

HI ENERGY EFFICIENCY, NZ BUILDING CODE SCHEDULE & CALCULATION METHODS



BUILDINGS AFFECTED BY CHANGES TO CLAUSE H1

All housing

Commercial up to 300m²

Communal Residential (aged care)



COMPLIANCE WITH CLAUSE H1 OF THE CODE

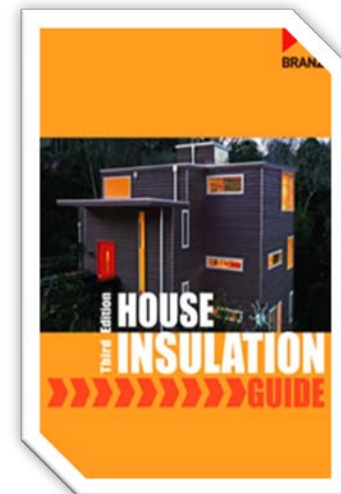


Schedule method (H1/AS1)

Calculation method (H1/AS1)

Modelling method (H1/VM1)

- May be used providing certain conditions are met.
- BRANZ House Insulation Guide provides Acceptable Solutions as a method of compliance.
- Calculates and provides the R value for the insulation needed to meet the R values for the total roof & wall as given in the modified NZS4218 tables.



SCHEUDLE METHOD

MODIFIED NZS4218 NON SOLID CONSTRUCTION – TOTAL R VALUE REQUIREMENTS

	Zone 1	Zone 2	Zone 3
Roof	R2.9	R2.9	R3.3
Wall	R1.9	R1.9	R2.0
Floor	R1.3	R1.3	R1.3
Glazing (vertical)	R0.26	R0.26	R0.26
Glazing (skylights)	R0.26	R0.26	R0.31

Glazing R values based on max 30% glazing.

	<i>Zone 1</i>	<i>Zone 2</i>	<i>Zone 3</i>
Roof	R3.5	R3.5	R3.5
Wall	R0.8	R0.9	R1.0
Floor	R1.3	R1.3	R1.3
Glazing (vertical)	R0.26	R0.26	R0.26
Glazing (skylights)	R0.26	R0.26	R0.31

Glazing R values based on max 30% glazing.

SCHEUDLE METHOD

CONDITIONS FOR USING THE SCHEUDLE METHOD

- Total glazing not exceed 30% (windows, doors, skylights)
- Vertical E, S & W wall: glazing ratio not exceed 30%
- Skylights not exceed 1.2m²
- Leadlight glazing not exceed 2.6m²



- The R values are for the total wall or total roof element.
- In **most** cases the insulation R value will be higher than that needed for the total wall or roof element.
- The insulation R value differs by construction type and by framing content.
- Timber is a “thermal bridge” – the more timber (closer the studs), the higher the R value of insulation required.

Solid Construction.

- Insulation to the exterior.
- Strap and line – use non solid tables.
- False internal wall.
- Firth HotBloc exempt.



- Mixed construction types. Use non solid tables.
- Separate wings. Calculate individually.
- Recessed light fittings (downlights). If more than 1 per 5m², use Table 7 (page 25 BHIG).



Two storey house, Zone 1

BOTH suspended (bubble foil) and Slab-on-ground (perimeter EPS 50mm)

BOTH weatherboard & brick veneer

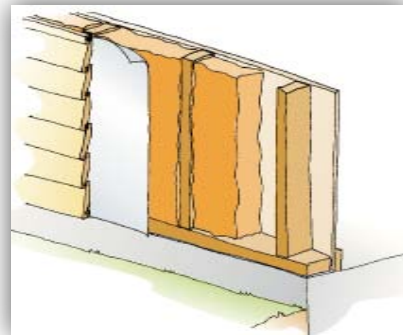
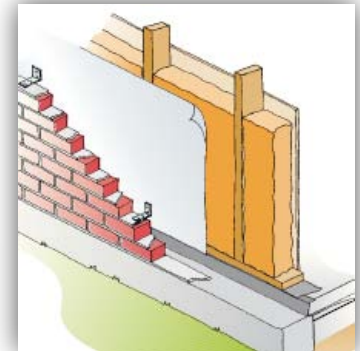
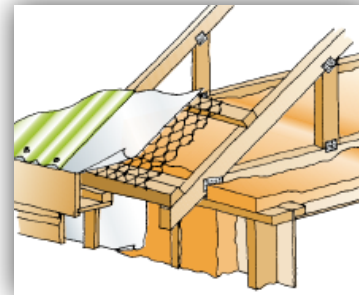
- R 2.2 wall insulation
- 90mm frame, 400mm stud x 800 dwang

