DESIGN RIGHT

Compliance for H1 5th edition design

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The BRANZ helpline has received many calls asking how to approach designing new houses that are compliant with the higher thermal requirements of New Zealand Building Code clause H1 *Energy efficiency* 5th edition. The first step is to look further than just the schedule method.

IN 2021, MBIE consulted the public and the construction industry on changes to Acceptable Solution H1/AS1 and Verification Method H1/VM1 to increase the minimum requirements for insulation in new homes and buildings. These are used to demonstrate compliance with clause H1 of the New Zealand Building Code.

The changes are the first steps of the major transformation to a more-sustainable low-carbon construction industry.

Currently in transition period

The revised Acceptable Solution and Verification Method were first issued on 29 November 2021, with a 1-year transition period.

While designers and builders can also currently use the previous generation H1/AS1 and H1/VM1 methodologies to show compliance, from 3 November 2022 onwards (MBIE may extend this by 6 months), only the new 5th edition options can be submitted for building consent applications.

Changes needed but there are solutions

New Zealand has now been divided into six climate zones from the previous three and the minimum required R-values for most parts of the thermal envelope of residential buildings have been significantly increased (see *Building Code changes 2021* in *Build* 188).

Most previous H1-compliant design solutions will no longer suffice, and all new dwellings will begin to use different, more thermally efficient construction solutions. While this has created some concern, there are still relatively straightforward solutions for residential building consent applications.

Schedule method likely to be used less

The schedule method remains the simplest compliance path available, with the minimum required R-values listed in H1/AS1 5th edition. This basic method of Building Code compliance has been the mainstay for most designers of homes to date.

However, with the increased minimum R-values, construction detail and aesthetic appearance of new homes will start to change as designs evolve to accommodate increased thermal performance requirements – for example, skillion roof design.

The schedule method can only be used where the glazing area is 30% or less of the total wall area of the building and the combined glazing area on the east, south and west-facing walls is 30% or

less of the combined area of these walls. Skylight and opaque door areas are also limited.

Architects and designers now accept that they will often have to move beyond the schedule method to craft the buildings that many owners of new-build homes require.

Calculation method gives flexibility

The first option to consider after the schedule method is the calculation method – see section 2.1.3 in H1/AS1 5th edition. This method can only be used where the glazing area is 40% or less of the total wall area.

Comparison with reference building

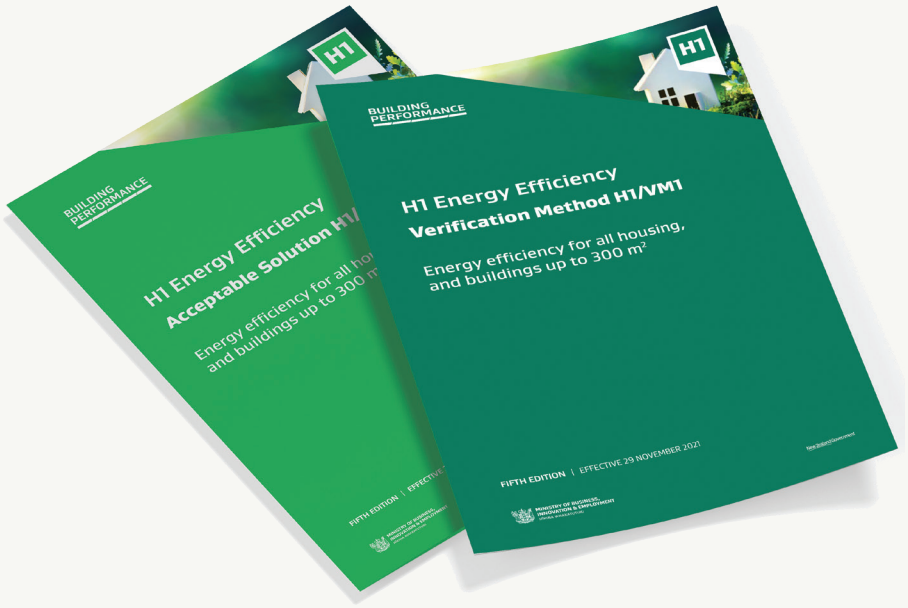
This methodology uses a comparison between the proposed building and a reference building, which is insulated in accordance with tables outlined in the schedule method of H1/AS1.

The calculation method allows roof, window and skylight, wall and floor insulation combinations that differ from these tables, but the proposed building must perform as well or better than the reference building.

The heat loss for the reference building can be calculated using Table 2.1.3.4 in H1/AS1. The reference building used in these equations will use the minimum construction R-values for the appropriate climate zone as given in the schedule method. It also must have the same roof, floor and skylight areas as the proposed building, but the total wall area in the reference building is assumed to contain a glazing area of 30%.

A note of caution – remember that there is a longer transition period for higher minimum construction R-values for windows and doors in climate zones 1 and 2 (currently extended out to 2 November 2023).

