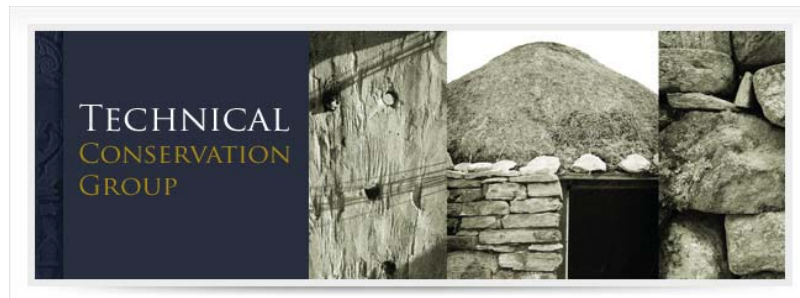


Draft for Comments - November 2009



# Technical & Scientific Research Strategy 2009 - 2011

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## **Draft for Comments – November 2009**

The Technical Conservation Group of Historic Scotland is developing its Technical & Scientific Research Strategy for consideration by Stakeholders. It seeks to explain how research projects are considered and evaluated as a process, both with internal research proposals and proposals from outside Historic Scotland. Current and proposed projects are also listed.

The document can be downloaded at: [www.historic-scotland.gov.uk/currentconsultations](http://www.historic-scotland.gov.uk/currentconsultations)

We would welcome comments directed to [Carsten.Hermann@scotland.gsi.gov.uk](mailto:Carsten.Hermann@scotland.gsi.gov.uk) by 01 February 2010.

## **Contents**

1. Introduction.....	3
2. Context.....	4
3. Objectives .....	4
4. Thematic areas of technical and scientific research.....	5
5. Stakeholders.....	7
6. Prioritisation.....	7
7. Frameworks for delivery and outcomes.....	9
Appendix A – Research Project Evaluation Sheet for TCG Management Group.....	10
Appendix B – Technical & Scientific Research Programme 2009 - 2011 .....	12

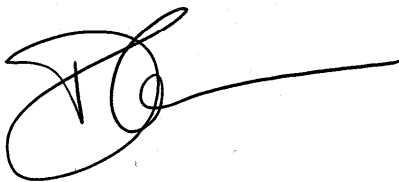
## 1. Introduction

The objective of Historic Scotland's Technical Conservation Group (TCG) is to *inform and sustain the conservation, repair and maintenance of the built environment*. This is achieved through:

- Undertaking technical and scientific research
- Supporting the perpetuation and understanding of traditional building skills
- Understanding and promoting the use and availability of traditional building materials
- Provision of specialist technical and scientific advice
- Provision of applied specialist conservation services
- Delivery of technical education and outreach activity

Effective conservation, repair and maintenance of the traditionally built environment requires a sound technical knowledge base from which to make informed decisions. This strategy sets out the context for our research, the broad themes our research relates to in terms of scope, and how we prioritise our research programme.

Our key stakeholders and delivery mechanisms are identified. The work of TCG places much emphasis on working in partnership with others. The challenges in this area are significant and require a range of specialist knowledge which we cannot all master. Therefore we will continue to work with others in the planning and delivery of our technical and scientific research.



David S Mitchell

**Director**

**Technical Conservation Group**

November 2009

## 2. Context

This strategy is related to wider Scottish Government strategic objectives:

- Scottish Government's Strategic Objectives for a wealthier, healthier and safer Scotland
- To focus government and public services on creating a more successful country with opportunities for all of Scotland to flourish through increasing sustainable growth
- Scottish Government National Performance Framework 2007 & National Outcome 12 (to protect and enjoy the historic environment)
- To raise the GDP growth rate in Scotland to the UK level by 2011
- To reduce carbon emissions by 80% by 2050
- Historic Scotland Framework Document (2008)

There are other influences and partnerships that assist TCG in planning including the National Heritage Science Strategy and the British Isles Technical Forum.

## 3. Objectives

This research strategy and the programme that falls out of it seeks to meet the needs of a wide range of stakeholders (internal and external) and to build upon the significant technical research undertaken by TCG (formerly Technical Conservation, Research and Education Group, TCRE) to date. It also takes account of ongoing projects and commitments at the time of development and the forecast resources, both financial and in terms of staff resources.

