

The Research Work Approach of Technical Conservation, Research and Education Group (TCRE), Historic Scotland

Ingvall Maxwell

Historic Scotland, Longmore House, Salisbury Place, Edinburgh, EH9 1SH, Scotland, United Kingdom

1. Role of Historic Scotland

As an Executive Agency Historic Scotland is an integral part of the Scottish Executive. It is directly accountable to Scottish Ministers who, in turn, are directly accountable to the Scottish Parliament for its performance. Historic Scotland's central mission is to ensure that a broad range of people can enjoy the contribution made by the built heritage now and in the future.

Established in 1993, Technical Conservation, Research and Education Group (TCRE) directly fulfils four of Historic Scotland's Corporate Plan objectives, and has a key role to play in pursuit of the Scottish Executive's Policy on Architecture for Scotland that was launched on 5 October 2001.

2. Scottish Executive Policy on Architecture

The Policy on Architecture sets out the Scottish Executive's commitment to the promotion of good architecture and building design and the means by which this will be realised.

In particular, with regard to the objective "to promote the value and benefits of good architecture, encourage debate on the role of architecture in national and local life and further an understanding of the products and processes of building design", the aim is to "work through Historic Scotland to commission and publish research on matters relating to building conservation and traditional materials."

With regard to the objective "to foster excellence in design, acknowledge and celebrate achievement in the field of architecture and the built environment, and promote Scottish architecture at home and abroad", this will be met by working through Historic Scotland to "promote the imaginative re-use of old buildings and develop the skills necessary for their conservation, repair and maintenance".

On both counts the work of TCRE is central to the achievement of these Policy intentions.

3. Technical Conservation, Research and Education Group Work Strategy

The principal remit of Historic Scotland's Technical Conservation, Research and Education Group (TCRE) is to improve operating quality and standards of practical conservation work on Scotland's built heritage. It also aims to develop relevant conservation understanding and skills through education and training at professional, technical, craft and lay levels of interest. Much of the programme relates directly to the use and understanding of stone technology

To date the overall approach has been determined by assessing priorities where levels of "loss" of fabric, materials, craft expertise or knowledge has occurred. As a result, work has concentrated on establishing why such loss is taking place, where traditional building materials were originally sourced, and which traditional building technologies need to be rediscovered. In turn, this impacts on material supply requirements, skill developments and

educational awareness – all three factors being necessary in equal measure to achieve satisfactory on-site work.

In the past a natural confidence existed in the comprehension of these integrated factors that we no longer possess today. To help rectify this inadequacy TCRE set about:

- networking with relevant bodies
- establishing strategic partnerships
- encouraging the revival of key industries
- working with education and training establishments
- investigating the supply of traditional building materials
- undertaking appropriate associated research
- publishing relevant technical material

The Group's research, outreach and publication programme for 2002/03, and beyond, will therefore continue to address the provision of the most appropriate guidance for the protection of the built heritage. To do this it will continue to work with 3 integrated and inter dependent units:

- Division 1: Research and Education (commissioning and managing)
- Division 2: Historic Scotland Conservation Centre (practical specialist work)
- Division 3: Scottish Conservation Bureau (databases, support and publications)

Initially the Group was charged with providing informed technical support for Historic Scotland's Historic Buildings Repair Grant-aid schemes and to offer practical conservation advice for the work programme on Properties in Care. As the Grant-aid programme is currently injecting some £11million per annum into the Scottish building industry and directly influencing some £60million of construction related business each year, the potential sphere of influence from this approach is considerable. By researching, printing and issuing relevant technical guidance and advice, the Group helps ensure that this money is spent wisely.

The Research, Education and Training Division also has the responsibility of addressing quality and setting standards. It commissions and controls the research that produces the technical publications through contracts, negotiated partnership arrangements or Minutes of Agreement. It works with a variety of industry and professional lead bodies and has long established training and education links across Scotland.

The Historic Scotland Conservation Centre is a specialist hands-on conservation unit that operates in the fields of structural painting, easel painting, and stone conservation. It is also charged with producing specialist Reports offering conservation advice in support of the Agencies repair grant scheme, and scheduled monument and listed building consent processes. It supports the Scottish Conservation Bureau's intern and fellowship programme through providing work placement experience, and undertakes a limited degree of specialist repayment work for the private sector.

The Scottish Conservation Bureau is the central focal point for conservation information in Scotland. It has a holistic interest in all Scottish conservation matters and operates in a partnership role with the Scottish Museums Council. Over the years it has compiled, holds and maintains a number of publicly accessible comprehensive databases. These hold relevant up-to-date information on a wide range of Scottish conservators, building contractors and practitioners working in the field. In support of Scottish interests it disburses some (limited) support grants for conservation set-up and training. It also runs a dedicated Intern and Fellowship programme to augment the pool of available conservation skills and expertise in Scotland. The Bureau is also responsible for the promotion, marketing and sales of the

Group's technical publications. Completed research work is promoted in the form of Conference Proceedings, Research Reports, Reference Reports, Practitioners Guides and Technical Advice Notes (See Annex A).

Of course, considerable diversity exists in the built heritage sector. Buildings of different date, period and style have used different skills and materials in their original construction and subsequent adaptations or changes. Different colours, textures, scales and weathering characteristics add to the variations. Consequently, a wide range of variations need to be considered when thinking about what physical conservation, repair or maintenance needs have to be deployed in effecting an appropriate work project. This requirement calls for a number of supporting initiatives. To maintain the position of Historic Scotland as a leading built heritage conservation body, TCRE's role will therefore continue to address this complexity so that its expertise can act and advise on:

- Policy aspects of technical conservation, research and education issues
- Offering excellence in oral, and published, pragmatic technical conservation advice
- Commissioning research into traditional building materials and construction methods.
- Ensuring practical conservation work is guided and informed by research results.
- Producing and promoting up-to-date relevant technical literature.
- Raising the quality and standard of conservation practice.
- Raising the standard of craft-based, technological and academic courses, and continuing professional development (CPD) delivery methods.

