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An investigation into how Energy Performance Certificate variables relate to damp

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Abstract

Excess dampness and mould can lead to poor indoor air quality, building damage, and negative health impacts for occupants. This study investigates several Energy Performance Certificate (EPC) variables such as efficiency rating, building type, and wall types and their relationships to damp issues. An EPC gives a property an energy efficiency rating from A (most efficient) to G (least efficient) and is valid for 10 years. 859 homes in England's housing stock were analysed, and a significant relationship was found between wall types and damp levels. The result of this study will help in the management of damp issues and the prediction of risky homes.

Peer-review under the responsibility of the organizing committee of the ICMB23.

Keywords: Damp; Mould; EPC; Indoor quality; Building fabric

1. Introduction/Background

Indoor dampness/mould has been widely reported in many countries, regions, and climate zones. The World Health Organization (WHO) estimates that 10-50% of indoor environments in Europe are damp [1]. In 2020, the English Housing Survey reported 897,000 homes likely have dampness, representing 3% of the UK housing stock [2]. Furthermore, damp problems are very common in homes that are not heated adequately due to fuel poverty [3]. This is a problem, as moisture can deteriorate building materials in physical, mechanical, chemical, and biological ways, affecting structural durability, building-scale energy efficiency, indoor environmental quality, and occupant health [4]– [6]. Damp and mould growth is the result of a complex interaction of poor ventilation, irregular heating, poor thermal properties of external walls, and high moisture generation by occupants' indoor activities [7]. The sources of moisture in buildings are numerous, including water used in construction; groundwater; flooding and rainwater penetration; pipe leakage; and moisture production by occupants' indoor activities such as cooking, washing, drying, and breathing [8]. The purpose of this research was to investigate some of the building characteristics and their relations in terms of damp issues. As well as identifying the defective locations, and possible damp causes in UK homes.

2. Method

Data was collected on 859 properties in England's housing stock. These data were obtained from a housing association and represented homes in which a disrepair job had been lodged. The disrepair job could be due to dampness/mould but could also be due to other issues in the building. Surveyors from the housing association visited the homes to gather data on the required repairs. Where applicable, they took photos of the damage. 308 homes out of 859 were reported as damp homes. The surveyor's notes and photographs were manually read to identify the defective locations and likely damp causes of those case studies. Following that, the main building characteristics of those case studies were extracted from the national EPC database. The data associated with each building, therefore, included EPC data, surveyors' reports, and indoor photos of damp properties. The statistical programming language “R” was used to analyse the incidence and cause of dampness across these variables. The count of damp properties across different variables was analysed with chi-squared tests to check for statistical significance. The data collection and analysis process took place from October 2021 to October 2022

3. Result and discussion

Figure 1 shows the percentage of defective locations per each wall type. The most defective locations are the bathroom and kitchen. Furthermore, multiple locations, which are regarded to have more than one defective room, are common. Figure 1 further shows that the worst wall types for dampness are uninsulated solid walls and, surprisingly, as-built insulated cavity and insulated timber walls. It is especially intriguing that the as-built cavity insulation has a stronger correlation with dampness than retro-filled cavity insulation. It is not apparent from the data why this may be. One potential reason is that, because as-built insulated cavities will tend to reflect newer properties, they may also have reduced ventilation compared to the older homes. Figure 2 shows the percentage of possible damp sources in damp homes per each wall type. Condensation is the most common cause, with leakage coming in second. The increased levels of dampness in as-built insulated cavities seem to be driven by condensation dampness. This, therefore, adds further evidence to ventilation is one of the contributors. An alternative explanation could be that flaws in either the EPC assessment process or the EPC software itself, are causing some incorrect identifications of as-built insulated cavities. As researches find that at least 27% of all EPCs lodged between 2008

and 2016 have a discrepancy which indicates an error has been made[9]. This study further looked for a relationship between dampness, EPC rating, and building type. No significant relationship was found between these variables. This may be due to the sample being too small, rather than the non-existence of a relationship. However, a relationship between wall types and the damp level was found.

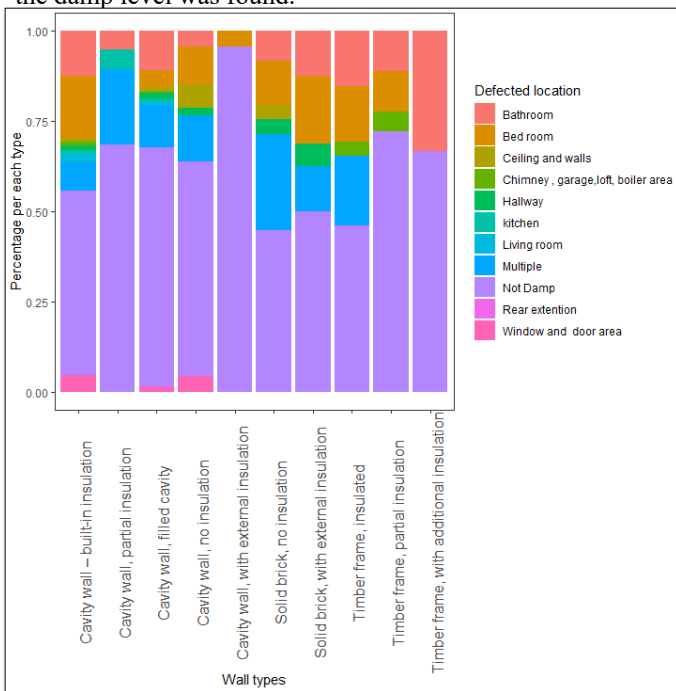


Figure 1. Percentage of defected location per each wall type

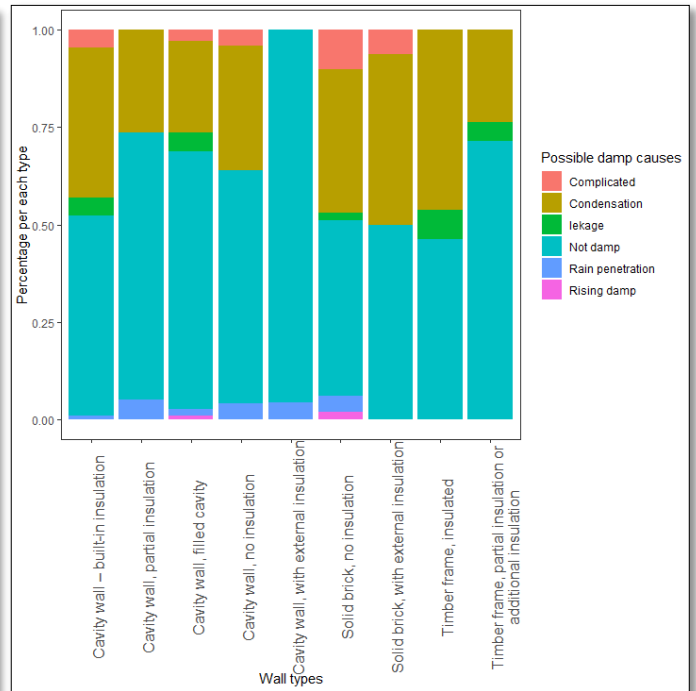


Figure 2. Percentage of damp causes per each wall type

Conclusion

This study looks at many EPC characteristics, such as energy rating, building type, and wall type, and how these relate to dampness in 859 dwellings. The results found no significant link between dampness and either building type or EPC energy rating. However, a relationship between wall types and the damp level was found. Interestingly, the results suggest some as-built insulated walls have higher levels of dampness than retrofit walls. Further work is planned into why this might be, along with a more sophisticated analysis to identify dampness from EPC variables.

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