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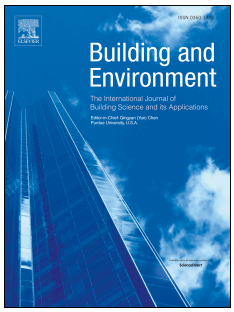

Thermal and moisture monitoring of an internally insulated historic brick wall

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Thermal and moisture monitoring of an internally insulated historic brick wall

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Abstract

Internally insulating walls is an effective method of energy retrofitting buildings. However insulation changes the hygric behaviour of a wall and can increase the risk of wall decay by moisture accumulation. This paper investigates thermal and moisture behaviour of internal insulations applied to a brick wall over a two and a half year period with probes positioned near the interface between the leveling plaster and brick wall.

The in-situ performance of the insulations agrees with their laboratory measured thermal and moisture properties. It is consistently evidenced that the vapour permeability of the insulation has a large impact on the wall moisture. Walls with vapour permeable insulations closely reflect internal room relative humidity (RH) conditions and show the greatest response and the shortest lag time in reflecting changes in room RH. Conversely, the walls with low vapour permeable insulations display lower RH fluctuations and longer lag periods as moisture movement is impeded. There is a reduction in the wall's RH for all insulations when room heating is applied with the walls with vapour permeable insulations showing the largest reduction in RH due to wall moisture drying and raising wall temperatures while the less vapour permeable insulation lowered RH mostly on account of rising wall temperatures. The results suggest that vapour permeable insulations are suitable in moisture environments with periods of low RH that provide the wall with an opportunity to dry. The thermal performance of an insulation must be counterbalanced against moisture performance and the resultant longterm durability of the building.

Thermal and moisture measurement; solid brick wall; internal insulation; vapour permeability.

1. Introduction

The building sector accounts for 40% of energy consumption and 36% of the total carbon emissions in the European Union [1]. European policy such as the 2030 European climate and energy framework targets to reduce greenhouse emission and improve energy efficiency. In this context of environmental damage and legislative obligation, it is essential to reduce building energy consumption. Retrofitting insulation to existing buildings can lower energy requirements reducing both emissions and energy consumption. This has been recognised by the EU and several legislative initiatives have been introduced for renovation and improving the energy performance of buildings.

Historic buildings (predating c.1940) form a large proportion of the existing building stock of most European cities. Historic buildings in Ireland (and commonly in Europe) have solid brick or stone walls. Thermally upgrading these buildings should yield good improvements as they were constructed prior to the introduction of regulations relating to the conservation of fuel and energy. Internal insulation can impact on the character of an historic building by altering room proportions and through the removal of plasterwork and joinery to accommodate it but it is typically considered the least invasive option for upgrading historic walls. Most importantly the application of internal thermal insulation increases the risk of moisture accumulation within the wall with the consequent structural and material decay [2]. High moisture levels in walls can result in frost and salt damage, distortion of structural elements, decay and corrosion of embedded timber and metal elements and material loss by dissolution along with problems such as mould growth, staining and poor internal environment. The Sustainable Traditional Buildings Alliance's (STBA) report on the responsible