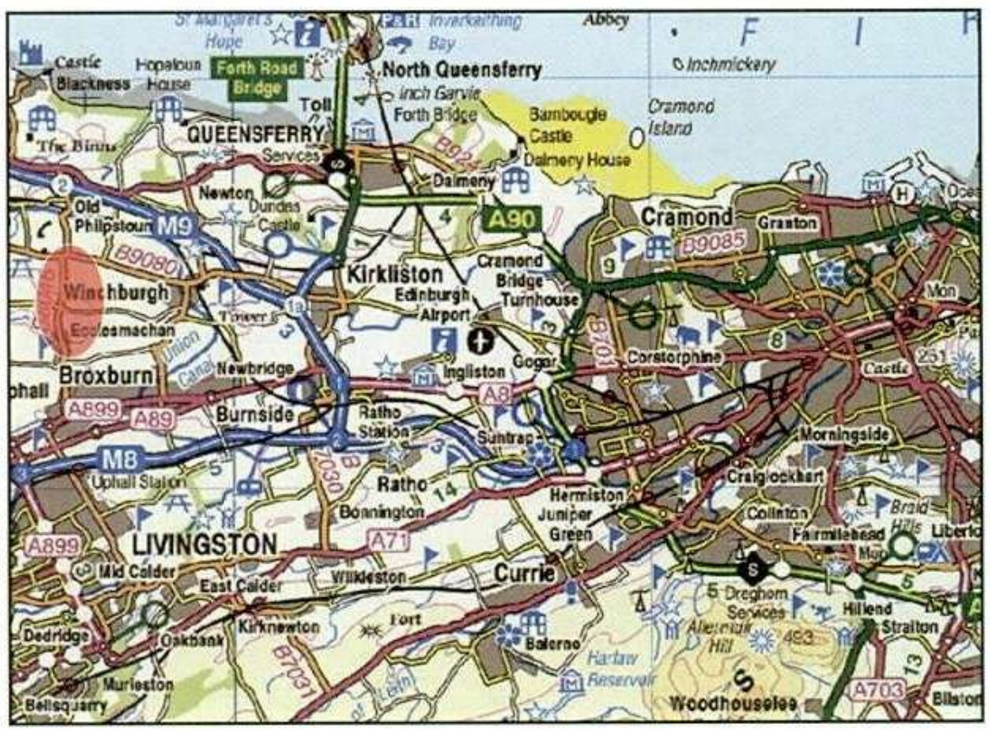

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Site

- 0.1 ha of grazing land
- 150 m west of nearest houses
- Within an area of Great Landscape Value
- Close to listed building

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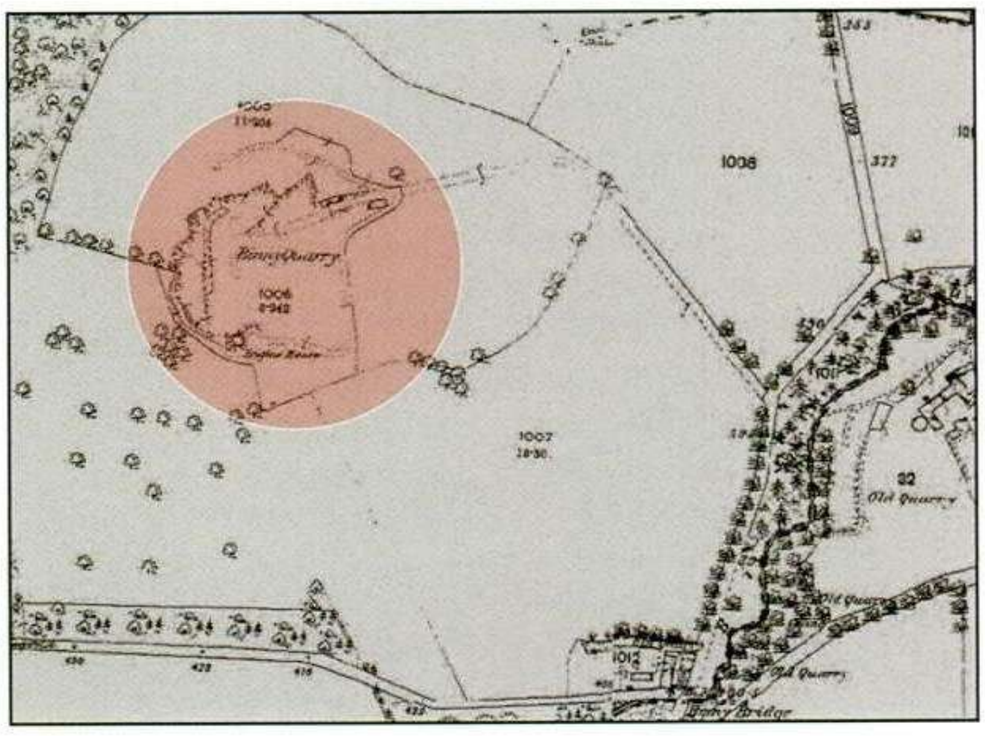

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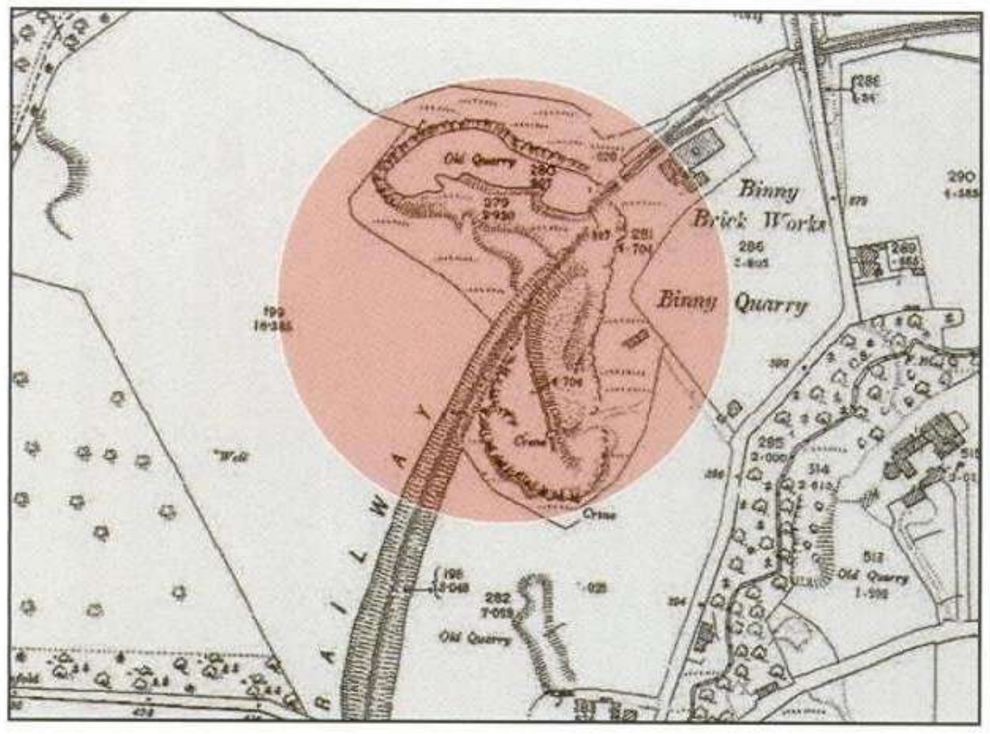

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Proposal

- 10 years ago
- Small extraction area (20m x 15m)
- Extracting 450 cubic metres
- To supply 75 cubic metre need
- 9 week project with 4 weeks extraction
- Blocks to be transported to store area
- Onward transportation to stone yard
- 3-4 return lorry movements per day for 10 days
- 8 am - 5 pm working per day
- Land to be reinstated to grazing

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Local Liaison

- Consultation with local residents and Community Councils
- Applicant's agent met local representatives
- Two letters of objection relating to noise, dust, public health, disturbance of habitat and vibration
- Some unfortunate press coverage

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Consultations

- Environmental Health analysis of predicted noise levels confirm unlikely to be intrusive
- Vibration would not occur as blasting will not take place
- Dust extractors to be used on drills
- Drilling in a location unlikely to cause dust
- Highways happy with small number of movements
- Applicant agrees to meet expense of any damage to roads

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Policy Considerations

- Planning policy would not normally have supported this. However it was deemed acceptable in terms of:

- Limited and temporary nature
- Local acceptance
- Highways and Environmental Health
- Scott Monument factor – an exception
- HS/HLF requirement and support
- Subject to legal agreement

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Section 75 Agreement

Occupier, Developer and Planning Authority enter into legal agreement on:

- Maximum tonnage to be quarried
- Size of lorries and route to be used
- Restriction of use of stone to Scott Monument only
- Excess stone to be stored and used for approved purposes only
- Future quarrying on the site restricted

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Planning Conditions

- Duration
- Amount
- Hours
- Control of noise and dust
- Timing and frequency of lorry movements
- Site restoration
- Tree planting

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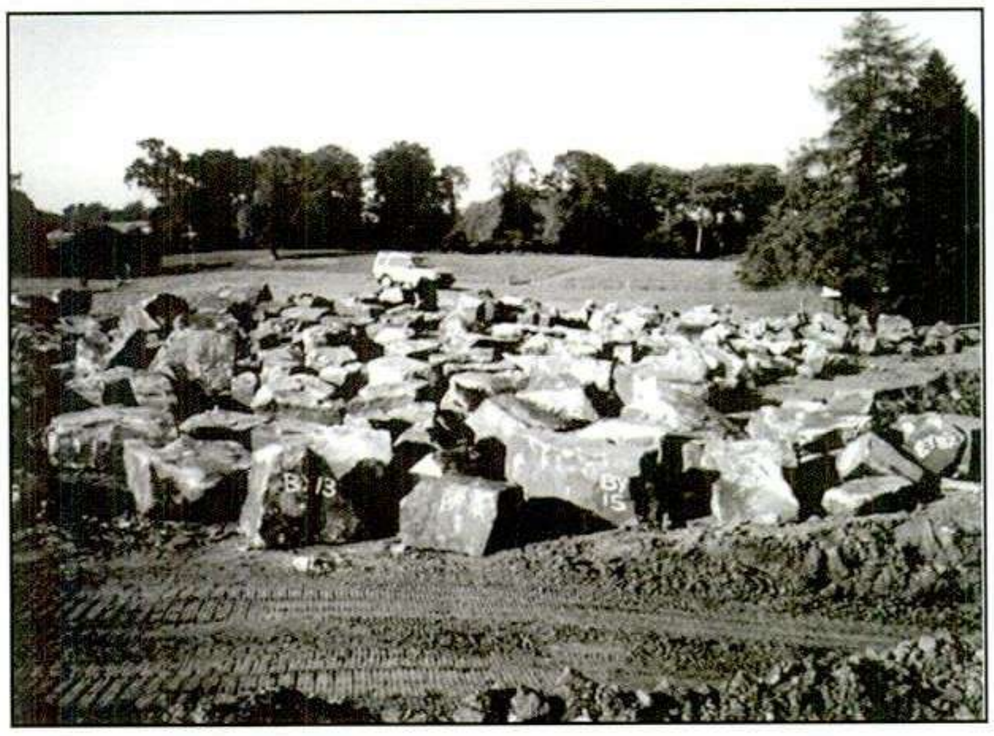

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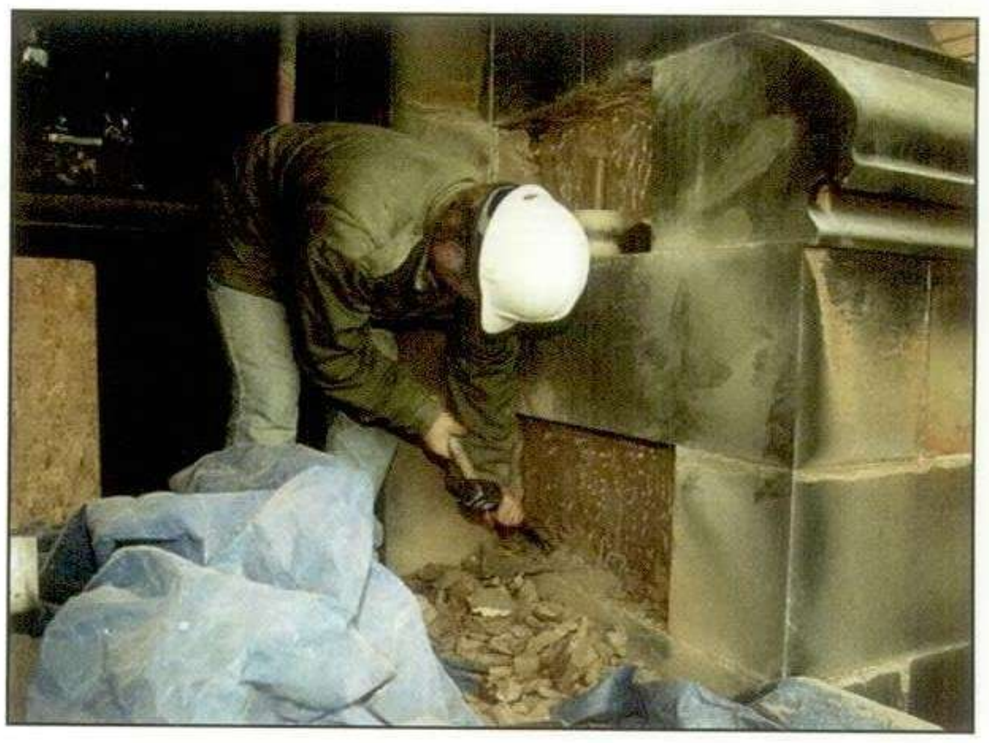

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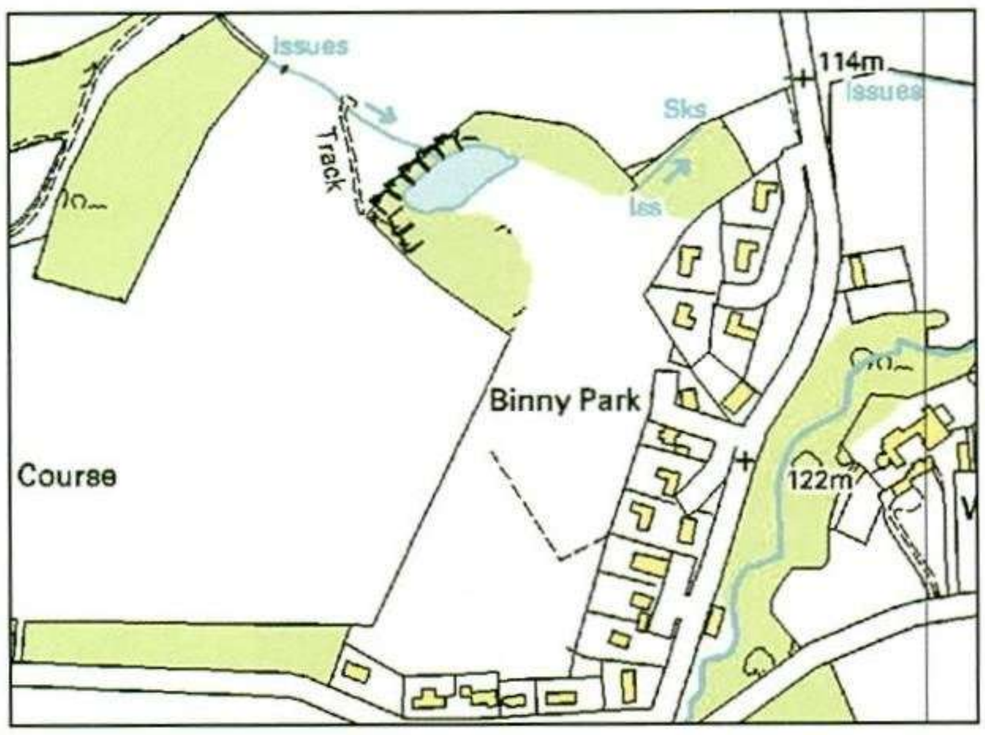

