

1. Introduction

On the internal surface of thermal bridges low temperatures occur in wintertime, causing a risk of surface condensation and mould growth. A 3D corner joining 2 façade walls and a flat roof is analysed as an example.

2. Case study data

TRISCO data [3D corner surface condensation.trc](#)

TRISCO data [3D corner surface condensation RADCON.trc](#)

TRISCO data [3D corner surface condensation hi heatloss.trc](#)

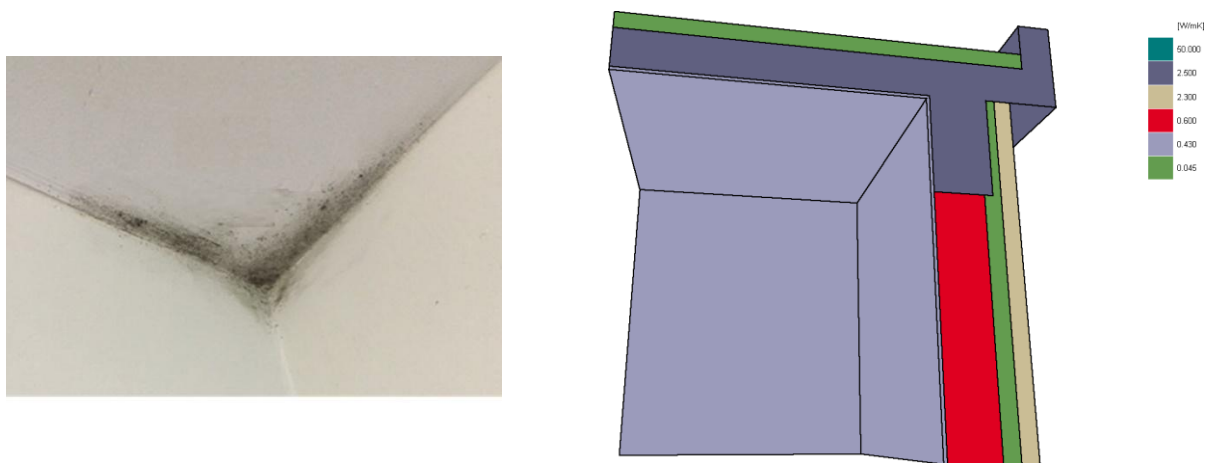


Figure 1 - Room corner with mould growth.

Figure 2 - Room corner geometry and material data.

The picture in Figure 1 shows a bedroom corner with a severe mould growth. The construction detail is shown in Figure 2. The external cladding in natural stone is fixed to the concrete structure using metal brackets.

Material properties: see Figure 2 and TRISCO data.

Outdoors temperature $\theta_e = 0^\circ\text{C}$, and indoors temperature $\theta_i = 20^\circ\text{C}$

According to EN ISO 13788 for the assessment of mould growth an internal surface heat transfer coefficient $h_i = 4.0 \text{ W/m}^2\text{K}$ and an external surface heat transfer coefficient $h_e = 25 \text{ W/m}^2\text{K}$ shall be used.

Two supplementary simulations will be done, using other values of the internal surface heat transfer coefficient:

- 1) using a calculated internal surface heat transfer coefficient (RADCON module)
- 2) using the internal surface heat transfer coefficients used in heat loss calculations (EN ISO 6946).

3. Case study results

TRISCO data [3D corner surface condensation.trc](#)

TRISCO data [3D corner surface condensation RADCON.trc](#)

TRISCO data [3D corner surface condensation hi heatloss.trc](#)

