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High-performance details

A handbook of high thermal performance construction details due for release by mid-2021 will be indispensable to New Zealand architects and designers as well as builders, suppliers and consenting officials.

AS PART of its *Building for climate change* programme, the Ministry of Business, Innovation and Employment has signalled that the New Zealand Building Code requirements under clause H1 *Energy efficiency* will change. H1 will require better performance in the thermal envelope of new buildings.

Timber-framed buildings, as they have typically been built in New Zealand, have known limitations that result in poor thermal performance (see *Moving beyond the bridge*, pages 72–75). This includes excessive thermal bridging, especially in corners and internal-to-external wall junctions, and inadequate design of skillion roofs, so optimising thermal performance is difficult.

Need for high-performance details

Until now, the industry has had limited publicly available, proven construction details that can deliver improved thermal performance and quality.

The need is evident – the Passive House Institute of New Zealand (PHINZ) routinely receives requests for guidance with construction details. Knowledge and experience with high thermal performance design exists but until now has been locked up in specific Passive House projects and design practices.

Providing practical solutions

With funding from the Building Research Levy and in-kind contributions, PHINZ and Sustainable Engineering Ltd undertook a project to give design and construction professionals practical tools to exceed the Building Code thermal performance minimums. It will also support building consent officials who are increasingly encountering projects that include high-performance Alternative Solutions.

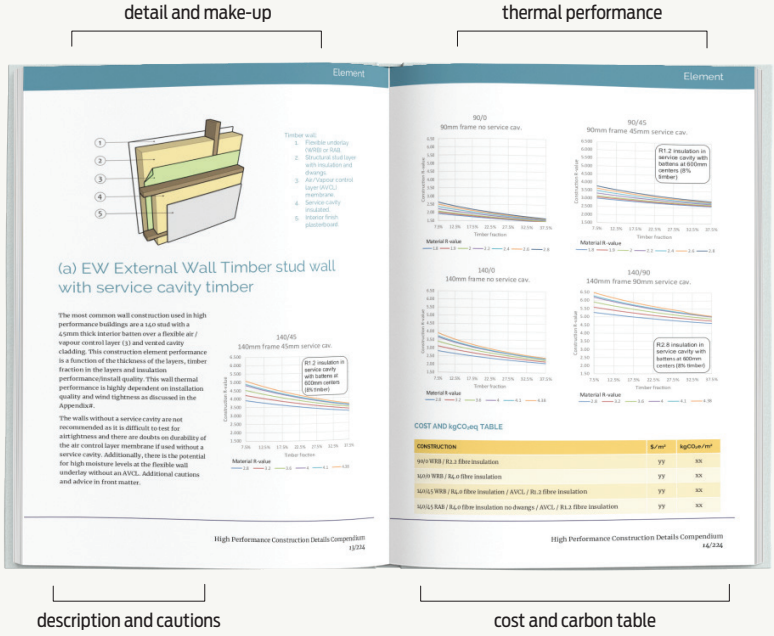

Figure 1 **Elements pages from the handbook.**

While this is a handbook based primarily on previously consented Passive House details, it is widely applicable to any project that wants to go beyond the Building Code's Acceptable Solution for thermal performance. Standard practice details are also included for the sake of comparison. This makes it easy to understand how small changes in construction practice can dramatically improve thermal performance, in turn reducing or removing interior cold spots that are a risk for mould growth.

The publication has 101 details, both elements (1D details) and junctions (2D details), with more comprehensive heat transfer calculations for:

- walls plus door and window penetrations
- roofs
- floors, including both suspended floors and slab foundations.

Construction types covered include:

- timber framing
- insulated concrete forms
- structural insulated panels
- a straw-bale wall element.

The details are not theoretical – they have been successfully used in built New Zealand projects and demonstrate advanced practice already in use. The drawings contain generic products and materials that represent a broad spectrum of what is locally available. Due to the generic nature of ➤

