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

Imre Csáky, Ferenc Kalmár

www.elsevier.com/locate/jobe

PII: S2352-7102(17)30084-0
DOI: http://dx.doi.org/10.1016/j.jobe.2017.05.002
Reference: JOBE259

To appear in: *Journal of Building Engineering*

Received date: 10 February 2017
Revised date: 2 May 2017
Accepted date: 2 May 2017

Cite this article as: Imre Csáky and Ferenc Kalmár, Investigation of th relationship between the allowable transparent area, thermal mass and air chang rate in buildings, *Journal of Building Engineering* http://dx.doi.org/10.1016/j.jobe.2017.05.002

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

Imre Csáky, Ferenc Kalmár*

University of Debrecen, Faculty of Engineering, 4028 Debrecen, Ótemető u. 2-4, Hungary

imrecsaky@eng.unideb.hu

fkalmar@eng.unideb.hu

*Corresponding author. Tel: +36 52 415155; Fax: +36 52 418643

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