BRANZ

# Webinar

## H1 Calculation method

# Outline for the webinar

| | |
|---|---|
| Updated H1/AS1 calculation method – requirements and format | Christian Hoerning<br>MBIE |
| Using the BRANZ H1 calculation method tool | Andrew Pollard<br>BRANZ |
| BRANZ *House insulation guide* (6th edition) | Ian Cox-Smith<br>BRANZ |
| A more complex H1 calculation method example | Andrew Pollard<br>BRANZ |
| Questions and answers | All |

# Updated H1/AS1 Calculation Method for housing and small buildings

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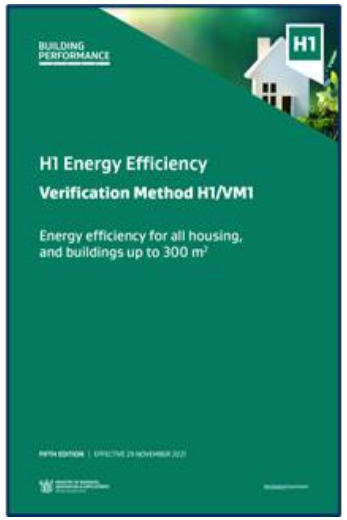
BUILDING PERFORMANCE

Te Kāwanatanga o Aotearoa
New Zealand Government

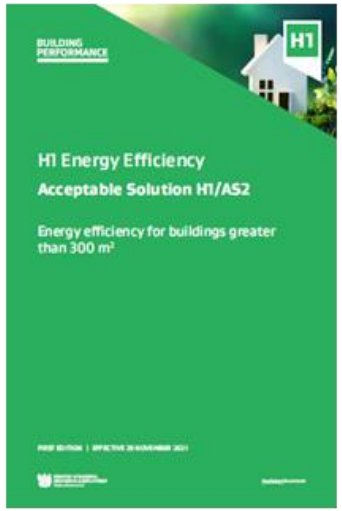
# Five new H1 Energy Efficiency AS and VMs


H1/AS1
5th edition
Amd 1

**All housing**
**Small buildings up to 300m²** (Communal residential, communal non-residential and commercial buildings)

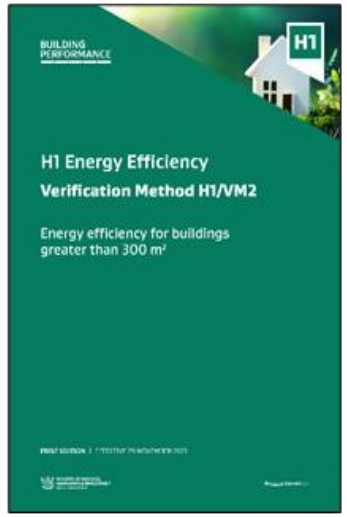



H1/VM1
5th edition
Amd 1

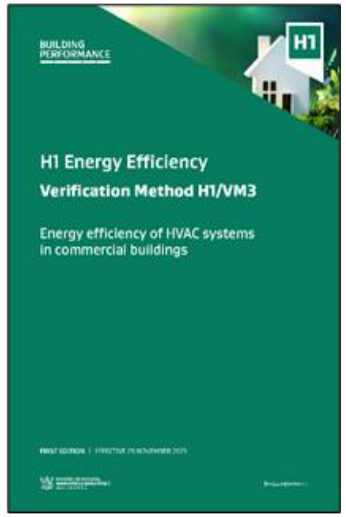



H1/AS2

**Large buildings over 300m²**
(Communal residential, communal non-residential and commercial buildings)




H1/VM2




H1/VM3

**HVAC systems**
in commercial buildings

# Transition period for housing

Extended transition for housing:

- Window, door and skylight R-values start staged implementation from 3 November 2022
- Transition to new wall, floor and roof R-values extended to 1 May 2023
- Only new 5th edition H1/AS1 and H1/VM1 documents to be used from 3 November 2022 (4th editions archived)

