INDUSTRY VIEWFINDER
FEBRUARY 2023

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A NEW ERA OF ENERGY EFFICIENT BUILDINGS

PRODUCED IN ASSOCIATION WITH

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PHOTO BY JAVIER ALLEGUE-BARROS ON UNSPLASH

FEBRUARY 2023

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EXECUTIVE SUMMARY

The UK has the oldest – and some say the most inefficient – housing stock in Europe. Workmanship and cost-cutting has been a widespread issue in recent decades, and new homes' performance has been hampered by poor practice on construction sites, meaning that they are not offering the energy efficiency which designers had intended.

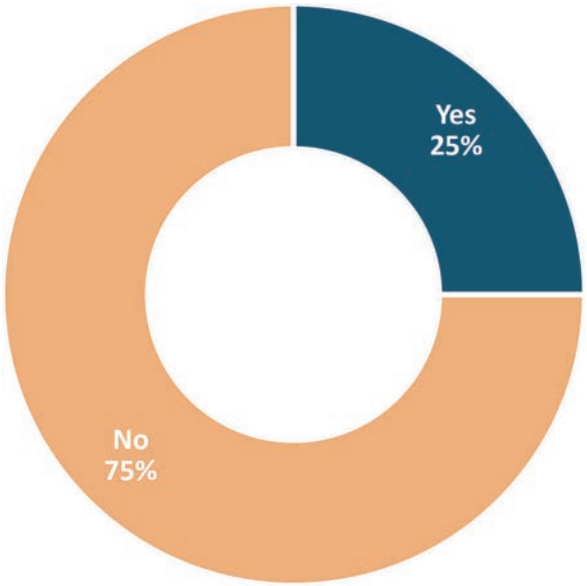
This challenging legacy, along with a gradually more determined drive at Government level to lead interventions to reduce the UK's emissions to meet its legal 2050 net zero goal, has led to a progressive tightening of Building Regulations in terms of energy use. The latest update encompasses Parts L and F, launched in June 2022 but fully in force from June 2023, and also introduces a new regulation to mitigate overheating resulting from more energy efficient building designs; Part O.

Part L, labelled 'Conservation of Fuel and Power,' previously saw a major update in 2013, amplifying factors like air-tightness of dwellings. However, as part of the race to net zero in 2050, the Government has gone further, mandating far higher building performance from the construction industry in the short and medium term. The Future Homes Standard will in 2025 require all new dwellings to produce 75-80% fewer emissions than current levels, with the 2021 uplift to Building Regulations being an interim step towards that new level. The major change for the whole supply chain to grapple with is the de facto banning of gas heating for most new homes (although the Government's Heat and Buildings Strategy in the end ducked the challenge of an explicit ban).

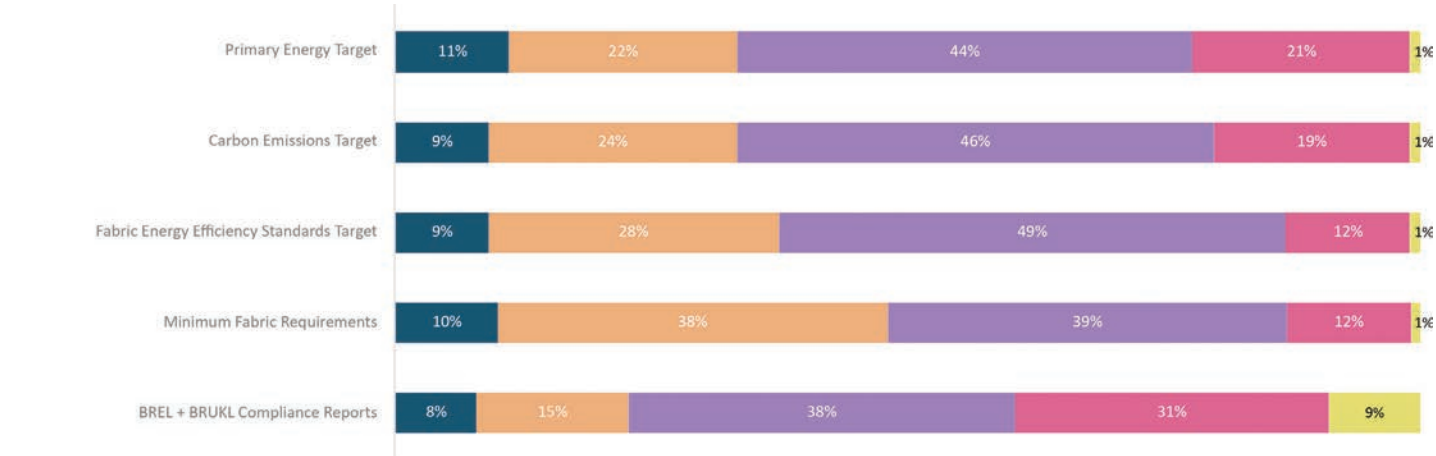
Along with changes to Part L, Part F (covering ventilation) is being updated too, to ensure that the ramifications of much more air-tight homes is mitigated by appropriate levels of ventilation to try and safeguard occupants' health. The need for this is particularly acute following the well-publicised 2020 death of two-year old Awaab Ishak in a housing association flat in Rochdale, blamed on poor ventilation leading to dampness and mould.

The new Regulations will bring significant improvements to the performance of homes (and non-residential buildings in the Future Buildings Standard which encompasses the Future Homes Standard), but also come with serious challenges for the industry. Beyond simply finding the means to update designs in a way that users will tolerate in terms of greater capital investment, there is the widespread issue of whether building contractors are able, but more importantly willing to adapt their practice to achieve more rigorously constructed, probably more costly dwellings when they are arguably not penalised for not doing so.

We surveyed architects to discover their views on these important changes to the Building Regulations – the majority were involved directly in new housing developments, self-build or mixed use including residential. We wanted to find out their understanding of – as well as opinions on – the new changes, their views on how relevant they are to architects, and the design approaches they are already taking to meet the new Parts L, F and O. We not only looked at their attitudes towards the challenges and benefits of solutions for new homes, but also for the non-domestic sector.



"Do you have a good understanding of compliance requirements for Part O for new dwellings (in terms of the 'dynamic thermal modelling method' of predicting overheating versus the 'simplified method')?"



"How well do you understand these areas within Part L?"

Very Good *Good* *Acceptable* *Poor* *Very Poor*

INTRODUCTION

The 2013 uplift to Building Regulations Approved Document Part L (covering England only for the first time), saw the then Government pledging to make all new homes zero carbon by 2016. Sadly this was to be a doomed venture, one of several sustainability initiatives axed during the 'austerity' years of Cameron's government. However the regs remained, introducing far more air-tight construction and energy improvements in a range of other parameters.

The Future Homes and Buildings Standard

In 2019, the Government launched its first consultation on strengthening the Building Regulations to increase energy efficiency, which would pave the way for the Future Homes Standard. (Last year this was amalgamated with the non-domestic Future Buildings Standard as the somewhat clunkily-named Future Homes and Buildings Standard).

The consultation included a range of new and upgraded fabric efficiency requirements, as well as proposals to encourage the use of electrically-based technologies such as air source heat pumps or solar panels, as well as the move to phase out certain gas boilers and other fossil fuel heating systems in new homes.

