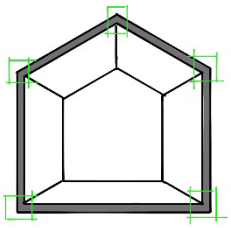
Powell Dobson
PassivHaus
Papers

Series 1_Paper 6_**Thermal Bridging**



It's all in the detail.

What is a thermal bridge? This isn't a term that belongs to just PassivHaus, this is something that architects and designers have had to overcome for years. A thermal bridge is a zone or interface of construction that has a higher heat transfer than the materials surrounding it. A simple example would be a steel beam punching straight through an external wall filled with insulation to support an external balcony. The steel beam would give an easy route for energy to zip through your insulation to outside, undoing all your hard work and expense in providing a well-insulated and airtight wall.

Different materials allow energy to pass through them with different 'ease', metal for example is a fantastic conductor of heat, so one needs to be careful of when detailing. Timber performs much better but still does give a route for heat to escape.

Why are they bad? Two reasons, the first already touched upon above, is heat loss and energy performance. In particularly poorly designed examples, thermal bridging can be responsible for 20 to 30% of your homes overall heat loss. As you are all experts now in the other PassivHaus principles, you know that letting energy escape from the fabric is not the plan. Once you apply the other principles of PassivHaus to a house, allowing for high levels of insulation and airtightness, any weakness in detailing resulting in thermal bridging becomes more important, as it will be the only 'poor performing' element of the build, and be the 'thing' that lets you down.

The second reason is the impact on internal surface temperatures. Cold spots can lead to mould growth, which isn't at the top of anyone's wish list for their living room.

How do we limit these thermal bridges? First step, keep it simple. We typically avoid 'punching' through the external envelope, and try to maintain a simple building form. Every corner, return, tricky junction is a potential cold spot, as additional structure is needed to make it 'work', which usually creates pathways for energy to make its way out of the envelope.

If we need to allow for a balcony, or shading framework, it is always favourable to allow for an independent structure, which doesn't need to be tied back to the building. This may not be the most 'elegant' of proposals, but it is very necessary to keep energy loss to a minimum and ensure compliance.

Generally, the rule of thumb for PassivHaus is to ensure that you maintain at least two thirds of the thickness of the typical insulation at junctions where you can. On previous projects, we opted to use pumped Warmcell (Cellulose) insulation for the walls and roof, meaning we were able to maintain an unbroken line of insulation from the vertical line of the wall to the horizontal line of the roof.

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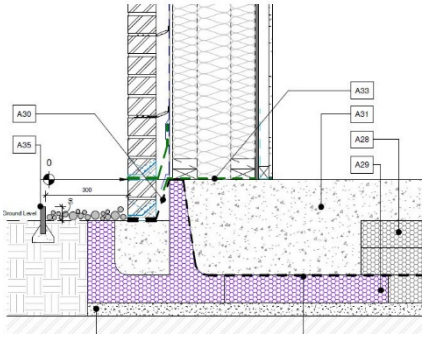
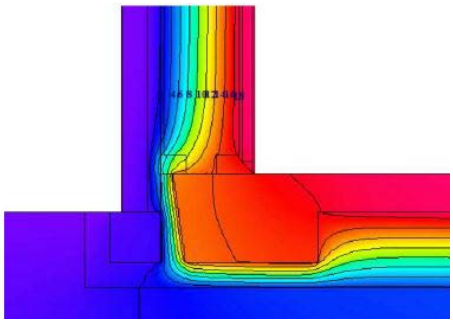
The twin stud timber frame system used on previous projects allows for a nice big void, which can be filled with the insulation. However, we did need to tie these two studs together at 600mm ctrs, to ensure structural stability. These ties of course 'bridged' the insulation zone, which wasn't ideal, but apparently was necessary (engineers, always the killjoys! ☺). What we hadn't appreciated, was the impact that this 'tie' would have on the performance of the wall. The tie consisted of a sold timber block, with metal gusset plates either side. When we plugged this configuration into the PHPP in the form of a 'Chi' value (a single 'point' of thermal resistance) over 3000 times (yes, we had that many gusset plates!) it very nearly tipped us into the realms of non-compliance. We learnt our lesson, and on future phases opted to drop the metal gusset plate (as explained above, metal is a very good conductor of heat) and went for ply plates in their place, which significantly improved our buildings performance, as timber is not as efficient at pulling heat across. (image on the PDF shows the pesky gusset plate, apologies it is a little blurry but hopefully you will get the idea).

Some junctions are of course harder to get the rule of two thirds to work. For these, we commission a Psi-value, which is a value given for a linear thermal transmittance. We ensure that insulation is 'breaking' the route from inside to out as best we can (in the below example (on the PDF), we allowed for a small strip of insulation to wrap up the face of the foundation). We then plug these Psi-values into our PHPP, along with a length, which calculates the amount of energy that will be lost at the particular junction. This is a nice accurate way to calculate performance. Below is an example from our latest Mulberry Park PassivHaus project for Curo. (you will see the images on the PDF attached).





Quite a hard one to explain in two sides of A4 that one, as always, fancy a chat, please don't hesitate to get in touch. On this subject, thank you to everyone that has reached out, it has been great to hear everyone's thoughts, and chat through all things PassivHaus. Next week is the final paper of this series.

Next week: Series 1_Paper 7_**Solar Orientation.**

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How wonderful it is that nobody need wait a single moment before starting to improve the world.