



# Thermal comfort analysis of fired-clay brick, cement-sand block and cement stabilized earth block masonry house models

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## Abstract

Fired-clay brick, cement-sand block and cement stabilized earth blocks are the most commonly used material for masonry construction in Sri Lanka. Strength, durability and cost are three major factors that influence the selection of material for wall construction. Even though Sri Lanka has a tropical climate, the benefits of insulating the external walls of the house are often not considered. Apart from thermal comfort of the internal environment, there is concern regarding increase in energy consumption. However, in recent years, as awareness of sustainable and green building concepts increased, interest in using sustainable and thermal comfort materials for house construction has increased. Because external walls play a major role in thermal insulation, there is a need to select suitable wall materials that can be energy efficient and reduce cooling load. Therefore, the present study aims to understand thermal comfort in house units constructed with commonly used wall material such as fired brick, cement-sand block and cement stabilized earth block. Temperature and humidity inside and outside house models were observed to compare the impact of masonry materials on thermal comfort. To compare the thermal comfort performance of the house models, three thermal comfort analysis models: steady-state comfort model, adaptive criteria model and deterministic models were used according to the British Standard European Norm (BS EN) 16798, CIBSE TM52 and ANSI/ASHRAE 55. Results show that house units constructed with cement stabilized earth blocks and fired-clay bricks are significantly more comfortable in terms of temperature and humidity variations. Energy-efficient house units thereby minimized energy consumption through reduction in indoor temperature. Therefore the cement stabilized earth block and fired-clay brick house model are found to be a suitable choice for construction.

**Keywords** Masonry · Bricks · Cement-sand blocks · Cement stabilized earth block · Thermal comfort

## Introduction

Nowadays, energy is one of the main aspects that play a vital role in socio-economic development in all countries. The energy consumption of building materials turns out to be an important factor in the determination of the energy efficiency of the construction. In the life-cycle of the construction in every phase, energy consumption happens at different levels. The selection of suitable building material increases energy efficiency of a construction [1].

Heating and cooling of common buildings consume a huge amount of energy. For several countries, the energy consumed to attain thermal comfort of the indoor is observed

to be half the amount of energy generated. Applying thermal insulation to the wall or selecting energy-efficient wall materials are few techniques to reduce indoor air temperature naturally [2]. In addition, this can also reduce the cost of cooling of indoor space, energy consumption and as a result reduce pollution of the environment [3]. Engineers, architects, planners and other responsible people consider better ways to reduce energy usage in buildings and especially in residential house units. By use of proper materials for masonry walls in a building with proper techniques, the energy consumption of a building can be minimized [4]. Generally, the masonry unit type used for the construction predominantly influences the thermal condition inside the building.

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