Whitepaper

How can Thermally Broken Lintels support the new Part L 2021 improvements & Future Homes Standard (FHS)?

Catnic — A Tata Steel Enterprise

Contents

Introduction

Heating and powering all buildings in the UK accounts for around 30% of national greenhouse gas emissions. The associated emissions from buildings within the residential, commercial, and public sector show that residential buildings are by far the biggest contributor, accounting for 64% of the total. To address this issue, the Government uses Approved Document L – Conservation of fuel and power – Volume 1 Dwellings, to drive down residential carbon emissions.

Selecting thermally broken lintels can play a significant role in reducing heat loss associated with thermal bridging. This allows them to make a significant contribution to improving fabric performance. Section three explains the composition of a thermally broken lintel and how this special type of lintel can improve thermal bridging and reduce heat loss Thermal bridging is measured using psi values and these values are used in SAP calculations to check compliance with the targets set out in Part L. Lower psi values obtained using thermally broken lintels can therefore have a positive impact on compliance with building regulations. Some of the benefits of using thermally broken lintels with lower psi values will be demonstrated on typical house types detailed in section four. The removal of accredited construction details in Part L 2021 has in turn removed a common path for obtaining psi values for use in SAP calculations. The options remaining for specifiers are discussed in section five and the benefits of getting project specific psi values based on calculated psi values from product manufacturers. Section six looks at The Performance Gap, another factor to consider when looking at ways to ensure carbon emission reductions translate from specification through to actual 'As-Built' performance. Information on The Future Homes Standard, where even more demanding carbon reduction targets will be in place from 2025, can be found in section seven.

This white paper outlines the changes required to achieve that goal in the Part L 2021 amendment from the 15th of June 2022. It looks at the key amendments to Part L made to deliver a 31% reduction in CO_2 emissions and the requirement for an increase in the thermal performance of all areas of the building fabric.

[1]Heat and Buildings Strategy Business, Energy, and Industrial Strategy (BEIS) October 2021.

[2]Committee on Climate Change (CCC) Factsheet: Buildings.

Section 2

Part L 2021 changes for dwellings

Before we look specifically at the role of lintels in the thermal performance of the building fabric, it is helpful to understand the main changes in Part L 2021 and how they will impact on building fabric design.

New performance metric

A new target primary energy rate has been introduced to work alongside the existing target fabric energy efficiency standard (FEES) and overall CO_2 reduction target.

This new target seeks to reduce the amount of energy required by the dwelling and it, along with the FEES and CO_2 targets are all influenced by the fabric performance of the building.

Limiting fabric requirements more demanding

The term 'limiting fabric' describes the worst U-value that a wall, floor or roof can have and for it to still be possible that the building in which it is situated will comply with the regulations.

The tightening of these limits shows the need to ensure that all parts of the fabric perform to similar levels with no weaker sections where heat loss will be higher and reduce the chances of producing an energy efficient building.

Junction details such as those including lintels at windows and door heads have always provided areas of thermal bridging where heat finds it easier to escape. The move to uplift all areas of the fabric will only serve to make the difference between the fabric and these thermal bridging weak spots, even more pronounced. This makes the thermal performance of lintels an important area where improvements can reap rewards.

Part L Edition	Wall Limiting U-value	Floor Limiting U-value	Roof Limiting U-value	Window Limiting U-value
2021	**0.26**	0.18	0.16	1.6
2016	0.30	0.25	0.20	2.0

Requirement to use photovoltaic panels and waste water heat recovery

There was no requirement to use photovoltaic panels (PV) in the old Part L but now, PV must be present with the power output required based upon the percentage of floor area. Where showers are installed, including showers over baths, waste water heat recovery (WWHR) technologies with a minimum efficiency level must now be fitted. An efficient fabric specification will ensure that no extra renewables are required to meet the targets required and can help to reduce demand on technologies making them operate more effectively for longer.

ACDs can no longer be used

Accredited construction details (ACDs) are standard ways to build various junction details to improve their effectiveness with respect to heat loss through thermal bridges and air leakage. Using ACDs allows their stated psi values – measurements of heat loss through the junction – to be used.

ACDs cannot be used in Part L 2021. This leaves a choice of either using default values in the SAP calculation or seeking calculated psi values for the actual construction details used in your project.

