

## THE EFFECT OF VENTILATION ON THE INDOOR ENVIRONMENT QUALITY IN A NATURAL VENTILATED OFFICE BUILDING, A CASE STUDY

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### EXTENDED ABSTRACT

During the last two decades, the scientific community appreciated the significance of indoor environmental quality (IEQ) in buildings. At the same time it faced the fact that some of the goals in that aspect could not be met, mainly as a result of the prevailing poor indoor air quality (IAQ) conditions. Since the early 1980's IEQ has, therefore, become one of the major concerns in the area of building physics. Ventilation is an important tool for securing a good indoor climate and IAQ. In buildings without central ventilation and air conditioning systems, which are in most European countries the majority, natural ventilation is the only possible approach for achieving indoor thermal comfort and for complying with IAQ requirements. A series of experiments carried out by the authors confirmed the role of ventilation, due to its impact on the carbon dioxide (CO<sub>2</sub>) concentrations.

This study focuses on two parameters that determine the IEQ, the thermal comfort and the IAQ in a naturally ventilated office building in an urban area. Indoor and outdoor temperatures as well as relative humidity were monitored, as these are two of the main parameters that determine thermal comfort conditions. CO<sub>2</sub> was monitored, as it is often used as an indicator for the effectiveness of ventilation, together with particulate matter bigger than or equal to 0.5 and to 5 microns aerodynamic diameter, which is considered as a major air pollutant. A questionnaire was handed out to the employees to track their behavioral patterns with respect to ventilation, to their activities and to smoking and also to estimate their apprehension of the indoor environmental conditions. The measurements confirmed the occupants' dissatisfaction with respect to IEQ. As far as thermal comfort is concerned the fluctuations' range of temperature and sometimes of relative humidity exceeded the limits that the thermal comfort standards foresee. A vital outcome is that either single side or cross natural ventilation seem to be ineffective to control relative humidity levels, which were low enough and sometimes lead to thermal discomfort during the heating period. As far as IAQ is concerned, the average CO<sub>2</sub> concentrations were generally below the limits set by contemporary standards, though on some occasions high values were monitored. Natural ventilation plays an important role in reducing the CO<sub>2</sub> concentration and, moreover, cross ventilation was proven to be more efficient than single sided ventilation. With respect to particle concentration the results indicated that natural ventilation can have a considerable impact on the particle levels in the building's interior. The results of this study are discussed in detail in this paper.

**Key words:** Natural ventilation, single sided ventilation, cross ventilation, indoor air quality, thermal comfort, temperature, relative humidity, carbon dioxide, particles