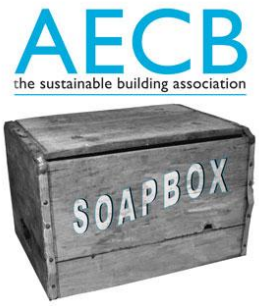

We must change our disgraceful approach to build quality – or wave goodbye to energy savings

Three years of experience with thermographic imaging and airtesting on all kinds of buildings have led AECB member Paul Buckingham to the depressing conclusion that almost without exception, buildings in this country are shoddily assembled and fail to meet the standards set. What is worse, the prevailing ethos seems not to be 'how well can we build?', but 'how quickly and cheaply can we get these boxes ticked?' In the latest AECB soapbox, Paul shares some of his horror stories, and calls for an enforcement regime which delivers real, as opposed to imaginary, construction standards.

For a number of years now I have been involved with carrying out thermal imaging surveys on properties, and more recently carrying out air tightness testing on new builds. I find it staggering that with all the new 'tighter' building regulations being introduced over the past few years, energy efficiency still appears to be a matter of choice rather than a requirement.

I have probably surveyed something like 150 properties of all kinds, residential and commercial, and of all of them, I can honestly say only two were built to a high energy efficiency standard. The first was a German prefab house, which was excellent, and the other was an eco-house built with energy efficiency as the driver.

All new builds (well at least one of each design on each development) requires an air tightness test in order to pass building regulations, but extensions do not. I was called to look at a new extension recently because the owners had a few concerns about the insulation. Suitable materials had been used and the correct thicknesses installed, but the standard and detailing of the installation was, to be blunt, a disgrace.

Air tightness was nonexistent; the roof insulation in the loft conversion had been put in without any real understanding of what it was supposed to achieve, resulting in cold air bypassing it. When you

opened the eaves cupboards you could see daylight from the soffits, and feel the cold wind cutting through into the bedrooms.

Thermographic images of the upstairs ceiling (figs 1 & 2) showed how the cold air was bypassing the insulation – or the insulation was simply absent. Images of the ceiling below (fig 3) also showed large cold areas where cold air was penetrating between the ceiling and upstairs floor. These are just a few examples of what was found, the whole house displayed similar areas everywhere - a whole article could be written just on this one property.

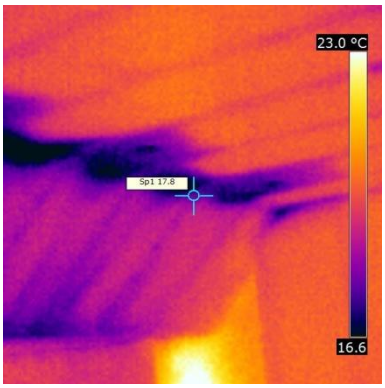

Figure 1: Cold air is bypassing the roof insulation on the vaulted section, and missing insulation above is clearly seen

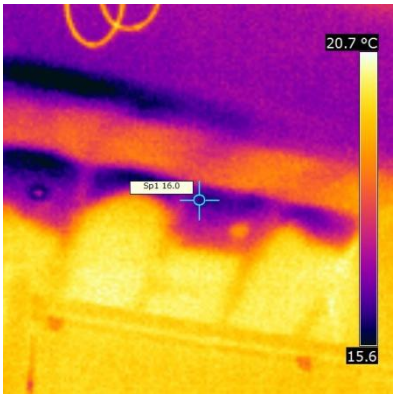

Figure 2: Missing insulation above another part of the ceiling.

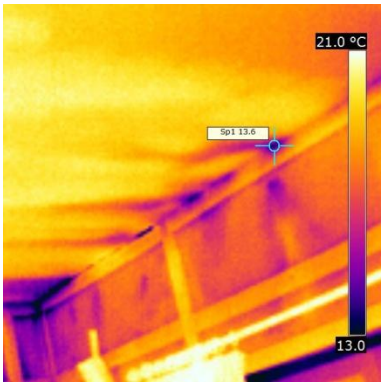

Figure 3: Downstairs ceiling: cold air from the soffits is penetrating between the floor and ceiling. No sealing of this area had been carried out. The room had wood panelling around the walls; cold air passing behind this can also be seen

Leaky Buildings

Most new builds are finished using the dry lining method because it is cheaper, easier and has a faster drying time than the traditional wet plastering, but is one of the biggest causes of poor air tightness in buildings. On nearly every air test I have worked on, leaks can be attributed to dry lining – and these draughts in turn pointing to air gaps in the outer skin, eg at roof level or where mains services go through the shell.