The 2022 interim uplift in energy performance to reduce emissions in new homes by 31% (against Part L 2013) is predicated on the idea of bringing industry to a point where it's ready to grapple with the requirements of the 2025 standard. And that in turn is based on being able to produce dwellings that require no upgrades post-2025 to get to net zero, once the grid becomes fully 'decarbonised.' Therefore, the 2022 uplift is a key part of a chain of events that needs to keep progressing on schedule for net zero to be a reality. The interim measures already apply to projects unless a building notice or full plans were submitted with local authorities before 15 June 2022. In any case, the new regulations will apply to all projects from 15 June 2023.

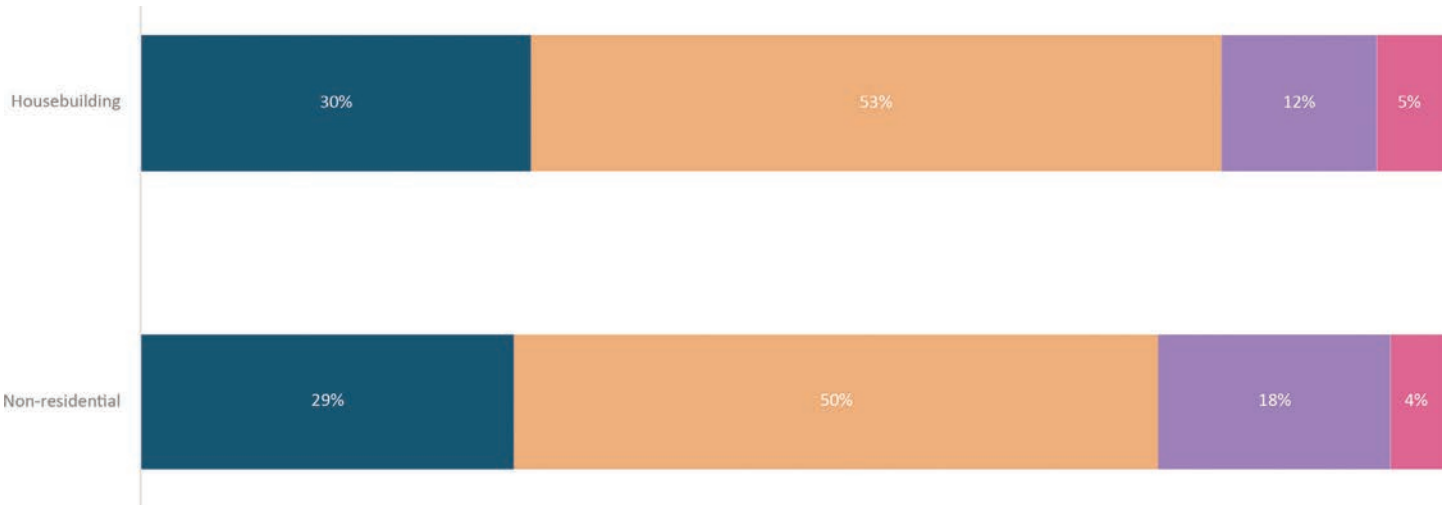
Many of the improvements required within Parts L and F have been the subject of controversy across the industry, which is entirely understandable given the pressures which construction is under, and the difficulties of changing established practices. For example, the introduction of a new metric for measuring a dwelling's energy efficiency in terms of heating (as well as delivery of energy to a site) – 'Primary Energy' – was rejected by 62% of those industry professionals consulted on the new Regs, and the Government has said it would review this approach. The metric specifies the maximum primary energy use for a dwelling.

However painful and in need of flexibility to adapt to different project-by-project requirements, change and an increase in rigour were essential first principles for the industry to accept. Arguably it will not be architects whose practices will be the most affected, and will do the most resultant complaining; but contractors who have been accustomed to doing things a certain way for a long time. The move to a much more robust audit trail on sites, a core part of the new Regs, is – together with the move away from gas – the biggest change in the new Part L. It's also likely to be the most challenging aspect of all for the industry to adapt to.

Key changes

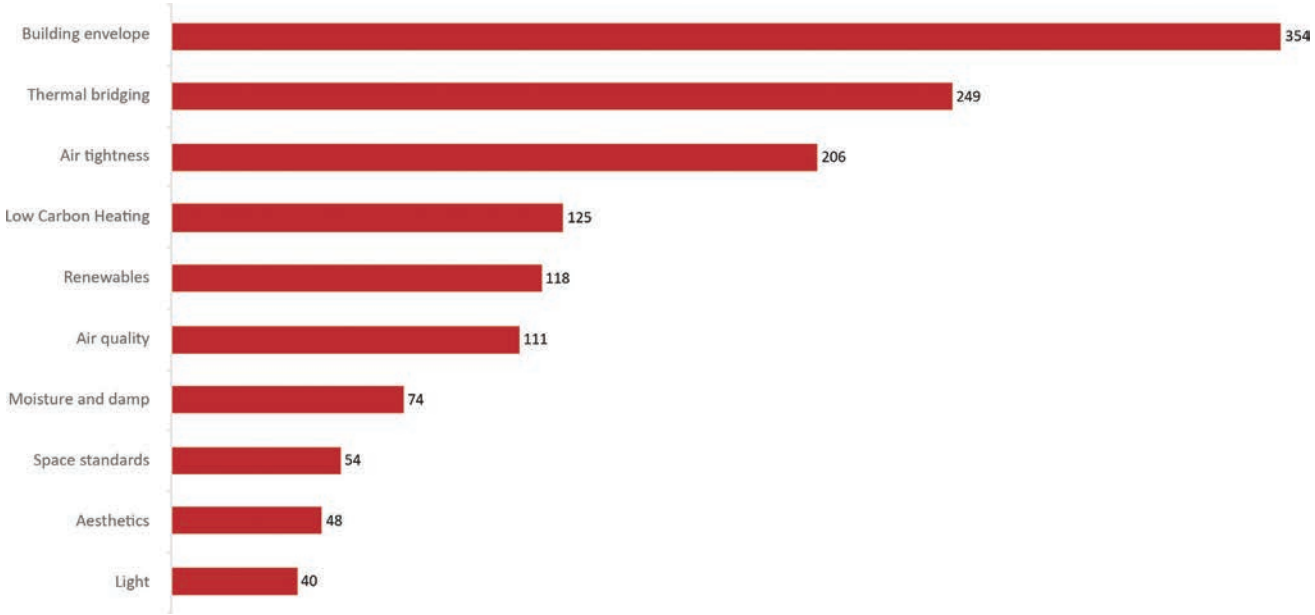
The fundamental changes to specification in new builds in the domestic and non-domestic sectors, from Parts L, F and O 2021, are as follows:

- To produce 31% fewer carbon emissions in new homes, using a combination of building fabric, installation of electric heating systems such as heat pumps, and renewable energy sources
- New non-domestic builds to produce at least 27% fewer carbon emissions
- Maximum U-value for windows and doors (new build) 1.6 W/m²K (was 2.0 W/m²K)
- Notional building U-value target for windows and doors 1.2 W/m²K (was 1.4 W/m²K)
- Maximum 0.18 W/m² for walls
- Non-domestic U-values lowered – 0.26 W/m² for walls and 1.6 W/m² for windows
- New and replacement heating systems (domestic and non-domestic) maximum flow temperature of 55°C and existing non-domestic buildings to have new controls for heating and hot water
- Part L minimum air supply rate of 0.5 l/s.m²
- Background trickle vents recommended for non-domestic buildings and CO_2 monitors in all offices



"How difficult do you believe it will be to achieve the new carbon emissions targets in Part L 2021?"

