FRONTIER
ESTATE

# A GUIDE FOR

Achieving 150% Insulation of the Building Code to Satisfy Covenant 4.5(i) for Frontier Estate.

# Welcome to Frontier Estate.

Frontier Estate is an exciting new residential subdivision in Te Awamutu offering a unique lifestyle opportunity for those looking to build their next home.

## Sustainable Living

WARM, DRY, & QUIET HOMES

Sustainability is a central feature of every aspect of the Frontier Estate Development.

The layout of the subdivisions, the inclusion of park areas, and the sustainable building requirements that will ensure every home is warm, dry, and quiet for generations to come.

## Contact us

Visit our website for more information on Frontier Estate or contact our sales team.


Website: www.frontierestate.co.nz
Call sales: 027 496 0007
Address: Lot 42 Pioneer Drive,
Te Awamutu.

# Contents

# Building Code Requirements for house insulation.

### Insulation Requirements

Homes in New Zealand must have adequate insulation, so you need to make sure they have the correct level of thermal resistance (R-value) for their location.

All buildings constructed at Frontier Estate are required by clause 4.5(i) of the building covenants to have no less than 150% of thermal insultation required by H1 of the New Zealand Building Code for the Te Awamutu region.

# Reasons to Insulate.

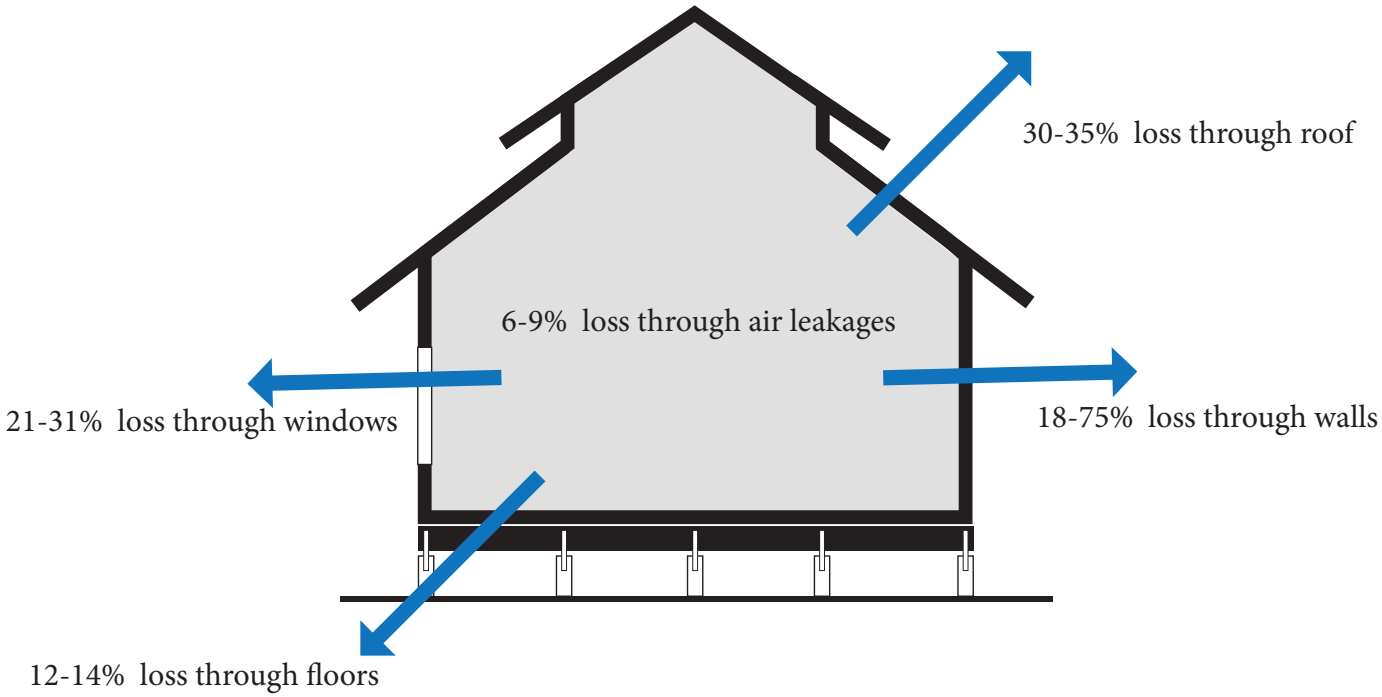
### Why Insulate?

Besides providing year-round comfort, a well insulated home costs less to heat and cool. With the added benefit of exterior noise control.

