



Aalborg Universitet

AALBORG UNIVERSITY
DENMARK

Measurement of Air Flow Rate in a Naturally Ventilated Double Skin Facade

Kalyanova, Olena; Jensen, Rasmus Lund; Heiselberg, Per

Published in:
Proceedings of Roomvent 2007

Publication date:
2007

Document Version
Publisher's PDF, also known as Version of record

[Link to publication from Aalborg University](#)

Citation for published version (APA):
Kalyanova, O., Jensen, R. L., & Heiselberg, P. (2007). Measurement of Air Flow Rate in a Naturally Ventilated Double Skin Facade. In O. Seppänen, & J. Säteri (Eds.), *Proceedings of Roomvent 2007: Helsinki 13-15 June 2007 : Abstract Book* (pp. 238). FINVAC ry.

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- ? Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- ? You may not further distribute the material or use it for any profit-making activity or commercial gain
- ? You may freely distribute the URL identifying the publication in the public portal ?

Take down policy

If you believe that this document breaches copyright please contact us at vbn@aub.aau.dk providing details, and we will remove access to the work immediately and investigate your claim.

Measurement of air flow rate in a naturally ventilated double skin facade

Olena Kalyanova, Rasmus Lund Jensen, Per Heiselberg

Department of Civil Engineering, Aalborg University, Aalborg, Denmark

Corresponding email: ok@civil.aau.dk

1 Introduction

Air flow rate in a naturally ventilated space is extremely difficult to measure due to the stochastic nature of the wind, and as a consequence non-uniform and dynamic flow conditions. Moreover, the air flow rate in a naturally ventilated cavity of a double skin facade may have significant variation in order of magnitude and occurrence of reverse flow.

This paper describes three different methods to measure the air flow in a full-scale outdoor test facility with a naturally ventilated double skin facade.

2 Methods

In the first method the air flow in the cavity is estimated on the basis of measured velocity profiles, which are measured in a number of horizontal planes equipped with 46 hot-sphere anemometers in total. The second method is represented by constant injection of CO₂ tracer gas in the lower part of the facade and measurement of the CO₂ – concentration in the upper part of the facade. In the third method a measured relation in the laboratory between pressure difference across the opening and the air flow rate is used to estimate the flow rate on the basis of continues measurement of the pressure difference between the surface pressure at the opening and inside pressure of the double skin facade.

3 Results

The airflow measured in the naturally ventilated cavity in external air curtain mode show reasonable agreement between the velocity profile and tracer gas method (Table 1). The pressure difference method, in this case, shows poor results.

Table 1. Mean measured air flow in external air curtain mode.

Method	Mean measured flow, m ³ /h
Tracer gas	1011
Velocity profile	1007

Improved performance of the pressure method is observed when the double facade cavity is mechanically ventilated (preheating mode) and results show correspondence with the tracer gas method.

4 Conclusions

The tracer gas method as well as the velocity profile method are very sensitive to the flow direction in the cavity and can be applied within a number of limitations.

Due to the repeatedly changing shape of the velocity profile in the cavity, the number of measurement points within the velocity profile and measurement frequency is very essential for the measurement accuracy.

Partial success of the pressure difference method argues for further investigation as the method is very sensitive to the positioning of the surface pressure and reference measurement, to the fluctuations in wind direction and wind speed.

Although all three measurement methods are difficult to use under such dynamic air flow conditions, have sources of error and compared to laboratory conditions have relatively large uncertainties, the results show reasonable agreement and can be used for experimental validation of numerical models of natural ventilation air flow.