Back to Earth SW Ltd
7 Tuns Lane
Silverton
Exeter
EX5 4HY

Project Information
Reference
Date 17 November 2023

Construction Type
Element : Wall - Walls-timber frame-fire rated-render
Internal surface emissivity : High External surface emissivity : High

	Thickness (mm)	Thermal Conductivity (W/mK)	Thermal Resistance (m²K/W)	Pitch (º)	Bridge details Air gaps (Level, Delta U")
Outside surface resistance	-	-	0.040		
Render, lime-sand	8.0	0.800	0.010		
Udi Diffutherm	60.0	0.046	1.300		L:0 0.000W/m²K
SteicoFlex	160.0	0.036	4.400		15.000% Prefabricated panels (160.0mm) L:0 0.000W/m²K
Oriented strandboard (OSB)	15.0	0.130	0.115		
Ampatex Sinco	-	-	-		
SteicoFlex	38.0	0.036	1.050		11.800% Softwood (38.0mm) L:0 0.000W/m²K
Fermacell	13.0	0.320	0.041		
Gyproc FireLine	12.5	0.240	0.052		
Inside surface resistance	-	-	0.130		
Total thickness	**306.5mm**				

U-value = 0.17W/m²K

U-value, Combined Method : 0.166W/m²K (upper/lower limit 6.306 / 5.763m²K/W, dUf 0.0019, dUg 0.0000, dUp0.0000, dUr0.0000, dUrc1 0.0000, dUrc2 0.0000)

Correction factors
Mechanical fasteners :-
Warm pitched roof - insulation over rafters
Alpha : 0.80 per m lambda f : 50.0000W/mK nf : 6.700 per m² Af : 12.500mm² Recess : 0.0mm
Delta Uf for Udi Diffutherm : 0.0019
nf = fasteners per m² Af = fasteners cross-sectional area
Air gaps, Delta Ug = 0.000W/m²K

(Based on the combined method for determining U-values of structures containing repeating thermal bridges)

	Thickness (mm)	Thermal Conductivity (W/mK)	Thermal Resistance (m²K/W)	Vapour Resistivity (MNs/gm)	Vapour Resistance (MNs/g)
Outside surface resistance	-	-	0.040	-	-
Render, lime-sand	8.0	0.800	0.010	50.00	0.40
Udi Diffutherm	60.0	0.046	1.300	25.00	1.50
SteicoFlex	160.0	0.036	4.400	5.00	0.80
Oriented strandboard (OSB)	15.0	0.130	0.115	250.00	3.75
Ampatex Sinco	-	-	-	-	25.00
SteicoFlex	38.0	0.036	1.050	5.00	0.19
Fermacell	13.0	0.320	0.041	65.00	0.85
Gyproc FireLine	12.5	0.240	0.052	50.00	0.63
Inside surface resistance	-	-	0.130	-	-
Total thickness	**306.5mm**				

Detailed U-value Calculation Results

Construction includes 2 bridged layers

Non-bridged layers

Outside surface resistance	0.040 m²K/W
Render, lime-sand	0.010 m²K/W
Udi Diffutherm	1.300 m²K/W
Oriented strandboard (OSB)	0.115 m²K/W
Fermacell	0.041 m²K/W
Gyproc FireLine	0.052 m²K/W
Inside surface resistance	0.130 m²K/W
Resistance of non-bridged layers, R_{NB} =	1.688 m²K/W

Bridged layers

SteicoFlex (L1) bridged by Prefabricated panels (B1)
SteicoFlex (L2) bridged by Softwood (B2)

Path 1 - SteicoFlex
Path 2 - Prefabrica
Path 3 - SteicoFlex
Path 4 - Prefabrica

Resistance and fraction of heat flow paths

$R_{P1} = R_{NB} + R_{L1} = 1.688 + 5.450 = 7.138$ m²K/W $F_{P1} = 74.970\%$
$R_{P2} = R_{NB} + R_{L2} = 1.688 + 2.383 = 4.071$ m²K/W $F_{P2} = 13.230\%$
$R_{P3} = R_{NB} + R_{L3} = 1.688 + 4.692 = 6.380$ m²K/W $F_{P3} = 10.030\%$
$R_{P4} = R_{NB} + R_{L4} = 1.688 + 1.626 = 3.314$ m²K/W $F_{P4} = 1.770\%$

Upper resistance limit

$R_{upper} = 1 / ((F_{P1}/R_{P1}) + (F_{P2}/R_{P2}) + (F_{P3}/R_{P3}) + (F_{P4}/R_{P4}))$
$R_{upper} = 1 / ((0.750/7.138) + (0.132/4.071) + (0.100/6.380) + (0.018/3.314)) = 6.306$m²K/W

Lower resistance limit

$R_{lower} = R_{NB} + 1 / ((F_{L1}/R_{L1}) + (F_{B1}/R_{B1})) + 1 / ((F_{L2}/R_{L2}) + (F_{B2}/R_{B2}))$
$R_{lower} = 1.688 + 1 / ((0.850/4.400) + (0.150/1.333)) + 1 / ((0.882/1.050) + (0.118/0.292)) = 5.763$m²K/W

