Thermal performance of the new bioclimatic hall of the historical hospital in Florence.

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Abstract

The main aim of the present work is the study of the energy performances of the new hall of the Old *St.Maria Nuova* Hospital in the center of Florence (Italy). In particular this study aims to evaluate thermal, energy and environmental performances of the refurbishment project for the new hall of the historical hospital and to evaluate the significant reductions of energy consumption obtained. Transient simulations were carried out of the 3D model of the hall to analyse the air flow patterns, distribution and velocity, provided by an existing typical fan-coils air system. The present study highlights the importance of CDF-FEM simulation to predict and analyse the energy and thermal performance of the system (thermal buffer called *hot room*), when experimental measurements cannot be carried out due to high costs and time needed.
Conclusions: We believe that this work can provide important recommendations towards thermal comfort control and careful design and optimization of ventilation in important hall such as of the hospitals. Comsol simulation, that is rather inexpensive compared to monitoring campaigns, is applied to an hall of a historical hospital but could be equally extended to other target mainly connected to building-plant refurbishment and energy retrofitting design. From the analysis on the air flow patterns, air temperature and air velocity distribution we can draw important indications for the best location of openings and particularly for architectural bioclimatic solutions (greenhouses, double glazed façades, ventilated façades etc). Comsol simulation allows to design ventilation strategies, thermal effects on the cooling plant operating conditions but also to indicate the selection of the best type of the air inlet/outlet diffusers in order to minimize the intermixing between the supply air and the air movement in the room due to door opening and closing, in medium-low latitude when climatic stress mainly due to solar radiation is very important.
When the fan-coils system is running, the air flows from the supply vents to the return vents through the conditioned space (i.e., a room). There is always some airflow from each supply vent to all the return vents. Depending on the location of the vents, the airflow paths and amount of airflow can vary. When there is disruption to the airflow, there is a change in the static pressure in the air handler as a result of the resistance in the airflow. Depending on the location of return vents, a disruption in airflow can cause a more persistent change in the overall static pressure, such as from a direct blockage of a return vent. In a home, one contributor to this airflow disruption is doorways, where airflow can either be disrupted by the closing or opening of a door or the partial blockage of an adult passing through the threshold. Sometimes, an individual may even feel the "resistance" from the airflow when trying to open a door. Applying CFD methods, GL is able to compare alternative designs and provide consultation on qualitative questions concerning air ventilation systems by volume flow variations.