Pitched timber framed roof

- R 2.7 ceiling insulation
- 900 joist centres

IGU, clear glass, aluminium frame

- R 0.26 glazing (WERS)



One step for slab, two steps for suspended.

Total R value combines: Effect of insulation and distance for heat to escape.

Heat escape distance is based on the ratio of Area: Perimeter.

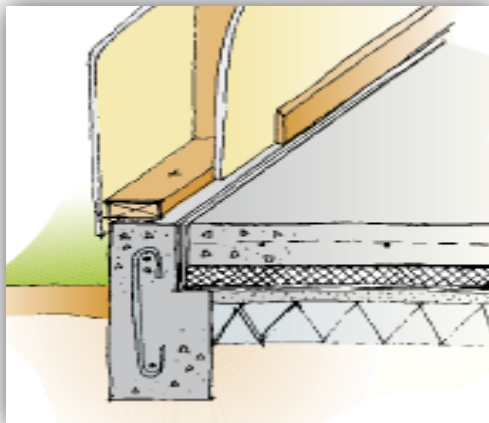
Floor areas

- Slab = $11.8\text{m} \times 10.3\text{m} = 122\text{m}^2$ area. Perimeter 44.2m.
- Suspended = $5.7 \times 6.4 = 36.5\text{m}^2$ area. Perimeter 24.2m.

Calculate area, perimeter & ratio

	Area	Perimeter	Ratio
Slab	122	44.2	2.76

Look up ratio on graph (Page 89); achieves minimum R1.5 construction R value. R1.3 is the requirement - **COMPLIES**



Construction	Area/perimeter ratio						
	1.3	1.9	2.2	2.5	2.8	3.1	4.0
	Total construction R-value						
140 mm stud, 1.2 m x 50 mm perimeter EPS	1.1	1.4	1.5	1.7	1.8	1.9	2.3
90 mm stud, 1.2 m x 50 mm perimeter EPS	1.0	1.3	1.4	1.5	1.6	1.7	2.1
Plain slab with 250 mm masonry wall	1.0	1.3	1.4	1.6	1.7	1.9	2.3
Plain slab with 200 mm masonry wall	0.9	1.2	1.4	1.5	1.6	1.8	2.2
Plain slab with 150 mm masonry wall	0.8	1.1	1.3	1.4	1.5	1.7	2.1
Plain slab with 90 mm stud wall	0.7	1.0	1.2	1.3	1.4	1.5	1.9

EXAMPLE – SUSPENDED FLOOR (STEP 1)

Calculate area, perimeter & ratio

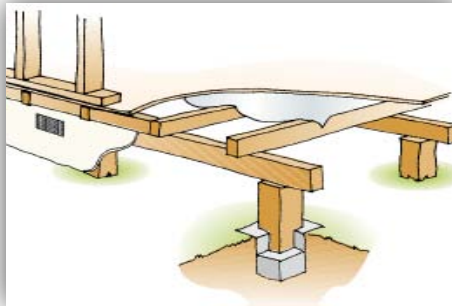
	Area	Perimeter	Ratio
Suspended	36.5	24.2	1.5

Look up ratio on graph (Page 84); construction R value required is R1.3. Ground underneath contributes 0.15 – GO TO STEP 2