Traditional buildings (generally those constructed before 1919) are an irreplaceable asset to Scotland. The traditionally built environment plays a substantial role in creating a sense of place and national identity as well as contributing significantly to the Scottish economy. This includes not only the tourism industry, but the broader economy as a whole, in particular the construction industry. One third of all repair and maintenance work, which accounts for nearly 50% of the total Scottish Construction Industry, relates to traditional buildings.

We share and align our technical research with our counterparts in English Heritage, Cadw and the Northern Ireland Environment Agency.

Ongoing technical research is crucial to safeguard Scotland's resource of traditional buildings and contribute to sustainable development. TCG research will cover a wide range of technical issues relating to materials, skills, technologies, conservation, and repair and maintenance issues.

One of TCG's most important contributions to reducing emissions will be the provision of technical knowledge related to this issue. The research strategy will focus strongly on conducting research into energy efficiency, embodied energy and climate change.

Encouraging and increasing the value and enjoyment of Scotland's built heritage is another key Historic Scotland activity in support of the National Performance Framework. Technical research will inform our technical education and outreach activity, and our TCG Technical Outreach and Education Plan.

Protection and enhancement of traditional buildings will continue to be supported by TCG research, in particular by specific research focusing on the current skills gaps and shortages within the traditional building skills sector. The TCG Research Strategy also aims to develop technical expertise within the agency to enable ongoing advice and guidance to be given to councils and developers in support of well-designed and sustainable places.

#### **4. Thematic areas of technical and scientific research**

TCG has a remit to undertake technical research in relation to materials, skills, technologies, conservation, repair and maintenance. The research activities of the Group have been designated under the following primary themes, and indicative subject matter in each theme is outlined below:

##### **Traditional materials**

Source and supply, specification and analysis, decay mechanisms. Intervention, conservation, repair and maintenance. Stone, timber, metals, glass, brick and clay based materials, roofing materials, concrete, mortars and binders, paints and finishes.

**Traditional structures and components**

Design and specification, uses and application, manufacture and supply chain, analysis of performance, decay mechanisms. Intervention, conservation, repair and maintenance, sustainability issues. Typological studies e.g. ecclesiastical, bridges, shopfronts, etc.

**Traditional building trades and skills**

Assessment of what skills remain and predicted shortfalls. Skills and qualification mapping. Recording of skills at risk. Quantifying training provision and demand. Investigating lost skills and techniques where relevant.

**Energy efficiency in traditional buildings**

Thermal performance of building elements such as mass walls, windows, floors and roofs. Improvement options and testing. Testing of materials and benefits. Methodologies for assessment of traditional building performance.

**Sustainability and embodied energy**

Embodied energy of materials and components. Embodied energy of existing structures versus replacement. Payback times, both in financial and carbon terms with regard to replacement products.

**Impacts of climate change**

Physical effects of climate change. The effects of future climate patterns on traditional elements and structures. Performance of traditional coatings and surfaces. Performance of traditional mortars and binders. Drainage systems and durability.

**Facilities and building management functions and equipment**

Fire management, maintenance, heating, ventilation and air conditioning, energy conservation, use of micro renewables, environmental control, biological growth, scaffolding and access, building adaptation and re-use, natural hazards, direct impacts of climate change.

**Evaluation of emerging technologies and techniques**

Recording equipment and techniques. Resource assessment, repair and maintenance techniques and materials, technical education, developing themes in building pathology.

**Regulatory control**

Evaluating technical impacts of regulatory changes on traditional buildings or their components.

## 5. Stakeholders

The broad range of interests in relation to the traditionally built environment is reflected in the wide range of stakeholders in developing the Research Strategy and the broader activities of the Group. Many of those identified as stakeholders are also important partners in the delivery of our research, dissemination of results, and sharing of knowledge.

The range of stakeholders, in general terms, comprise of the following:

- National and local governments
- Heritage bodies
- Educational sector
- Professional bodies
- Historic Scotland Groups (Inspectorate, Policy, and Properties in Care)
- Practitioners
- Research bodies
- Sector Skills Councils

External and internal stakeholders are welcome to suggest areas of research for consideration, and these ideas will be considered and assessed by the TCG Management Group. Initial research suggestions, both external and internal, should be submitted in writing and preferably accompanied by the evaluation sheet at Appendix A.

