POLICY FOR RESIDENTIAL LAND UTILIZATION WITH ENVIRONMENTAL CONSIDERATIONS

A THESIS

Submitted in fulfilment of the requirements for the award of the degree of

DOCTOR OF PHILOSOPHY

in

ARCHITECTURE AND PLANNING

By

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FEBRUARY, 2001

CANDIDATE'S DECLARATION

I hereby certify that the work which is being presented in the thesis entitled **POLICY FOR RESIDENTIAL LAND UTILIZATION WITH ENVIRONMENTAL CONSIDERATIONS,** in fulfillment of the requirement for the award of the Degree of Doctor of Philosophy, and submitted in the Department of Architecture and Planning of the University, is an authentic record of my own work carried out during a period from Feb 1995 to February 2001, under the supervision of Dr. V. Devadas, Assistant Professor, Department of Architecture and Planning, University of Roorkee, and Dr. Balagopalan .T.S. Prabhu, Professor, Civil Engineering Department, Regional Engineering college, Calicut.

The matter presented in this thesis has not been submitted by me for the award of any other degree of this university or any other university.

(LIZMOL MATHEW)

This is to certify that the above statement made by the candidate is correct to the best of my knowledge.

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ABSTRACT

The fact that residential land uses are being engulfed by the invading economic forces, in a competitive urban land market is well known. Yet, it continues to remain as the basic requisite of all settlements and consequently, play a decisive role in an urban system. A study of residential land utilization, therefore, becomes important for all efforts in urban studies and planning.

Residential land utilization essentially refer to quantity of land under residential use, its spatial distribution, the changing densities, and typologies. Several studies have been presented by researcher regarding the social, economic physical, aesthetic, legislative and environmental aspects of residential development. However, the purpose of most of the studies, have been to explain residential land utilization, in terms of one of more these factors. This study aims at deriving a model integrating all these factors and user preferences, which will serve as a tool for formulating policies for an ideal residential development satisfying the desirable criteria of each of the subsystem. Kochi city, a metropolis and the largest city in Kerala has been selected as the study area for this research. The following set of objectives were framed for the research (I) to study the historical changes in residential land utilization pattern in Kochi, (ii) to examine the role of the environmental factors affecting the credential development, (iii) to identify the control parameters, which determine the pattern of residential land utilization in the system, (iv) to formulate an optimum user satisfaction model for residential land utilizations, (v) to evolve a set of policy guidelines for optimum residential land in Kochi city.

Survey research methods have been extensively employed in the present investigation. The surveys were personally undertaken by the investigator using pretested schedules. Six primary surveys covering various categories of people namely occupants of multi-storeyed apartment buildings, prospective clients of ready built housing, general populace, neighbours of multi storeyed apartments, decision makers in urban development and builders were undertaken along with visual surveys for this research.

Computer software like MS ACCESS, MS EXCEL, SPSS statistical package have been used for data processing and analysis. Analytical techniques, such as, weighted index methods, multiple regression and factor analysis have been used for detailed analysis and modelling.

It has been possible to extract 6 components contributing to user satisfaction. A mathematical model has been developed based on the results of the analysis. Policy guidelines have been evolved for optimum residential land utilization with environmental considerations.

ACKNOWLEDGEMENT

"A human heart makes the plan, Yahweh gives the answer" (The Bible – proverbs 16/1). I bow my head before Him in all reverence acknowledging His loving guidance for the successful completion of this thesis.

Dr. Balagopal T.S. Prabhu, Professor, Regional Engineering College, Calicut and my guide, Philosopher and friend throughout my research work is the first and foremost in the long live of kind hearted souls who helped me complete this thesis. My reverence, gratitude and praise for him is beyond any form of expression.

Prof. Viswamitter, my first guide and Dr. Devadas who took over, both of the University or Roorkee, who have consented to guide me in this research in spite of my study area 'Kochi' being far away, and were so kind and understanding. I owe my respect and indebtedness to both, especially to Dr. Devadas for tolerating my long absences and intermittent appearances at the University due to pressures of family and professional commitments beyond my control. I am especially grateful to Dr. Devadas for his guidance and valuable suggestions.

I am especially grateful to Dr. Najammuddin for being extremely supportive during various difficult stages of this research work. I would also like to record my special thanks to all the staff of the department of Architecture and planning for the support extended to me.

I wish next, to record my deep gratitude and respectful regards to Dr. Nagaraj, Professor, Regional Engineering College, Calicut for volunteering to help me in mathematical models and statistical solutions that were essential tools in this research, but unfamiliar to me being an architect.

I also wish to express my heartfelt thanks to all my collegues, particularly to Dr. Jevamma for their valuable cooperation and timely help in the preparation of this thesis.

Mrs. Elizabeth Philip, Chief Town Planner, Mrs. Mary Mathew, Jr. Town Planner and their Junior Collegues in GCDA were all very kind and helpful to me in providing data and drawings required for this research. Dr. Benjamin P.V. , Landscape Architect of GCDA also provided me valuable information on physical, geological and topographic details of the region. My most grateful thanks to all of them.

M/S Joseph Alexander as C.K. Thomas, both CTPs (since retired) deserve special mention among a host of experts besides Civic Officials, elected representatives and elites who were so kind and cooperative in providing me valuable insight in the research subject. I express my deep gratitude to each and everyone of them.

I am also grateful to a number of households, officials and friends who have spared their valuable time in participating and helping me in the various surveys undertaken.

Coming nearer home, my long suffering husband, who had to bear the brunt of my tantrums, thrown-up due to academic, professional and domestic pressures, deserve my best words of love, appreciation and gratitude.

Let me also say a word of apology and affection to my two little daughters Richa and Divya and a darling son Abel who missed a lot of "mummies care" which were their rightful due, all because of "Mummys Ph.D" which has become a haunting household term.

I have to make here a special mention of heartfelt thanks to "Kunjammachy" my Aunt who comes, to my aid of and on to look after the house and children whenever the regular domestic help breaks off without warning.

I wish to thank my two little nieces Febi and Minnyu and my two sisters for their help in the surveys and its compilation.

Finally it is my parents whole hearted encouragement and constant supporting role that I have to acknowledge, which enabled me to persist in this research, against all odds, until its successful completion.

"May God grant me to speak as he would wish and conceive thoughts worthy of the gifts I have received"

(Bible-Wisdom 7/15).

CONTENTS

APPENDIX L: Plans

APPENDIX M: Acknowledgement to contributors

APPENDIX N: Author's Vitae

LIST OF TABLES

LIST OF FIGURES

LIST OF PHOTOGRAPHS

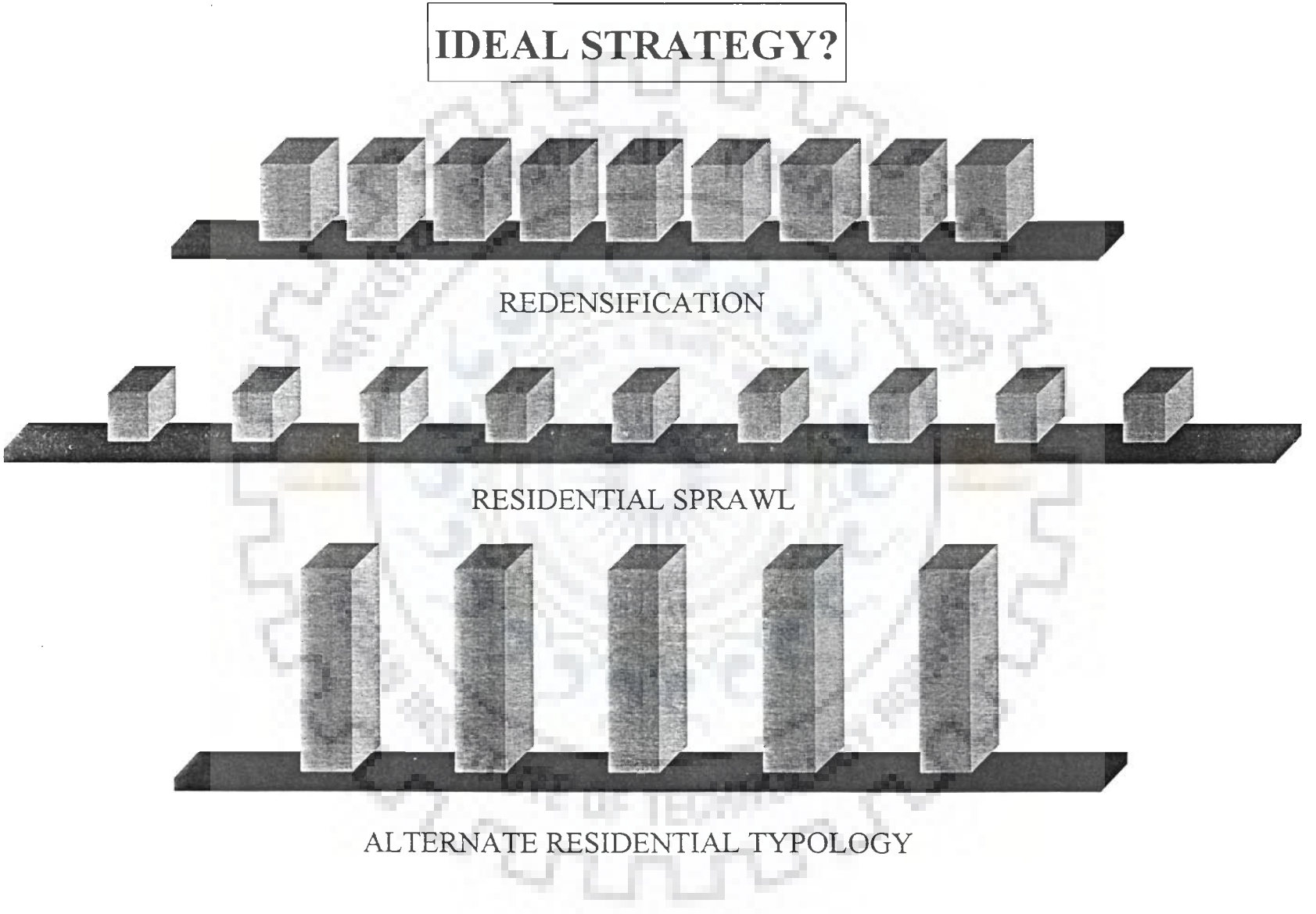
CHAPTER 1

INTRODUCTION & SCOPE

CONTENTS

This chapter defines the problem and identifies the scope of the study. It sets the objectives for the research work, and outlines the research design. The methods employed for data collection and the analytical techniques used, are detailed. The important components constituting each of the subsystems of the residential land system viz., Techno-physical, economic, social, legislative and bio-aesthetic, are identified.

Fig. No. 1.1 Common Strategies adopted to ease pressure on residential land



1.1 INTRODUCTION

Land is the stage for all human activities. Before the advent of industrial revolution and consequent urbanisation, all land in a habitat was primarily under residential use. Urban development and specialisation of functions brought about division of land under different occupancy classifications like residential, commercial, industrial, institutional, recreational, etc. As the city size increased and urban functions became more varied, the urban land use pattern also became increasingly complex. It gave more weightage to non-residential functions, with the economic type land uses bidding out the social type uses, like residential and amenity uses (8). As allotment of land for amenity uses result through statutes of governmental policy, it is the residential land, which often gets engulfed by the invading economic forces. Consequently, it is generally seen that such land uses progressively show a decreasing trend in growing cities. Residential land, nevertheless, continues to remain as the basic requisite of all settlements, and it does play a decisive role in an urban system. A study of residential land utilisation, therefore, becomes important for all efforts in urban studies and planning. Residential land utilisation essentially refers to quantity of land under residential use, its spatial distribution, the changing densities, and typologies.

It is well known that the relative share of land under residential use is steadily decreasing, in growing cities. However, the approach to this problem is not yet well defined. The strategies suggested to ease the pressure on residential land, cover:

1. achieving higher residential densities through zoning and development controls,
2. phased spatial distribution of residential development by expansion of city limits,
3. and innovating suitable residential forms to minimise uneconomic use of land. (Refer Fig. No. 1.1)

The actual combination of strategies has to be decided with an aim to improve living conditions in physical and social terms, provide better quality of life, and make efficient human settlements in economic terms (87, 143). This demands an understanding of the various aspects affecting residential land utilisation viz. physical and economic resources, technology, and the political, legislative and administrative framework, within which housing is produced (94, 95).

The policy formulation for residential land utilisation has many constraints: physical, political and socio-economic. Often, physical planning is taken as an extension of economic planning. The planning process has to have its roots in the physical and socio-economic surveys, and detailed analysis of economic base, developmental costs, etc. Yet, right from the 1960's, urban planning has almost been reduced to a technical exercise, concerned only with assigning land uses for a perspective period, and framing zoning regulations (142, 86, 189). In this process, residential land is just treated as one of the many types of land uses, to be apportioned in the land utilisation plan. Nowhere in this process, is there an attempt, to recognise the cultural importance of residential landuse. Rarely does the planning process emphasise on environmental considerations, which will influence aesthetics, social harmony, psychological satisfaction, security, etc., nor does it involve the people concerned in various stages of planning (189, 182, 87, 72, 164). The neglect of the socio-cultural aspects in residential development, has wider impact on the urban fabric, leading to the failure of the very concept of planning.

The overemphasis on demographic criterion, functionalism, economic priority and physical targets, has led to the marginalisation of the historical, social, aesthetic, cultural and environmental characteristics of the city (117). It is believed that some of the reasons for this failure of planning are, the inability of planners to understand peoples problems of access to land and housing, lack of knowledge of their preferences, non-involvement of public in the

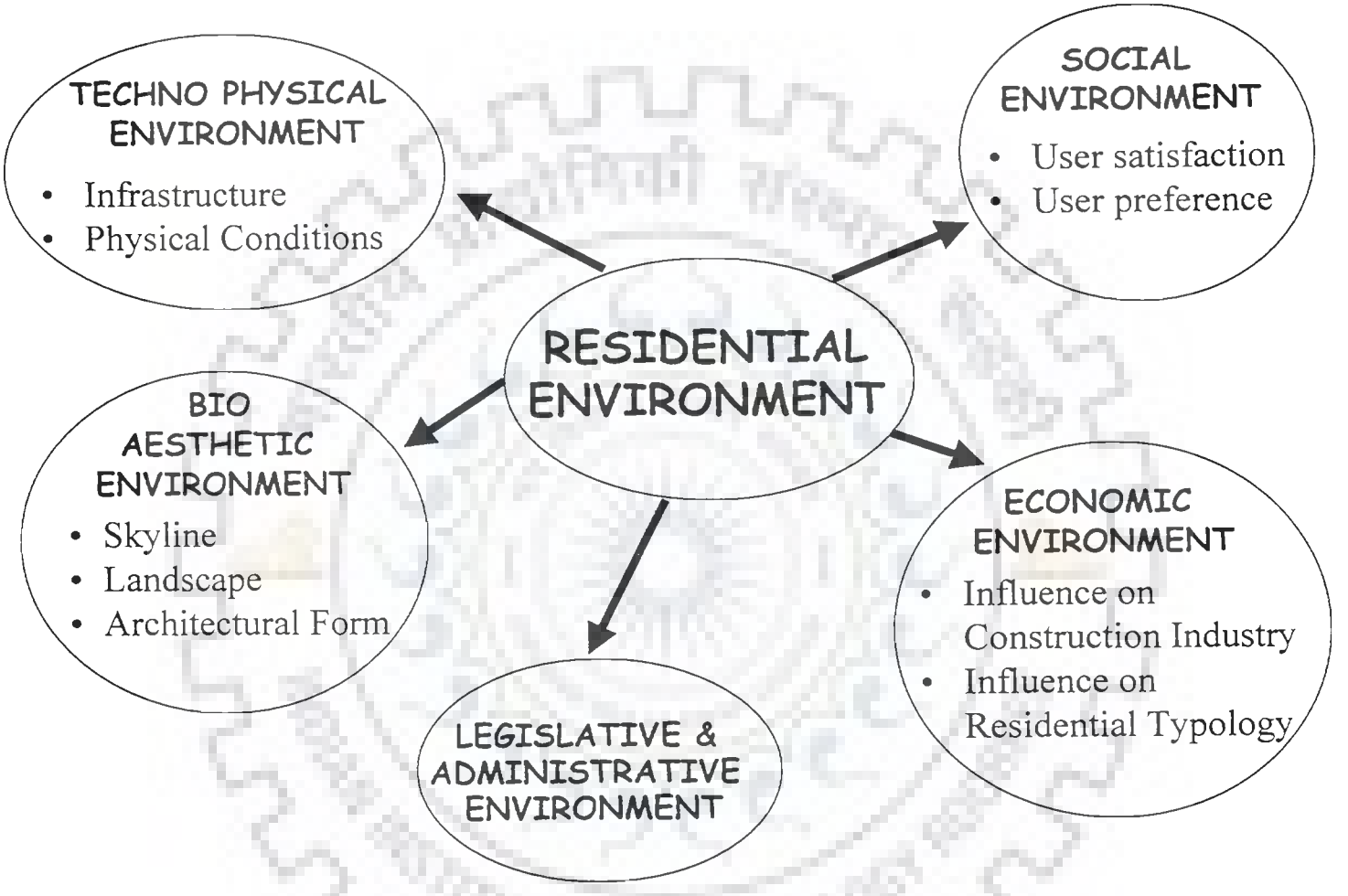
planning process, construction, and management of housing, and a disregard to free market forces (200, 203, 161, 228, 87, 95, 269, 166, 157, 234, 184, 181, 20). This view is also endorsed in the central theme of the Global Shelter Strategy to the year 2000, approved by the United Nations General Assembly in 1988 (230). In spite of such awareness, views and opinions are seldom sought from knowledgeable citizens, prospective occupants, developers, etc., on designing residential development appropriate for the settlement. It is hypothesised that such an inquiry will highlight issues relevant to residential development, and help to suggest policies that will lead to an enhanced quality of life, without additional economic inputs.

1.2 PARAMETERS OF RESIDENTIAL ENVIRONMENT

Environment may be broadly defined as 'The total of circumstances surrounding an organism or group of organisms' (American Heritage Dictionary). It can be divided into two types: i) natural environments: consisting of physiography, climate, vegetation, soil, water bodies, wildlife and minerals; and ii) human environments: consisting of all elements with a human touch in origin, including all manifestation of human activities (205, 96). Over the years, it is the natural environment which has received extensive coverage, with most research highlighting the impacts of human behaviour and settlements on the natural environment (238, 199, 112, 75, 25, 158, 152, 273, 98, 74, 214).

The importance of the human environment was brought to world focus only after the Conference on the Human Environment in Stockholm in 1972, the UN Habitat Conference in 1976 in Vancouver BC, the UN Conference on Environment and Development (UNCED) in Rio de Janeiro in June 1982, and the publication of the Report of the World Commission on Environment and Development in 1987 (242). Environment here refers to a 'complex and comprehensive aspect of human life that shapes his modes while, in its turn, being shaped by

Fig. No. 1.2 Sub systems of residential environment



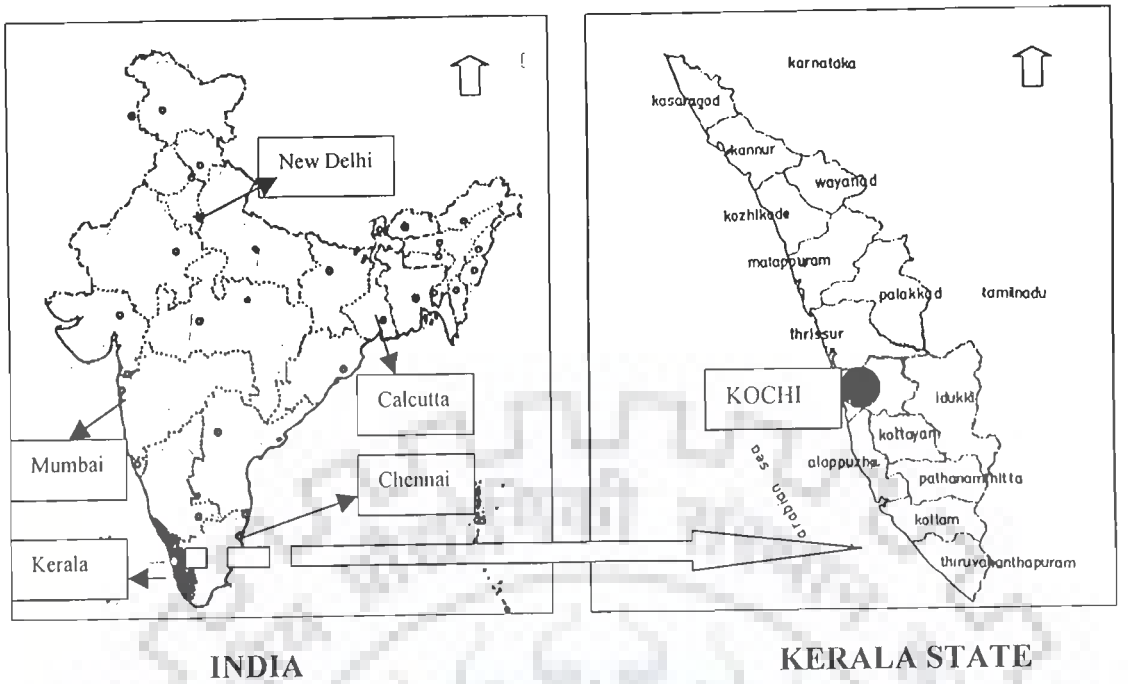
human beings themselves' (42, 183). It is the total physical product of man's impact on the landscape. It is about buildings, their appearance and placement in their surroundings; different types of spaces and spaces between buildings; integration of hard and soft elements; streetscape; use of different materials, sounds, smells etc; about how uses relate to his surroundings and the impact his surroundings have upon him (179).

The residential environmental system functions as a whole with the interaction of the five subsystems- Physical, economic, social, legal and bio-aesthetic having their specific components. Each of these can be defined as consisting of:

1. The **techno-physical conditions** that affect and influence the development of residential areas like geography, location, topography, subsoil conditions, infrastructure, services etc.,
2. The **economic factors** influencing construction and development of housing and typology of residential development,
3. The **social considerations** of safety, health, well being and quality of life affecting socio-psychological satisfaction from housing,
4. The **legal and administrative measures** which controls, supports and guides residential development, and
5. The **aesthetics** of natural and built form, created by the perceptual qualities of biotic features, landscape elements, and of artefacts (Refer Fig. No. 1.2)

The resultant of all these environmental forces decides the form, aesthetic character, efficiency, quality, and direction in which residential development, as a whole, moves. All these aspects are interrelated and interdependent on each other, and are dealt with in this thesis, while analysing the residential land utilisation system.

Every city has a unique mixture of environmental conditions, which characterise it. These, the city size, and the urban problems perceived in a particular city, ultimately


New Delhi
Calcutta
Mumbai
Chennai
Kerala
karnataka
kasaragod
kannur
wayanad
kozhikode
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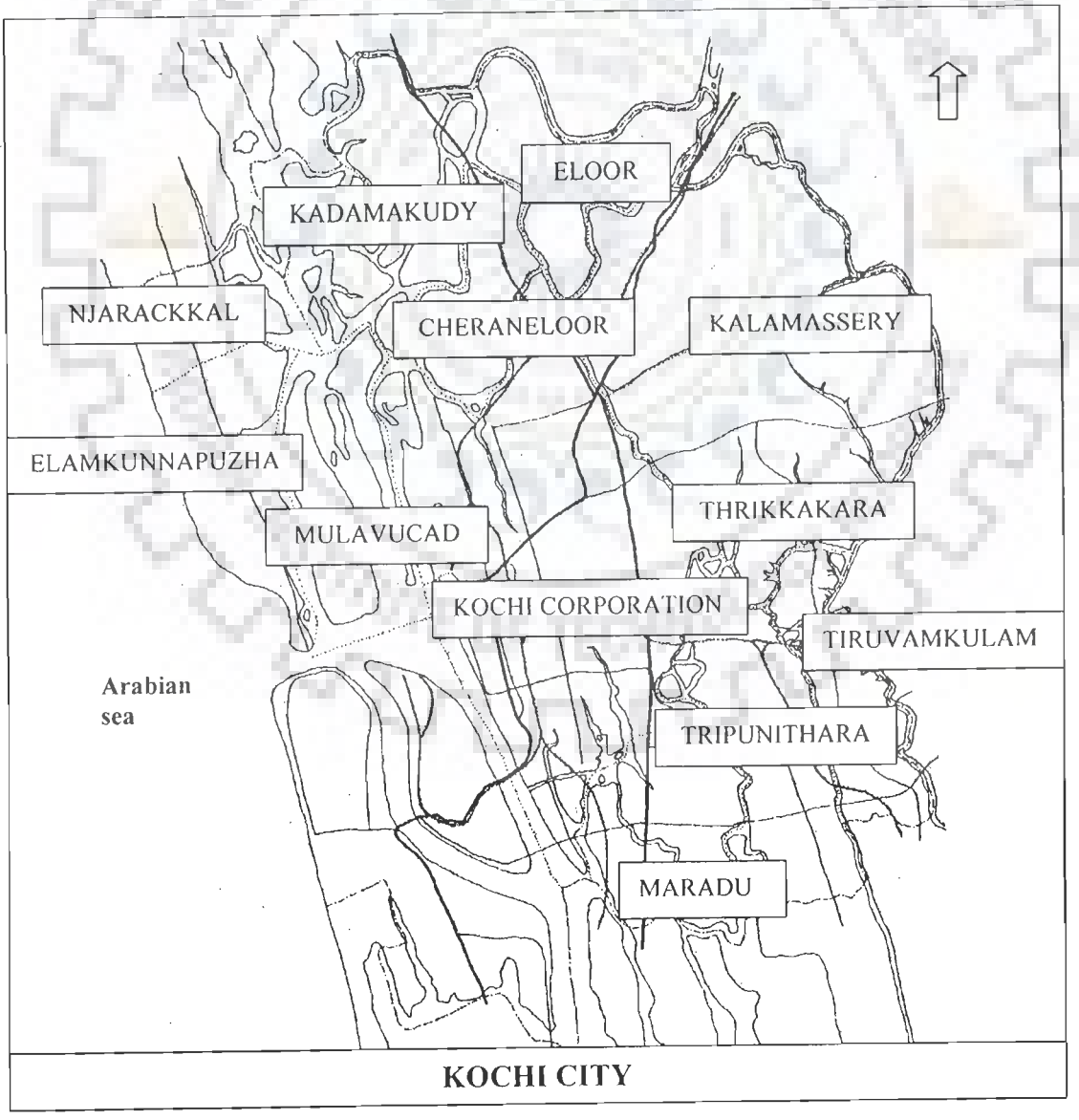

ELOOR
KADAMAKUDY
NJARACKKAL
CHERANELOOR
KALAMASSERY
ELAMKUNNAPUZHA
THRIKKAKARA
MULAVUCAD
KOCHI CORPORATION
TIRUVAMKULAM
Arabian
sea
TRIPUNITHARA
MARADU
KOCHI CITY

Fig. No.1.3

determine the way in which solutions are sought, and the solutions themselves (270). Therefore, patterns evolved for a particular city may not altogether suit another. No generalisation is hence possible, for the ideal mode of residential land use in a town. The search for a policy or strategy is hence more valid, than the solution itself. This search should theoretically cover every town, each with its own specific problems and characteristics. However, considering the limitations for such an extensive study, a medium sized city, is considered as an ideal case study for this purpose, avoiding cities on either end of the city size scale.

1.3 LOCATION AND OBJECTIVES OF THE STUDY

1.3.1 LOCATION

Kochi has been selected as the study area for this research. It is the biggest city in Kerala State with a population of around one million (Refer Fig. No. 1.3). Cochin Port has trade connections with countries all over the world. Being the focal point of an extensive regional network of transport and communication, a major centre for production, export and distribution of goods and services, and a centre of higher education and specialised medical facilities, it functions as the nerve centre of a large urban agglomeration. The commercial importance, cosmopolitan fabric and central location, have made it the focus for investment in land and housing in Kerala. The two national highways NH 17 and NH 47, the establishments of the international airport, and the increased railway linkages, have all served to further consolidate the position of Kochi, as an ideal ground for the real estate market. From the point of view of physical planning, it is also a city with good administrative controls, planned growth centres, and developed infrastructure. Availability of data, familiarity of the researcher with the place, and the convenience in carrying out the primary survey, were among the other

Fig. No. 1.4 People surveyed for this study

important considerations in the choice of the study area. Above all, the morphology of this town from a humble trading centre to a sprawling metropolis, as well as the changing pattern of residential development over a period of more than 150 years, can be still traced in its urban fabric. The emphasis of the study is in the residential development of last three decades.

1.3.2 OBJECTIVES

The following set of objectives have been framed for this research:

1. To study the historical changes in residential land utilisation pattern in Kochi.
2. To examine the role of the environmental factors affecting the residential development.
3. To identify the control parameters, which determine the pattern of residential land utilisation in the system.
4. To formulate an optimum user satisfaction model for residential land utilisation.
5. To evolve a set of policy guidelines for optimum residential land utilisation in Kochi city.

1.4 RESEARCH DESIGN

1.4.1 METHODOLOGY

Given the complex nature of the problem addressed, the enquiry cannot be confined to an exclusive quantitative plane, relegating intangibles to the background. A multi faceted approach was therefore adopted, to identify and survey the varied parameters, and analyse them within the overall problem. This involved collection of extensive information on various aspects of residential development, from (a) the general populace, occupants of multi-storeyed residential buildings, prospective consumers of ready built housing, developers, elected representatives, town planners and administrators who are directly involved; (b) from residents of the immediate environs of multi-storeyed buildings, who are indirectly affected by the development; and (c) from environmental activists, who are vocal on most urban developments in the city (Refer Fig. No. 1.4). Survey research methods were therefore employed in this investigation. The surveys were carried out using pre-tested schedules and

questionnaires, 'in depth' personal interviews (234) and by visual observations, with occasional voluntary assistance from friends and acquaintances.

The paucity of secondary data in a form amenable for research purposes, other than the census records and administrative reports of government departments, has been an impediment in this work. This necessitated laborious and time-consuming primary surveys, requiring the personal visit of the researcher, for collecting data.

1.5 DATA COLLECTION

1.5.1 SECONDARY SOURCES

Secondary sources of data consist of:

1. Census reports, Planning statistics, Development plan and Structure plan for Kochi, government reports, and such other publications.
2. Books, journals, conference proceedings, study reports and newspaper reports.

1.5.2 PRIMARY SOURCES

Primary sources for data consist of:

1. Primary surveys using pre-tested schedules and questionnaires.
2. Visual surveys.
3. Search of statistics from local authority.

The **Primary surveys** conducted were:

1. Survey of occupants of multi-storeyed apartment buildings,
2. Survey of households (general),
3. Survey of prospective consumers of apartment housing,
4. Survey of neighbours of multi-storeyed apartments,

5. Survey of decision makers in urban development (Mayors, Civic officials, Town planners and Technical experts), and
6. Survey of builders.

The **visual survey** covered the general profile of residential development, the pattern of land conversion, and a survey of multi-storeyed residential development in selected areas.

Search of statistics from unpublished records of local authority consisted of compilation of data on new residential construction viz., location and spatial spread, amount of land brought under residential use, rate of yearly construction, residential form employed, and supply by various actors, from the records of local authorities, and from housing suppliers in public and co-operative sectors. The information on multi-storeyed private sector housing collected from the local authorities was supplemented by the **survey of multi-storeyed residential buildings** and from the survey of builders. Information was collected on 215 apartment projects covering more than 6000 apartment units. The format under which information was collected regarding the various characteristics of each multi-storeyed building is given in Appendix A. This was undertaken from July 1995- January 1996 and supplemented in later years.

1.5.3 PURPOSE OF PRIMARY SURVEYS

(A) **Survey of Occupants of Multi-storeyed apartment buildings:** This survey was aimed at identifying the reasons for the choice of multi-storeyed buildings over the traditional independent houses, the criteria used to select the location, and typology of housing, the positive and negative aspects of life in such typologies, and the actual satisfaction obtained from living in them. The schedule used for the survey is given in Appendix B.

(B) **Survey of general populace:** This survey was aimed at identifying the housing preferences of the general populace regarding housing typology, attitudes towards tenure types, and preferred methods of acquiring a house and reasons for the same, which may

be based on the socio-economic and demographic characteristics of the households. The schedule used for the survey is given in Appendix C.

(C) **Survey of prospective consumers of ready built housing**: This survey was aimed at identifying the locational and housing preferences of the people aspiring to buy a ready built house, unconstrained by the actual choices available in the market. The questionnaire used for this survey is given in Appendix D.

(D) **Survey of Neighbours of multi-storeyed residential buildings:** This survey was aimed at identifying the reactions of the residents living adjacent to multi-storeyed residential buildings, towards the changes perceived in the Techno-physical, social, economic, and bio-aesthetic environment of the particular area, consequent to the construction of such multi-storeyed housing. The schedule used for the survey is given in Appendix E.

(E) **Survey of Decision makers:** This survey was aimed at perceiving the views of decision makers viz., Town planners, Elected representatives, and Administrators; knowledgeable citizens and environmental activists; and the developers towards the newly emerging multi-storeyed residential buildings in the city. Opinions were solicited from them on the most important problems faced by the city, since these were being increasingly linked to the emergence of multi-storeyed buildings, particularly by the media. This survey was undertaken during November 1995-January 1996. The schedule used for the survey is given in Appendix F.

(F) **Survey of Builders:** This survey was aimed at identifying the role played by private sector in the past decades, their operation and organisational set-up, the locational aspects and spatial spread of activities, the pace of construction over the years, demand assessment, clientele, housing types constructed and the problems faced by them in the supply of housing. The schedule used in the survey is given as attachment 6 in Appendix G.

1.5.4 SAMPLING

(A) Survey of Occupants of multi-storeyed apartment buildings: A sample of 17 percent of the total apartment buildings was identified, through stratified random sampling method. For study purposes, the city was divided into three zones, namely, inner zone, central zone and outer zone. The sample was chosen in such a way as to proportionately represent the multi-storeyed residential buildings, from each of the three zones. 35 percent of the sample was drawn from the inner zone, 45 percent from the central zone and 20 percent from the outer zone. Further, the apartment buildings were grouped according to the height of the buildings i.e., walk up apartments (up to 4 floors), medium rise (between 5 and 6 floors), and high rise (above 7 floors). The largest number of apartment buildings in the city are of high rise variety, followed by the walk up, while those of the medium type constitute the least number. The sample included consisted of 14 percent of the medium rise buildings, 22 percent of the low rise buildings and 64 percent of the high rise buildings so as to give a fair representation to the various typologies based on height. The apartment dwelling units within the buildings were chosen, so as to give a fair representation of dwellings, at various floor levels. 37 percent of dwelling units chosen were from floors below three, 31 on floors between three and six, and 32 percent were on floors above seven. The survey was conducted during November 1995-January 1996. A check survey was also carried out in December 1999.

(B) Survey of general populace: The sample size for this survey covered around 278 households, belonging to various social and economic strata. Random sampling method was used for this survey. This survey was undertaken between September 1999 and January 2000.

(C) Survey of prospective consumers of ready built housing: This survey covers the responses of 2684 prospective consumers of ready built housing, towards their preference

for location and type of housing. This was undertaken during a property show, held in Kochi in November 1995.

(D) Survey of Neighbours of multi-storeyed residential buildings: The apartments for this survey consisted of 15 percent of the total apartments in the city, distributed over the various zones of the city, and of various building heights. The respondents were chosen in such a way as to include neighbours located on the four sides of the high rise multi-storeyed building. Stratified random sampling method was used for selecting the multi-storeyed apartment building and the respondents.

(E) Survey of Decision makers: The survey covered three broad categories of decision makers, namely, Town planners, Elected representatives, Administrators and two categories of non decision makers namely, Builders and Citizens knowledgeable in the field, in order to assess their reactions towards the new residential forms emerging in the city. The sample included 100 per cent of the Town planners, 60 percent of the Administrators, 50 percent of the Elected representatives, 10 percent of the Builders and knowledgeable citizens, chosen from various walks in life. Stratified random sampling method was used for this survey, to have an equal representation of the various categories of people, according to their involvement in decision making in physical planning, at city level.

(F) Survey of Builders: This survey covered 25 per cent of the builders in Kochi. Builders in Kochi were broadly classified into large builders, medium builders, and low-rise builders, according to their organisational set up, scale of operations and the residential typology constructed. While the large builders are few, and the medium builders are of a limited number, there are a relatively larger number of low-rise builders. The sample surveyed consisted of 90 percent of the large builders, 50 percent of the medium builders, and 10 percent of the low rise builders. The builders were selected using the stratified

random sampling method. A pilot survey was conducted in July 1995, and the survey of builders was completed in two phases, viz. November 1995-January 1996 and in August 1999, so as to cover all representative groups.

1.5.5 UTILISATION OF SURVEYS

Data regarding the five subsystems constituting the residential land utilisation system in Kochi, was collected using the various surveys. The details were collected under the following heads:

(i) Techno-Physical Considerations: Much of the macro level information regarding the Techno-physical environment was available from secondary sources. The micro level information collected through primary surveys can be grouped under two heads:

1. level of satisfaction with infrastructure inside multi-storeyed buildings, and
2. level of satisfaction with general urban infrastructure.

The survey of Occupants of multi-storeyed residential buildings, survey of Builders, survey of Neighbours of multi-storeyed apartments, and survey of Decision makers, and visual surveys were utilised for this purpose.

(ii) Economic Considerations:

The information on economic concerns were broadly grouped into three 1) from the suppliers point of view, 2) from the consumers point of view, and 3) as perceived by non users.

Data regarding the economic considerations affecting the supply of housing was collected from the survey of Builders. Information regarding the economic motivations behind the purchase, mode of acquisition, locational choice, preferred form, budget and period of purchase etc of the different user categories were grouped from the survey of Occupants of Multi-storeyed residential buildings, survey of Prospective consumers of ready built housing, and from the survey of General populace. The economic and the socio-cultural

pressures responsible for the spurt in multi-storeyed apartments as perceived by decision makers, environmental activists and knowledgeable citizens were identified from the survey on decision makers.

(iii) Social Considerations:

Social indicators such as (i) cultural attitudes towards housing, (ii) socio-economic reasons in choosing different typologies, (iii) satisfaction and quality of life, (iv) locational preferences and (v) effect on immediate environs of multi-storeyed buildings were collected from the surveys conducted among occupants of multi-storeyed apartments, general populace, prospective consumers, decision makers in housing, and neighbours in the immediate environs of multi-storeyed buildings.

(iv) Legislative and Administrative Considerations:

Broadly, two aspects of administrative and legislative practices were investigated viz. (i) The perception of the general public on undertaking house construction themselves, considering the controls and hassles involved, and (ii) the perception of the housing suppliers on existing legislative controls, in production of housing. These were collected from surveys of general populace, occupants of multi-storeyed apartments, and builders.

(v) Aesthetic considerations:

The aesthetic sensibilities of the populace towards the emerging residential forms, were obtained from (i) the response of present occupants and prospective consumers of ready built housing, towards the aesthetic qualities pertaining to their housing and neighbourhood , and (ii) the perception of the builders, decision makers, and senior citizens on the visual quality of the city, as a result of the proliferation of multi-storeyed residential structures. Responses on this aspect was solicited in the survey of occupants of multi-storeyed residential buildings, survey of prospective consumers of ready built housing, and survey of Decision

makers. The researcher also, owing to her architectural background, carried out an evaluation of the visual quality of the residential development.

1.6 TOOLS AND TECHNIQUES

Pre-tested schedules have been used for conducting the surveys. Computer software like SPSS statistical package Ver.7.5, Microsoft EXCEL 97 and Microsoft ACCESS 97 have been used for data processing and analysis. Analytical techniques, such as, Weighted index methods, Multiple Regression and Factor analysis have been used for detailed analysis and modelling.

1.7 SCOPE

The present investigation aims at formulating an ideal user satisfaction model, and evolving a set of policy guidelines for optimum residential land utilisation in Kochi City. It is believed that the realisation of this model, will aid in the development of suitable architectural forms and an appropriate residential land use pattern, which will be: (a) Economically justifiable from the developers and investors point of view; (b) Environmentally satisfying from the users point of view; (c) Techno-physically appropriate from the point of view of decision makers, vocal groups, and neighbours of high rise residential buildings; (d) reasonably realisable by enforcing authorities through greater compliance from developers; (e) enhance the bio-aesthetic environment of the city by providing a visually interesting architectural form, and pleasing skyline, while retaining the pristine natural biotic beauty of the city; and at the same time (f) providing a wide choice of residential typologies, for users and developers, to ensure greater user satisfaction and compliance respectively.

1.8. LIMITATIONS

The researcher being an architect planner, the objective of the work has been limited to the derivation of a meaningful direction for planning and design of ideal residential environments, to ensure greater user satisfaction, and to evolve a set of policy guidelines for optimum residential land utilisation. Attempts have been made to carry out the surveys at the grassroots level for the above purpose. Suitable techniques like factor analysis have been used to identify the factors amenable to control in the residential land utilisation system. The other urban uses like commercial, industrial, transportation network etc., have not been incorporated directly in this study of residential land utilisation pattern. This inter alia provides scope for further research, on the complex urban form.

1.9 THESIS ORGANISATION

Chapter one identifies the goal of the study, and defines the problem. It sets the objectives for the research work. The important factors under each of the subsystems have been identified, and the methods used for the analysis are presented. The scope and limitations of the study are also spelled out.

Chapter two gives an overview of literature on various aspects of residential environment. It identifies the patterns of residential landuse and building typologies, and enumerates the merits and demerits of each. The importance of this research is established.

Chapter three introduces the regional setting of Kochi, the study area. It presents the historic, economic, social, techno-physical and legislative factors that have shaped residential architecture of Kerala. This provides the background for study on the residential land utilisation of Kochi.

Chapter four describes the rich architectural diversity of Kochi and proceeds to present the circumstances, which led to the change in the residential typology, in terms of architectural plan, quality and form.

Chapter five based on a survey, is devoted to the study of the residential land and housing supply mechanism in Kochi. It describes the characteristics of land, and identifies the specific problems, related to utilisation of land. It lists out the role of various actors in land and housing supply in Kochi, and presents their contribution to residential development.

Chapter six gives a detailed analysis of the survey on the temporal and spatial growth in new residential development in terms of a) quantitative growth in apartment housing, b) growth trend in building typology by height and c) growth trend of dwelling unit size. It identifies the factors propelling the growth of new residential development and their unique features.

Chapter seven presents the perception of the general populace, the prospective consumers of ready built housing, and the occupants of multi-storeyed residential buildings, regarding the new building typology that have emerged in Kochi during the last decade, based on their response to a questionnaire. Firstly, it identifies the housing choices of general populace and their attitudes regarding the newly emerging housing forms. Secondly, attempt is made to assess preferences of prospective consumers, regarding location, characteristics and amenities. Lastly, it analyses the response of the occupants, on the choice of multi-storeyed residential forms, in terms of locational and other characteristics. The satisfaction derived from the various aspects is examined.

Chapter eight attempts to model the user satisfaction by identifying the important components which contribute to it, using factor analysis. The significant factors and variables, and their sensitivity to user satisfaction is identified through multiple regression

techniques. The control variables are identified, to enable the formulation of policy guidelines for planning and architectural design.

Chapter nine deals with the perceptions and reactions of the general public and decision-makers towards the newly emerging multi-storeyed apartment forms. The opinions of town planners, administrators, elected representatives, builders, social elite, and neighbours of multi-storeyed apartment buildings, regarding the impact of the proliferation of new residential typologies is examined.

Chapter ten presents the discussions, and attempts to give an architectural interpretation to the mathematical model. A set of policy guidelines are evolved for optimum residential land utilisation in Kochi.

CHAPTER 2

ENVIRONMENTAL CONSIDERATIONS IN RESIDENTIAL LAND UTILISATION - A REVIEW OF LITERATURE

CONTENTS

This chapter elaborates on residential development and its various subsystems, namely: Techno-physical, economic, social, legislative and administrative, and bio-aesthetic aspects. It gives an overview of literature regarding the various environmental aspects considered and their influence on residential environments. It identifies the various patterns of residential landuse and building typologies, and enumerates the merits and demerits of each. The need for the present research is also established.

2.1 PARAMETERS OF RESIDENTIAL ENVIRONMENT

The term human settlements signifies "all natural elements and man made structures which result from the process of settling, the establishment of shelter, the boundaries that separate them, the spatial relation which link them with the immediate as well as distant places, and the institutions, social, cultural, economic, political, and others created to manage and govern them" (159). This statement recognises the embryonic role of residential land uses in the formation of a settlement. This is substantiated by Doxiadis, according to whom, human settlements are subject to five groups of influences namely cultural, social, political, technical and economic. Here again the cultural and social aspects of "Ekois" precede the technical and economic aspects (59). Architectural historians also affirm that architectural development influenced by geographic, geological, climatic, social, historical, and political factors, had its genesis from the humble residence (68). Obviously, studies linking the physical, political, economic and socio cultural structure of residential development will help in the creation of a satisfying living environment, and promote aesthetic values. This concept is the very basis of an environmental design approach to residential development.

It is now well recognised that, every organism, is in constant adjustment with the environment comprising not only the physical aspects but the social aspects involving other organisms and their activities as well (166, 132, 161). Lewis Mumford viewed an ideal environment as seeking continuity, variety, orderly and purposeful growth, as opposed to an environment that magnifies authoritarian power and minimises or destroys human initiative, self-direction and self-government (170). The complex interaction between man and residential environment is well captured in the observation of the architect Lars Lerup "We design things and things design us"; or of Sir Winston Churchill "we shape our buildings and afterwards our buildings shape us". Architecture is one such instrument whose central

function is to modify the environment in man's favour (206). Residential areas are particularly important for man-built environment interrelationship studies, as man spends the greatest part of his life there. The importance of housing is highlighted by Strassman who notes 'The use of no other product by one family intrudes as much on the community with its ugliness, beauty, hygiene, noise, smells, dangers, traffic congestion, and several other externalities and inequities' (230). The state of housing is also an important measure of the level and contents of the socio-economic, industrial, architectural and planning development in every human society (180). Good housing is a tool for the macro-economic development of a country, with substantial multiplier linkages throughout the economy (4). Many studies have highlighted the effect of the housing environment on the physical and mental health of man especially in his formative stages (161, 166, 207, 249, 115). According to Agan, housing may affect the social and emotional aspect of family life, by influencing the behaviour of the individual members, which depends on the effectiveness of the architectural design in providing for rest, privacy, and quiet, that gives a sense of peace and inner strength (2, 3). In modern times, the pressures of urbanisation have effected changes in the characteristics of traditional housing, primarily due to pressures on land. As noted in section 1.1 of chapter 1, the pressure is highest on residential land, necessitating studies on its judicious utilisation.

2.2 THEORIES OF SPATIAL PATTERN OF RESIDENTIAL LANDUSE

Residential land utilisation essentially refers to the location, spatial distribution and the intensity of residential use as determined by the density and typology of the built form in it. The earliest treatise on residential land dwells on the selection of land, physical attributes and its suitability for a healthy living.

2.2.1 HISTORICAL TENETS OF RESIDENTIAL LANDUSE

Ancient Indian literature reveals the importance of the topographical, hydrological and biotic characteristics, which decide the suitability of land for establishing residential settlements (1, 202). The importance of location of settlements in areas with wholesome air and near fresh water bodies, and the effect of changes in seasons, wind and temperature on the physical health of man, has been noted in some of the ancient western literature (204).

In India, the planning of settlements 'Vastuvidhana' has its origin from the Sanskrit root "Vaas" which means to dwell. Vaastuvidhana describes numerous types and sizes of villages and towns, all formalised within the symbolic form of 'Mandala' (117). There are 32 kinds of mandalas, from the one consisting of a single square to that consisting of 1024(32x32) squares, with the grid lines oriented in cardinal directions. The cells were grouped in finite order depending on their location and distance with reference to the focal point of the mandala, to be zoned for different uses. The central zone of cells was always occupied by a symbolic building viz. a temple (Prasada), palace, or other administrative buildings and the residences for different classes 'Varna', were allotted in different zones. Location for markets, crafts, and institutions were also earmarked in special zones in a pattern designated within the canons of planning (1, 191, 82). There were similar schemes for allotting residential uses in cities in other ancient systems like that of the Greeks, Chinese etc.

2.2.2 LATER RESIDENTIAL LAND THEORIES

With industrialisation, and the development of cities as economic centres, studies were undertaken on land as an economic good (8). Almost simultaneously, studies were initiated which tried to understand spatial pattern of land as shaped by social forces (34). Progressively, cities started being viewed from an aesthetic angle, with studies on the visual effect of different landuse patterns and governing building regulations on the form of cities (46, 176). Modern literature is replete with studies on the location and spatial distribution of

land uses, particularly by economists, geographers and sociologists, who have tried to explain the household's choice of location, and the spatial distribution of households within the city, each from the point of view of his own discipline.

The earliest attempt to understand the urban land market is found in the work of the economist Thunen, in 1826. He laid the foundations for the formal spatial analysis of agricultural rent and location and said that the urban market operated under the same principles. Hurd, in 1903 and Haig, in 1927 attempted to create a theory of urban land in the footsteps of Thunen, but their theory failed to consider residential land, the predominant land use in urban areas. Meanwhile, some economists held that residential patterns were caused, due to non-economic factors like personal utility and individual tastes and preferences. The expansion of the city takes place by the invasion of each zone into the next lower income group. Hoyt in 1934 concluded after studies on 142 American cities, that residential patterns conformed to sectors. The highest rental sector is located on some area with natural topographic advantages and is flanked by sectors of the lower rentals. The city grows by expansion of high rental sector radially outwards into the vacant land, while the lower rentals expand as a band from the centre and are successively occupied by the next income groups. On the other hand, Harris and Ullman in 1945 propounded the multiple nuclei theory, which states that the city is built around several nuclei and differentiated districts exist due to the advantages of the profits of cohesion of specialised facilities.

Focus on residential land studies started around the late fifties to early sixties. It was the rapid urbanisation, which propelled this interest in residential land. The problem now was to relate transport costs, and housing costs, between the two predominant land use areas- residential and the working zone in the city. The first economists who tried to explain the pattern of residential location as a trade off between transport costs and housing costs were Hoover and Vernon in 1959. Called by various names like Trade off theory by Richardson,

and Least cost theory by Beed, its original formulation is attributed to the sociologist Schnore in 1954 (65). In the late fifties, this theory was developed to explain the relationship between land rent and location by Alonso, transport system and landuse by Wingo, and residential location and journey to work by Kain (65, 8). Alonso, in 1960 developed the bid rent curve, which states that "Bid rent functions map an indifference path between the price of one good (land) and quantities of another and strange good, distance from the centre of the city". Every land user has a family of bid rent curves, and the steeper curves capture the central location. This explains why in many cities, central locations are captured by commercial uses, followed by residential and agricultural uses. Muth modified the Trade off theory by incorporating the theory of supply of space to explain the patterns of residential location.

Many studies have highlighted the change in residential patterns of modern cities brought about by improvement in transport system and the resultant increase in income elasticities (171, 65, 26). The rich who occupied central locations in historical cities started moving towards the peripheries as their income elasticities for demand for space increased, while the poor occupied central areas and middle-income groups occupied intermediate distances. Evans extended this theory to explain that while the rich with large income elasticities could be found in the peripheral areas, those houscholds with low income elasticities and high value of travel time and cost move towards the city centre, with the rich being the closest. Hence in most cities, both rich and poor can be found in city centres, while middle income occupy intermediate distances and rich are again on the peripheries. Within this broad framework, wealthy residents or high- status establishments obtain prestigious sites close to natural amenities, select stores and high order employment while a reverse process compels lower- income groups to settle for areas overlooked by wealthier residents, often adjacent to disamenities (67). Some researchers report that cities that have administrative

CBD's without heavy industry and with significant commuting distance to the suburbs from the core, were likely to contain middle class and upper class house holds near the centre (141).

The oldest theory, linking residential patterns to non-economic factors was by the sociologist Burgess, in 1925. He stated that the city can be represented by a series of concentric rings starting from central business area with the deteriorated environment and followed by the zone of transition, workmen zone, high quality single-family zone and the commuters' zone. He described the dynamics of housing as a process of invasion and succession in which new population, penetrate areas occupied by other groups and come to dominate those areas after displacing the initial groups. Subsequently others have presented theories on residential distribution from the viewpoint of their own disciplines. It was Evans who attempted to integrate the various aspects of economic and social theories like income of households, efficiency of its transportation system, social agglomeration characteristics of various groups of households, their household characteristics, and the location of their work centres, and develop a positive theory, which could be used to explain and predict residential location patterns in cities (65).

Studies reveal that households vary concentrically from the centre depending on the family status, and move from the centre to the periphery as they advance in life cycle. The sizes of the households also increase with distance from the city centre subject to income constraints. In the case of the low-income group, irrespective of their work centres, they are restricted to a small distance around their work centres, with no marked variation with respect to their household size (65, 171). In each income group, the number of larger households with more members outside the working age, and households with no adult females working outside the home, tend to increase with distance from the centre. When a city has several work centres, those households with members working in a particular sector will tend to live, along a radius connecting this sector to the city centre (65, 154). The trade off theory holds

good only for large cities and hence in smaller cities, there may be variations in the residential patterns based on the scenic surroundings, topographical advantages, residential proximity of influential persons (65), quality of the environment which may depend on the residential density, socio-economic status, and variations in terrain, condition of housing (34), special attractions, personal values, location of consumer services, location of previous work places, availability of jobs (154, 49), and cost of moving (65), which may pull the household in random directions. Thus, while economic and social theories have been able to explain certain aspects of residential land utilisation, none have been totally successful. A satisfactory theory of residential location and city structure has remained elusive, and a 'scarce commodity', inviting continuing studies (185, 7).

A. Influence of technological changes

The rapid urbanisation, and developments in transportation technology, encouraged the growth of dispersed communities called by various names viz; suburbs, fringe development, satellite townships and new towns. The density profile of the traditional city with its peak at the city core and tapering to the edges was altered by this development. By this development, the density profile of the city underwent a change from the steeply descending pyramid of the historical cities to the gently sloping profiles of modern cities (171, 67). With the movement of residential areas to the suburbs, the density profile is further modified, with the peak shifting away from the central zone.

2.3 ALTERNATE SPATIAL PATTERNS OF RESIDENTIAL LANDUSE

The kinetics of urban growth has generated new theories of locating residential development vis-a-vis the form of the city; whether it is to be compact high rise or sprawled low rise. While some have strongly condemned the gross misuse of land through sub urbanisation (269) and advocated re-densifying the city (220, 263), others argue that sub

urbanisation increases land supply and controls land prices (70). Studies have also been made in various countries to determine the best housing typology for a specific density (15, 76, 35). The Institute of Town Planners (India) is initiating a study of Indian cities to determine the appropriate housing typology.

2.3.1 THE DISPERSED RESIDENTIAL SPATIAL ORDER

Normative studies advocate the suburban type residential development, providing large plots and low densities at affordable prices, an option absent in compact urban forms. A deep-seated consumer preference for low-density and strong anti-intensification sentiments, promote this type of development (67). The findings by sociologists and psychologists on the ill effects of high-density living, has further strengthened the arguments in favour of suburban developments.

It was believed right from the Middle Ages that high-density living encouraged diseases (204). Some researchers have reported that physical and mental health problems, juvenile and adult crime rates, and social alienation increase with increasing density (211). High densities were shown to create stress, cause deleterious behavioural after effects, promote irritability and physiological damage that may accumulate over time (166).

Architecturally one may distinguish between high density and crowding, to show that it is the latter which is undesirable. While density is a conceptual and abstract measurement and a planning statistic, crowding is a sociological condition, a psychological and subjective state. Some countries have therefore attempted to create and achieve high densities with less crowding, by creating vertical streets using high-rise buildings (139). However, some researchers argue that space use and reaction to spatial invasions may vary with the cultural background. Traditionally, most oriental settlements have always been of high-density close knit spaces. Studies have shown that the Indians, Arabs, and Chinese for example are well adapted psychologically to congested settlements. This cultural adaptation towards congestion

is reflected in traditional settlements with closely spaced buildings, small courtyards, and narrow streets. Such developments have also been found climatologically appropriate in these regions (131, 134). Hence while there is no universal cultural attitude towards high density, it is believed that the social and economic characteristics of some cultures make them more suited to live in higher densities (139).

2.3.2 THE COMPACT RESIDENTIAL SPATIAL ORDER

Proponents of the compact urban form opine that dispersion is highly undesirable from an environmental point of view and to some extent from social and political point of view as well. Suburbs are criticised for their (i) environmental consequences: voracious fuel consumption, loss of agricultural land and natural open areas; (ii) high cost of linear infrastructure: roads, sewer, water main, electricity, and cable, especially under low density and poor soil conditions (85) and (iii) high service delivery costs: garbage collection, transit and school bus costs. Expanding suburbs would not only necessitate more private vehicle ownership and increase congestion, but also marginalise those without access to a private vehicle: the old, the young, and low income families (92). They point out that even the densest[1] areas on the globe have chosen high densities opposing decentralisation and loss of precious natural environment (139). They argue that '...evidence is staring us in the face that the basic growth trends are...toward higher, rather that lower density'. Hence they advocate that a tighter and more efficient use of land should be made. While big spaces are saved, open spaces accessible to all should be created, and small spaces efficiently used. They opine that though official land policy may be decentralist and against high densities, it is necessary to accommodate the growth by combining intensity and efficiency of use (269).

[1] Only 10% of Hong Kong is built up and 27% is rural developed land. Rest is all woodland, parks, swamps, agricultural land and fish farms. Land can be created from conversion of any of these but it is argued that decentralisation will destroy valuable recreational outlets and also reduce Hong Kong's ability to produce its own food (139)

Contrary to popular opinion against high-density spatial order and the deleterious effects of crowding on human functioning, redensification and concentration have some psychological advantages to offer. According to Le Corbusier, "The virtue of the big city is that, it becomes a magnetic pole of attraction from which emanates the spiritual achievement resulting from intense concentration" (45). Jane Jacobs has also extolled the excitement and vitality associated with the exuberant diversity of people and places and has stated that a concentrated area of humanity may be an asset rather than a liability. According to her the optimum human situation may be one of access to a variety of densities rather than simple high or low density as such (116,166).

In addition to studies from the economic, psychological and architectural points of view, there are those which report the locational preference of households for larger suburban homes or smaller central city homes, depending on the characteristics of the household such as the family size, lifecycle, socio-cultural and socio-economic characteristics (141). Moderates therefore view the solution to this dilemma, as a compromise between concentricity and sprawl. Hence they suggest the scattering of nodes across the suburban landscape, to increase density and mass transit use. They recommend that green spaces and buildings should be integrated so that one can reach a green space in two minutes (67, 59). Increasing densities at least in some nodes is thus inevitable in any city. High densities can be achieved by adopting (1) low-rise close knit built form (Constrained horizontal expansion) and (2) high rise multi-storeyed form (Vertical expansion). While the former method was popularly deployed in historical cities, it is the latter, which has found increasing favour in the modern times.

2.4 THE MULTI-STOREYED RESIDENTIAL FORM

The history of residential architecture reveals that multi-storied buildings of the double-storied variety were common in the cities of the ancient world as can be seen in the architecture of ancient civilisations like Indus valley, Greece etc while buildings of even four to five-storeyed varieties were common among the Romans (68). India was not far behind. According to Sheikh Ramzan, Aurangabad was once Chicago and New York of India and four storey buildings were very common. Except for the mansions of the feudal lords, most of these were used for commercial purposes on the lower floors and for living on the upper ones. High-rise buildings of eight to nine stories became possible and started to be constructed in Europe, when cast iron emerged as a building material, in the aftermath of the industrial revolution (68). The construction of tall buildings in good numbers started with the manufacture of steel structural and the invention of the hydraulic lift in 1852, and the electric one in 1880. According to Fazl-ur-Khan, the engineer for the Sears Towers in Chicago, technical possibility and newer materials apart, central location, easy transportation, optimum use of floor area with minimum ground coverage, shortage of work space for expanding activities, rapid vertical communication system, maximum output with minimum input, working at the same address, romance of being up in the tallest building, prestige of the occupant, occupant of the highest level liking or having illusion of gathering cloud around him, psychology of one up thy neighbour, and publicity for the property owners, are all reasons for the construction of tall buildings. Other factors which have encouraged construction of high rise buildings are financial viability, availability of advanced building techniques, development in environmental control technologies, computerised design of structural system; electric and telecommunication services inside tall structures, and general

safety measures like alarm system, smoke detectors, sprinklers, fire escape etc. (23). Increase in housing demand, due to break down of joint family, desire of couples for social recognition, material comfort and better living conditions, western cultural absorption in case of developing countries, socio economic considerations of people, etc. also contributed for this choice (180). Multi apartment housing, which became a necessity owing to space intensive work culture, locational affinity to central amenities, and social compactness, can thus be conceptualised as a system of urban cohabitation evolved to partially or substantially guarantee the living needs and privacy of a household within a defined housing unit of multi family occupancy (180). In the early part of the twentieth century, multistoreyed apartments started being constructed in all major cities of India (215).

In 1965, a report of the Economic Commission for Asia and the Far East, stressed on the necessity for Indian cities to expand vertically, in order to conserve land for productive purposes, and for the development of a compact urban structure, which reduces the cost of urban infrastructure (62). The issues arising out of such high density-high rise development were discussed for the first time in the National Conference of Tall buildings in Delhi in 1973. While tall buildings were justified as an inevitable feature to achieve higher densities and a new architectural typology, this development was viewed with caution by the Conference. The importance of social aspects of high-rise living has further been highlighted in the Draft Status Report on Housing and Construction Technology prepared by National committee on Science and Technology, Government of India, New Delhi in July, 1975. Since then, the phenomenon of tall apartment buildings has moved from the metropolises to the small towns, and even to the countryside of India. But even a quarter century after this report, while studies on the economic, organisational and operational aspects have been undertaken for various cities like Delhi (117), Cochin (11, 232), Guwahati (124), Baroda (147), Madras (172), Hyderabad (178, 19), Coimbatore (213), Pune (208), Lucknow (225) and Ahmedabad (265)

etc, studies on socio-environmental aspects of high rise living are still limited. A critical inquiry into the problems and potentials of this building form, hence, becomes all the more topical and relevant today.

In India, as in many countries like China, Britain, Canada, Venezuela, Denmark and the United States of America (63, 267, 16, 266), the acceptability of the tall apartment building, has remained an unresolved issue. Recently a suit has been filed against a government building in Calcutta, on the ground that it would deteriorate the environment (73). Veteran politicians and environmentalists have also criticised some of the high rise developments executed by renowned architects, for limiting their perception within the narrow boundaries of their project, and totally ignoring the larger environmental issues (73). Others caution that 'the architects who desire to create, albeit, tall structures on the Indian sub continent, would be well advised to evaluating *(sic)* their designs and if need be even learn the real lessons of building vertically'. Their doing otherwise might create cities without souls, just the same way that had happened in many of the advanced countries of the world' (23). Two common objections raised against high rises in the Indian context are that, tall multi-storeyed buildings need extensive energy and are not always conducive to good urban aesthetics. Increasing building height necessitates elevators, and pump sets for pumping water, standby generators and multiple basements for parking (212). Others counter that, denser developments tend to use less energy per unit than single family houses do because the common walls and ceilings and multi-storeyed structures reduce their surface to volume ratio (38). The (INTACH) Indian National Trust for Art & Cultural Heritage is also of the view that higher Floor Area Ratio's are counter productive besides having a potential for creating urban chaos, traffic congestion and pollution (212). On the other hand, some architects maintain that the challenge of urbanisation can be met more by tall buildings and advocate the demolition

of closely spaced four to five storied buildings, so that the land can be better utilised to raise tall structures with enough open spaces (23).

While tall apartment buildings have not been viewed favourably in some countries, it has not been so in others. It has been reported that Hong Kong, with its difficult topography has successfully met massive housing requirements, including housing of one million refugees from china by resorting to high-rise apartment buildings. Moscow too resorted to multi-storeyed apartment buildings to solve the huge housing problem of the metropolis (23). In Korea it was found that the provision of high-quality apartments in prestigious commercial developments (incorporating a retail space or office) encouraged many wealthier Koreans to live and work in the city centres. This was responsible for the growth of cities as socio-cultural centres and easing traffic problems by reduced travel-to-work distances. This was also hailed as an efficient use of land resources in the CBD (71). Some researchers therefore opine that tall apartment buildings should not be banned, just because it is unsuitable for certain family types, as they are ideal for some, and fill some others need at least in some period of their lives. Instead, efforts should be made to improve architectural design and minimise drawbacks of this building type, and thus increase the choice available to all (146, 267).

Policy makers in India are also, thus, caught in the ideological conflict of desirable apartment typology for and against tall buildings, increasing density and reducing congestion, suburban spread and compact development. Their confusion may be seen in the frequent change of rules regarding high rises with enforcement of strict control alternated with complete relaxation. Some view this as a game of 'snakes and ladders' played by builders, planners and politicians, earning fortunes for some, but with no benefit for the common man (212, 29).

The residential development system is seen to have five essential sub systems. Of these the technological, economic, and political factors, directly influence the housing typology. The social and aesthetic aspects have remained secondary in planning decisions, as qualimetric evaluation of these aspects are possible only through user surveys.

2.5 USER STUDIES ON MULTISTOREYED RESIDENTIAL LIVING

The effects of the proliferation of high-rise residential structures on the community may be diverse, viz. economic, environmental, political, social and techno physical. They may be economic in that they may be caused and may cause high land values; sociological in that there may be occurrence of social pathologies such as murder, suicide, and child abuse, depending on population density and the location of high rise buildings; political considering the impacts arising from policy decisions made by public and private decision making bodies; techno physical in that they may cause change in automobile ownership and alteration of movement patterns due to central location of the high rise building, and affect infrastructure through increased congestion on roads, pressure on water supply, power supply and sewage disposal (218).

User studies are hence the most popular in the evaluation of building typologies (123, 268, 250). It is noticed that the same environment may affect different people in different ways. User satisfaction hence, cannot be assessed in absolute terms, as it is a function of different variables such as (i) the characteristics of the residents - age, stage in life cycle, social class, cultural background, outlook and values, expectations, earlier experiences etc; (ii) characteristics of the housing environments like location and number of block, flexibility, and amenability to alterations, and (iii) the occupants perception about the aspects the physical environment, the service facilities management, and the interaction with other residents (14, 166, 23).

Some studies in India reveal that people are reluctant to accept high-rise residential buildings unless forced by circumstances like housing shortage. While studies in Nigeria and Mumbai reveal that at least half of those living in an apartment viewed it as a symbol of social achievement and prestige, only one tenth in a western sample felt so (23, 180). Nearly half of the residents living in high rises in France and Germany viewed it only as a temporary arrangement, which gave them a sense of belonging, but in an impersonal environment and served to fill their need at some points in their lives (267, 146). Micro environmental factors for adopting particular locations or high rises by users include, locational aspects like access to central city and work places, social needs like the desire for anonymity, the feeling of exhilaration (anxiety), social status and values of the neighbours with whom they and particularly children will interact, and a mix of aesthetic and physical factors ranging from overall architectural design to the nearness of other towers and the quality of elevator service (23, 271).

Opinions are diverse regarding the experience of living at different heights. A study in Hong Kong reported that multiple family dwellings on upper floors suffered more from emotional stress symptoms like headache, nervousness and insomnia when compared to similar kind of dwellings on lower floors, due to the inability to adopt an adaptive behaviour like stepping into the street for more space (166). Studies in India reveal that there is a general preference for single storied buildings and for lower floors. A study by Central Building Research Institute around the sixties, on residents of four storied apartments from different social strata in Delhi showed that 71% preferred single storey while the rest 29% preferred double storey. A study on 460 households in Mumbai after nearly two decades also revealed the same preference with 65% of residents preferring buildings not greater than 3 stories, 20% preferring 4-6 storied ones and 15% preferring higher than seven stories. Among high-rise occupants a majority of 75% preferred 1-5 floors, while the remaining 25%

preferred more than 6 floors. Out of the 75%, 36% liked ground floor, 31% 2-3 floors, and 8% 4-5 floors. Of the 25% who preferred more than six floors, 9% preferred 6-8 floors, 10% 9-11 floors, and 6% >12 floors. The preference for the lower one third seemed to be out of fear of earthquakes, fire and poor construction (215, 239, 23).

Choice of floor was also found to vary with the age, stage in lifecycle and occupation. Families with elderly parents chose lower floors presumably due to fear of faulty lifts, difficulties in climbing and loneliness. Families with young children lived on lower floors for ease of access to the play area and for easy parental supervision, while households with grown up children preferred upper floors. Studies in Germany and France reveal that preference for living in upper floors is determined by the desire for view and to escape from noise. Even in Mumbai, the aspect most liked by three quarters of high rise residents was the distant view of scenery from the heights and the quiet environment (90, 146, 23). More than half of the Mumbai residents reported the relative absence of household pests, in high-rise buildings.

The Mumbai study also revealed that the aspects most disliked by 40-65% of the residents were concerning safety of children, fear of fire and earthquake, crime, facelessness and isolation. A majority of the residents also felt uneasy, frightful and isolated and revealed a phobia of heights (215, 23, 30). The issues of highest concern were related to socio-psychological aspects, especially manifested near elevator, waiting lobby and the basement parking area. This is because of the tension of waiting, of having to be in overcrowded situations, lack of legibility of the facilities due to improper location and the fear of crime when alone in lifts or basement parking (215). Other irritants were related to poor design and services like garbage chute, storage space, safety provisions at balconies, and lack of contact with nature (146).

A number of studies indicate a positive correlation between high quality landscaping and overall satisfaction (146). Studies conducted in Liverpool, London, Manchester, Germany, US, Belgium, and Holland indicated that the problems experienced by families in large blocks of apartments were related, among others, to lack of courtyards, and kitchen gardens. A study of high rise apartments in Mumbai also revealed that while 82% were concerned of lack of green space, gardens and natural surroundings, 48% actually disliked apartments due to lack of greenery (23).

2.6 ARCHITECTURAL DESIGN ASPECTS IN MULI-STORTEYED RESIDENTIAL BUILDINGS

One of the drawbacks in the planning and design of residential development is that, they are designed for average users. Neither the differences of occupant's characteristics, nor the changing needs of residents in time are considered in design, leading to limited satisfaction (14). Suggestions to improve user satisfaction in a layout broadly cover three aspects (i) improvement of social interaction (ii) betterment of architectural design and (iii) increased security.

High densities are known to inhibit intense social relations (88), generally due to the short and rare contact opportunities among themselves, unlike those in single-family houses, with adjoining semi-private spaces, where they happen to meet frequently during domestic chores (146). Studies reveal that social status, homogeneity, lifestyles and tastes of the people are correlated with intense neighbourly relations. None of these can be ensured in high-rise, the residents being of different background and, tastes and outlooks. It was found that the interaction among lower and lower middle class groups was relatively high through visits, borrowing of food / repair tools etc. (88, 27). A study among the Mumbai high rise residents

also, confirmed that the high income businessmen who occupy upper floors seem less sociable than those on lower floors, and preferred to develop social contacts away from residences, in clubs and other institutions (23). On the other hand, others relate this phenomenon generally to urbanisation and city living rather than high-rise living (206).

2.6.1 SOCIAL INTERACTION

There has been attempts to achieve greater social interaction through conscious physical design of architectural elements (14). These attempts through architectural design were to satisfy the needs of people for activities outside their dwelling, with more opportunities for mutual contact, thereby weaving a social fabric among themselves. According to Gutman, site plans can influence social behaviour in three ways: 1) by providing adequate amenities; 2) through the physical network facilitating communication; 3) through site aesthetics (89). The physical configuration of neighbourhoods also influences neighbourly behaviour (88). It is reported that a component of architectural design, which greatly affects behaviour, is proximity (166). Most propinquity studies however, differentiate between the two distances: functional and physical. Physical distance is the linear distance that needs to be traversed in walking between two apartments while functional distance includes all variables of design, which affect involuntary contacts between people. Functional distance can vary between units in two sets of apartments even when the individual units are separated by the same physical distances. Functional distances when smaller than the physical distance formed more friendships (166). Several studies suggest that the site plan, or relative orientation of and distance between doorways should be designed to affect behaviour by fostering or encouraging passive, casual contacts between neighbours engaged in their every day household tasks. Further, there should be a purposeful arrangement of facilities, encouraging formation of informal groups and thereby permit social interaction (166, 206).

2.6.2. ARCHITECTURAL DESIGN

Studies suggest that architectural design should take care to provide maximum privacy to ground floor residents who are affected due to many residents passing by and peeping in. Exterior spaces and the overall site plan and landscaping and the actual layout of buildings on the site should be made such that there is variety in building heights, facade treatments, size and character of the space between buildings and no dwelling has a view of numerous other similar dwellings, without some relief through landscaping facade differentiation etc. They also suggest limiting a maximum of only six or seven households to share each floor so that people will recognise their neighbours and feel greater sense of safety and responsibility towards their own floor (146).

2.6.3 SECURITY

A vital aspect of satisfaction from social interaction is security. Security has been identified as the most important aspects of the living environment from times immemorial, as evident from the many traditional settlements all over the world. Recent surveys reveal that the safety of the living environment is considered the most important variable by at least 75% of the people (206, 219). It is followed by attractiveness of the area, appearance of the house and privacy for more than half of the population (67). Neighbourhood security has therefore become an important necessity of residential development in both India and abroad (210, 48). Within buildings, seldom used staircases, apartment entrances visible from only one other apartment entrance, and elevators have been found to be frequent sites for crimes of all kinds (166). Hence researchers suggest that the entry from the car parking should be made more homelike, with attractive, comfortable, well maintained lobbies with seating, and be oriented to street or parking areas, to increase natural surveillance from these areas and thereby increase safety (146). Newman calls this as defensible space, which inhibits crime by creating the physical expression of a social fabric that defends itself. The potential criminal

perceives such a space as controlled by its residents, leaving him an intruder easily recognised and dealt with (177).

2.7 SUMMARY

The review of environmental considerations in residential land utilisation in this chapter reveals the following:

1. Residential areas have formed the embryonic feature of settlements in all ages (159, 59).
2. The residential environment consists of five distinct subsystems, namely: techno physical, economic, administrative, social and aesthetic (68, 59).
3. From the early times, selection of areas for settlements was influenced by detailed study of techno-physical-economic factors (1, 117).
4. The urban form further resulted from zoning residential areas in relation to some unifying symbolic features and distribution of activity spaces (1, 191).
5. The theories on residential development till recently centred around economic and social criteria (171, 65).
6. The development of transportation system generated two distinct types of residential development namely: low density dispersed spatial pattern and high density compact patterns, with their distinct advantages and disadvantages (269, 166,).
7. The rapid urbanisation has made high density living a reality in all growing cities. Increasingly, research has focussed on the impact of this changing lifestyle and on evaluating the user satisfaction on such living. Such studies have revealed many problems of security, faulty services and socio-psychological shock (23, 90).
8. Architecture and Planning is based on the concept that conscious planning and design of residential developments and design of architectural elements can provide a satisfying

living environment by minimising the problems of security, faulty services, and socio-psychological shock (146; 177).

Although the theories on residential development have dwelt on various aspects, no attempt has been made to synoptically combine the theories and evolve a model for residential development, which can be adopted for a city, combining the various parameters like economic, social, techno physical, or architectural aspects. It is the intention of this research study to evolve a user satisfaction model, with selected variables of all these parameters, group the major ones by employing a factor analysis, and to combine them in a regression model. It is further aimed, to arrive at an optimum residential built form, thereby helping to evolve a set of policies for residential land development. Kochi city is taken for the present investigation, in this perspective.

