DRY LINING AS A METHOD FOR MAINTAINING COMFORT LEVELS BENEATH PITCHED ROOFS: AN EXPERIMENTAL CASE STUDY

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Introduction

Loft spaces and roof voids present quite a challenge in the refurbishment and conversion of spaces beneath pitched roofs. There is a tendency for expensive heat loss in winter and excessively high temperatures during the summer months. Recent work on a small property in Northern France was used as an opportunity to undertake some tests whilst adopting some modern materials to obtain consistent comfort levels whilst also addressing fuel costs and sustainability issues.

Description of the building and context

Situated in the Parc Naturel Regional Normandie-Maine about two hours drive south of Caen, the building is a single-storey dwelling with a footprint of 40 square metres with an underlying cellar traditionally for storing apples and a loft space for pears. The roof has a pitch of about 42 degrees and is of a simple rafter system with a mid-point principal truss with purlins running into each gable-end. The ridge runs from north to south exposing the slates to morning sun on the rear elevation and afternoon sun on the front. It is believed that the building was constructed in about 1760 with the walls re-heightened about 100 years later to provide windows to the loft space. The walls are approximately 550mm thick and are of local granite with clay mortar. The building was derelict for more than thirty years and had a new covering of slates following storm damage in 1999. Three small skylights were added at this time to introduce more light into the loft space.

Strategy

The building is protected and owners are expected to follow guidelines similar to those we use in the UK for our conservation areas. Minor changes can be agreed with the local mayor with more significant interventions needing approval at Department level in conjunction with the Parc Naturel authorities. In this case all the alterations have been agreed locally as all have been internal apart from new windows and doors which respect the pattern of those being replaced. The new windows are in wooden frames and are double-glazed using conventional glass.

The thickness of the solid granite walls is such that considerable heat would be required to raise the temperature of the building during the winter months and, as building usage is anticipated to be intermittent, it was decided that the walls should be dry lined to enable a simple wood-burning stove to raise the internal air temperature as rapidly as possible.

Pre-renovation tests

A number of simple tests and measurements were made during the first year of the project after the new windows and door were fitted. Essentially internal temperatures were measured to enable a comparison before and after the dry-lining. Winter temperatures, particularly in the loft space, varied dramatically on a day-by-day basis throughout the seasons, but most markedly in the mid-winter and high summer. The mid-winter temperature variations related directly to external weather conditions especially when there were clear skies when temperature in the loft could range from -3 degrees centigrade just before dawn to 30 degrees in mid-morning when the low-angle sun warmed the roof. Summer temperatures had a wide range in the loft space with night-time temperatures averaging about 14 degrees regularly rising to as high as 50 degrees in the early afternoons. Temperatures in the ground-floor accommodation showed less severe changes in temperature than the loft, but still significant on a daily basis but also consistently above 18 degrees in the summer and below five in the winter.

Although only based on a single year (June 2007-June 2008) the data is especially valid as the weather experienced during the 12 months was statistically consistent with the range of weather experienced over the last ten.

Choice of materials

The underside of the roof was lined with a modern 8mm 'foil and bubble' composite liner then covered with insulated plasterboard

(10mm plasterboard with 40mm of foam). The walls had a similar quilt liner, followed by an aluminium frame and the same insulated plasterboard.

Post-renovation tests

A similar monitoring exercise was carried out following the dry-lining of the building in 2009-10. Results showed that all temperature extremes were reduced especially night-time/daytime swings. Average winter temperatures (including when the building was unoccupied) remained consistently warmer. There was also a reduction in average temperatures during the summer months especially in the loft space where it was reduced to a daytime average of 17 during August.

Conclusion

Although it was expected that dry lining would improve comfort levels during both winter and summer, it was particularly effective in keeping the building from overheating during the hottest months. During the winter the spaces became much easier to heat rapidly with a small wood-burning stove easily producing enough heat to raise the temperature within half an hour to 17 degrees throughout the ground floor and similar temperatures in the loft space (by circulation through the open stair-well).

Profile

Charles Hippisley-Cox is Course Leader for Architectural Technology and Senior lecturer in Building Conservation at Huddersfield University. He has nearly thirty years of experience of working with historic buildings and studied Architecture at Sheffield University after working in local government and for English Heritage. He taught at Bournemouth University in the award-winning Department of Conservation Science before taking his current post.

CONSULTATIONS

RSVP

The Association endeavours to represent the views and interests of its members by responding to consultations which are issued by various government agencies and other bodies. In order to ensure that your opinions are taken into account, please consider any consultations which are relevant to your area of expertise and provide comments to the Association. In addition, if you become aware of a matter to which you feel the Association should be responding please contact Kevin Blunden at kevin.blunden@abe.org.uk

Communities and Local Government

Andrew Stunnell MP, the Parliamentary Under Secretary of State responsible for Building Regulations, has sent a letter to organisations asking for ideas in relation to 'Future Changes to the Building Regulations'. Unfortunately, the timescale for responses has not enabled the ABE to seek the views of all members. A response has been drafted and details will appear in a future edition of 'Building Engineer'.

Defra, DECC (Department of Energy and Climate Change) and the Welsh Assembly Government

A consultation has been issued relating to Environmental Permitting, with support and advice on the practical implementation from the Environment Agency.

Environmental Permitting is a major initiative that has already created a single more user-friendly and modern permitting and compliance framework for a range of permitting and licensing regimes.

In this consultation it is proposed to introduce civil sanctions into Environmental Permitting and make a series of other amendments to the Environmental Permitting (England and Wales) Regulations 2010. The consultation invites views on these proposals.

The full consultation package can be found on Defra's website: www.defra.gov.uk/corporate/consult/env-permitting-regs/index.htm

The consultation ends on 24 September 2010 and comments to ABE for inclusion in response should be sent to kevin.blunden@abe.org.uk by 09/09/2010.

The Welsh Assembly Government

A consultation has been issued in relation to Planning Policy Wales: Section 12.8 Planning for Renewable Energy seeking views on a proposed update to national planning policy on renewable energy in Wales. The update is intended to enable the delivery of A Low Carbon Revolution – Wales' Energy Policy Statement and renewable energy and climate change commitments.

It should be noted this is not a consultation on renewable energy policy and the energy aspirations contained with it. This was published in March 2010.

Full details can be found at http://new.wales.gov.uk/consultations/planning/ppwrenewableenergy/?lang=en

The consultation ends on 08/10/2010 and comments to ABE for inclusion in response should be sent to kevin.blunden@abe.org.uk by 20/09/2010.

Department of Finance & Personnel – Northern Ireland

The Department is proposing replacing the Building Regulations (Northern Ireland) 2000 with a new set of Building Regulations and changing the format of the accompanying Technical Booklets.

Phase one of this consultation is underway and details can be found on the Building Standards Branch website www.buildingregulationsni.gov.uk.

The consultation ends on 29/10/2010 and comments to ABE for inclusion in response should be sent to kevin.blunden@abe.org.uk by 11/10/2010.

Scotland

Although there are currently no formal consultations issued by the Scottish Government which are relevant to Building Engineers, the Association has recently held talks at Lutyens House with representatives of the Building Standards Division regarding the future of the verification process in Scotland. We would be pleased to receive your comments in relation to this issue.