## 6. Prioritisation

How TCG assesses potential research areas or topics, and prioritises them is an integral part of this Research Strategy. TCG will assess the value of a proposed topic by considering a series of questions about the project. The points that will be considered and evaluated from the evaluation sheet will seek to address the following matters / questions:

**Requirement for the project**

- What is driving the need, what are the project partners?
- Is this new or building on existing knowledge?
- Who will use the information and what penalty will there be on the historic or traditional environment if the research is not done?
- Anticipated area of application and how will the information be used?
- Will the research be relevant to TCG Objectives, National Outcome 12, and Scottish Government's Strategic Objectives?

Generally our focus is on knowledge that can be applied to historic or traditionally built structures including maintenance, operation or other related functions or requirements.

**Other factors for consideration**

- Duration of project?
- Funding requested?
- What other funding has been secured?
- What media will the outcome be in and how will it be disseminated?
- How long will publication of any findings take?
- What is the nature of Historic Scotland's support if not financial?

Such questions cannot be rigid, and the research topics will be adjusted as circumstances and conditions change.

These questions do not seek "yes or no" answers as such; this process is not intended to act as a scoring or ranking mechanism, but prompts consideration of important issues, such as collaborative working, Government and Agency needs, and how this work fits in with existing research.

Following consideration by TCG's Director and Depute Director, the TCG Management Group will assess how the project is fitted in with existing commitments and resources. Following assessment, projects will be judged as high, medium, low or not relevant. High, medium and low priority are self explanatory; the not relevant option refers to proposed research projects that are outside the remit of TCG, and is no reflection on its potential intellectual or practical use.

## 7. Frameworks for delivery and outcomes

Technical and scientific research delivered by TCG requires a range of research frameworks to be applied to take advantage of available expertise and resources, and to maximise impact and benefits. These will include:

- In-house research delivered by TCG's Applied Conservation, Science, and Technical Research Units
- Commissioned research to external parties
- Collaborative research with external partners, particularly academic institutions and national bodies
- Part or fully funded studentships, normally at Masters level or above
- Sponsored student research projects
- Joint / collaborative research with other Historic Scotland Groups

A three year working programme (see Appendix B for current projects) shall be maintained with a forward look extending to ten years to assist with resource planning and horizon scanning. Stakeholders may contribute to this at any time accepting that any proposals will be looked at and subjected to the criteria above.

Peer review and the use of technical steering groups around specific projects have proven to be effective in producing high quality and effective research, but also in improving stakeholder participation and ownership. In addition, TCG will facilitate an annual Technical & Scientific Research Seminar for stakeholders where progress and current activity will be discussed and discussion encouraged.

Outputs of the research will be disseminated using a broad range of media, including conferences, seminars, printed and -increasingly- electronic media in accordance with TCG's Technical Outreach and Education Plan.

**Appendix A – Research Project Evaluation Sheet for TCG Management Group**

<b>Contact details</b>	<b>Applicant to complete</b>	<b>TCG comments</b>
Proposed project name		
Sponsor or proposer		
Project partners		

<b>Project details</b>	<b>Applicant to complete</b>	<b>TCG comments</b>
Brief description of project		
Requirement for the project		
Project partners		
New or building on existing knowledge		
Anticipated area of application		
Who will benefit from this work?		
Risks of not doing this work?		
Relevance to TCG Objectives, National Outcome 12 and Scottish Government's Strategic Objectives?		
Duration of project?		

*continued overleaf*

*Research Project Evaluation Sheet - continued*

<b>Project details</b>	<b>Applicant to complete</b>	<b>TCG comments</b>
HS funding requested?		
Other funding achieved?		
What is the outcome?		
What media will the outcome be in and how will it be disseminated?		
Publication timescale?		
Nature of HS support sought if not financial?		

