

**AN EMPIRICAL STUDY OF THE WINDOW DESIGN AND STRATEGIES TO  
MAXIMIZE THE THERMAL COMFORT ON COMMERCIAL BUILDING IN  
DIFFERENT CLIMATIC ZONES**



LIBRARY  
UNIVERSITY OF MORATUWA, SRI LANKA  
MORATUWA

A Dissertation submitted to the university of Moratuwa  
As a partial fulfilment of the requirements  
For the Degree of  
Master of science in Architecture.



University of Moratuwa, Sri Lanka.  
Electronic Theses & Dissertations  
[www.lib.mrt.ac.lk](http://www.lib.mrt.ac.lk)

72" 02"

725.2 (342.4)

Pathirana K.P.D.M.R.  
Department of Architecture,  
University of Moratuwa,  
Sri Lanka.  
March 2002.

78181

University of Moratuwa



78181

78181



# TABLE OF CONTENTS

* ACKNOWLEDGEMENT.	I
* LIST OF ILLUSTRATION.	II
<b>CHAPTER ONE</b>	01
1.0. INTRODUCTION	01
1.1. TOPIC EXPLANATION.	01
1.2. INTENTION	01
1.3. NEED OF STUDY.	02
1.4. AIMS AND OBJECTIVES.	02
1.5. SCOPE AND LIMITATION.	02
1.6. METHOD OF STUDY.	02
<b>CHAPTER TWO -</b>	03
2.0 CLIMATE OF SRI LANKA AND ITS EFFECT ON WINDOWS.	03
2.1 Approach to climatic zones	03
2.1.1 Definition of climate	03
2.1.2 Types of climate	05
2.1.3 Warm Humid Climate	06
2.1.4 Climate of Sri Lanka	07
a) Climate of Colombo	07
b) Climate of Nuwara Eliya	07
2.2 Thermal Comfort and window Design	08
2.2.1 Definon of Thermal comfort	08
2.2.2 Thermal comfort Index	09
a) Operative tempracture	09
b) P M V	09
c) P P D	09
d) P M V and P P D parameters	10
2.2.3 Thermal comfort of Sri Lanka	12
a) Thermal comfort requirements in Colombo	12
b) Thormal comfort requirements in Nuwara Eliya	12
2.2.4 Window and window modification as climatic building elements.	13
a) Historical Development of windows	14
b) Types of windows	15
c) Components of windows	18
d) Function of Windows	19
2.2.5 Effect of windows on Thermal Desingn.	19
a) Orientation	19
b) Thermal effect of window size	21
c) Thermal effect of Glass type	22
d) Thermal Effect of shading devices	23
2.3 Lighting comfort and Window design.	30

2.4 Visual comfort and window design.	35
---------------------------------------	----

<b>* CHAPTER THREE</b>	<b>36</b>
------------------------	-----------

<b>3.0 CASE STUDY.</b>	<b>36</b>
------------------------	-----------

3.1. Indra traders building at Colombo	36
--	----

3.2. District secretariat complex at Nuwara eliya.	51
--	----

3.3.

<b>* CHAPTER FOUR</b>	<b>66</b>
-----------------------	-----------

4.0 Analysis	
--------------	--

4.1 Analysis of indra Traders Building	66
--	----

4.2. Window design strategies of Colombo	71
--	----

4.3. Analysis on district secretariat complex at Nuwara Eliya	72
---	----

4.4. Orientation	78
------------------	----

4.5. Window design strategies in Nuwara Eliya	78
---	----

<b>* CHAPTER FIVE</b>	<b>81</b>
-----------------------	-----------

5.0 Conclusion	81
----------------	----

5.1 DIRECTION FOR FUTURE STUDIES.	82
-----------------------------------	----

<b>* BIBLIOGRAPHY.</b>	<b>84</b>
------------------------	-----------



## ACKNOWLEDGEMENTS

This study would not have been success without the guidance kind co-operation, assistance and intellectual support of a number of authorities and inthorities and indiviecuals. It gives a great pleasure to express the author's gratitude.

Professer Nimal de Silva head of the Department of Architecture, Dr, Rohinton Emmanuel my tutor for his quidandce, comments, and valuable criticism, who helped me much by giving pace to develop my thoughts and an approach to this study. I am exteremely grateful for his help and appreciate the time and efforts extended to me to carry out the study.

Archit Prasanna Silva Director western Province U.D.A. Archt Hemantha S.E.C. and Mr: S. Ranasinghe to whom I am grateful for their encouragement offfered at the onset of the study.

I am grateful to Roshani , Anil , Chandana , and my calleagues for their advice and enocouragements. Specially to my parents Uditha and my sister For their whole hearted sapport say no more as words can hardly express in any real measure the help they have given.



University of Moratuwa, Sri Lanka.  
Electronic Theses & Dissertations  
[www.lib.mrt.ac.lk](http://www.lib.mrt.ac.lk)

<u>No</u>		<u>Page</u>
1)	Building seen with surroundings	03
2)	W. T. C. Twin towers (Balance with surroundings)	04
3)	The relationship between PPP and P M V	10
4)	Bauhaus building at Dessau	15
5)	Types of windows	16
6)	Window opening	17
7)	Fixed ventilator also included as a part of the window head	18
8)	Component of a window frame	18
9)	Component of a window Casement	18
10)	Orientation with openings	20
11)	Cross ventilation through inlet and outlet	20
12)	The best building orientation	21
13)	Thermal effects of window	21
14)	Different glass types	22
15)	Shading in different levels	23
16)	External means of shading	24
17)	Large horizontal shading	25
18)	Shading with external appearance	25



<u>No</u>	<u>Page</u>
19) Horizontal pergolas planed parallel to the wall	26
20) Placing angularity	26
21) Pergoals placed parallel to the wall (Bothways)	27
22) Pergoals placed angular to the wall	27
23) A vertical shading device	28
24) Narrow blades with wider spacing	28
25) Different types of egg circate devices	28
26) The best building orientation	29
27) Light in Architecture	30
28) Components that contribute to the day light factore	32
29) Balance with Environment	33
30) Window as an external Feature	33
31) Visual comfort	35
32) Visual comfort	35
33) Front view of the indra traders Building at Colombo	36
34) Elevation to W. A. D. Ramanayake Mawatha	37
35) Side elevation to private road	38
36) Section A – A	39
37) Ground Floor plan	40

<u>No</u>	<u>Page</u>
38) Second Floor plan	41
39) Third Floor plan	42
40) Fourth Floor plan	43
41) Roof Structure	45
42) Distribution of the windows in the facades	46
43) Glass Façade in Front	47
44) Internal lighting arrangement	47
45) Internal viwes and Roof	48
46) Glass facades	49
47) Front Elevation of District secretarial complex at Nuwara Eliya	53
48) Elevation to police quarters	54
49) Elevation to police lane	55
50) Section X – X	56
51) Plan at + 300 Level	57
52) Plan at + 3300 – 4500 Level	57
53) Plan at + 7000 Level	59
54) Plan at 1000 level	60
55) Plan at 13000 Level	61
56) Plan at + 16000 level	62
57) Plan at + 2000 level	63