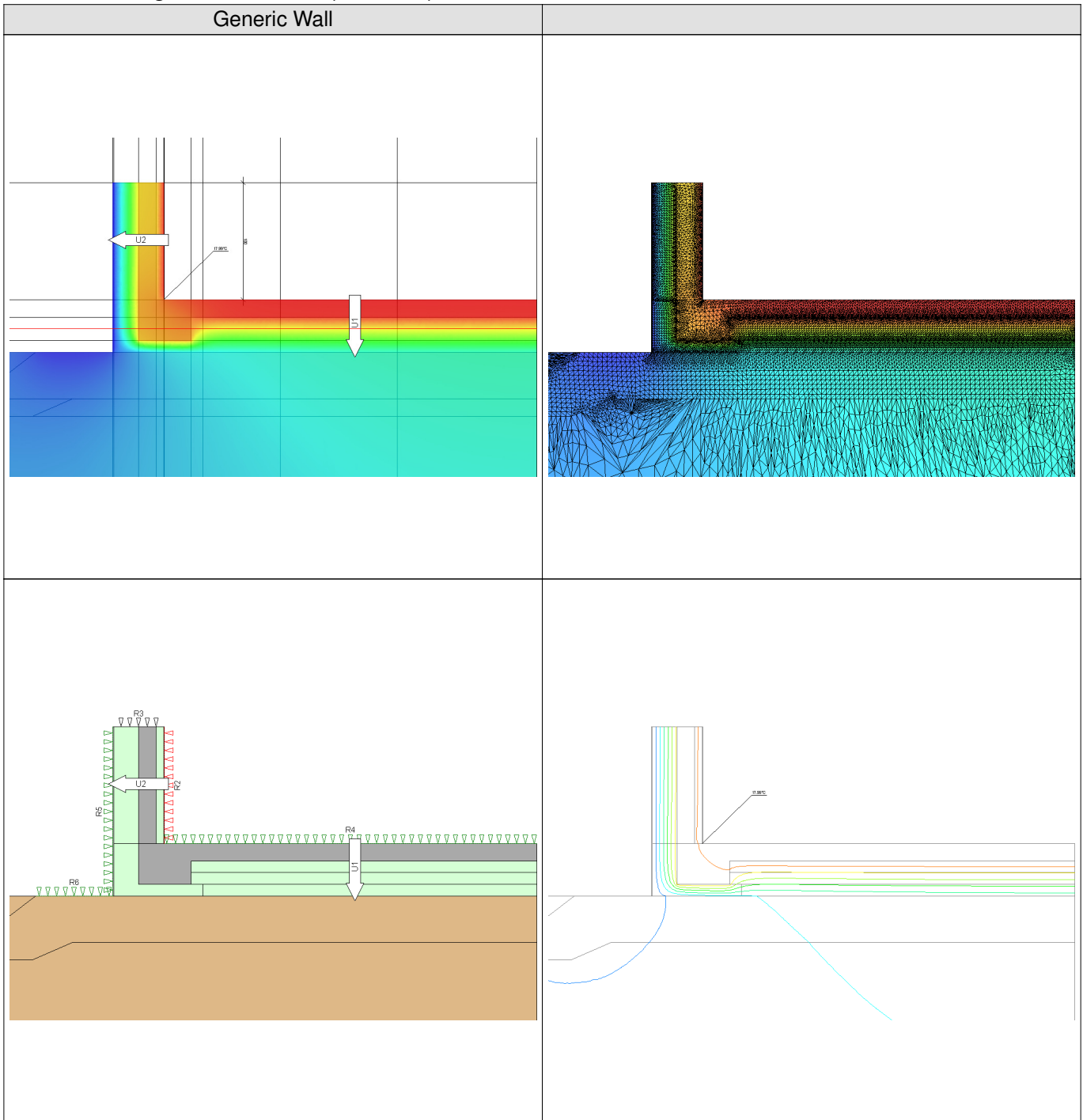


Thermal bridges calculation (Ψ -Value)



Nr.	Description	Length	U-value	Correction factor
U1	U2	3.200 m	0.11 W/(m ² K)	F _e (1.00)
U2	U2	1.000 m	0.12 W/(m ² K)	F _e (1.00)

