



## STBA / SPAB Technical Panel Energy Efficiency Research Update Conference 2014

Date: 17 June 2014      Venue: The Gallery, 77 Cowcross Street, London EC1M 6EL

# CONFERENCE NOTES

(As taken by Cathie Clarke, Heritage Skills HUB)

### STBA Introduction to the STBA Guidance Tool and Knowledge Centre

*Adrian Leaman (Usable Buildings Trust)*

The Guidance Wheel has been developed by the Sustainable Traditional Buildings Alliance ([www.stbauk.org](http://www.stbauk.org)) with DECC funding. It can be accessed and used here: [www.responsible-retrofit.org/greenwheel](http://www.responsible-retrofit.org/greenwheel)

The Wheel is designed as a decision making tool for those working on traditional buildings. It allows for a systemic approach to retrofit and provides a holistic view of all elements that should be considered:

- Graphical context of the retrofit
- Categories of intervention (fabric, services, behaviour)
- Measures in more detail
- Different Retrofit perspectives (technical, heritage, energy)
- Measure to Measure linkages
- Concern colours (Red means high risk!)
- Outcomes and consequences
- More detail if needed
- Live links to source material (knowledge centre) with or without paywalls

It is straightforward and easy to use, communicating complex information in a responsible and even-handed way. It is also easy to update as new research becomes available. Play with it now!

What next? – Case studies are required. Individual Case Studies can be ‘Bell Weathers’ and can inform coherent strategies for the future. There should be a focus on “interactions” not “processes”. There is too much emphasis on ‘proof’ and it is not required. However, there must be a clear protocol for the collection of Case Studies to ensure a coherent and sensible record.

## The SPAB Building Performance Survey: 2014 Refurbishment Update

*Dr Caroline Rye Lead Researcher SPAB / Archimetrics*

Research work started in 2011, and only 3 of the six original buildings selected for the project have been monitored. The project is focussing on interstitial moisture monitoring and dew-point margins and how these can be used to predict moisture saturation of solid walls. Different forms of insulation have been applied to three very different buildings in different parts of the country, and measurements of temperature and dew point have been taken over time to monitor changes in interstitial moisture. It is important to note that any form of internal wall insulation will cause cooling of the wall, and also that when Relative Humidity exceeds 80% damage to timber can be expected (through rot and beetle infestation). Occupant behaviour, location, orientation and construction materials vary:

**House 1** – Drewstaignton 600mm thick granite walls. 100mm PIR insulation was used. Walls demonstrate an upward trend in Relative Humidity and are above 80% - favourable conditions for mould growth, although no convergence of temperature and dewpoint apart from monitor closest to the external face of the wall and this is explained by wind driven rain seeping into the wall.

**House 2** – Brick end of terrace, Shrewsbury with a different orientation to the Drewstaignton house – Handmade soft brick, 345mm thick which is much more porous as it has a more open structure. Internal insulation was woodfibre covered with a lime plaster. Dewpoint margins continue to be separate with fairly steady Relative Humidity (RH) over the year. Continues to perform well with low risk of interstitial moisture. Monitoring shows that the insulation appears to be performing a buffering role with respect to temperature and humidity. However, measurements from sensor 3, which is placed 210mm from external wall face, reflects the extreme weather during January 2014 with very high RH. This was when there was continual wind-driven Southerly rain for a 3 day period!

**House 3** – Cob house . This house was treated with an external insulating render which replaced the failing cement render. This house did not behave as expected over the year, as the dew point readings increased after insulation render was applied. It is considered that considerable additional moisture was introduced into the wall as part of the re-rendering process, as can be measured through Absolute Humidity readings. Several peaks were also seen on the readings. It is not certain what processes are occurring, but it is thought that the wall could be 'sweating' to allow the moisture to escape. It is hoped that continued monitoring will give a clearer picture as to the movement of moisture in this building.

## Hygrothermal Research and EFFESUS project.

*Carsten Hermann Senior Technical Officer Historic Scotland*

Measurements have been taken to assess hygrothermal activity on an insulated Glasgow tenement. There is high levels of wind-driven rain in Glasgow. In winter, there are low sun/light levels and high amounts of rain. WUFI modelling has been used, but the simulation has been based on German sandstone data as none exists

for UK sandstones. Inevitable differences will compromise accuracy of modelled data. Modelling has so far shown no problems, although modelling and in-situ measurements differ at interface between insulation and the wall, concluding that better modelling is required!