A fully insulated home needs about half the heating an uninsulated home requires. It provides a healthier environment and also helps reduce condensation, damp and mould. Insulation reduces the rate heat is lost through ceilings, walls and floors. It traps air in small pockets and provides a barrier to stop heat from escaping.

### Typical areas for heat loss

In poorly insulated homes, 30–35% of heat is lost through the roof, 21–31% through the windows and 18–25% through the walls. The floor and air leakage account for the remaining heat loss.



# How Much Insulation is Enough?

## R-value Ratings.

Insulation performance is measured in R-values, which quantify the thermal resistance of a building material, or any part of a building such as the roof, wall, or floor.

Available insulation materials are labelled with their manufacturer's R-values.

The R-value of any part of the building depends not only on the insulation but also on the thermal performance of other elements such as the framing and cladding.

Concrete, brick or stone provide excellent thermal mass but have low R-values and so are poor insulators. Metals such as profiled steel claddings and fibre-cement sheets also have low R-values and are therefore poor insulators.

To determine insulation requirements, it is necessary to calculate R-values for each part of the building.

## Methods to Calculate R-values.

The New Zealand Building Code allows for calculation of the insulation R-value through three different methods.

- Schedule Method
- Calculation Method
- Modelling Method - *This requires specific Modelling and normally would not be applicable to a standard residential house.*

Frontier Estate covenants require that the new dwelling meet a minimum of 150% or more of the building code requirements.

A guide to how this can be achieved for each method follows, with working examples for each option...

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# NZS 4218:2009 - Schedule Method.

| | NZBC H1 / NZS 4218 (Climate Zone 2) | 150% Requirement **Option 1** | 150% Requirement **Option 2** |
|---|---|---|---|
| Roof | R 2.90 | R 4.35 | R 5.5 |
| Wall | R 1.90 | R 2.85 | R 2.40 |
| Floor | R 1.30 | R 1.85 | R 2.25 |
| Windows & Glazing | R 0.26 | R 0.39 | R 0.32 |
| Skylights | R 0.26 | R 0.39 | R 0.44 |
| As per NZS 4218:2009 requirements, this is only suitable for residential housing with a floor area of less than 300m², together with less than 30% of the exterior walls being glazing. | | | |

## Schedule Method — Option 1

**Roof :** R 4.35 roof insulation can be achieved by adding an extra layer of insulation over top of the normal single layer. This can be achieved in both Trussed roofs and Skillion roof provided adequate depth is allowed for.

**Walls :** R 2.85 wall insulation can be achieved by either;

a) The use of an insulating RAB board such as Kingspan Kooltherm® K12 Framing Board[1] fixed to the exterior of standard 100x50 steel or timber framing, or;

b) Using thicker / denser insulation such as R4.0 Bradford Gold Hi-Performance Wall Segments[2] in between larger 150x50 steel or timber framing.

**Floors :** R 1.85 floor insulation can be achieved by several methods depending on the floor construction being using.
For concrete floors the two basic options are;

a) Polystyrene insulation underneath a standard concrete floor slab,

b) Engineered Ribraft type floor system

c) A standard concrete floor slab with a floor "Area to Edge (m²/m)" ratio of less than 3.55.

**Windows:** R 0.39 for glazing and skylights will typical require a Low-E coating to be applied to one of glazing panels, together with the use of thermally broken aluminium joinery.

1 www.kingspan.com/nz/en-nz/products/insulation/resources/product-brochure/kooltherm-k12-framing-board
2 www.bradfordinsulation.co.nz/-/media/bradford/files/nz-files/gw-gold-wall-segments.pdf

## Schedule Method **Option 2**

Roof : R 5.5 roof insulation can be achieved by adding an extra layer of insulation over top of the normal single layer. This can be achieved in both Trussed roofs and Skillion roof provided adequate depth is allowed for.

