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**THERMALLY COMFORTABLE PASSIVE HOUSES FOR
TROPICAL UPLANDS OF SRI LANKA**

**THESIS SUBMITTED TO THE
DEPARTMENT OF CIVIL ENGINEERING
IN FULFILMENT OF THE REQUIRMENT FOR THE DEGREE OF
MASTER OF SCIENCE IN ENGINEERING**



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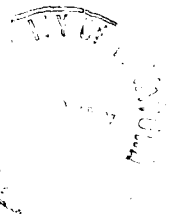
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DECLARATION

I, Muditha Priyanvada, hereby declare that the content of the thesis is the original work carried out over a period of 15 months at the Department of Civil Engineering, University of Moratuwa. Whenever others work is included in this thesis, it is appropriately acknowledged as a reference.



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ABSTRACT

The main aim of this project is to determine the ways and means possible to create a thermally comfortable environment in the house located in tropical uplands with the use of passive elements. Initially, a broad literature survey was conducted to determine passive techniques desirable for tropical highlands. The technique used here was to establish comfort zones for tropical uplands and investigate the effect of various passive features on thermal comfort such as orientation of the buildings, the roof, the windows and the number of air changes. The thermal effect of the various design options was established by using computer simulations carried out with the aid of DEROB-LTH.

The outdoor climatic conditions were obtained from Meteorological Department of Sri Lanka. The required climate data were maximum and minimum temperatures, sun shine hours and relative humidity. The software was validated for tropical upland areas by using actual measurements. As an outcome of this detailed study, a set of rules were developed along with a conceptual house. It is shown that this conceptual house could give a very good improvement for the internal minimum temperatures when the passive features given in the guidelines were adopted.

Houses having an upper floor in a part of it should be constructed except under the geological and structural circumstances, financial problems or any other circumstances. Since the effect of ridge direction is insignificant, ridge of the roof should be directed to either north-south or east-west. New GI sheets are highly recommended as a roofing material. If asbestos sheets are used they should be painted in dark colour as recommended below. Burnt clay tiles should be strictly avoided.

The orientation of the house should be faced either south or north. By this, heat transfer in to the house through glazing can be reduced. Hence overheating can be avoided. All the roofs and walls should be painted in dark colour which has higher absorptance values. The colours like Green, Blue and Grey are recommended. All the openings, doors and windows in the house should be closed at night time. The curtains should be provided from the top of the window including the lattice. The maximum effort to avoid infiltration in the nighttime should be taken. Ceilings should be provided to avoid cold air entering in to the house. . Windows should be provided on north, east and south. West should be avoided in order to control the hot discomfort. If and only if, one of the walls are gable walls of the house, providing windows facing west is allowed. Fins, sunshades and all the types of shading devices can be removed if and only if, they are not used to divert the wind which flow in to the house.

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CONTENTS

Declaration

Abstract

Acknowledgement

Content page

List of Tables

List of Figures

List of Charts

| | | |
|-------|-----------------------------------|----|
| 1.0 | <u>INTRODUCTION</u> | |
| 1.1 | General | 1 |
| 1.2 | Energy crisis | 1 |
| 1.3 | The Objectives | 3 |
| 1.4 | Methodology | 3 |
| 1.5 | Main finding | 3 |
| 1.6 | Over view of the thesis | 5 |
| 2.0 | <u>LITERATURE REVIEW</u> | |
| 2.1 | General | 6 |
| 2.2 | Thermal comfort | 6 |
| 2.3 | Energy crisis | 7 |
| 2.3.1 | A solution with passive houses | 8 |
| 2.4 | Climate in Sri Lanka | 9 |
| 2.4.1 | Climatic conditions in Sri Lanka | 9 |
| 2.4.2 | Climatic zones of Sri Lanka | 9 |
| 2.5 | Design for thermal comfort | 11 |
| 2.5.1 | Comfort conditions and standards | 11 |

| | | |
|---------|---|----|
| 2.5.2 | Standard method of developing of climatic zones | 11 |
| 2.6 | Passive design techniques | 12 |
| 2.6.1 | Common passive techniques | 12 |
| 2.6.2 | Design for tropical uplands | 12 |
| 2.6.2.1 | <i>Building Design</i> | 14 |
| 2.8 | Traditional architecture of Sri Lanka | 17 |

