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BPN BUILDING PRODUCTS NEWS

Insulation across the nation

Alistair McLean describes how the National Construction Code sets out the many climate zones across the country and explains how that can help those specifying insulation.

IS HOME INSULATION THE LEAST INTERESTING OF ALL RESIDENTIAL BUILDING PRODUCTS?

For new home buyers it can't readily be seen, touched or smelt. There is the vague assumption that it is there in a new home, and that it complies with the necessary star energy requirements. Once it is installed and sealed behind the plasterboard then it is a bit tricky to check, or upgrade, and the occupants never really think about it until that first hot day of summer, or that first chill of winter. It is one of those "out of sight, and out of mind" type products that doesn't have a high profile for the buying public, so often doesn't rate highly with architects, building designers, builders and specifiers.

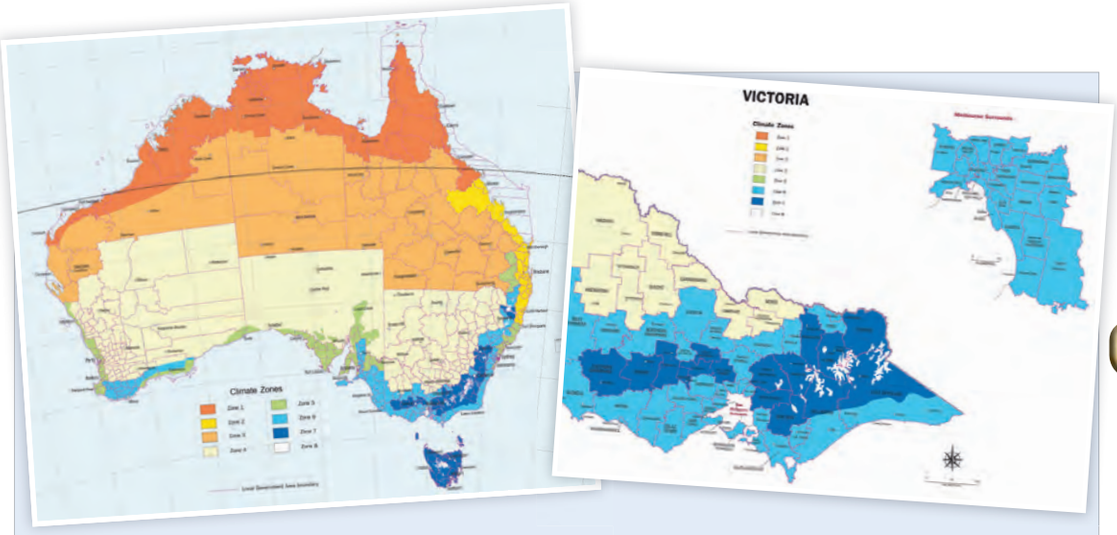
R-VALUES AND OVER-SPECIFICATION

The resistance of insulation or a building element to a change in temperature is expressed as an R-Value. The R-Value is a measure of thermal resistance. The higher the R-Value the better the thermal performance.

My experience with working with many builders is to specify what worked on the last job. Often it exceeded the minimum requirement and there weren't any issues. Architects and building designers are also guilty of this in specifying, and often over-specifying, without applying a lot of thought to it.

However, specifying the most appropriate insulation is actually more than just meeting the minimum R-Value requirements and achieving an energy efficient home is a lot more than specifying the right insulation levels.

Architects and building designers have long been familiar with the way appropriate orientation and window selection will have a huge impact on the thermal comfort of



EIGHT DIFFERENT CLIMATE ZONES

Due to Australia's climate varying greatly, and different locations having vastly different heating and cooling needs, the National Construction Code has divided Australia into eight climate zones for thermal design.

The zones are defined as:

Zone 1 High humid summer, warm winter (Darwin, Cairns)
Zone 2 Warm humid summer, mild winter (Coffs Harbour, Brisbane)
Zone 3 Hot dry summer, warm winter (Birdsville, Alice Springs)
Zone 4 Hot dry summer, cool winter (Broken Hill, Mildura)
Zone 5 Warm temperate (Sydney East, Adelaide)
Zone 6 Mild temperate (Sydney West, Melbourne)
Zone 7 Cool temperate (Hobart, Bright)
Zone 8 Alpine (Perisher, Smiggins)

It is possible to download an easy-to-read full colour versions of the national map in PDF from the ABCB website: (http://abcb.gov.au/major-initiatives/energy-efficiency/climate-zone-maps).

It is also possible to download PDF files on a state by state basis which show the boundaries of each zone, which are local council boundaries. It is interesting that even in a small state like Victoria there are four climate zones with different thermal design requirements:

Zone 4 Hot dry summer, cool winter (North Western Victoria – Mildura)
Zone 6 Mild Temperatures (Melbourne)
Zone 7 Cool Temperatures (Southern Victoria, South Gippsland, Warrnambool)
Zone 8 Alpine

A table, (1.1.2 Climate Zones for Thermal design – Various Locations) in the National Construction Code also lists various towns and cities across Australia. The boundaries of each Climate Zone are defined by council boundaries, so can change if a council boundary ever changes. If a property is located close to the edges of two climate zones, such as the south of Shepparton, which is in a "Zone 4 –Hot dry summer, cool winter", but adjacent to a "Zone 6 Mild temperate", there should not be a huge difference in thermal requirements, but common sense and local experience should point towards the most appropriate.

a home. Fortunately, the relationship between good house orientation and thermal comfort is now starting to be understood by new home buyers.