Walls : R 2.4 wall insulation can be achieved by either;

a) Using thicker / denser insulation such as R 2.8 Bradford Gold Wall Segments[3] in between standard 100x50 steel or timber framing with plywood RAB board, or

b) The use of an insulating RAB board such as Kingspan Kooltherm® K12 Framing Board[4] fixed to the exterior of standard 100x50 steel or timber framing;

Floors : R 2.25 floor insulation can be achieved by several methods depending on the floor construction being using;

For concrete floors the two basic options are;

a) A standard concrete floor slab with a floor "Area to Edge ($m^2/m$)" ratio of less than 4.55,

b) Polystyrene insulation underneath a standard concrete floor slab,

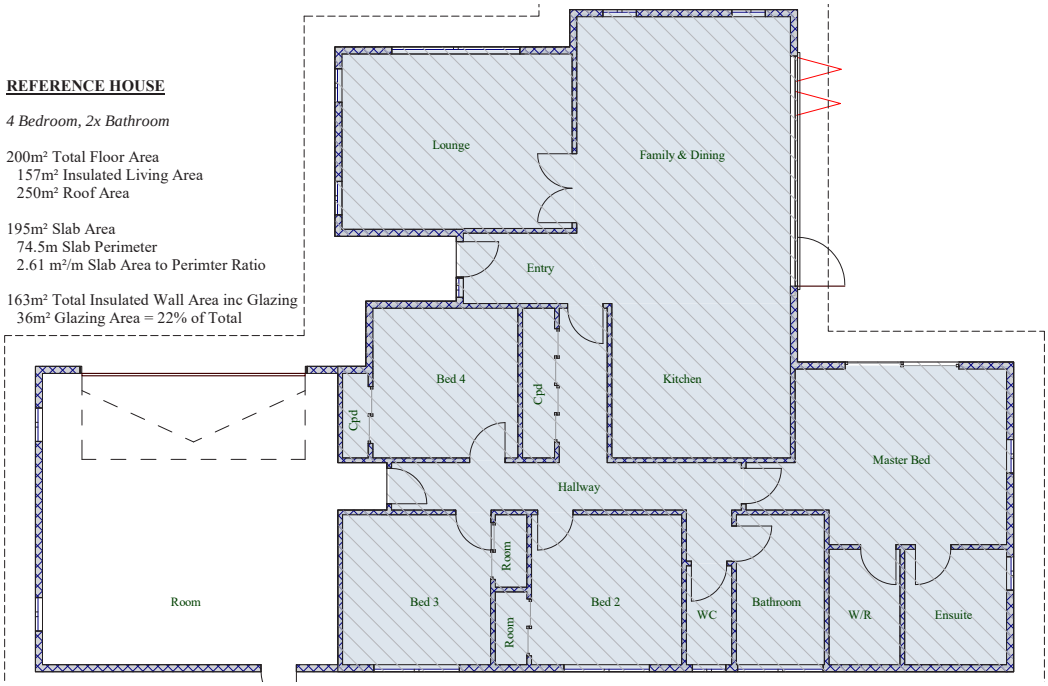
c) Or an Engineered Ribraft type floor system.

Timber Floors just require the careful selection of insulation to be installed between the floor joists, such as Bradford Gold Optimo Underfloor R 2.6.

Windows: R 0.32 for glazing typical Low E double glazed units with standard aluminium joinery.

3 www.bradfordinsulation.co.nz/-/media/bradford/files/nz-files/gw-gold-wall-segments.pdf
4 www.kingspan.com/nz/en-nz/products/insulation/resources/product-brochure/kooltherm-k12-framing-board