Default values are not really an option as it will be extremely difficult to reach a compliant fabric specification if they are used. Therefore, it will be essential to seek calculations for the junction details you propose to use in your projects. These will be dependent on the products chosen and specific psi calculations should be sought from the manufacturer concerned.

Limiting heat loss

Part L 2021 recognises the importance of limiting heat gains and losses. Advice is given on heat loss due to thermal bridging and there is a specific mention that opportunities should be considered to use products that can help to reduce thermal bridges.

One such opportunity is when addressing thermal bridging around windows where using lintels with a non-continuous base plate and insulation is included should be considered – showing Part L 2021 recognises the value of using products such as thermally broken lintels.

There is a new requirement to record the quality of the build using photographic evidence, giving an incentive for manufacturers to make products that are easy to install and are provided with clear installation guidance.

Section 3

The role of thermally broken lintels in enhancing fabric performance

Now that we have established from Part L 2021 that fabric performance plays a very significant role in reducing carbon emissions, we will look how thermally broken lintels can help with this goal.

What is a thermally broken lintel?

Before we explore how they can enhance fabric performance here is a brief overview on steel lintels and the features of the thermally broken version.

A lintel is a structural member, usually made of steel or concrete, that spans an opening in a wall, usually above a window or door. Its job is to provide support for the construction elements above the opening. In the case of a cavity wall construction, it will provide structural support both for the inner and outer leaf.

When compared to concrete, lintels made of steel are lightweight, strong, and durable. As steel is a good conductor of heat, the lintel provides a pathway across a cavity for heat to flow from the warm building to the outside.

How can a thermally broken lintel enhance fabric performance?

A thermally broken lintel, as the name suggests, breaks that heat transfer across the cavity reducing the effect of thermal bridging. It does this by keeping the steel supporting the inner leaf separate from that supporting the outer leaf. Also, insulation is secured between the two lintels, so this further reduces any heat loss across the cavity. This makes specifying them a great way to reduce heat loss in an area of the fabric where the focus is sometimes solely on structural perspective and the opportunity to also enhance thermal performance can be missed.

How is a thermally broken lintel's performance measured in Part L?

The level of thermal bridging at a junction detail is expressed as something called a psi value. This measures the heat loss associated with that junction and, like the U-value of a construction element such as a wall, the lower the number the better.

The ability of a thermally broken lintel to reduce thermal bridging will therefore enable it to reduce the psi value of a junction where it is installed. The significant effect that this psi value reduction can have when looking at the overall fabric performance will be looked at in detail in section 4.

The overall performance of the fabric of a dwelling is assessed by something called a SAP (Standard Assessment Procedure) calculation. The SAP methodology assesses how much energy a dwelling will need to deliver a defined level of comfort and services. It does this using standard assumptions around occupants and their behaviour and is quantified in terms of energy use, energy efficiency and CO_2 emissions. Inputs into SAP include the U-values of the walls, floor, roof, and windows; the airtightness of the building; the efficiency of the heating system; effect of any renewables fitted and the psi values of all the thermal bridges at junctions. The final SAP score is used to assess if the building complies with regulations and enables an EPC (Energy Performance Certificate) to be issued.

It is estimated that up to 30% of heat loss from a dwelling can be accounted for through thermal bridging alone. The importance of thermal bridging in SAP calculations has risen over the years due to the improvement in fabric U-values. The better the fabric thermal performance the higher the proportion of heat loss through junctions – making it a vital area to address when seeking ways to comply with Part L 2021 and its required improvements in energy use and carbon emissions.

Section 4

Examples of how using TBL's will enhance performance by house type

To analyse the effectiveness of using TBLs to enhance the performance of different house types we compared them to other carbon reduction measures by using the following methodology:

Methodology

A

Choose different house types

Four different house types were chosen and the cost effectiveness of six different carbon reduction measures was analysed using the new Elmhurst SAP 2012 software.

Each house type was analysed twice: once with a boiler as the main heat source and then again with an Air Source Heat Pump (ASHP).