ISSUES WITH OVER-SPECIFYING

Many of the larger builders who are building across a number of climatically different regions try to minimise design and development costs by standardising their range of housing products and specifications. A standard range of houses with a standard specification can lead to substantial discounts and cost efficiencies with their purchasing power. While this is true for most products specified in a home, the climatic differences between the regions should mean that the specification of insulation should very much be a localised decision. Specifiying the insulation for a new home without reference to the climate zone has the risk of being massively over-specified (and more expensive than actually required), or a more appropriate, and cheaper form of insulation may be available.

One big builder that I consulted for had opened up a Queensland office and used the same specifications for windows and insulation as the Victorian office, without taking into account the local conditions. As a result, the over-specified bulk insulation, which exceeded the requirements of the National Code for the Climate Zone, did a great job of keeping out the heat in the morning. However, by evening when all the local designed houses were cooling down, the Victorian builder's house also did a great job of retaining the heat. In addition to the over-specified bulk insulation, the house also had awning style windows, so good cross-flow ventilation was impossible to achieve, while all the neighbouring houses were enjoying the cooling breeze with their large sliding windows.

TYPES OF INSULATION

Types of insulation fall into three main categories: reflective insulation, bulk insulation and a hybrid style that combines elements from both. They all work in different ways, and are more suited to different zones. Most consumers would be familiar with the bulk insulation, such as the glass wool ceiling batts, which work on the blanket principle. This type of insulation resists the transfer of conducted and convected heat, relying on pockets of trapped air within its structure. Its thermal resistance is essentially the same regardless of the direction of the heat flow through it. This means that bulk insulation is a good choice for zones where reducing heat loss is the main priority such as Zone 7 Cool temperate, and Zone 8 Alpine. Houses in these two zones are likely to have some form of indoor heating, and bulk insulation will help reduce their heat loss to the external environment.

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The other type of insulation is the reflective insulation, which is usually shiny aluminium foil laminated onto paper and is available as sheets, concertina type batts or multi-cell batts. Reflective insulation mainly resists radiant heat due to its high reflectivity, and low ability to re-radiate heat. However, unlike bulk insulation, the thermal resistance of reflective insulation varies with the direction of heat flow through it. As reflective insulation is good at reflecting radiant heat, but not at resisting conducted or convected heat, it is probably more suited for the Zone 1 "High humid summer, warm winter", Zone 2 "Warm humid summer, mild winter" and Zone 3 "Hot dry summer, warm winter", where coping with the summer heat is a higher priority than preserving a warm interior temperature in winter. Reflective insulation is also a

good choice for verandah roofs to reduce the amount of heat radiating from the underside of the verandah roof.

The reflective insulation is a great material for the hotter climates where people like to open up their houses to make the most of cross-flow ventilation to cool houses in the cooler evenings. Unlike bulk insulation, there is no warm air trapped in tiny cells, so the house walls should cool down faster with reflective insulation, resulting in a cooler house faster.

Other factors that can influence the selection of roof insulation are explained in "Table 3.12.1.1a Roof and Ceiling – Minimum Total R-Value" in the National Construction Code in Section 3.12.1.2. They include altitude for Zone 2, either above or below 300m, as well as solar absorptance for the roof material.

The effect the colour of the roof has on the reflection or absorption of the energy from the sun has an effect on the R-Value required for that roof. So in Darwin (Zone 1), a light coloured cream roof only requires a minimum roof and ceiling R-value of 4.1, whereas if it was a dark slate grey colour the minimum roof and ceiling R-value is 5.1.

The "Table 3.12.1.1a Roof and Ceiling – Minimum Total R-Value" has a row for direction of heat flow that is most important for this zone to achieve the best thermal comfort. For Zone 1 "High Humid summer, warm winter" only the downward flow, or heat from outside coming inside, is an issue, so this is a good opportunity to use reflective foil batts. For Zone 3 "Hot dry summer, warm winter" the direction of the flow of heat, both coming in from outside in summer, and leaving from inside during winter, is important, so "Downward and Upwards" has been nominated in the table, so this roof would be more suited to bulk insulation.

It is worthwhile for all specifiers to become familiar with it and work out which climate zone(s) are most appropriate

So what do the requirements of the National Construction Code mean for those specifying insulation? This part of the National Construction Code has been introduced relatively recently, so it is worthwhile for all specifiers to become familiar with it and work out which climate zone(s) are most appropriate. Based on the required resistance to heat flow in roofs (upwards/downwards) it may be possible to review alternative types of insulation which are cheaper and perform better than what was used on the last job. However at the end of the day the specification of the insulation is only one aspect of the thermal efficiency of a house.

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