With dry lining, particular weak points are behind bath panels and kitchen units, where the plasterboard finishes and there is a gap between it and the floor. Leaks here also indicate that the top of the board is not sealed at the ceiling junction, allowing cold air to pass behind the board, effectively bypassing any cavity or roof insulation. (See figs 4&5) Draughts are also regularly found at any penetration through the plaster board such as electrical sockets, pipework, etc.

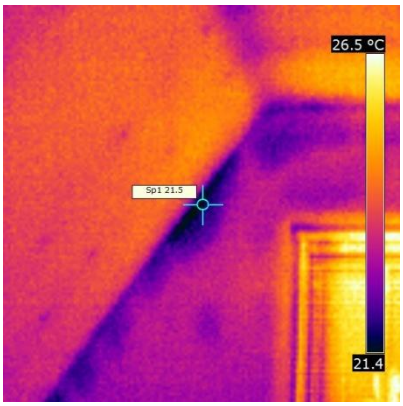

Figure 4

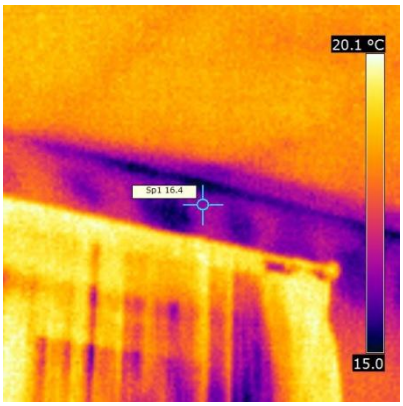

Figure 5

Figures 4 and 5: Two different properties built within the last 5 years, both have dry lining and both show cold air penetrating behind the lining board.

Air tightness testing is regulated in theory, but it is really down to the integrity of the individual tester to determine whether a building passes or fails. Very often on arriving at a site we are met by a team of guys armed to the hilt with rolls of duct tape ready to slap over any draught found, in order to cover the holes and get the all-important pass. But of course as soon as the test is over the tape is removed, and the building reverts back to its leaky state.

This is not however the way we practice. We start with the test, and if it fails, which in many cases it does, we use tape to help identify, demonstrate and prove to the builders where their issues are, and they are advised to rectify these and call us back for a retest.

Several air test companies blatantly advertise that they will guarantee an air test pass, and one has even been rumoured to turn up on occasion and issue a certificate without getting their gear out of the van – which is a bit like issuing an MOT without seeing the vehicle.

Meanwhile, we have been accused of failing buildings because 'we didn't use as much tape as other companies do'!

The trouble is of course, 99 times out of 100 by the time the air test is done, the building is mostly finished and ready to be occupied. But to ensure the shell has been properly constructed, a test should be carried out before any finishing, so air tightness is built in to the fabric as the build progresses. You wouldn't put your boots on, realise your feet are cold, and try to put your socks on without removing your boots. Yet trying to retrofit air tightness after finishing is just as nonsensical.

Air testing, in my opinion, should be witnessed by the building control officer and passed on his or her say so. They should have the authority to demand the builder to strip out the building and achieve a pass before they can complete the build. This would only happen once, because the cost would ensure air tightness is achieved on every future build.

Gaping cavities

Cavity wall insulation is always assumed to be perfectly installed, but for a couple of reasons I believe that retrofitted insulation blown into the cavity is highly unlikely to fully fill the cavity on the majority of buildings. Firstly, I wrote my thesis on Urea Formaldehyde CWI and having looked at several older installations, the only conclusion I could reach was that if you have it, you are probably uninsulated. Over the years since it has been installed it has degraded to such an extent that there is very little with any substance left to do its job. Most cases show 20% shrinkage and large cracks, allowing air movement around the insulation and effectively rendering it useless.

The second issue is incomplete installations. This is well illustrated in a small cavity wall in my own house. Many years ago the integral garage was converted into a dining room, and this little wall was built between the two brick wall pillars (big thermal bridges either side, but that's another story!). The wall is about 2m wide and about a meter high, with a 70mm cavity. I did a quick thermal

imaging survey of the external wall which showed warm patches below the window, the wall had three injection holes where the insulation had been blown in (see figures 6 and 7).

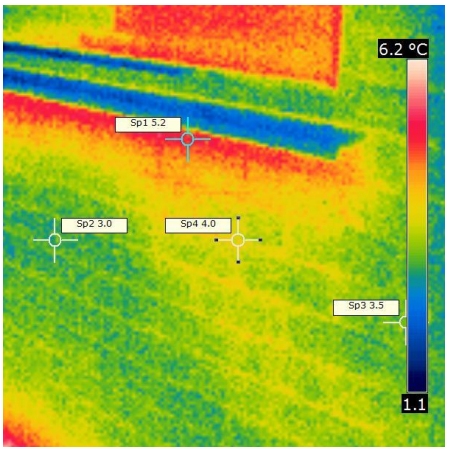

Figure 6 A warm area below the window ledge indicates the likelihood of limited CWI.