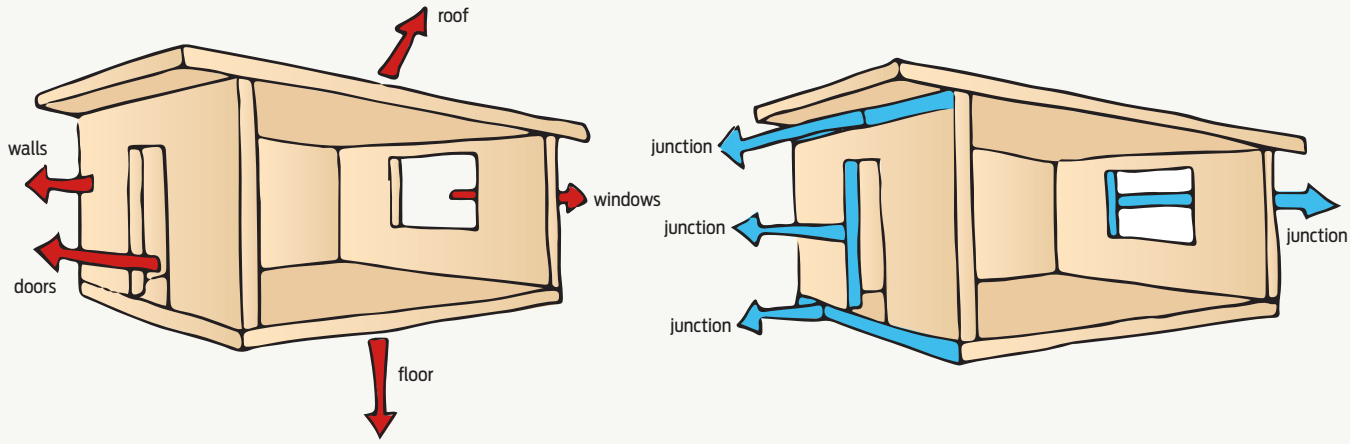

Figure 2 **Elements (left) vs junctions (right). High-performance buildings require junction performance for sufficiently accurate predictive thermal modelling.**

the details, Building Code clause E2 *External moisture* data is not provided – that technical advice is specific to individual building materials.

The detailed drawings of key junctions and elements have been costed and also account for embodied carbon.

Focus moves to junctions

Both the New Zealand Building Code and the New Zealand Green Building Council thermal performance (energy) modelling requirements are based on wall, roof, floor and window areas. These parts of the building fabric are elements. Their performance is adequately captured by an R-value, and this is sufficient for current standard practice.

As we move to higher thermal performance, the heat loss through junctions becomes critical. Elements in high-performance buildings have such high R-values that the junctions between them also need to be calculated – where the wall meets the slab, for instance, or a window installation detail.

Looking to the future

In the longer term, this project and its outcomes will inform and support MBIE's *Building for climate change* programme and associated revisions to the Building Code.

Current initiatives suggest the government has two main priorities for construction:

- Ensuring healthier homes that are warmer, drier and cheaper to run.
- Mitigating climate change.

Building for climate change will require buildings with very high thermal performance, and the first step to achieving this is modelling thermal performance – often called energy modelling.

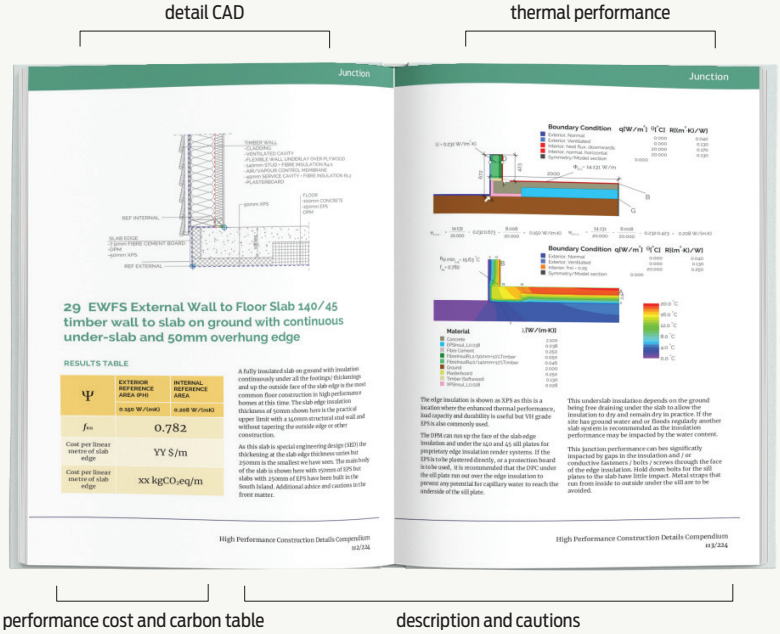

Figure 3 **Understanding the junctions pages. This example is of a very good slab edge insulation detail suitable for all New Zealand climates as the interior surface temperature ratio (fRSI) is high.**

A word of caution

A designer can take details from this handbook and incorporate them into a standard project to make incremental improvements to thermal performance.

However, attempting to deliver a high-performance home that aims for significant improvements over Building Code without predictive thermal modelling is inadvisable. There is considerable risk of serious overheating and unnecessary cost, especially in warmer climate zones.

Available mid-2021

In mid-2021, the construction details will be released by PHINZ and the handbook will be available as research report ER61 from www.branz.co.nz/pubs. *High-performance domestic walls* (pages 32–33) includes a detail from the handbook.

Note **Elrond Burrell also works for MBIE. This article expresses his opinion as Chair of PHINZ and not the views of MBIE. For more, contact PHINZ at enquiries@passivehouse.nz.**