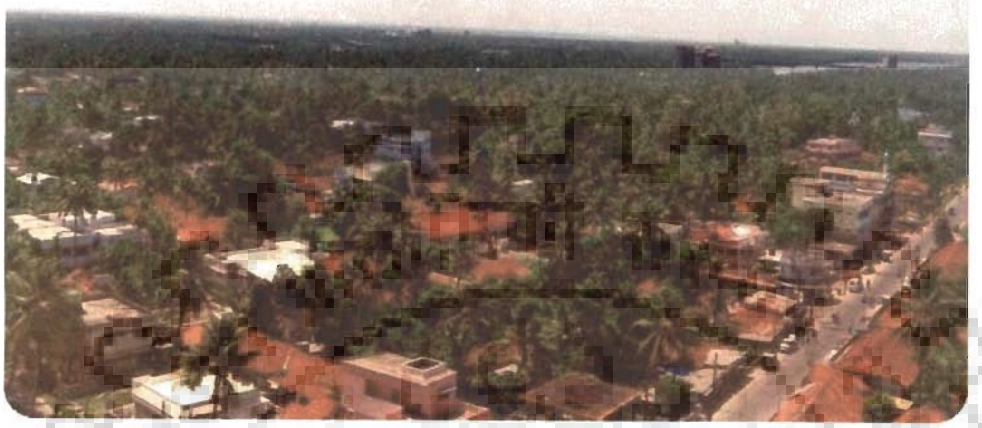
CHAPTER 3

REGIONAL FACTORS SHAPING RESIDENTIAL LAND UTILISATION IN KOCHI

CONTENTS:

This chapter introduces the regional setting of Kochi, the study area. It presents the historic, economic, social and techno-physical factors that have shaped the residential rchitecture of Kerala. This provides the background, for the study on residential land utilisation in Kochi.

Figure No. 3.1 Dispersed settlement pattern of Kerala



A Dispersed residential pattern

B Large expanse of lagoons

3.1 INTRODUCTION

Kochi, located between 9° 57'and 10° 3' North latitude and 76° 13' and 76° 19' East longitude, had a population of 936,486 in 1991 and is the largest city of Kerala[1] state. Kerala is a narrow strip of land on the western seaboard of India, around 550 Km in length and with a breadth varying from 12 km to 120 km. The land slopes down from the Western Ghats in the east to the Arabian sea in the west, and is topographically divided into (i) a highland with an altitude of more that 75 m, (ii) a midland with an altitude between 7.5 and 75 m, and (iii) a lowland with a maximum altitude of 7.5 m. above Mean Sea Level. The proliferation of urban nodes along the coast, the maritime based economy, and the fertile nature of land, has made the low lands, one of the densest in the State. Kerala has a salubrious climate, with lush green countryside interspersed with numerous rivers and lakes, sandy beaches, lagoons and extensive coconut groves all over.

3.2 RESIDENTIAL PATTERN OF KERALA

The residential pattern of Kerala is distinct from other Indian states in three aspects: (i) the dispersed pattern of residences (ii) the distribution of residences over urban and rural areas and(iii) density of distribution and change over years in urban and rural areas.

3.2.1 THE DISPERSED PATTERN OF RESIDENCES

The spatial pattern of residences in Kerala is characterised by the dispersed homestead pattern, in contrast to the compact, nucleated one, found in the rest of the country. Woodcock remarks thus: " Kerala settlements bear little resemblance to the tight squalid settlements of northern India which huddle along a single street or in a knot of houses for mutual protection. Because of its geographical isolation, Kerala has rarely experienced invasions like those that have been a recurring feature of life in North India" (272).

"Kerala represents a riparian civilisation unique and unparalleled anywhere else in India" (173). Water transport, through the multitude of rivers linking east-west, and the vast expanse of lagoons connecting north-south provided ideal mode of transport for both people and goods. This natural mesh of waterways provided cheap and comfortable transportation, made it possible to inhabit any land found suitable, and thus provided freedom from dependence on compact forms. Availability of potable ground water all over the state, must have been another important factor that facilitated a dispersed pattern of homesteads. Further, the climate of Kerala, obviates the need for compact design of settlements. The tropical climate (annual temperature variation between 20.6°C and 33.2°C), with high humidity (70%), would encourage open loose knit forms which permit more air movement, and provide relief in the sultry climate (131,134). The torrential monsoons (exceeding 3000mm) generous over 5 months of the year, makes agriculture less irrigation dependent, and makes the dispersed pattern the preferred type (10, 227).

Politically, the settlement pattern would have originated from an autocratically organised agrarian system. The system had the *tharawads*[2] of landed aristocracy at the apex, and a crowd of tenants at the bottom. The land held on lease by the tenants were large enough to support a family, and their houses were built separately on such big lands. This dispersed settlement pattern might have become established by the time of the visit of travellers like Ibn Batuta in the 14th century, who reported "We next came to the country of black pepper, Malabar. Its length is a journey of two months from Sindabar to Kalwam...And in all this space of two months journey, there is not a space free from cultivation. For every man has his own orchard, with his house in the middle and a wooden fence around it." (222). Refer Figure.No.3.1.

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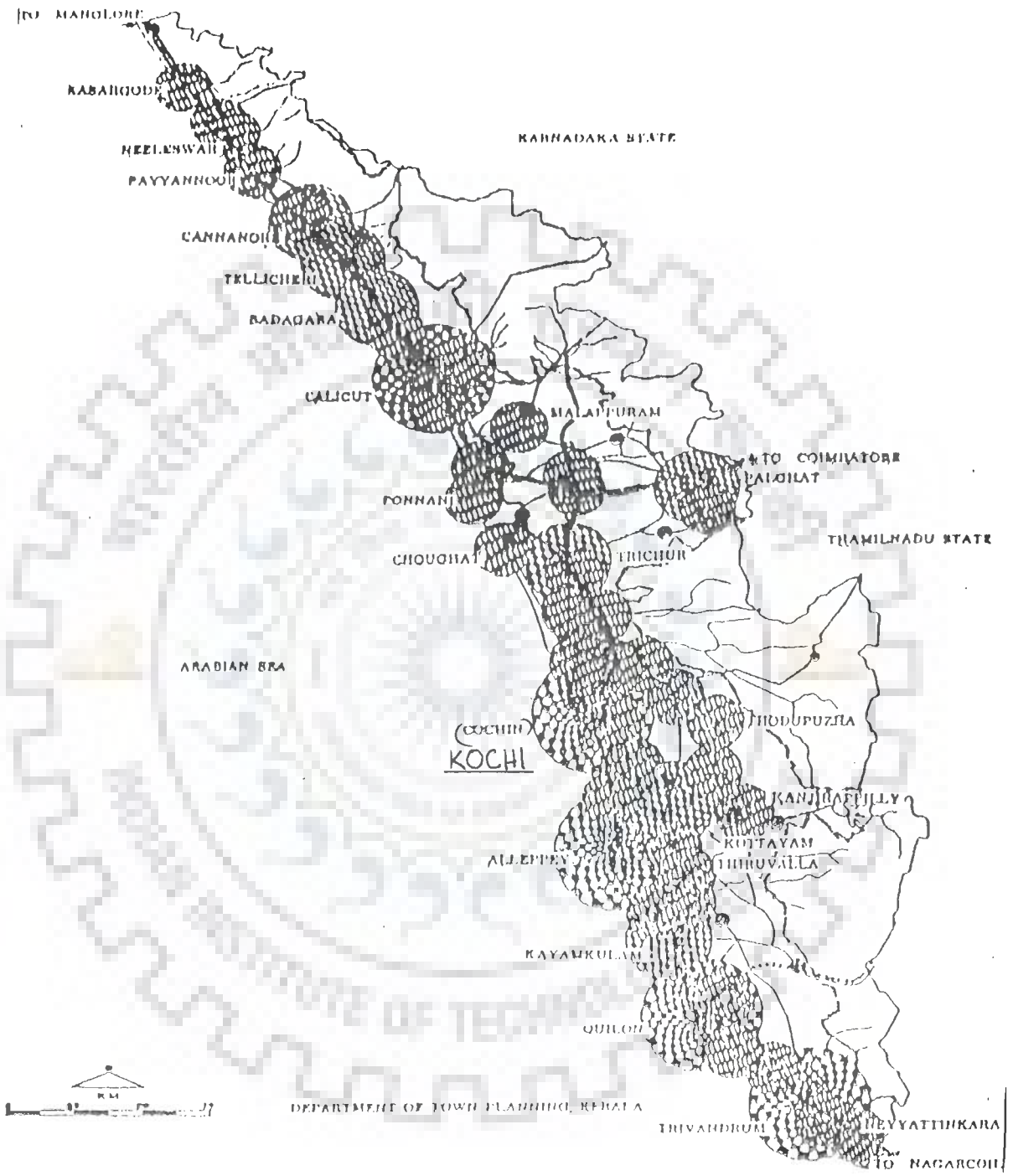
[1] According to legend, Kerala was gifted to Brahmins by Lord Parasurama, the sixth incarnation of Lord Vishnu, in atonement of his sins for killing the Kshatriyas of Bharatvarsha.



FIG·NO 3·4c URBAN CENTRES IN KERALA

THE CONTINUUM

3.2.2 RURAL URBAN CONTINUUM

A characteristic feature of the residential pattern is the continuous spread of the residences over the whole state, with no marked difference in the quality or character of residential architecture, in urban and rural areas. As Logan described it in 1887 "the coastal tracts of Malabar were so densely populated, that it was difficult to say, where one of the municipal towns began, and where the other ended. From one end to the other end of the district, on the low-lying lands, there is an unbroken belt of coconut palms and orchards dotted with settlements". This unique settlement pattern, makes Kerala appear as a single garden city to some, and a single high-density village to others (188).

Under colonial initiation, the numerous navigable waterways flowing from the ghats to the coasts were linked through canals and roads laid from east to west, and rail line from north to south (222). Refer Table No.3.1 in Appendix I. At the cross junctions of this transportation network, there developed small settlements or 'knots'. The Development plan of Cochin identifies four orders of rural-urban knots, in this settlement system. This residential pattern with rural-urban knots, and a continuous dispersion of residences over rural and urban areas, all over the state, is called the 'rural-urban continuum' or 'rurban' pattern, characteristic of Kerala.

3.2.3 URBAN SYSTEM WITHOUT A DOMINANT URBAN NODE

Another characteristic feature of the residential pattern is the absence of a large residential concentration in the urban areas, as typical of other regions. Refer Table. No 3.2 in Appendix I. The difference in residential density between urban and rural areas do not present stark differences either. The reason attributed to this feature is historical.

The maritime economy with the emphasis on overseas trade and commerce led to emergence of towns with the suffix *angadi* or market in the lowlands. These towns which

were nodal points on river routes supplying the other lowland towns, and binding together the economy of rivers and oceans were the earliest concentrated settlements with urban characteristics. There also developed a constellation of small towns along the coast, which were in fact natural harbours or ports built under the colonial initiative. The increasing functional specialisation of these towns and linkages, resulted in the emergence of a settlement system with numerous urban centres located at distances as close as 10-15 km, and within easy commutation from rural areas. Refer Table no. 3.3 in Appendix I. The central location of Kochi gave it a unique position in this settlement system. Refer Figure No. 3.1c.

3.3 SOCIO ECONOMIC CONDITIONS

3.3.1 SOCIAL REFORMS AND EDUCATION

Traditionally, Kerala had an agrarian economy, dominated by the landlords or '*Jenmies*' and their agricultural tenants or '*Kudiyans*. By the nineteenth century, the British colonisers brought about a change in this pattern by (i) encouraging plantation and cash crop cultivation and importing food grains, (ii) development of commerce in spices, and consequent transportation system to the port. Simultaneously, the Christian missionaries introduced education and health facilities, among the masses (223,155). The resultant social awakening widened their horizons, and created aspirations for better living conditions (77). The military service in the first world war, and the migration to colonial plantations abroad, exposed the isolated native society to the outside world, and encouraged further migrations to regions like Burma, Thailand, Malaya, Singapore, East African countries, Carribean islands, and Srilanka. This brought about changes in the feudal system, creating a middle class who could afford freehold land for putting up their houses. This coincided with other major developments like, (i) reforms in land tenure permitting partitioning of entailed lands, which

resulted in disintegration of joint families or '*Tharawads*', (ii) a marked shift towards commercial crops, which led to increase in price of dry lands (iii) social reforms like temple entry proclamation, and (iv) politicisation of working classes. The changes in social environment coupled with economic prosperity created a demand for residential land and housing (81). After the second world war, the economy was sustained and strengthened by the cash crops, migration for new jobs elsewhere, and above all, development of infrastructure, such as, Cochin port and related road, rail and air linkages (37,163). The hinterland of Kochi covered not only the whole of Kerala State, but also much of the western districts of neighbouring states of Tamil Nadu and Karnataka. This stands out as a unique factor in the development of Kochi, as the major residential and commercial hub of the Kerala economy.

Perhaps the most radical change in the history of the social structure of Kerala was initiated by the introduction of the Kerala Land Reforms Act in 1963. It imposed a ceiling on the total acreage a primary family unit of landlords could own, and sought to assure permanent tenure to all tenants, and the right to purchase the land (50). The consequent demise of agrarian capitalists and the emergence of small and medium farmers, further hastened the shift towards commercial crops from the labour intensive paddy cultivation, and led to further subdivision of land (133). The Kerala Land utilisation Act 1967 was therefore promulgated to curtail conversion of paddy fields in principle, though it was not very successful in arresting the trend. In the decades between 1951-71 medical and other social welfare facilities brought improvement in health bringing down death rate resulting in higher population growth rate (201, 61).

3.3.2 THE GULF WAVE

With the rise of international oil prices in 1973, the oil producing gulf countries started recruiting immigrant labour for developmental activities. The educationally backward and unemployed Muslims were the first to avail of these opportunities in a big way, due to their religious affinity. The trickle to the Middle East gained momentum, and by the eighties a large number of Keralites from all walks of life, including the educated and professionals found employment in the gulf (110, 54). By the nineties, it even overtook the migration to other Indian states. Refer Table no.3.4 in Appendix I. The average annual net migration by the end of seventies was around 70,000. It had increased to around 5 lakhs by mid eighties and towards the end of the nineties, half of the Indian migrants to the gulf region were from Kerala (54).Refer Table. no. 3.5 in Appendix I.

Reports reveal that the migration to the gulf was predominantly a male phenomenon, female being as low as 2 per cent, and non working dependents were discouraged. They were from relatively poor families, unskilled or semi skilled workers with educational attainment of matriculation or below, most being unemployed unmarried men aged between 25 and 35 at the time of migration (114). The gulf employment being of a temporary nature, with no eligibility to own business or real estate in the host country, the emigrant viewed it 'as perhaps his only chance to accumulate enough to purchase some land, construct a house, educate his children, marry away his sisters and daughters and save funds with which to start some independent career on repatriation from Gulf countries' (175). The natural consequence of this has been the steady flow of remittances to Kerala (54). As a result, while Kerala declined in rank from 6th to 10th place among other Indian states in per capita domestic income between 1970-78, it improved its rank from 9th to 6th place in per capita bank deposits during the same period. Refer Table.no.3.6. in Appendix I. While reliable information on actual remittances from the Gulf countries was not available, the State Planning Board has

estimated it to be 400 crores in 1978 (78). According to the World Bank, the remittances to Kerala increased from 824 crores in 1980 to 5539 crores in 1995. In 1995, these remittances accounted for 22 percent of the state domestic product of Kerala.(192). Refer Table.No. 3.5 in Appendix I.

The large inflow of foreign remittances, altered the socio-economic balance in the traditional, caste-based society. 'The Gulf boom was a great leveller. It stood traditional social hierarchy on its head, empowering overnight even the lowest strata, offered a distant safety valve for the frustrations of a growing army of unemployed, permanently altered the Malayalee's consumption pattern,[7] and caused a somersault of his attitudes to life' (113.).The inequality ratio in asset distribution declined leading to the emergence of a more egalitarian society. Refer Table no.3.9 in Appendix I.

During this period, the production and prices of plantation crops like rubber, tea and cardamom also shot up, coinciding with the increasing inflow of gulf remittances. The price index of plantation crops increased four-fold, between 1970-84. (77). Refer Table.nos.3.7 and 3.8 in Appendix I. Economic prosperity promoted jobs in tertiary sector, growth in consumption, increased literacy health facilities, and aspirations for better living standards. (192, 61, 126, 201, 114, 175). Refer Table Nos. 3.10, and 3.11, in Appendix I. The per capita commercial bank deposits which were lower than national average till the mid seventies, increased to greater than the average by 1977-78 with the ratio per capita deposits to the national average peaking in 1983-84. Refer Table No. 3.12 in Appendix I.

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[7] The per capita consumer expenditure in Kerala which was lower than India till the early seventies increased by 293% over the 12 year period 1970-71 to 1982-83 and was significantly above the national average in 1983-84.(201). Kerala moved from 10th place to 4th place in per capita expenditure in the decade 1970-80. A good amount was also spent on purchasing consumer items, luxury items, gold ornaments, and construction materials (192, 193).

3.3.3 THE SOCIO-POLITICAL ENVIROMENT

Kerala has always been a State with intense political activity and militant labour unions. 'Protest marches, general strikes, hunger strikes, and other public demonstrations are as much a daily occurrence in Kerala as the monsoon rain in July. For some people, participation in processions and protest meetings is a full time job' (81). This has invited the wrath of the public, leading to even a few judicial orders in this regard (257). The higher aspirations of the general populace for better living standards, created a situation of rising cost of living. The labour unions translated such a situation, to bargain for higher wages. (125,126). The wages in Kerala became almost double that of the rest of the country (81). Refer Table no 3.13 in Appendix I. The wages among the unorganised labourers engaged in activities such as transport, loading and unloading and in construction and manufacturing sectors as a whole were much higher. These coupled with the profile of the militant labour unions had a disastrous effect on the blooming industrialisation (126, 237, 231, 125). This also led to large investments in building sector as a safe form of investment.

3.4 HOUSING CONDITIONS

3.4.1 HOUSING IN THE 18TH AND 19TH CENTURY

A. Upper class housing:

One of the early documentation on the quantitative and qualitative aspects of housing is found in the Census Report of 1931. The 1961 Census Report of Housing and establishments, gives a historical outline of housing of the different socio-economic classes. The houses of the nobility were double-storied and had a small hall '*verandah*[10]' supported on

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[10] Open pillared entrance hall, often with a low wall or railings at the periphery.

Teak-wood pillars in the front. The upper storey called *Maliga* was used to sleep, study and for other personal matters. The house was of laterite[11] or bricks set in mud with thatched roofs. Only palaces and temples, were permitted to be tiled. Only in the late eighteenth century, the upper class Hindu[12] families were permitted to tile their thatched roofs, as a special favour conferred on them by the East India Company[13]. The spacious courtyard houses of the upper class were known as *Nalukettu*[14] and *Ettukettu*[15] depending on its configuration.

B. Lower class housing:

While this period marks the building of such grand mansions for the landlords or '*jenmies*', the housing conditions of the poor were miserable. Their closely spaced huts, housing individual families were of coconut leaves or straw, with low entrances, and dark interiors. Even in the early decades of the twentieth century, their lot was not far different. They lived in houses which varied from 100 to 200 square feet, constructed on a two feet high plinth of mud or laterite stone, with walls and roof of coconut or palm leaves. (77)

3.4.2 HOUSING IN THE FIRST HALF OF THE 20TH CENTURY

A. The Emergence of the Middle Class

The emergence of the middle class and the better economic conditions brought about a change in the housing conditions. Most of these neo-rich were the emigrant *Mappilas*[16] and *Thiyas*[17], and ex-service men returning from Burma, Malaya etc, with their savings. The 1931 Travancore Census reports that 'In towns as well as rural areas, one finds a large number of new buildings constructed on sanitary principles, making due provisions for ventilation and

[11] A widely prevalent soil in Kerala, which can be cut into building blocks. It gets increasingly hardened on exposure to atmosphere.
[12] Hinduism is the predominant religion in Kerala.
[13] Colonial organisations, which administered areas under their power.
[14] A courtyard house. This house type is dealt with in detail in the forthcoming chapter.
[15] A house form combining two *Nalukettus*
[16] A sect of malayali muslims of Malabar region

drainage'. Stone and lime started replacing bamboo, mud or wood in the construction of houses. Some important towns were even electrified. The percentage of tiled houses, which were as low as 0.75 percent in 1891, increased to 18.8 per cent in Cochin by 1941. Well-to-do families constructed 'modern' houses in the western style, with drawing, dining, and bedrooms with attached bath, kitchen and store. A typical house of the middle income stratum, had plastered masonry walls of granite, brick or laterite.

B. Government Intervention in housing:

With the Indian independence, the government started initiating several housing schemes as part of the five year plans. Under the central government directive, the state monitored two major housing schemes (i) Settlement and Colonisation Schemes during the first Five Year Plan period, and (ii) two Low Income Group Housing Schemes during the second Five Year Plan period. Housing schemes for weaker sections of the society, in general, were introduced during the Third Five Year Plan period. The growth rate of both people, and houses, increased progressively during 1951-71, though the compounded annual growth rate (CAGR %) of residential houses continued to be less than that of the population. However, by 1971-81, this trend was reversed, with the greater increase in the growth rate of housing, as indicated in the Table No.3.1.

Table No.:3.1

Growth rate (compounded) of population and houses in Kerala

Period	Compounded growth rate (CAGR %)	
	Population	houses
1901-51	1.51	1.27
1951-71	2.30	2.22
1971-81	1.77	2.32

Source: Gopikuttan

C. Land legislation:

One of the reasons for this increased growth rate in housing, was the Kerala Land Reforms Act 1963, which conferred freehold ownership of land for housing, to more than a

[17] A subsect of backward Hindus of Malabar region

million land-less poor. The efforts of the government had helped to improve housing conditions. Yet, at the end of the Third Five Year Plan period in 1970, the total expenditure incurred on housing, was only 47.2 million. Co-operatives had assisted in the construction of only 1384 houses in the state. All these efforts made by the government could, but touch the fringe of the housing problem (52, 77).

3.4.3 HOUSING IN THE SECOND HALF OF TWENTIETH CENTURY

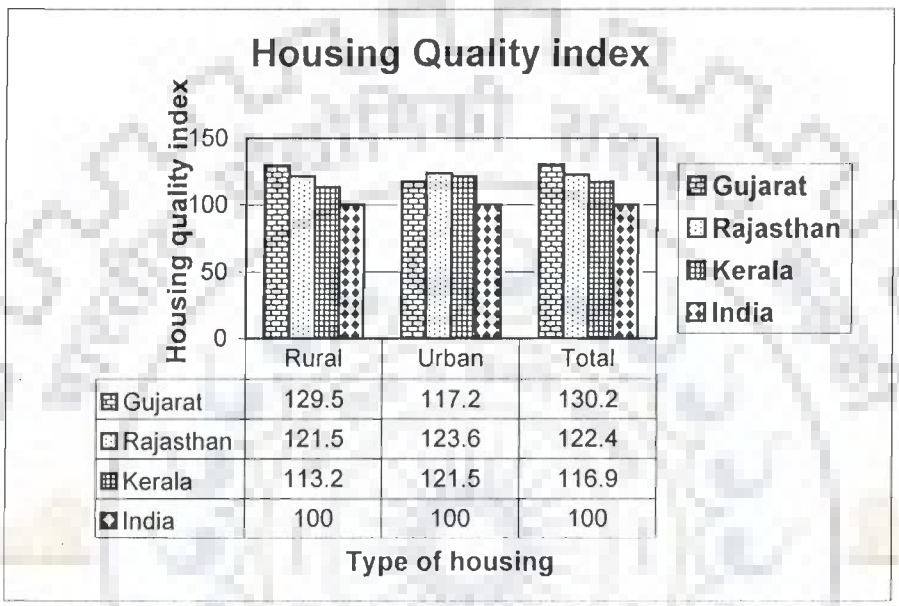
A. The Building Environment (legislative and administrative)

In Kerala, the design and construction of residences had been the domain of traditional *shilpis*[18] and *aasaris*[19]. Even the Public Works Department also utilised their services to a great extent, for their 'modern' buildings. However, the sixties and seventies witnessed the formation of Municipal Corporations and Development authorities in various major urban centres in the state. Building legislations like The Kerala Municipalities Act 1960, the Kerala Municipal Corporations Act 1961, and the Kerala building regulations 1968 were also enacted during this period. The building regulations laid down specifications for construction of buildings and made the approval of building plans, with necessary drawings mandatory. Now, house construction was no longer a work which could be carried out by traditional craftsmen, without involving architects, engineers, supervisors, contractors and building tradesmen. Most of these trained personnel, were educated with western concepts, and therefore often designed houses, which did not suit local lifestyle. The High level committee on Social Infrastructure and Services (1984), also endorsed this view in their report which reads "Formally trained engineers and architects blindly adopt their bookish knowledge based on conditions prevailing in advanced countries." However, the neo rich patronised this school of architecture, due to the so-called social status attached to it. The specifications and plans prepared by qualified

[18] sculptor
[19] carpenter

Figure.no.3.2

Comparison of Housing quality of Kerala with selected Indian States



	Rural	Urban	Total
Gujarat	129.5	117.2	130.2
Rajasthan	121.5	123.6	122.4
Kerala	113.2	121.5	116.9
India	100	100	100

Source: Gopikuttan.

Note: Only states with better or comparable quality have been shown here.

personnel became a prerequisite even for obtaining housing loans etc. The increasing complexity in house construction made people, depend more on full fledged building contractors, who could undertake the job on a turn key basis. The owners, often abroad, on the other hand were relieved from the drudgery of obtaining various approvals, squirmishes with militant labour unions and sourcing materials and skilled labourer who had become a scarce commodity. The Report on the survey of household construction activities in Kerala in 1980-81, found only 11.5 per cent of construction works as being undertaken through the contracting system, but the beginnings had been made.

B. Qualitative changes:

Changes came about in the quality of housing, by the second half of the twentieth century. In 1960, 26 percent of the houses had tiled roofs, when compared to the 12 percent in 1941. A housing quality index considering three characteristics of housing: Structure, amenities, and space, revealed that the housing quality of Kerala in 1971, was higher in both rural and urban areas, than those of India as a whole (Refer Figure No. 3.2).

C. Governmental Efforts:

In 1972, the Kerala government started the implementation of the one lakh housing scheme. It was designed to provide permanent dwelling for land-less agricultural labourers, who had not received homesteads, under the Kerala Land Reforms Act 1963. Under this scheme, 57000 houses, each with a plinth area of 25 Sq .m., were completed. It generated a keen awareness about the importance of having own houses, among all sections. The annual expenditure incurred by the government, on housing schemes and programmes sponsored by it since 1974-75, and the number of houses constructed, are presented in the Table no.3.14 in Appendix B. The expenditure was highest in 1981-82.

D. Quantitative Changes

The intervening period between the mid seventies and eighties, proved to be the most eventful, in the development of land and housing activities. The Kerala government Survey of Housing and Employment 1980, revealed that the number of houses in the State has increased from 36.26 lakhs to 40.66 lakhs during the period of two years1979-80, giving an average annual rate of increase of 6.07 percent. This was mainly due to increased efforts of the government, and the increased demand for housing, combined with the wherewithal for the same. The number of houses constructed by the house construction programmes of the different public sector agencies involved, during 1980-81, was found to be only 47,093 as against an annual estimate of nearly 2.2 lakhs new constructions. Obviously, the bulk of the new constructions during each year, was built by the household sector (55).

E. Entry of Increased Financial Resources:

To the steady flow of foreign remittances and the profits from the plantation sector, were added funds, freely made available for housing by government and public sector employers, co-operative societies, banking and financial institutions. Refer Table no.3.15 in Appendix I. According to government studies, 30 per cent of the expenditures on housing in 1980-81 came through borrowed funds. Refer Table No.3.16 in Appendix I. Another important source was inherited wealth, (including land, gold ornaments etc.) which many middle income groups sold, to construct houses of their own, due to social respectability, attached to ownership housing. One third of the financial resources in housing construction came from foreign remittances. Refer Table no 3.2 .

Table. No 3.2

Distribution of source of finance for housing investment in 1980-81

Source of finance	Housing investment	
	in Rs(Crores)	% to total
Remittances from abroad	245	31.7
Borrowings from governmental and co-operative sectors	41.55	5.4
Borrowings from other sources	186.31	24.1
Other own resources	299.81	38.8

Source: Gopikuttan

3.5. IMPACT OF REMITTANCES ON LAND AND HOUSING

3.5.1 IMPACT ON HOUSING DEMAND:

The impact of remittances on the growth of housing, is to be viewed in the back ground of the general housing conditions, given in section 3.4. It is well documented by various government reports and micro level studies, that a substantial amount of the gulf remittances found their way into land and housing. There were two reasons for this. Firstly 'The innate conception of the safest investment, being that in landed property.... Every person, in whatever avocation, desires to have some at least of his earnings invested in landed property (37). Secondly, it was a ladder to social respectability (114, 54). 'Possession of land is still considered an easier route to respectability than wealth in any other form' (84). A study in 1977 revealed that, 48.9% of the remittances from the Gulf went into purchase and improvement of housing, and 27.2% went towards purchase of land (175). A micro level study in 1978 found that, one third of the migrants had built new houses within five years of migration. Another 20 per cent had repaired and reconstructed their houses within that period (84). The government report of the Survey on the Utilisation of Gulf Remittances in Kerala in 1987, for the period 1982-86 revealed that, 21 percent, and 36 percent of the savings from foreign remittances, were spent on purchasing or improving of land and housing respectively (192). According to the Report of the National Family Health survey 1992-93, the emigrant

households who had acquired houses by utilising remittances had increased to 58.3 percent, while those who had acquired land increased to 40.6 percent (186). The net effect was an improvement in housing quality of migrant households compared to that of non migrant households as can be seen in Table No. 3.17 in Appendix I.

The inflow of foreign remittances since mid 1970's, led to a spurt in prices of land, construction materials, consumer goods etc. and an increase in wages of all category of casual workers (193). Refer Table No. 3.3. However, such an unprecedented expansion in house construction activity with heavy demand for construction materials, did not generate any backward linkage and foster the industrial growth due to unfavourable conditions (137, 77, 61).

Table no. 3.3

Daily wages of workers in construction sector 1970-71 to 1985-86

Year	Skilled				Unskilled			
	Mason		Carpenter		Men		Women	
	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban
1970-71	8.2	8.7	8.2	8.6	5.4	5.7	3.7	3.9
1975-76	NA	13.8	NA	13.8	NA	9.3	NA	6.5
1977-78	14.9	15.2	14.8	15.2	9.4	10	7	7.6
1979-80	16.8	17.4	16.7	17.4	10.4	11.4	8.1	8.9
1980-81	18.8	19.4	18.7	19.3	12.3	13.1	9.6	10.2
1981-82	22.7	23	22.5	22.9	15.2	16	11.4	12.2
1982-83	28.1	30.1	28	30.7	17.9	19.1	13.5	14.4
1983-84	33.3	35.1	33.4	35	20.3	21.2	14.8	16.1
1984-85	36.7	35.1	38	36.6	21.9	22.8	16.4	17.4
1985-86	39.8		41.8		24.8		19.8	

Source: Gopikuttan

3.5.2 IMPACT ON LAND MARKET

The high demand for construction of residential houses, created demand for bigger house plots, particularly in the migrant pockets. As demand increased, landowners, especially those owning uneconomic agricultural lands, succeeded in obtaining exorbitant prices, thus setting a trend for the escalation in land prices. According to one study, the price per unit of

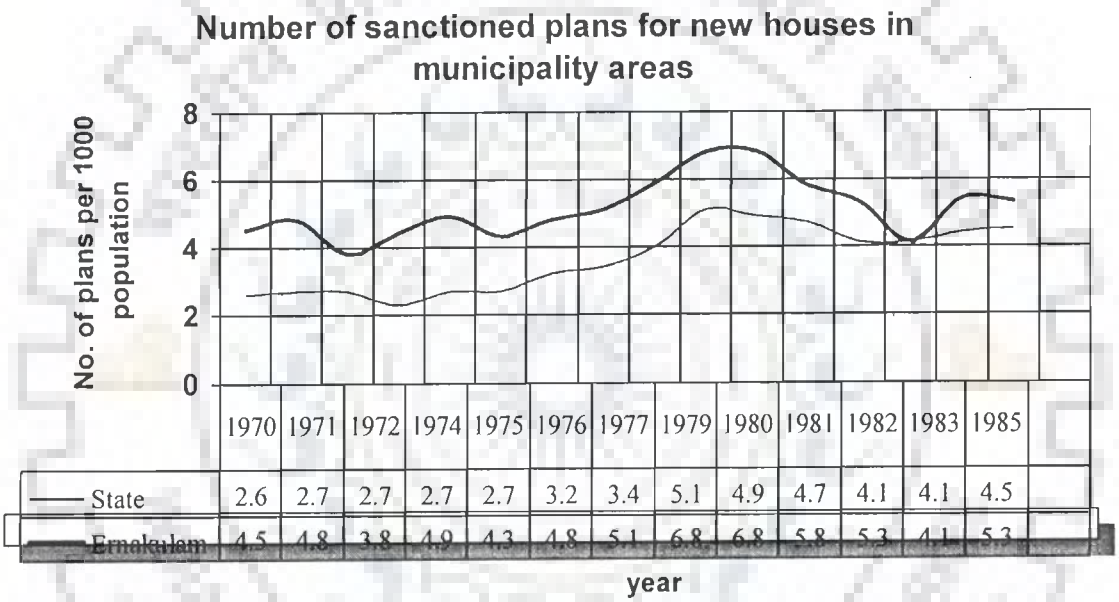
land, had increased 10 to 20 times, within a short period since mid seventies. In certain pockets, the rate of increase was more that 2000 percent, within a period of ten years (77). A continuous increase in land price, was reported from different parts of Kerala, during 1975-83 (192). To land owners within the urban areas, as well as to those who owned larger holdings in the urban fringe, the escalation in land prices was an unexpected windfall. Many households apprehensive of investing in risky ventures found it convenient to convert their windfalls, into housing assets. Thus, the increased land transactions intensified demand for house construction, which was already high and increasing (77). The purchase of landed assets by the migrant households, as a safe investment, and to improve their socio-economic status, expanded speculative activities especially in land transactions, pushing prices still higher. The All India Debt and Investment Surveys reveal that, the value of land owned by a rural household in Kerala, increased by 600 per cent between 1971 and 1981, against the increase of 100 per cent in 1961-71. Micro level studies reveal that, land assets of migrant households doubled between 1975 and 1985 (114). The upward trend in land prices, kept soaring, until it reached its peak during 1984-85. Refer Table No.3.18 in Appendix I. While land price increased manifold between (1975-86), land productivity did not increase, due to labour problems. Hence, profitability declined with respect to investment in agricultural land (125). This therefore, acted as a catalyst leading to the increase in the conversion of more agricultural lands, into residential use (198). The land ownership condition in the state improved, as revealed from the reduction in the land-less households from 32.8 per cent in 1968 to 6.7 per cent in 1980 (54). It was found that only 1.27 per cent (52000) of the households did not own a house, but even they possessed land for the purpose.

3.5.3 QUALITATIVE CHANGES

Structural changes also took place in the State during the decade 1971-81. In 1971, only 44.4 per cent of houses had tiled or, RCC roofs. The government survey of Housing and

Fig. No.3.3

Number of sanctioned plans for new houses in municipality areas.



Source: Gopikkutan

Employment 1980 reported that, the proportion of residential houses constructed with pucca[20] wall and roof materials increased from 49 per cent in 1971 to 72 per cent in 1980. (54). Half of the pucca houses had a plinth area of less than 500 sq. ft while 31 per cent had plinth areas ranging from 501 –1000 sq. ft. Only 12 per cent had houses between 1001-1500 Sq. ft, while 7 per cent had plinth area over 1500 sq. ft (54). The proportion of new houses, aged less than 2 years old was found to be high (10.89 %) all over the state, but more concentrated in its low lands. This large proportion of new houses is attributed to the stepping up of construction activities by the various state agencies, and due to large-scale foreign remittances. New houses were found to be greater in rural areas, when compared to urban areas (54).

3.5.4 QUANTITATIVE CHANGES

The total number of houses constructed in Kerala during the period 1971-1981 was 0.879 million, excluding improvements and replacements (52). Out of this, 75 percent were constructed during 1978-81 and 15 per cent in 1980-81. The annual compounded rate of residential construction for the first seven years of the decade 1971-81, was 0.85 per cent, whereas for the remaining three years, it was as high as 5.8 percent. Average number of housing plans sanctioned annually in Kerala almost doubled between 1975 and 1980. The demand for houses as represented by application for building sanctions reveals that this spurt has begun in 1976, while the physical manifestation came in the years following (56, 77). Refer Figure No.3.3.

Such significant changes in the growth, quality, possession and mode of housing construction are usually attributed to the socio-economic determinants of housing demand. But in Kerala, no significant change seems to have taken place in the trend of established demand variables viz. per capita income, urbanisation, population growth, and cost effectiveness either in magnitude or direction, during the 1970's, or thereafter. Population

[20] denotes permanent building construction

growth was at a lower rate during the 1970's, than the earlier decades. Similarly, the rate of increase in per capita net domestic product at constant prices 1970-71, and rate of growth of urbanisation was lower too. On the other hand, the rate of increase in cost of materials, and labour, were quite high (index being 271 in 1980 with the base year as 1971) (3). Hence, none of these factors can be considered responsible for the high growth rate in housing demand (77). It may be therefore be concluded that these changes may be attributed only to the various socio-cultural and economic factors resultant on the Gulf influx and partially to the institutional factors already discussed.

3.6 HOUSING SINCE MID EIGHTIES

The mid eighties started witnessing a change in the pattern of housing: towards multi-storeyed apartment buildings usually associated with compact high density cities, not hitherto found in Kerala. Multi-storeyed apartment buildings are basicallya response to land pressures, land values, and socio-cultural changes of a people. None of these appear to be totally true, in the regional context of housing development in Kerala. Due to the dispersed pattern of settlement system, there was no undue pressure towards cities. Reasonable infrastructure comparable with urban areas, was available even in the rural fringes. The spiralling land values were showing a flattening trend around 1984-85. Population growth rate had decreased. Finally, the sentiments of quietness and retirement which a Malayali longed for in selecting a site for his dwelling, and prestige associated with such bungalow type dwelling had not changed either. Why then did the tall residential building appear in the milieu of Kerala? To answer this one will have to turn to the residential development at micro level, as typically seen in Kochi, the study area.

3.7 SUMMARY

A historical overview of residential development at the regional and local level of Kochi leads to the following observations.

1. The settlement pattern of Kerala is dispersed in nature, with a system of urban nodes, well distributed to meet the socio-economic forces.
2. Kochi is the largest of these settlement nodes, but does not show the characteristics of primacy, as seen in other urban systems.
3. The important socio-economic condition which influenced residential development, is the change from a feudal agrarian economy to a commercial-service economy, as a result of (a) high density of population; (b) higher levels of education; (c) migration of people to other parts of India as well as outside India.
4. The traditional residential typologies of the region show adherence to the principles of *Vastuvidya*, but the political changes such as land reforms, social changes like the emergence of the middle class, and the economic changes, created by the Gulf boom gave rise to new house forms.
5. The phenomenal growth of housing in Kerala in the eighties, does not appear to stem from the conventional socio-economic determinants of housing demand, but as a result of the increased role of the State government, and the inflow of Gulf remittances into housing.
6. Of the two new forms introduced in the region, one is the change to the modern bungalow type dwelling, and the second is a change towards apartment living.

The change towards apartment living generally associated with land pressure, high land values and socio-cultural preference. None of these forces appear to be totally true, in the regional context of a dispersed settlement system, and hence, the reasons for it are searched at the micro level of Kochi City.

CHAPTER 4

THE ARCHITECTURAL DIVERSITY OF KOCHI

This chapter describes the rich architectural diversity of Kochi, and proceeds to present the circumstances, which led to the change in the residential typology, in terms of architectural plan, quality and its architectural form.

4.1 INTRODUCTION

The residential development in Kochi is characterised by the variety, intensity, spatial spread, and the environmental quality of its residences. This residential development has its roots in the historic evolution of Kochi, from an obscure lagoon, to a major port city of the Malabar Coast. This ancient region ruled by the Chera kings[1], had its capital in Tiruvanchikulam, located 18 Km, north of Kochi. Conquests by neighbouring rulers[2], led to the fragmentation of this large empire in 1100 AD, and formation of the kingdom of '*Perumpadappu swaroopam'*, or later Cochin[3]. Early literary works[4] do not mention Cochin, but mention the adjacent port of Muziris[5] with its Roman and Greek enclaves, as the 'Primum Emporium Indiae' or the most important port[6] among the many others[7] on the Malabar Coast. Muziris served as an international centre of trade, and the main emporium of transit goods between China and the Roman empire, between 300 BC and 300 AD. The trade links, attracted settlers to Muziris, from many commercial nations of the ancient world.

In 1341 AD, an extraordinary flood silted up the mouth of Muziris harbour, and burst through the narrow sand banks, which separated the backwaters from the sea, creating a new outlet at Cochin. With this, the old merchants of Muziris shifted to Cochin, with which, began its prominence as an international seaport. The early settlement of Cochin was at Mattancherry, facing the protected lagoons in the east. These navigable inland waters, connected it to the entire stretch of coastal Kerala, and soon, it grew into a busy oriental

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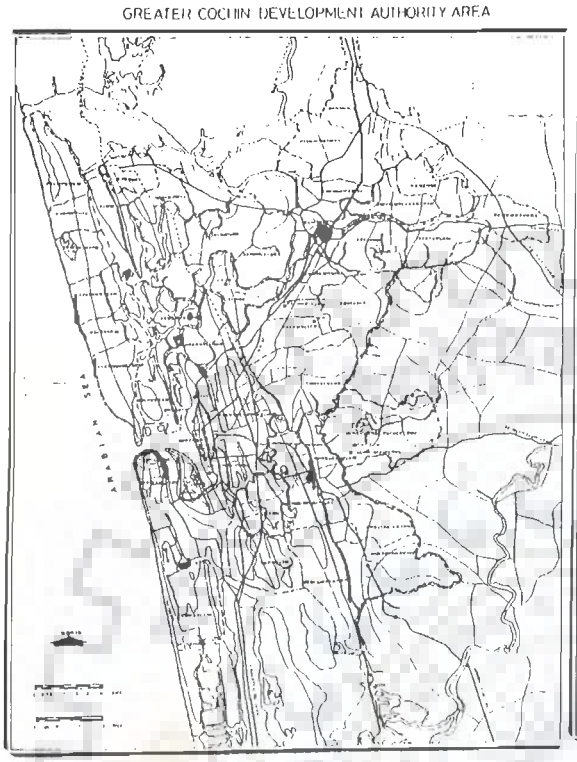
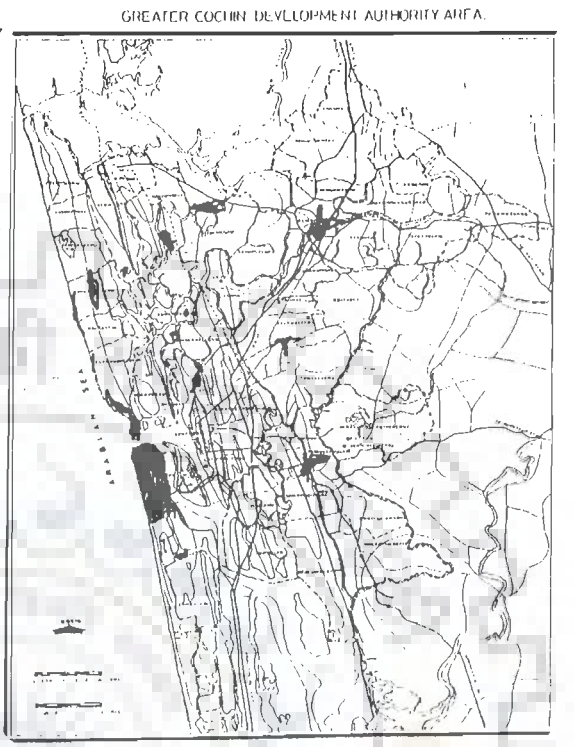
[1] Right from the Sangam age (0-500 AD), Kerala was divided into three parts,: north, south and central Kerala and ruled by the Ezhimala rulers, the Ays and the Cheras respectively. The old kingdom of Cochin, which was part of central Kerala stretched from the Malabar and Palghat areas on the north up to Ettumannoor on the south.
[2] Zamorin from the north and Travancore Rajas from the south
[3] Cochin is the past name of Kochi.
[4] Pliny's 'Natural History' (23-79 AD), and Ptolemy's 'Geography' (126-161 AD), Marco polo (1290-93 AD), Ibn Batuta (1342-42 AD)
[5] Greek name for Kodungaloor port. The Jews called it '*Shingly'*. The *Ramayana* refers to it as '*Murachipattanam'*.
[6] Around 120 Roman ships from visited the Kerala coast every year in 30 BC (226).

Fig. No. 4.1

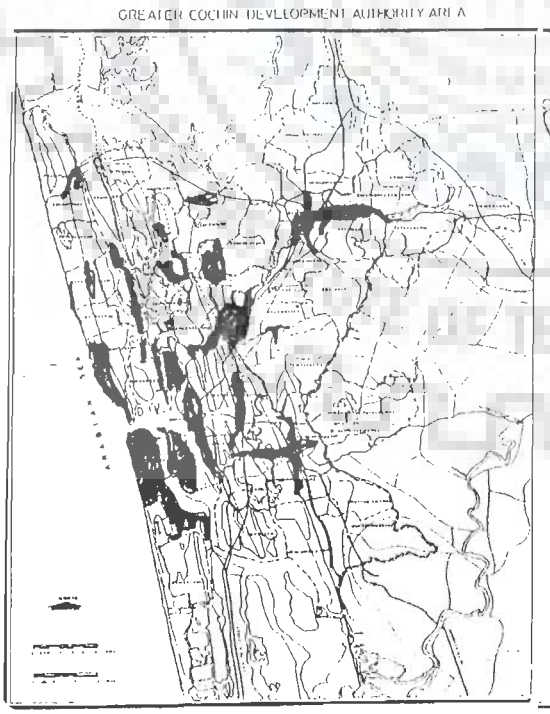
The evolution of Kochi



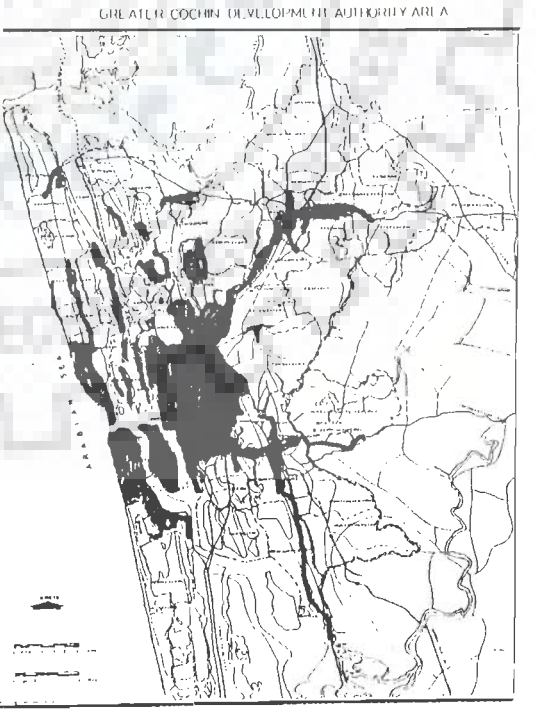
A.Kochi 1891



B.Kochi 1921



C.Kochi 1951



D.Kochi 1981

market town, attracting traders both from within, and outside the country. Over time, some of these traders settled down in Kochi, transforming it, into a rich canvas of different cultures, together with its religious and architectural diversity. In 1409 AD, the Chinese, Muhammedan Ma Huan, visited Cochin. He was followed by Nicolo Conti, an Italian, in 1440 AD, who recorded that, it was a city five miles in circumference, and Arabs and Chinese carried on brisk trade here. In 1500 AD, the Cochin royal family shifted their capital to Mattancherry, the central core of the then Kochi.

The Colonial era started with the arrival of the Portuguese under Vasco da Gama, in 1502 AD. The Portuguese founded Fort Cochin, kept garrisons, established many factories, built convents, schools, palaces, warehouses and churches. Cochin came under the Dutch in 1663. Trading was at its peak during their times. In 1795, the British captured Fort Cochin, renaming it British Cochin. By 1814 AD, Cochin State came under the British suzerainty, as a self-governing princely state. By 1840 AD, Mattancherry was so congested that the royal family shifted to the eastern mainland, Ernakulam. With this, Ernakulam started developing with new roads, markets, educational institutions etc. Fort Cochin became a municipality in 1866 AD. An early form of local self-government appeared to have begun in the crowded Mattancherry, as early as 1890 AD, culminating in the form of a municipality by 1911 AD. Simultaneously, Ernakulam was also declared as a municipality. Refer Figures no. 4.1.A and 4.1 B.

Meanwhile, the opening of Suez Canal in 1869, increased the importance of Cochin as a coaling station, on routes to the Far east. In 1870, the idea of making a harbour in Cochin was mooted, but technical difficulties prevented it from being realised or even begun until 1920's.

[7] Other ports are Naura (Cannanore), Tyndis (Kadalundi), Nouroulla, Kouba, and Paloura to the North and Barake and Nelcynda to the south.

The dredging[8] of the shipping channel provided enough spoils for the reclamation of the 365 hectare Wellington island, in the lagoons. Railways arrived in Ernakulam in 1902 AD, and was extended to the Wellington island, on completion of the port works in 1940. The island earmarked exclusively for port activities and defence, with its harbour, aerodrome, road and rail connections became a nerve centre of trade, transport and defence. At this period of time, Cochin was under the jurisdiction of three political entities: the Port and Fort Cochin being directly administered by the British; Ernakulam and Mattancherry by the Maharajas of Cochin State; and the industrial area of Eloor by the Maharajas of Travancore State. The industrialisation[9] of Cochin made its beginnings along with port activities and commissioning of the Pallivasal Hydro electric project, in the forties.

After the Indian independence in 1947, the princely states of Travancore and Cochin were merged to form the Travancore Cochin state in 1949, followed by the formation of Kerala State in 1956, consequent to its merger with the Malabar district of erstwhile British presidency. The creation of the State Town planning department in 1959, Cochin Corporation in 1967, Cochin Town Planning trust in 1968, and the Greater Cochin Development Authority (GCDA) in 1976, are important milestones in the planned development of Cochin. The jurisdiction of GCDA extends over the primary influence zone of Cochin City consisting of 5 municipalities and 33 panchayats. (221, 186, 69).

The Structure plan for Cochin, prepared by GCDA in 1984 has delineated a part of the Cochin Region for a comprehensive development of the area. This area identified as central city, consists of the Corporation of Kochi (consisting of Fort Kochi, Mattancherry, Ernakulam town, and fringes) and Kakkanad outgrowth, the municipalities of Tripunithara, Kalamassery, and Eloor, the census towns of Maradu, Varapuzha, Mulavucad, Cheranelloor,

[8] Dredging was completed by 1928 and steamers entered the harbour by 1930.

Thiruvamkulam, and Vazhakkala, and the panchayats of Njarakkal, Elamkunnapuzha, and Kadamakudy. This area spread over 275,000 hectares, has also been identified as the Metro region of Kochi, and the same has been taken as the study area here. Refer Figures No.4.1 C and 4.1 D.

4.2 RESIDENTIAL ARCHITECTURE OF KOCHI

4.2.1 THE BASIC HOUSE FORM

The general design of the earliest house type, was based on the traditional building science called '*Tachushastra*'. The basic plan was modular, with the dwelling unit called the *Ekasala*. Refer Figure No. A in Plate 1. When another unit was added to it, it was called *Dwisala*. The third and fourth addition generated *Trisala*, and *Chatursala* respectively. The *Chatursala* or *Nalukettu* had a courtyard in the middle (*Nadumuttam*). Refer Figure No. 1A in Appendix K. The simple core house of *Ekasala* was the residential type of commoners, which suited the middle class also, with its extension and addition of the lean to areas (*Chaayuppu*), on the four sides. The prestigious house form was however that of *Nalukettu*. When two such courtyard houses were joined together, it formed the *Ettukettu*. This form of accretion was particularly suitable for the prevailing system of joint families with entailed lands, as it permitted any number of additions, providing flexibility for the growing family. The form of this house also had climatological and social benefits. Door openings led from the passages around the *Nadumuttam,,* to rooms located all around. Refer Figure No. 1C in Appendix K. These inward looking houses with central courtyards called *Nadumuttam* were climatically suitable for Kerala, as it provided a system of stack effect for ventilation, served as light wells for lighting the inner rooms, and provided private spaces for the household women. In some

[9] The Tata oil mills 1918, Aspinwall & Co. 1920, Burmah shell oil Co. 1925, Sree Chitra mills 1937 and Indian Aluminium Co.1938 were among prominent industries which existed even before the commissioning of the port.

A. TYPICAL HOUSE FORM

B. MANA

Plate 1

cases, long *verandahs* of modest widths ran round the house on the outside. The *verandahs* had broad eaves, which protected the walls and floors from the driving rains and the glare of tropical sun, while maximising the air flow. A distinct space was allotted for every activity, and the plans were detailed to suit the particular caste, customs and household headship system. The house was laid out in a garden plot with trees, planted in prescribed locations (194).

Figure No. 4.2 present the location of different archetypes of houses in Kochi.

A few archetypes of houses adapted to urban situation at Kochi are detailed below:

1. The *Kottarams* or houses of the Royal household

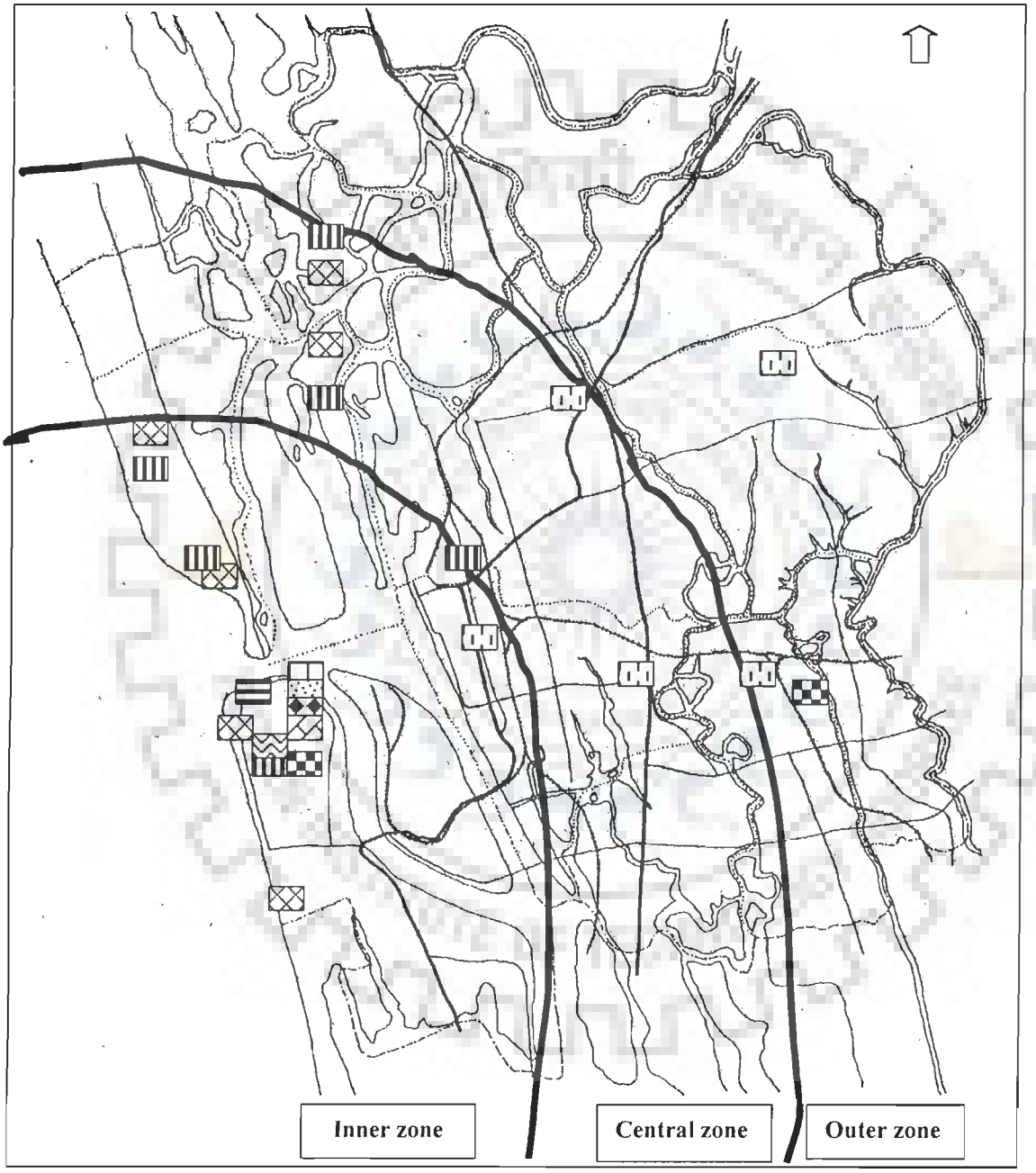
Kottarams were large courtyard houses of royalty, usually near temples associated with the household deity. The palaces in large walled up compounds are entered through gateways or *Padipuras to* a portico or *Poomukhas,* which led to the courtyard. Numerous rooms like council chamber or *mantrasala*, storeroom or *Sambharapura*, Kitchen or *Adukala* etc., are located around the courtyards. The upper rooms or *Maliga* used for sleeping or reading is a climatologically and aesthetically appealing structure. The hipped roof of the *Kottaram,* with beautifully carved projecting gables perhaps, lends it the greatest aesthetic appeal. Refer Figure no.1D in Appendix K. Many other accessories like prayer hall on south called '*Thekkekettu*', big dining hall for marriage feasts '*Agrashala*' teaching hall '*Ezhuthupalli*' etc are also found suitably located within the complex.

2. *Madhoms/ Ilams/ Manas* of Malayali Brahmins

The *Namboothiris* are native Brahmins and their houses are called '*Madhoms*', *'Illams, or 'Manas'.* Refer Figure No.1B in Plate 1. These were, basically single courtyard '*Nalukettus*' or double courtyard houses '*Ettukettus*'. *Madhoms* had walled compounds with gateways called *Padipuras*. The entrance to the house was generally through a pillared verandah or *Purathalam* on the southwest corner. The kitchen located on the northeast had a

Figure 4.2

Distribution of different house types in Kochi



A. ETTUKETTU

B. THARAVAD

Plate 2

well adjacent to it, such that, water could be drawn directly from the kitchen area. Refer Figure no. 3B in Appendix K. These houses were 'all-wooden structures,' with thatched or tiled roofs.

3. Christian houses in Kochi

Historically, the Christian community of Kerala can be divided into three groups, based on their genesis. The earliest called the Thomas Christians or Syrian Christians were *Namboothiris* converted into Christianity in 52 AD, by the apostle St. Thomas, on his arrival at Kodungaloor port (Muziris), in the company of a Jewish trader. The second category, known as *Knanaya* Christians, are the descendants of 72 families, who arrived at Kodungaloor in 325 AD from Edessa of Syria, under the leadership of a merchant called Thomas of Cana. The third category, called Latin Christians were converted by the Jesuit frair St. Francis Xavier, from backward and fishermen communities, in 1500 AD during the Portuguese colonial period. The houses of many a Syrian Christian was a double courtyard house or Ettukettu with an entrance gateway or *Padipura.* Refer Figure No. A in Plate 2. Some were three storeyed and consisted mainly of two parts: a *Malikapura,* the living area and an *Arapura,* for storage of paddy. The *Malikapura* is entered through a *Poomukha*, which in turn opens into the sitting room for guests called *Natayilakam.* The upper floor of the *Maligapuras* is spacious with verandahs facing the inner courtyard. Accessory structures in the compound include cowshed or *Thozhuthu* and bathing tanks or *Kulams.* The Knanaya Christians adapted themselves to the vernacular housing pattern and customs, but still formed a close-knit community. The houses of Latin Christians retained, by and large, the humble characteristics of their pre conversion living (226).

4.*Tharawads or Nair* houses

The Nair community held prominence in the society owing to their association with the ruling class. The house of an average Nair family was an Ekasala (*Padijattini*) facing east.

It consisted of a core unit or '*Thaippura*' with two or three rooms connected by a common passage in front. Horizontal expansion of the house was effected by extending rooms on all the four sides of the core house. Often the core house as such was also extended vertically to form a second floor. A few among the Nair community who were given powers for collection of taxes for the king, rose in social hierarchy which was reflected in their housing as well. These Nair families or '*Tharawads*' adopted the courtyard house modified to suit their social customs. Refer Figure no. B in Plate 2. The courtyard houses '*Nalukettu*' of the Nairs can be distinguished from those of the Brahmins and the Syrian Christians in their internal layout, although externally they exhibited the same features.

5.The *Kudis* or agricultural labourer houses

The agricultural labourers belonged to the landless backward castes. While the households of landlords sited themselves comfortably on the garden lands, the agricultural labourers were allotted a place for their make shift houses, at best, on the far end of the garden land or on bund of paddy fields. Most of them lived in one-roomed thatched huts. Coconut and Arecanut wood was used for all the wooden members required to support the house. Walls were of mud and some times laterite in a few improved dwellings. Some had a small *verandah* in front in addition to a small room and a kitchen.

6. Fishermen huts

The houses were usually of one room, with walls and roofs made of coconut leaf mats and dispersed along the seashore, mainly for their occupational convenience. Some had small windows of latticed pieces of coconut wood. They had to be often rebuilt -all most as an annual feature- due to destruction caused by rising rough seas, during the monsoons.

7. *Agraharams* or Tamil Brahmin houses

The Tamil Brahmins of Kochi hail from the adjacent state of Tamil Nadu. They came to Kerala primarily for rendering priestly services to the Royal Cochin household. Many

A. AGRAHARAM

B. GUJARATI ROW HOUSE

Plate 3

being of the educated class, were also absorbed into administrative posts. The traditional way of life is preserved in their row houses, on either side of a central street. Refer Figure No. A on Plate 3.

The plan of each house consists of a series of rooms placed one behind the other, with the doors arranged in line, so that from the front entrance door in the *verandah,* one has an uninterrupted view up to the backyard. This aids in providing excellent cross ventilation and the much required lighting in row houses, deprived of lighting from the sides. A paved courtyard with a well at the rear, separates the main structure from the bath and toilet at the rear end. A distinctive feature of their dwellings is the '*Koalam*', an intricate decorative design drawn on the ground at the entrance of houses every day using rice flour. The *Agraharams* are located around a temple, and they thus form a distinct neighbourhood with close ties and intense kinship.

8. The *Gujarati* houses of Kochi

The *Gujaratis* came to Kochi from the state of Gujrat, in western India, as coastal traders in spices, textile and general goods. *Gujarati* houses were of two types: independent houses of the *Seths* or tradesmen, and the *chawls* of the tenants. The *Chawls* were row houses clustered around a central courtyard, with common toilets grouped on one side. Refer Figure no. B on Plate 3. A courtyard serves for social interaction, the focus of which is a well, and a square *Tulsi*[10] platform.

The house of the Seth is a large independent house representative of his status in society. Refer Figure no.2A in Appendix K. It is separated from the main road by a high wall with an entrance gateway. The inner portion of this entrance gateway has a platform for waiting. The *Tulsi* platform is located in the centre of the front yard of the house. A large wide portico with side platform runs through the entire facade of the house. These platforms

serve as seating. The architecture of the house is of mixed style. The Kerala influence is evident in the shape of the roof, while the European influence is revealed in the segmental windows and cast iron railings. A characteristic element manifested in the building is its doorway, with an outer shutter of iron rods, with the inner shutter being of thick wood. Walls are very thick, made of laterite and have decorative and painted dadoes. The interior consists of a large sitting room, around which the bedrooms are located. Behind the sitting hall, at a distance, is the kitchen. Steps from this intermediate space lead to the upper floor, with the same number of rooms repeated at the top.

9. The *Kutchi Memons* houses of Kochi

The *Kutchi Memons* are muslim trader communities who migrated to Kochi, from Kutch, in Gujrat state. They owned most of the godowns located on Bazaar Street in Mattancherry, where most trading took place. Their houses of a double storeyed row of shops in the front, with an inner open courtyard at the back for drying and storing the goods. Rooms around the courtyard were used as godowns, while those on the upper floors were used as offices. Most of the manual labour required for the trade was provided by the Muslim communities of Malabar. The *Kutchi Memons* have their residences within the yard containing their work centres. The arrival of the British, who banned trading with natives, was a period of great depression for the business communities of Mattancherry. The *Kutchi Memon* community slowly drifted away, after renting out their properties to the Wakf board.

10. The Goa Brahmin houses or *Konkani* houses of Kochi

The *Kokanis* arrived in Kochi due to religious persecution in Goa, during Portuguese colonial times. They were mainly engaged in retail trade in food grains, textiles, gold and metal ware. Their settlement centres around the temple. The residences of the *Konkanis* are generally row houses along the streets radiating from the temple. Refer Figure no.2B in

[10] A plant sacred to the Hindus, often grown in courtyards of houses.

Appendix K. The simplest house had a pillared *verandah* in the front, which led to a multipurpose room. Behind it was located the bedrooms, with the Kitchen in the rear. Steps from the multipurpose room led to an attic at the top. There were a few double storied courtyard buildings of the rich called '*Chowki mali*'.

11.The Jew houses of Kochi

Jews had trade links with the Malabar Coast from the period of King Solomon. They arrived in Kochi in 1567 AD. They settled down near the King's palace and their settlement was later known as Jew town (251). Refer Figure No. 4A in Appendix K. The Jew town consisted of tightly built up settlements, with no open spaces at all. Jew houses lined either side of the street, and were predominantly double storied wall-to-wall structures with big windows. Refer Figure No. A on Plate 4. Shops and offices occupied the ground floor, and residences were on the first floor. The Jewish synagogue and clock tower occupied the end of the street. With the Jews gradually leaving Kochi, most of these houses are being converted into new uses, from spice trade centres to curio shops.

12. European houses in Kochi

European houses in Kochi were of three kinds: large courthouses, bungalows and street houses. The large courthouses around eight to ten in number were set on the edge of the street with a good access to the water sheet in the characteristic Dutch style. Houses were entered through a *verandah*, which faced the tree-lined streets. Entrance doors were placed centrally in the facade, and gave access to the houses and courtyards at the rear. Louvered wooden screens were placed in front of the main entrance doors, to permit natural ventilation without visual intrusion. Their architecture was devoid of ornamentation, except for some European motifs. A variety of carved wooden fan light grilles and ornamental lintels over openings, helped to lend individuality to the houses. Brick vaulting was the characteristic style of roofing with iron tie rods at springing level, and plastered internally.

A. JEW HOUSE

B. BUNGLOW

Plate 4

The bungalows largely of English origin were double storied and accessed from wide roads with shady trees. Refer Figure No. B of Plate 4.The houses are set back from the plot boundary, with open spaces around. Entrance porches feature columns of classical styles. Doors and windows have arched openings with keystones defined, and roofs were a combination of hipped and gabled tile roofs. Doors and windows were usually half glazed with fanlights, to admit light into the interiors. There were balconies on the western side to protect from the heat, and many offered glorious views of the sea or backwaters according to their location. Large wooden staircases lend access to the upper floors in the front. An outhouse was also provided behind the kitchen for servants. Many bungalows had separate garages located at one corner.

Street houses are typical of European townhouses, were 100 in number and were double storeyed. Refer Figure No.4B in Appendix K. They were accessed at both floors directly from the narrow street in the front. They reveal mixed architectural styles with sloping English *chajjas,* above the Dutch four shuttered windows jutting from under the arches into the streets. There were large entrances on the ground floor, which was used as stables (221).

Figure no 2C and 2D in Appendix K, show the residential settlements of the Jain community and the Malayali Brahmin community respectively. Figure 4.2 shows the distribution of the archetypes of residences discussed above as located in the city.

4.3 RESIDENTIAL ARCHITECTURE 1900-1950 AD

The social and economic changes in the beginning of the twentieth century, discussed in section 3.3 of chapter 3, resulted in fragmentation of lands and break up of joint families. These changes were first felt in growing cities. The small irregular plots which could not

satisfy the tenets of *Tachusastram*, and the small family sizes generated the need for a new typology of small houses, in place of the traditional sprawling ones. Space constraints did not permit internal courtyards, leading to the disappearance of the *Nadumuttam*. This necessitated houses with higher ceiling heights, larger openings and *Verandahs* around the house, to substitute for the climatic and social benefits of the traditional *Nadumuttams*. As a result of small family sizes, the number of rooms reduced from the 10-15 in traditional houses, to a modest 4-6 rooms. The intimate family structure also led to compact residential design, stressing more on convenience rather than privacy. Life styles changed too. With the arrival of modern furniture, rooms became larger[12] and assigned for specific activities. The size and number, and the linear traditional alignment of doors and windows changed, to provide better lighting and ventilation, to suit the new lifestyle. With constraints of space, due to small plot sizes, single storied buildings gave way to double storied ones.

With gradual shift towards secondary and tertiary sector, agricultural produce was no longer the main source of income. The granaries or *Arapuras* were relegated to a small portion of kitchens. Similarly, cattle sheds or *Thozhuthus* started to disappear due to the decline in agricultural activities and the cattle population. The arrival of kerosene as subsidiary fuel gradually eliminated the need for firewood stores or *Virakkupuras*. With the arrival of piped water in towns, the all-important position of wells in traditional houses diminished. In town houses, toilets of either dry pit or conservancy type of disposal appeared, usually detached at the rear. Similarly the rooms appurtenant to traditional bathing ponds, the *Kulipuras,* were replaced by compact bathrooms or *Kulimuris*. Refer Figure no. 3A in Appendix K. The entrance gateways or *Padipuras* of the traditional houses vanished and were replaced by iron gates in compound walls. (Refer Figure no 1B in Appendix K)

Housing also started displaying a change towards use of better and durable materials. Thatch was replaced by tile and mud and wooden walls were replaced by laterite and brick masonry. Architectural detailing also changed. Window bars originally of wood were replaced by iron rods. Towards the forties, cement floors replaced mud floors.

4.4 RESIDENTIAL ARCHITECTURE 1951-1975 AD

The industrialisation of Kochi, and the increasing employment opportunities, lured many towards it. The social ties within the traditional community led to the convergence of such groups on the established nodes in the town. *Madhoms* and *agraharams* started getting sub divided and *Padipuras* were extended as living quarters to house migrant families. Refer Figure No. 4C in Appendix K. At one *Madhom,* visited by the investigator 15 families were found to reside. The design of *agraharams* does not permit expansion by addition of new structures in the compound. Hence, with increasing population they were heavily subdivided. The lack of scope for expansion in the courtyard pattern of Gujarati chawls, led to new houses appearing in the middle of the open courtyard inside. Such infilling can be seen as the first step, in densifying residential precincts. The large trading courtyards of *Kutchi memon* houses disintegrated, being rented or leased for multiple uses as shops, godowns, offices, and residences by the Wakf board.

Improvements in building technology and arrival of new materials like steel and cement, led to the emergence of flat roofs, especially in new houses in main land. Increasing cost of timber and carpentry had made construction of tiled roofs uneconomic, besides unfashionable. A hybrid type of roof with RCC in the front and tiling at the rear, also emerged. The introduction of mosaic finishes enhanced the quality of flooring. With the introduction of RCC lintels, bigger windows with glazed panels could be provided, permitting

[12] Habitable rooms were of 3.5 x 3.5 or 2.4 x 2.4 m in size and was bigger than traditional upper caste bedrooms

better ventilation and lighting. The erstwhile lean to verandahs around the house, shortened into attractive flat roofed sit outs in front, and work areas for the kitchen. RCC cantilevered open porches also became fashionable among the rich. Bed rooms were increasingly designed with attached toilets. In 1971, Ernakulam district ranked first among the districts of the state having 70 per cent of buildings of pucca[13] category. Refer Table no 4.1 in Appendix K. Kochi contributed substantially to this statistics .

4.5 RESIDENTIAL ARCHITECTURE 1975-85

4.5.1 QUANTITATIVE AND QUALITATIVE CHANGES

The influx of remittances from the gulf, which began around the late seventies, had great effect on both the quantity and quality of housing. This increase was marked during the years from 1979 to 1981 as revealed by government surveys (54, 55). It was reported that during 1980-81, 23 percent of all construction activities undertaken in the urban areas of Ernakulam district were new building construction, while 74 percent related to improvements and alteration. Construction activities other than building were a mere 3 percent and it was still greater than the state average. Nearly 85 per cent of these new buildings were residential in nature (54).

The rate of construction of residential buildings in the urban areas of Cochin region during the year 1980-81, stood at 6161 houses annually which was close to the estimated annual requirement of 6416 houses (55). Table no. 4.1 gives the occupancy rate of residential buildings in the urban areas.

The survey of housing and employment 1980, also revealed that 12 percent of the residential buildings in Kochi were less than 2 years in age, having been constructed in the

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of 2 x2 m(194)

[13] denotes permanence and high quality

Table no 4.1

Household size and number of rooms occupied 1981

Percentage of Households by size and number of rooms occupied 1981										
no. of members Households	Total Households	no exclusive room	1 room	2 room	3 room	4 room	5 room	6 room	Unspecified no of rooms	House -less
Total	100	0.23	16.40	27.77	20.41	14.68	9.11	9.12	0.55	515
1	100	0.98	52.01	18.35	7.49	3.58	1.74	1.19	3.37	325
2	100	0.49	30.78	27.85	15.15	8.79	4.97	3.83	0.57	50
3	100	0.22	24.78	31.91	18.99	9.96	6.01	5.21	0.58	55
4	100	0.28	18.39	30.49	20.83	14.28	7.60	6.58	0.46	35
5	100	0.14	15.90	30.16	21.45	14.38	8.54	8.21	0.59	35
6+	100	0.15	9.73	25.87	21.79	17.43	11.53	12.35	0.32	15

Source: Ernakulam district census 1981

Table no 4.2

Distribution of new buildings according to nature of construction 1980-81

Distribution of new buildings according to nature of construction 1980-81									
	Rural			Urban			Total		
	pucca	semi pucca	katcha	pucca	semi pucca	katcha	pucca	semi pucca	katcha
Ernakulam district	88.02	11.98	na	84.48	13.79	1.73	87.2	12.4	na
Kerala	92.47	6.99	0.54	93.15	6.44	0.41	92.54	6.93	0.53

Source. Report on the survey on household construction activities in Kerala 1980-81

Figure no.4.3

Age of housing 1980

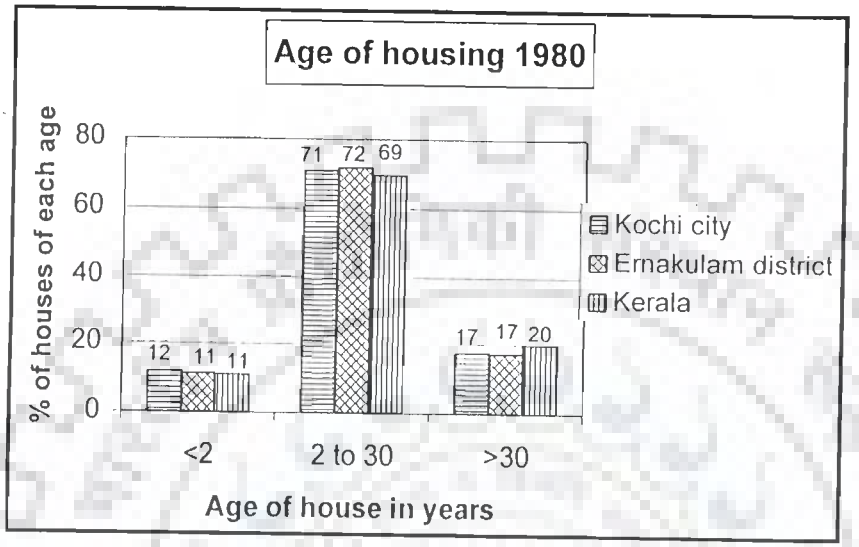
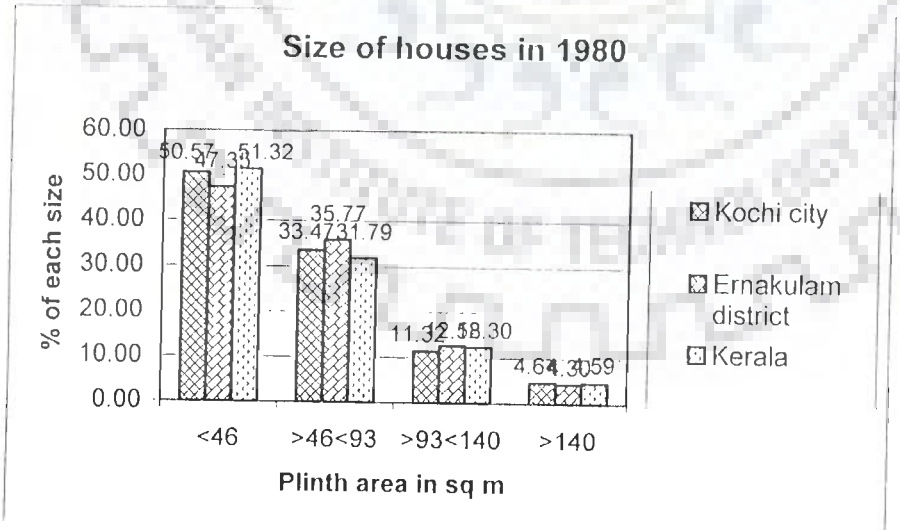


Figure no. 4.4

Size of houses 1980



A. GULF HOUSE

Plate 5

two years 1979 and1980. Refer Figure No.4.3. This has been attributed to the increasing inflow of money from the emigrants and due to the stepped up activities of the organised building sector. Table No 4.2 indicates that a large share of these houses were of pucca[14] materials.