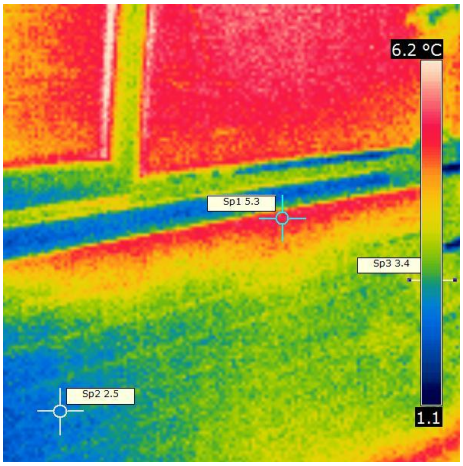

Figure 7 A similar warm area below the middle of the window.

The wall is tiny, so fully filling with blown in CWI should have been very straightforward and easy to do. However, when I removed the window sill to investigate, this was far from the reality (see figures 8, 9 and 10.)

Figure 8

Figure 9

Figure 10

Figures 8, 9 and 10 show that the cavity in this wall was approximately 2/3 full

If a small area like this cannot be fully filled, what chance does the cavity of a whole house have? I have seen other examples of this, and again could probably write an entire article on them.

With insulation, you can specify as much as you like, using the highest-performing materials, but if it isn't installed properly, then it isn't going to perform. Performance is all about how you install it, the detailing, and the time you take to ensure everything is fully insulated. I have seen research demonstrating that 100mm board installed in the usual fashion (no sealing tape to cover the joints, and gaps where it had been cut by hand and butted together) had equivalent performance to 60mm installed correctly. In other words, if the installation is incorrect, you could be wasting about half the insulation that has been bought.

SAP versus reality

SAP calculations are based on the assumption that all the insulation is perfectly installed, and air tightness meets the required score without the use of temporary sticky tape patches. The reality is that insulation on virtually all buildings would fail a 'to the book' investigation if the current building regulations were enforced to the letter. SAP calculations and EPCs work on the assumption that builders know how insulation works and what is to be achieved by installing it, and are given time to put that understanding into practice, but in general it is just put in to satisfy a quick building inspection and get a tick to prove it has been done.

This is also an issue when it comes to retrofit. So, for example, for a Reduced Data SAP for the Green Deal the survey consists of:

Question - 'do you have CWI?'

Answer – 'yes.'

Verdict – 'Your walls are fully insulated.'

If the basics of what the building actually contains (and how it has been installed) are not investigated, there is no chance that any of these calculations and predictions can be accurate and achieve what is expected, either for the individual household, or for our national energy and carbon targets.

Assessors need to know how buildings are put together, how the buildings and materials perform, and all the issues that are likely to be present within a building, new or existing. None of this is addressed by any official assessment process, but is fundamental to producing energy efficient buildings.

As it is, in newbuild, the SAP calculation and EPC will often fail to give a realistic idea of energy consumption and emissions for the purchasers. For retrofits, the estimates both of the performance of the existing building, and, if measures are installed in the ways illustrated above, then the estimated savings too, are liable to be inaccurate. (With retrofit the errors could be significant in either direction – either promising too much, or missing worthwhile improvements on current faulty construction and installation).

Within the building industry, energy efficiency is only being achieved by a small number of builders and construction companies who are dedicated to and driven by energy efficiency. The rest do what they are required to do to get building regulation approval and are not producing buildings to the potential energy efficiency standards that they could be. Green Deal providers, if anyone actually signs up to have work carried out, will likely be of the latter so energy savings are going to be less than potentially achievable.

Moving forward with energy efficient construction to meet future targets needs not only higher standards, but also enforcement. Building control officers must be more closely involved with a hands on role throughout the life of the project. Energy efficiency cannot be based solely on predictions, calculations and assumptions. If we actually started to address the built reality, we might be able to deliver savings in reality too. If we ignore what is really happening, those savings will remain assumptions, and won't be real at all.

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Paul worked for many years as a maintenance engineer involved with production and facilities and developed an interest in energy efficiency, renewables and the environment. In 2009 he started studying at The Centre For Alternative Technology in Wales for an MSc. For the last 3 years he has also been carrying out energy audits and building surveys, advising people how to reduce energy consumption and energy efficient refurbishment and more recently carrying out air tests and installing PV systems .