Project Information

Reference UC31231
Date 15 August 2019
Client Robinson Clark Ltd Project Cheddar Pavilion
BS27 3NA

Construction Type

Element : Pitch roof, horizontal ceiling - Roof with VCL
Roof pitch : 30.0°
Internal surface emissivity : High External surface emissivity : High
Building use : House or flat

	Thickness (mm)	Thermal Conductivity (W/mK)	Thermal Resistance (m²K/W)	Pitch (º)	Bridge details Air gaps (Level, Delta U")
Outside surface resistance	-	-	0.040	30.0°	
KS1000 SS	0.7	50.000	0.000	30.0°	
Cavity >=25mm, roof (CIBS)	-	-	0.160	30.0°	6.800% Softwood (0.0mm)
Loft space	-	-	0.180		
Rockwool Cavity Batts (50mm to 400mm)	300.0	0.037	8.100		6.800% Softwood (300.0mm) L:0 0.000W/m²K
VCL	-	-	-		
Gypsum plasterboard (700 kg/m³)	12.5	0.210	0.060		
Gypsum plastering (1000 kg/m³)	5.0	0.400	0.013		
Inside surface resistance	-	-	0.100		
Total thickness	**318.2mm**				

U-value = 0.13W/m²K

U-value, Combined Method : 0.133W/m²K (upper/lower limit 7.561 / 7.454m²K/W, dUf 0.0000, dUg 0.0000, dUp0.0000, dUr0.0000, dUrc1 0.0000, dUrc2 0.0000)

Correction factors

Air gaps, Delta Ug = 0.000W/m²K
Loft hatch (No loft hatch), Delta U = 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 (m^2K/W)	Vapour Resistivity (MNs/gm)	Vapour Resistance (MNs/g)
Outside surface resistance	-	-	0.040	-	-
KS1000 SS	0.7	50.000	0.000	-	25.00
Cavity >=25mm, roof (CIBS)	-	-	0.160	-	0.00
Loft space	-	-	0.180	-	-
Rockwool Cavity Batts (50mm to 400mm)	300.0	0.037	8.100	5.90	1.77
VCL	-	-	-	-	250.00
Gypsum plasterboard (700 kg/m^3)	12.5	0.210	0.060	50.00	0.63
Gypsum plastering (1000 kg/m^3)	5.0	0.400	0.013	50.00	0.25
Inside surface resistance	-	-	0.100	-	-
Total thickness	**318.2mm**				

Detailed U-value Calculation Results

Construction includes 2 bridged layers

Non-bridged layers

Outside surface resistance	0.035 m²K/W (0.040 * cos(30.0))
KS1000 SS	0.000 m²K/W (0.000 * cos(30.0))
Loft space	0.180 m²K/W
Gypsum plasterboard (700 kg/m³)	0.060 m²K/W
Gypsum plastering (1000 kg/m³)	0.013 m²K/W
Inside surface resistance	0.100 m²K/W
Resistance of non-bridged layers, R_{NB} =	0.387 m²K/W

Bridged layers

Cavity >=25mm, roof (CIBS) (L1) bridged by Softwood (B1)
Rockwool Cavity Batts (50mm to 400mm) (L2) bridged by Softwood (B2)

Path 1 - Cavity >=2
Path 2 - Softwood /
Path 3 - Cavity >=2
Path 4 - Softwood /

Resistance and fraction of heat flow paths

$R_{P1} = R_{NB} + R_{L1} = 0.387 + 8.239 = 8.625$ m²K/W $F_{P1} = 86.862\%$
$R_{P2} = R_{NB} + R_{L2} = 0.387 + 8.100 = 8.487$ m²K/W $F_{P2} = 6.338\%$
$R_{P3} = R_{NB} + R_{L3} = 0.387 + 2.446 = 2.833$ m²K/W $F_{P3} = 6.338\%$
$R_{P4} = R_{NB} + R_{L4} = 0.387 + 2.308 = 2.694$ m²K/W $F_{P4} = 0.462\%$

Upper resistance limit

$R_{upper} = 1 / ((F_{P1}/R_{P1}) + (F_{P2}/R_{P2}) + (F_{P3}/R_{P3}) + (F_{P4}/R_{P4}))$
$R_{upper} = 1 / ((0.869/8.625) + (0.063/8.487) + (0.063/2.833) + (0.005/2.694)) = 7.561$m²K/W

