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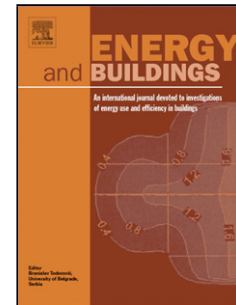
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Authors: Ana Brás, Paulina Faria

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Effectiveness of mortars composition on the embodied carbon long-term impact

Ana Brás¹ and Paulina Faria²

¹Built Environment and Sustainable Technologies (BEST) Research Institute, Department of Built Environment, Liverpool John Moores University, UK

²CERIS and Department of Civil Engineering, Universidade NOVA de Lisboa, Portugal

Abstract:

Refurbishment activities represent more than 17% of the saving potential of the EU up to 2050. However, studies on buildings structure and finishing repair of rendering mortars using LCA are still lacking. An innovative design approach is required to drive the minimisation of embodied carbon using objective performance information of buildings behaviour. This research work is focused on the repair of rendering mortars and intends to demonstrate that the choice of mortars for buildings affects the maintenance actions needed and can increase the construction environment liability and embodied carbon expenditure. A new leaching risk analysis combined with LCA of different mortars composition (cement and lime based) was implemented enabling to predict the longevity of the rendering and the embodied carbon expenditure on 20th century buildings. It is demonstrated that some mortars may have a higher impact at the outset, such as cement-based mortars, but result in a much lower impact across the building service life. The embodied carbon of repair actions of mortars similar to OPC are expected to reduce the environmental impact of rendering repair actions at least in 10 times in comparison to less hydraulic mortars.

Keywords: performance based-design; embodied carbon expenditure; rendering mortars; LCA

1. Introduction

40% of the total energy consumption in the EU is consumed by the buildings. The rate of new construction will remain generally low and the existing buildings will be working for the next 30 years. The oil crisis forced the implementation of buildings energy saving measures and in a near future, they shall be nearly zero-energy consumption buildings. However, the slow renewal rate of the buildings makes vital their rehabilitation.

Currently only at 1.2% of the European building stock is renovated per year, meaning that the biggest challenge reducing energy use in buildings is to increase the rate, quality and effectiveness of building renovation. To do this it is necessary to reduce the costs and to increase the speed to minimise disturbance for occupiers and city users – highly associated with the effectiveness of maintenance actions. To achieve an ambitious increase of the renovation rate (up to 2 - 3 % per year until 2030, according to the European Performance Building Directive (EPBD)), effective solutions need to be extensively demonstrated and replicated [1,2].

Regarding the high levels of carbon dioxide in the atmosphere, the European Commission target is to reduce the CO₂ emissions by 90% for the building sector by the year 2050 [3]. This would mean retrofitting 80% of the 25 billion m² of the current useful floor space in EU-27, Switzerland and Norway around the European territory [4]. Therefore, it is demonstrated that the renovation of buildings has a high capacity to influence the environmental impacts and global objectives of climate change mitigation. In fact, the refurbishment of existing buildings represents more than 17% of the saving potential of the EU up to 2050 [4].

From a rehabilitation point of view, the energy requirements for buildings is obviously a function not only of the users and standards/regulations requirements, but also a function of each building rehabilitation technique used. Special attention must be paid to the environmental impact of each constructive solution

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