Very Difficult *Slightly Difficult* *Not Very Difficult* *Not Difficult At All*



"What are the most critical areas to focus on when designing to the new Part L in residential properties?"

- 'Full fabric specification' adopted for Fabric Energy Efficiency Standard (FEES)
- New Approved Document O introduces glazing limits in new-build homes (as well as care homes, schools and student accommodation) and enforces new levels of cross-ventilation
- Removal of overheating risk assessment from Part L and SAP
- New Approved Document S requires all domestic new builds to have the preparatory work completed for future installation of an electric vehicle charging point.

Part L remains split into two legally-binding documents – Approved Document Part L1A, covering new homes, and Part L1B, covering requirements for renovations and extensions to existing buildings. However the requirements within Part L1B are somewhat ambiguous, as they take into account that the standards possible with new builds are not always possible in refurbishments. Despite this, Part L1B states that if a 'thermal element' (roof, wall or floor) is replaced or renovated, it must be done to Part L1A standard.

Further Part L changes for existing homes/refurbs:

- Raised fabric standards for new thermal elements
- Replacement windows in existing properties now max 1.4 W/m²K
- New roofs on extensions and conservatories should have a U-value of no higher than 0.15 W/m²K; refurbished roofs to have maximum 0.16 W/m²K
- For domestic extensions, maximum 0.18 W/m² for walls, and 1.4 W/m² for doors, windows and rooflights
- Primary energy and fabric energy efficiency metric for whole house energy use calculation method for extensions
- New heating systems to be designed to accept low carbon heating in future
- Revised guidance on work to ventilation systems
- SAP compliance to be applied to extensions.

The Regs background

The 2013 uplift to Part L had already seen significant improvements in areas like air-tightness and fabric efficiency more generally. Amended again in 2016, the progress towards much greater efficiency was set in train, with 2025 (Future Homes Standard) being the first major milestone towards net zero in 2050.

The new Approved Document L 2013 came into force on 6 April 2014, for the first time covering England only. Wales would introduce their own version in July 2014 with different targets, and Scotland in 2015. The 2013 Approved Document L required new homes to deliver a 6% reduction in CO_2 emissions above 2010 standards and non-domestic, a 9% 'aggregate reduction.'

The new Approved Document L required new builds to deliver a further 6% reduction in carbon emissions on the 2010 Building Regulations. It also introduced a new Fabric Energy Efficiency (FEES) target and a 'notional building' which alongside the existing Target Emissions Rate (TER) and Dwelling Emissions Rate (DER), set the benchmark for a building's fabric performance.

SAP & the notional building

New homes will now be assessed under a new Standard Assessment Procedure (SAP) calculation – SAP10. This sets requirements for higher levels of insulation, as well as a new Primary Energy metric. The main change within the new SAP (10.2) is that the carbon weighting within the TER (Target Efficiency Rate) is now different so that electricity now has a lower 'carbon factor' than gas. The new 2021 Part L also added the 'Primary Energy' rate to TER and TFEE (Target Fabric Energy Efficiency) to make up a fuller picture of the building's energy use within the overall 31% emissions reductions target. There were however other, more challenging jumps to make for architects, clients and contractors and the whole supply chain, in terms of design and workmanship, as our survey bears out.

The notional building is a hypothetical dwelling used to calculate the TER and TFEE in SAP software, and based on the same geometry and orientation as the proposed 'real' building – but with default 'reference values' for various build elements. There is scope for design flexibility under the new Parts L and F; as long as the required TER is achieved, the ratios of how it is achieved within the various elements of the building are down to the project team in each individual case.

ASSESSING THE PROBLEM

Levels of understanding

In surveying our architect readership, we wanted to initially discover their levels of understanding on all three new regulations (the updated Parts L and F, but also the new Part O). A healthy 9% believed they had a 'very good' understanding of the Part L changes, however 12% said their understanding was 'poor.' Part F fared less well, with 6% saying they had 'very good' understanding, and 3% describing their level as 'very poor.'

Unsurprisingly given it being a standard only introduced in 2022, Part O was only seen to have 'very good' understanding by 5%, with 7% admitting their understanding was 'very poor.' The majority of respondents however graded their understanding as 'acceptable' across all three standards.

When it came to specific key areas of Part L, level of understanding ratings varied somewhat. The new reports required to show onsite compliance ('BREL' for residential and 'BRUKL' for non-residential) are discussed below and represent a major change for housebuilders at least in showing comprehensive compliance including photographic evidence. However, they were only well understood by 23% of our survey respondents (rating themselves as 'good' or 'very good'). By contrast, 31% said they had poor knowledge of them, suggesting that architects aren't as engaged with this part of the compliance process as others in the supply chain.

The factor with the greatest understanding level was the new Primary Energy metric to be used as the measure of a building's energy use (11% said they had 'very good' knowledge, however 44% said it was only 'acceptable'). The carbon emissions target within Part L was well understood by 33% of respondents, and the FEES target by a decent 37%. Minimum fabric requirements were well understood by 48%, and the 'notional building' by only 30%.

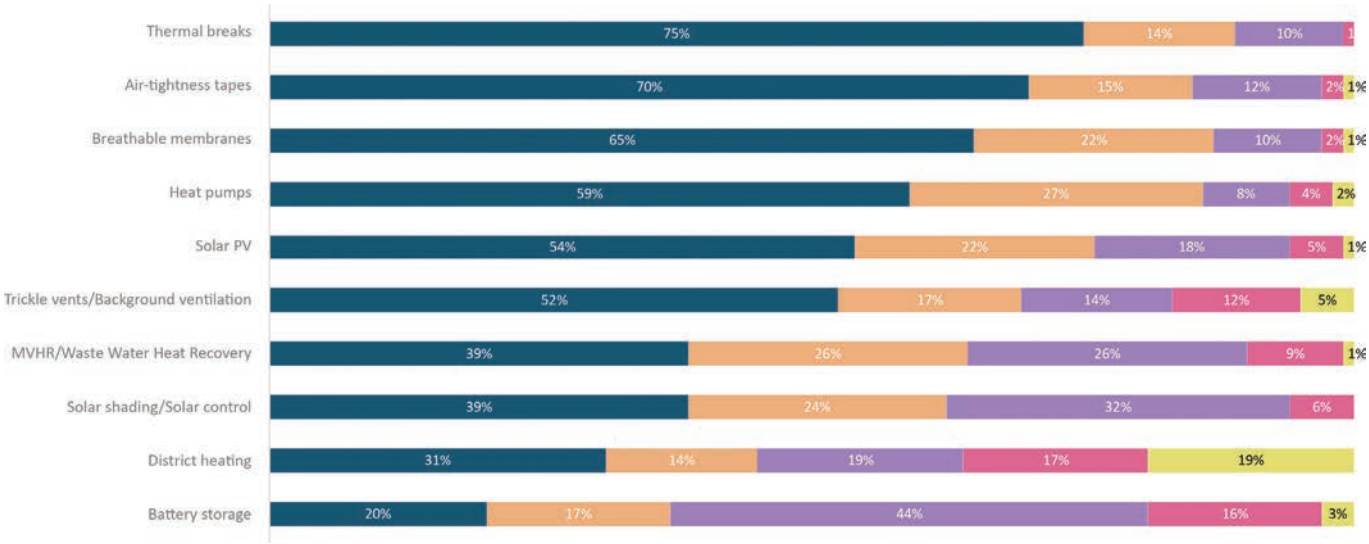
The notional building is a set of benchmarks that requires understanding due to its importance in potentially driving designs, but also its potential to create problems. Industry commentators believe there are issues with the default values within the notional building approach, which can theoretically be adopted 'as is' by designers to comply with the new Part L. The contention is that default values are formulated around energy loss, rather than a more holistic assessment of thermal bridging for example, and that if the 'minimum temperature factor' is not included, condensation and mould remain a risk.