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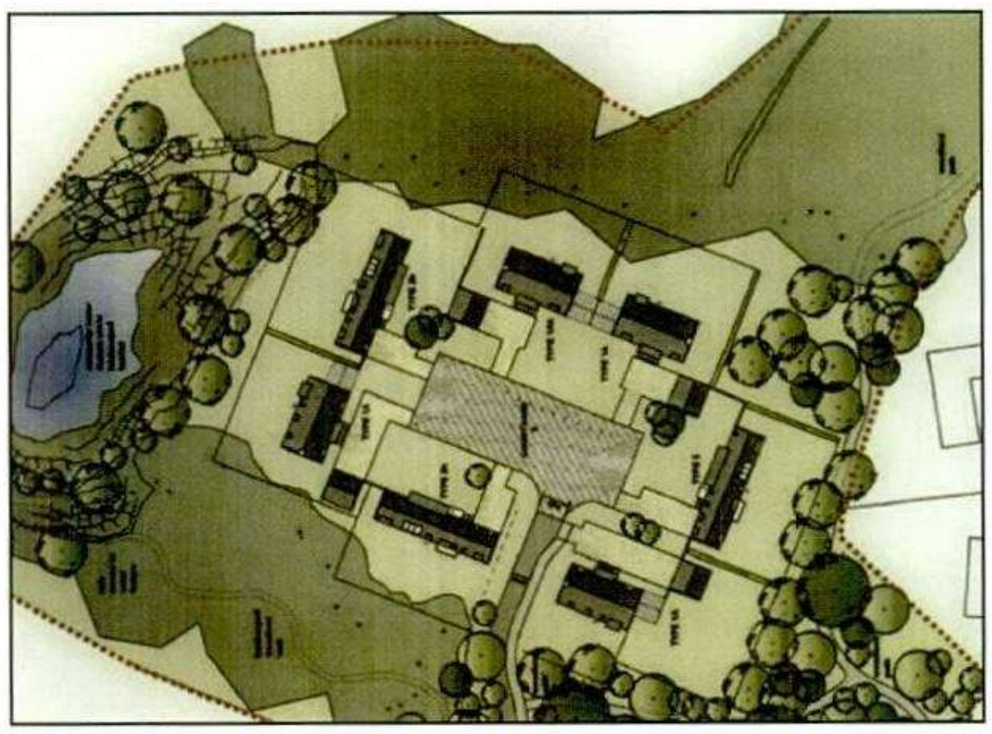

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SOURCING LOCAL STONE: PLANNING DILEMMAS

Miriam Frier, Orkney Islands Council

Orkney is made up of around 70 islands, with 17 inhabited and a population about 19,000. The largest island is Mainland with capital city Kirkwall and 10,000 people live within a 3 mile radius. Although attractive to many how live there the quality of life is rated 2 in Scotland for fuel poverty and low average earnings. The most northerly city with that status in the UK it is home to the Category A St Magnus Cathedral. Belongs to the people of Orkney work began in 1137 with the construction of the west end, the nave was finished in the 15th - late 16th century. The stone used was Eday yellow with Red from Eday and the Mainland. In looking at some of the issues pertinent to sourcing local stone in Orkney they translate elsewhere.

With an introduction to some of the stone buildings we have, some of the issues and challenges we face result from the past and present planning policy and currently there is a need to try to find a way forward.

There is 1000's of years experience of building in local stone on the islands with the oldest house in Europe aged at 3500 BC and the world heritage site with Skara Brae. There are also some more recent stone structures.

Traditionally the Orkney landscape was littered with scattered single storey buildings and large farm houses with various stone structures particularly in the roof styles of slabs with smaller flags and (thick) slates being used This reflects the availability and type with Westray and North Ronaldsay showing the use of larger flags in particular but during the early 20th C Orkney started importing Welsh slates with greater numbers coming in during the 1870's and 1880's

In the towns more harling is used particularly where there is a SW exposure and the use of soft sandstone.

There are currently some good and now some not so good examples of the use of stone. Many bad examples result from a lack of information and conservation expertise

The present planning policies which is being reviewed, has a presumption towards new build with a replacement house constructed (1 for 1) if it can be proven that the old one was used as dwelling during the last 50 years. This results in the old structure being removed - losing any history. Related issues involve how to-

- utilise the old
- deal with low income and high fuel poverty
- translates policies to avoid loosing the vernacular

So is this because of a lack of raw materials? Is it just planning policy? So is it new build because we don't have raw materials that respect the Orkney landscape and give some sense in the build of where we are?

On the mainland there are four main quarries, with a small quarry taking stone for repairs to the cathedral. Privately owned Cruaday quarry is the only current source for flags and building stone. There is a stored quantity of slates that are council owned (about to be moved and sorted) – but these are not enough for many jobs providing at best for patching but, all round the island there are examples of slates and flags laid out in farms that could be utilised if a mechanism to pool and store was devised.

A review of the local plan could see a greater introduction of awareness of local materials but ethically this can be difficult to adopt if there is no source of stone able to meet new criteria. This raises the need for education on every level so what we have is looked after properly. General education is required for those living in traditional buildings to avoid picking and pointing and harling removal and to realise the benefits of using the right materials for the right geographic location. This also calls for a raising an awareness of locally sourced materials up the political agenda.

But, there is no good in putting planning criteria in place if no one can do the work and it's too costly or prohibitive for anyone to have the work done. The need is to have stronger guidance where, hopefully, demand will create supply. The related challenge is the limited amount of skilled masons who are dying out with no one new following on to learn the trades especially as new timber building is becoming so prevalent,

In Stromness the originally stone taken from the shore and placed on yules and taken round the coast of the Hoy sound and used for roofing. With the need for new sources, importing Caithness slate costs approximately 3 times as much as Welsh slate roof

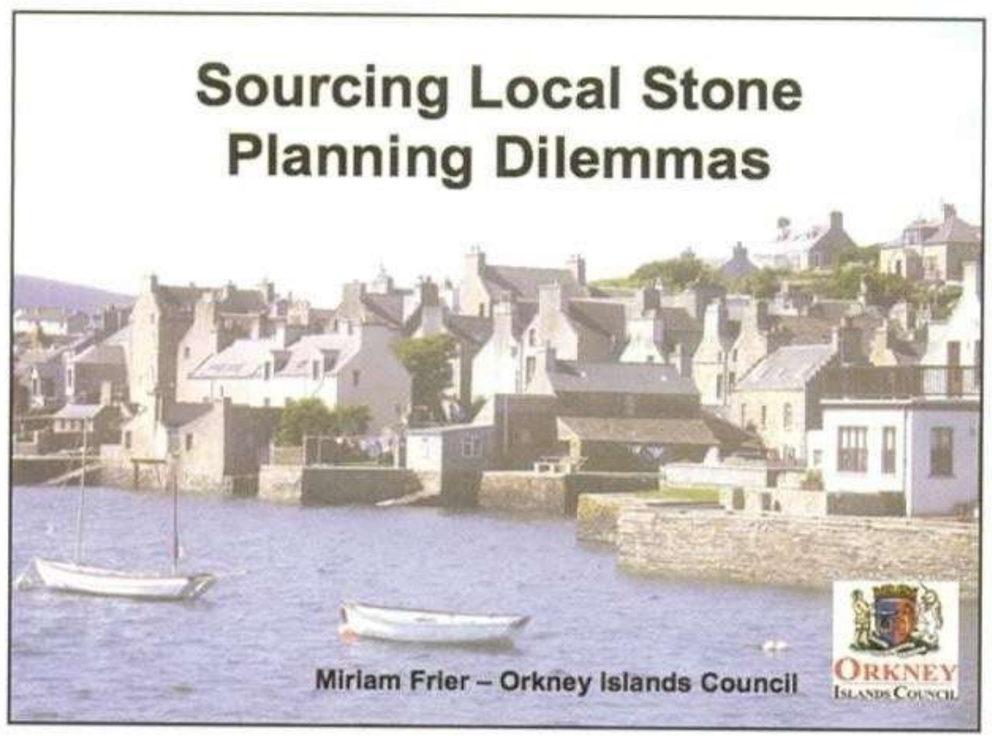
Some positives moves now occurring but grant funding support is a must to achieve progress. There are skills on the island but more are required. Having just got through stage one of a Heritage Lottery Fund bid for Stromness hopefully that will bring in around £3.8m of funding to work on the historic fabric. This could help raise the profile of conservation and overcome some of the issues around the supply of the right materials in Orkney.

To be successful policy working needs to go in hand with a general education to bring about a cultural change explaining how to use materials, explore opportunities to open quarries so we have the right materials for the location, and recycle those already around to give a sustainable approach that will have a positive impact on the Orcadian environment.

Flagstone Quarry, Orkney

SOURCING LOCAL STONE PLANNING DILEMMAS

Miriam Frier, Orkney Islands Council



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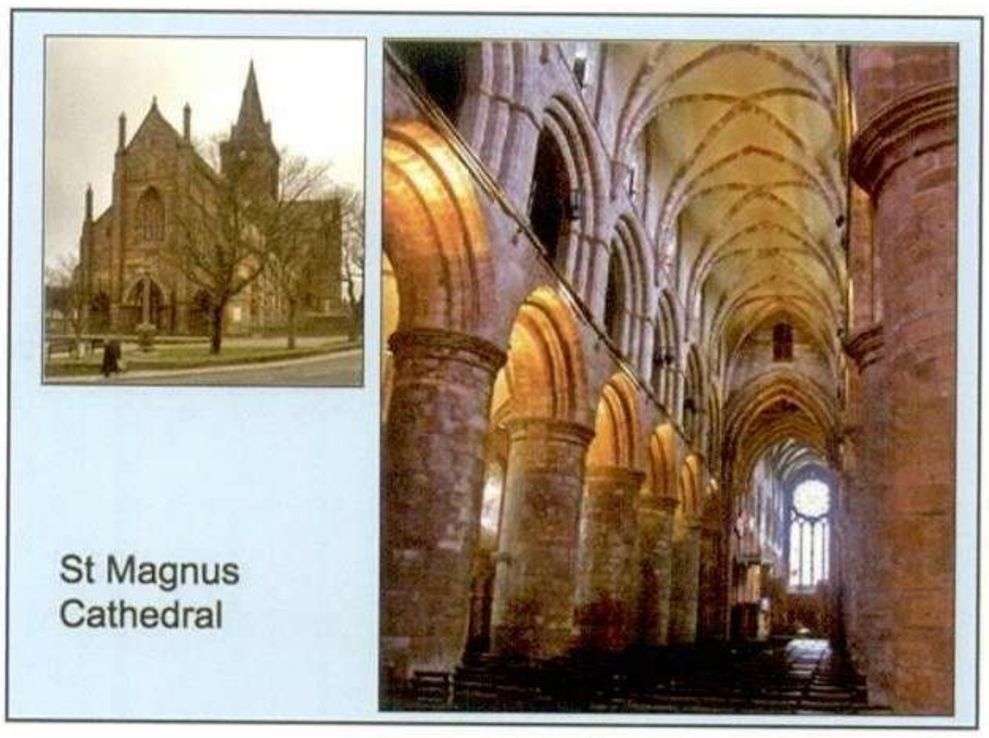

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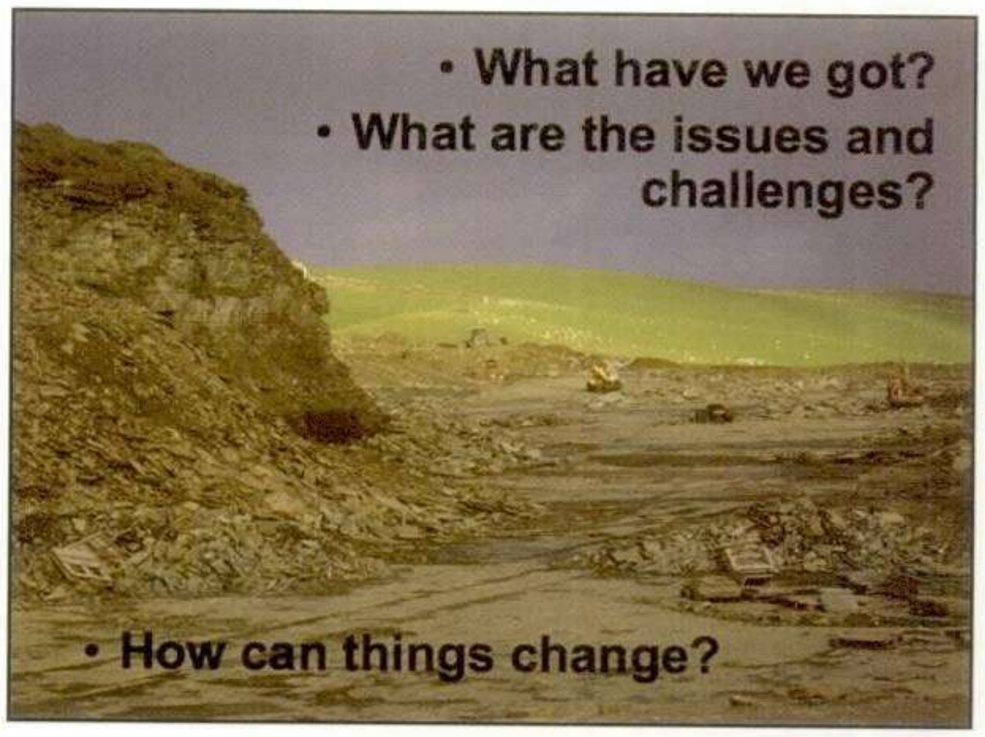

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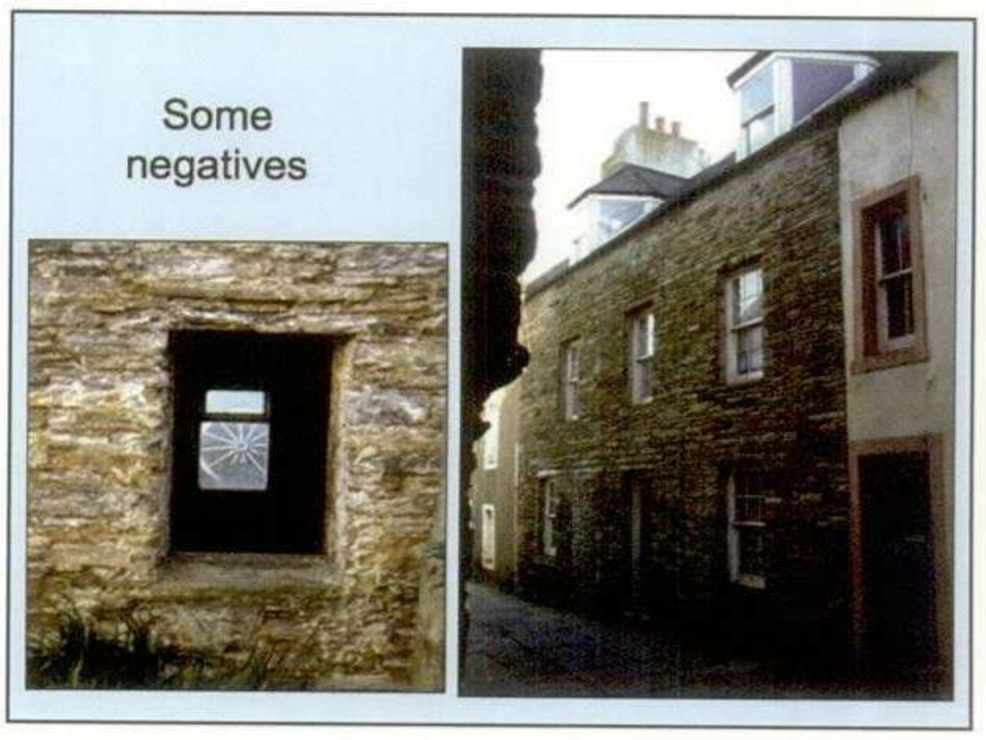