The change towards durable materials is further reflected in the use of concrete as the roofing material for 14 per cent of the houses, and burnt brick as walling material for 48.71 per cent of the total houses built. Refer Table no. 4.3 and 4.4.

Infrastructure also improved. Sewerage system was laid out for some part of the city, and most households possessed septic tanks. The survey of housing and employment in 1980, reported that the houses in Kochi, were superior to that of the district and state in the number of houses with electricity and water sealed latrines. Refer Figure no 4.5. By 1981 a gross improvement had taken place, as can be seen from Table no. 4.5

4.5.2 The Gulf House

During the decade 1971-81, large number of residential buildings started becoming double storied. There were two main reasons for this. Firstly, the small plots restricted horizontal expansion. Secondly, the double storey was an indication of increased socio-economic status. Most emigrant households possessed house of four to five bedrooms, in addition to a servant's room. Many of them had separate structures like dovecotes, and kennels etc to show opulence. One of the greatest changes that came about was, in kitchens. It was common to have two kitchens. One with imported cooking ranges and a host of other electric kitchen appliances and the other mainly for use firewood. By and large, these houses were foreign in design and materials and were popularly known as the 'gulf houses'. Refer Figure no A on Plate 5.

[14] Permanent materials

Table no.: 4.3

Roof material in Kochi urban agglomeration 1981

Roof material in Kochi urban agglomeration 1981								
Grass, leaves, Reeds, Thatch Wood, Mud, Unburnt bricks, Bamboo	Tile,Slate Shingle	Corrugated iron, Zinc, Metal sheets	Asbestos cement sheets	Brick, Stone, and Lime	Stone	Concrete/ Reinforced brick concrete, Reinforced cement concrete	All other materials	Total
16.48	66.44	0.18	0.40	0.59	0.09	14.19	1.62	100

Source: Ernakulam district census 1981

Table no.4.4

Wall material in Kochi urban agglomeration 1981

Wall material in Kochi urban agglomeration 1981										
Grass,	Mud	Unburnt bricks	Wood	Burnt bricks	GI sheets or other Metal	Stone	Cement concrete	All other materials	Total
10.09	1.26	1.86	4.38	48.71	0.08	30.01	2.48	1.15	100.00

Source: Ernakulam district census 1981

Table no.4.5

Households by availability of electricity, and toilets 1981

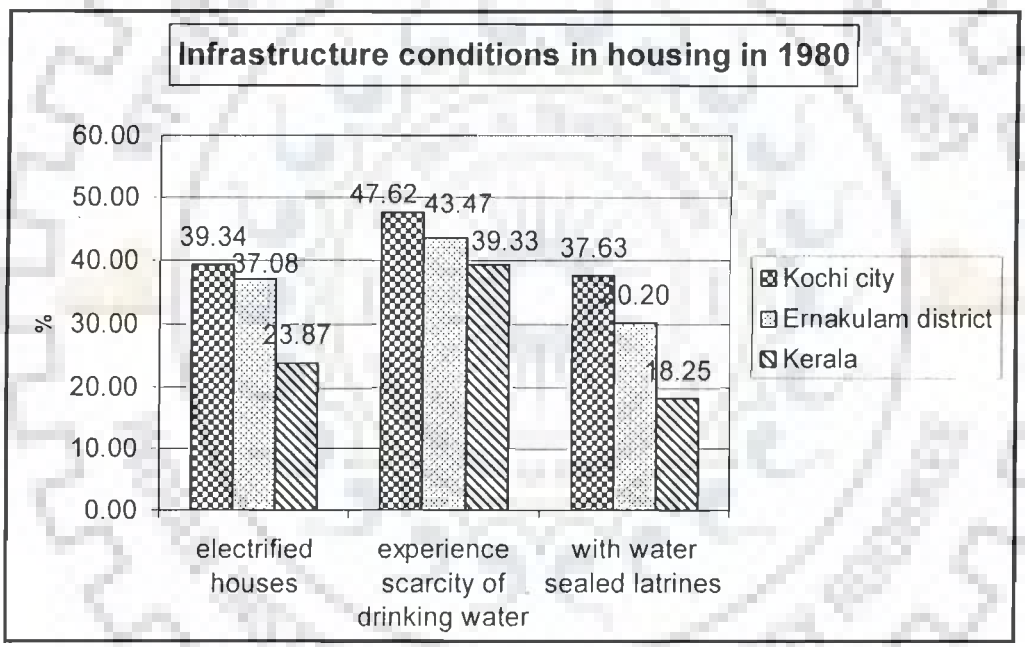
Households by availability of electricity and toilets 1981					
	Total households	Electricity		Toilet	
		available	not available	available	not available
Cochin UA**					
Total	100	61.5	38.5	68.6	31.4
Owned	74.1	41.3	32.7	46.7	27.3
Rented	25.9	20.2	5.7	21.9	4.1
Cochin corporation*					
Total	100.0	62.9	37.1	70.6	29.4
Owned	72.6	42.0	30.5	47.5	25.1
Rented	27.4	20.8	6.6	23.1	4.3

Source: Ernakulam district census 1981

Note:** includes all areas marked *

Figure no 4.5

Infrastructure conditions in Housing 1980



A change also came about in the exterior appearance of the building. The flat roofs were considered insufficient to demarcate their socio-economic status. The new roof pattern was the sloping roof in RCC, with the top surface plastered in long stepped bands or covered with tiles. The use of an arch in the front, under the sloping roof was used to achieve elegance. Different type of show walls started appearing in most buildings. Even openings inside the houses were spanned using the semi circular arch. Front doors were heavily carved and in a single piece of wood. The modest porches of the previous decade, either had to be expanded to accommodate the owner's car, and even that of a visiting guest. Most houses had landscaped gardens complete with lily ponds, and lawns. Some even had a watchman's kiosk. The emigrants also wanted to possess fancy houses with architectural designs, often borrowed from foreign architectural magazines or from the ultimate in architectural opulence, the movies.

4.5.3 Towards multiple dwellings:

The GCDA came up with the twin house a concept for the common man compromising the economy of the small plots, and desire for ground space. With the high cost of construction, this was acceptable for people, who could not afford separate plots and houses. This was also the period of transition towards multi-storeyed apartments. The initiative in this direction was again taken up by public sector agencies, who had development schemes consisting of individual plots, twin houses and finally group housing consisting of 3-4 storied structures.

This set the trend for a compact modern design of houses.

The large demand for housing consequent to the gulf migration in the late seventies has already been discussed in section 3.5.1 of chapter 3. It was also observed that housing was at its peak in the early eighties 1980-81 in Ernakulam. The large amount of housing being undertaken created excessive demand on land and building materials particularly cement

Figure no.4.6

Building cost index number in Kerala 1981-85

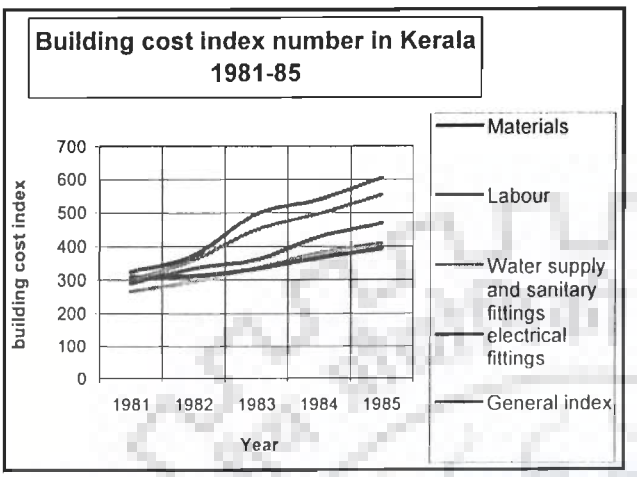


Figure no 4.7

Prices of building materials

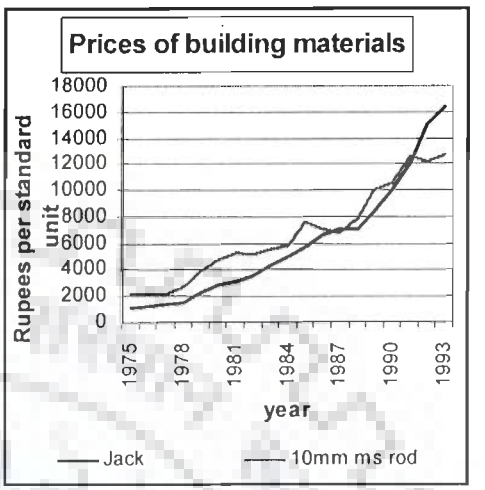


Figure no.4.8

Prices of building materials 1

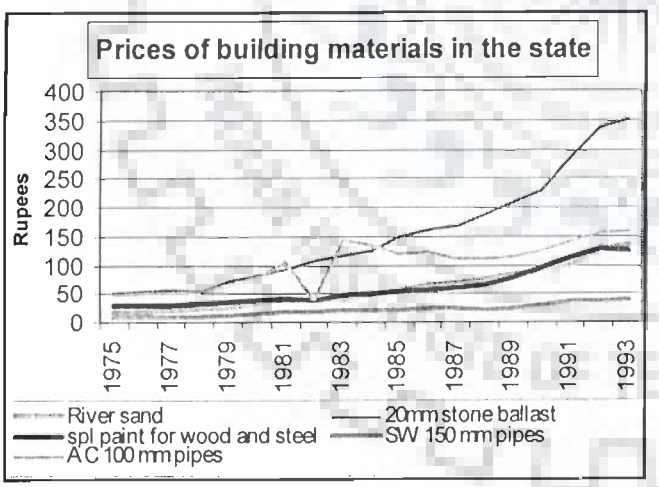
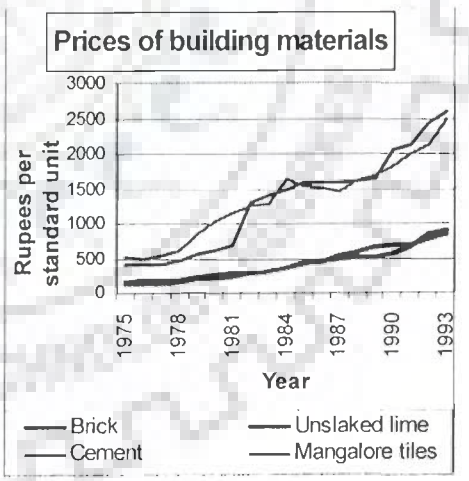


Figure no. 4.9

Prices of building materials 2



According to a study by the Town and Country Planning Organisation, the annual growth of land prices in Cochin was 505 per cent between 1981–83, which was the highest in the country (162). Not only did the material prices shoot up, cement was available only in the black market. The increasing cost of construction on grounds of shortage, was further aggravated by the shortage of skilled labour, most of them having left for the gulf. (56). Refer Figure no. 4.6, 4.7, 4.8, 4.9.

It was also increasingly felt that Reinforced concrete structures were unsuitable from the economic point of view, due to material and labour costs and, from a climatic point of view as they were hot when compared to those built with traditional materials like tiles, bricks, lime and mud. Since control of land prices was not within an individual's hand, it was only on construction cost that one could hope to economise. This was the time when Laurie Baker introduced his concept of cost effective housing. He reprimanded[15] the building professionals for this deterioration in values of economy and comfort, and advocated a style incorporating cost effective and climatically appropriate technology, where concrete was used sparingly, often in a folded slab with broken and discarded tiles used as filler, thereby making the roof light and inexpensive. Rat trap bonding techniques using brick and mud block walls helped to make half brick thick walls and hollow walls. Other cost reduction techniques included the use of R.C.C frames for doors and windows, use of brick *jallies* instead of windows, flat arches instead of lintels, while glass, shutters, sills and lintels were dispensed with and replaced by brick corbels. Walls were left un-plastered. Refer Fig. No. 60 in

[15] 'The whole of the building trade in the state has naturally been eager to cash in on this great fountain of wealth. Architects, engineers and contractors design flamboyant, extravagant and expensive buildings. Masons, carpenters, labourers and service technicians all charge three to four times as much as they did a few years ago. Every new Gulf house shouts out loud and clear " See, what a lot of money I can throw around"... Among the pleasant, homely tiled and thatched houses, these bold, painted, concrete complications of gimmicks stand out like sore thumbs...The most unsuitable material for walls in a hot climate is glass...But gulf houses must have big glass windows...One panel of glass is removed to accommodate the now necessary air conditioner. Cement is used extravagantly in Gulf housing...The ordinary Keralites now wants to keep up with the Gulfer.. Worse, the

Appendix K He called for keeping building heights below the height of the Coconut tree. He called for designing with minimum disturbance to the site . 'Yet, despite the presence of Baker and his buildings that blend into the lush, tropical environment of Kerala, many of Kerala's literate majority, still prefer the concrete slab and the pucca colonial house, with plastered walls and bright, multi-coloured, lurid paint. The 'westernised' house is after all a symbol of prosperity' (169). But in contrast to this observation it was found that the 'Baker model' gained acceptance even among the higher income groups. Refer Fig. No. 6c in Appendix K. It created an awareness on alternate technologies, new approaches in spatial design and new forms of exterior.

4.6 RESIDENTIAL ARCHITECTURE 1985 ONWARDS

The spiralling land prices having reached a peak in 1984, started to flatten around 1985. But cash continued to flow in the form of surpluses from the plantation crops, which recorded a steady increase in prices and remittances from abroad. This brought about a renewed search for new investment avenues viz. Teak plantations, Orchards, goat farms etc, many of them dubious, which eventually collapsed. Attention again focussed on land, as the only form of safe investment. Around the same time, financial institutions started opening their doors to finance individuals for housing needs. A tax concession on interest on housing loans was announced. With this many young families started aspiring to own houses. Around the same time, the organised private sector entered the housing scene, with low-rise town house concepts. With ready built housing becoming attractive to the consumer, and savings pouring in, more such developers stepped in. All these resulted in an increasing demand for residential land, leading to a phenomenal increase in its prices, towards the early nineties. The

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government housing agencies seem to have been bitten by the same bug. Saddest of all is the fact that the people of Kerala seem to have accepted this vulgar display of wealth'(17).

increasing land prices led to heavy speculation, leaving the middle and lower income groups priced out. Cost effective housing with respect to location, soon arrived in the form of apartment housing. It was the low-rise builders who catered to this demand, making available affordable, centrally located, budget, walk up apartments. Many traditional areas like the Gujarati *chawl* got converted into multi-storeyed apartments, still retaining the Gujarati community and their tradition. Refer Figure no. 4D in Appendix K. Many other ethnic communities also started purchasing apartments, as it could provide the security, which they were enjoying in their traditional community living. Since apartment housing in Kochi started at a time when the Gulf returnees had brought in a modest standards of luxury, these constructions also had to go by those standards. The early multi-storeyed apartments of Cochin, thus originated to provide cost effective housing on one hand, and security of group living and luxury of independent living on the other.

4.7 SUMMARY

1. Kochi city presents a variety of residential archetypes, some of native origin, some adapted from cultural contact and others transplanted from other places. Twelve different archetypes with many variations in each are traced. All these archetypes, evolved in the socio cultural context of the city development can still be seen in different parts of the city
2. The formation of the state of Kerala joining the erstwhile three regions of Travancore, Cochin and Malabar, the administrative reforms in the use of land, enactment of building laws and such other forces, are seen as the reason for the genesis of new forms of housing distinct from the traditional ones.

3. Experiments on alternative building systems such as that of Laurie Baker and others, appeared to influence for a new outlook for housing typology. This however, did not have any impact on high-density apartments.
4. The pioneering effort of planned high-density development was started at the initiative of the Development Authorities through comprehensive development programmes. These developments included plotted areas for individual houses, twin houses, low-rise apartments, and in a few cases, tall multi-storeyed apartments.
5. The lack of investment avenues for surpluses from cash crop cultivation, and foreign remittances, led to heavy investment in real estate. The consequent land price rise, priced out the low and middle class who therefore opted for low-rise budget apartments to obtain the economic advantages of multi family living.
6. The deterioration of the building condition in the congested parts of the town directed redevelopment for houses towards low-rise apartments.
7. The standards of living set by independent Bungalows simultaneously became an input for certain minimum standards in these multi-storeyed apartments. The multi-storeyed apartments thus appear to emerge satisfying the three requirements of cost effective housing, security of group living and the luxury of independent living, the three attributes, which strongly influenced the prospective house builder to opt for this development.

The housing scene in the early nineties in Kochi, presents quite a different picture, with a proliferation of tall, luxury apartments all over. The reasons are not obvious; hence a deeper inquiry of these forces at work controlling the demand-supply mechanism of housing becomes necessary. This is attempted in the next chapter.

CHAPTER 5

STUDY OF AGENCIES IN LAND ASSEMBLY AND HOUSING SUPPLY

This chapter deals with the supply of hosing in Kochi. It examines the characteristics of land, which forms the basic element in the housing system. It identifies the contribution made by the different actors towards housing in Kochi.

5.1 INTRODUCTION

Traditionally, all residential development, from times immemorial has been the domain of the household sector. Till the seventies, houses in Kochi were owner built. Public agencies entered the house building activity in seventies. This was followed by the entry of organised private sector agencies in land and building market. Public sector housing is supplied by various government and quasi-government agencies, of which the greatest contributors are the Greater Cochin Development Authority and the Kerala State Housing Board. Private sector housing comprises of the housing contributed by the Household sector, Co-operative sector and Private developers. The decade 1981-91 has witnessed the construction of 4108 houses/ annum in the city as against 3380 houses /annum in the decade 1971-81. The rate of housing supply has increased from 3.95 houses/1000 population in 1971-81 to 4.3 houses/1000 population in 1981-91. Only meagre share of less than 5 percent of the total housing stock has been contributed by the public sector, while around 95 percent has been contributed by the private sector (11). This chapter gives an overview of the contribution of these agencies to the housing in Kochi. As housing is rooted to the problem of land supply, attempt is made first to study the characteristics of landforms, and land supply mechanism for urban use.

5.2 LAND CHARACTERISTICS OF KOCHI

Kochi city, mostly falls within the low land regions of the State. Water sheet, comprising of, lagoons, canals and ponds constitute 18.91 percent of the total area. The remaining 81.09 percent is designated as the land mass, which is again classified into dry land (57.66 percent) and wetland (23.43 percent). Land formation and sea erosion are both continuing processes in this coastal geography, although at a very slow pace. These natural

land formation processes have over the decades, encouraged the formation of new islands in the lagoons and the reclamation of new land for urban uses (156).

5.2.1 WATER SHEET:

The characteristic feature of this land use pattern of Kochi is the predominance of the water sheet. These water sheets rich in marine foods, minerals and shells, form a means of livelihood and inland water transport. These water fronts have thus served ideal for these water based economic activities, and encouraged the siting of residential landuses alongside. Their scenic beauty has presented a great potential for recreation and tourism, and encouraged the siting of attractive luxury housing on its banks.

5.2.2 LAND:

A. Physical zones identified for study purposes

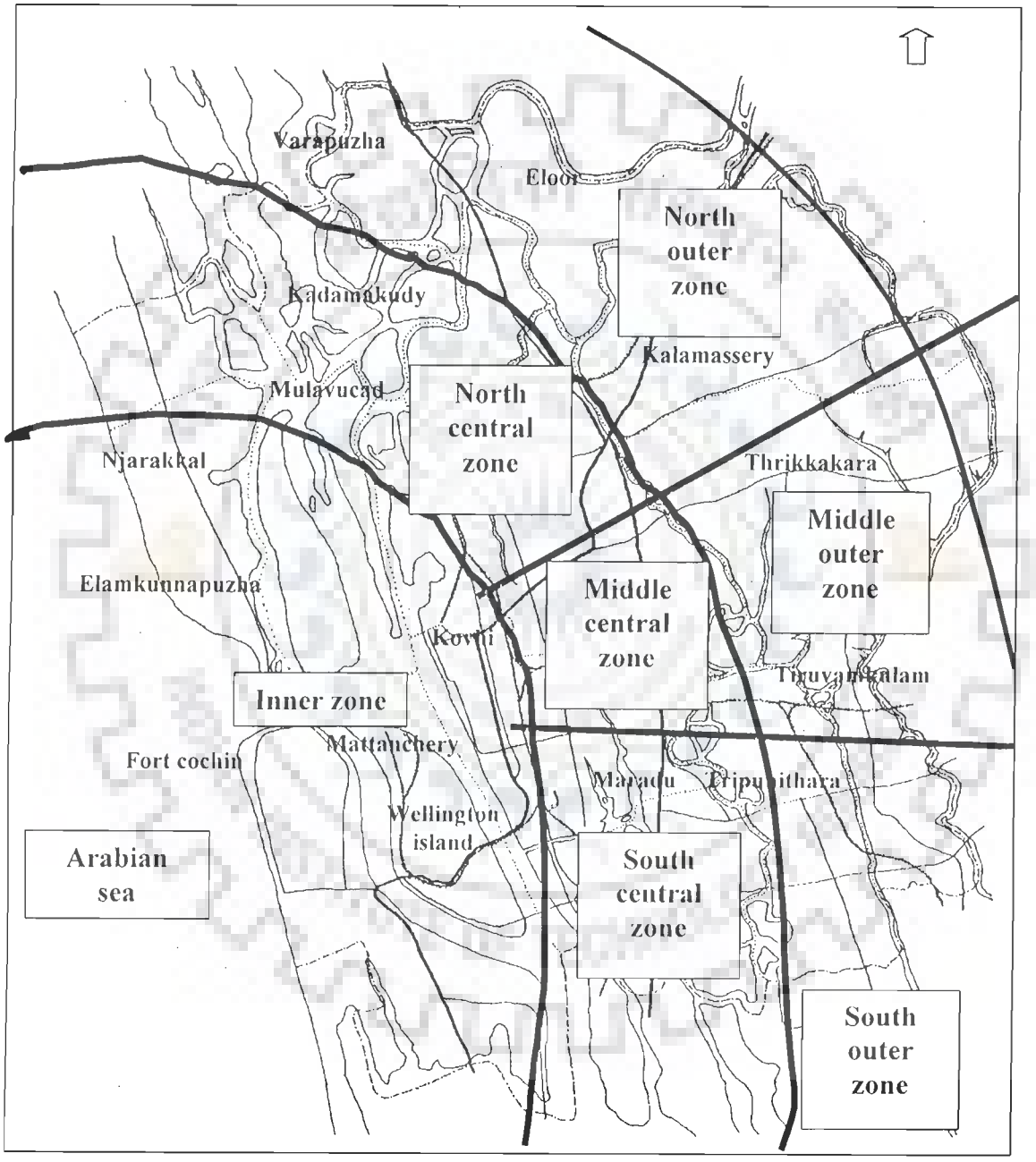
The central city of Kochi can be broadly divided into three zones, by cutting arcs of 3 km radius from the tip of the old city of Kochi. Refer Figure No. 5.1. The inner zone has the railway line as the indicator of its eastern boundary. The central zone can be further divided into three zones, namely a north central, middle central, and south central zones, by the two important radial roads the Banerjee road on the north, and the Sahodaran Iyappan road on the south, connecting Kochi to the next order urban centres, namely Alwaye, and Tripunithara respectively. The eastern boundary of this zone, is the limits of the Kochi corporation. The outer zone is also further divided into three zones, a north outer zone, middle outer zone and a south outer zone, separated by the same radial roads. This eastern boundary of this zone is the limit of the central city.

B. Soil conditions

The city has two kinds of soils; alluvial (sandy loam, peat) and laterite soils. Refer Figure No. 5.2. The part of Kochi on the western sea board in the inner and central zones, consisting of Mattancherry, Fort Kochi, Njarackkal, Elamkunnapuzha etc., and parts of the

Figure 5.1

Physical zones identified for study



mainland consists of sandy loam. This deposit extending even up to depths of 50 m and beyond, with bearing capacity as low as 3-6 tonnes/sq. m. presents unique foundation problems in this area. While this soil can support buildings up to two stories with normal foundation, taller buildings invariably require pile foundations, increasing cost of construction considerably. This is all the more true, in case of walk up apartments (2 to 4 storeys), which in better soils, can be on simpler foundations.

Lateritic soil covers the midland eastern part of the city, predominantly the outer zone. The soil is porous and well drained and has a soil bearing capacity of 20 tonnes/m^2. It is hence well suited for building construction. On removal of the top soil, laterite is found as a homogenous mass, which can be quarried as building blocks. This being a popular traditional building material, many lands are subjected to its mining. The activity being largely unregulated, has altered not only landform and topography, but also, the aesthetic character of the landscape in such areas. (246)

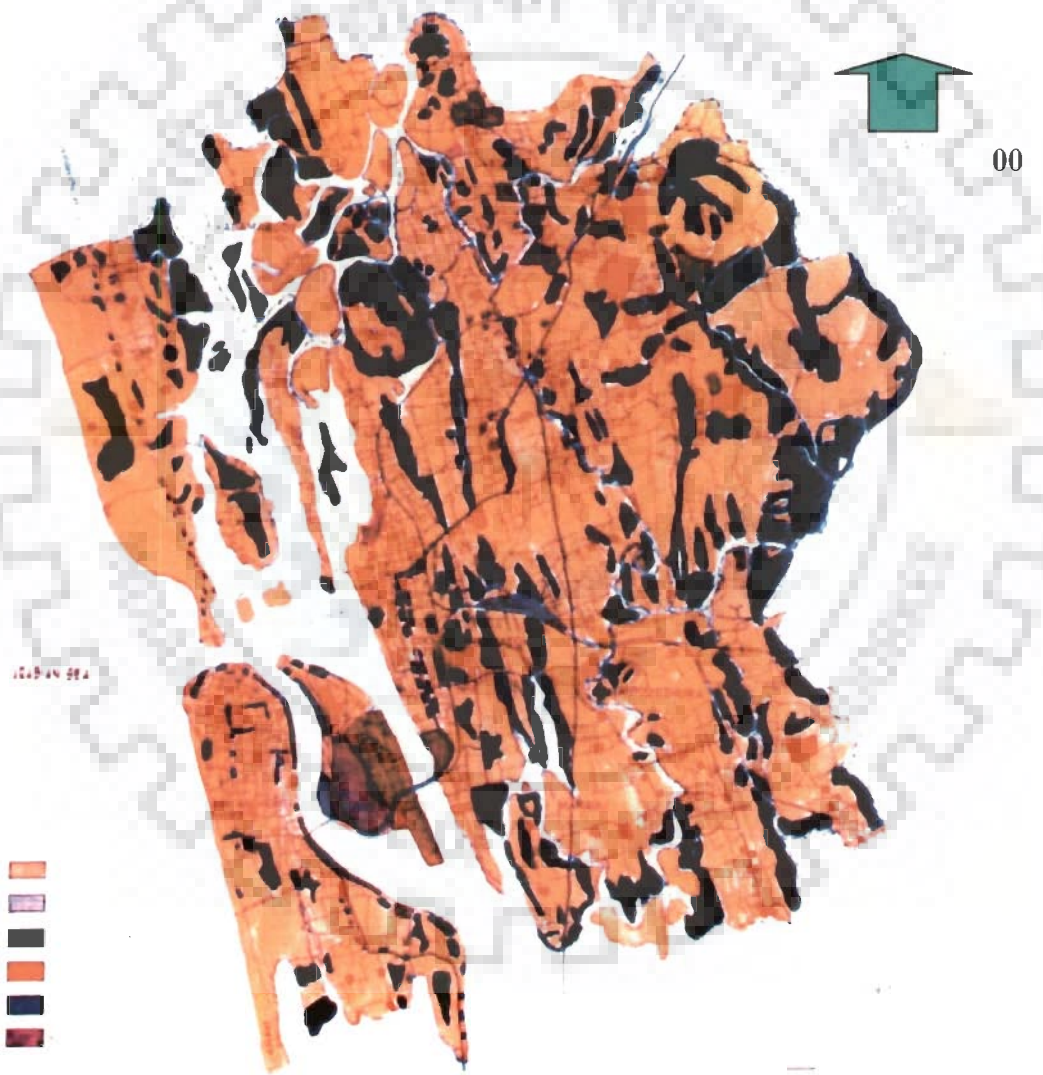
C. Type of lands

1. Wet Lands:

The wet lands in Kochi are formed by the gradual leaching of dry lands, into the flood basins of watercourses, canals and estuaries. Forty percent of the wet lands are marshy, and is more concentrated in the central zone(69).Refer Figure No. A on plate 6. These marshy lands, drained by a network of canals and flushed by tidal action from the sea, were earlier used for paddy cultivation. But the uneconomic nature of agricultural operations[1] have increased fallow lands on one hand (241, 66), while on the other hand, the increasing demand

[1] These areas are plagued by water logging, poor soil, and yield conditions. In addition are problems of increasing wages of agricultural labour and non availability when essential, opposition of labour unions to mechanisation, high fertilizer prices etc.(66)

Figure 5.2
Landuse map of Kochi



A. TYPCIAL MARSH LAND (CENTRAL ZONE)

B. RESIDENTIAL DEVELOPMENT ON MARSH LAND

Plate 6

by other uses have encouraged the conversion of these lands for shrimp farming, cultivation of garden crops[2], brick making and for residential land uses. (127, 79).Refer Figure No. 5B in Appendix K.

The fallow wet lands of Kochi are distributed scattered all over the city, and mostly concentrated in the central zone. In the early fifties, all residential development was concentrated in the inner zone, mostly along the 22 m. commercial Mahatma Gandhi Road and residential Chitoor road, the railway line being laid out on the periphery of this. With the construction of over-bridges over the railway line in the north and south ends, the threshold retarding residential development beyond this was overcome, and residential development spilled over beyond the railway line, to the dry land of central zone. The ribbon development along the radial road left a sizeable amount of marshy land within the city centre, with a potential for conversion into urban use when required. They become ideal sites for speculation and also present potential for re-densification of residential land use, particularly since they are of small sizes. Refer Figure No.5.2.

2. Utilisation of dry land:

The net dry land available for urban use in the city amounts to only 57.66 percent of the gross land. The land utilisation pattern of this land is as given below. Refer Figure No.5.2.

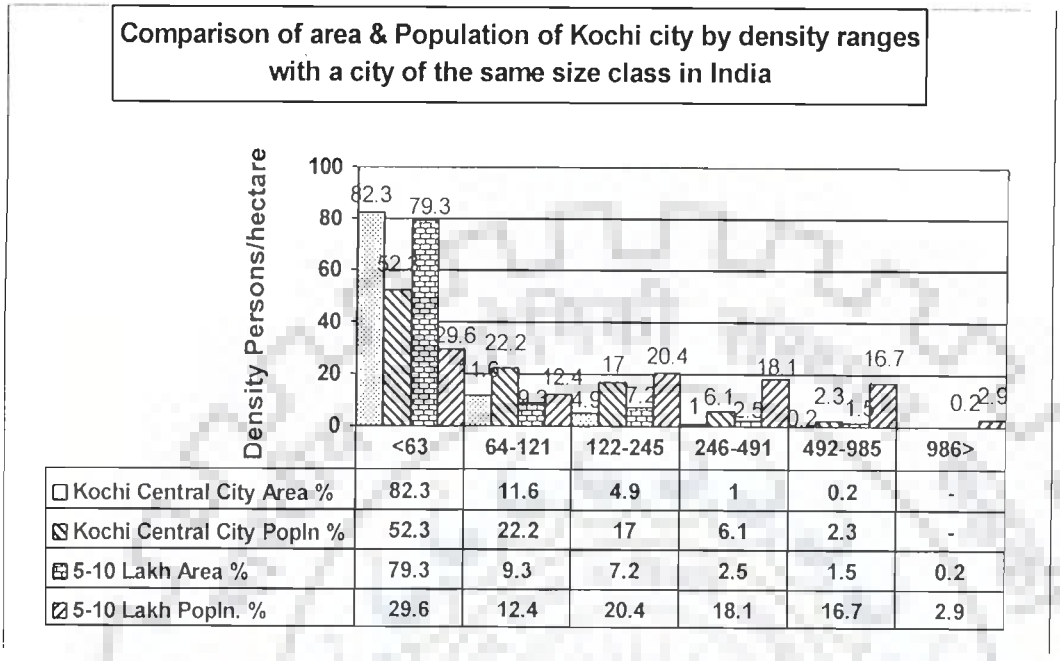
i) Residential landuse

Nearly 84.64 percent of this net dry land is under residential use. Most of the residential land is built over with isolated single storey single family homes in Kochi, except in the City centre (246). In the city centre, the residential land is mixed with commercial and public uses in its natural development. Changes in the character of land use from residential to

[2] There has been a decline of more than 3 lakh hectares of land under paddy cultivation in the state between

Figure 5.3

Comparison of area and population of Kochi by density ranges with a city of the same size class in India

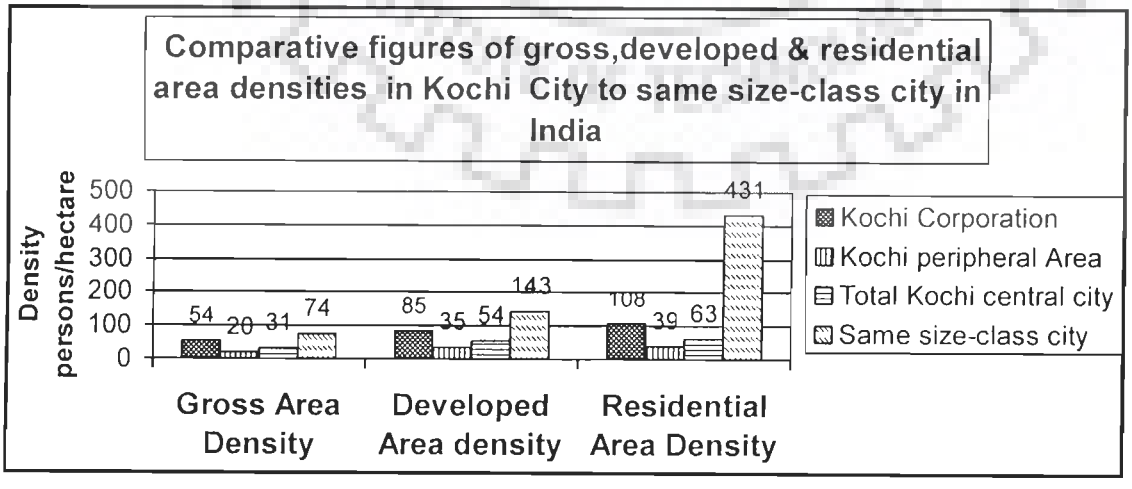


	<63	64-121	122-245	246-491	492-985	986>
Kochi Central City Area %	82.3	11.6	4.9	1	0.2	-
Kochi Central City Popln %	52.3	22.2	17	6.1	2.3	-
5-10 Lakh Area %	79.3	9.3	7.2	2.5	1.5	0.2
5-10 Lakh Popln. %	29.6	12.4	20.4	18.1	16.7	2.9

Source: Sinha,R.L.P

Figure no.5.4

Comparative figure of gross , developed and residential area densities in Kochi city to same size class city in India



Source: Sinha,R.L.P

commercial uses are seen in the central business district, and at the intersection of important roads. About 85 percent of the developed land in Kochi is surveyed as under residential use, whereas in other comparable cities in India it is only 33 percent. Refer Figure No.5.3. The average residential density in the city is only 63 p/ha as compared to 431 p/ha in other cities of the same class. Refer Figure No 5.4. Nearly 75percent of the population live in densities less than 121persons/hectare, as against 40 percent in a city of the same size-class. (220).

ii) Transportation landuse:

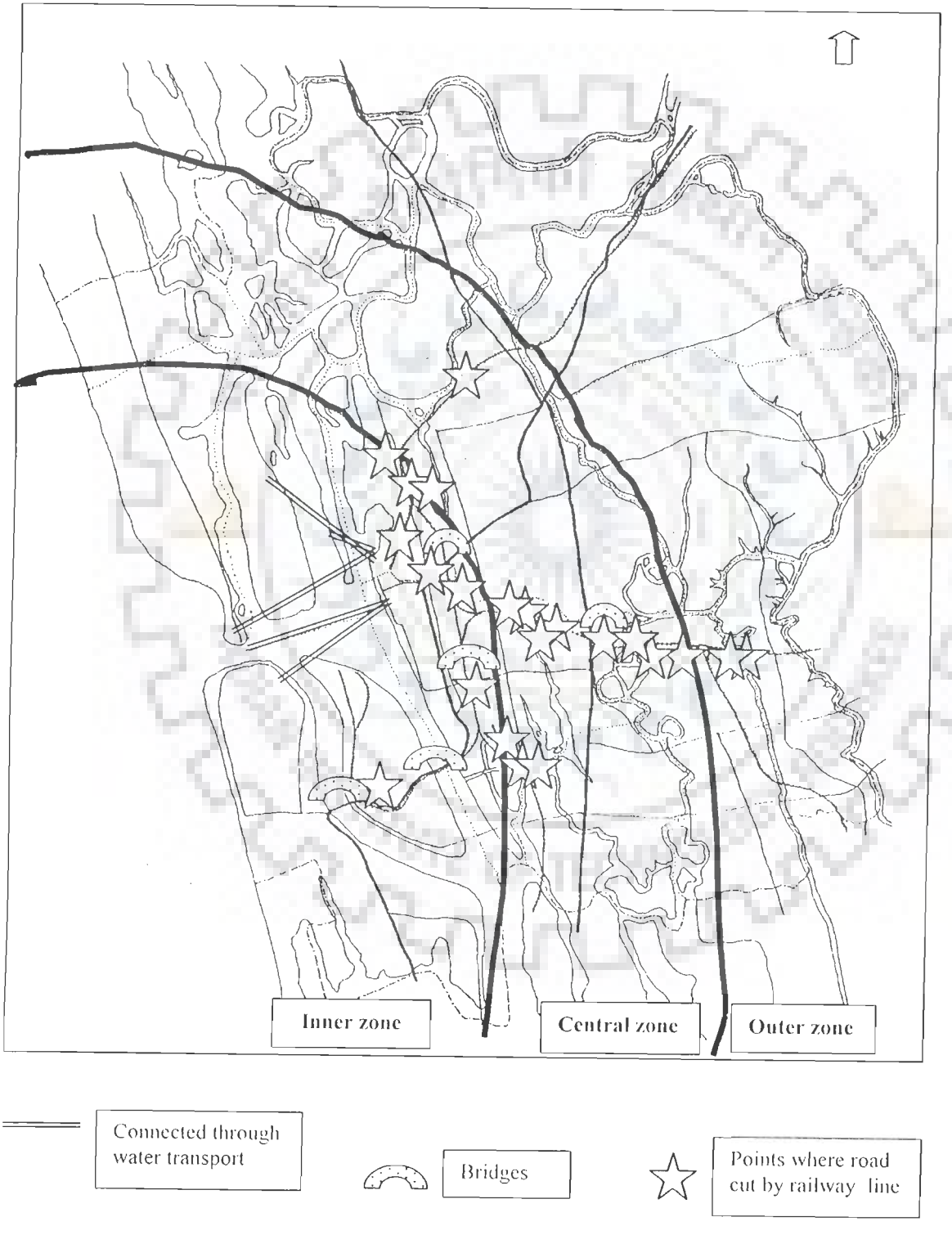
The land under transportation is an index of infrastructure of the city. The area under transportation use in Kochi is low, being only 6.14 percent of the net dry land area, when compared to the average of 9 to 11 percent in other cities. The roads are generally narrow, and streets irregular. One of the greatest problems in transportation in Kochi, other than the narrow streets, high vehicle ownership etc, is the position of the railway line. The rail lines to industries like Tata oil mills, Cochin refineries etc, the island and the shunting yard together, effectively divide the city into three parts in N-S and E-W directions. There are 25 level crossings within the study area, with only four over-bridges. Refer Figure No.5.5.The narrow bridges across water bodies like the Venduruthy and Mattancherry bridges across the backwaters cause untold delay.(108) The landing facilities for ferry services and for inland navigation services are inadequate with poor change over facility, from land to water modes. Refer Figure No. 5D in Appendix – K.

iii) Open spaces:

The percentage of land under parks, playgrounds and open spaces in the city amounts to only 0.78 percent of the net dry land. Although the water sheet and agricultural land provide the lung space of the city and supplement the open space requirements, their use for passive and active recreation is limited. The Structure plan for Cochin, and the plan proposals

Fig no.5.5

Fragmentation of city by water sheets, canals, and unbridged railway lines



of the Goshree island development authority, (GIDA) envisage to increase this through the development of water front area for recreational needs and creating a system of green lands by planned conversion of paddy fields.

iv) Commercial landuse:

1.39 percent of the net dry land of Kochi is under commercial use. Commercial land is concentrated in the centre of the city, as a ribbon development along important roads, and at other nodal points formed by the intersection of important roads and along the roads. Presently proposals are being made, to develop some of the islands for trade and commerce and for imports and export of goods, while the CBD[3] activities are to be distributed at nodes identified in different parts of the city.

v) Industrial landuse:

Industrial land use take 2.53 percent of the net dry land of the city. All the types large scale, medium scale, are included in this category. Large scale industries are mostly concentrated in Eloor-Kalamassery area, medium scale industries are distributed along the foreshore areas, and small scale units are spread all over the city. The industrial estate in Kalamassery with a number of small scale units, and the export processing zone at Kakanad are some of the other areas with concentration of industrial character.

vi) Public & Semipublic landuse:

Public and semi public use which include all areas under administrative, educational, religious uses etc, constitute 4.52 percent of the dry land area. The spatial pattern of this land shows a balanced distribution all over the city.

[5] Central business district

The Structure Plan proposals anticipate that the future land requirement per worker will more or less be governed by the present ratio for economic activities, and the land requirement per 1000 population, will dictate the land for community needs. Based on this concept, all the areas under uses other than residential land use will tend to increase, as can be seen from the Table Nno. 5.1 below.

Table No.5.1

Land use in Kochi city (1981—2000)

Landuse	Past %(1981)	Future %(2001)	Diff. in terms of land
Commercial	1.39	1.91	+ 114.2 ha
Industrial	2.53	7.14	+ 1041.6 ha
Transport	6.14	17.76.	+ 488 ha
Public and semi-public	4.52.	8.95	+ 855.5 ha
Open spaces	0.78	6.5.	+ 1018.5 ha
Residential	84.62	58.61.	- 2874.7 ha

Source: Structure plan for Kochi 2001, 1984

Clearly, this trend, combined with the increase in demand for residential land due to population increase, is likely to put pressure on existing residential land and other convertible/reclaimable lands to ease the problem. This will be even more severe as studies already reveal that the per capita availability of land for housing which was1.8 cents or 72 sq m in 1971 is likely to be halved by 2001. A family of five members may only have 5 cents or 200 sq m of land for housing.(209). The search for options in residential development essentially arises in this context.

5.3 LAND CONVERSION:

Generally, methods adopted to bring more land under residential use are twofold: 1) creation of new land by reclaiming it from waters.2) conversion of other land .

A. BACK WATER RECLAMATION

Plate 7

5.3.1 LAND RECLAMATION FROM BACKWATERS

Reclamation of the backwaters is a classic approach for creating new land. Refer Figure No.B on plate 5. This was first employed in Kochi during the creation of Cochin harbour. This practice continues to be adopted by Greater Cochin Development Authority, Goshree Island Development Authority and the Cochin Port Trust.

The Greater Cochin Development Authority(GCDA) has advocated the reclamation of land from backwater, in its Structure Plan 1984. It mentions that 'Reclamation of land from waters, however, necessitates identification of strategic areas based on the community needs, study of economic viability base on cost benefit analysis, and research on technological feasibility with reference to hydro-dynamic and ecological impact'. It continues that according to rough analysis about 10 % of the area under water may thus be reclaimed for use in next 20 years 'without adversely affecting the system' which will mean an additional supply of 521.7 hectares of land for urban use. With this rationale, the GCDA has gone ahead with its reclamation schemes of around 23.91 ha on Ernakulam foreshore, and utilised some of it for park, roads, commercial and residential uses. Future proposals for reclamation include a proposal to reclaim another 256 ha on the northern foreshore for urban development, 6 ha of backwater off Shanmugham road, Thevara foreshore reclamation scheme and a water sports project of around 60 ha. (Prathapan). The details of backwater reclamation by GCDA is given in Tableno.2 in Appendix D.

The latest reclamation proposal is that of the Goshree Island Development Authority. Refer Figure No 5A in Appendix K. It proposes to connect the mainland to Vypeen on the sea board, through four bridges connecting the intervening islands and developing boulevards, marine drives, high income housing, water sports amusement parks and shopping centres. To finance the 506 crore project, 250 ha of back waters is proposed to be reclaimed, of which

139.16 ha will be auctioned for commercial purposes (138). The issue has generated much heat between the development authority and environmentalists, with both conducting studies to support their respective views.(256, 255, 253, 252, 103, 104, 156, 197, 144, 259, 101, 253, 102, 261, 233, 224, 100, 102). They argue that it has led to shrinkage of water basins, extinction of certain species of marine life, destruction of wetland ecology (104, 196) and anticipate a depletion in fish resources and consequent reduction in foreign exchange earnings, (255, 253, 256, 156 260)inefficient dispersal of toxic urban effluents, cause loss of livelihood to fishermen, increase turbidity (104) and also trigger earthquakes (22).

While mandatory environmental studies are being undertaken for large identifiable public projects, a sizeable quantity of land reclamation does take place in the private sector(developers) unnoticed, and without little or no regard for ecological or environmental concerns.(156, 197). There have been some reports of such activity from Kundanoor, Vallarpadom and Vypeen, but the larger portion remains unnoticed (145, 261). While permission for building construction in Kochi has to be taken from both GCDA and Kochi Corporation, neither has any information regarding reclamation of land. While there are no environment cells in either of these bodies to control such activities, they are themselves accused of 'competing with licensed and unlicensed private developers' to reclaim the backwaters.(224, 197). The extent of back water reclamation till date and proposed is given in Table No. 5.1 in Appendix J.

5.3.2 CONVERSION FROM OTHER LAND:

Other lands feasible for conversion falls into two broad categories: dry land and wet land. Conversion of low lands(marshy wet lands) into urban land is a comparatively economic and easy process. The Structure plan envisages that about 10 percent of the low lands, can be

converted increasing the supply of dry land by 646.2 hectares by 2001. Accordingly, this form of reclamation was undertaken for the first public sector residential development project at Panampilly nagar under which 64 hectares of marshy land was reclaimed (69). Other areas where marshy lands have been filled by public and private individuals include Maradu, Kathrikadavu, Edapally, Elamkulam, Kundanoor, Kadavanthara, Tripunithara, Vytilla, Vaduthala, Chalikavattom, Chilavanoor, Gandhi nagar, Elamakkara, Giri nagar, Vennala, Arkkakadavu, Thevara, and sides of Aroor -Edapally bypass, as reported in the survey of planners, administrators, elected representatives, builders and social elite. Table no. 2 in Appendix J gives the extent of reclamation from low lying lands ,that have been undertaken by the GCDA. This potentiality of converting the paddy fields and marshy lands into urban land has presently led to filling of such low land areas, for urban landuse by private agencies also. Refer Figure No. A on plate 7.

A common method of land supply is a gradual conversion of wet lands to dry lands, by planting of cash and garden crops such as coconut. This method of conversion and had been highly favoured both by the farmers and the government, due to the stable external market these crops command. Alternately planting of Acacia, Casuarina, Teak, Eucalyptus, Mangium etc., was undertaken. Here, while the wood fetches the landowner some profit, a gradual conversion of wetland to dry land takes place. The land can then be easily converted to other urban uses. But the accelerated decline in paddy fields has led to stringent enforcement of the Kerala land utilisation act 1967 since the year 1990. The ban on the conversion of paddy fields for any other use, has encouraged the growth of fallow fields, deterred any cultivation, and at the same time led to lot of land within the city, to remaining unavailable either for agriculture or urban use.

5.4 OTHER LAND CHARACTERISTICS

While land can be made available by either of the above methods, the characteristics of residential land utilisation is determined more by the actual sizes of land parcels available, and its price. In this context a glimpse into these characteristics is not out of place.

5.4.1 LAND TENURE AND HOLDING SIZE

Nearly 85 per cent of land in Kochi is under private ownership. (148). A perusal of land holdings within the Kochi corporation area reveal that 85 per cent of the land holdings in the corporation area are of size smaller than 1500 sq m, with 64.6 per cent being less than 600 sq m,. 80 per cent of the holdings in the peripheries are of size less than 2000 sq.m (246). This fact has presented problems of land assembly for all housing producers, indirectly influencing the scale of the operations, quantity and type of housing development (240).

5.4.2 LAND VALUE

The land value in Kochi depends on four factors namely, density, distance to CBD, distance from major roads and availability of services (151). See Table 5.3 in Appendix J.. The land values have increased faster in the inner zone, at distances of 0.25 km from the major roads, and with availability of infrastructure. Land values have also been found not to depend entirely on the distance from the core due to the nature of the land forms of the city. Given the various thresholds of water bodies and railway lines, these values further varied with available transportation linkages, soil quality and landuse classification. The increase in residential land values were found to be uniform, with land values[5] ranging from Rs 56 to Rs 400 for outer zone and inner zone respectively in 1982. The highest land value for residential lands was Rs 350 per sq m and for commercial lands it was Rs 763 per sq m in 1982. (151).

[5]are registered land values

Land value[6] ranged from Rs 3700/m2 in the CBD to Rs 125/m2 in the paddy fields in 1987. The price of residential lands in the corporation area ranged from Rs 250/m2 to Rs 3000/m2 in 1987. There has been an average escalation of about 22% in the land prices during 1960-1980, and an average escalation of 25% during the years 1980-84. The escalation was at a rather uniform rate both in towns and villages. The highest land value was observed to be in the corporation area, followed by the industrial areas of Kalamassery and Eloor. Mulavucad, and Kadamakudy and had the least values as they were islands not connected to the main land by roads. Areas of Thrikkakara, Tripunithara and Maradu which were developing at a fast rate had their land values are changing drastically due to high speculation in these fringe panchayats during the eighties. The striking feature of the land values is that while high values exist all along transport corridors, it reduces drastically, irrespective of actual distance to the core, in the absence of easy access by transport. The efficient linear transportation system has made it easier to access more distant places, than the physically close but locked low lying land areas in the city (148). Clearly, this provides great potential to obtain and develop cheaper areas for residential development closer to the city, if proper access can be provided.

5.5 PUBLIC SECTOR IN RESIDENTIAL DEVELOPMENT

The major agencies engaged in residential development at Kochi may be grouped under (i) Public, (ii) Co-operatives and (iii) Private. Among the public agencies active in housing in Kochi, are the Greater Cochin Development Authority, and the Kerala State Housing Board. The Girinagar housing society is the only active housing co-operative

[6] are market values

operating in the city. The private sector comprises of the household sector, and the private developers.

5.5.1 GREATER COCHIN DEVELOPMENT AUTHORITY

The Greater Cochin Development Authority (GCDA) was created in 1976 to implement the development proposals in the Development Plan 1976. GCDA started implementation of the Development plan proposals, with the composite housing scheme on reclaimed marshy land at Panampilly Nagar, being one of the earliest. Till 1991, the GCDA had acquired nearly 20.06 hectares of land, undertaken nineteen house construction schemes, and assisted in the construction of nearly 10,000 houses in Kochi (229). Among the development town planning scheme areas undertaken, 57 percent are on reclaimed marshy lands while 3percent are on lands reclaimed from backwaters. Only 32percent of the projects undertaken are on dry land these being located mostly in the fringe areas. Refer Figure No. 5.6. Table No 5.2 presents the details of the total amount of land developed by GCDA, from various sources, for undertaking detailed town planning schemes and for residential development.

Table no. 5.2

Types of land developed by the Greater Cochin Development Authority

TYPES OF LAND DEVELOPED BY THE GCDA		
Nature of lands	Scheme area in ha	Residentially developed area in ha
reclaimed from marsh lands	542.48	142.62
dry land	302.6	4.944
reclaimed from backwaters	25.29	4.83
River bank	74	9.8
TOTAL	944.37	162.194

Source: based on data collected from GCDA

Figure 5.7 reveals that , 88 percent of the land developed for residential purposes has been converted from marsh lands. Dry land constitutes only 3 percent.

Figure No 5.6

Types of land developed by GCDA for all purposes

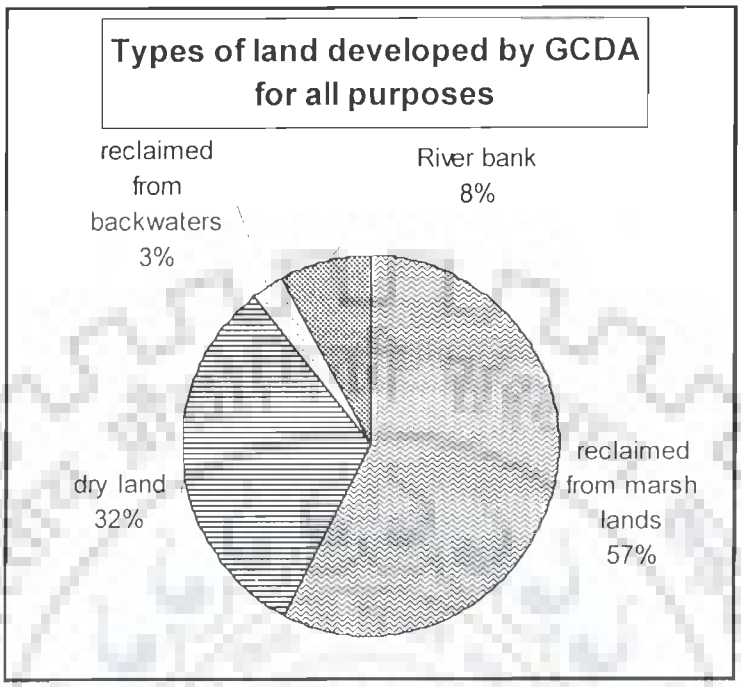


Figure No. 5.7

Types of land developed by GCDA for residential purposes

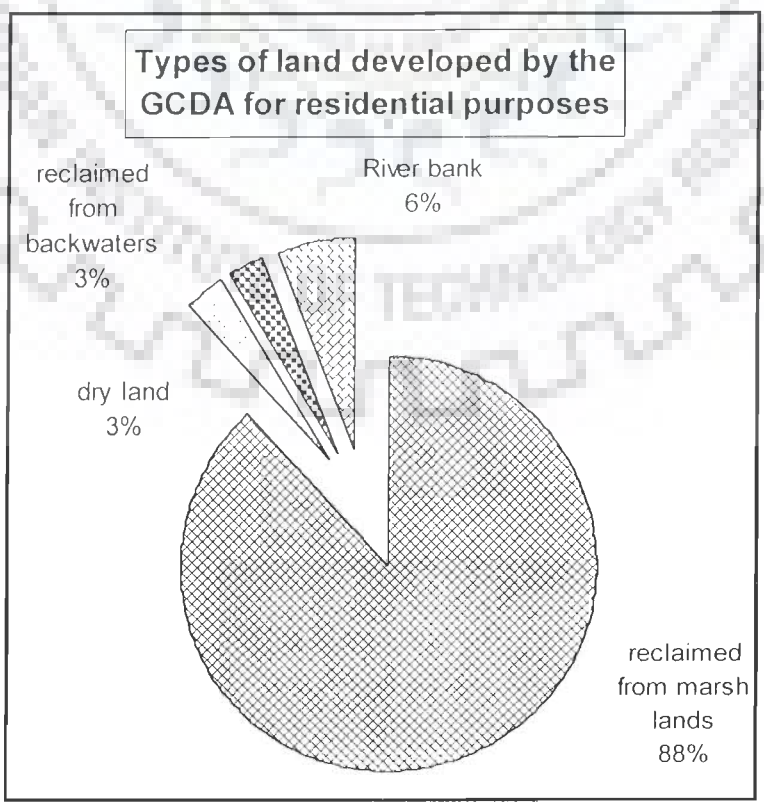
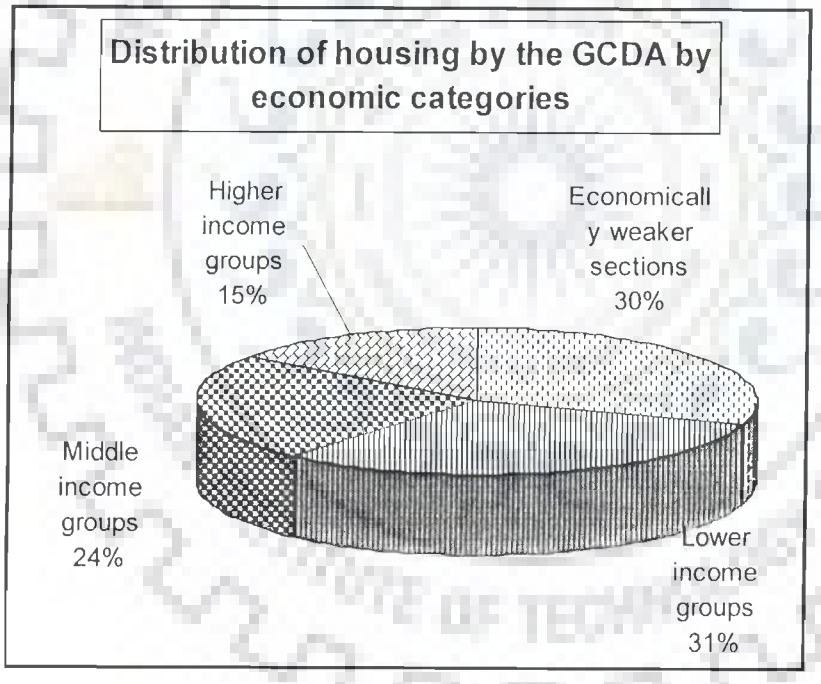


Figure no 5.8

Distribution of housing by the GCDA by economic categories



More than half of the housing constructed by GCDA has been for the lower classes, it being 30 percent for economically weaker sections, and 31 percent for lower income groups. Refer Figure No.5.8 36 percent of the housing projects were composite in nature, of which 20 percent were for economically weaker sections, 15 percent were for middle income groups and 25 percent were exclusively for higher income groups respectively.

The housing typology includes all types –plotted, twin, and multi-storeyed. The economically weaker section housing is generally single, while the others are largely double storied. GCDA started vertical development by construction of Asokha flats on lands reclaimed from the backwaters. The 204 flats constructed in two blocks and completed in 1984, became the first public sector ownership high rise apartments in Kochi. Refer Fig.No. 6B in Appendix K. The Apartment Act 1983 which came to force in 1984 was enacted for the purpose of transferring the deed of this apartment in the individuals name (11). The non-acceptance of apartment culture and low demand, coupled with cost escalation, put GCDA in a very difficult position till Navy bought 102 flats. The Table No. 5.4 in Appendix J, shows the detail of the land and housing schemes undertaken by GCDA. Figure 5.9 shows the location of the schemes in the city.

5.5.2 THE KERALA STATE HOUSING BOARD:

The Kerala state housing board(KSHB) was created in 1971 to undertake direct housing, and assist housing, through routing financial assistance for housing programmes in the State. In Kochi, it has brought around 57 hectares of land under housing. Out of it, 35 percent was on lands reclaimed from marshy lands, and the rest was on dry land. Out of the dwellings undertaken by the KSHB through aids from the Housing and Urban Development Corporation, 92.28 percent was for EWS, 3.18 percent for LIG, 2.94 percent for MIG and 0.13 percent for HIG category (162). The residential land housing schemes of the KSHB are

detailed in Table No.5.5 in Appendix J. Figure No.5.9 shows the location of housing schemes of the Kerala State Housing Board.

There were many reasons for the decline of the public sector towards the late eighties, and early nineties. One of them was the inability to complete the projects, at the promised prices and the consequent loss of public confidence[7]. The most important reason for this, was the problems of land assembly. Most public agencies assembled land, using the Land acquisition act 1894. Here, small plot sizes posed a problem, as it meant innumerable legal tangles and court cases, as people tried to appeal against it, primarily due to low compensations received. Certain provisions of the act were modified subsequently (148).

5.6 CO-OPERATIVE SECTOR IN RESIDENTIAL DEVELOPMENT

The co-operative sector consists of a group of people who come together and register themselves as a co-operative society, with a common objective of building a house for themselves. Housing co-operatives take advantage of the concessions given to these societies, by way of low interest loans, assistance in the procurement of land, and the benefits of economies of scale in group housing. The Housing Co-operative societies work under the regulations of the Cochin Co-operative Societies Regulation of 1913. In 1961, there were 4 Co-operative Housing Societies with 132 members in Ernakulam (50).

The Girinagar Co-operative Housing Society was the first Co-operative housing society in Kochi. Its first project was the construction of Girinagar colony in Kadavanthara on reclaimed marshy land. Subsequently, it has undertaken many projects within the city as well as in the periphery, consisting of housing as well as plots. The society has brought nearly 36

[7] A classic example is the experience cited by a respondent. He had registered for a three bedroom flat with the KSHB in 1981 on an installment basis, which at the prevailing then market rate would have amounted to Rs 300,000. In 1994, he received a letter from the KSHB stating that the house was ready and the respondent could purchase it on a ready cash basis at a cost of Rs. 2,600,000. Meanwhile, the respondent and some of his children had already constructed their own houses.

hectares of land under residential use, constructed 379 houses, and distributed around 681 housing plots. The larger share of housing by this sector has been on marshy lands.The details of the housing schemes undertaken by this society is given in Table No5..6 in Appendix J.

The first apartment constructed by housing co-operatives was the Kairali apartments, completed in 1984. It was built by a co-operative of Income Tax officers and was constructed in Panampilly nagar, on reclaimed marshy land. The structure was 10 storied in height and consisted of 72 units of 2 and 3 bedroom units, ranging from around 1450 to 1600 sq.ft, at a price of Rs.350/sq.ft. Kairali apartments is considered one of the most successful and efficiently managed projects due to the efficient functioning of its residents association, in the pre and post construction period. Nearly 2.6 percent of the total housing stock of Kochi is contributed by these co-operative societies. The average housing supply of this sector has been around 12 percent of the total housing supply per year.

One of the difficulties faced by Co-operative societies, is the availability of land. With the establishment of the Greater Cochin Development Authority in 1976, Co-operatives could request the Authority for allotment of land. Many lands so allotted were in the peripheral areas which were not well developed with respect to infrastructure. This resulted in a low demand for Co-operative housing. In the nineties, financial institutions opened their doors to housing finance. With increasing ease of obtaining housing loans on a competitive basis, the importance of Co-operative society housing, started to wane. Further, availability of ready built apartments in the prime city locations, started attracting consumers towards the private commercial sector. At present, the housing supply through assistance from the State co-operative housing finance is negligible in the city, those constructed being mostly employees housing, and in the city peripheries.

The contribution of GCDA, Kerala State Housing Board, and housing co-operative societies was at the rate of 700 houses/annum constituting 20.7percent of the housing

construction in 1971-81. In the period 1981-91 the share of public sector has was only 14 percent of the annual housing supply, the share of the Greater Cochin Development Authority being 318 houses/year .

5.7 PRIVATE SECTOR IN RESIDENTIAL DEVELOPMENT

The private sector housing agencies in Kochi can be classified based on its objectives into household sector, and private developers

5.7.1 Household sector:

The household sector consists of individuals, engaging in house construction for their own use, with the objective of obtaining shelter, security, and social status attributed to it. The household sector is traditionally the largest supplier of private housing. However, there is a decline in the share of the household sector in housing supply, owing to many reasons such as increased pressure on land, spiralling land price, administrative controls, complexities in construction etc. (265). Here, the private developer housing has emerged as an attractive alternative due to its ready built nature, the vantage locations, greater amenities, essential security arrangements, and the economy in land and construction costs in group housing (149). It would be interesting to examine this sector in detail.

5.7.2 PRIVATE DEVELOPERS:

The private developers may be identified as individuals or firms involved in constructing houses, for sale in the market, with the objective of maximising their profits. They have been be operating in the large cities from as early as the 1960's (265, 83).

Private sector housing in Kochi began its activities in the sixties. At that time, its activities were limited to a group of real estate brokers, and building contractors engaged in building and trading a couple or more single storied residences at a time, and business men

with surplus cash. Some of the earliest low rise projects were the Tharakam flats in 1962 in Atlantis, and the low cost prefabricated housing by A.R.S Vadhyar in Mattancherry and Mamangalam,. in 1976. The first high rise apartment block in Kochi was constructed by an enterprising business man, who from his visits to Bombay, was inspired to make the first prestigious high rise building in Kochi called the Fernson's Apartment in 1971. Refer Fig. 6A in Appendix K. It was a 12 storied building, housing two and three bedrom apartments. This was followed by the Bayview apartments in the scenic Fort Kochi in 1982. These early projects catered to wide clientele. While the Mattancherry and Mamangalam projects were tailored for the industrial workers, the Fernsons apartment was meant for the white collar workers, and the Bay view apartments in Fort Kochi, mainly served as guest house for the business community in old Kochi.

A. Consolidation of the sector in Kochi

In the late seventies and early eighties, the private sector in Kochi started to become organised and professional. Large builders from other cities descended on Kochi with the entry of the Southern Investments, from Tamil nadu in 1981. They started with low rise projects like the the Town houses Anchorage, and went on to construct high rise apartments, the first being Kadavil Court in 1985. The first residential neighbourhood project was launched in the early eighties by the Ajit Associates, in Beaver island in the backwaters between the Kochi corporation and Tripunithara municipality. But, in spite of the early beginnings of private sector activities in Kochi, the number of projects executed were dismally low till the late eighties, because of the apprehensions regarding the acceptability of multi-storeyed apartment housing, particularly of the high rise type.

B. Casual factors for growth of the sector in Kochi

Around the early nineties, international political events like the Gulf war 1990, and the socio-political unrest in other parts of India, like the Bombay riots 1992 resulted in a loss of

savings and properties of many Keralites there. The resultant insecurity led to overseas deposits and cash from sale of real estate properties elsewhere, being channelled, to the safe investment pastures at home. This increased demand for residential property primarily for investment, led to the genesis of the apartment boom in the early 90's. The high profits in the newly booming real estate market, attracted established builders contractors, real estate agents, repatriate non-resident Indians, and even other professionals outside the building industry, which led to the mushrooming of building activity in Kochi. Of the nearly 120 builders operating in the city, more than 95 percent joined the fray during this period. Many of the less experienced builders with limited capital and experience, opted to build low rise apartments of three to four storeys, while the established larger developers invested in tall buildings, between seven to sixteen stories in height. Apartment construction thus propelled, reached its peak in 1993-94. During this period, around 20 percent of the new dwelling units constructed in the city, were apartments units (11).

C. Private developers in Kochi

1. Classification:

The Private developers active in the real estate scene in Kochi, may be broadly classified based on their size, scale of operation, and activity into small, medium and large operators.

Small operators consist of local real estate brokers, building contractors, low rise builders engaged in the construction of few low-rise houses at a time, and petty land developers. The operations of this sector has remained largely unaffected, in spite of the emergence of major builders and the apartment boom, due to demand from the lower and middle income groups, and those preferring independent houses.

Medium operators are engaged in building low and medium-rise multi-storeyed structures up to five stories in height, or budget housing for the middle income groups. These

A. VILLA HOUSING

B. LOW RISE HOUSING

Plate 8

consist mainly of groups of local businessmen and professionals, who ventured into apartment construction in the early nineties, during the beginning of the apartment boom. While many of the early operators like Jyoman builders, were able to consolidate themselves and build a couple of dozen apartments and graduate into high rise typologies, the survey revealed that 26 percent of the medium operators constructed only one apartment, while 75 percent had only constructed up to three apartments. None of the medium had constructed more than 5 projects. With the decline in the apartment boom, many of them managed to exit without loss, while many small and medium operators who joined late, suffered heavy losses.

High rise builders are a category of builders who arrived after the apartment boom started in the 90's, who engaged only in the construction of tall buildings. They did not graduate from building low to high rise buildings. Instead, most of them were professionals and businessmen with a sizeable amount of cash, who ventured into the business purely for making profit. Tall buildings with modern amenities in prime locations in the city, could be easily financed by them, which would also attract the right clientele to give them maximum profits from each project. Since their experience was limited, and investment high, they undertook only one project at a time. High rise builders have further been categorised into, those who came before the peak of the activity in 1993, and those who came after the peak.

Large builders and developers are those handling many building projects, of at least 40-50 dwelling units each, at a time, or are engaged in development and subdivision of large areas. This group consists of builders and developers with vast experience in the field, who had been operating in large cities, and had now expanded their operations to Kochi . They usually cater to upmarket clients and are engaged in construction of luxury villas. Around 60 percent of the medium operators were also involved in luxury housing, especially during the

peak of the apartment boom in 1992-93. Big builders have been further categorised into those operating only within the state, and those operating in other states also.

Having identified the different categories of operators, it would be interesting to unravel the modus operandi of their operations.

D. The Organisation and entry into the market

Table No.5.3 gives the details of the entry of the various categories of private developers into housing in Kochi, and the period of their activity.

Table 5.3

Percentage of projects undertaken by private developers over time

	<1984		85-89		>90	
	Year of inception in %	% of projects	Year of inception in %	% of projects	Year of inception in %	% of projects
Low rise builders	0	0	17	0	83	100
Medium rise builders	0	0	25	0	75	100
High rise builders	0	0	0	0	80	100
Large builders	28	7	43	16	29	77

Source: Primary survey of builders

Among the lowrise builders surveyed, 17 percent were engaged in the business, much before the boom, while 83percent had joined in 1990-94. Those engaged as individuals, engaged as petty operators and small time operators, have always co-existed, in tune with the urbanisation in the city. For individual buildings, many prepared the plan by themselves, while those operating as builders, engaged architects for the individual projects. Many of them operating over a period of time, and engaged in it as a profession, maintained small offices with a couple of staff, consisting of a typist and one or two site supervisors.

A quarter of the medium rise builders started their operations in the city right from 1985, though three quarters of them joined during the boom, after 1990. High rise builders, arrived only after 1990, after evaluating the scope and profits in the business, 80 percent of them starting operations in 1990-94. They continued to arrive even after 1995, not really realising than the business was on the wane, and hence, most of these late entrants, had to struggle with marketing their flats. Most of the medium and high rise builders had other businesses, this being only a temporary profitable diversion.

Large builders consist of those whose main business activity is construction and commercial sale of properties. They operate from large permanent offices, with different sections dealing with design, purchase and procurement, construction, public relations and marketing, liasoning, and overseas marketing offices. Realisation of the opportunity in this city which was ripe for this development, they started cropping up from home, and from other parts of India, and around 43 percent started operations in the city during 1985-89 period. It is noticeable that a major chunk of them arrived before the boom, even before the unpredictable stock market crash, Mumbai riots, or Gulf war had ever happened. Large builders with marketing offices in various countries, while engaged in business in other States would have realised the potential offered by the large number of Non resident Indians from Kerala. The large builders with their established marketing offices, could offer a facility of direct dealing

with clients, at their place of work. This, and the potential in the developing city with the tertiary sector having little time to engage in house building activity, are the reasons for the early arrival of the large builders.

E. The Operation

(i)Methods employed for demand assessment

The assessment of demand is prerequisite to any business venture. The survey of builders conducted by the researcher in Kochi revealed that, only 8.6 per cent of the builders actually undertook market surveys either by themselves, or with the assistance of professionals. For the rest 91.4 percent of the builders, there were no definite scientific and reliable demand assessment methods. Some of the methods employed in demand assessment by major builders are :-

1. Advertisement: Circulating brochures on new projects among salaried employees of the target group and Non resident Indians.
2. Direct canvassing: In case of luxury housing projects for company executives, Non resident Indians, etc., the builder or his representative personally visit them, to canvass their projects.
3. Incentives: Offering incentives to previous clients, for canvassing fresh clients for oncoming projects.
4. Exhibitions: Another method consists of organising building exhibitions or related gatherings, and using the venues for circulating questionnaires to perceive the attitudes towards private developer housing, and to identify the locational, typological, and other characteristics of housing preferred.

However, there exists no reliable information on the actual need and demand for housing among the different strata of society, their affordability or preferences. Under these

circumstances, most private developers operate based on notions of demand. Likewise, there is no reliable information on the total number of producers, their schemes, and the kind of housing they have produced, or are planning to produce.

(ii) Factors determining housing operations

A developer makes his decisions based on three major aspects.

1. The land and its attributes such as location, topography, size, value, tenure and governmental regulations.
2. The operations dependent on its size, corporate structure, equity situation and range of activities.
3. External conditions such as the available financing, anticipated levels of demand, relative attractiveness of alternative investment, and the attitudes of local interest groups.

This agrees with the general rule of housing market that, each may limit his operations to one or many interrelated sub-markets of the housing market, which may be differentiated by geographic location, housing price , housing type, income category, tenure status, legal status, age of housing etc.(28)

The survey of the builders in Kochi reveals their origin and size characteristics, the markets in which they operate, the clientele, typology, quality, prices, and identifies the nature and difficulties faced by them in the housing supply operations, as given below.

