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Trombe Wall Application with Heat Storage Tank

Kıvanç Topçuoğlu [a *]

[a] *Building Inspection Programme, Construction Department, Muğla Sıtkı Koçman University, Muğla 48000, Turkey.*

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Abstract

In this study, an investigation was made of the performance of a Trombe wall of classical structure used together with a heat store. Most Trombe walls are able to supply the heating needs of a space to which they are connected without the need for extra heating at times when the sun is shining. However, the heat obtained from the Trombe wall can be in excess of needs at such times, and measures must be taken to provide ventilation to the heated space. It is thought that the heat energy can be used more efficiently and productively by storing the excess heat outside the building and using it inside the building when there is no sunlight. To this purpose, a tank full of water and marble was built as a heat store as an alternative to the general Trombe wall design, and an attempt was made to minimise heat losses by burying it in the ground. It was concluded that in place of a traditional Trombe wall system using a massive wall heat store, a heat store could be constructed in a different position and with different materials. The Trombe wall system which was developed and tested met up to 30% of the energy needed for heating and cooling the building, and reduced the architectural and static disadvantages of Trombe wall systems. As a result of the study, it was seen that where a standard reinforced concrete wall could supply heat to the inside for 7 hours and 12 minutes, the figure for a wall made of paraffin wax was 8 hours and 55 minutes. In the same study, the heat storage thickness of a reinforced concrete wall was calculated as 20 cm, while that of a paraffin wax wall was calculated as 5 cm.

Keywords: Energy Efficiency; Trombe Wall; Greenhouse; Building Construction Material; Heat Storage.

1. Introduction

Despite the great advantages provided by Trombe walls in reducing heating costs, it is seen that they are little used by the building sector. The reason for this is generally that they do not fit in with the architectural design. However much heat a Trombe wall provides when the sun is shining, it is not able to meet heating needs when there is no sunshine. Attempts have been made to solve this problem by storing the heat obtained during the day using heat-storing walls, water tanks, or black-painted structural elements. The problems of aesthetics and functionality so created in building design have been the main hindrance to the use of Trombe walls.

In the design of the Trombe wall which we present, a water tank filled with pieces of marble is used as a heat store. By burying this water tank in the ground, heat loss is limited, and also the design of the building is made easier. When there is no sun, heat energy stored in the water and marble in the tank when the sun is shining is directed to a panel radiator in the space to be heated by means of a manually started water pump.

In this way, the heating requirements of the room are wholly or partially met when there is no sun by heat energy obtained from the Trombe wall. The rising costs of energy mean that passive systems must be used more in the heating and cooling of buildings. Studies have shown that solar energy systems using passive heating techniques can reduce

* Corresponding author: erdoganmer@itu.edu.tr

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