House Type	Floor Area m^2	Wall Area m^2	Window Area m^2	Lintel Length m
END TERRACE	94.27	87.76	13.09	10.80
MID TERRACE	74.82	37.03	8.25	7.72
TOWNHOUSE	90.51	67.45	10.77	7.86
DETACHED HOUSE	166.38	169.85	36.97	22.80

B

Select carbon reduction measures

Six different measures were chosen that would either decrease the CO_2 emissions by:

- Increasing fabric thermal efficiency (measures 1 to 4)
- Recovery of heat (measure 5)
- Renewable energy generation (measure 6)

Measures chosen:

1. **Introduction of thermally broken lintels with a psi value of 0.05**

Two scenarios were chosen here when thermally broken lintels replaced:

- Standard lintels with a psi value of 0.25
- Lintels with a psi value of 0.30

2. **Increase of 25mm Mineral Wool wall insulation**

Taking the wall U-value down from 0.24 W/m2K to 0.21 W/m2K

3. **Increase of 25mm PIR insulation wall insulation**

Taking the wall U-value down from 0.24 W/m2K to 0.19 W/m2K

4. **Triple Glazing replacing double glazing**

Taking the window from U-value/g-value of 1.2/0.63 to 0.90/0.57

5. **WWHR (Waste water heat recovery)**

Recoup model plumbed system

6. **Photovoltaics (PV)**

0.5 kWp SW

C

Establish the cost of each measure

For the fabric only measures, the extra cost of using thermally broken lintels, increasing the wall insulation, and switching from double to triple glazing was calculated for each house type. The direct cost of installing WWHR and PV was established for each house type.

D

Calculate the cost effectives of each measure to reduce carbon emissions

The output from the SAP modelling and cost analysis data was used to calculate the cost effectiveness of each measure to reduce carbon emissions.

To make it easier to compare one measure with another, two metrics were chosen, averaged across all four house types, to show the ability of each of the six measures to:

- Reduce the CO_2 emissions by 1Kg CO_2/m2/yr
- Gain a 1% improvement in the Fabric Energy Efficiency

Cavity Wall Lintels	Average cost to save 1 Kg CO_2/m2/yr across all 4 house types		Average cost to get a 1% FEE gain. Average cost to get a 1% FEE gain across all 4 house types
	Gas Boiler	ASHP	Gas Boiler or ASHP
THERMALLY BROKEN LINTELS (AVERAGE VALUES OF THE 2 SCENARIOS)	£324.1	£699.94	£27.13
25MM INCREASE IN MINERAL WOOL WALL INSULATION	£528.97	£1047.63	£55.44
25MM INCREASE IN PIR WALL INSULATION	£648.40	£1516.48	£66.49
TRIPLE GLAZING	£1159.26	£2160.60	£86.92
WWHR	£421.51	£553.48	
PV	£573.16	£573.16	

Conclusion from the SAP analysis

The analysis shows that using thermally broken lintels is the most cost-effective fabric measure to help reduce both the CO2 target and meet the Fabric Energy Efficiency standard. As this is done at the early stage of the build, the benefits are locked in and reduce the amount of work that the other measures need to do to achieve the CO2 and FEE targets.

Notes

- WWHR and PV don't affect the fabric performance of the building and therefore don't affect the FEE calculation
- The heating source – either gas boiler or ASHP, does not affect the FEE calculation, so the cost for all the measures to reduce Fabric Energy Efficiency by 1% will be the same

Section 5

Easier specification using pre-calculated lintel psi values

As you can see from the examples above, using thermally broken lintels to achieve improved psi values in SAP calculations is most cost-effective way to reduce CO_2 and increase fabric energy efficiency. The benefits of thermally broken lintels apply across all house types and work for both traditionally heated dwellings using gas boilers and for the ASHP that will become more popular as we approach the Future Homes Standard.

The removal of Accredited Construction Details in Part L 2021 means that the psi values commonly used to calculate thermal bridging in SAP assessments are no longer available. Whilst the use of default values is still allowed, they are so poor that achieving compliance using default values alone is extremely difficult and costly.

The use of pre-calculated psi values for specific junctions will therefore be the favoured route when assessing the thermal bridging requirements of SAP calculations for Part L 2021 and, as we have discovered in our SAP analysis, they will also be the best route to maximise the carbon reduction value of every pound spent.

