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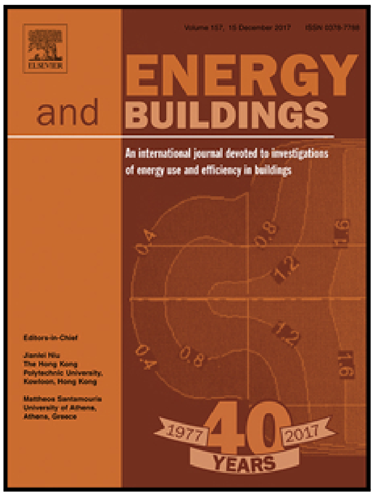

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Comparison of Prediction Tools to Determine their Reliability on Calculating Operational Heating Consumption by Monitoring No-Fines Concrete Dwellings

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Abstract

Nowadays most retrofit decisions are based on reducing CO_2 / heating consumption. The aim of this study was to determine the reliability of three tools (RdSAP, SAP and IES) often used to predict these reductions. Three no-fines concrete (NFC) dwellings (C1, C2, and C3) with similar floor area and construction but different occupants were monitored. Key information about the thermal performance of the fabric; the behaviour of the occupants and the energy consumption was collected before and after 110mm of external wall insulation (EWI) was added. The target was a 30% reduction on energy consumption due to the EWI. However, only C3 decreased it by 30% as expected, C2 only by 14% due to a subtle rebound effect and C1 actually increased consumption by 75%, due to rebound effect.

Steady state tools (RdSAP and SAP) were found to be inaccurate in predicting the operational energy consumption of dwellings, only dynamic performance analysis software (IES) was suitable to carry out this type of prediction accurately. However, this type of software requires highly accurate and detailed information regarding: the baseline performance of the fabric, external weather conditions and, most importantly, accurate pre- and post- heating operational habits of the occupants. Few retrofitting projects have the resources and time to gather this information. Unless those are available, the retrofit decisions should be based in a different criteria, rather than using inaccurate SAP or RdSAP energy consumption predictions.

The coefficient of heat loss of the fabric of a dwelling is independent of the occupants. SAP was found quick to calculate reasonable predictions of the coefficient, by using accurate fabric data, and to show the impact of different factors on the heat loss of the fabric. Therefore, it could be claimed that the coefficient of heat loss of the fabric is a suitable alternative criteria to make pre-retrofit decisions.

Keywords:
Standard Assessment Procedure (SAP); Reduced Data SAP (RdSAP); Integrated Environmental Solutions (IES); Building Performance Evaluation; Operational Energy Consumption; No-fines concrete; Social housing; Energy loss; Fuel poverty; Heating energy consumption; Retrofitting; External wall insulation;

1. Introduction

In the last decade, research and policy have moved towards reducing CO_2 emissions and improving the building stock to reduce its impact on climate change. Uninsulated solid walls, like those made from NFC, contribute a large proportion of domestic CO_2 emissions due to their poor thermal performance. No-fines concrete (NFC) was a construction method for mass-production of low-rise dwellings at a low cost. Around 300,000 NFC houses were built in the UK between 1940s and 1980s (Ross, 2002). Although this research is based in the UK, NFC was extensively used for housing in South Africa (Bekker, C. 1998), the Middle East, West Africa and countries like Venezuela or Hungary (Moss, 1979). Therefore, some of the findings will also have a global impact.

The thermal transmittance of NFC walls is far from the backstop of 0.30 W/m²K required by current Part L1 for England (DCLG, 2013), making these dwellings expensive to run (Williams and Ward, 1991). In addition, more than 45% of all fuel-poor households live in solid wall properties, most of them uninsulated (Platt and Rosenow, 2014). Therefore, the report by the Centre for Sustainable Energy (2005) argues that in the current context NFC is not thermally efficient anymore,