# Transition period for other buildings

- For commercial, communal residential and communal non-residential buildings transition remains unchanged
- Higher R-values from 3 November 2022
- Irrespective of building size

# Compliance methods

## Acceptable Solution H1/AS1 5th edition


### Schedule Method

tabulated minimum R-values for roof, walls, floor, windows, doors and skylights

### Calculation Method

Simplified comparison methodology that permits different insulation combinations for roof, walls, floor, windows, doors and skylights

## Verification Method H1/VM1 5th edition


### Modelling Method

complex comparison methodology that permits different insulation combinations for roof, walls, floor, windows, doors and skylights

Based on computer building energy modelling

## Alternative Solution

Also able to demonstrate compliance using an alternative solution

# When to consider the H1/AS1 Calculation Method

1. For designs that:
   - exceed the Schedule Method limits for the glazing area, skylight area or opaque door area
     AND
   - are within the 40% glazing area limit of the Calculation Method.

**2.1.2 Schedule method**

2.1.2.1 The schedule method shall only be used where:

2.1.3.2 The calculation method shall only be used where the *glazing area* is 40% or less of the *total wall area*.

30% or less of the combined total area of these walls; and

c) The *skylight area* is no more than 1.5 $m^2$ or 1.5% of the *total roof area* (whichever is greater);

d) The *opaque door area* is no more than 6 $m^2$ or 6% of the *total wall area* (whichever is greater).

# When to consider the H1/AS1 Calculation Method

2. For designs where achieving the Schedule Method minimum R-values is difficult or uneconomical (e.g. skillion roofs); or where the R-value of some elements is unknown.

| Building element | Construction R-values ($m^2 \cdot K/W$)[1] | | | | | |
|---|---|---|---|---|---|---|
| | Climate zone 1 | Climate zone 2 | Climate zone 3 | Climate zone 4 | Climate zone 5 | Climate zone 6 |
| *Roof*[2] | R6.6 | R6.6 | R6.6 | R6.6 | R6.6 | R6.6 |
| Wall | R2.0 | R2.0 | R2.0 | R2.0 | R2.0 | R2.0 |
| Floor | | | | | | |
| *Slab-on-ground* floors | R1.5 | R1.5 | R1.5 | R1.5 | R1.6 | R1.7 |
| Floors other than *slab-on-ground* | R2.5 | R2.5 | R2.5 | R2.8 | R3.0 | R3.0 |
| Windows and doors[3] | R0.46[3] | R0.46[3] | R0.46 | R0.46 | R0.50 | R0.50 |
| *Skylights* | R0.46 | R0.46 | R0.54 | R0.54 | R0.62 | R0.62 |

# How does the calculation method work?

**Proposed building:**

- Proposed R-values
- Proposed glazing area (up to 40% of total wall area)

**Reference building:**

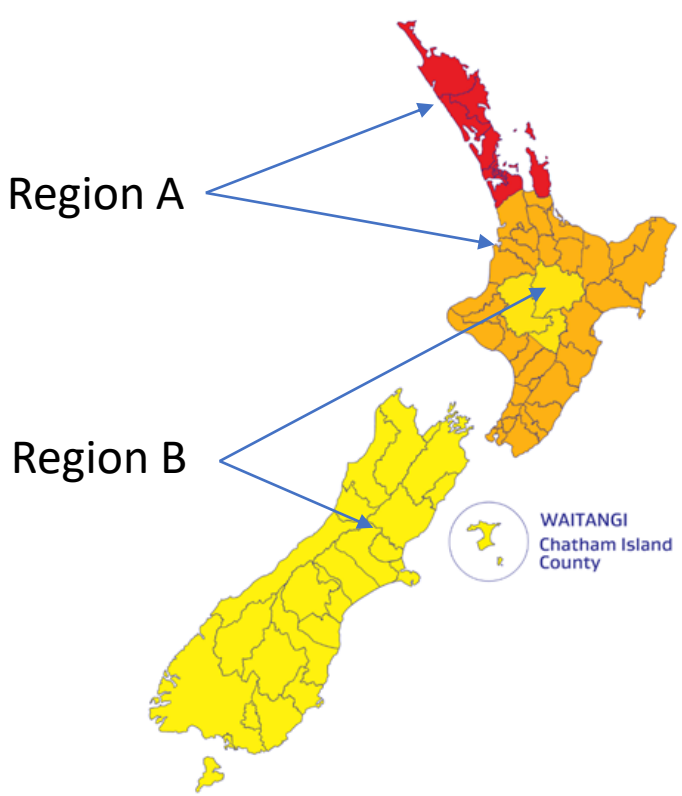
- Schedule method R-values
- Identical building element areas but combined window and door area adjusted to 30%
- No skylights