Total resistance of wall

$R_T = (R_{upper} + R_{lower}) / 2 = (6.306 + 5.763) / 2 = 6.03$ m²K/W

Mechanical fasteners :-

Calculations to BS EN ISO 6946:2007

Warm pitched roof - insulation over rafters
Alpha : 0.80 per m lambda f : 50.0000W/mK nf : 6.700 per m² Af : 12.500mm² Recess : 0.0mm
Delta Uf for Udi Diffutherm : 0.0019
Correction for air gaps, Delta Ug = 0.0000W/m²K

(Delta Uf + Delta Ug + Delta Up + Delta Ur) is less than 3% of (1 / Rt) so U = (1 / Rt) + (Delta Ur) + (Delta Urc) = 0.17 W/m²K

Structure element : Wall
Condensation calculations performed in accordance with BS5250:2021

Condensation is occuring at the following layers interfaces:-

Month	Int (C°)	Int (%RH)	Ext (C°)	Ext (%RH)
Jan	21.00	45.10	3.10	85.00
Feb	21.00	44.60	3.10	83.50
Mar	21.00	45.40	5.20	79.50
Apr	21.00	46.70	7.60	75.50
May	21.00	51.40	10.60	76.00
Jun	21.00	57.20	14.00	74.50
Jul	21.00	61.90	15.80	75.00
Aug	21.00	62.60	15.40	77.50
Sep	21.00	58.60	13.20	79.50
Oct	21.00	53.90	10.00	83.00
Nov	21.00	48.00	6.00	84.00
Dec	21.00	46.40	4.20	85.50

Gc = Monthly moisture accumulation per area at an interface
Ma = Accumulated moisture content per area at an interface

Peak accumulated moisture content per area at interface (Ma) = 0.00000 Kg/m²

Annual moisture accumulation = 0.00000 Kg/m²

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Thermal Mass Details

	Thickness assessed (actual) (mm)	Density (kg/m³)	Specific heat capacity (J/kgK)	Heat capacity (kJ/m²K)
Render, lime-sand	0.0 (8.0)	1600.0	1000.0	0.0
Udi Diffutherm	0.0 (60.0)	240.0	2100.0	0.0
SteicoFlex	0.0 (160.0)	60.0	2100.0	0.0
Oriented strandboard (OSB)	0.0 (15.0)	650.0	1700.0	0.0
Ampatex Sinco	0.0 (-)	280.0	850.0	0.0
SteicoFlex	0.0 (38.0)	60.0	2100.0	0.0
Fermacell	13.0 (13.0)	1150.0	1000.0	14950000.0
Gyproc FireLine	12.5 (12.5)	0.0	0.0	0.0
Total				14950000.0
kappa value				14.9500

Limiting condition: insulation

Admittance : 1.49 W/m²K Decrement : 0.20 factor Decrement delay : -13.40 hours

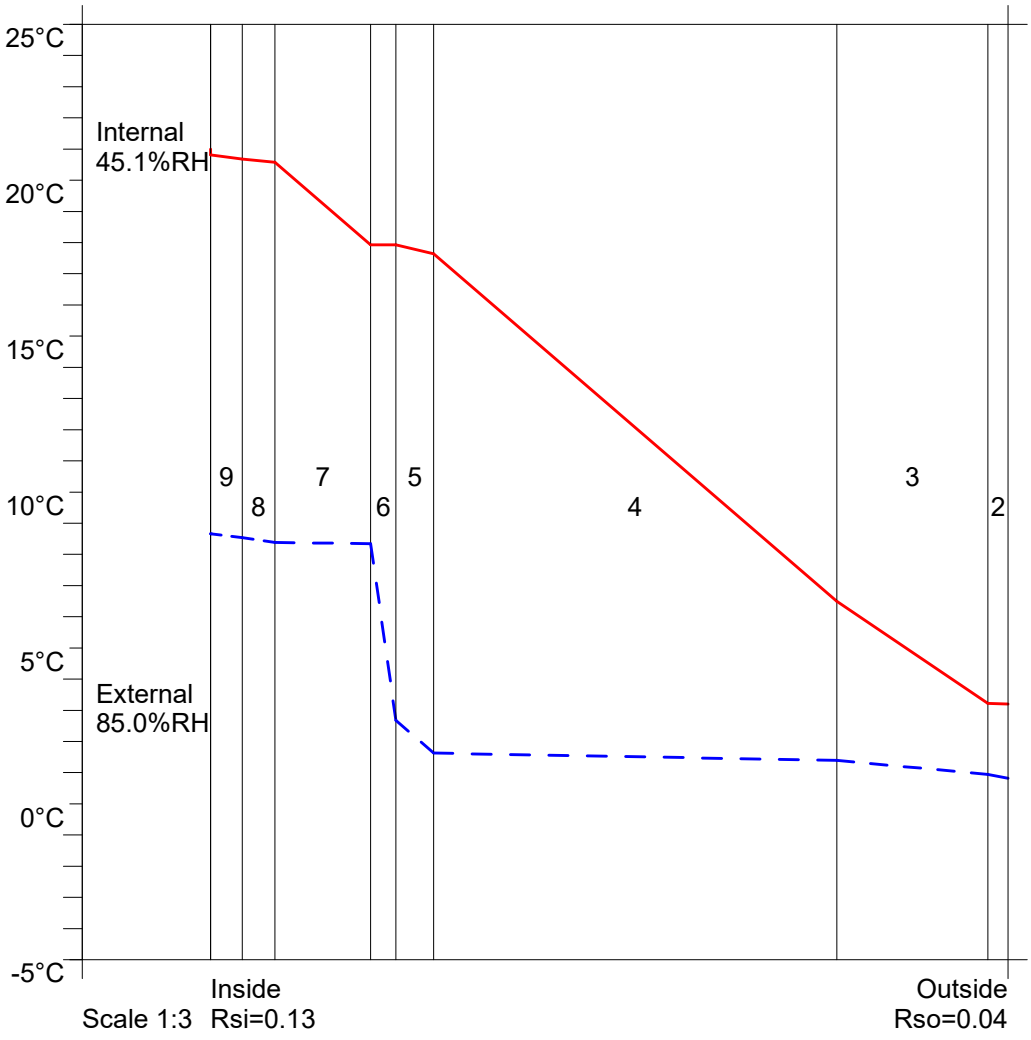
Condensation Risk Analysis (no account taken of thermal bridges)

