THIS IMAGE System building methods are vital believes the UKTFA **RIGHT** Crest Nicholson is currently involved in the collaborative AIMC4 project **FAR RIGHT** DuPont AirGuard AVCL is an advanced, lightweight and easy to answer to improved water resistance and thermal performance in building **BELOW** DuPont Tyvek Supro and DuPont AirGuard AVCL work together at this high-spec housing development in Scotland

Even the best laid plans may not translate perfectly into a new home. ROGER HUNT discusses how to ensure what is being delivered in terms of energy performance is exactly the same as the original design.

Closing the performance GAP

Another acronym was born at Ecobuild this year: DvAB. It stands for Designed v As-Built and is the name of a project being undertaken by the Zero Carbon Hub to examine the energy performance of new homes.

Ensuring that what has been designed is the same as what is being delivered is ever more crucial as we strive to improve the energy efficiency and overall performance of buildings. It is increasingly believed that new housing is failing to deliver the anticipated levels of CO2 emissions as well as other key areas of design. The industry and government backed DvAB project will consider the construction process as a whole, from design and planning to testing and verification, gathering evidence of areas where an energy use 'performance gap' could occur.

The issue is not new and has already been considered in 'Low and zero carbon homes: understanding the performance challenge', an enlightening NHBC Foundation publication written by Cutland Consulting. In the foreword, the chief executive of the Zero Carbon Hub, Neil Jefferson points to the fact that "Addressing the CO2 performance gap will be critical to the delivery of the zero carbon homes policy and maintaining confidence in new homes."

Mike Leonard, CEO of the Modern Masonry Alliance welcomes the Zero Carbon Hub project. "Only by taking a representative sample and looking at all stages of the process will we really know if there is a substantive issue and, if so, where we need to direct our resources to solve it." ▶

The UK Timber Frame Association is also involved with the DvAB project. Paul Newman, chair of the UKTFA technical committee, notes that the gap between design and as-built performance can be caused by inaccuracies in U-value calculations, SAPs calculations, or thermal bridging modeling. It can also be affected by changes in materials leading to changes in performance, or it can simply be down to poor quality workmanship on site.

Newman believes system building methods have a strong role to play in minimising the gap between design and as-built performance. “Offsite building methods ensure quality of construction, which can be monitored at every stage, whereas other methods are reliant on a multitude of trades, with no interest in the next phase of the build programme. Factory based activities allow better and safer working conditions, while also protecting the workers from the changeable British climate, which is more likely to lead to better quality work.”

When it comes to identifying the reasons for performance failings, the emphasis tends to be on thermal bridges, badly detailed joints and air gaps, which are often caused by movement or inadequate detailing. Inaccuracies tend to creep in during the structural design, the manufacture of the components and installation on site.

At Natural Building Technologies, managing director Neil May takes a broader view than many, believing that the performance gap is more than just an energy gap. “Most new and retrofitted buildings fail to deliver in practice the designed performance in three key areas. Firstly, thermal and energy performance, most importantly in regard to space heating, but also hot water, cooking and appliances. Secondly, health and comfort, which relates to the level of breathability of the building fabric, moisture control, toxins created due to damp and mould, and overheating. Thirdly, the impact on the environment, in terms of carbon emissions, pollution and consumption of resources. These need to be measured both during the construction and throughout the lifespan of the building.”

May believes that taking an informed systems approach to building design is the first step towards closing the performance gap as this starts to deal with the interaction between products and building elements and services. “Looking at building products or elements in isolation will fail to take into account their compatibility in a building as a whole, and could be counter-productive even if products or elements seem good in themselves.”

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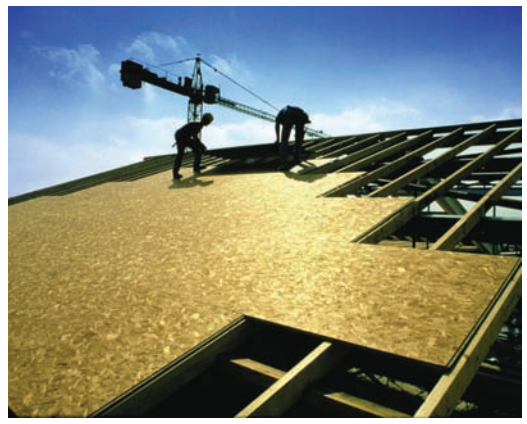
CLOCKWISE FROM TOP LEFT The UKTFA believes system building methods have a strong role to play in minimising the gap between design and as-built performance | The UK Timber Frame Association is also involved with the DvAB project | Natural Building Technologies ThermoPlan blocks in use | The UKTFA notes that the gap between design and as-built performance can be caused by inaccuracies in U-value calculations, SAPs calculations, or thermal bridging modeling

OPPOSITE PAGE

TOP Natural Building Technologies Pavawall insulation system has been on used on these Coastal Homes **MIDDLE** Natural Building Technologies ThermoPlan blocks in use **BOTTOM** Thin-joint masonry in use



There is a perception that the issues leading to the performance gap run right through the delivery system. “The issues are sometimes small but always incremental and, by the time you add it all up, the difference between design and built can be as much as 300%,” says Chris Wilford, associate director at PRP Architects.