The construction R-value for roofs, walls and floors that form part of the building thermal envelope must also be at least 50% of the construction R-value of the corresponding building element in the reference building equation. Heated elements must meet the specific heated element minimum R-values of the schedule method.



H1 5th edition can already be used to demonstrate Building Code compliance and will soon replace the earlier version.

Offset insulation in other areas

One advantage of using the calculation method is that it enables the total heat loss of the proposed building to be compared with the total heat loss of the reference building.

The designer can then choose where to add additional insulation in the proposed building to increase the total R-value if required to meet or better the heat loss equation of the reference building. For example, the designer could alter the external wall stud sizes or spacings to enable inclusion of more insulation to increase the building's total thermal efficiency if some other aspect of the envelope is slightly below par.

If elements of the proposed building are to be scaled or streamlined for aesthetic reasons – which may limit the insulation capacity – other elements can use higher insulation to offset the shortfall.

For example, it may be difficult to achieve R6.6 for a skillion roof. However, a lower roof R-value could be compensated for by:

- specifying a higher R-value wall insulation product (which may still fit in 90 mm wall framing or in 140 mm framing)
- specifying higher-performing windows
- limiting the glazing area to well below 30% of the total wall area.

This gives designers flexibility to achieve clients' design expectations without compromising the overall thermal performance of the building.

Modelling method most comprehensive

Another methodology to consider is the modelling method, as outlined in Appendix D of Verification Method H1/VM1. This has no restrictions on the proposed glazing area. This method is more comprehensive and has its place in the delivery of safe, warm, quality New Zealand homes. Note that the ALF/BPI method is no longer a compliance pathway.

Modelling energy use of building

The envelope of the proposed building shall be constructed to provide adequate thermal resistance. Verification of the design is achieved by showing that the energy use of the proposed building does not exceed the energy use of the reference building.

This is shown by using computer modelling to predict the space heating and cooling loads of the proposed building. These are compared with the performance of the reference building of the same shape/size, 3D form and orientation as the proposed building. The reference building construction R-values are listed in tables in H1/VM1 and are identical to the schedule method R-values of H1/AS1.

Modelling software options

There are several options for the modelling software including PHPP, IES Virtual Environment, Energy Plus (and tools based on it) and others. Again, there are default values and schedules included in H1/VM1 that can be used if needed unless the designer can demonstrate different assumptions that better characterise the building's use over its expected life.

The modelling method has the facility to enable different internal spaces that have significantly different space conditioning requirements to be modelled as separate zones (if the program allows this). Roof spaces and enclosed subfloor spaces must be modelled as discrete thermal zones.

Internal partitions as modelled in the proposed building shall be modelled in the reference building. Fresh air ventilation rates are modelled and again are to be the same for the proposed and reference buildings, and heat release into the building from occupants and plug loads are also considered.

Detailed analysis provides benefits

Clearly, the level of analysis of the modelling method is very thorough and more detailed, but the resultant modelling data is far more comprehensive and gives a more detailed evaluation of the proposed building's performance.

It also enables the early evaluation of how interconnected internal spaces will behave thermally – something that has traditionally been very difficult to achieve.

Many smaller design practices may choose to contract out this modelling method research to secondary consultants, but the quality of the analysis – and subsequent level of design detail – will reward the cost and effort.

Methods enable detailed design tailoring

Both the calculation and modelling methods take the design process to new levels for the thermal analysis of the proposed building. They also create opportunities to tailor the thermal performance of specific building elements to what is most practicable for the specific design requirements of a project.

In the future, these methods of modelling will become even more important as they will become part of the life cycle analysis of our buildings.

Tools and resources

Finally, a mention of some of the tools and resources available as we transition towards a more sustainable construction industry.

BRANZ is updating the H1 calculation method tool to align with H1 5th edition. This can be used to show compliance using the calculation method (available from www.branz.co.nz/energy-efficiency/h1-support).

It is worth watching *The carbon challenge* webinar series, which covers compliance, calculating building carbon footprints and the design and construction of low-carbon dwellings (see www.branz.co.nz/webinars).

There has also been a recent series of free webinars looking at the free tools available to move to the next level of new-build analysis – the role of carbon in the construction, operation, occupation and use of our residential buildings including HECC, LCAQuick, CO_2RE and LCAPlay.

Tools such as these and others that will be developed will become an important part of our design processes as we transition to a lower-carbon construction industry.

Where to start?

While it may seem daunting to evaluate such a broad selection of material, the BRANZ CO_2RE tool is perhaps a good place to start. Most home designers in New Zealand will be familiar with the Design Navigator tool to meet H1 compliance for our Building Code applications, and the CO_2RE tool could be considered the next step.

It, too, evaluates the building on a per m^2 basis and goes further to provide guidance to achieve low-embodied carbon construction and construction R-values in a user-friendly fashion. It can also be used with the current BRANZ *House insulation guide* so you can practise using it before the updated *House insulation guide* is released later this year.

As with many new processes, these changes initially seem to be a considerable load to take on, but when the dust settles, they can be seen as opportunities that enable better outcomes and better work.