

DEVELOPMENT OF CORRELATION BETWEEN SICK BUILDING SYNDROME AND MICRO-CLIMATE

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This thesis submitted in fulfillment requirements for the degree of Master of Philosophy

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May 2015

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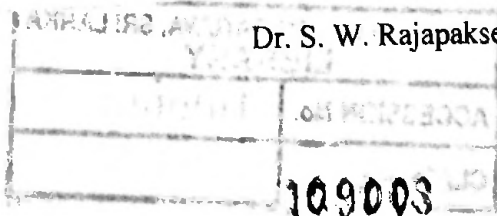
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ABSTRACT

It has been identified that the incorporation of vegetation in built-environments is a sustainable solution for reducing the energy demand for thermal comfort and air quality in tropical climate and reducing building related stress to improve the human condition. Even though a considerable amount of research has been carried out in order to identify the effect of vegetation on built-environment, hardly any guideline can be found in such incorporation. This study is aimed at the development of guidelines for incorporation of vegetation in built-environments in national scale.

In order to achieve this objective incorporation of vegetation in both indoor and outdoor was studied separately. Initially the effect of the indoor plant on indoor environment was studied in order to quantify the amount of plants to be kept inside a room. This quantification was carried out based on the CO₂ absorption capacity. An equation was developed to determine the amount of leaf area per space, using absorption rate and ventilation rate as parameters. The need for a database of CO₂ absorption rates for varying species was identified consequently.

Framework criteria to develop such database were also identified based on theory, literature review, and experiments. Experiments were carried out in a large-scale chamber with and without plants, and varying several conditions. The identified framework criteria are indoor temperature and relative humidity, lighting source and combinations, orientation of windows, leaf area density per window length, existing CO₂ concentration and night time CO₂ emission. The opinion survey was carried out to identify the public preference towards keeping indoor plants. Majority of the respondents preferred to have indoor plants majorly due to the visual comfort provided by the plants.

Subsequently, incorporation of vegetation in outdoor micro-climates was studied. An experimental study was carried out to measure temperature, relative humidity, CO₂, NO₂, and PM_{2.5} concentrations in five residential buildings selected based on their micro-climatic features. A parametric study was also carried out using CFD based software, 'ENVI-met' in order to identify strategies to design and plan garden vegetation for residential buildings. The computer models were validated for wind

speed, temperature, CO₂ concentration and wall surface temperatures using field measured data.

It was identified that locating vegetation in northern and southern sides of the building provides the highest beneficial effect on atmospheric temperature and CO₂ concentration where locating vegetation in eastern and western sides provides the highest beneficial effect on wall temperature. It was also identified that the effect of vegetation in the ground level diminishes after a certain height. Thus it was concluded the necessity of the vertical greenery systems in high-rises.

Air pollutant concentration may vary based on vertical elevation. Therefore, a separate study was conducted to evaluate vertical dispersion profiles of several air pollutants. A declining trend of several air pollutants were observed with the building height. A stagnation of air pollutant in street canyons and dense building arrangement was observed. A higher level of air pollution was observed in such arrangements than in locations surrounded by vegetation and water bodies.



ACKNOWLEDGEMENT

My sincere gratitude is first expressed to my main supervisor; Prof. Mrs. C. Jayasinghe of Department of Civil Engineering, University of Moratuwa for giving me this valuable opportunity to read for a MPhil together with motivation, valuable thoughts and for the continuous guidance provided throughout this research.

I am grateful and indebted to my co- supervisors, Prof. S. A. S. Perera of the Department of Chemical and Process Engineering, University of Moratuwa and Dr. S. W. Rajapakse, medical officer in charge, counselling unit, National Cancer Institute for their helpful suggestions, important advices and constant encouragement during the course of this work.

I am thankful to the members of the Progress review panel (Prof. R. A. Attalage, Dr. Jagath Manatunge, Dr. L. L. Ekanayake) for their continuous monitoring of this research despite their busy schedule and the valuable input provided. I am grateful to Prof. M. T. R. Jayasinghe, Senior professor, University of Moratuwa for his valuable advices given when it is needed. I wish to thank Mr. M. Ekanayaka, the curator of the University of Moratuwa for providing required plants for the study. I also wish to thank all the staff members of the Department of Civil Engineering, who helped me in various ways during the time I spent as a full time research student.

My special thanks go to the Senate Research Grant of University of Moratuwa (Grant no: SRC/LT/2013/1) for creating this opportunity to me by providing financial support during this research study.

I am grateful to Mr. Senaka Wanigarathna and Mrs. N. N. Wijeyrama for their assistance provided on taking permission to carry out experimental work in multi-storied buildings.

I wish to express my deep appreciation to Mr. S. Yathavan, Mr. M. R. M. Rihan, and Mrs. D.S.P.R.D. Premachandra for the assistance given in experimental work. My sincere gratitude for those who participated in the experimental work as occupants and those who supplied valuable data for our questionnaire forms during our study.

I cannot end without thanking my Parents, family members, friends and colleague for their constant encouragement, love and guidance in my life.

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