	Area/perimeter ratio				
	1.0	2.0	3.0	4.0	5.0
	Sub-floor R-value				
Continuous perimeter wall, sheltered from wind (e.g. garage or foundation wall)	0.1	0.2	0.3	0.4	0.5
Continuous perimeter wall, exposed to wind (e.g. garage or foundation wall)	0.05	0.11	0.17	0.22	0.28
Exposed floor (e.g. pole house)	0.00	0.00	0.00	0.01	0.01

EXAMPLE – SUSPENDED FLOOR (STEP 2)

Insulated floor contributes R1.2 (Page 85). With R0.15 (ground underneath) = R1.35



Insulation options	Total construction R-value
bubble-foil under joist, enclosed perimeter	1.2
foil draped over joist with 100 mm sag, enclosed perimeter	1.1
foil draped over joist with 50 mm sag, enclosed perimeter	0.8
foil draped over joist with 25 mm sag, enclosed perimeter	0.6

Construction R value required is R1.3, therefore COMPLIES

Window & Total wall areas (excluding garage)

Orientation	Window	Total Wall
North	36.6	81.6
East	7.2	48.6
South	13.2	75.3
West	22.3	50.4
TOTAL	79.4	255.9
Total E, S, W	42.7	174.3
Skylights	2.4	
TOTAL GLAZING	81.8	

Total glazing = 81.8m² (79.4 + 2.4)

Total wall area = 255.9m²

Ratio is 32% - NOT COMPLIANT

Reduce glazing by 5.03m²

Don't use Schedule Method

E, S, W glazing = 42.7m²

E, S, W wall area = 174.3m²

42.7/174.3 = 24.5% - COMPLIES

Skylight area < 1.2m²

Reduce skylight area to 1.2m²

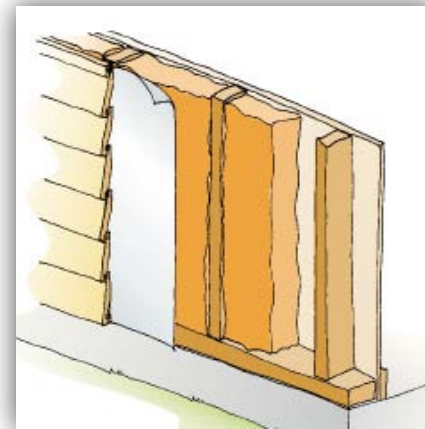
Don't use Schedule Method

No leadlight glass in this design

EXAMPLE – CHECK WALL R VALUE (STEP 1)

Bevel backed weatherboard, 90mm frame (Page 56). Zone 1 construction value required R1.9

Framing timber spacing	Insulation material R-value					
	1.8	2.0	2.2	2.4	2.6	2.8
	Total construction R-value					
studs 600, dwangs 800 (14%)	1.9	2.0	2.1	2.2	2.3	2.4
studs 600, dwangs 600 (16%)	1.8	1.9	2.0	2.1	2.2	2.3
studs 400, dwangs 800 (18%)	1.8	1.9	2.0	2.1	2.2	2.2
studs 400, dwangs 600 (20%)	1.8	1.9	2.0	2.0	2.1	2.2
(22%) framing ratio	1.7	1.8	1.9	2.0	2.1	2.1
(24%) framing ratio	1.7	1.8	1.9	1.9	2.0	2.1

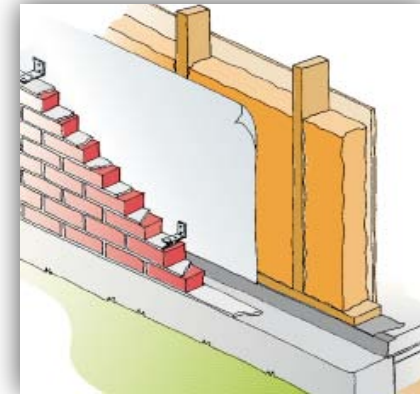


R2.2 insulation will achieve construction R value of R1.9.