# Reference building heat loss equations

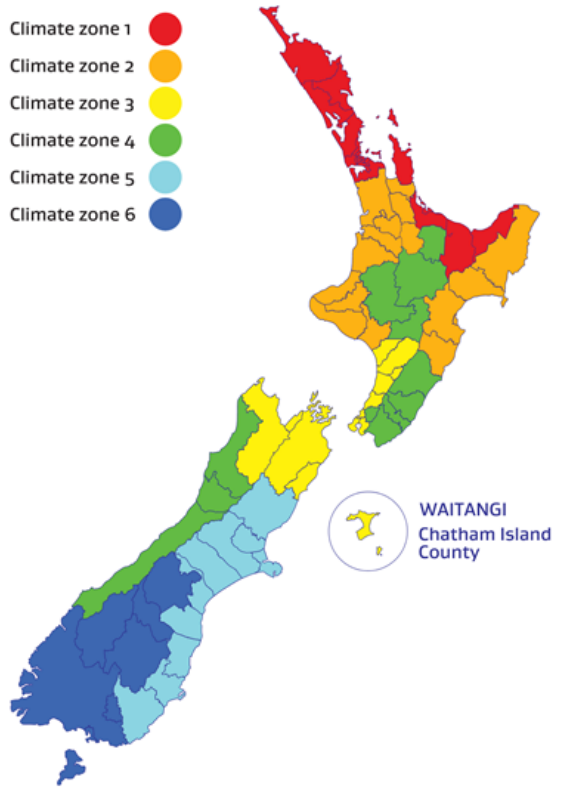
**For housing only where building consent applications are submitted before 1 May 2023**

| Location | Reference building heat loss equation[1] |
|---|---|
| Region A[2] | $HL_{Reference} = \frac{A_{roof} + A_{skylight}}{2.9} + \frac{A_{70\% \text{ of the total wall area}}}{1.9} + \frac{A_{slab\text{-}on\text{-}ground\ floor}}{1.3} + \frac{A_{other\ floor}}{1.3} + \frac{A_{30\% \text{ of total wall area}}}{0.37}$ |
| Region B[3] | $HL_{Reference} = \frac{A_{roof} + A_{skylight}}{3.3} + \frac{A_{70\% \text{ of the total wall area}}}{2.0} + \frac{A_{slab\text{-}on\text{-}ground\ floor}}{1.3} + \frac{A_{other\ floor}}{1.3} + \frac{A_{30\% \text{ of total wall area}}}{0.37}$ |