## Schedule Method  Worked Example #1



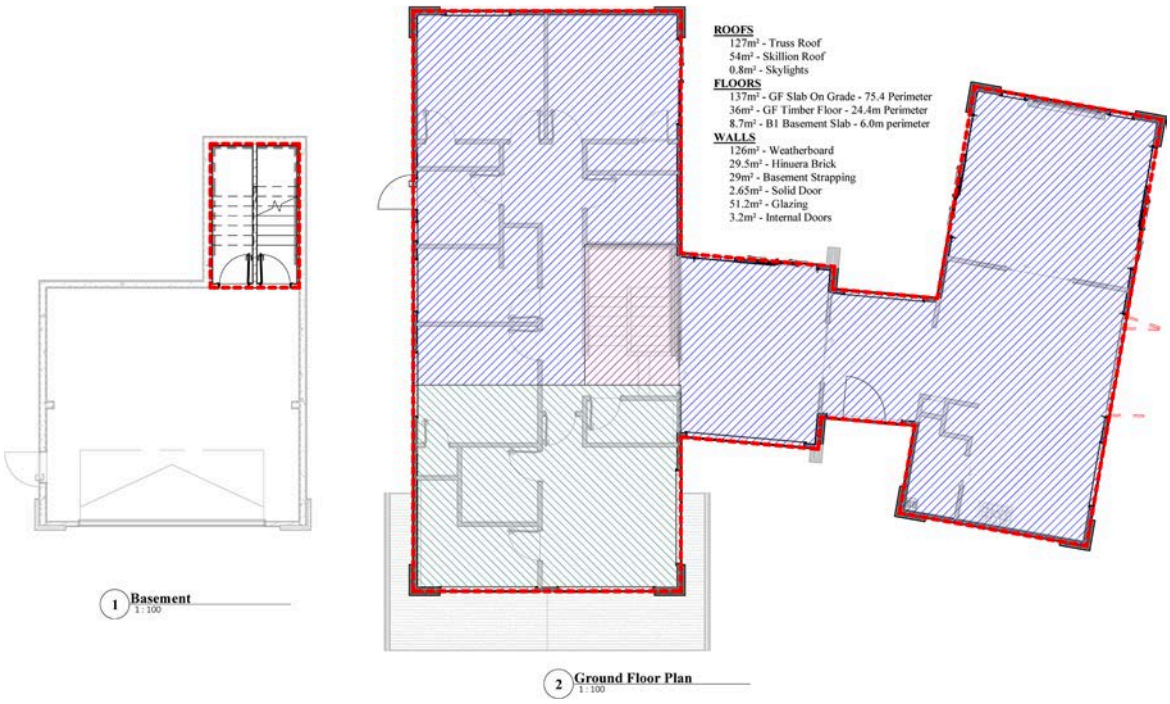

| | ROOF | WALL | FLOOR | WINDOW & SKYLIGHTS |
|---|---|---|---|---|
| NZBC H1 Compliant | **R 2.92 (R2.90)** | **R 2.02 (R 1.90)** | **R 1.44 (R 1.30)** | **R 0.26 (R 0.26)** |
| | Timber Truss Roof, with trusses at 900mm c/c. R 3.5 insulation between board truss chords. | 70mm Brick Veneer Cladding, over air cavity, of 100x50 studs at 600 c/c, dwangs at 800 c/c, with R 2.20 wall insulation, and 10mm plasterboard | 100mm thick concrete floor slab, with insitu concrete foundation edges, over polythene DPC. | Standard clear double glazed 4/10/4 units in standard aluminium frames. |
| 150% of NZBC OPTION 1 | **R 4.58 (R 4.35)** | **R 3.18 (R 2.85)** | **R 2.17 (R 1.85)** | **R 0.41 (R 0.39)** |
| | Timber Truss Roof, with trusses at 900mm c/c. R 1.8 insulation between board truss chords, with an extra layer of R 2.7 over top of truss chords | 70mm Brick Veneer Cladding, over air cavity, 100x50 studs at 600 c/c, dwangs at 800 c/c, with 25mm Kingspan Kootherm R2.9 RAB, no insulation between studs and 10mm plasterboard | 100mm thick concrete floor slab, with insitu concrete foundation edges, over R 1.3 50mm thick polystyrene | Low E clear double glazed 4/10/4 units in thermally broken aluminium frames. |
| 150% of NZBC OPTION 2 | **R 5.76 (R 5.5)** | **R 2.40 (R 2.40)** | **R 2.26 (R 2.25)** | **R 0.32 (R 0.32)** |
| | Timber Truss Roof, with trusses at 900mm c/c. R 1.8 insulation between board truss chords, with an extra layer of R 4.0 over top of truss chords | 70mm Brick Veneer Cladding, over air cavity, over 4mm RAB board, on 100x50 studs at 600 c/c, dwangs at 800 c/c, with R 2.8 insulation between studs and 10mm plasterboard | 100mm thick concrete floor slab, with insitu concrete foundation edges, over R2.10 75mm thick polystyrene, over polythene DPC. | Low E clear double glazed 4/10/4 units in standard aluminium frames. |

Construction R-Values quoted above have been calculated using Design Navigator Calculator and supplier R-values, based on the reference house plan referenced above. All new house designs will require careful consideration depending on the preferred method of construction., and specific framing requirements.

