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STRAW BALE CONSTRUCTIONS: LABORATORY, IN FIELD AND NUMERICAL ASSESSMENT OF ENERGY AND ENVIRONMENTAL PERFORMANCE

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ABSTRACT

The use of straw in buildings has been common since the ancient times, but only at the beginning of the twentieth century, house made of straw bales were built in Nebraska. After a period of abandon, due mainly to the spread of Portland concrete, this building technique has gained a new attention in the last decades, at least in a niche sector of self-builders. Indeed, the main issue that an engineer or an architect must face when he/she decides to build a straw bale house is the absence of certain data about the various technical performance. The aim of the present paper is to investigate a straw bale wall, both in laboratory and in situ, and to perform a Life Cycle Assessment to identify strong and weak points of this building technique. After a section reporting the state of the art of the main features of straw bale constructions, including the most important physical parameters that affect durability and indoor comfort conditions, the paper reports the results of laboratory measurements aimed at assessing the sound absorption coefficient with an impedance tube and thermal conductivity with a guarded hot plate apparatus. Then, results of in-situ measurements of thermal and sound insulation are reported. Data show that in winter (steady-state) conditions the investigated wall offers adequate thermal insulation, but the lightness of the structure can be detrimental for the summer (unsteady-state) season, leading to possible overheating in warm climates. Furthermore, the sound insulation is limited by the lightness of the structure. Finally, the Life Cycle Assessment demonstrates that the use of straw bales in walls is capable of reducing the energy and carbon embodied in the building.

KEYWORDS

Sustainable building; straw bales; thermal insulation; sound insulation; Life Cycle Assessment; embodied energy.