# Climate zones




Old climate zone map




New climate zone map

# Reference building heat loss equations

| Climate zone[1] | Reference building heat loss equation[3] |
|---|---|
| 1 and 2[2] | $HL_{Reference} = \frac{A_{roof} + A_{skylight}}{6.6} + \frac{A_{70\% \text{ of the total wall area}}}{2.0} + \frac{A_{slab\text{-}on\text{-}ground\ floor}}{1.5} + \frac{A_{other\ floor}}{2.5} + \frac{A_{30\% \text{ of total wall area}}}{0.37}$ |
| 3 | $HL_{Reference} = \frac{A_{roof} + A_{skylight}}{6.6} + \frac{A_{70\% \text{ of the total wall area}}}{2.0} + \frac{A_{slab\text{-}on\text{-}ground\ floor}}{1.5} + \frac{A_{other\ floor}}{2.5} + \frac{A_{30\% \text{ of total wall area}}}{0.46}$ |
| 4 | $HL_{Reference} = \frac{A_{roof} + A_{skylight}}{6.6} + \frac{A_{70\% \text{ of the total wall area}}}{2.0} + \frac{A_{slab\text{-}on\text{-}ground\ floor}}{1.5} + \frac{A_{other\ floor}}{2.8} + \frac{A_{30\% \text{ of total wall area}}}{0.46}$ |
| 5 | $HL_{Reference} = \frac{A_{roof} + A_{skylight}}{6.6} + \frac{A_{70\% \text{ of the total wall area}}}{2.0} + \frac{A_{slab\text{-}on\text{-}ground\ floor}}{1.6} + \frac{A_{other\ floor}}{3.0} + \frac{A_{30\% \text{ of total wall area}}}{0.50}$ |
| 6 | $HL_{Reference} = \frac{A_{roof} + A_{skylight}}{6.6} + \frac{A_{70\% \text{ of the total wall area}}}{2.0} + \frac{A_{slab\text{-}on\text{-}ground\ floor}}{1.7} + \frac{A_{other\ floor}}{3.0} + \frac{A_{30\% \text{ of total wall area}}}{0.50}$ |

Before 2 November 2023

# Reference building heat loss equations

From 2 November 2023

| Climate zone[1] | Reference building heat loss equation[3] |
|---|---|
| 1 and 2[2] | $HL_{Reference} = \frac{A_{roof} + A_{skylight}}{6.6} + \frac{A_{70\% \text{ of the total wall area}}}{2.0} + \frac{A_{slab\text{-}on\text{-}ground\ floor}}{1.5} + \frac{A_{other\ floor}}{2.5} + \frac{A_{30\% \text{ of total wall area}}}{0.46}$ |
| 3 | $HL_{Reference} = \frac{A_{roof} + A_{skylight}}{6.6} + \frac{A_{70\% \text{ of the total wall area}}}{2.0} + \frac{A_{slab\text{-}on\text{-}ground\ floor}}{1.5} + \frac{A_{other\ floor}}{2.5} + \frac{A_{30\% \text{ of total wall area}}}{0.46}$ |
| 4 | $HL_{Reference} = \frac{A_{roof} + A_{skylight}}{6.6} + \frac{A_{70\% \text{ of the total wall area}}}{2.0} + \frac{A_{slab\text{-}on\text{-}ground\ floor}}{1.5} + \frac{A_{other\ floor}}{2.8} + \frac{A_{30\% \text{ of total wall area}}}{0.46}$ |
| 5 | $HL_{Reference} = \frac{A_{roof} + A_{skylight}}{6.6} + \frac{A_{70\% \text{ of the total wall area}}}{2.0} + \frac{A_{slab\text{-}on\text{-}ground\ floor}}{1.6} + \frac{A_{other\ floor}}{3.0} + \frac{A_{30\% \text{ of total wall area}}}{0.50}$ |
| 6 | $HL_{Reference} = \frac{A_{roof} + A_{skylight}}{6.6} + \frac{A_{70\% \text{ of the total wall area}}}{2.0} + \frac{A_{slab\text{-}on\text{-}ground\ floor}}{1.7} + \frac{A_{other\ floor}}{3.0} + \frac{A_{30\% \text{ of total wall area}}}{0.50}$ |