Key Part L challenges

We asked readers to rate four crucial areas within the new Part L framework on how challenging they were for designers. These were: the new U-values, the CIBSE TM23 method of air-tightness testing now adopted as the standard by Building Regs, primary energy being the 'Principal Performance Metric,' and lastly, the notional building within SAP10.

The 'leading' challenge picked by our survey respondents overall was the maximum U-values now required. For example external walls now require a maximum of 0.18 W/m²K (a 36% improvement on 2013 Part L), potentially meaning much wider cavities in brick and block constructions, constraining specification of mineral wool. A total of 60% of the architects and technologists we asked picked this factor as 'moderately' or 'very' challenging. However, the TM23 method of air testing wasn't far behind, with its revision in 2022 including a 'pressure pulse' method instead of the previous 'blower door' method.

Primary Energy being the 'Principal Performance Metric' for judging buildings' energy performance received the same amount of ratings saying it was 'very or moderately challenging' as the TM23 method (67%) relative to 27% saying it was only 'slightly challenging,' and only 6% saying it wasn't at all challenging. This latter figure was the lowest of the four factors, suggesting this is a particularly difficult area for some designers. Lastly, the notional building was also a challenging requirement (for 61%). Overall, each of the four factors were rated as



"What technologies/approaches do you expect to use to meet the new requirements within Part L in residential projects?"

Will Definitely Use *Will Probably Use* *Potentially Will Use* *Unlikely To Use* *Will Not Use*

more challenging than not by our respondents.

One of our survey respondents acerbically summed up just a couple of practical issues for them in addressing the new Part L: "materials costs are high, but we need to source materials with low U-values, also the primary energy metric means we are forced to use heat pumps when clients don't want them."

A range of interesting comments were made by respondents on the challenges posed by Part L 2021. One commented on the rigorous air-tightness requirements, saying: "Natural ventilation is suffering from the obsession with air-tightness," while another posed the issue of builders needing much greater knowledge on the importance of air-tightness and insulation; "Builders, generally, have a very poor understanding of insulation and air-tightness, and are constantly trying to use cheaper methods." Another agreed that onsite issues were the key: "It's relatively easy to 'design for' these standards, but the realities of achieving them on site through quality of workmanship and budgetary constraints will be the challenge."

Another commenter said that the regs were not appropriate for bespoke dwellings: "They have been written for mass produced cookie-cutter homes where the economies of scale can cover the costs of Part L experts. For bespoke homes, they are massively overcomplicated." However, another summed up the practical challenge for the industry, in adopting better practice for more efficient structures: "It's something new, and it's about producing better junctions."

Part F

Part F, covering the ventilation aspects of buildings guidance, is a fundamental adjunct to Part L, with the need for adequate ventilation becoming proportionally more important as buildings become more thermally efficient. While Part L tries to minimise air 'infiltration' through a wide range of air leakage paths in the building structure, Part F relates to 'purpose-provided ventilation' i.e. the controlled air exchange between the inside and outside of a building using natural and/or mechanical devices. If a building is designed with an air permeability level below 5 $m^3h.m^2$, a fixed amount of purpose ventilation, whether natural, mechanical or a hybrid, is required under Part F.

We asked our readers who in their experience was responsible for ensuring compliance with Part F – architect, M&E engineer, main contractor, or another party? Perhaps surprisingly, 54% of our respondents said that this was under the remit of the architect, whereas 29% said it would be the M&E engineer, and 11% saying the main contractor. The 'other' category was picked by 6%, with comments clarifying this may 'depend on the contract,' 'could be a combination of all three,' or could be an architectural technician, technologist, subcontractor or energy consultant.

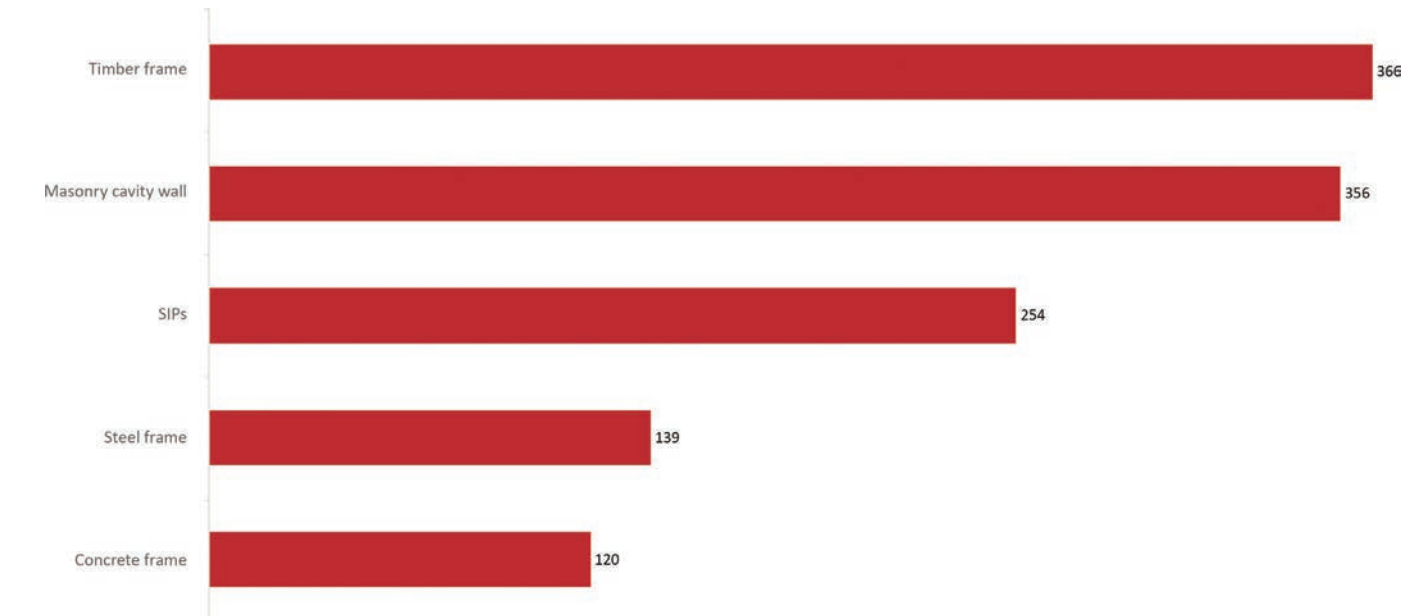
An air of improvement needed

In an article published online in 2022, Steve Hodgson of the Property Care Association argued that the sort of accommodation that was alleged to have contributed to the death of Awaab Ishak in Rochdale is far from unusual, and that tougher enforcement of Approved Document F is required.