2 - Offices, shops and dwellings with low occupancy

Jan (worst)	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
21.0C 45.1%	21.0C 44.6%	21.0C 45.4%	21.0C 46.7%	21.0C 51.4%	21.0C 57.2%	21.0C 61.9%	21.0C 62.6%	21.0C 58.6%	21.0C 53.9%	21.0C 48.0%	21.0C 46.4%
3.1C 85.0%	3.1C 83.5%	5.2C 79.5%	7.6C 75.5%	10.6C 76.0%	14.0C 74.5%	15.8C 75.0%	15.4C 77.5%	13.2C 79.5%	10.0C 83.0%	6.0C 84.0%	4.2C 85.5%

	Interface Temp. ºC	Dewpoint Temp. ºC	Vapour Pressure (kPa)	Saturated V.P. (kPa)	Worst Cond. (g/m²)	Peak Buildup (g/m²)	Conden-sation
1 Outside surface resistance	3.2	0.8	0.65	0.77			No
2 Render, lime-sand	3.2	0.9	0.65	0.77			No
3 Udi Diffutherm	6.5	1.4	0.68	0.97			No
4 SteicoFlex	17.6	1.6	0.69	2.02			No
5 Oriented strandboard (OSB)	17.9	2.7	0.74	2.05			No
6 Ampatex Sinco	17.9	8.3	1.10	2.05			No
7 SteicoFlex	20.6	8.4	1.10	2.42			No
8 Fermacell	20.7	8.5	1.11	2.44			No
9 Gyproc FireLine	20.8	8.7	1.12	2.46			No
10 Inside surface resistance							

Worst case internal / external conditions for graph : 21.0°C @ 45.1%RH / 3.1°C @ 85.0%RH



Condensation Risk Analysis (no account taken of thermal bridges)

2 - Offices, shops and dwellings with low occupancy

Jan (worst)	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
21.0C 45.1%	21.0C 44.6%	21.0C 45.4%	21.0C 46.7%	21.0C 51.4%	21.0C 57.2%	21.0C 61.9%	21.0C 62.6%	21.0C 58.6%	21.0C 53.9%	21.0C 48.0%	21.0C 46.4%
3.1C 85.0%	3.1C 83.5%	5.2C 79.5%	7.6C 75.5%	10.6C 76.0%	14.0C 74.5%	15.8C 75.0%	15.4C 77.5%	13.2C 79.5%	10.0C 83.0%	6.0C 84.0%	4.2C 85.5%

	Interface Temp. ºC	Dewpoint Temp. ºC	Vapour Pressure (kPa)	Saturated V.P. (kPa)	Worst Cond. (g/m²)	Peak Buildup (g/m²)	Conden-sation
1 Outside surface resistance	15.8	11.4	1.35	1.80			No
2 Render, lime-sand	15.8	11.4	1.35	1.80			No
3 Udi Diffutherm	16.8	11.5	1.36	1.91			No
4 SteicoFlex	20.0	11.6	1.36	2.34			No
5 Oriented strandboard (OSB)	20.1	11.8	1.38	2.35			No
6 Ampatex Sinco	20.1	13.3	1.53	2.35			No
7 SteicoFlex	20.9	13.3	1.53	2.47			No
8 Fermacell	20.9	13.4	1.53	2.47			No
9 Gyproc FireLine	20.9	13.4	1.54	2.48			No
10 Inside surface resistance							

Worst case internal / external conditions for graph : 21.0°C @ 61.9%RH / 15.8°C @ 75.0%RH