MULTI-PURPOSE CENTRE, MAKURDI
Appraisal of Tropical Building Materials

BY

OGWUCHE, IGBAH PATRICK

B. Sc (Hons)

A.B.U., ZARIA

A THESIS SUBMITTED TO THE POST GRADUATE SCHOOL
AHMADU BELLO UNIVERSITY, ZARIA
IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE
AWARD OF MASTER OF SCIENCE DEGREE IN ARCHITECTURE

DEPARTMENT OF ARCHITECTURE
FACULTY OF ENVIRONMENTAL DESIGN
AHMADU BELLO UNIVERSITY
ZARIA, NIGERIA.

NOVEMBER 1992

DECLARATION

I, Ogwuche I. Patrick, do hereby solemnly declare that this research work has been a personal academic undertaking executed under the supervision of my mentors, Arch. Madusolumou D. U. and Arch. Yeboah, in the department. All quotations and information utilized therein and their sources have been duly acknowledged.

Signed: _____

Supervisor: _____

CERTIFICATION

This thesis report entitled "Multi-purpose Centre, Makurdi", by Ogwuche I. Patrick, meets the regulations governing the award of the degree of Masters of Science (M. Sc.) in Architecture and is approved for its contribution to knowledge and literary presentation.

Chairman, Supervisory Committee	Date
Sub-group Mentor (Supervisor)	Date
Member, Supervisor Committee	8-12-92 Date
Head of Department	Date
Dean, Post Graduate School	Date

DEDICATION

To thee O' Lod, God Almighty, the giver of wisdom, knowledge and understanding. To thee be the honour, glory and praise, for taking me through all the mountains of this work, unto thy glorious success. I will serve thee forever and ever, Lord.

To my father and mother (Ogwuche Igbah and Ajima Ajunwa) for their financial and moral support.

To Veronica Ocheme who stood by me through thick and thin and to all the members of my family.

ACKNOWLEDGEMENT

My sincere gratitude goes to my parents, Ogwuche Igbah and Ajima Ajunwa who took the challenge one day to train me in my primary and secondary school.

To God almighty for providing all the opportunities to continue on my own up till this level, despite my family background.

My appreciation goes to my able, humble and experienced Supervisor, Architect Madusolomuo D. U. who not only supervised this thesis, but have taken the responsibility of a senior brother whose advice mode my conduct in the University. Thank you, sir, for all you have done in the course of my studies; it is unfortunate that you were not around at the end of the whole journey. Appreciation also goes to Arch. Qurix W. B. and Arc. Yeboah who finally completed the supervision.

I am also indebted to my Head of Department, Dr. O. Solanke who so much cared and advised fatherly.

All persons who facilitated the data gathering and compilation processes, especially in Makurdi, with special reference to Mr. Aduku Aba of Ministry of Finance.

It would be a criminal act, if the contributions of various interest groups are not mentioned here. Among whom I wish to express my profound gratitude to, that for which I am most sincerely grateful:

- Mr. Simon Obekpa and his wife who played the role of my father and my mother. I thank them so much for their financial and material supports.
- Alhaji Abdullahi Garba who took care of me after my first degree.

- Chief Godwin Okpeh who gave me the advice and encouragement to come back for my post graduate studies.

- Engineer Andrew Agom for his financial, moral and encouragement to ensure that I do no lose hope.

- Lawrence Igwue Okoh who helped financially when all was not well.

- Audu Patrick Dio, a friend anybody could be proud of and who was out at all times to help any situation financially and with whose help the thesis has been finally completed.

- Andrew Ikwoyi Ochai who was a very daring and close friend.

- My cousin, Emmanuel Obande, who was never tired of me in terms of financial assistance.

- My younger brother, Ignatus Obeya Ogwuche who deferred his studies for the sake of mine.

- My senior sister, Mrs. Theresa Obilikwu, for her care and love.

- Veronica Ocheme whose moral support, encouragement, love and prayers have been my inspiration.

My fraternal gratitude to all members of "Adiga Mature Minds (ADMINDS), whose company, love, criticisms I have found useful in the course of my struggle.

All staff, students and well wishers who helped in one way or the other to ensure my success.

Lest I forget, my regards go to Mr. Femi Ogunsola and the whole of his family for the love and kindness, and my able typist, Mohammed Ibrahim of NTC PLC, Zaria.

ABSTRACT

A community, according to Oxford dictionary definition, is physically incomplete without a centre. It is a centre (a communal focal point) like the courtyard concept of a typical African setting, that makes a community a community and not merely an aggregate of individuals. It is like an open air lobby with a centripetal force that pulls different people together informally, achieving unity and so on from the diverse languages, customs and traditions within that settlement.

The centre represents actually a psychological parking place within the civic landscape. If one visualises the streets as rivers, channeling the stream from human communication which means much more than mere technical "traffic" - then the centre represents a natural or artificial lake. The centre dictates the flux of life not only within its own confines but also through the adjacent streets for which it forms a quasi-estuary.

The Makurdi sub-region like any other town, has its own places of works, seat of government, residences and place of assembly. The multipurpose centre is an attempt to provide a distinct central place of assemblies to serve as prestige for such a big town. A flexible complex that will accommodate various functions within the limit of various assemblies in Makurdi. It shall not only serve as a revenue generating complete for self maintenance but shall also seek to improve and encourage the study of theatre arts, provide entertainment and interraction among various professionals, transforming the existing site into an architectural entity.

The focus of this thesis is to appraise tropical building materials and to see how best they could be used to reduce cost and comfort in building.

The envisaged limitation is that any sociological and scientific research application like this can only be adjudged successful or otherwise with passage of time.

TABLE OF CONTENTS

		PAGE
Declaration	.. ..	i
Certification	.. ..	ii
Dedication	.. ..	iii
Acknowledgement	.. ..	iv
Abstract	.. ..	vi
Table of Contents	.. ..	viii
List of Tables	.. ..	xiii
List of Figures	.. ..	xiv
List of Plates	.. ..	xv

PART I GENERAL INFORMATION

CHAPTER ONE

1.0	Introduction	.. ..	1
1.1	Statement of the Problem and Motivation		2
1.2	Aims and Objectives	..	3
1.4	Research Methodology	..	4
1.5	Scope and Limitations	..	5
1.6	Users of the Centre	..	5
1.7	Client	.. ..	5

CHAPTER TWO

2.0	Literature Review	.. ..	6
2.1	A Historical Review	..	6
2.2	A Centre in Antiquity	..	7
2.2.1	Acropolis	.. ..	11
2.2.2	The Agora	.. ..	12
2.2.3	The Forum	.. ..	13

		PAGE
2.2.4	Medieval Towns	20
2.2.5	Renaissance Towns	21
2.2.6	Towns in Baroque Era ..	22
2.2.7	Open Space in African Towns ..	22
2.3	Open Space in Modern Town Concept. ..	24
2.4	Human Perception of Open Space. ..	25
2.5	Architecture and Space Phenomenon. ..	28
2.6	Inferences from Historical Development.	29
2.7	Theories of Human Centres. ..	32
2.8	Centre Characteristics. ..	33
2.9	Environmental Problems Peculiar to Communcal Centres.	34
	Summary and Conclusions. ..	35
CHAPTER THREE		
3.0	Design Parameters/Analysis. ..	36
3.1	Comfort Level	36
3.1.1	Body Heat Exchange	36
3.1.2	Heat Radiation Effect on Buildings. ..	37
3.1.3	Pedestrian Comfort. ..	38
3.2	Design Parameters for Theatre. ..	38
3.2.1	Theatres in Nigeria. ..	39
3.2.2	Effect of Site and Slope. ..	40
3.2.3	Stage Types.	41
3.2.4	Floor Shape and Their Accoustic Effects.	43
4.2.5	Theatre Accoustic Requirements ..	44
4.2.6	Open Air Theatre Accoustics ..	48
4.2.7	Seating and Aisle Arrangements ..	49
4.2.8	Lighting	49
3.3	Summary anc Conclusions ..	50

PAGE

PART II DOCUMENTATION

CHAPTER FOUR

4.0 Case Studies. 52

4.1 Yaba Community Centre, Yaba - Lagos. .. 52

4.2 Isolo Community Centre, Isolo - Lagos. 58

4.3 Public Safety Building, Maine - U.S.A. 62

4.4 Jewish Community Centre, Toronto. .. 66

4.5 Summary and Conclusions. .. 69

CHAPTER FIVE

5.0 Thessis site and Environs. .. 71

5.1 Introduction 71

5.2 State of Location 71

5.3 Town of Location 71

5.4 Climatology 72

5.5 Geagraphical Character .. 79

5.6 Site Analysis 81

5.7 Population Structure .. 85

5.8 Summary and Conclusions .. 85

CHAPTER SIX

6.0 Tropical Building Materials .. 87

6.1 General Introduction .. 87

6.2 The Tropical Climate .. 92

6.3 Climatic Evaluation for the Tropical Climate. 102

6.4 Effect of Tropical Climate on Building Materials. 117

6.5 Plastic 129

6.6 Summary and Conclusions .. 134

PAGE

PART III DESIGN CHAPTERS

CHAPTER SEVEN

7.0	Evaluation of Design Hypothesis ..	139
7.1	Problem Synthesis	139
7.1.1	Introduction	139
7.1.2	Design Implications Drawn from Preceeding Stages.	139
7.1.3	Zoning Relationship ..	144
7.1.4	Functional Relationship ..	144
7.1.5	Form, concept and Planning. ..	145
7.1.6	Summary and Conclusions ..	146
7.2	Problem Solution ..	146
7.2.1	Introduction	146
7.2.2	General Design Parameters. ..	147
7.2.3	Architectural Interpretation ..	150
7.2.4	Landscape	151
7.2.5	Summary and Conclusions ..	152
7.3	Construction Materials and Technology	153
7.3.1	Introduction	153
7.3.2	The Foundation	154
7.3.3	Floors	155
7.3.4	Walls	156
7.3.5	Roofs	156
7.3.6	Finishes	156
7.3.7	Structure	158
7.3.8	Summary and Conclusions ..	159

PAGE

CHAPTER EIGHT

8.0 The Design Brief 161

8.1 The Site 165

8.2 Site Selection Criteria .. 165

8.3 Schedule of Accommodations .. 166

CHAPTER NINE

9.0 Conclusion 174

9.1 Recommendations 174

9.2 Conclusions 174

References. 178

LIST OF TABLES

		Page
1.	Monthly Mean Rainfall for Makurdi.	73
2.	Monthly Temperature Figures for Makurdi.	74
3.	Relative Humidity Value for Makurdi.	75
4.	Comparative Analysis of Shading Devices.	113
5.	Schematic Breakdown of Climatic Effects.	116

LIST OF FIGURES

		PAGE
1.	The Acropolis	14
2.	The Agora	14
3.	Agora Anthens	17
4.	Plan of Forum at Rome ..	18
5.	Plan of forum at Pompeii ..	19
6.	Site Plan (Yaba Community Centre) ..	54
7.	Floor Plans (Yaba Community Centre) ..	55
8.	Site Plan (Isolo Community Centre) ..	59
9.	Elevations (Isolo Community Centre) ..	60
10.	Plan (Public Safety Building, Maine, U.S.A)	63
11.	Views of Public Safety Building, Maine, U.S.A.	65
12.	Rainfall (Makurdi)	76
13.	Relative Humidity (Makurdi) ..	76
14.	Tempearture (Makurdi)	77
15.	Sun-days (Makurdi)	77
16.	Wind (Makurdi)	78
17.	Climatic Zones of the World ..	94
18.	The Tropical Zones of the World ..	95
19.	Planning Characteristics of Various Tropical Zones.	97
20.	Shelter Planning for Hot Humid Area. ..	98
21.	Shelter Planning in Hot Humid Climate ..	99
22.	Traditional and Modern Building Materials employed in the Tropical Climate.	100
23.	Use of Local Building Materials. ..	101
24.	Influence of Climate on Site Planning. ..	103
25.	Heat Conduction of Different Materials.	123

LIST OF PLATES

		PAGE
1.	Elevations (Yaba Community Centre).	56
2.	Plan and Elevation (Jewish Community Centre), Toronto.	67
3.	View of Building Climatic Consideration.	89
4.	Devices in building to control extremes of climatic effect.	90
5.	Use of Brick Projecting and Screen Against Sun.	114
6.	Use of Aluminium Channels for Protecting Against sun.	115
7.	Use of Timber Battens to completely enclose building from excessive solar heat.	120
8.	Use of Roof or Balcony and sunshade over openings.	135

CHAPTER ONE

1.0 INTRODUCTION

Man's desire to express his innermost feelings gave birth to many languages with which to express his feelings and satisfy his needs. However, the needs of the entire members of the community to communicate and interract with each other necessitated a central common ground or place.

Through the active participation by the members of the community with diverse views, ideas and opinions, there emerged the town centre, community centre or cultural centre as the case may be, most active and bubbling with enthusiasm.

With the advent of modern technology, such centres became institutions themselves and their importance was recognised. An institution of learning, where exchange of ideas, opinions and views on any subject forms a pillar of education must incorporate this fundamental requirements of a centre intricately woven into the fabric so as to achieve a desired unified concept of education.

This thesis studied the various tropical building materials, in terms of their merits and demerits, how they could be used to achieve comfort in the hot humid climate of Makurdi town and cost reduction in building generally.

The thesis consists of three parts - part one is on the general information on centres and the tropical building materials. Part two is the analysis of the thesis site and the environs, while the last part deals with the design proper.

1.1 STATEMENT OF PROBLEM AND MOTIVATION

Kalinger (1971) defined 'problem' as an interrogative sentence or statement that asks; what relationship exists between two or more variables? Variables within the definition shall be taken as those functions to be provided with a view of establishing intricate relationship between them.

Whenever a man could, he has shaped and changed the environment to suite his needs. In doing so, he has also misused and sometimes abused it with disastrous results. Industries and population growth have wrought a heavy toll on the human environment. So much so that the continued and accelerated despoliation of the man-made and natural environment is not only inhibiting sound economic and social development, but clearly threatening the physical, social and spiritual well-being of man. The need for intensified remedial action to improve the environment for man's total well-being has never been more urgent nor more clearly recognised than at the present time.

In the Benue State capital as a whole, the Makurdi sub-region, from studies available, there is lack of diversity in social activities in the area. The prospect of increasing levels of urbanisation suggest an increase demand for shopping facilities, leisure spaces, services and other facilities in the city. That such items are lacking in the administrative headquarters of Benue State, Makurdi has in no doubt motivated the purpose of this work.

1.2 AIMS AND OBJECTIVES

The idea of a multipurpose centre evolved as a response to inadequacy of necessary social facilities within the Makurdi metropolis as compared to other state capitals in Nigeria. The centre is aimed at:

- architecturally solving the problem.

- providing an effective environment that will function in a way to the development of a sound body and mind through wholesome and creative activities.

- providing a place for effective counselling and basic knowledge generally and about the norms of the society in particular.

- developing and strengthening social relationship within the family and the community through close group associations and activity participation.

- developing community stability by providing an environment conducive to wholesome family living and community life.

- generating income for the state and acting as an organ of bringing people together to achieve unity.

- developing the state capital in terms of its social and physical structure.

- And as a student, to see how various design parameters are used in achieving flexibility in the planning of a complex.

- To see the integration of spatial functions on site with a view to achieving harmony.

1.4 RESEARCH METHODOLOGY

This thesis research was conducted in the following ways:

- Library source: Literature review of books and thesis was carried out to enable the researcher have a greater grasp of the subject.

- Government reports and gazette, maps and related documents were obtained and studied.

- Interviews and discussions were conducted among the community and those in related professions in government ministries and corporations.

- Visual and physical inspection of the community and their way of life was carried out.

- Photographs were taken and analysed for design synthesis.

1.5 SCOPE AND LIMITATIONS

The centre made provision for administrative, maintenance, recreational facilities, welfare, reading and exhibition spaces, offices for clubs and associations. Conference hall and accommodation are also provided.

1.6 USERS OF THE CENTRE

The facilities in the centre are to be used by all the age groups in Makurdi town, environs and visitors from other towns close to Makurdi. People outside the town could use any of the facilities as they may prove useful to them.

1.7 CLIENT

The client of this Multipurpose Centre shall be the Benue State Government in conjunction with the Benue State Community Development Board, Makurdi.

CHAPTER TWO

2.0 LITERATURE REVIEW

Communal space has been treated and, many names have been given to it. It has been called community centre, neighbourhood centre, district centre, civic centre and open space, dpending on the functions of the centre, the population it serves and the standard of the facilities available in the centre.

The aim of this review is therefore:

- To have indepth knowledge of the subject.
- To know the direction of thinking of past researchers on the subject.
- To avoid repetition or duplication where necessary.
- To understand and identify the general trend on the subject.

2.1 A HISTORICAL REVIEW

Communal centre is as old as when the Greek architects created the first set of human beings. They are put in a communal space where all their needs are within reach.

Advancement in civilization and the increase in human population necessitated the need for communal space to be indispensable in the agrarian society, as a result, settlement were built around large open space for easy access from all parts of the community. The setting made communal space as the hub of human activities in the town. Important public buildings like the administrative seat (palace),

market, temples and shrines were added within the large open space. To understand how this open spaces are organised, it is necessary to look at settlement patterns in Mesopotamia which was regarded as the first organised human settlement in the field of Ekistics. However, towns in Europe and African would also be investigated for better understanding.

2.2 A CENTRE IN ANTIQUITY

Different planners see centre differently depending on its purpose; to some, it is an open space around which traffic circulates with buildings on all four sides; to others, it is a central point of meeting around which are public buildings. The fact remains that they are pedestrianised zones and could be furnished or unfurnished.

According to Zucker, P (1959), a centre or square is that which makes the community a community and not merely an aggregrate of individuals.

Most of the existing works on the communal space aimed at establishing a focus in an existing traditional town or settlements. In some cases, such towns have no proper planning, hence the works are always aimed at integrating such communal space to suit the existing planning. For instance, Aboyade (1984) was concerned with the arrangement of space to stimulate social interraction amongst the members of the community. This, she approached by analysing the basic human behaviour in relation with various space systems. She adopted the Humphrey Osmond's classification of space

as either 'socio-fugal' (spaces which tend to keep people apart) and 'socio'petal' (spaces that bring people together). She employed the 'socio-petal' principle in "activity areas", Lobbies and hallways, since areas like these tend to bring people together. She failed to realise that although such areas are major circulation nodes, interraction does not necessarily accomplished with seating arrangement because human interraction is controlled by socio-cultural belief which in turn governs the behaviour of individual as a social animal.
She went further to embrace the research finding of environmental psychologist - Robert Sommer, on the "spatial factor" in various seating arrangements. It is a very sound academic submit which can only be effectively employed in urban neighbourhood centres, where people congregate either on social status or based on economic level. Such seating arrangement could enhance easy discussion and exchange of business cards that can encourage further contact. In a situation where openness or open space serves as a hub of social or communal life, such an arrangement might be too rigid for them to sit, hence exchange of compliments.

Her approach to social interraction was basically on human behaviour within such space. She modified Edward T. hall's 'proximics' (nearness) theory to include the dimensions and the geometry of the space.

Filiya S. (1987) proposal for Bauchi aimed at integrating its design within the existing recreational

facilities in the town. His major focus was how to achieve space flexibility that can adapt well to various uses.

Sifiyanu (1989) defines communal space as "Any space which members of a community share for a certain activity either individually or collectively". For Sifiyanu, the modern trend of grouping people together along class, income and social status destroys African concept of communal space. However, he did not state what a communal space should be, instead, he laid more emphasis on multi-functional use of communal space.

Fitz Stephen (1961) asserts the 12th century communal space in London was purely utilitarian and the facilities were located to serve group of houses or ward to decentralize the essential social functions. This was in line with the conclusion of Adeagbo (1988) who also proposed that communal space no matter the culture or religion of the people all developed for same purpose - Administrative seat, and socio-economic function among citizen within the community. He justified this when he wrote "For this reasons, such centres are usually centrally located for accessibility. The important of which led to creation of distinct architecture e.g. Agora, Forum, Town hall and palaces".

According to Adesiyan (1980), open spaces in some cities are used to make the population have sense of unity as well as of pleasure by revealing to itself the variety

of age, class, nationality and race of which cities are composed. He cited August Heckscher to butress his point that "Imaginative civil leaders have long been aware of a link between a city's amenities and the soundness of other aspect of life, without exception being accompanied by a feeling for the importance of well used parks and other spaces". He believed that Agora in Greek was an ideal use of open space. That people do not only "met but got in each other's way", and that it was the integration of various communal spaces with the Agora that gave their cities its unique characteristics. He went on to elaborate on Jane Canter Loeffler, that open space is not just a container of a setting but that tends to encourage social interraction and that within this space one "may encounter the easthetic value of trees, sky and feeling of enclosed space".

Adebiyi (1990) argued that for one to write on communal space, the word community should be understood, as the meaning differs from one profession to another. However, he as a planner, defines it as a group of people in certain geographical area with common aims and interest whichi is diverse in nature and without limits to the participating individuals. He went further to define communal spaces as those organised spaces found within the compounds and town centres for the general benefit of the community, and that it forms the major point of social contact (especially in Africa) within the Agglomeration of human settlements.

He also added that communal space is the area within the community where all the participating individual within the community could come together for certain activities common to every member of the community. This could be buying and selling, recreation or relaxation and display of cultural activities etc.

Gleanable from past works treated each problem in isolation and failed to realise that none of the issues can singularly make communal centre (space) functional on its own, however, it was Adesiyan and Adebiyi that really encompasses the major components by appreciating the need for diversity of facilities within the space to encourage social interraction. It is when this is attained that issues on human behaviour in response to space setting, and spatial organisation of these diverse facilities stimulate efficient human response can be effectively tackled.

2.2.1 ACROPOLIS

Acropolis, the nucleus of early Greek towns, developed generally from a fortified place of refuge. The possibilities of an easy defence were decisive for its establishment. So, it became gradually the seat of the dominant power and eventually a sacred area, where temples monuments, and altar were located as were in earlier times the palaces of the kings. The acropolis was walled, but never became part of the fortification of the settlement which stretched beneath it. Once the whole town became walled, the acropolis gradually lost its importance for

defence. During the earlier archaic centuries, it also served as a gathering place, a function it lost to the Agora with the increasing growth of the town proper.

2.2.2 THE AGORA

The Greek social life is organised around a central open space called Agora. The Agora started developing dated back to 500BC. The Acropolis and Agora were referred to as the twin foci of Greek cities. The Agora was the multipurpose everyday heart and witnessed an intense and sustained concentration of varied activities. It did not function on occasions but was the daily scene of social life, business and politics, being the focal point of a planned city. The Agora is the single most important space in Greek. It is approached by narrow alleys and a major possession avenue for mass movement at ceremonies especially during war victories. The Agora was a centrally located as possible. The early Agora had an amorphous and irregular form. If it was sometimes an open square, in a town like Thera, it might be little more than the widening of the main street. The Agora served as a sort of informal club, where, if one waited around long enough, one would meet one's friends and cronies. East of the Agora, two important Roman buildings are shown: the library of Hadrian and the market of Caesar Augustus. A typical linear group of organic growth housing is shown south of Areapagus hill.

Agora's related structures

Baths	:	Public bathing place.
Bouleution	:	Meeting place for councils.
Metroum	:	For keeping public documents.
Odeum	:	Concert hall.
Pompeium	:	Hall, club and picture gallery.
Prytaneum	:	Committee of state meeting place.
Stoa	:	Meeting place for business purposes.
Temple	:	Place of worship.
Theatre or pynx	:	Place of assembly.

2.2.3 THE FORUM

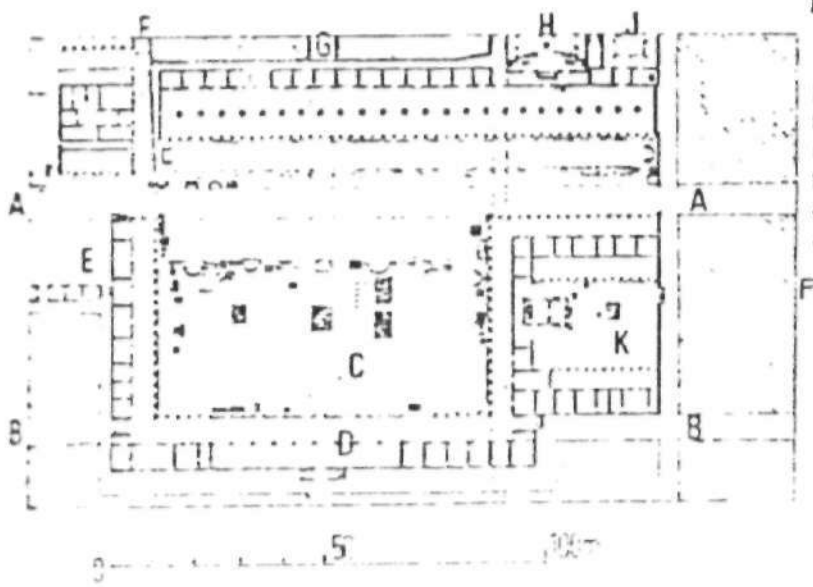
The Roman Forum was an equivalent of Greek Agora. The Forum which is the centrally organised open space is a prototype of the Agora, but was ingeniously landscaped to meet their own taste for environmental surroundings. Hellman (1986) wrote, "Like Movie Monguls, they took over Greek ideas and inflated them into big vulgar production for the benefit of the state".