# Proposed building heat loss equation

**Proposed building:**

$$HL_{Proposed} = \frac{A_{roof}}{R_{roof}} + \frac{A_{wall}}{R_{wall}} + \frac{A_{floor}}{R_{floor}} + \frac{A_{glazing}}{R_{window}} + \frac{A_{door,\,opaque}}{R_{door,\,opaque}} + \frac{A_{skylight}}{R_{skylight}}$$

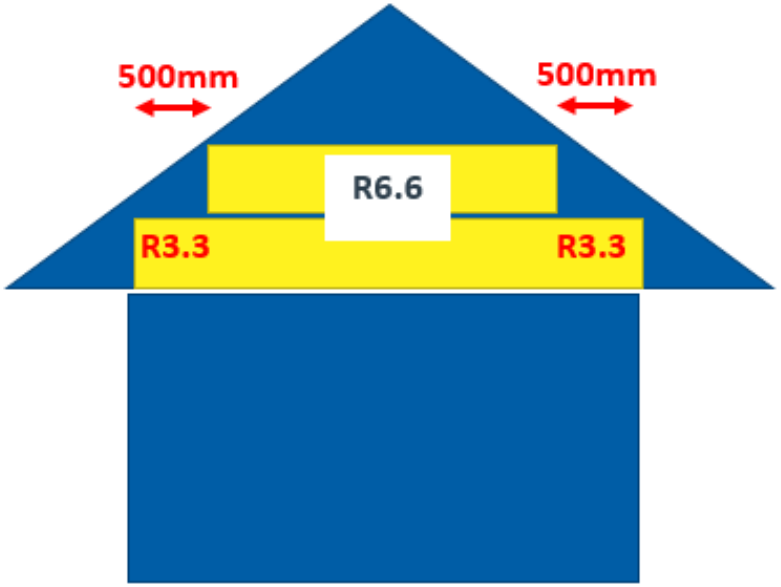
$$\frac{A_{wall}}{R_{wall}} \text{ becomes } \frac{A_{wall(1)}}{R_{wall(1)}} + \frac{A_{wall(2)}}{R_{wall(2)}}$$

# Some limits on R-value flexibility

1. Roof, wall and floor R-values in the proposed building must not be less than 50% of the corresponding reference building R-values (= Schedule method R-values)

2.1.3.8 The *construction R-value* in the proposed *building* for *roofs*, walls, and floors, that form part of the *building thermal envelope* shall be at least 50% of the *construction R-value* of the corresponding *building element* in the reference *building* equation.

# Reducing roof R-value along perimeter




$$HL_{Proposed} = \frac{A_{roof}}{R_{roof}} + \frac{A_{wall}}{R_{wall}} + \frac{A_{floor}}{R_{floor}} + \frac{A_{glazing}}{R_{window}} + \frac{A_{door,\,opaque}}{R_{door,\,opaque}} + \frac{A_{skylight}}{R_{skylight}}$$

$$\frac{A_{roof,centre}}{R_{roof,centre}} + \frac{A_{roof,perimeter}}{R_{roof,perimeter}}$$

Roof R-value cannot be reduced below R3.3!
(=50% of R6.6 reference building roof R-value)

This includes the ceiling perimeter!

# Some limits on R-value flexibility

2. For building elements with embedded heating, the following minimum construction R-values apply and cannot be reduced with the Calculation method.

(5) For **housing** only, for *building consent* applications submitted before 1 May 2023, the minimum *construction R-value* for *heated ceilings* in all climate zones is permitted to be reduced to R3.5.

(6) For **housing** only, for *building consent* applications submitted before 1 May 2023, the minimum *construction R-value* for *heated walls* in all climate zones is permitted to be reduced to R2.6.

(7) For **housing** only, for *building consent* applications submitted before 1 May 2023, the minimum *construction R-value* for heated floors in all climate zones is permitted to be reduced to R1.9.

# Some limits on R-value flexibility

3. For housing and communal-residential buildings, wall and roof construction R-values in the proposed building cannot be less than the R-values required to comply with Building Code clause E3 Internal Moisture.