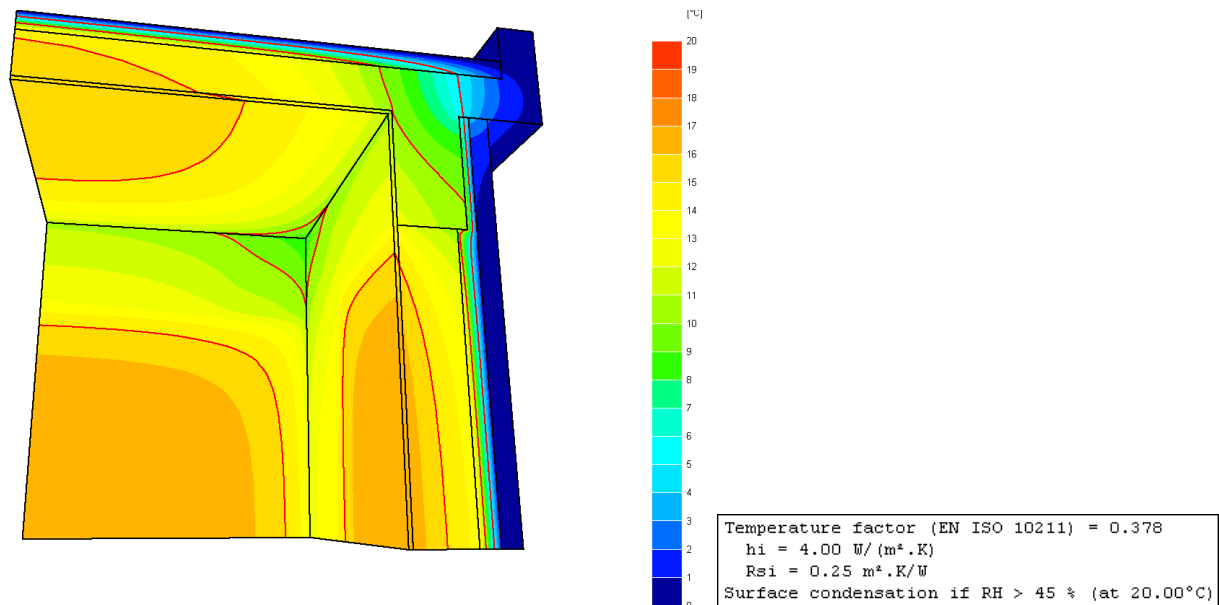


**Figure 3: isotherms (colour increment 1 °C, line increment 5°C)
case $h_i = 4 \text{ W/m}^2\text{K}$ (EN ISO 13788)**

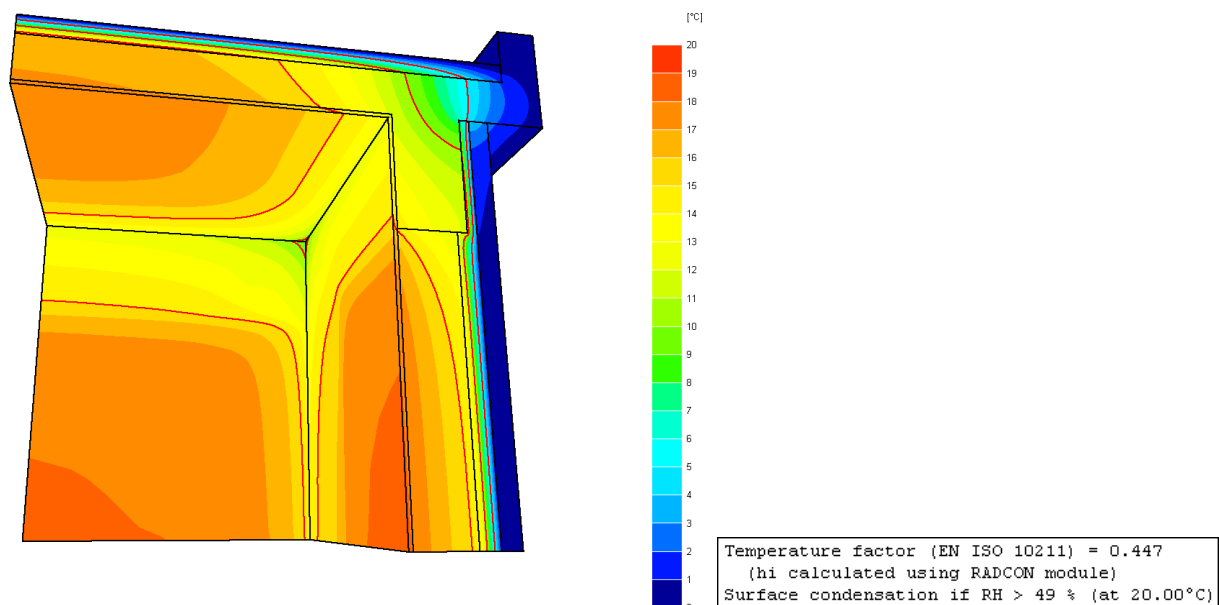


**Figure 4: isotherms (colour increment 1 °C, line increment 5°C)
case h_i calculated using RADCON (convective part $2.5 \text{ W/m}^2\text{K}$)**

The simulation using an internal surface heat transfer coefficient $h_i = 4 \text{ W/m}^2\text{K}$ results in a very low corner temperature (7.6°C) (Figure 3). As a consequence, the occurrence of

surface condensation and mould growth is quite evident, even for average dwelling air humidity conditions.