The Forum is located at the heart of built up areas of the city. This resulted in the irregular shape of the Forum since it was defined by the surrounding structures. However, the interior was painstakingly made regular with lines of colonnaded varandahs which were decorated with statues and flanked by massive public buildings. The initial orientation of the Forum was to to serve a multipurpose functions, combining market and civic activities with political business. Basilica was



A ACROPOLIS
B THEATRE
C AGORA COMPLEX
D GYMNASIUM & STADIUM

PRIENE, GENERAL PLAN

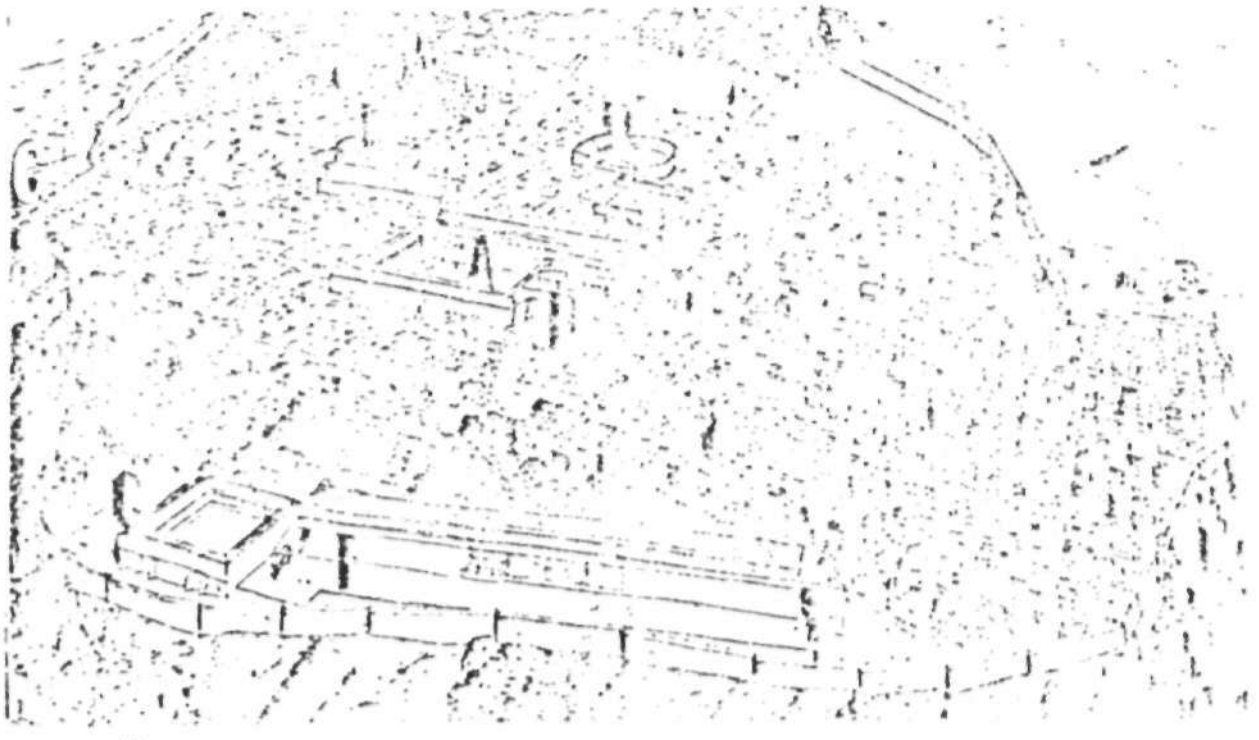


A-A MAIN E-W STREET ACROSS CITY
B-B GRID STREET ACROSS SOUTHERN STOA
C MAIN AGORA SPACE
D COLONNADED HALL
E FISH & MEAT MARKET
F STEPPED GRID FOOTPATH ON HILLSIDE
G NORTHERN STOA
H BOULEUTERION
J PRYTANEION
JK TEMPLE OF ZEUS

PRIENE, PLAN OF AGORA

A AGORA
B TEMPLE OF ZEUS
C GYMNASIUM
D THEATRE
E TEMPLE OF ATHENA
F STADIUM
G MAIN ENTRANCE INTO CITY

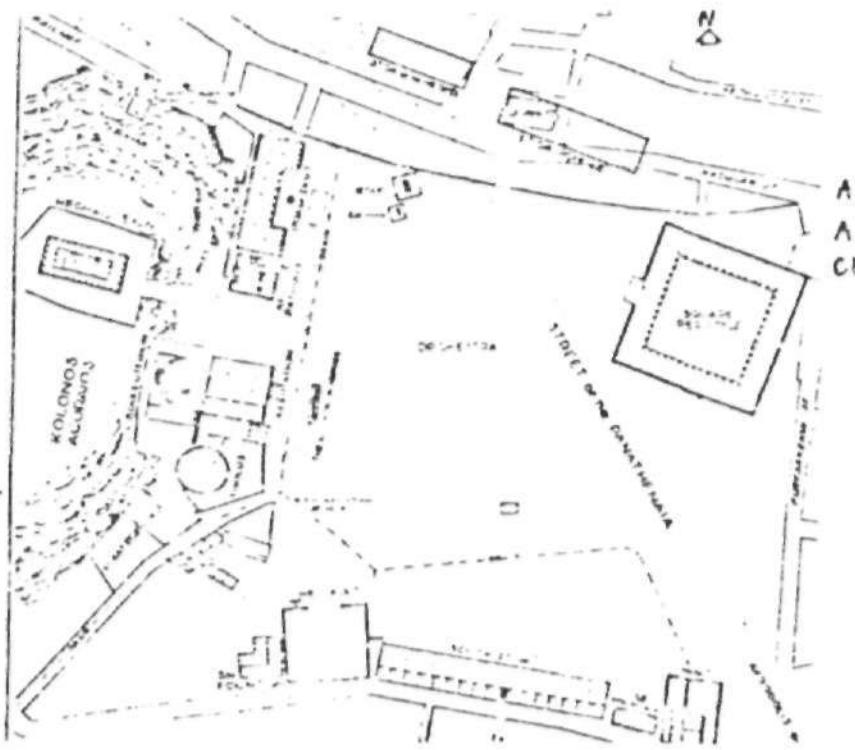
IMPRESSION OF PRIENE





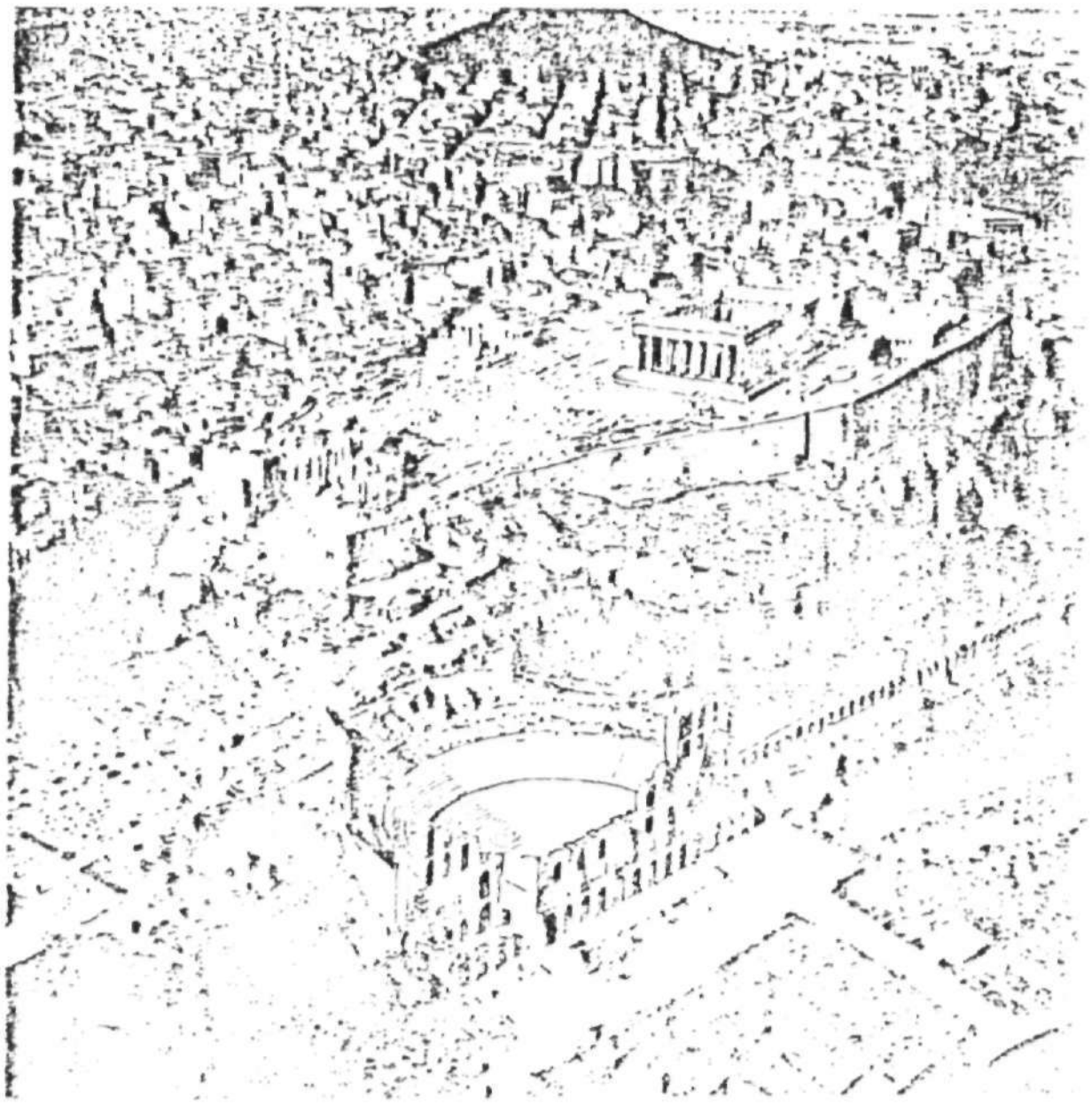
1 STOA OF ZEUS
2 TEMPLE OF APOLLO
3 METROON
4 BOULEUTERION
5 THOLOS
6 GREEK BUILDING
7 ENNEAKROUNOS
8 UNEXCAVATED BLOCK
9 SOUTH STOA
10 STOA OF THE HERMS
11 ALTAR OF THE 12 GODS
12 TEMPLE OF ARES
13 ODEION

PLAN OF THE NORTH-WESTERN PART OF ATHI IN THE SECOND CENTURY A

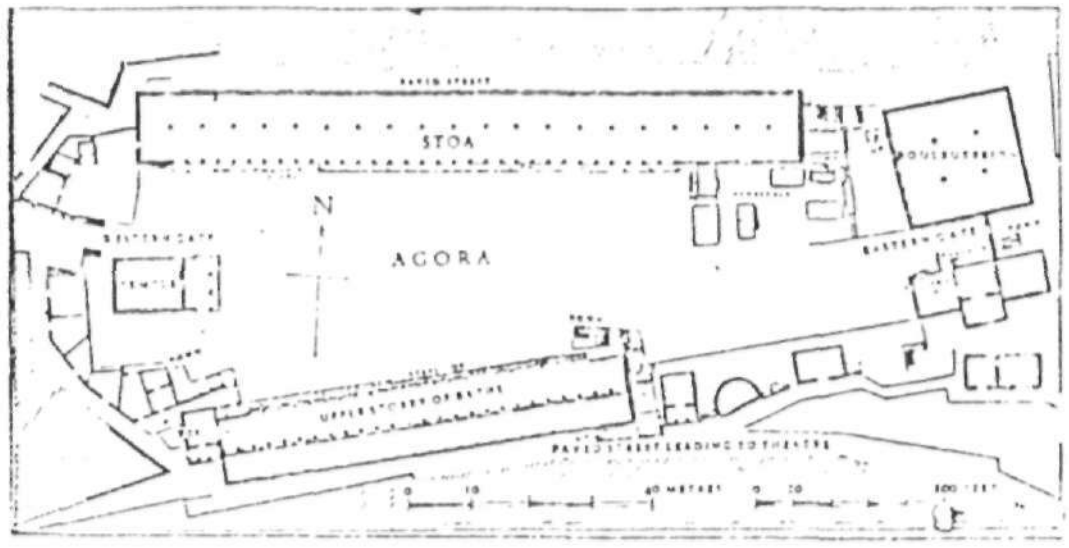


ATHENS, THE AGORA AREA IN THE THIRD CENTURY BC

Source: M. s, A E J , 1112



ATHENS, AERIAL VIEW OF THE ACROPOLIS FROM SOUTH-WEST, LOOKING ACROSS PARTIALLY RESTORED RUINS OF THE ROMAN THEATRE OF HERADIES



PLAN OF AGORA, ATHENS

IT CONSTITUTES OF BATHS, BOULEUTRION, METROUM, STOA, TEMPLE AND THEATRES

THE TRAPEZOIDAL SHAPE, WIDE AT THE WESTERN END, WAS DETERMINED BY THE SHAPE OF THE NARROW NATURAL TERRACE ON WHICH THE AGORA WAS LOCATED.

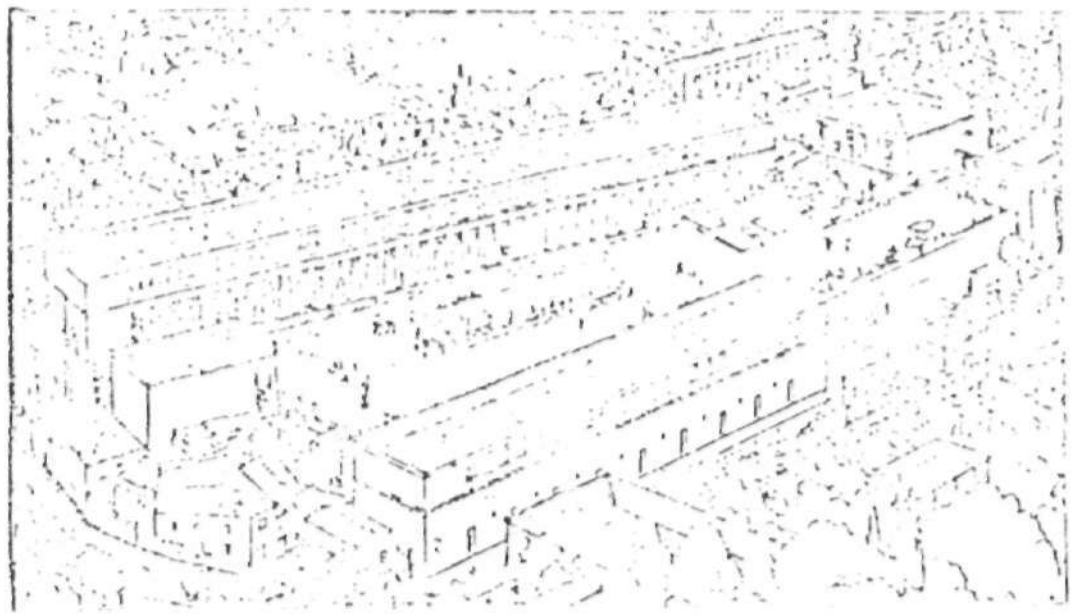


FIG. 3 RESTORED VIEW OF AGORA, ATHENS

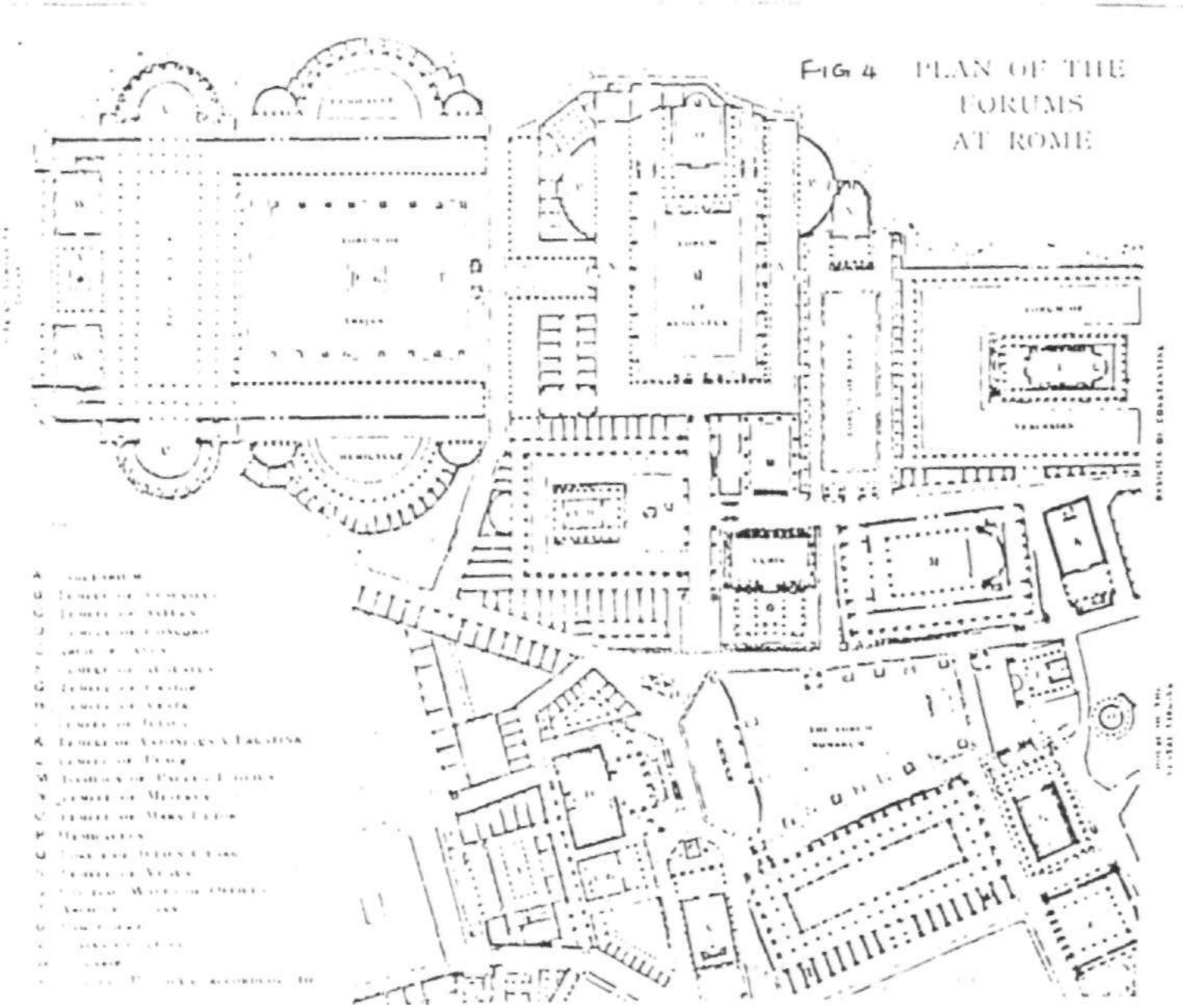
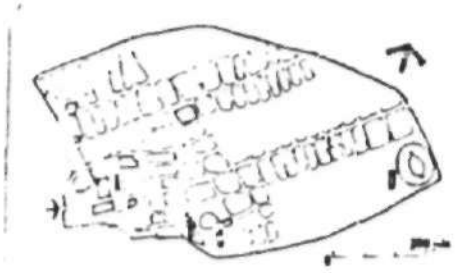


FIG 4 PLAN OF THE FORUMS AT ROME



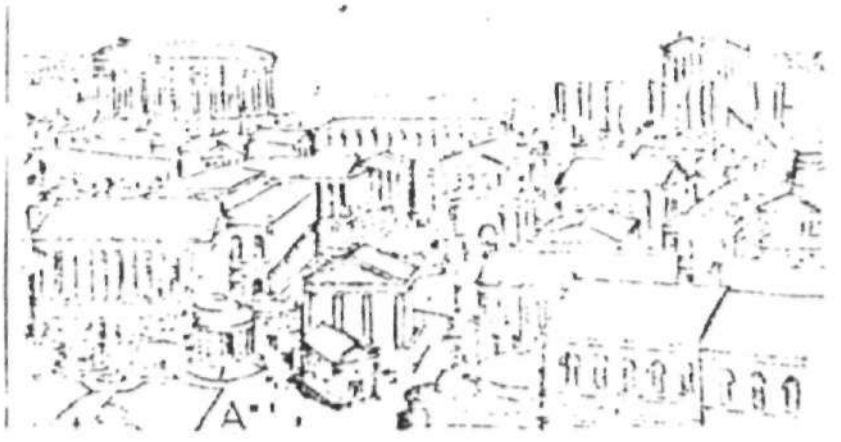
A MAIN FORUM
B TRIANGULAR FORUM
C THEATRES
D ARENA

FIG 5A POMPEII, PLAN OF THE CITY



VII TEMPLE OF JUPITER
IX TEMPLE OF APOLLO
XVI PUBLIC CONVENIENCES
XVII MARKET
XVIII BASILICA
XIX 3 CIVIC HALLS
XX COMITIUM
XXI BUILDING OF EUMACHIA
XXII TEMPLE OF LARES
XXIII COVERED MARKET

FIG 5B POMPEII, PLAN OF THE FORUM



THE FORUM ROMANUM

later introduced into the Forum to serve as the court of Justice (e.g. Basilia of Trajan Rome).

Forum's related structure

Basilica	:	Hall of justice
Lecture hall	:	In connection with public baths.
Library	:	Columnated reading court.
Public buildings:		Temple, theatre, public baths, small shops concentrated in and around the fora area.
Tabularium or achinium	:	Building in which archives of the city or state were deposited.

2.2.4 MEDIEVAL TOWNS

As trade became internationalised, new towns were established. The main focus of the towns were the market space and the Church. Spatial organisations of the towns revolved around communal space or central facilities which later became the hub of human activities for socio-cultural, religious, political and commercial life. The power of the religious leader - the Pope, was absolute during this period such that the Catheral and large open space became the vintage point of the town. In towns of organic growth, the central open space are usually irregular, many sided and oval in configuration since the surrounding buildings dictate its form. In Medieval towns, communal space were later decentralised because of automobile and rapid expansion of town. The communal space was made to serve group of houses in what was later called

neighbourhood centre while the catheral and market space remain the central node of the town around which other activities revolve. The central area is connected by network of foot parths. This narrow path helps in reducing the menace of winter wind in the large open space.

2.2.5 RENAISSANCE TOWNS

Renaissance was the period of rebirth; it was a time to look at the Roman era for a model through the application of well ordered classical language in a more delicate style.

The period witnessed a new language of "openness" in the open spaces as different from Greek and Roman style. The new towns were planned for easy expansion with time in line with the achievement witnessed in the automobile industries. Communal facilities like plaza, square and catheral were at the central location of the town on which social life radiate to other parts of the town.

The architectural elements of the public buildings within the squares are of classical culture adopted creatively from Roman era. Alberti celebrated this phenomenon when he agreed that the city is not built wholly for the sake of shelter, but ought to be so contrived, that besides more civil conveniences, there may be handsome space for squares, course for charriots, garden and places to take for both amusement and recreation.

The spatial organisation of the town was juxtaposed around one or more axis, vast use of controlled vista was made possible by the selective location of imposing statues, obelisks and monumental buildings.

2.2.6 TOWNS IN BAROQUE ERA

The 17th century Baroque of France was controlled by the Monarch who was not only the state and business but the art and science were regulated through him.

While mannerism advocates order, the Baroque subordinated them to the single unified dynamic concept, both in buildings and urban landscape. This was reflected in the articulated spatial organisation of open spaces in their towns. The cities are planned around a node which serves as a focal point or central core where important monuments and communal facilities like catheral, gardens and squares are situated.

Their planning concept manipulates space for sequential expansion with passage of time or what is regarded as flexible design approach. The cities are laid on vast scale with long vistas to give an illusion of infinity and endless change to observers. The open space remains the major element of towns. Bernini, religiously implemented this principle when he was commissioned to add a plaza in front of St. Peter's Catheral to allow for continum in an unlimited scale.

2.2.7 OPEN SPACE IN AFRICAN TOWNS

Most towns and cities in Africa, south of Sahara, like those of Mesopotamia, are arranged around a closed open-space system. The centrally located space is the main communal activity area for these towns which are basically agricultural settlements. They also serve as the town centres where political and administrative matters are discussed. The Oba and Emir's Palace is the large single landmark in the space. It was the palace that usually gave rise to the large open-space.

In Hausa land during the reign of Hausa Bakwa, communal space is known as Dandali like other Nigerian towns; it is used for dancing and gathering of children to listen to stories and the night moon hide and seek games. In the village, equivalent of Dandali is called "Kofan Fada". With the advent of Jihad, the mosque and Emir's palace were introduced into the large open space. The architecture of these buildings are exquisitely compounds. The Friday Mosque and the Emir's palace are good examples that readily come to mind.

In Yoruba and Benin towns, the entire town radiates around the Oba's palace, with large open market square like the plaza called 'Oja Oba'. The Ibo settlements do not usually exhibit any particular power centre as all the compounds are built around a communal space at clan's or kinship level. The only noticeable centrally located communal space is the market square and shrines. It was the missionaries that actually introduced churches as the major rallying point.

In general, the Nigerian climate has made the people to spend most of their life in the open or outdoor space. Even domestic activities as cooking and relaxation are done in the open court-yard. For instance, the Yoruba, Hausa and Ibo etc even during the raining season and harmattan still carry out their habitual communal life in the open. This could justify their relative contented life style, while the Europeans spent time and money on "Le confort anglai". The people here are more comfortable under the tree shades or the varandahs in the compound. The domestic and craftworks are always done in the open courtyards. Space in any part of Africa is based on social space for communal and social matters. Their space concept exhibits a continum

which grows from inside to outside. The space is generally associated with human activities. The village squares are moulded and shaped by human behavioural pattern and cultural belief. The central area of the town is dominated by the communal facilities with a huge symbolic tree or trees that offer shade all over the space, where recreational activities, commercial and political matters are discussed. The African idea of "place" is a space that can generate the maximum human contacts that bring communal feelings of belonging. All roads usually terminate at this central hub of activities in the town. The setting is so beautiful that Krapt Askari (1969), wrote "what is so universally striking about the feature of urban life of African towns is its ebullience and gusto, its camaraderie, and causal ease with which social contacts are established".

The squares are ritualised to free the community from negative power of the unseen. In Ashante (Ghana), cities were segregated into parts according to profession, but the market and the Shantene's palace is the unifying factor.

One can conclude that African towns employed open-space as the traditional symbol for unity and cohension. It is the centre of human focus and consequently dramatized its daily events. Village organisations and family relationships are arranged along "physical disposition" of community and their use of space was controlled by social hierarchies.

2.3 OPEN SPACE IN MODERN TOWN CONCEPT

The traditional open space concept is so cherished that in the field of urban and regional planning, it has become the major design tool in the hand of planners for new towns

or city proposals.

The neighbourhood concept and the 'central place theory' employed open space as the structural framework to which forms and activities can relate to produce scale and character. This enhanced communal living with open vitality and diversity that gave legibility, clear meaning, and sequence experience in urban environment. Hence, Seymour (1980), concluded that "the opportunity to experience an architectural element from the vantage point of open space and vice versa is a unique visual quality. Perhap, no single element can better shape and complement urban form than well placed open space".

This was justified in the spatial layout of both the Black Arts Festival Village in Lagos and the Nigeria's new capital city, Abuja, Nigeria.

SOURCE: Adebiyi '90.

2.4 HUMAN PERCEPTION OF OPEN SPACE

Human perception of open space is abstract in nature. Man's acquirement of schemata directly mediates to him a three dimensional space. Therefore, it is the operational schemata that enhances man's space consciousness. The schemata are culturally determined and comprise of qualitative properties resulting from the need for effective orientation to the environment.

Parts of the space that receive the whole gamut of sense impression involves selected numbers of stimuli needed for conscious attention. Man also requires special ability of psychological dimension to enable him distinguish between immediate perceptual space and the relative more stable space schemata. Space schemata contain human invariance such as

universal elementary structures, however, human orientation and idosycrasis comes in to enable him conjure the image of space experience with three dimensional relation between meaningful objects.

Amos Rapport (1961), divided space into human (behavioural) and non-human (physical). The physical or geographical space is the external environment which can be limitless or limited with human action. While behavioural environment is governed by "congntive process" which enable him to interprete or give meaning to the perceived environment with cultural environment acting as (positive or negative) catalyst to the overall response. For instance, those that live in the desert are used to the unbroken vista of the open space which no longer create emotional fear of loneliness in them. This implies that knowledge about organisation of space of a particular response of such setting.

Zanzan (1985), grouped perception and human response to a particular setting according to the dominant 'sensory receptors' that was involved in the transmission of the response; these are what he classified as : Visual, Auditory, Olifactory, Tactile and Kinesthetic; each of these, he argued, has its own related space.

Visual Space: Is a function of privacy in the organisation of space, for example, the enclosed courtyards and barriers in the Hausa's compound are meant to discourage unwanted visual contact within the inner courts, while the "impluvium" of the close knit Yoruba, Benin and Ibo traditional home concept are the level of visual tolerance of the people.

Olifactory Space: In east and south Africa, people have a keen sense of detecting smell. The Tindigo people of Tanzania, pygmy of Zaire Basin and the Bushmen of Kalahari desert use their sharp olifactory instinct to locate "game".

Tactile Space: Africa achieved this through the extended family system which enables kins to have psychological tactile contact.

Kinesthetic Space: It is the awareness of body's orientation and displacement. This is experienced by those living in an uneven terrain and rocky lands like the Angas people of Jos plateau while those in the forest region made their roads winding and narrow along the thorn forest and trees, it is a defending strategy dictated by their physical setting, such that one has to be conscious to move successful within such environment in order not to do physical harm to one's body.

The overall impression of space is also influenced by the space character itself; whether it is static, in which it is defined principally by solid vertical planes as the main domain in this case visual flow is destroyed in or out of the enclosure. Whereas, a dynamic space draws people to itself and generate an uninterrupted visual flow. Other characteristics of space are repetition caused by recurring urban elements, and complex space originated from spatial arrangement. Each of these elements affects human perception and response in their own ways.

2.5 ARCHITECTURE AND SPACE PHENOMENON

The space is the basic tool readily available to be manipulated in the field of environmental design, and because of its enormous scale, numerous human needs and the need to control harsh climatic environment, man evolved the principle of creating shelter as early as the stone age era. The architect apart from creating shelter against climatic elements also bring down the scale of the space to an appreciable human scale so as to improve on the quality of the perceived environmental context.

In modern times, space is developed for shelter, park, recreational purposes, conservation of land and natural resources as well as for historic and scenic purposes.

The sociology of space involves what and how people experience space and to what extent this affect their feelings and personality. The affectual scale of an enclosure is dictated by space defining elements like walls, ceiling and floor. If a space is enclosed with no light from outside, the observer experiencing the space have the feeling that the space is static and that it is actually smaller than its geometric dimension. An enclosure with opening or void to allow in sunlight enlivens the colour and texture of the space, it dramatized the space and brings out its three dimensional configuration to a richly appreciable level. Hence, an enclosed solid space can create a claustrophobic tendency, while an over illuminated space can create a dynamic feeling and if the space is large enough can result in Agora-phobic. The resultant effect of Agora-phobic can be intimidating and dehumanizing. Human response according to Peter Smith (1972) is the resultant of complex

interraction of mental tendencies, and outcome of what he called "cortical referendum".

As a result, the architect must be adequately equipped to be able to create a balance or equilibrium between the space, needs, and human cognitive system. Built environment should be handled in a skillful way to enhance positive human response. It can be therapetic if diverse elements of high easthetic values are incorporated with feelings for human scale and proportion. The architect has to contrast visual amplitude as an entedote to "insipient mental homeostasis".

Finally, architecture could become a means of mental therapy if it arouses novelty in variability of urban environment. This would enable communal space to mode human response to nature and man-made environment and at the sametime creating Greek Agora for discussion of common conditions. This can result in lasting impressions among participating individuals or groups to the level of encouraging further contact.

2.6 INFERENCE FROM HISTORICAL DEVELOPMENT

A better understanding of some preconditions of environmental design does not guarantee a more successful design synthesis per say, it only facilitates a designer's attempt to synthesize. The goodness of an open space is a measure of how it has been able to successfully support human social existence and moreso what ype of memory it has created on the human's mind; and to what extent it has been able to orientate man to relate efficiently to other larger environment. Social scientists have been able to corroborate the physical

environment to behavioural pattern in the open space. This is to say that the architecture of the environment impinges on behaviour. To be able to achieve social interraction in a communal space it then means that the facilities should be diverse enough to cater for young and old, male and female. Lack of well organised and articulated open space to recreate and relax the mind in the cities contribute a great deal to juvenile deliquency among the youths. The urban monotony is so unfriendly to the youthful mind, and in an attempt to compensate for what urban environment was lacking, the youths are driven to all sorts of social vices.