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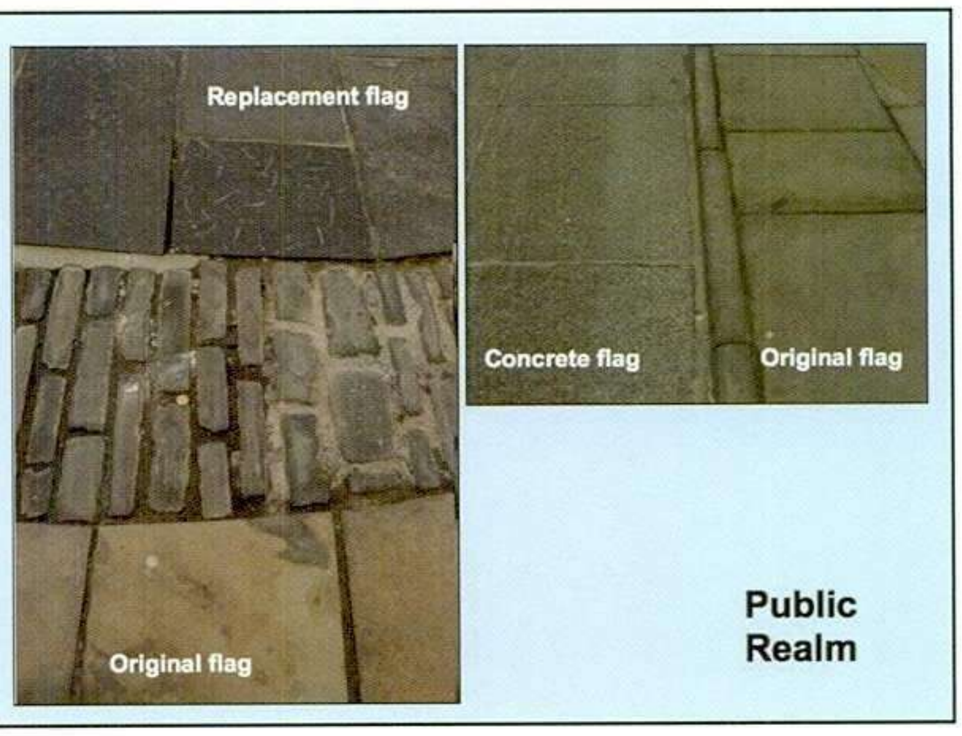

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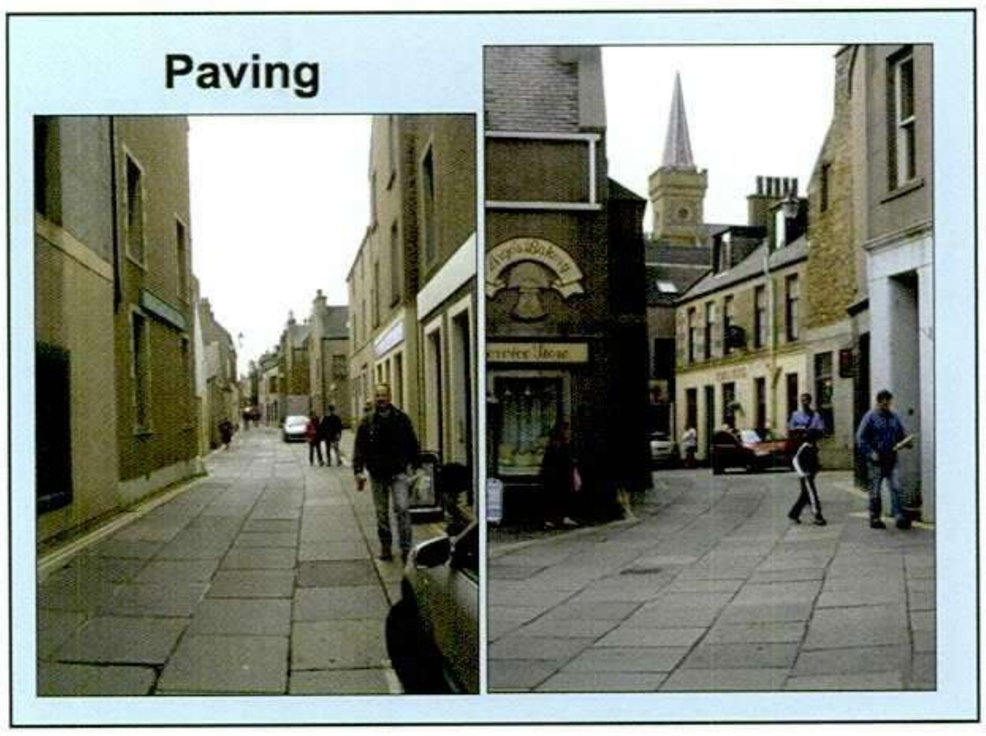

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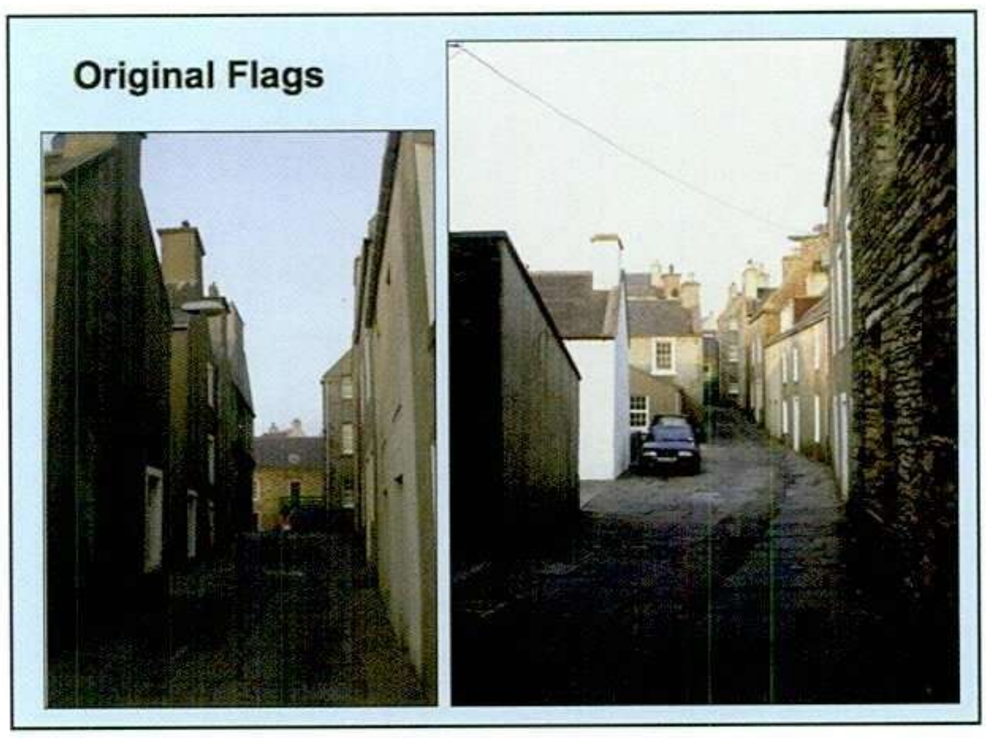

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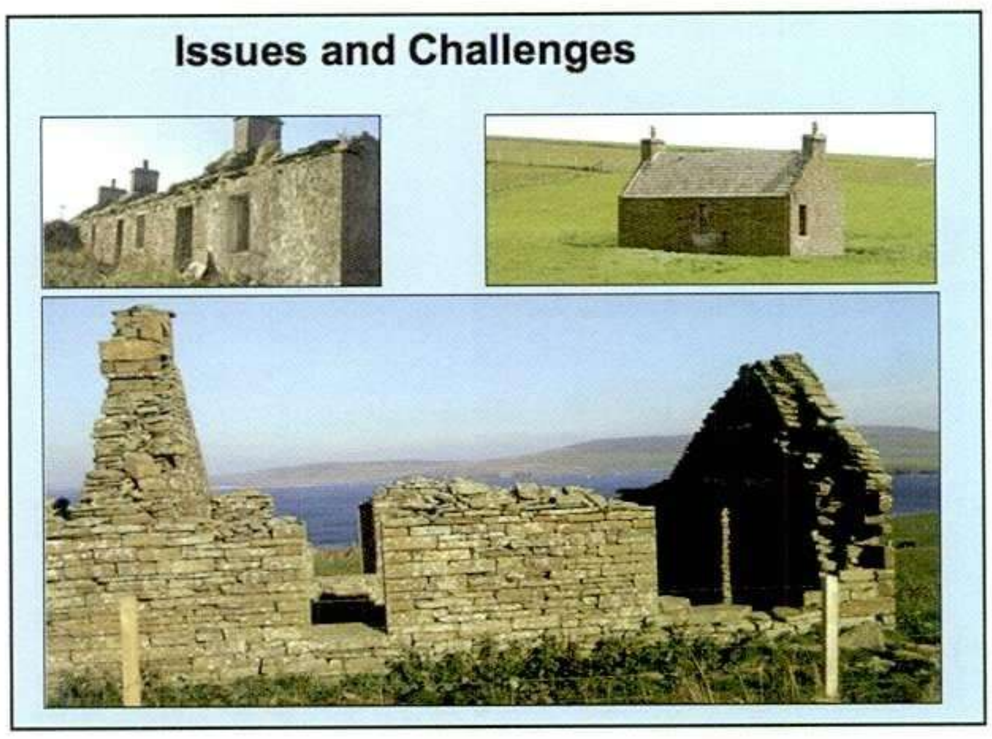

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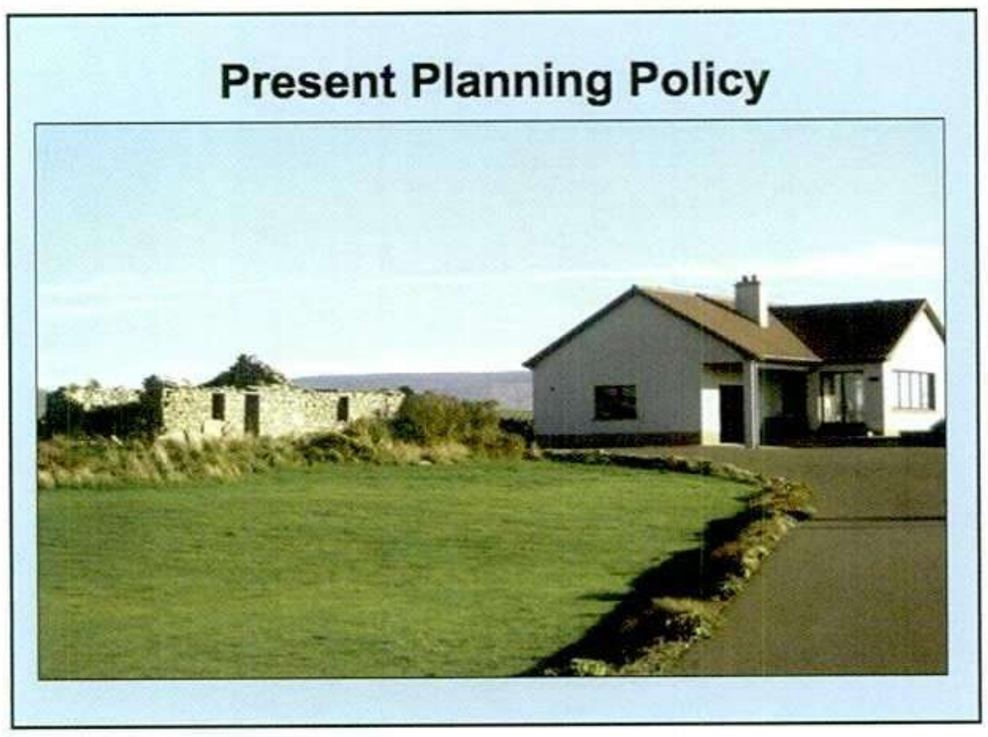

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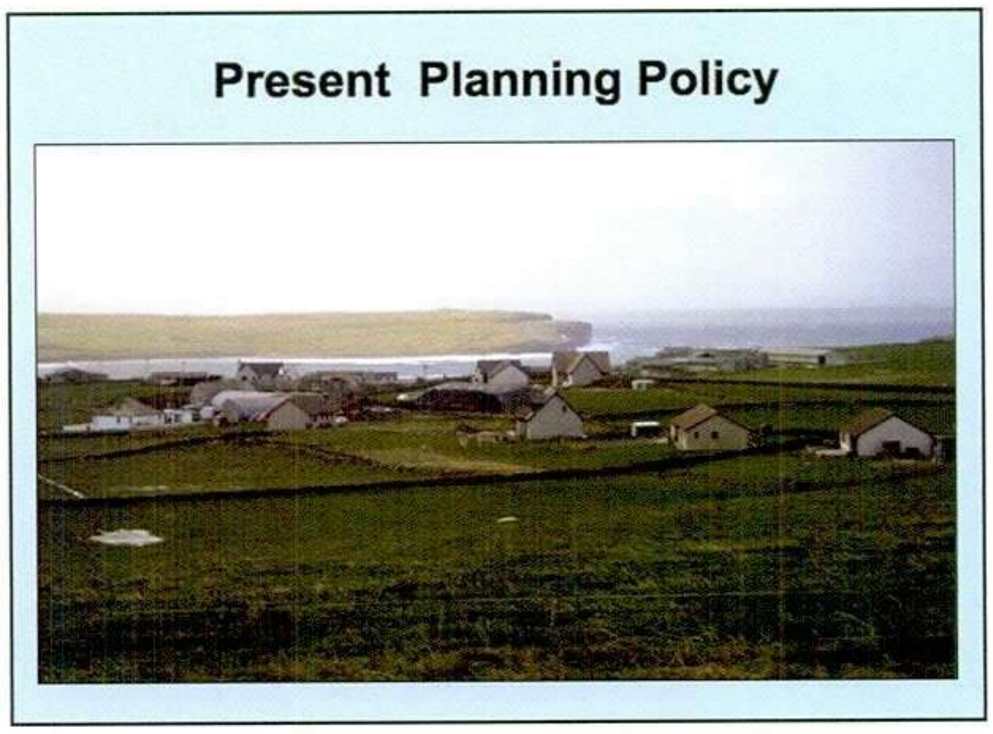

