DESIGN RIGHT

High-performance domestic walls

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Wall design will play a key role in the improved thermal performance of new houses as we move toward net-zero carbon construction. One recent research project found problems with current wall construction, but another developed high-performance details that take us a leap ahead.

THERE IS EVIDENCE that walls in New Zealand houses are often constructed to little more than Building Code minimums, and these are already comparatively low by international standards. New Zealand currently allows more than twice the heat loss through the walls of new houses than the UK and almost three times more than the EU.

Current framing affecting thermal values

A recent BRANZ-funded research project found that our house walls may not actually be achieving the designed and intended R-values (see *Moving beyond the bridge*, pages 72–75). Beacon Pathway investigated the external timber-framed walls of 47 new-build houses. It found the average percentage of timber framing compared to total wall area (excluding windows and doors) was above 34%, significantly higher than generally assumed.

The problem is thermal bridging – timber framing carrying heat from the interior to the exterior of a building. The more bridging, the more heat loss.

Figure 1 shows how construction R-values in a wall with 90 mm framing fall away as the percentage of timber in the wall increases. The minimum construction R-values required for walls in the schedule method of NZS 4218:2009 *Thermal insulation: Housing and small buildings* are R1.9 (climate zones 1 and 2) and R2.0 (climate zone 3). It is clearly difficult with traditional construction (90 mm framing and a high percentage of timber in the walls) to achieve the minimum thermal performance required, let alone exceed it.

Calculating thermal bridging

BRANZ has a thermal bridging calculation tool that is useful to help determine the thermal performance of cavity insulated timber-framed walls. It is available at www.branz.co.nz/thermal-bridging-calculation-tool/.

Thermal bridges can be reduced:

- Don't specify things like double sills or double studs at centres smaller than necessary for structural or fixing requirements. Frame and truss company detailers may be able to provide advice on this.
- Carefully think through the placement of windows and external doors in relation to studs and fixing points for claddings or linings. In some instances, shifting a window even a small distance could avoid the need for additional studs/dwangs to carry fixings, with the window studs being the fixing point.
- Take a wider view around wall framing – don't just consider structural compliance or practical issues like fixing but specifically consider how a design can be refined to minimise framing in the walls to achieve a better-performing thermal envelope.

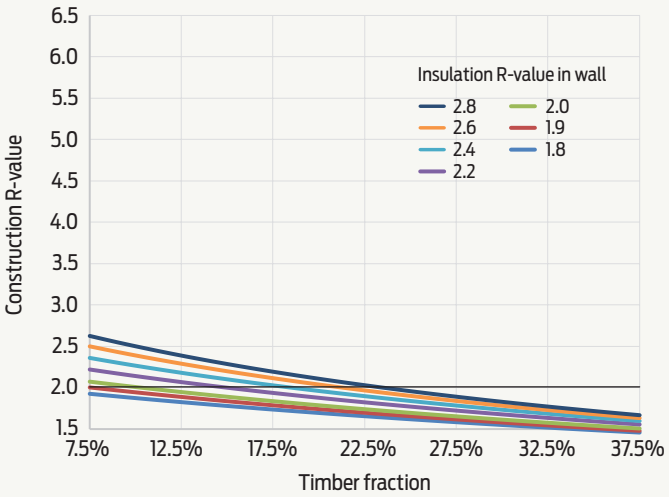

Figure 1 **Construction R-values that can be achieved for walls with 90 mm timber framing and different insulation R-values and timber framing percentages. (Courtesy of PHINZ.)**

High-performance wall details

A set of construction details that deliver significantly improved thermal performance have been developed in a project involving the Passive House

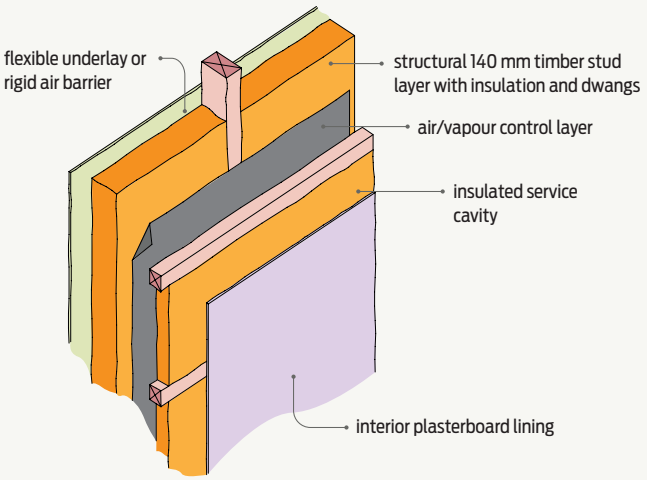

Figure 2 **Timber frame wall with an additional timber batten insulated service cavity.**

Institute New Zealand (PHINZ) and BRANZ, with funding support from the Building Research Levy (see *High-performance details*, pages 29–30). These are not theoretical drawings – they are from homes that have been consented and constructed in New Zealand.