The open space must provide contextual benefit for creative play and learning for all age groups. It should be adventurous in philosophy. Children in an urban environment benefit by the qualities of adventurous, creative and co-operative actities, contact with peers, nature and animal life. These are fundamentals of living, that urbanization has destroyed. Since the youth learn about themselves and the world they live in through play and games, it should be systematically employed to solve problems confronting young ones through creative approach. This creative approach equip the mental and emotional character of the youth and stimulate a self-actualisation. Meanwhile, it relaxes the mood of the working class by diverting the mind away from streneous working hours in their various working places and the individualised city environment. The spatial organisation and architecture of a communal space should be geared toward arousing the mind. The more the mind is aroused to process "novelty and variability", the greater its future capacity

to assimilate the unfamiliar. A restricted mind in a monotonous environment will prevent the mind from interpreting the unfamiliar.

The environment could be aroused with the following:

1. If the space stimuli are strengthened like the primitive rules such as size of an object is assumed to determine its importance, hence the palace and shrines are made structurally big. It is important to note that monumentality enhance focal edifices and serves as fertility symbols of group aspiration to secure optimal condition of life.

2. Contrast in environmental classification and context. A structure could command attention because of its stylistic sense. In this situation, it is not the size but novelty that makes the building to command focal awareness.

3. Form may qualify for conscious attention if it is symbolic.

4. Sheer complexity and density of interest could promote emotional feeling. The Baroque Church in rome attracts attention because of its sudden exuberance in the context of restrained element.

Apart from arousing the feeling of the observer, a good urban space should be able to adequately incorporate and manipulate all the elements that enhance quality of space.

The total composition of the design should have character, coherent and provides for scale continuity. Scale and proportions could result in psychological illusion if not well articulated between the human and the building elements. Wrights idea of free flow of space between spatial domain is important, if defined by levels, colour and mode of treatment.

The time element should not be trivialised; it is the measure of emotional hue, variation, tone and colour.

Attention of an architect to enhance quality of space should not be restricted to basic space defining elements such as walls, terrace, steps and levels alone, natural elements like trees, shrubs, grasses and water bodies create a welcoming spectacular in human's mind. Water with its pure, gentle quality has uncountable manifestation to transform space and its ability to diffuse and reflect light is of great inspiring phenomena. It could help in creating legible visual and balanced "accoustic traffic" between sense and modality. If structures, shapes and form, and differentiate light and shadow into rhythmic, melodic and harmonious patterns.

Ability to articulate these elements in equilibrium with urban space will not only enhance interraction, but will also enable the people to be able to identify and feel or be proud of their space.

2.7 THEORIES OF HUMAN CENTRES

Synthesis of the architects, planners and sociologists views resulted in the following inter-relationships:-

Hierarchial system of human centre that is, a central square

and several secondary squares as depicted by the theoritical or actual conditions.

Uni-dimensional limitation of successful centre as 0.36 hectare to 2.1 hectares. The dimension of centre are derived from the maximum which people can hear or see events taking place in the centre, not more than 100 yards in length or width.

Common Uni-dimensional range for a successful plaza was 60 - 145m, which is equal to a minimum centre size of 0.36 hectare and a maximum of 2.1 hectare. However, the lower distance limitation is non-restrictive because as the uni-dimension decreases below the defined lower limit, the centre becomes more intimate.

Central business district has pre-ponderant effect on centres.

2.8 CENTRE CHARACTERISTICS

For a centre to dunction as human centre, it must have qualitative characteristics that generate a community "sense of identity".

Continuity "a sense of order": expressed by spatial organisation and visual reference.

Intimacy "a sense of place": described through environment, traffic and enclosure.

Vitality "a sense of life" : expressed through two factors, commercial services and population density.

Diversity "a sense of variety" : expressed through community services and transporation.

2.9 ENVIRONMENTAL PROBLEMS PECULIAR TO COMMUNAL CENTRE OR SPACE

The followings are the summary of major problems confronting communal space especially in developing countries like Nigeria:-

1. After the official handing over of such projects, the authorities always play "lip services" to its maintenance, thereby reducing the efficiency of the centre. In some cases, confusion arises between the government and community as to who should be responsible for its maintenance, or running of the complex.

2. Location of such spaces sometimes are not centralised enough for people to come from all parts of the community.

3. Supportive facilities (Kiosks, bars, car park, water and toilet etc) are generally lacking. This makes its not attractive to many people.

4. Poor easthetic value and lack of relevance to the socio-cultural setting of the people.

5. Facilities are not diverse enough for all age group to patronise.

6. The money made available for such project is always inadequate for a gradiose scale.

7. The community are not involved in the design and decision making concerning such centres.

SUMMARY AND CONCLUSION

A communal space should be made to enhance social interraction if it encourages the participating citizen to cultivate a balance way of life which include enjoyment, self fulfilment, political activities and religious observance within its contextual setting and through facilities and planning. For a communal space to be regarded as successful, it should provide opportunity within its spatial arrangement for people to glance at passer-by while sitting or strolling.

Arrangement and planning should allow for people to move freely in a manner that pleases them. Efforts must be geared towards making the place legible, contineous and territorial charity of functions for publicness and social interractions. It is important to know that elements like step-platform attract young people because it supports variety of sitting styles but benches attract adults. Placement of catchment point or stopping points, along pedestrian paths support the users' desires to "watch the action". The space must be spatially flexible and adaptability of supportive structure should be in line with users' orientation.

The community should be involved at the planning stage to enable them identify what are their social and recreational needs. This will eliminate the failure of past communal facilities that have little relevance to the people they are meant to serve. The environment should be made dynamic to eliminate dehumanizing effort through application of moveables and soft parts.

CHAPTER THREE

DESIGN PARAMETERS AND ANALYSIS

3.0 INTRODUCTION

It is natural that the body and the mind need to be brought back to their original state, after the physical and mental activities. This to and fro movement is often or can be impeded by unfavourable climatic conditions, thereby tasking the designer to create the best possible indoor climate in the face of extreme outdoor conditions.

The occupants of a building will judge the quality of the design from both their physical and emotional point of view. Accumulated sensations of well being or discomfort will contribute to a total verdict of the building in which occupants work or live in. Criteria for total comfort are dependent upon each of the human senses.

3.1 BIOCLIMATIC APPROACH TO ARCHITECTURE

Man is always striving for a point at which minimum expenditure of energy is needed to adjust to his environment, therefore the design to achieve a high level of thermal comfort (enhanced by the choice of appropriate building materials) becomes imperative.

3.1.1 BODY HEAT EXCHANGE (Comfort-level)

The exothermic reaction in the human body produces heat. But only 20.0 per cent of this heat is used by the body. 50.0 per cent is released, as 'surplus' into the environment. As a result of human activities, sweat is produced,

evaporation of this sweat from the body through air movement results in cooling and comfort because the evaporating sweat takes its latent heat of vaporization from the heat produced by the body.

The table below shows typical excess heat output from various activities of an average human being.

ACTIVITY	EXCESS HEAT OUTPUT
Sleeping, moderate movements, standing, light work on machine or bench.	70 - 90 watts
Sitting, heavy arm and leg movements, standing, walking living or pushing.	90 - 410 watts
Intermittent heavy work, digging hardest-sustained work maximum heavy work for 30 minutes duration.	410 - 1,100 watts

4.1.2 HEAT RADIATION EFFECT ON BUILDING

Part of the incoming solar radiation from the space is reflected, some absorbed, while some are scattered by the atmospheric elements. Part of the radiation received at the ground level is reflected, while those absorbed changes to heat, which varies the temperature of the air, ground

and the surrounding objects like buildings.

Therefore, designing to check those negative effects of this radiation becomes of paramount importance, to guarrantee human comfort.

4.1.3 PEDESTRIAN COMFORT

*Shaded pedestrain areas, modify intense heat. On north-*south avenues maximum solar radiation is from the west. Buildings can be used to shade the west side while the east side can be protected by vegetation, arcades or mass transit guideway.

Humid breeze: This is important for cooling effect and air cleaning. It can be captured by properly locating vegetation and positioning and sizing of buildings. Wide pathways on the streets serve as breeze corridors with the street actually increasing wind velocity.

Surfaces: Extensive paved surfaces should be avoided near pedestrian areas. The pavement reflects heat, grass absorbes. In very high use areas, elevated planting areas channel pedestrian movement while reducing maintenance cost.

Pedestrian security: During the evening hours, it is important for stimulating activities. Visual contact from the street to the pedways and elevated plazas, and from buildings to the street and side walks, is therefore *important.*

4.2 DESIGN PARAMETERS FOR THREATRES

The development from Ēpidauro's to the modern playhouse has been a slow process, gradual and evolutionary. The function

determining theatre design, however, remains, essentially the same. although, artistic, philosophical and social conditions, as well as technical developments, have affected theatre design, the major changes in the form of theatre building have been due to purely physical factors.

4.2.1 THEATRE IN NIGERIA

The vigour of African theatre is not confined with, in a building, but is free and flexible and is more 'functional' in the sense that it serves a purpose within communities and cultures that is much greater than simply that of entertainment or diversion. In African theatre is being used as a means of education, celebration, protest and discovery.

Ossie Enekwe explained that "a ritual becomes an entertainment once it is outside its original context when the belief that sustains it has lost its potency.

SOURCE: Gupta, M. Thesis 1988.

TYPES OF NIGERIAN THEATRICAL PERFORMANCE

1. Rituals : Dance, drama performed during sacred religious and cult observances.

2. Ceremonials: Traditional dances are performed during occasions like marriage, chieftancy, birthday, naming ceremony.

3. Masquerade: In this performance, the artist is in form of masquerade with a mask to perform and grace the occasion.

4. War: These performances take place before or after a war battle signifying victory. Mock combats or pantomine rituals are staged to depict their enemies in a caricature form.

5. Acrobatics: Body agility is displayed through gymnastic or dance performance.

6. Vocational: Traditional performance having its background from certain profession, done by immitation and mockry.

7. Social entertainment: Traditional dances for pleasure, revealing joy, good news, etc. Musical bands are invited to grace the occasion by praising the guest and the audience.

8. Maiden Dances: Traditional dances performed by young girls at a premarital stage as an expression of beauty and innocence.

9. Puppet theatre: Traditional show using puppets, dramatising folktals of a particular society.

4.2.2 EFFECT OF SITE/SLOPE

Apart from the artistic, philosophical, technical development, social and physical factors, natural factors like natural site condition affect the design of theatres greatly.

The site structure affects both the form, the orientation, interior design like the raking etc. A good natural stepped or sloppy site could easy the construction of raking. The site condition generally is among the factors that determine (reduce or increase) the cost of a particular project.

4.2.3 STAGE TYPES

A functional theatre must accommodate a performance and bring audience and actor together in the most effective relationship.

1. Proscenium stage: The performing area is at one end of the auditorium with the audience looking in one direction towards the performance.

   Pronounciations: It affects the best arrangement for presenting maximally perceptible presentation. It has the ability to continue elaborate scenic effects and transformations, the mechanics of which can be concealed from the audience.

   Denounciations: Since the audience can take the performing area from one side only, it is difficult to seat a large audience close to the proscenium opening (for more than 650 audience a balcony becomes necessary). It separates the actors from the audience.

2. Thrust Proscenium stage: In addition to a stage house and acting area of nominal size, it has a thrust stage in front of the proscenium which projects into the

audience at a wide fan of about 90°.

Pronounciations: It can give an open stage effect by bringing the acting area into the same space as the audience.

Denounciations: It is difficult to achieve satisfactory sight-lines for both the thrust (apron) and the area behind the proscenium arch, especially for balconies. Any scenery used in front of the safety curtain may have to be *in combustible*.

3. Open (thrust) stage: The main performing area projects into *the audience and is surrounded by it on several sides.* While performers and audience are contained within the same space, some acting can also take place behind openings of the backstage.

Pronounciations: It places more audience closer to the performer, contributiong to good seeing. End of play is not marked by sharp drawing of curtain thereby diminishing *the illusionistic style of stage design.*

Denounciations: Difficulties of entrances and exits of *actors. Difficulties pertaining to the scenic investiture.*

4. Theatre-in-the round (arena stage): Has a stage in the centre of the house and is surrounded by ring of audience.

Pronounciations: Economy of space, it sits the maximum audience within the shortest distance from the acting area.

4.2.4 FLOOR SHAPES AND THEIR ACCOUSTIC EFFECTS

It is fundamental to enhance choice of floor for good theatre design, with particular interest in accoustics.

1. Rectangular shapes: For larger halls the auditorium is likely to be too wide for the stage itself.

   Accoustics: It produces cross reflections which between parallel surfaces causes flutter echoes.

2. Horse-shoe shaped: This is the traditional shape for opera houses.

   Accoustics: (1) The concave halls must be sound absorbent materials or by covering them with tiers of galleries. (2) The concave surface causes sound concentrations or echoes.

3. Fan-shaped: This has the advantage of containing the maximum number of people in a given angle for a specified maximum source-receiver distance. This characteristic is attractive for economic reasons as well as enabling the hall to fulfil multipurpose requirements.

   Accoustics: The curved rear wall and the curved balcony front unless treated accoustically or rendered diffusive, are likely to create echoes or sound concentrations.

4. Elongated hexagonal shape: This is a compromise concert hall form, which if properly designed may overcome the accoustical limitations of the fan shaped.

5. Irregular floor shape: (1) Can bring the audience usually close to the sound source. (2) Can secure accoustic intimacy and definition since surface used to produce short-delayed reflections can be easily integrated into the overall architectural design. (3) The irregular layout gives an opportunity for the random distribution of absorbent elements and diffusive surface irregularities.

4.2.5 THEATRE ACCOUSTIC REQUIREMENTS

Theatre accoustic requirements are as follows:

1. Adequate loudness in every part of the auditorium.
2. Uniformly distributed (diffused) sound energy in the room.
3. Optimum reverberation characteristics.
4. Free of such accoustical defects as echoes, long-delayed reflection, flutter echoes, sound concentrations and sound shadows.
5. Noise and vibrations which would interfere with listening or performing should be reasonably reduced.

MAIN APPROACHES TO ACCOUSTICAL DESIGN

1. Natural/architectural factors: Dependent upon volume, shape and surfaces (reflecting, absorbing, diffusing, etc) and the mechanical changes of surface.

2. Artificial Factors: Technologically dependent, for example, microphones, amplifiers, electrical artifices like delay, artificial reverberation, loud speakers and so on.

REMEDY FOR ACCOUSTICAL DEFECTS

1. Adequate loudness: (1) The auditorium should be shaped so that the audience is as close to the sound source as possible. (2) The sound source should be raised as much as feasible to secure a free flow of direct sound waves to every listener. (3) The auditorium floor should be properly raked as sound is readily absorbed when it travels over the audience at grazing incidence. The gradient of sloped auditorium floors without stairs should not be more than 6° - 10°. In case a balcony is provided, the rake should not exceed 35°. (4) The sound source should be closely and abundantly surrounded with large sound reflective surfaces. (5) The floor area and volume of the auditorium should be kept at reasonable minimum (for drama 7 - 14m^2/audience seat, for concert 20 - 35m^2/audience seat) thereby shortening the distance that direct and reflected sound must travel.

2. Sound diffusion: The surface irregularities like exposed structural elements, coffered ceilings, serrated enclosure, sculptured surface decorations etc. must be abundantly applied and reasonably large.

3. Reverberation control: Sound absorbing material should be installed along those boundary surfaces of the

auditorium which are likely to produce such accoustical defects as echoes, flutter echoes, long delayed reflections and sound concentration on the rear wall opposite the sound source, those portions of the side walls which are farthest from the source or along the perimeter of the ceiling.

In multipurpose theatre, reverberation time varies with particular production. Optimum is 1.5 to 2.0 seconds for music and 1.0 second for speech. Reverberation time can be calculated, using Sabin formula:

$$RT = \frac{0.16V}{A + XV}$$

Where RT = Reverberation time.

V = Volume of room in M^3.

A = Total room absorption in M^2.

X = Air absorption coefficient.

Adjustability: (1) Decreasing with baffles to achieve a smaller chamber volume or by adjusting the ceiling to reduce the volume of the auditorium. (2) Covering panels and other hard surfaces with soft material of high absorptive value. (3) Designing the theatre with short RT required for drama. That of music can be achieved by use of artificial electronic extension.

4. ELIMINATION OF ROOM ACCOUSTIC DEFECTS

Echo occurs if a maximum interval of 1/25 second (for speech) to 1/10 second (for music) elapse between the perception of the direct and reflected sound originating

from the same source since the speed of sound is approximately 344 m/s. The critical path difference of minimum 14m for speech and 34m for music between direct and reflected sound. Unless accoustically treated, a concave surface and sound reflective rear wall is a potential echo producing surface.

Delayed reflection is identified in character to echo except that the delay between the perception of direct and reflected sounds is to an extent less.

Flutter echo consists of a rapid succession of noticeable small echoes and is observed when a short burst of sound such as clap or shot is produced between parallel sound reflective surfaces.

Sound concentration is caused by sound reflections from concave surfaces.

Sound shadow is noticeable under a balcony which protrudes too far into the air space of an auditorium. It creates poor audibility of the remote seats underneath of the listening area.

Vibration and noise control: The use of protective buffer zone such as rooms, lobbies, circulation areas, restaurants, bars, etc. permit the use of less insulation against exterior noise. The buffer zones should have absorbing ceilings and carpeted floors and shut off from the main theatre by doors. The ventilating and airconditioning system should be so designed that the noise level created by the system is 5 to 15 dB

below the permissible background noise level.

4.2.6 OPEN AIR THEATRE ACCOUSTICS

Factors responsible for poor audibility outdoors are:

1. The drop of sound energy when sound waves travel in the open air. This is related to the inverse square law.

2. The audience absorption of some considerable sound.

3. It is also due to inferring noises emanating from the surrounding.

REMEDY

1. Seats should be within considerable minimum distance.

2. Elevate the platform, seating area steeply banked, with increased rake towards the rear to provide the maximum amount of direct sound to the audience.

3. Accommodate the maximum amount of reflective surfaces close to the sound source. Nearly reflective sources of existing buildings should be carefully checked for echoes or harmful effects.

4. Absorption and diffusion of the incident sound waves likely due from rear reflection converging upon platform from concentric benches particularly noticeable with totally or partially unoccupied seats should be eliminated.

4.2.7 SEATING AND AISLE ARRANGEMENT

For the purpose of seeing, radial aisles are the best with curved aisles only slightly less efficient, in continental aisles, none of the best viewing positions is lost to gangways and from actor's point of view, the audience is undivided. As the space between the row has to be wider, the audience has the bonus of better knee room but it could be distracting when an audience is passing between rows and during fire hazards, the whole audience will find it difficult to get out in time.

4.2.8 LIGHTING

There is the need for visual harmony and the ability of the audience to be satisfied with performers' expression with little obscurity. A large part of the lighting from the direction of the audience should be such that it strikes the performer's face at 45 degrees above the horizontal. If the angle is steeper, dark unflattering shadows under the brows result and if at a shallower angle, there is the danger of unwanted shadows on the set or on the other performers.

Lighting Position

1. Ceiling slots: Are spots lights at acting area and are essential for proper lighting of performers in frontal acting areas. Slots should extend from wall to wall with adequate space for positioning and rotating instruments in plan and section, for maximum aiming.

SHUM ID... ...BRARY

Slot should space not more than 4.5m apart, measuring from stage outwards.

2. Side walls slots: Are also used as acting area spot lights, essentially for the front corners of the stage and that of forestage areas. Useful for low angled wide lighting slots should extend down from the ceiling to a level approximately 3 meters above stage level.

3. Balcony fascia: Is an alternative to where ceiling and side walls are absent. The spot light is slotted in front of balcony.

SUMMARY AND CONCLUSION

To achieve a comfort condition within a building, there should be a measure to enhance evaporation of heat from the building to check those negative effects of heat radiation, to have a proper orientation of building and there should be as much as feasible, attempts to allow the humid breeze into the building for its air-cleaning and cooling effect.

Extensive paved surfaces should be avoided within the premises near pedestrian areas because of its heat reflective quality.

In theatre design, all the factors both social, physical, artistic etc. that affect the design of theatres have to be critically analysed, as it serves a multipurpose function. The theatre accoustic requirements are of paramount criteria. It is important to have a good choice of floor for good theatre design with particular interest in accoustics. To avoid accoustical defects like flutter echoes, cross reflection of sound etc., a good choice of floor shape is necessary. Irregular floor shape can bring audience usually

close to the sound source, secure accoustic intimacy and definition since surface used to produce short delayed reflections can easily be integrated into the overall architectural design. The irregular layout gives an opportunity for the random distribution of absorbent elements and diffused surface irregularities.

A functional theatre must accommodate a performance and bring the audience and the actor together in the most effective relationship.

CHAPTER FOUR

CASE STUDIES

4.0 INTRODUCTION

The objective of a case study is to critically study existing related projects with a view to identifying the positive and negative aspects of such projects. It is agreed that architecture can only be tested as being successful if it stands the test of passage of time. Hence it is only with time that we can conveniently adjudge a design to be successful if it performs the functions it was meant to perform, or a failure if instead of solving the problems it in the process creates more problems for the users.

The informations obtained from the study will guide the designer of new and similar projects. The positive aspect shall be incorporated in the new proposal while attempts will be made to solve the problems of negative aspects. It is only through this that an architect can better enhance the quality and efficiency of building in the society.

For a good analysis, four case studies will be conducted. Two will be from Nigeria (Lagos metropolis) while the two others would be foreign.

4.1 YABA COMMUNITY CENTRE

Yaba Community Centre was designed by architect (Prof) O. Adeolu for the Saint Dominic Catholic Church, Yaba, Lagos.

The ₦300,000.00 project was jointly financed by the German and the Nigerian community.

The centre is located within the Saint Dominic Church and Saint Patrick's Primary School premises along Herbert Macaulay Way in Yaba, Lagos.

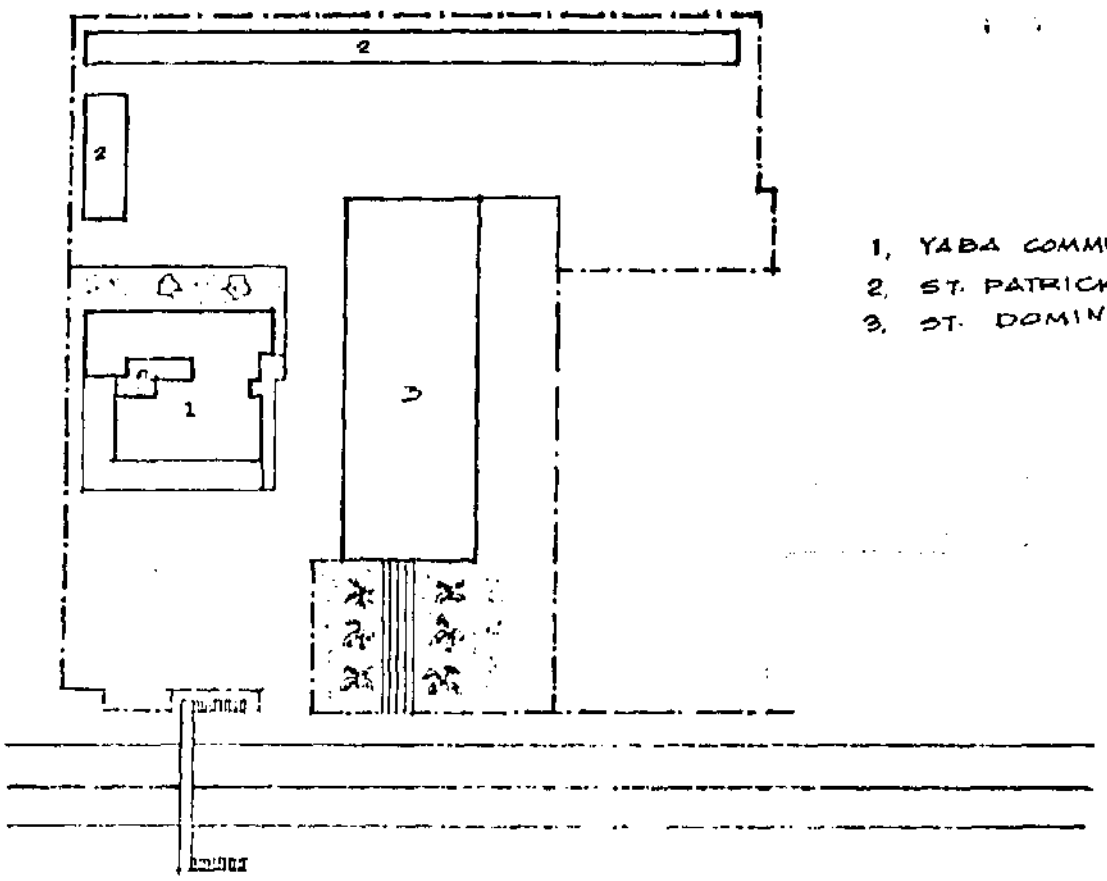
The centre consists of a medical clinic, catering section, library for 300 volume and 65 seats for readers, career counselling, multipurpose hall for 3,000 people and an administrative unit.

DESIGN CONCEPT

The building is a combination of a two storey buildings and a one-stoery building linked together with a central courtyard. Two entrances lead into the centre - one into the main lobby and the other to the clinic area. The front facade emphasise horizontality with a band of concrete beam and parapet defining the continuous louvres glass window of the multipurpose hall on the upper floor. The overall composition is simple and attractive.

CONSTRUCTION MATERIALS

The two storey part of the centre is a concrete frame structure. This is filled with non-load bearing sandcrete block walls. The one-storey area is made of load bearing sandcrete walls. The two storey part has a flat concrete roof and the bungalow is timber trusses and asbestos roof coverings.



1, YABA COMMUNITY CETRE
2, ST. PATRICK'S PRY. SCHOOL
3, ST. DOMINIC CHURCH

Fig. 6 SITE PLAN

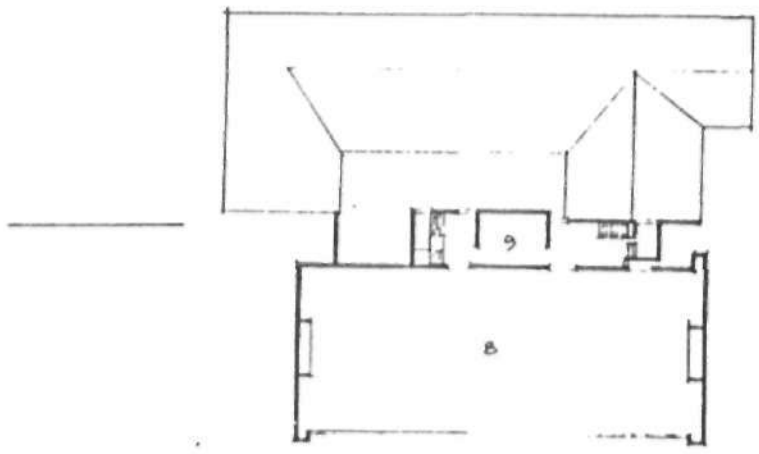


Fig. 7A FIRST FLOOR PLAN

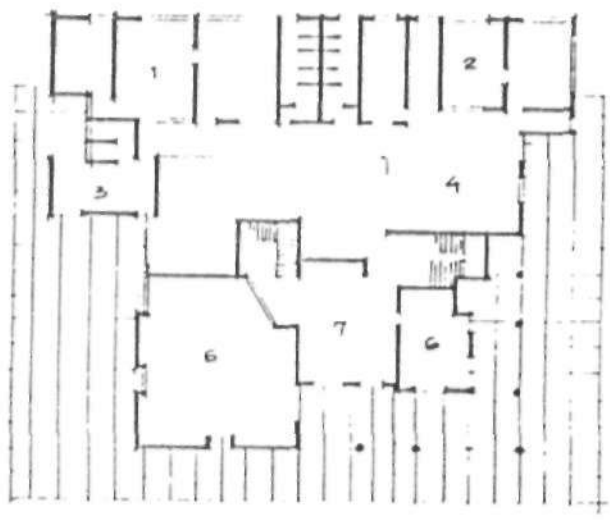


Fig. 7B GROUND FLOOR PLAN

KEY

1. CATERING DEPT.
2. MEDICAL CLINIC
3. OFFICE
4. WAITING ROOM
5. LIBRARY COUNSEL RM.
6. CAREER
7. LOBBY
8. MULTI-PURPOSE HALL
9. STORE

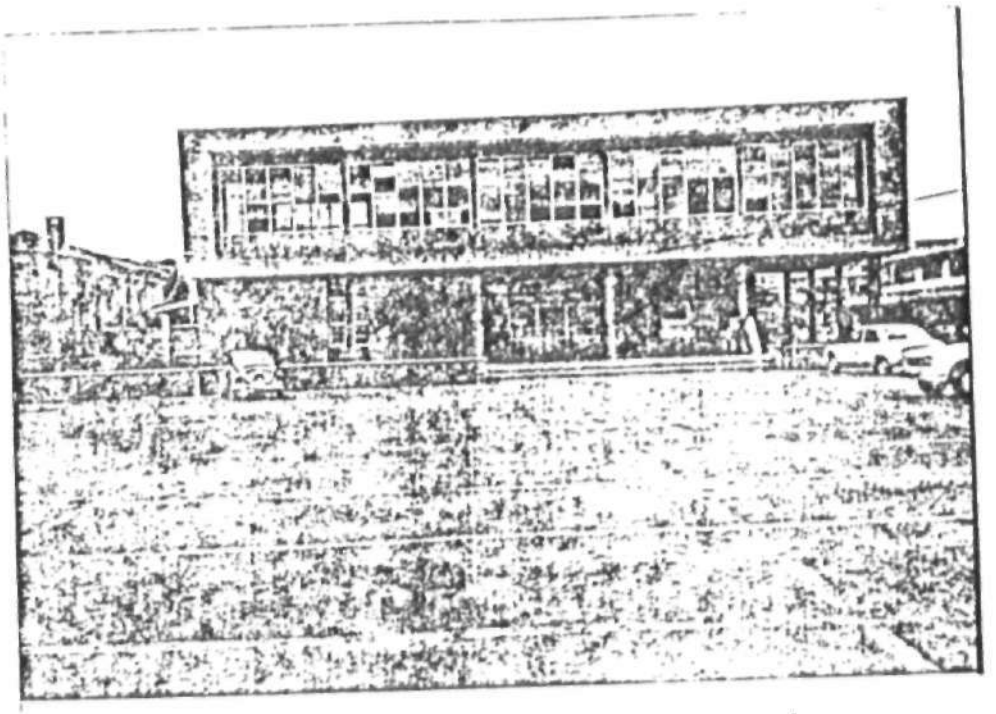


PLATE 1A APPROAC FACADE



PLATE 1B PANORAMIC VIEW OF CENTRE FROM THE PRIMARY SCHOOL.