(iii) The identification of clientele

It is well known that the targeted client group determines the characteristics of the product marketed, and the success of the operation. Survey revealed that 52.04 percent of the clients were non resident Keralites. Further, 73 percent of the private developers had nearly 65 percent of clients who were non resident Keralites. Given that the non resident Keralites generally are financially better off, this reveals that around three fourths of the private developers were into producing up-market housing. Keralites from other towns of Kerala

accounted for 17.83 percent, while non-Keralite clients constituted 5.79 percent. This reveals that 75.66 percent of the clients were from outside Kochi, and hence, the rising demand for apartments in Kochi was not due to demand from the local housing need, or due to need of non-Keralites attracted to the State due to reasons like economic growth, but due to the demand from non resident Keralites, who needed to make a safe investment in ones home state. Clients from local populace, who opted to buy either apartments or Villas from builders, constituted only 24.34 percent. It may further be observed from the table below, that it is the low-rise builders and large builders in Kerala, who have got the larger chunk of the local populace.

Table no.5.4

Type of Clientele of private developers

Type of builders	Local populace from Kochi	Other Keralites	Non resident Keralites	Non-Keralites
Low rise builders	36	15	45	5
Medium rise builders	23	11	57	10
All high rise builders	21	24	52	4
Do <1993	23	25	48	4
Do >1993	16	26	54	4
All large builders	28	13	52	7
Do-all kerala	36	15	42	7
Do –all India	18	10	67	6

Source: Primary survey of builders

It may be observed in the case of highrise builders that, while the other Keralite and non-Keralite clientele remained steady throughout, there has been a shift from local populace towards greater concentration on non resident Keralites during the peak period after 1993. In the case of large builders, it may be observed that all Kerala builders had double the number of clients from local populace, as compared to all India builders. The latter with well established overseas marketing offices, found lesser acceptance among the local populace, and hence concentrated on non resident Keralite clients.

F. The production process

(i) Evaluation of location

The evaluation of the location for housing supply involves three distinct steps (28). The first step consists of an area wide assessment by the developers, regarding the attractiveness of an area or section of the city, for their proposed investment, in terms of accessibility, and the nature of planning restrictions. The second step involves evaluation of sub areas in terms of their relative potential, amenities, services and the quality of adjacent housing developments. The third step involves selecting particular sites in terms of their availability, zoning, ownership, physical properties, and in the case of redevelopment, the demolition costs of existing buildings.

(ii) Choice criteria for identification of location

A perusal of literature reveals that, the critical locational characteristics which influence the developers choices of location for new construction are, market factors, ease of obtaining planning permission, availability of basic services, neighbourhood social class, good access to employment, school, and city centre, transportation facilities, availability of the site and asking price, size of the site, topographical conditions and condition of subsoil, physical environment quality and the existing ground cover and clearance grant. Which of these factors dominates in the choice of a particular location, varies with the area and time involved, the condition of the housing market, the nature of the planning process, and the type of the development planned . It has been observed that, projects targeted at wealthy residents or high- status establishments are situated on prestigious sites, close to natural amenities, select stores and high order employment. (67)

The survey among the builders in Kochi to identify the locational criteria for siting residential projects revealed that, 78 percent of the builders considered proximity to

transportation facilities and other residential areas, as the most significant feature for selecting site for residential projects. Refer Table No.5.5.

Table No.5.5

Locational criteria for undertaking housing projects by private developers

Signifi-cance for locational choice	Proximity to Residential areas	Proximity to Transportation facilities	Proximity to Amenities	Proximity to Commercial facilities	Scope for future development	Proximity to scenic settings	Proximity to work places
High significance	78.2%	78.2%	73.9%	60.8%	69.5%	60.8%	21.7%
Low significance	13%	17.3%	21.7%	26%	13.04%	17.3%	17.3%
No significance	8.8%	4.5%	4.4%	13.2%	17.46%	21.9%	61%

Source: Primary survey of builders

Proximity to amenities was considered next in importance by 74 percent of the builders. But, comparison of the overall significance for residential areas and amenities reveals that, amenities are considered more important. It rank high, being next only to proximity to transportation facilities. Around 61 percent of the builders felt that, proximity to commercial facilities, scenic settings and scope for future development in the area, was also an important criteria for identifying sites for residential development. It is particularly interesting to note that 60 percent of the builders felt that, proximity to work places was not an important criteria in the identification of sites for housing. It appears that due to the limited spread of Kochi, and good mass transit travel arrangements, travel time and cost were not considered significant criteria by the developers. A weighted average score for identifying the locational choice criteria for undertaking housing, by the various categories of builders is given in Table No. 5.6.

Table No.5.6

Locational criteria for siting housing projects by various categories of builders

Builder type	Weighted average score						
	residential	transportation	Commercial	amenity	work place	future devlopment	scenic
lowrise builders	1.5	1.3	1.5	1.8	1.3	1.5	1.0
mediumrise builders	2.0	1.8	1.3	1.5	0.3	1.0	1.5
highrise builders	1.6	2.0	1.5	1.6	0.4	1.7	1.4
large builders	2.0	1.9	1.6	1.9	0.6	1.4	1.3
large kerala blders	2.0	2.0	1.5	1.8	0.5	1.0	1.3
large india bldrs	2.0	1.7	1.7	2.0	0.7	2.0	1.3

Source: Primary survey of builders

The results revealed that the importance given by the developers are different for different aspects, and are mainly dependent on the clientele they serve. It is observed that, it is only the low-rise builders who have considered proximity to work places, as important as the proximity to transportation. Proximity to amenities like schools, markets, hospitals has been ranked highest while scenic settings has been given the least importance by this group. It has already observed been that, it is these builders who have the local populace as clients, who consider work places are more important, than the scenic settings. While residential and transportation aspects have been considered important by medium and high rise builders, it is noticeable that they have given the greatest importance to scenic settings. One of the reasons for this, is their late arrival into a market, which had already become pretty saturated. This was a period when builders were trying to attract clients by offering something different and competitive like beautiful scenic settings, and a host of amenites within flats. It may be observed that big builders have accorded equal and very high importance to residential areas, transportation and amenities. This is mainly because they attach importance not only to the building in question, but also to its overall setting. In the last phase, even they, accorded

importance to scenic settings, to lure the non resident Keralites who had already bought more than a house, and were in search of something of a different kind as variety.

(iii) Spatial distribution of housing

It may be interesting to examine the areas that have been found ideal by the builders, in this regard, as revealed by the actual siting of their projects and the reasons for identifying these locations. Table No. 5.7 gives the spatial distribution of housing projects undertaken by private developers in the city.

Table No. 5.7

Spatial distribution of private developer housing in Kochi

Type of housing supplier	Inner zone a) Ward 1-25 old area b) Ward 39-43 new area	Central zone a) Ward 26-29 south subzone b) Ward 30-38 middle subzone c) Ward 44-50 north subzone	Outer zone
Private sector	29 % a) 5 % b) 25 %	60.82 % a) 14.8 % b) 35.44 % c) 10.58 %	10.17 %
Public sector	17 %	66 %	17 %
Total	23 %	63.41 %	13.59 %

Source: Primary survey of builders

The inner zone between the back waters and the railway line, consisting of the CBD of old Kochi and mainland Kochi, contains 29 per cent of the total projects. Within this, old Kochi areas consisting of colonial Fort Cochin, the ancient commercial centre, Mattanchery and Palluruthy are observed to hold only 5 per cent of the apartments. The main reason for this is that old Kochi has poor connections with the mainland, where all the administrative offices and modern offices are located. There is no railway line to this area. It is congested with population and buildings, and usually those who live there are traditional occupants, or have their work places there. Hence, it does not attract clientele for apartments either from investment point of view, nor from facilities point of view. The few multi-storeyed apartment buildings here, are mainly used as guest houses of companies, and as holiday homes.

Mainland Kochi, with the CBD, the concentration of amenities like educational institutions, medical facilities, recreational facilities, commercial facilities, work centres, and good traffic network, contains 25 per cent of the projects.

The central zone between the railway line and the corporation limits is well connected to the CBD, in spite of the bottlenecks on the two railway over-bridges on the two main link roads between the CBD and the rest of Kochi. Easy accessibility to the facilities in the CBD, the predominant residential nature of the area, and plenty of low lying and marshy land at low prices, have made this zone particularly attractive for the siting of apartment projects. It is found that 60.82 per cent of the projects of different varieties are located in this zone. Of these, 14.8 percent is located in the north central sub zone, 35.44 per cent in the middle central subzone, and only 10.58 per cent Is located in the south central sub zone.

The outer zone of the study area which consists of municipalities, census towns and panchayats, east of the corporation boundary, is generally considered low priority for siting apartment projects, and consists of only 10.17 per cent of the projects. This is because of location outside the corporation boundaries, the relatively lower transportation facilities, and the lack of access to the amenities and facilities in the CBD. The only area where there is a concentration of apartments in this zone, is in Kakkanad. This is because of the excellent transport facilities reducing the travel distance to the core, in spite of the physical distance. Plenty of vacant, cheap land with good high ground and well drained soil conditions, are available here. It must be noted here that the sustained efforts of the Greater Cochin Development Authority to decentralise the city, through development of alternate nodes by shifting government offices and quarters to this area, has been especially causative for the increased activity in this area.

(iv) Redensification of residential areas:

A survey of the builders in the city revealed that, 36 percent of the housing projects have come up on lands obtained by demolishing old structures, especially single storied traditional housing. About 39 percent of the multi-storeyed apartment projects came up on vacant lands, while 25 percent of the projects have come up on either fallow agricultural lands, or marshy lands. This reveals that 64 percent of the projects have come up on vacant land. Marshy lands and fallow paddy fields are located in the central zone, in all the wards particularly, Thevara (ward 26), Panampally nagar (ward 27), Kadavanthara (ward 28), Vvytilla (ward 29), Elamkulam (ward 37) Indiranagar (ward 36) and in the areas outside the Corporation limits. Further, almost all the projects constructed after demolishing old structures have come up around the core of the City ie., in the inner zone. It may be concluded that the larger chunk of housing supplied by the Private sector within the City core has been through redensification. This has prevented urban sprawl, afforded savings in transportation cost and time, reduced air pollution and aided in protecting the valuable, limited agricultural land in the fringes.

Table No. 5.8 gives the details of the different types of lands brought into use by the different types of builders. It may be seen that large builders have constructed 43 per cent of their projects through demolition of core area properties, owing particularly due to their better financial capacity. Low rise builders have adopted the cheapest method of construction and brought in 59 per cent of their projects through construction on good vacant lands. Marshy lands being costly to construct on, they have used to the minimum. Medium rise have also followed the same trend. High rise builders have also gone in for greater amount of demolition as their projects are mostly in the core.

Table No. 5.8

Type of lands brought to residential use by private developers

All builders	Lands obtained by demolishing old structures %	Marshy lands %	Vacant lands %	Total
large builders	**43**	**33**	**24**	**100**
large kerala	33	42	26	100
large India	65	15	20	100
low rise builders	**24**	**17**	**59**	**100**
Medium rise builders	**25**	**0**	**75**	**100**
High rise builders	**38**	**31**	**31**	**100**
Do <1993	44	33	22	100
Do>1993	28	29	43	100
Total	33	20	47	

Source: Primary survey of builders

(v) Land assembly

A. Temporal variation in plot sizes

One of the greatest draw backs in undertaking mass housing in Kochi, unlike other cities, is the non-availability of large chunks of land. Figure No 5.9 reveals that the private developers has been able to bring to use a large amount of small land parcels, by negotiated purchase. Thus they have contributed positively towards better utilisation of small pockets of under-utilised lands by 1) intensifying densities by rebuilding on through demolition of old low density housing and 2) by being economically able to undertake reclaiming of marshy and other lands unfeasible for use by individual owners. It appears that the increasing land prices, and the difficulty in availability of big parcels of land, has led to the progressive utilisation of small plot sizes over time, as can be seen from the Figure. No 5.10. The temporal trend in change of plot sizes over the years, reveals that the Private developers has been making increasing use of small sized plots. Further, plots sizes of less than 2500 sqm

Figure no.5.9

Distribution of plot sizes of private developer housing projects

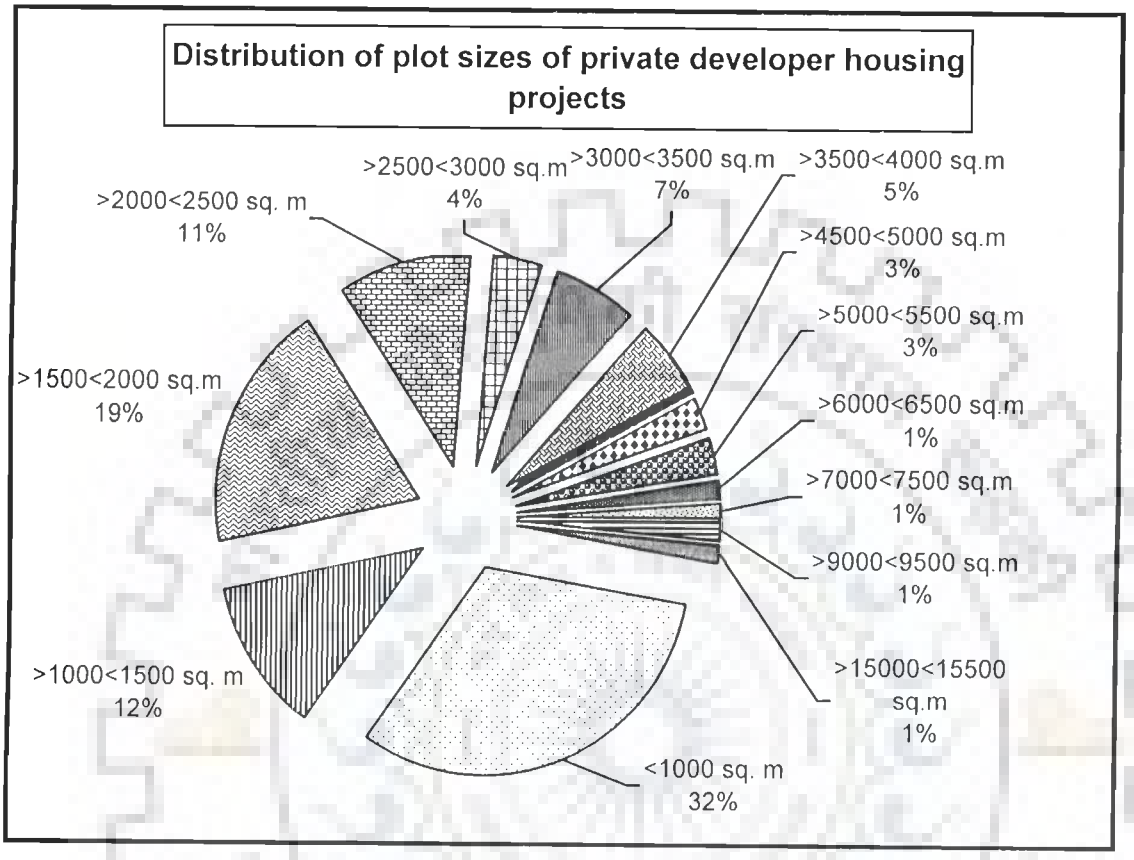
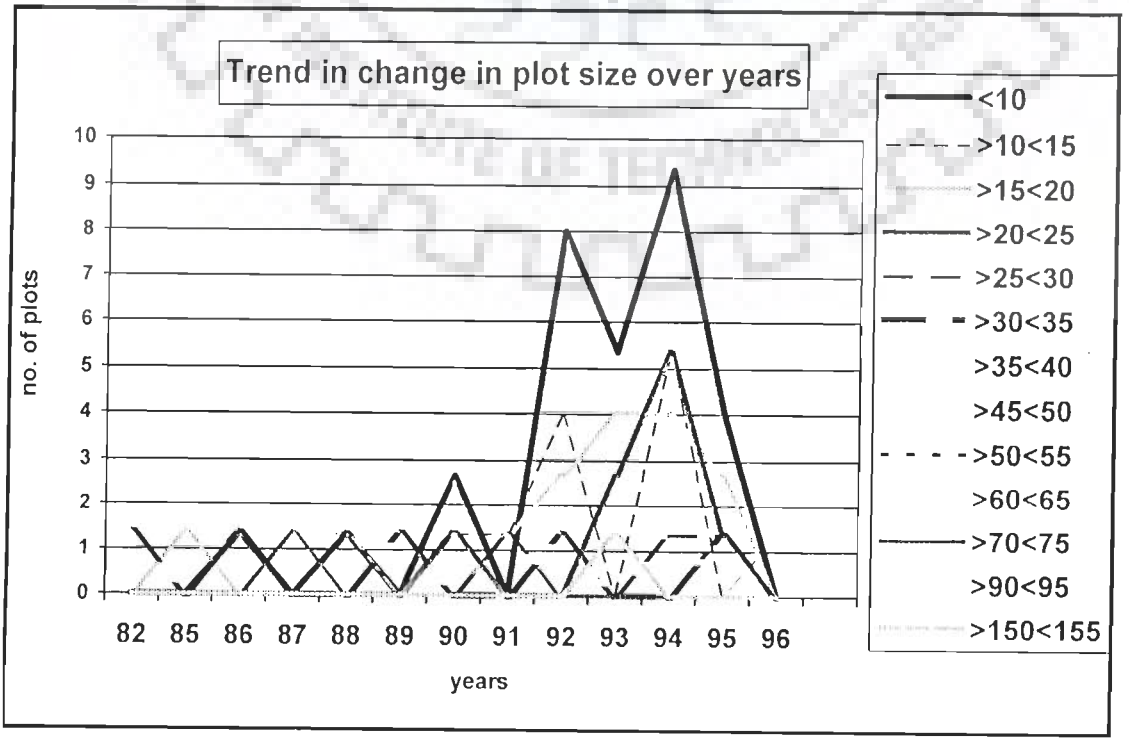


Figure no.5.10

Trend in change in plot size over years



have been recording an increase over the years. The steep increase in the use of small plots of less than 1000 sqm, is especially marked during the peak period.

B. Spatial distribution of plots of different sizes

It is observed that the wards of the inner and central zone that have been active over a longer period, and areas in the outer zone, display a wide variety of plot sizes ranging from less than 500sq m to 7500 sq m. This may be a pointer to the changing availability of lands at different points in time, combined with the ability to maximise built up area in the peak period. Within the central zone, around 40 percent of the plots are smaller than 500 sq m. Nearly 55-75 percent of these are low rise projects. The small plot sizes combined with high and medium rise typologies, in some of the wards of the inner and central zones((High Court(ward 41), North of High Court(ward 42), Kadavanthara (ward 28),Edapally(ward 48)), suggest a high FAR ratio. Further, the large number projects here have come up in the peak period since 1992, during when all high rise buildings availed of the special sanction facility to increase FAR .Many of the other wards with relatively higher densities of both inner and central zones were also found to have projects of small plot sizes.

To summarise, small plot sizes have been observed in three kinds of wards, namely, core wards which are densely built up with little large vacant lands, wards with predominantly low rise buildings, and those with high rise buildings, which have developed mainly during the peak period, when a large number of special sanctions to increase FAR were taken. On the other hand, where lands were available even close to city centres in the central zone, but with poor access, high rise was not constructed. Hence, it appears that it is the profitability in a particular location, and the land prices which have determined the typology, more than density or suitable plot sizes. It may therefore be concluded, that the density of the area, and

consequent non-availability of lands of suitable sizes, have not been determinative of housing typologies.

C.Method of assembly of land

The popular method of land assembly employed by the private developers consists of negotiating with the land owners. Usually, it consists of part payment and the rest paid as exchange of building area after construction. This limits financial commitment on their part, and also saves on stamp duties.

(vi)Typology of housing

At the site, the actual densities are governed by the relative costs of the land input, non land input consisting of labour, materials and capital and the marginal revenue that is expected (28). The average cost of non land inputs increases with increase in density but at a decreasing rate while the cost of land decreases with increase in density (65). The average cost of construction increases with the rising number of storeys except for double-storey construction where it is less than the single storey. The increase in the average cost is marked for fifth, seventh and eleventh storeys, and this is reflected by the marginal cost, which rises to 2.0, 2.7,and 1.2 times that of the fourth, sixth and tenth storey values respectively. The high cost of non-land inputs in building construction as can be observed from the building cost index numbers for government LIG housing, has also been the main cause for multistoreyed construction (135, 162). Land is increasingly becoming a larger component of the total cost of development. This, in addition to the higher value of land closer to the city centre, has created high density housing near the core, and lower densities at farther distances.

The survey revealed that all categories of builders constructed buildings of all heights, except the medium builders who did not engage in building tall buildings, and the tall builders who did not build medium sized buildings. It was found that generally most builders of all categories,, started out by constructing low rise buildings, particularly those who started early. It was those who entered late, particularly the tall and medium builders, who directly started construction of tall and medium rise structures. In most cases, such builders undertook few projects only.

Table no 5.9

Private developer housing according to developer categories andheight

	Percentage distribution of buildings constructed by different categories of builders according to height			
	0-4 storeys	5-6	7-9	>10
Lowrise builders	69	3.4	17	10
Mediumrise builders	13	88	0	0
Do <1993	14	86	0	0
Highrise builders	6	0	38	56
Do <1993	0	0	44	56
Do >1993	14	0	29	57
Large builders	32	6.5	16.13	45

Source: Primary survey of builders

The most important factor responsible for deciding the typology of housing is land price. It is reported to constitute 55 per cent of the cost of even high rise buildings(135). The builders prefer high rise due to the soaring land prices, ease and speed of construction, and for the containment of roof leakage problems common with single storied construction, in areas with heavy monsoon. The main reason for the spurt in tall buildings during the peak period was the high profitability of real estate, which drove many developers to maximise the built

up area, by taking special sanctions for violation of the prevailing FAR norms. The low rise apartments which appeared during this phase, were mainly the nervous contributions, of the horde of inexperienced self proclaimed developers, who appeared on the scene.

(vii) Use of private sector housing space

It has been observed that, even in the inner zones, there is a dominance of single use structures. Only 10 percent of the apartment projects are of residential cum commercial type. The main reason for this, is the loss of privacy, and reluctance on the part of the clients to share their residential entrances, with the public. Many who opt for flats in Kochi, are very well to do. Hence, they value an exclusive lifestyle, and relish the privacy and security, that is offered by flats. In the last phase of the activity, some of the developers attempted to construct high rise apartments right in the heart of the CBD, amidst the commercial uses. Refer Figure No B in plate 9. It is only here, that multiple residential and commercial/office uses were bought by clients , mostly as investment or guest houses.

(viii) Size of private sector housing

One bedroom houses have an area of 55 -70 sq.m. Two bed range from 70-100 sq. m, three bed from 100 -130 sq. m., while bigger houses have an area of 130-186 sq m. Survey of builders to assess the demand for dwelling unit size based on number of bedrooms reveals that, only 4.56 percent of the clientele (consist of middle and upper income only) demand one bedroom flats. Only less than 0.025 percent of the builders, are engaged in one bedroom house construction. The highest demand is for two and three bedrooms, at 27.17 percent and 52.8 percent respectively. There is a demand from 14.78 percent of clients, for dwellings with more than three bedrooms. Refer Table. No 5.10.

Table No.: 5.10

Client demand for dwelling sizes in private developer housing

All builders	1 bed	2 bed	3 bed	4 bed
big builders	4	24	50	22
Big Kerala	7	30	56	7
Big India	4	24	50	22
low builders	10	26	53	12
medium builders	0	50	44	6
tall builders	7	31	51	12
Do <1993	7	24	60	9
Do>1993	6	37	42	15
Total				

Source: Primary survey of builders.

The affinity of the private developers to up market clientele is revealed by the type of dwelling units constructed. Three bed units constitute 54 percent of the Private sector housing projects, while two bed units constitute 36 percent. Four bed units and single bed units constitute 6 percent and 3percent respectively.

5.8 SUMMARY:

The detailed study and analysis of the land assembly and housing supply in the residential system of Kochi may be summed up as follows:

1. The land utilisation of Kochi presents a unique distribution of land mass (81percent), and water sheet (19 percent). 28.4 percent of the dry land consists of marshy wet land, not amenable for building construction, according to the legal restriction. This means that, practically 42 percent of the land is open space and the urban development is confined to 58 percent of the total land.
2. The landuse pattern of the dry land shows that the predominant use (85percent) is under residential category, and 6 per cent is under transportation land use. Though the

percentage of land under residential category is high, as compared to other cities of India, the net residential density is higher and the index of infrastructure is low. The severance of the land by the railway line, and poor interchange facility between land and water modes, aggravate the problem of residential development.

3. The land supply mechanism for meeting the demand of future residential land within the study area, is basically identified as (a) land reclamation from lagoons and (B) conversion of marshy land to dry land.
4. Land reclamation from back waters has been the approach adopted by public agencies for making land available for the port development, and limited urban development. This process however, is strongly contested by environmentalists.
5. The structure plan of Kochi proposes the conversion of marshy wet land dispersed in the land mass, for urban uses. Indeed, this approach has been adopted by Development authorities to put up public housing projects, which have served as models of residential development. An analysis of the land supply system suggests that, this provides a possible option for redensification of the city.
6. The supply of housing in Kochi is effected through the public agencies, co-operatives and private developers. The public sector agencies had marked contribution(20 percent) during 71-81, which however, got reduced to 11.4 percent in the next decade. The co-operative sector also contributed to the residential development during this period, by supplying about 12 percent of the housing supply. Co-operative sector housing also showed a declining trend after 1980's.
7. The private sector made entry into the housing supply in 1960, and have steadily captured the market. By 1990, there were 120 registered builders and many others. A survey of the builders by the researcher has helped to classify them into four types: low rise, medium rise, high rise and large builders.

8. The operation and organisation of these private sector agencies indicate that they are able to serve effectively by procuring land through negotiation, as against under land acquisition, and putting houses to cater to the needs of a variety of owners/ clients.
9. The location and type of development by the private sector, indicate certain clear patterns in the city fabric.
10. There are three distinct zones and six subzones of urban development. The inner zone is of small plot size and lower number of projects. The outer zone is of extensive plots but a lower number of projects. The middle zone has a mix up of small and large plot sizes which is favoured by the builders. The study shows that a number of projects have come within this zone, and this area still presents future potential for redensification.

In the next chapter an attempt is made to trace the temporal and spatial distribution of apartment typology in the city, and the reasons for the same.

CHAPTER 6

SPATIAL AND TEMPORAL GROWTH OF RESIDENTIAL DEVELOPMENT

This chapter covers the study of the spatial and temporal growth of multi-storeyed housing in Kochi. Attempt is made to analyse the trends in the spatial and temporal growth of housing, and variations in the height and dwelling size characteristics.

Table 6.1

Housing statistics of Kochi

Location	Cochin corporation	Thripunithara	Njarackkal	Thrikkakara	Eloor	Kalamassery	Mulavucad	Maradu	Thiruvankulam	Cheranellur	Elankunnapuzha	Kadamakudy
hhs 61	44342	2316	2651	2880		3066	2477	2845	1677	1974	4463	1528
hhs 71	68142	5876	2994	4462	7301	5274	2995	3487	2141	2275	5622	1760
hhs 81	87566	7815	3622	6676	9586	8123	3524	4823	2918	3052	7271	2244
hhs 91	108924	10434	4350	10468	11932	11436	4248	6769	3966	4106	8971	2702
houses 61	40767	2120	2564	2850		2932	2393	2787	1632	1917	4273	1476
houses 71	61510	5663	2921	4396	6825	5022	2904	3441	2130	2225	5561	1675
houses 81	79782	7575	3559	6587	9374	7877	3441	4788	2846	3014	7048	2192
houses 91	103751	10415	4348	10448	11927	11430	4247	6769	3966	4104	8970	2699
grwth rate%hhs 61												
grwth rate%hhs 71	54	154	13	55	#DIV/0!	72	21	23	28	15	26	15
grwth rate%hhs 81	29	33	21	50	31	54	18	38	36	34	29	28
grwth rate%hhs 91	24	34	20	57	24	41	21	40	36	35	23	20
grwth rate%houses 61												
grwth rate%houses 71	51	167	14	54	#DIV/0!	71	21	23	31	16	30	13
grwth rate%houses 81	30	34	22	50	37	57	18	39	34	35	27	31
grwth rate%houses 91	30	37	22	59	27	45	23	41	39	36	27	23
hsg shortage 61	3575	196	87	30	0	134	84	58	45	57	190	52
hsg shortage 71	6632	213	73	66	476	252	91	46	11	50	61	85
hsg shortage 81	7784	240	63	89	212	246	83	35	72	38	223	52
hsg shortage 91	5173	19	2	20	5	6	1	0	0	2	1	3
area sq km 51	18											
area sq km 61	65	10	9	27			13	14	20	12	10	11
area sq km 71	95	14	9	27	22	27	19	12	10	11	12	13
area sq km 81	95	19	9	27	22	27	19	12	10	11	12	13
area sq km 91	95	19	9	27	22	27	19	12	10	11	12	13
density 61 pp/sq km	3623	1500	1835	608	#DIV/0!	662	775	1379	959	1088	2194	715
density 71 pp/sq km	4627	2056	2235	978	2022	1110	1006	1848	1267	1429	3118	916
density 81 pp/sq km	5409	2335	2520	1395	2393	1621	1110	2328	1479	1736	3766	1060
density 91 pp/sq km	5951	2733	2672	1863	2595	2013	1158	2836	1755	2021	2021	1135

Source: Ernakulam district census 1961,71,81,91

6.1 INTRODUCTION

This chapter covers detailed analysis of the spatial and temporal growth in residential development at Kochi, based on data collected from builders, local authority offices, and planning department. The researcher also carried out field visits covering most of the locations where new developments were coming up, and had informal discussions with local people, and real estate agents on the development trend.

The temporal pattern of residential development is analysed in terms of (a) growth in multi-storeyed apartment housing, (b) growth trend in building typology by height, and (c) growth trend in dwelling unit size. The spatial distribution has been further analysed in relation to (a) growth trend along the urban fabric, (b) distribution of typologies in space, and (c) distribution by dwelling size in space.

The distinct features observed under each of the above analysis are presented, and attempt is made to sum up the trend in residential development in Kochi.

6.1.1 GROWTH TRENDS IN HOUSING AT KOCHI:

Table No. 6.1 presents the housing statistics of Kochi. It may clearly seen from the table that till the 1970's, there has been an increase in the growth rate of households, more than that of houses. A gradual shift can be perceived in the decade 1971-81, with the growth rate of houses marginally exceeded that of households. While the increasing trend of growth of houses continued into the 1981-91, it may be observed that the growth rate of households has decreased, widening the gap between the two. The result of this can be perceived in the housing shortage which has decreased since 1981. In 1991, the numerical housing shortage reduced to 5173 from 7784 in 1981 in the Kochi corporation area. Similar trends were noticed in the other constituent areas also. The spatial distribution of the households in the city and the densities are presented in Table No. 2, two features may be noticed. Firstly, there is a lack

Figure no 6.1

Temporal growth of all apartment housing projects

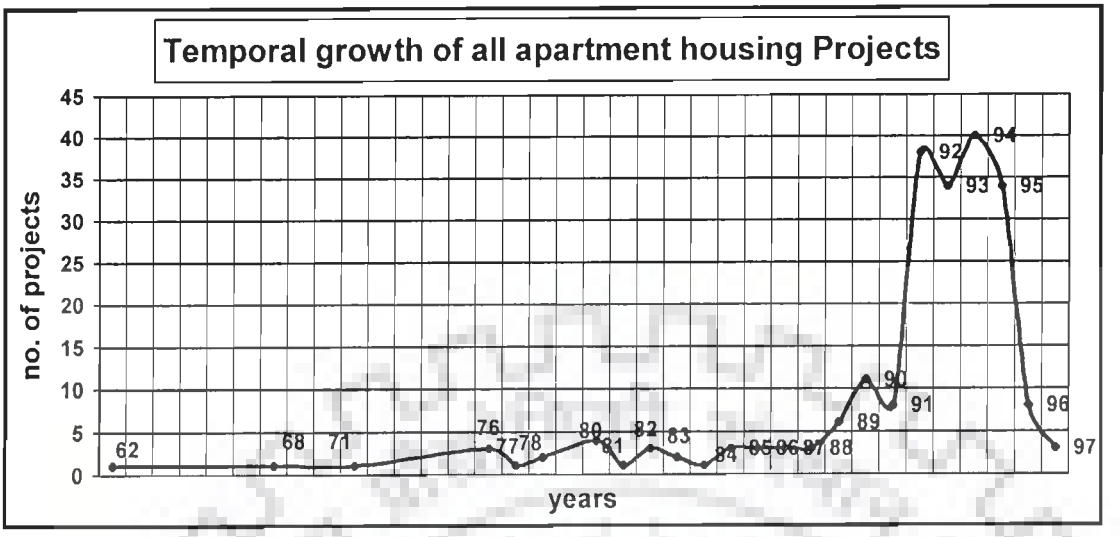


Figure no 6.2

Temporal growth of Public-co-operative-employees apartment housing projects

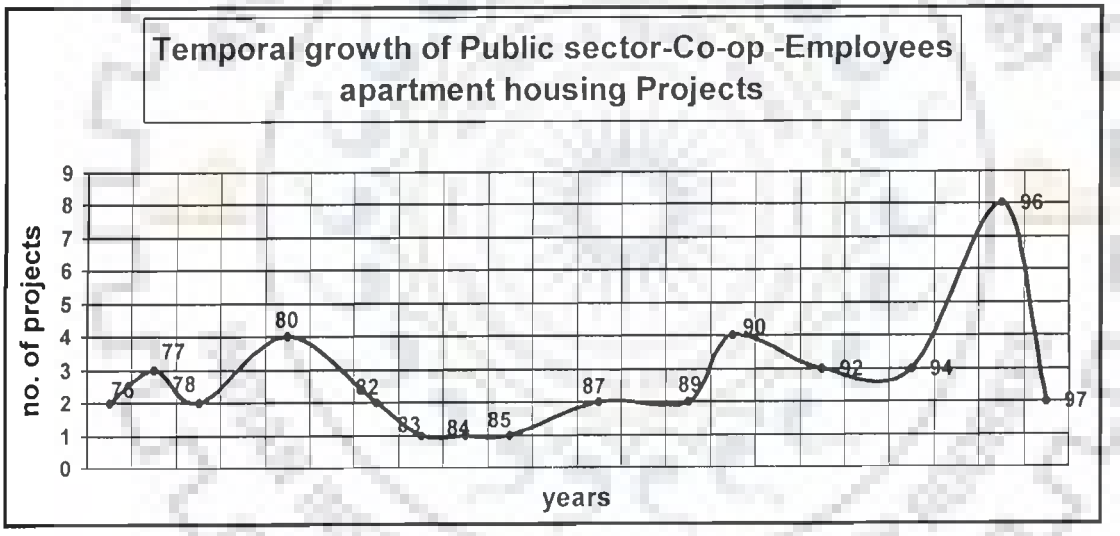
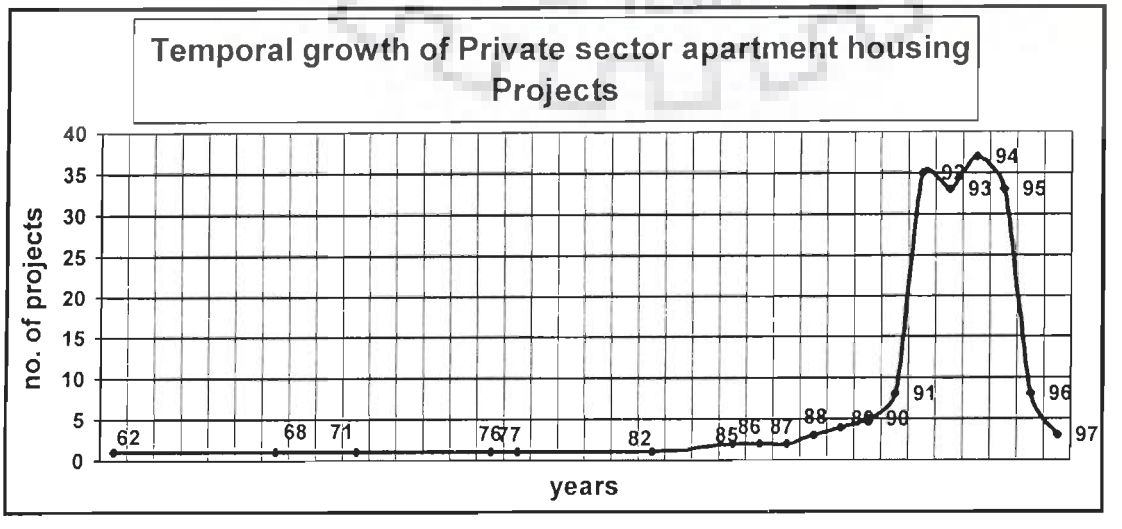


Figure 6.3

Temporal growth of private sector apartment housing projects



of marked difference in density between the difference wards in the city. Secondly, densities are not dependent on distance to the city core.

6.2 GROWTH PROFILE OF MULTI-STOREYED APARTMENTS HOUSING IN KOCHI:

Figure No 6.1, shows the trend of multi-storeyed apartment housing projects for the central city of Kochi as a whole, over a 30 year period. Figure No. 6.2 isolates the projects in the public and co-operative sector. (note the scale on X-axis is magnified). Figure No.6. 3, indicates the share of private sector in housing supply statistics.

The decade 1955-65 records only one multi-storeyed housing project with 12 apartment units. The period between 1985-91 witnessed a growth in multi-storeyed apartment construction, marked by the entry of the organised private sector into apartment construction. The period from 1991-1997 was a period of 'boom' for multi-storeyed apartment construction, which witnessed the construction of nearly 160 housing projects, consisting of around 4000 apartment units. The period also saw the growth of developers from less than 8 in the late eighties, to more than 120 in the early nineties. In spite of the lukewarm reception given to vertical development in the late seventies and early eighties, multi-storeyed apartments soon became the most sought after residential development, in the early nineties. It would be interesting to examine the reasons for this transformation.

A. The Causes for the Housing Boom

High literacy, coupled with lack of employment opportunities, have lured many a Keralite, to seek their fortune beyond the Indian shores. This massive exodus especially to the gulf countries became a phenomenon in the late seventies, giving rise to a new class of neo-rich, with sizeable surplus money. With little knowledge in financial management, and

Table. no.6.2

Ward density in Kochi city

Ward no	Density/ sq km 1991
1.	7894.531
2.	7477.778
3.	9182.796
4.	9045.378
5.	8017.347
6.	5023.664
7.	5626.667
8.	6840.426
9.	7869.643
10.	7973.504
11.	6369.343
12.	8040.566
13.	7586.538
14.	9913.934
15.	9600
16.	6492.481
17.	7774.342
18.	8950
19.	9100.719
20.	11118.4
21.	8272.059
22.	6650.318
23.	10283.85
24.	5902.105
25.	637.234
26.	7368.391
27.	9200.595
28.	6438.424
29.	7323.558
30.	4641.969
31.	6509.091
32.	5675.934
33.	8925.688
34.	4680
35.	7063.83
36.	5892.135
37.	2569.186
38.	6970.44
39.	8409.392
40.	4005.263
41.	6611.486
42.	6067.442
43.	2515.203
44.	5421.116
45.	5612.568
46.	5732
47.	3141.036
48.	5932.794
49.	4061.745
50.	3573.209

lacking business acumen, a substantial part of these savings were frittered away, in construction of palatial mansions and opulent living. Thereafter, the booming stock market lured many, but its subsequent crash in the early nineties, left them disillusioned. This brought about a renewed interest in real estate investment. Most of the people who left Kerala had adopted an urban living style, and therefore, multi-storeyed apartment housing had become acceptable to them. The availability of ready built multi-storeyed apartments, made it a convenient and safe investment. The prime locations in the city, emerging concept of a second home, and high expected returns due to escalating apartment prices, offered added advantages. The rural rich also were tempted by the appeal of multi-storeyed city apartments, as a measure of social status, besides being a sound investment proposition.

The multi-storeyed apartment boom witnessed during early nineties was also the result of international political events like the Gulf war 1990, and socio-political unrest in other parts of India (1992 Bombay riots etc). The loss of sense of security outside their home state, prompted many Keralites to channel their savings into safe havens at home.

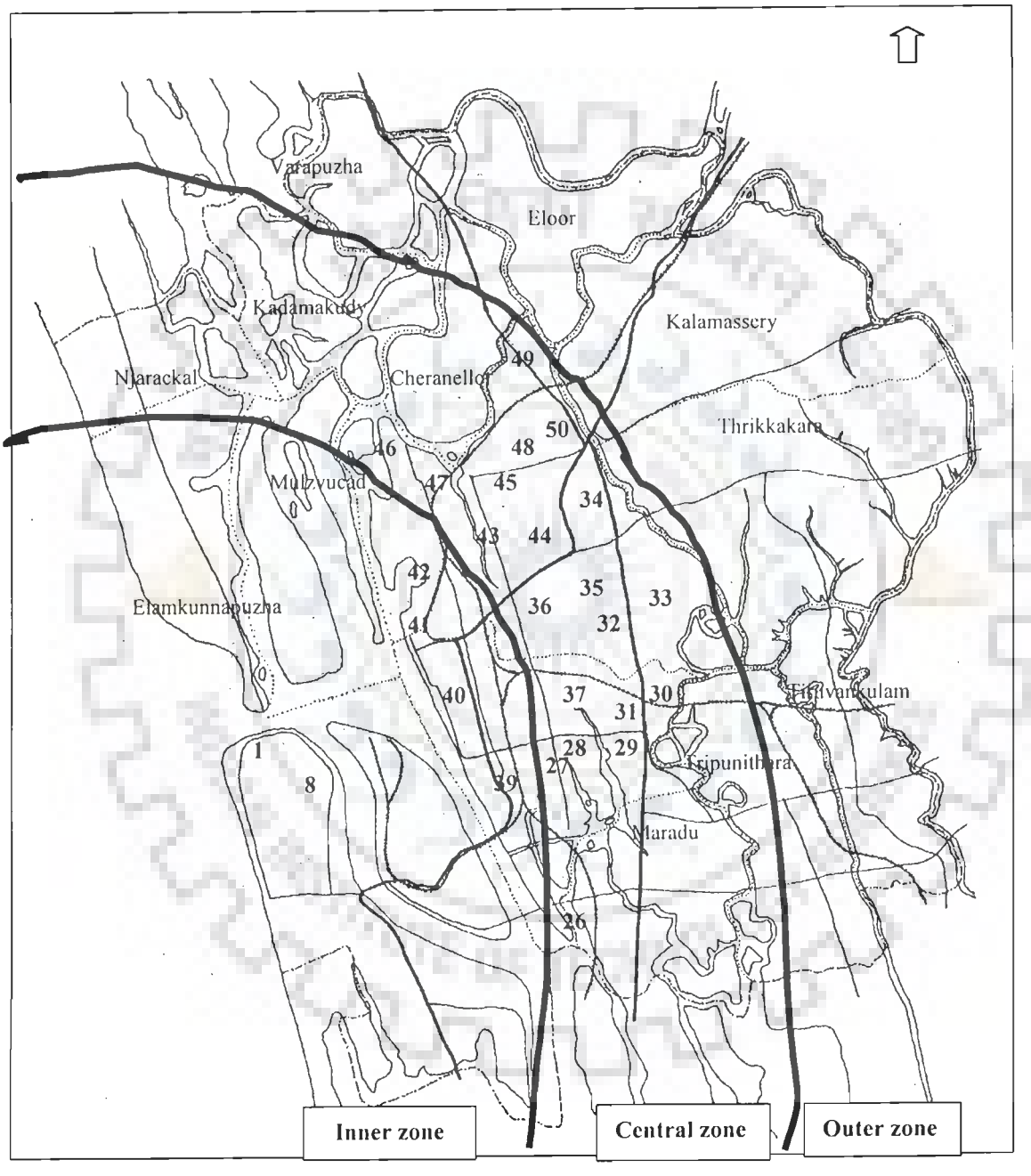
B. The study zones

The spatial distribution of housing is studied under the three zones, namely, inner zone, central zone and outer zone identified in section 5.2.2 in chapter 5. Refer Figure 6.3 a. The inner zone on the western extreme of the central city, can be broadly divided into two parts namely, the old inner zone consisting of the wards[1] 1-25 of the old Kochi[2]; and the Ernakulam[3] inner zone consisting of the wards 39-40(present CBD), 42-43, and the historic fishing settlements of Elamkunnapuzha and Njarackal old Kochi, which includes Fort Kochi, Mattanchery and Palluruthy, was observed to have very few apartments. These areas comprise

[1] The Kochi corporation is divided into 50 divisions. Each is called a ward.
[2] Old Kochi refers to the historic settlement on the western part of the central city on the sea coast.
[2] Ernakulam is the eastern part of the central city which consists of the mainland.

Figure 6.3a

Corporation Wards and peripheral areas with multistoreyed building activity 1962-97



historical Kochi, where the densities are also very high. old Kochi has a gross density of 6583 persons/sq. km., while some of the wards with closely spaced houses, have very high densities reaching up to 53,375 persons/sq. km. The connectivity of this zone to the mainland is by boat or through an old narrow bridge. Traffic restrictions on the bridge result in pronounced congestion during peak hours. This has led to a low demand for apartments in old Kochi, in spite of the scenic view of tranquil backwaters and vast expanse of beaches.

The early development in mainland Ernakulam in the inner zone, was along its western shore. The Fore shore road links the Ernakulam market and public buildings like the Kerala High Court, Kochi Guest house, Maharaja's College, Siva Temple and Krishna Vilas Palace. This zone extending eastwards up to the Railway line, has a concentration of educational institutions, medical facilities, commercial establishments and work centres. It thus forms the CBD of Kochi, and has become the favoured location for construction of flats.

The second zone encompasses a region between the railway line and the city limits. Two major radial roads, Banerjee road and Sahodaran Ayyappan road, divide this zone into three portions. The north sub zone consists of wards 44-50, industrial area of Eloor, Varapuzha, Cheranaloor and Kadamakudy. The middle central zone consists of wards 30-38, and the south central zone consists of wards 26-29, and Maradu census town. These areas represent the next phase of the development of Ernakulam, where a lot of low-lying areas and marshy lands were reclaimed and built by the Development Authority. The largest number of apartments of various types have come up in the western part this zone, due to the closeness to the CBD, and availability of developable lands locked between ribbon development.

The third zone consists of the area of the central city beyond the Kochi Corporation, in the adjoining municipalities and census towns namely, Tripunithura, Tiruvankulam, Kalamassery and Thrikkakara. In contrast to the low lying marshy lands of the Corporation,

this zone has gently rising topography, well drained laterite soil, and plenty of vacant land with good road linkages. Apartments picked up very slowly here due to low demand, due to the notion of being far away from the city, and its amenities.

6.2.2 THE SPATIAL PATTERN OF GROWTH

A. Spatial pattern and characteristics of public-co-operative –employees' housing

Multi-storeyed apartments by the non-private sector in Kochi, was initiated with the police quarters in ward 42 near(high court), and ward 27(panampally nagar) in 1976. The five year period between 1975-80 found the sector most active in housing. The break up of the multi-storeyed apartment projects undertaken by this sector, over the years, is presented in Figure No 6.4. It is found that 83 percent of the total multi-storeyed apartment housing constructed by the public sector, cooperatives and employees' housing, are concentrated in the south and middle central zone. The maximum is in ward 27 Panampally Nagar. Refer Figure No. 6.5 .This sector has been engaged in the construction of predominantly walk-up apartments of four stories in height. The break up of the multi-storeyed residential projects constructed by this sector, according to height, is presented in Figure No 6.6. This sector has also been found to engage in houses of small dwelling sizes, as can be seen from Figure.No.6.7. It is found that more than half the dwelling units are of one bedroom type.

B. Spatial pattern of growth of private sector housing

Figure no. 6.8 shows the spatial pattern of growth of private sector housing activity in Kochi. It started in the two well-developed nodes of Kochi, one in the old Kochi sub-zone consisting of wards 1 and 8 and the other in the Ernakulam sub-zone consisting of the wards 39, and 41. Refer Figure No. 6.9. These wards represented the best infrastructurally endowed core areas, of the then city of Kochi. The four maiden projects undertaken here between 1962 to 82 were of different types, were motivated by different reasons, and remained the only projects of the private sector, for nearly two decades. The Tharakam Estate in 1962 was

Figure no 6.4

Distribution of Public sector, co-operative and employees housing over time

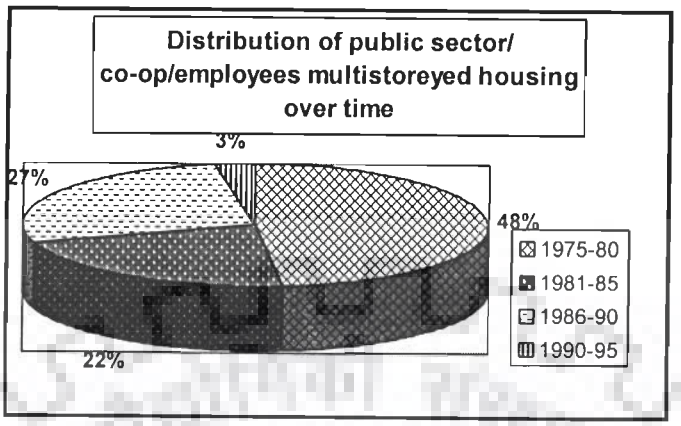


Figure no.:6.6

Multi-storeyed housing projects undertaken by public sector-co-operative sector-employees housing sector combine

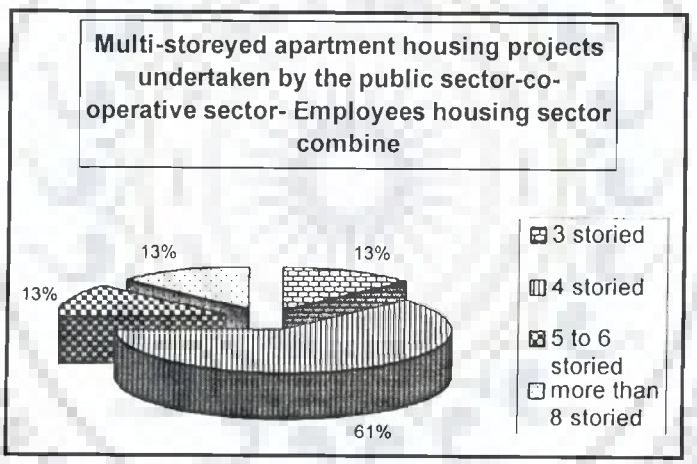


Figure no.: 6.7

Size of dwelling unit constructed by public sector-cooperative-employees combined

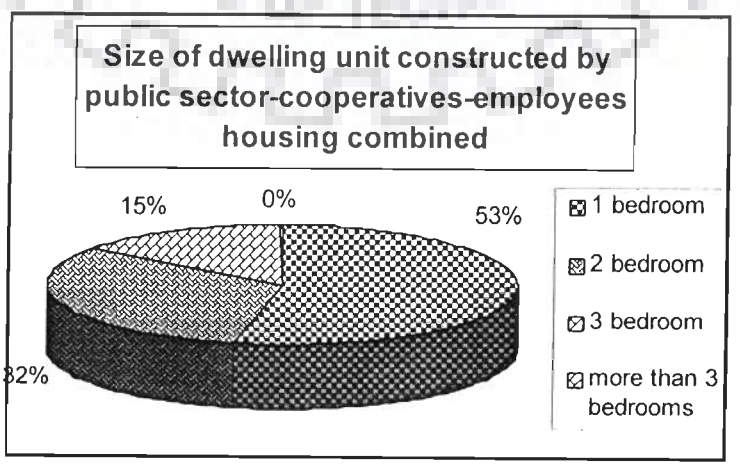


Figure 6.5

Spatial distribution of multistoreyed apartment construction by

Public sector-Cooperatives-Employees housing combine

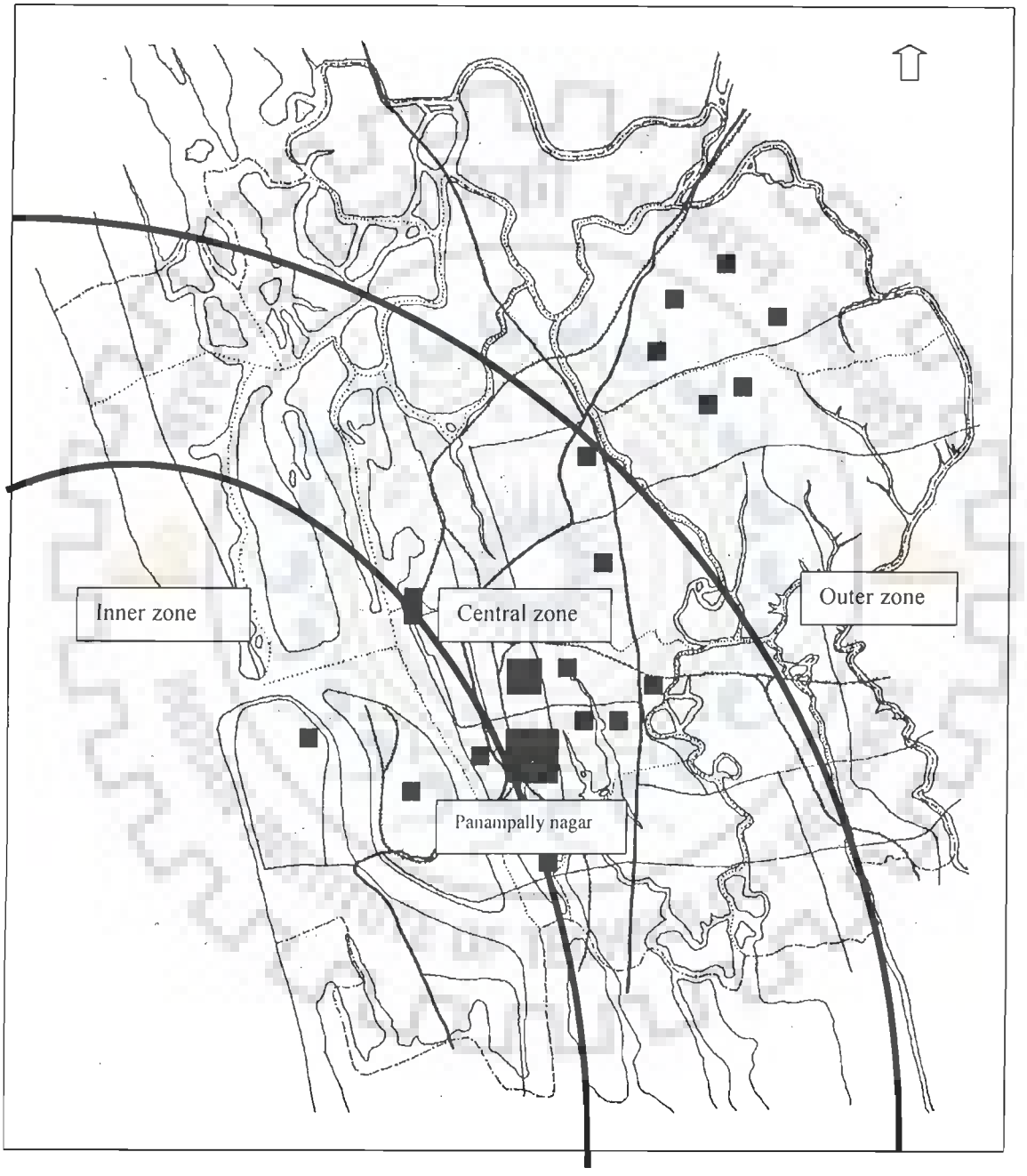


Figure 6.8 a

Spatial and temporal growth of private sector housing

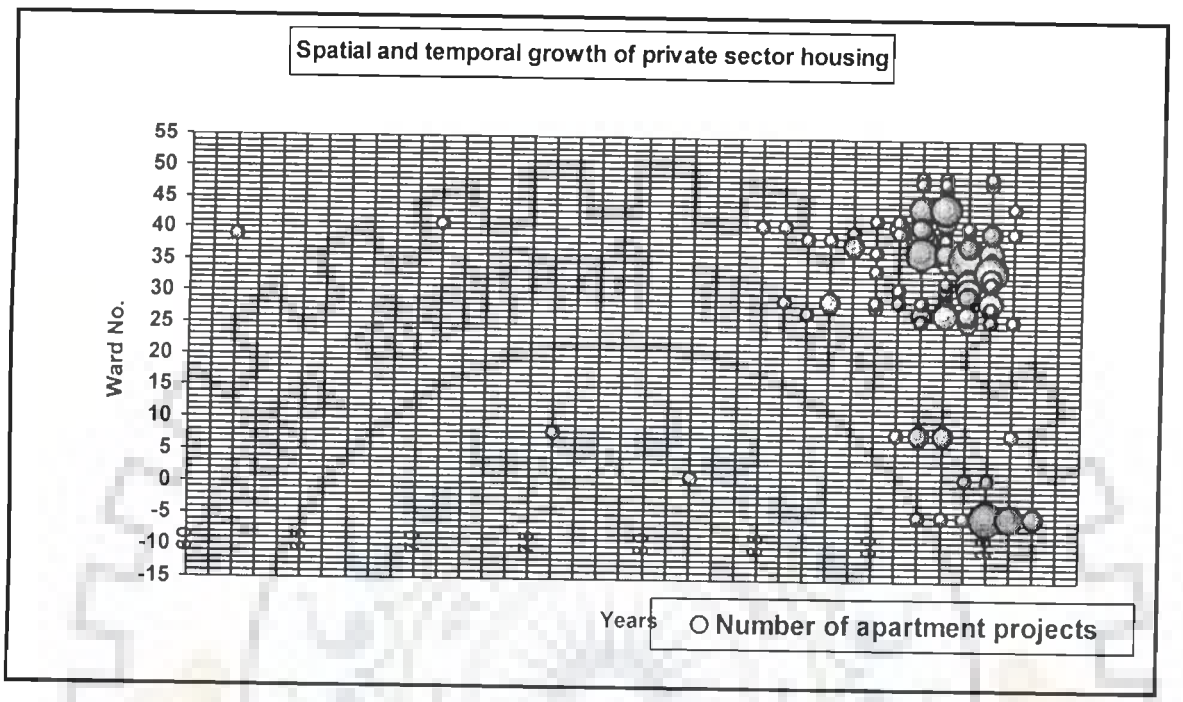


Figure no 6.8 b

Spatial and temporal growth of apartment units

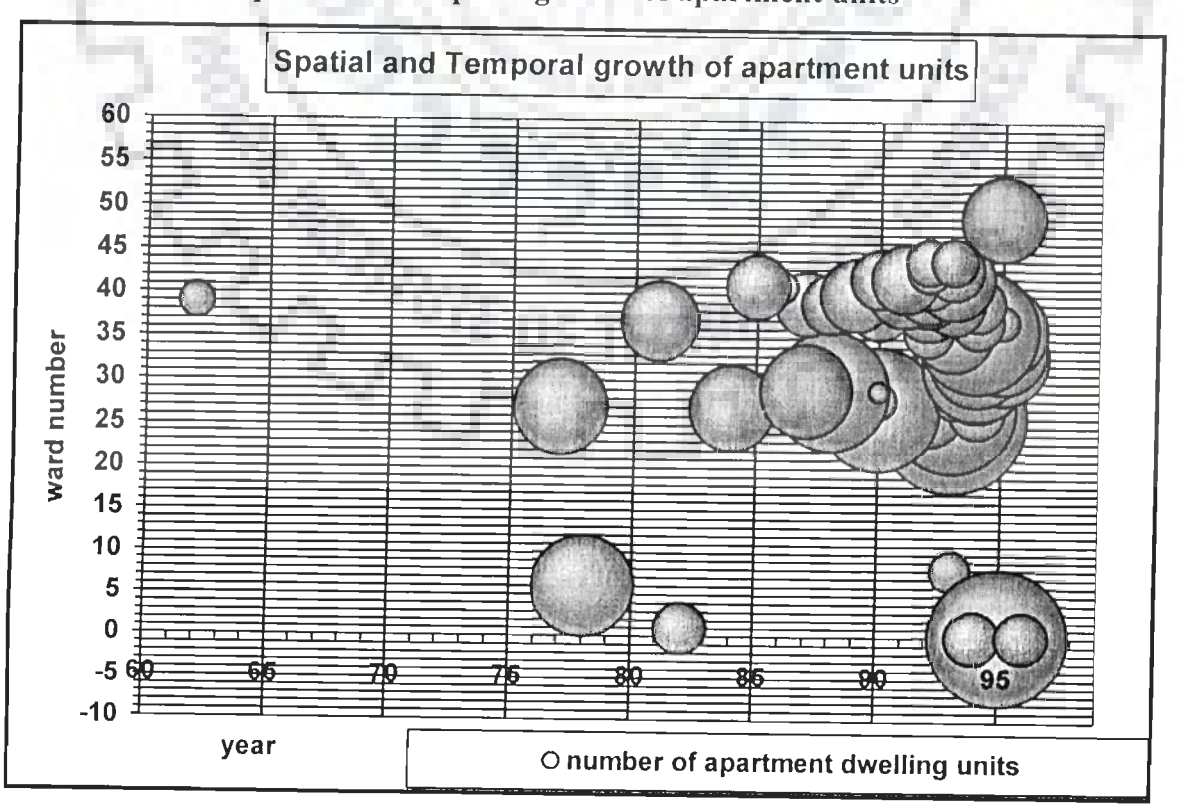


Figure 6.9

Early nodes of multistoreyed apartment construction by

Private sector 1962-84

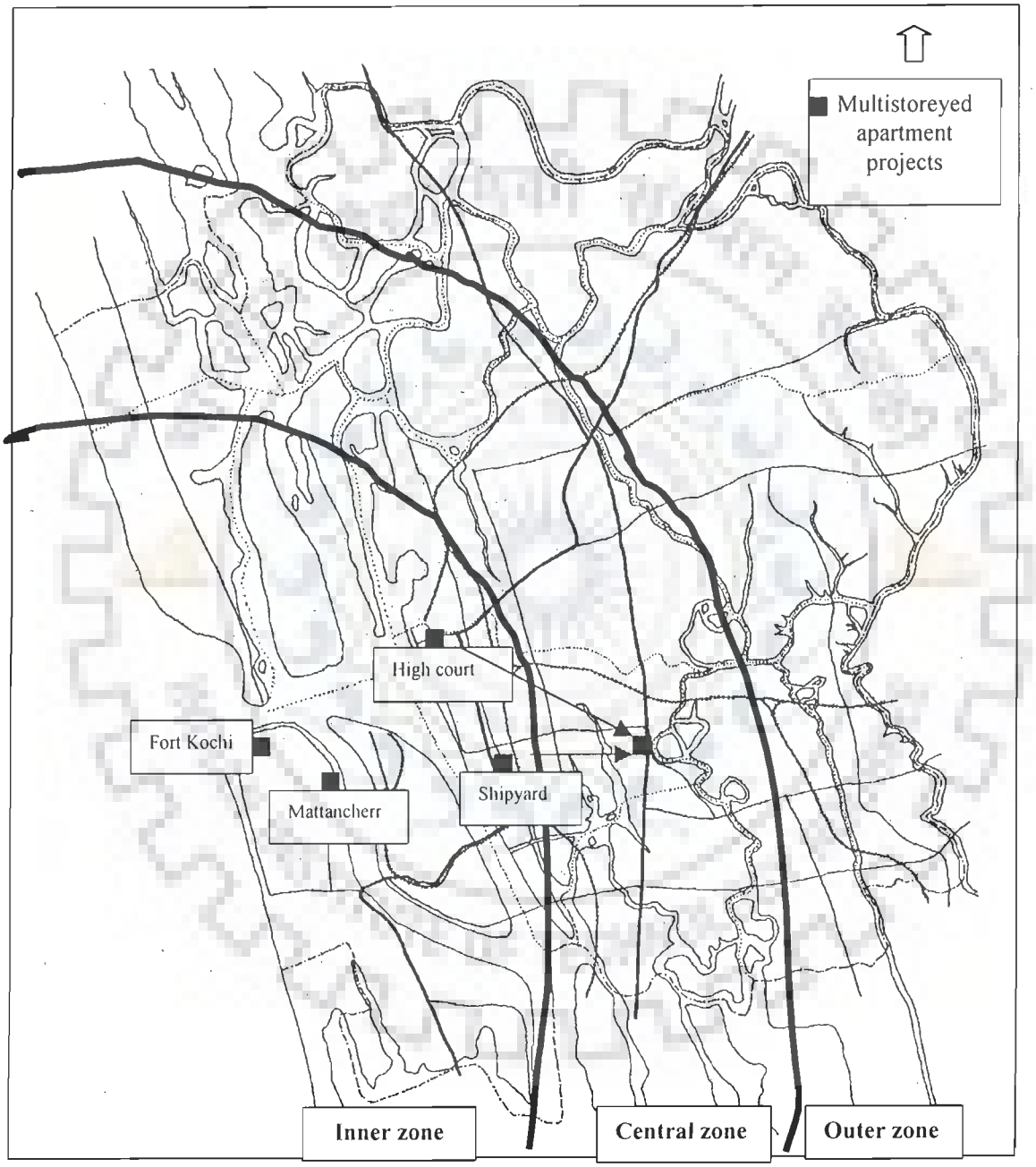


Figure 6.9

Early nodes of multistoreyed apartment construction by

Private sector 1962-84

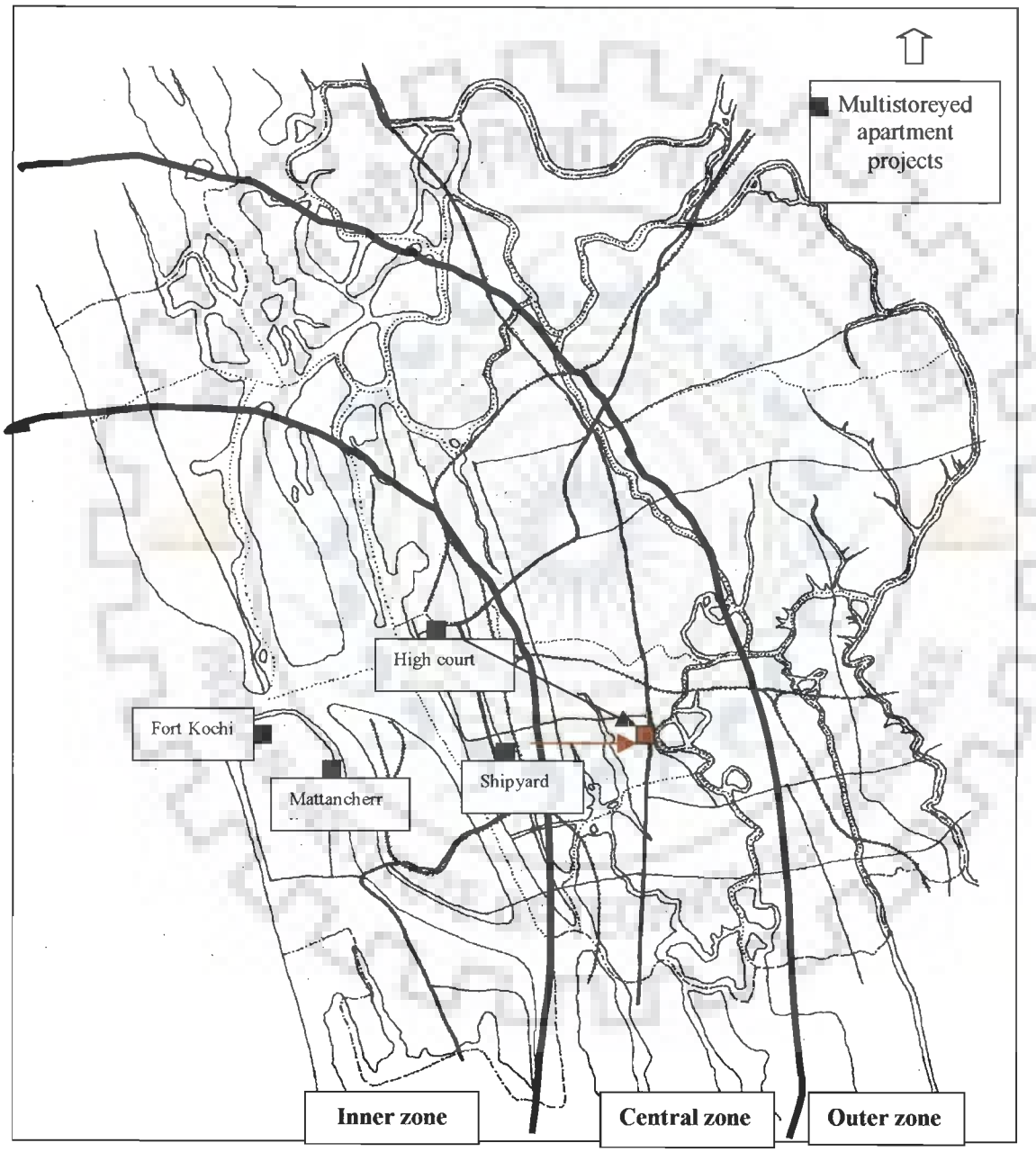
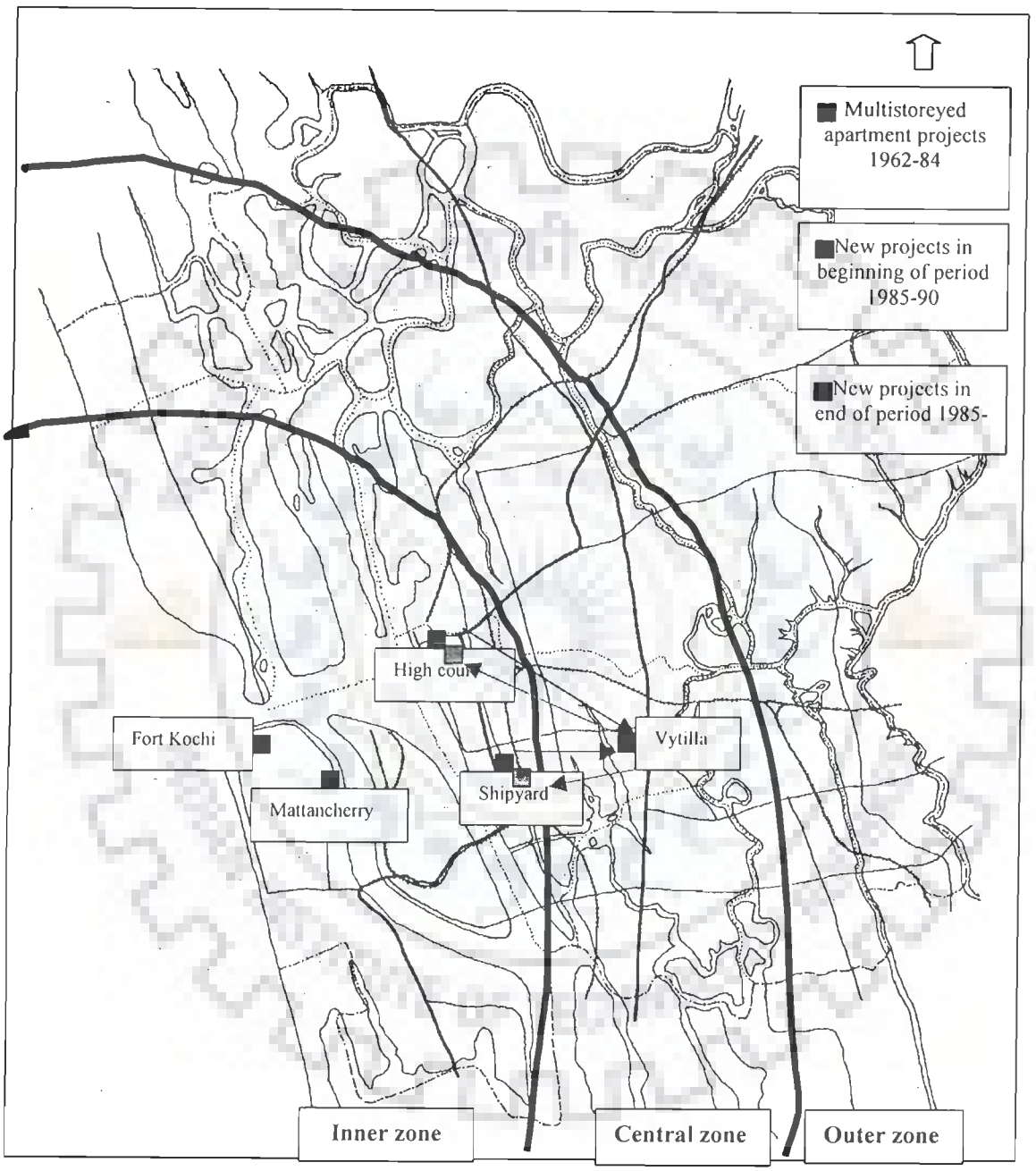


Figure 6.10

Multistoreyed apartment construction by

Private sector 1985-90



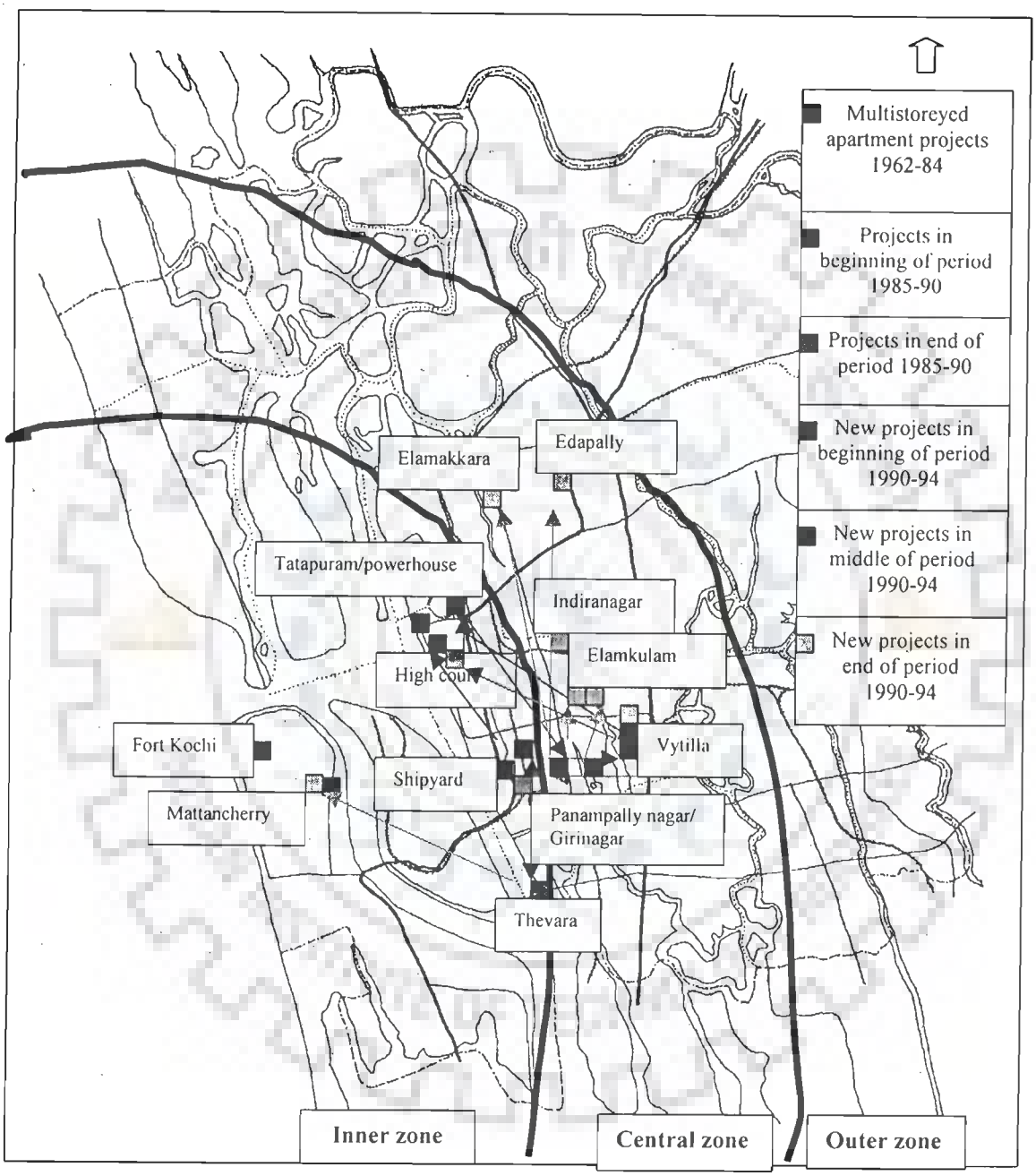
constructed in ward 39 of Ernakulam, and consisted of two blocks of three storied houses. This was adjacent the Cochin Shipyard, a major employer in Kochi. This was followed by the 12 storied Fernsons Apartments in 1971, consisting of 44 apartments of two and three bed units. It was the first vertical development residential experiment and was located in ward 41, adjacent the next major employment centre of Kochi, consisting of the Burmah Shell Oil Company, Tata Oil Mills, and Kerala High Court. The first project in old Kochi came in 1976, with the experimental low cost prefabricated housing by an entrepreneur, in ward 8, in Mattancherry. In 1982, the seven storied Bay View Apartments was constructed in ward 1, of the scenic and historical Fort Cochin. A large number of these , were bought as guest houses by various companies. The first Private sector planned residential neighbourhood was initiated by an Architect in the early eighties, in an island called 'Beaver Island', in the backwaters between the Kochi corporation and Tripunithara muncipality, in the outer zone.