EXAMPLE – CHECK WALL R VALUE (STEP 2)

Brick veneer, 90mm frame (Page 64). Zone 1 construction value required R1.9

Framing timber spacing	Insulation material R-value					
	1.8	2.0	2.2	2.4	2.6	2.8
	Total construction R-value					
studs 600, dwangs 800 (14%)	1.7	1.8	1.9	2.0	2.1	2.2
studs 600, dwangs 600 (16%)	1.7	1.8	1.9	2.0	2.1	2.1
studs 400, dwangs 800 (18%)	1.6	1.7	1.8	1.9	2.0	2.0
studs 400, dwangs 600 (20%)	1.6	1.7	1.8	1.9	1.9	2.0
(22%) framing ratio	1.6	1.7	1.7	1.8	1.9	1.9
(24%) framing ratio	1.5	1.6	1.7	1.8	1.8	1.9



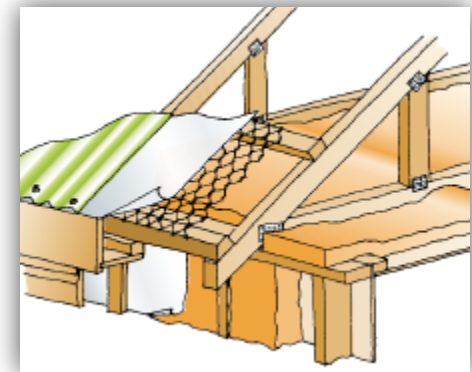
R2.2 insulation will only achieve construction R value of R1.8

Specify Bradford R2.6 wall for brick veneer walls.

Specify Bradford R2.6 for all walls if two storey (brick ground floor, weatherboard first floor).

Pitched timber framed roof, profiled steel, joists 900mm centres (Page 30). Zone 1 requires construction R value of 2.9.

Framing timber spacing	Insulation material R-value						
	2.4	2.8	3.2	3.6	4.0	4.4	4.8
	Total construction R-value						
Joist/chord 1200 (3.75%)	2.4	2.8	3.2	3.5	3.8	4.1	4.3
Joist/chord 900 (5%)	2.5	2.8	3.1	3.4	3.6	3.9	4.2
Joist/chord 600 (7.5%)	2.4	2.6	2.9	3.1	3.4	3.6	3.8



R 2.7 ceiling will not comply. Specify R3.2 or use the calculation or modelling method.

Where design does not meet schedule method criteria, use calculation or modelling method.

Calculation method is good up to 50% glazing.

Modelling method can be used for any design.



- Compares heat loss of a proposed design to a reference building that complies with the code.
- Heat loss of proposed building must be \leq heat loss of reference building.
- If proposed heat loss $>$ reference building, need to modify design.
- Heat loss = Area \div R value. For example: 100m² roof with total construction R value of R2.9 has a heat loss of 34.48.
- Also good for showing you where heat is lost.

- Allows mixed construction types & mixed glazing types (single, double glazed).
- Allows limited R value trade-off.
- Is more complex.
- Total glazing \leq 50% total wall area, otherwise must use modelling method
- ALF programme can apply the calculation method. May be easier than doing manually. Try Design Navigator.

CALCULATION METHOD

ACCEPTION SOLUTION – SOME ALGEBRA

H_{REF}	$=$	$\frac{A_{ROOF}}{R_{ROOF}}$	$+$	$\frac{A_{WALL}}{R_{WALL}}$	$+$	$\frac{A_{FLOOR}}{R_{FLOOR}}$	$+$	$\frac{A_{GLAZING}}{R_{GLAZING}}$		
H_{NEW}	\leq	H_{REF}								
H_{NEW}	$=$	$\frac{A_{ROOF}}{R_{ROOF}}$	$+$	$\frac{A_{WALL1}}{R_{WALL1}}$	$+$	$\frac{A_{WALL2}}{R_{WALL2}}$	$+$	$\frac{A_{FLOOR}}{R_{FLOOR}}$	$+$	$\frac{A_{GLAZING}}{R_{GLAZING}}$

This will be explained in the next few slides...