APPRAISAL

Merits

The merits are as follows:

1. The diversity of facilities in the centre encourage an optimum usage.

2. The location of the hall on the upper floor eliminates the need for interior support that can reduce the maximum utilization of circulation area.

3. The design and choice of materials is cost effective.

4. All facilities in the Centre can be used simultaneously.

5. Circulation and security of the Centre are efficient.

Demerits

The demerits are as follows:

1. The parking spaces are not adequate.

2. No provision for recreational facilities.

3. The site will not allow for future expansion.

4. It is difficult for disables to make use of the multipurpose hall on the upper floor.

4.2 ISOLO COMMUNITY CENTRE

Isolo Community Centre was financed by the Rotary Club of Ikeja, and donated to the people of Isolo in 1977. the one-storey building occupied a land area of about 3.78 hectare of land located along Lagos State Property Development Corporation (LSDPC) housing estate, off Isolo Road and a few metres away from S. O. S. Children Village and Lagos State Polytechnic.

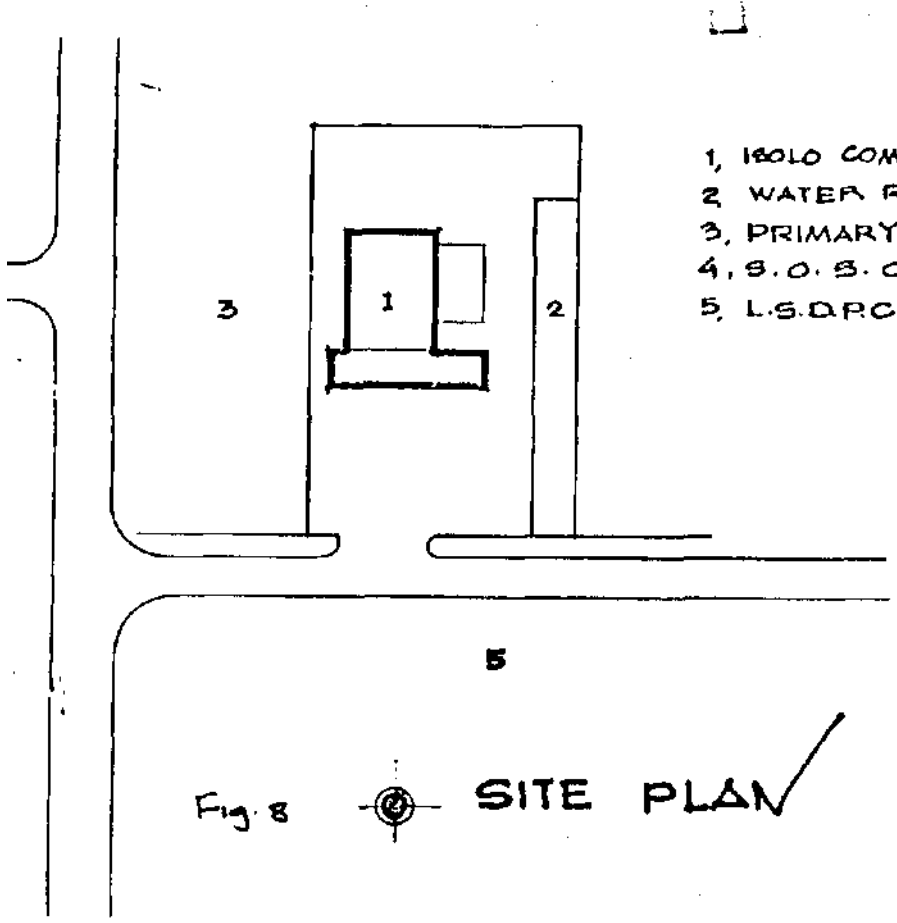
The facilities in the Centre include: Library, clinic, multipurpose hall of about 400 seating capacity, male and female dressing room, stage, kitchen, stores and toilets. The Rotary Club of Isolo later made an additional provisions for children recreational garden, table tennis and boxing ring. There is a future proposal for an additional swimming pool to the Centre.

DESIGN CONCEPT

The Isolo Community Centre is a bungalow structure with an adjoining open-paved courtyard. The major circulation area is the large entrance porch from which major facilities in the Centre can be approached.

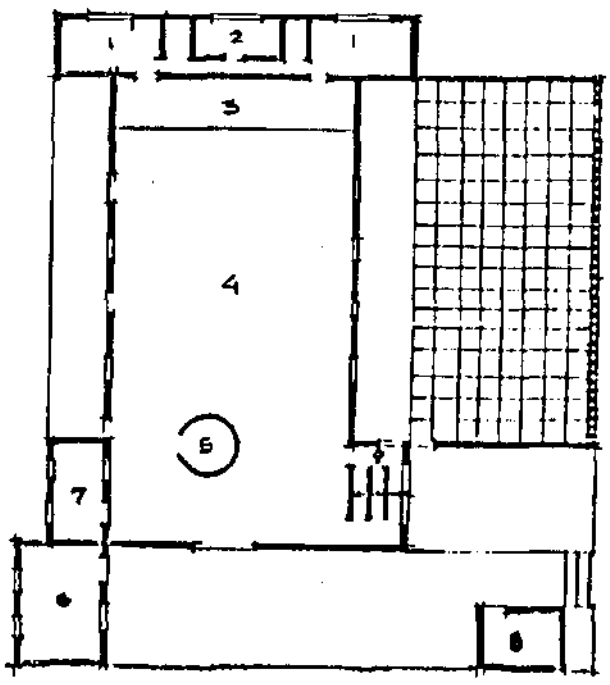
CONSTRUCTION MATERIALS

Economically and locally available materials were employed in the construction of the Centre. The wall is load bearing sandcrete hollow blockwork, roofed with timber truss and asbestos roofing sheets.



1, ISOLO COMMUNITY CENTRE
2, WATER RESERVOIR
3, PRIMARY SCHOOL
4, S.O.S. CHILDREN VILLAGE
5, L.S.D.P.C HOUSING ESTATE

Fig. 8 SITE PLAN



1, DRESSING ROOM
2, STORE
3, STAGE
4, MULTI-PURPOSE HALL
5, PROJECTION ROOM
6, LIBRARY
7, CLINIC
8, KITCHEN
9, TOILETS

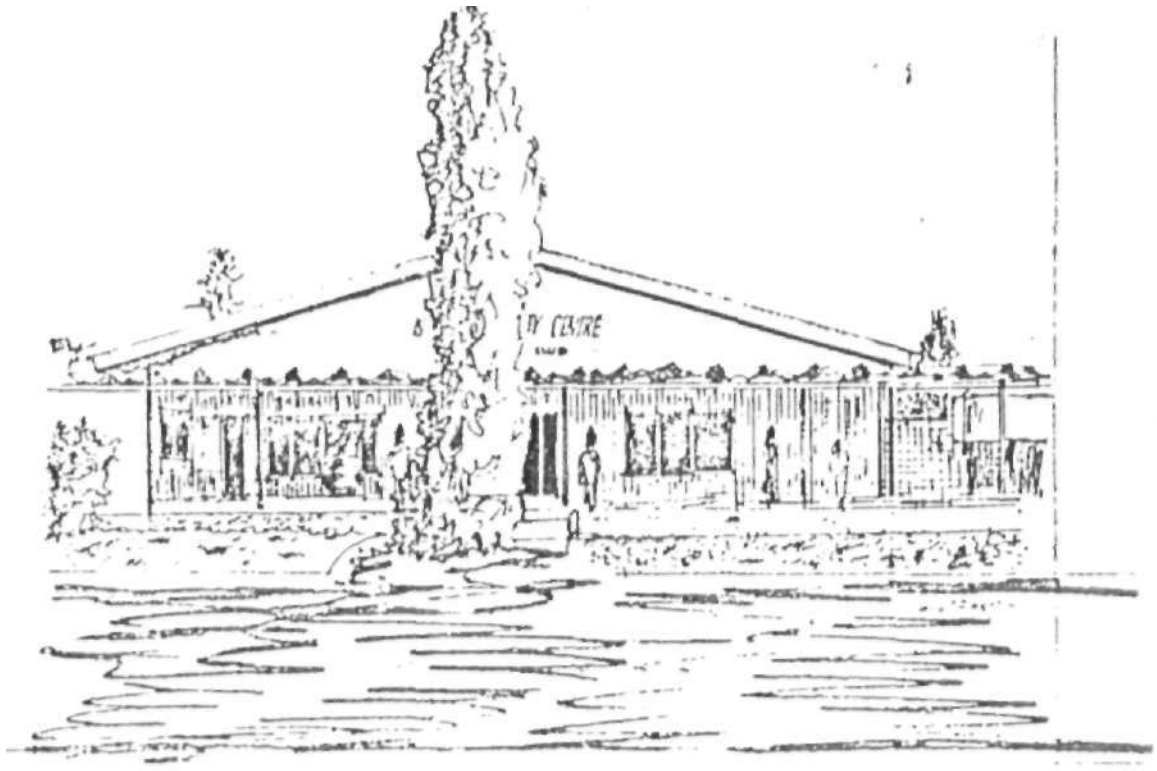


Fig 9A APPROACH VIEW WITH THE TALL ELEGANT SHRUB STANDING LIKE THE EGYPTIAN OBELISK OR THE 'EYO' MASQURADE

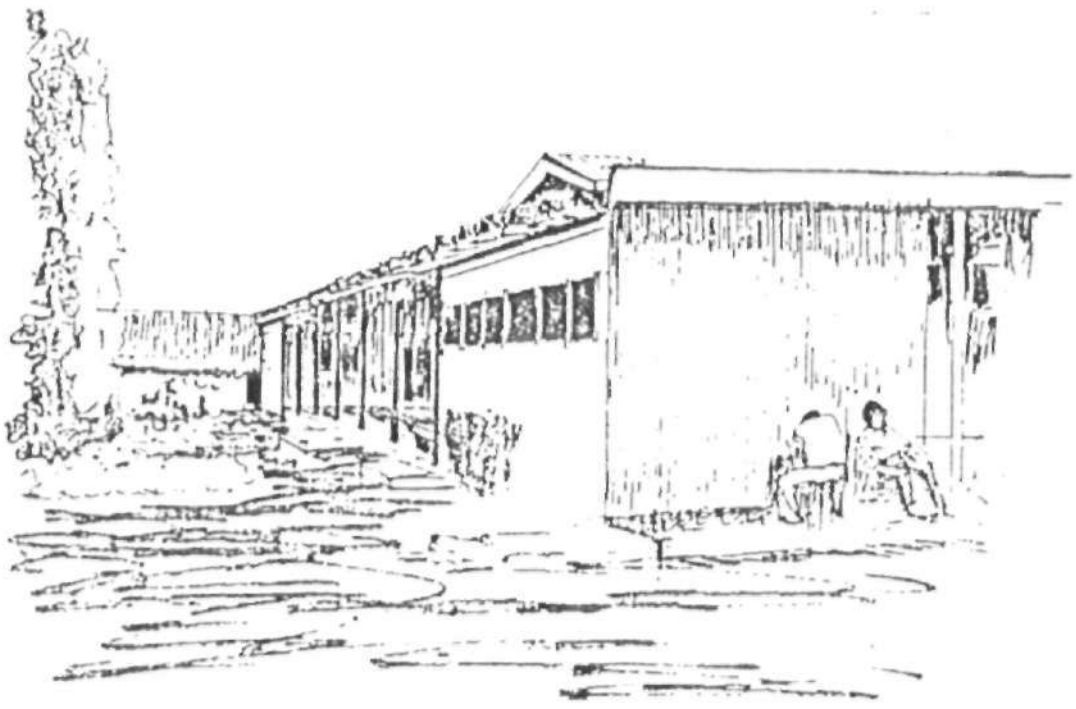


Fig 9B SIDE VIEW WITH THE PRIMARY SCHOOL AT THE BACKGROUND.

APPRAISAL

Merits

The merits of the Centre are as follows:

1. There is adequate cross natural ventillation in the multipurpose hall.

2. An articulated circulation point was achieved with the entrance porch.

3. There is sufficient open space in the front of the hall for the other outdoor activities.

4. The location of the Centre is accessible to all members of the community.

Demerits

The demerits are as follows:

1. The architecture is not impressive enough for the social taste of the community members.

2. Location of the projection room is obstructing efficient circulation in the hall.

3. The toilets and the kitchen were badly located.

4. The spatial arrangement does not consider expansion in the multipurpose hall.

5. The security at the Centre is not adequate.

4.3 PUBLIC SAFETY BUILDING, MAINE, U.S.A.
(Coomunity Centre, Maine, Portland, U.S.A.)

The centre was designed by Johnson, Hotvedt, Dinsco, Steve Albert Associate for the city council of Portland.

The centre is occupying a 600 metre sequare of land and was designed to cater for the Fire Service, Police Headquarters, and community facilities like the public plaza, gymnasium, auditorium, classrooms, cafeteria, etc.

DESIGN CONCEPT

The five storey building is approached through an elevated plaza with garage underneath to serve as parking for police vehicles. The main lobby is used as an exhibition of arts and craft works.

The building though have an administrative office appearance, has a welcoming approach facade.

CONSTRUCTION MATERIALS

A modular design approach was adopted in locating the main structural members which is basically reinforced concrete framed structure filled with non-load bearing partition. Glass windows are used to soften the solid form.

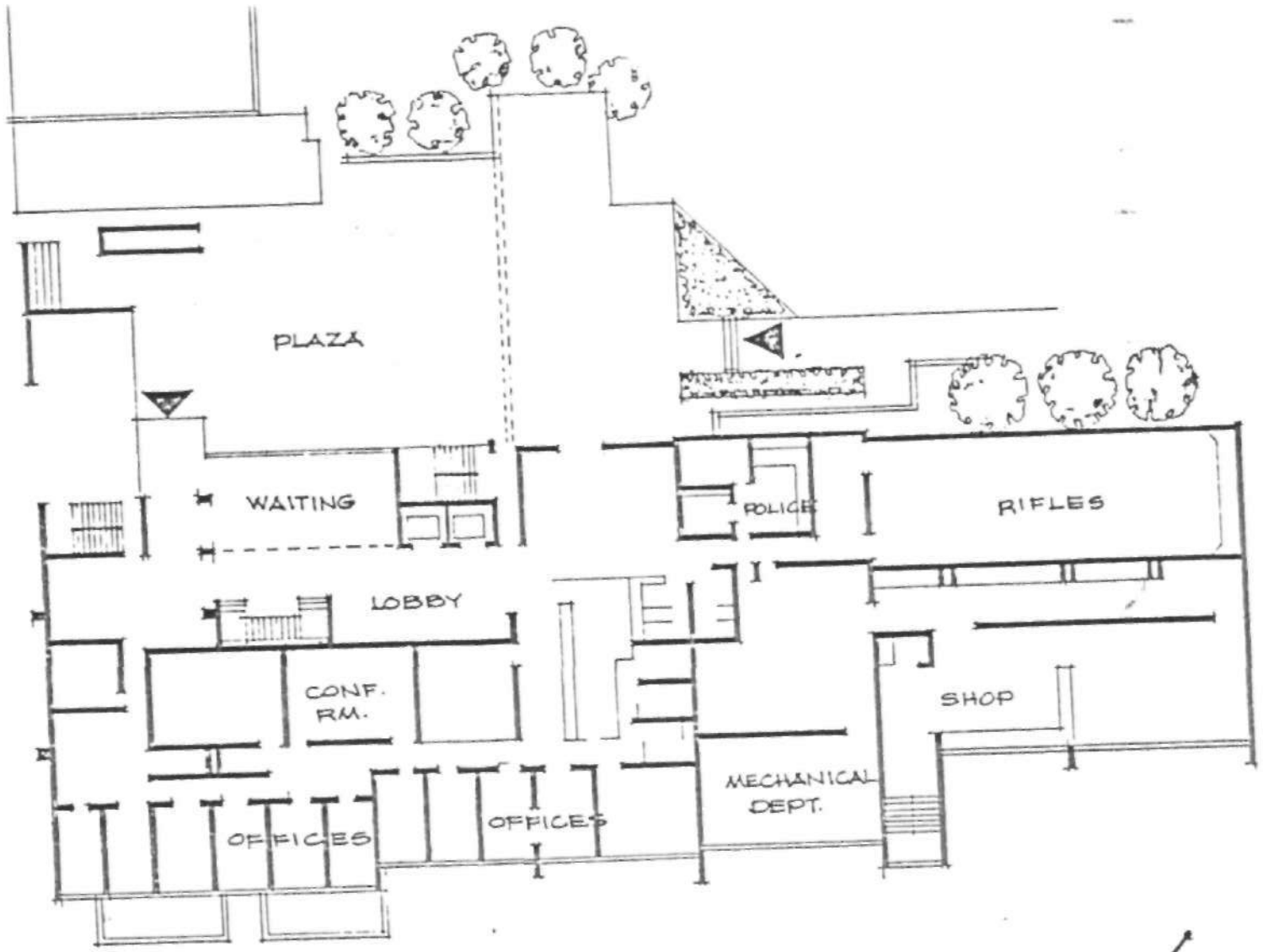


Fig. 10A — FIRST FLOOR PLAN

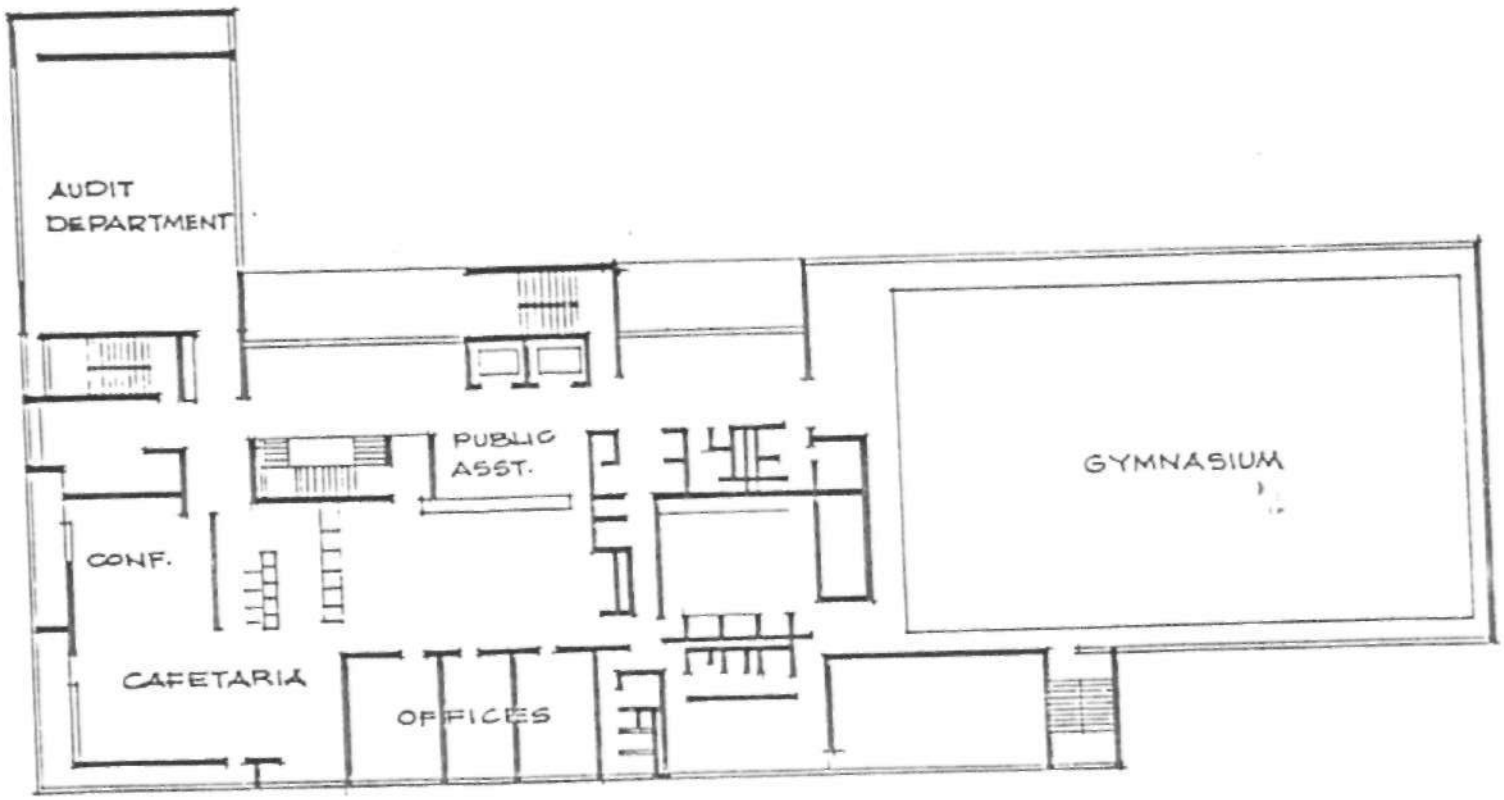


Fig 10a SECOND FLOOR PLAN

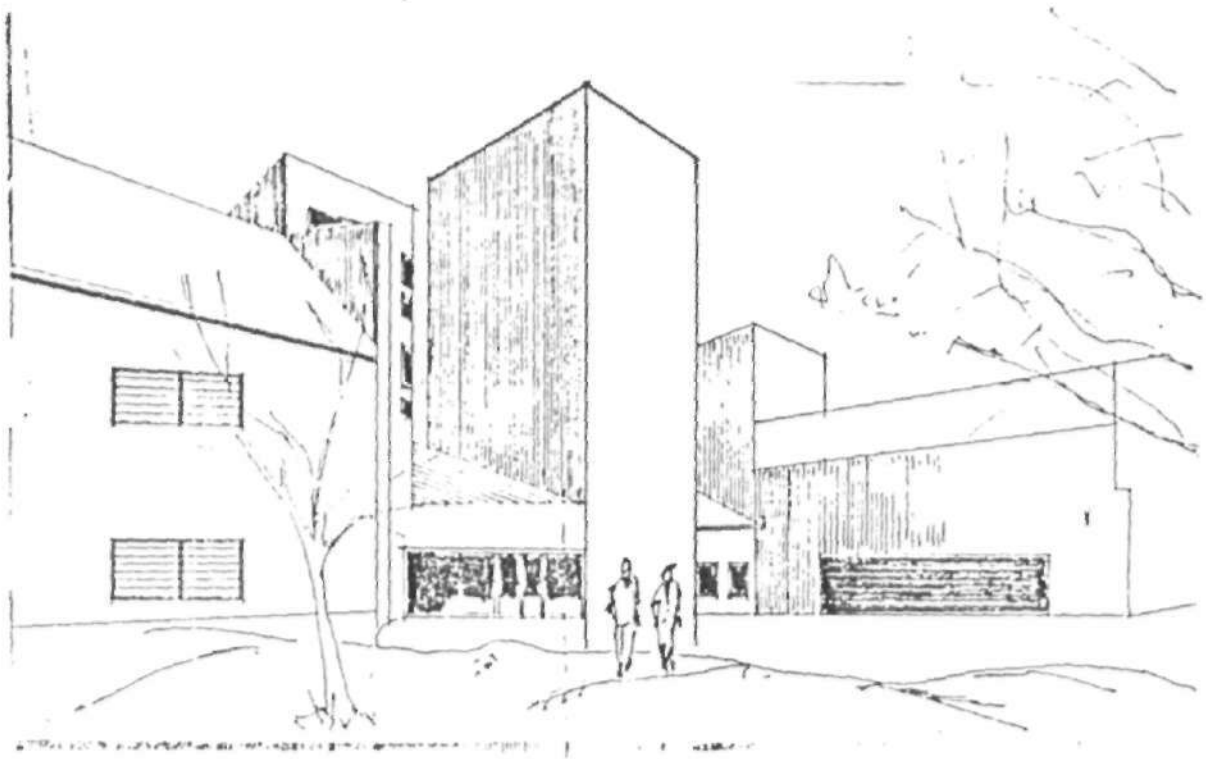


Fig11A A WELCOME APPROACH, THROUGH A COMPOSITION OF LEGIBLE CUBIODS. THE LARGE GLAZED AREA OPENS INTO THE PLAZA. GRAPHICS COMM. UNICATION WAS EMPLOYED TO GUIDE PUBLIC AT THE PLAZA.

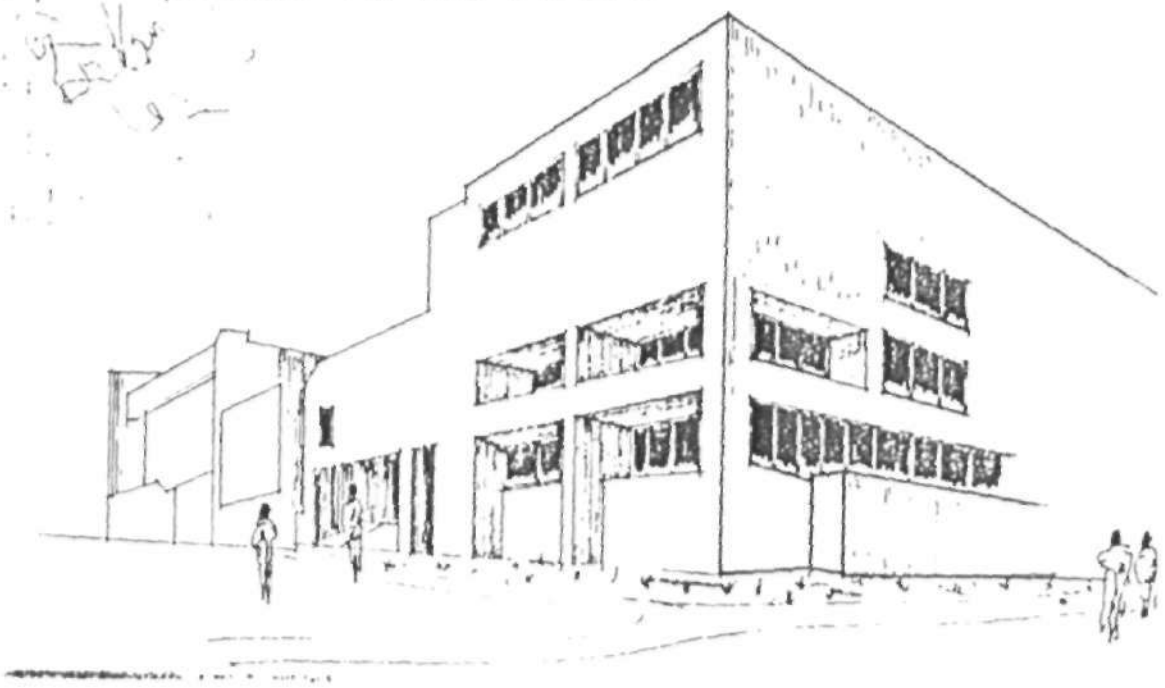


Fig 11B THE BUILDING FITS GRACEFULLY INTO ROWS OF ADJACENT EXISTING STRUCTURES. IT CAN BE ENTERED FROM RAISED PLAZA ON FROM SECOND FLOOR.

APPRAISAL

Merits

The merits of the centre are as follows:

1. The planning saves cost and maximised space utilization.
2. It has pleasing and welcoming facade.
3. An organic integration with the site.
4. Diversity of facilities encourage users across age groups.

