

Project Outcomes

The scientific outcome of the project will be an increased understanding of the wetting properties and drying out processes of masonry walls, specifically those constructed of porous brick and red sandstone. This will be based on data from both laboratory experiments and field measurements at two case-study sites.

In order to apply this understanding, the project is developing a computer model of the wetting and drying processes. The main project outcome will therefore be a computer model that can predict how long masonry walls, of two main construction methods and materials, take to dry under different conditions of external climate, room temperature and relative humidity. The model will be used to test out different drying scenarios to determine their appropriateness for traditional wall fabric and construction, where damage could be caused by shrinkage and mobility of salts within the wall, for instance.



Inside test area, showing salt damage at Blickling

A practical outcome of the project will be a set of user-friendly guidelines produced in co-operation with the stakeholder partners, on the drying of historic buildings and adaptation to moisture-related climate change problems.

Stakeholder's comments

"The National Trust looks forward to the outcomes of this project as an aid to management planning for the drying of flooded buildings. We are anticipating that flood events will occur more frequently as a result of climate change"

The National Trust

Project Description

Monitoring of the external climate, indoor temperature and relative humidity and wall moisture content is under way at two case study sites. At Blickling this is being undertaken in a damp basement corridor which has flooded several times in recent years. The Brodick monitoring is in a contrasting part of the building: a room in the Castle tower that suffers from moisture penetration from driving rain. Laboratory replica test walls have been constructed following a detailed study of the design and materials of the brick and stone walls at Blickling and Brodick.



Exterior of test area, showing brick damage at Blickling

Bricks were especially made to a 17th century formulation by Bulmer Bricks, a company specialising in handmade bricks. The sandstone wall was constructed from stone from the Locharbriggs quarry, which is a good geological match for the Brodick stone. Materials testing is currently under way in the laboratory and the test walls' moisture contents are being monitored to obtain their baseline conditions prior to the project wetting experiments. The computer modeling is progressing well, and a model that successfully couples wall conditions to room relative humidity has been developed. The next step is to couple room sources of heat and moisture to wall boundary conditions.

The project application will come through the user friendly guidelines on adaptation of drying strategies to moisture related climate change problems. These will be based on the project research cost, justified through socio-economic evaluation and prepared in cooperation with the stakeholder partners.

Potential Applications

The project has three main elements.

The first element consists of laboratory measurements of (i) the physical and moisture properties of brick and sandstone and (ii) the wetting properties of traditional replica test walls, based on the brick and sandstone walls at the two case study sites. This work is being undertaken at Glasgow Caledonian University.

The second element of the project is University College London's development of a computer model of the drying out processes of a masonry wall, using the Matlab® kit of modeling tools.

The project case studies form the third element and these are being undertaken at two buildings in the care of the stakeholder partners. Blickling Hall, Norfolk is a 17th century brick-built National Trust property with a history of damp and susceptibility to flooding, whilst Brodick Castle on the Isle of Arran is a sandstone building, the earliest parts of which date back to the 13th century. Brodick Castle is in the care of the National Trust of Scotland and Historic Scotland and is in an exposed location where it is susceptible to wetting from heavy rainfall and driving rain.



Brodick Castle – the Tower case study area is on the left



Stone and brick samples for testing of moisture properties by X-ray method at Glasgow Caledonian University

Sharing the Outcomes

The user friendly guidelines will be launched at project workshops to take place in London and Glasgow in the Spring of 2006. A project website has been set up for both public information and as a reference site for the project partners.

Papers will be submitted to peer-reviewed scientific and conservation journals in late 2005/early 2006, with publication likely to be in 2006 or 2007.

See website for up-to-date details:
www.ucl.ac.uk/sustainableheritage/research/HistoricFutures/

Anticipated project completion date:
April 2006

Contact Details

Project Manager:

Prof. May Cassar

UCL Centre for Sustainable Heritage

m.cassar@ucl.ac.uk

UKCIP:

Gerry Metcalf

UK Climate Impacts Programme

OUCE/University of Oxford

gerry.metcalf@ukcip.org.uk

Stakeholder Contact:

Sarah Staniforth

The National Trust Conservation Directorate

sarah.staniforth@nationaltrust.org.uk

EPSRC:

Dr Filomena La Porta

Climate Change, Energy Efficiency and Fusion

Engineering and Physical Sciences Research Council

filomena.laporta@epsr.ac.uk