DMC Design Management Consultants Ltd

* Calculations prepared by Design Management Consultants Limited

## Schedule Method  Worked Example #2: Lot 3




| | ROOF | WALL | FLOOR | WINDOW & SKYLIGHTS |
|---|---|---|---|---|
| NZBC H1 Compliant | **R 2.93 (R 2.90)** | **R 1.97 (R 1.90)** | **R 1.81 (R 1.30)** | **R 0.26 (R 0.26)** |
| | Timber Truss Roof, with trusses at 900mm c/c. R 3.6 insulation between board truss chords. | Linea weather board cladding, of 100x50 studs at 600 c/c, dwangs at 800 c/c, with R 2.20 wall insulation, and 10mm plasterboard | 100mm thick concrete floor slab, with insitu concrete foundation edges, over R1.1 40mm polystyrene over polythene DPC. | Standard clear double glazed 4/10/4 units in standard aluminium frames. |
| 150% of NZBC OPTION 1 | **R 5.24 (R 4.35)** | **R 3.27 (R 2.85)** | **R 2.17 (R 1.85)** | **R 0.41 (R 0.39)** |
| | Timber Truss Roof, with trusses at 900mm c/c. R 6.0 ceiling insulation between truss chords | Linea Weatherboard Cladding, over 150x50 studs at 600 c/c, dwangs at 1200 c/c, with R 3.5 insulation between studs and 10mm plasterboard | 100mm thick concrete floor slab, with insitu concrete foundation edges, over R 2.8 100mm thick polystyrene, over polythene DPC. | Low E clear double glazed 4/10/4 units in thermally broken aluminium frames. |
| 150% of NZBC OPTION 2 | **R 5.24 (R 5.5)** | **R 2.40 (R 2.40)** | **R 2.40 (R 2.25)** | **R 0.32 (R 0.32)** |
| | Scissor Truss Roof, with trusses at 900mm c/c. R 6.0 ceiling insulation between truss chords | Linea Weatherboard Cladding over 6.5m RAB board, over 100x50 studs at 600 c/c, dwangs at 1200 c/c, with R 2.8 insulation between studs and2x byers of 10mm plasterboard | 18mm flooring over 200x50 joists at 600 c/c with R2.4 insulation between joists. | Low E clear double glazed 4/10/4 units in standard aluminium frames. |

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# NZS 4218:2009 - Calculation Method.

The calculation method requires that the heat loss of the proposed building is no worse than that of a reference building having identical dimensions and functions to the proposed building. This allows flexibility in the R-values of each building component to accommodate different design solutions.

The Calculation Method may be used where:

- Greater design flexibility is required than the schedule method eg: more than 30% glazing.
- The total area of glazing (including skylights) is 50% of the total wall area.

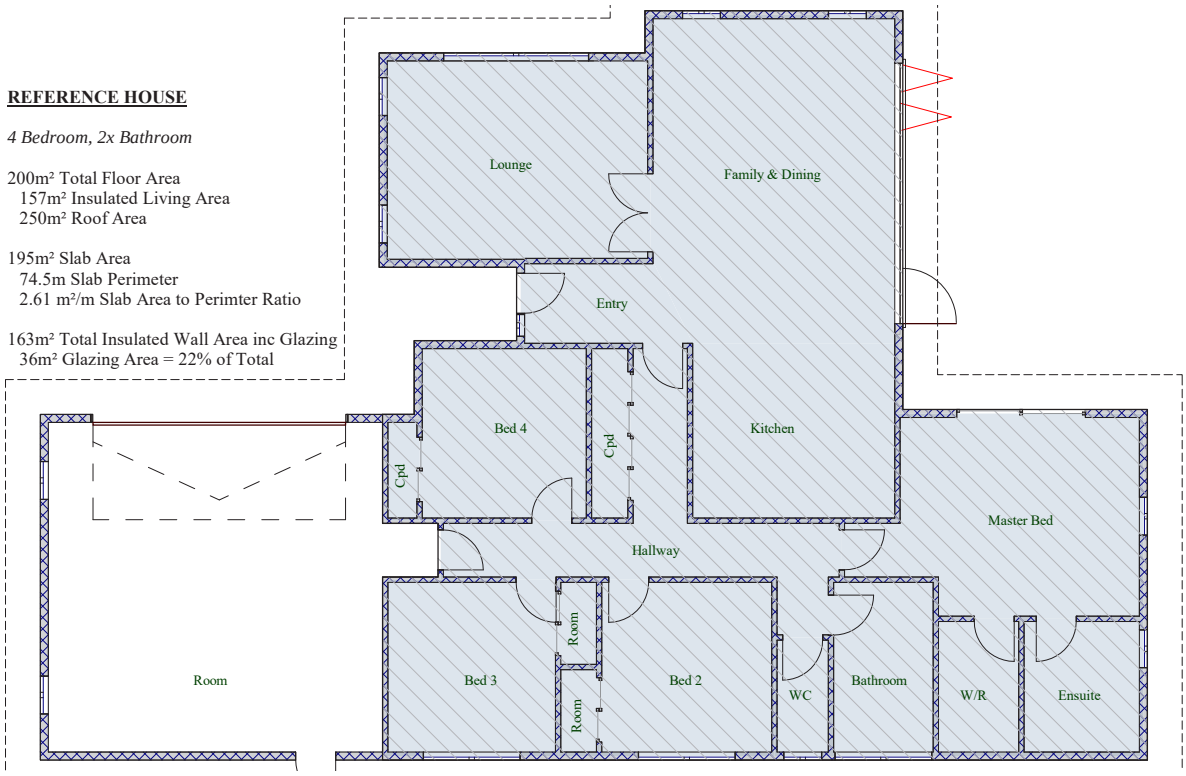
Note: 1) The calculated area of glazing includes the frame as the R value refers to the whole glazed element.