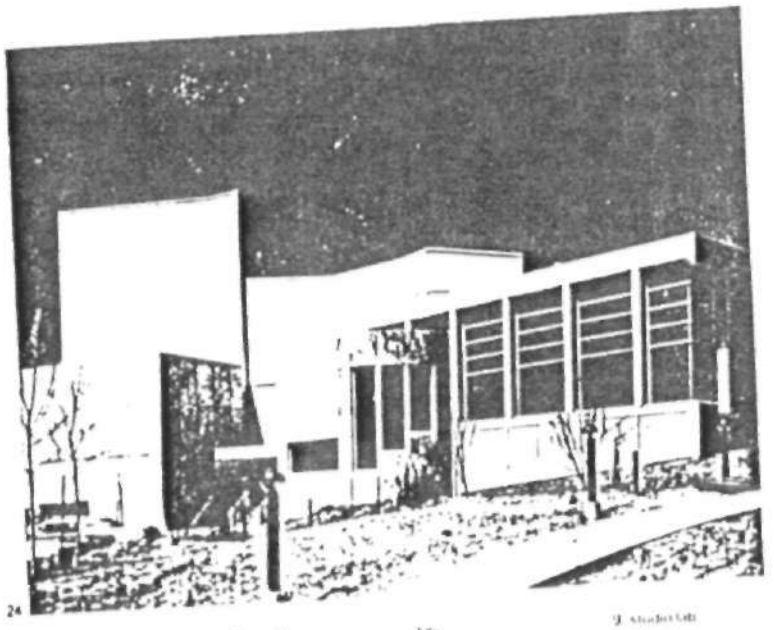
Demerits

The demerits of the centre are as follows:

1. Rigid planning layout, only vertical expansion is possible.
2. The location of large hall on the upper level increases structural loads and hence instability is likely to occur.
3. Possibility of clashing between the Police and other users especially the youth.
4. Architectural composition does not suggest the function of the building.

4.4 JEWISH COMMUNITY CENTRE, TORONTO

The Jewish Community Centre, Toronto, was designed by Jerome Makson for the young men's Hebrew Association, in a



24

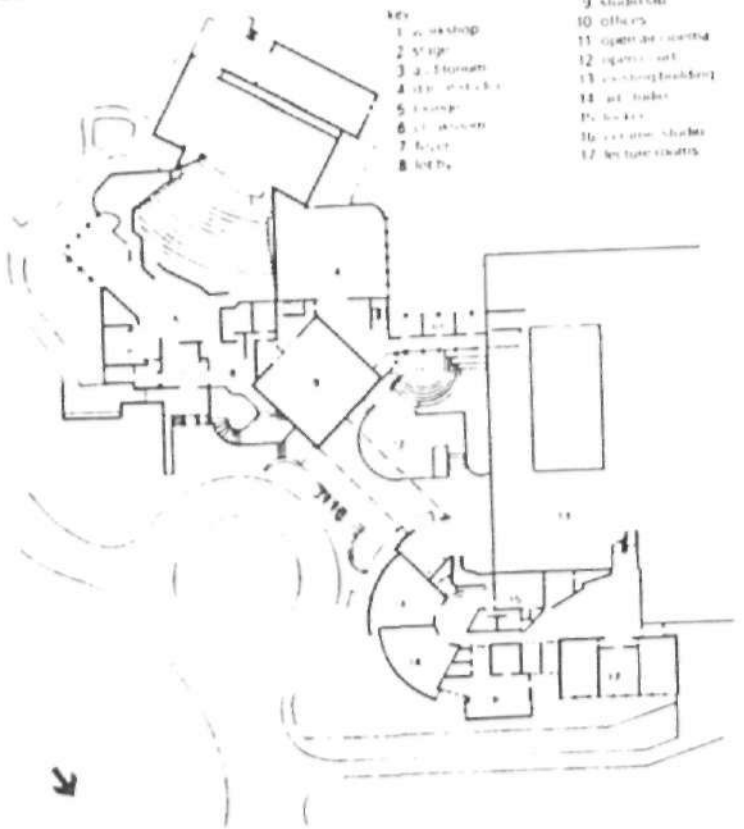


PLATE 2A

PLATE 02B JEWISH COMMUNITY CENTRE
TORONTO.

'park-like' setting north of Toronto. The building is annexed to the existing building on a steepy slope.

It contained a fan-shaped threatre complex, workshop, dancing studio, amphi-theatre, studio laboratory, lecture rooms, lounge and administrative offices.

DESIGN CONCEPT

The complex is designed with a modern architectural language of discovery in freedom of spatial planning and organisation. This was permitted by reinforced concrete and adaptation of flat roofs. The skilful and engaging complex is adjoined onto an existing building in a 'park-like' setting that arouse the mind and interest of passer-by. The spatial planning slides into one another. The design produced an effect of openness and intimacy. The spatial organisation which seemly complex produced a simple attractive elevation when seen in three dimensions.

CONSTRUCTION MATERIALS

The building was constructed with reinforced concrete and concrete flat roofs.

APPRAISAL

Merits

The merits of this Jewish Centre are as follows:

1. An exquisite three dimensional composition.

2. Organically planned with site.

3. It eliminates boxes in spatial composition.

4. The facilities are diversed.

5. Emotional arousing complex with richly interplay of concrete and glass.

Demerits

The demerits of this Centre include:

1. Integration of different geometrical forms resulted in waste of functional spaces, through dead and narrow ends.

2. This Centre has too many uncontrolled entrances.

4.5 SUMMARY AND CONCLUSION

There are striking differences between the case studies in Nigeria and those in the U.S.A. The differences arose in diversity of facilities and scale. The followings are the summary of other observations made:

1. Location of the centre is very importance and proximity to other communal facilities in the community is essential.

2. Community Centres in Nigeria are mainly for educational and welfare facilities.

3. Diversity of the facilities makes the centre more attractive and encourage users across age groups, sex, and religion.

4. Spatial arrangement and noise control is important.

5. The structure must be economical at the sametime arouse emotion and should also respect human scale.

6. Security is important in the Centre.

7. The Centre must be made to generate its own revenue for easy maintenance of the facilities.

CHAPTER FIVE

THESIS SITE AND ENVIRONS

5.1 INTRODUCTION

This chapter covers all the necessary data analysis of the site of the project and its immediate environs. It starts with a broad overview of the state of location, the town of location and finally, the micro-site of the project.

5.2 STATE OF LOCATION

The project is located in Benue State of Nigeria. It is one of the 'Middle Belt' states created in 1976 out of the then Benue-Plateau State. It is bounded by Plateau State to the north, Taraba State to the east, Kogi State to the west and Enugu State to the south.

The major tribes in Benue State include the Idomas and the Tivs. We also have other minor tribes like the Igede and so on. While the major towns include Makurdi (the state capital and the project site), Gboko, Otukpo, Katsina-Ala, Adoka, Okpoga, Otukpa, Aliade etc. Agriculture is the main source of revenue of the state. Cash crops like Beni-seed, Ground-nut and soya beans and food crops like yams, rice, cassava, potato, guinea-corn and maize are in abundance.

5.3 TOWN OF LOCATION

The project is located in Makurdi the Benue State capital which came into lime-light when the headquarter of then Benue

Province was transferred from Abinsi to Makurdi which became the state capital in 1976. It is located on the banks of river Benue. Geographically, it lies on latitude N and longitude E, at approximately 90m above sea level.

Makurdi is made up of four distincts which are the present Makurdi South, and High Level Settlements, North Bank, the wide land below the depression crossing Aliade road and the large parcel of land on the east of the new bridge.

It is possible to reach Makurdi by air, road, rail or water (River Benue). Makurdi is a kind of link between the political northern and southern parts of Nigeria.

5.4 CLIMATOLOGY

Makurdi is located in the tropics and its macro-climate is that of the warm humid type characteristic of tropical areas and its also associated with high humidity values.

The climate of Makurdi has two distinct seasons which are the dry and rainy seasons. The rainy season being from March to October and the dry season from November to March. The seasons are dominated by the tropical mari-time air mass which blows from the south-west and the continental air mass which blows from the north-east.

a. RAINFALL

The average annual rainfall is 104mm. The rainy season lasts for about seven months from March/April to October/November with the highest rainfall usually recorded between July to September. The early and late

rains are usually torrential, preceded by high winds, thunderstorms and squalls.

MONTH	RAINFALL (MM)
JANUARY	0.2
FEBRUARY	4.9
MARCH	38.2
APRIL	107.6
MAY	161.9
JUNE	161.9
JULY	211.8
AUGUST	198.5
SEPTEMBER	218.6
OCTOBER	133.8
NOVEMBER	0.4
DECEMBER	0.0

TABLE 1 : MONTHLY MEAN RAINFALL FOR MAKURDI

SOURCE: NASME, CIVIL DIVISION, 1990.

b. TEMPERATURE

The mean annual temperature for Makurdi is between 25 - 30°C with as high as 36°C daily peak, and a minimum of 17°C. The highest temperature recorded is usually between the dry and rainy seasons in the months of February to April.

MONTH	MAX (°C)	MIN (°C)	MEAN (°C)
JANUARY	34.4	18.3	26.4
FEBRUARY	36.1	21.1	28.6
MARCH	36.1	23.9	30.0
APRIL	33.8	23.9	28.9
MAY	32.2	22.8	27.7
JUNE	30.5	22.2	26.4
JULY	27.8	22.2	25.0
AUGUST	30.0	22.2	26.1
SEPTEMBER	30.0	21.7	25.9
OCTOBER	31.1	21.7	26.4
NOVEMBER	32.8	20.5	26.7
DECEMBER	32.8	17.2	25.0

TABLE 2 : MONTHLY TEMPERATURE FIGURES FOR MAKURDI
SOURCE: KYADO G, M. Sc. THESIS, 1990.

c. RELATIVE HUMIDITY

Makurdi has very high relative humidity values, about 71 - 82% on the average, between April and December, which are usually very hot. From January to March, relative humidity is between 54 - 61%.

MONTH	MAX (%)	MIN (%)
JANUARY	80	29
FEBRUARY	74	28
MARCH	82	41
APRIL	88	53
MAY	92	62
JUNE	94	67
JULY	94	69
AUGUST	94	71
SEPTEMBER	95	69
OCTOBER	95	65
NOVEMBER	94	50
DECEMBER	90	51

TABLE 3 : RELATIVE HUMIDITY VALUES FOR MAKURDI
SOURCE: ALI, J. M., M. Sc. THESIS, 1991.

MAKURDI

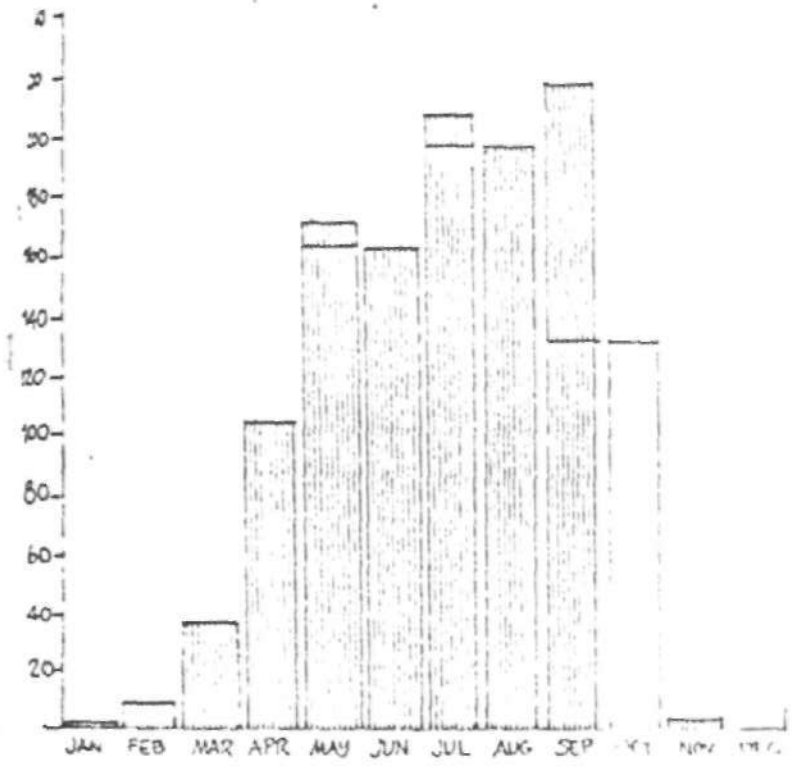


Fig.12 RAINFALL

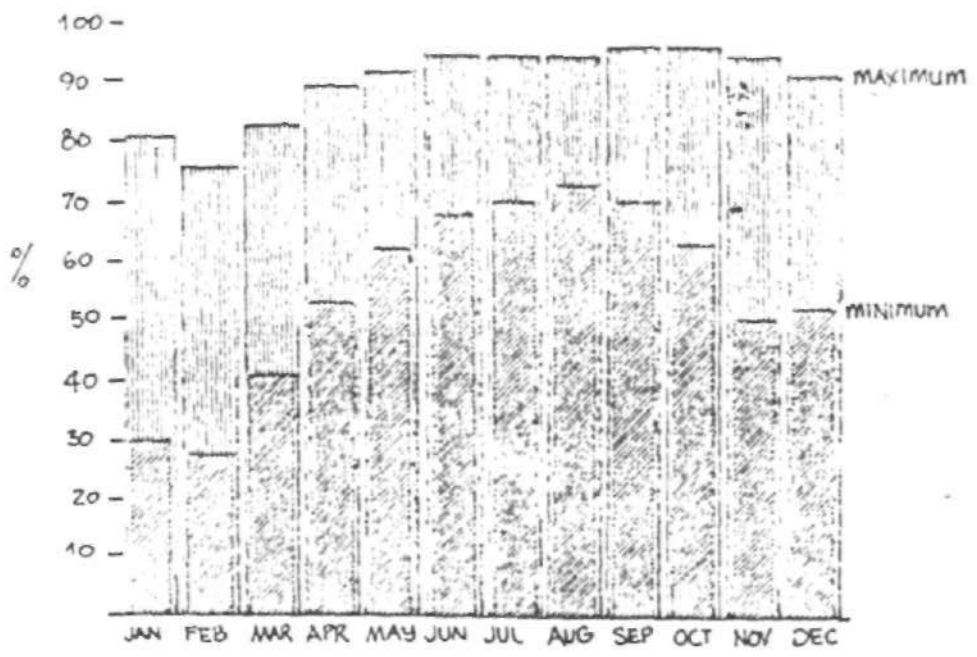


Fig.13 RELATIVE HUMIDITY

SOURCE: KYADO, 90

MAKURDI

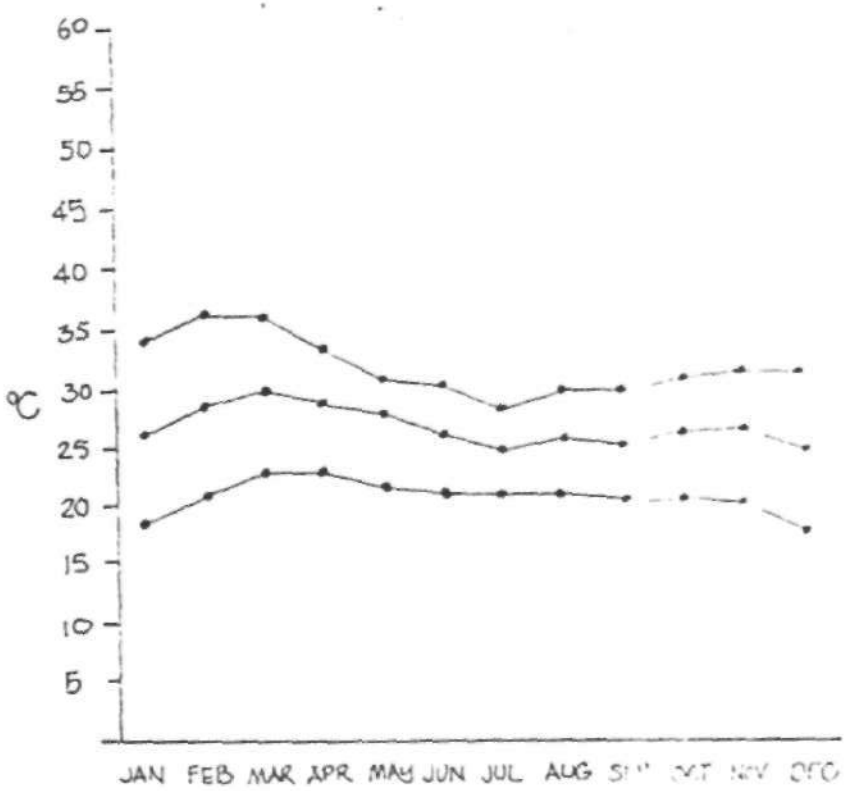


Fig.14 TEMPERATURES

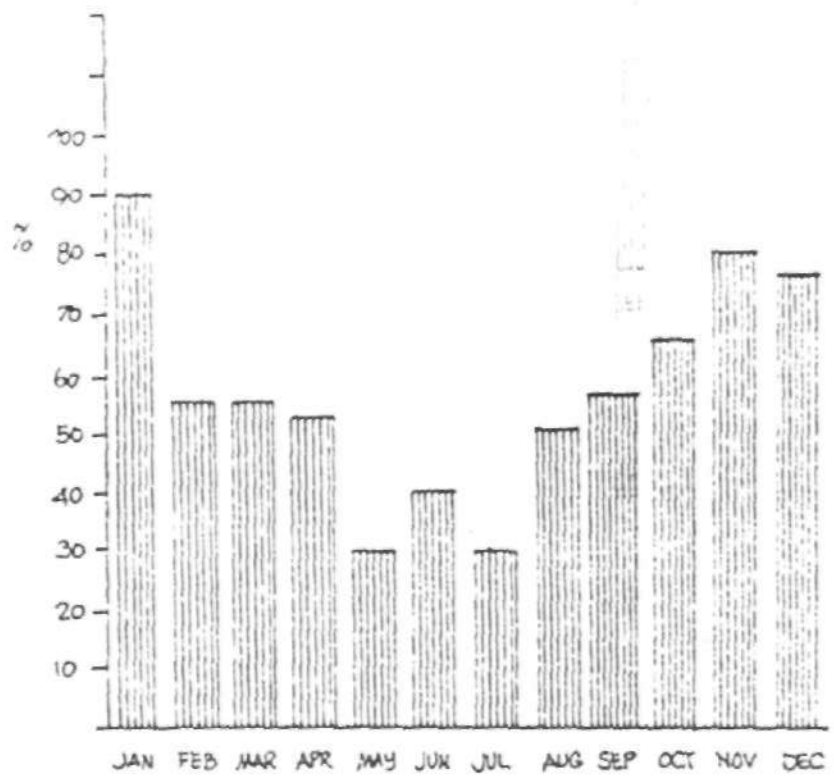


Fig.15 SUNNY DAYS

SOURCE: KYADO, 90

MAKURDI

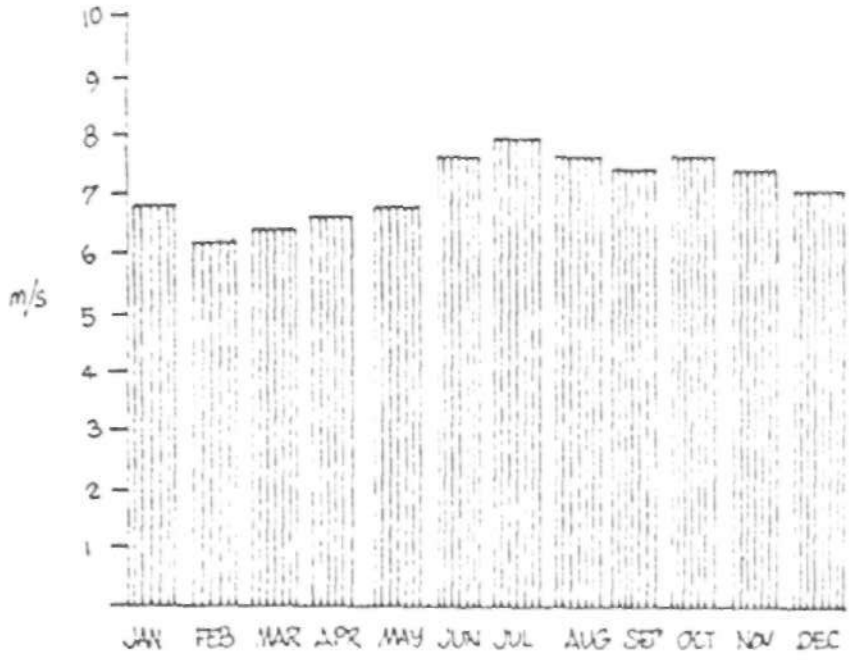


Fig 16a WIND SPEED

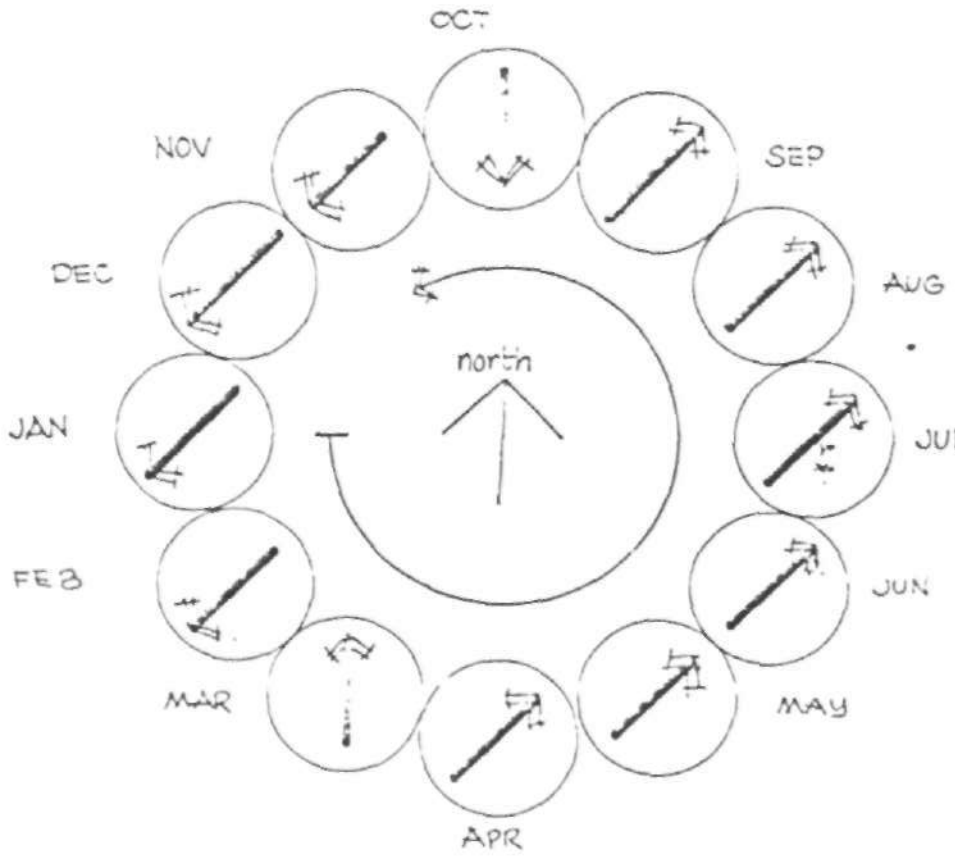


Fig. 16b WIND DIRECTIONS

d. SUNSHINE

Makurdi has a high number of sunshine hours per month. Solar radiation is high between January and April, with cloudless sky most of the time. There is some cloud cover in the months of June to September, and heavy dusty cloud and ground cover during the harmattan period of November to January.

e. WIND

Makurdi experiences the North-East trade winds during the months of November to January and the South-West trade winds March to September.

Occasional thunderstorms and squalls especially at the inception of the rainy season in March and April, usually heralded by strong windstorm, thunder and lightning. Occasional destruction of poorly constructed houses and other structures occurs. The average windspeed of about 7m/s is very low.

5.5 GEOGRAPHIC CHARACTER

a. VEGETATION

Makurdi vegetation is of the transition between the rainforest and the savannah. The large expanse of grass-land is dotted with typical trees like palm, oil bean, locust bean and shea butter trees.

b. TOPOGRAPHY

Makurdi is approximately 90m above the sea level, and slopes towards the river Benue on both sides of its banks. It has good natural drainage towards and into the river, and there is little or no erosion threat. The general slope of this centre is on the 4.0% average gradient.

c. GEOLOGY AND SOIL TYPE

Makurdi falls within the lower south Benue valley. In this sub-region, very thick, marine dark grey shales silt stones and sub ordinate lime stones were deposited in the middle Albian/lower cretaceous age. The under-laying base soil consists of a thick mass of cement bedded coarse grained deposits described as the Makurdi sandstone, which has a thickness of up to about 90cm. Its basalt parts are literally equivalent to the Keana sandstones of the middele Benue valley.

The site has predominantly sandstone with rare shale bands with the upper cretaceous being the Keana sandstone. Soils and sub-soils comprise mainly of Ferratic combsoil and loamy sand of weak structure and slightly acidic.

d. DEMOGRAPHIC CHARACTER

The populace of Makurdi town consists of people of different ethnic groups. Predominant among them are the Tivs and the Idomas, Hausa and Ibos. It is a fact that the population of the Yorubas is very low in comparison to other state capitals.

The people here are mainly civil servants, farmers, fishermen, traders and military personnel. The level and degree of interraction between these classes of people is low as it seems everyone in Makurdi goes about his or her own business as if in isolation. This shows that there is a need for a common centre for social interraction.

The site was formerly used as market and presently been fenced round pending the completion of the proposed multipurpose centre which the State Government proposed for it.

e. TRAFFIC

The traffic situation in Makurdi is chaotic as compared to other state capitals. There are no taxi cabs in Makurdi except for buses which ply particular routes and motor cyclists ('express'), which supplement the bus services. Boat and ferry services exist across the Benue especially between the site and the North bank of the river.

Makurdi is also linked with the railway network of Nigeria. Express, limited and local train services are available. There is also an airport located within the Nigerian Air Force Base, Makurdi.

5.6 SITE ANALYSIS

To achieve a successful design, it is important to analyse the site so as to enhance its potential on the building structure and meet any particular response and also

harmonise with the site, the activities within the structure being designed. Moreso the site analysis will ensure the flexibility of the site's potentials and the successful integration of its natural and cultural factors (features) into the design.

a. TOPOGRAPHY

The site topography is quite favourable to the design of a Community Centre. It slopes gently northwards towards the river Benue. The average gradient is less than 4%, which is quite gentle and poses no threat as far as erosion is concerned, but a good drainage characteristic towards the river Benue.

b. GEOLOGY AND SOIL

The soil is fertile and well structured. The site has predominantly sandstone with rare shale bands with the upper cretaceous being the Keana sandstone. The soils and sub soils comprise mainly of ferralic combsoil and loamy sand of weak and slightly acidic.

c. HYDROLOGY

The most prominent hydrological feature around the site is the river Benue and to a much lesser extent, smaller streams drain into the river.

During the day time, some kind of 'sea breese' effect is felt on the site from the large water body and should be utilised for ventillation and evaporative cooling effects.

The river also has a very good visual quality as it gives interesting views from its banks. In addition, it serves as the main water supply source for the Centre as the Water Works site is located along the bank which supply water to the town and its environs.

d. VEGETATION

Trees are dotted all over the site which include mango, shea butter trees. There are shrubs and also extensive ground cover of short grasses.

e. MICRO-CLIMATE

The predominant features of the micro-climate are the trade winds. The North East trade wind, cold, dry and dusty, blows from the north-eastern part of the site from November to January. The impact is felt most in the mornings and night with poor visibility.

South-West Monsoon wind, moist, blows from the south western part from March to October, bringing along with it, the rain. The rainfall is accompanied with occasional thunderstorms and squalls usually heralded by strong wind-storms, thunder and lightning. The wind speed across the site is low, about 5 - 7m/s.

The sunpath, through the site varies with the month of the year, but generally, the sun rises from the east-north-east and sets in the west-south-west. The sun could be tolerated, but minimal shading could be provided where-ever possible. The west sun, however, is very uncomfortable

and openings in thid direction should be avoided as much as possible and its imperative, the opening should be shaded.

The river Benue has a tremendous effect on the site. A kind of 'sea breese' effect is experienced during the day, especially during the hot afternoons. This should be utilised to increase the wind movement to enhance ventillation and evaporative cooling.

f. TRAFFIC

Traffic is high in this area. The only road that pass by the site is too busy as it is the only good road there as far as motor vehicles are concerned. Possible site ingress and egress is from the existing main road that pass by the southern side. An alternative entrance could come from the eastern side which is an untarred road between the Police Post and the site. This particular access is preferred as it is from the lesser busy road.

g. UTILITIES

The main utilities within the site include the 11KV power lines along the main Wadata Road. There is a Water Works located close and along the bank of river Benue, which is the source of water to the environment, and there is the main telephone line running along the road.

h. EXISTING LAND MARKS

The existing land marks in and around the site include the river Benue, the Water Works and no other obstructible object as the site was a market place before the movements to the new Makurdi Modern Market. Good and interesting views of the river Benue and the fishing activities going on the river, with the canoe riding across the river.

5.7 POPULATION STRUCTURE

The total population of Makurdi as recorded by the 1963 Census is 53,963 and based on the 3.2% steady population growth rate, the 1992 projected population is 136,607. While the projected population of Makurdi ten-years to come will be about 170,000.

The occupational distribution of population is as follows: Commerce - 33%, Agriculture - 36%, Ministries and Government employed - 36%.

The sex structure of the population is given as 57% male and 43% female.

5.8 SUMMARY AND CONCLUSION

This chapter has covered all the data analysis of the site, its immediate environs an a general overview of the town of location, Makurdi, and Benue State as a whole.

Makurdi generally has, on the average, very high temperature values all the year round; the average daily peak being about 36°C. Humidity is also high with low air movement except during rainstorms. The number of sun shine hours is also high.

The site of this project is located in the Wadata area of Makurdi near the river Benue. All the Micro-climatic data analysis are applicable to the site with some modification from the sun breeze effect of the river Benue.

Entrance and exit to and from the Centre is possible from two points. The one from the untarred road on the eastern part is preferred as it is less busy.

