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Building with Straw Bales as a Low-Tech Solution

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Introduction

Low-tech technologies that draw on the tradition of building with organic and unprocessed materials are gaining popularity. Constructions made of straw bales are one such technology. The use of straw bales as wall filling in a timber-frame structure is demonstrated in this paper. The small, year-round single-family home is in the northern part of Poland. It is possible to draw the conclusion, based on the available literature and experimental studies, that the straw bale technology poses a number of potential threats in relation to the chosen technology, the standard of workmanship and the climate. The building's airtightness, heat transfer coefficient U and analysis of straw wall humidity are all described in the article. The findings of the study confirm the dangers posed by the building's low airtightness and the possibility of water vapour condensation in the external partitions. Since the 20th century, there has been a growing interest in building with on-site technologies using materials that are available locally and have not been processed, often agricultural waste. Thermal insulation made from plant fibers, buildings constructed from rammed earth, hemp concrete and sheep's wool and straw are some examples. Since the horse-powered agricultural baler's invention, straw bales have been used in construction. Unusual construction procedures (like prepping straw bales on the spot), uncertainty regarding the repeatability of physical parameters, biological corrosion risk, fire risk and animal pests that live in the building are all associated with the use of this kind of material.

Description

Straw is a side-effect of horticulture and is utilized in different ways destroyed and left on the field, it is a phenomenal wellspring of humus. It is likewise utilized as a substrate in creature farming, as an item for mushroom bedding makers, lastly, for consuming for energy. Huge quantities of straw hit the market each year following harvest. This kind of building is also being built in Poland, but there are only a few of them compared to other countries. Since the Polish government does not keep statistics on the construction of straw bale homes, it is not known how many have been constructed. The French RFCP or the Austrian ASBN is two examples of associations in Europe that are enthusiastic about straw building. These associations promote the technology and bring people who are interested in building straw houses together. Technical research on straw components is carried out with the assistance of these and similar organizations. Additionally, the organizations are working to develop technical specifications for straw and straw-building products and to regulate this sector of the construction industry. The Ogólnopolskie Stowarzyszenie budownictwa natural ego (OSBN) and the Foundation Cohabitate are examples of such organizations in Poland. Laws pertaining to the construction of straw bales have not been regulated in Poland [1-3].

Both load-bearing and non-structural thermal insulation (structural infill) applications exist for straw bales. The second option is preferable because it allows for significant preservation of structural timber. A non-load-bearing straw bale building will be the subject of this investigation. It is necessary to carry out a projected energy performance when designing the building and selecting the heating installations. The heat transfer coefficient is one of the input elements. As a result, it is critical to accurately determine this parameter during the design phase. Different coefficients of thermal conductivity can be achieved with compressed straw. The type of grain, the arrangement of the stalks along heat fluxes and compression all have an impact on this factor. Thermal conductivity decreases with density until it reaches a certain point, when it stabilizes and then begins to rise. Based on various authors' publications, the thermal conductivity coefficients of straw bales are summarized below. A study of a straw bale-constructed residential building reveals a number of dangers. The first is not meeting the assumed energy standard based on energy performance calculations, of which the heat transfer coefficient U of external walls is one of the most crucial aspects. The result, which was lower than expected, may have been due, among other things, to the building's inadequate airtightness. Therefore, it is recommended to carry out the test once more in wind-free conditions after the building has been resealed and with more stable thermal conditions inside. An early test of this kind is planned. It's possible that each of these factors will have an impact on the others. For instance, a wall's lack of airtightness may result in increased humidity and water condensation. Conversely, an increase in humidity lowers the thermal conductivity coefficient, which raises the likelihood of condensation. Making internal plasters with increased diffusion resistance, such as clay plasters with linseed varnish or lime plasters, as well as good ventilation inside (which allows for low relative humidity of the internal air) are all ways to avoid this risk. A ventilated façade should shield exterior plasters, like clay plasters, with low diffusion resistance from precipitation. Installing a weather station is a good idea for determining the wind's direction and strength. Because the building is on a hill, a weather station will make it easier to understand the measurements [4,5].

Conclusion

Despite these drawbacks, living in this building is extremely comfortable. Additionally, using natural materials with a low carbon footprint, like straw, is unquestionably good for the environment. The details of straw bale buildings vary across the globe. The parameters of the finished product-straw bales may vary slightly depending on the location of grain crops, the climate that year and the harvesting and compression method. Additionally, a variety of building construction methods, such as the use of unskilled labor and various forms of clay plastering, may influence the outlined parameters. Environment contrasts in which the structure is utilized are one more component influencing the boundaries of the structure. Sadly, the literature on straw buildings in cooler northern hemisphere climates only contains a small database. The author hopes that the above work will add new value to this area of research for these reasons.

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