COMPUTER SOFTWARE AND VALIDATION

| | | |
|---------|--|----|
| 3.1 | General | 25 |
| 3.2 | Computer software | 26 |
| 3.3 | Dynamic Energy Responsive Of Buildings | 27 |
| 3.4 | Validation of the computer software DEROB-LTH | 32 |
| 3.4.1 | Introduction | 32 |
| 3.4.2 | The house use for validation | 32 |
| 3.4.3 | The instruments use to take readings | 38 |
| 3.4.3.1 | <i>Procedure</i> | 40 |
| 3.4.4 | Actual measurements taken at the house one day one and day two | 40 |
| 3.4.5 | Model house used for simulations | 43 |
| 3.4.6 | Climatic data use for simulation | 44 |
| 3.4.7 | Material properties used for the simulations | 44 |
| 3.5 | Results obtained from simulations | 46 |
| 3.6 | Comparison between the observed measurements and the simulated values | 47 |
| 3.7 | The results of validation | 52 |
| 3.7.1 | The reasons for difference between predicted and actual values | 52 |
| 3.7.2 | The suitability of simulation tool | 52 |
| 3.8 | Conclusions | 52 |

INFLUENCE OF ROOF SYSTEMS AND ROOF MATERIALS

| | | |
|-----|---|----|
| 4.1 | General | 54 |
| 4.2 | Objectives and Methodology | 54 |
| 4.3 | The comfort zone for Bandarawela | 55 |

| | | |
|-------|--|----|
| 4.4 | Orientation of roof and roof materials on thermal comfort in high altitudes | 58 |
| 4.5 | The computer simulations | 58 |
| 4.6 | The model house used for simulations | 60 |
| 4.6.1 | Material properties used for simulations | 63 |
| 4.7 | Results and Analysis | 63 |
| 4.7.1 | Effect of roof orientation on indoor thermal comfort | 64 |
| 4.7.2 | Effect of roof orientation on indoor thermal comfort | 67 |
| 4.7.3 | Effect of shading on indoor thermal comfort | 70 |
| 4.8 | Conclusions | 72 |

THRMLLY COMFORTABLE PASSIVE HOUSES FOR TROPICAL UPLANDS

| | | |
|-------|--|----|
| 5.1 | General | 73 |
| 5.2 | Passive houses for tropical uplands | 73 |
| 5.3 | Case study for tropical uplands | 74 |
| 5.3.1 | Details of the case study | 74 |
| 5.3.2 | Data and variables used for simulations | 76 |
| 5.4 | The results and Discussion | 78 |
| 5.4.1 | The effect of the number of air changes | 79 |
| 5.4.2 | The Effect of orientation of windows | 81 |
| 5.4.3 | The effect of colour of walls and the roof | 82 |
| 5.4.4 | The thermal performance of July | 83 |
| 5.4.5 | Application of findings | 83 |
| 5.5 | Guidelines for passive houses in tropical uplands | 84 |

AN ASSESSMENT OF THE THERMAL PERFORMANCE OF A HOUSE SUITABLE FOR TROPICAL UPLANDS

| | | |
|-----|---------------------------------------|----|
| 6.1 | General | 85 |
| 6.2 | The objectives and Methodology | 85 |
| 6.3 | The methodology | 85 |
| 6.4 | The computer simulations | 86 |

| | | |
|------------|---|-----------|
| 6.4.1 | The simulation software | 86 |
| 6.4.2 | The details of computer simulations | 86 |
| 6.4.3 | The material properties used for simulations | 89 |
| 6.5 | Results and analysis | 90 |
| 6.5.1 | Effect of infiltration | 91 |
| 6.5.2 | Effect of wall and roof colours | 93 |
| 6.5.3 | A comparison between orientations | 94 |
| 6.5.4 | A comparison between indoor air and operative temperature | 95 |
| 6.6 | Conclusions | 97 |