<b>Depute Director comments</b>
<b>Director comments</b>
<b>Assessment</b>
<input type="checkbox"/> High <input type="checkbox"/> Medium <input type="checkbox"/> Low <input type="checkbox"/> Not relevant
<b>Budget allocation</b>
<input type="checkbox"/> New <input type="checkbox"/> Existing <input type="checkbox"/> Other

<b>Allocated to Project Manager</b>	<b>Date</b>	<b>PID due</b>

## Appendix B – Technical & Scientific Research Programme 2009 - 2011

### 1. Traditional materials

Project title	Partners	Timescale	Notes / output
Shell lime - use and practice	Internal research project	Ongoing	Basic understanding of practice
Scottish timber supply chain and suitability in conservation work	Forestry Commission Scotland, Napier University Timber Research Unit, Confederation of Forest Industries	Ongoing	Investigate the use of native timber in conservation projects and encourage uptake
Building stone assessments / mapping historic sources	Scottish Stone Liaison Group, British Geological Survey	Ongoing	Under Scottish Stone Liaison Group Memorandum of Agreement
Building stone - quantification of demand	Glasgow Project extensions	Ongoing	Under Scottish Stone Liaison Group Memorandum of Agreement
Thatch survey	Highland Council, National Trust for Scotland, HS Inspectorate	Ongoing	Update Thatch buildings survey to baseline position to better inform grant provision.
Research into the technical development of Scottish brickwork	Internal research project	Ongoing as part of an internal PhD	Evolution, use and conservation issues
Regional character and building stones	British Geological Survey	Sep 2009	Commissioned Regional Volumes of Scottish Building Stone to be e-published

*Table continued on next page*

*1. Traditional materials - continued*

<b>Project title</b>	<b>Partners</b>	<b>Timescale</b>	<b>Notes / output</b>
Baseline assessment of current state of traditional material supplies	Broad range of suppliers, trade bodies and specialists	Dec 2009	A summary of issues, present situation and possible developments
Provenance of lime in traditional buildings	University of the West of Scotland	Year 2 of 3	PhD studentship
Mapping traditional materials and emerging sustainable building market	SUST, Scottish Government Architectural Policy Unit, Scottish Environmental Design Association	Apr 2010	Identify mutual benefit and crossover
Traditional street masonry - understanding and issues	Scottish Stone Liaison Group, British Geological Survey, Glasgow City Heritage Trust, Merchant City Townscape Heritage Initiative, Edinburgh World Heritage Trust	2009/2010	Understand extent and tradition as basis for guidance and skills development
Quantification of moisture movement through traditional lime mortars and stone, and effects of Ordinary Portland Cement	Academic partner	2009/2010	Quantify existing evidence with some empirical data on moisture movement and impacts on building decay
Methodologies for evaluating and projecting decay and loss of masonry	Digital Design Studio (Glasgow School of Art)	2009/2010	Possible laser scanning / photogrammetry project

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*1. Traditional materials - continued*

<b>Project title</b>	<b>Partners</b>	<b>Timescale</b>	<b>Notes / output</b>
Understanding traditional masonry mortars to improve the compatibility of mortar repair	University of the West of Scotland	2011/2012	Part funded studentship
Bronze statuary - maintenance issues	Local authorities	To be set up	Develop technical and ethical debates
Selection principles for slate	British Geological Survey, Scottish Stone Liaison Group	To be set up	To inform best practice
Architectural paint research	Lincoln University, local authorities	Ongoing	Analysis of historic decorative schemes to inform conservation and restoration works
X-ray diffraction analysis of stone	National Museum of Scotland, British Geological Survey	Ongoing	Identify salts, alterations and deposits to inform conservation practices
Assessment of timber performance within traditional buildings and assessment of potential replacements	AOC Archaeology, Forestry Commission Scotland, Scottish Green Woodworkers, Centre for Timber Engineering (Edinburgh Napier University), University of Glasgow, University of St Andrews	Begins 2010	Scientific analysis of wood structure and identifying / sourcing of potential replacement material

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*1. Traditional materials - continued*

Analysis of earth structures	University of Sterling	To set up	Analysis of samples taken from earth buildings to assess performance, conservation and condition
Pine beam dendrochronology	AOC Archaeology	2008-2010	Explore dating and source of pine beams c1580-1630; historic development of paint

