Standardisation activity on the protection of sensitive materials like wood within CEN Technical Committee 346

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The framework

CEN Technical Committee 346 ‘Conservation of Cultural Property’, chaired by professor Vasco Fassina

Working Group 4 ‘Environment’

draft CEN standard prEN 15757 ‘A guide to specifying temperature and relative humidity in order to limit climate-induced physical damage to organic hygroscopic materials’
The standard adopts two approaches

1. Environment – acclimatisation approach

Maintain the same microclimate in terms of levels, seasonal cycles and fluctuations of temperature and RH, to which the materials have acclimatised for a long time, if this climate has been proved not to be harmful
2. Material – understanding the mechanical behaviour of painted wood

Variations of environmental parameters should stay below a critical level above which risk of physical damage appears.
Knowledge of **historic climate** required

The standard provides guide to determining the RH target from the past indoor conditions (Informative Annex)

- monitor for one of more years
- describe the historic RH pattern by calculating:
  - average RH level over a selected period
  - seasonal cycle
  - short-term fluctuations
Church of Annunciation Skepe, Poland

valuable paintings

1750-53
Yearly average - arithmetic mean of the RH readings
Seasonal cycle - the 30-day central moving average of the RH readings smooths out the fluctuations and highlights long-term cycles.
Short-term fluctuation - a difference between a current RH reading and a 30-day moving average

Fluctuation amplitude 17%
Target RH range – 14% of the largest, most risky fluctuations are excluded.
Absolute allowable RH variation

• If the analysis of the historic climate determines that RH fluctuations depart by less than 10% from the seasonal RH level, the calculated limit is considered unnecessarily strict and can be disregarded.

• The 10% RH threshold can be accepted instead under responsibility of a qualified conservation professional.
• the standard proposes a **mathematical** processing of historic climate records to define a clear **quantitative** target microclimate

• **criteria** for defining tolerable fluctuations should be informed by research or condition surveys

• **± 10%rh** is allowed whatever the historic climate
Heating system installed
Localised heating
Low energy consumption

- total power 12kW
- benches – 7kW, 100W/1 m of a heating element, $T_{\text{max}}$ - 50°C,
- platforms – 5 kW, 300W/1 m² of a heating foil, $T_{\text{max}}$ - 30°C
Monitoring and control
Monitoring and control
Recording and calculating the parameters
Conditions governing the operation of the heating system - initial

- \( RH_{nave} \) and \( RH_{choir} > RH_{30 \text{ day av.}} - \Delta RH \)

- \( \Delta RH = 11\% \)

- Safety precautions
An episode of dry outdoor weather
Conditions governing the operation of the heating system - improved

- $\text{RH}_{\text{nave}}$ and $\text{RH}_{\text{choir}} > \text{RH}_{30 \text{ day av.}} - 11\%$

and

- $\Delta \text{RH}_{\text{nave}}$ and $\Delta \text{RH}_{\text{choir}}$ in 1.5 hour less than 2%
Warning! The harmlessness of the pre-existing climatic conditions has been a key assumption in the approach.
Harmful aspect of the historic climate - condensation events on the ceiling
Condensation events – when?

![Graph showing mixing ratio over time with New Year events highlighted.](image-url)
IR heating of the ceiling
Conditions governing the operation of the ceiling heating

The control is independent for the nave and the choir:

\[ T_{\text{surface}} > \text{Dew Point} + 0.75^\circ\text{C} \]

(hysteresis 0.25 °C)
Capacity of IR heaters

Heating rate of the ceiling: $1^\circ\text{C} / \text{hour}$
The system has prevented the episodes of condensation
Conclusions

- Programmable criteria to control the active systems (like heating) in historic buildings and museums can be derived from historic climate

- A standard can be a useful guide to procedures in such process

- If the historic climate is harmful, for whatever reason, studies and measures must be undertaken