Lower resistance limit

$R_{lower} = R_{NB} + 1 / ((F_{L1}/R_{L1}) + (F_{B1}/R_{B1})) + 1 / ((F_{L2}/R_{L2}) + (F_{B2}/R_{B2}))$
$R_{lower} = 0.387 + 1 / ((0.932/8.239) + (0.068/2.308)) + 1 / ((0.932/8.100) + (0.068/2.308)) = 7.454$m²K/W

Total resistance of roof

$R_T = (R_{upper} + R_{lower}) / 2 = (7.561 + 7.454) / 2 = 7.51$ m²K/W

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) = 0.13 W/m²K

Structure element : Pitch roof, horizontal ceiling
Condensation calculations performed in accordance with BS5250:2011

Condensation is occuring at the following layers interfaces:-

Month	Int (C°)	Int (%RH)	Ext (C°)	Ext (%RH)
Jan	0.00	0.00	0.00	0.00
Feb	0.00	0.00	0.00	0.00
Mar	0.00	0.00	0.00	0.00
Apr	0.00	0.00	0.00	0.00
May	0.00	0.00	0.00	0.00
Jun	0.00	0.00	0.00	0.00
Jul	0.00	0.00	0.00	0.00
Aug	0.00	0.00	0.00	0.00
Sep	0.00	0.00	0.00	0.00
Oct	0.00	0.00	0.00	0.00
Nov	0.00	0.00	0.00	0.00
Dec	0.00	0.00	0.00	0.00

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

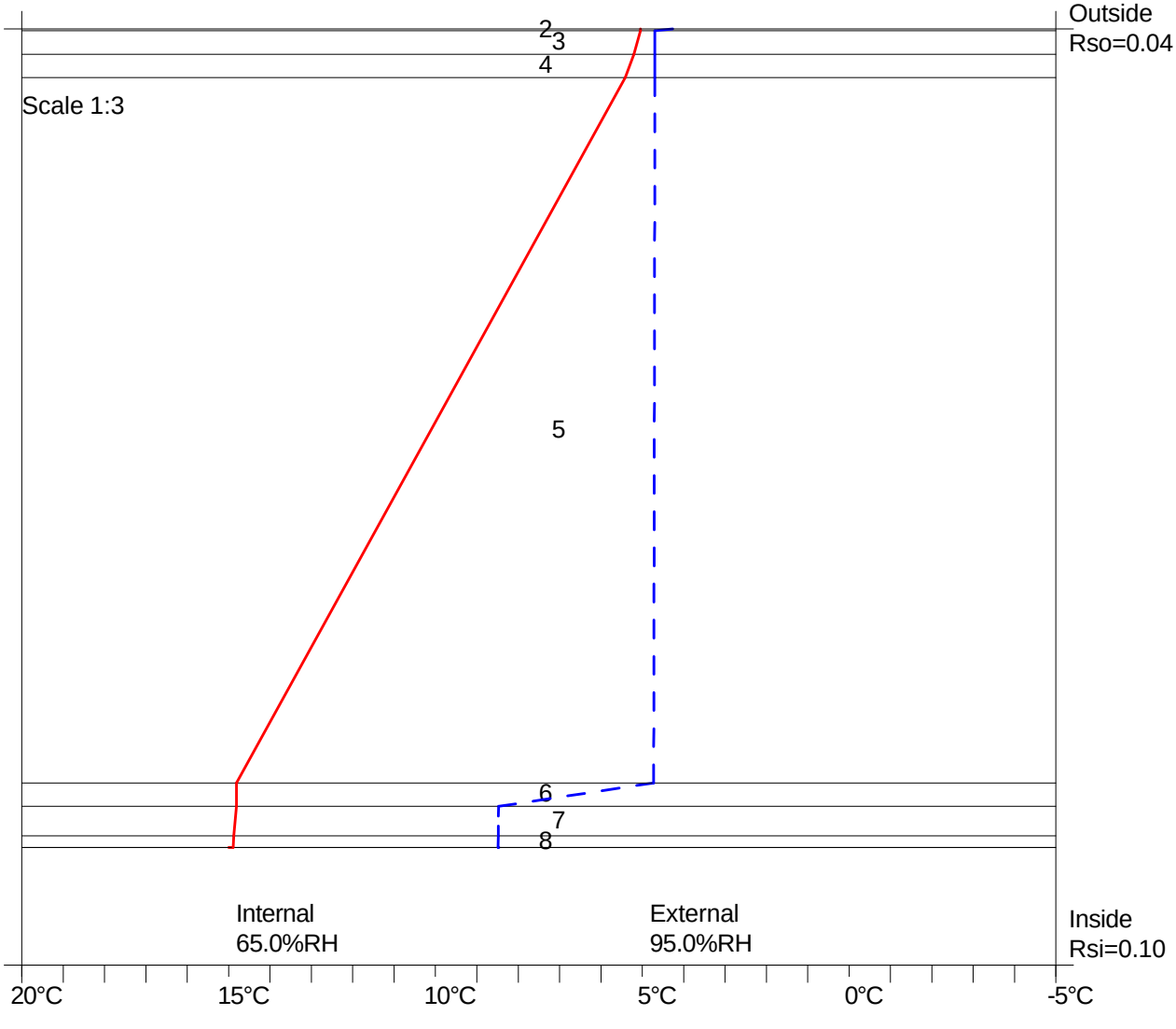
	Thickness assessed (actual) (mm)	Density (kg/m³)	Specific heat capacity (J/kgK)	Heat capacity (kJ/m²K)
KS1000 SS	0.0 (0.7)	7800.0	450.0	0.0
Cavity >=25mm, roof (CIBS)	0.0 (-)	0.0	0.0	0.0
Loft space	0.0 (-)	0.0	0.0	0.0
Rockwool Cavity Batts (50mm to 400mm)	0.0 (300.0)	0.0	0.0	0.0
VCL	0.0 (-)	0.0	0.0	0.0
Gypsum plasterboard (700 kg/m³)	12.5 (12.5)	700.0	1000.0	8750000.0
Gypsum plastering (1000 kg/m³)	5.0 (5.0)	1000.0	1000.0	5000000.0
Total				13750000.0
kappa value				13.7500