In taking these challenges forward on an integrated front, TCRE will continue to co-ordinate and work with other Scottish interests to -

- Liaise with relevant professional and industry-lead conservation bodies.
- Set up, facilitate and service communication networks on conservation themes.
- Establish and maintain "outreach" partnerships in areas of mutual gain and benefit.

It will also establish and maintain a variety of European cultural heritage links to help raise international awareness of Scottish conservation matters and achievements.

4. Sustainability

Under Sustainability and "Green" issues, investigating the past can reveal that little is new. However, modern Codes and Standards that have been developed to accommodate modern building technologies pay little direct acknowledgement to the existing historic building stock. New comers by comparison, there is a case to suggest that a greater understanding of the issues they purport to deal with could be better informed if a fuller awareness of traditional building technologies could be incorporated in their formative stages. That is not to say that Codes or Standards are irrelevant, more that they could better serve the structures they cover if they were more investigative in approach.

What is also intriguing in this regard, is the number of marketed "standards controlled" new products that hanker to the past for their promoted character and visual appearance. High energy-embodied synthetic material building-elements such as replica windows, doors, cast stone, textured roofing paving and applied "cure-it-alls" can be readily listed. Fashion, of course, has always played a part in the building process, and it remains a considerable influence in modern-day thinking. With greater market choice buyers are targeted in ever increasingly aggressive ways. Under such pressure, logic often fails to prevail.

With traditional sash and case windows, for example, the growth in replacement units has been phenomenal in recent years. Of course, nothing is ever as straightforward, but the logic of changing building elements that have given up to 150 year service life (with the potential of a similar life into the future) with modern replacement units only holding a 30 year guarantee seems fundamentally flawed. The consequential commitment to costly further re-replacement cycles that will be at least five multiples of a traditional repair approach puts any perceived short-term cost gains into a more relevant perspective. If we are to be serious about sustainability options, such 21st C trends demand more focussed research to identify and address exactly what the real issues are.

5. Conservation as Repair and Maintenance

With the "repair and maintenance" sector now accounting for over 50% of the annual construction spend of £28 Billion in the UK, the case exists for the need to create a better correlation between what is taught and what the industry actually requires. Whilst it may be too simplistic a parallel to make, a recent survey of Architectural opinion, published in the Architects Journal of 22 March 2001, reported that 46% of responding Architects considered that their architectural education did not give them a suitable training for practice. In the same survey, 25% of Architects considered that the current skills shortage was the second largest threat to their profession, whilst the "Conservation" work sector had risen from a zero base in 1999 to become 4% of the identified new business opportunities with the most potential in 2001.

Unfortunately, the general training and educational processes in the UK does not offer much of relevance for the well being of existing buildings. The majority of the emphasis is placed on teaching and understanding new-build technologies. This approach could be argued as being at the heart of many difficulties that confronts much of the repair and maintenance factor of the construction industry at this time. A better understanding of how traditionally constructed buildings were erected, how they performed, and how they decay, is therefore required by most current professional disciplines, technologists and craft sector personnel.

Given the high loss levels in what should be an intuitive understanding of traditionally constructed buildings the underlying issues of who "educates the educators", "trains the trainers" and "supplies the supplier" urgently need to be considered.

6. Links with Education and Trainer Providers

Established in 1994 the Scottish Conservation Forum in Training and Education (SCFTE) was initiated by TCRE as a Scottish network that links with other National bodies. Meeting at six-monthly intervals, the SCFTE acts as a focus group for all interested parties in the field of Scottish conservation. Members freely give of their time and come from a wide range of Universities, Building Colleges, Industry, Industry lead bodies and Professional Bodies where conservation interests already exist. Well-attended meetings keep participants informed of relevant national and international developments, and act as an exchange mechanism for the dissemination of appropriate information and data.

Resulting in effective co-operation across trade, technical, professional, accrediting and industrial boundaries, the Forum has been successful in raising, integrating and enhancing the awareness of a wide range of Scottish conservation issues. To aid this process, and as part of its remit to outreach and educate, TCRE issues copies of all its published technical information to all the member bodies. In consequence, the material is then more readily absorbed into the standing curriculum and associated developments. The key need is to build upon existing courses and facilities to establish new, more effective, links across craft, technological and professional boundaries, and thereby a better degree of integration and resolution.

The emergence of developments to create a UK suit of Vocational Qualifications in Architectural Conservation in 1994 produced the necessary vehicle for such connections. This emerged at the same time as other related initiatives, such as the professional body Accreditation schemes, were taking shape. An ideal opportunity arose which allowed an integrated plan to be developed.

Whilst many interpretations exist of what the word "conservation" actually means, ICOMOS, in their 1993 Guidelines on Education and Training in the Conservation of Monuments, Ensembles and Sites, suggests that:

"The object of conservation is to prolong the life of cultural heritage and, if possible, to clarify the artistic and historical messages therein without the loss of authenticity and meaning. Conservation is a cultural, artistic, technical and craft activity based on humanistic and scientific studies and systematic research"

As it turned out, this international document persistently emerges as the key strategic reference point to which most, if not all, steps in Historic Scotland's developmental process to raise technical conservation standards can be related.

7. ICOMOS Training and Education Guidelines

At present the 1993 ICOMOS Training and Education Guidelines are the only internationally recognised promoted standards for upholding the quality of the countries post-graduate architectural conservation courses. Behind their production it was the ICOMOS aim:

"To promote the establishment of standards and guidelines for education and training in the conservation of monuments, groups of buildings ("ensembles") and sites defined as cultural heritage by the World Heritage Convention of 1972".