The EFFESUS project involves 23 partners from 13 countries. It will produce 7 demonstration case studies from Historic Urban Districts built before 1945 across the EU. Districts contain old buildings – they don't have to be listed. The project is developing new retrofit measures and looking at energy management systems as well as renewable energy. It is supporting the development of AEROGEL insulation for application behind existing wall finishes as currently it is not in a stable enough form for it to work. Early trials showed that the AEROGEL was turning to dust, sometimes even in the packaging. Reversibility issues will be considered. The project is also developing a software tool for Urban Districts that can be used to make informed decisions about improved measures. Heritage Significance will be an important consideration within the new tool. A 5 step rating system will be employed to define Heritage Significance and it will be balanced against the impact of interventions (eg solar panels) [www.fffesus.eu](http://www.fffesus.eu)

## **Hygrothermal Research Overview – Thermal Performance & Risk**

*Soki Rhee, English Heritage*

This research has been concerned with the thermal performance of traditional brick walls, floors and roofs. 18 houses in 3 locations have formed the study undertaken by Soki Rhee and Paul Baker.

The Bolsover Project involved insulating with PIR in the ground levels, with wood fibre insulation and lime render at first floor level. Secondary glazing installed with new timber single glazed units and the addition of roof insulation. Measurements to monitor the temperature, relative humidity and moisture content were performed by using wooden blocks in contact with the brickwork. Gable wall shows more variability than others, particularly in winter.

They have also undertaken simulation and WUFFI modelling on test walls in lab conditions (UCL & Glasgow Caledonian) to test the 3 types of insulation systems used in the buildings:

1. Mineral Wool with timber battens
2. PIR
3. Lime Render

Testing of BS8104 & BSEN15927 on the Ditherington Flax Mill in Shrewbury. The earliest iron-framed building in the world and is Grade 1 Listed. South Engine House walls – after installation of 75mm PIR with vapour barrier on both sides of the insulation. Monitoring starting June 2014. Results will be compared with the results from the Bolsover project and WUFFI Lab model results.

Important to note that the way data is measured generates considerable discussion. Which is best? Resistance-based, capacitance, probes, wooden dowels, watermark probes?

Also – moisture measurements can vary dramatically within walls, so one-off readings can be unreliable, but more comprehensive monitoring restricted due to funding.

Also looking at impact of roof insulation – it is assumed that this will require additional ventilation to avoid condensation. Same for floors.

Project will also be looking at U-value testing on conservation and secondary glazing.

Nick Heath's review of insulation – report will be available soon on the English Heritage website

### **BRE (DECC) Solid Wall Heat Loss Research Project**

*Colin King Associate Director BRE Wales*

This is a new research project, funded by DECC concerned with all types of solid walls excluding massive historic walls (eg castles). It will result in guidance on how to assess Unintended Consequences of retrofit interventions. It will analyse data from projects that are up to 6 years old to try to establish where and when problems start. It will look at design, occupier behaviour and the impact of lack of funding on the effectiveness of actual retrofit over designed retrofit.

BRE consider a probable 74 un-intendend consequences ranging from health (building and occupant), lack of performance, increased or new problems not existing before intervention.

However, current calculations for moisture are steady state, not weather dependent, so it is difficult to classify materials and performance. Walls undergo massive changes in temperature and moisture-they are in a constant state of flux, not steady-state.

What is the effect of poor workmanship and lack of simple maintenance. LACK OF SKILLED WORKFORCE! Improved quality control is required on site to reduce this. Who is taking responsibility for works and managing consequences?

Cold bridges – significant problem, often caused by poor specification or installation (or both!) and could negate energy savings predicted for planned retrofit intervention.

Old buildings are not 'leaky'. If we make them more airtight we create more condensation, which leads to mould and damp where none was before. Leading to the question – is insulation the correct thing to do???

This knowledge MUST be used by assessors, but current training is INADEQUATE!

Correct knowledge and understanding leads to correct intervention system, correct installation.

## **STBA Moisture Research**

*Neil May – STBA*

Neil highlighted the lack of knowledge, skills and interest in the built environment sector. Some knowledge on moisture within buildings will take years to gain and understand. Timescales are therefore very important. Moisture affects both the buildings and occupants. Reports can be found on [www.stbauk.org](http://www.stbauk.org) including new guidance document: 'Moisture Conventions & Standards' – written for DECC. Standard EN13788 is based on steady state measurements and Standard EN15026 on dynamic measurements. BUT, nearly all guidance is based on EN13788 and is therefore not at all suitable for traditional buildings with solid walls – this then means the wrong advice is being given out for these buildings.