## 2. Traditional structures and components

<b>Project title</b>	<b>Partners</b>	<b>Timescale</b>	<b>Notes / output</b>
Work with Scottish House Condition Survey to develop better data gathering for traditional construction types	Scottish House Condition Survey	Ongoing	Revised data sets for the Scottish House Condition Survey to assess in judging demand for in
Hill House - Research of technical archival sources and 3D modelling to interpret and model interventions and building pathology techniques	National Trust for Scotland	Student placement ongoing	Report on building repair sequence
Short Guide for Concrete Repair	HS internal, Heriot-Watt University	Feb 2010	Printed guide for owners and building professionals / trades
Short Guide for Brick	HS internal	Feb 2010	Printed guide for owners and building professionals / trades
Short Guide on War Memorial Conservation	HS internal, War Memorials Trust	Feb 2010	Printed guide for owners and building professionals/trades
Window trials - in situ testing of timber window	HS internal, community groups	2010/2011	Report on thermal performance and durability of structure
Scottish industrial archaeology in South America		Possible MSc student on placement	Relates to ferrous metals theme / report
3D laser scanning and digital documentation of traditional structures	Digital Design Studio (Glasgow School of Art), CyArk Foundation	Ongoing	Provides accurate 3D models of structures; allows analysis and measurement to a millimetre scale

### 3. Traditional building trades and skills

<b>Project title</b>	<b>Partners</b>	<b>Duration</b>	<b>Notes</b>
Qualifications mapping to identify gaps and inform future work in this area.	Scottish Qualifications Authority, Construction Skills Industry	Ongoing	Under strategic partnership agreement; key report
Ongoing identification of audio and film footage for Scottish Archive of Building Skills Project	Scottish Screen, Learn Direct and Build, School of Scottish Studies	Launch: Nov 2009	
Building Scotland publication and travelling exhibition	Various contributors from industry	Nov 2009	Hardback publication and exhibition

#### 4. Energy efficiency

<b>Project title</b>	<b>Partners</b>	<b>Duration</b>	<b>Notes</b>
Assist Climate Challenge Fund - training of energy assessors	Scotland-wide community groups	Ongoing	HS training of energy assessors as additional service
Assist in Development of Scottish Government Carbon Assessment Tool (DEMSCOT)	Scottish Government Housing Unit	Ongoing	Contribute to Scottish Government project via expert panel
Windows trial - glazing options in traditional windows	Changeworks, Energy Savings Trust, and others	Nov 2009	Highlight and test best practice - written report
Thermal testing of internal insulation	Reidvale Housing Association	Nov 2009	Update HS report on U-values of mass walls
Simulated air flow modeling in a traditionally built room	Integrated Environmental Solutions Ltd	Mar 2010	Report
Best practice refurbishment of two properties	Dumfries House Trust	Design stage complete by Mar 2010	Construction phase 2010-2012
EPCs and traditional buildings - case studies	National Trust for Scotland	Ongoing, to complete Mar 2010	Improvement recommendations included in report
Sensitive refurbishment of 19 <sup>th</sup> century school – post project evaluation of improved elements	Strathclyde Building Preservation Trust, Campbeltown Conservation Area Regeneration Scheme	Site start Mar 2010	Written reports and best practice

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4. *Energy efficiency- continued*

<b>Project title</b>	<b>Partners</b>	<b>Duration</b>	<b>Notes</b>
Pilot project for energy efficiency improvements in Glasgow City Chambers	Glasgow City Council, HS Inspectorate	Nov 2010	Case study report on large public building
Dialogue with Carbon Trust and Energy Saving Trust	Carbon Trust, Energy Saving Trust	2010/2011	Knowledge exchange and development
Test thermal upgrading of a timber floor	Academic partner, Reidvale Housing Association	2010/2011	Report and guidance
Test thermal upgrading of a roof elements	Strathclyde Building Preservation Trust	2010/2011	Report and guidance
Comparative testing of modern and traditional internal finishes and their effect on air climate	Academic partner	To be set up	Written report
Test external insulation	To be confirmed	To be set up - awaiting suitable community building 2010/2011	Technical report on performance, durability and associated issues
Energy efficiency in historic buildings	Part of EU FP7 funding bid – 3 possible collaborative projects	Awaiting bid outcome	Reports and data
Thermal imaging of buildings and components	HS internal	Ongoing	Assessment of areas of thermal performance, dampness, and hidden structural features