Hodgson said that the HSE protects workers in their place of work, but wonders "why is there no such mechanism to protect tenants in their homes?" He cites gas and electrical safety legislation too as an example of where regulations put the onus on landlords, but asks why not dampness, which can have lethal consequences.

A tenant-focused regulation framework overseen by HSE would still require housing officers, landlords, surveyors and building professionals to be educated in the causes and implications of dampness, he adds. Although he warns that currently, "regulations and guidance setting out minimum requirements are routinely ignored and often misunderstood," and Approved Document F "does not get the attention it deserves" and "is not enforced to the same extent as other areas of the Building Regulations."

He says the new regulation needs to be accompanied by more robust reporting structures, "coupled with a culture of learning for housing professionals," based on science rather than assumption and prejudgements."



"How likely are you to use these construction methods to meet the new Part L requirements for housebuilding?"

Part O challenges

This main intention behind the newly-introduced Part O is to limit excess solar gain in new build residential schemes, and remove the excess heat from the indoor environment. The new regulation breaks from previous Building Regs, by evaluating the overheating impact of designs on a room-by-room basis. It requires that an adequate means of cooling must be included where required to ensure a healthy environment for occupants. Part O also relates to noise, pollution and security where they are implicated by opening windows, but does not apply to residential extensions.

Although perhaps not being completely within architects' aegis, the new regulation asks designers to pick a 'simplified' method of calculating the overheating risk on a building, versus a more complex 'dynamic thermal modelling' method. Understanding of the relative qualities of these methods for Part O compliance was poor among our cohort of architects and technologists – asked whether they had a 'good understanding,' 75% said they did not. However, if the glazing on a scheme exceeds that within the simplified method, then the dynamic modelling will be required to pass Part O.

Despite their expressed dearth of knowledge, our respondents believed that they would be more likely to be asked to use the dynamic method to estimate overheating than not (63% versus 37%). The simplified method would be called for by even more projects, according to 86% of respondents, with 40% saying it would be 'always' or 'frequently' used. However, in comments to the survey, our respondents were critical of its credentials – "The simplified method doesn't make sense" saying they preferred the dynamic modelling option. One explained that: "the simplified method is an architectural assessment, modelling is a specialist software driven result."

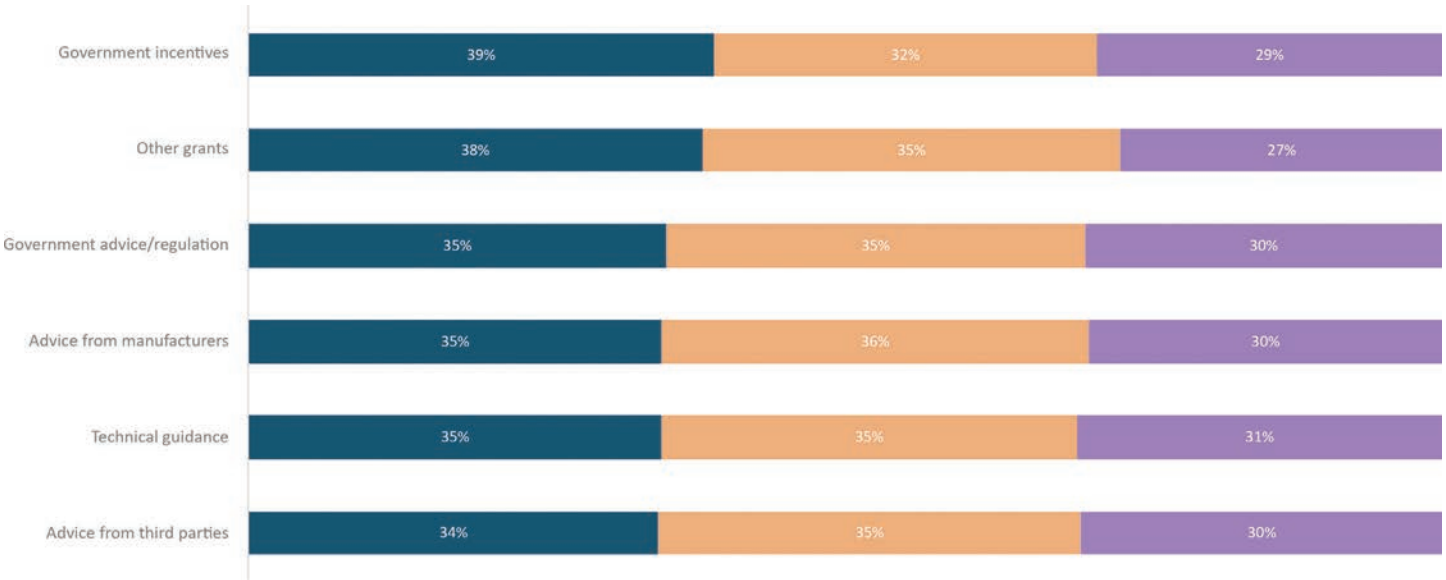
Part O would logically be a particular challenge in some residential designs, for example taller buildings with design teams looking to reduce glazing and minimise cooling loads. Of our respondents, 37% said that minimising glazing in houses would be 'very difficult,' followed by 32% for apartment blocks. 32% believed that cross-ventilation to offset overheating would be 'very difficult' in apartment blocks, whereas the figure for houses was just over half that, at 18%, with houses clearly being more easy to create double aspect rooms.

Avoiding mechanical cooling in apartment blocks would be difficult to some extent for a mammoth 81% of our respondents, and mitigating overheating in homes and apartment blocks would be 'very difficult' for 25%. Although Part O has only just been launched, and has an important role in trying to ameliorate the potentially dangerous effects of more heavily insulated, energy efficient buildings, there is clearly a long way to go before residential designs will be able to fully benefit from its well-intentioned provisions.

We asked respondents to select and rate their top five 'most important solutions' for minimising overheating and complying with Part O (with their first choice being allocated five points and their fifth allocated one point). According to our respondents, the most important was 'better envelope design,' with by far the most ratings at 211 points. The next in line was natural ventilation (148), followed by shading (135), insulation (126), solar control glazing (102), triple glazing (94), passive cooling (78), trickle vents (66), and mechanical cooling (50 points).

Many high-risk buildings (those over 18 metres high), remain specified with substantially glazed elevations, creating a further challenge for Part O compliance. One commenter in our survey mentioned that they are currently working on a project with a "Part O specialist" and that they are "currently achieving what's required with vents, but it is restricting design options. Incidentally, we have had no opportunity to meet LABC to discuss how they see the profession meeting requirements."

However, another commenter said that by working with a "controls specialist" on a solution that "fully integrates active and dynamic shading, MVHR and HVAC, and light controls etc," these design implications can be mitigated – in fact it's only achievable with a fully integrated solution." Others suggested that the requirements could vary on a project basis, and would also potentially depend on the Building Control requirements locally.



"What additional help do you need in meeting compliance with Parts L, F & O?"

