Project:	Passive Sills Thermal Modelling
Project No.:	11003
Address:	Foxhole Industrial Estate Youghal
Modelled by:	Shane Fenton IAB/TM/13

NSAI Agrément
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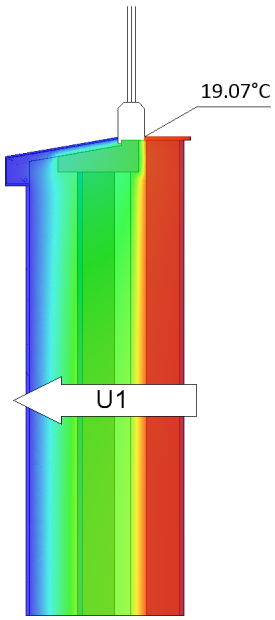
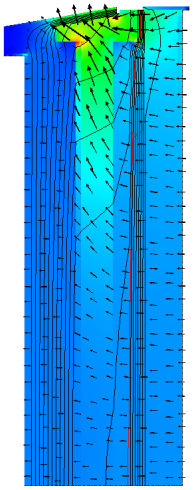
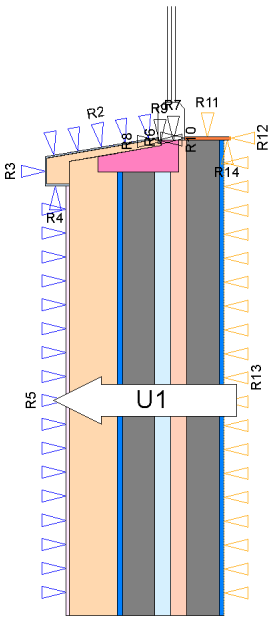
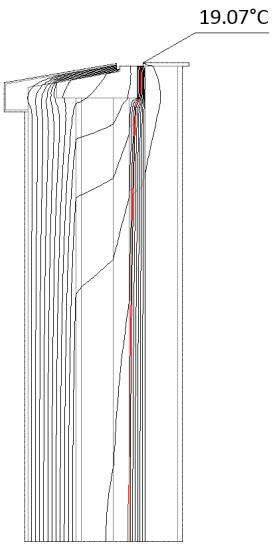
Thermal bridges calculation (Ψ-Value)

Date: 25.11.2019	Revision:A
Measurement Convention: 11003-TB01-Passive Oversill	Report Ref.: ISO 10211:2017; BR497:2016









Nr.	Description	Length	U-value	Correction factor
U1	External Wall	1.500 m	0.15 W/(m²K)	F_e (1.00)

Thermal bridges calculation

Ψ = +0.079 W/(mK)

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Comments:

Materials list:

	Description	Lambda
	Generic-EPS Insulation-038	0.038 W/(mK)
	Generic-Nano Render-040	0.400 W/(mK)
	Generic-Polymer Resin-070	0.700 W/(mK)
	ISO10456:2007: Concrete: Medium density (1800 kg/m3)	1.150 W/(mK)
	ISO10456:2007: Plasters and Render: Cement,Sand	1.000 W/(mK)
	ISO10456:2007: Plasters and Render: Gypsum plastering (Density 1300 kg/m3)	0.570 W/(mK)
	ISO10456:2007: Table A3: EPS	0.025 W/(mK)
	ISO10456:2007: Timber: Density (500 kg/m3)	0.130 W/(mK)
	ISO6946: 2017: Air Layer: Horizontal-50mm	0.271 W/(mK)
	Manufacturer: Litepac: EPS 200	0.034 W/(mK)
	TGD L: Concrete block (heavyweight)	1.330 W/(mK)

Boundary conditions and Flow of heat:

Nr	Temp	Rsi/Rse	Length	Flow of heat
R 1	0.49 m			
R 2	0.00 °C	0.04	0.36 m	-2.425 W/m
R 3	0.00 °C	0.04	0.09 m	-0.013 W/m
R 4	0.00 °C	0.04	0.07 m	-0.057 W/m
R 5	0.00 °C	0.04	1.35 m	-3.677 W/m
R 6	0.01 m			
R 7	0.07 m			
R 8	0.01 m			
R 9	0.01 m			
R 10	0.02 m			
R 11	20.00 °C	0.17	0.14 m	0.432 W/m
R 12	20.00 °C	0.13	0.01 m	0.003 W/m
R 13	20.00 °C	0.13	1.49 m	5.707 W/m
R 14	20.00 °C	0.10	0.02 m	0.029 W/m

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Calculation of the thermal conductivity L2D temperature for 2 conditions

Conductance L2D	+0.30864 W/mK
Psi-value	+0.07863 W/mK

Confidentiality / Terms

This report and any accompanying references may be relied upon by the client only and may only be used for the project and specific purpose for which it has been requested.

The use of this report and its appendices shall not confer on any third party any benefit or right.