Limiting condition: insulation

Admittance : 1.95 W/m²K Decrement : 15.57 factor Decrement delay : -0.40 hours

Condensation Risk Analysis (no account taken of thermal bridges)
Internal / External Conditions : 15.0°C @ 65.0%RH / 5.0°C @ 95.0%RH Buildup period 60 days

	Interface Temp. °C	Dewpoint Temp. °C	Vapour Pressure (kPa)	Saturated V.P. (kPa)	Winter Buildup (g/m²)	Annual Buildup (g/m²)	Conden-sation
1 Outside surface resistance	5.0	4.3	0.83	0.87	-	-	No
2 KS1000 SS	5.0	4.7	0.85	0.87	-	-	No
3 Cavity >=25mm, roof (CIBS)	5.2	4.7	0.85	0.88	-	-	No
4 Loft space	5.4	4.7	0.85	0.90	-	-	No
5 Rockwool Cavity Batts (50mm to 400mm)	14.8	4.7	0.86	1.68	-	-	No
6 VCL	14.8	8.5	1.11	1.68	-	-	No
7 Gypsum plasterboard (700 kg/m³)	14.9	8.5	1.11	1.69	-	-	No
8 Gypsum plastering (1000 kg/m³)	14.9	8.5	1.11	1.69	-	-	No
9 Inside surface resistance							



Condensation Risk Analysis (no account taken of thermal bridges)
Internal / External Conditions : 15.0°C @ 65.0%RH / 18.0°C @ 65.0%RH Buildup period 60 days

	Interface Temp. °C	Dewpoint Temp. °C	Vapour Pressure (kPa)	Saturated V.P. (kPa)	Summer Buildup (g/m²)	Annual Buildup (g/m²)	Conden-sation
1 Outside surface resistance	18.0	11.3	1.34	2.06	-	-	No
2 KS1000 SS	18.0	11.1	1.32	2.06	-	-	No
3 Cavity >=25mm, roof (CIBS)	17.9	11.1	1.32	2.06	-	-	No
4 Loft space	17.9	11.1	1.32	2.05	-	-	No
5 Rockwool Cavity Batts (50mm to 400mm)	15.1	11.1	1.32	1.71	-	-	No
6 VCL	15.1	8.5	1.11	1.71	-	-	No
7 Gypsum plasterboard (700 kg/m³)	15.0	8.5	1.11	1.71	-	-	No
8 Gypsum plastering (1000 kg/m³)	15.0	8.5	1.11	1.71	-	-	No
9 Inside surface resistance