The 14 Guidelines (See Annex B) create an invaluable starting point for the development of a more coherent and consistent educational process for professionals working in the field. In introducing the various topics the document states that:

"Conservation work should only be entrusted to persons competent in specialist activities" and emphasises that "focussed education and training should produce a range of professional conservationists who are able to undertake the Guideline functions".

Like the UK Conservation Post-graduate Course Directors, Historic Scotland saw considerable merit in adopting the guidelines as an effective framework upon which to focus developments. Consequently, they are embedded in much of the networking activities and thinking of its TCRE Group.

8. The Stirling Charter: 2000

The ICOMOS Training and Education Guidelines also guided the drafting work on Scotland's principal policy statement on the built heritage, the Stirling Charter. To ensure consistency in understanding the Charter uses word definitions that were initially established by BS 7913: 1998 Guide to the Principles of the Conservation of Historic Buildings. In its final form the document was published with Ministerial support and addresses Scottish Conservation needs through 6 Articles (Annex C)

Of course, buildings do not have to be legally recognised as being important to have same technical problems and requirements as those covered by Statute. In addition to those that are legally protected, many structures can be of similar age, be constructed of the same materials, and have identical problems to be overcome. Addressing and resolving the needs of those structures and sites that are deemed important can therefore have an equal validity for those that are not.

9. Traditional Material Supplies

The majority of Scotland's 18th and 19th Century urban structure was constructed of stone. This was obtained from a wide variety of locations; with virtually each village, town and estate having their own local quarry source. Given the geological diversity in Scotland, the range of stone types used as building materials was considerable. Incorporating many natural variations in the local character, colour and weathering characteristics, stone was originally worked with a good understanding of how it should function appropriately in the relatively wet climate

By the turn of the 20th Century circumstances had begun to change, and a major decline in the use of building stone was hastened by the 2 World Wars. Although a brief revival occurred during the 1920's and 30's, it was well into the 1960's before an awareness of stone as a building material started to re-emerge with any significance. By that stage much of the traditional understanding of the material, how it should be worked, used and detailed was lost. Aesthetic considerations often overruled its structural potential. In addition, due to the perceived high costs, the many variables in traditional masonry construction, and the increasing demand for paper evidence to provide stone's functional and operation effectiveness, it became impossible to ensure compliance with emerging codes and standards.

With a few exceptions, the indigenous stone industry was generally rejected in preference to accepting developing and new construction techniques and building materials. In the event, these promised much but, by comparison with traditional technologies, lacked longevity of use and performance. Sadly, the consequential effects of these trends are all too readily seen in even the most superficial investigation of the current construction industry. In particular, the number of operational building stone quarries around Scotland has quite literally shrunk to a handful.

One of the most elementary stipulations of adopting an effective conservation strategy is to ensure that any replacement work is undertaken on a like-for-like basis. The question then arises as to where to obtain the appropriate matching stone to undertake replacement masonry works where that is required. Combined with a lack of knowledge of how to use stone properly, inevitable consequences of emerging misunderstanding and misuse of the material abound. Often decisions are being taken that are to the detriment of what we are attempting to conserve, and the historic value suffers. At the same time the traditional masonry building stock is increasingly suffering from the effects of natural decay. The problems involved in turning round such a complex area of the Scottish building industry are considerable, and can only be achieved with the full co-operation of all involved.

10. TCRE Group Project Activities

Previous research work, initiated by TCRE Group, has led to 58 technical volumes being printed over the last 9 years (Annex A). This work has not necessarily been carried out by the Group's own staff. It is not resourced to undertake research work in this way. In essence, the Group capitalises on a wide range of Scottish academic and professional contacts. Through a series of Minutes of Agreements and other mutually beneficial arrangements, various jointly funded, or driven, initiatives have produced these meaningful results. To disseminate information and research findings a series of major conferences have also been arranged. This programme has included:

- Stonecleaning (1992) [International event]
- Lime Technology (1995)
- Scottish Traditional Building Materials (1997)
- Fire Protection and the Built Heritage (1998) [International event]
- Scottish Traditional Roofing (2000)

- Conservation of Historic Graveyards (2001) [International event]

Currently, some 51 projects are being taken forward. These are at different stages of completion, and the programme includes research and publication works on:

1. 17th Century Plasterwork: TAN (Technical Advice Note)
2. Access to the Built Heritage: TAN Revision
3. Carved Stones of Scotland: Database Development
4. Cast Iron: TAN
5. Consequences of Stonecleaning: Research Report and TAN
6. COST Fire Loss to Historic Buildings: Agreement development
7. Earth Walls Experiment: Monitoring
8. Experimental Earth Structures, Plasters and Renders: Research Report
9. Exposure Testing of Traditional Sash and Case Windows
10. Ferrous Metal Cladding in Scotland: Research Report and TAN
11. Fire Loss to Scottish Historic Buildings: Database Development
12. Laser Stonecleaning: Research Report
13. Lime Mortars in Traditional Building: Literature Review
14. Measured Survey and Recording of Historic Structures: TAN
15. Minimal Intervention Techniques: TAN
16. Reinforced Concrete Repair Case Study
17. Scaffolding Historic Buildings: TAN
18. Scottish Limestone Evaluation: Research Report
19. Scottish Slate Test Extraction
20. Stone and Masonry: Database Development

In addition, attendance at construction industry Trade Fairs and events, a variety of one-off conservation training initiatives and annual in-house TCRE Research Seminars have been arranged. These opportunities enable the Group to explore preliminary aspects of topical issues and research work in progress.