All comments/details provided will only concern the thermal performance of the building/junction ONLY in relation to the thermal bridge report. The client remains responsible for the performance of the building/junction in terms of all Building Regulations, water penetration, weathering, air tightness, structural performance, aesthetics, durability, retention of guarantees and so forth.

Please note the following:

1) Junctions are modelled only on the information provided to WMA by the client

2) Appropriate provision for on-site inspection and related quality control procedures should be made by, and carried out by the client, or by the relevant project design and construction team members so that to ensure the junction has been constructed as detailed

3) The Thermal Bridge Calculations are only valid for the detail(s) as described by the information provided to WMA

4) Calculations have been carried out in accordance with the following standards and guidance documents where relevant:

a. BR443 Conventions for U-value calculations
b. BR497 Conventions for calculating linear thermal transmittance and temperature factors
c. BRE IP 1/06 Assessing the effects of thermal bridging at junctions and around openings
d. IS EN ISO 6946: 2017 Building components and building elements – Thermal resistance and thermal transmittance – Calculation method
e. IS EN ISO 10211: 2017 Thermal Bridges in Building Construction – Heat Flows and Surface Temperatures – Detailed Calculations
f. IS EN ISO 13370: 2017 Thermal performance of buildings — Heat transfer via the ground — Calculation methods
g. IS EN ISO 10456: 2007 Building materials and products - Hygrothermal properties –Tabulated design values and procedures for determining declared and design thermal values
h. IS EN ISO 10077-2: 2017 Thermal performance of windows, doors and shutters - Calculation of thermal transmittance
i. Building Regulations 2011, Technical Guidance Document L: Conservation of Fuel and Energy – Dwellings
j. Building Regulations 2017, Technical Guidance Document L: Conservation of Fuel and Energy - Buildings other than Dwellings

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PSI - VALUE CALCULATION

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N E T W O R K G E N E R A T I O N

Combining the thermal bridge areas... ready

Generation of the element cells

There were : 1047 Element cells produced.

Topology optimization... ready

E N D : N E T W O R K G E N E R A T I O N

Assembling the finite element structure... ready

Number of elements_____:1330

Number of nodes_____:742

S T A R T : F I N I T E E L E M E N T C A L C U L A T I O N

Initialize matrices...Number of nodes 742

Assembling the stiffness matrix and load vector... ready

Solve equations:

Begin the iteration. According to the method of conjugate gradient:

... Finished, the system of equations was solved.

Number of iterations 182

The temperatures in the network nodes are calculated.

E N D : F I N I T E E L E M E N T C A L C U L A T I O N

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*** CONVERGENCE TEST **********

*** To DIN10211:2008-04, A.2 **********

Convergence - structure... ready

Number of elements_____:5320

Number of nodes_____:2813

S T A R T : F I N I T E E L E M E N T C A L C U L A T I O N

Initialize matrices...Number of nodes 2813

Assembling the stiffness matrix and load vector... ready

Solve equations:

Begin the iteration. According to the method of conjugate gradient:

... Finished, the system of equations was solved.

Number of iterations 466

The temperatures in the network nodes are calculated.

E N D : F I N I T E E L E M E N T C A L C U L A T I O N

Sum of absolute values ??of all penetrating heat flows:

from the baseline [W/m]:6.197

from the convergence calculation [W/m]:6.173

Convergence [%] 0.4 <= 1

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Calculation of heat flows

Boundary condition	Type	Heat flow q [W/m]	Length [m]	Temperature	Rs(i,e) [m2K/W]
4	Robin	-0.057	0.065	0.000	0.040
3	Robin	-0.013	0.090	0.000	0.040
2	Robin	-2.425	0.358	0.000	0.040
10	Neumann	0.000	0.020	--	--
9	Neumann	0.000	0.010	--	--

7	Neumann	0.000	0.073	--	--
8	Neumann	0.000	0.010	--	--
1	Neumann	0.000	0.493	--	--
5	Robin	-3.677	1.347	0.000	0.040
13	Robin	5.707	1.490	20.000	0.130
11	Robin	0.432	0.143	20.000	0.170
14	Robin	0.029	0.021	20.000	0.100
6	Neumann	0.000	0.010	--	--
12	Robin	0.003	0.010	20.000	0.130

Total: 0.00022

Total heat flow (positive) Q+ = 6.17270 [W/m]

Total heat flow (from interior outwards) Q = 6.17270 [W/m]

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Psi-value calculation:

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Table of undisturbed U-values

Number	Description	Length [m]	U-value undisturbed [W/m2K]	Temperature correction factors Designation	Factor
1	External Wall	1.500	0.153	F_e	1.000

Calculation of the L2D for 2 temperature conditions

Temperature difference (DeltaT) : 20.00000 [K]

L2D = Q / deltaT = 0.30864 [W/mK]

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L2D = 0.309 [W/mK]

- (0.153 * 1.500 * 1.000) = -0.230 [W/mK]

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Psi-value = 0.07863 [W/mK]

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*** E N D of C A L C U L A T I O N ***

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