SOURCE: Ali, John M. 1991
KYADO, G. A. 1990.

CHAPTER SIX

6.0 TROPICAL BUILDING MATERIALS

6.1 GENERAL INTRODUCTION

Though architectural design principles are universal, they cannot be applied the same way in various environments. The manner in which a particular design principle is applied in one environment may not be the same as in another. Since comfort is the major target in design, the nature of the different environments will warrant a modification or adaptation of these design principles to suit the environment concerned. The manipulation of the principles arise from the fact that the environment cannot be changed. There are basically three different environments on earth, they are: the cool, the temperate and the tropics (see plate) A given architectural design princple will have a different modes of application in these environments after taking some basic factors into consideration.

Looking at the three environments, one will see that a particular environmental factor makes them differ from each other. the factor is the climate. Climate is the most important environmental factor to be considered in the design and construction of buildings most especially in the tropics. In the other environments (cool and temperate), a naturally favourable climate is offered as such climate is not quite a major consideration, although carefully balanced design is called for in this area as well to act as sun trap in the winter and a shaded shelter in the hot days, to cater generally for the variations and to act as a summer jacket and a warm over coat. Design in the tropics is far more challenging, this thesis will concentrate on the tropics alone and comparisons with other environments will be made where

necessary.

The climate is thus only an important consideration but also indispendable. Vitruvius, a father of climate conscious design said in his book "De Architectura":-

> For the style of buildings out manifestly to be different in Egypt and Spain, Pontus and Rome and in countries and regions of various characteristics, for in one part of the earth is oppressed by the sun, in its course in another part, the earth is far removed from it in another, it is affected by it at a moderate distance.

Therefore, building in the tropics have to be designed with great care and thought and with due regards to climatic conditions and building material selections.

CLIMATE AS AN INDISPENSABLE ELEMENT

The spread of populations and modern communication have accelerated the age old interchange of ideas between different climatic regions, for example, the wide dissemination of western forms without due regards to climate. We must realize that the western forms evolved from the challenge of cool climate and can pose grave problems when adopted in tropical environments. The climatic conditions of this environment have to be worked with appropriately, so as to bring up a design that naturally adapt to the environment. It is unarchitectural to disregard the effect of climate on buildings as it is presently practiced for example in the United States despite the great variety of climatic conditions, building design often reflect on heedless uniformity. Building elements and designs are too often used in

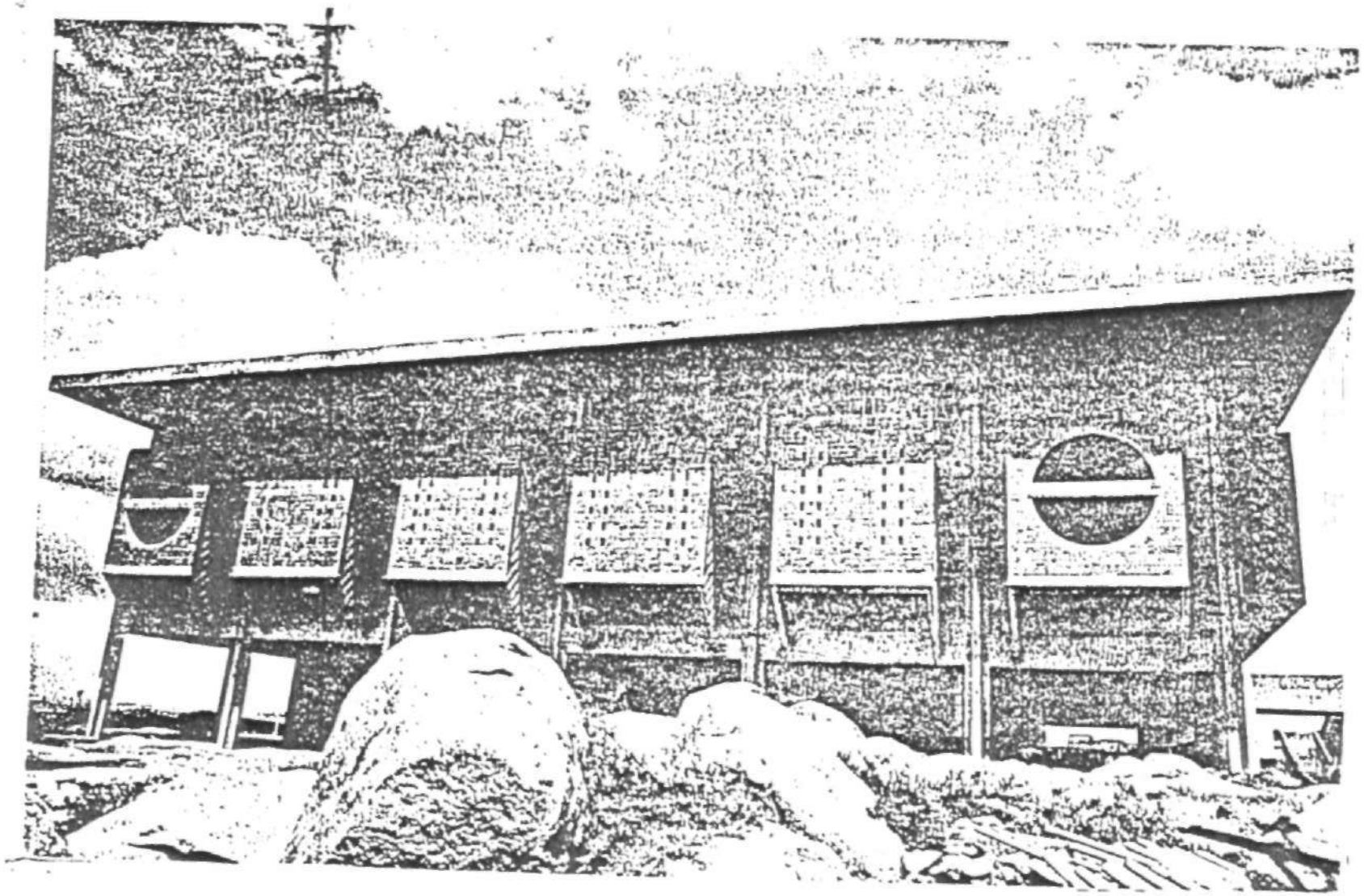


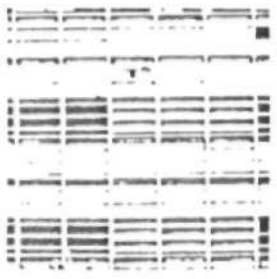
PLATE 3
View of a building (computer center). Climatic consideration manifested by the use of roof covering and brick wall screens for outside glazing.



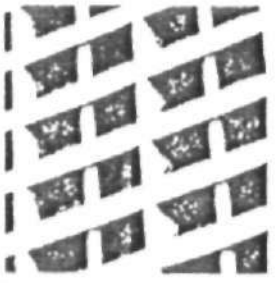
142.



141.



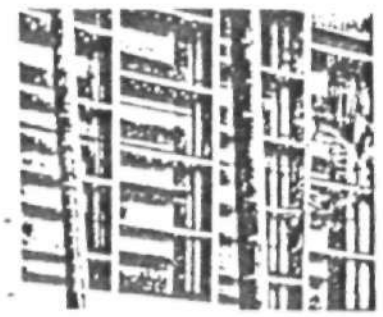
140.



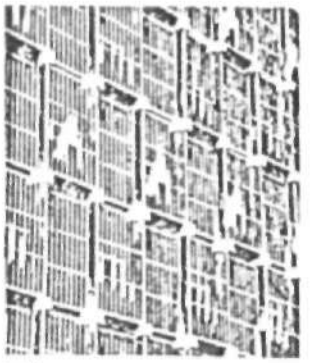
143.



145.



144.



146.

PLATE 4 Other Examples

-showing devices in building to control Extemes of climatic effects.

diverse environments with little or no relevant to their effect on human comfort or even to the performance of materials. The buildings do not reflect the environmental character but are transplanted by a migrant populaton. Many causes of this wasteful uniformity can be cited but perhaps the most decisive impact came from the technological advances of house heating and house cooling.

Walter Gropius said:-

> True environmental character cannot be found through a sentimental or imitative approach by incorporating either old emblems or the newst local fashions which disappear as fast as they appear. But if you take into consideration the basic differences imposed on architectural design by climatic conditions, diversity of expression can result if the architect will use the utterly contrasting indoor, outdoor relations as focus for the design conception.

The desirable procedure would be to work with and not against the forces of nature and make use of their potentialities to create better living condition. That is the environmental setting/climatic conditions considered to achieve building structures which reduces undesirable stresses and at the same time utilizes all the natural resources favourable to human comfort.

Therefore, before desining new dwellings in a region, it would be more often than not rewarding to study the climate of

that area. The climate of a region basically consists of various elements like the wind velocity, temperature, and rainfall. All these should influence directly or indirectly the design of any building in a particular environment. Plate Nos. to present typical examples of climatic considerations being manifested on building designs. The architectural solution to problems of climate are evident on these buildings (shading devices, choice of materials etc). These produce a striking form of expression and good aesthetics in addition.

The examples shown on the Plates are to demonstrate that the design of human dwellings and settlements in a region are influenced beside other factors to a great extent by the climate and physical environment of a region. Notice the use of various shading elements, roof overhangs to combat the effect of solar radiation in the tropics.

Summing up, this chapter intends to study extensively the tropical building materials and the tropical climate generally with the view to creating pleasant indoor and outdoor conditions without much use of modern mechanisms, as a means of reducing building cost.

6.2 THE TROPICAL CLIMATE

Climate from Greek (Klima) is defined by the Oxford Dictionary as region with certain conditions of temperature, dryness and wind. A more scientific definition is an integration in terms of physical states of the atmospheric environment characteristics of certain geographical location or an integration in terms of weather conditions.

Tropical climate are those where the heat is the dominant

problem. For the greater part of the year, buildins in the tropics serve to keep the occupants cool rather than warm when the annual temperature is not less than 20°C.

The tropic is a comprehensive geometrical term. The tropics comprise a wide belt around the middle of the earth, extending approximately 23½ degrees towards both the poles from the equator and containing nearly 40% of the total land surface area of the earth. They consist of parallels of latitude between the tropics of cancer and the tropics of capricon along which the sun can be vertically overhead at noon (see Plate P25).

Broadly speaking, there are two basic types of tropical climates (humid and dry). Either of these conditions prevail in most of the regions like Arab region, Australia, Bangladesh, Brazil, Birma, Cambodia, Carribean Islands, Congo, Malagasy, Malaysia, Mexico, Mozambique, Surnam, pakistan, Nigeria, Sierra Leone, Pillipines, Singapore, Sri Lanka, Ghana, Guyana, India, Indonesia, Kenya, Surinam, Zaire, Tanzania, Uganda, etc.

Apart from the hot dry and hot humid types, minor tropical climate also exist which are between the intervals of humid and dry e.g. the composite climate and the upland tropical climates but generally speaking, hot dry and hot humid are more dominant. In this thesis, greater emphasis will be laid on them, as the thesis site (Makurdi) lies within the hot humid zone.

The different tropical climates have resulted in the development of two dominant contrasting architectural forms of these climates. The last humid and hot dry conditions are the extremes, naturally there are exceptions and gradation between these extremes.

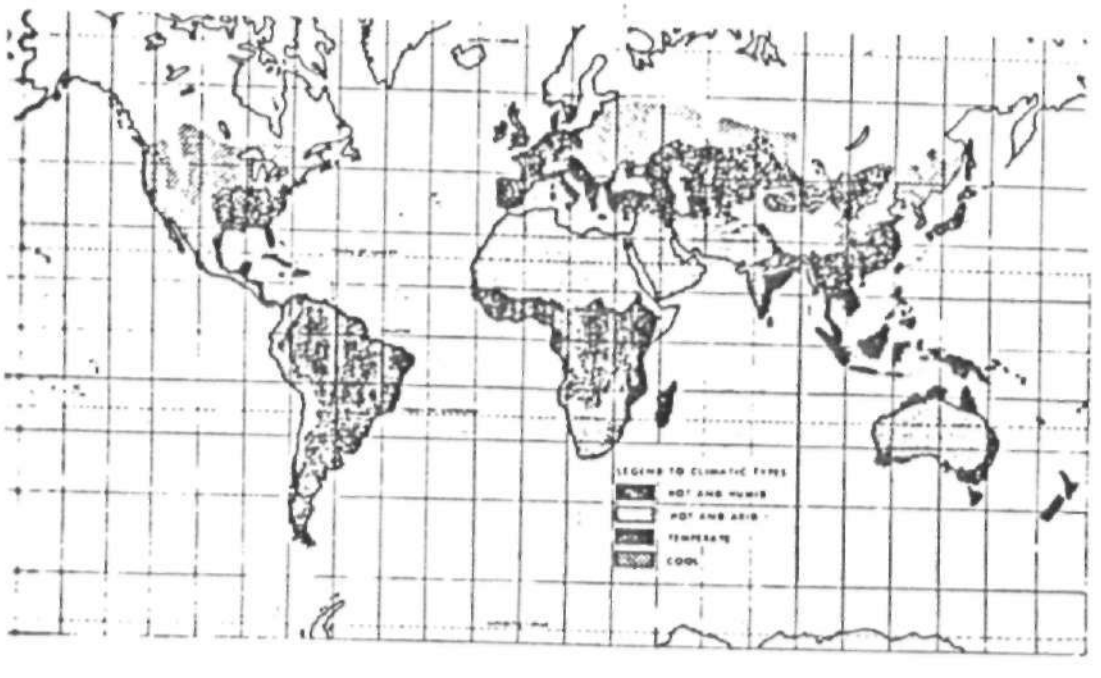


Fig 17 Climatic Zones of the World.

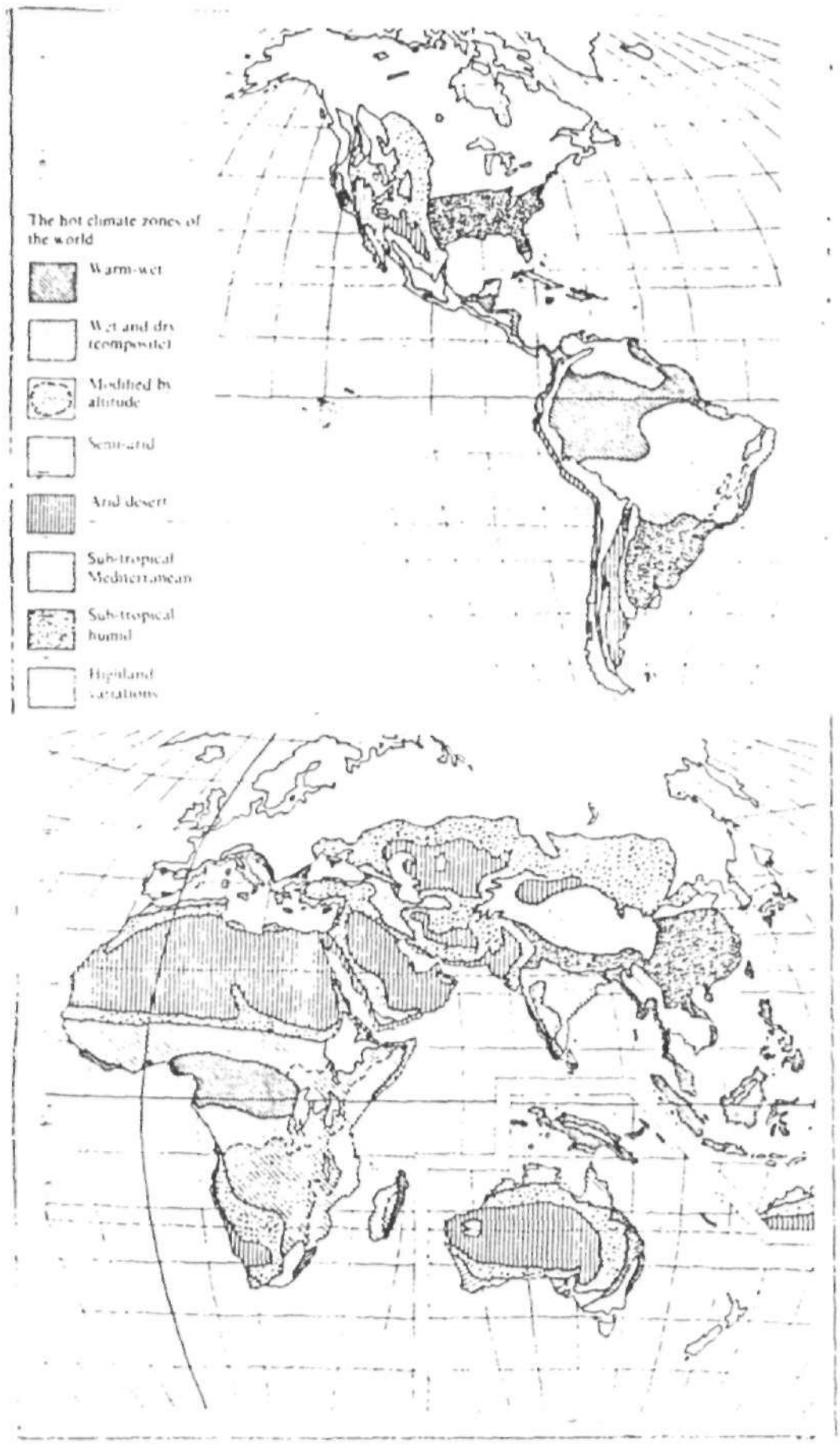


Fig 1a The tropical Zones of the world.

6.2.1 The Hot Humid Climate

Hot and humid climates are found in countries nearer to or at the equator, even though the temperature of the shade in these countries rarely exceeds 90°F (32.2°C). The atmosphere has high vapour pressure. This often makes this region more unpleasant to time than the hotter, though drier region.

The sky in humid regions is bright and glaring even when thinly clouded, but dull when thickly overcast. As one goes inland from the equator, seasonal variations in climate becomes more marked with a wetter season and a drier winter period. During the rainy season, the climate is very much like that of the warm humid tropics while in the dry season on the other hand, conditions are nearer to those of a hot dry climate.

6.2.2 The Hot Dry Climate

Nearer to the Sahara, where the annual rainfall is less, mostly hot and dry conditions prevail. In this region, roughly between the latitudes 15°N and 25°S of the equator, the highest temperatures occur. These are the sunniest parts of earth perhaps the only region where there is too much sun. The characteristic topographical features of these zones are strong sunlight reflected from the dry light coloured ground. Frequent dust storms which usually occur in the late afternoon when conventional winds of 24 to 32km/h stir up the dry surface of the ground, low humidity and little or no rain.

Generally, in the tropics, buildings have to be designed with great care and thought and with due regards to climate. Shade and protection from dust storms may have the highest priority in some regions while in other regions, ventilation

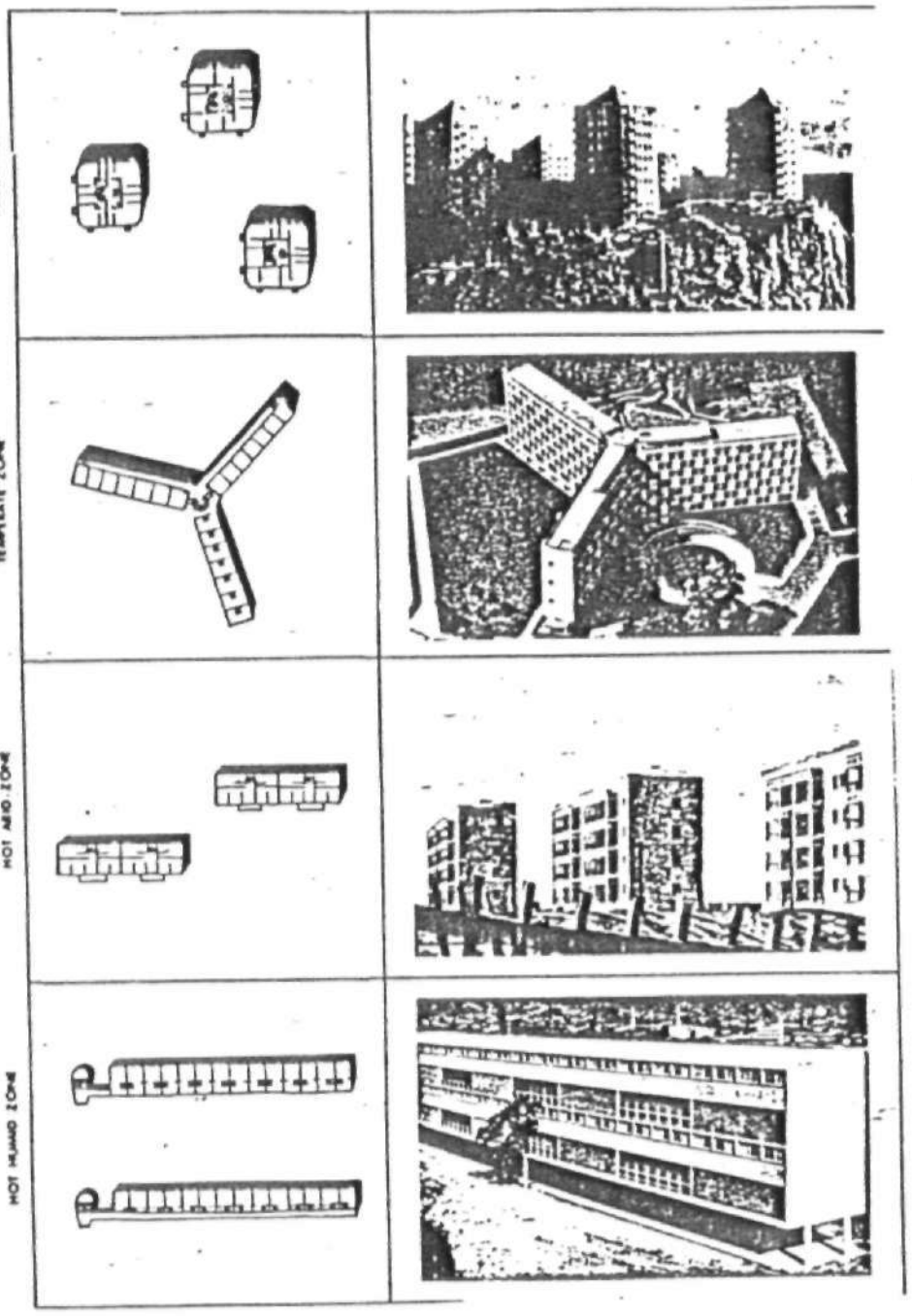
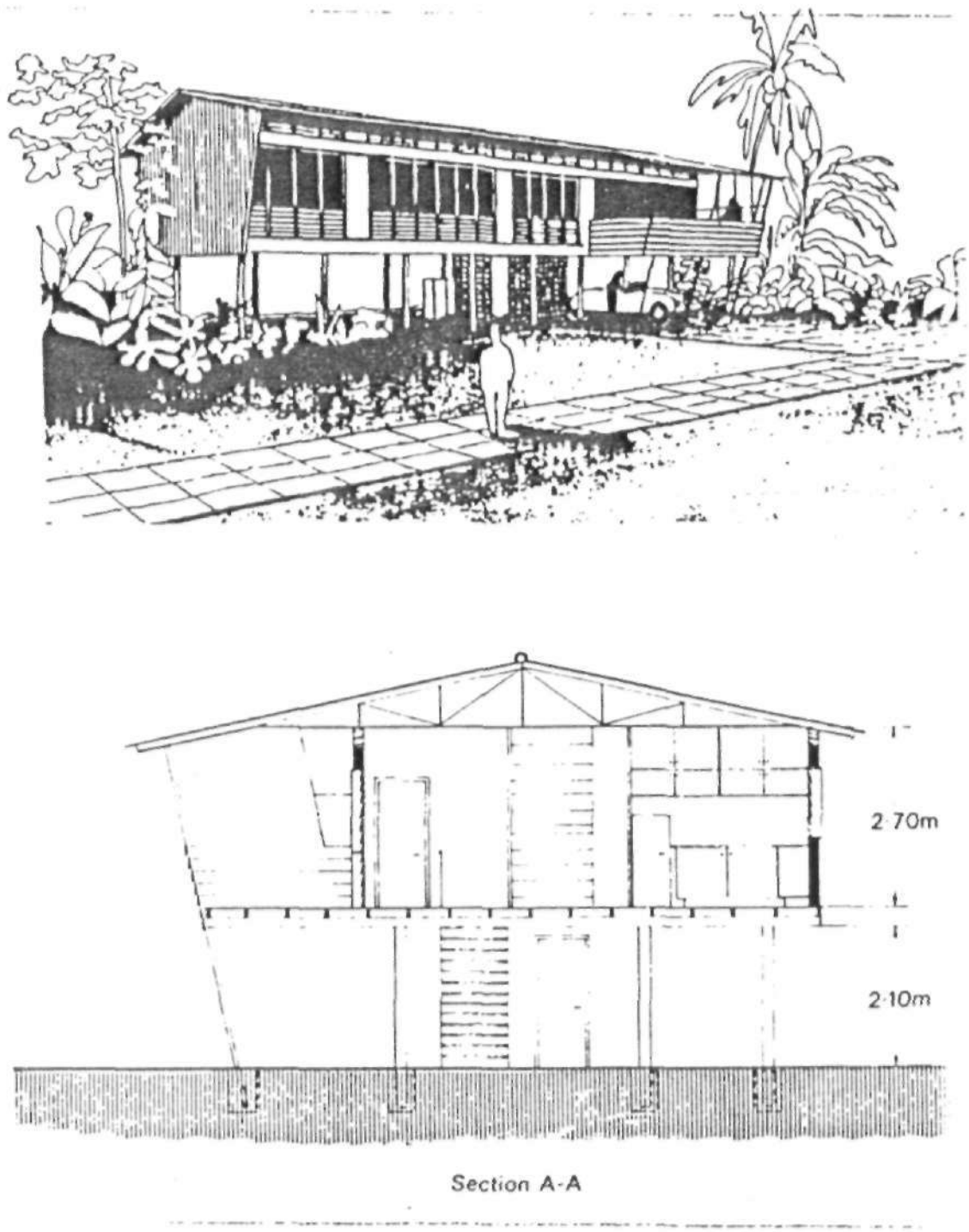
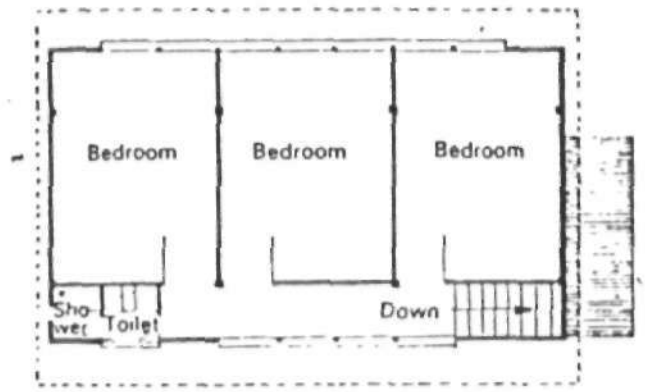


Fig 19. Further Example showing planning characteristics of various tropical zones with comparism with other zones.

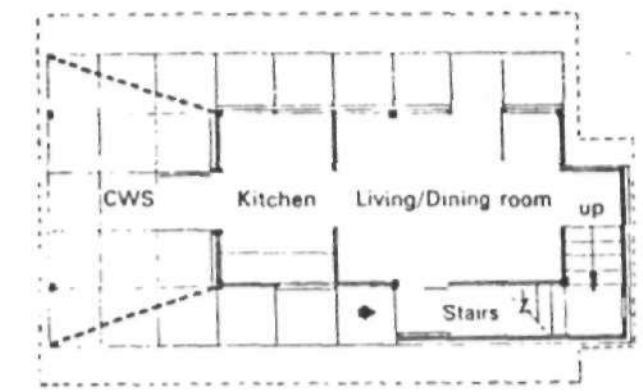


Section A-A

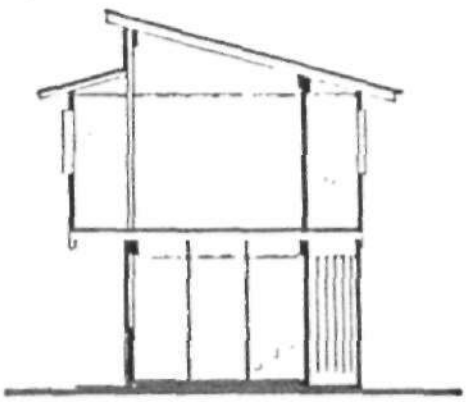
Fig 20 Shelter planning in hot humid area.
-outward looking plan catch breezes.