11. Current areas of Significant Technical Concern

In addition to the fundamental needs of ensuring an effective craft skills base and adequate traditional material supply sources in the field of repair and maintenance, four major areas of concern are presently being addressed in Scotland:

- Understanding Lime Technology
- The consequences of stonecleaning
- Fire loss to historic buildings
- Modern Technological Developments

12. Lime Technology

In recent years there has been increased interest in traditional building techniques and materials. This has had a considerable impact in the field of historic building conservation and maintenance. It has also led to a renewed awareness of the quality of traditional materials themselves, and the value of the skills required to work them. Central to this thrust is a full understanding of lime, and lime technology. The move towards this revival came at the end of a century that saw the widespread acceptance of synthetic, pre-fabricated and mass-produced materials, decreasing the demand for specialised and local craft skills and materials developed over many centuries.

Historic Scotland's interest in the effective use of lime on the nation's historic buildings and ancient monuments has existed for some time. It has been required in Historic Buildings Repair Grant Schemes since 1953, and used in the Historic Scotland Properties in Care Group masonry consolidation work programme on Scottish Ancient Monuments for over 100 years.

A number of pre-1990 technical publications were produced that promoted the need to use lime in building repair and conservation work. Included can be listed the Ministry of Public Building and Works (MPBW) "Standard Notes on Masonry Consolidation" from c1960, and the Historic Building and Monuments Directorate (HBMD) "Preparation and use of lime mortar" Notes that were made available from 1988. (MPBW and HBMD were predecessor Departments of Historic Scotland.) With the formation of TCRE in 1993 a more focused programme of technical research and associated publications on lime technology started to come on stream.

In promoting a broader awareness, Historic Scotland hosted a major Lime Conference in Edinburgh in 1995. This event drew together many directly involved in lime work to air and promote theoretical, technical and practical issues in its understanding. (The Agency also participated in the International COST C5 Workshop on Lime Technology in Stockholm, Sweden in 1998).

The intention of Historic Scotland's follow-up National conference, on Traditional Building Materials in 1997, was to develop that awareness into the value of traditional building materials, and to promote Scottish resources. It was also intended to encourage the revival of skills needed for their manufacture, extraction and use. Lime played a key part in the programme.

In the private sector, the Scottish Lime Centre Trust (SLC) was formed as a charitable company in 1994. Its objectives are to:

- become a national training and advisory centre for the conservation and repair of traditional masonry buildings
- promote the appropriate repair of traditional and historic buildings
- advance education through providing advice, training and practical experience in the use of lime for repair and conservation
- promote and further the preservation and development of Scottish building traditions, crafts and skills

TCRE works closely with the Scottish Lime Centre to produce technical publications and to create and develop comprehensive database information. This focuses on historic mortars, matching available materials and aggregates. The SLC also provides an effective technical advisory support role for the Division and the public.

On the academic front, the University of Paisley has worked with TCRE on a lime mortar/masonry interaction research programme and has also produced a draft Literature Review on Lime Technology that is pending publication. The University however has independently initiated a 3-year Experimental Lime Kiln (ELK) research project. This Scottish

Higher Education Funding Council supported study started in January 1999 and aims to research production methods and evaluate the traditional burning techniques of a variety of Scottish limestones. A 1/4 scale working kiln, capable of burning 27 tonnes of stone at each firing, has been constructed at a site in Charlestown, Fife adjacent to the Scottish Lime Centre Trust's training unit and valuable results are anticipated from this facility when testing gets underway.

13. Stonecleaning

Two fundamental methods of cleaning buildings have habitually been adopted, although a number of specialised techniques have become available in recent years. Physical methods include brushing and rubbing, washing and steaming, wet and dry abrasives, or surface redressing. Chemical methods, applied as liquids or poultices, may employ, singly or in combination, the use of alkaline treatments, acidic treatments or organic solvents. More specialised techniques, such as impregnated sponge, laser technology, ultrasonic equipment, heat lances, gypsum inversion, bacteria, poultices or gels, and soaps are now being developed. Not all treatments are appropriate for all materials, and extreme care needs to be exercised when deciding which system to adopt. Due to the need to minimise the risk of damage, the "do not clean option" should also be borne in mind.

It is far from clear when the recent euphoria for cleaning stone buildings started to gain ground, but it has been suggested that it can be traced to the resurrection of the Paris Cleaning Order by Andre Malraux in 1959. With beneficial visual consequences emerging as a result the aesthetic gains were even more sensational when the jet-black Portland Stone face of London emerged sparking white following its introduction in the early 1960's. From there, the desire to clean seems to have spread rapidly throughout the country, often using the most major public buildings to illustrate what could be achieved.

Some fundamental research was carried out at the time but this appears to have been either relatively superficial, or the true understanding of the findings were suppressed. Little related independent published information can now be traced. The best that is available lies in various manufacturers and suppliers information sheets. To highlight the "obvious" benefits, related publicity shots of buildings generally showed them in their entirety, and viewed from a distance. Little or no consideration was offered as to what was actually happening on the building's surface. Cleaning became synonymous with maintenance and the need for its routine adoption became firmly established. Scotland, like the rest of the country, was hooked into the process.

Much was achieved on the back of this enthusiasm. It epitomised the benefits that emanated from the introduction of the Clean Air Acts, and the changes that came about from a positive weaning away from burning fossil fuels. Urban regeneration projects flourished. New life was breathed in old hearts. And a growing recognition of the counties rich remaining architectural heritage started to stir in an increasingly receptive public. Yet all was not as it seemed. Many jumped on the bandwagon of a rapidly expanding market to offer their "unqualified" expertise and skill. Assumptions were made about the relevance of techniques and approaches. Even although geological properties and performance characteristics might be totally different, what was considered appropriate to clean one type of material was determined equally suitable for another.