CONCLUSIONS AND FUTURE WORK

| | | |
|------------|--|------------|
| 7.1 | Passive guidelines for tropical uplands and proposing a house | 99 |
| 7.3 | Future work | 100 |
| 7.4 | Concluding remarks | 100 |

REFERANCES


APPENDIX A




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LIST OF TABLES

| <i>Table No</i> | <i>Title</i> |
|-----------------|--|
| Table 2.1 | Main difference between climatic zones in Sri Lanka |
| Table 2.2 | Climatic data for Colombo |
| Table 2.3 | Climatic data for Bandarawela |
| Table 4.1 | Climatic data for Bandarawela |
| Table 4.2a | Absoptances and emmitances used for simulation of roof orientation |
| Table 4.2b | Absoptances and emmitances used for simulation of roof materials |
| Table 4.3 | Material properties use for simulations |
| Table 4.4 | Constituent material properties |
| Table 4.5 | Number of air changes used |
| Table 4.6 | Maximum and minimum temperature according for various roofing materials during December |
| Table 4.7 |  Maximum and minimum temperature according for carious roofing materials during March |
| Table 4.8 | Maximum and minimum temperature according for various roofing materials during June |
| Table 5.1 | Computer simulations conducted |
| Table 5.2 | Properties of materials used for the simulations |
| Table 5.3 | Constituent material properties |
| Table 5.4 | Absoptance and emittance used for materials |
| Table 5.5 | Applications of findings |
| Table 6.1 | Number of air changes used |
| Table 6.2 | Different cases simulated |
| Table 6.3 | Material properties used |
| Table 6.4 | Constitute material properties used for the simulations |
| Table 6.5 | Absoptances and emittances used for simulations |

LIST OF FIGURES

| <i>Figure No</i> | <i>Title</i> |
|------------------|--|
| Figure 2.1 | Climatic zones of Sri Lanka |
| Figure 2.2 | Clustered buildings sharing walls to reduce exposure to cold wind |
| Figure 2.3 | Sharing walls, reduce the exposure |
| Figure 2.4 | Building on south slope for maximum winter sun |
| Figure 2.5 | Cave became a house |
| Figure 2.6 | Traditional house |
| Figure 2.7 | Ena De Silva house |
| Figure 2.8 | Mada midula from Lunuganga niwasa |
| Figure 2.9 | Example of old house |
| Figure 2.10 | Long leaves and short walls |
| Figure 3.1 | DEROB-LTH user interface |
| Figure 3.2 | Spread sheet for opaque materials |
| Figure 3.3 |  Input data form to define the building components of building model <small>Electronic Theses & Dissertations model@mrt.ac.lk</small> |
| Figure 3.4 | Input form to give the location of the building, data and climatic data file |
| Figure 3.5 | HVAC schedule |
| Figure 3.6 | View of the building |
| Figure 3.7 | Overall view of the site |
| Figure 3.8 | Floor plan of the actual house |
| Figure 3.9 | 3D view of the actual house |
| Figure 3.10 | View of the upper floor living room from with the main entrance |
| Figure 3.11 | View of the upper floor living room with the main entrance |
| Figure 3.12 | View of the upper floor master bed room |
| Figure 3.13 | View of the upper floor visitor bedroom |
| Figure 3.14 | View of the environment of the western side of the house |
| Figure 3.15 | View of the environment of the western side of the house |
| Figure 3.16 | View of the roof from the eastern side of the house |
| Figure 3.17 | Normal thermometer |
| Figure 3.18 | Digital thermometer, manual thermometer, maximum and minimum thermometers |
| Figure 3.19 | Sun shine Recorder |

| | |
|-------------|--|
| Figure 3.20 | 3D view of the simulated house with the actual house |
| Figure 3.21 | 3D view of the inside of the simulated house from the best point of view |
| Figure 4.1 | Comfort zone of Bandarawela |
| Figure 4.2 | Floor plan of general case of the model house |
| Figure 4.3 | Front and side elevation of model house with east-west roof |
| Figure 4.4 | Ceiling types for simulations |
| Figure 4.5 | Roof orientations |
| Figure 4.6 | 3D view of the model house |
| Figure 5.1 | Floor plan of the model house |
| Figure 5.2 | Front and side of the elevations of the model house |
| Figure 5.3 | The 3D model used for the simulations |
| Figure 5.4 | Floor plan and the 3D view of the proposed house for Bandarawela |
| Figure 6.1 |  The plan arrangements used for the ground and upper floor and corresponding 3D view. |

