Monday, October 12

Does Lightweight Stack Up?

Contributor:
Sarah Bachmann
Published: 16 March 2015

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Anyone in the design and construction sector is well aware of one of the latest fads of the sector – lightweight construction.

In fact there are those out there, including some from within the academic fraternity, who strongly advocate this form of construction over and above the more traditional – and heavier – methods of construction. It raises some serious questions and concerns about how these buildings will perform from a lifespan, durability, thermal performance, fire and flood perspective.

Certainly, the producers of lightweight construction materials have carefully prepared their various testing, supporting documentation and glossy feel-good marketing material, which address some of these issues. But do the products really tick all the boxes and will they stack up in the face of the increasing climatic fluctuations we are experiencing?

Lightweight products that are imported need to first come under scrutiny. By specifying them, are we supporting our local economy and local communities? Have the many transport miles they have travelled been factored into their sustainability equation? Surely there is a substantial argument here in favour of locally produced products.

We all know that some of the more traditionally constructed structures, made from concrete, brick, block and even steel, stand the test of time. There is evidence of extremely old structures built from such materials all around us.

Given that Australia is a newer nation, many of the really old structures are to be found overseas; nonetheless, they are there and they are not just hundreds, but thousands of years old in many cases. Are lightweight structures able to compare? Do we see them of a similar age? Can they be refurbished and reused, rather than having to be demolished and rebuilt? I'd suggest the answer to all these questions is "no."

Durability and ongoing maintenance are also questionable. What is the life of lightweight structures? What treatments have they been given to make them durable (or termite resistant) and are those

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treatments friendly to our environment? Do the materials require recoating to maintain their integrity over their lifespan? One thing we do know about some of the higher thermal mass products in particular, such as concrete, brick, block and stone, is that they require minimal maintenance. They are inherently low maintenance and still durable, with a long life.

From a thermal performance perspective, how do lightweight structures stack up? Most need to be heavily loaded with insulation, and it is only the insulation which provides any degree of reasonable thermal performance. This is not the case with high thermal mass products.

Research at the University of Newcastle over the last 10 years has demonstrated that the inclusion of mass in a building provides increased levels of natural thermal comfort and reduces the dependence on artificial heating and cooling. The research showed that buildings without mass perform poorly in comparison to those with mass, even when the R-value is similar. R-value therefore does not necessarily correlate with the actual energy used to maintain thermal comfort in a building.

Thermal mass not only reduces the temperature fluctuations in a building, it also delays the heat flow by up to eight hours, outside of the peak energy demand time. This is critical in reducing the heating and cooling loads and particularly the peak demand on energy networks.

This practical research is supported by more recent work by Prof Terry Williamson from the University of Adelaide, whereby a method of calculating the benefits of thermal mass, and resultant mass-enhanced R-values, have been developed. The method is used in a suite of R-value calculators for precast concrete, brick and block.

The fire and flood resistance of lightweight structures would have to be the other serious concern. Certainly, the lightweight materials industry – including the suppliers of one lightweight option, cross laminated timber – will claim safety and durability in such disasters, but talk to the fire protection industry and you will get a different view.

Fire fighters ask questions such as "are we prepared to risk the lives of our fire fighters to rescue occupants of a five storey burning building when it's made from timber?" There are very real concerns amidst their ranks about the spread of fire both within a structure and to adjacent structures, plus the emission of fumes, and the time which it takes to rescue occupants many stories up. Already, there have been deaths associated with fires in multi-storey timber structures in the UK, France and Sweden. It will be interesting to see exactly how they perform when the first disaster strikes.

Maybe the lightweight trend is just that, a trend, or maybe it is here to stay, but the decision of whether to specify lightweight materials needs to be all encompassing.

Published on 16 March 2015

CONTRIBUTED BY:

Sarah Bachmann

Sarah has been in her current role of CEO of the National Precast Concrete Association for the last 11 years. Now running the Association's national office from Adelaide, she has spent 16 years in state and national association management roles and 10 in senior marketing/public affairs positions,...

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