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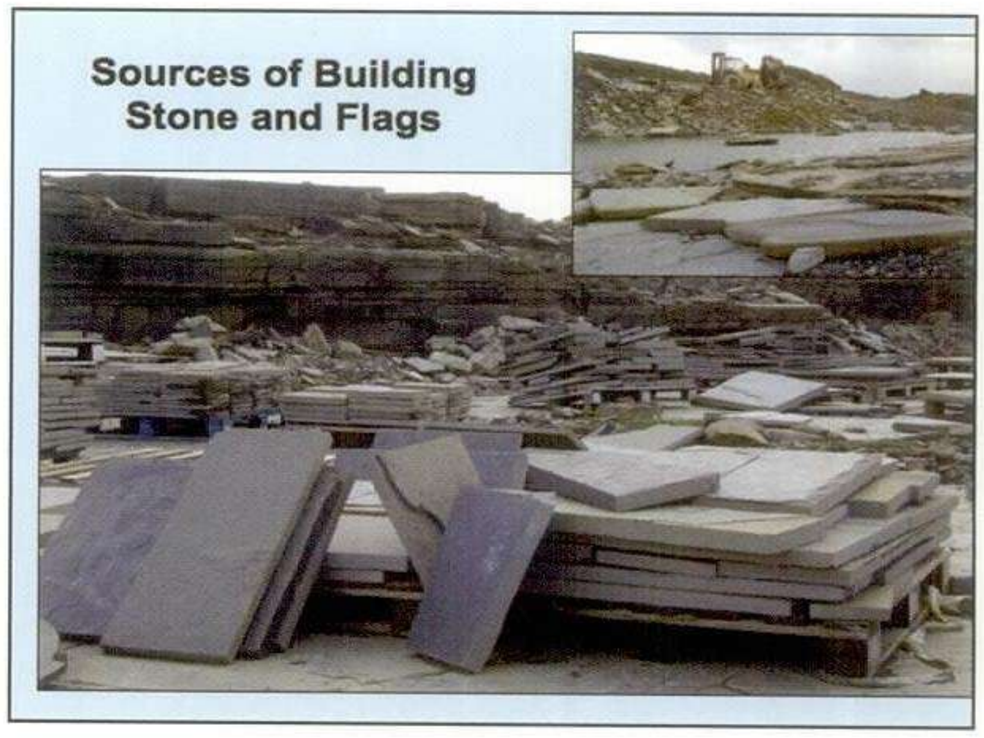

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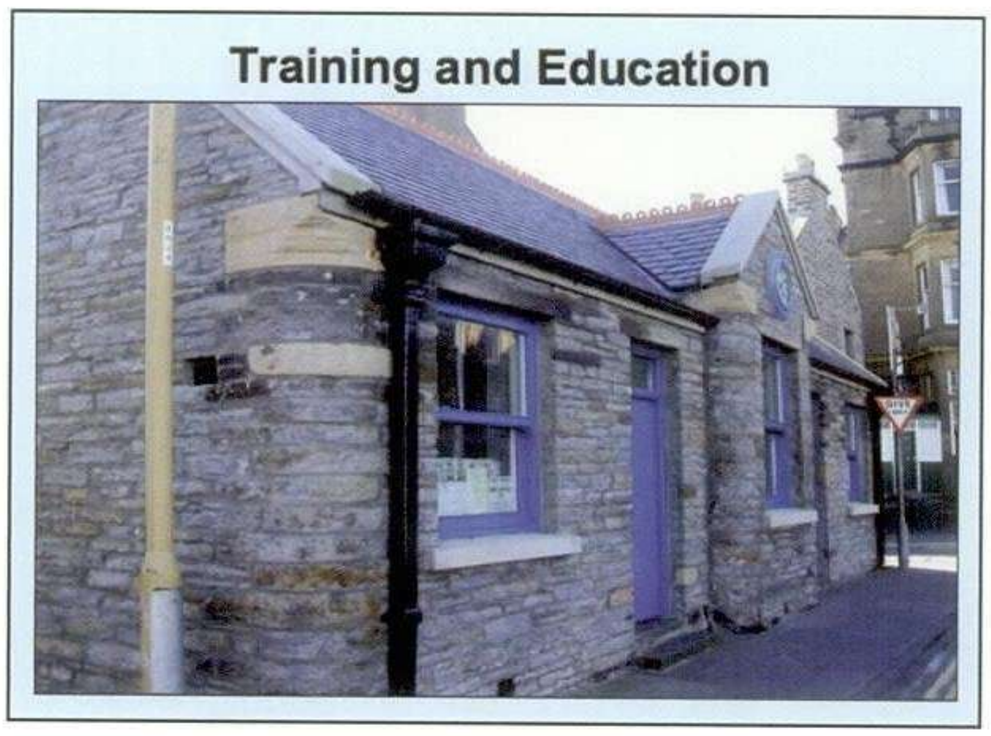

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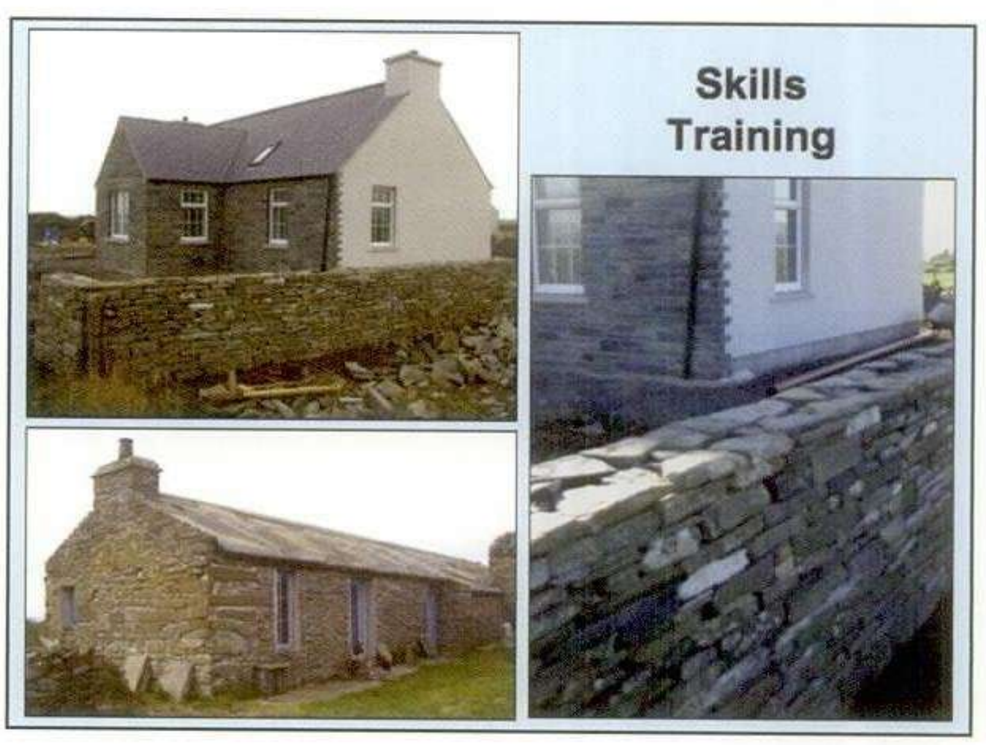

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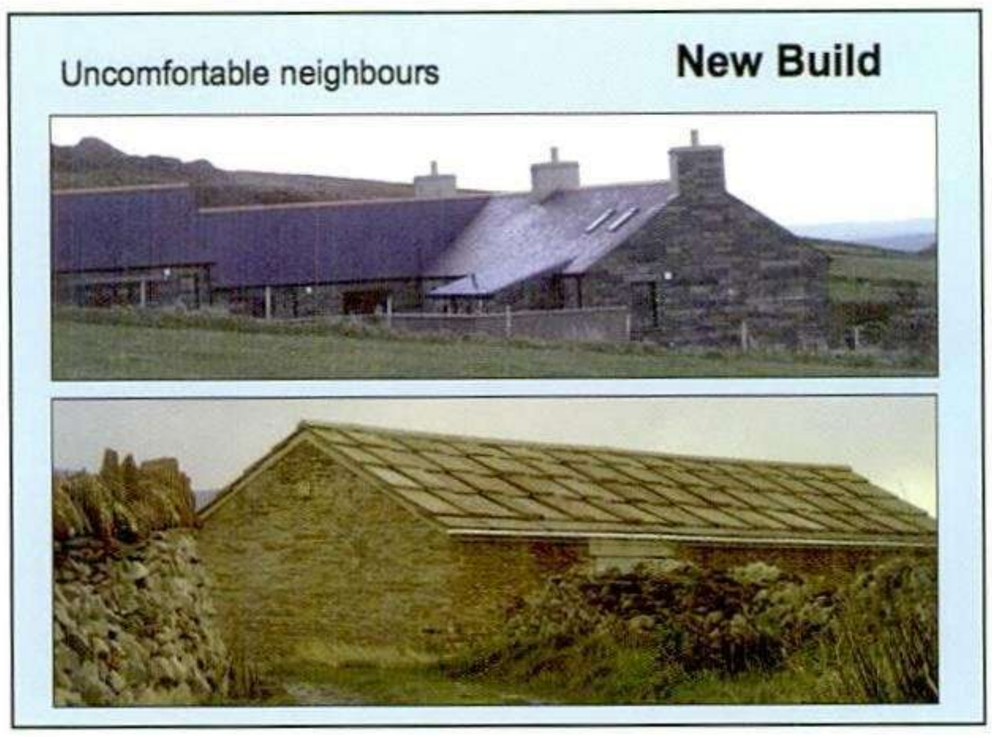
Uncomfortable neighbours
New Build

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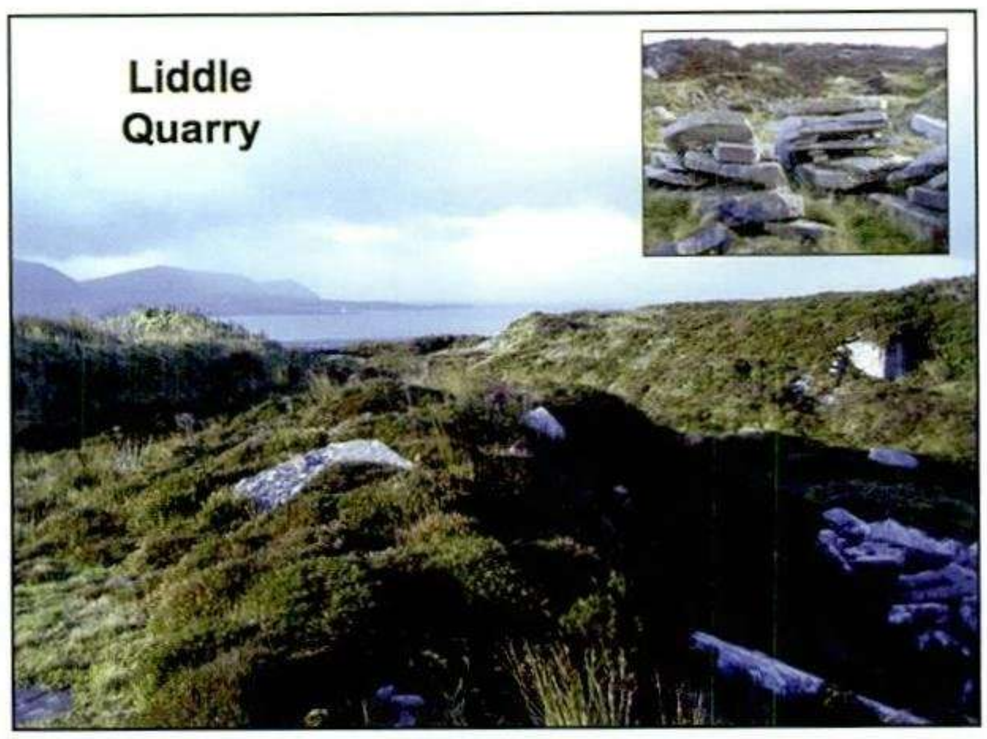
Liddle
Quarry

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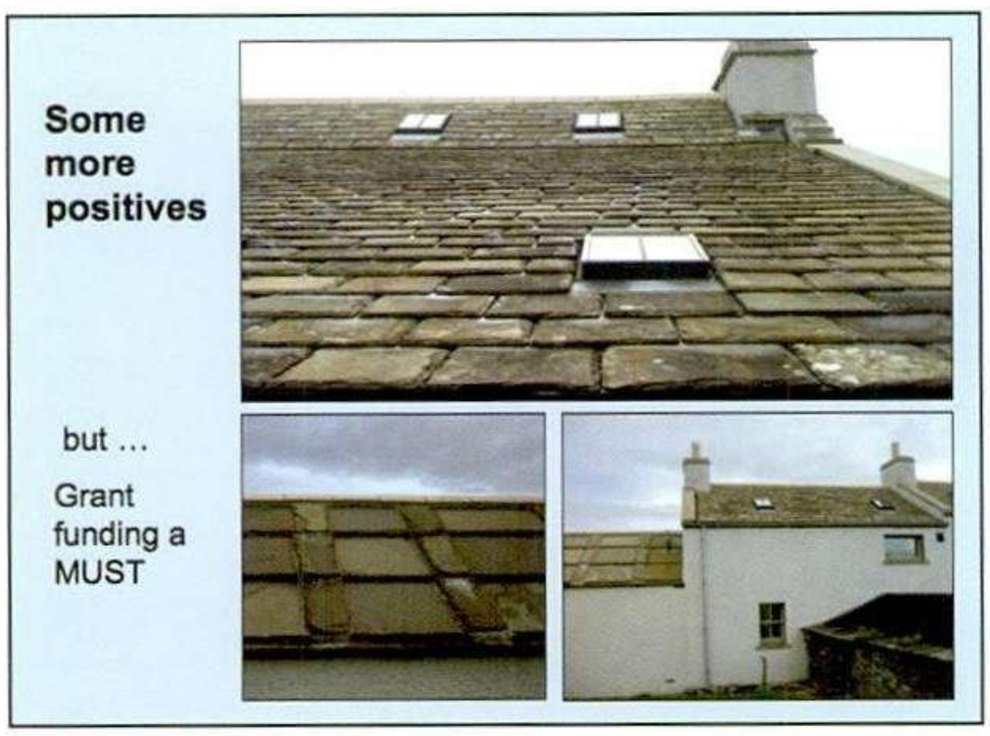
Some more positives
but …
Grant funding a MUST

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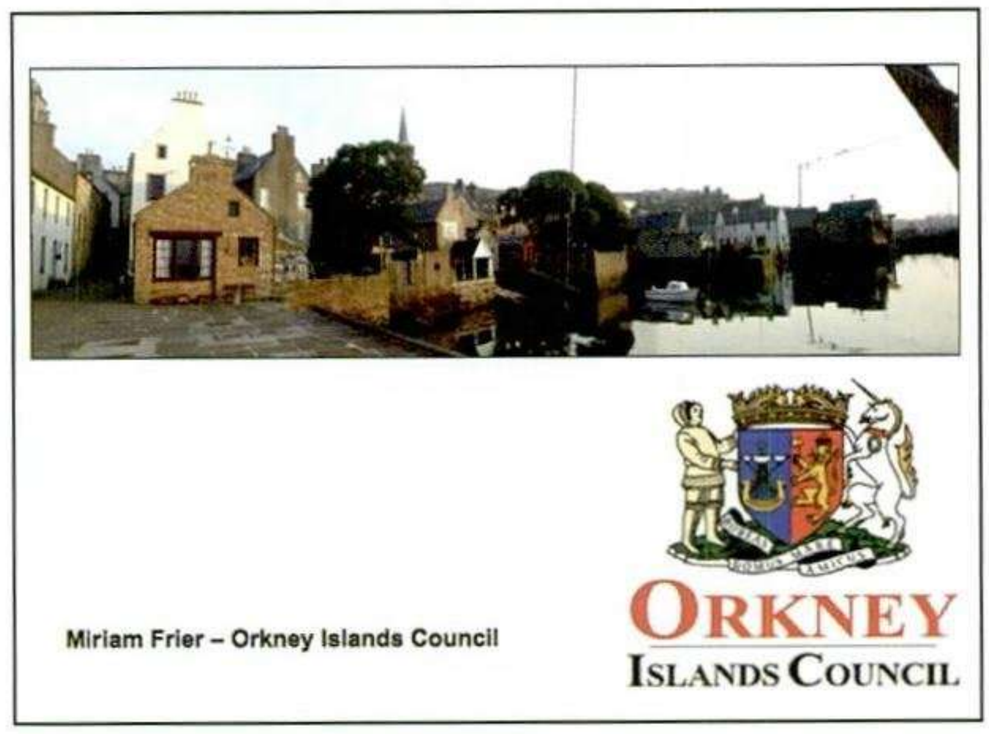
Miriam Frier – Orkney Islands Council
ORKNEY
ISLANDS COUNCIL

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CHALLENGES IN STONE CONSERVATION

Christa Gerdwilker,
Historic Scotland Conservation Centre

Scotland's built heritage is a reflection of its complex and varied geology and environment. It is therefore not surprising that the conservation problems commonly encountered by the Historic Scotland Conservation Centre are equally diverse.

