Application Of A Tool To Estimate The Level Of Airtightness Of Residential Buildings

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ABSTRACT

Estimating airtightness is challenging due to variability in influencing factors. Existing models face limitations such as a lack of standardization, sensitivity to construction quality, insufficient representative data, and complexity that reduce their practical utility for designers. This work explores the application of a predictive approach from measured data using Generalized Linear Models (GLIM) that is applicable across diverse construction scenarios. The model incorporates 13 main variables and 4 interaction terms, which explain almost 50% of the variability in airtightness (n_{50}). A typical case study has been chosen in order to show the model's application, making it user-friendly. This example explores the criteria followed for each variable and building characteristics so that the model can be easily extrapolated to other contexts and applied to other cases.

INTRODUCTION

Building envelope airtightness affects energy use and ventilation efficiency. While it is typically measured with pressurization tests, estimation methods are widely used. In such cases, reliable estimations can provide useful insights into energy modeling or support strategic decisions in renovation projects. This is, for example, the case of Spanish building regulations (Ministerio de Vivienda y Agenda Urbana. Gobierno de España 2022), where airtightness testing is not mandatory and reference values obtained by an equation can be used to show compliance with building energy requirements. This equation estimates the air change rate at 50 Pa (n_{50}) based on building dimensions (internal volume, area of the opaque thermal building envelope and area of doors and windows), manufacturer permeability values for doors and windows and reference permeability values for the opaque part of the envelope (new or existing buildings). The accuracy of this model for existing buildings was studied in Poza-Casado et al. 2022 (2022).

Estimating airtightness is complex due to variable and context-dependent factors. Existing models were assessed by Prignon and Van Moeseke (2017) and Poza-Casado et al. (2022). Specific samples used to build models usually hinder the possibility of making them applicable to other contexts. Also, several drawbacks related to the lack of standardization, the

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