With hindsight it is, of course, easier to be critical about the work that was often undertaken without sufficient thought being given to the consequences. But, contrary to the popular beliefs that are still held in many quarters, the act of stonecleaning a building is far from straightforward. Early on in the surge of activities it was known that cleaning caused damage, yet it only became slowly accepted that the processes involved demanded more careful consideration and investigation. It had to remain until 1988 before the view was openly expressed in Scotland that there was a need "to assist those involved in stonecleaning make more fully informed decisions". As a result, a detailed research programme was devised and implemented. This aimed to have the issues fully investigated

and reported on. But, there was much to retrieve. Cleaning continued unabated and, as it turned out, the rate, degree and extent of it had only just reached its peak.

The need to clean a building is commonly perceived as being crucial to its well being. Such a physical act is repeatedly driven by aesthetic and commercial considerations, without due regard being paid to the after-effects or consequences. The case for it is also frequently argued on townscape or streetscape concerns. It often does not consider the physical impact on the actual face of the structure. A basic difficulty of deciding when to clean is determining where to stop. This can lead to a form of facadism, with only the principle elevation being treated. From the analytical and research perspective, such an approach readily makes it possible to measure any changes that subsequently emerge. The effects on the cleaned extent can be easily assessed against the untouched return faces of the same stones.

Until relatively recently, the act of cleaning was carried out for the cheapest price and frequently lacked proper specification and site control. This has resulted in a wide variety of techniques being promulgated, without due regard being given to the full consequences of their effect. Manufacturers or suppliers showed little or no detailed consideration to this need. In attempting to deal with all problems in one approach, recommended specifications catered for worst-case scenarios. In consequence, over-treatment was the established norm. Insufficient consideration was given to the wide range of natural materials being dealt with and the relative susceptibility of them to deteriorate as a result.

No building is homogeneous in its construction or detail. Materials such as sandstone, limestone, granite, brick and terra-cotta are generally bound by lime mortar. Some may be used in combination, and other factors such as variations in colour, texture, tooling and form are likely to be met. In many, the composition will vary, and different combinations can lead to the interaction of materials, one with the other. Decay may also be present and different patch repairs, with different substances at different times, may further complicate the issue.

In the cleaning debate, soiling is often presumed to be only an external agent, with particulate deposition and reaction resulting from either wet or dry conditions. Damaging surface crust formation can be evident on limestone, but the prospect of benign mineral movement occurring from within the body of sandstone is rarely considered.

Biological surface soiling is equally complex, with bacteria, algae, fungi and lichens each seeking out the appropriate colonisation conditions within which they will flourish. Influencing factors in the form of exposure, orientation, altitude, atmospheric and micro-climatic conditions, fluid movement and concentrations, surface roughness and physical changes all play their part. Incidents of resoiling, iron mobilisation, efflorescences, vandalism and graffiti further complicate matters.

Determining the actual testing methodology, and the validity of trial area results, can be an elaborate process if it is to be carried out effectively and meaningfully. Topics that should be considered for use include colour measurements, depth profiling, surface roughness tests, assessment of the petrology and pH values, scanning electron microscopy, porosity and permeability measurements. Care needs to be exercised when contemplating the consequences of downloading chemicals onto low level masonry during rinse-off stages. The question of how to stop "washing-in" occurring on porous stone surfaces when "washing off" chemicals should also be addressed.

Reporting and recording the consequences of tests should lead to a full analysis of results before writing a relevant specification and obtaining statutory consents (if required). Selecting an experienced and suitable contractor, determining the training and experience of site operatives, ensuring effective site controls and health and safety precautions, and the maintenance of adequate site progress records also reduces risk.

In a perverse way, the masonry industry is also gaining from the mistakes of the past. Over the past few years a number of sandstone buildings which were previously cleaned, and left in a sound and stable condition some 25 years ago, have emerged as requiring major masonry repairs. Preliminary analysis of some projects revealed a number of cases where the natural decay rate of the stonework has been enhanced by a factor of between 6

and 10. This revelation required further detailed work to accurately quantify and establish the causes for such escalation. As a result, Historic Scotland in partnership with The Robert Gordon University, Aberdeen, developed a new study.

Support research work is currently completing on the topic of the Consequences of Stonecleaning, and two related publications are pending. The core of this work has concentrated on quantifying the scale of the problem. This has involved devising and undertaking comparative elevational mapping techniques so that a meaningful direct comparison can be made between cleaned and uncleaned buildings that are of the same age, material, orientation and exposure. Preliminary findings are suggesting that, in the worst case, up to 25% of the overall surface area of a previously cleaned façade may now be requiring significant repairs.

It is also consistently being shown that cleaned buildings are decaying at a faster rate than their uncleaned adjacent neighbours. Projecting these findings it would seem that major masonry repair projects will continue to emerge for the foreseeable future. These will increasingly be required on buildings that were left in a supposed sound condition following their earlier stonecleaning work.

A significant underlying problem exists where there is no longer a matching source of stone from which sympathetic repairs can be carried out. In a manner similar to the dilemma of deciding where to start and stop any stonecleaning work, a similar difficulty will arise in determining where to start and stop masonry repair work. The research study aims to provide some meaningful direction to practitioners in a dilemma much of their own making. It is also ironic to speculate that a number of contractors who might have been involved in the earlier cleaning regimes could be back working on same site, some 25-30 years on, effecting consequential repairs.

A further aspect arises as a result of this research. In the past, the consequences of selling a cleaned building showed that cleaning did have a positive effect on its marketability and sale value. The building appeared bright, fresh and apparently well cared for. If, 25 years on, such a building now has to have up to 10 times more stonework repairs carried than its uncleaned neighbour, that belief seems to have been badly misplaced and misguided. There is also a significant implication for any planned maintenance programme.