Part L *Part F* *Part O*

SOLUTION ADVANTAGES

Key areas to focus on

In our reader survey, we asked respondents to choose and rate their top five factors affecting constructions in terms of their importance for designers to focus on to meet the new Part L in new homes. The list included building envelope, thermal bridging, air tightness, low carbon heating, renewables, air quality, moisture and damp, space standards, aesthetics, and light.

For our respondents, the top aspect of design and construction to focus on in order to meet the requirements of the new Part L, was the building envelope. The fact this was by some distance the leader (with 354 points, ahead of thermal bridging with 246) probably confirmed expectations, given the tightened new U-values, however air tightness was still awarded 206 points, which is somewhat related to the building envelope, therefore there may be a need to correlate these figures.

Low carbon heating was next, with only a relatively modest 125 points, followed by renewables, air quality, and moisture and damp, with a lowly 74. Perhaps concerningly, few among our respondents picked aesthetics or light as key factors to focus on in designing to meet Part L (receiving 48 and 40 rating points respectively).

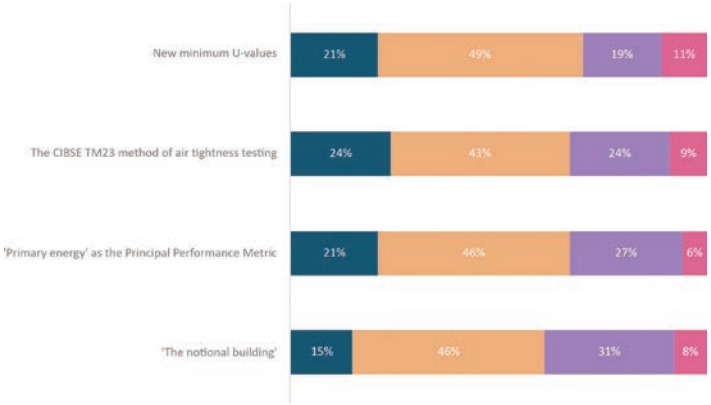
Closing the performance gap

Part of the new regime under Part L is resting on contractors, to provide a proper audit trail that demonstrates that they have achieved the necessary quality of construction onsite, in order to close the stubborn 'performance gap' that exists currently. The BREL compliance reports which are now to be provided by housebuilders to Building Control as part of SAP are in-depth, requiring builders to provide comprehensive photo evidence of their work – for example at junctions – and produce a 'design stage' report and a subsequent 'as-built' report signed by the SAP assessor and builder. (Somewhat strangely, this photographic evidence is not required by the BRUKL reports in the non-domestic sector, suggesting an assumption that contractors do not require as much scrutiny in this broad area of the market).

Copies of these reports must also be given to the homeowners, demonstrating that their completed building meets energy efficiency standards both in its design and in actuality. Our survey respondents said they only had a limited amount of knowledge and understanding on these reports (40% saying they had a poor or very poor level of understanding), however this possibly illustrates that building contractors rather than architects are the target.

The reports will need to show such factors as continuity of insulation (avoiding heat losses through gaps), in design drawings but also in the as-built construction. Thermal bridging needs to be minimised, to provide an insulation layer that's as continuous as possible, and details will have to be provided to demonstrate this. The new regulations state that opportunities should be considered to reduce thermal bridges, and any product substitutions should be reflected in the SAP calculation and documented to ensure they are still compliant.

One of our survey sponsors, Schock, asked a key question within the survey regarding how the new Part L has greatly increased the rigour of demonstrating compliance on site, chiefly by mandating



"Please rate these factors and methods in terms of how challenging they are for meeting the new Part L requirements"

Very Challenging *Moderately Challenging* *Slightly Challenging* *Not At All Challenging*

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reporting methods. "As part of the new Part L Regulations for new dwellings, there is a requirement for reporting evidence of compliance at critical junctions to prove that building work complies with energy efficiency requirements. How important do you think this new auditing requirement will be in making sure that the as-built finish meets the expected performance of the specification design?"

Answering this question, a convincing figure of 64% of designers and specifiers responding thought that the new audit process within Part L (BREL and BRUKL compliance reports) was 'very important,' and a negligible 2% dismissed it as 'not important at all.' The ultimate arbiters of these reports will be Building Control, therefore ensuring their rigour will rest on the level of rigour being applied at that stage.

Choice of construction methods

Our respondents (perhaps confirming expectations due to its popularity in housebuilding, in particular in Scotland), picked timber frame as the most likely method to be used to meet new Part L requirements in homes. Second came masonry cavity wall (only 10 points behind timber frame), but SiPs (Structural Insulated Panels) came in a respectable third, way ahead of steel and concrete frame. However both of these have a limited presence in UK housebuilding currently.

When it came to non-residential projects, steel frame was most popular (272 points to brick and block cavity wall construction's second place with 202 points). Timber frame was seen to be most likely by a fairly strong number of respondents however – 192 points indicated they would be likely to specify timber frame for non-residential projects, potentially suggesting a growth in the method driven by sustainability aims.

CASE STUDY 1: REYNAERS

Reynaers curtain walling transforms the city skyline

The 82-metre tower is one of the most ambitious projects ever undertaken in Newcastle-upon-Tyne and has transformed the city skyline. With an exceptionally high-quality architectural finish, the building provides residents with panoramic views – made possible thanks to the specification and installation of Reynaers' Concept Wall 65 (CW 65) unitised system which combines optimum performance and sustainability while achieving an iconic appearance.

Hadrian's Tower maximises the potential of its location in a constrained city-centre site. Home to 162 luxury apartments, a premium cocktail bar and fine dining restaurant, the 82-metre tower is at the heart of the city's bold regeneration scheme. By building up, this project has demonstrated the viability of tall buildings in the region and answered a local need for housing in a modern, innovative way.

Faulkner Browns Architects specified Reynaers' CW 65 system, because it met both the aesthetic and performance requirements, and could be constructed off-site in modular panels – which were then erected in units on site, radically reducing installation time.

The unitised facade system provides a slim profile design for architects which meets the highest performance requirements. Working in city centre locations on constrained sites is an engineering challenge, so prefabrication of systems offsite in a climate-controlled environment under strict quality assurance significantly speeded up the installation time without compromising on accuracy or safety.

Spanning the full height and width of Hadrian's Tower, the unitised curtain wall system gives every occupant access to the views by including full height glazing. It also meets the highest performance requirements in water and air tightness and wind load resistance. The building has also achieved the appropriate British Research Establishment Environmental Assessment Method (BREEAM) credit.

The CW 65 system is available with different insulation levels, answering to the appropriate requirements of the building, and other environmental assessment systems such as the Leadership in Energy and Environmental Design (LEED) Green Building Rating System. In practice, this allows architects to rely on high-quality systems which achieve the Centre for Window and Cladding Technology (CWCT) test standards, while supporting their project programme, timescale, and budget.

Hadrian's Tower was awarded a coveted Tall Building Award for 2022 for the 'Best Tall building Facade and Fenestration Engineering Project.'

For more information please visit www.reynaers.co.uk

CASE STUDY 2: IDSYSTEMS

When the current owners bought River House in Essex, they faced a choice to either renovate the existing property that had been built in the 1930s and extended a number of times, or demolish it entirely and start again from scratch

After much discussion with architects and the planning authorities the decision was made to create a brand new, contemporary home to their exact specification.

