Research on the temporally variation of the humidity in interior rooms in regards of the moisture transport through constructions and the prevention of mould grow on the internal surfaces of constructions

## from Prof. Dr.-Ing. Thomas Ackermann

**Abstract:** The diagnose of measurements dealing with the temperature and moisture in the internal air at 57 places all over Germany shows that in modern buildings there are – in controversy to buildings erected between 1950 and 1970 – different values for temperature and moisture. Because of the higher value of air tightness energy saving buildings show higher values for the absolute and relative humidity in the internal air. Regarding to air tight buildings it is even by the use of technical equipment for ventilation not possible to reduce the moisture content in the internal air by the exchange of humid air through dry air in the way you can find in elderly less air tight buildings.

The comparison of curves based on regressions shows that it is possible to find parameters for evaluation values of the external air to create the chronical sequence of regression curves regardless of the region with exception of areas with extreme meteorological conditions.

On the other hand the examined curves show that it is not possible to find standardised parameters to develop chronical sequences for evaluation values of the internal air.

In regards to indoor conditions the behaviour of the users of buildings and the equipment of building technology are having such an enormous influence that the formation of clusters e.g. with reference to the age of buildings is not possible. The evaluated data also show that in contrast to DIN 4108-3:2018-10, DIN EN ISO 13788:2013-05 and DIN EN ISO 15026:2007-07 it is not possible to assign a singular value of the relative or absolute humidity to a defined external temperature. Instead of a linear connection between  $\theta_e$  /  $\phi_i$  you can see a relation in form of an ellipse.

When presenting the relation between the external temperature and the relative or absolute humidity based on regressions or average daily or average hourly values it is obvious that an expansion of the time interval is connected with the reduction of extreme values. That means that bevor determining the boundary conditions of calculations relating to building law, especially when using simulations, it is necessary to define the safety level; viz. under the regard of DIN EN 1990:2010-12 it has to be clarified if it is a calculation in regards to the structural stability or if it is a calculation in regards to the serviceability. Based on that decision the relevant quantile and linked to the serviceable life of a construction or a building a decision has to be made how long the evaluation period lasts. In addition to that and depending on the unit of time (average value / daily average value / hourly average value) an increased safety factor has to be defined to compensate the effect of reduced amplitudes because of expanded averaging periods.

Because of the elliptical relation between the external temperatures and the internal humidity for thermal dynamic constructions the highest risk for the germination or the grow of mould spores is in the period from August to September while for thermal inert constructions the highest risk for the germination or the grow of mould spores is in the time from January until February.

Regarding to the position of furniture the evaluation of this research project shows that despite the reduce of the heat flow from the interior of a room to the surface of heat transferring components there is no increased risk of mould formation in buildings having a contemporary thermal insulation. So in this case there is no need for requirements dealing with the position of furniture.