

HIGHER TECHNICAL INSTITUTE

CIVIL ENGINEERING DEPARTMENT

DIPLOMA PROJECT

THE OPENINGS OF BUILDINGS FOR
INDOOR COMFORT

C/849

BY: KALLIA DEMETRAOU

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THE OPENINGS OF BUILDINGS FOR INDOOR COMFORT

Project Report Submitted by
KALIA DEMETRIOU

In part satisfaction of the award of Dimpoma of
Technician Engineer in Civil Engineering of the
Higher Technical Institute, Cyprus

Project Supervisor: **Dr. D. Serghides**
Senior Lecturer in Civil Engineering,
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External Assessor: **Andreas Kyprianou**

Type of project : Individual

Group

June, 1998

Project No.	C-849
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HIGHER TECHNICAL INSTITUTE	PROJECT NO. <u>2831</u>
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HIGHER TECHNICAL INSTITUTE
NICOSIA - CYPRUS

CIVIL ENGINEERING DEPARTMENT
Diploma Projects
1997/98

Project Number: -C/849

Title: "The openings of Buildings for Indoor Comfort"

Objectives:

1. To study and analyse the design of openings and the potential of climate and environment for provision of support in buildings for cooling, heating and lighting.
2. To carry out a photographic and drawing survey of buildings employing appropriate design of openings for:
 - a) Solar gain in winter
 - b) Sun protection in the summer
 - c) Natural lighting and visual comfort

Terms and conditions:

1. The study is to cover both Traditional and contemporary buildings in Cyprus.
2. Information in the form of bibliography publications and notes will be provided by the supervisor.
3. Guidance and bioclimatic design will be provided by the supervisor.

Student : Kalia Demetriou
Supervisor : Dr D. Serghides
External Assesor : Andreas Kyprianou

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ACKNOWLEDGMENTS

I wish to express my appreciation for the valuable assistance and guidance rendered to me during the course of the execution of this project, to Dr D. Serghides, my project advisor.

I also want to dedicate this project to my family and especially to my mum and my twin sister, which they provided me with the strength to carry on.

ABSTRACT

This project deals with the design of openings in order to achieve thermal comfort in the building over the entire year. For this purpose a study of the human thermal comfort and the weather conditions in Cyprus was carried out. Also the strategies for heating and cooling were outlined.

Then a proper design of openings that can be used in building to achieve the required conditions for cooling, heating and lighting was suggested and analysed.

At last a brief analysis of the openings used in Cypriot Traditional buildings was then carried out. In order to facilitate this analysis Cypriot traditional houses are classified in two main categories:

The houses build in towns

The houses build in villages

INTRODUCTION

It is becoming clear that the buildings contribute significantly to the serious environmental problems of the planet.

The close connection between a building's energy use and environmental damage arises because we still look to technical solutions to meet our energy-related needs. In so doing, we rely on mechanical systems to solve climate-related heating, cooling and lighting problems induced by inadequate building design. It is time to think again about our approach.

To make a building is to create a system linked to its surrounding environment and subject to a range of interactions affected by seasonal and daily changes in climate and by the requirements of occupants varying in time and in space.

Some twentieth century buildings seek to deny these inevitable interactions and subdue them with expensive heating, cooling and lighting equipment. By changing our design approach, a building can be created which not only meets the occupants needs for thermal and visual comfort but also requires less energy to run and consequently has a reduced impact on the environment. A more climate sensitive approach is proposed which recognises and responds to seasonal and daily changes in the environment of the well-being and comfort of the occupants.

This project attempts to demonstrate the benefits of an approach to design of openings and their immediate surroundings which takes advantage of natural phenomena instead of fighting the influence of nature with expensive and often environmentally destructive heating, cooling or lighting equipment and the energy they consume.

The design and construction of a building which takes optimal advantage of its environment need not impose any significant extra cost, and compare to more highly-serviced buildings it may be significantly cheaper to operate.

In most situations it is necessary to provide some additional heating or cooling at certain times. Similarly, daylighting cannot meet all lighting requirements and therefore these auxiliary inputs and their control must be addressed once the contributions by natural means and the patterns of use are known.

The openings whether glazed or not, operable or not, play a significant role in the thermal performance of a building, due to their great effect on the heat transfer of the building fabric. Through the openings the heat transfer may occur in any or in all of the three modes of: (Fig.1)

- Conduction
- Convection
- Radiation

Therefore, their contribution to heat gains and losses is considerable and their design is significant for the thermal performance of the building.

Operable windows do an amazing number of things. They admit light and heat; supply fresh air and a view; provide a tantalizing physical and visual connection to the outdoors; insulate interiors from the weather; offer visual privacy; and mirror our world.

So, from the point of view of energy, windows are the most important element of the envelope of a building.

Windows are an unassailably dramatic building element!