"We spent a lot of time trying to work with the house as it was, but in the end it was obvious that we weren't going to be able to achieve what we wanted or to do the plot of land and the view over the river justice, unless we bit the bullet and went for the self-build option."

The owners created a brief for Ben Powell Architects but it was his vision that really transformed a dream into reality, changing the orientation of the house from the previous incarnation, so that the river-facing elevation would allow for the maximum amount of glass to make the most of the view.

At ground floor level the main family space consists of an open-plan kitchen, dining and living room which extend across the entire width of the back of the house. To maximise the views out the architect worked with IDSystems to specify a 4-panel set of theEDGE2.0 sliding doors from IDSystems which span the entire 12m ground floor width of the elevation.

Rather than opt for a centre-opening set of doors, as would typically be the case with a 4-panel set of doors, theEDGE2.0 is designed with 3-panels sliding behind a fixed frame at one end to create an incredible 9m opening when the doors slide back. The other benefit of the system design is that the narrow frames are consistent across the width of the doors, maximising the amount of glass and providing almost uninterrupted views out.

"As a couple we have spent a lot of time travelling for work so as we start looking to the future and a time where we might start to slow down a bit we wanted to create something that we could really call home and create a space that worked for us but also was perfect for having our family here."

At first floor level three sets of theEDGE2.0 have been incorporated into the design. All three are designed as 2-panel systems to maintain the symmetry of the building, with the central set of doors featuring a fixed frame gable window above. As you climb the stairs from the ground floor the first thing you are aware of is the huge double-height ceiling and the incredible views out of the river that the elevation allows.

To complement the sliding doors and windows the house was designed with thirty-four triple glazed Thermo65 aluminium windows on the other three elevations of the property, including a triple-height window that brightens up the stairwell and the house also features IDSystems' Hoveton aluminium front door finished in RAL 7022 Umbra grey in a matt finish to complement the finish of the sliding doors and windows.

With such large expanses of glass on a south-facing elevation, the attention to detail of the design came in to its own to mitigate overheating. At ground floor level the doors are recessed back slightly to allow for an overhang on the floor above. The overhang is further extended by the inclusion of brise soleil which significantly reduce the solar gain when the sun is at its highest in summer months.

In addition to the brise soleil, theEDGE2.0 doors are manufactured with solar control glass to reduce the solar gain all year around, whilst the house was also designed with mechanical ventilation to allow excess heat to be removed from the living spaces.

For more information about IDSystems aluminium glazing systems or to arrange a webinar or CPD session covering the specification of glazed doors visit www.idsystems.co.uk or call 01603 408804.

CASE STUDY 3: SCHOCK

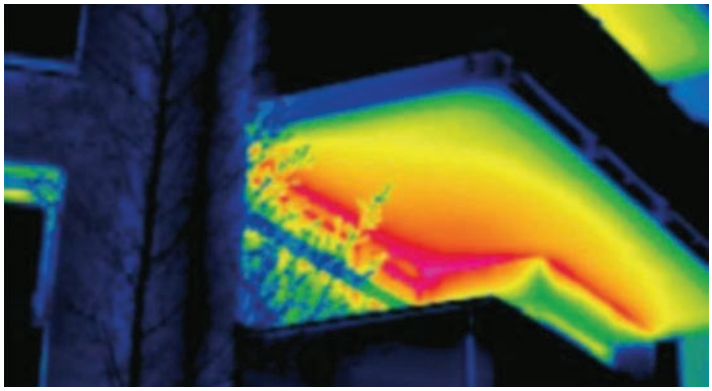
Thermal bridges compromise insulation performance

The changes to Part L of the Building Regulations came into force on 15th June, with CO_2 emissions now reduced by 31% for dwellings and 27% for other buildings. So improving the thermal performance of building envelopes becomes even more critical and designers need to be aware of how significantly thermal bridges can compromise insulation values; says Simon Hill of Schock.

A thermal bridge is a localised area of the building envelope with significantly higher thermal conductivity than surrounding areas, typically occurring where a material with high thermal conductivity penetrates the insulation layer. Cantilevered balconies are critical examples, resulting in higher heat transfer through the building assembly and colder surface temperatures on the warm side. The main consequences will be non-compliance with regulations, higher energy consumption for heating, condensation and mould growth. The 2021 edition of Part L (which replaces L1A 2013) sets out the minimum thermal requirements for avoiding such issues.

It is now a requirement that thermal bridging must be included in fabric heat loss calculations and the Standard Assessment Procedure calculation (now updated to SAP 10.2) includes the term HTB (heat loss due to thermal bridging). A further change is that for new dwellings, before elements are concealed by subsequent work, an on-site audit should be undertaken to confirm the designed details have been constructed. Photographs should be taken to verify that the products used are those shown in the original design. If there are substitutions, the revised specification should be reflected in the SAP calculation and report in the Building Regulations England Part L compliance report (BREL report).

The revised Part L also includes general tightening of U-values, requiring greater insulation requirements and the construction of better performing thermal break details. Additionally, it encourages HTB assessment to be carried out through thermal calculation for a more realistic evaluation of existing thermal junctions. The default y-value has been increased to 0.20 W/(m².K) to discourage generic estimations, as this does not reveal the performance of thermal break junctions, including failure to meet (fRsi) figures.



Thermal performance and structural integrity

Many designers though are still not fully aware of just how significantly thermal bridges compromise insulation. The most effective way to minimise thermal bridging at cantilever balcony detailing is to incorporate a load-bearing structural thermal break. This is a highly efficient balcony connector that minimises the flow of thermal energy between the interior and exterior of a building, providing both structural integrity and thermally isolating the balcony. The units have a very specific purpose and for long-term effectiveness require certain physical characteristics – optimum thermal insulation thickness for the application, load-bearing components and a combination of reinforced and stainless steel. A range of thermal break solutions are available for applications as diverse as concrete-to-concrete; concrete-to-steel; steel-to-steel; renovation projects – and even Passivhaus.

Condensation & mould growth

One consequence of thermal bridging is that cold surfaces can form condensation, resulting in both visual deterioration and structural damage. However, an even bigger concern is mould growth. To identify areas where there is a risk of condensation and therefore mould growth, a 'surface temperature factor' (fRsi) should be used. It allows surveys under any thermal conditions and compares the temperature drop across the building fabric with the total temperature drop between the inside and outside air. The recommended (fRsi) value for offices and retail premises is equal to or greater than 0.5; and to ensure higher standards for occupants in residential buildings, equal to or greater than 0.75.

Responsible design for the future

The UK has set in law a target to bring all its greenhouse gas emissions to net zero by 2050. As part of that journey, there is a commitment to introducing the Future Homes Standard in 2025 – and the higher performance targets of CO_2 emissions being reduced by 31% for dwellings and 27% for other buildings – is an interim step towards that standard. The thermal performance of the building envelope is therefore of increasing importance – and critical to this is the avoidance of thermal bridging.

For more information, please visit www.schoeck.com/en-gb

CASE STUDY 4: KINGSPAN

Kingspan gets on the GRID

Sitting at the shore of a scenic ornamental loch on Heriot Watt's Ricarton Campus in Edinburgh, the GRID centre sets out an ambitious vision for the future. The building brings together computer sciences, engineering, mathematics and physical sciences under a single roof, aiming to support cross collaboration between each discipline and enable greater cohesion between academic research, business enterprise and entrepreneurial talent.