2) Total wall area is calculated from the overall dimensions including glazing elements eg: 4m x 5m = 20m²

Where the design exceeds these parameters, either the design can be altered or the modelling method can be used.

| | **NZBC H1 / NZS 4218 (Climate Zone 2)** | **150% Requirement $HL_{REF}$ Values** |
|---|---|---|
| **Roof** | R 2.90 | R 2.90 minimum |
| **Wall** | R 1.90 x 70% of Wall area | R 1.90 x 70% of Wall area Minimum |
| **Floor** | R 1.30 | R1.30 minimum |
| **Windows & Glazing up to 30% Total Wall Area** | R 0.26 x 30% of Wall area | R 0.26 x 30% of Wall area minimum |
| **Windows & Glazing over 30% Total Wall Area** | R 0.40 x Wall area above 30% of Total Area | R 0.40 x Wall area above 30% of Total Area minimum |
| **Skylights** | R 0.26 | R 0.26 minimum |
| **TOTAL** | Less Than $HL_{REF}$ | Less Than "$HL_{REF}$ x 0.667" (= 100 / 150) |

# Calculation Method Worked Example # 3




| | | Roof/Ceiling | WALL | FLOOR | Glazing & Doors | Total |
|---|---|---|---|---|---|---|
| 150% of NZBC | | **R 5.01** | **R 2.32** | **R 2.17** | **R 0.32** | |
| | Area | 157m² | 163m² | 157m² | 36m² (22%) | |
| | Proposed Heat Loss | 30.9 W/°C | 70.3 W/°C | 72.4 W/°C | 112.5 W/°C | 286 W/°C (171.4%) |
| | | Timber Truss Roof, with trusses at 900mm c/c. R 1.8 insulation between board truss chords, with an extra layer of R 3.2 over top of truss chords. | 70mm Brick Veneer Cladding, over air cavity, of 100x50 studs at 600 c/c, dwangs at 800 c/c, with R 2.8 insulation between studs and 10mm plasterboard | 100mm thick concrete floor slab, with insitu concrete foundation edges, over R 1.3 50mm thick polystyrene, over polythene DPC. | Low E clear double glazed 4/10/4 units in standard aluminium frames. | |
| | $HL_{REF}$ | 54.1 W/°C | 85.8 W/°C | 120.8 W/°C | 229.6 W/°C | 490.3 W/°C |

Construction R-Values quoted above have been calculated using Design Navigator Calculator and supplier R-values, based on the reference house plan referenced above. All new house designs will require careful consideration depending on the preferred method of construction., and specific framing requirements.