Thermal bridges calculation

$\Psi = -0.055 \text{ W/(mK)}$

Psi-Therm 2D

Date: 6.5.2014

Materials list:

	Description	Lambda
	Normal concrete (2200)	1.600 W/(mK)
	Extruder polystyrene foam as perimeter insulation (WLG 030)	0.035 W/(mK)
	Extruder polystyrene foam (WLG 030)	0.035 W/(mK)
	Soils (natural moisture): sand, sand-gravel	1.400 W/(mK)
	Acrylic plaster	0.700 W/(mK)
	From Lime plaster, gypsum plasters	0.700 W/(mK)
	Light clay 1000	1.500 W/(mK)

Boundary conditions and Flow of heat:

Nr	Temp	Rsi/Rse	Length	Flow of heat
R 1	--	--	64.52 m	--
R 2	20.00 °C	0.13	1.00 m	2.268 W/m
R 3	--	--	0.44 m	--
R 4	20.00 °C	0.13	3.19 m	8.421 W/m
R 5	0.00 °C	0.04	1.45 m	-3.927 W/m
R 6	0.00 °C	0.04	0.66 m	-6.762 W/m

Calculation of the thermal conductivity L2D temperature for 2 conditions

Conductance L2D	+0.42757 W/mK
Psi-value	-0.05534 W/mK

Psi-Therm 2D

Date: 6.5.2014

Input data - material regions

		Description	Lambda	
	M1	Normal concrete (2200)	1.600 W/(mK)	
Description	Nr	X	Y	
Contour	1	-0.61 m	+0.63 m	
	2	-0.76 m	+0.63 m	
	3	-0.76 m	-0.37 m	
	4	-0.61 m	-0.37 m	

		Description	Lambda	
	M2	Extruder polystyrene foam as perimeter insulation (WLG 030)	0.035 W/(mK)	
Description	Nr	X	Y	
Contour	1	-0.55 m	+0.63 m	
	2	-0.61 m	+0.63 m	
	3	-0.61 m	-0.37 m	
	4	-0.55 m	-0.37 m	

		Description	Lambda	
	M3	Extruder polystyrene foam (WLG 030)	0.035 W/(mK)	
Description	Nr	X	Y	
Contour	1	-0.76 m	-0.37 m	
	2	-0.98 m	-0.37 m	
	3	-0.98 m	-0.82 m	
	4	-0.21 m	-0.82 m	
	5	-0.21 m	-0.72 m	
	6	-0.76 m	-0.72 m	

		Description	Lambda	
	M4	Soils (natural moisture): sand, sand-gravel	1.400 W/(mK)	
Description	Nr	X	Y	
Contour	1	+2.65 m	-0.82 m	
	2	-1.65 m	-0.82 m	
	3	-2.16 m	-1.22 m	
	4	-2.08 m	-1.37 m	
	5	-1.67 m	-1.37 m	
	6	-1.33 m	-1.22 m	
	7	+2.65 m	-1.22 m	


		Description	Lambda	
	M5	Acrylic plaster	0.700 W/(mK)	
Description	Nr	X	Y	
Contour	1	-0.98 m	+0.63 m	
	2	-0.99 m	+0.63 m	
	3	-0.99 m	-0.82 m	
	4	-0.98 m	-0.82 m	

		Description	Lambda	
	M6	From Lime plaster, gypsum plasters	0.700 W/(mK)	

Psi-Therm 2D

Date: 6.5.2014

Description	Nr	X	Y
Contour	1	-0.54 m	+0.63 m
	2	-0.55 m	+0.63 m
	3	-0.55 m	-0.37 m
	4	-0.54 m	-0.37 m

	Description	Lambda
	M7 Light clay 1000	1.500 W/(mK)

Description	Nr	X	Y
Contour	1	-15.99 m	-0.82 m
	2	-15.99 m	-16.37 m
	3	+2.65 m	-16.37 m
	4	+2.65 m	-1.22 m
	5	-1.33 m	-1.22 m
	6	-1.67 m	-1.37 m
	7	-2.08 m	-1.37 m
	8	-2.16 m	-1.22 m
	9	-1.65 m	-0.82 m