CALCULATION METHOD

CALCULATIONS – HREF

	Area	R - value	Heat Loss	
Roof	140.0	2.9	48.28	
Wall	176.5	1.9	92.89	
Floor	140.0	1.3	107.69	
Glazing (≤30%)	76.80	0.26	295.38	
Glazing (>30%)	2.6	0.26	10.00	Total Loss
Skylights	2.4	0.26	9.23	563.47



Areas = Actual Areas of building

R – value = Construction R – values as stipulated in NZBC H1 for the zone (this example located in Climate Zone 1)

Heat Loss = Area/ R-value

Total Loss = Sum of all the Heat losses (**Reference Building**)

BUILDING DESCRIPTION		
ROOF	ROOF CLADDING	CONCRETE TILE
	ROOF FRAMING	PITCHED, 140MM JOISTS @ 900
WALL	WALL CLADDING	50% BRICK
		50% WEATHERBOARD
	WALL FRAMING	90MM FRAME, 600 STUDS, 800 DWANGS
FLOOR	FLOOR	CONCRETE SLAB WITH 1.2M EPS (50MM)
WINDOWS	GLAZING	DOUBLE GLAZING

PROPOSED BUILDING HEAT LOSS


COMPONENT	DESCRIPTION	INSULATION USED	AREA	R - VALUE	HEAT LOSS	
ROOF 1	CONCRETE TILES 140MM JOISTS @900 CENTRES	BRADFORD GOLD R3.2 CEILING 165MM	140.0			HEAT LOSS=
WALL 1	BRICK 90MM 600 STUDS, 800 DWANGS	BRADFORD GOLD R2.2 WALL	95.6			AREA/ R - VALUE
WALL 2	WEATHER BOARD 90MM 600 STUDS, 800 DWANGS	BRADFORD GOLD R2.2 WALL	80.9			
FLOOR 1	CONCRETE SLAB 1.2M X 50MM EPS	EPS 1.2M X 50MM	140.0			
GLAZING 1	DOUBLE GLAZING		79.4			
SKYLIGHT 1	DOUBLE GLAZING		2.4			TOTAL LOSS
SKYLIGHT 2						

We now have the required details and must use the schedule method to work out the construction R – value for each section...

CALCULATION METHOD

CONSTRUCTION R VALUES – ROOF

ELEMENT	CLADDING	CONSTRUCTION
Roof	Concrete or clay tile	Pitched timber-framed roof 140 mm ceiling joists and dwangs



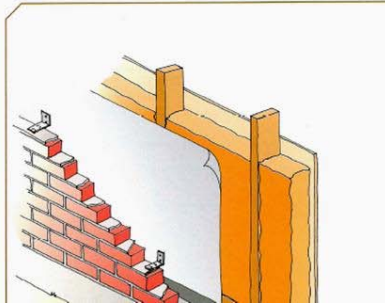
Framing timber spacing	Insulation material R-value						
	2.4	2.8	3.2	3.6	4.0	4.4	4.8
	Total construction R-value						
joists 1200, dwangs 900 (8.6%)	2.5	2.8	3.1	3.4	3.9	3.9	4.1
joists 900, dwangs 900 (10%)	2.5	2.7	3.0	3.3	3.5	3.8	4.0
joists 600, dwangs 900 (12%)	2.4	2.7	3.0	3.2	3.4	3.6	3.8

Using a **R3.2** product the construction R value is **R3.0**...