Private sector activity picked up during the 1985-90 period, in the wake of the growing investment demand for housing. The early nodes of this activity were in ward 39(near Shipyard), and ward 41(near High court), in the Ernakulam inner zone. With these wards getting densified, activity leaped beyond the railway line along the Sahodaran Ayyapan road, into the central zone. It bypassed ward 27 (containing the Panampally nagar of Greater Cochin Development Authority), and ward 28 (containing Girinagar cooperative housing colony), and moved to ward 29 (Vytilla).Refer Figure No. 6.10. This ward on the main transport corridor linking Ernakulam to its next town Thripunithara and Shertallai, thenceforth, became the hub of activity. With well developed roads on three sides, plenty of low lying marshy vacant land, lower land costs, less congestion and yet located close to the city, this is the only ward other than the old activity nodes, which has seen unabated private sector activity for a decade.

Figure 6.11

Multistoreyed apartment construction by

Private sector 1990-94



The period between 1991 and 1995 is called as the period of the apartment boom. Records show that nearly 120 'builders'(from various professions) registered with two builders associations, had entered this field in this period. Many opted to build low-rise apartments of three to four storeys. But, larger developers invested in tall buildings, between seven to sixteen stories in height. Activity again concentrated along the two nodes, wards 39(near Shipyard) and 41(near High court) in the inner zone, and ward 29(Vytilla) in the central zone. Refer Figure No. 6.11.

With increasing demand, prestigious and luxurious apartments tailored for the NRI and the elite, spilled over to adjacent similarly attributed wards 42 (Tatapuram) and 43 (near power house). In these inner zone wards, congestion necessitated the demolishing of old structures, to pave way for the new. In these wards, small unused land parcels, under-utilised properties, and old traditional buildings were bought at exorbitant prices, and transformed into multi-storeyed luxury apartments. Such was the apartment boom, that even a couple of cinema theatres, 'Laxman' in the inner zone and 'Chitra' in Vazhakkala census town in the outer zone, were demolished to erect multi-storeyed apartment housing.

With spiralling land values and increasing non availability of lands in the inner zone, luxury multi-storeyed apartments slowly moved to the central zone. Areas in ward 27(Panampally nagar GCDA housing colony), ward 28(Girinagar cooperative housing colony), and ward 26(Thevara) of the south central zone, located just outside the central business district(CBD), but set a little away from the main transportation corridor became most sought after, for the siting of luxury apartments. The wards 27 and 28 were particularly attractive due to proximity to the central business district, good infrastructure, and being less congested unlike the inner zone wards. It had a pull factor due to the availability of extensive marshy land on its southern end. Projects in these wards hugged the spine road of the housing

colony, maximising on easy transportation advantages, while those in ward 26(Thevara)were distributed along the backwater fringes, increasing its scenic value.

Projects which were low rise and budget apartments came up in the wards just outside the CBD in the central zone, or in parts of the inner zone, in areas with low land values. These were located deep inside from the main road in ward 44 (North Kaloor), ward 48 (near Edapally high school), ward 49 (Elamakkara) in the north central zone and in ward 8 (Mattancherry) in old Kochi area of the inner zone. The peak period between 1992-95, also witnessed the construction of a large number of apartment projects concentrated in two wards, 36 (Indiranagar) and 37 (Elamkulam), in the middle central zone. These two wards located close to the city centre consist of large expanses of marshy land without access. The development of the Gandhinagar housing colony by the Greater Cochin Development Authority, and opening of the Kaloor-Kadavanthara road, paved the way for the development of the interiors of these wards.

In 1993, works were initiated for the laying of the new Ernakulam-Alleppey national highway bypass road, in the eastern extreme of the central zone. This ring road connecting the two major radial roads, was aligned through the areas of Kochi, with relatively lower land values. Apartment construction being in its peak, the access provided by this road was soon taken advantage of, and budget and low rise apartments started developing in the wards 30(north east of Vytilla junction), ward 31(north west of Vytilla junction), ward 34(Palarivattom), and ward 33 (east of bypass road) of the eastern extreme of the middle central zone. There was a mushrooming of apartments, between Vytilla and Palarivattom stretch of the bypass. During this period, traces of activity was noticed, even in areas far from the core with limited transportation facilities as in wards 46 and 47 (Vaduthala on both sides of Chittoor road) in north central zone, and ward 35 (Thammanam) with densely built-up

wards with traditional housing, in the middle central zone. However, building activity in the core wards started to decline due to the high land cost, and low land availability.

With the declining trend of the apartment boom in 1995, all new projects came up in the low density central zone areas with marshy developable land, in wards 48 (near Edapally high school), and ward 49 (Elamakkara) in the north central zone, and wards 32 and 33 (east of national highway bypass road), ward 34 (Palarivattom), in ward 26 (Thevara), ward 27 (Panampally nagar), ward 28 (Girinagar), ward 36 (Indiranagar) and ward 37 (Elamkulam) of the middle central zone. Refer Figure No. 6.12. During this period, high rise apartments started appearing even in the eastern extreme of the central zone, at all cross roads like the Vytilla junction between wards 30 and 31, Palarivattom junction between wards 33 and 34, and Edapally junction between wards 34 and 48. The initial wards of construction activity ie., wards 39, 41, and 29 continued to remain active, but at a declining pace. With the high land values and low land availability, apartment construction in the Corporation areas ceased to be profitable.

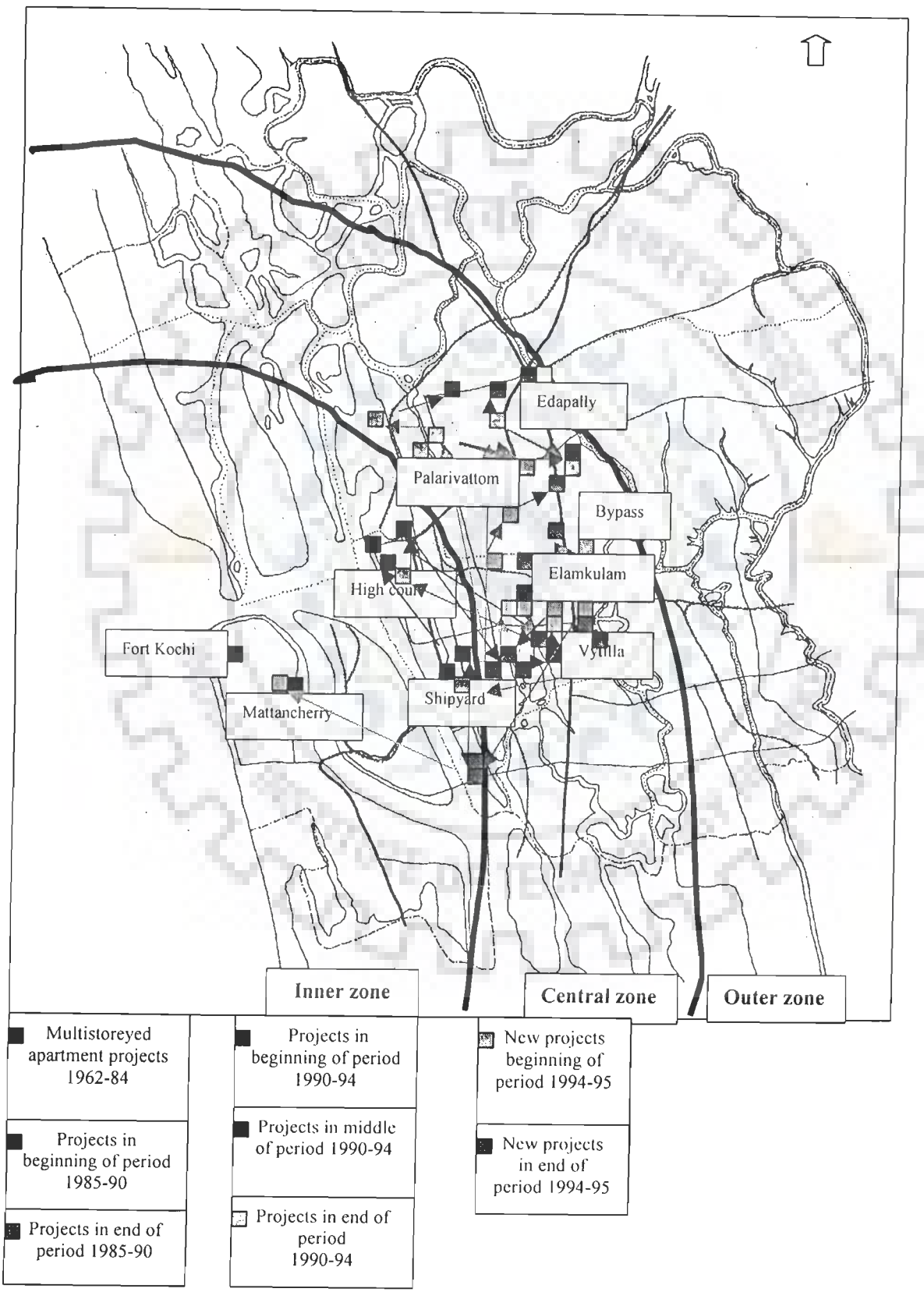
Apartments now started appearing in the outskirts of the city, in the panchayat areas and surrounding municipalities. It was publicised that the proliferation of apartments within the city, had 'caused' many infrastructural problems like water and power shortage. The Government therefore, started a series of measures, to discourage apartment construction in the inner areas. Some of the measures included, a single tap delivering potable water from the Water Authority to an apartment, insistence on separate transformers, sewage treatment plants, and strict enforcement of building rules by the government. Prohibition on further apartment construction within the Corporation areas, was also envisaged at one stage.

In this final wake of apartment construction, two trends were noticed. Firstly, the activity spread to the adjoining fringe areas with reasonable transportation facilities, like ward 48 (near Edapally high school), ward 49 (Elamakkara) ward 46 (Vaduthala), Cheranelloor

Figure 6.12

Multi-storeyed apartment construction by

Private sector 1994-95



census town in the north central zone, Maradu census town in the south central zone, Kakanad outgrowth and Vazhakkala census town in the middle outer zone, and Tripunithara municipality in the south outer zone. Refer Figure No. 6.13. Kakkanad outgrowth was the favourite area for the siting of apartments, with an abundance of vacant land with good soil, at low prices. It had high frequency of bus services. Thirdly, the good soil reduced foundation costs when compared to the inner zones. The location of the Cochin Export Processing Zone and the Civil Station as employment centres, and the proposal for the link road between Alwaye and Tripunithara through this Panchayat, assured progression in the land values. This resulted in a great demand for plots and apartments for speculative purposes. The high ground, and countryside in serene setting, were attractions for households preferring quiet lifestyles refer Figure 7D in Appendix K. There were no stringent building regulations in these panchayat areas. Proposals to expand the Corporation limits to encompass these areas, resulted in a spate of building activity, in a bid to maximise the built up area, before the Kerala Building Rules became applicable, there also. Consequently, apartments were constructed maximising built up areas, often avoiding adequate setbacks, parking space, and luxury facilities like play lots, lawns etc., normally provided, in other city locations.

Secondly, the private sector tried to woo the consumers by creating a demand for apartments, which fostered an exclusive lifestyle in scenic settings. The vast backwater front areas of Kochi, were purchased by the builders, and transformed into luxury apartment complexes, with centralised air conditioning, boating facilities, health club, jogging tracks and swimming pool. The ward 40(CBD area) along the Marine Drive with its manifold advantages of prime location, well-developed infrastructure, transportation network, and high investment value, coupled with the scenic setting, became ideal for the development of multi-storeyed commercial cum residential luxury apartments. Luxury apartments also came up in

A View of shipyard & backwaters beyond-INNER ZONE

B View of CENTRAL ZONE

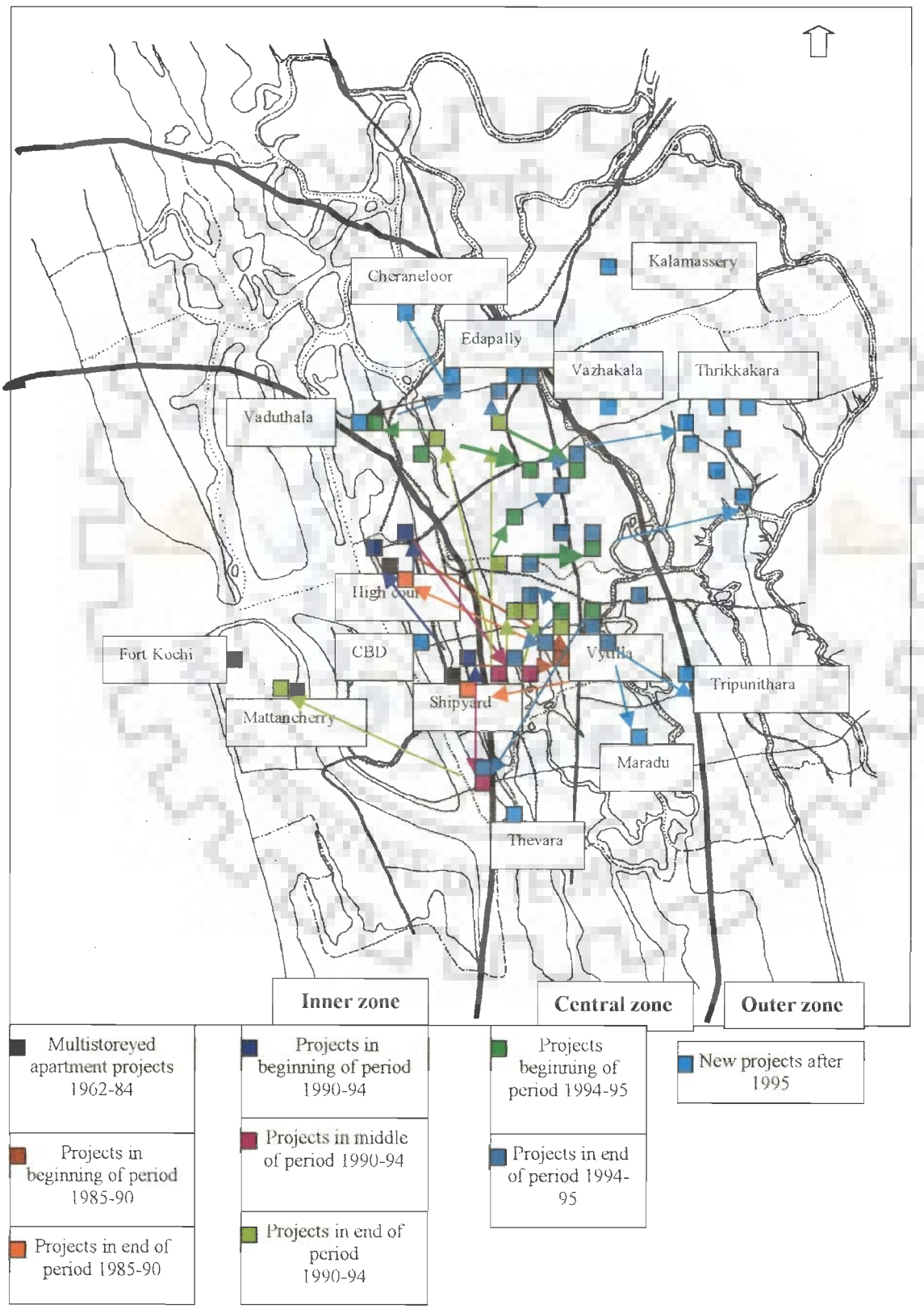
Fig. 6.13a

Fig 6.3d OUTER ZONE

Figure 6.13

Private sector muiti-storeyed apartment construction

after 1995



the scenic areas along the water front areas, in ward 26 (Thevara). The arrival of the Coastal Zone Regulation Act became a deterrent to construction activities, along scenic backwater fronts. With it started the lull period in the activities of this sector refer Figure No. 7C in Appendix K.

It may be concluded that the larger chunk of housing supplied by the private sector in the City has been through redensification. This has prevented urban sprawl, afforded savings in transportation cost and time, reduced air pollution and aided in protecting the valuable, limited agricultural land in the fringes.

6.2.3 EFFECT ON THE RESIDENTIAL LAND USE

Many surveys were conducted by the researcher, to ascertain the kinds of lands which were utilised for apartment projects, and their spatial pattern. A survey of the builders in the city revealed that, 36 per cent of the projects have come up on lands obtained by demolishing old structures, especially single storied traditional housing, mainly in the inner zone. This means a redensification of the wards 38,39,40,41 of the CBD has taken place.

Further, 39 per cent of the apartments have come up on vacant lands, and 25 per cent on marshy and fallow lands. As can be observed from Figure No 5.2 in Chapter 5, such lands are extensively seen in the central zone, particularly ward 26 (Thevara), ward 27 (Panampally nagar), ward 28 (Kadavanthara), ward 29 (Vytilla), ward 37 (Elamkulam) and ward 36 (Indiranagar) and in the outer zone. The development on such vacant lands will therefore, result in an increase in the net densities, and have consequent repercussions on the existing infrastructure. The effect on gross residential densities, and congestion by such development, however will be marginal.

The foregoing analysis reveals that, the proliferation of apartments is likely to induce strain on the existing infrastructure. But, the magnitude of the strain is likely to vary,

Figure no. 6.14

Vertical characteristics of private sector housing

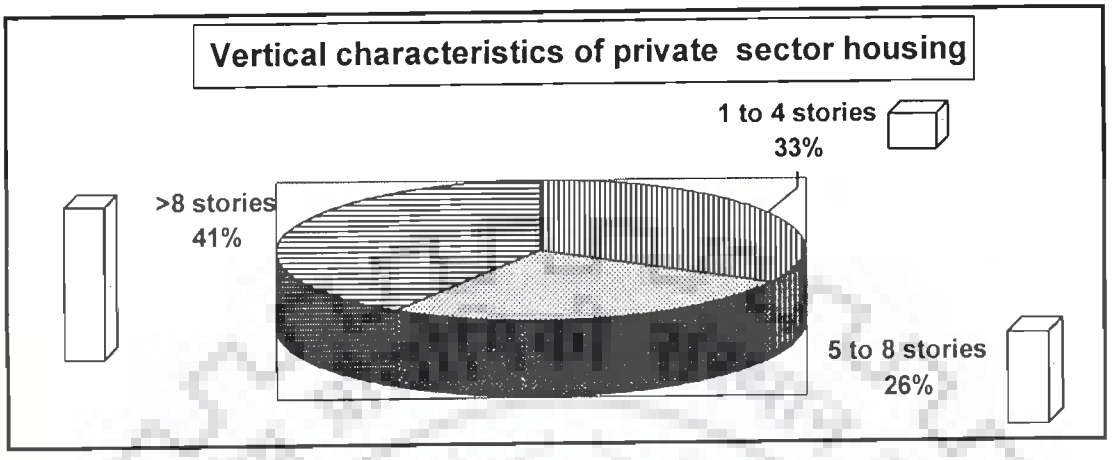
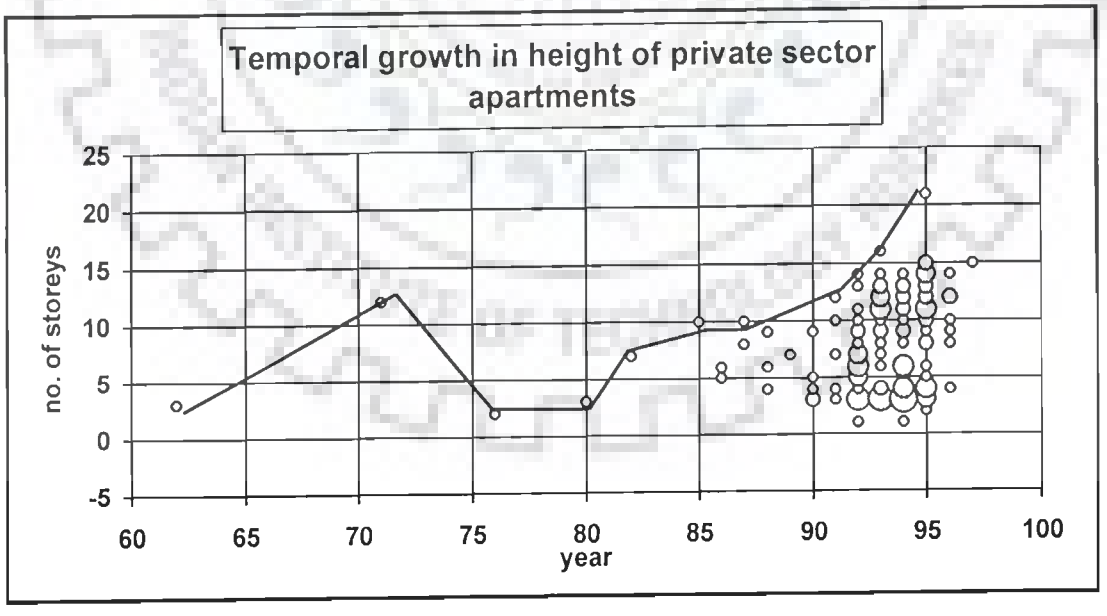


Figure 6.15

Temporal growth in height of private sector apartments



depending on the type of apartments, and life style of its occupants. Hence, it would be rational to examine the characteristics, and spatial pattern, of the various types of apartment housing projects in the city.

6.3 GROWTH TRENDS IN MULTI-STOREYED APARTMENT HOUSING BY HEIGHT

6.3.1 SPATIAL DISTRIBUTION ACCORDING TO HEIGHT OF BUILDING

Private sector apartment housing in Kochi can be divided into three categories based on height: 0-4 storey, low rise/walk up apartments, 5-8 storey medium rise apartments and high rise buildings of more than 8 storeys. In the period between 1955-65, private sector activities concentrated on buildings of two and three stories, some of them low cost, mainly meant for housing the industrial workers. The next decade witnessed the construction of two high rise apartments, one in the mainland and one in old Kochi. With the arrival of the organised private sector in 1975-85, started the phase of high rise buildings in Kochi. The period of boom was witness to a variety of housing of different heights, spread all over the city. While the city core and sides of main transport corridors everywhere were filled with high rise housing, the peripheries, inner city areas and the old city contained low-rise housing. With the decline of the boom, large builders started fanning out into the inner, cheaper, low density areas and peripheries bringing with them the high rise typology to these areas.

A Survey of Private sector apartment housing projects in Kochi reveals that at the end of 1995, 33 per cent of the houses were 1-4 storeys in height, 26 per cent were 5-9 storied and 41 per cent were of more than 10 storeys in height . Refer Figure No. 6.14. Out of the low rise projects, 52 per cent are of three storey and 31 per cent are four storied in height.

Figure 6.16

Spatial distribution of private sector housing according to height

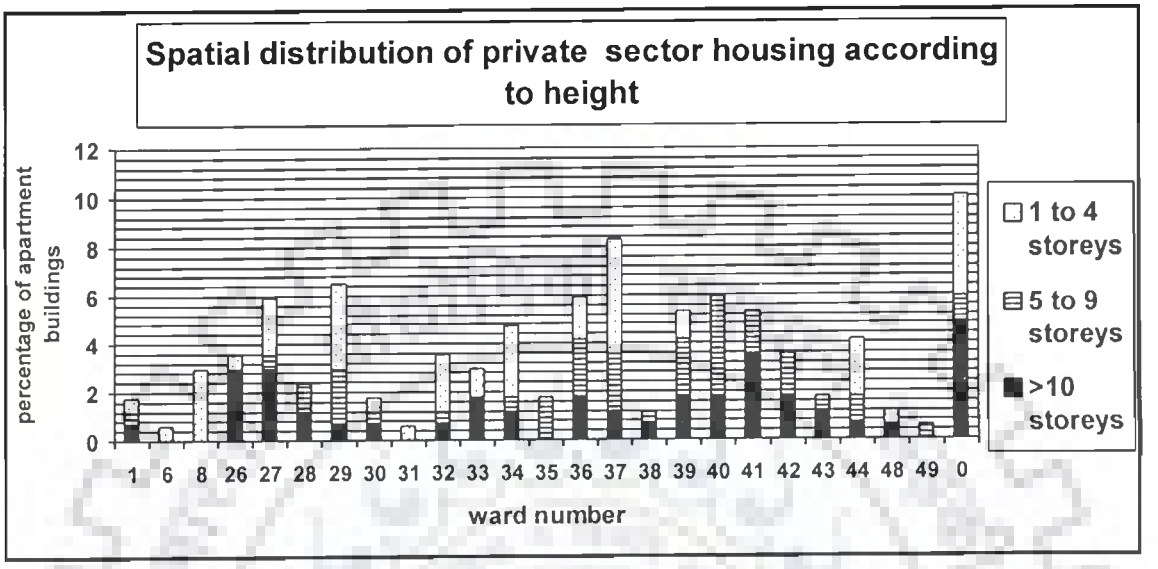
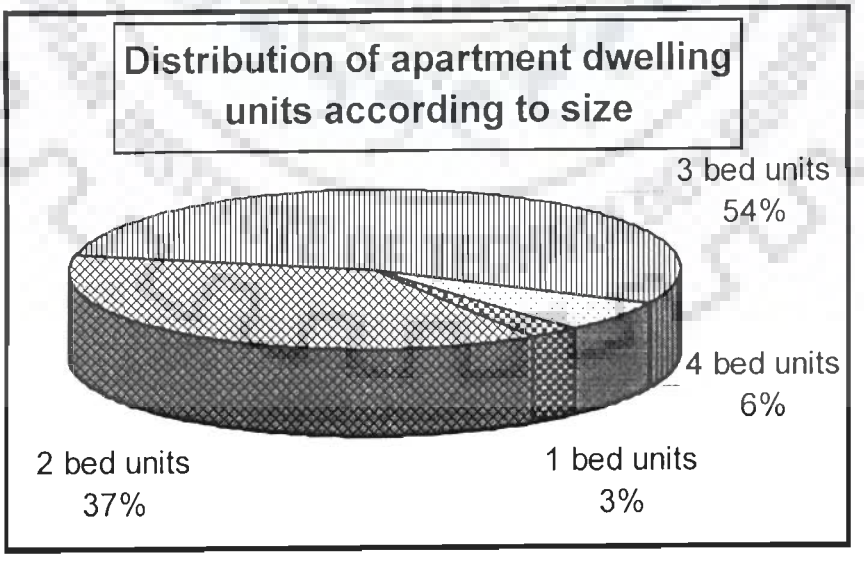


Figure no 6.17

Distribution of apartment dwelling units according to size



Five storied buildings constitute 19 per cent of 5-8 storied buildings, with six storeyed apartments constituting 36 per cent. Five storied apartments are more popular in most metropolitan cities, as they provide the maximum density possible, without the use of a lift thus reducing the cost of housing. For instance, Calcutta has 63% of its multistoreyed buildings of five storeys (83). Here households trade off difficulties and energy loss in climbing five floors, against the advantages of an affordable price at a suitable location. The statistics of Kochi point to a different situation. Here, the buildings rules allow only up to four storeys without lift. Hence, the number of five storied housing is a meagre 5 percent. Apartments of more than six stories using lifts, with the additional expenses of installation and maintenance, constitute 60% of the apartment housing. Obviously, the larger chunk of multi-storied residential buildings in Kochi, are not budget oriented as in other metropolises. Out of the 41 percent of high-rise buildings, only 12 per cent are 8 to 10 storied, while 29 per cent are above 11 stories. Tall buildings of more than 15 storeys in height constituted 10% of the high rise buildings.

Figure No 6.15 reveals that though there has been a steady increase in the height of apartment buildings, the rate of growth has been markedly steep in the mature period. For example, in 1995, 53% of the apartment buildings were of more than ten storeys in height, with half of them more than 14 stories in height. The dominance of tall buildings in the private sector housing scenario, has been mainly due to the preference of both clients and builders, for this housing typology. The clients have preferred high rise living, for security, privacy, ease of maintenance, better ventilation, the panoramic view, and to avoid dirt, dust, mosquitoes and flies associated with the ground.

6.3.1 SPATIAL VARIATION IN HEIGHT CHARACTERISTICS OF PRIVATE SECTOR HOUSING

Figure 6.16 reveals that the ward 41 (near High court) where the earliest experiments in vertical development were conducted, continued to receive and hold the largest number of high rise buildings. Ward 40, the CBD contained the largest amount of medium rise buildings while ward 37, in Elamkulam contained the largest number of low rise buildings. Other zones of low rise buildings are also indicated in the Figure. No 6.16.

It may be observed that single storied houses are located only in the fringe central and outer zones, mainly due to the high cost and non availability of large chunks of land, within the Corporation areas. Such housing is designed to cater to two categories of people. Firstly, are those who wish to have privacy, a quiet, restful, retired lifestyle, adjacent natural scenic settings and outside the hustle bustle of cities, while still taking advantage of the superior kind of life offered by them. Secondly, are those who prefer to have single storied housing due to cultural preferences, but who need to still keep close contact with the City, for educational and employment purposes. While the first type of villas are located in Vaduthala, Cheranellor, Thanthonni and Beaver islands, the second type are located in Tripunithara and Vazhakkala with excellent transit facilities.

Medium type housing is present in the densely built up areas with traditional housing, namely Ward 35(Thammanam), ward 36(Indiranagar), ward 37(Elamkulam) in the middle central zone; wards 29(Vytilla) of south central zone; and inner zone wards 39(near shipyard) and ward 40(CBD).

High rise buildings are present in wards 26 (Thevara), 27(Panampally nagar), 28(Kadavanthara) of the prestigious south central zone, and ward 1(Fort Cochin), wards 40(CBD), 41(Kerala High Court-Kacheripady), 42(North western side of Kerala High Court), and 43(North of Banerji road and east of railway line) of the inner zone with high land values.

Out of these except for ward 27(Panampally nagar), and ward 26(Thevara) all the other wards have only buildings above five floors. Obviously, all these apartments requiring elevator, and located in areas of high land values, cater to upper income groups.

6.3.2 TEMPORAL VARIATIONS IN HEIGHT OF PRIVATE SECTOR APARTMENT BUILDINGS

It may be recalled that the organised private sector made a cautious entry into the residential scene, in the aftermath of the dismal response to the variety of the experimental projects, spread over different parts of the city between 1962-75. The pioneers in private sector residential development, therefore, tried to comprehend the housing market with a supply of culturally friendly housing of one to three storeys in height. It was only after the entry of the public sector and the co-operative sector into vertical development, that the private sector made its diffident entry.

Figure 6.15 reveals that the height of private sector apartment housing has been steadily increasing over the years. The period of apartment construction can be divided into three periods: the first experimental phase from 1962 -84, the developing phase from 1985 – 89, and the mature phase after 1990. A perusal of the growth trend reveals that all apartments in the developing phase1985-89, during which the organised private sector cautiously entered the housing market, varied from five to nine stories in height. While one of the reasons here may be the apprehensions regarding the commercial viability, a second but plausible reason may be, the strict enforcement of the floor area regulations(FAR) in the building rules. Though the first apartment by the organised private sector was the ten storied Kadavil Court by the Southern Investments in 1985, it was not commercially successful. Two years later when the ten storied Harbour Point was offered by the same Group, the results were encouraging. The Apartment boom was setting in.

During the mature phase of apartment construction 1990 onwards, apartments of all heights started appearing. Low rise apartments constituted 33%, medium rise 27% and high rise apartments of more than ten stories constituted 40%. Tall buildings of more than 15 storeys in height constituted 10% of the high rise buildings. It may be observed from Figure 6.15 that the increase in the number of high-rise buildings was steep during the mature period. One of the reasons for the tall buildings in this phase was the high profitability of real estate during this peak period, which drove many developers to maximise the built up area by taking special sanctions.

6.3.3 RELATIONSHIP BETWEEN HEIGHT OF BUILDING AND DWELLING UNIT SIZE

Figure no. 6.17 shows the distribution of private sector housing according to dwelling unit size. It may be observed that, in sharp contrast to the dwelling unit sizes of public sector apartment housing as seen in Figure no 6.7, 60 percent of the private sector apartment dwellings have more than three bed rooms. One bed dwelling units constitute just 3 percent. A typical plan of one, two and three bed units is shown in Appendix L.

It may be observed from Figure No 6.18, that there is a positive correlation between the height of the building and dwelling unit size. One bed units (55-70 sq m) are mostly present in four storied buildings, and are absent in high rise buildings. They represent economy houses considering savings on land value and construction cost due to avoidance of lifts. Two bed units(70-100 sq m) are located in buildings upto 5 floors in height. They increase with building height upto five storeys, and taper with further increase. Three bed units (100-130 sq m) are located in three storied buildings, and in buildings above six stories. Nearly 50% of units in three storied buildings are of this type, while four bed type, constitute 3%. Between 3 and 6 stories there is a increasing decline in three bed units. Dwelling units with four beds(130-186 sq m) are present only in buildings taller than seven stories. The

Figure 6.18

Relationship between height of building and dwelling unit size

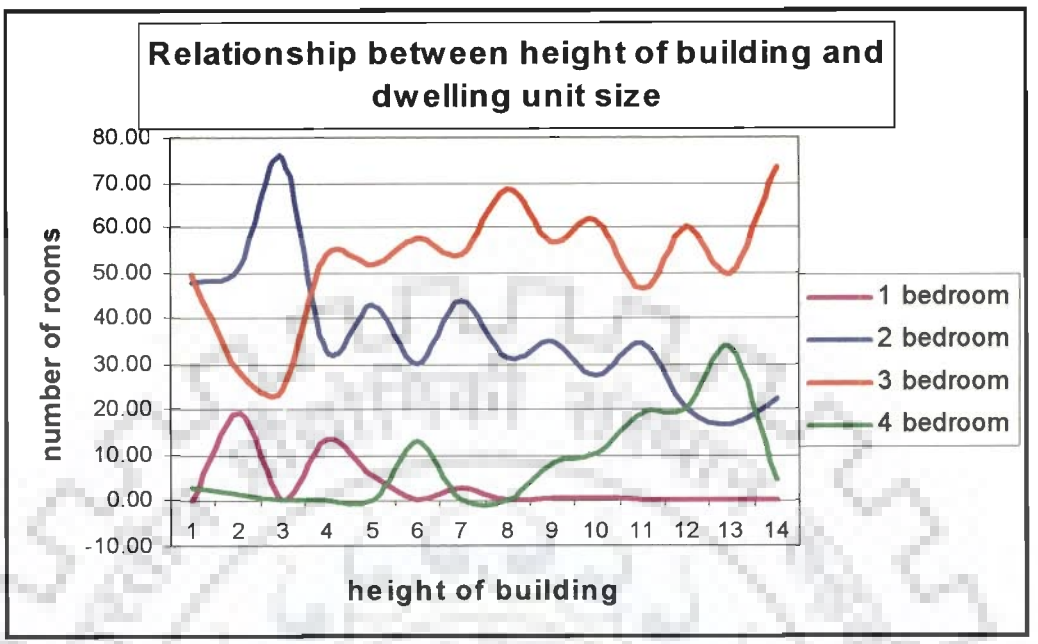
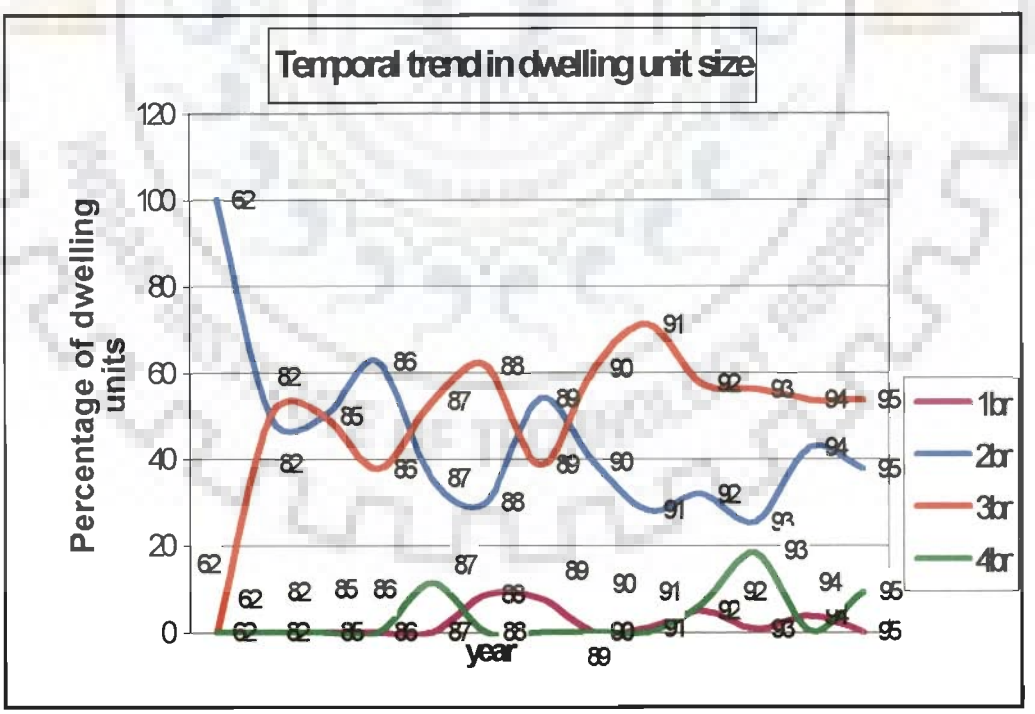


Figure no 6.19

Temporal trend in dwelling unit size



number of four bed units are observed to steadily increase with buildings of greater than eleven stories in height. Thus it may be observed that one bed units are usually located in the economy four storied buildings catering to lower middle class, two beds in medium rise buildings catering to middle class, three bed units in both low rise buildings unto three stories and in high rise catering to upper middle class, and four bed are found only in luxury high rise apartments catering to high income group.

6.4.1 TEMPORAL VARIATION IN DWELLING UNIT TYPE

Figure no. 6.19 reveals that two bed room dwelling units were the dominant type of dwelling units in the early period 1962-85. With the entry of the organised private sector in 1985, three bed units were introduced into the private sector housing scenario. The succeeding two years saw the entry of two other dwelling types, the single bed unit and the four bed unit, though to a limited extent. The trend in the dwelling unit type reveals a gradual decrease in the two bed units, during the developing phase 1985-90, with the decrease being marked in the mature period, in the peak years from 1990-95. The three bed units on the other hand, have registered a steady increase, especially in the peak period. Four bed units which first appeared during the developing phase, shows a marked increase in the peak period from 1991-95. One bed units started appearing in the late eighties, and was constructed to a limited extent in the succeeding years, especially during the peak period.

It may be concluded that the demand for a greater number of bed rooms have been increasing with the years, particularly during the apartment boom. Since there has not been an increase in family size, it may be concluded that the need for more rooms may be mainly attributed to socio-economic reasons, like increased economic or social status.

6.4.2 SPATIAL VARIATION IN DWELLING UNIT TYPE

Figure no 6.20 reveals that one bed room dwelling units are located in the early active inner zone ward 39(near shipyard); ward 29(Vytilla) in south central zone; ward 36(Indira

nagar), ward 32 and 30 (near Vytilla junction on either side of bypass road) in middle central zone; ward 44 (north kaloor) in the north central zone; Tripunithara in the south outer zone, and Kalamassery in the north outer zone, which are areas with relatively lower land values

Two bed dwelling units are maximum in the interiors of the central zone in ward 36(Indiranagar), and ward 37(Elamkulam). Other wards with more than 75% of two bed units are on either side of the bypass (ward 31,35,48). All these, are areas with large areas of marsh lands and relatively lower land values, due to problems of accessibility though physically close to the city core. Few two bed units also exist mixed with three bed in the inner zone wards CBD(ward 40&41), ward 29(Vytilla) in south central zone, ward 32(either side of bypass), and ward 44(north Kaloor).

Three bed units are maximum in the prestigious, environmentally superior, wards, 27 (Panampally nagar), 28(Kadavanthara) and 26(Thevara) and constitute more than 75% of the dwelling units here. Other wards with a larger share of three bed units are the high land value inner wards 40,41,42,43 (near CBD), ward 39(Shipyard), ward8 (Mattancherry); ward 29(Vytilla) of south central zone, and fringe middle central ward 33,and 34 which contain more than 50% of three bed units.

Four bed units are maximum in the early and highly active ward 29(Vytilla), prestigious ward 27(Panampally nagar), and scenic ward 26(Thevara), of south central zone, high land value wards 41 &42 (CBD core) of inner zone, and scenic areas Thrikkakara in the outer zone.

It may be concluded that luxury flats with four bed and three bed units are found in scenic areas of backwater front in Thevara, elevated scenic areas in the outer zones as in Thrikkakara, in prestigious areas like Panampally nagar, and CBD wards. One bed and two bed units are mostly concentrated in the interiors and fringes of the central zone, with lower access.

Figure no.6.20

Spatial distribution of apartments according to size

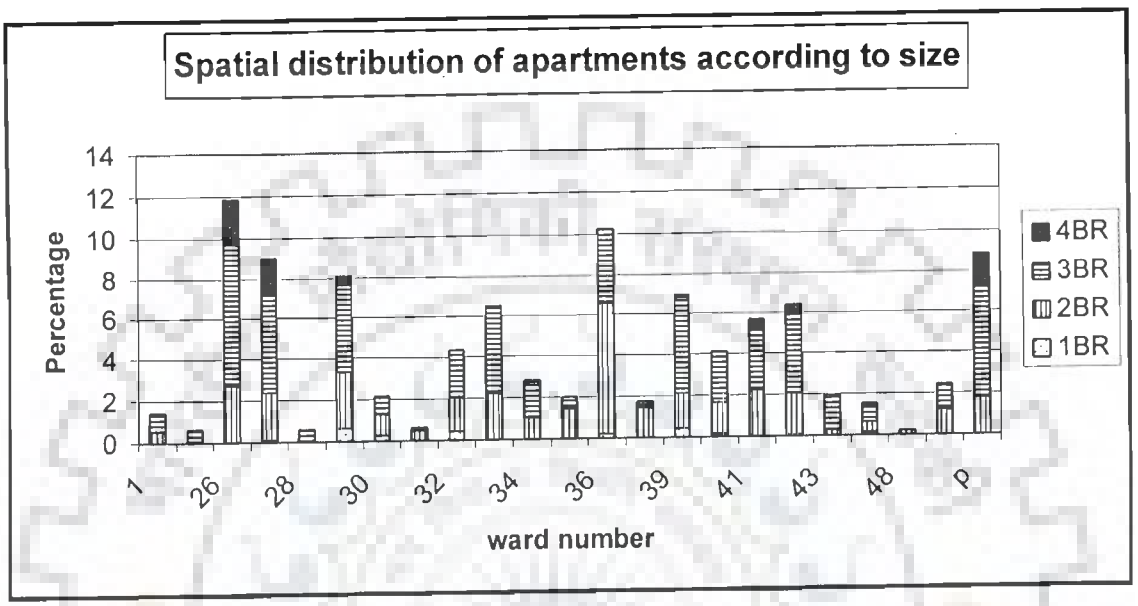
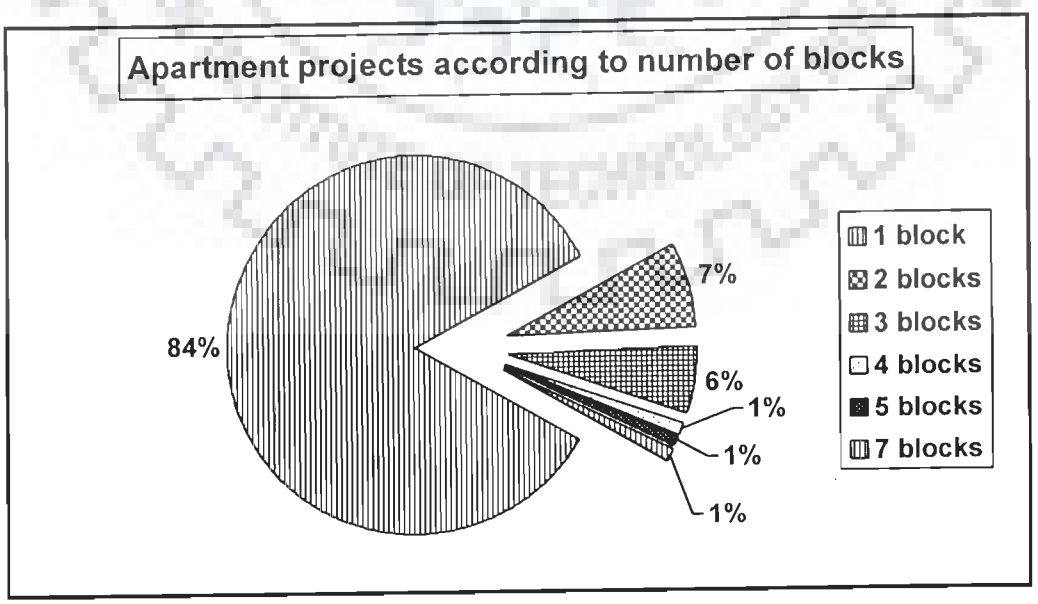


Figure 6.21

Apartment projects according to number of blocks



6.5 MASSING

A characteristic feature of the apartments in Kochi is the dominance of single block structures. Buildings having only one block constitute 84% of all projects. Refer Figure no 6.20. Around 13% of the buildings have two or three blocks. Buildings of more than three blocks constitute only 3%. This reveals that a large share of private sector housing consist of small independent projects, and are not of large public and co-operative group housing type. The beneficiaries from a project are therefore limited in number. Further, there is no correlation between plot area and number of blocks. This reveals that the plot area may not be a decisive factor, in deciding the number of blocks in a project. It might be dependent on land values, and socio-cultural preferences of the high income groups, whom these buildings cater to, who have a preference for limited crowding

6.6 DISCUSSION

6.6.1 INVESTMENT MOTIVATED SUPPLY

The residential activity has always been related to the with increased / decreased demands. The growth trend of apartments over a period of 36 years has been traced, of which the 2 decades from 1976-96 is the focus of the study. The first decade is marked by the initiation of apartment development through housing projects by the public sector agencies, namely, Greater Cochin Development Authority & Kerala State Housing Board, co-operatives, and employees housing. This was a period of steady supply of housing to meet the demand of a predominantly middle income group of city dwellers. Being undertaken by public agencies, co-operatives and as employees housing, these were essentially walk up apartments of small sizes. A part of the housing units were also ear marked for economically weaker section (EWS), which was financially justified by a system of cross subsidy from

asmaller number of higher income units.. The second decade denotes a trend, with a steep supply reaching a peak between 92 to 94, and followed by a declining trend, terminating practically to its initial rate of construction.

The housing development of the second decade, is obviously attributed to the economic boom generated by the Middle East employment on the one hand, and spiralling prices of cash crops , on the other. A doubt arises whether such a trend can be generalised.

It has been observed in chapter 3 and 4 that the economic development is implicitly reflected in the housing boom, as was seen by a high rate of house construction during 1975-81 all over Kerala. The first phase of the curve in the Figure No. 6.1, clearly coincides with this trend. Similar trends are also seen in all growing towns like Bangalore for example, but, how will one generalise the boom observed in Kochi in the last decade?

To get an insight into this phenomenon, we may compare the housing shortage and supply during the census period 1981-91. As per the census, the shortage of housing in the central city was given as 5227 houses. The number of apartment housing units constructed during 1985-95 period as collected from the apartment survey amounts to nearly 6300 dwelling unit which is more than the numerical shortage. If that be the case, the apartments which have come up from 1991, to date, are clearly, investment motivated supply. Naturally, the house being a product of heavy expenditure, huge investment in this field cannot continue, beyond its holding capacity of the builder. This trend, therefore, explains the rise and fall of a speculative business. This is reflected in the incomplete construction, and abandoned projects. Refer Figure No 7C in Appendix K.

6.6.2 AN ACCELERATED MODEL OF HOUSING SUPPLY

However, meaningful deductions regarding housing supply-demand of any city, can be made from this trend graph. The supply-demand trend of housing over time, clearly has a phase of growth, a phase of steady supply, followed by a declining trend, closely matching

with the economic development. It always follows a cyclic pattern. Public interest interferes in the market mechanism in this recession stage to ensure steady development.

The building boom as is seen in Kochi, reveals that this interference did not take place in early eighties, and hence, the money was diverted into speculation of apartments, leading to a pseudo residential development. The building boom in Kochi, provides a researcher, an accelerated model of housing market behaviour. Had the investment been spread over a longer period of say three decades, the X co-ordinate of this graph would have extended, and the trend curve would have flattened, as that in the case of any steadily growing metropolitan town.

6.6.3 TREND TOWARDS MORE HEIGHT

The housing development of the private sector suppliers, reveals valuable insight into the economic and environmental aspects of housing. A natural trend of densification of the urban area, is the first point noticed in this development. The distribution of apartments over time, shows a transition from low rise to high rise apartment, over the years. As discussed in section 6.3.2, the trend of increasing height is perceptible in Kochi. This appears to have two specific purposes (1) to economise the infrastructure and services, and (2) to enhance the environmental quality by providing better views, less pollution etc. A shift from the economic aspects to the environmental aspects of housing, is revealed in this trend.

6.6.4 STATUS BASED DWELLING SIZE

A significant aspect of the temporal variation with the size of apartment, is that of the increase of dwelling unit size with time. Figure no.6.19 shows the dwelling unit size over years. It can be seen that, increasingly, new buildings have large number of rooms. It is found that the percentage of small dwelling units is decreasing with time, with a corresponding increase in dwellings with large number of rooms. This appears paradoxical in a State, where family size is reducing due to increasing literacy This paradox can be explained by two

factors: (1) the apartment dwelling and its size is more of a status symbol (2) a changing concept of privacy where each member wants to have a separate room. Evidently, the socio-cultural values influence the choice of apartment typology.

6.6.5 CYCLIC PATTERN OF RETURN WAVE TO THE CORE

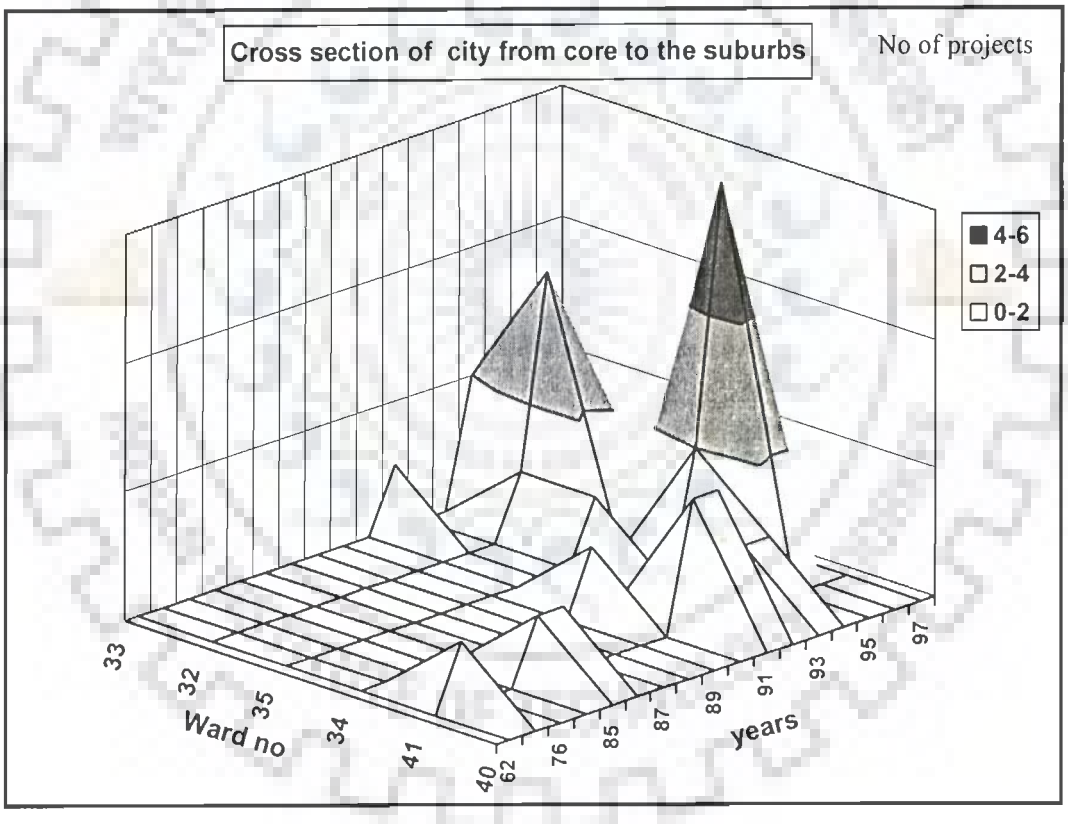
The residential development in the city during the decades 1985-95 indicates interesting spatial preference. Apartment construction started in the inner zone of the city. It leap-frogged over in search of vacant land into the central zone. With intensification of demand, it returned to the inner zone, while also spreading to other parts of the central zone. With increasing restrictions and reduced demand, it declined in the inner and central zones near the city core. Subsequently, it moved to the fringe areas of the central zone, and to the outer zone, which was ripe for development and at the same time, free from restrictions. The recent trend is a spurt in completing the projects in the core initiated earlier, which can be viewed as return wave of construction.

Spatial imprint of building activity

The rate and nature of construction activity in a location in the city varies with time and leaves a spatial impression in the city. According to Bourne, as most of the new housing is constructed on the edge of the city, a map of average housing age at any given time, would show a wave-like pattern of building activity, the crest of which shifts outward with each decade. As the peak of new building moves further from the centre, a smaller wave of rebuilding emerges near the centre, although usually not until several decades after initial construction, and it too continues to move outward over time. These various phases on construction activity are related to many external factors like swings in the building cycle, hidden technological innovations, especially in transportation, changes in building design, consumer tastes and public policy (28).

Fig. No. 6.22

Cross section of city from core to the suburbs



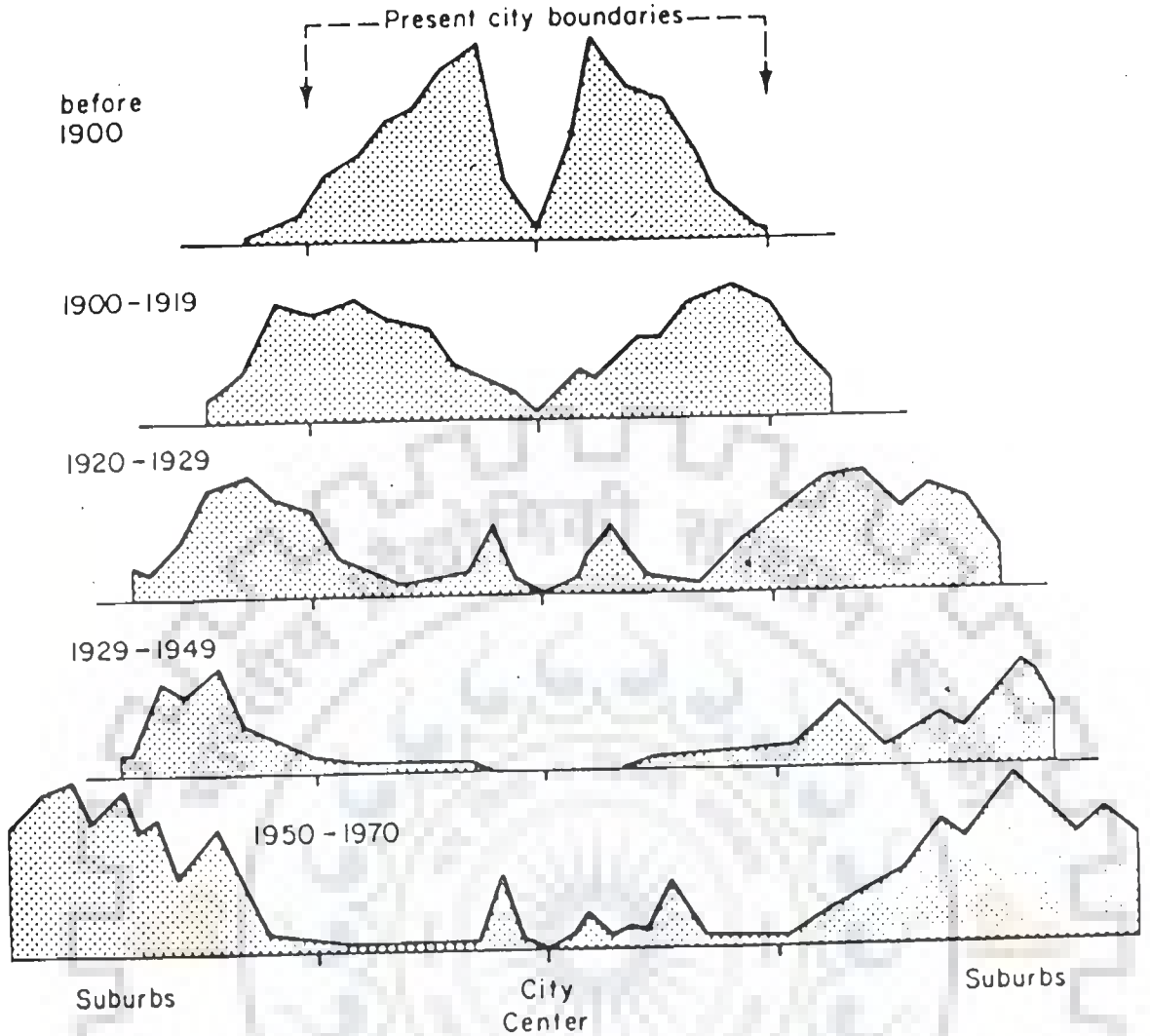


Fig. 2.6. Spatial cross section of building patterns and age of housing in a typical city.

The spatial pattern of apartment housing operations in Kochi appear to have followed a cost-benefit policy, depending on the availability, price and proximity of land to the city centre, distance from the city transport facilities available, the cost of development influenced by foundation cost etc. and the demand for the housing. This is manifested in the cyclic movements in activity, which can be observed between the core and the peripheries, depending on the demand for housing, and the increased price obtainable. With each successive increase in demand, the building activity wave has returned to the core, and a redensification of the core has taken place.

6.6.6 AN EVOLVING HIERARCHY OF TYPOLOGIES

The typology of buildings which have come up in the above mentioned trend, is unique in that, there is a mix up of medium and high rise, in the inner and central zones. In the core of the city, apartments are predominantly medium and high rise, from economic considerations. The low-rise traditional buildings which existed here, and the new apartments were to be economically and environmentally competitive to attract consumers. In the central zone, there is a mix up of high, medium and low rise buildings, although the mix up differs in the central, northern and southern subdivisions of the zone. In the outer zone, the buildings are predominantly high rise or low rise Villa type. Analysed in the background of the section above, the movement of building activity from the centre to the fringes, and followed by a back flow to the centre, can be seen in this urban residential typology. The zones and sub-zones of intense building activity have an evolving hierarchy of low, medium and high rise buildings, in the areas served by ring roads and radial roads, to suit a variety of clients.

6.6.7 SOCIAL ASPECT OF DWELLING UNIT SIZE

The Figure no. 6.18 shows the variation in the size of dwelling units, in the different typologies. There is a positive correlation between size of dwelling unit and height of building. This means that the low and middle-income group show an affinity towards lower

rise buildings. Given the density equation, such buildings are built closer to each other, and this physical proximity of apartments, finds analogue with a close knit social system. Hence, it becomes more acceptable to the majority, in the traditional society. On the other hand, the tall building with lesser ground coverage, security, luxury amenities, central location, and quality construction, becomes associated with opulence and status, analogous to that of Villa living. These buildings are hence, of larger unit size, and owned by the high income groups.

The next chapter examines the factors influencing choice of a particular residential typology and the user satisfaction derived from living in it.

CHAPTER 7

PREFERENCE FACTORS FOR CHOICE OF LOCATION AND RESIDENTIAL FORM

CONTENTS

This chapter examines the preferences for location and housing typology, by three categories of users: the general populace, the prospective consumers of ready built housing, and the occupants of multi-storeyed apartments, and the reasons for the same.

7.1 INTRODUCTION

This chapter presents the perceptions of (1) the general populace (2) the prospective clients (3) and the occupants, regarding their preferred housing typologies. Firstly, it examines the choice of the general populace to identify whether any change has taken place in the preferences for traditional housing, particularly with the emergence of new housing typologies. Secondly, it examines the preferences of prospective consumers of ready built housing, to identify their choice for location and typology. Lastly, it deals with the choice for multi-storeyed apartments by their occupants, and reasons for the same. It dwells into the criteria for choosing the particular location and residential typology, and examines the satisfaction obtained from living in it.

7.2 RESIDENTIAL CHOICES OF GENERAL POPULACE AND INTERMEDIATE ECONOMIC CLASSES

The survey of general populace was used to identify the residential choice of this group. The sample size covered 278 households, selected at random, covering all strata of social and economic levels. The schedule used for this survey is given in Appendix C.

7.2.1 HOUSING TENURE:

Of the respondents covered, 86 percent owned houses and 14 percent lived in rented houses. Of the owner group 95.26 percent were staying in their own house, the rest 4.73 percent having let it out on rent. The ownership status of the respondents are given to show that this perception was not influenced by subjective aspects. For the query 'what prompted people to actually own houses when renting is cheaper?', 48 percent reported that the most important reason was sentimental satisfaction. A weighted average ranking revealed that it

ranked higher than economic reasons Table No. 7.1 gives the weighted average rank of the various reasons for ownership as expressed by the respondents.

7.2.2 HOUSING TYPOLOGY

Survey revealed that 88.68 percent of the people preferred to stay in a house with independent garden land, within reasonable reach of the city. Only11.32 percent chose to live in a house with a little or no compound, near to work place and other facilities. This reveals that the traditional attachment to the dispersed homestead pattern remains and combined with the sentimental satisfaction of possession, the villa type is still the acceptable typology for people at large. This psychology was well understood by the GCDA, which was reflected in its first housing project at Panampilly Nagar, when they opted for duplex houses, combining the advantages of detached housing with individual staircase and independent walled up compound, but with minimal ground area, as that of group housing.

7.2.3 MODE OF OBTAINING HOUSING:

The personal involvement of the people in constructing their own house is revealed in the fact that 79 percent of them prefer to construct it by themselves. Erosion of confidence in the public housing agencies can be seen from the mere 5 percent preference for such housing, whereas housing from governmental agencies like GCDA, Housing Board etc. were in great demand till 1980's. Some of the reasons for this are faulty design, inappropriate location, inordinate delays in execution and transfer of ownership, finalisation of pricing, poor quality of construction etc. The preference pattern is as shown in Table No. 7.2.

On probing for the reasons for the above preferences as indicated in Table no. 7.2, it was found that those who opted for co-operative housing, wanted to take advantage of housing sites at better locations which co-operatives were often allotted by the planning agencies, at concessional rates. Those who wanted to buy ready made houses wanted to do so, due to lack of time and technical know how, to avoid hassles of obtaining permissions for

Table no.:7.1

Reasons for housing ownership

Reasons for owning house	Weighted average rank
Sentimental satisfaction	2.00
Economic security	2.48
Good investment	2.80
Social status	3.69
Project family name	4.94
Avail tax benefits	5.10

Source: Primary survey of general populace.

Table no.: 7.2

Mode of obtaining a house

Mode of constructing	%
Construct by themselves	79
Purchase Ready built house	10
Book housing from Public agencies	5
Book housing from Private agencies	3
Book housing from co-operative societies	3

Source: Primary survey of general populace

Table no.: 7.3

Reasons for preferred mode of obtaining a house

Mode of obtaining housing	Lack of time	Better location at cheaper cost	Cheaper interest rates for loans	Due to timely delivery	More economical	Ensure better quality and design	Attractive credit and flexible	Lack of technical know how	To avoid hassles to get planning permissions	total
Purchase Ready built house	31.43	14.29	2.86	5.71	8.57	2.86	0.00	20.00	14.29	100.00
Book housing from co-operative societies	11.11	33.33	0.00	11.11	11.11	0.00	0.00	11.11	22.22	100.00
Book housing from Private agencies	33.33	41.67	0.00	0.00	8.33	8.33	8.33	0.00	0.00	100.00
Construct by themselves	0.00	8.00	2.22	1.33	16.89	70.67	0.89	0.00	0.00	100.00
Book housing from Public agencies	14.29	7.14	0.00	0.00	7.14	0.00	42.86	0.00	28.57	100.00

Source: Primary survey of general populace

construction etc. Those who wanted to book with private agencies seemed to do so as they felt that private agencies could give them better location at cheaper cost. Those who wanted to construct by themselves felt this would give them an opportunity to have a design to their personal liking. Those who wanted public sector housing did so due to lack of time and since they thought they could obtain loans through agencies like HUDCO etc at concessional rates. These responses are summarised in Table No. 7.3.

7.3 RESIDENTIAL CHOICE OF PROSPECTIVE CONSUMERS OF READY BUILT HOUSING

The survey of residential preferences of prospective consumers of ready built housing covered a sample of 2984 respondents. This was organised by the Rotary club of Kochi, as part of 'Property show 95', and the data was made available to the researcher. The questionnaire used for the survey is given in Appendix D. The survey revealed the following trends in preferences for housing.

7.3.1 LOCATIONAL AND TYPOLOGICAL PREFERENCES

It was found that around 34 percent of the future buyers preferred to buy an apartment in the core of the city, whereas nearly 66 percent preferred a location in the suburbs. Out of the latter, 36 percent preferred apartments, while around 30 percent independent houses. This response contradicts with the fact that houses in the core were always preferred as seen in last chapter. Further, the apartments were preferred in the suburbs, even when villas were also made available at competitive rates. This indicates that there is a clear shift towards apartment typology, in spite of the fact that the memory of the detached house remain in the cultural background.

The preference of 70 percent of the people for flats typology, irrespective of the location in the core or suburb reveals two motives. Firstly, it may be assumed that there is preference for flat lifestyle. Secondly, that the flat is preferred for reasons other than lifestyle, like security of single women, and elderly, investment, organised care-taking and security .

7.3.2 PREFERENCE FOR SIZE OF DWELLING

The preferred size of dwelling unit as given by the respondents is given in the Table No.: 7.4.

Table No. 7.4

Preferred size of dwelling among prospective consumers

Plinth area required	% of respondents
1000 to 1500 sq ft	47.33
1500-2000 sq ft	21
> 2500 sq ft	5.84

Source: Survey of prospective consumers of ready built housing

Considering a unit cost of Rs. 750/ sq. ft., the pattern indicates that those who approach the building suppliers are upper middle class and high income group.

7.3.3 PREFERENCE FOR NUMBER OF ROOMS

Around 53.4 percent of the people preferred to .purchase a three bedroom house., while 36.2 percent preferred two bedroom house. Only 7.98 percent wanted a four bedroom house and 1.15 percent felt the need to have more than four bedrooms. This preference of the vast majority for three bed housing is also corroborated in the survey conducted on builders, and by the numbers of the apartments of different sizes as revealed by the flat survey. An increasing preference for privacy is seen in their choices.

7.3.4 PREFERRED PRICE RANGE

61.20 percent of the people wanted houses costing less than 10 lakhs. Nearly32.58 percent of the people preferred to purchase houses costing 10-20 lakhs. Only 4.25 percent of the people wanted to buy houses costing more than 20 lakhs. Considering the fact that one could build an independent bungalow with this investment, the preference for apartment arises mainly out of its locational advantage or its prestige value.

7.3.5 AMENITIES PREFERRED

The attitudes of the consumer towards the higher living standards can be gauged from their demand for special facilities which 58 percent of the respondents requested for. The special facilities are listed in the Table No. 7.5. It can be clearly seen from the table that the special amenities demanded by a large number of respondents relate to facilities like car parks, and recreational facilities swimming pools, health clubs, social clubs, playing courts etc., clearly, revealing their socio-economic-cultural characteristics. Others aspects important was the availability of infrastructure like water supply, electricity, drainage, garbage, etc., desire for larger drawing rooms, balconies, spaces for growing plants and pets, landscaped gardens, good quality materials etc. Those who wished for a location in the suburbs, seemed to prefer to live in scenic areas free from pollution. They were also seen to give weightage to availability of transportation aspects, proximity to essential facilities like hospitals, daily shopping etc. It appeared that that those who chose flat in the suburbs, had been concerned regarding the financial aspects as can be seen from their response regarding this. Generally those who opted for apartment in the core seemed to want to live at higher floor heights, while those in the suburbs preferred lower floors.

Table No 7.5 : Special facilities wished for by prospective consumers of ready built housing

Item	Flat in core	Flat in suburb	Villa in suburb	Total
Scenic settings, quiet and pollution free	**2.0**	**5.0**	**4.2**	**3.5**
Want to be on river front/water front/boating facility	0.9	1.7	6.7	2.7
Want road frontage	0.3	0.0	0.8	0.3
Close to bus stop and good transportation to public amenities	**1.2**	**5.8**	**5.4**	**3.7**
Close to clinic, medical shop, immediate shopping	**2.3**	**3.7**	**5.0**	**3.4**
Mosquito free environment	0.7	0.0	0.0	0.3
Wanting to be among same income, religious, social group	0.4	1.7	0.2	0.7
Wanting security	**2.4**	**3.5**	**3.1**	**2.9**
Adequate drainage and garbage disposal facility	**1.3**	**1.0**	**1.3**	**1.2**
Good lighting and ventilation	**1.7**	**1.9**	**0.4**	**1.4**
Uninterrupted water supply & electricity/ generator & lift	**5.9**	**6.7**	**4.8**	**5.8**
Want ground floor	0.4	0.4	0.0	0.3
Want 1st, 2nd or 3rd floor	0.8	0.2	0.4	0.5
Want top floors	1.1	0.0	0.0	0.5
Want attractive appearance for exterior	0.5	0.0	0.0	0.2
Want day care in premises	0.3	0 0	0.6	0.3
Want guest rooms in complex	0.3	0.0	0.0	0.1
Want room for servants & drivers	**1.7**	**1.7**	**0.6**	**1.4**
Want yard space for garden, to grow pets	0.1	0.0	2.5	0.7
Want freedom to choose finishes	0.3	0.0	0.2	0.2
Want completely furnished house	0.4	0.6	0.0	0.3
Want laundry facility	0.3	0.6	0.0	0.3
Want loft and other storage space	0.0	0.4	0.4	0.2
Want ward robe in bedrooms	**1.6**	**1.0**	**0.6**	**1.1**
Want centralised A/C, /provision for A/c	**3.9**	**1.3**	**2.5**	**2.7**
Specify cabinet provision, work area and platform top of kitchen	**1.6**	**1.5**	**1.0**	**1.4**
Have requirement & specification of attached toilets, number , finishes,	**2.5**	**2.5**	**1.7**	**2.3**
Have need for pooja rooms	0.3	0.0	0.2	0.2
Need many balconies	1.2	1.3	1.0	1.2
Need large living rooms	**1.6**	**0.4**	**0.2**	**0.9**
Want good floors, particulary marble and granite	**3.1**	**2.5**	**2.9**	**2.9**
Want teak wood ,rosewood panelling& frames	0.7	0.4	0.0	0.4
Want intercom facility	1.6	0.8	2.1	1.5
Need dish antennae/cable TV	**4.0**	**1.7**	**3.1**	**3.1**
Need common hall for social gatherings/ library/ indoor games	**4.5**	**3.7**	**2.1**	**3.6**
Childrens club	0.8	0.0	0.0	0.3
Childrens playground with play equipment	**6.3**	**6.0**	**5.8**	**6.1**
Adult playing courts/ tennis courts	**4.5**	**1.9**	**5.4**	**4.0**
Landscaped area and garden	**4.7**	**5.6**	**4.2**	**4.8**
Jogging track	0.1	0.2	0.2	0.2
Swimming pool	**10.7**	**7.3**	**10.0**	**9.5**
Health club	**7.3**	**6.0**	**8.1**	**7.1**
Car park	**11.3**	**15.8**	**7.3**	**11.5**
All the best modern amenities	0.4	1.2	1.5	0.9
Limited facilities within budget	**2.1**	**4.2**	**3.1**	**3.0**
	100.0	100.0	100.0	100.0

Source: survey of prospective consumers of ready built housing

7.4 RESIDENTIAL CHOICE OF MULTI-STOREYED APARTMENT OCCUPANTS

Both the above surveys namely, the general populace and the prospective consumers of ready built apartments do not take into consideration the present living condition. The former carries the nostalgia of the past and while the latter gives their responses for the future. A real insight into the preferences, the expectation and realisation; and the factors which give them the overall satisfaction in the different types of residential typologies can be had only through a survey of the apartment occupants. With this view, a survey of occupants of apartment buildings was conducted for a sample of 97 households living in different locations in the city, in houses of different quality, in both low and high rise, and in living in different floors. The schedule used for this survey is given in Appendix B. The following three aspects were investigated in this survey.

1. the factors for the choice of this built form in place of the traditional house,
2. criteria utilised in favouring a type and location in the city
3. the expectations and satisfaction regarding various aspects of the multistoreyed buildings.

7.4.1 REASON FOR CHOOSING KOCHI

It was found that among the apartment occupants, nearly 95.83 percent had chosen to buy an apartment in Kochi because of socio-economic reasons. Around 40 per cent had chosen it due to reasons of employment, while for a good 17 percent, it was the educational facilities in the city. Nevertheless, it is significant that 4 per cent had chosen Kochi only from investment point of view, with no other socio-economic reasons attached to it. Other reasons are given in Table no. 7.6

Table 7.6

Reason for choosing to purchase apartment in Kochi.

Reason for choosing Kochi	
Good investment	4.17
Like cosmopolitan lifestyle	8.33
Other family reasons	12.50
Schooling for kids	16.67
Belong to Kochi	18.75
Reasons of employment	39.58

Source: Survey of apartment occupants

7.4.2 REASONS FOR OPTING FOR READY BUILT HOUSING

The Figure no.7.1 gives the summary of the reasons for opting apartment dwellings by the occupants. It has been observed earlier that house construction was, and still is, largely undertaken by households themselves in Kerala. It was found that lack of time accounted for 36 percent of the reason for opting for ready built housing. This was followed by hassles in obtaining necessary approvals etc. While lack of time was the most important reason generally, it was found that among low rise occupants, the difficulties in obtaining loans has been the most important factor to opt for ready built housing. Most builders would arrange to obtain loans for properties purchased from them, and this facility seems to have been important for the less affluent walk up apartment residents. On the other hand, it was the lack of time and hassles which were the propelling reasons for high rise occupants to opt for such housing. The other reasons for opting the ready built houses are given as lack of experience and lack of confidence. Figure No 7.2 presents the reasons given by low rise and high rise occupants separately.

