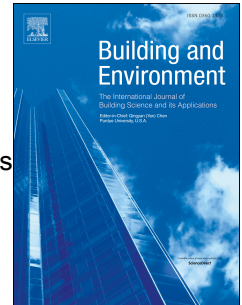


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Stressing the passive behavior of a Passivhaus: an evidence-based scenario analysis for a Mediterranean case study

Vincenzo Costanzo^{*1}, Kristian Fabbri², Stefano Piraccini^{2,3}

*corresponding author: v.costanzo@reading.ac.uk. Tel: +44 1183787379

¹School of the Built Environment, University of Reading, Reading (UK), RG1 5DU

²Department of Architecture, University of Bologna, 40126 Bologna (Italy)

³Studio Piraccini Architettura sostenibile a consumo zero, 47521 Cesena (Italy)

Abstract

This paper first reports the outcomes of a one-year measurement campaign of a passive house built in the Mediterranean climate of Cesena (Italy) in terms of thermal comfort parameters temperature and relative humidity and Indoor Environmental Quality (IEQ) parameter CO₂ concentrations. The design carried out with the help of the steady state Passive House Planning Package (PHPP) was able to guarantee good comfort conditions during the heating period, but on the other hand, overheating occurrences during the cooling season have been recorded for almost 50% time according to EN 15251 Standard. Further analyses conducted with the help of dynamic simulations in EnergyPlus allowed identifying the insulation levels and ventilation mode as the key design factors to change in order to reduce overheating to less than 20% of time while keeping a comfortable indoor environment in winter.

The simplifications that can be made by reducing the insulation material thickness (up to a third of the original value) on the roof and on the walls, replacing triple-glazed windows with double-glazed windows and implementing a hybrid ventilation strategy instead of using Mechanical Ventilation with Heat Recovery (MVHR) alone could also lead to economic savings. These savings, due to both lower construction costs and operational energy savings, amount to 8755 euros in terms of Net Present Value (NPV) over 30 years' time.

The Passivhaus Standard can still be regarded as a good reference for designing low-energy and comfortable houses in a Mediterranean climate if some simplifications are made according to detailed building performance simulations.

Keywords: passive house, thermal comfort, indoor environmental quality, monitoring campaign, dynamic simulation, scenario analysis

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