Standards need to be dynamic to account for location, orientation, weather etc. Condensation leads to dry rot, dustmites and damp. However, EN15026 is not ready yet – it still needs systemic effects included and skills to use it.

Moisture can be in the form of solid, liquid and gas and it's movement within a building fabric is complex and dynamic.

Initial STBA research points to thermal bridging being more of a problem than first thought. Indeed, it may well not be sensible to insulate at all. Insulation makes the role of doors, windows and unintended thermal bridges very important.

We have to deal with issues in context. Key points from the guidance report are:

1. New understanding of moisture mechanisms
2. Renovation of existing buildings
3. Increased airtightness
4. New awareness of relation of moisture and health of building & occupants
5. Uncertainty & complexity issues

They should be tackled using the following principals:

- Quality
- Context & compatibility
- Coherence
- Capacity for errors
- Caution

Each principle is broken down into more detailed elements.

## **National Trust's New Environmental Standards and EPC Case Studies for the PRS**

*Morwenna Slade, National Trust, Russell Smith of Parity Projects*

The Energy Act 2011 is a provision for the Rental sector and gives Tenants the right to request energy efficiency interventions. By 2018, EPC rating 'E' will be a minimum requirement. If this increases to 'C' in subsequent years, this will create significant issues for landlords. It doesn't apply to listed buildings.

National Trust have over 5000 rental properties and most are pre1919 and unlisted. They currently have a 10 year maintenance cycle, but work needs to start now to implement energy efficiency measures.

Parity Projects have modelled the building stock and estimate that 50% of the buildings are currently rated 'F' or 'G'. A rating of 'E' is achievable without major interventions, 'D' is significantly harder. There is a big gap between desk-based assessment and level of input needed.

A training exercise raised issues with RdSAP. PRS regulation is requiring National Trust to change focus from care and sustainability rather than fuel cost and compliance. For example, LPG is now a problem, not a solution with respect to PRS compliance.

Is Internal Wall Insulation inevitable – despite all the evidence against it?? Interestingly, Solid wall insulation costs work out as £6.5K to get to 'E', £26.8K to get to 'D' and £55million to get to 'C'. Compare this with all interventions except solid wall insulation, then £4.4K to get to 'E' and £19.2K to get to 'D'.

Some buildings will NEVER reach EPC standards, no matter what intervention is carried out.

How do we get the message out to policy makers? More time is required for further research!

## **100 Unintended Consequences of policies to improve Energy Efficiency of the UK's housing stock**

*Clive Shrubsole, UCL*

Single focus policies do not work! Simply trying to reduce CO2 is not the answer – one size does not fit all! Take a look at the Australian Home Insulation Policy (HIP) – this has created lots of building fires and some deaths due to unskilled workforce – this policy has now been scrapped.

UK policies like Green Deal and ECO have some positives, but they could create many potential health issues – both known and unknown un-intentional consequences. See paper by Davies M & Oreszczynt 2012 'The Unintended Consequences of Decarbonising the Built Environment'.

New research has identified about 120 unintended consequences to the building and the environment.

Would integrated policy formulation help? Look at HEW, the Housing Energy & Wellbeing pilot project.

Wellbeing is a valuable issue and should be using this terminology. The project showed through a small simulation that all stakeholders are involved. More research required.

## **Current Perspectives on Traditional Buildings**

*Hunter Danskin, Science & Innovation DECC –*

Hunter referred to the BRE U-values study (due to be published in July 2014) and Moisture Guidance project. Variations are seen in brick density and moisture content, air gaps found between stretchers which act as a mini-cavity. Local bricks have differing properties. Lots of variation – too costly for extensive monitoring.

Other projects:

- Solid Walls
- EHS
- ETI Retrofit Project (smart systems and heat)

## **Heritage & Philosophy of Sustainability**

*Neil May Director, Natural Building Technologies*

Neil quoted a statement from a top Virgin executive “Sustainability is not about ethics, it’s about logistics” and was saddened by it. Is that really the aim of sustainable policy?

There are no grounds for a discussion between Energy and Beauty and the value of Heritage and Craft.

There is a philosophical view and a tactical view – ie good enough for now. The Sustainability agenda cannot just be based on energy! Values of heritage, craft and beauty need to be included. But numbers are more powerful than ethics.

Assumptions also dominate, so the issues are not properly discussed.

Proposal – There is a strong need for a philosophical discussion:

- What are buildings for?
- How do they relate to the natural environment and sense of place?