7.4.3. CHOICE CRITERIA FOR OPTING TO LIVE IN MULTISTORIED APARTMENT HOUSING:

A weighted score on the reasons for opting to live in an apartment instead of an independent house among the entire sample of multistoreyed housing occupants revealed that,

Figure no. 7.1

Reasons for opting for a ready built house

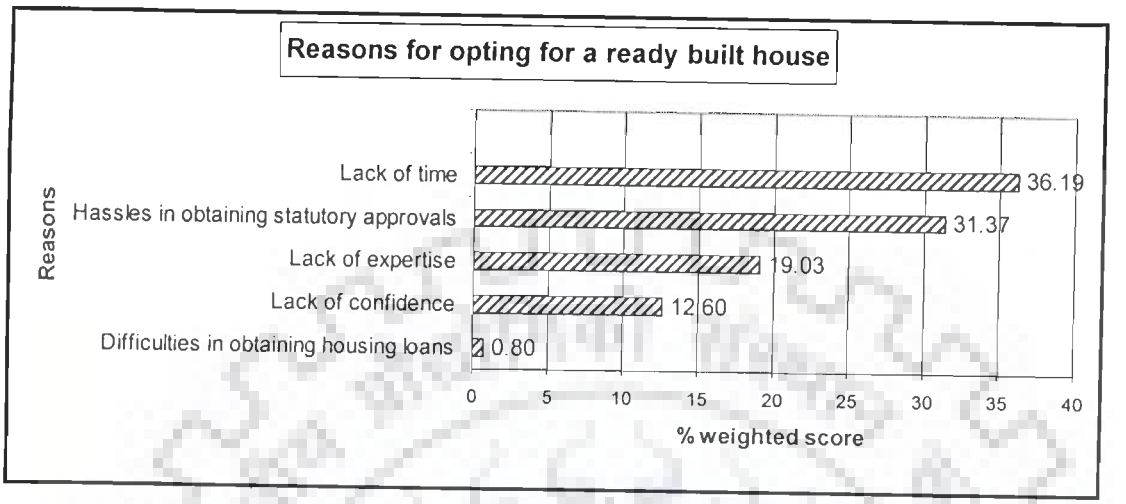


Figure no. 7.2

Reasons for opting for a ready built house by low rise and high rise occupants

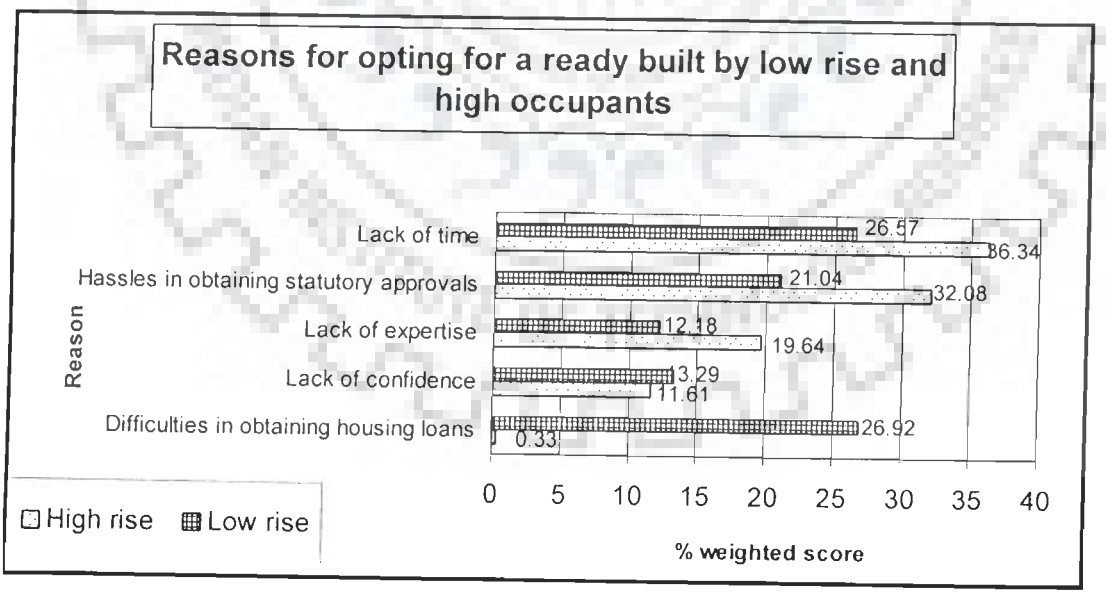


Figure No. 7.3

Choice criteria for opting to live in multistoreyed apartments

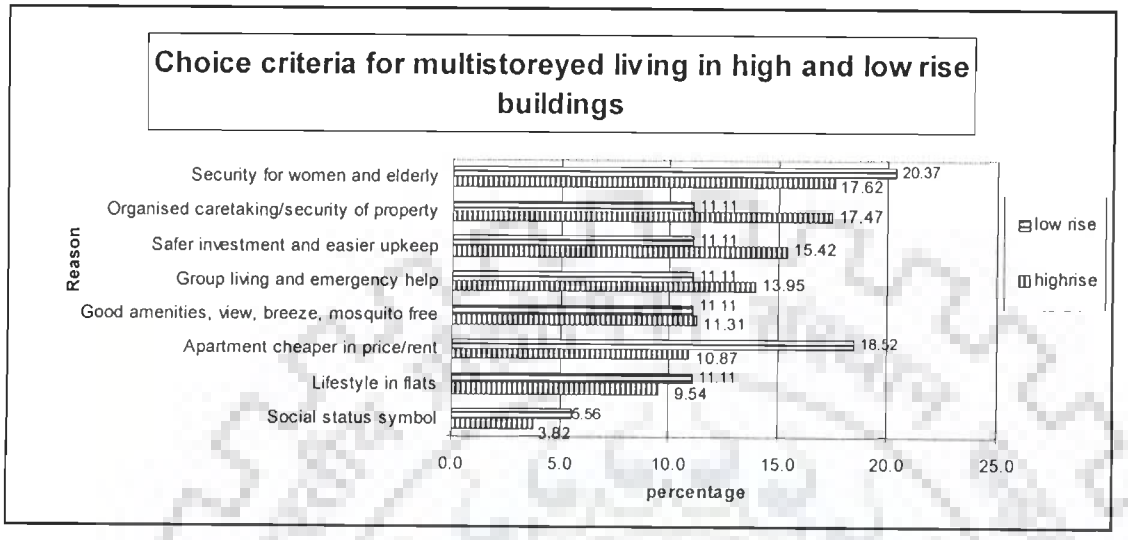
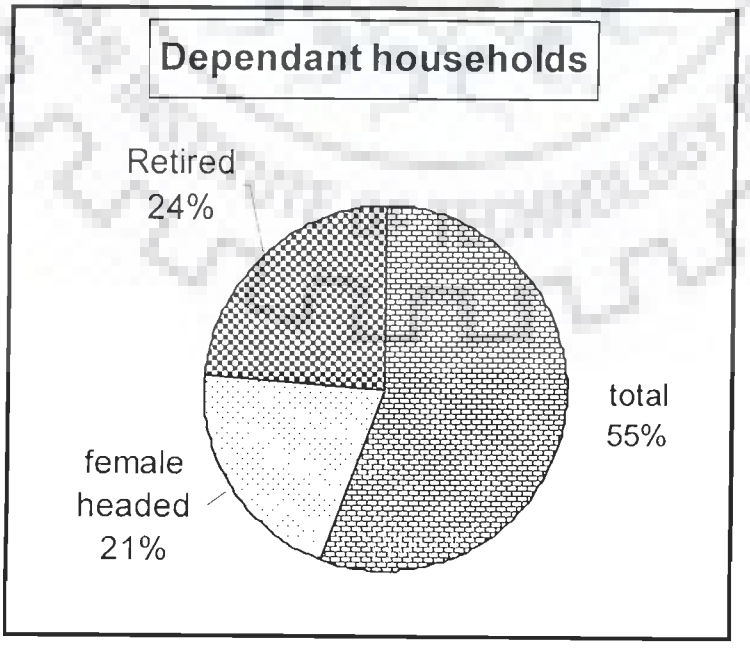


Figure No. 7.4

Characteristics of households living in multi-storeyed apartments



it was the security associated with living in multistoreyed buildings that was the most important reason for choosing this form, followed by the need for a safe investment, organised caretaking and advantages of group living.

While security ranked among the most important reasons for both the high rise and walk up apartment occupants, the weightage given to other factors varied. Refer figure no 7.3. It was found that the unaffordability of an independent house at a central location was an important reason for the choice of low rise housing, followed by a feeling of greater social status and availability of better living environment. In general, the walk up apartments in Kochi are comparably cheaper than high rise due to being located away from main roads, having lesser plot area, savings in lift costs, and since they have no any special amenities. On the other hand, facilities for organised caretaking, safe investment and easier upkeep, group living and emergency help were the important reasons for occupants to opt for high rise apartments.

The overemphasis on security and organised caretaking has been mainly due to the large proportion of retired and dependent households occupying the apartments. Refer Figure No.7.4. 45 percent of female headed households had their husbands employed abroad. These, and the elderly who lived here, often had to leave their houses unattended, while on visits to children, or abroad. In addition, many of these apartments were as already observed in the last chapters bought by NRI's or speculators who wished to keep these apartments locked. This tendency was mainly due to two reasons: firstly, the rent control act, protected the tenant from eviction in such a way, that it created fear in the mind of the owners, regarding obtaining the apartment back. Secondly, most of the high rise apartments were expensive, leading to a reluctance to let it out due to fear of the house being damaged. All these reasons required

some form of absentee owner caretaking of their houses, which was possible only in multistoreyed apartments with owners associations.

7.4.4 CRITERIA FOR CHOICE OF LOCATION

It is well known that location is a multi-dimensional aspect. Much research has highlighted the relationship between the working zone and the residential zone. The survey of builders, has nevertheless revealed, that in Kochi, builders choose location, based on transportation routes rather than work zones. The survey of occupants also revealed that proximity to transportation routes ranked highest among locational choice criteria. Refer Figure no. 7.5. One of the major reasons for this is the good public transportation system in Kochi. Kerala is one of the states with the highest road density in the country. The integrated network of road, rail, and water transport provide efficient and easy commutation. How ever, cheap para transit facilities like cycle rickshaws[1] are absent in the state as a whole. Auto rickshaws although available, are costly, and concentrated only around road junctions and transport terminals. Kerala also ranks highest in literacy in the country. Schools are available well distributed in the city, and most children travel to school by school buses, making proximity to schools unnecessary. This is one of the reasons for the low priority given to proximity to schools and work zones and greater importance given to markets and shopping.

A comparison of high and low rise development occupants revealed that even though location was not considered the most important by low rise occupants, both the classes gave highest importance for proximity to public transportation routes, followed by markets and shopping. Refer Figure no 7.6. While proximity to schools was considered important by low rise dwellers, it ranked very low among high rise occupants. Appreciation of property value

[1] The upliftment of the economically weaker classes and high literacy, has led to such occupations considered demeaning by the labour class.

Figure No. 7.5

Locational choice of multi-storeyed apartment housing

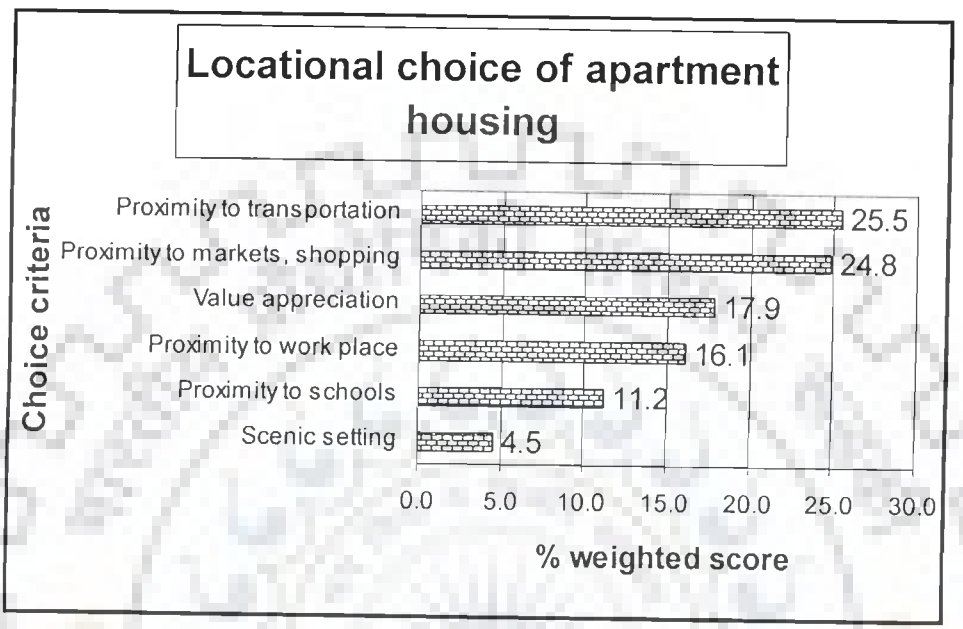
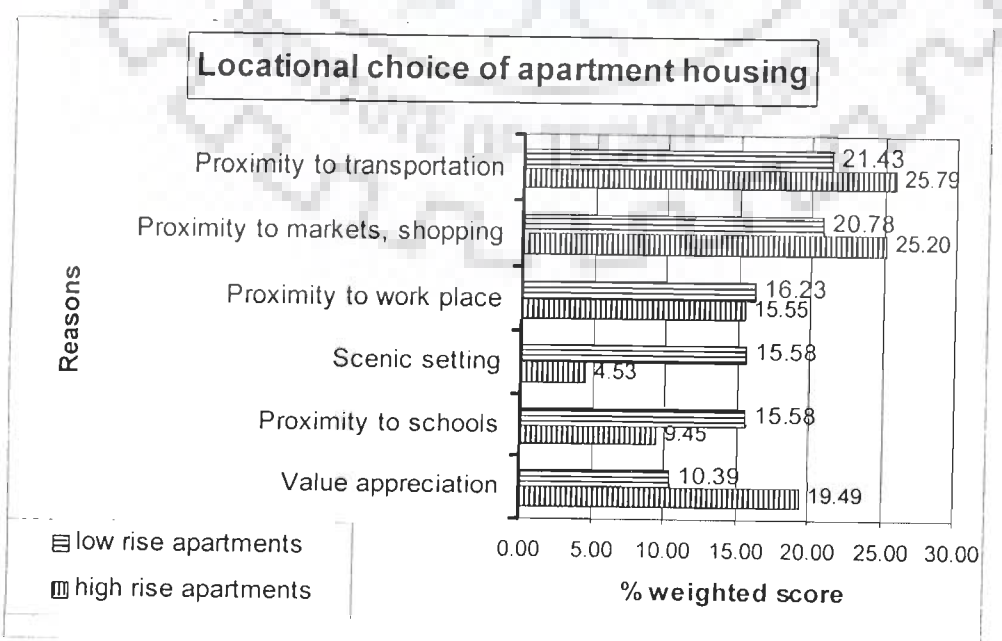


Figure no. 7.6

Locational choice of multisoreyed apartment housing by low rise and high rise occupants



was a criteria given nearly as much importance as transportation and proximity to markets etc by high rise owners. This is particularly due the high cost of these apartment.

7.4.5 CRITERIA FOR SELECTING A PARTICULAR MULTI-STORIED APARTMENT BUILDING IN THE CITY

Given the wish to live in a multi-storeyed building, and the availability of such housing of different characteristics, and at different locations in the city, it is important to identify the criteria based on which such housing is evaluated by households. The survey revealed that the locational aspects of the building was the most important reason for settling on the purchase of an apartment followed by financial considerations Refer Figure No. 7.7. Good plan was ranked higher than the construction quality. It was seen that all major suppliers were specifying and delivering identical quality of work and hence this response. While only about 13 percent were concerned regarding the reliability of the builder, the group who considered it important were particular regarding the brand of their product due to concerns regarding easy resaleability and steady market obtainable for such housing[2]. Among other reasons, most chose buildings based on proximity to location of old parents, other relatives or near a plot in which they hoped to construct an independent house later in their life.

A comparison of occupants in low and high rise apartments revealed that there was a difference in the criteria for choosing apartment buildings. Refer Figure No. 7.8. For low rise occupants, financial considerations, good plan and reliability of the builder were most important while location, construction quality and amenities were of secondary importance. This is mainly because the cheaper price of such housing usually compromise on these

[2] In Kochi, the apartment housing promoted by the Southern Investments is considered to be superior in quality, the builders more reliable due to longer association with the city, and though slightly more priced, most affluent people consider it prestigious to own and SI apartment.

Figure no. 7.7

Choice criteria for choosing a particular apartment.

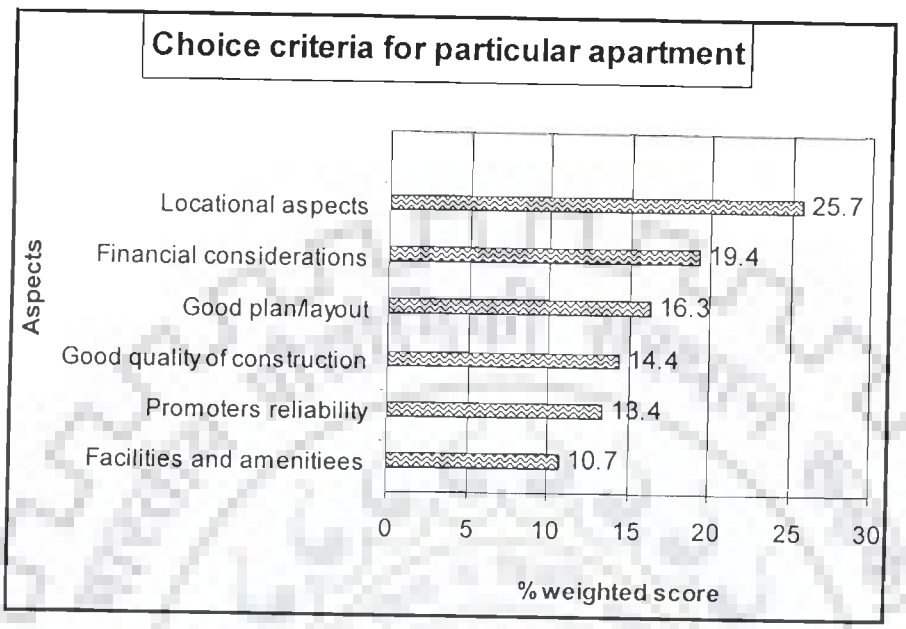
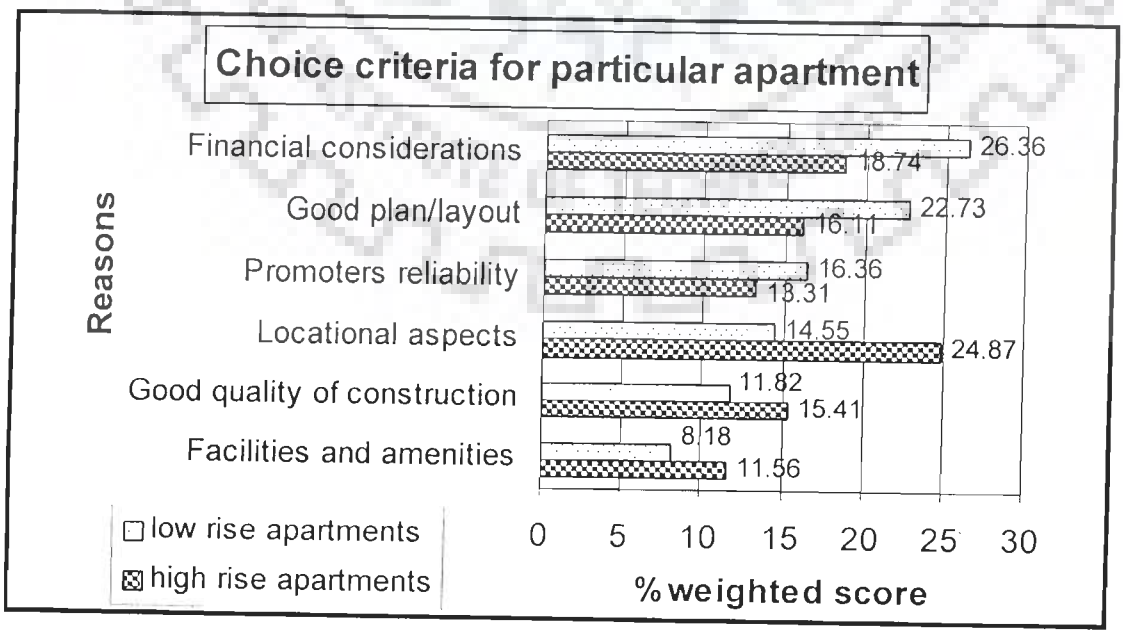


Figure no 7.8

Choice criteria for choosing a particular apartment among low rise and high rise occupants.



aspects to achieve lower price of housing. Most of the low rise housing is away from main roads, in interiors, and of cheaper finishes and without amenities like landscaped gardens, swimming pools etc, usually found in high rise apartments. Hence the former three reasons were the only ones on which choice could be made, without incurring additional cost on housing. On the other hand, locational aspects were ranked even higher than financial considerations in high rise buildings. It was followed by good planning and construction quality.

7.4.6. SATISFACTION FROM LIVING IN MULTI-STOREYED HOUSING

Satisfaction from various aspects of living in apartments was gauged by picking respondents of different tenure status and living in various floors in apartments. Refer Table.No.7.7.

Table No 7.7

Tenure status and floor occupied by apartment occupants

Tenure status	**percentage**
no of owners	73.85
no of tenants	26.15
floor presently occupied	**percentage**
ground and floor I	29.23
floors two to four	15.38
on fifth and sixth floors	23.08
above 7 floors	32.31

Source: Primary survey of apartment occupants

A weighted average score found that occupants of both high and low were generally dissatisfied with the quality of landscaping of the ground spaces and the amenities provided in the flats. They were most satisfied with the layout of the building, and good behaviour of neighbours.

In addition, in the case of low rise apartments, aspects of dissatisfaction consisted of lack of attractive views, security, organised caretaking, lack of good maintenance and

[3] The upliftment of the economically weaker classes and high literacy, has led to such occupations considered demeaning by the labour class.

adequate parking facilities. Aspects most satisfied with were the layout of the house and other areas, freedom from problems of bad odours, and good orientation. In high rise, least satisfaction was regarding dust, and lack of gardening facilities. Highest satisfaction was regarding vertical circulation, good maintenance, visual and acoustic privacy, breeze, lighting and ventilation, sufficiency of balconies and carparking and security.

7.4.7 TYPOLOGY PREFERRED IF GIVEN CHOICE

Table No 7.8

Preferred housing typology if given choice

Apartment type presently living in	Independent house	Walk up apartment	High rise apartment
All apartments	37.11	15.46	47.42
lowrise	66.67	28.57	4.76
highrise	28.95	11.84	59.21

Source: Primary survey of apartment occupants

On questioning the occupants on their preference for housing typology, given a freedom from the constraints that had made them choose the apartment type they were presently living in, they responded as given in the Table no . 7.8 .

It was found that generally there was a low preference for walk up apartments. Among those who lived in low rise, 66 per cent wished to live in and independent house. It was found that they had no preference what so ever for highrise as revealed by the mere 5 percent who had such a wish. Among the high rise occupants, it was found that while nearly 60 per cent were happy with the typology they were living in, around 28 per cent wished to live in and independent house, nurturing dreams of a villa to live in later in life.

7.4.8 REASONS FOR PREFERENCE OF DIFFERENT RESIDENTIAL TYPOLOGIES

On their reasons for such preferences, it was found that though who opted for multifamily living, did so mainly considering the security aspect, freedom from cleaning yards, easy upkeep, and to minimise problems of noise, dust and mosquitoes. It occupied the

most important reason for those in high rise apartments. Those who chose walk up seemed to be apprehensive regarding dependence on lifts. It was clearly seen that the one third who still longed for an independent house, did so due to cultural affinity and wanting a personalised dwelling and greater privacy. Refer Table 7.9.

It was found that those who wanted to live in independent houses but were constrained to choose high rise, showed a tendency to fulfill their dreams of being close to the ground , as revealed by their choice of floor heights. It was found that nearly 62 per cent of such respondents were presently staying in floors lower than second. Nearly 20 per cent also chose ground floors, usually considered trouble some due to problems of parking, and other activities in the common spaces, problems of privacy etc. Obviously, it was pressing problems of security or organised caretaking that had led them to this compromise, where they could obtain the desire of being close to the ground, at the same time feeling secure. Refer Table no. 7.10. In this context it may be relevant to note that nearly 29 per cent of the apartment occupants owned other houses in the city. Out of this only 16 per cent had rented it out. 50 per cent had kept it vacant, and were living in these apartments for the advantages it offered. The main reasons for not occupying these were difficulties in maintaining yards, and security in case of retired and female headed households.or young families, whose lifestyle required them to leave their homes unattended often.

It was also expressed by 27 per cent of the occupants that they wished to purchase another flat. Their preferences for price ranges preferred is shown in Table no.7.11.It is that only one third of the occupants wished to purchase flats of around 8 lakhs. Nearly 52 percent wished to book flats between 11 to 20 lakhs or more clearly revealing the income category of those who lived in apartments in Kochi. It may be noticed that unlike as in many cities, apartments are not the choice of those with limited financial capabilities, but those of the very

Table no 7.9

Reasons for choice of particular typologies

Reason for choice of independent typology	% respondents
Good privacy and greater freedom	25
Cultural affinity for this type	37.5
Individualistic design of house	37.5
Reason for choice of walk up	
Easy climbing	61.54
Need security	15.38
Easy upkeep of house, freedom from cleaning yards	7.69
More privacy compared to high rise	7.69
Freedom from mosquito, which are greater in independent houses	7.69
Reason for choice of high rise	
Need security	35.14
Like lifestyle in flats	29.73
Easy upkeep of dwelling, freedom from cleaning yards	18.92
Organised care-taking in absence of owner	8.11
Less pollution of noise and dust	8.11

Source: survey of apartment occupants

Table no. 7.10

Present floor occupied by those who want independent house

Present floor occupied by those want independent house	
Ground	19.04
First	28.57
Second	14.28
Fourth	4.76
Fifth	4.76
Sixth	9.52
Seventh	9.52
Ninth	9.52

Source: survey of apartment occupants

Table no.7.11

Price range preferred

Price range of apartments they wished to book for	% of those who wanted to book new flats
< 5 lakhs	0
5-8 lakhs	29.63
8-11 lakhs	18.52
11-15 lakhs	22.22
15-20 lakhs	29.63

Source: survey of apartment occupants

rich who can easily afford and independent house within the city. Secondly, it also reveals the wish for the second home by these who appear to have money for investment.

7.5 SUMMARY

The survey of the general public indicates the strong affinity of the Keralites to own a house out of (1) a general feeling of possession (2) a form of security and (3) a symbol of social status. Given a choice, one would construct his own house rather than accepting a typical plan or ready to occupy product by a public or private builder.

The survey of the prospective consumers of ready built housing reveals that this desire is latent in their heart, but given the realities, there is a clear shift towards apartment typology. The sample of this survey is clearly drawn from upper middle income and high income groups, which is reflected in their choice of central location, larger size of dwelling in terms of area, number of rooms and luxury amenities.

The survey of apartment occupants reveals that they chose to purchase ready built housing, because of lack of time and hassles involved. It was preferred by most of them, because it provided security on one hand and was a sound investment on the other. The choice criteria for particular typologies , locations or apartments was influenced by many factors mainly socio-economic. Highrise apartments had a large share of dependent households who desired for security, easy upkeep and organised caretaking. A majority who lived in highrises preferred to live there. About 30 percent of high-rise occupants and 66 percent of low-rise occupants still nurtured a desire to live in independent houses, even though they had opted for multi family living, due to other reasons. In spite of such desires, is found that there is a clear trend for preference for high rise typologies among the respondents,

with around 30 percent of them owning other houses in the city , yet opting to live in high rise apartments .

The next chapter attempts to examine the satisfaction obtained by the occupants who have opted to live in multi-storeyed apartments, so as to enable identification of those aspects which contribute to satisfaction.

CHAPTER 8

MODELLING USER SATISFACTION

CONTENTS:

This chapter attempts to model user satisfaction, by identifying the important dimensions contributing to it, from a set of identified variables, using factor analysis. Attempt is made to identify the factors, and to work out variable sensitivity to user satisfaction, using

multiple regression techniques, to enable the formulation of policy guidelines for planning and architectural design.

8.1 INTRODUCTION

The previous chapter has dwelt on the preference factors for choosing multi-storeyed apartment typology in Kochi. This chapter aims at assessing the satisfaction obtained from living in such typologies. Factor analysis tools are used to isolate the important components contributing to satisfaction, and to identify the significant variables which contribute to user satisfaction.(41, 268) Attempt is made to pick out control variables, which may be utilised for policy formulation.

8.2 ANALYSIS

The survey of occupants of multi-storeyed residential buildings, undertaken to identify the choice criteria for opting to live in such residential typologies, and the satisfaction from living in them, was used for the analysis of user satisfaction. 10 per cent of the occupants of the multi-storeyed residential buildings, selected through stratified random sampling as detailed in section 1.5.4 of chapter 1, were chosen for this survey. The respondents were asked to respond to a set of questions pertaining to the reasons for choice of a ready built house against undertaking construction on one's own, as is traditional; the choice of a multi-storeyed residential building over the traditional independent houses; criteria for the selection of a particular location, and a particular building in a location; satisfaction with the various infrastructural facilities, the positive and negative aspects of their dwellings and whether they were likely to hold the same preference for typology and floor chosen, after their experience of living in the particular dwelling. The schedule used for the survey is presented in Table no. 8.1. The response of the occupants on a set of 30 interdependent

variables in the survey, consisting of a mixture of characteristics of the household, the building typology, and the satisfaction derived from the various aspects of multi-storeyed living, was used for analysing user satisfaction. Respondents were asked to indicate their satisfaction from the various aspects on a Likert scale increasing from 1 to 5. An objective rating of satisfaction level on a 0 to 100 scale was used to measure overall satisfaction.

8.2.1 CHOICE OF FACTOR ANALYSIS AS THE ANALYTICAL TOOL

In a conventional study, the variables chosen to study user satisfaction, are selected and studied one at a time. They are then analysed using multiple regression techniques (167). In a human behavioural research many of these may be highly intercorrelated. Hence, it is difficult to partition the contributions of all variables unambigiously, owing to a weakness called multicollinearity. Further, some are selectively chosen for inclusion as the variables, while others are selectively omitted. In analysing the data of the survey of occupants connecting all the 30 variables, an intercorrelation matrix was obtained connecting all the 30 variables, with the user satisfaction level. It was seen from this intercorrelation study, that many of the independent variables, had very little correlation with the satisfaction level. Hence, it was not quite clear from this correlation study, which were the real variables that had to be included in the regression model. Further, in order to reduce the dimensions to a meaningful number, it was decided to use factor analysis tools in this research.

A. Factor analysis:

Factor analysis is a multivariate statistical method whose primary purpose is data reduction and summarisation. It attempts to analyse the interrelationships among a large number of variables and then explaining these variables in terms of their common underlying dimensions or factors (91). For statistical analysis the SPSS Package Ver.7.5 was utilised.

Figure no.8.1 shows the steps followed in the application of factor analysis techniques. R factor analysis has been used to identify the set of dimensions that are latent in thirty

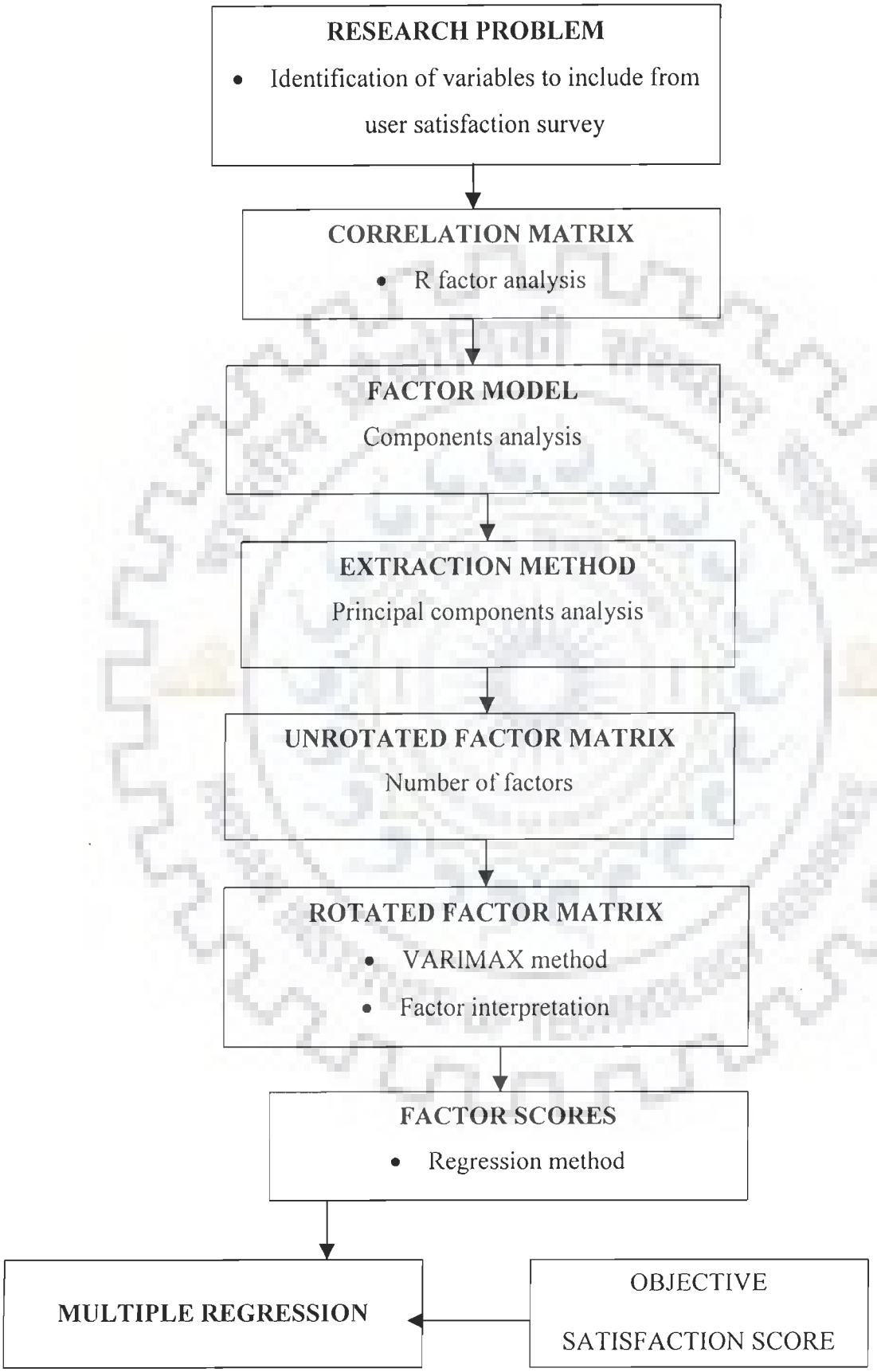


Figure No. 8.1: Outline of method used

variables used for the analysis Since the objective of the research was to summarise the inter-correlations between the variables , the R factor analysis and the components factor model was used. Since the unrotated factor solutions can only achieve the objective of data reduction, the rotational method was used to obtain simpler and theoretically more meaningful factor solutions. The VARIMAX method of rotation was used for this. Only factor conditions for positive definiteness were taken. Only factors with Eigen Values more than 1 were considered significant for extraction of the factors as it is considered more reliable, when the number of variables is between 20 and 30. This factor analysis was done separately for the total samples (97 apartments) and for the low rise walk up of less than four storeys in height (21 numbers) and high rise of greater than four storeys in height (76 numbers).

B. Factor Structure Study

Tables numbered 8.2, 8.3, 8.6, 8.9 and 8.10 shows the Factor structure matrix with the Communalities, Eigen values, and Rotated component matrix for the total sample, high rise and low rise samples, respectively. Though factor loadings more than $\pm$ 0.40 may be considered significant, only factor loadings greater than $\pm$ 0.60 were considered in this analysis. Since all the factors were having high intercorrelation with one or two variables and nearly zero correlation with others, it was possible to identify the factors and their traits unambiguously in the components extracted.

The factor scores for each of the components was obtained from the factor analysis. Multiple regression analysis was undertaken using factor scores to explain the variance in user satisfaction level. The coefficient of determination, the standardised values of regression values and are t values of the multiple regression analysis with factor scores for the total sample, low rise and high rise are given in tables 8.4, 8.7 and 8.11 respectively. From the factor structure tables, it is clear that except for the first factor which has very high loading on many variables, several of the other factors are loaded on only one or two variables. It is

because of this virtue, it was possible to identify the character of each of these factors without overlaps and confusions. Since many of the factors which have emerged after factor rotation, have been found to have significant correlation with a few original well grouped vector variables, it is advantageous to run regression models using most significant original variables, so that interpretation becomes far more easier than using factor dimensions. Hence, step-wise regression using original variables have also been attempted. The coefficient of determination, the standardised values of regression values and are t values of the multiple regression analysis with original variables for the total sample, low rise and high rise are given in tables 8.5, 8.8 and 8.12 respectively. The stepwise additive method was used to determine the best predictive model.

8.3 ANALYSIS OF TOTAL SAMPLE

8.3.1 FACTOR COMPONENTS FOR TOTAL SAMPLE

Ten components were extracted from the factor analysis considering all the apartments surveyed for this work. Refer Table 8.2 and 8.3. This accounted for 76.8 percent of the variance. The first factor was able to extract 14 per cent of the variance, while the last factor was able to extract only 4.5 per cent of the variance.

Table no.:8.2 **Factor components and variance extracted for total sample**

Names of interpreted factors	Height factor F_1	Essential F_2 infrastructure	Prosperity F_3	External F_4 environment	Life cycle F_5	Architectural Fenestration F_6	Social interaction F_7	Neighbour behaviour F_8	Architectural. Design F_9	Bio-aesthetic F_{10}
Rotation Sums of Squared Loadings										
Total	4.239	3.8074	2.2231	2.1665	2.117	1.9427	1.8504	1.6852	1.647	1.3716
% of Variance	14.13	12.691	7.4102	7.2217	7.056	6.4757	6.1681	5.6174	5.489	4.5722
Cumulative %	14.13	26.821	34.232	41.453	48.51	54.986	1.154	66.771	72.26	76.833
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.										
a	Rotation converged in 10 iterations.									

Table no. 8.3

Rotated component matrix for total sample

ROTATED COMPONENT MATRIX FOR TOTAL SAMPLE											
S.no	Variables	Factor components									Communalities
		F_1	F_2	F_3	F_4	F_5	F_6	F_7	F_8	F_9	F_{10}	
X_1	Floor occupied	**0.871**	0.088	0.049	-0.047	-0.096	0.078	-0.141	0.140	0.112	-0.035	0.840
X_2	View	**0.852**	0.060	0.023	0.043	-0.102	0.044	-0.205	-0.086	0.151	0.075	0.822
X_3	Breeze	**0.781**	-0.033	-0.084	-0.023	-0.101	0.090	0.150	-0.173	-0.083	0.214	0.743
X_4	Total floors in building	**0.695**	0.152	0.148	-0.220	0.084	0.116	-0.206	0.271	0.133	-0.328	0.838
X_5	Total apartments	**0.617**	0.052	-0.012	0.168	0.137	0.295	-0.087	0.317	-0.110	-0.414	0.810
X_6	Preferred type of building	**0.459**	0.231	0.141	0.140	0.166	0.052	-0.101	0.112	-0.449	0.230	0.611
X_7	Water supply	0.006	**0.804**	-0.185	0.002	-0.099	0.093	0.151	-0.048	0.076	0.088	0.738
X_8	Garbage	0.039	**0.762**	-0.145	-0.060	0.015	0.132	0.002	0.110	0.037	-0.210	0.682
X_9	Arrangements for repair	0.229	**0.732**	0.092	-0.196	0.246	0.084	0.079	-0.108	-0.108	-0.095	0.742
X_{10}	Maintenance	0.335	**0.712**	0.146	-0.169	0.203	0.096	0.152	-0.109	-0.110	0.147	0.788
X_{11}	Vertical circulation	-0.120	**0.698**	0.120	0.162	-0.081	0.006	-0.054	0.030	0.075	0.135	0.577
X_{12}	Power supply	**0.501**	**0.558**	-0.197	-0.100	0.113	-0.283	0.131	0.110	0.229	0.072	0.791
X_{13}	Security	**0.458**	**0.518**	0.057	-0.366	0.165	-0.015	0.154	0.121	-0.224	-0.132	0.749
X_{14}	Non resident keralites	-0.061	-0.039	**0.834**	0.092	0.093	0.119	0.241	-0.023	0.067	0.014	0.795
X_{15}	Female headed households	0.118	-0.185	**0.803**	0.024	-0.192	0.021	-0.031	-0.053	0.073	0.018	0.740
X_{16}	Income	-0.035	0.370	**0.673**	0.088	-0.210	0.306	-0.049	0.114	0.049	-0.086	0.762
X_{17}	Noise pollution	0.104	-0.054	0.117	**0.908**	-0.043	0.024	-0.051	0.056	-0.065	-0.061	0.868
X_{18}	Dust	-0.167	-0.049	0.052	**0.851**	0.006	-0.090	0.018	-0.060	0.075	0.164	0.802
X_{19}	Age of husband	-0.055	0.026	0.040	0.009	**0.927**	-0.090	-0.101	0.020	0.045	0.037	0.887
X_{20}	Age of wife	-0.049	0.108	-0.311	-0.045	**0.886**	-0.114	-0.089	-0.017	0.011	0.074	0.925
X_{21}	Lighting	0.068	0.121	0.150	0.059	-0.129	**0.858**	0.011	0.058	0.100	0.045	0.813
X_{22}	Ventilation	0.210	0.119	0.120	-0.160	-0.065	**0.841**	0.080	-0.024	0.148	0.030	0.839
X_{23}	Social interaction	-0.125	0.256	0.102	0.083	-0.025	0.114	**0.787**	-0.065	0.090	-0.164	0.770
X_{24}	Neighbours recognisable	-0.058	0.214	0.039	-0.388	-0.205	-0.002	**0.635**	0.149	-0.037	-0.146	0.691
X_{25}	Neighbours close contact with	**-0.496**	-0.150	0.089	0.044	-0.158	-0.070	**0.611**	0.003	0.022	0.270	0.755
X_{26}	Neighbour behaviour	-0.022	0.002	-0.076	-0.160	-0.029	-0.080	-0.021	**0.838**	-0.094	0.188	0.786
X_{27}	Acoustic privacy within building	0.153	-0.023	0.075	0.166	0.028	0.147	0.075	**0.762**	0.311	-0.060	0.765
X_{28}	Architectural plan	0.089	0.129	0.061	0.035	-0.012	0.097	-0.097	0.079	**0.814**	0.002	0.716
X_{29}	Visual privacy	0.133	-0.058	0.225	0.021	0.183	0.236	0.300	0.092	**0.628**	-0.055	0.658
X_{30}	Gardening facilities	0.049	0.055	-0.018	0.119	0.125	0.093	-0.142	0.159	-0.074	**0.808**	0.748

The factors were interpreted as:

1. **Factor 1:** This is interpreted as a **Height factor** as it is predominantly related with the height and bulk of the apartment building, and the satisfaction obtained from being positioned at a particular height. It is observed that, as this factor score increases, the respondents are found to increasingly prefer high rise apartments, are positioned in higher floors, and are able to obtain greater amount of breeze, and view. In Kochi, organised arrangements for maintenance, security, and generators to take over during power failures, are an essential feature of high rise buildings. Hence, these variables are also found to be positively correlated with this factor. The negative correlation with the variable 'close contact with neighbours' reveals that, interaction with neighbours appears to get progressively poor, with increase in this factor, reflecting poor social interaction, in high rise typologies.
2. **Essential infrastructure:** This is interpreted as a factor predominantly related to the essential infrastructural services, required for an enhanced quality of living within an apartment building. It is observed that as this factor score increases, the respondents are more satisfied with water and power supply; garbage disposal and vertical circulation facilities; and organised arrangements for repair, maintenance and security. All high rise residential buildings are provided with generators, which take-over during the frequent power failures in the city, which provides great satisfaction to the residents. All these buildings also have round-the-clock security. Owner associations are mandatory and are active in maintenance, and providing such services as repair, paying of water, power, telephone bills etc., which is of great convenience for women and elderly. The positive correlation with income, probably points to the fact that, the respondents with higher income are able to obtain apartments, which are more satisfactory in these aspects. This

factor appears to represent respondents belonging to high rise typologies, as can been seen from the positive correlation, with factors representing high rise typologies.

3. **Prosperity:** This factor was interpreted as one predominantly related to monthly income, the number of non resident Keralites and of female headed households. (either wives of NRI's or rich widows, who form the major group of female headed households in Kochi). It was observed that as the score on this factor increases, the number of respondent families who belong to affluent households, increases. In Kochi, the non resident Keralites working in the Middle East, form a distinct category of newly affluent. As discussed in section 3.3.2 of chapter 3, most of them leave their young wives behind. They are observed to prefer to live in cities for providing better education to their children. The security arrangements, organised repair and care-taking facilities, provided in high rise residential typologies are found to attract these households which contain only wives and children, to such building types. Most high rise typologies in Kochi are centrally located, and have luxury facilities like health clubs, swimming pools, playing equipments for children, playing courts for games, manicured lawns etc., due to which they are expensive to purchase and to maintain considering the hefty sums to the paid monthly for maintenance of these facilities. As a result, these are generally affordable only to the affluent. These affluent groups however, seem to be less satisfied with water, power, garbage disposal arrangements, and the large number of dwelling units, in these typologies.

4. **External environment:** This is interpreted as a factor predominantly related to the quality of the external environment, particularly noise and dust. It is observed that as this factor increases, the respondents are increasingly satisfied with the ability of their apartments, to filter out dust and noise. This can be achieved in two ways- by choosing locations away from main roads, and by choosing to live on upper floors. The loadings on

the variables seem to suggest that, this factor is negatively correlated with all the variables predominantly identified with high rise buildings. In Kochi, most high rise buildings are generally located in the inner and central zones. Hence, this factor seems to represent low rise buildings, which in Kochi are generally located away from the main roads, in the shadow zone of noise and dust. It was found that those wished to keep away from pollution, chose the upper floors of high rises, with the last but one floor being the most popular, considering protection from transmission of heat through the roof , in this tropical climate.

5. **Lifecycle stage** : This is interpreted as a factor predominantly related to the age of the respondents. It is observed that, this factor is positively related to age, and negatively correlated with monthly income. This factor therefore, seems to represent a class of households, with a head of household, who has retired. It appears that, these households choose to live in the lower floors of high rise buildings in the inner and central zones, as may be observed from the negative correlation with floor height occupied, and satisfaction from environmental noise, on the one hand, and positive correlation with all variables representative of building height, and size on the other. These households appear to be the most satisfied with the maintenance, organised arrangements for repair, and the security available, as part of high rise residential buildings, as they provide great convenience to such households. Discussions revealed that, their choice of lower floors, stemmed from apprehensions regarding power and elevator failures. These households are observed to be less satisfied with these aspects, and with variables like breeze, view, lighting, ventilation etc, which are better obtained on higher floors. They are also found to be less satisfied with the behaviour of neighbours, particularly with the social interaction with them, as can be seen from the negative correlation with these variables.

6. **Architectural fenestration:** This is interpreted as a factor predominantly related to natural lighting and ventilation aspects within the apartment dwelling unit, as seen from the high factor loading on these variables. It is observed that this factor is positively correlated with all variables denoting high rise typology, and upper floors, and negatively correlated to variables generally associated with low rise building typologies. Generally, lighting is better as one moves higher, mainly due to the negative effects of thick vegetation and neighbouring buildings, at the lower floors. The positive correlation with income, probably points out that, affluent groups are the ones occupying high rise typologies.
7. **Neighbour behaviour:** This was interpreted as a factor relating to good behaviour and quietness facilitated by neighbours. As the score on this factor increases, satisfaction from having well behaved neighbours, acoustic privacy from noise created in other dwelling units, contact and social interaction with neighbours is found to increase. This factor seems to better represent low rise apartments as can be seen from the negative correlation on variables associated with high-rise typologies. It appears that low-rise apartments are more inhabited by younger, less affluent families, as can been seen from the negative correlation with age, and monthly income. Satisfaction from visual privacy may also be observed to increase, probably since, the fewer number of blocks, fewer dwelling units per floor and fewer balconies in the low-rise typology, help to provide visual privacy across floors, and across adjacent blocks. In high rise buildings, the presence of ducts, and efforts to obtain lighting through openings into ducts, and common lobbies, for some of the rooms were found to present problems of acoustic privacy.
8. **Social interaction:** This factor has been interpreted as one, measuring the intensity of neighbourly relations within the apartment building. As this factor loading increases, the greater are the neighbours whom the respondent recognises, and has close contact with,

increasing satisfaction. This factor appears to be positively correlated with low rise typologies, and negatively correlated with all variables representing high rise typologies. In high rise typologies, social interaction appeared to be less, probably due to the higher socio-economic status of the occupants, and due to the greater number of households when compared to the low-rise types.

9. **Architectural design:** This factor has been interpreted as related to the plan of the dwelling, and ability to provide visual and acoustic privacy. As this factor score increases, greater is the satisfaction from the architectural design aspects, and greater is the preference of respondents, for living in lower rise typologies. This factor seems to generally represent respondents, living in lower rise buildings, and those who have expressed a wish to live in low-rise and independent houses, as can be seen from the negative correlation with variables representative of these. In high rise buildings, there were problems of privacy, particularly due to the positioning of large number of units per floor, and the alignment of doors, windows and balconies, close to each other, or exactly in line, with that of another dwelling unit.
10. **Bio-aesthetic factor:** This factor may be interpreted, as one measuring the satisfaction from greenery and relating to an ability to be able to grow plants within residences. Satisfaction is very high among low-rise apartment occupants, which is generally reflected in the positive correlation with all variables representing low rise typologies. Satisfaction appears to be high also among those from both low and high rise typologies living on the ground or lower floors, respectively as can be observed from the negative correlation with floor occupied. Those on the ground floor of low-rise are immensely satisfied, due to at least ground space for gardening, usually at the rear. In the case of high rise, satisfaction seems to stem from (i)the larger plot areas and set backs, and care-taking efforts which strive to maintain lawns, gardens etc and (ii) from larger dwelling

sizes, number, and size of balconies provided in high rise typologies, as observed in section of chapter 6.

8.3.2 MULTIPLE REGRESSION WITH FACTOR SCORES FOR TOTAL SAMPLE

Multiple regression analysis was undertaken with user satisfaction as the dependent variable, and the factor scores as the independent variables. The results are presented in Table no. 8.4

Table no.: 8.4

Multiple regression using factor scores for total sample

Sl no	Model equation with t values in parentheses	R^2
1	$Y = 0.472\ F_6$ (t) (5.1)	0.222
2	$Y = 0.472\ F_6 + 0.425\ F_2$ (t) (5.78) (5.21)	0.403
3	$Y = 0.472\ F_6 + 0.425\ F_2 + 0.316\ F_8$ (t) (6.30) (5.68) (4.22)	0.502
4	$Y = 0.472\ F_6 + 0.425\ F_2 + 0.316\ F_8 + 0.231\ F_3$ (t) (6.44) (5.98) (4.45) (3.26)	0.556
5	$Y = 0.472\ F_6 + 0.425\ F_2 + 0.316\ F_8 + 0.213\ F_3 + 0.218\ F_4$ (t) (6.98) (6.29) (4.68) (3.42) (3.22)	0.603
6	$Y = 0.472\ F_6 + 0.425\ F_2 + 0.316\ F_8 + 0.231 F_3 + 0.218\ F_4 + 0.163\ F_{10}$ (t) (7.19) (6.47) (4.82) (3.53) (3.32) (2.49)	0.630

F_6 = Architectural fenestration F_2 = Essential infrastructure
F_8 = Neighbour behaviour F_3 = Prosperity
F_4 = External environment F_{10} =Bio-aesthetic factor
Y = User satisfaction level

The multiple regression analysis using factor scores reveals that, six factors are found to contribute to explaining 63 per cent of variation in satisfaction level, viz., Architectural fenestration, Essential infrastructure, Neighbour behaviour, Prosperity, External environment and Bio-aesthetic factors. The four factors viz., the Architectural form , Lifecycle, Social interaction, and Architectural plan factor did not make statistically significant contribution to user satisfaction, and hence they have not been included in the step-wise regression.

8.3 MULTIPLE REGRESSION USING ORIGINAL VARIABLES FOR TOTAL SAMPLE

The results of the multiple regression analysis using the original variables are presented in Table. no.8.5.

Table no.:8.5

Multiple regression using original variables for Total sample

Sl no	Model equation with t values in parentheses	R^2
1	$Y = 0.49\ X_{21}$ (t) (5.52)	0.24
2	$Y = 0.43\ X_{21} + 0.34\ X_8$ (t) (5.13) (3.99)	0.35
3	$Y = 0.40\ X_{21} + 0.38\ X_8 + 0.34\ X_{30}$ (t) (5.16) (4.85) (4.49)	0.502
4	$Y = 0.36\ X_{21} + 0.36\ X_8 + 0.34 X_{30} + 0.26\ X_{27}$ (t) (4.83) (4.97) (4.71) (3.54)	0.53
5	$Y = 0.35\ X_{21} + 0.37 X_8 + 0.32\ X_{30} + 0.23\ X_{27} + 0.19\ X_{17}$ (t) (4.86) (5.26) (4.63) (3.22) (2.63)	0.56

X_{21} = Lighting X_8 = Garbage disposal facility
X_{30} = Gardening facility X_{27} = Acoustic privacy
X_{17} = Noise pollution Y = User satisfaction level

The multiple regression analysis with the original variables reveals that only five original variables viz., Lighting, Garbage disposal facility, Gardening facility, Acoustic privacy, and Noise pollution contribute significantly towards explaining 56 per cent of variation in user satisfaction level.

8.4 ANALYSIS OF LOW-RISE SAMPLE

8.4.1 FACTOR COMPONENTS FOR LOW RISE

In conducting the factor analysis for low rise building type, only nine variables which satisfied the factor conditions for positive definiteness were taken. Five components were extracted from the factor analysis, which accounted for 86 percent of the variance. The first factor was able to extract 27 per cent of the variance, while the last factor was able to extract 13.5 per cent of the variance. Refer Table no. 8.6.

Table no. : 8.6

Rotated component matrix for Low rise sample

ROTATED COMPONENT MATRIX FOR LOW RISE							
		Factor Components					Communalities
Sl.no	Variables	F_1	F_2	F_3	F_4	F_5	
X_1	Lighting	**0.953**	-0.165	-0.024	-0.071	-0.104	0.951
X_2	Ventilation	**0.932**	0.141	0.085	0.008	0.083	0.903
X_3	Monthly income	**0.601**	-0.214	0.284	0.395	-0.499	0.894
X_4	Neighbours close contact with	0.374	**-0.794**	-0.198	-0.207	-0.010	0.852
X_5	Breeze	0.409	**0.640**	-0.468	-0.008	0.083	0.802
X_6	View	0.047	**0.639**	-0.094	-0.312	-0.119	0.531
X_7	Noise pollution	0.122	-0.014	**0.958**	-0.060	0.057	0.940
X_8	Security	-0.013	-0.051	-0.078	**0.954**	0.093	0.928
X_9	Gardening facilities	0.000	-0.094	0.076	0.132	**0.955**	0.943
Names of interpreted factors		**Architectural fenestration**	**Social interaction**	**External environment**	**Security**	**Bio-aesthetic**	
Rotation Sums of Squared Loadings							
Total		2.463	1.552	1.285	1.233	1.211	
% of Variance		27.371	17.247	14.278	13.698	13.460	
Cumulative %		27.371	44.618	58.896	72.594	86.054	
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.							
a	Rotation converged in 9 iterations.						

The factors were interpreted as;

1. **Architectural fenestration**: This factor is interpreted as a factor predominantly related with the quality of openings in the apartment, and the satisfaction obtained from them. This factor is positively correlated with income, lighting, ventilation, breeze, and freedom from noise. It appears to represent respondents living on upper floors of single block low-rise residential buildings. The ground floor generally has lower lighting, due to the thick vegetation characteristic of this tropical region. The first or second floor is usually preferred, since they combine the advantages of freedom from noise, pests, flooding

during the monsoons etc., common on the ground floor, and lesser roof heating, due to presence of upper floors.

2. **Social interaction factor**: This factor is interpreted as indicative of the actual interaction with neighbours. The positive correlation with breeze and view and negative correlation with neighbourly contacts, security, gardening facilities, and income appears to suggest a category of respondents occupying top most floors of single block apartments, which are least attractive. Generally, those on the ground floor had greater contacts, due to the advantage of being at the ground level, where social groups gathered, particularly in the evenings.
3. **External environment**: This may be interpreted as one related to the satisfaction obtained through freedom from noise and other pollution. As this factor loading increases, the building tends to be more satisfying from pollution point of view. This is true of most low rise buildings, as they are situated in pocket roads, and in the inner areas where such negative aspects are minimal.
4. **Security:** This is interpreted as satisfaction obtained from possessing security arrangements in buildings. The positive correlation with income reveals that security is a feature associated with dwellings of upper class respondents. Most enclaves or group housing of low rise type in Kochi is provided by established builders. Most of these have facilities like play areas, gardens and round-the –clock security. They are therefore generally more expensive than single block low rises. Usually, in single block low rises with lesser number of dwelling units, no security personnel are employed, as it is not often economically viable. Only in group housing type, security is employed.
5. **Bio-aesthetic factors**: This is interpreted as a factor related to satisfaction from greenery, and facilities for growing plants. Satisfaction on this factor is greater for those on ground floor, and those in group housing type of low rises, as can be seen with the negative

correlation with variables denoting upper floors. In single block low rises, satisfaction from greenery is poor, as larger part of the ground space is used for parking, often only leaving minimum set backs.

8.4.2 MULTIPLE REGRESSION USING FACTOR SCORES FOR LOW-RISE

The results of the multiple regression analysis with factor scores for the low-rise sample is presented in Table. no.8.7.

Table no. 8.7

Multiple regression using factor scores for Low rise

Sl no	Model equation with t values in parentheses	R^2
1	$Y = 0.57\ F_1$ (t) (3.053)	0.329
2	$Y = 0.574\ F_1 + 0.506\ F_4$ (t) (3.78) (3.33)	0.585
3	$Y = 0.574\ F_1 + 0.506\ F_4 + 0.41\ F_5$ (t) (4.75) (4.19) (3.39)	0.75
4	$Y = 0.57\ F_1 + 0.506\ F_4 + 0.41\ F_5 + 0.137\ F_3$ (t) (4.80) (4.23) (3.42) (1.14)	0.77

F_1 = Architectural fenestration; F_4 = Security
F_5 = Bio-aesthetic F_3 = External environment
Y = user satisfaction level

The multiple regression using factor scores for low-rise sample reveals that, only four factors were found to contribute to explaining satisfaction significantly, namely, Architectural fenestration, Security, Bio-aesthetic factors, and External environment. The Social interaction factor did not make statistically significant contribution to the user satisfaction model.

8.4.3 MULTIPLE REGRESSION USING ORIGINAL VARIABLES FOR LOW-RISE

The results of the multiple regression using original variables for the low-rise sample is presented in Table no. 8.8. The multiple regression analysis using the original vector reveals that, only 3 independent variables namely, Ventilation, Security and Gardening facility contribute significantly towards explaining 81 per cent of variation in user satisfaction level.

Table no. 8.8

Multiple regression analysis using original variables for Low rise

Sl no	Model equation with t values in parentheses	R^2
1	$Y = 0.65\ X_2$ (t) (3.72)	0.42
2	$Y = 0.65\ X_2 + 0.52\ X_8$ (t) (4.91) (3.92)	0.69
3	$Y = 0.63\ X_2 + 0.44\ X_8 + 0.36\ X_9$ (t) (5.96) (4.06) (3.28)	0.81

X_2 = Ventilation X_8 = Security

X_9 = Gardening facilities Y = User satisfaction level

8.5 ANALYSIS FOR HIGH RISE SAMPLE

8.5.1 FACTOR COMPONENTS FOR HIGH RISE SAMPLE

Ten components were extracted from the factor analysis from the high-rise sample. This accounted for 75.5 per cent of the variance. The first factor was able to extract 14.3 per cent of the variance, while the last factor was able to extract only 5 per cent of the variance. Refer Table no.8.9 and 8.10.

Table no.: 8.9

Factor components and variance extracted for high-rise sample

Names of interpreted factors	Essential F_1 infrastructure	Height factor F_2	External F_3 environment	Lifecycle F_4	Architectural plan F_5	Social interaction F_6	Prosperity F_7	Architectural fenestration F_8	Neighbour behaviour F_9	Bio-aesthetic F_{10}
Rotation Sums of Squared Loadings										
Total	4.44	2.88	2.32	2.29	2.15	2.09	2.07	1.93	1.68	1.55
% of Variance	14.33	9.28	7.47	7.39	6.95	6.74	6.67	6.24	5.43	5.00
Cumulative %	14.33	23.62	31.08	38.48	45.43	52.17	58.83	65.07	70.50	75.51
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalisation.										
a	Rotation converged in 10 iterations.									

Table no.: 8.10

Rotated component matrix for high rise

ROTATED COMPONENT MATRIX FOR HIGH RISE												
		Factor components										
S.no	Variables	F_1	F_2	F_3	F_4	F_5	F_6	F_7	F_8	F_9	F_{10}	Communalities
X_1	Arrangements for repair	**0.83**	-0.07	-0.16	0.15	0.11	0.02	-0.06	0.06	-0.06	-0.04	0.76
X_2	Maintenance	**0.83**	0.09	-0.16	0.05	-0.03	0.21	0.03	-0.13	-0.03	0.13	0.80
X_3	Water Supply	**0.80**	0.07	0.00	-0.09	0.03	0.15	-0.15	0.20	-0.03	-0.01	0.74
X_4	Garbage disposal	**0.76**	-0.05	-0.05	-0.04	-0.05	-0.18	0.01	0.21	0.07	-0.17	0.70
X_5	Vertical circulation	**0.69**	-0.05	0.17	-0.06	-0.03	-0.12	0.21	0.07	-0.01	0.13	0.59
X_5	Power supply	**0.65**		-0.05	0.07	0.27	-0.03	-0.18	-0.32	0.05	0.05	0.76
X_6	Security	**0.62**	0.22	-0.37	0.07	-0.05	0.08	-0.11	-0.16	0.20	-0.09	0.67
X_7	View	0.06	**0.84**	0.07	-0.08	0.03	-0.28	0.13	0.07	0.03	0.10	0.83
X_8	Breeze	0.01	**0.81**	0.10	-0.14	-0.11	0.19	-0.11	-0.01	-0.15	0.11	0.78
X_9	Floor occupied	0.05	**0.80**	0.00	-0.11	0.10	-0.32	0.16	0.07	0.19	0.00	0.83
X_{10}	Amenities	0.14	**0.53**	-0.03	0.29	0.15	0.00	-0.41	-0.16	0.01	-0.24	0.66
X_{11}	Environmental noise	-0.10	0.15	**0.86**	-0.01	-0.12	-0.04	0.15	0.04	0.08	-0.03	0.82
X_{12}	Environmental dust	-0.13	-0.02	**0.83**	-0.02	0.12	0.08	0.00	-0.21	-0.05	0.20	0.82
X_{13}	Total no of flats	-0.03	0.32	0.43	0.12	0.06	-0.28	-0.23	0.22	0.35	-0.42	0.78
X_{14}	Neighbours recognisable	0.36	-0.01	-0.43	-0.30	0.08	0.39	0.06	-0.11	0.14	-0.26	0.67
X_{15}	Age of husband	0.04	-0.05	-0.01	**0.95**	-0.01	-0.07	-0.03	-0.06	0.04	0.06	0.93
X_{16}	Age of wife	0.01	-0.13	0.02	**0.95**	0.04	-0.05	0.11	-0.07	0.06	0.02	0.94
X_{17}	Architectural plan	0.06	-0.01	0.03	-0.14	**0.81**	-0.07	0.13	0.14	0.06	-0.06	0.73
X_{18}	Visual privacy	0.04	0.07	-0.03	0.21	**0.75**	0.12	0.16	0.17	0.00	0.07	0.68
X_{19}	Neighbours close contact with	-0.04	-0.18	-0.08	-0.09	-0.01	**0.80**	0.17	-0.01	0.06	0.06	0.73
X_{20}	Social interaction	0.38	-0.02	0.05	-0.02	0.25	**0.65**	0.08	0.10	-0.11	-0.33	0.77
X_{21}	Total floors in building	0.11	0.28	-0.13	0.06	0.41	**-0.56**	0.13	-0.04	0.28	-0.28	0.77
X_{22}	Female headed households	-0.22	0.18	-0.06	0.06	0.06	0.03	**0.76**	0.05	-0.03	-0.04	0.67
X_{23}	Non resident Keralites	0.00	0.01	0.12	0.21	0.23	0.25	**0.72**	0.03	-0.07	-0.04	0.70
X_{24}	Monthly income	**0.31**	-0.20	0.16	-0.22	0.11	-0.06	**0.64**	0.24	0.08	0.06	0.70
X_{25}	Lighting	0.11	0.03	0.09	-0.06	0.12	-0.08	0.13	**0.84**	0.02	0.03	0.77
X_{26}	Ventilation	0.03	0.03	-0.21	-0.07	0.22	0.13	0.06	**0.84**	-0.02	0.05	0.83
X_{27}	Neighbours behaviour	0.02	-0.01	-0.11	0.07	-0.09	0.00	-0.02	-0.05	**0.90**	0.08	0.85
X_{28}	Acoustic privacy	0.01	0.05	0.28	0.01	**0.48**	-0.06	-0.01	0.09	**0.68**	0.05	0.80
X_{29}	Gardening facilities	-0.01	0.09	0.12	0.05	0.04	-0.01	-0.04	0.09	0.09	**0.84**	0.76
X_{30}	Preferred building typology	0.29	0.24	0.21	0.15	-0.39	-0.07	0.12	-0.04	0.12	0.43	0.58

The factors were interpreted as: Essential infrastructure factor, Height factor, External environment, Lifecycle stage, Architectural design, Social interaction factor, Prosperity factor, Architectural fenestration, Neighbour behaviour and Bio-aesthetic factors. The factors are found similar to that of the total sample.

8.5.2 MULTIPLE REGRESSION USING FACTOR SCORES

The results of the multiple regression for the high-rise sample using factor scores, is presented in Table no.8.11

Table no. 8.11

Multiple regression analysis using factor scores for high rise

Sl no	Model equation with t values in parentheses	R^2
1	$Y = 0.444\ F_8$ (t) (4.17)	0.197
2	$Y = 0.444\ F_8 + 0.402\ F_1$ (t) (4.64) (4.20)	0.358
3	$Y = 0.444\ F_8 + 0.402\ F_1 + 0.305\ F_9$ (t) (4.98) (4.50) (3.42)	0.451
4	$Y = 0.444\ F_8 + 0.402\ F_1 + 0.305\ F_9 + 0.284\ F_3$ (t) (5.35) (4.86) (3.67) (3.43)	0.532
5	$Y = 0.444\ F_8 + 0.402\ F_1 + 0.305\ F_9 + 0.284\ F_3 + 0.267\ F_7$ (t) (5.77) (5.23) (3.96) (3.7) (3.48)	0.604
6	$Y = 0.444\ F_8 + 0.402\ F_1 + 0.305\ F_9 + 0.284\ F_3 + 0.267\ F_7 + 0.238\ F_{10}$ (t) (6.19) (5.60) (4.25) (3.97) (3.73) (3.323)	0.630

Factors: F_8 = Architectural fenestration F_1 = Essential infrastructure
F_9 = Neighbour behaviour F_3 = External environment
F_7 = Prosperity F_{10} =Bio-aesthetic factor
Y = User satisfaction level

The multiple regression analysis using factor scores reveals that, six factors were found to contribute to explaining 63 per cent of the satisfaction, namely, Architectural fenestration, Essential infrastructure, Neighbour behaviour, External environment, Prosperity, and Bio-aesthetic factors. The four factors namely the Height factor, Lifecycle factor, Social interaction factor, and Architectural plan factor, did not contribute significantly to the model.

8.5.3 MULTIPLE REGRESSION USING ORIGINAL VARIABLES FOR HIGH RISE

The results of the multiple regression analysis using original variables for the high rise sample is presented in Table. no. 8.12.

Table no.: 8.12

Multiple regression analysis using original variables

Sl no	Model equation with t values in parentheses	R^2
1	$Y = 0.487\ X_{25}$ (t) (4.80)	0.237
2	$Y = 0.427\ X_{25} + 0.358\ X_4$ (t) (4.5) (3.78)	0.36
3	$Y = 0.40\ X_{25} + 0.39\ X_4 + 0.29\ X_{11}$ (t) (4.46) (4.32) (3.312)	0.45
4	$Y = 0.32\ X_{25} + 0.41 X_8 + 0.23\ X_{30} + 0.27\ X_{27} + 0.23\ X_{17}$ (t) (3.96) (5.08) (2.81) (3.38) (2.82)	0.519
5	$Y = 0.33\ X_{25} + 0.38 X_4 + 0.20\ X_{11} + 0.22\ X_{29} + 0.23\ X_{28} + 0.169\ X_{30}$ (t) (4.16) (4.75) (2.51) (2.71) (2.91) (2.06)	0.57;

X_{25} = Lighting
X_4 = Garbage disposal facility
X_{11} = Environmental noise
X_{29} = Gardening facility
X_{28} = Acoustic privacy
X_{30} = Preferred typology
Y = User satisfaction level

The multiple regression analysis with the original variables reveals that, six independent variables, namely, lighting, garbage disposal facility, environmental noise, gardening facility, acoustic privacy, and preferred typology, contribute significantly towards explaining 59 per cent of the variation in user satisfaction level.

8.6 MODELLING CHOICE CRITERIA AND USER SATISFACTION

The above analysis so far was confined to a study of variables, confined to living within the chosen apartment dwellings. A factor analysis was therefore undertaken, to have a wider view of all aspects which led to the choice of apartments, in combination with the satisfaction obtained from living in them. From the survey of occupants, undertaken to study the preferential structure and user satisfaction of occupants of apartment buildings, 43 variables, consisting of a mixture of various aspects, viz., preferential factors, criteria for

assessment of choice, satisfaction from life in it, building bulk, economic factors, etc., were chosen for performing the factor analysis. Table no 8.13 presents the Communalities, Eigen values, and Rotated component matrix.