Aside from workmanship and quality issues on site, Wilford identifies some other less often mentioned factors, in particular he is concerned that SAP is a poor predictor of real life. For example, it does not allow for regional variation whereas France’s tool contains three climatic zones.

Julia Plaskett, Crest Nicholson’s group sustainability executive, notes that the SAP tool was developed to assess the energy performance of homes during the design process and it therefore gives a design output. “It was never intended to predict in-use performance, not least because in-use performance has a high dependency on lifestyle – much as the mpg of a vehicle depends on driver behaviour and the driving conditions.”

As homes become increasingly energy efficient, Plaskett believes it has become more important than ever to understand how our homes behave in practice. “We need to ensure that future versions of the SAP tool can be aligned with building performance, as well as gain an understanding of the key areas of lifestyle behaviour which influence energy use.”

Crest Nicholson is currently involved in the collaborative AIMC4 project to design and deliver innovative homes as part of a consortium supported by funding from the Technology Strategy Board. Notably the homes are being monitored and evaluated over a long period of time by the BRE – with initial findings expected towards the middle of 2014 – to increase understanding of fabric performance, emission levels and to gain customer feedback.

Understanding how buildings and building products perform is essential. The BBA, supported by the NHBC Foundation, has recently published the results of a research project looking at a variety of roof insulation materials. A key finding outlined in the ‘Air Movement and Thermal Performance’ report is that thermal insulation performance is affected very significantly by air movement, with the U-value of the roof constructions tested increasing by up to 80% at higher wind speeds.

Nick Williams, UK technical manager, DuPont Building Innovations, says that the BBA’s conclusions point to factors and solutions that certain leading manufacturers have been addressing diligently for some time. “These recommendations include ‘the development and promotion of improved guidance on installation and workmanship’ plus ‘more robust thermal design techniques’; and ‘the acceptance of alternative construction methods’.”

The supply chain can play a vital role in helping to improve construction standards. Kevin Riley, vice president, construction industry at Metsä Wood, explains that the company’s engineering team liaises constantly with housebuilders and provides the ▶

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engineering knowledge and finished designs for all the structural timber components in a house design. "Accuracy of design should be further improved as BIM becomes more widely used. Using BIM will reduce the possibilities for error as clashes or omissions will become obvious and be resolved before the site work starts."

The standard of product installation is undeniably as important as the specification of the product itself. Andrew Orriss, head of business development at SIG Insulation, believes the stage has now been reached where manufacturers are developing products that are capable of meeting the highest efficiency performance levels. "However, with government legislation driving efficiency standards up at such a rapid rate, many contractors are finding they haven't had chance to equip themselves with the requisite skills to correctly install these new, super-efficient products to the standard required."

Neil May raises another important consideration, the need to look ahead past the present idea of practical completion to take into account the building's use and whether it is going to be healthy. "The whole notion of practical completion should be changed. There needs to be a 'construction completion' and then a 'contract completion', perhaps two years later. Without this we are setting ourselves up for an in-use performance gap further down the line."

Another crucial fact to be remembered is that the fabric of a building can only do so much. If the eventual owner of a new property does not know how to, or does not want to, change the way they use energy, for example by turning up the thermostat in winter while leaving windows open, a gap between design and performance will be inescapable, says Orriss. "Housebuilders and those who have direct contact with owners, such as estate agents and property managers, therefore have a role to play in educating households as to the value of energy efficient living. Otherwise, the great things that housebuilders are achieving in designing and building efficient properties can quickly go to waste." sh

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NHBC Foundation www.nhbcfoundation.org
PRP www.prparchitects.co.uk
SIG 360 www.sig360.co.uk
UKTFA www.uktfa.com
Zero Carbon Hub www.zerocarbonhub.org

Read Roger Hunt's blog: www.huntwriter.com or follow him: www.twitter.com/huntwriter

THIS IMAGE Natural Building Technologies' (NBT's) Pavawall system has been used to construct the UK's first social housing community that is 'carbon negative', Sinclair Meadows in South Shields

INSET IMAGES Thin-joint masonry in use