PASSIVE TECHNIQUES FOR ENERGY EFFICIENCY OF BUILDINGS IN SRI LANKA

THESIS SUBMITTED TO THE DEPARTMENT OF CIVIL ENGINEERING IN FULFILMENT OF THE REQUIREMENT FOR THE DEGREE OF
Master of Philosophy

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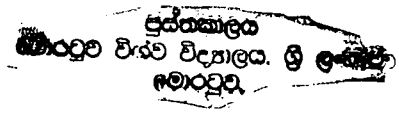

DEPARTMENT OF CIVIL ENGINEERING

UNIVERSITY OF MORATUWA

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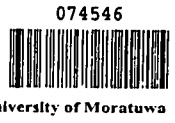

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Declaration

I, Asitha Indika Jayawardena, hereby declare that the content of the thesis is the original work carried out over a period of 2 ½ years at the Department of Civil Engineering, University of Moratuwa. Whenever others' work is included in this thesis, it is appropriately acknowledged as a reference.

Abstract

Rising demand for electricity is a major contributory factor to the energy crisis that Sri Lanka is now facing. One potential candidate for energy conservation is the domestic sector. By way of adopting an environment-friendly solution (i.e. a passive solution), there remains a potential to achieve indoor thermal comfort in houses, thus reducing, or sometimes even totally eliminating, the need for active means such as fans.

The main objective of this study is to conserve electricity in the domestic sector of Sri Lanka, by developing a set of guidelines for the achievement of indoor thermal comfort at houses in the low altitudes of Sri Lanka through passive means, which are energy-efficient and environment-friendly.

In order to achieve the above objective, the following methodology was adopted in the study. A comprehensive literature survey was conducted to determine the passive concepts and techniques desirable to warm humid climatic conditions prevailing in the low altitudes of Sri Lanka. Then, in order to identify the undesirable features of the building envelope with respect to thermal comfort and the indoor temperatures that occur in reality, a series of thermal and comfort surveys was conducted at several existing buildings, mostly houses. In order to identify the current situation with respect to thermal comfort and their preferences which would be crucial in developing a solution, a pilot questionnaire survey was conducted among a group of adults. A series of computer simulations was carried out using the software DEROB-LTH on a simple model to determine the effect of various features of the buildings envelope on indoor thermal comfort since such simulation software is quite good in predicting the trends.

Using the findings of the literature survey and the results of thermal surveys, comfort surveys and computer simulations, a comprehensive set of desirable and undesirable features with respect to indoor thermal comfort was prepared. Incorporating desirable features and eliminating the undesirable ones whenever possible, a set of conceptual house plans of various floor areas and catering to the requirements identified from the questionnaire survey, was developed. A set of land subdivision guidelines suitable to develop a passive housing scheme was developed, highlighting the need for an integrated approach for energy conservation. In addition, two sets of guidelines for the enhancement of indoor thermal comfort were developed for a house being planned and for an existing house.

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