8.6.1 FACTOR COMPONENTS FOR CHOICE CRITERIA AND USER SATISFACTION

Thirteen components were extracted from the factor analysis, considering all the apartments surveyed for the work. This accounted for 74.74 percent of the variance. The first factor was able to extract 9.63 per cent of the variance, while the last factor was able to extract 3.32 per cent of the variance. They were interpreted as:

1. **Factor 1**: This was interpreted as **essential infrastructure factor,** which has already been discussed in section 7.3.1 of this chapter.
2. **Factor 2**: This was interpreted as **organised care-taking factor** as it was loaded on variables associated with residential typologies, where such facilities were known to exist. In Kochi, the larger and taller apartments alone, had active owners associations, who could care for the properties of absentee owners. Most retired and families of non resident Keralites, preferred this typology, as it enabled them to travel freely to meet other family members, while leaving their homes unattended during those spells.
3. **Factor 3**: This was interpreted as **height factor**, which has already been discussed in section 7.3.1 of this chapter.
4. **Factor 4:** This was interpreted as **attitudinal factor,** as it was heavily loaded on those attitudes and lifestyles of the people, which led them to buy ready built housing instead of constructing it, as is conventional with the people of Kerala. Sentimental reasons are sidelined, for more economic considerations by such people

Table no. :8.13

Factor structure table for choice criteria and user satisfaction

ROTATED COMPONENT MATRIX															
		Factor Component													
sl.no	Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	Communalities
X1	Water supply	**0.81**	-0.11	0.02	-0.15	-0.03	0.08	0.09	-0.01	0.03	-0.12	-0.02	0.02	0.00	0.73
X2	Organised repair facilities	**0.77**	0.20	0.07	0.08	-0.16	-0.02	0.04	0.17	-0.04	0.11	-0.06	0.03	0.04	0.72
X3	Maintenance	**0.76**	0.11	0.21	0.09	-0.12	-0.11	0.11	0.15	0.00	0.15	0.10	0.13	0.23	0.81
X4	Garbage disposal	**0.76**	0.19	-0.09	-0.06	-0.03	0.01	0.12	-0.14	-0.07	0.08	-0.17	-0.08	-0.13	0.72
X5	Vertical circulation	**0.65**	-0.16	0.03	-0.01	0.25	-0.20	0.09	0.10	0.00	-0.19	0.12	-0.11	-0.01	0.63
X6	Power supply	**0.61**	0.18	0.36	-0.05	-0.14	0.10	-0.32	-0.14	0.26	0.11	-0.12	-0.07	0.17	0.82
X7	Accessibility of strangers	**0.57**	0.37	0.27	0.02	-0.31	-0.17	-0.07	0.07	0.07	0.09	0.03	0.38	0.00	0.82
X8	Easy upkeep of dwelling	0.03	**0.77**	-0.05	0.05	0.14	-0.02	0.17	0.11	0.07	0.15	-0.15	0.10	0.00	0.71
X9	Total apartments	0.10	**0.69**	0.29	0.16	0.07	0.18	0.16	-0.12	0.19	-0.03	0.06	0.11	-0.02	0.74
X10	Total floors	0.17	**0.69**	0.38	0.18	-0.21	-0.05	0.08	0.00	0.23	-0.01	-0.11	-0.16	0.02	0.83
X11	Neighbours close contact with	-0.11	**-0.67**	-0.37	0.02	0.08	0.06	0.08	-0.02	0.15	0.20	-0.18	0.28	0.04	0.79
X12	Organised care-taking	0.05	**0.64**	0.33	0.33	-0.06	-0.27	0.16	0.00	0.04	0.13	0.14	0.10	-0.05	0.79
X13	view	0.07	0.31	**0.85**	-0.07	0.07	-0.03	0.08	0.05	0.01	0.08	0.00	-0.08	-0.02	0.85
X14	breeze	0.05	0.07	**0.81**	0.16	-0.05	0.03	0.08	-0.03	-0.04	0.00	0.05	0.13	0.06	0.73
X15	Floor occupied	0.10	0.45	**0.74**	0.04	-0.01	-0.01	0.10	-0.10	0.10	0.06	-0.20	-0.08	0.05	0.84
X16	Amenities available	0.20	0.36	**0.42**	0.15	-0.26	0.14	-0.23	-0.19	0.23	0.05	0.20	0.14	0.04	0.66
X17	Lack of time	-0.07	0.08	0.02	**0.89**	-0.08	-0.02	-0.10	0.00	0.04	0.07	-0.03	0.00	-0.09	0.83
X18	Hassles in construction	0.03	0.19	0.06	**0.85**	-0.02	-0.09	-0.05	0.00	0.01	0.04	0.03	0.01	-0.04	0.79
X19	Resale value	-0.10	0.06	0.08	**0.62**	-0.06	0.07	0.08	0.21	-0.11	0.30	0.23	0.05	0.00	0.61
X20	Safe investment	0.00	0.04	0.12	**0.58**	0.09	0.15	0.04	0.15	-0.08	0.22	**0.51**	-0.01	0.01	0.72
X21	Noise pollution	-0.08	0.12	0.07	0.02	**0.89**	0.07	0.03	-0.11	0.05	0.01	0.05	0.02	0.00	0.84
X22	Air pollution	-0.10	-0.11	-0.13	-0.17	**0.81**	0.06	-0.10	-0.07	0.10	-0.08	0.12	-0.01	0.11	0.78
X23	Proximity to school	-0.08	0.02	-0.13	0.01	-0.01	**0.80**	-0.14	0.15	-0.08	0.04	0.05	-0.08	-0.06	0.73
X24	Proximity to scenic areas	-0.07	-0.04	0.21	0.08	0.16	**0.69**	0.02	0.05	0.01	0.25	-0.12	0.03	0.10	0.66
X25	Proximity to workplace	0.05	-0.08	0.07	-0.11	0.06	**0.64**	-0.03	0.31	-0.13	-0.25	0.11	0.29	-0.21	0.76
X26	Lighting	0.12	0.11	0.06	-0.08	0.02	-0.05	**0.86**	-0.19	0.14	0.02	0.01	-0.05	0.11	0.84
X27	Ventilation	0.12	0.19	0.17	-0.04	-0.14	-0.07	**0.81**	0.07	0.18	0.07	0.03	0.02	-0.05	0.81
X28	Monthly income	0.25	0.09	-0.05	0.20	0.30	-0.32	**0.45**	0.34	0.09	-0.08	-0.36	-0.06	-0.06	0.77
X29	Proximity to public transport	0.10	0.00	-0.06	0.14	-0.03	0.12	-0.10	**0.84**	-0.06	0.02	0.13	0.05	-0.01	0.78
X30	Proximity to market	0.04	0.05	-0.05	0.01	-0.15	0.22	0.02	**0.82**	0.15	-0.02	0.06	-0.10	0.14	0.81
X31	Visual privacy	-0.02	0.01	0.11	-0.02	0.01	-0.10	0.21	0.04	**0.76**	0.07	-0.07	-0.07	-0.04	0.67

X32	Acoustic privacy	-0.04	0.38	-0.04	-0.02	0.15	-0.05	0.05	0.07	**0.67**	-0.05	-0.05	-0.01	0.04	0.63
X33	Social interaction	0.38	-0.39	-0.11	0.25	0.04	0.04	0.19	-0.13	**0.39**	0.01	-0.09	0.27	-0.20	0.69
X34	Emergency help from neighbours	0.02	0.06	-0.01	0.23	-0.08	0.03	0.08	-0.01	0.00	**0.83**	0.08	0.00	-0.02	0.77
X35	Good living environment	0.09	-0.11	0.46	0.08	-0.09	0.23	-0.05	-0.10	0.25	**0.58**	0.02	-0.08	0.05	0.72
X36	Security concerns	0.07	0.38	0.21	0.20	0.21	0.04	-0.02	0.24	-0.05	**0.46**	0.18	0.33	-0.14	0.71
X37	Financial concerns	-0.07	-0.01	-0.06	0.22	0.18	-0.06	0.01	0.15	-0.09	0.06	**0.78**	0.06	0.02	0.74
X38	Importance of architectural plan	0.13	-0.02	0.14	-0.09	0.06	-0.02	0.15	-0.02	0.46	0.14	-0.04	**-0.64**	-0.13	0.72
X39	Prefer apartment lifestyle	0.15	0.03	0.44	-0.19	0.10	0.19	0.09	-0.12	0.11	0.25	0.13	**0.54**	0.01	0.70
X40	Neighbours recognisable	0.27	-0.23	-0.09	0.22	-0.35	-0.22	0.09	-0.17	0.24	-0.02	-0.31	**0.38**	-0.15	0.71
X41	Gardening facilities	-0.02	-0.08	0.05	-0.33	0.13	-0.12	-0.01	0.07	-0.05	0.04	0.03	0.00	**0.73**	0.70
X42	Importance of location	0.20	-0.08	-0.09	0.44	-0.14	0.14	0.10	0.03	0.14	-0.28	0.23	-0.02	**0.54**	0.73
X43	Preferred residential typology	0.20	0.33	0.29	0.17	0.19	0.01	0.06	0.12	-0.23	0.02	-0.24	0.20	**0.51**	0.72

Factors interpreted	Essential infrastructure	organised caretaking	Height factor	Attitudinal factor	External environment	Organised trips	Architectural fenestration	Unorganised trips	Architectural design	Social factor	economic factor	Group living	Typological preference
						Rotation Sums of Squared Loadings							
Total	4.14	3.90	3.60	3.24	2.31	2.17	2.12	2.10	2.01	1.91	1.64	1.56	1.43
% of Variance	9.63	9.08	8.37	7.55	5.38	5.05	4.94	4.89	4.67	4.44	3.81	3.62	3.32
Cumulative %	9.63	18.71	27.08	34.62	40.00	45.05	49.99	54.88	59.55	63.99	67.80	71.42	74.74

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a Rotation converged in 19 iterations.

5. **Factor 5**: This factor was interpreted as **external environment factor,** which has already been discussed under section 7.3.1 of this chapter.

6. **Factor 6**: This was interpreted as **organised trips factor**, as it was loaded on variables associated with daily trips. Since most daily trips were pre-arranged particularly for children, respondents did not seem to choose locations, particularly close to schools. So was the case for those who travelled to work, using own vehicles. Other considerations appeared to weigh more heavily in locational choice, than proximity to schools, or work places.

7. **Factor 7**: This factor was interpreted as **architectural fenestration factor,** which has already been discussed in section 7.3.1 of this chapter.
8. **Factor 8**: This factor was interpreted as **unorganised trips factor,** as it was loaded heavily on occasional and emergency trips. Respondents were found to give great importance to locations within walking distance of a bus stop, and to location of markets and shopping.. This was firstly due to the good public transportation existing in the city and secondly, due to limited availability of modes other than auto-rickshaws[1], which are not a very cheap means for daily travel.
9. **Factor 9**: This was interpreted as **architectural design factor,** which has already been discussed in section 7.3.1 in this chapter.
10. **Factor 10**: was interpreted as a **social factor,** as it was loaded heavily on the social aspects which respondents looked for, in choosing multi-storeyed buildings, namely emergency help from neighbours, good living environment and security aspects.
11. **Factor 11**: This was interpreted as **economic factor,** as it was heavily loaded on financial considerations, like resale values, being a safe investment etc., which led to choice of particular apartment buildings. Such considerations seemed to weigh more among the lesser affluent as can be seen in the negative correlation with income.
12. **Factor 12**: This was interpreted as **group living factor,** as it was loaded on variables concerned with preference for lifestyle, conducive to such social group living.
13. **Factor 13**: This was interpreted as a **typological preference factor,** as it was loaded on variables concerned with location, preferred residential typology, satisfaction from greenery, and facilities to grow plants within residences.. As this factor score increases, respondents attached great importance to the location of their dwellings, preferred high rise typologies and were increasingly satisfied with gardening facilities, possibly due to

larger well kept ground areas and larger dwelling sizes and provisions for balconies in these posh central city high rises

8.6.2 MULTIPLE REGRESSION USING FACTOR SCORES

Factor scores were computed and used for conducting a multiple regression analysis, in order to determine those factors with greater explanatory power. The coefficient of determination, standardised regression values, t values are given below in Table 8.14.

Table no. 8.14

Regression model using factor scores

Sl no	Model equation with t values in parentheses	R^2
1	$Y = 0.455\ F_7$ (t) (4.98)	0.207
2	$Y = 0.\ 455\ F_7 + 0.366\ F_1$ (t) (5.43) (4.37)	0.265
3	$Y = 0.455\ F_7 + 0.366 F_1 + 0.292\ F_5$ (t) (5.79) (4.67) (3.72)	0.426
4	$Y = 0.455\ F_7 + 0.366\ F_1 + 0.292\ F_5 + 0.245\ F_{13}$ (t) (6.09) (4.9) (3.91) (3.28)	0.519
5	$Y = 0.455\ F_7 + 0.366\ F_1 + 0.292\ F_8 + 0.245 F_{13} + 0.208\ F_2$ (t) (6.98) (6.29) (4.06) (3.41) (2.89)	0.529
6	$Y = 0.455\ F_7 + 0.366\ F_1 + 0.292\ F_5 + 0.245 F_{13} + 0.208\ F_2 + 0.175\ F_9$ (t) (6.51) (5.24) (4.18) (3.51) (2.97) (2.51)	0.560

F_7 = Architectural fenestration
F_5 = External environment
F_2 = Organised care-taking
Y = User satisfaction level
F_1 = Essential infrastructure
F_{13} = Typological preference
F_9 =Architectural design

It was found that six factors contributed to explaining 56 per cent of the satisfaction of the respondents. They are Architectural fenestration, Essential infrastructure, External environment, Typological preference, Organised care-taking and Architectural design. Other factors such as height factor, attitudinal factor, organised trips, unorganised trips, social factor, economic factor, and group living factor did not contribute significantly towards explaining satisfaction.

8.7 DISCUSSIONS

[1] A three wheeler taxi used for widely local conveyance.

From the results of both factor analysis and multiple regression analysis for the total sample and the high rise sample, the following dimensions have emerged as important in explaining the consumer satisfaction, namely, lighting, belonging to the Architectural fenestration factor component; garbage disposal facility, belonging to the Essential infrastructure factor component; gardening facility, belonging to the bio-aesthetic factor component; acoustic privacy, belonging to neighbour behaviour factor component; and environmental noise, belonging to the External environment factor component.

From the results of both factor analysis and multiple regression of the low-rise sample, the following dimensions have emerged as important in explaining consumer satisfaction, namely, ventilation, belonging to the Architectural fenestration factor component; security belonging to Security factor component; and gardening facilities belonging to Bio-aesthetic factor component.

The factor analysis of the combination of choice and user satisfaction reveals that the following factors could significantly explain user satisfaction, namely, Architectural fenestration, Essential infrastructure, External environment, Typological preference, Organised care-taking and Architectural design.

It may be concluded from the analysis of total sample, low-rise sample, high-rise sample and the combined choice criteria and user satisfaction sample that, out of the total eight factors that can contribute to explaining satisfaction, five factors namely Architectural fenestration, External noise, Essential infrastructure, Architectural design, and Bio-aesthetic factors, are amenable to control by town planners and architectural designers. Two others, namely, security and organised care-taking may be facilitated through proper planning and design.

The multiple regression analysis taking original variables has revealed that the variables namely, lighting, ventilation, garbage disposal facilities, gardening facilities,

acoustic privacy, environmental noise, and security are able to significantly explain user satisfaction. Designers may therefore concentrate on these variables to improve user satisfaction. Further research may also economise on data collection by collecting only information regarding these.

Having obtained the various factors contributing to user satisfaction, an attempt was made to find out the relative importance given by a group of ten experts, to these factors, while undertaking planning and design. The experts consisted of civil engineers, architects, architectural engineers, city planners, transportation planners and housing experts. The questionnaire used for the purpose, is presented as attachment 7 in Appendix A. The variation in the importance given to the factors within the expert group, and when compared to that of user occupants, can be seen from Table no. 8.15.

Table no.:8.15

Weightage given by experts to for improving user satisfaction

Factors	Essential infrastructure	Architectural form	External environment	Architectural fenestration	Social interaction	Behavioural factor	Architectural plan	Bio-aesthetic	Total
expert 1	16.0	9.5	8.0	10.5	7.5	14.0	29.0	5.5	100.0
expert 2	20.0	16.0	8.0	10.0	12.0	6.0	24.0	4.0	100.0
expert 3	29.5	6.0	17.5	6.0	5.5	6.0	23.5	6.0	100.0
expert 4	30.0	9.0	11.0	21.0	2.0	4.0	16.0	7.0	100.0
expert 5	31.0	16.0	6.0	9.0	4.0	5.0	26.0	3.0	100.0
expert 6	32.0	10.0	0.0	0.0	0.0	16.0	26.0	16.0	100.0
expert 7	33.0	6.0	6.0	11.0	11.0	6.0	16.0	11.0	100.0
expert 8	41.0	11.0	8.0	14.0	5.0	2.0	13.0	6.0	100.0
expert 9	49.0	7.0	5.5	10.0	4.0	5.5	15.0	4.0	100.0
expert 10	53.0	5.0	2.0	4.0	1.0	21.0	11.0	3.0	100.0
user weightage	**1.6**	**25.9**	**13.3**	**28.7**	**1.0**	**19.2**	**0.4**	**9.9**	**100.0**

A large variation is noticed in the importance given to essential infrastructure and architectural design factors, by experts and users. This is mainly due to the fact the

respondents were already living in the dwellings, and had already accepted these as essential liveability factors, so that sensitivity was only expressed with regard to other features. It is also noticed that there is a wide variation in the weightages given by various experts on the various factors. In such situations, tools like factor analysis can help in the identification of factors, that will aid in reflecting the latent traits providing user satisfaction. Identification of the significant factor components will aid builders and designers working in a competitive field, to identify those extra variables which significantly contribute to satisfaction level, over and above the minimum expectation of the consumers from their dwellings.

8.7.1 FACTOR AND VARIABLE SENSITIVITY

A factor sensitivity chart was prepared to be able to obtain an independent assessment of sensitivity, for each of the factors, in explaining user satisfaction. Such a chart would be helpful for formulation of policies, regarding residential development. The factor sensitivity is computed as the percentage of the square of the beta values, obtained from the multiple regression with factor scores. The factor sensitivity chart for the total sample, is presented in Figure no. 8.2.

The variable sensitivity is the weighted average of the standardised regression coefficients for all the factors For this, the standardised values of regression coefficients (Beta values), were combined with the factor loading of each of the original variables, to obtain their sensitivity, in explaining user satisfaction.. These coefficients indicate the relative importance of each of the factors, while the square of the factor loading is used as a weight, since it represents the proportion of the variance of each original variable, that is accounted for by the factor in question. The sensitivity of variables in explaining user satisfaction was computed as follows:

$S = a^2_1 * B_1 + a^2_2 * B_2 + \ldots\ldots a^2_k * B_k$

S = Variable sensitivity

a =Factor loading from rotated component matrix

B = Standardised regression coefficients

The variable sensitivity chart for the total sample is presented in Figure no. 8.3. The factor sensitivity and variable sensitivity charts for low-rise sample are presented in Figures no. 8.4 and 8.5. The factor sensitivity and variable sensitivity charts for high rise sample are presented in Figures no. 8.5 and 8.7. The factor sensitivity and variable sensitivity charts for choice criteria and user satisfaction combined sample are presented in Figures no. 8.8 and 8.9.

It may be observed from the various figures that, the variable lighting is the most sensitive to user satisfaction. Others are water supply, and garbage disposal, security facilities, organised care-taking, repair and maintenance facilities, freedom from noise pollution, gardening facilities, and acoustic and visual privacy. The results indicate that, if policy makers give greater attention to these aspects, it can help improve user satisfaction in residential buildings.

The next chapter attempts to comprehend the perceptions of policy makers and vocal interest groups on their perceptions to planning problems in Kochi.

Figure no. 8.2

Factor sensitivity on user satisfaction for total sample

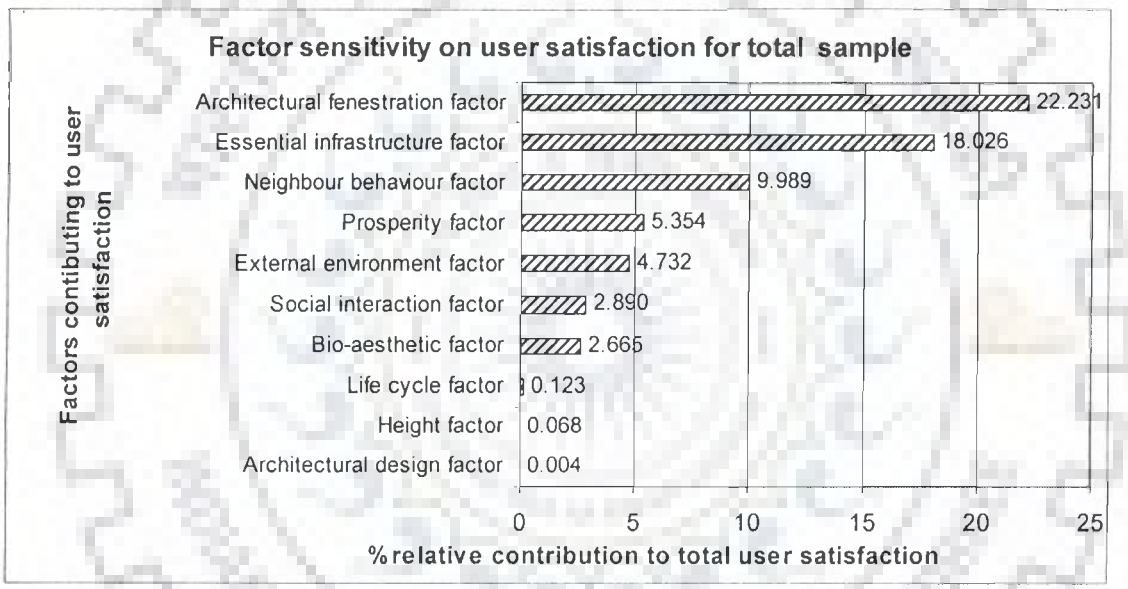


Figure.No. 8.3

Sensitivity of variables to user satisfaction for total sample

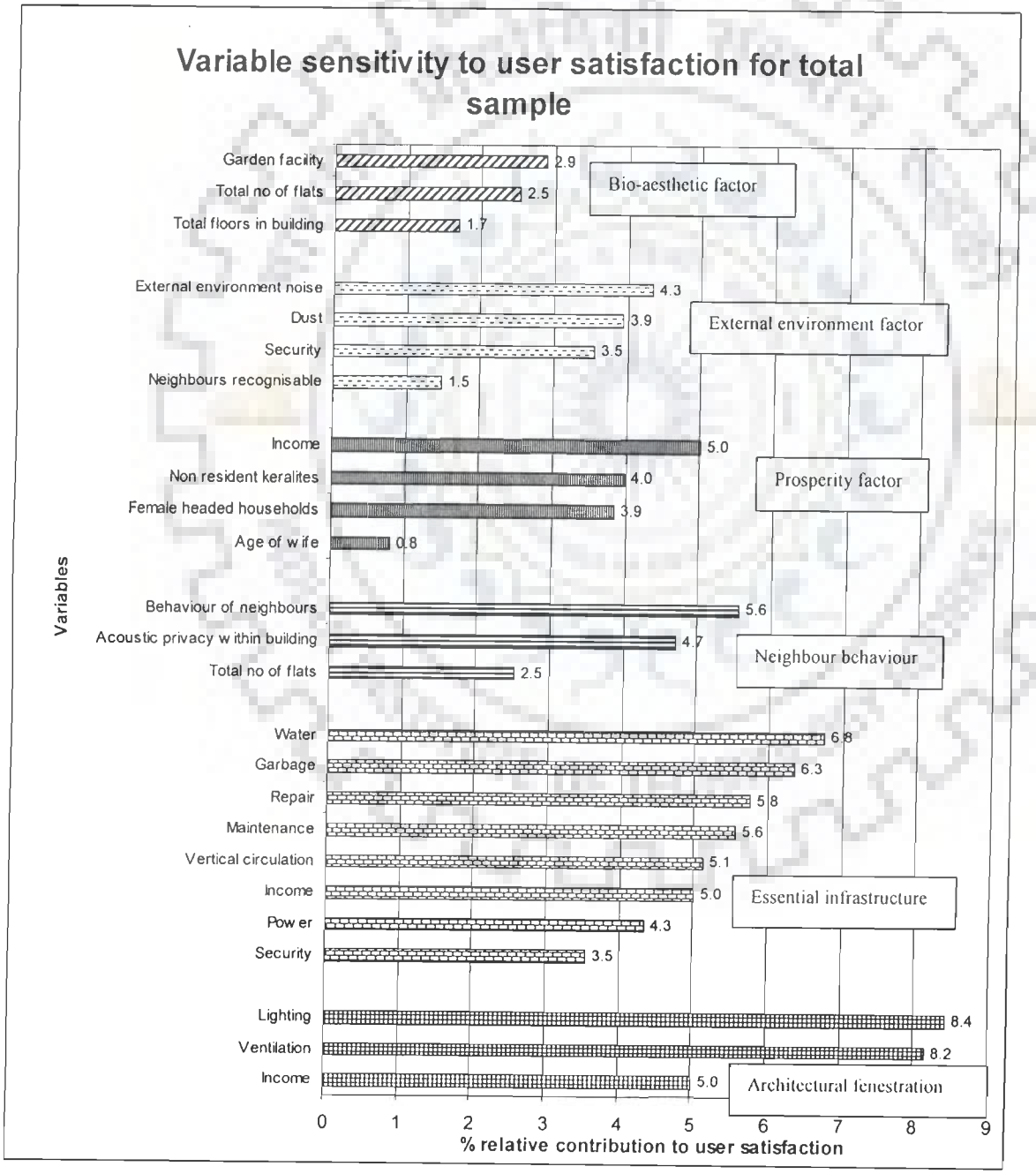


Figure no. 8.6

Factor sensitivity to user satisfaction in high-rise sample

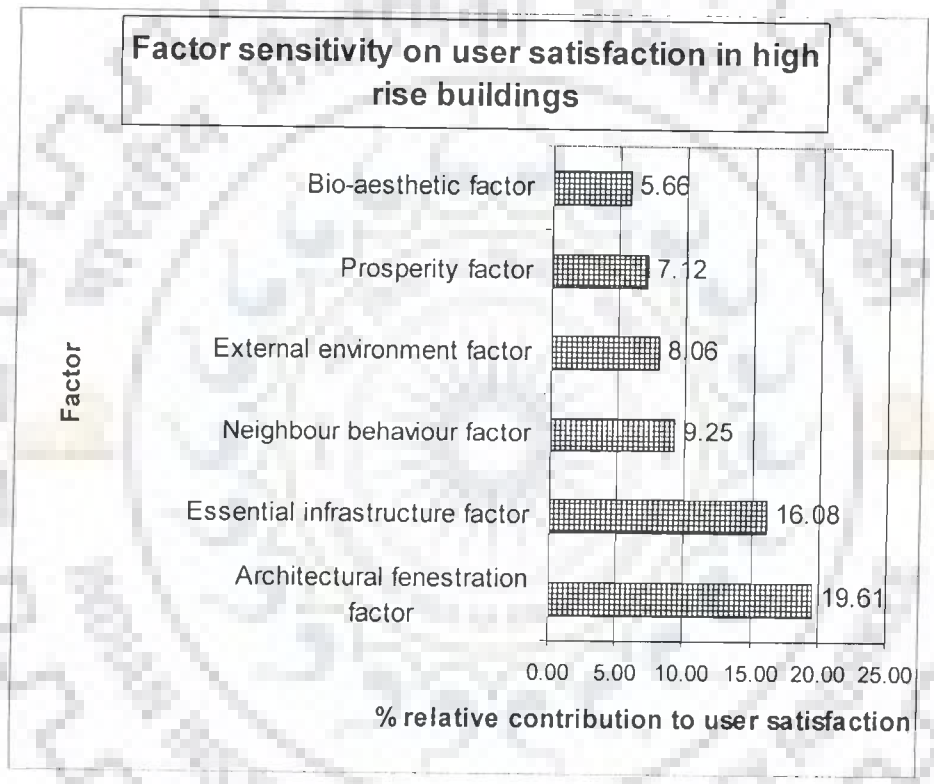


Figure no. 8.7

Variable sensitivity on user satisfaction in high rise sample

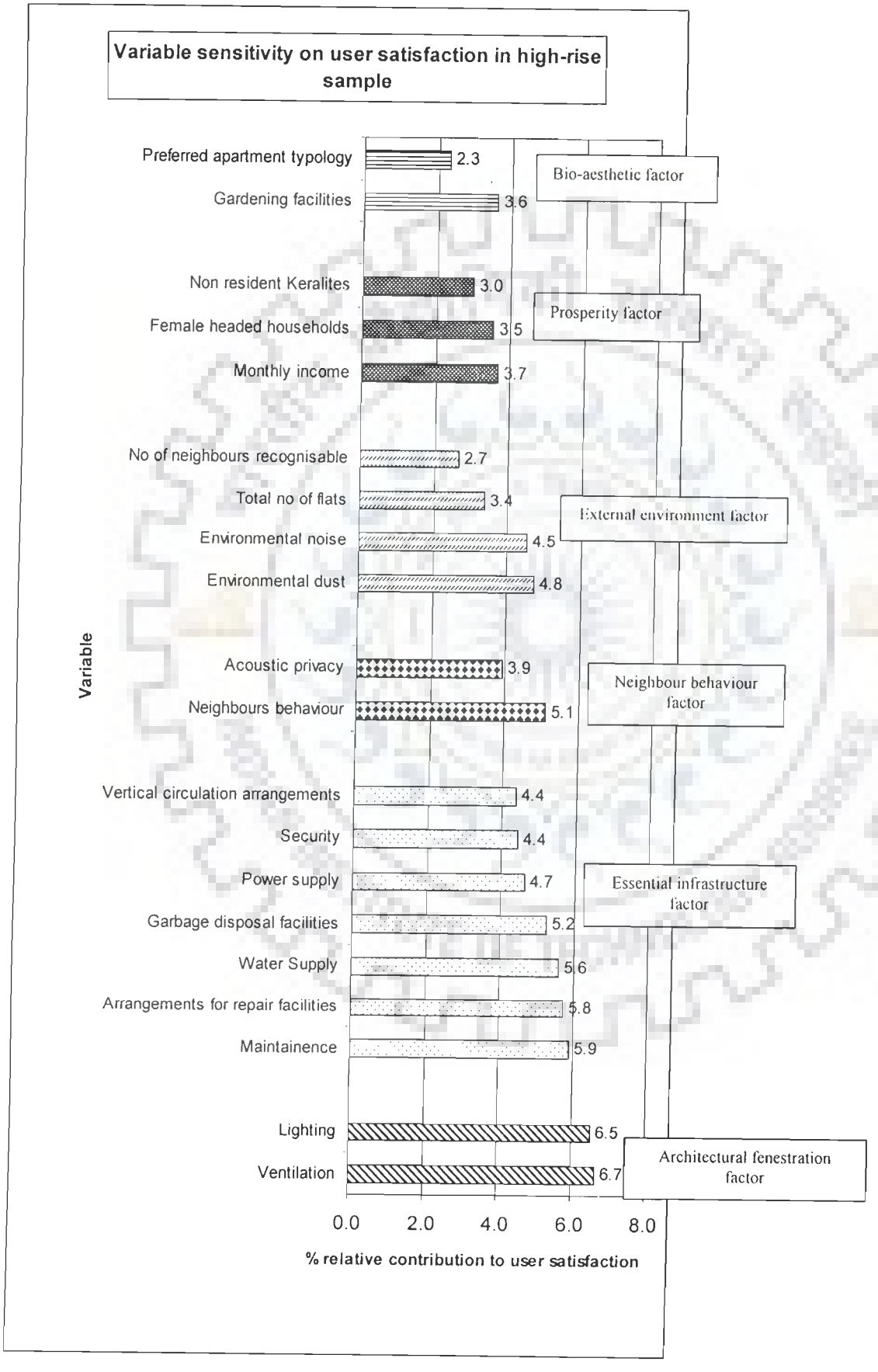


Figure no. 8.4

Factor sensitivity on user satisfaction for low rise sample

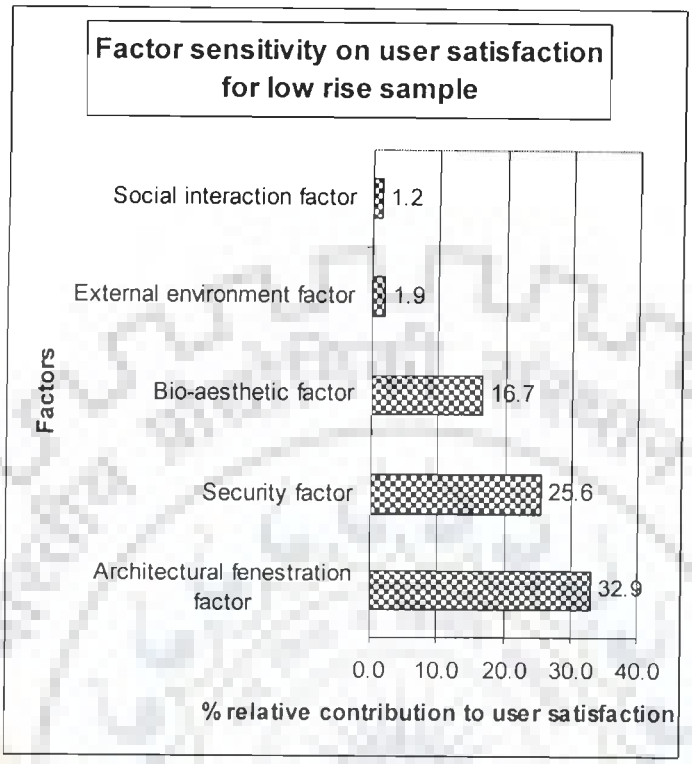


Figure no.8.5

Variable sensitivity on user satisfaction for low-rise sample

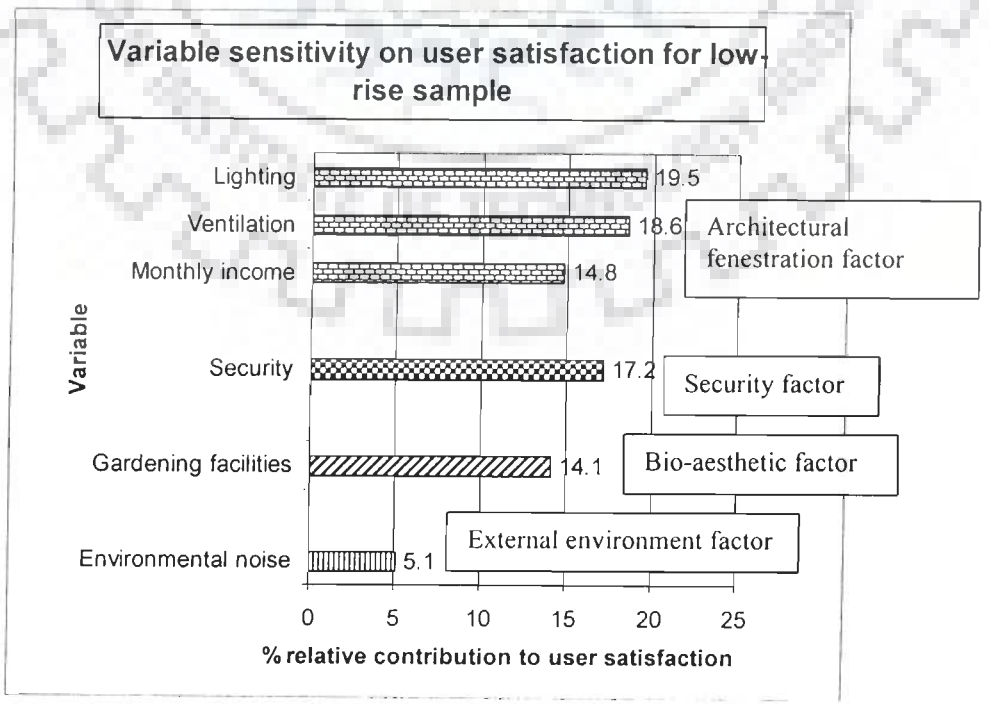


Figure no. 8.8

Factor sensitivity on user satisfaction for choice criteria and user satisfaction combined sample

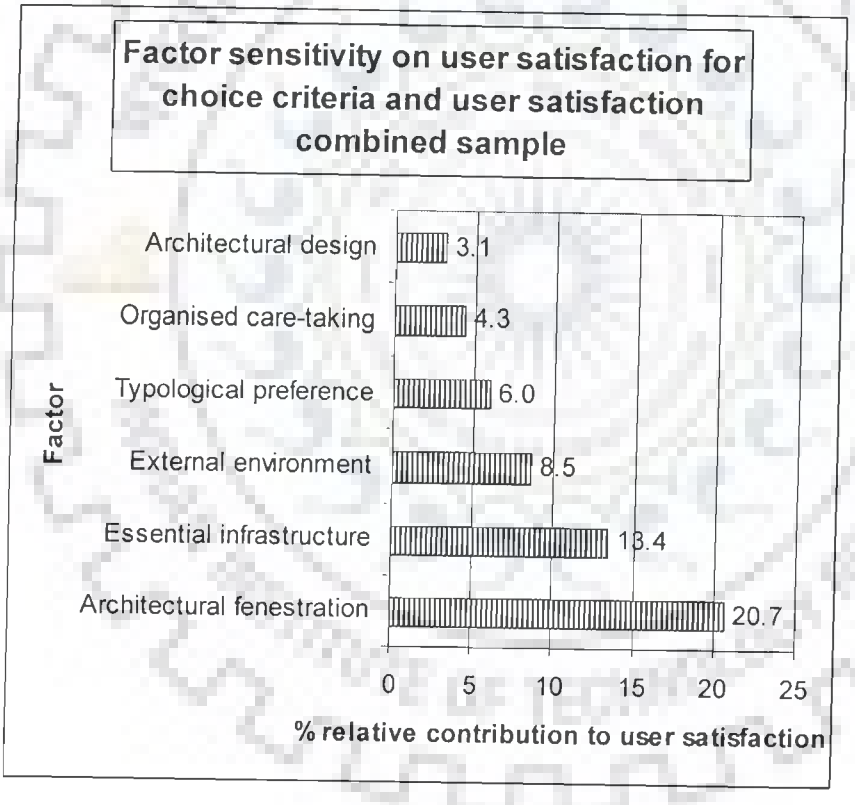
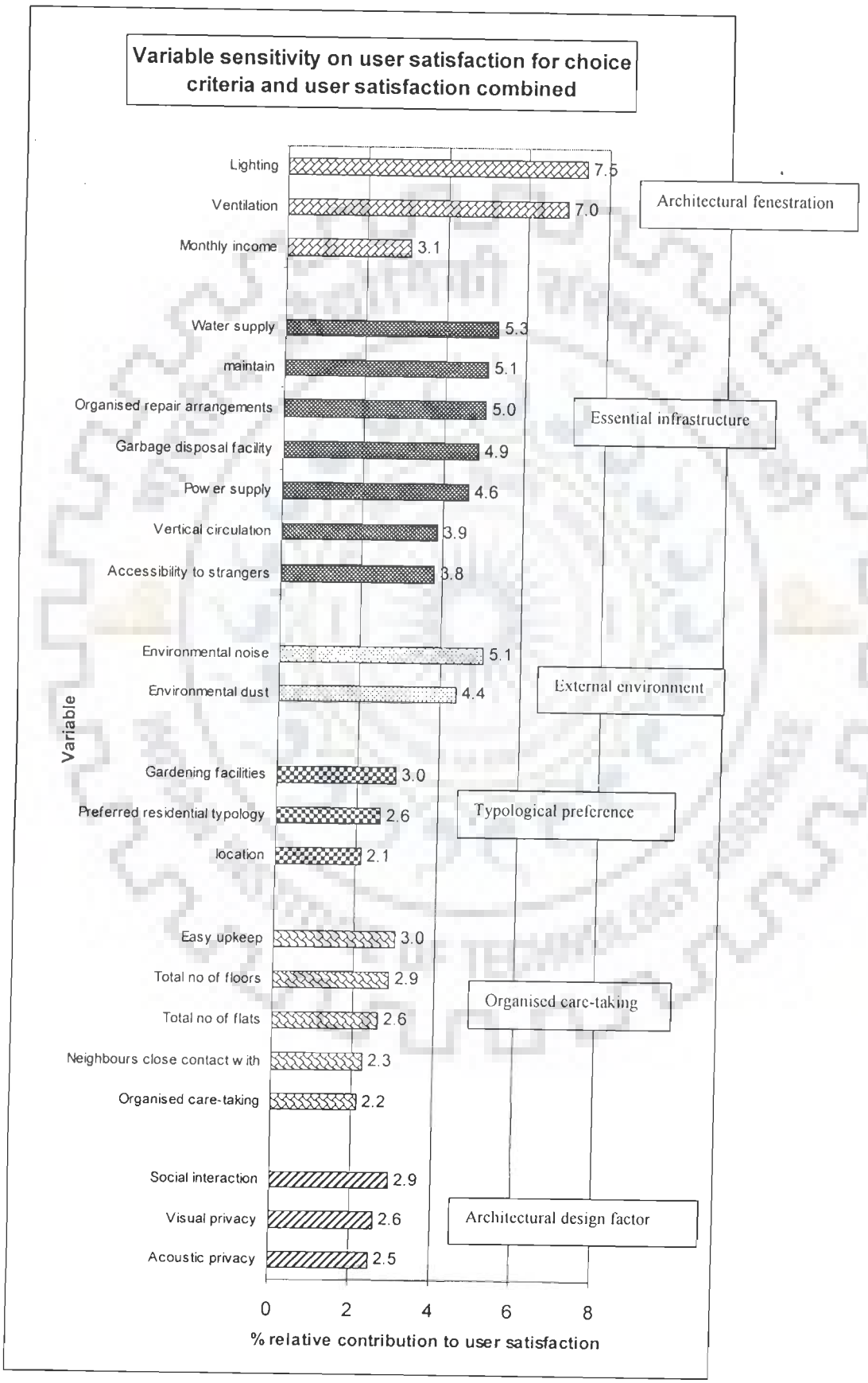


Figure no. 8.9

Variable sensitivity on user satisfaction for choice criteria and user satisfaction combined



CHAPTER 9

PERCEPTIONS OF GENERAL PUBLIC ON EMERGING RESIDENTIAL DEVELOPMENT

CONTENTS

9.1 INTRODUCTION

The growth and variety in residential activity at Kochi, during the last decade, have evoked keen interest not only on the building professionals, but also on the general public. It has also generated much debate by public agencies, regarding the unscrupulous methods by developers to circumvent rules; by developers, regarding the economically illogical building regulations; by the general public, against the public officials permitting non conforming building construction; and by the environmentalists, against both public bodies and builders, for the accelerated deterioration of the urban environment. (258, 259, 9, 244, 195, 245, 21 220, 118, 174, 243, 106, 100, 109, 110, 254). There were also activism by different interest groups, and public meetings regarding these developmental issues. Opinions on methods to solve the city's problems, ranged from arresting all further growth in the city and spilling all further development to the suburbs (70), to the diametrically opposite view of redensifying the city (220).

In such a scenario, it was felt necessary to interview the general public, in order to identify their views and options on the various issues related to the residential development. Fivegroups were identified for survey through interviews: Town planners, elected representatives like mayors and councillors, administrators of local bodies, builders and social elite. The schedule used for the survey is given in Appendix F. Weighted index methods were used in the analysis of the survey.

9.2 CAUSATIVE FACTORS FOR PROLIFERATION OF MULTI-STOREYED APARTMENTS

It was observed that, there were differences in the perception on the causative factors for multi-storeyed apartment growth of the different groups, and within the groups Refer Table no. 9.1. The general perception was that multistoreyed apartment buildings have come

up primarily due to economic factors, directly resulting from the need to invest in real estate property and building, as it was a safe investment with reasonable returns and liquidity, in urban areas. The social factors like demand for better amenities, changes in socio-cultural life style, only contributed to this process. Within the different groups, the elected representatives, social elite, and administrators involved in development activities, awarded a high score to scarcity and consequent pressure on land to meet the demand for housing, as the reason for the genesis of multi-storeyed apartment typology in Kochi. The social elite, who are the least technically informed also gave it the highest score given by any group, for any reason. It is therefore the perception of these groups, that there is a genuine housing need, and the multi-storeyed apartments are therefore, a genuine response to the need. Obviously, the opinion of the social elite on the causative factors for the phenomenon, point to the fact that probably the general populace invested in multi-storeyed apartments, believing that the demand would be sustained enough to earn them high profits.

Table No. 9.1

Opinion on Causative Factors for Growth of multi-storeyed apartments

	Weighted average score					
Causative Factors	**Town planners**	**Elected representatives**	**Elite**	**Builders**	**Bureaucrats**	**Total people**
Safe investment	**2.9**	**2.1**	1.6	**3.4**	**2.1**	**2.3**
Amenities	2.0	1.8	1.7	1.8	2.0	1.9
Pressure on land	**2.2**	**2.6**	**3.6**	2.0	**2.7**	**2.6**
Lack of time	1.5	1.9	**2.0**	**2.5**	**2.1**	1.9
Socio cultural changes	1.5	1.7	1.3	0.4	1.2	1.3

Source: Primary survey on decision makers

The town planners and administrators strongly felt that, it is the better environment, providing amenities like play areas, swimming pool, health clubs, dish antennae, organised care-taking and the security aspects of the multi-storeyed apartments, which have led to a

demand for this typology. In contrast all other groups - the elected representative, social elite, administrators and builders - believed that it is the lack of time for the people to engage in construction, that has led to a demand for ready built multi-storeyed apartments. In fact, the builders have scored it higher than pressure on land, making it the second most important reason for the growth of multi-storeyed apartments, next only to safe investments. The scores between amenities and lack of time do not vary much in the other groups, as much as between builders and town planners. It may be interpreted that both are right. The opinion of the builders giving high score to lack of time reflects the situation of the large chunk of Non Resident Indian (NRI) clientele they have, who had neither the time nor inclination to take up the trouble of construction activities. Interestingly, though there is a consensus by everyone that the leaning of the Malayali towards his traditional homestead lifestyle persist, it is the multi-storeyed apartment typology that has proliferated all over the city, the villas being in limited demand. It appears therefore, that the opinions of both the town planners and the builders are correct, from different perspectives.

9.3 IMPACT OF PROLIFERATION OF MULTI-STOREYED APARTMENTS ON THE CITY

Though the builders consisted of the smallest sample, they had the greatest consensus on various aspects. 87 per cent of them felt that the multi-storeyed apartment typology served to make optimum utilisation of existing land, especially since, most of it came up close to the city centre. 100 per cent of the builders and elected representatives, and 81 per cent of the town planners, endorsed this view. But, in spite of this overwhelming consensus on optimum use of land, strangely, the GCDA and the civic administrators, called for a ban on more multi-

storeyed apartments within the city and directed that all such development be allowed, only on the peripheries!

79 percent of the people felt that multi-storeyed apartments would positively influence the availability of housing. Almost 100 percent of the elected, social elite and builders, also agreed to this view, but the technically informed town planners and administrators, did not appear to be so convinced. Refer Table No. 9.2 below.

Table no:9.2

Impact of proliferation of multi-storeyed apartments on the city

Impact of multi-storeyed apartments on city	Positive %	Negative %	Cannot say %	Total
Infrastructure economics	54.65	22.09	23.26	100.00
Availability of housing	79.07	16.28	4.65	100.00
Optimum land utilisation	87.21	10.47	2.33	100.00
Visual quality	47.67	36.05	16.28	100.00
Disaster management	6.98	74.42	18.60	100.00
Social cohesion	33.72	36.05	30.23	100.00

Source: Primary survey on decision-makers

The cost of developing and maintaining infrastructure, depends on the spread over which it has to be laid and disruptions in the land form. The implications of the cost of infrastructure in a dispersed residential pattern is obvious, especially in a city like Kochi, with criss-crossing railway lines, canals and large water sheets. Obviously, it would appear that the multi-storeyed apartment typology should be ideal for the nature of this city. But, only 54 percent of the people thought so. Here, opinions of different interest groups were vastly different. 100 percent of the builders, 64 percent of the elite and 56 percent of the elected representatives agreed that multi-storeyed apartment typology made economic sense in development of infrastructure. However, only 45 percent of the planners and administrators thought so. The positive opinion seemed to be highest among the least informed. Refer Table

no.:9.3. . Most experts like chief town planners, were undecided on the relative economy in redensifying the dispersed settlements from the infrastructure point of view.

Table No. 9.3

Detailed response on impact of proliferation of multi-storeyed apartments on the city

Impact of proliferation of multi-storeyed apartments	Town planners	Elected	Elite	Builders	Administrators	Total
Positive	%	%	%	%	%	%
Infrastructure economics	45.45	55.56	64.29	100.00	45.45	54.65
Availability of housing	77.27	100.00	92.86	100.00	63.64	79.07
Optimum land utilisation	81.82	100.00	85.71	100.00	84.85	87.21
Visual quality	31.82	77.78	50.00	87.50	39.39	47.67
Disaster management	0.00	33.33	0.00	0.00	9.09	6.98
Social cohesion	27.27	22.22	42.86	75.00	27.27	33.72

Negative	Town planners	Elected	Elite	Builders	Administrators	Total
Infrastructure economics	31.82	11.11	7.14	0.00	30.30	22.09
Availability of housing	13.64	0.00	7.14	0.00	30.30	16.28
Optimum land utilisation	13.64	0.00	14.29	0.00	12.12	10.47
Visual quality	40.91	22.22	42.86	12.50	39.39	36.05
Diasaster management	72.73	55.56	92.86	100.00	66.67	74.42
Social cohesion	36.36	33.33	35.71	12.50	42.42	36.05

cannot say	Town planners	Elected	Elite	Builders	Administrators	Total
Infrastructure economics	22.73	33.33	28.57	0.00	24.24	23.26
Availability of housing	9.09	0.00	0.00	0.00	6.06	4.65
Optimum land utilisation	4.55	0.00	0.00	0.00	3.03	2.33
Visual quality	27.27	0.00	7.14	0.00	21.21	16.28
Disaster management	27.27	11.11	7.14	0.00	24.24	18.60
Social cohesion	36.36	44.44	21.43	12.50	30.30	30.23

Source: Primary survey on decision-makers

The intangible aspects, created the greatest difference of opinion among the various interest groups. Only 47 percent of the people felt that, sight of these tall multi-storeyed apartment blocks enhanced the visual quality of the city. The elite were divided on the positive and negative aspects. Almost 87 percent of the builders themselves were convinced of the positive contribution of their product to the visual quality of the city. 77 percent of the

elected representatives thought that it improved the status of their city. The category who would not endorse this view point, were the technical groups involving planners and administrators. Most of this group consisted of architects and civil engineers, were of the opinion that, although individual buildings were not unsightly, these buildings scattered in a haphazard fashion, marred the skyline of the city, and destroyed its architectural character and unity.

Kochi being a low lying coastal zone, with an oil refinery close by and sensitive defence establishments and port, the question how the city with its narrow congested roads, and few major transport corridors, interrupted land mass, and haphazard high rise buildings on narrow streets, would react to disaster, was another important aspect of the survey. The ill preparedness of the city to the scenario was conceded by 100 percent of the builders, 77 percent of planners, 66 percent of administrators, and to 55 percent of the elected representatives.

9.4 OPINIONS ON CITY'S MOST PRESSING PROBLEMS

The opinion of the various interest groups was solicited regarding their concern for five pressing city problems, as a result of the proliferation of multi-storeyed apartments, identified from perusal of relevant literature. Table No. 9.4 summarises the response regarding this.

Table 9.4 Opinion on the City's most pressing problems

	Weighted average score					
Problems	Town planners	Elected	Social elite	Builders	Bureaucrats	All
Extensive filling	1.68	2.44	2.33	1.00	2.00	1.92
Destruction of scenery	1.55	1.11	1.08	0.88	1.21	1.24
Blockage of drains	2.05	2.33	2.50	1.63	2.38	2.24
High price rise	1.73	1.56	1.58	3.63	1.62	1.82
Pressure on infrastructure	3.00	2.56	2.50	2.63	2.79	2.76

Source: Primary survey on decision-makers

The greatest concern expressed by all the groups together, especially the planners, has been about the pressure on infrastructure, followed by blockage of drains, and extensive filling.

A strange consensus prevails over the lack of importance given to visual effect on the city, due to destruction of coastline scenery by water front multi-storeyed apartments, which attracted the least concern of all groups. The greatest concern on this is rightly expressed by planners and the least, understandably by the builders. While the visual effect on the skyline has been held to be negative by this technical group, it only ranks least, when compared to other issues. There appears to be a general indifference to this most important issue, which is irreversible. If adequate measures are not taken, the natural environmental setting of the city may be permanently destroyed.

In spite of these mixed reactions, only 2 percent of the people felt that multi-storeyed apartments should be discouraged. A majority 73 percent thought that flats should be controlled, while 11 percent felt that multi-storeyed apartments should be actually be encouraged. Even among those who encouraged multi-storeyed apartments, 70 percent felt that the city core was not the right place for encouragement of the siting of the same. Only 9 percent of the respondents felt that multi-storeyed apartments should be permitted within the first ring between the railway line and the back waters. The majority 62 percent felt that multi-storeyed apartments should be permitted only 5 km beyond this inner core. 34 percent were of the opinion that, flats should not be permitted within 10 km from the city core. They were of the opinion that, multi-storeyed apartments should be located only in outer municipal and panchayat areas of Tripunithara, Kakanad, Kalamassery etc. The opinions for and against

multi-storeyed apartments in the core and the suburbs at best, suggests that the new typology had evoked keen interest among public men.

One of the positive effects of the proliferation of multi-storeyed apartment was the large amount of redensification made possible on the vacant land within the city core. Table No. 9.5 gives the percentage distribution of different types of land that have been brought under residential development in Kochi.

Table No. 9.5

Distribution of land according to type brought to residential use

Respondents	demolished	Marshy/Vacant	Total
Planners	31.77	68.23	100
Elected	34.38	65.62	100
Elite	31.93	68.07	100
Builder	40	60.0	100
Administrators	32.9	67.1	100
Total	**31.61**	**68.39**	**100**

Source: Primary survey on decision-makers.

It was found from the survey that the greater chunk (68%) of residential development has come up on empty lands. Combined with the fact that the development on such land-locked vacant land is by tall buildings, it has indirectly led to the development of a new urban form.

9.5 OPINIONS ON RESIDENTIAL DENSITY AND TYPOLOGY

As is already known, the densities and form of residential buildings in a city, are shaped by physical planners, with the objective of achieving efficient and healthy cities. But often, cities are visualised as compartments based on the limitations of the human mind, seeking simplicity and order in everything, while also inadvertently being biased towards certain socio-economic classes, to which he may belong (72).

A user survey in Bangalore revealed that the peoples perception of living conditions and that of the planner do not converge (200). Despite the view that the planners perceptions

may be biased towards some sections, none of the income groups ratings of living conditions, converge well with the common yardsticks of planning good residential layouts. It was found that neither high densities, nor low densities prescribed by planners, are attractive to live in.

The building rules stipulate a Floor Area Ratio (FAR) of 1.5, with a ground coverage of 50 percent, for residential buildings in Kochi. Availing full ground coverage, it was not possible to go beyond three floors, with this FAR restriction. This did not agree with the economics of construction, given the high land price in city core and prevailing cost of construction. Hence, most builders made use of the exemption clause in building rules, under which they obtained sanction from higher authorities for their projects, which were at least 6-10 stories on an average. According to veteran planners the power of the government to exempt buildings, is the most misused, and misunderstood (187). These sentiments were also reflected in the opinions of the planners surveyed, who felt that because of this clause in the building regulations, they were unable to control the haphazard and non conforming constructions. Around half (48. 27 %) of them revealed in the survey, that they strongly believed that, the clause regarding exemptions should be done away with, if they were to ever achieve planned development. 17% felt that the FAR regulations should be modified. Opinions on the modification required was diverse, with 3% opining that FAR should be reduced in the core, preventing tall buildings, and increased in the suburbs, and 1% opining just the opposite.

Opinions on ground coverage also varied, with the majority maintaining that, it should be increased to 75% for residential buildings. Around 10% opined that it be reduced to 40% with increase in FAR, while few others felt that the present 50% may be retained, but with no FAR restrictions. The preferences of the overwhelming number of planners for low density and spread out developments, have been strongly criticised as being wasteful of precious land resources. It is alleged that such, 'preferences are heavily biased towards order, cleanliness,

deconcentration, reflecting colonial legacies in urban thought (164,165). However, such opinions continue as can be seen in the Report of the National Commission on Urbanisation (1988). It observes that under-utilisation of land should be curbed, calls for review of FAR and density specifications, advocates tax on vacant land, but suggests low rise, high density form for cities (153). The issue of the ideal urban form has become a point of contention. Arguments have been made that better light and ventilation, the basic objectives of building regulations can be better obtained by (i) reducing ground coverage and permitting higher FAR, as a 50 percent coverage effectively leaves only the roads around, and (ii) reducing the minimum distance between two buildings, to permit construction of taller thinner blocks, instead of massive single blocks resorted to, in order to obtain more built up area (6). The All India Conference on 'Housing- The challenges and solutions' held in New Delhi in November 1998, also recommended that 'the government of India should permit higher FSI/FAR in the cities on payment of an additional premium to the local authority'. Others advocate a more flexible approach towards density and form, so as to accommodate market forces and the peoples desires also (33,36). The Fifth International Congress on Human Settlements in Developing Countries held at Madras in 1989, recommended that, 'Realising that the existing building bye-laws, zoning regulations and land use pattern are not suitable for majority of the population, it is essential to amend, these to meet the requirement of majority of the population.'

9.6 SURVEY OF NEIGHBOURS OF HIGH RISE APARTMENTS

The previous sections have discussed the opinions of various interest groups on various problems generated by multi-storeyed apartments, as highlighted in literature, and newspaper reports. But, all these remain only as opinions based on observation or hearsay. The issue cannot therefore be closed, without getting a first hand report from the

neighbourhood residents. Broadly, the survey covered four aspects namely, social and comfort aspects, economic aspects, physical aspects, and aesthetic aspects.

55% of the immediate neighbours reported that, the emergence of apartments has caused flooding problems in their neighbourhood. Flooding is common in areas without drains, when adjoining, low lying marshy lands, which hitherto collected all neighbourhood storm water, got filled up due to development work.

In one case, the resulting flooding has actually necessitated the raising of the ground level, by an entire neighbourhood of people. In some of the core city areas, natural canals have been filled, while corporation drains remain clogged, accentuating the problem. Discussion with corporation officials also revealed that, this was one of the aspects on which maximum complaints were received, not particularly against multi-storeyed apartments, but generally from all areas where marshy lands were being filled up.

None of the neighbours reported any improvement in the public transport system, as a result of apartment in their neighbourhood. While 56% of the neighbours reported that traffic congestion on the existing roads had increased, one third agreed that there has been an improvement in the conditions of the existing road. This is usually the case if the apartment is located on pocket roads, where builders assist in surfacing the roads and forming the drains.

Another major complaint of neighbours (66 %) were regarding the shortage of water supply. It was reported that apartments were collecting all available water into deep under ground sumps, using bigger pipes, resulting in the neighbourhood taps going dry. Multi-storeyed apartments being a new phenomenon, the neighbours were not aware of such practices, until the problem actually surfaced. This complaint was not confined to high rise apartments, but equally applicable to all, multi-storeyed apartment buildings. While a similar situation is being experienced in other developing areas, without multi-storeyed apartments, it

became conspicuous with the coming up of these apartments and hence this reaction. So is the case with low voltage and garbage disposal.

About 40% reported that, they suffered a loss of personal identity, after the multi-storeyed apartment came up. This is not applicable to predominantly commercial zones, where the households have already accepted the loss of identity, and hence did not feel a worsening of the situation. Most neighbours had some contact with just one or two residents of high-rise apartments. The apartment occupants seem to behave as self contained communities, different in social, economic and cultural aspects. Even children seemed to stick to separate groups. However, there are concerted efforts by them to become accepted into the neighbourhood, through invitations to neighbours for socio-religious celebrations. Better neighbourly relationship seem to prevail in low rise apartments, and the socio-economic divide less sharp. One positive aspect of the high rise apartments, was the sense of security it gave to neighbours. The neighbours seemed to be happy about having a security personnel of the multi-storeyed apartment near their property, and felt safer.

66% of the neighbours reported reduction in breeze and air circulation whereas only 25% reported the effects of shadow . The more serious concern was the loss of visual privacy within their premises, as reported by 76% of them. Many felt embarrassed to take up backyard activities, like washing clothes etc. This was more so for their open verandahs, one of the intensely used spaces, in Kerala culture.

All agreed that by the emergence of multi-storeyed apartments, land values shot up-in built up areas by about 25%, and up to 100% or more in undeveloped areas. One of the reasons was that during this period of frenzied apartment building. Demand for apartemnts and the profits were very high, that builders were prepared to pay any price, for the right extent of land at the right location.

There were many complaints during the construction phase of apartment, the most serious being the fear instilled in the neighbours regarding the safety of their own dwellings, during piling operations. Other complaints were of dust and noise disturbances, plaster and other construction debris falling into their premises etc.

Survey revealed that 30% of the plots on which muti-storeyed buildings were constructed did not contain any mature trees. 21% contained up to five trees and 8-10% contained around 30, mostly coconut trees, with around ten trees being lost, during every multi-storeyed apartment construction activity. Though any development, low or high rise may require removal of trees, the lone long trunk of the coconut trees with crown as high as 10 metres and above, permits construction of low rise buildings, with relatively lesser damage to the biotic environment. However, in case of high rise complexes, usually much higher than the trees, only a few trees can be saved. Therefore, one of the most striking impacts of the apartment typology is the resultant alteration of the visual and aesthetic environment. A birds eye view of Kochi, reveals a vast expanse of coconut trees interspersed with water bodies. Very little of the built up areas are actually visible over the green canopy of trees and the coast line presents a picture of serene, virgin lands lined with coconut trees. The tall buildings piercing through the canopy of green, alters, not only the unique skyline and coast line of the city, but also reduces the green cover substantially with unpredictable environmental ramifications. Refer Figure no. A on plate 11.

9.7 **Views on public opinion**

The response of the decision makers to the question of whether public opinion was essential prior to a development, is given in Table no. 9.6. In a democratic set up as in India, it is surprising to find that only one third of the various interest groups felt that it is essential to gauge the public opinion before undertaking any scheme. Though the theory of planning lays

down clearly the importance of taking the public into confidence, it was certainly surprising to note that only 32% of the planners thought it essential. Not even half of the elected representatives felt it was essential, while 11% maintained it was altogether unnecessary to consult the public and expert opinion alone mattered!! Even more surprising was that only 50% of the elite representing the general public thought it was essential, that the public should be consulted.

Table No. 9.6

Importance of public opinion in plan making

Category	essential	necessary	desirable	unnecessary	total
Planners	31.8	45.5	18.2	4.5	100.0
Elected	44.4	44.4	0.0	11.1	100.0
Elite	50.0	50.0	0.0	0.0	100.0
Administrators	32.4	32.4	26.5	8.8	100.0
Builders	0.0	87.5	0.0	12.5	100.0
Total	33.3	44.8	14.9	7	100.0

9.8 DISCUSSION

The present approach to the planning of settlements is that the problems, solutions and their priorities are to be identified through public opinion and the plans are to be formulated taking their views into consideration. This principle however is more preached but seldom practised. The attempt of the researcher was to survey the perception of the general public on the emerging residential Developments of Kochi during the last decade by interviewing them, in five groups: decision makers, administrators, social elite, builders and the neighbours of multi-storeyed apartments. The survey has revealed the following points.

1. The spurt in residential development can be attributed to the need for investment and a sense of possession. The scarcity of land has led to increased demand and pressure to meet the housing need and this has led to the multi-storeyed apartment typology in Kochi. While there is a general agreement on this point, opinion are varied on the

consequence of this development. While all the five groups favoured this typology as justified from the consideration of good land utilisation, infrastructure economics and increasing the supply of housing in general. In spite of this overwhelming consensus, the policy makers and the planners were the same people who advocated a ban on such multi-storeyed apartment buildings in the city centre and its shift to the suburbs. This dichotomy in the perception of people and practised by planners violates planning concepts.

2. Kochi located in the low land areas has unique problems in infrastructure development. With a land severed by railway lines, canals and water bodies, infrastructure development has been riddled with problems as revealed by respondents, even from areas where there are no multi-storeyed apartments. In fact the lack of development of infrastructure has stagnated the growth of the city as in the case of old Kochi. The issue of disaster management such as fire fighting, evacuation during floods, flooding of roads, blocking of drainage canals are all related to this problem itself. This calls for policies for infrastructure development to be given priority in healthy urban development, more than any other input.
3. The lack of cohesion as perceived by the general public is not substantiated in the survey of the occupants of the multi-storeyed apartments. This shows that there exists a clear gap between the perception of the decision makers and that of the user in the matter of residential development. This difference is all the more glaring regarding the visual quality of the environment. While the social elite and public men are highly vocal against the 'concrete jungles' that are generated by multi-storeyed apartment buildings, the personal interview of the researcher with these groups, indicates that elected representatives look upon these apartments as a status symbol of the city. At the same time majority of the people involved in planning and development of the city like

planners, architects and engineers felt that the development appeared scattered and haphazard marring the sky line of the city. They event felt the architectural character and unity of the city is there by destroyed. This paradoxical situation arises from the fact that plans now are unrelated to peoples participation and has remained a bureaucratic technical process with neither accountability to the public nor a vision to the future.

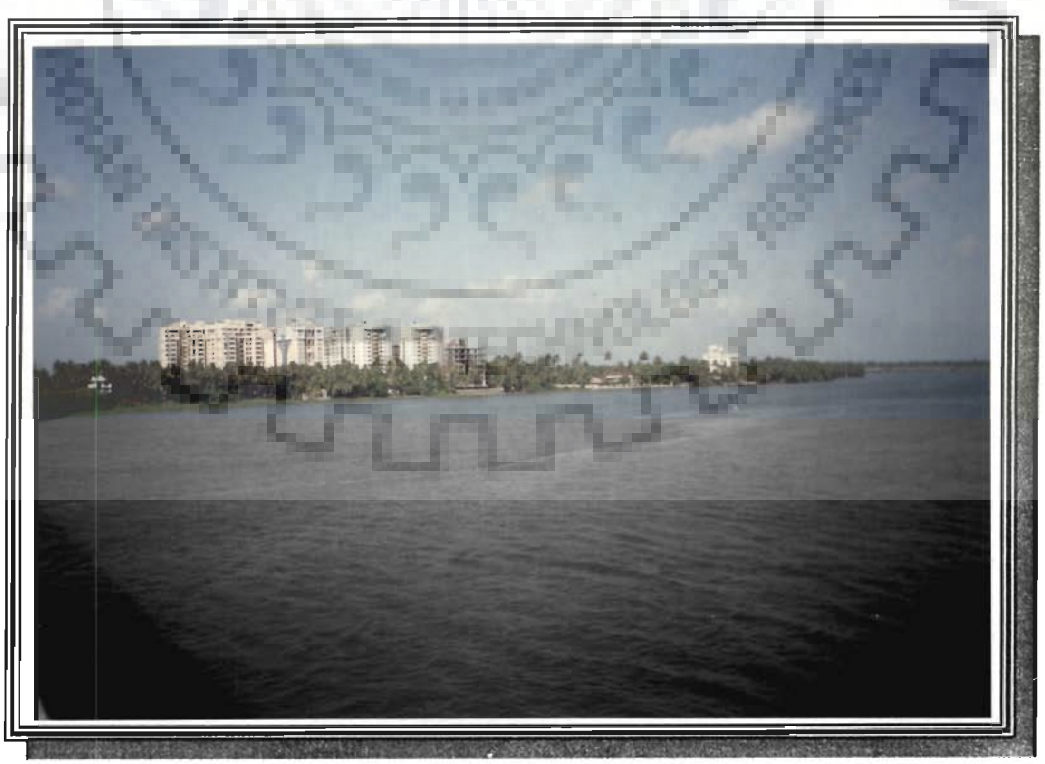
4. The public opinion reveals that by and large the tall buildings are to be accepted for a developing city. The problems perceived by them are related the factors which could be controlled by good governance and policy decisions. Even with the traditional preference of the people for villa type housing, no strong opposition has been expressed regarding the new trends. The debate essentially was restricted as to whether such development should be within the city or in the periphery. This shows the adaptability of people to move with socio-technical changes and from a rural to urban system with pragmatic approach.
5. Clearly, the skyline of the city with tall buildings projecting above the greenery of the land evokes despair as well as interest. The fear of the planners regarding the architectural character of such development arises out of lack of the image of an ideal urban form. All over the world, the issue of an ideal urban form is a point of contention and a goal of research. The analysis of the housing pattern and typology discussed in chapter 7 indicates that factors and variables which influence the ideal residential form can be identified. Within the limitations of this research, it is further possible to search for models of this residential development and describe it in qualitative an architectural vocabulary. It is further possible to evolve a policy for achieving the desirable model at the macro level and to suggest guidelines in the planning and designing of apartments at the micro level. This is attempted the next chapter.

A. LOSS OF GREENERY

B. TRADITIONAL HOUSE CAMOUFLAGED

Plate 10

A. DESTRUCTION OF SCENIC BACK WATER FRONT



B. DEVELOPMENT WITHOUT DESTRUCTION OF BACK WATER FRONT

Plate 11

CHAPTER 10

RESIDENTIAL LAND UTILISATION WITH ENVIRONMENTAL CONSIDERATIONS

CONTENTS

10.1 INTRODUCTION

Residential land utilisation encompasses (a) the description of the spatial distribution of residential uses in a city, (b) definition of building typologies and (c) density (quantification of dwellings/unit area), which jointly decide the form of residential

development. In the classical approach to town planning, the aetiology and morphology of urban settlements, is attributed to the formation and spread of basic activities, such as, commerce, industry and administration. Consequently, in the plan formulation, these institutions take the prime positions, about which, residential development organises itself. Researchers, in the field of sociology, economics, and geography have presented several theories of residential development. However, the present study reveals that, in addition to social, economic, and physical factors, other aspects also influence to explain and model the spatial distribution of residential development. Studies by planners and architects (39, 217, 190, 168, 60, 23, 22,) reveal that, environmental factors also play a decisive role in the residential land utilisation, planning of residential zones, and architectural design of microenvironment of residences. Further, residential area development cannot be treated as a left over, after the basic and service land uses are located. Instead, they are to be planned and developed, integrally, with other landuses of the city, in a holistic manner.

10.1.1 RELEVANCE OF THEORIES OF RESIDENTIAL DEVELOPMENT

In the context of this research, the words environmental considerations include all the factors, which go into the holistic concept of residential land utilisation. These factors have been spelled out in section 1.2 of chapter 1 comprising of (1) Techno-Physical conditions, (2) Economic factors, (3) Social considerations, (4) Legal and administrative measures, and (5) Bio-aesthetics. It is generally acknowledged that, residential land utilisation has been modelled in relation to each of these environmental factors. However, the purpose of most of these studies, have been to explain the phenomenon of residential land utilisation, in terms of one or more of these factors. The researcher being an architect planner, had the goal of deriving a model integrating all the factors, which will serve as a tool for formulating the policies for an ideal residential development satisfying the desirable criteria of each of the subsystems.

10.1.2 STUDY AREA

Kochi has been taken as a typical study area for this research. The formation and growth of the city show that the existing residential pattern has followed the classical morphological theories, till the recent past. With the growth of urbanisation, the spread of residential development over-spilled the early nodes, and spread over a large area encompassing the city limits, the urban fringes and the rural environs. In this urban form, there is no predominant concentration of residential densities, even in the core regions of the city, as can be seen from the ward densities within the urban areas. This observation is in contrast with the theories of residential pattern observed in developed countries, with high densities in the central area, thinning out into the suburbs.

10.2 PARADOX IN THE KINETICS OF RESIDENTIAL DISTRIBUTION:

The spatial distribution of residential areas in the city has strong socio-cultural factors, as revealed from this study. The development, as in all other urban centres was initiated in the central area. It then moved to the peripheral zone, along the major radial roads linking the centre with the suburbs, for accessibility on the one hand, and bypassing the thresholds of railway lines and canals, which severed the land mass on the other, in search of cheaper land for residential development. The pull factors of the central area, however, have always created a return movement of residential activities to the centre, re-densifying the core. This pattern of outward movement and the return wave, in more than one cycle during the duration of this present study, is a conspicuous variation from the general findings on residential distribution, as seen in developed countries. This kinetics can only be explained in the light of the competing forces of supply and demand. More significantly, the focal importance of the central core area appears to continue as a magnet pulling residential development towards it, in traditional cities (121). This observation is of great value in policy formulation regarding

residential development. Clearly, the redensification of the central zones of the city has overwhelming preference over decentralisation and dispersal of densities, as revealed in this study.

10.3 EMERGING RESIDENTIAL FORM

10.3.1 RESIDENTIAL FORM AND GROWTH TRENDS

The central zone in this context, is to be seen as the zone where the amenities and facilities are concentrated, and not as the limits of the earlier city core. As the city grows by expansion of its boundaries, clearly, the limit of the central core is also seen to grow, with input of facilities and amenities. Therefore, the central core zone is to be defined in relation to a time frame. The expanding trend of the central core zone in Kochi is presented in Figure no.4.1 in chapter 4. In the light of the above, it can be deduced that if this growth trend had continued, a unique residential land utilisation pattern would have emerged. In this pattern, high-density apartment buildings will be located within the major activity node areas of the city. As the core of the city will be the prime area of urban activity concentration, tall apartments will be a characteristic feature of the area. The same pattern will be seen at a lower scale, in other urban nodes like regional centres of development.

This residential land utilisation pattern of prominent peaks in the activity nodes and sparse development in between, will be influenced by community perception. A survey of the decision-makers and social vocalists has revealed that the community perception of the above spatial pattern is varied. As discussed earlier, while a minority of the respondents are able to foresee its potentialities for the future urban growth, by and large, the majority of planners, administrators and elite, continue to hold the conservative view that low rise buildings are appropriate to Indian cities.

10.3.2 RESIDENTIAL FORM EMERGING FROM PREFERENCE FOR DIFFERENT RESIDENTIAL TYPOLOGIES

Till 1960, the predominant type of development in Kochi was of single or double storeyed buildings. Walk up apartments or multi-family dwellings, were introduced in the 70's by the Greater Cochin Development Authority. Tall buildings appeared in the late eighties. At present, there is a mix of all these three types in the city. The surveys the occupants of multi-storeyed apartments, prospective consumers of ready built housing and general public, indicate that there is no predominant preference for any one typology. The study revealed that independent houses were preferred by at least 80 per cent of the general populace, and 30 per cent by prospective consumers of ready built housing. The study also revealed that though the memory of the independent house, still lingered for 37% of occupants of multi-storeyed apartments, they chose to live in this typology for other reasons such as, security, easy upkeep, organised care-taking etc., as discussed in section 7.4.7 of chapter 7. A small proportion of 15 per cent of multi-storeyed apartment occupants preferred walk up typology. Nearly 70 per cent of prospective consumers of ready built housing and around 50 percent of the occupants of multi-storeyed apartments preferred the high rise typology. The survey of occupants further showed that 55% of them wanted to live on floors above six, of which a small portion preferred higher floors of ten and above.

It may be concluded that the building types, namely, independent, walk-up, medium and tall buildings have all come to stay in the city fabric. Of these, the independent type houses will get increasingly displaced to the suburbs, due to economic and environmental reasons, as seen by the preference of respondents. Only 11 per cent of those who wished to live in independent houses wanted to live in houses with small compounds near work places in the city. Nearly 90 per cent wished to live in independent houses with compounds with space for kitchen gardens etc., within reasonable distance from the city centre. Of the

remaining three types, it may be safely assumed that the choice of dwelling is more or less equally divided. This indicates that the number of buildings of the three typologies that will be required to satisfy the needs will almost be in a geometrical series. This equation may be architecturally interpreted to give rise to a hierarchy of residential buildings conforming to a pyramidal pattern. Such a residential form will have the tallest buildings occupying in the centre, and a larger number of medium and walk up buildings of decreasing height, away from it in any residential zone. Clearly, if we take a sector bound by roads on all the four sides, the spatial requirements of these three typologies will be best satisfied, by having the tallest building occupying the least ground space in the middle of the sector, medium rise surrounding that, and the low rise/walk-up building along the periphery, near the roads.

A. Balancing density equation

If the pyramidal pattern is a viable built form for residential development, how will it be explained through a density equation? Here an anomalous situation will arise in which, the higher floor area ratio (FAR) will have to be allowed in the interior of the residential zone and a lower floor area ratio near the road. Viewed from the present trend of urban land utilisation, this appears paradoxical, but it can been clearly seen that, land utilisation is a function depending on the location, and accessibility to roads, and above all, the permissible built up area of the place. The last factor namely permissible built up area, is decided by the floor area ratio. A land having a higher floor area ratio is also one having higher land value, in an urban situation. The control of floor area ratio, can hence, serve as an effective tool to guide development in the desired direction, as for example, in the case of the pyramidal form visualised above. A policy through which, the floor area ratio permitted at a location may be related to the distance from the road, appears an easy solution for achieving this i.e., a belt of land adjoining the roads will have low floor area ratio, whereas, a belt away from the roads will have increasingly higher ratio. In this scheme, the residential density permissible in a

zone may have to be redefined in terms of residential population load, over a well-marked zone defined by the peripheral roads. With the increasing choice of permissible residential forms, builders may therefore reduce availing of exemption clauses. This may help town planners in exercising greater control on construction activities on one had, and prevent the negative visual and environmental effects of haphazard development.

B. Economic relevance of the residential form:

Control of floor area ratio, in the prime area adjacent to roads for the purpose of density control, may appear to be unrealistic, and only academic in nature. In this connection, it may be realised that there is increasing shift towards mixed land use strategies, recommended for enlivening the central areas of cities, all over the world (71). Further, there are clearly high economy functions such as, whole sale and retail business, manufacturing and service, which have a locational affinity to proximity of roads. Clearly, the first belt of land adjoining the highways will be the natural choice of such areas. Offices and institutional buildings require proximity to roads, but a location alongside the road may not be preferred. Such activities may therefore, occupy the second belt from the roads. An interior location like that of the centre of the zone may have no locational value for these activities. Clearly, residential use can therefore, be located in the central area of the zone, and developed with a hierarchy of buildings. The identification of users preferences may be useful in the allotment, and detailed distribution of different areas within these residential sectors. The economic value of the urban land can be maximised by such a locational choice, when combined with the floor area ratio rules. This model will be economically feasible from the builders point of view, as it will be possible to construct high rise typologies, which will economically justified, while also satisfying consumer demand. This model will also provide freedom for the development of various typologies, by different categories of builders. If this pattern of sector development is repeated all over the city, an urban form will emerge, with a hierarchy

of pyramidal forms conforming to the different sectors, decreasing in height from the city centre to the peripheries. Refer figure no 10.1.

10.3.3 RESIDENTIAL FORM RELATED TO MODEL OF SATISFACTION

The five factors identified in the beginning of this research may now be related and interpreted in terms of the above residential development form. The factor analysis on user satisfaction revealed that eight factors, namely, Architectural fenestration, Essential infrastructure, External environment, Architectural design, Organised care-taking, Security, Prosperity and Bio-aesthetic factors influence user satisfaction. Of these, the first four, namely, Architectural fenestration, Essential infrastructure, External environment and Architectural design factors are clearly techno-physical factors, Organised care-taking and Security are social factors, prosperity is an economic factor, and gardening facilities is a bio-aesthetic factor.