CALCULATION METHOD

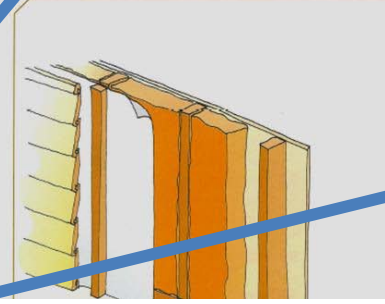
CONSTRUCTION R VALUES – WALL

ELEMENT	CLADDING	CONSTRUCTION
Wall	Masonry Veneer	Timber framed 90 mm frame



Framing timber spacing	Insulation material R-value					
	1.8	2.0	2.2	2.4	2.6	2.8
	Total construction R-value					
studs 600, dwangs 800 (14%)	1.7	1.8	1.9	2.0	2.1	2.2
studs 600, dwangs 600 (16%)	1.7	1.8	1.9	2.0	2.1	2.1
studs 400, dwangs 800 (18%)	1.6	1.7	1.8	1.9	2.0	2.0
studs 400, dwangs 600 (22%) framing ratio						
(24%) framing ratio						

ELEMENT	CLADDING	CONSTRUCTION
Wall	Bevel-back Weatherboard	Timber framed – cavity 90 mm frame



Framing timber spacing	Insulation material R-value					
	1.8	2.0	2.2	2.4	2.6	2.8
	Total construction R-value					
studs 600, dwangs 800 (14%)	1.8	1.9	2.1	2.2	2.3	2.3
studs 600, dwangs 600 (16%)	1.8	1.9	2.0	2.1	2.2	2.3
studs 400, dwangs 800 (18%)	1.8	1.9	2.0	2.0	2.1	2.2
studs 400, dwangs 600 (20%)	1.7	1.8	1.9	2.0	2.1	2.1
(22%) framing ratio	1.7	1.8	1.9	1.9	2.0	2.1
(24%) framing ratio	1.7	1.8	1.9	1.9	2.0	2.0

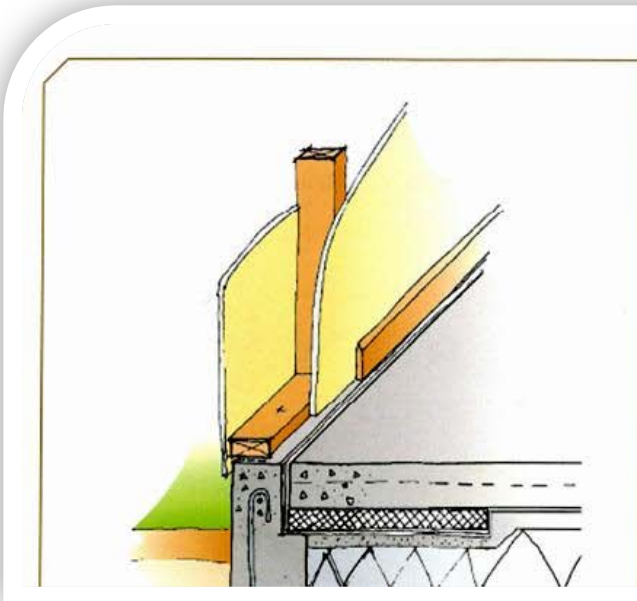
Using an **R2.2** product the:

Brick Area construction R value is **R1.9**

Weather Board area construction R value is **R2.1**

CALCULATION METHOD

CONSTRUCTION R VALUES – FLOOR



Construction	Area/perimeter ratio						
	1.3	1.9	2.2	2.5	2.8	3.1	4.0
	Total construction R-value						
140 mm stud, 1.2 m x 50 mm perimeter EPS	1.1	1.4	1.5	1.7	1.8	1.9	2.3
90 mm stud, 1.2 m x 50 mm perimeter EPS	1.0	1.3	1.4	1.5	1.6	1.7	2.1
Plain slab with 250 mm masonry wall	1.0	1.3	1.4	1.6	1.7	1.9	2.3
Plain slab with 200 mm masonry wall	0.9	1.2	1.4	1.5	1.6	1.8	2.2
Plain slab with 150 mm masonry wall	0.8	1.1	1.3	1.4	1.5	1.7	2.1
Plain slab with 90 mm stud wall	0.7	1.0	1.2	1.3	1.4	1.5	1.9

