What is a thermal bridge?

Thermal bridges are thermally weak points or interruptions in the building envelope. More heat is lost here than in areas without interruptions. Due to this, the temperature of the interior surface near the thermal bridge is lower. If this spot becomes too cold, there will be increased moisture and mould may even form, potentially damaging the building structure. A better level of thermal protection generally leads to higher temperatures, including near thermal bridges, therefore highly energy efficient buildings are always less problematic in this regard.

In general, a distinction is made between linear and point thermal bridges. Linear thermal bridges include ceiling junctions, projecting balcony slabs, outer corners, verges and eaves. Point thermal bridges are single penetrations in the thermal envelope of the building. Examples of these include mounting brackets for canopies, penetrations by electrical cables, sub-constructions for ventilated façades and insulation fasteners.

Calculating thermal bridges
Thermal bridges are determined in three steps:

1. Determining heat flow through the uninterrupted building component Q_{reg} [W/m] with a height [h] using the PHPP or heat flow software:
   $$Q_{reg} = U \cdot h \cdot \Delta\theta$$
2. Determining heat flow through the actual building component Q_{WB} [m] by means of heat flow software. For this, the height of the building component and the temperature difference [Δθ] must be the same as in the first step.
3. The thermal bridge coefficient Ψ [W/(mK)] is calculated according to the following formula:
   $$\psi = \frac{Q_{WB} - Q_{reg}}{\Delta\theta}$$

Example: projecting balcony slab
If the concrete ceiling continues through the insulation as a balcony, then the thermal building envelope will be completely penetrated by the heat conducting concrete, resulting in a significant thermal bridge. In existing buildings, mould growth or mould stains often occur at this point. If the balcony is placed in front of the building, the insulation can continue uninterrupted and a thermal bridge will not occur. However, this is not always possible. One way to handle this is to use a "thermal break". Instead of the ceiling passing directly through the insulation, thermal breaks are used. This minimises the thermal bridge by up to 75 percent, and the indoor temperatures remain unproblematic.

The thermal bridge coefficient must always be viewed in connection with the weakened building component. With penetrating balconies, the value is higher with insulated walls – this gives the impression that problems with thermal bridges are intensified by wall insulation. However, in the case of uninsulated walls, the heat loss is very high anyway, so the situation is hardly worsened by the projecting balcony slab. If the wall is insulated, energy loss through the uninterrupted wall will be lower. The balcony slab will then represent a significant deterioration.

It is important to note that the total heat loss is considerably reduced by the insulation measure and the temperature of the interior surface is increased so much so that it is higher than the critical level of 12.6° C, as mould growth can occur below this level with normal indoor air humidity levels.