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Estimation of Air Leakage in High-Rise Residential Buildings.

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ABSTRACT

Both infiltration and exfiltration has a predominant influence on the space heating requirements in cold climates. Good predictive design methods are required to estimate the air leakage component in buildings. This predictive methods will be useful in implementing the air leakage control strategies for reducing the problems associated with air infiltration in both new and existing high-rise buildings. The objective of this paper is to provide simple analytical methods for quantifying the air infiltration in high-rise buildings, and to present the results of field tests of two high-rise buildings to verify the estimation procedure.

A simplified air infiltration estimation procedure has been developed primarily based on equivalent air leakage area and local net pressure distribution. The pressure difference at a given location depends on the infiltration driving forces (stack, wind and mechanical ventilation) and the characteristics of the opening in the building envelope. A simplified network of air-flow paths can be established using the following information: climate and exposure, building types, building form, building dimensions, surface to volume ratios, shafts, and envelope types, windows and doors, envelope crack lengths, openings, and make-up air strategies. The algebraic sum of air-flow through these paths must always be equalled to zero. By applying the mass balance equation, component of air infiltration which would be occurring during the peak winter condition can be determined. This air-flow is responsible for the space heating load due to uncontrolled infiltration. Any reduction in this infiltration flow should decrease the heating requirements for the building.

The method has been used to predict the infiltration flows and heating loads for two high-rise residential buildings. The field tests have been conducted to verify the predictions of air leakage in these buildings, and also to assess the effects of air-sealing on overall building airtightness, indoor air quality, and power consumption before and after air-sealing.

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