The most common treatment requirements are cleaning, desalination, consolidation, replacement/replication and preventive conservation. A number of brief case studies are shown to illustrate the treatment approaches to these problems taken by Historic Scotland's stone conservators. By considering any action as intervention and therefore assessing each need for conservation individually, wholesale and potentially damaging treatments are avoided.

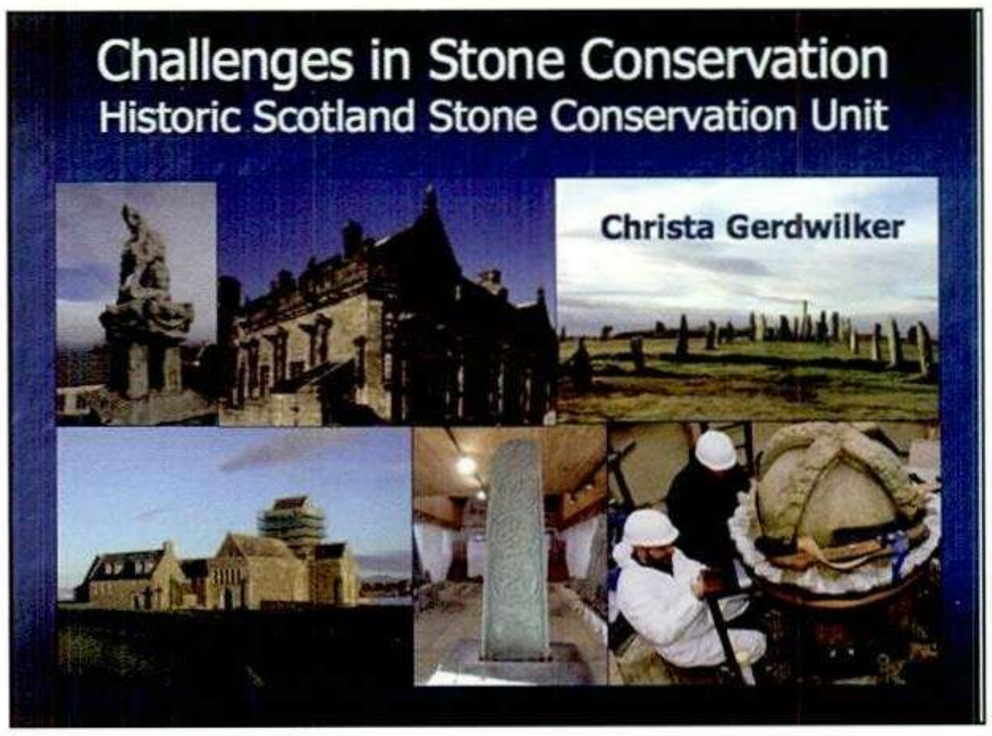
Low impact cleaning was undertaken at Stirling Castle. The removal of pollution crusts and graffiti is often more complex. Salts cause extensive deterioration problems which are often difficult to resolve. The lack of specific consolidants and non-destructive testing methods means that consolidation can only be carried out locally. Replacement and the replication of stone is discussed and illustrated in case studies from Huntly Castle and Linlithgow Palace fountain.

Skelmorlie Aisle houses a stone memorial below a painted timber ceiling while being located in an historic graveyard. The monument suffers extensive deterioration and a team of experts has been assembled to try and combat the moisture and salt intake into the monument by preventive means. This illustrates the holistic approach required in dealing with the conservation of historic structures.

Stone erosion of a moulded capital.

CHALLENGES IN STONE CONSERVATION

Christa Gerdwilker
Historic Scotland Conservation Centre



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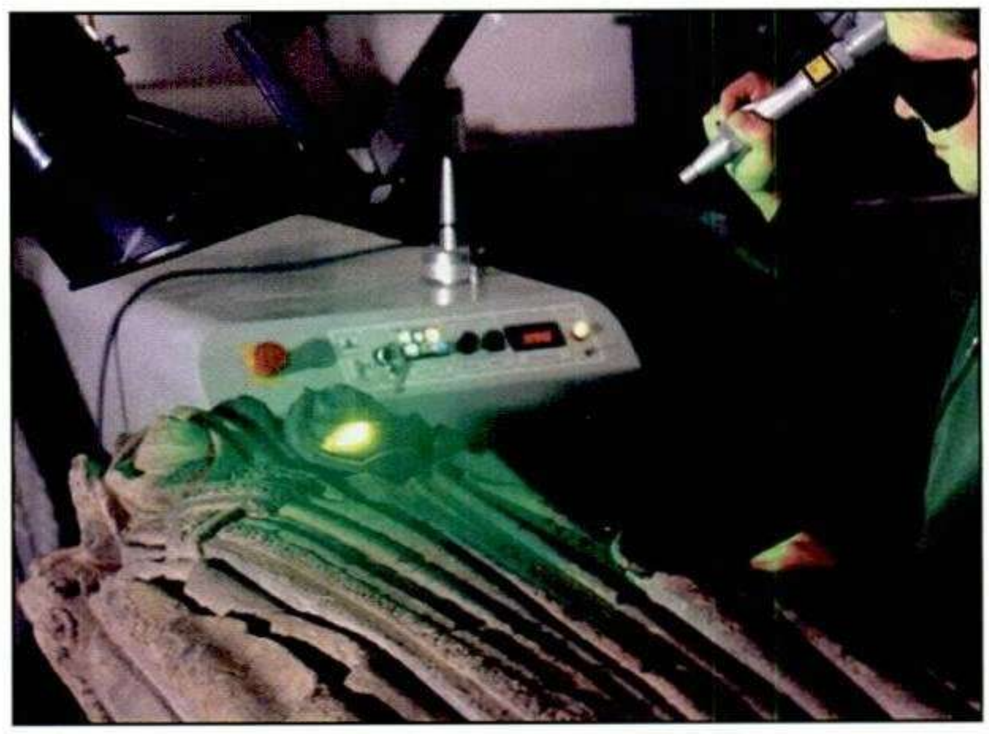

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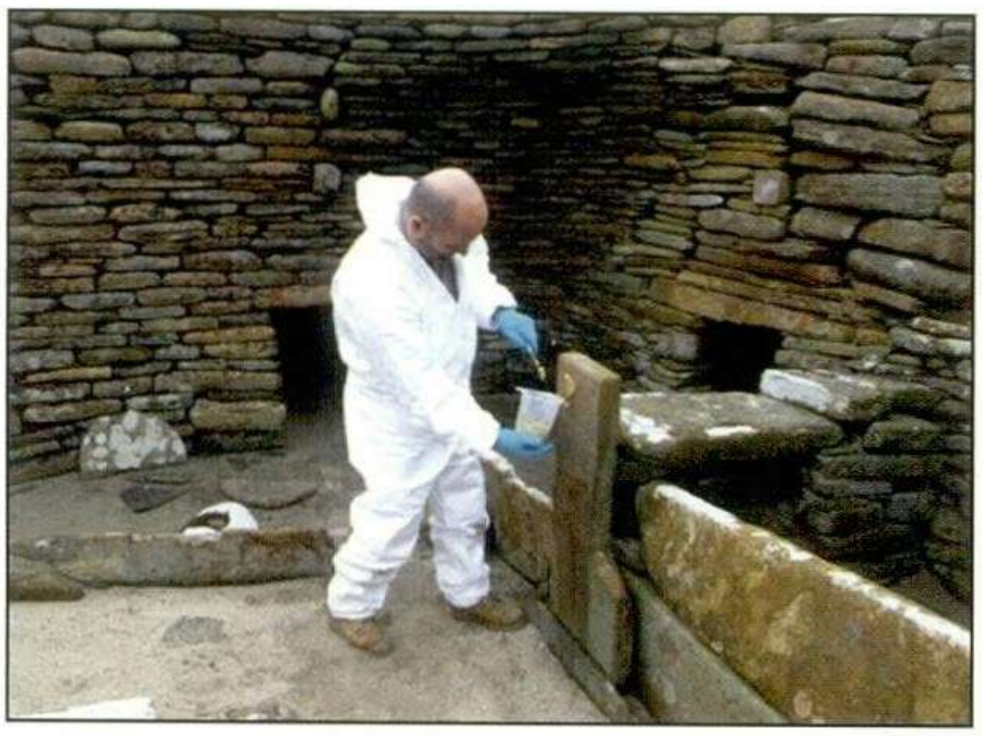

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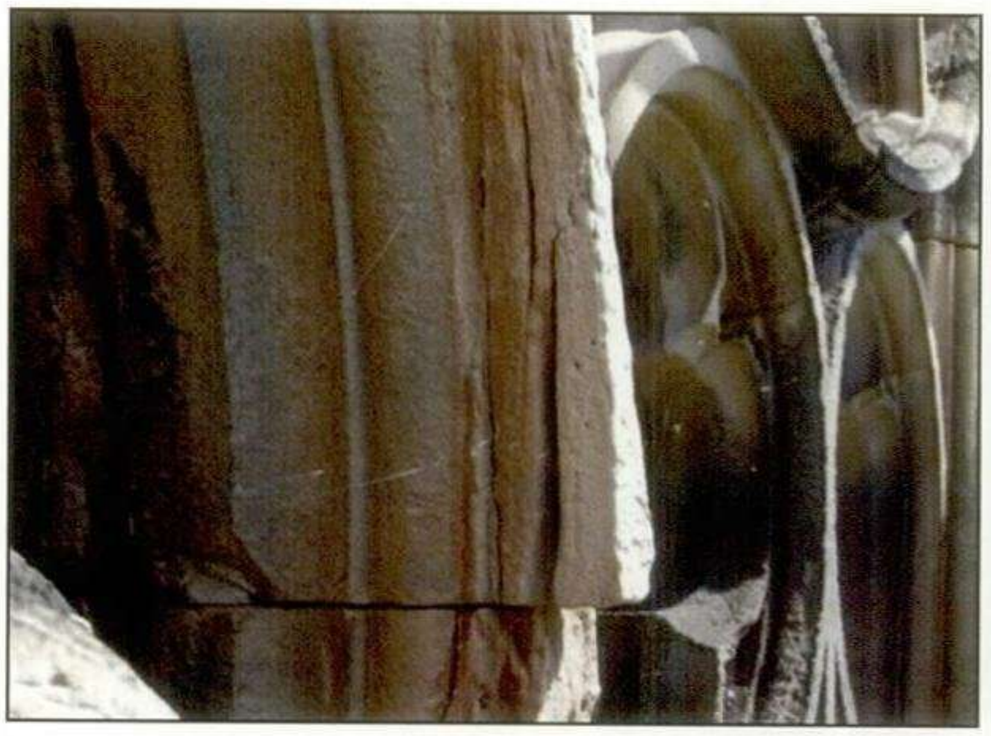

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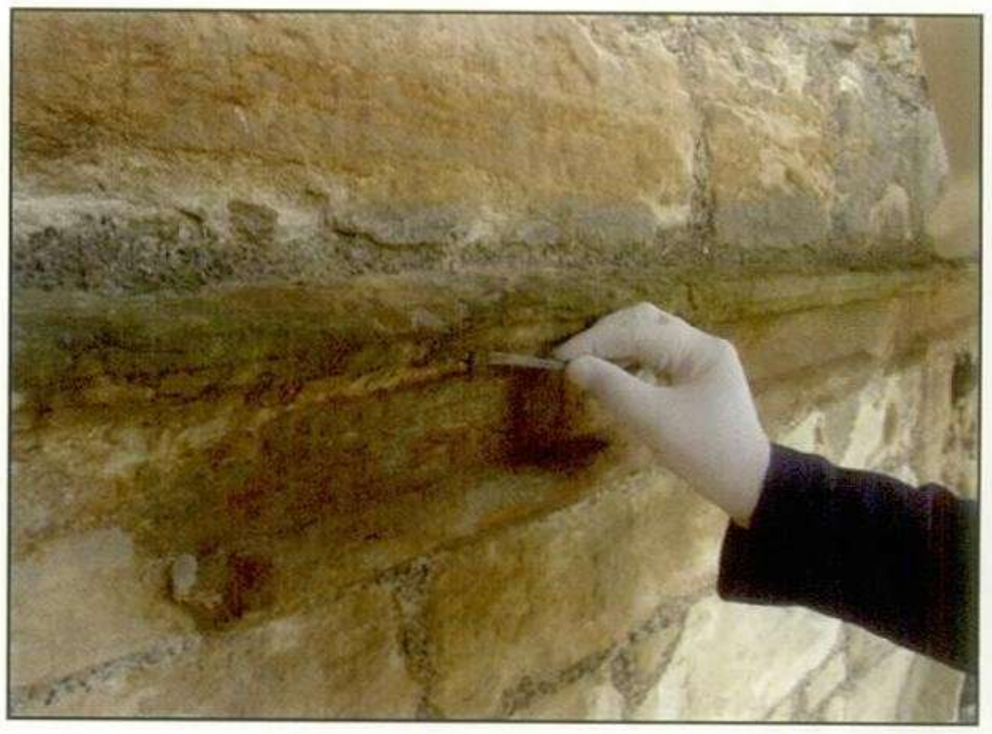