LIST OF CHARTS

| <i>Chart No</i> | <i>Title</i> |
|-----------------|---|
| Chart 2.1 | Electricity usages in Sri Lanka |
| Chart 3.1 | Indoor air temperature comparison between observed and simulated values for G-NW volume-First day |
| Chart 3.2 | Indoor air temperature comparison between observed and simulated values for G-NW volume-First day |
| Chart 3.3 | Indoor air temperature comparison between observed and simulated values for U-NW volume-First day |
| Chart 3.4 | Indoor air temperature comparison between observed and simulated values for U-NW volume-First day |
| Chart 3.5 | Indoor air temperature comparison between observed and simulated values for G-NW volume-Second day |
| Chart 3.6 | Indoor air temperature comparison between observed and simulated values for G-NW volume-Second day |
| Chart 3.7 | Indoor air temperature comparison between observed and simulated values for U-NW volume-Second day |
| Chart 3.8 | Indoor air temperature comparison between observed and simulated values for U-NW volume-Second day |
| Chart 4.1 | The variation of solar radiation in March |
| Chart 4.2 | The variation of solar radiation in June |
| Chart 4.3 | The variation of solar radiation in December |
| Chart 4.4 | Maximum indoor air temperature for two types of ridge directions, sloping ceiling |
| Chart 4.5 | Maximum indoor air temperature for two types of ridge directions, Flat ceiling |
| Chart 4.6 | Minimum indoor air temperature for two types of ridge directions, sloping ceiling |
| Chart 4.7 | Minimum indoor air temperature for two types of ridge directions, Flat ceiling |
| Chart 4.8 | Maximum and minimum indoor air temperature for various types of roofing materials, flat ceiling, December |
| Chart 4.9 | Maximum and minimum indoor air temperature for various types of roofing materials, flat ceiling, March |

| | |
|------------|---|
| Chart 4.10 | Maximum and minimum indoor air temperature for various types of roofing materials, flat ceiling, June |
| Chart 4.11 | Maximum indoor air temperature with and without shading devices |
| Chart 4.12 | Minimum indoor temperature with and without shading devices |
| Chart 5.1 | Maximum operative temperature for number of air changes for dark colour walls |
| Chart 5.2 | Minimum operative temperature for number of air changes for dark colour walls |
| Chart 5.3 | maximum operative temperatures for orientation of windows for dark colour walls |
| Chart 5.4 | Minimum operative temperature for orientation of windows for dark colour walls |
| Chart 5.5 | Maximum operative temperature for dark colour and light colour walls |
| Chart 5.6 | Minimum operative temperatures for dark colour and light colour wall |
| Chart 5.7 | Operative temperature variation in D-NE volume for the months March and July |
| Chart 6.1 | Operative temperature variation for the Month March for various number of air changes |
| Chart 6.2 | Operative temperature variation for the June March for various number of air change |
| Chart 6.3 | Operative temperature variation for the Month December for various number of air changes |
| Chart 6.4 | Variation of operative temperature for March for dark colour walls and light colour roof |
| Chart 6.5 | Comparison of operative temperature for month March for light colour walls and roof. |
| Chart 6.6 | Comparison of operative temperature for BR1 and BR2 at ground and upper floor during March |
| Chart 6.7 | Comparison of operative temperature and indoor air temperature for March |
| Chart 6.8 | Comparison of operative temperature and indoor air temperature for December |



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★ Chart 6.9

The variation of operative temperature of the C2R2Z3 cases against C1R1Z2 cases for the three months March, June and December



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