Upper floor



Ground floor



Section

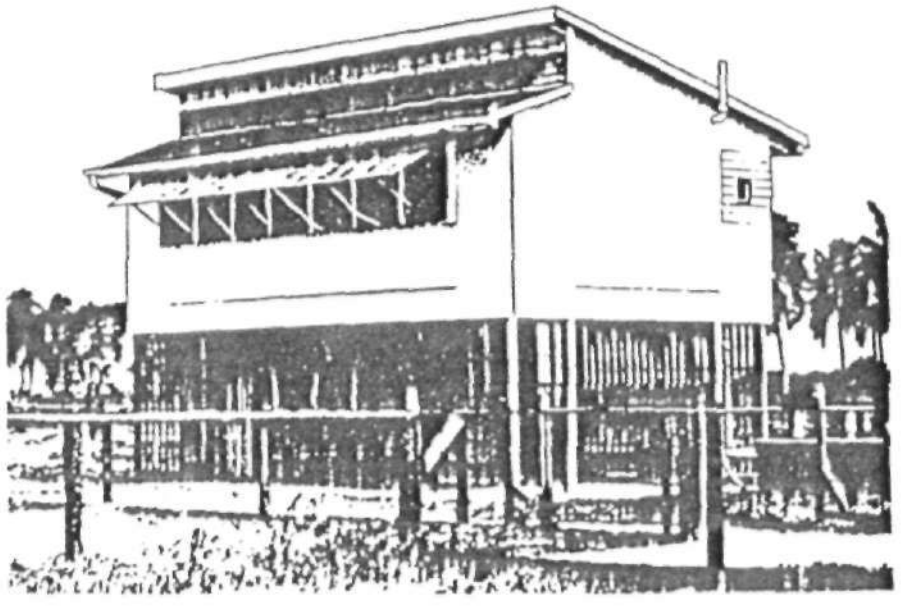


Fig 21
Shelter, planning in hot humid climate use of Extrovert plans with shaded openings.



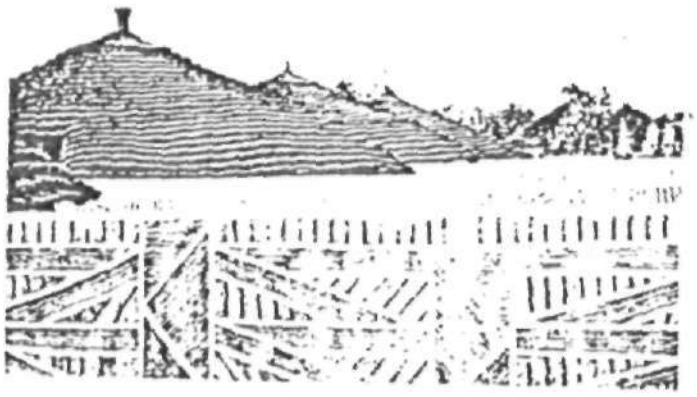






Fig 28: Traditional and modern building materials .oyed in this elegant buildings to compat the proulem tropical climates.



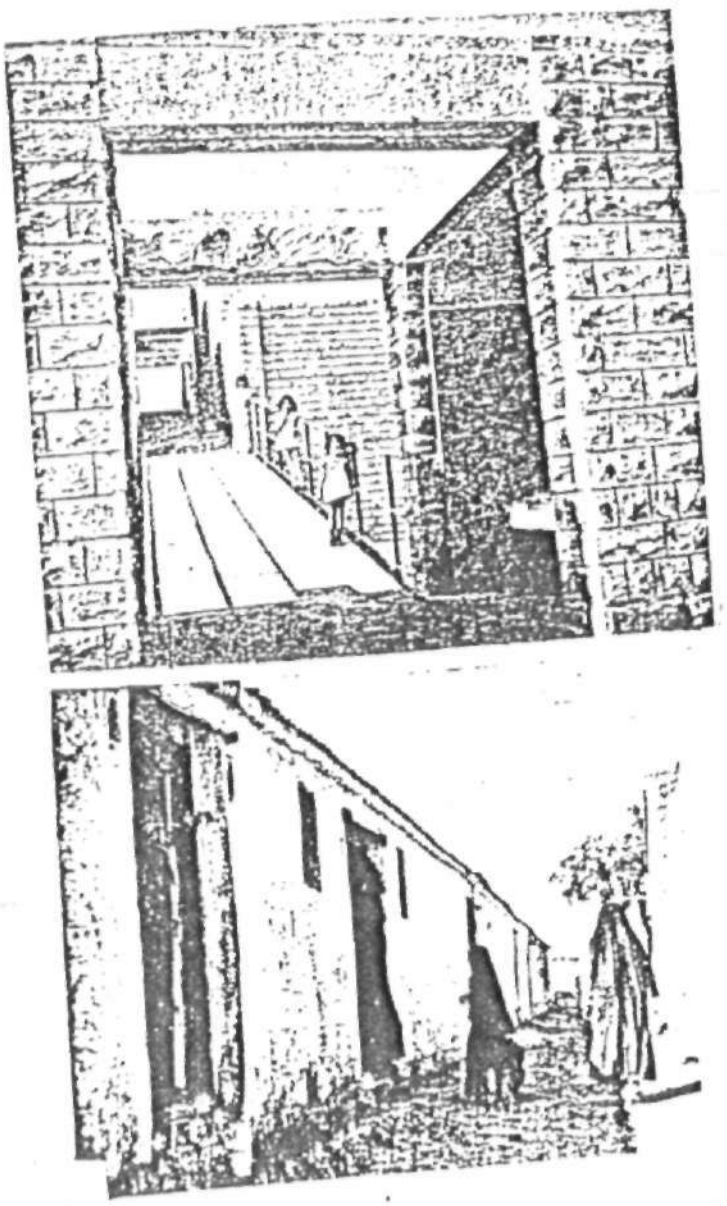


Fig 23
i. use of local building materials creating
ii. architectural forms of regional character and also bring
i. Economy in cost of construction.

HIM IBRAHIM LIBRARY

and trapping of air currents and breeze are the primary considerations.

6.3 CLIMATIC EVALUATIONS FOR THE TROPICAL CLIMATE

The interraction of solar radiation with the atmosphere and the gravitational forces together with the distribution of land and sea masses produce an almost infinite variety of climates. However, certain zones and belts of approximately uniform climate can be distinguished. It is essential for the designer to know and consider the character and location of these zones as they are indicative of climatic problems he is likely to encounter.

The classification of the tropical climate is based on the two atmospheric factors which dominantly influence human comfort, air temperature and humidity. The main interium is that extremes of these two features are likely to cause discomfort. Accordingly, the tropical regions of the earth are classified as follows:

6.3.1 The Hot Humid Climate

This is subdivided into two:

6.3.1.1 Equotorial Hot Humid Climate

Hot humid climate are found in a belt near the equator extending to about 15°N and examples of cities in this region include Lagos, Dare-Salam, Mombasa, Colombo, Singapor etc. There is a very little seasonal variation throughout the year, the only punctuation being that the periods with more or less rain and the occurrence of dusty winds and electric winds, it is characterised by the following climatic conditions:-





COOL ZONE Hackarregen, Stockholm



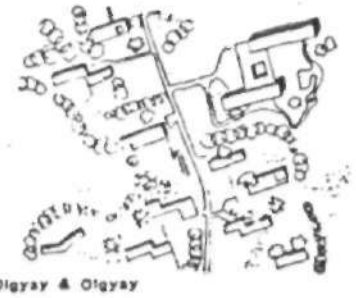


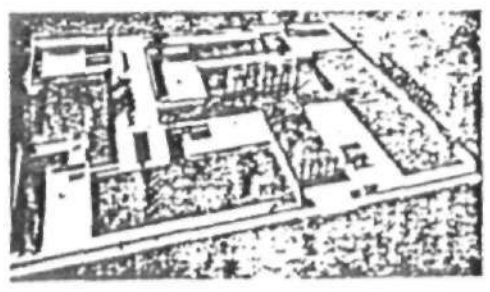
TEMPERATE ZONE Furno & Harrison, East Norwich, L.I., N.Y.





HOT-ARID ZONE Wiener & Sert, Chimbote, Peru





HOT-HUMID ZONE Olgyay & Olgyay

Fig. 24 Figure shows influence of climate on site planning of various environments -with comparims with Cool/temperate Zones.

Air Temperature: Air temperature in the shade reaches a mean maximum during the day of between 27°C but occasionally, it may exceed the latter value. At night, the mean minimum varies between 21 and 27°C. Both the diyrnal and annual ranges of temperature are quite narrow.

Humidity: Relative humidity remains high at about 75% for most of the time, but it may vary from 55 to almost 100%.

Precipitation: This is high throughout the year, generally becoming more intense for several consecutive months. Annual rainfall can vary from 200 to 500mm and may exceed 500mm in one month - the wettest month. During severe storms, rain may fall at the rate of 100mm/h for short periods.

Sky conditions: Fairly cloudy throughout the year, cloud-cover various between 60 and 90%. Skies can be bright, with a luminance of 7000cd/m^2 or even more when it is thinly overcast or when the sun illuminates white cumulus clouds without itself been obscured. When heavily overcast, the sky is dull.

Solar Radiation: It is partly reflected and partly scattered by the high vapour pressure of the atmosphere; therefore, the radiation reaching the ground is diffused but strong, and can cause painful sky glare. Cloud and vapour content also prevents or reduces outgoing radiation from the earth and thus the accumulated heat is readily descipated.

Wind Velocities: These are typical low calm periods very frequent, but strong winds can occure during rain squalls. Dusts of 30m/s is found and there are usually one or two dominant directions.

Vegetation: The red of brown laterite soils are generally poor for agriculture. The subsoil water table is usually high and ground may be water logged.

Special Characteristics: High humidity accelerates mould and algae growth; this brings about rushing and rotting and organic building materials tend to decay rapidly.

6.3.1.2 Island Hot Humid Climate: Islands within the equatorial belt and the trade winds zone belong to this climate type. Typical examples are the Carribeans, Philipines and other island groups and the Pacific ocean. Seasonal variations are negligible. It is characterised by the following conditions:

Air Temperature: This reaches a mean maximum of between 29°C and 32°C and rarely rises above skin temperature. Night mean minimum can be as low as 18°C, but it is normally between this figure and 24°C. The Diurnal range is rarely more than 8°C, and annual range of only 14°C.

Relative Humidity: This varies between 55% and almost 100%, the vapour pressure being between 1760 and 2500N/m^2.

Precipitation: High, 1250 to 1800mm per annum and 200-250mm in the wettest month.

Sky Conditions: This is normally very clear or filled with white broken clouds of high brightness, except during storms when the sky are dark and dull. Clear blue skies are of low luminance between 1700 to 2900cd/m^2.

Solar Radiation: This is strong and mainly direct with a very small diffuse component when the sky is clear, but various with cloud cover.

Winds: The predominant trade wind blows at a steady 6-7m/s and provides relief from heat and humidity. Much higher velocities occur during sea blows.

Special Characteristics: The tropical cyclones or hurricanes with wind velocities from 45 - 75m/s which constitutes a serious seasonal hazard. The high salt content of the atmosphere encourages corrosion in coastal areas.

6.3.2 The Hot Dry Climate

This is subdivided into two as well:-

6.3.2.1 Semi Desert Hot Dry Climate: This climate occurs in two belts between approximately 15° and 30° North and South of tje equator. Examples of settlements in this zone include Baghdad, Allice Spring Phonix. Two marked seasons occur in this area, a hot and somewhat cooler period and it is characterised by the following climatic conditions.

Air Temperature: The shade rises quickly after sunrise to a day time mean temperature maximum of 43 or 49°C. During the cool season the mean maximum temperature ranges from 27 - 32°C. Night time mean minima are between 24 and 80° in the hot season and between 10 and 18°C in the cool season.

Humidity: This varies from 10% to 55% as the wet bulb depression is large. The vapour pressure is normally between

between 750 and 150N/m^2.

Precipitation: This is slight and variable throughout the year, from 50 to 155mm per annum. Flash storms may occur over limited areas with as much as 50mm rain in a few hours but some regions may not have any rain for years.

Sky Conditions: These are normally clear. Clouds are few due to the low humidity of the air. The sky is normally dark blue with a luminance of 1500 - 2500cd/m^2 and further darkened during dust or sand storms to 850cd/m^2 or even less towards the end of the hot period; dust suspended in the air may create a white haze, with a luminance of 3500 - 10000cd/m^2 which produces a diffuse light and painfull glare.

Solar Radiation: This is direct and strong during the day, but the absence of cloud permits easy release of the heat stored during the day time in the form of long wave radiation towards the cold night sky. Diffuse radiation is only present during dust haze periods.

Winds: This is usually local. Heating of the air over the hot ground causes a temperature inversion and as the lower warm air mass breaks through the higher cooler air, local whir/winds are often created. Winds are hot, carrying dust and sand and often develop into dust storms.

Vegetation: This is sparse and difficult to maintain of the lack of rain and low humidities. The soil is usually dusty, strong sunlight illuminating a highly reflective light coloured and dry ground can create a luminance of 20,000 to 25,000cd/m^2. Soil dries quickly after rain and would generally be fertile if irrigated. The subsoil water table is low.

Special Characteristics: During certain months, dust and sand storms may be frequent; the high day time temperatures and rapid cooling at night may cause materials to crack and break up.

6.3.2.2 Desert Hot Dry Climate: These are regarded to be amongst the most unfavourable climates of the earth. Typical example include Autofagesta Karachi and Kuwait. There are two seasons, a hot one and a somewhat cooler one. It is characterised by the following climatic conditions:-

Air Temperature: In the shade reaches a day time mean maximum of about 38°C but in the cool season, it remains between 21°C and 26°C. The night time mean minimum temperature of the hot season ranges from 24 to 30°C and cool season from 10 - 18°C.

Humidity: Steadily high between 50 and 90% with vapour pressure of 1500 to 2500N/m^2 as the strong solar radiation causes strong evaporation from the sea. The moisture is however not precipitated but remains suspended in the air creating intensely unfavourable conditions.

Precipitation: Low as in other desert regions.

Sky Condition: Little clouds occur in the form of thin transparent haze which is likely to cause glare.

Solar Radiation: This is strong with a high diffuse component than in semi-desert climate due to the thin clouds and suspended moisture.

Winds: Winds are mostly local coastal winds caused by the unequal heating and cooling of land and sea surfaces. These tend to blow off the sea towards the land during the day and in the inverse direction during the night.

Vegetation: This is sparse, not more than some dry grass. The ground and rocks are brown and red, it is dry and dusty throughout the year. Ground glare can be intence.

Special Characteristics: Dust and sand storms may occur. The salt laden atmosphere accelerates corrosion.

6.3.3 The Hot Dry Climate

This climate usually occurs in large land masses sufficiently far from the equator. There is a marked seasonal changes in solar radiation and in wind direction. Examples of cities with composite climates include Kano, Zaria, Lahore, New Delhi, Madalay etc. This season occurs here normallu approximately two thirds of the year is hot and the other one third is ward humid. Localities further north and south often have a third season best described as cool dry. It is characterised by the following climatic conditions:

SEASONS	HOT DRY	HOT HUMID	COOL DRY
Day time Mean Max.	32-43°C	27-32°C	Upto 27°C
Night time	21-27°C	24-27°C	4-10°C
Diurnal Mean	11-22°C	3-6°C	11-12°C

Humidity: Low throughout the dry periods at 20 to 55% with a vapour pressure of 1300 to 1600N/m^2. During the wet period, it rises from 55 to 95% with a vapour pressure of 2000 to 2500N/m^2.

Precipitation: The monsoon rains are intense and prolonged occasionally 25 to 38mm can fall in an hour. Annual rainfall varies from 500 to 1300 with 200 to 250mm in the wettest month. there is little or no rain during the dry season.

Sky Conditions: Vary with seasons. The sky is heavily overcast and dull during the monsoons and clear with a dark blue colour, in the dry season. Towards the end of the hot dry season, the sky becomes brighter and frequent haze. The intensity of sky glare varies strongly.

Solar Radiation: Alternates between conditios found in the warm humid and the hot dry desert climates. Winds are hot and dusty during the dry period. Directional changes in the prevailing winds at the beginning of the warm humid season brings rain, clouds and humid air from the sea. Monsoon winds are strong and steady.

Special Characteristics: Seasonal changes in relative humidity causes rapid weakinng of building materials. Dust and sand storms may occur. Termites are common, occasional condensation problems also occur.

6.3.4 Tropical Upland Climate

Mountainous regions and plateaux, more than 900 to 1200m above the sea level. Experiences such climates, between the

two 20°C 150 therms. Examples of cities in such regions include Addis Ababa, Bogota, Mexico City and Nairobi.

Seasonal variations are small in upland climates near the equator, the seasons follow those of the nearly low lands. The upland climate is characterised by the following conditions:

Air Temperature: This decreases with altitude. At an altitude of 1000m, the day time mean maxima may range from 24 to 30°C and the night time mean minima are around 10 to 13°C. At some locations, it may fall below 4°C and ground frost is not uncommon. The day and night diurnal range is great. The annual range depends on latitude at the equator. It is slight, but at the tropics of cancer capricon, it may be 10 - 20°C.

Humidity: This varies between 45 and 99% and vapour pressure between 800 and 1600N/m^2.

Precipitation: This is variable, but rarely less than 1000mm. Rain often falls in heavy concentrated showers reading an intensity of 80mm per hour.

Sky Conditions: These are normally clear or partly cloudy to the extent of about 40% during the monsoon rains and sky is overcast, heavy and low.

Solar Radiation: This is strong and direct during the clear periods, stronger at the same latitude but at sea level. Ultra violet radiation especially is stronger than at the lower altitudes. It becomes more diffuse as cloud cover increases.

Winds: These are variable predominantly north-east and south easterlies, but may be drastically deflected by local topography, wind velocity exceeds 15m/s.

Vegetation: Vegetation is green. Although not very Luxurant during the wet season. The soil may be damp in the rains but dries quickly.

Special Characteristics: Heavy dew at night, strong radiation loss at night during the dry season which may lead to the formation of radiation fog. Thunder storms with a far proportion of electric discharges occur. Hail may also occur. Generally, the different subzones of the tropical zones have different climatic characteristics which thus present different challenges to the designer. This has already been enumerated. the different climatic characteristics possess different problems to be overcomed.

The tropical climate has effect on building site, the man and the building which he lives in and the building materials as well. The subsequent stage is the effect on building materials which the thesis centralised.

SCHEMATIC BREAKDOWN OF CLIMATIC EFFECTS

(Plate) from the breakdown of the effects of climate, five design considerations can be deduced for the tropical architectural designs.

These are:-

1) Site consideration;

2) Climatic effect on man and buildings;

COMPARATIVE ANALYSIS OF SHADING DEVICES

TYPE OF CONTROL	PERCENTAGE REDUCTION IN TOTAL HEAT GAIN	PERCENTAGE EFFICIENCY TO ENSURE CROSS -VENTILATION	PERCENTAGE OF NATURAL LIGHT RESULTING FROM CONTROL	APPROX. AVERAGE EFFICIENC AS MEANS OF CONTRO
Curtains	10-20	5-25	30-50	35
Metal Venetian blinds	20-30	5-90	5-75	64
Heat Resisting glass (coloured)	60	70 (presumed)	40	57
Roof or Corridor Overhang	75-80	80-100	40	69
Concrete hood and fins	70-80	80-100	40	70
Louvred hood	87	80-100	77	84
Vertical louvres	70-80	10-50	45-65	54
Horizontal louvres	70-80	15-50	45-70	53
Suspended louvres	80-85	80-100	70-80	82

TABLE 4 The types of solar control devices used depend on the various requirements needed to reduce heat to maintain adequate ventilation effect of device on internal lighting etc a comparative analysis is given above.

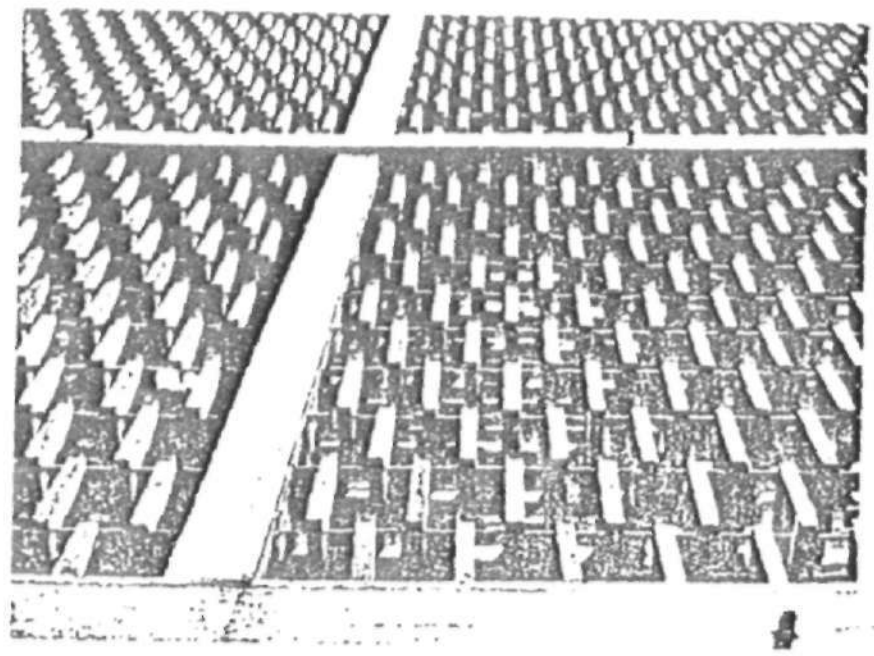


PLATE 5A

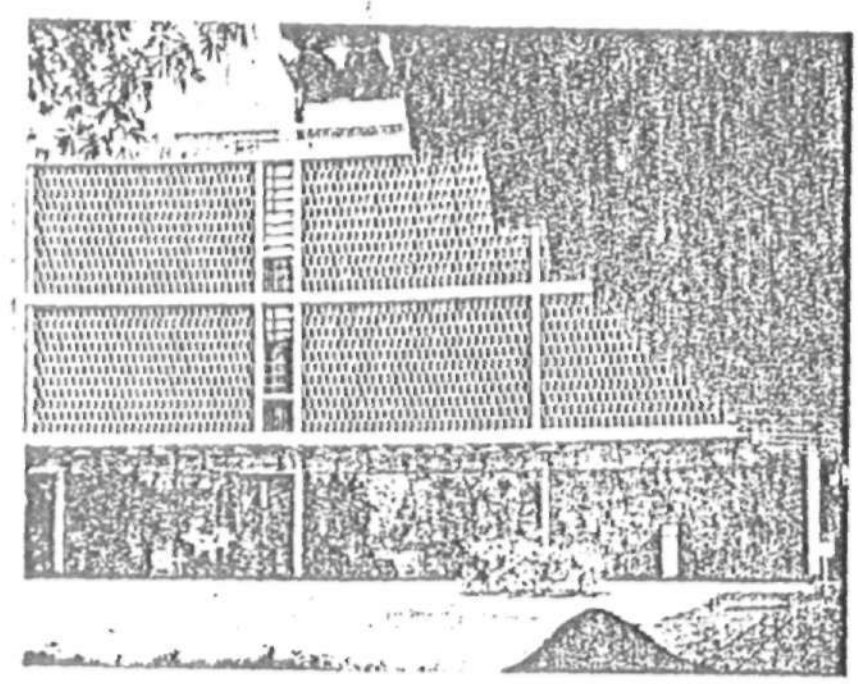
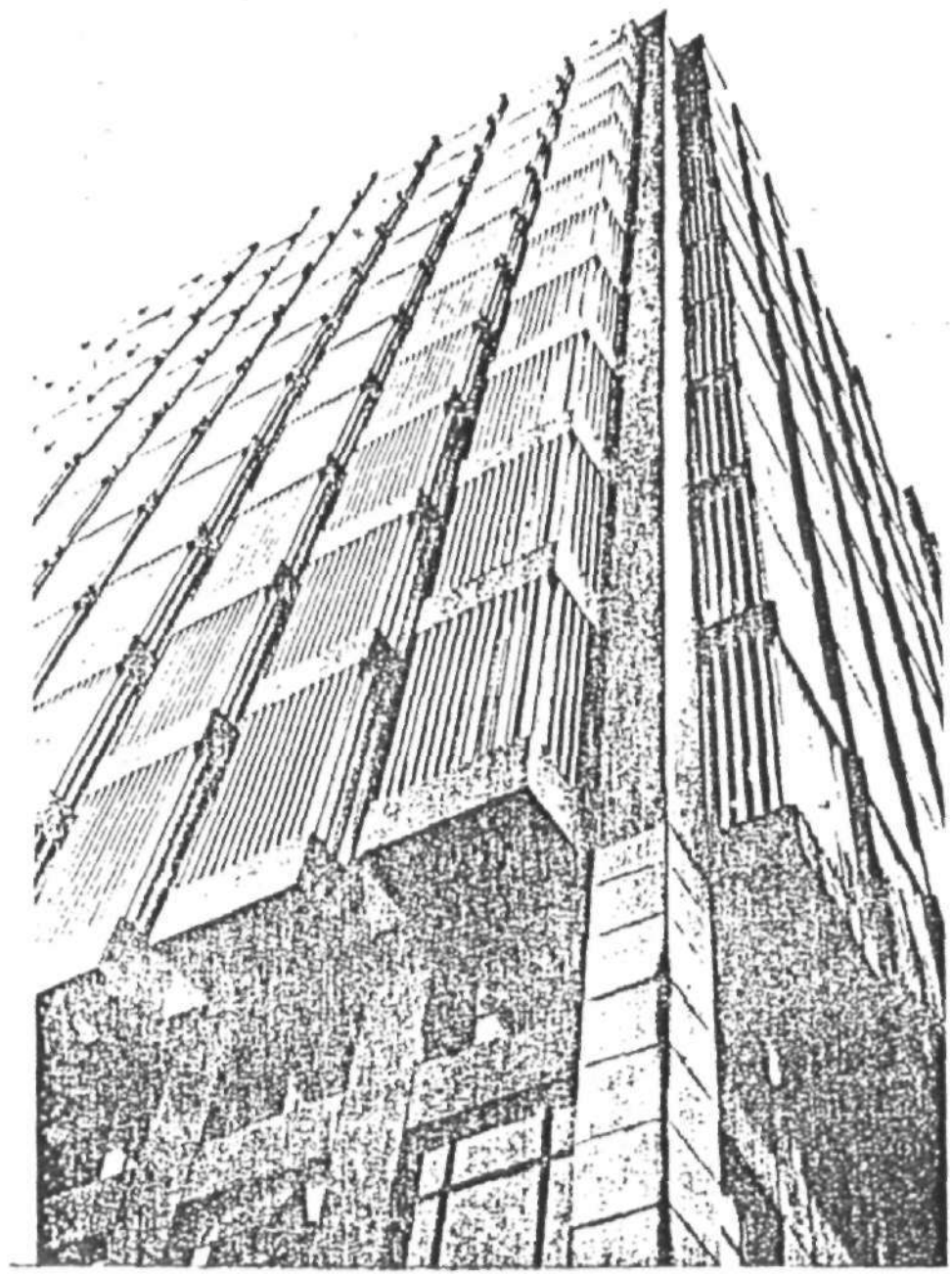


PLATE 5B(D) Use of brick projection and screen against sun. - Architectural attempts to combat the effect of climate.



. PLATE 6 Use of Aluminium channels for protecting against sun and at the same time taking in enough light.
-Also potray evidences or respond to Climatic influence.

M IBRAHIM LIBRARY

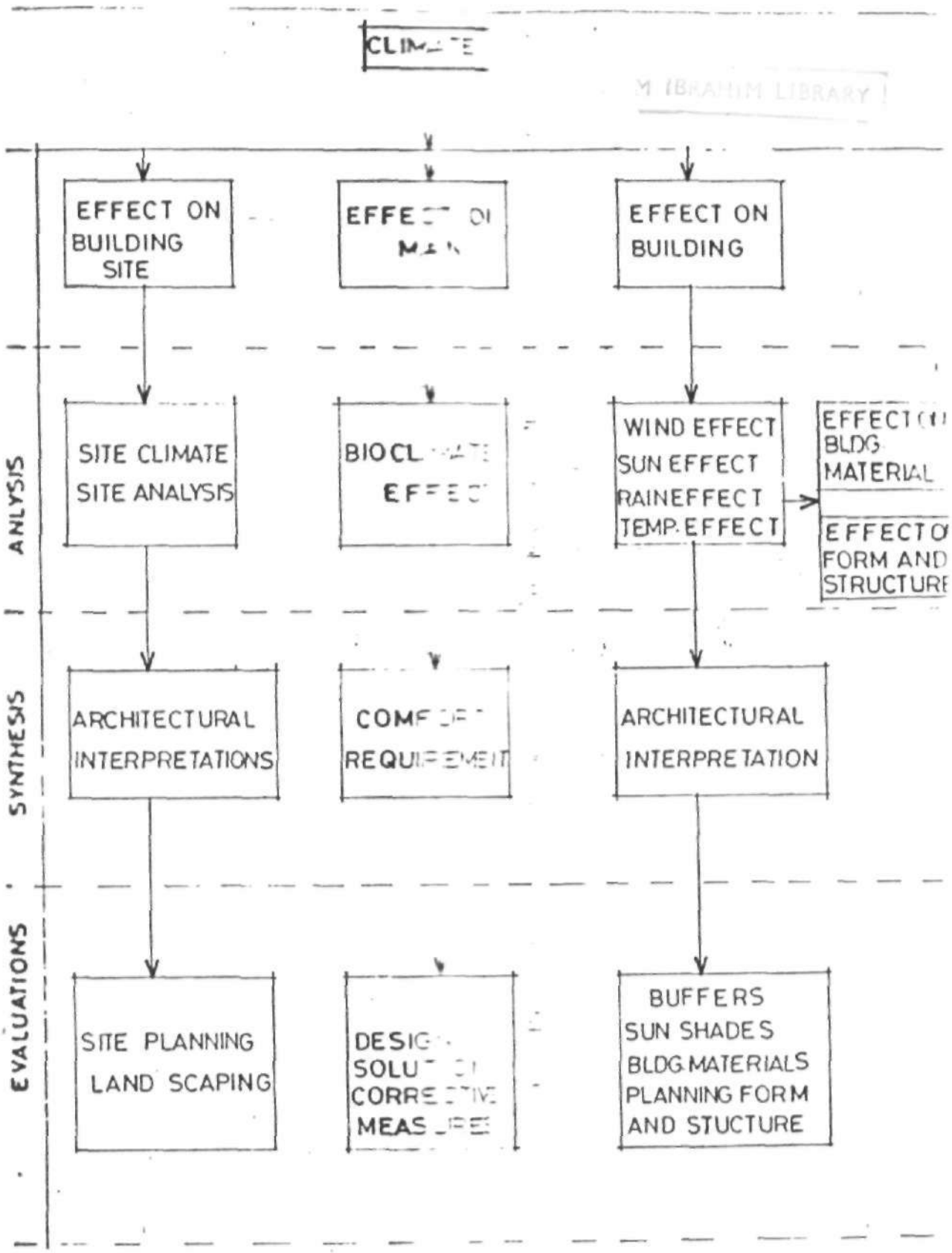


TABLE 5 -Schematic breakdown of climatic effects.