One of the details is the most common wall construction in high-performance houses in New Zealand – a 140 mm stud with a 45 mm thick interior batten over a flexible air/vapour control layer and an insulated service cavity (Figure 2). This insulated service cavity minimises thermal bridging and raises the construction R-value and is used for services such as wiring and plumbing.

Comparing the construction R-values that can be achieved with this detail (Figure 3) with the conventional 90 mm framing (Figure 1) shows that a doubling or better of R-values is achievable. Even better construction R-values can be achieved with a 90 mm service cavity (Figure 4).

Details available by mid-2021

The details will be released by mid-2021 in BRANZ research report ER61, available from www.branz.co.nz/pubs.

Things to note

Most of the high-performance construction details have a prescribed means of achieving airtightness. In most cases, this is an air/vapour control layer that has the dual function of limiting uncontrolled air movement (and therefore air carried water vapour) and moisture movement via diffusion. This reduces the risk of moisture generated in the building from penetrating the wall cavity.

It is crucial that mechanical ventilation is considered to adequately manage and maintain healthy moisture levels indoors.

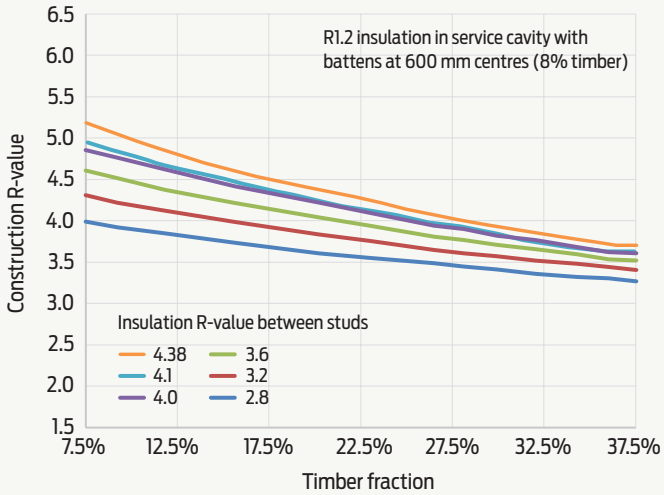

Figure 3 **Construction R-values for high-performance detail – 140 mm wall framing and a 45 mm service cavity. (Courtesy of PHINZ.)**

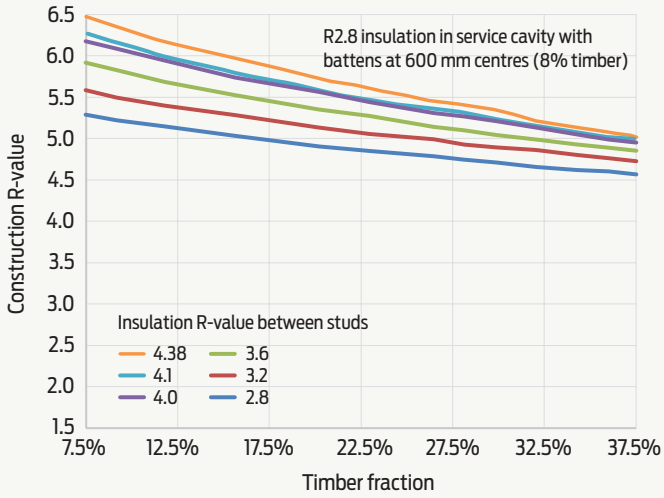

Figure 4 **Construction R-values for high-performance detail – 140 mm wall framing and a 90 mm service cavity. (Courtesy of PHINZ.)**

Range of insulation options

While fibreglass insulation is by far the most commonly used material for domestic wall insulation in New Zealand with a market share around 90% or higher, other materials have the potential for greater use in houses. This includes structural insulated panels (SIPs) such as panels constructed of oriented strand board (OSB) and polyurethane or EPS foam insulation.

Start talking about wall design early on

Designing walls to have high thermal performance must be part of the discussion at the very earliest stages of planning a new house. Everyone – client, designer, builder, subcontractors, materials suppliers – needs to be involved and committed.