Stonecleaning is a complex issue. In the past it has been undertaken without sufficient thought to the consequences. As a result, an incalculable amount of permanent damage has been caused to the building stock of the country. How well this point is accepted greatly depends upon the perceived value of carrying out cleaning in the first place. For those committed to broader planning and social benefits, it is possible that no amount of evidence to the contrary will shake their belief that cleaning is totally beneficial. Unfortunately, the health of a building is not determined by its appearance as viewed from a distance, or across a street. It should be judged by what is happening on the actual surface of the materials used. Here, the true need for cleaning must be driven by establishing what can be accepted as appropriate. The adoption of a damage limitation approach should also inform the final choice of mechanism or technique.

In accordance with Historic Scotland's policy on undertaking relevant technical conservation research projects, the results of the current studies will soon be published and made available for practitioners' use. Combined with the information already published on sandstone cleaning, granite cleaning, graffiti removal and biocide surface controls, the overall understanding of this previously little addressed area of concern has been much improved. By promoting this knowledge Historic Scotland hopes that with a greater awareness of the issues now to hand, there should be no excuse for uninformed decision making.

Although there is no standard method applicable to all situations, in the selection and execution of the most appropriate technique all involved must share in the responsibility of getting it right and so reduce the inevitable consequence of damage.

Despite the detailed research work that has been completed and published so far, a number of significant questions remain unanswered at this time. For example, what can be done with the Physical effects on the facades of buildings as a result of:

- dressed off and abraded faces
- scoured faces and mouldings
- reformed mouldings and carvings
- enhanced levels of erosion

and the Chemical effects of:

- residual contamination
- interaction with other minerals
- colour changes on elevations

It is being increasingly recognised that due to the incompatibility of the materials that are used, plastic repair techniques are not the recommended answer for sandstone or granite buildings. More traditional techniques and technologies are revealing themselves as being the only appropriate way forward but this raises a number of additional the key issues for the future. Particularly, who is aware of the real size of the problem and who is it going to be able to quantify the real future repair needs? To help address this need a variety of parties, including industry, building owners, practitioners, planning authorities and grant giving bodies need to come together with a common aim. Clearly, to assist in this process, additional information that is based on accurate survey work and research is required. But, a number of associated questions also need to be asked:

- What forward-looking strategic planning is being effected to cope with the emerging consequences of induced decay?
- With a limited number of available quarry sources, where are the replacement matching stone materials coming from?
- What level of appropriate training of masons is being planned for?

Many of these issues remain un-addressed at this time.

14. Fire Loss to Historic Buildings

In addition to associated levels of life loss, the number, authenticity and quality of European historic buildings is being steadily eroded through the effects of fire. In 1983 this was recognised by the Council of Europe Committee of Ministers, who recommended 'That the governments of the member states adopt all legislative, administrative, financial, educational and other appropriate measures' to protect the built heritage from fire and other natural disasters. Therefore there is a need to find a balance between technological and management solutions to counter this disastrous effects of fire.

The real scale of loss of historic buildings to the effects of fire is unknown but superficial data suggests that the annual and aggregated effect is considerable, perhaps as high as one important historic building each day.

There is a general lack of statistical information, and a common lack of understanding and appreciation of what measures are available and required, to counter the effects of fire. Good guidance is urgently called for on how to sensitively retrofit modern day equipment into historic fabric. There is also a need to develop related management expertise in the dealing with this problem in historic premises.

To assess the specific risks to a historic building requires the need to define possible, or expected, damage due to a particular hazard or phenomenon. The term “historic building” should be taken to be synonymous with the entire architectural heritage - comprising monuments, groups of buildings and sites, as well as movable objects having particular historical or aesthetic association with the protected building. There are a considerable number of historic buildings requiring protection. It is important to recognise that these historic buildings are a major contributor to the ‘sense of place’ and recent information indicates that they are of great importance to both inhabitants and tourists.

In some countries, the most important historic buildings are included on statutory lists. However, the criteria for selecting buildings for inclusion change from country to country. These listed buildings form only a small percentage of the total number of buildings that can be considered as part of the built heritage. As an indication, there are almost 36,000 listed buildings in Austria, 110,000 in Bavaria and 45,000 in Scotland, but detailed figures for all of Europe are lacking.

To be effective in the resolution of this problem, the need is to develop a high level of international co-ordination and strengthen the levels of trans-national multi-disciplinary co-operation. The need is to exchange and enhance experiences to increase awareness and understanding, and to focus future action. Networking partnerships have been identified, their specialist input recognised and roles they perform classified. The associated skill and knowledge needs to be pooled, assessed and best practice developed.

In integrating new technologies with traditional disciplines there is a need to develop synergies within related organisations so that loss levels can be reduced and, ideally, halted. The underlying objective must be to retain the remaining cultural built heritage in an authentic state for future availability, access and enjoyment by all. This requires making best use of the limited resources available and recognising that conservation is a cultural process – however the priorities may not be the same in all partner countries. There is, therefore, an urgent need to integrate, co-ordinate, and assess the associated factors on a pan-European level so that a common state of the art understanding emerges to help combat such levels of loss.

15. Modern Technological developments

Many new products are now available to assist in the building process. What is intriguing in this regard, is the number of marketed new-build products and materials that hanker to the past for their promoted identity. Various elements can be quoted such as -

- “traditionally designed” UPVc replica doors and windows
- plastic and cast "stone"
- textured look-alike "roofing slates"
- concrete "stone" paving slabs
- "marble and timber" finished melamine, vinyl and paper veneers

Many other new techniques and technologies can be welcomed but other “Magic”, synthetic, cure-it-all solutions require a more cautious consideration. There is also an implied, and explicit, advertised adoption of historic qualities and past performance for these products. For example, some reinterpretations of the promoted and advertised claims for new products might read differently when considered against repair and maintenance requirements:

<u>Application claims in new-build work</u>	<u>Maintenance, repair and removal consequences</u>
Excellent adhesion	Difficult to remove
Resistant to abrasion	Difficult to remove by mechanical methods
Resistant to chemicals	Difficult to dissolve and may require the use of expensive, poisonous and dangerous materials
Special	Narrow and limited use
New	Not yet proven
Modern	Short stockholding

There is a current need to reflect on what is actually happening in both sectors of the industry especially since repair and maintenance needs are not adequately addressed in either the professional education or the craft and technological training sectors.