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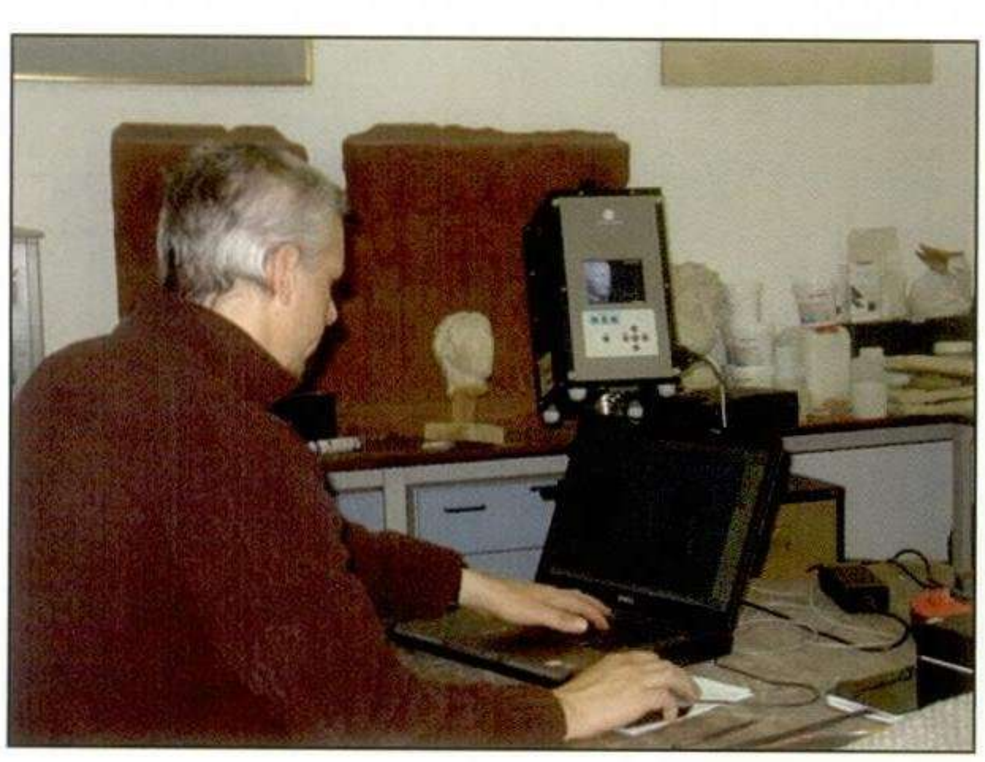

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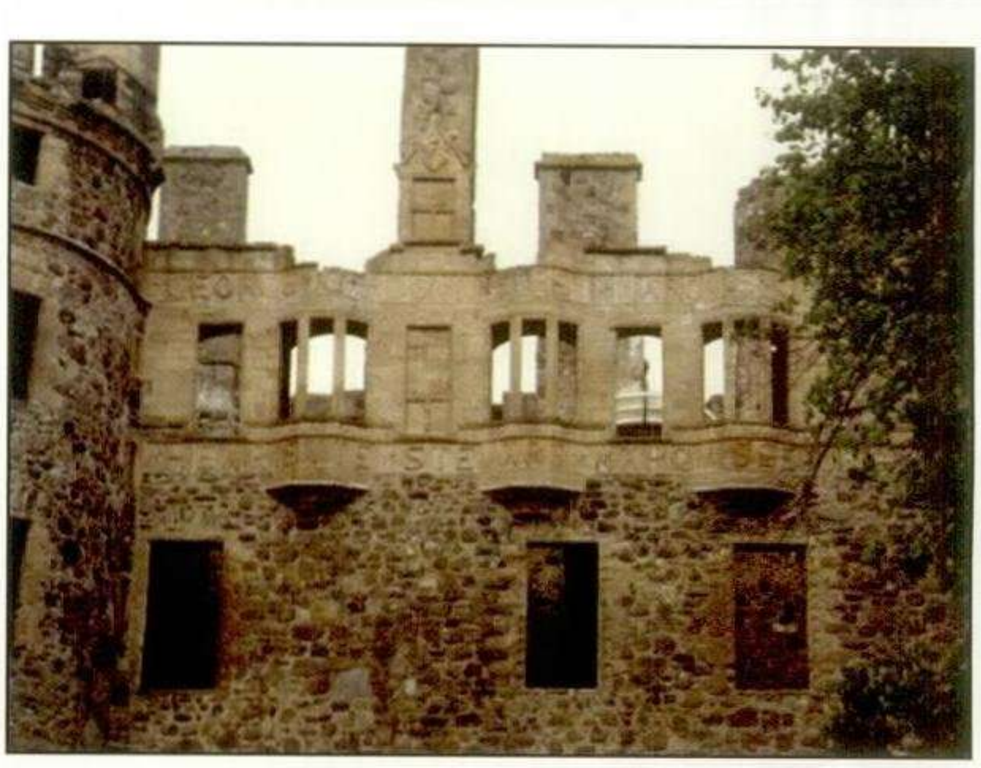

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Original Stone
1930's replacement stone
Concrete
Other replacement stone

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THE POTENTIAL FOR NATURAL STONE IN CONTEMPORARY ARCHITECTURE

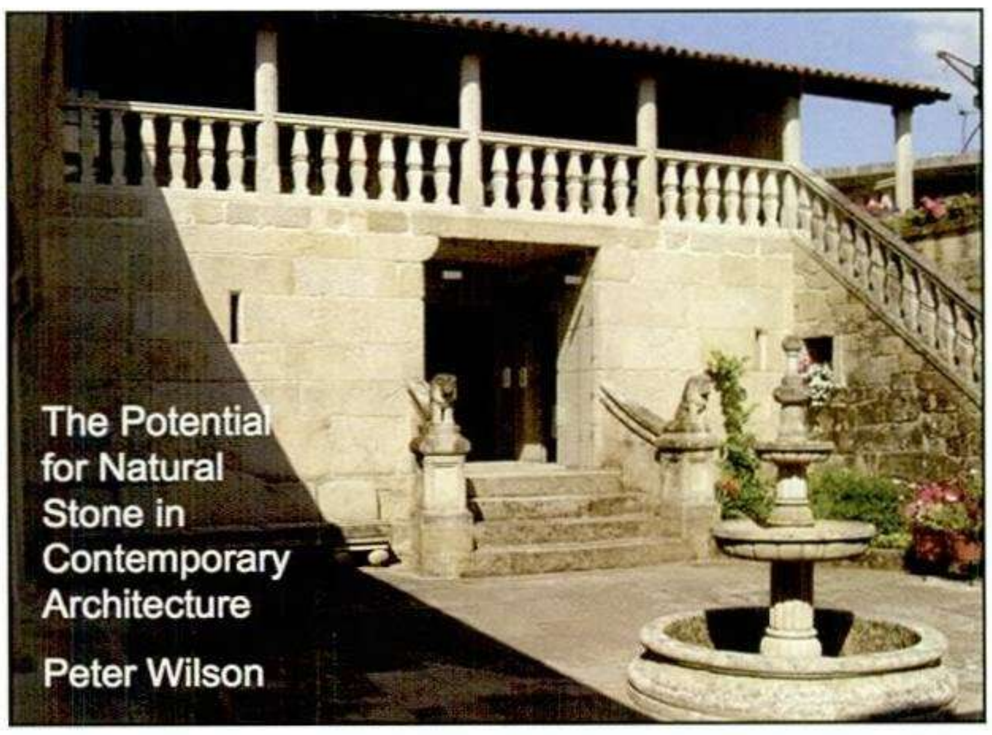
Peter Wilson, Napier University,

There are some wonderful examples of stone used in modern. Spain has used stone very successfully in many modern buildings. However, stone is frequently applied and detailed inappropriately. The need for proper training in materials and sourcing traditional materials is fundamental to new build design. Essential too is learning from traditional buildings to gain an understanding of how to use these materials appropriately.

Mureo del Prado

THE POTENTIAL FOR NATURAL STONE IN CONTEMPORARY ARCHITECTURE

Peter Wilson, Napier University,



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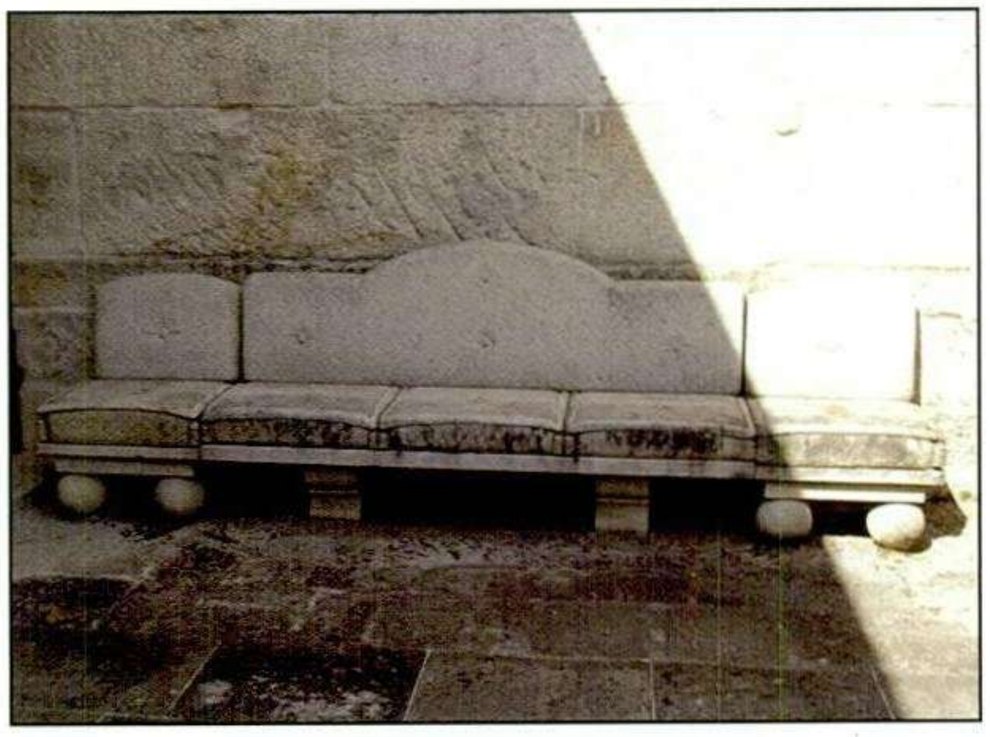

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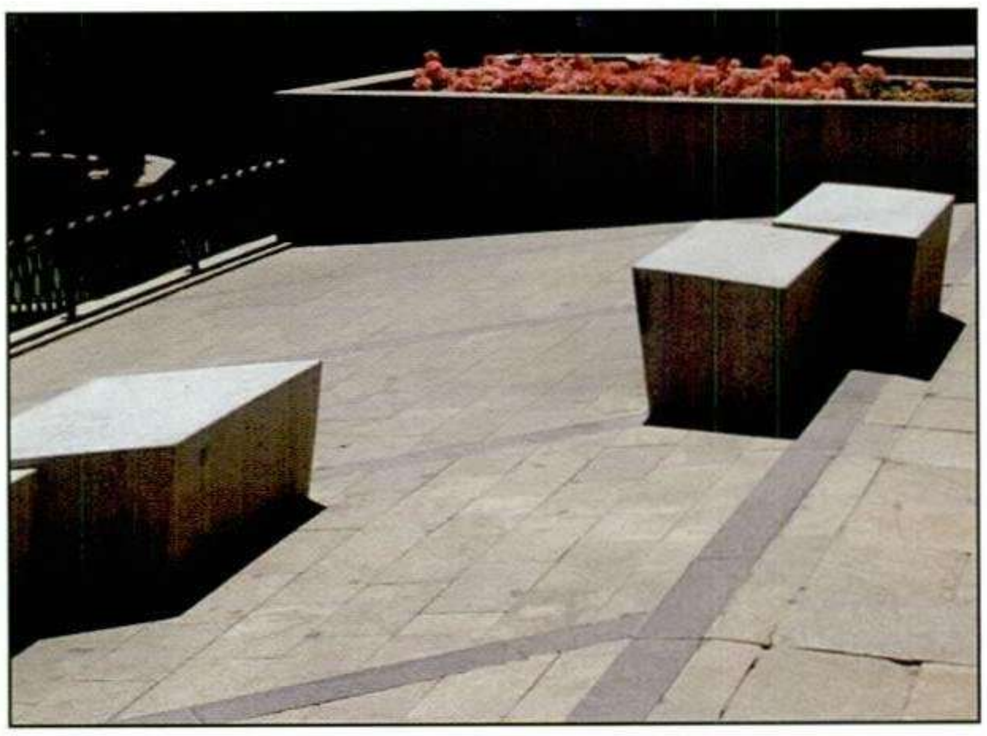

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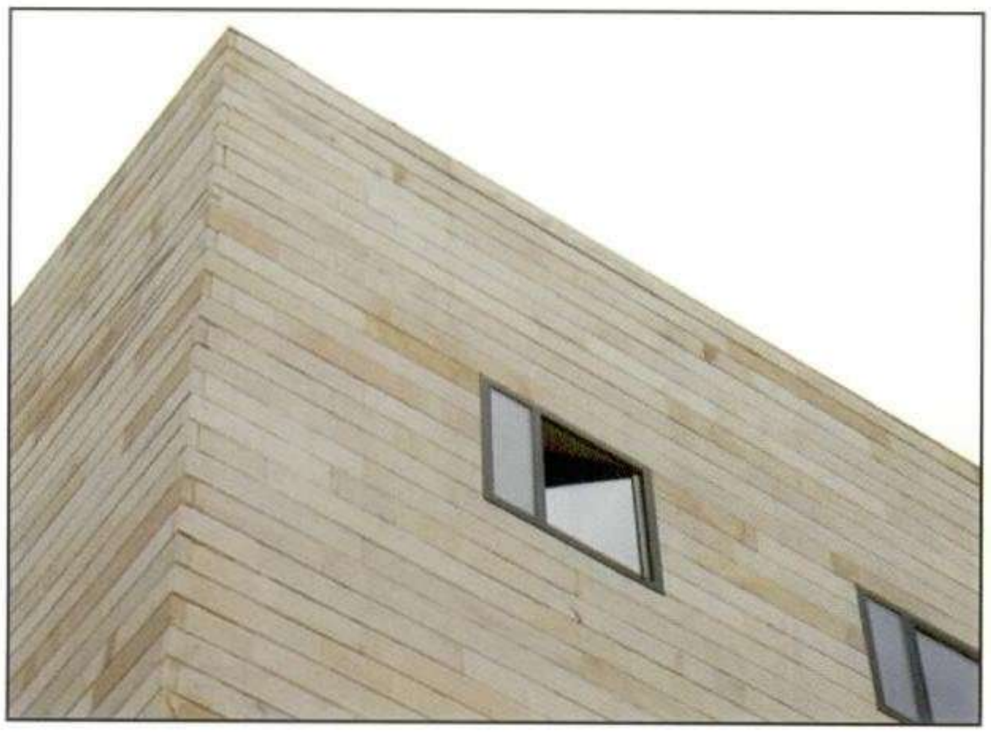

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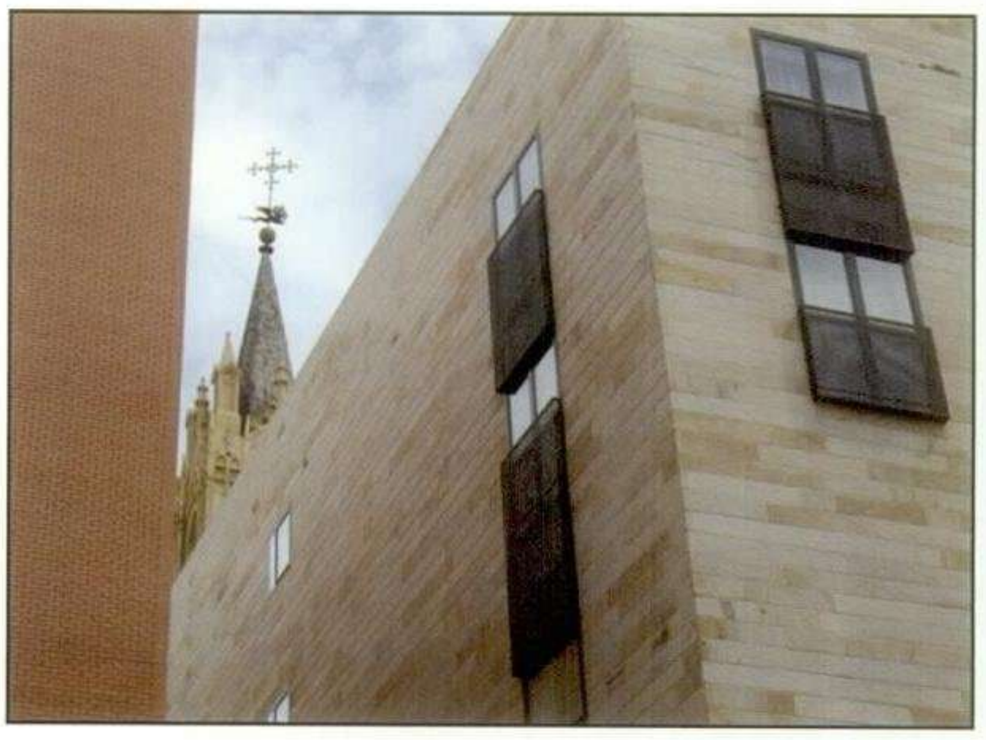