## 5. Sustainability and embodied energy

<b>Project title</b>	<b>Partners</b>	<b>Duration</b>	<b>Notes</b>
Comparative evaluation of embodied energy of existing and modern windows	Crichton Carbon Centre	Dec 2009	Report
Embodied energy of two traditional buildings	Dumfries House Trust	Mar 2010	Report
Stone and natural building resource mapping	Dumfries House Trust	Completion: Mar 2010	Written report in conjunction with other projects
Energy use and carbon emissions from traditional buildings in Scotland	Heriot-Watt University	2009-2012	PhD studentship; HS to publish final thesis
Carbon foot printing of imported stone against indigenous materials	Commissioned work with Heriot-Watt University, Scottish Institute of Sustainable Technology, Scottish Stone Liaison Group	1 year study, completion: Jun 2010	Report and delivery to HS Energy Seminar Mar 2010

## 6. Impacts of climate change

<b>Project title</b>	<b>Partners</b>	<b>Duration</b>	<b>Notes</b>
Soft cappings report	Arc Architects	Dec 2009	Research report
The effect of climate change on Glasgow's sandstone buildings	University of Glasgow, British Geological Survey, Natural Environment Research Council (NERC)	Year 2 of 3	NERC CASE PhD studentship with TCG acting as industrial partner
Binder migration	Heriot-Watt University	Year 1 of 3	Interim reports annually
Written guidance on reinstatement after flooding of traditional buildings	University of Bath, Arc Architects, Association of British Insurers	Awaiting funding bid	Guidance publication
Current mechanisms and future patterns of stone decay in cleaned sandstone and granite buildings	University of the West of Scotland, Robert Gordon University, British Geological Survey	Year 2 of 3	Existing project, part funded by TCG, remainder by other 3 partners

## 7. Evaluation of emerging technologies and techniques

Project title	Partners	Duration	Notes
Ferrous metals research project evaluating practical interventions - cleaning, repairs, coating, recording	Edinburgh Napier University, Ferrous Metals Working group, practitioners	Year 2 of 4	Existing research project to inform best practice
Evaluation of laser scanning and visualisation applications to building pathology, interpretation and technical education.	Digital Design Studio (Glasgow School of Art), Royal Commission on the Ancient and Historical Monuments of Scotland, CyArk Foundation	2 years	Various smaller research projects
Testing of a limecrete floor slabs for vapour permeability and thermal performance.	Glasgow Caledonian University	2009-2011	Test results of thermal performance and basic technical guidance
Combining thermal imaging data with point clouds from 3D laser scanning as an informative tool	HS internal	Ongoing	Initial animations already produced; currently working on refining the images
Evaluation of plastic repairs	University of the West of Scotland, consultants	2010/2011	To assess suitability, durability and performance of a range of repair mortars and systems
Evaluation of timber treatments	HS internal	2010/2011	Assessing the need for chemical intervention and any legacy issues.
Testing methods of wicking salts from sandstone walls	HS internal	2008-2011	Assessing methodologies for removing harmful levels of salts from buildings

## 8. Facilities management

<b>Project title</b>	<b>Partners</b>	<b>Duration</b>	<b>Notes</b>
Scottish Historic Fire Database	Grampian Fire & Rescue Service	5 years until 2012	Outputs to fire and rescue services in Scotland
Fire testing of traditional doors	Norwegian academic partners	Ongoing	HS contribution to wider EU project
Scaffolding traditional and historic buildings	Author identified	1 year	Guidance publication
Insurance guidance	Association of British, HS Inspectorate, insurance companies	2010/2011	Guidance publication

**9. Regulatory control**

<b>Project title</b>	<b>Partners</b>	<b>Duration</b>	<b>Notes</b>
Update of HS publication 'Practitioners Guide no. 6: Conversion of Traditional Buildings - Application of the Scottish Building Standards'	HS, Scottish Building Standards Division	2 years	To include fire and energy efficiency
Impact of new CE designation on the supply of traditional materials	Stone Federation of Great Britain, Scottish Stone Liaison Group	Ongoing	