A. Techno-physically suitable residential form

(i) Justification of the spatial residential development pattern

It is well known, that households make locational and typological choices based on various aspects, which may vary over time. An ideal residential development should satisfy the preferences of various categories of people, at different points in their life. This model for residential development will enable the development of all typologies, walk-up, medium and high rise categories in each sector, in the city, irrespective of its distance from the centre. While the tallest buildings will always be in the centre of each zone, its actual height may depend on its distance from the centre. It will be seen that the centre of the inner sector may be occupied by a high rise building, while the centre of the outermost sector with independent houses, may be occupied by walk-up apartments, due to economic reasons. The preferences of those who wish to live in independent houses in the fringes, those who wish to live in multi-storeyed apartments in the fringes, walk-up apartments in the central zones, and high rises in

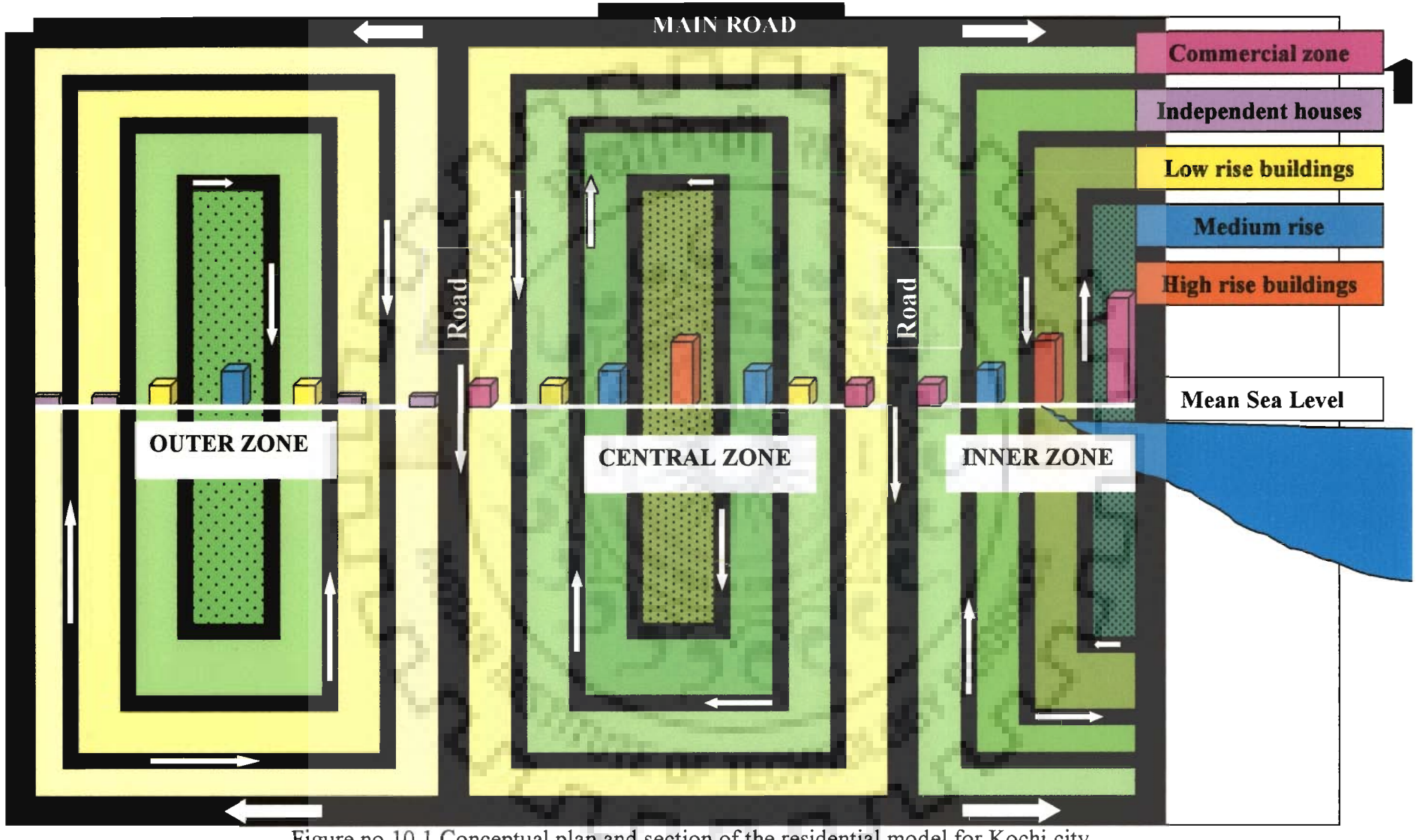


Figure no 10.1 Conceptual plan and section of the residential model for Kochi city

the central zones (as observed in chapter 7), are all accommodated in this model. The central zones may also be developed with further developed with a concentration of facilities and amenities, to improve user satisfaction.

(ii) Infrastructural advantages of the residential development pattern

One of the common infrastructural problems faced by growing cities, is the inability to provide essential infrastructure, particularly water supply. The problem gets accentuated with the proliferation of buildings in a spatially haphazard manner, within a short period of time. This has also been identified as the most pressing problem by all sections of the people, particularly town planners, as seen in section 9.4 of chapter 9. An infrastructurally ideal model would be one, in which areas can be clearly demarcated, based on the load on the infrastructure, so as enable planning an economic infrastructural network. This is particularly so, in terrain as in Kochi, where cost of laying infrastructure is high due to severance of land by railway lines etc., as discussed in section 9.3 of Chapter 9. The model of residential development envisaged, tends to segregate the residential building typologies into distinct areas, based on which, an adequate level of essential infrastructure can be provided in the earmarked zones. This will help decision-makers to plan a suitable infrastructural network to accommodate future needs, in demarcated zones. This will also prevent excessive loading on infrastructure by haphazard development of buildings, and mitigate the problems faced by residents of adjacent low-rise buildings (discussed in section of chapter 7). To a certain extent, the pattern of mixed landuses will also ensure a uniform loading on infrastructure, within each sector, by balancing the varying daytime and nighttime densities of the sector.

The segregation of typologies would also minimise problems of flooding experienced by the neighbours, when large low lying areas, particularly marshy areas are filled by high rises. It will also prevent the excessive traffic on small pocket roads, because of the haphazard development of high rises.

(iii) Environmental suitability of the residential development:

One of the serious problems of modern cities is clearly the environmental pollution. Technical and legislative measures to control the levels of pollution are not within the purview of an architect planner. A pragmatic approach available to him consists of (1) regulating the urban development, minimising the total exposure of people to these environmental pollutants, and (2) design the microenvironment, to insulate the interior of homes from environmental pollutants. It is well acknowledged that in all but the industrial zones, the pollutants originate from vehicle omissions on the roads. The propagation of these pollutants are controlled by geometrical laws of inverse square, as in the case of noise by factors such as wind flow and turbulence, as in the case of smoke, dust and acrosols. A pattern of development which will minimise the population exposure to these pollutants, hence, will require a form which keeps the people away from the pollution source on the one hand, and improve the wind speed in the urban environment on the other, much valued in tropical climates. Both these objectives will be achieved by the residential model, as detailed above.

(iv) Satisfaction from Architectural fenestration aspects

It has emerged from the analysis that the most important aspects influencing user satisfaction, are lighting and ventilation. A model of tall buildings in the centre, located spatially apart, can provide greater lighting and ventilation, to all the dwellings. The segregation of typologies by height as seen in this model will also help in the mitigation of lighting problems caused to lower rise typologies caused by adjacent taller buildings. It can also prevent blocking of breeze by taller buildings and hence provide a more satisfying internal environment.

(v) Satisfaction from Architectural design aspects

An important determinant of user satisfaction as has emerged from the analysis, is the architectural design. Privacy was found to be a problem within high rise buildings, and also in

adjacent buildings. The segregation of high rises will help to minimise loss of privacy, experienced by residents in adjacent lower rise dwellings. Better privacy can be obtained within high-rises, through proper architectural design of elements.

B. Socially relevant residential form

No other land use reflects the socio-cultural milieu of a populace as much as residential landuse. The possession of a house provides economic and physical security, and provides sentimental satisfaction to its possessor. Increasing urbanisation, improvements in socio-economic conditions, transformation in family structure, changing lifestyles, and increasing crimes in urban environments are in the present times, making new demands of residential environments. A socially ideal residential environment, thus becomes one, which provides a good living environment, socially compatible neighbourhood, facilitates easy upkeep, and provides organised care-taking and security, particularly for women and elderly. The ideal residential development should therefore provide a variety of residential typologies, to suit the different categories of people. In this model, the security and organised care-taking needs of women and elderly, who prefer high rise typologies, as well as the economic considerations, and sentimental needs of those who prefer low rise and independent houses are all taken care of, through the combination of a variety of typologies in each sector. The single block low rises, can also take advantage of the grouping of such housing within an area, as in this model, to explore possibilities for shared security facilities. This segregation of typologies in this model also prevents the loss of identity and social segregation experienced by local residents with the arrival of high rises. The combination of a variety of typologies in the sectors, will also satisfy the various criteria, viz., locational, economic, environmental and sentimental reasons, which shape the preferences of those who wish to live in other typologies like medium, low rise or independent houses. It will also create areas in each

sector, with a rich intermix of land uses, building types, and people, lending vitality to the city.

C. Bio-aesthetically attractive residential form

One of the factors of great importance in the optimum residential land utilisation with environmental considerations is the bio-aesthetic aspect. This becomes very important particularly in two types of cities: (1) cities with a long architectural history, with a rich variety of traditional and historic styles, and (2) cities, blessed by natural scenic beauty. Kochi, has both. The model of residential land utilisation in which the building heights gradually increase, with the peaks of tall buildings rising above the surrounding landscape, in a planned order within each sector, is likely to enhance the environmental quality and aesthetics of the urban space. Such a form will prevent the monotonous appearance of tall buildings on the side of main roads, which create tunnel like main traffic corridors. This model envisages only low-rise buildings on the roadsides, which may reduce in relative height from the sectors in the core to those on the peripheries. The popular coconut tree, which towers over two or even three storied buildings will, therefore offer a more visually pleasing movement corridors for the city. The high-rise typologies which occupy lesser ground space can offer attractive views of the scenic backwaters, and make it possible to have larger green spaces at the ground level, providing the much wished for bio-aesthetic satisfaction, even in the central zones. Such ground space may also contribute to serve as valuable open spaces, grossly inadequate in the city (structure plan). Such a model will also prevent the backwater fronts and coastline, from being littered with high-rise typologies, destroying the appearance of these idyllic lagoons, alongside the core of the city. If efforts are made to incorporate some of the traditional design elements even in multi-storeyed buildings, as can be seen in Figure B of Plate 9, these buildings can also harmonise with the general architecture character of the city. The grouping of different typologies in a pyramidal form within sectors, held within a

larger pyramidal form, decreasing from the centre to the peripheries, is likely to provide a more visually interesting skyline. If efforts are made to incorporate some of the traditional design elements, even in multi-storeyed buildings, these buildings can also easily harmonise with the general architectural character of the city. Refer Fig. No. 7B of Appendix –K. This, when combined with the effect created by the tall coconut trees, which alternately conceal or reveal the low-rise and high-rise buildings within each sector, with the green canopy increasing towards the peripheral sectors due to the reducing building heights, is also likely to lend a more picturesque appearance, to the city.

It has been discussed that the control of floor area ratio and land use zoning for residential use in the centre of each zone, will result in urban form with commercial uses in the periphery of each sector, followed by offices and institutions, walk up apartments, medium rise apartments, and high rise apartments in the centre. On moving from the centre to the peripheries, the height of the various typologies will gradually reduce, in such a manner, that the low-rise buildings may occupy the central area of the outer sector. If residential landuse zoning is not applied, it will be seen that depending on the economic conditions, the commercial uses on the periphery and office uses inside may spread to more number of belts, and offices may also occupy the high-rise buildings in the centre of the sector. In such a case, residences may occupy the upper floors of these structures, to obtain good living environments with less environmental pollution, breeze and attractive views. On moving from the centre to the periphery of the city, a gradual transformation will be seen with a reduction in the commercial and office uses and an increase in the quantity of residential landuse. However, this is only one of the architectural interpretations that can be given to this model. Other options may be explored.

In this context, it can be seen that the model evolved in this research, by considering all the factors of the residential environment: socio-psychological preferences of the users,

economic decisions of the builders, concentration of physical infrastructure and amenities, and state of technology, and perception of the community, is the one which can be realistically applied for the cities in developing countries. However, this model can be best achieved by employing feasible planning policies.

10.4 POLICY GUIDELINES FOR AN OPTIMUM RESIDENTIAL LAND UTILISATION

The broad policy guidelines initiated from the findings discussed in the earlier chapters are given below.

1. Residential land use must be given due importance during the stage of formulation of city plans, and should involve people's participation at various stages, to ensure quality of life and welfare of the people.
2. Development of infrastructure shall be given the first priority, and shall be used to guide development in the desirable direction.
3. The private sector has been highly efficient in utilising small pockets of lands in the city, and in pooling land through negotiations, for housing supply in the city. Their efforts shall be highly promoted.
4. A hierarchical intermix of residential typologies shall be provided in the city, to suit a variety of people.
5. The pyramidal residential form as interpreted by the investigator is only one of the architectural interpretations of the satisfaction model. Other options may also be explored.
6. The planning regulations related to land use zoning and building regulations related to floor area ratio (FAR) shall be modified to suit the realisation of the model.

7. The great importance given by people to the design of the interior environment, as well as the aversion to pollutants, indicate the great importance of architectural design and detailing in providing user satisfaction. Building designers shall, therefore, attempt to have more interactive sessions with users. Research in such consumer oriented approaches shall be promoted.

8. Committees may be formed to evaluate the visual quality of the city and for bio-aesthetic planning. Regulations may be formulated to preserve the aesthetics of the natural green canopy and the coastline.

10.5 RECOMMENDATIONS FOR ARCHITECTURAL DESIGN

The architectural design guidelines, which may help to provide more user satisfying environments, as emerging from the analysis of the various typologies, and the observations made by the researcher, are given below in Table 10.1

Table no.: 10

Recommendations

	Problems observed	Recommendations
	Problems of Essential infrastructure	
1.	Older residential properties are increasingly flooded, due to filling done to maintain higher ground levels by new building constructions.	Given the flat, low-lying topography in Kochi, local authorities should provide a plan for drainage covering the whole city. This will enable proper drainage of runoff.
2.	Irregular clearance of garbage and disposal of organic wastes into the innumerable narrow natural canals that litter the landscape cause bad odours to be carried by wind especially to high rises.	Efforts should be made by local authorities for prompt disposal of garbage, and measures should be undertaken to prevent disposal of wastes into public spaces, not ear-marked for the same.
3.	Problems of garbage littering common spaces if those employed for garbage disposal do not turn up	Provide garbage chutes of appropriate design and in appropriate positions.
	Problems related to Architectural fenestration	
4.	Occupants were dissatisfied with lighting in drawing rooms as often it was provided through windows into cut outs or common lobbies.	Drawing rooms being important rooms which reflect the status of the occupants, care should be taken for its proper lighting.

5.	Lighting is relatively low in lower floors due to obstruction by neighbouring buildings and vegetation	Design should incorporate larger or more number of window openings at lower floors, in an aesthetically satisfying manner
6.	The design of kitchens with the ducts serving as the only means of lighting and ventilation has been found unacceptable to many apartment occupants due, to the low lighting levels, and the transfer of cooking odours between dwelling units.	Care should be taken to locate kitchens which are intensely used spaces, with adequate natural lighting and ventilation, from the point of view of user satisfaction and hygiene.
	Problems related to architectural design and privacy	
7.	Occupants of high-rises were found to express dis-satisfaction regarding lack of visual privacy, in rooms, toilets and balconies.	Visual privacy may be improved by: • staggering entrances to apartments • staggering door and window openings • avoiding projecting balconies of two adjacent houses on the same side. • Locate toilets and ventilators for the same to ensure privacy through appropriate design. • Avoiding the design of lighting into rooms from common lobbies.
8.	Occupants of middle blocks in group housing were found to suffer from problems of visual privacy, from all sides.	Tall point blocks should be preferred to numerous lower blocks, so as to avoid problems of visual privacy, and also provide better lighting, ventilation and view.
9.	Occupants were dis-satisfied with loss of acoustic privacy in high-rises particularly in bedrooms, drawing rooms, and balconies	• Avoid placing balconies of adjacent dwelling units close to each other • Avoid design of toilets of one dwelling adjacent bedrooms of another, to prevent transfer of flushing noises. • Avoid providing windows and ventilators into common spaces
10.	Occupants were found displeased with entrances to two dwellings from the doors in perpendicular walls, as these caused confusion and questions relating to responsibility for maintenance	Entrances to dwelling units are to be designed as to provide for personalised spaces.
11.	Occupants were dis-satisfied with numerous small sized balconies, as these could not be used efficiently for childrens play, for hobbies like growing plants, sitting out or drying clothes.	Design should provide for providing few but larger balconies which may be used for the various purposes mentioned. It will also prevent the displeasing sight of clothes fixed to projecting rods, as is practised in some high rises.

12.	Entrance lobbies of dwelling units are un-inviting with two sides occupied by residences and the other two by elevators and stairs, and fire escapes.	Design common entrance lobbies so that at least one side is open to the outside, so as to enliven the visual quality of lobbies. They will also provide much required play spaces for small children, within parents supervision.
	Problems related to social interaction	
13.	Social interaction is low in high-rise buildings	Design and maintenance of attractive lawns and outdoor seating, provision of common rooms with facilities for games, libraries, etc., can foster social interaction.
	Problems related to bio-aesthetics	
14.	Loss of greenery due to construction of multi-storeyed buildings	• High rise buildings may be encouraged over medium rise buildings, in order to preserve greater ground space for greenery • Provisions should be incorporated in the building rules for reserving a certain area as green spaces in all residential buildings • Efforts should be made for providing for the replacing of trees cut, in another part of the site if possible.
15.	Dis-satisfaction with greenery at dwelling unit level	• Provide larger balconies to enable undertaking hobbies like gardening in dwelling units • Provisions should be made to maintain attractive landscaping of ground spaces
	Problems related to external environment	
14	Dis-satisfaction with environmental noise and dust	Avoid openings and balconies on sides presenting the greatest problem in these aspects

Future scenario

It will be interesting at this juncture to conceptualise the influence of technological development, on the residential land utilisation. The influence of fast modes of transportation on the changing spatial pattern of land utilisation has been well documented (Evans,Muth). Transportation can become a tool for concentration or dispersion of residential land. The

model of residential peaks indicated in this work clearly envisages a case of concentration of urban infrastructure including transportation in the activity areas of the city providing a strong pull factor for residential development. Developments in information technology, and concepts like E-commerce, tele-shopping, teleconference etc., provide possibilities for the dispersal of functions such as commercial activities, offices, banking institutions, etc., away from the central areas, to more spacious and cheap location in the suburb. In this back ground, residential areas will remain in the city due to dependence on the essential amenities and due to its cultural importance . A residential land utilisation model is therefore, likely to emerge in which the residences will be the basic elements of the city plan, consciously designed to achieve quality of life, in ideal locations, with the economic activities distributed about them.

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APPENDIX - A

SURVEY OF MULTI-STOREY APARTMENTS IN KOCHI

1. Name of building :

2. Division No :

3. Location, name and right of way
   Of access road :

4. Year in which construction
   had started :

5. Plot area :

6. No. of blocks :

7. No. of stories :

8. Total plinth area of
   The building :

9. No. of car parking :

10. Area of play ground if any :

11. Total no. of units :

12. No. of occupied units :

13. No. of bedrooms/unit
    a. No. of single bed units :
    b. No. of double bed units :
    c. No. of triple bed units :
    d. Others (specify) :

14. Methods of water supply :
    Is it adequate :

15. Methods of power supply :
    Is it adequate :

16. Method of garbage disposal :

17. Nature of occupancy :

18. Is there any extension
    proposed for the building? :

APPENDIX : B - OCCUPANTS OF MULTISTOREYED APARTMENTS

Overall satisfaction Score:----------

1.	**How satisfied are you with the following arrangements in your flat? (pl.tick)**	Very good	Good	Satisfactory	Poor	Very Poor
A	Water supply arrangements					
B	Power supply arrangements					
C	Garbage disposal arrangements					
D	Vertical circulation arrangements					
E	Car parking facilities					
F	Natural lighting					
G	Natural ventilation					
H	Arrangements for repair facilities					
2.	**Rate the following positive aspects of your flat. (pl. tick)**	Very good	Good	Satisfactory	Poor	Very poor
A	Environmental quality with respect to noise					
B	Environmental quality with respect to dust					
C	Attractive views					
D	Breeze					
E	Architectural layout and adequacy of spill over spaces like balconies, utility areas etc.					
F	Amenities and general maintenance					
G	Social interaction and emergency help					

3.	**Rate the following negative aspects of your flat? (Pl. tick)**	Highly concerned	Concerned	Little concerned	Not concerned
A	Harassment/ mis-behaviour in lifts etc				
B	Poor upkeep of common amenities				
C	Poor acoustic privacy				
D	Easy accessibility for strangers				
E	Constraints in keeping pets/ gardening				
F	Poor visual privacy				

4.	**Significance of the following reasons for buying a flat rather than constructing an independent house to your taste at a preferred locality**	High significance	Low significance	No significance
A.	Lack of time			
B	Lack of expertise			
C	Lack of confidence in taking up a major project			
D	Hassles in obtaining various statutory approvals/ electric & water connection			
E	Difficulties in obtaining housing loans			
5.	**How significant are the following reasons for buying a flat in this apartment block?**	High significance	Low significance	No significance
A	Good quality of construction			
B	Good layout/plan			
C	Facilities and amenities offered			
D	Financial considerations			
E	Locational aspects			
F	Promoters reliability			
H	Others(specify):			
6.	**Reason for selecting this location in the city.**	High significance	Low significance	No significance
A	Proximity to work place			
B	Proximity to schools			
C	Proximity to markets/ shopping			
D	Proximity to transportation corridors			
E	Scenic setting			
F	Value appreciation/ resale value			
G	Others (specify):			

7.	**How significant are the following reasons for preferring an apartment instead of an independent house?**	High significance	Low significance	No significance
A	Apartment cheaper in price/ rent			
B	Good amenities, breeze, views, mosquitoes free etc.			
C	Advantage of group living, emergency help etc.			
D	Social status symbol			
E	Security for women and elderly living alone			
F	Organised care taking/security arrangement			
G	Lifestyle in flats & its social status			
H	Safer investment and easier upkeep			

8.Floor occupied:	**9.No. of bed rooms:**	**10. No. of toilets:**	**11. Area of flat:**
12. Position of flat occupied: Front/ Rear/ Side		**13.Total no of blocks in this apartments:**	
14.Total no. of floors in each block:		**15.No. of flats in each floor:**	
16.Total no. of flats in apartment block:		**17. Age of building/year of construction:**	
18.Name of apartments:		**19.Name of builders:**	

20.aGiven a choice, which floor would you have preferred? _____

b.Reason; _____

21.Total no. of families residing in your block:	**22. No. of families with whom you have close contact:**	**23. No. of families whom you can just recognise:**

24. Do you have any particular reason for buying a flat at Kochi and not in any other town?

_____

25.Tenure status: Owner / Tenant	**26. Period of stay here:**	**27. Hometown:**
28. Market value at time of purchase: **Year: Price:**	**29.Present market value:** **Year: Price**	**30. Rental value:** **Year: Rent:**

31. Amenities in this apartment: (tick those applicable)				
(a) common hall/social club	(b)Landscaped garden	(c) swimming pool	(d) Dish antennae	
(e) childrens play equipment	(f) Car parking	(g) Adult playing courts	(h) Health club	
(i) boating	(j) intercom	(j) Centralised A/C	(j) generator	(k) no. of lifts:

32. Household details:

Sl no	Sex	Age	Relationship to head of household	Occupation	Distance to work/ school	Family income
1						
2						
3						
4						
5						
6						

33.a.Given a choice would you have chosen to live in a:

(a)high rise apartment (>4 stories) (b) walk up apartments(1-4 stories) (c) independent house

b.Reason: _____

34.Have you booked/intend to book a

a. Flat in Cochin? Yes ( ) No( )	**b. Independent house in Cochin?** Yes ( ) No( )

35.If you intend to buy a flat, the purposes/preferences: (pl. tick those relevant)

a. Floor preferred	b. Cost preferred	c. Size of Flat	d. Purpose of purchase	E. Location
(i) 1-3 stories	(i) below 5 lakhs	(i) 1 bedroom	(i) own stay	
(ii) 4-6 stories	(ii) 5-8 lakhs	(ii)2 bedroom	(ii) Rent out	
(iii) 7-10 stories	(iii) 8-11 lakhs	(iii)3 bedroom	(iii) Holiday home	
(iv) 11-15 stories	(iv) 11-15 lakhs	(iv)4 bedroom	(iv) Resale	
(v) 16-20 stories	(v) 15-20 lakhs	(v) more than 4 bedroom	(v) For other family members	
	(vi) > 20 lakhs			

APPENDIX – C: SURVEY OF HOUSING PREFERENCES IN KOCHI

1) Home state:	2) Home town & district (if in Kerala) :	3)Year of first arrival in Cochin:

4) Reason for coming to Cochin: (tick those applicable)

(a) Native place	(b) Education of children	(c) Central location & city facilities	(d) For employment
(e) Availability of city facilities	(f) To stay near own people	(g) Business reasons	(h) Others (specify):

5. Household information:

Sl no	Sex	Marital status m-married um-unmarried	Relation -ship to head of family	Age	Education 1.Below matric 2.Undergraduate 3.Graduate 4.Professional degree	Occupation	Location of work/ school	Distance from home (km)	Mode of transport	Time taken to reach work/ school	Daily travel cost (Rs)	Monthly Income 1- below Rs.2500 2- 2,500-5,000 3- 5,000-10,000 4- 10,000-20,000 5- Above 20,000
1.	M/F	(m) (um)			(1) (2) (3) (4)							(1)(2) (3)(4) (5)
2.	M/F	(m) (um)			(1) (2) (3) (4)							(1) (2)(3)(4) (5)
3.	M/F	(m) (um)			(1) (2) (3)(4)							(1) (2) (3)(4) (5)
4.	M/F	(m) (um)			(1) (2) (3)(4)							(1) (2) (3)(4) (5)
5.	M/F	(m) (um)			(1) (2) (3) (4)							(1)(2) (3) (4) (5)
6.	M/F	(m) (um)			(1) (2) (3)(4)							(1) (2) (3)(4) (5)
7.	M/F	(m) (um)			(1) (2) (3) (4)							(1) (2) (3)(4) (5)

6.Which is your most preferred method for acquiring a house ? (pl. tick those applicable)

(a) Buy a ready made house available in the market	(b) Enlist in a co-operative society	(c) Book a flat made by builders
(d) Constructing it myself	(e) Book a house in schemes of GCDA, KSHB etc	(f) Others (specify):

7.Reasons for the above preference: (pl. tick those applicable)

(a) Lack of time	(b) Better location at cheaper cost	(c) Cheaper interest rates for loans	(d) Due to timely delivery	(e) More economical
(f) To ensure better quality/design	(g) Due to credit arrangements, flexible payment plans etc	(h) Lack of technical know-how in construction	(i) To avoid hassles of obtaining statutory permissions, water/ electric connections etc.	

8. Given a choice would you prefer to live in a: (pl. tick those applicable)

(a) house with little or no compound in the city core, near to work place and other city facilities.

(b) house with a compound where you can have a kitchen garden/fruit trees etc within reasonable reach of city.

9. Do you own any house/ houses in Cochin? Yes( ) No ( )

10. If yes, use/uses to which they are put: (Pl. tick those applicable)

(a) own use	(b) rented out	(c) left unoccupied	(d) given for use to relatives

11. If yes, what are your reasons for owning a house when renting it is cheaper? (Pl. rank the reasons in order of importance)

(a) Economic security ( )	(b) Social status ( )	(c) Good investment( )	(d) Avail tax benefits ( )	(e) Project family name ( )	(f) Sentimental satisfaction of ownership ( )

Details of residences occupied at Kochi, starting from present and all previous residences in chronological order

Location & Corpn ward no	Year of occup-ation	Type of house F-Flat T-Twin V-Villa	Floor area Sq ft	Tenure type O-Owner T-Tenant S-Staff-qrtrs	If rented, monthly rent	If ownership			Reasons for choosing/ shifting this house (Pl. rank the reasons in order of importance selecting from the last column in the table)		Additions /improve-ments made to house (choose from column on the side)[3]
						Land area	Land Cost	House Cost	Choosing[1]	Shifting[2]	
E X A M P L E											
1.Vytilla Ward:29	1985	V	1000	O	——	8 cents	1 lakhs	2.5 lakhs	5,7,2,11	10,12	4, 6
1.											
2.											
3.											
4.											
5.											
6.											
7.											
8.											

Reasons for choosing[1] this house:

1. Near work place/ schools etc.
2. Near transportation routes.
3. Near public amenities/ parks etc.
4. Near places of worship
5. Familiar area among friends/ relatives.
6. Among elites to climb up social ladder
7. To be among similar social groups
8. Ancestral property.
9. Topography/ free from water logging
10. Attractiveneighbourhood/ scenic areas
11. Good structural quality/ appearance
12. Good Privacy/ security
13. Adequate water/ power
14. Cost considerations
15. Others(specify):

Reasons for shifting house[2]:

1. To change to own house.
2. Inadequate space
3. Too large space
4. Change of work place/ transfer
5. Change of income/ unaffordability
6. Retirement
7. For schooling
8. To have a yard for gardening/ hobbies
9. For a modern looking house
10. Unsafe & poor social environment.
11. Poor structural quality
12. Water logging/ Physical environment
14. Pollution -noise, dust, mosquitoes etc
15. Inadequate water/ power
16. Poor transport facility/ accessibility to public utilities
17. Others(specify):

Additions &improvements[3] :

1. Added/extended rooms/spaces for own use
2. Sublet part of house, earlier under own use
3. Structural repairs to roofs/ walls
4. Added wardrobe/ kitchen cabinet/ doors
5. Improvement of site drainage/ septic tank
6. Changed /improved flooring
7. others (specify):

APPENDIX - D: QUESTIONNAIRE

(Pl. tick you preference in the appropriate box)

1. **My preference of location.**
   A. Center of City ( ) B. Suburban area ( )

2. **My preference of the type of home.**
   A. Apartment in the city ( ) B. Apartment in Suburban area ( )
   C. Villa in suburban area ( )

3. **Total area preferred by me.**
   A. Below 1000 sq ft ( ) B. 1000-1500 sq ft ( )
   C. 1500-2500 sq ft ( ) D. Above 2500 sq ft ( )

4. **My budget.**
   A. Below 10 lakh ( ) B. 10 to 20 lakhs ( ) C. Above 20 lakhs ( )

5. **Total no. of bedroom preferred by me.**
   A. 2 bedrooms ( ) B. 3 bedrooms ( )
   B. C. 4 bedrooms ( ) D. Above 4 (pl. specify):
   C.

6. **I would like to make the purchase in**
   A. next three months ( ) B. next six months C. later ( )

7. **Financial assistance required? :**

8. **Specify other amenities preferred if any:**

APPENDIX – E : **SCHEDULE - NEIGHBOURS OF FLATS**

1. Details of flat:

Sl. no	Name of flat	Builders name	Location	Type of road	Name of road	No of blocks	No. of floors	Total no. of flats	Year of construction	Previous land use	Present land value here	Value before flat came	No. of People in this flat you can recognise	No. of people you have close contact with

2. Please comment on the changes in the following characteristics in your locality as a result of flat construction in your neighbourhood:

Sl. no	Characteristic	(a) Improved	(b) Worsened	(c) No change	(d)Can't say at present
1	Availability of water in Neighbourhood				
2	Adequate voltage in Neighbourhood				
3	Flooding of streets and other adjacent properties in the locality				
4	Efficiency of garbage disposal and associated problems				
5	Physical state of existing roads in locality				
6	Traffic congestion on existing roads & ensuing difficulties				
7	Public transport system to area				
8	Land value in the locality				
9	Incidence of robbery in the neighbourhood				
10	Visual privacy for neighbours of adjacent houses from upper level flats				
11	Flow of breeze to adjacent houses				
12	Effects of shadow /problems of constant shade on adjacent houses				
13	Personal touch & identity within Neighbourhood				
14	Other facilities like shops, other services				
15	Any other (Pl. state)				

3. Are you for or against more flats coming up in your neighbourhood? A. For ( ) B. Against ( )

4.

Name	Position with respect to flat	No. of years of stay here	Any other comments

APPENDIX - F: SCHEDULE

1. **How significant are the following reasons for the spurt in the growth of apartments in Cochin?**
(Kindly **rank** them in the boxes provided)

A	Safe investment with reasonable returns and liquidity and easy availability of finance	
B	Amenities, Security and better environment	
C	Pressure on residential land and consequent price rise	
D	Lack of time and expertise for the common man in house construction	
E	Influx of cosmopolitan population and consequent socio-cultural changes in life styles	

2. **Please give your opinion on the impact of proliferation of multi-storeyed apartments in Cochin on the following.** (Kindly **tick** in the relevant box)

		Positive	Negative	Cannot say
A	Infrastructure economics due to residential land densification			
B	Availability of housing			
C	Optimum residential land utilization			
D	Visual quality/ effect on skyline			
E	Disaster management aspects			
F	Social Cohesion			

3. **How many apartments can you recall which have come up on these types of lands?** (Pl. tick)

		1-3 nos	4-6 nos	7-9 nos	> 10 nos
A	Lands obtained by demolishing old structures				
B	Lands converted from paddy fields and marshy areas				
C	Vacant pockets of land within city				

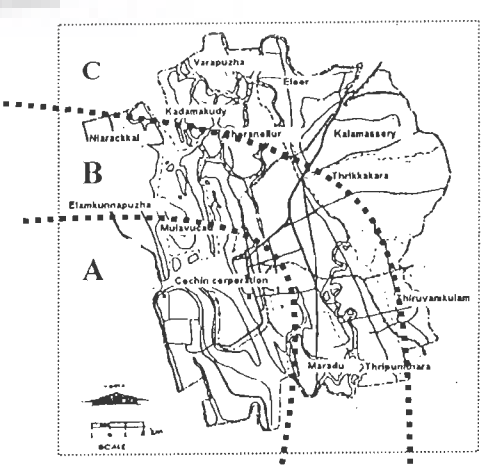
4. **Do you know of any large scale reclamation for residential activity in :**

		Yes	No	Location	Extent (approx)
A	Backwater fringes				
B	Marsh lands				
C	Paddy fields				

5. **Do you think flats should be:** (Pl. tick)
a. Encouraged ( ) b. Controlled ( ) c. Discouraged ( )

6. **What is your opinion of more apartments being developed in these areas?**(Pl. tick)

	Positive	Negative
A. City core (0-5 Km)	( )	( )
B. 5-10 Kms	( )	( )
C. >10 Kms	( )	( )



7. **Which of the following regulations are to be modified to promote/ control flats?**

		Pl. tick	Suggested modifications
A	FAR/ coverage		
B	Fire regulations		
C	Zoning regulations		
D	Sub division regulations		
E	Land conversion rules		

8. **How concerned are you about the following?** (Kindly <u>rank</u> them in the boxes provided)

A	Extensive filling of marshy lands/ backwater fringes/ paddy fields for construction of apartments	
B	Destruction of natural coastline scenery due to spurt of water front apartments	
C	Blockage of natural drainage canals by garbage dumped from adjacent houses	
D	Exhorbitant rise in price of lands within the city due to demand created by apartments & consequent developments	
E	Pressure on water supplu, sewerage & transportation systems due to proliferation of apartments	

9. **Do you think that public opinion should be considered in the formulation of town planning Schemes?**

   a. Desirable ( ) b. Necessary ( ) c. Essential ( ) d. Unnecessary ( )

10. **Can you recall any instances wherein the lack of mobilisation of public opinion was instrumental in the failure of any schemes?**

11. **Would you like to suggest any improvements in coordination between any public agencies for a better management of urban problems in Cochin?**

Your designation	Department/ Organisation	No. of years of association with Cochin	Name (not compulsory)

APPENDIX - : G SCHEDULE-BUILDERS

1.Name of builder:	2. Area of operation: Core of Kochi / Kochi city periphery Other Kerala towns / Other states	
3.Year of establishment:	5.Year of establishment in Kochi:	6.No. of employees:

7. Your assessment of the demand profile of flats:

a. Type of house	Demand in %	b. Floor preferred	Demand in %	c. Preferred cost (lakhs)	Demand in %
A. Independent		A.Ground		Below 5 lakhs	
B. Twin/duplex		B.1-3 floors		5-8	
C. Walk up (1-4)		C.4-6 floors		8-11	
D. Medium rise (5-9)		D.7-10 floors		11-15	
E. Tall bldg. (>10)		E. 11-15 floors		15-20	
		F.16-20 floors		Above 20	

d. Size of flat	Demand in %	e. Client profile	Demand in %	F. Type of occupancy	Demand in %
A. 1 bedroom		A. Cochinites		A. Own use	
B. 2 bedroom		B. Non-Keralites		B. Rented	
C. 3 bedroom		C. NRI's		C. Vacant	
D. >3 bedroom		D. Other Keralites		D. Retained by builder	

8.What is your system for demand assessment? _____

9.	How significant are the following criteria for identifying land for apartment construction?	High significance	Low significance	No significance
A	Proximity to predominantly residential zones			
B	Proximity to main transportation corridors			
C	Proximity to commercial centers of the city			
D	Proximity to other facilities like markets, hospital, schools etc			
E	Proximity to industrial/Government work centers			
F	Land with scope for future development			
G	Scenic settings			
H	Others (pl. specify):			

10. Total time required from inception to completion of project: _____

11. Do you use management tools like PERT etc: a. Yes ( ) b. No ( )

12. a. Current cost of construction: _____ **b. Approximate annual escalation:** _____

13.	Causes for delay of projects	Frequent	Sometimes	Never
A	Delay in approval of plan			
B	Delay in procuring materials			
C	Problems of labour management			
D	Climatic reasons			
E	Financial problems			
F	Other (specify):			

14.	Have you faced any local opposition while developing land/ during construction due to following apprehensions among local residents?	Yes	No
A	Land fill causing flooding in surroundings		
B	Reduced water availability		
C	Reduction in voltage in surroundings		
D	Increased traffic causing inconvenience		
E	Others (specify)		

15. Feasibility of combining low and high income groups in a single housing project: Yes( )No ( )

16. How long do you keep in touch with your clients after handing over of the apartments?

(a) Do not keep in touch	(b) less than a year	(c)1-5 years	(d) 5-10 years	(e)10 years

17. Your estimate of the number of builders operating in Kochi during the years:			
(a) 95-99:	(b) 90-95:	(c) 85-90 years:	(d) before 85:

18. Do you foresee a continued demand for flats? : Yes ( ) No ( )

19.State any pressing problems facing the building industry.

_____

_____

20. Details of projects executed in Kochi:

Sl. no	a. Name of project	b. Location /Ward no	c. Year of Constr-uction	Number of		e.Previous Landuse[1]	f.Faci-lities[2]	g.Water Supply[3]
				Floor	Flats			
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								

e[1]

1. Marshy land
2. Paddy field
3. Demolition of old structures
4. Vacant land

f[2]

1. Common hall
2. Playing courts
3. Dish antennae
4. Landscaped garden
5. Playing equipment
6. Swimming pool
7. Health club
8. Boating
9. Centalised A/C
10. Intercom
11. Sewage treatment facility

g3

1. Corporation supply
2. Corpn+ Borewell
3. Corpn+Tanker
4. Corpn+Tanker+Well

APPENDIX : H

QUESTIONNAIRE FOR PLANNING/DESIGN EXPERTS

How would you rate the following factors considering their relative importance, to improve the satisfaction level among residents of multi-storeyed housing? Kindly rank them and also give a percentage breakup.

1. Essential infrastructure factor (pertaining to water, power, garbage disposal facilities, vertical circulation, security, etc) ----------

2. Architectural form (pertaining to total number of floors, apartments, the height of floor occupied and related characteristics like breeze, views etc)----------

3. External environment factor(pertaining to that obtained from reduced environmental noise and dust)----------

4. Architectural fenestration factor (pertaining to lighting, ventilation, views etc)---- ----------

5. Social interaction factor ----------

6. Behavioural factor (pertaining to good behavior of neighbours, and lesser disturbance from noise etc)----------

7. Architectural plan factor (pertaining to good design, privacy etc)----------

8. Greenery factor (pertaining to gardens, green spaces etc)----------

Name:

APPENDIX I

Table no.:3.1

Transportation network in Kerala in the pre-independence period 1900-1946.

Year	Travancore State		Cochin State		Malabar District	
	Road	Rail	Road	Rail	Road	Rail
1900-01	30.05	-	32.0	-	30.0	1.70
1905-06	43.0	0.90	32.0	3.32	31.0	2.26
1910-11	44.0	0.90	34.0	3.32	32.0	2.26
1915-16	45.0	0.90	35.0	3.32	31.0	2.26
1920-21	51.0	1.52	36.0	3.32	31.0	2.26
1925-26	54.0	1.54	36.0	3.32	31.0	2.26
1930-31	57.4	1.54	39.0	3.32	32.0	3.07
1933-36	60.0	1.54	39.0	3.82	NA	3.45
1940-41	62.4	1.54	40.0	3.82	NA	3.45
1945-46	62.5		43.0	3.82	NA	3.45

Source: Sreekumar, thesis)

Note: Road density of Malabar for 1900-01, 1905-06,1910-11 actually relate to 1901-02, 1906-07, 1911-12.

Table no.: 3.2

Share of urban population by size class of towns in the southern states 1981

Share of urban population by size class of towns in the southern states 1981				
Size class	Population Concentration			
	Kerala	Tamil nadu	Karnataka	Andhra pradesh
I	39.84	62.19	58.60	53.69
II	10.74	15.99	6.46	16.17
III	42.38	12.52	17.75	20.95
IV	5.93	7.40	13.74	7.32
V	1.02	1.76	2.87	1.75
VI	0.09	0.14	0.58	0.12

Source: Sreekumar

Table no.: 3.3

Number of Towns per 1000 Sq.KM 1961-81

Number of Towns per 1000 Sq.KM 1961-81			
Country/state	1961	1971	1981
Kerala	2.367	2.264	2.728
Tamil nadu	1.999	1.845	1.884
Karnataka	1.111	1.184	1.304
Andhra pradesh	0.771	0.749	0.851
India/state	0.79	0.77	0.987

Source: Sreekumar

Table no. 3.4

Distribution of out migrants from Kerala

	Number		Percentage	
	1980	1992-93	1980	1992-93
Gulf countries	186545	641387	36.6	53.79
Other countries	21260	27480	4.2	2.3
Total abroad	207805	668867	40.8	56.09
Other states of India	301810	523456	59.2	43.91
Total out migrants	509615	1192323	100	100

Source: Survey on Housing and Employment 1980, Report of migration survey 1994

Table no.3.5

Annual outflow of labour to West Asia and inflow of remittances

year	Annual labour outflow from India (lakhs)	No. of Indian migrants to west Asia (lakhs)	No. of Keralite migrants (lakhs)	Remittances to India (Rupees in crores)	Remittances to Kerala (Rupees in crores)	Remittances to Kerala as % of Net domestic Product of Kerala
1976	0.42					
1977	2.29					
1978	6.9				400	
1979	17.18	5.01	2.50			
1980	23.62			1648	824	21.5
1981	27.6	5.99	2.99	1560	780	19.2
1982	23.95			1822	911	19.3
1983	22.5	9.16	4.58	1986	993	17.9
1984	20.6			2236	1118	18.2
1985	16.3			2036	1018	15.6
1986	11.35			2242	1121	15.2
1987	12.54	9.57	4.78	2648	1324	16.0
1988	17.01			2414	1207	13.1
1989	12.61			2732	1366	12.8
1990	14.18	12.35	6.17	2620	1310	10.7
1991	19.2	16.50	6.4*	4670	2335	15.4
1992	41.68			4132	2066	12.0
1993	48.33			7174	3587	19.0
1994	42.54			11714	5857	27.0
1995				11078	5539	21.5
1996		28.0	14.0			

Source: Prakash B.A 1998, * Report on migration survey

Table No.:3.6

Per capita bank deposits and Per capita domestic income of Indian States

	Per capita bank deposits in scheduled commercial banks			Per capita domestic income of Indian states		
	1971	1976	1980	1969-70	1975-76	1977-78
Maharastra	335(1)	728(1)	1380(2)	752(3)	1377(2)	1628(2)
Punjab	252(2)	620(2)	1441(1)	945(1)	1597(1)	1962(1)
West Bengal	222(3)	500(3)	933(4)	522(9)	1116(5)	1268(5)
Gujarat	217(4)	470(4)	961(3)	696(4)	1215(4)	1340(4)*
Karnataka	126(5)	299(5)	606(7)	495(12)	1005(7)	1129(7)
Tamil nadu	109(6)	284(7)	612(9)	536(7)	840(12)	1036(8)
Jammu & Kashmir	107(7)	287(6)	810(5)	15	883(10)	986(11)
Haryana	104(8)	264(10)	651(8)	811(2)	1274(3)	1600(3)
Kerala	102(9)	266(8)	682(6)	541(6)	907(8)	987(10)
Himachal pradesh	94(10)	265(9)	595(10)	586(5)	1078(6)	1178(6)
Uttar pradesh	69(11)	180(12)	405(12)	522(8)	730(16)	916(14)
Bihar	57(12)	140(14)	276(15)	403(17)	661(17)	735(17)
Andhra pradesh	56(13)	185(11)	428(11)	521(10)	903(9)	999(9)
Rajasthan	55(14)	142(13)	327(13)	497(11)	850(11)	948(12)
Madhya pradesh	43(15)	128(15)	281(14)	269(16)	769(14)	905(15)
Assam	38(16)	111(16)	227(16)	491(14)	776(13)	932(15)
Orissa	26(17)	74(17)	196(17)	491(13)	747(15)	857(16)
India	132	484	675	598	1021	1169

Source: Nair.P.R.G
*refers to 1975-76
Rank is shown in parentheses

Table no.:3.7

Wholesale prices of Crops

Index numbers of wholesale prices of crops (1970=100)			
Year	Plantation crops	Food crops	All crops
1970	100	100	100
1973	109	110.2	116.2
1975	175.4	148.7	143
1977	219.6	173.7	167.3
1978	218.2	169	177.5
1979	217	170.9	175.4
1980	234.8	182.2	201.6
1981	252.9	195.8	209.4
1982	274.5	194.4	206.1
1983	360	234	268
1984	415	280	375
1985	397	273	295
1986	361	319	326

Source: Gopikuttan, (Various issues of Statistics for planning, Economic review)

Table no.: 3.8

Production of important plantation crops (production'000 tonnes)

and Price(Rupees)

Year	Tea		Rubber		cardamom	
	production	price per kg	production	price per quintal	production	price per kg
1970-71	41.5	5.4	78.7	464.7	1.25	45.4
1975-76	45.8	10.8	126.3	482.7	2.05	80.6
1977-78	52	17.8	135.9	872.1	2.9	156.6
1979-80	52.4	16.1	136.6	1123.2	3.3	132
1980-81	50.7		140.3		3.2	
1981-82	45.5		139.5	1460	2.8	139.1
1982-83	45.4	23.1	152.7	1440	1.9	170.5
1983-84	44	27.1	162	1752	2	342.6
1984-85	56	21.8	172.1	1655	2.9	237.1
1985-86	53.1		184.7	1732	3.3	156.68

Source: Gopikuttan, Various issues of Statistics for planning, Economic review

Table no.: 3.9

Inequality Ratio in Kerala

Year	Inequality ratio
1960-61	0.71
1970-71	0.66
1980-81	0.63

Source: Isaac

Table 3.10

Percentage literate in Kerala and India 1901-81

Year	Kerala	India
1901	12.9	5.4
1911	15.5	5.9
1921	22.0	7.2
1931	25.0	9.5
1941	-	16.1
1951	47.4	16.7
1961	55.1	24.0
1971	60.4	29.5
1981	70.4	36.2

Source: Kerala Fertility survey 1980

Table no.:3.11

Health facilities in Kerala and India 1979-80

Measure	Kerala	India
Hospital beds per 100,000 population		
Urban	458	263
Rural	107	12
Average area per square kilometer		
Primary health centre	232	563
Sub centres	21	63
Health	79	108
Family welfare	29	149
Persons per unit of health staff		
Doctor	2385	2674
Nurse	2538	4774
Midwife	3068	4947

Source: Kerala Fertility survey 1980

Table 3.12

Consumer expenditure and Bank deposits-Kerala vs India

Year	Per capita SDP in Kerala	SDP Ratio Kerala to India	Per capita consumer expenditure Kerala	Consumer expenditure ratio Kerala to India	Ratio of consumer expenditure to SDP	Per capita Bank deposits in Kerala	Deposit ratio Kerala to India	Per capita Remittance	Ratio of Remittances to SDP
1970-71	594	0.94	455.52	0.95	0.77	102.3	0.77	2.69	0.005
1971-72	592	0.9	N.A	N.A	N.A	115.9	0.76	3.8	0.006
1972-73	662	0.93	538.44	0.93	0.81	148.5	0.81	3.3	0.005
1973-74	811	0.93	691.8	1.02	0.85	170.7	0.81	4.65	0.006
1974-75	910	0.91	N.A	N.A	N.A	207.2	0.83	9.89	0.011
1975-76	954	0.93	N.A	N.A	N.A	266	0.83	34.42	0.036
1976-77	1009	0.94	N.A	N.A	N.A	356	0.92	64.31	0.064
1977-78	1043	0.87	910.68	1.01	0.87	488	1.01	109.63	0.105
1978-79	1121	0.89	N.A	N.A	N.A	569	0.99	107.39	0.096
1979-80	1271	0.95	N.A	N.A	N.A	682	0.01	172.91	0.136
1980-81	1385	0.89	N.A	N.A	N.A	672	0.04	258.88	0.187
1981-82	1438	0.83	N.A	N.A	N.A	817	0.07	232.64	0.162
1982-83	1626	0.86	N.A	N.A	N.A	967	0.08	282.22	0.174
1983-84	1883	0.86	1816.44	1.21	0.96	1149	0.09	302.95	0.161
1984-85	2104	0.89	N.A	N.A	N.A	1347	1.07	339.01	0.161
1985-86	2140	0.82	N.A	N.A	N.A	1629	1.09	285.83	0.134
1986-87	2371	0.84	2445.48	1.25	1.03	1682	1.1	299.95	0.127
1987-88	2834	0.86	2673.48	1.23	0.94	N.A	N.A	351.33	0.124
1988-89	3146	0.81	2772	1.16	0.88	N.A	N.A	397.46	0.126

Source: Isaac

Table no.:3.13

Average field labour wage rates(Rs)

Period	Kerala	India
1969-70	4.80	2.98
1978-79	7.32	5.28

Source: Report of Kerala Fertility Survey 1980

Table :3.14

Government Expenditure on Housing Schemes and Houses constructed

Year	Expenditure (Rs in lakh)	Number of house constructed
1951-56	18.46	
1956-61	157.70	
1961-66	182.27	
1969-72	261.0	
1974-75	483.63	NA
1975-76	313.53	NA
1976-77	341.24	NA
1977-78	616.72	NA
1978-79	1360.56	NA
1979-80	2706.1	45902
1980-81	3541.11	43563
1981-82	4069.37	38460
1982-83	2250.93	26420
1983-84	2330.88	25235
1984-85	1020.19	40366
1985-86	767.34	46661

Source: Gopikuttan, Chapter 8 of Census of Kerala, 1981

Table no.:3.15

Assistance provided by Co-operative Societies 1970-86

Year	Number of Primary societies	Loans advanced (Rs.Lakhs)	Number of houses constructed	Estimated value of houses constructed (Rs.Lakhs)
1970-71	93	7.33	143	18.74
1971-72	108	23.58	373	69.45
1972-73	126	51.8	643	115.15
193-74	142	125.76	560	88.69
1974-75	145	90.77	535	171.53
1975-76	150	92.03	586	96.39
1976-77	154	199.98	726	123.43
1977-78	156	201.07	1865	431.5
1978-79	162	326.89	1274	256.05
1979-80	211	408.15	2216	564.37
1980-81	252	614.36	3540	996.49
1981-82	264	993.51	2983	935.9
1982-83	269	936.02	3636	1062.75
1983-84	269	733.45	2465	820.08
1984-85	..	790.24	..	..
1985-86	204	1593.08	4864	..

Source: Gopikuttan

Table 3.16

Distribution of finance by source for building construction works

1980-81(in percentages)

Source of Finance	Rural	Urban	Total
Borrowing from employer	2.4	2.42	2.4
Borrowing from government; semi-government; and other finance agencies	25.26	33.02	27.09
Other sources(excluding borrowing)	72.34	64.56	70.51
total	100	100	100

Source: Report on survey of household construction activities in Kerala 1980-81

Table no.:3.17

Comparison of Housing Conditions of Migrants and Non migrants

(1975 and 1985) at Chavakad, Kerala

Type Of House	Migrant Households		Non Migrant Households	
	1974	1985	1974	1985
ROOFING				
Thatched roof	83.2	3.2	41.67	33.33
Tiled roof	15.6	19.6	51.67	46.67
Tiled and Terraced roof	0.8	8.8	5	10
Terraced roof	0.4	68.4	1.66	10
TYPE OF FLOOR				
Mud	80.4	2.4	38.33	21.67
Cement	19.6	35.2	60	58.33
Cement & Mosaic	0	26.4	1.67	13.33
Mosaic	0	36.0	0	6.67
NUMBER OF STORIES				
Single storied	98.4	60.4	68.33	63.33
Double storied	1.6	39.6	31.67	36.67
OTHER ASSETS				
Average land area	0.26 ha	0.58 ha		
Gold and jewellery	27.2 gms	207.2 gms		

Source: Isaac

Table no.: 3.18

Number, Index number and total value of sale deeds registered in Kerala during 1972-73 to 1985-86

Year	Number of sale deeds		Total value (Rs. Crore)	Average value per deed(Rs)
1972--73	221545	100	42.94	1938
1975-76	315573	142	92.57	2934
1977-78	356705	161	124.91	3502
1979-80	424731	192	204.65	4818
1980-81	447427	202	211.99	4738
1981-82	455762	206	271.53	5958
1982-83	469767	212	325.34	6926
1983-84	474976	214	311.68	6562
1984-85	508098	229	351.89	6926
1985-86	502993	227	318.88	6340

Source: Gopikuttan

Table no. 4.1

Proportion of Pucca houses in districts of Kerala

State/district	1971		1980	
	proportion of pucca houses	Rank	Proportion of pucca houses	Rank
State	49.2		71.6	
Cannanore	49.9	6	75.9	4
Kozhikode	53.8	4	75.4	5
Malappuram	42.8	8	71.8	7
Palghat	55.6	3	76.9	2
Trichur	61.9	2	78.8	1
Ernakulam	70	1	76.1	3
Kottayam	52.1	5	68.9	8
Allepey	43.6	7	59	10
Quilon	42.1	9	66.2	9
Trivandrum	21.6	10	73.7	6
SourceGopikuttan				

APPENDIX J

Table no1:

Extent of back water reclamation till date

Willington island	365 ha
Port development	280 ha
Fisheries harbour	11 ha
Vathuruthy	200 ha
Cochin shipyard	Extent not known
Central Institute of Marine Fisheries	Extent not known
Link road in the southern Mattancherry bridge (completed?))	140 ha
Ernakulam foreshore	23.91 ha
Northern foreshore for further development (proposal)	256 ha
Backwater off Shanmugham road	6 ha
Thevara foreshore reclamation scheme	Extent not known
Water sports project Chilavannur-Kundanoor canal (proposal)	60 ha
GIDA project (underway)	250 ha
Private reclamations	(not known)
Total area under back water reclamation	15.91.91ha ie; 1592 ha

Source: Compiled from references in the text above

Table no 2

Extent of land developed through different methods by GCDA.

Types of land developed by the gcda		
Nature of lands put to use	Scheme area in hectares	Residentially developed area in hectares
reclaimed from marsh lands	542.48	142.62
dry land	302.6	4.944
reclaimed from backwaters	25.29	4.83
River bank	74	9.8
TOTAL	944.37	162.194
Source: based on data collected from GCDA		

Table no 3

Variation in land values in Kochi based on density, landuses, distance to CBD, distance to major road, and availability of services

Variation of land values (Rupees)			
Density	**1972**	**1977**	**1982**
low density 0-40 pph	1250	2000	2500
medium density 41-80 pph	1750	4000	4200
high density	4000	11750	5500
landuses	**72**	**77**	**82**
public and semi public	1750	1500	1500
residential	2000	3000	4000
commercial	7750	9000	12500
distance to CBD	**72**	**77**	**82**
>6 km	1250	2000	2250
4 to 6	1500	2750	3500
2 to 4	2500	4000	5225
0 to 2	10500	6500	16000
distance to major road	**72**	**77**	**82**
1 km	750	1500	1500
0.5 -1 km	1000	1750	2000
0.25-0.5km	1500	2750	3500
0-0.25 km	2750	4250	5000
0 on road	5000	7750	7750
Availability of service	**72**	**77**	**82**
no road accessibility or electricity	500	2000	875
only road	1250	3500	2750
only electricity	875	1250	1275
both available	2000	3500	4250

Table no.4

Housing schemes by Greater Cochin Development Authority

HOUSING SCHEMES UNDERTAKEN BY THE GREATER COCHIN DEVELOPMENT AUTHORITY						
Year of notification of scheme	Year of obtaining govt. sanction	Name of scheme	Area	plots/ purpose	No. of houses	Total residential area in scheme
1964	1969	Elamkulam west (P'ngr)	63.05 ha	385 res plots	556 hses	26.64 ha
1964	1971	Kaloor	45 ha			2.13 ha
	1971	Marine drive(foreshore reclmation)	25.29 ha		204 flats	4.83 ha
1967	1971	Pattupurackal at thrikkakara	220 ha	231 res plots	HIG 31 nos, MIG 100 nos, LIG 60 nos	104.112 ha
1969	1973	Thottakkattukara, Alwaye	74 ha	105 res plots		9.8 ha
1969	1973	Thevara-Perandoor canal II & III	44.40 ha	105m res plots	156 LIG hses,72 MIG	9.2 ha
1971	1978	Thevara-Perandoor canal I			46 MIG, 56 LIG, 48 flats	
1969	1974	Elamkulam north	18.24 ha			5.79 ha
1970	1974	Rameswaram West	79.63 ha		60 EWS,	25.13 ha
1972	1975	Elamkulam road	29.62 ha		47 NRI,	15.20 ha
1972	1977	Alwaye vicinity control	6.6 ha		26 HIG	0.0044 ha
1973	1977	Elamkulam West Extension	118 ha	74 plots	26 HIG,56 MIG, 78 LIG	24.3 ha
1972	1977	Perandoor road	76 ha			5 ha
1974	1988	Elamkulam east	76.58 ha			16.92 ha
1974		Kadavanthara West	37 ha		26 HIG, 34 MIG, 52 LIG	3.83 ha
1989		Elamakkara	31 ha			13.48 ha
		Total	944.37			162.94

Source: Greater Cochin Development Authority

Table no.5

Housing schemes by Kerala State Housing Board in Kochi City

HOUSING SCHEMES UNDERTAKEN BY THE KERALA STATE HOUSING BOARD					
Sl no	**Name of scheme**	**Place**	**occupancy**	**Plots**	**area**
1	Changapuzha nagar	Kalamassery	330 hses & commercial		11.19
2	Elamkulam (East) Navy	Elamkulam	108 flats		1.26 ha
3	Elamkulam (East) Navy	Elamkulam	90 flats		do
4	Elamkulam (West), old stages	Panampally nagar	132 flats		3.28 ha
5	Elamkulam(West), stages II	Panampally nagar	48 flats		0.62 ha
6	Elamkulam North	Near Kumaranasan nagar		145 plots	5.28 ha
7	Kumaranasan nagar scheme	Kumaranasan nagar		11 plots	0.48 ha
8	Kudumbi projects	Elamkulam		226 plots	2.15 ha
9	Kaloor scheme	Kaloor	234 flats,1,2 & 3 bed		2.186 ha
10	Kaloor NRI	Kaloor	4 hses, 28 flats		
11	Edapally scheme	Edapally		71 plots	6.92 ha
12	Edapally stage I	Edapally		65 plots	do
13	Edapally stage II	Edapally	17 houses	7 plots	do
14	Thrikkakara I satellite	Thrikkakara	13 houses	27 plots	13.57 ha
15	Thrikkakara II satellite	Thrikkakara	166 houses	28 plots	Do
16	Thrikkara II (2) satellite	Thrikkara		32 plots	Do
17	Thrikkakara extension	Thrikkara		34 plots	do
18	Thrikkakara NRI	Thrikkara		38 plots	do
19	Fort Cochin scheme		53 houses		1.25 ha
20	Rameswaram scheme rehabilitation in lieu of Navy acquisition	Rameswaram	250 houses		2.6 ha
21	Irumpanam stage I			16 plots	2.66 ha
22	Irupanam stage II		20 houses	30 plots	do
23	Njarackkal			51 plots	1.69 ha
24	Thrikkakara		84 flats		1.833 ha
25	NRI TD Road		14 flats		0.0756 ha
26	Kaloor(Proposed)		28 flats & commercial		
27	Kumaran asan nagar(proposed)		50 flats		
28	Satellite township	Thripunithara			
			total		57.725 ha total

Source: Kerala State Housing Board

Table no.6

Housing schemes undertaken by Girinagar housing cooperative society

HOUSING SCHEMES UNDERTAKEN BY THE GIRINAGAR HOUSING COOPERATIVE SOCIETY				
Sl.no	Year	Name of Scheme	Area in hectares	No. of houses
1.	1967	Girinagar south colony,Kadavanthara	8.81ha	279 hses
2.	1970	Girinaga north, near Gandhinagar	2.4 ha	164 plots,
3.	1980	Jawahar nagar, Kadavanthara	6.4 ha	164 plots,
4.	1983	Subhash nagar, Elamakkara	3.2 ha	
5.	1983	Indira nagar, Thuthiyoor	12 ha	100 hses,282 plots
6.	1997	Paracamugal housing scheme	2.8 ha	63 plots
7.	1998	Irimpanam	0.6 ha	16 plots
8.		Total	36.21	379 hses, 689 plots

Source: Girinagar Cooperative Housing Society

APPENDIX K

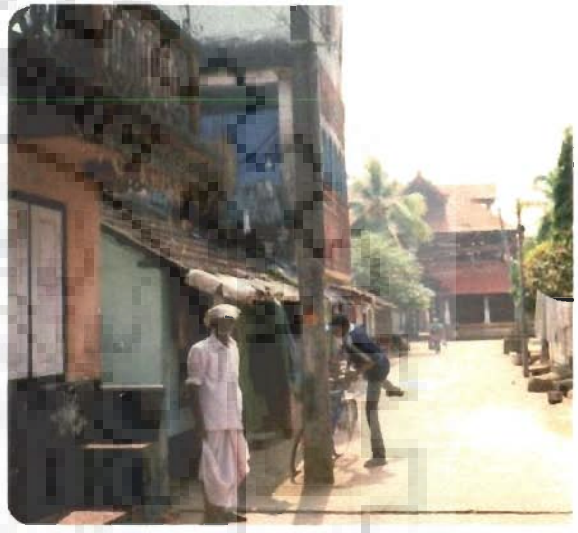
JA Nadumuttam

JB Padipura

JC Passage around Nadumuttam

JD Detail of hipped roof

2A Gujarati Seth's house



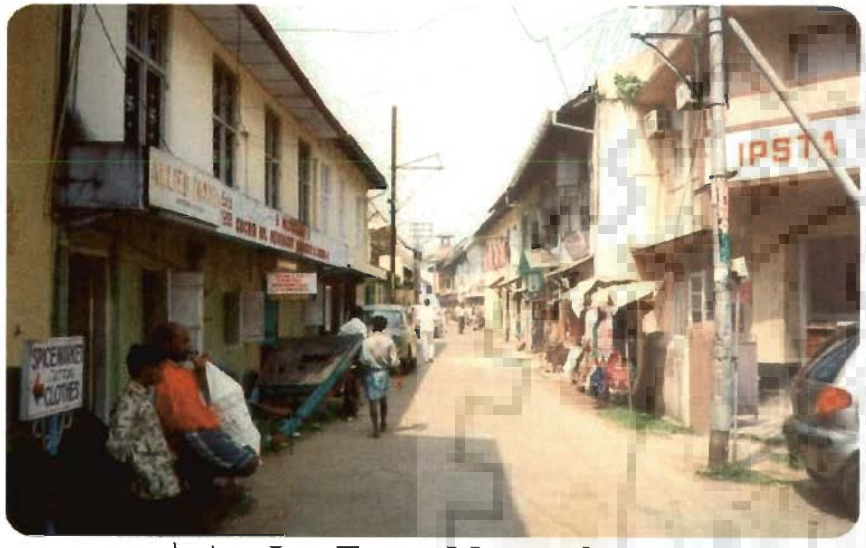
2B Konkani temple and street

2C Jain row housing

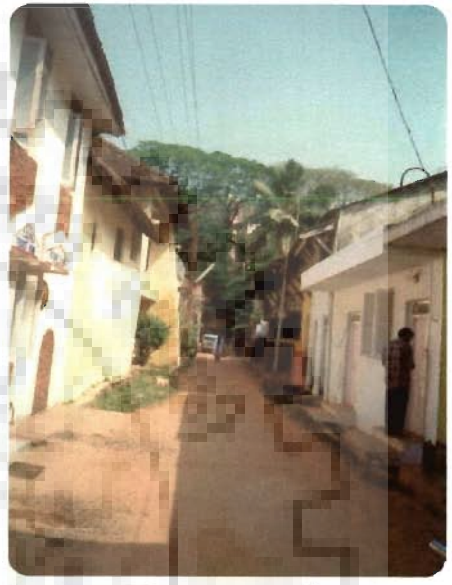
2D Malayali Brahmin street

3A **Well attached to kitchen**

3 B ***Kulipura***



4 A Jew Town, Mattancherry



4 B English street houses under transformation

4 C *Agraharams* under transformation

4 D Gujarati *Chawl* under transformation

ऽA Back water reclamation in progress

ऽB Pisciculture

ऽC Once navigable canals

ऽD Thresholds for development

6A Fernsons Apartments

6 B Ashoka flats

6C BAKER model

6 D Interior of BAKER house

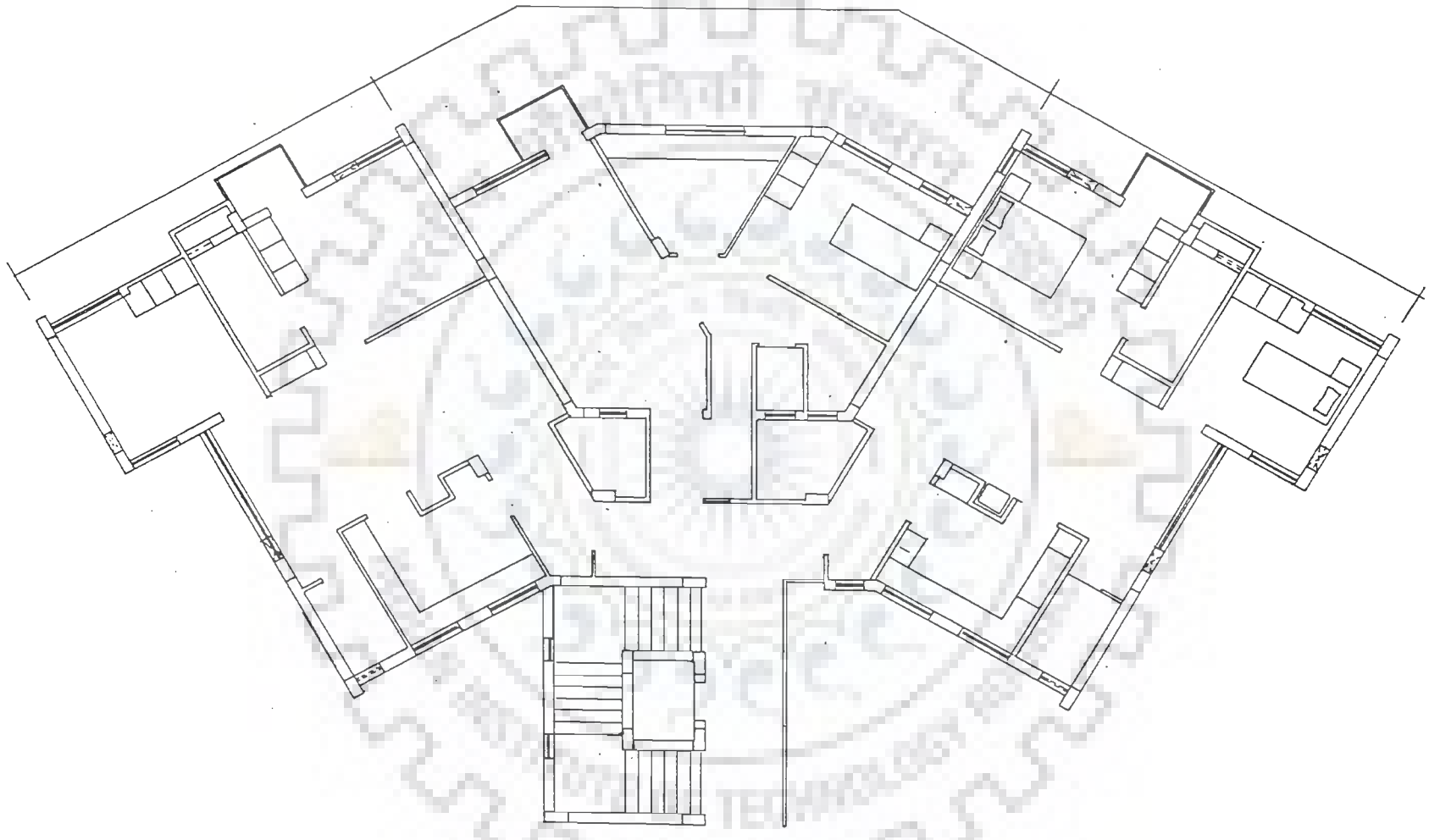
7A Greenary in flower pots!

7B Traditional style in modern building

7C End of the boom- Abandoned project

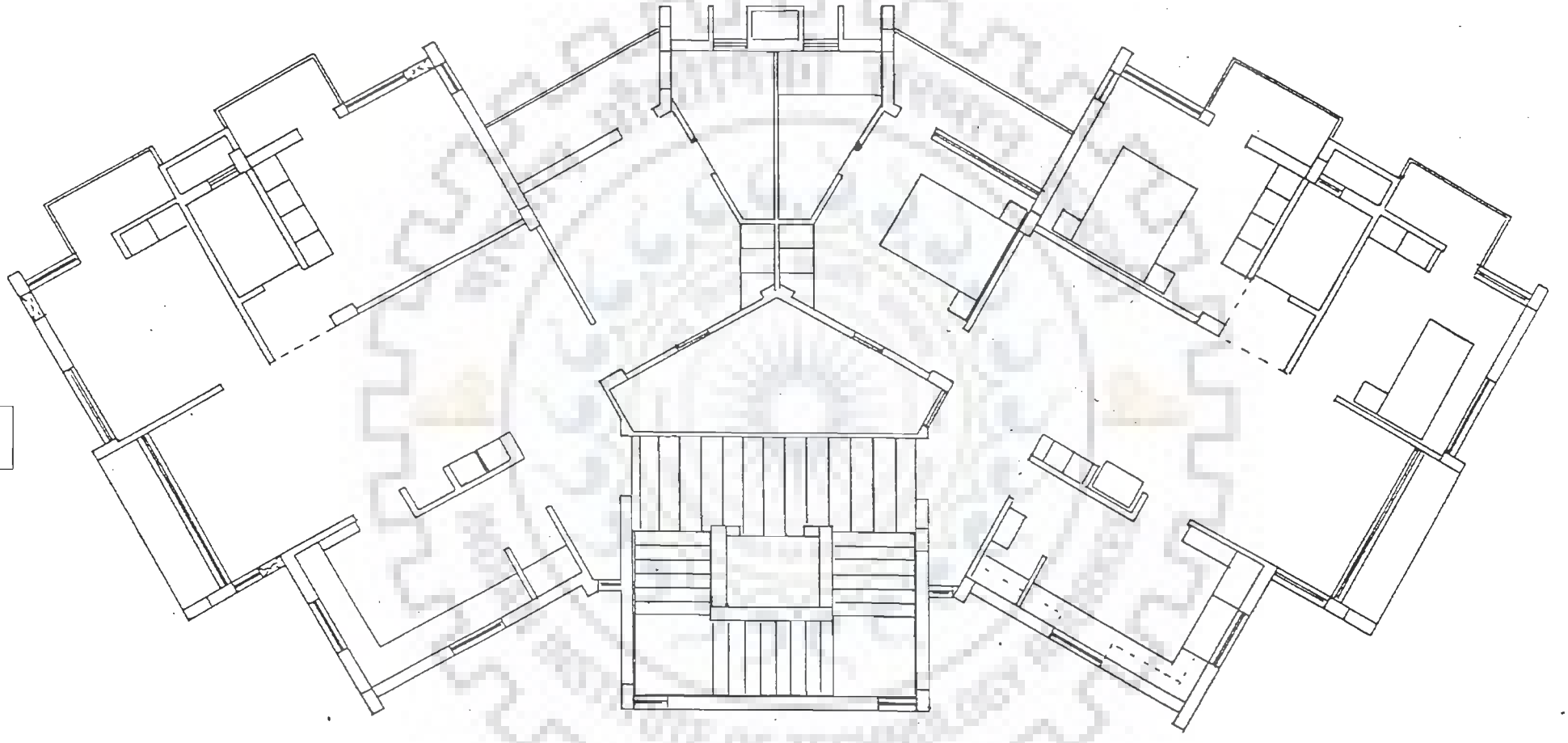
7 D Investment housing in scenic setting

APPENDIX - L



B. One & Two Bed room apartments

APPENDIX - L



Three bed room apartments 108.142 Sq.m.

APPENDIX - M

I wish to record my heartfelt thanks to the following elected representatives/ academicians for lending their valuable time for active discussions with me in the problems of urban residential planning in Kochi:

1. Shri Somasundara Panicker	: Mayor, Corporation of Cochin.
2. Shri Sabu George	: Deputy Mayor, Chairman-Finance Committee Corporation of Cochin.
3. Prof. Mathew Paily	: Ex Mayor, Corporation of Cochin
4. Shri A.K Seshadri	: Ex Municipal chairman 1965-67, Ex Mayor 1975-79, Councillor since 1962.
5. Shri K. Balachandran	: Chairman, Greater Cochin Development Authority, Ex Mayor, Corporation of Cochin.
6. Shri P.A. Madhavan	: Ex Mayor, Councillor & Chairman-Tax appeal Committee, Corporation of Cochin.
7. Shri Seenulal	: Councillor & Chairman, Town Planning Committee & Heritage study, Corporation of Cochin
8. Shri C.K Manisankar	: Councillor & Chairman-Works Committee Corporation of Cochin
9. Shri K.P. Thomas	: Secretary, Corporation of Cochin
10. Prof. Rema Menon	: Councillor, Corporation of Cochin
11. Shri C.K. Thomas	: Retired Chief Town Planner, Dept. of Town Planning.
12. Shri Joseph Alexander	: Retired Chief Planner, Trivandrum Development Authority.
13. Shri K.J.Philip	: Chief Town Planner, Greater Cochin Development Authority.
14. Shri Sadasivan Chettiar	: Senior Town Planner, Regional Town Planning office.
15. Shri P.K Thampy	: President, Environment Monitoring Forum
16. Dr. U.K.Gopalan	: Secretary, Working group on Environment

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36. Smt. Thresiamma	: Deputy Town planner, Greater Cochin Development Authority.
37. Shri N.Jayanandan	: Deputy Town Planner, Greater Cochin Development Authority.
38.Shri Gopalakrishnan	: Deputy Town Planner, Greater Cochin Development Authority.
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40. Shri T.O Mathew	: Deputy Town Planner, Regional Town Planning office, Cochin.
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APPENDIX – N

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