**1.1 Thermal resistance**

**1.1.1** *R-values* for walls, roofs and ceilings shall be no less than:

a) For light timber frame wall or other framed wall *constructions* with cavities, 1.5.

b) For single skin normal weight masonry based wall *construction* without a cavity, 0.6.

c) For solid timber wall systems no less than 60 mm thick, 0.6.

d) For roof or ceilings of any *construction*, 1.5.

Acceptable Solution E3/AS1

# Helpful calculation method tools

Two free ones are:

1. The BRANZ H1 Calculation method tool - https://www.branz.co.nz/energy-efficiency/h1-calculation-method-tool/

2. The New Zealand Green Building Council's H1 Calculator - https://nzgbc.h1calculator.org.nz/

The BRANZ House Insulation Guide (6th edition) provides construction R-values for many common wall, floor and roof systems.

# Determining window and door R-values

**New generic window R-value table**

in H1/AS1 Appendix E – for housing only!

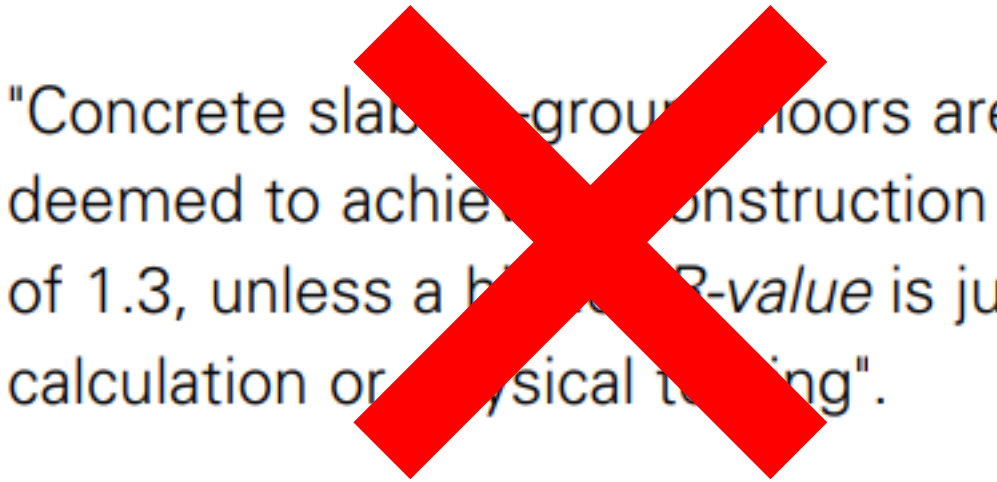
Replaces outdated tables from NZS 4218

**TABLE E.1.1.1:** Construction R-values ($R_{Window}$) of selected generic vertical windows and doors

Paragraph E.1.1.1 a)

| Type of glazing | $U_g$ [1] | Spacer type [2] | Example IGU [3], [4] (informative) | $R_{window}$ ($m^2$·K/W) for different frames | | | |
|---|---|---|---|---|---|---|---|
| | | | | Aluminium frame | Thermally broken aluminium frame | uPVC frame | Timber frame |
| Double pane | 2.63 | Aluminium | Glass: Clear/Clear<br>Gas: Air | R0.26 | R0.32 | R0.40 | R0.44 |
| | 1.90 | Aluminium | Glass: Low $E_1$/Clear<br>Gas: Argon | R0.30 | R0.39 | R0.50 | R0.56 |
| | 1.60 | Thermally improved | Glass: Low $E_2$/Clear<br>Gas: Argon | R0.33 | R0.42 | R0.56 | R0.63 |
| | 1.30 | Thermally improved | Glass: Low $E_3$/Clear<br>Gas: Argon | R0.35 | R0.46 | R0.63 | R0.71 |
| | 1.10 | Thermally improved | Glass: Low $E_4$/Clear<br>Gas: Argon | R0.37 | R0.50 | R0.69 | R0.77 |
| | 0.90 | Thermally improved | Glass: Low $E_4$/Clear<br>Gas: Krypton | R0.40 | R0.54 | R0.76 | R0.85 |
| Triple pane | 1.89 | Thermally | Glass: Clear/Clear/Clear | | R0.38 | R0.50 | R0.56 |