Section 6

How thermally broken lintels can help to close The Performance Gap

Constructing a dwelling that complies with regulations does not guarantee it will deliver the expected performance. Here we will look at The Performance Gap and the importance of correct product selection and installation.

AThe difference between the expected designed energy performance of a building and the measured performance once it is constructed is known as The Performance Gap. It means that we are not getting the level of CO_2 reductions expected. If we are to ever get close to net zero carbon buildings, this gap must be reduced as much as possible.

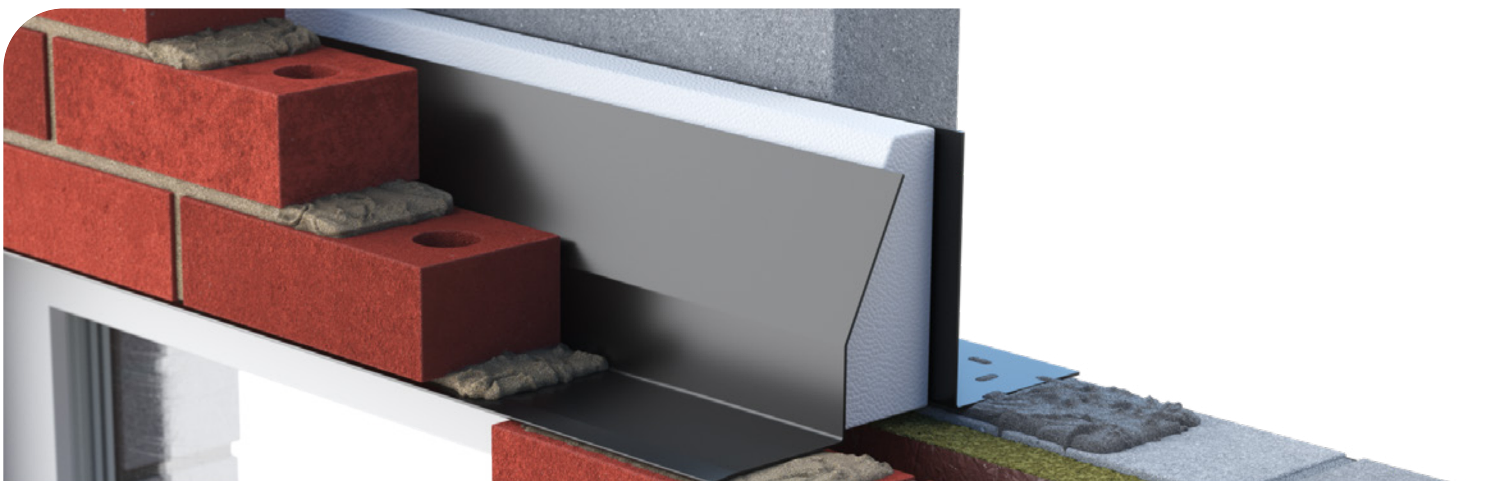
The Performance Gap was first brought to prominence by the Zero Carbon Hub back in 2013. Much research was done to look at its many causes. All areas from planning, design, procurement, installation, commissioning, and testing were assessed. Several house building projects on site were checked to determine where errors were occurring that could account for some of shortfall in performance.

There were many issues uncovered and some of the key recommendations were around product selection and use.

- The planning and concept teams were not always sufficiently aware of the impact of early decisions on the energy performance of completed dwellings
- The detailed design teams did not always understand site buildability issues and the calculation assumptions around thermal bridging (psi values)
- Building fabric was often incorrectly constructed reducing the thermal performance of the fabric
- SAP assessors were often unclear on modelling conventions around such issues as thermal bridging
- Products with different energy performance to those originally specified were used without feedback to the design teams and the As-Built SAP assessment was therefore inaccurate

Whilst some progress has been made since the report was published, The Performance Gap persists and steps to reduce its impact should be made throughout the construction process wherever possible. Early specification of thermally broken lintels, that are easy to install and can lock thermal performance within the fabric, will help close the gap on site. Clear and accurate psi value calculations for use by the SAP assessors will translate that benefit into a calculated performance for the junctions that is much closer to the ‘As-Built’ reality of the dwelling.