16. Conclusions

Architecture is a major part of, and contributes substantially to, the nations' heritage where conservation and refurbishment schemes have played, and will continue to play, a key part in retaining that heritage. In this process having the knowledge and understanding of traditional materials and a relevant Architectural Conservation philosophy is critical. Some guiding aspects, outlined in BS 7913, help point the way forward:

- Nothing is "static" in the field of caring for existing building
- Traditional buildings require "judgement" to be exercised when decisions are being made about their conservation. This should be based on -
 - an understanding of relevant principles
 - professional experience, knowledge and understanding
 - what has been proved to work through the test of time
- Modern Standards and Codes should not be "applied unthinkingly" in the context of building conservation.
- A "re-education" of how to access, understand, deal with, and reuse the wide range of traditional materials is urgently required.
- There is a need to increase the effective "service life" of existing buildings whilst decreasing the "life-cycle costing" through effective maintenance, repair and reuse.
- The ageing process, service life in use, and "replaceability" of the integral parts of historic buildings need to be predicted.
- "Replaceability" requirements should be guided by the need to preserve, for as long as possible, the authenticity and integrity of original materials; their substance, inherent craftsmanship and performance in use characteristics.
- "Embodied energy" should be recognised as a key factor that underlines "sustainability" needs, and its conservation should be borne in mind.
- "Multidisciplinary" working can offer a greater degree of ownership of the issues to be addressed, and a better chance of resolving the broad range of difficulties that need to be more overcome.

Future conservation and restoration work must be carried out in a “balanced manner” where education and understanding of the issues involved run hand-in-hand with craft skill training developments and material supply availability. Through re-identifying with previously well-understood techniques, economy of scale and integrated fitness for purpose can result. Traditional building techniques are there "waiting to be re-discovered" to show the way into the future. The requirement is to recognise the gains they can offer to the researcher and to incorporate in our current thinking more of the traditional solutions that intuitively resulted from a considerable degree of time honoured trial and error.

Annex A

1. TCRE TECHNICAL PUBLICATIONS 1992-2001

1.1 TAN (Technical Advice Notes)

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

1.2 Stonecleaning Research/Study Reports

- Stonecleaning in Scotland - Research Summary (1992)
- Stonecleaning in Scotland - Research Report: Volume 1 (1992)
- Stonecleaning in Scotland - Research Report: Volume 2 (1992)
- Stonecleaning in Scotland - Research Report: Volume 3 (1992)
- Stonecleaning in Scotland – Literature Review (1992)
- Biological Growths, Biocide Treatment, Soiling and Decay of Sandstone Buildings and Monuments in Scotland Research Report (1995) Literature Review (1995)
- Cleaning of Granite Buildings Research Report (1995) Literature Review (1995)

1.3 Other Research Reports

A Future for Stone in Scotland (1997)

Historic Landuse Assessment: Development and Potential of a Technique for Assessing Landuse Patterns (1999)

- Scottish Slate: The Potential for Use in Building Repair and Conservation area Enhancement (2000)
- The Future of the Scottish Burgh Survey (2000)
- The Pattern of Scottish Roofing (2000)
- Studies of the Domestic Dry Rot Fungus (2001)
- Impact of the Braer Oil Spill on Historic Monuments in Scotland (2001)
- Historical and Technical Development of Sash and Case Windows in Scotland (2001)

1.4 Guides for Practitioners

- Stonecleaning – A Guide for Practitioners (1994)
- Rural Buildings of the Lothians – Conservation and Conversion (1999)
- Timber Decay in Buildings – The Conservation Approach to Treatment (1999)
- Conservation of Historic Graveyards (2001)

1.5 Conference Proceedings

- The Historic Scotland International Lime Conference 1995 (1996)
- Historic Scotland Traditional Building Materials Conference 1997 (1997)
- Fire Protection and the Built Heritage Conference 1998 (1999)
- COST Action C5 – Lime Technology Workshop 1998 (2000)
- Scottish Stone Liaison Group Launch Abstracts (2000)
- Scottish Traditional Roofing Conference Abstracts (2000)
- Conservation of Historic Graveyards Abstracts (2001)

1.6 Other Publications

- Scottish Conservation Handbook (1994)
- The Repair of Historic Buildings in Scotland (1995)
- Case Studies of Traditional Lime Harling – A Discussion Document (1996)
- Dictionary of Scottish Building (1996)
- Assessment Methodology Handbook: Carved Stone Decay in Scotland (1999)

1.7 Reference Reports

- Directory of Conservation Training (1999)
- Parchment/Vellum Conservation Survey & Bibliography (2000)

Annex B

ICOMOS: CONSERVATION TRAINING AND EDUCATION GUIDELINES, 1993

The 1993 ICOMOS Conservation Training and Education Guidelines are set out as follows:

