

Abstract

The Trombe Wall as a Passive Air Conditioning System for Hot Climates [†]

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Abstract: The residential and service sectors are responsible for a large portion of energy demand in modern societies. Therefore, today, buildings are expected to be energy-efficient and environmentally friendly. In this context, bioclimatic architecture and its related systems seem to show a good way to achieve this. A relevant system in this issue is the Trombe wall, under study in the present work. Although this system has been studied and implemented in cold climates (in heating mode), not so many theoretical and experimental studies have examined its operation in hot climates (in ventilation mode). To collaborate in this regard, an air-ventilation Trombe wall prototype was made and analysed, both theoretically and experimentally. The size of the prototype is 1 m height, 0.6 m width and 0.2 m length and it has an outer glass surface with a hole at the top, an air chamber, and an inner insulating panel with a hole at the bottom. These experiments were carried out both under controlled conditions in the laboratory and outside. In this sense, physical and psychrometric behaviour were obtained. As a conclusion, the system produced air currents between 0.2 and 0.4 m/s, improving the feeling of comfort by 3 °C. Thus, it demonstrates its possibility of use as a passive ventilation system. Additionally, both air temperature and speed data trends were fitted by mathematical formulation, which allows the prediction of the behaviour of the Trombe wall under different solar radiation conditions in hot climates.

Keywords: bioclimatic architecture; passive architecture; Trombe wall; energy saving; warm weather; arduino monitoring



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