The GRID centre has been constructed by Bowmer + Kirkland and its design takes advantage of a significant slope at the site, building into the hillside to create access for a large basement providing delivery and plant spaces along with bike storage. As part of a future-proofed design, the building is heated and cooled entirely via an air source heat pump. As this heats water to a lower temperature than a conventional gas system it was essential to ensure the outer envelope was effectively insulated.

Completing the envelope

The project team chose to insulate the ground floor slab to a U-value of 0.16 W/m²K. To raise the ceiling above the uninsulated basement space to the same level, Kooltherm K110 Soffit Board was installed. The premium performance soffit insulation achieves a thermal conductivity of 0.019 W/mK across all thicknesses. This allowed the project team to achieve the desired ceiling U-value with a slim thickness of insulation – maximising the floor to ceiling height within the space. The rigid, lightweight design of the boards also supported a simple installation process, ensuring the project was ready in time for the 2019 student intake.

Kooltherm K110 produced at our manufacturing facility in Herefordshire is supported with an Environmental Product Declaration (EPD). The facility is also operated at net-zero energy on an aggregated basis across the year.

Location: Edinburgh, Scotland
Sector: Education
Contractor: Bowmer + Kirkland
Client: Heriot Watt University
Completion Date: July 2019
Products: Kooltherm K110 Soffit Board
Application: Soffit

For more information, please visit www.kingspan.com/gb/en


Four Oaks © MJW Architects


The Didsbury

CASE STUDY 5: VELFAC

VELFAC composite windows – for the ideal indoor climate

A light-filled and comfortable home, economical to heat, requires the ideal balance of natural light, ventilation and insulation. Slim-framed VELFAC composite windows bring maximum daylight into every room and deliver excellent insulation – 0.8W/m²K for triple glazing – resulting in great energy efficiency and solar gain control, enhanced with specialist coatings if needed.

Four Oaks

Built to Passivhaus principles, Four Oaks is a stylish, ultra-low energy three bedroom family home which achieves impressive thermal efficiency and air tightness. Large VELFAC window walls are vital to Four Oaks' performance and are combined with moving external screens to ensure every room is comfortable to live in all year round.

When designing Four Oaks, architect Michael Williams, of MJW Architects, worked to a rigorous, low energy brief without compromising architectural vision – one reason why he chose VELFAC: "The system delivers excellent thermal performance with a slim frame design," he says. "Many Passivhaus-certified window systems are 'chunky' in appearance whereas VELFAC windows maintain sleek and minimal sightlines even when units are triple-glazed."

Full height sliding VELFAC windows are a major feature of the front facade, with additional glazing on the side elevations, including a VELFAC front door. Given the expanse of glazing, solar gain control was also important. 'The Passivhaus solution to excessive solar gain is to restrict window area, but by installing VELFAC glazing together with external sliding shutters, we could increase glazing by 25% without increasing solar gain. The internal VELFAC timber frame is finished in a clear lacquer so windows and shutters blend seamlessly, while external aluminium framing, finished in grey, enhances the sleek, minimalist design.'

The Didsbury, East Ham

Designed by Stirling Prize-winning architects dRMM for Newham's housing company Populo Living, and built by main contractor Bugler, The Didsbury comprises 148 'built to rent' apartments in two six-storey new-build blocks, with every apartment featuring VELFAC windows and patio doors and inward opening, tilt/turn VELFAC glazed doors

"VELFAC has become our 'go to' brand when specifying composite glazing," says Findlay McFarlane, architect at dRMM. "The system offers a good cost to quality ratio, and the frame design results in low embodied carbon, primarily due to the percentage of recycled aluminium used. This was important for Populo Living's sustainability targets, and for dRMM as we champion climate-conscious architecture and the use of natural wood, which again is a feature of the VELFAC frame."

The Didsbury's minimalist exterior may look sleek and simple but specification was very complex: "The stepped facade and variety of façade-specific performance targets meant that not all floors had an identical specification," Findlay explains. "In addition, while VELFAC double glazing met all low energy targets, we needed to fit acoustic trickle vents into road-facing windows and ensure lower floors and balconies had windows with Secured by Design accreditation. We worked closely with VELFAC on detailed drawings and were impressed with the level of support provided – another reason why we like to use VELFAC when we can."

For more information, please visit velfac.co.uk

CONCLUSION

Main barriers to compliance

For the respondents to our survey, somewhat unsurprisingly, 'Cost' was the stand-out factor in terms of being chosen as the most 'significant' barrier to overcome to achieve compliance with the new Part L. Although of course with compliance being mandatory, it is a hurdle that cannot be avoided. 66% picked it as a 'significant' barrier, and only 2% said it presented no difficulty.

Also receiving a high rating was 'Competency and quality of install,' with 52% of architects and architectural technologists/technicians surveyed saying it was a significant barrier. Then came 'technical knowledge (34%) and 'availability of suitable technologies' (28%). These figures help to explain the similarly high scores produced from the question 'how difficult do you believe it will be to achieve the new (31%) carbon emissions targets in Part L 2021?' A perhaps surprising 83% believed that it would be difficult to do in housebuilding, and not far behind was a 79% score for non-residential.

Despite the findings, the London Plan released in 2021 – the blueprint for all new development in the capital – has already mandated a 35% improvement on emissions, therefore some believe that a 31% lift on current Regs should not be overly onerous for architects and the wider sector to achieve. Section 9.2.5 of the London Plan says an "onsite reduction of at least 35% beyond the baseline of Part L of the current Building Regulations is required." In addition, "the minimum improvement over the Target Emission Rate will increase over a period of time in order to achieve the zero-carbon London ambition and reflect the costs of more efficient construction methods."

In 9.2.7 the Plan also says developments "are expected to achieve carbon reductions beyond Part L from energy efficiency measures alone to reduce energy demand as far as possible." Residential development should achieve 10% and non-residential development should achieve 15% over Part L."

The London Plan is leading the way, but the nationwide rollout of much more demanding, and transparently monitored, energy efficiency targets mandated by the new Parts L, F and O are plotting UK construction's path to net zero. It will be a demanding journey, with some detours into 'offsetting' inevitable, but it's one that the sector is now forced to make together. It would be better if the supply chain was able and willing to collaborate in probably unprecedented ways, to make this a more harmonious, and successfully realised proposition.

Help required

Given the challenges posed for the industry by the much tighter regulations, our surveyed architects said they needed assistance from a range of sources in how to comply. We asked them to identify which factors they needed more help with across Parts L, F and O, and in terms of Part L, and respondents gave virtually equal billing to all of the factors we proposed (government incentives, other grants, government advice and regulation, advice from manufacturers, technical guidance, and advice from third parties). Part L saw the most ratings for the first two factors, ie greater funding – a likely result of it being a more comprehensive, and therefore more cost-intensive, set of requirements.

Beyond the funding issues which could hamper progress on achieving far better constructions, Building Control is now in the hot seat, more than ever. The credibility of the new regime for ensuring low energy buildings for the future, constructed according to their design promises, rests on this hard-pressed profession being able to rigorously monitor the process. The question is, regardless of the design challenges for architects, will they be able to fulfil their end of the bargain?

Survey sponsors

We are grateful to our survey sponsors for their participation in this white paper research report:

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