The simulation with the RADCON module, using a convective surface heat transfer coefficient $h_{ic} = 2.5 \text{ W/m}^2\text{K}$ and a radiation temperature equal to the air temperature (20°C) results in a somewhat higher corner temperature (8.9°C) (Figure 4). Still the occurrence of surface condensation and mould growth is quite evident. The simulation can be considered as more realistic than the previous one, and therefore the use of $h_i = 4 \text{ W/m}^2\text{K}$ according to EN ISO 13788 can be considered as conservative.

The simulation using the surface heat transfer coefficients for heat loss calculations ($h_i = 7.7 \text{ W/m}^2\text{K}$ at wall surfaces and $h_i = 10 \text{ W/m}^2\text{K}$ at the ceiling, according to EN ISO 6946) results in a higher corner temperature (10.2°C) (Figure 5). The difference with the first results shows the importance of the internal heat transfer coefficient for the assessment of mould growth and surface condensation.

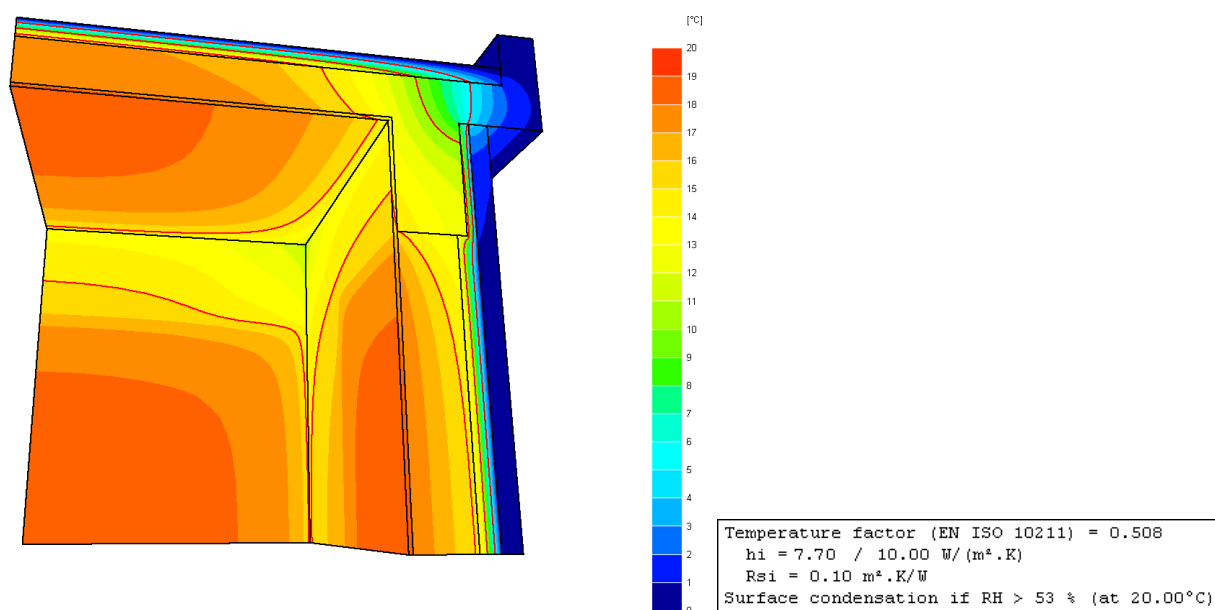


Figure 5: isotherms (colour increment 1°C , line increment 5°C)
case $h_{iwall} = 7.7 \text{ W/m}^2\text{K}$ and $h_{iceiling} = 10 \text{ W/m}^2\text{K}$

References

EN ISO 6946: 2017 Building components and building elements -- Thermal resistance and thermal transmittance -- Calculation methods

EN ISO 13788: 2012 Hygrothermal performance of building components and building elements - Internal surface temperature to avoid critical surface humidity and interstitial condensation – Calculation methods