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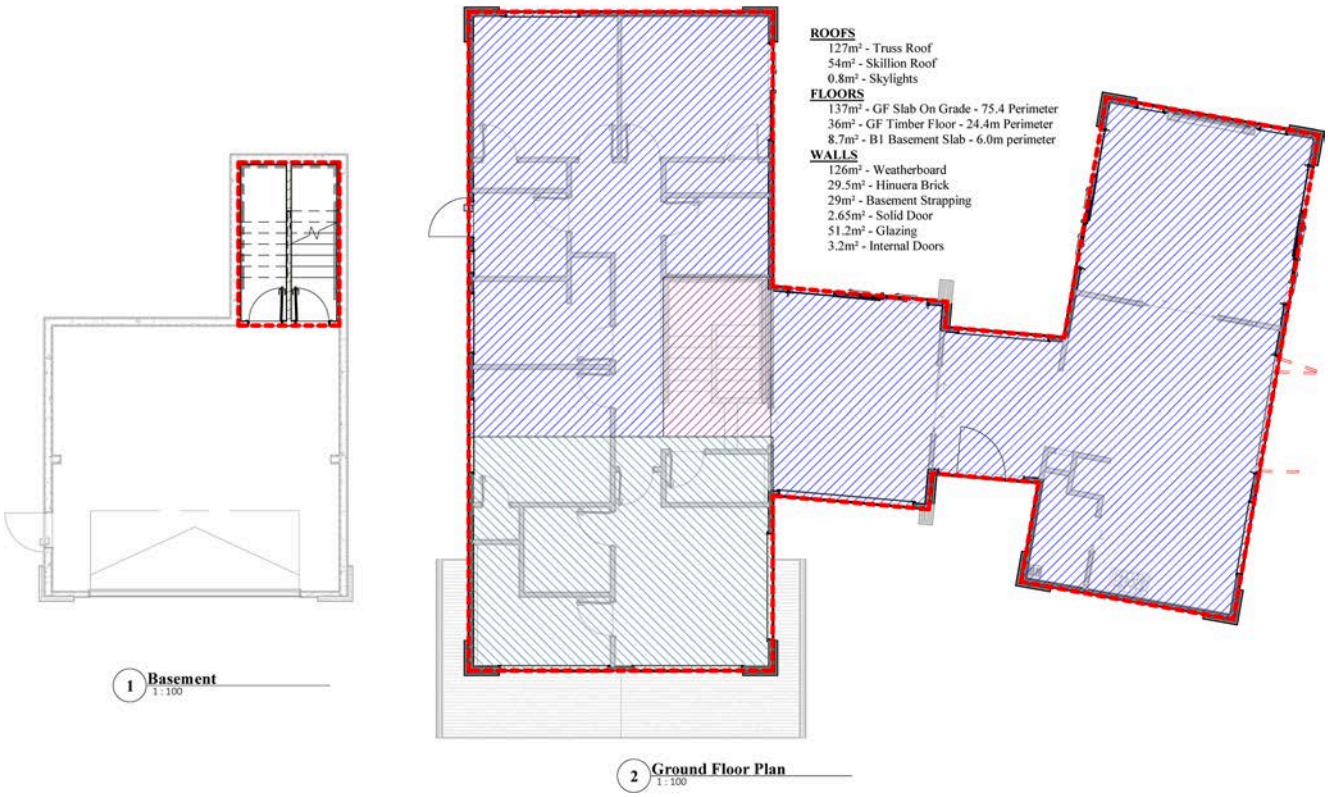
## Calculation Method Worked Example # 4




| | | Roof/Ceiling | WALL | FLOOR | Glazing & Doors | Total |
|---|---|---|---|---|---|---|
| NZBC H1 Compliant | | **R 5.64** (min R 2.90) | **R 2.13** (min R 1.90) | **R 1.41** (min R 1.3) | **R 0.34** (R 0.26) | |
| | Area | 181m² | 184.5m² | 181.7m² | 51.2m² (22%) | |
| | Proposed Heat Loss | 32.8 W/°C | 84.6 W/°C | 114.2 W/°C | 150.6 W/°C | 384 W/°C (151.4%) |
| | | Timber Truss Roof, with trusses at 900mm c/c. R 1.8 insulation between board truss chords, with an extra layer of R 3.2 over top of truss chords. | 70mm Brick Veneer Cladding, over air cavity, of 100x50 studs at 600 c/c, dwangs at 800 c/c, with R 2.8 insulation between studs and 10mm plasterboard | 100mm thick concrete floor slab, with insitu concrete foundation edges, over R 1.3 50mm thick polystyrene, over polythene DPC. | Low E clear double glazed 4/10/4 units in standard aluminium frames. | |
| | $HL_{REF}$ | 62.7 W/°C | 100.2 W/°C | 139.8 W/°C | 278.7 W/°C | 581.4 W/°C |

Construction R-Values quoted above have been calculated using Design Navigator Calculator and supplier R-values, based on the reference house plan referenced above. All new house designs will require careful consideration depending on the preferred method of construction., and specific framing requirements.

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# Window Glazing Options:

| Generic Windows | Winter (Heating) | Summer (Cooling) | Condensation | Fading | R ($m^2K/W$) | U ($W/m^2K$) | SC |
|---|---|---|---|---|---|---|---|
| **Aluminium Frame** | | | | | | | |
| GANZ single grey standard tint | ★ | ★★♦ | ★ | ★★★♦ | 0.15 | 6.7 | 0.71 |
| Single advanced tint | ★ | ★★★ | ★ | ★★★ | 0.15 | 6.7 | 0.66 |
| Double grey reflective / clear | ★♦ | ★★★★★ | ★★ | ★★★★★ | 0.26 | 3.9 | 0.35 |
| Single clear | ★★ | ★♦ | ★ | ★ | 0.15 | 6.7 | 0.98 |
| Double bronze tint/clear | ★★♦ | ★★★★♦ | ★★ | ★★★♦ | 0.26 | 3.9 | 0.64 |
| Double advanced tint/clear | ★★♦ | ★★★★♦ | ★★ | ★★★♦ | 0.26 | 3.9 | 0.53 |
| Double grey tint/clear | ★★♦ | ★★★★ | ★★ | ★★★♦ | 0.26 | 3.9 | 0.58 |
| Double clear laminated/clear | ★★♦ | ★★★★ | ★★ | ★★★★♦ | 0.26 | 3.9 | 0.81 |
| Double tint/low-e | ★★★ | ★★★★♦ | ★★ | ★★★♦ | 0.31 | 3.2 | 0.47 |
| Double clear | ★★★♦ | ★★ | ★★ | ★★ | 0.26 | 3.9 | 0.86 |
| Double clear/low emissivity clear | ★★★★ | ★★♦ | ★★ | ★★♦ | 0.31 | 3.2 | 0.8 |
| Double clear/low-e clear + Argon | ★★★★♦ | ★★♦ | ★★ | ★★♦ | 0.33 | 3 | 0.8 |
| **Composite Frame** | | | | | | | |
| Single advanced tint | ★ | ★★★ | ★ | ★★★ | 0.15 | 6.6 | 0.66 |
| Single clear | ★★ | ★ | ★ | ★ | 0.15 | 6.6 | 0.98 |
| Double advanced tint/clear | ★★★ | ★★★★ | ★★♦ | ★★★♦ | 0.26 | 3.9 | 0.53 |
| Double tint/low-e | ★★★ | ★★★★♦ | ★★♦ | ★★★♦ | 0.31 | 3.2 | 0.47 |
| Double clear | ★★★★ | ★★ | ★★♦ | ★★ | 0.26 | 3.9 | 0.86 |
| Double clear/low-e clear | ★★★★♦ | ★★ | ★★♦ | ★★♦ | 0.31 | 3.2 | 0.8 |
| Double clear/low-e + Argon | ★★★★★ | ★★ | ★★♦ | ★★♦ | 0.34 | 3 | 0.8 |
| **Thermally broken aluminium frame** | | | | | | | |
| Single advanced tint | ★ | ★★★ | ★ | ★★★ | 0.17 | 5.9 | 0.66 |
| Single clear | ★★♦ | ★♦ | ★ | ★ | 0.17 | 6 | 0.98 |
| Double advanced tint/clear | ★★★ | ★★★★♦ | ★★★ | ★★★♦ | 0.31 | 3.2 | 0.53 |
| Double tint/low-e | ★★★ | ★★★★★ | ★★★ | ★★★♦ | 0.38 | 2.6 | 0.47 |
| Double clear | ★★★♦ | ★★♦ | ★★★ | ★★ | 0.31 | 3.2 | 0.86 |
| Double clear/low-e clear | ★★★★♦ | ★★♦ | ★★★ | ★★♦ | 0.4 | 2.5 | 0.8 |
| Double clear/low-e + Argon | ★★★★★ | ★★♦ | ★★★ | ★★♦ | 0.43 | 2.3 | 0.8 |
| **PVC or Wooden frame** | | | | | | | |
| Single advanced tint | ★♦ | ★★★♦ | ★ | ★★★ | 0.19 | 5.2 | 0.66 |
| Single clear | ★★♦ | ★★ | ★ | ★ | 0.19 | 5.2 | 0.98 |
| Double advanced tint/clear | ★★★ | ★★★★♦ | ★★★★ | ★★★♦ | 0.36 | 2.8 | 0.53 |
| Double tint/low-e | ★★★♦ | ★★★★★ | ★★★★★ | ★★★♦ | 0.48 | 2.1 | 0.47 |
| Double grey tint laminated/low-e | ★★★♦ | ★★★★♦ | ★★★★★ | ★★★★♦ | 0.48 | 2.1 | 0.53 |
| Double clear | ★★★★ | ★★♦ | ★★★★ | ★★ | 0.36 | 2.8 | 0.86 |
| Double clear/low-e clear | ★★★★♦ | ★★★ | ★★★★★ | ★★♦ | 0.48 | 2.1 | 0.8 |
| Double clear/low-e + Argon | ★★★★★ | ★★★ | ★★★★★ | ★★♦ | 0.53 | 1.9 | 0.8 |

*Information sourced from Design Navigator https://www.designnavigator.solutions/WERS2.html, further information can be sourced from https://www.metroglass.co.nz/catalogue/105.aspx*

**Space for Notes:**

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