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# Investigation of the relationship between the allowable transparent area, thermal mass and air change rate in buildings

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## Abstract

In recent years, because of the high heat loads during the summer period and increased comfort needs of occupants, the energy used for the air conditioning of buildings has increased in most European countries. Choosing circumspectly the building materials and the transparent areas on the facades, proper indoor thermal conditions can be assured without cooling the fresh air. However, in this case the ventilated air flow has to be controlled properly. The aim of our research was to investigate the effects of thermal mass and air change rate on the allowable transparent area for different orientations of facades. Measurements were performed in a special rotating laboratory to determine the relation between thermal mass, incident radiation and indoor temperature. The incident solar radiation was determined for vertical surfaces using the measured global radiation data from 2009–2013. Measurements were carried out to determine the effect of stored heat on the internal air temperature excluding the effect of air change rate and solar radiation. Using the methodology given by standard EN ISO 13790, the allowable transparent area was determined assuming different building materials and air change rates. Based on calculations effectuated on 688 building models, it was proved that there is a linear relation between allowable transparent area and air change rate.

## Keywords

air change rate, building materials, solar gains, thermal comfort, thermal mass

## 1. Introduction

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