The Performance Gap leads to higher energy bills for occupiers although it is likely to go unnoticed as energy use fluctuates due to so many other factors. What would be noticed, however, is the effect of localised cold areas inside the house caused by poor thermal bridging details. These areas can give condensation problems and lead to mould growth. A visual reminder of the need to carefully address lintel junction details from a thermal perspective as well as a structural one.



Section 7

The Future Homes Standard and thermally broken lintels

Part L 2021 carbon emission reduction ambitions, whilst demanding, are just a stepping stone to the even more exacting requirements to come in the Future Homes Standard.

The standard points a way to the future where, from 2025, houses will be built with carbon emissions at least 75% lower than those built to Part L 2016. This will be achieved through low carbon heating rather than the use of fossil fuels and by ensuring that very high fabric standards are delivered to maximise energy efficiency. They are 'future proofed' as, once the electricity grid decarbonises, they will not require any retrofitting to become net zero carbon. The eventual decarbonisation of the grid will lead to the energy demand of a building becoming the key performance metric.

It is difficult to see such dwellings being built without maximising the performance of every inch of fabric to reduce the energy demand. Thermally broken lintels may be hidden from view but can make a visible difference in the quest to meet the demands of Part L 2021, whilst also ensuring that those locked in thermal benefits will be equally applicable to The Future Homes Standard.

Section 8

Conclusion

Building regulations, through Part L, have always supported a 'Fabric First' approach, however, it has been possible to still achieve compliance with a relatively weak fabric in some areas. The lower performing fabric element could be offset elsewhere in the design of the dwelling through other measures such as renewable technologies like PV or looking at the efficiency and type of the primary heating source.

As this white paper has shown, compliance with Part L 2021 is very difficult without first concentrating on ensuring that the thermal efficiency of the fabric has been maximised wherever possible. All three targets required to achieve compliance are influenced by the fabric and the tightening of the limiting fabric U-values compared with Part L 2016 is a good indication of the importance of ensuring less efficient fabric elements do not creep into the design.

We have explored the effect of thermal bridging on fabric performance and shown that the psi value of lintels can make a significant contribution to reducing heat loss. They may be primarily specified for their structural properties, however, the use of thermally broken lintels, with their lower psi values, ensures that heat loss through the fabric in these critical junction areas is also reduced.

The effects of specification of thermally broken lintels on various dwelling types showed that they are the most cost-effective way to reduce CO_2 emissions and increase the fabric energy efficiency across all dwelling types and fuel sources. Their impact on fabric performance can give design options elsewhere in the dwelling as they move it closer to compliance at an earlier stage.

Given that the Future Homes Standard in 2025 requires dwellings to further reduce their carbon emissions, it is difficult to see how this could be achieved without minimising the heat lost from junction details through use of thermally broken lintels. Their ease of installation and embedded nature means that they can also help to close The Performance Gap, delivering the robust energy demand reductions needed for dwellings to truly become net zero carbon.

If you are looking for ways to enhance fabric performance, reduce carbon emissions and drive down the energy demands on your next project you can download Catnic Thermally Broken Lintel (TBL) psi values.

About Catnic

Since its formation in 1969, Catnic has pioneered steel lintel design for UK house building. Part of the Tata group, Catnic is based in South Wales and has established itself as a multinational manufacturer, supplying lintels, roofing, plastering accessories and metalwork to 60 countries from three European manufacturing sites.

The complete range of Catnic lintels provides all the required performance characteristics for a range of applications. The product selector tool helps you to select the right lintels for your project. As well as the extensive range of standard lintels, special and bespoke lintels are also available.

To further help with specification and scheduling, CLASS is the Catnic Lintel Advanced Scheduling System. It provides a single document with a site summary, and outlines each lintel specification and their location, price and delivery time.

Product literature, CAD files and BIM objects are all available on the downloads page of the Catnic website. Catnic also offers CPD seminars to support professional development and aid learning and understanding about lintel solutions and specification.

Support and service

Catnic offers comprehensive technical support, with experienced engineers on hand to provide advice for projects and developments of all sizes, and at any stage of design or construction. Technical and sales support is available online and over the phone.

Contact us to find out more

catnic.com

Catnic
Pontypandy Industrial Estate
Caerphilly
CF83 3GL

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