Input data - border areas

	Description	Temperature	Rsi/Rse	Length
R2	Interior wall conditions	+20.00 °C	0.13	1.00 m
		X	Y	
Starting point		-0.54 m	-0.37 m	
Endpoint		-0.54 m	+0.63 m	

	Description	Temperature	Rsi/Rse	Length
R3	Adiabatic	--	--	0.44 m
		X	Y	
Starting point		-0.54 m	+0.63 m	
Endpoint		-0.99 m	+0.63 m	

	Description	Temperature	Rsi/Rse	Length
R4	Interior floor conditions	+20.00 °C	0.13	3.20 m
		X	Y	
Starting point		+2.65 m	-0.37 m	
Endpoint		-0.55 m	-0.37 m	

	Description	Temperature	Rsi/Rse	Length
R5	Exterior conditions	+0.00 °C	0.04	1.45 m
		X	Y	
Starting point		-0.99 m	+0.63 m	
Endpoint		-0.99 m	-0.82 m	

	Description	Temperature	Rsi/Rse	Length
R6	Exterior conditions	+0.00 °C	0.04	0.66 m
		X	Y	
Starting point		-0.99 m	-0.82 m	
Endpoint		-1.65 m	-0.82 m	

Input data - U-values

	Description	U-values	Fx
U1	U2	3.20	1.00

Building project: Pyefleet View foundation

Psi-Therm 2D

Date: 6.5.2014

X	Y	Alignment	
+1.09 m	-0.37 m	90 °	

	Description	U-values	Fx
U2	U2	1.00	1.00

X	Y	Alignment	
-0.55 m	+0.14 m	180 °	

Psi-Therm 2D

Date: 6.5.2014

PSI - VALUE CALCULATION

NETWORK GENERATION

Combining the thermal bridge areas... ready

Generation of the element cells

There were : 6364 Element cells produced.

Topology optimization... ready

END : NETWORK GENERATION

Assembling the finite element structure... ready

Number of elements_____:7636

Number of nodes_____:3972

START : FINITE ELEMENT CALCULATION

Initialize matrices...Number of nodes 3972

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 712

The temperatures in the network nodes are calculated.

END : FINITE ELEMENT CALCULATION

*** CONVERGENCE TEST *****

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

Convergence - structure... ready

Number of elements_____:30544

Number of nodes_____:15579

START : FINITE ELEMENT CALCULATION

Initialize matrices...Number of nodes 15579

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 1897

The temperatures in the network nodes are calculated.

END : FINITE ELEMENT CALCULATION

Sum of absolute values of all penetrating heat flows:

from the baseline [W/m]:10.737

from the convergence calculation [W/m]:10.689

Convergence [%] 0.4 <= 1

=====

Calculation of heat flows

Boundary condition	Type	Heat flow q [W/m]	Length [m]	Temperature	Rs(i,e) [m2K/W]
3	Neumann	0.000	0.444	--	--
1	Neumann	0.000	64.525	--	--
4	Robin	8.421	3.194	20.000	0.130
6	Robin	-6.762	0.663	0.000	0.040
5	Robin	-3.927	1.450	0.000	0.040
2	Robin	2.268	1.000	20.000	0.130
Total:		0.00000			

Total heat flow (positive) Q+ = 10.68926 [W/m]

Total heat flow (from interior outwards) Q = 10.68926 [W/m]

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Psi-value calculation:

Psi-Therm 2D

Date: 6.5.2014

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Table of undisturbed U-values

Number	Description	Length	U-value undisturbed	Temperature correction factors
		[m]	[W/m2K]	Designation
1	U2	3.200	0.113	F_e
2	U2	1.000	0.121	F_e

Calculation of the L2D for 2 temperature conditions

Temperature difference (DeltaT) : 25.00000 [K]
 L2D = Q / deltaT = 0.42757 [W/mK]

=====

L2D = 0.428 [W/mK]
 - (0.113 * 3.200 * 1.000) = -0.362 [W/mK]
 - (0.121 * 1.000 * 1.000) = -0.121 [W/mK]

=====

Psi-value = -0.05534 [W/mK]

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