1. Read the monument, ensemble or site and identify its emotional, cultural and use significance.
2. Understand the history and technology of monuments, ensembles or sites in order to define their identity, plan for their conservation, and interpret the results of this research.
3. Understand the setting of a monument, ensemble or site, their contents and surroundings, in relation to other buildings, gardens or landscapes.
4. Find and absorb all available sources of information relevant to the monument, ensemble or site being studied.
5. Understand and analyse the behaviour of monuments, ensembles or sites as complex systems.
6. Diagnose intrinsic and extrinsic causes of decay as a basis for appropriate action.
7. Inspect and make reports intelligible to non-specialist readers of monuments, ensembles or sites, illustrated by graphic means such as sketches and photographs.
8. Know, understand and apply UNESCO conventions and recommendations and ICOMOS and other recognised Charters, regulations and guidelines.
9. Make balanced judgements based on shared ethical principles, and accept responsibility for the long-term welfare of cultural heritage.
10. Recognise when advice should be sought and define the areas of need of study by different specialists e.g. wall paintings, sculpture and objects of artistic and historic value, and/or studies of materials and systems.
11. Give expert advice on maintenance strategies, management policies on the policy framework for environmental protection and preservation of monuments and their contents, and sites.
12. Document work executed and make same accessible.
13. Work in multi-disciplinary groups using sound methods.

Be able to work with inhabitants, administrators and planners to resolve conflicts and develop conservation strategies appropriate to local needs, abilities and resources.

Annex C

1. THE STIRLING CHARTER: CONSERVING SCOTLAND'S BUILT HERITAGE: 2000

1.1 Introduction

Scotland's rich and diverse built heritage of ancient monuments, archaeological sites and landscapes, historic buildings and townscapes, parks, gardens and designed landscapes is an authentic, tangible and visible record of the peoples of Scotland. Remains of the past bear testimony to all aspects of human endeavour from early prehistory through to modern times. They reflect our long interaction with the landscape and seascape and show how people have responded to the circumstances of our particular geology and climate. Distinctive Scottish styles of building have evolved since prehistory. Whether they are built in stone, such as brochs, abbeys, tower-houses, Georgian terraces and industrial mills, or the intricately carved stones of early history; of timber and earthen materials, as in most settlement throughout the prehistoric period; or in some combination, together they weave an intricate tapestry of types and materials that gives historical depth to the landscape.

This built heritage has a range of values to society. In addition to its own intrinsic worth, the heritage is vital to an understanding of our archaeology, history and architecture. It provides a sense of place and national identity and contributes to the fascinating diversity of townscape, landscape, ecology and culture of Scotland. It is also an important social, economic, recreational and educational resource. It is a rich source of enjoyment and inspiration, touching most aspects of everyday life and offering lessons from the past for the present and the future. This built heritage is irreplaceable and should be conserved for generations to come.

Conservation is the action needed to secure the survival of our built heritage for the future. It is the responsibility of all, from central and local government, to professionals working in the built environment, to the individual owners, occupiers and users of historic sites or buildings and to those who live or work in historic towns and cities and in the countryside.

Our built heritage embraces a range of types of subject. These include monuments, buildings and sites, the fabric of which is too important to the nation to warrant any change other than the very least intervention necessary for its preservation. They also include properties which remain in use and the fabric of which (but not the architectural quality and character) has to be adaptable to appropriate change in order to secure continued use.

This Charter sets out broad principles for the conservation of the built heritage in Scotland and is applicable to all its component parts. It has been informed by, and builds on, the body of international conservation charters already in being.

1.2 THE CHARTER

- Article 1 Actions taken in respect of Scotland's built heritage should secure its conservation for the benefit and enjoyment of present and future generations.
- Article 2 There should be a general presumption in favour of preservation: no element of the built heritage should be lost without adequate and careful consideration of its significance and of all the means available to conserve it.
- Article 3 Scotland's built heritage should be managed in a sustainable way, recognising that it is an irreplaceable resource.
- Article 4 Appropriate measures, which do not compromise cultural significance, should be taken, including through access, research, information and education, to assist all people to enjoy, appreciate, learn from and understand Scotland's built heritage.

Article 5 Conservation of Scotland's built heritage should:

- 5.1 be based upon sound knowledge and understanding of the particular site, building, monument or landscape, and of its wider context;
- 5.2 be founded on full awareness and consideration of its cultural significance and all phases of its development;
- 5.3 be carried out in accordance with a conservation plan, which brings together all of the information and research necessary to guide the proposed action;
- 5.4 ensure that what is to be conserved is properly recorded before, during and after work;
- 5.5 make provision for recording where continued preservation is no longer possible or where loss is taking place through change or ongoing decay, and ensure that all records are retained in readily accessible archives;
- 5.6 incur only the minimum degree of intervention considered appropriate for the type of site, building, monument or landscape;
- 5.7 use appropriate materials, skills and methods of working;
- 5.8 have regard to retaining, or where appropriate enhancing, the setting of the site, monument, building or landscape;
- 5.9 ensure that, where change is proposed, it is appropriate, carefully considered, authoritatively based, properly planned and executed, and (if appropriate) reversible;
- 5.10 include effective arrangements for monitoring the condition and safety of the site and for routine maintenance and good housekeeping.

Article 6 In relation to their respective roles, the relevant bodies and individuals should ensure that:

- 6.1 the statutory protection afforded to the built heritage is kept under review;
- 6.2 full use is made of the statutory provision available to protect the built heritage;
- 6.3 the built heritage is afforded due respect in all their activities;
- 6.4 the highest standards are set for, and applied to, conservation practice;
- 6.5 appropriate and effective systems are established for monitoring and recording the condition of the built heritage;
- 6.6 suitable knowledge, skills, materials and technologies are available to enable conservation and management to be carried out in ways that safeguard the intrinsic archaeological, architectural, historical and cultural significance of the heritage;
- 6.7 support, advice and encouragement, and clear and comprehensive guidance, is readily available to all whose activities have an impact upon the repair, management, protection and conservation of the built heritage;
- 6.8 training and education to enhance the quality of conservation practice is widely available;
- 6.9 they work in partnership where there are shared interests.