# Determining slab-on-ground floor R-values




*** For housing this continues to be permitted until 30 April 2023**

# Determining slab-on-ground floor R-values

- New generic tables in H1/AS1 Appendix F
- Finite-element modelling as per H1/VM1 Appendix F

**Table F.1.2.2D:** Construction R-values for concrete raft foundation floors with R1.0 vertical edge insulation, where the external walls do not have masonry veneer cladding

Paragraph F.1.2.2 d)

| Insulation type | Slab area-to-perimeter ratio [1] | $R_{floor}$ ($m^2 \cdot K/W$) for different effective thicknesses of external walls on slab[2] | | | | |
|---|---|---|---|---|---|---|
| | | ≥ 90 mm to < 140 mm | ≥ 140 mm to < 180 mm | ≥ 180 mm to < 250 mm | ≥ 250 mm to < 300 mm | ≥ 300 mm |
| R1.0 vertical edge insulation[3] | 1.6 | R1.3 | R1.3 | R1.3 | R1.3 | R1.3 |
| | 1.8 | R1.4 | R1.4 | R1.4 | R1.4 | R1.4 |
| | 2.0 | R1.5 | R1.5 | R1.5 | R1.6 | R1.6 |
| | 2.2 | R1.5 | R1.5 | R1.6 | R1.6 | R1.6 |
| | 2.4 | R1.6 | R1.6 | R1.7 | R1.7 | R1.7 |
| | 2.6 | R1.7 | R1.8 | R1.8 | R1.8 | R1.8 |
| | 2.8 | R1.8 | R1.8 | R1.8 | R1.8 | R1.9 |
| | 3.0 | R1.9 | R1.9 | R1.9 | R1.9 | R2.0 |
| | 3.2 | R2.0 | R2.0 | R2.0 | R2.0 | R2.1 |
| | 3.4 | R2.0 | R2.0 | R2.1 | R2.1 | R2.1 |
| | 3.6 | R2.1 | R2.1 | R2.1 | R2.2 | R2.2 |
| | 3.8 | R2.2 | R2.2 | R2.2 | R2.3 | R2.3 |
| | 4.0 | R2.3 | R2.3 | R2.3 | R2.3 | R2.4 |
| | 5.0 | R2.6 | R2.7 | R2.7 | R2.7 | R2.8 |
| | 6.0 | R3.0 | R3.1 | R3.1 | R3.1 | R3.2 |
| | 7.0 | R3.4 | R3.4 | R3.5 | R3.5 | R3.6 |
| | 8.0 | R3.8 | R3.8 | R3.9 | R3.9 | R4.0 |
| | 9.0 | R4.2 | R4.2 | R4.3 | R4.3 | R4.4 |
| | ≥ 10.0 | R4.6 | R4.6 | R4.7 | R4.8 | R4.8 |

**Notes:**

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F1.2.3 and F1.2.4. Where the slab area-to-perimeter

# Summary

- From 3 November, the 4th edition H1/AS1 and VM1 can no longer be used
- For housing only, 5th edition H1/AS1 and VM1 include extended transition to higher wall, floor and roof R-values. Windows, doors, skylights increase immediately
- Calculation method provides greater flexibility than Schedule method
- 40% glazing area limit
- 50% R-value reduction limit for walls, floors, roofs
- Heated floors/walls/ceilings have minimum R-values that cannot be reduced
- Methods for determining window, door, skylight and concrete floor R-values change

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# Webinar

## H1 Calculation method

Q&A