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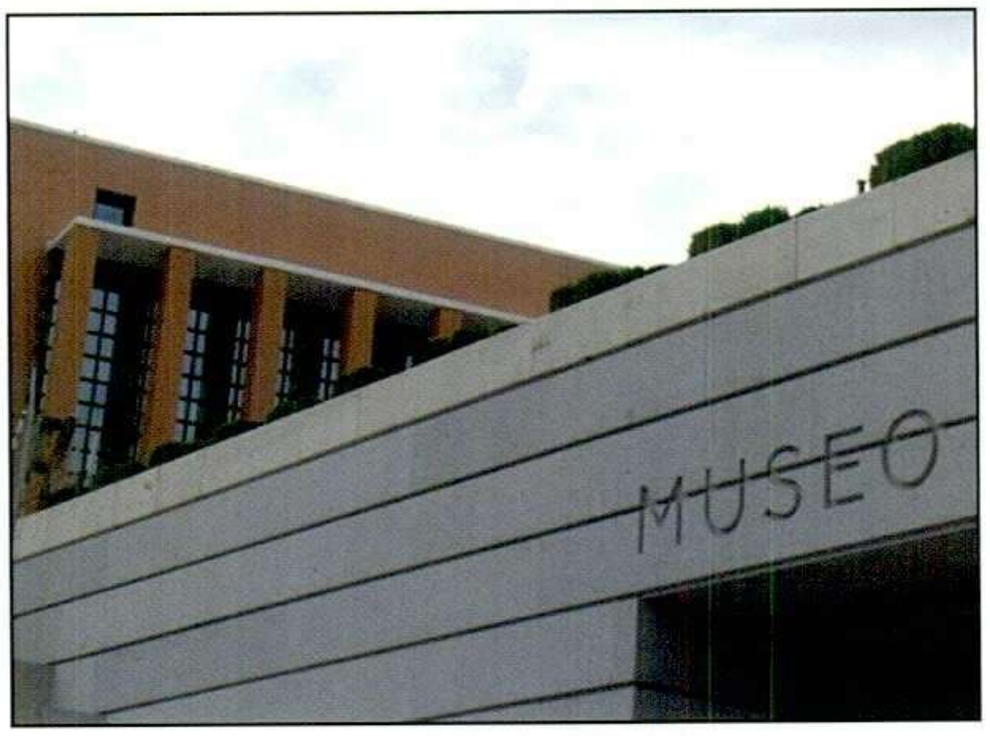

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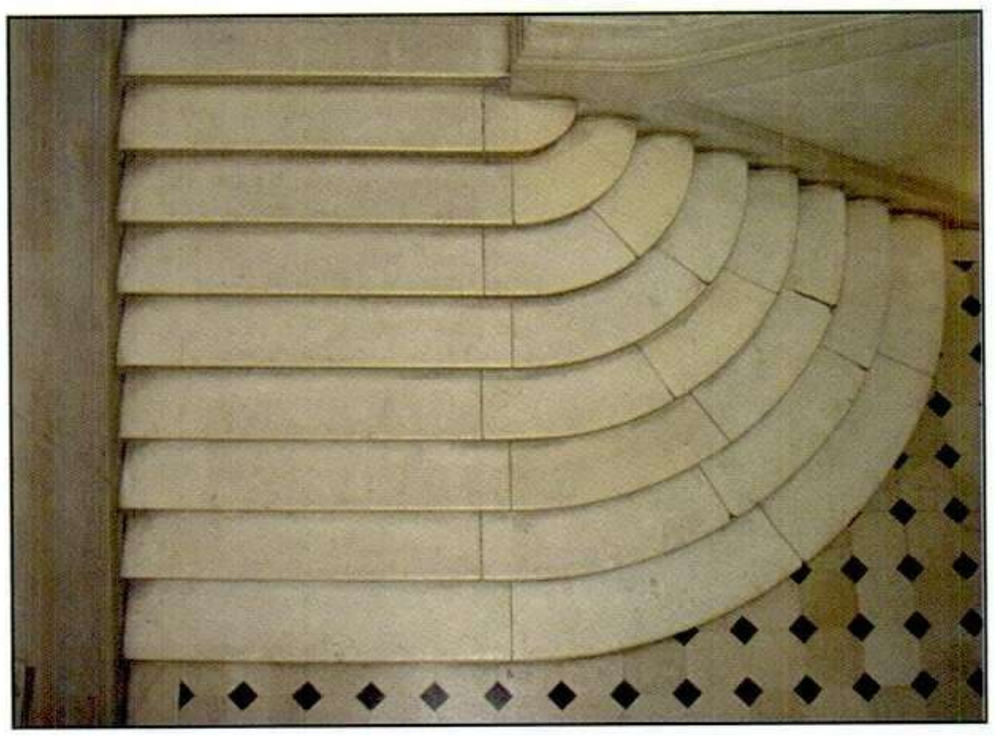

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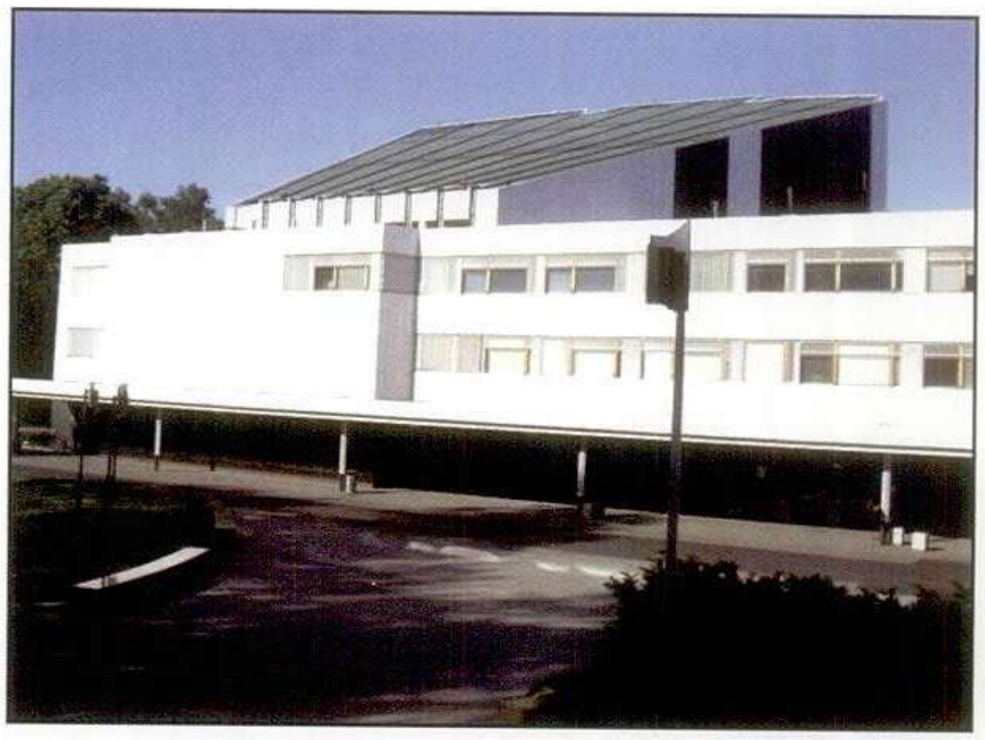

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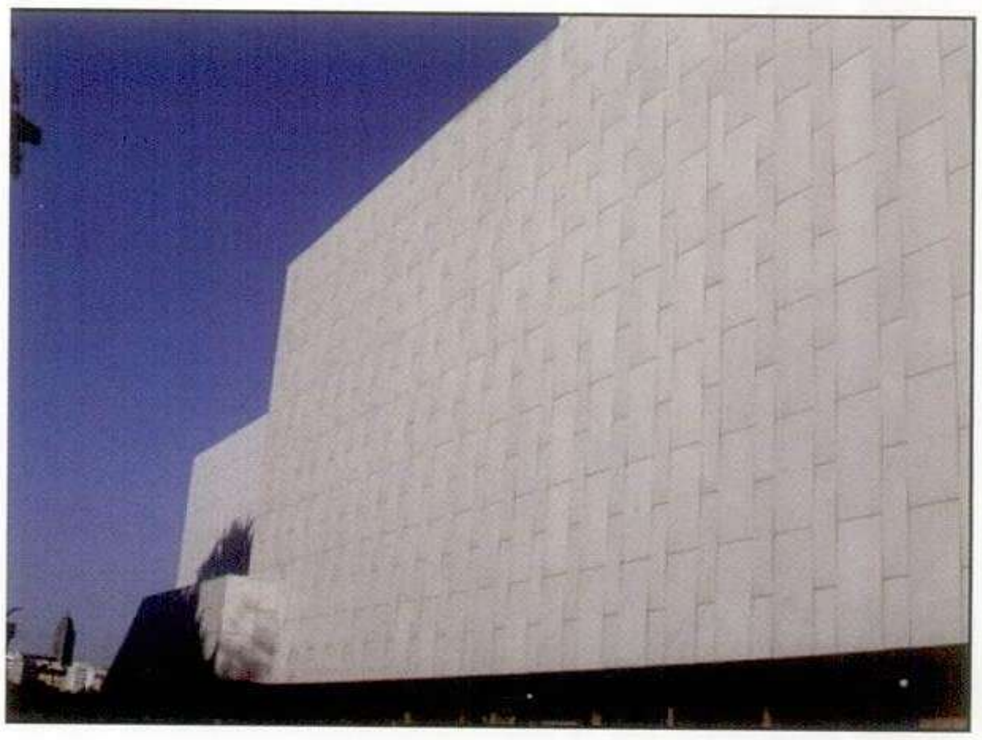

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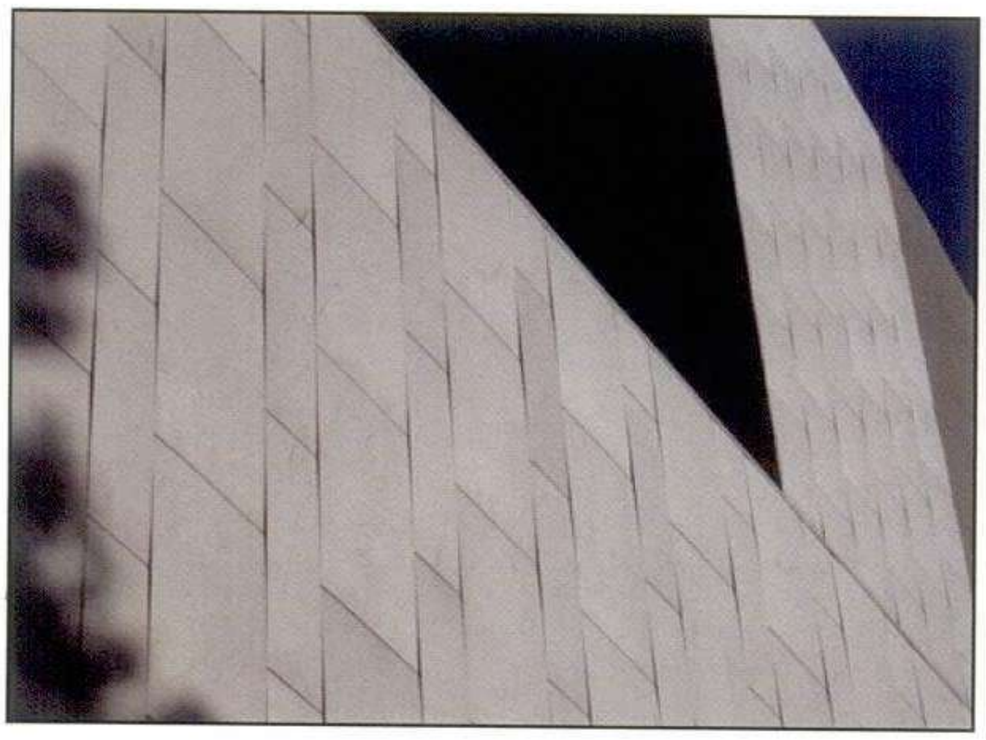

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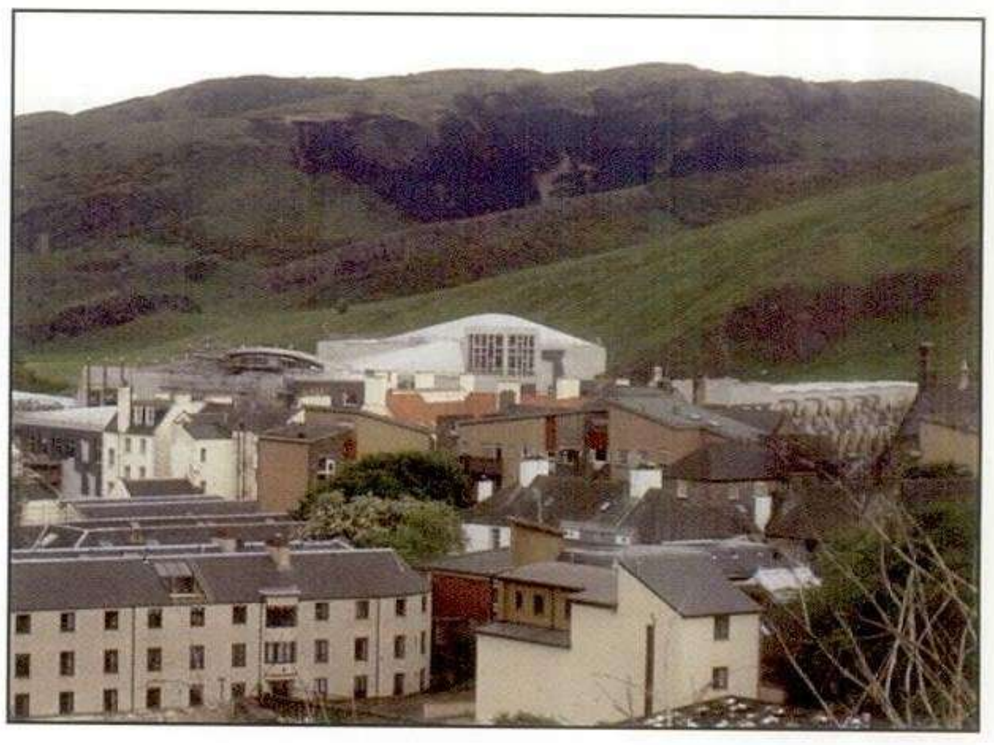

