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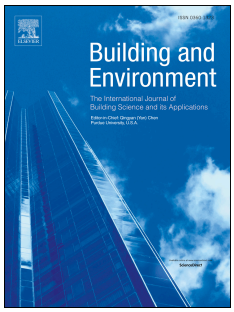

Hygrothermal assessment of internally added thermal insulation on external brick walls in Swedish multifamily buildings

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Hygrothermal assessment of internally added thermal insulation on external brick walls in Swedish multifamily buildings

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Abstract

To renovate efficiently and properly we must understand the behavior of existing buildings and thereby building materials. An analysis of hygrothermal measurements in two case studies, one with and one without an internally added thermal insulation system, identifies critical factors for further assessment through simulations. This leads to validation of a hygrothermal simulation model of a solid brick masonry wall, which is used for further assessment of different types of internally added thermal insulation systems. Assessment of mold risks based on a *mold resistance design* model (MRD-model) shows that the risk for mold growth with all internally added thermal insulation systems is significant with regards to solar driven vapor from the exterior, if biological material is present in two critical points: 1) the boundary between the thermal insulation and the existing masonry wall, and 2) the boundary between the thermal insulation and the exterior surface of an internally added vapor barrier. Furthermore, assessments of corrosion risks are conducted for two critical placements of the bed-joint reinforcement. For the corrosion risk at 30 mm from the exterior surface, capillary-active vapor-open systems can improve the situation in comparison to no thermal insulation at all while other systems increase the corrosion risk. For the corrosion risk at 90 mm from the exterior surface, all thermal insulation systems increase the corrosion risk. The exclusion of precipitation uptake eliminates all risks, showing that this is the most crucial factor. Solutions that limit this uptake or increase the dry-out rate should therefore be considered beneficial.

Key words: hygrothermal, insulation, masonry, brick, renovation, moisture.

1 Introduction

To renovate efficiently and properly we must understand the behavior of existing buildings and thereby building materials. Status determinations should therefore be used as pointers for decisions on renovation measures. Such status determinations can be conducted through measurements. However, sometimes the impact of a renovation measure cannot be determined through measurements but requires other methods, such as simulations. If we expect simulations to accurately describe the situation at hand, accurate input data is needed as well as validated models. What is also needed are guidelines for evaluation methods based on simulations should be developed.

If the purpose of a simulation is to determine risks with the application of a renovation measure the simulation should be based on a *use case* scenario. In this paper, an analysis on such scenario analyzes the robustness of a proposed renovation measure. This, through the use of a combination of factors that produce a less-than-beneficial situation based on the posed risks. However, for realistically applicable results, the modelling of the renovation measure should be based on a realistically applicable design, and factors affecting the outcome should be chosen as realistically as possible. Deeper analysis of in-