The slab area = 140.0m²

Perimeter = 50.0 metres

Area/perimeter ratio = 2.8

Construction R value = **R1.8**

PROPOSED BUILDING HEAT LOSS

COMPONENT	DESCRIPTION	INSULATION USED	AREA	R - VALUE	HEAT LOSS	
ROOF 1	CONCRETE TILES 140MM JOISTS @900 CENTRES	BRADFORD GOLD R3.2 CEILING 165MM	140.0	3.0	46.67	HEAT LOSS= AREA/ R - VALUE
WALL 1	BRICK 90MM 600 STUDS, 800 DWANGS	BRADFORD GOLD R2.2 WALL	95.6	1.9	50.32	
WALL 2	WEATHER BOARD 90MM 600 STUDS, 800 DWANGS	BRADFORD GOLD R2.2 WALL	80.9	2.1	38.52	
FLOOR 1	CONCRETE SLAB 1.2M X 50MM EPS	EPS 1.2M X 50MM	140.0	1.8	77.78	
GLAZING 1	DOUBLE GLAZING	N/A	79.4	0.26	305.38	
SKYLIGHT 1	DOUBLE GLAZING		2.4	0.26	9.23	TOTAL LOSS
SKYLIGHT 2						527.90

HL of 527.90 is less than the HL 563.47 of the Reference Building.
This design is compliant.

CALCULATION METHOD

CHANGE GLAZING – HNEW

Designer has a large north facing window which will be very expensive to double glaze
(Area = 15m²)

To reduce cost it is decided the large north facing window will be Single Glazed.

COMPONENT	DESCRIPTION	INSULATION USED	AREA	R - VALUE	HEAT LOSS	
ROOF 1	CONCRETE TILES 140MM JOISTS @900 CENTRES	BRADFORD GOLD R3.2 CEILING 165MM	140.0	3.0	46.67	HEAT LOSS=
WALL 1	BRICK 90MM 600 STUDS, 800 DWANGS	BRADFORD GOLD R2.2 WALL	95.6	1.9	50.32	AREA/ R - VALUE
WALL 2	WEATHER BOARD 90MM 600 STUDS, 800 DWANGS	BRADFORD GOLD R2.2 WALL	80.9	2.1	38.52	
FLOOR 1	CONCRETE SLAB 1.2M X 50MM EPS	EPS 1.2M X 50MM	140.0	1.8	77.78	
GLAZING 1	DOUBLE GLAZING	N/A	64.4	0.26	247.69	
GLAZING 2	Large Single Glazed window		15.0	0.15	100.0	TOTAL LOSS
SKYLIGHT 1			2.4	0.26	9.23	570.21

HL of 570.21 is greater than the HL 563.47 of the Reference Building. The design is NOT compliant.

CALCULATION METHOD

CHANGE GLAZING AND INSULATION – HNEW

To reduce cost it is decided the Large north facing window will be Single Glazed but the insulation levels are increased.

COMPONENT	DESCRIPTION	INSULATION USED	AREA	R - VALUE	HEAT LOSS	
ROOF 1	CONCRETE TILES 140MM JOISTS @900 CENTRES	BRADFORD GOLD R3.6 CEILING 165MM	140.0	3.3	46.67	HEAT LOSS=
WALL 1	BRICK 90MM 600 STUDS, 800 DWANGS	BRADFORD GOLD R2.6 WALL	95.6	2.1	45.52	AREA/ R - VALUE
WALL 2	WEATHER BOARD 90MM 600 STUDS, 800 DWANGS	BRADFORD GOLD R2.6 WALL	80.9	2.3	35.17	
FLOOR 1	CONCRETE SLAB 1.2M X 50MM EPS	EPS 1.2M X 50MM	140.0	1.8	77.78	
GLAZING 1	DOUBLE GLAZING	N/A	64.4	0.26	247.69	
GLAZING 2	Large Single Glazed window		15.0	0.15	100.0	TOTAL LOSS
SKYLIGHT 1			2.4	0.26	9.23	562.06

HL of 562.06 is Less than the HL 563.47 of the Reference Building.
The design is compliant.

QUESTIONS

For more information, please contact Bradford on 0800 277 123