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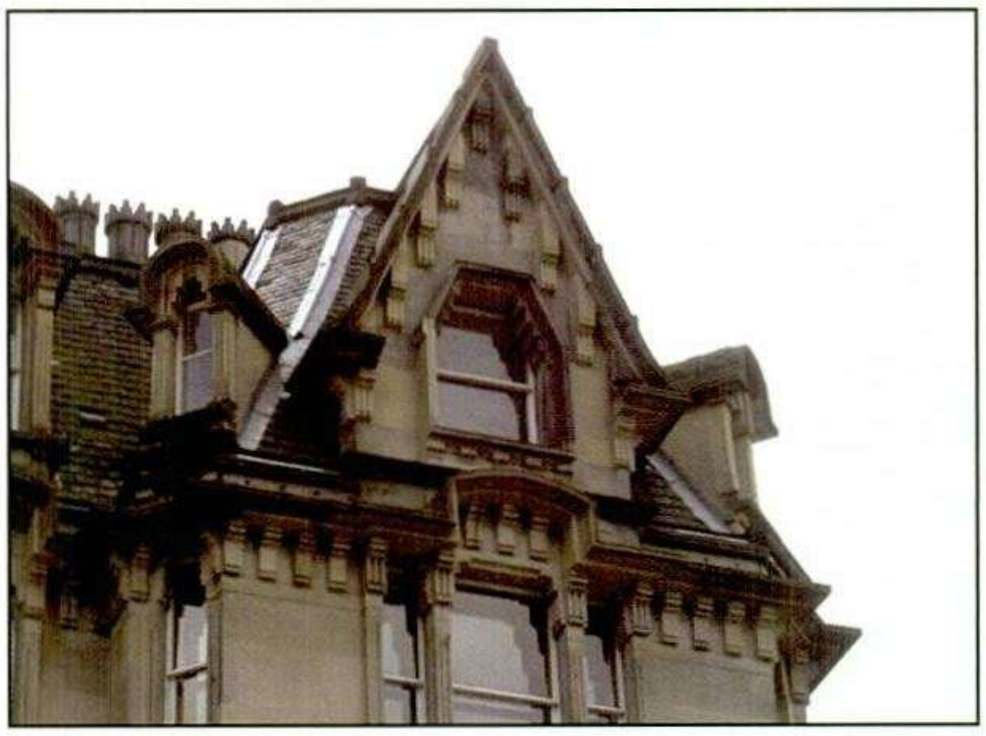

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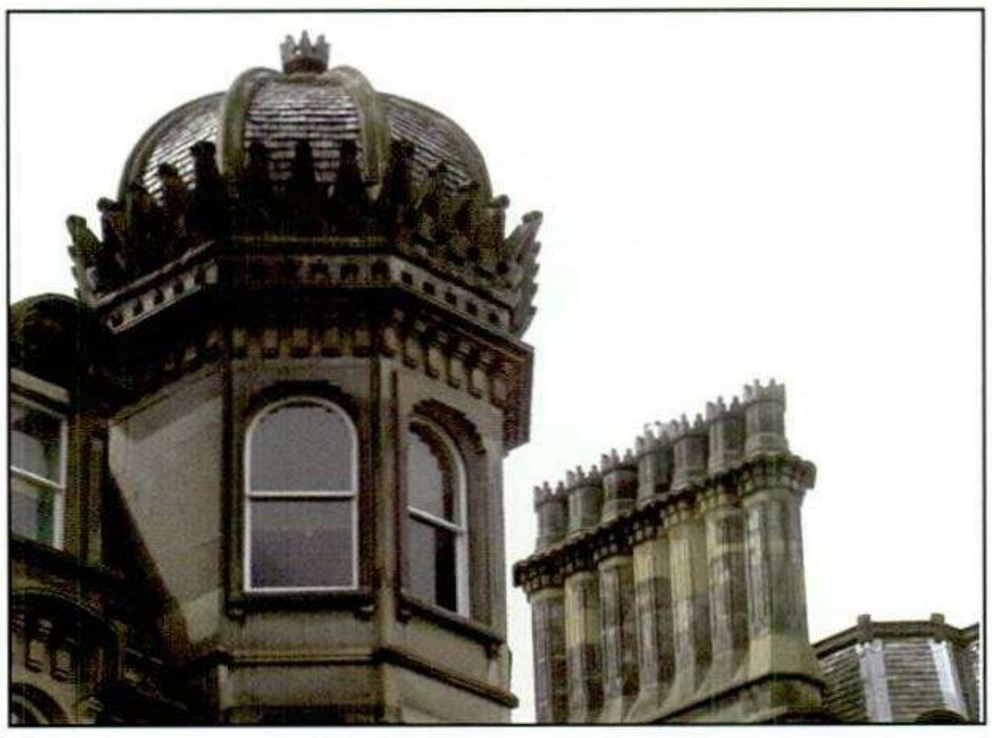

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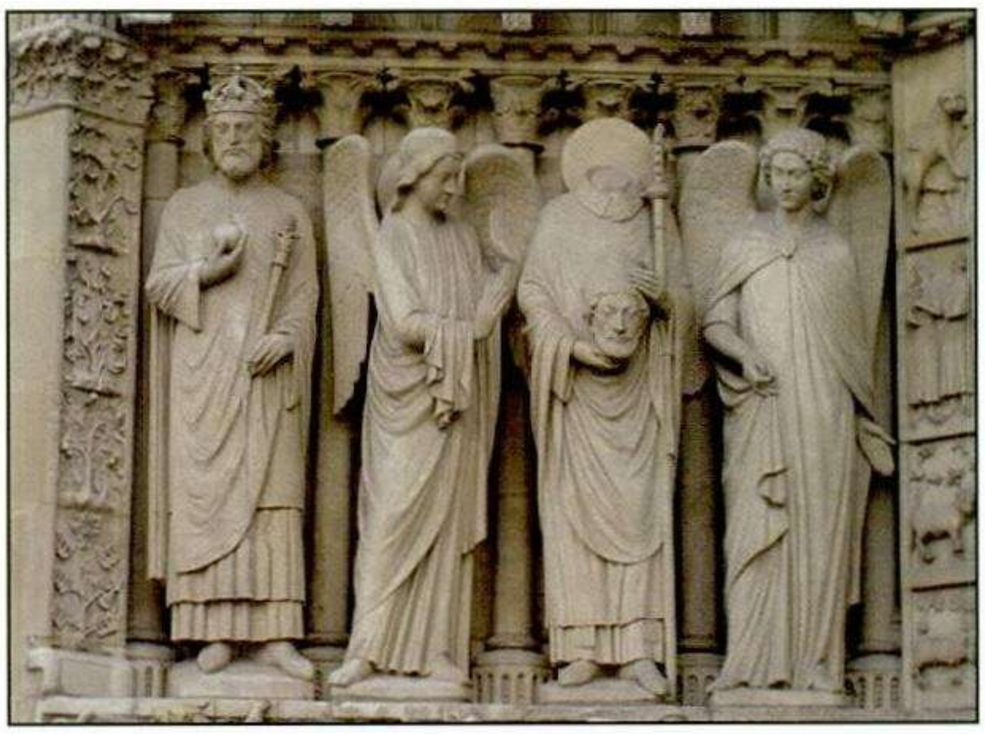

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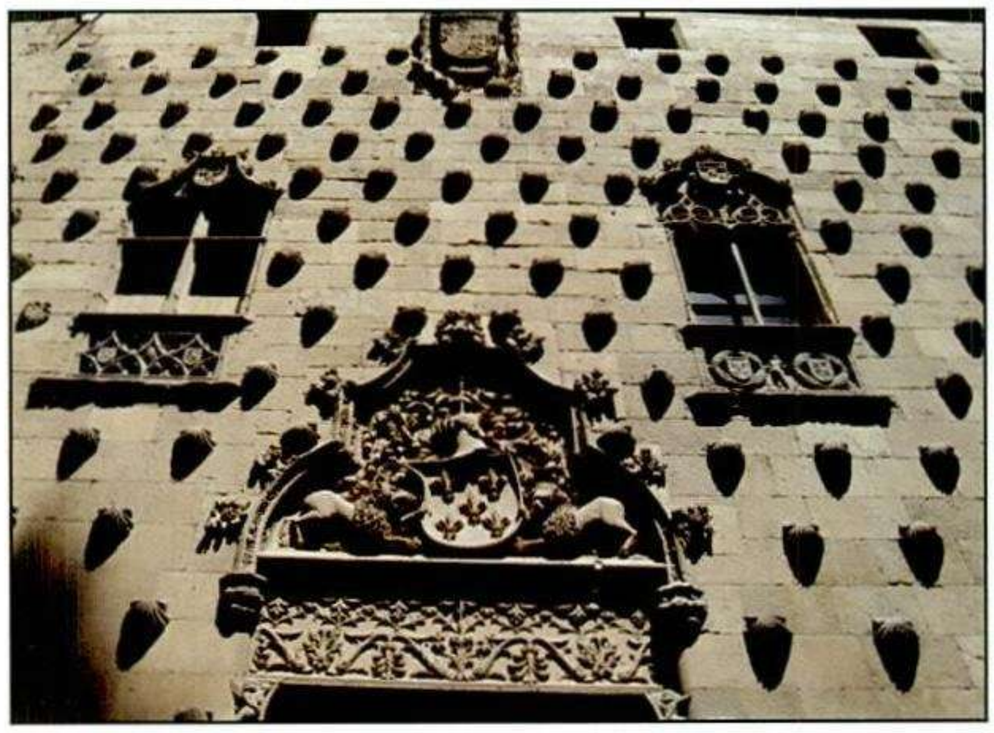

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HISTORIC SCOTLAND CONFERENCE
STONE IN CONTEXT
14 AND 15 NOVEMBER 2007: DELEGATE LIST

DELEGATE NAME	COMPANY
Rob Abbott	Macmon Chartered Architects
Alasdair Alldridge	Wittets Ltd
Allen Angus	Angus, Chartered Surveyors
Sarah Bailey	NSI
Balgonie the Younger	Balgonie Castle
The Laird of Balgonie	Balgonie Castle
Diane Barbary	Fife Council
John Barber	AOC Archaeology
Marc Beattie	The Scottish Lime Centre
Lawrence Begg	Historic Scotland Properties in Care
Alasdair Beveridge	Perth & Kinross Council
Keith Blades	Keith Blades Conservation Consultant
Cecilia Boman	BA Konsult
Nic Boyes	Nicolas Boyes Stone Conservation
Jim Brindle	Darroch & Allan (Joiners & Builders) Ltd
Michael Burgoyne	Historic Scotland Properties in Care
Colin Burness	Angus Council
Frank Burston	Frank Burston Architect
Douglas Campbell	Aberdeen City Heritage Trust
Graham Campbell	Historic Scotland Properties in Care
David Clyde	Historic Scotland Properties in Care
Lizzie Cooper	Simpson & Brown
Ian Cumming	Ian Cumming
Jocelyn Cunliffe	Gray, Marshall & Associates
Roger Curtis	Historic Scotland TCRE
Alice Custance-Baker	Edinburgh University
Tom Cuthbert	Historic Scotland Properties in Care
Kevin Davidson	North Highland College
Devon Decelles	Institute of Historic Building Conservation
David Denholm	Mast Architects
Cheryl Dewar	Scottish Building Standards Agency
Bryan Dickson	The National Trust for Scotland
Patrick Dignan	Dignan Read Dewar Architects
Laura Duthrie	Historic Scotland TCRE
Mike Farey	Singleton Birch Limited
Ed Farrell	Edina Property Consultants Ltd

Andrew Fordyce	Darroch & Allan (Joiners & Builders) Ltd
Alison Foster	
Richard Groom	Construction Skills
Torsten Haak	Glasgow City Heritage Trust
Graeme Hadden	Watson Stonecraft
Sharon Haire	Historic Scotland TCRE
John Halpin	Glasgow Metropolitan College
Malcolm Hammond	The Pollock Hammond Partnership
David Hasson	University of Glasgow
Robbie Henderson	Thomson Masonry Ltd
Donna Higgins	ATD Developments
Peter Horne	The Scottish Lime Centre
John Hughes	University of Paisley
Ronald Jamieson	
Moses Jenkins	Historic Scotland TCRE
Ken Johnston	Ken Johnston Architects
Paul Johnston	University of Glasgow
Robbie Kerr	R C Kerr Architect
Ed Laffey	
Henrik Larsson	Gotland University
Michelle Latimer	Dalgleish Associates Ltd
George Leese	Historic Scotland Properties in Care
Lindsay Lennie	Historic Scotland TCRE
Michael Levack	Scottish Building Federation
Alan Lodge	Fife Historic Buildings Trust
Thomas Goodlet	Historic Scotland TCRE
Suzanne Malcolmson	Redman + Sutherland Architects
Ewen Mann	Torrance Partnership
Harry Mantell	Mantell Ritchie
James Maxwell	Hypostyle Architects
Iain McCaig	John Renshaw Architects
William McFarlane	Glasgow City Assessor
Elizabeth McGrath	Historic Scotland TCRE
Declan McGrath	Scottish Enterprise Glasgow
John McKinney	Stone Federation GB
Graeme McKirdy	Historic Scotland TCRE
Paul McMahon	The Office of Public Works
Calum Millar	City Arc
Jane Milroy	Scottish Stone Liaison Group
Arthur Milson	
Martin Munro	University of Glasgow
William Napier	The National Trust for Scotland
Karen Nichols	Historic Scotland TCRE
Grahame Nicoll	

Joanna Parry	Hypostyle Architects
Alison Pearson	Glasgow Metropolitan College
Raffaela Portieri	Historic Scotland TCRE
Andrew Ramsay	St Mary's Cathedral Workshops Ltd
Peter Ranson	Historic Scotland Properties in Care
Douglas Read	Dignan Read Dewar Architects
Bernard Redman	Redman + Sutherland Architects
Graham Reid	Moray Estates Development Company Ltd
John Renshaw	John Renshaw Architects
William Revie	CML Ltd
Robert Riddell	Cyril Sweett Plc
Stewart Robertson	Robertson Eadie Ltd
Stephen Dickson	The City of Edinburgh Council
Alan Robertson	University of Glasgow
Fiona Russell	
Joann Russell	Historic Scotland Properties in Care
Darren Scutt	Singleton Birch Limited
Robert Shanks	Highlands and Islands Enterprise
Virginia Sharp	Historic Scotland Inspectorate
John Sinclair	Allen, Gordon & Co
Iain Small	The National Trust for Scotland
Anne Smith	The Smith Emsley Partnership
Gemma Smith	Wilkinson & Lowe
Alison Smith	Smith Architects
Anne Smith	Institute of Quarrying
Alex Stark	Stone Federation GB (Scottish Section)
Ann Steedman	Historic Scotland TCRE
Peter Stephen	Peter G Stephen
John Stevenson	University of Glasgow
Ewan Stewart	Stewart Consulting
Dr Stewart Stirling	Groves-Raines Architects Ltd
David Storrar	Historic Scotland Properties in Care
James Lawson	Charles Laing & Sons Ltd
Barbara Stuart	The City of Edinburgh Council
Fergus Sutherland	Icosse
Ed Thomson	Angus Council
Michael Thornley	Mast Architects
Gordon Urquhart	
David Valentine	The Largo Trust
Emma Vernon	The National Trust for Scotland
Ewan Walker	Historic Scotland TCRE
David Wear	Beamish Museum
Ian Williams	The City of Edinburgh Council
Robert Wilmot	Historic Scotland TCRE

Kate Wilson	English Heritage
Lyn Wilson	Historic Scotland TCRE
Luke Wormald	Historic Scotland Inspectorate
Maureen Young	Historic Scotland TCRE
Marta Zurakowska	Historic Scotland TCRE

Stone in the historic context

Stone in the modern context