3) Building material considerations;

4) Form and structure considerations;

5) Site planing and landscaping.

This thesis however intend to only consider the building materials alone which follows subsequently.

6.4 EFFECT OF TROPICAL CLIMATE ON BUILDING MATERIALS

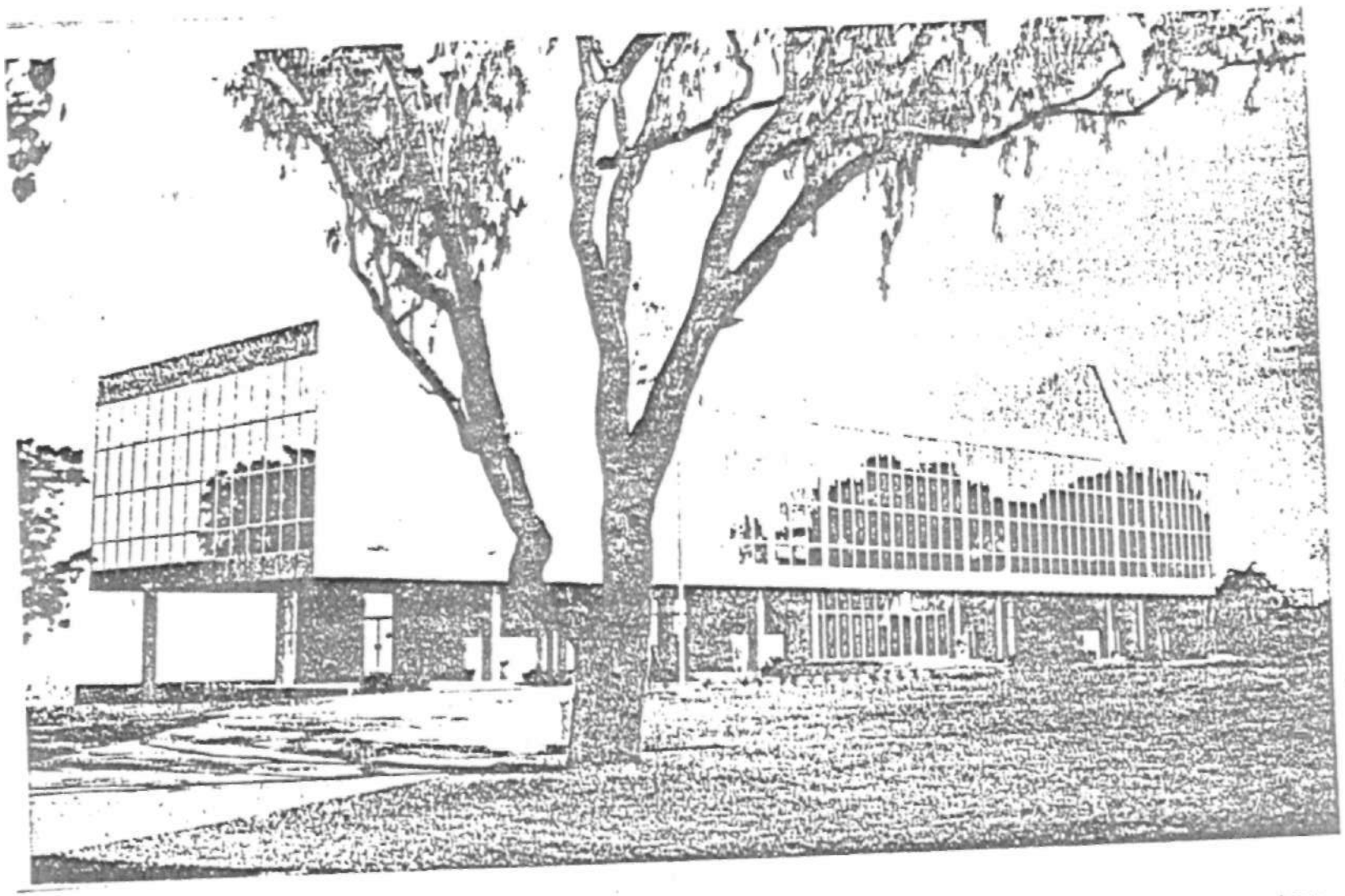
One crucial component of the basic design consideration in tropical architectural designs is the building materials. It is necessary for a designer to make a careful study of the available building materials thereby arriving at the suitable or appropriate materials to be utilised in his environment or even his site to achieve great comfort, durability of buildings and also less cost and inconveniences of construction.

Building materials are said to vary in performance and characteristics as such they respond alot to the natural influence of climate. A building material which is found to be ideal in the tropics may perform very badly when used in a temperate zone or vice versa. When considering building materials for a particular design, the aesthetic value of that material should not be allowed to supercede the behaviour of the material in a given environment. There has to be a natural balance between aesthetics and performance. If this is not obeyed, alot of problems will surely arise by increase in the cost of construction. Inconveniences of erection etc. for example in the United States, despite the great variation in climate, one will find out that building materials are almost same for all the regions, popular materials being glass, steel and concrete. This shows that the performance of this building materials within the various climates were overlooked just to achieve an aim of beauty and good aesthetics. This is

actually unrealistic as alot of money and time have to be spent to make sure that such materials (which are not in alignment with the climatic conditions) are adapted to the environment in which they are used. e.g. when designining a building in the tropics, and glazed/curtain wall are employed, throughout, great effort will have to be made to make sure that solar penetration and glare is eliminated. This will involve cantilivering of floors projecting of fins to serve as shading devices etc. This gives a drastic increase in cost of the building and in fact the material may not survive in the environment for long despite the spending, and there is likely to be more spending of money in the course of maintenance. Some finishes, however, the functions of a particular building might require the use of particular building materials but there is always a way of balancing the function with the cost and the building materials employed as well as vyming with the climate. Most designers tend to forget this.

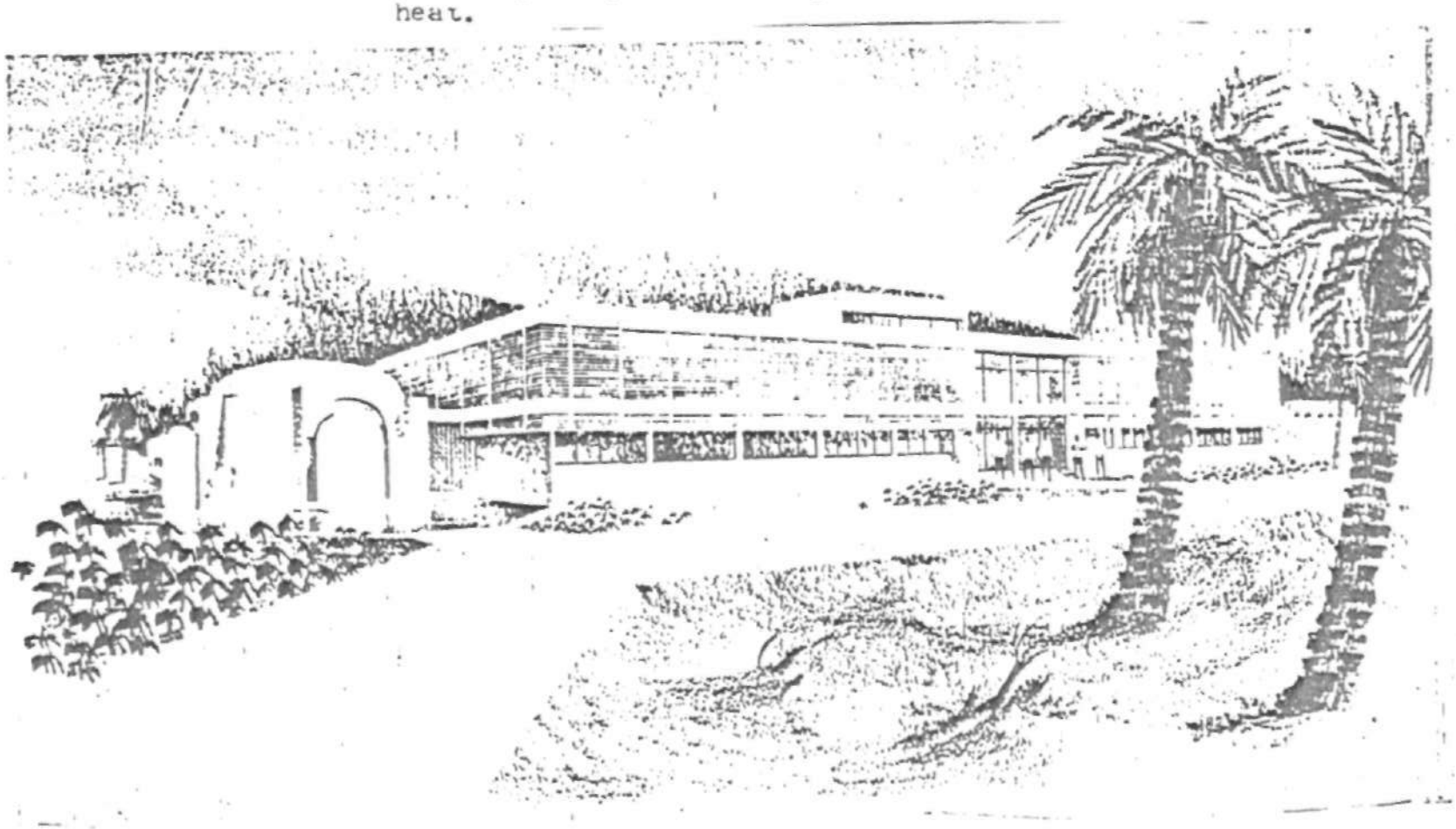
To make this point clearer, a typical example will be considered:-

The example is a building designed by C.P. Kukreja, an architect and writer, which he illustrated in his book - Tropica Architecture. The building was supposed to be a Union Carbide Research Centre at Bhopal, India. He made use of completely glazed external envelope and the building is situated in a hot climate. This gave tise to a lot of problems of glare, radiation and so on. He claimed that he wants to enable the occupants to have uninterrupted view of a lake around the site as such he employed a reflective film treatment on entire facade to reduce glare and heat. This might be very expensive



Materials for buildings needs careful selection for best results. here a research center in India was made of glass totally and reflective film treatment on entire faced was used to reduce glare and heat this is not the best solution (see text).

PLATE 7 (a) Use of timber battens to completely enclose building for protection against excessive solar heat.



and the glass might even start cracking with time as a result of excessive daily heat. This shows that he disregarded other problems likely to arise in an attempt to achieve design function in a way choosen by him. This eventually increased cost of construction and cost in the use which is not sound architecturally. A better way of achieving the same function would have been to limit the glazing to strategic points and covering the remaining area with a cheaper and more feasible material so that shading devices can be applied at points of glazing. The original function aimed at would still be achieved but in a more convenient and economical way. (See Plate).

The application of reflective film or the like on glass to reduce heat and glare is just like an after-thought. It is better to approach design problems from the grassroot observed with other building materials e.g. the application of bituminous felt in concrete roofs of the tropics to prevent them from cracking and leaking instead of using a better roof right from the sketch design stage.

From these, one can see that building materials deserve proper study and analysis of selection for avoidance of wear and tear in their usage. The analysis and proper choice of building material is very necessary and it is a task on the designers neck.

Two basic things have to be considered when materials are selected for building in hot climate - availability and performance/feasibility. There are obvious advantages in using local materials, although the extent and rate of deterioration of building materials is caused in part by design, workmanship and use. Environmental factor has a major influence and have a profound effect on the durability and

behaviour of materials and structures. Materials which last well in hot dry condition may simply not be suitable in warm humid conditions (as mentioned earlier). Moisture, temperature, ultra violet radiation and salf laden winds can all have detrimental effect on materials and two or more of these elements acting together almost invariably produce greater deterioration if they were acting independently. Not only must the materials used be suitable for the specific climatic conditions involved but the design and detailing must be appropriate to both the materials and the climate conditions.

In the tropics, various types of building material and techniques of construction have been evolved through the architectural developments that took place during the last century as a result of industrial revolution in Europe. Secondly, there are the traditional techniques which uses the outline of experience passed down from generation to generation. Very often these two systems may be found side by side as for example in new housing projects in Asia and Africa. Exogeneous ideas and techniques were applied in the tropics with varying degrees of understanding and these have been modified, subsequently - process which still continues. The general performance of some common building materials availably use are discussed below. The durability of the materials is greatly affected by local weathering agents. The most common causes leading to the deterioration are moisture, solar radiation, fungus growth and termites.

6.4.1 TIMBER

Availability: Timber is abundant in most of the hot humid regions with the exception of hot dry zones where all the timber and most timber products have to be imported (cheap board, plywood etc).

Performance: The characteristic of timber vary greatly from one region to another and timber should be selected carefully keeping in mind the task it has to perform.

Use: Timber for use in building should always be properly seasoned and dried to approximately its equilibrium moisture content in use. although this is necessary for all climates. Failure to do so can cause exaggerated problem in hot dry climates.

On its external use, preservative strains should be used rather than paints or varnishes which tend to deteriorate fairly rapidly in the hot zones. All woodwork should be vacuum/pressure treated, as most of the hot areas are within termite zone. Sapwood is particularly vulnerable and should never be used unless treated. Plywood is being used increasingly in the tropics; it should be used only for indoor construction because it splits and warps if subjected to rain followed by exposure to hot sun.

Problems and Durability: In hot dry zones, deterioration is usually caused by the extreme climatic conditions. Continuous dimensional changes provide check, splits, warping and raising of the grain. Distribution of timber in these climates can be severe. Wind blown sand and grip gradually erode exposed timber. In warm humid zones, timber is susceptible to wet

and dry rot and to attack by termites and beetles, thus proper preventive measures should be taken against deterioration.

6.4.2 EARTH/MUD

Availability: Thanks to the low cost, the most common material of rural construction in the tropics is earth or mud. It is widely used in hot dry lands. Earth walls have dictated both the construction and design of dwellins in various regions of the tropics for many centures, some areas do not have soil containing enough clay for the purpose. Earth has been used not only for walls but also for roofs, mud brick, vaults and domes are common in countries like Iran and Egypt.

Use: Pise and adobe are two main construction methods used pure monolithic construction - where damp earth is laid between formwork and compacted by ramming, high sand content density and low moisture content after ramming reduces problem of cracking. Walls need to be thicker than for adobe. Adobe construction - where sun dried bricks which are allowed to shrink before being laid in the wall. Soil with ahigh clay content is required.

Problems and Durability: Surface cracking of adobe walls, high risk of termite damage in some areas which can be reduced by addition of a small amount of cement walls exposed to weathering and rain requires frequent repair. Some water proofing can be obtained by using cement or lime renderings. Earth can be stabilised by using small quantity of cement or bitumen.

6.4.3 MUD BRICKS AND STONES

Mud bricks either in their traditional form or upgraded and stabilized are materials of great potentials for domestic as well as public buildings. Centuries ago, people in Egypt and Pevia came up with simple economical solutions to the problems of using mud bricks to construct walls even roofs. In fact, mud bricks became the standard roofing system in both rural and urban areas in these countries. As mud bricks are small and can be easily cut and trimmed, they allow great flexibility so that adjustment can easily be made during the process of construction.

Availability: They are one of the most widely used building materials throughout the tropics. Bricks production is well established in many places. A number of factories produce bricks from indigenous materials.

Use: There is considerable differences in size, shape, material composition and quality. Brick can be used for walls, roofs and external facings without rendering and are more durable and can be used for load bearing walls but not more than one storey. It is used widely throughout the tropics especially hot and arid areas.

Problems and Durability: Particular in warm humid climates; some bricks may be suitable only for internal use. Clay bricks can be used. Strength and durability also vary with different regions.

Availability (Stones): A wide variety of building stone is found throughout the tropics with the exception of the low lands in warm humid zones and some sandy parts of the arid zones.

Use: Stone is used mainly as decorative facing and for landscape work as although the material is often cheap, but labour cost can be high. Both walls and roofs can be built with stone slabs, thus bring very bold regional character of architecture.

Problems and Durability: It can be difficult to find good Monsoon high temperature may sometimes cause cracking.

6.4.4 CONCRETE BLOCKS

A common concrete product is the sandcrete block, usually made from a particular dry mixture of cement arid, a fine aggregate such as sand, mixed in a hand tamping machine. To reduce its weight and to save materials, the block could be made with a core. Where cement is relatively cheap and sand readily available, sandcrete blocks are likely to remain popular building materials.

Availability: The scarcity of natural clay deposits is in many places, e.g. in the Middle East, this has led to the wide spread of locally manufactured blocks.

Use: Both solid and hollow blocks are available, quality tend to be low when use as load bearing walls. concrete blocks are better as partitions especially in multi-storey buildings. Concrete blocks can be manufactured on site to keep maximum control of quality.

Problem and Durability: Cracking due to shrinkage caused by temperature fluctuations. Surfaces exposed to driving rain limited impermeability and should be rendered.

6.4.5 CONCRETE

Concrete and reinforced concrete are widely used throughout the tropics. Cement is manufactured locally in many places and imported at a very high cost. Sand is found almost everywhere but may be contaminated with soluble salts. Gravel is difficult to comeby in some areas and problem can arise with transportation which may be eratic and unreliable. The large amount of water needed can be present. The greatest difficulty is in hot arid areas, where much of the available water is either salty or brackish and considred unsuitable for concrete work.

Use: When used in hot climate, it can deteriorate rapidly as a result of minerals, water, bad workmanship and climate. High temperature accelerates the chemical reaction taking place. Large diurnal temperature differences cause considerable movements. Hot winds can dry the concrete too rapidly and high humidity can saturate it. Expert advice should be sought. The use of sulphate resisting cement may be required. Water and aggregates must be closely controlled. Simple testing must be constantly performed.

Problems and Durability: In areas of high humidity, concrete may set prematuredly. Considerable movement can lead to pronounced cracking either in the concrete itself of in the adjacent parts of the structure. Salts in aggregates and water can cause corrosion of the reinforcement and consequently spoiling of the concrete cover.

In hot dry areas, the rapid evaporation and storage of water makes curing difficult and can result in low strength, cracking and high permeability. Damage to concrete near or

or below ground due to salts or humic acid (in hot humid areas) present in the soil.

6.4.6 PLASTER

Availability/Use: This is used everywhere. Sand-cement plaster is the most commonly used. However, lack of skilled plastering in many places make the use of lime and gypim difficult because of their fast setting in high temperature. When used, require careful application by skilled men.

Problems and Durability: Sand-cement plaster are bristle and have a high drying shrinkage rate accelerated by improper curing. They are therefore vulnerable to cracking.

6.4.7 METALS

Availability: With some exceptions, all metals required for building have to be imported in finished form. In some places, door and window frames are made up from imported sections.

Use: There is no excessive corrosion of most metals in hot dry climate (except in coastal zones). Alluminium and copper have good durability in all climatic regions if correctly used. The use of profiled galvanized iron is very widespread in the tropics but is generally unsuitable for very hot climate.

Problems and Durability: Corrosion due to high humidity in warm wet zones and the combination of high temperature, high humidity and salt laden air in tropical maritime areas produces severe conditions in this respect. There used to be fatique, cracking of metals used as flashing and other exposed positions.

6.4.8 ASBESTOS CEMENT

Availability: Locally manufactured in many of the non-temperate parts of the world.

Use: Widely used as roof covering and wall cladding as well as for sun-screening, components and low-pressure piping systems (especially for soils having a high salt content).

Problems and Durability: In warm humid regions, algae tends to grow on damp sheets and lead to blackening. Sheets tend to become brittle and can be damaged by hail. High breakage rate when materials have to be transported over long distances.

6.4.9 GLASS

Availability: Widely used and freely available, but imported almost everywhere. Transport cost and wastage are high.

Use: Large glass area are justifiable if properly shaded or in regions where solar radiation is required during the cold season.

Problems and Durability: Wind-blown sand causes etching and abrasion to the glass in arid areas. Some of the special heating absorbing glasses can crack if provision is not made for expansion or if the glass is unevenly heated.

6.5.0 PLASTICS

Availability: Although many of the countries in question have abundant resources of the basic raw material - oil. Plastics are usually imported from highly industrialised countries.

Use: Although, plastics offer many advantages over conventional materials, the climate of the tropical zone does not favour their use externally. The insulation provides a glass fibre and some of the formed plastics such as expanded polytyrene and urethane can be used to advantage. Other major potentials are for water services, floor covering and electrical fittings.

Problems and Durability: Deterioration starts by ultra violet radiation and accelerated by high temperature. Plastics is far less durable in the hot climate available than in the temperate regions. As a result of their low resistance to abrasion, surface damage is caused by wind-blown sand. Some types are combustible and emit dangerous gases when burning.

6.5.1 PAINTS

Availability: Local production of some paints are in many places. Plastic-based paints are usually imported.

Use: The performance of most paints is poor in hot climatic regions. Exposure of paints to solar radiation and high temperature causes them to break down more frequently than in temperate zones. Frequent repainting is necessary and this may be kept in mind when comparing relative cost of various materials. Emulsion paints are likely to give best overall results in many instances as they allow surfaces to breath and permit trapped moisture to escape. This can be particularly important in humid regions. Like Wash - an excellent solar reflector and another advantage is its ability to emit long wave radiation - can be utilised for base paintings.

Problems and Durability: Storage in high temperature causes separation of ingredients. Paints may fail due to incompatibility with the surface it is covering.

In humid regions, oil-based paints (which seal the surface) may blister and peel off it moisture is trapped behind them. White paints tend to discolour within one year or two under very hot conditions, light tints may be preferable. Dark colours absorb more heat and tend to fade. Frequent changes between rainy and sunny conditions can cause chalking. Large and frequent changes in temperature result in brittleness and cracking. Lime wash if used alone is not very durable and has to be renewed regularly.

6.5.2 BITUMEN AND SEALANTS

Availability: Although bitumen is one of the by-products of oil refining, it is by no means much even in the oil producing lands. The specialised water-proofing systems, incorporate in most places.

Use: The life of these materials in the tropics is much shorter than in the colder parts of the world. Built up bituminous felt roofing system can be badly affected by fatigue, ultra violet degradation and water vapour build-up underneath the membrane.

Advice should be obtained from manufacturers to find a system appropriate to the specific conditions.

Problems and Durability: Repeated wetting and drying seriously affect visco-elasticity. Intense ultra violet radiation can result in materials becoming brittle and eventually cracking and crumbling. Heat causes softening and blistering, organic based felts can delay in warm humid conditions.

6.5.3 BAMBOO

Bamboo is commonly used throughout the humid tropics, for house construction. As bamboo is widely available in these areas, it is worth trying to develop it as a permanent building material. However, unless well stored, dried and protected from damp and termites, selected bamboo has a short life. Recently, research has been carried out both in India and in U.S.A. to use bamboo to reinforce concrete, even a partial substitution of bamboo for steel can lead to substantial savings and increase rural employment.

6.5.4 PALM FROND STEMS

Plam trees occur in varying forms and densities throughout the hot regions; the trunks of palm trees are often used for the construction of the basic framework of a house or a roof beams. Palm frond stems are ideal materials where high temperature and humidity make air movement vital. The stems of palm fronds can be used for non-structural panel curtain walls, screens and as a base for plastering (See Plate).

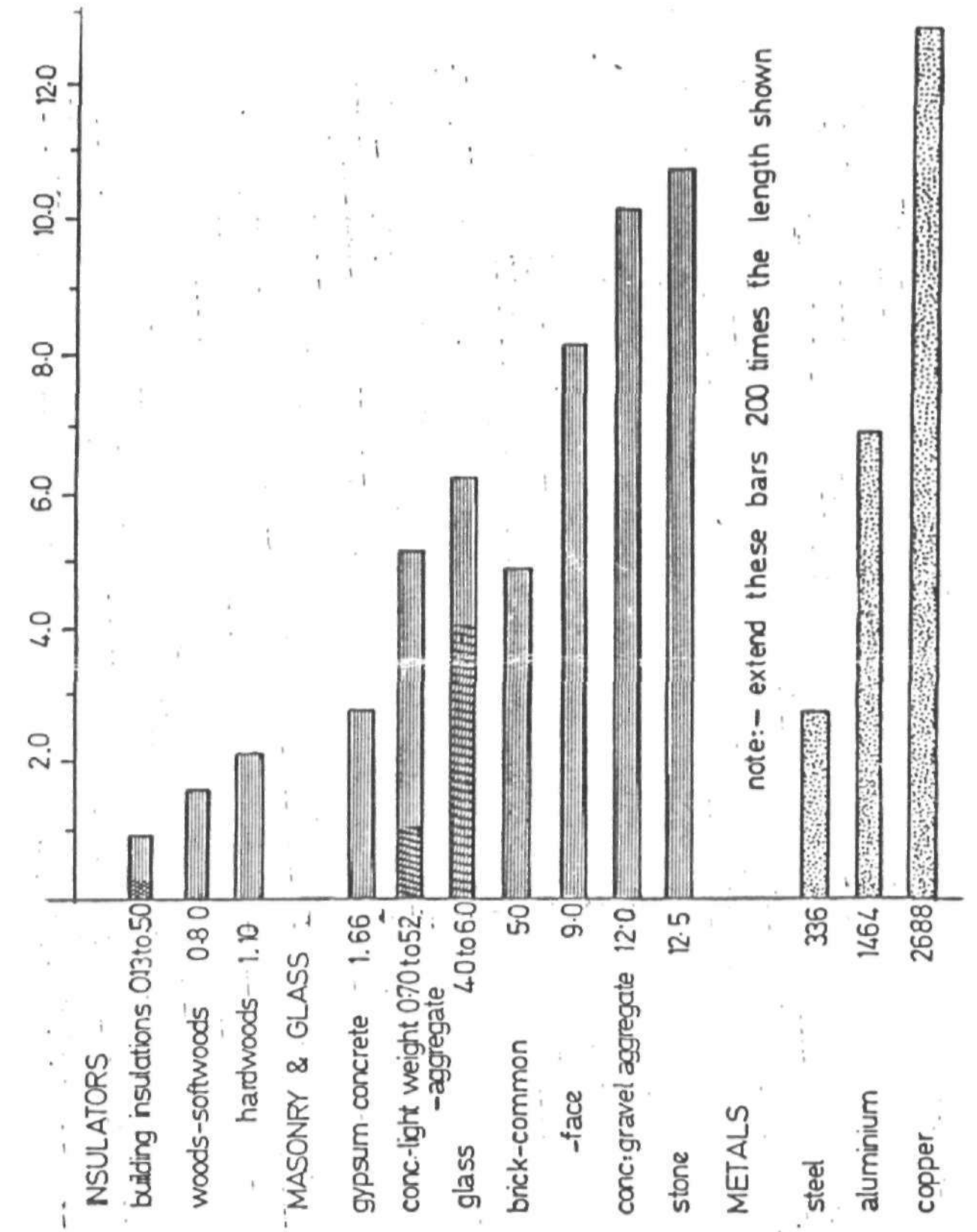


Fig 25 Chart showing heat conduction by different building materials.

6.6 SUMMARY AND CONCLUSION

In order to be able to choose the appropriate building material for a particular design, in a given environment, it is essential to have some knowledge of the properties of the building materials particularly the way they react to variations in temperature and heat flow, e.g. the extent of heat gained through conduction can be controlled reasonably well by an appropriate material and to do so, an architect must be familiar with the insulation values (k-values) of materials or their overall thermal transmittance or heat transmission eoefficients (Q-value) (See Plate).

6.6.1 Relationship of Material Structure and Climate

6.6.1.1 Frames: The use of structural steel can be confirmed to industrial buildings with most common structural system for a large building being a reinforced concrete frame work. Framework is most often of timber boarding erected by carpenters and any special sophisticated sluttering would probably have to be imported. Provision should be made for the structural movement which is caused by the intense solar radiation and large diurnal variation. In hot dry zones, there can be marked drop in temperature within a few hours once the sun sets, while in the humid areas, temperature can be reduced very quickly by a heavy downpour.

The stresses resulting from these continued rapid changes can cause bad cracks to develop sliding joints for instance, brick load bearing walls and concrete and expansion joints in reinforced concrete structures must be carefully planned

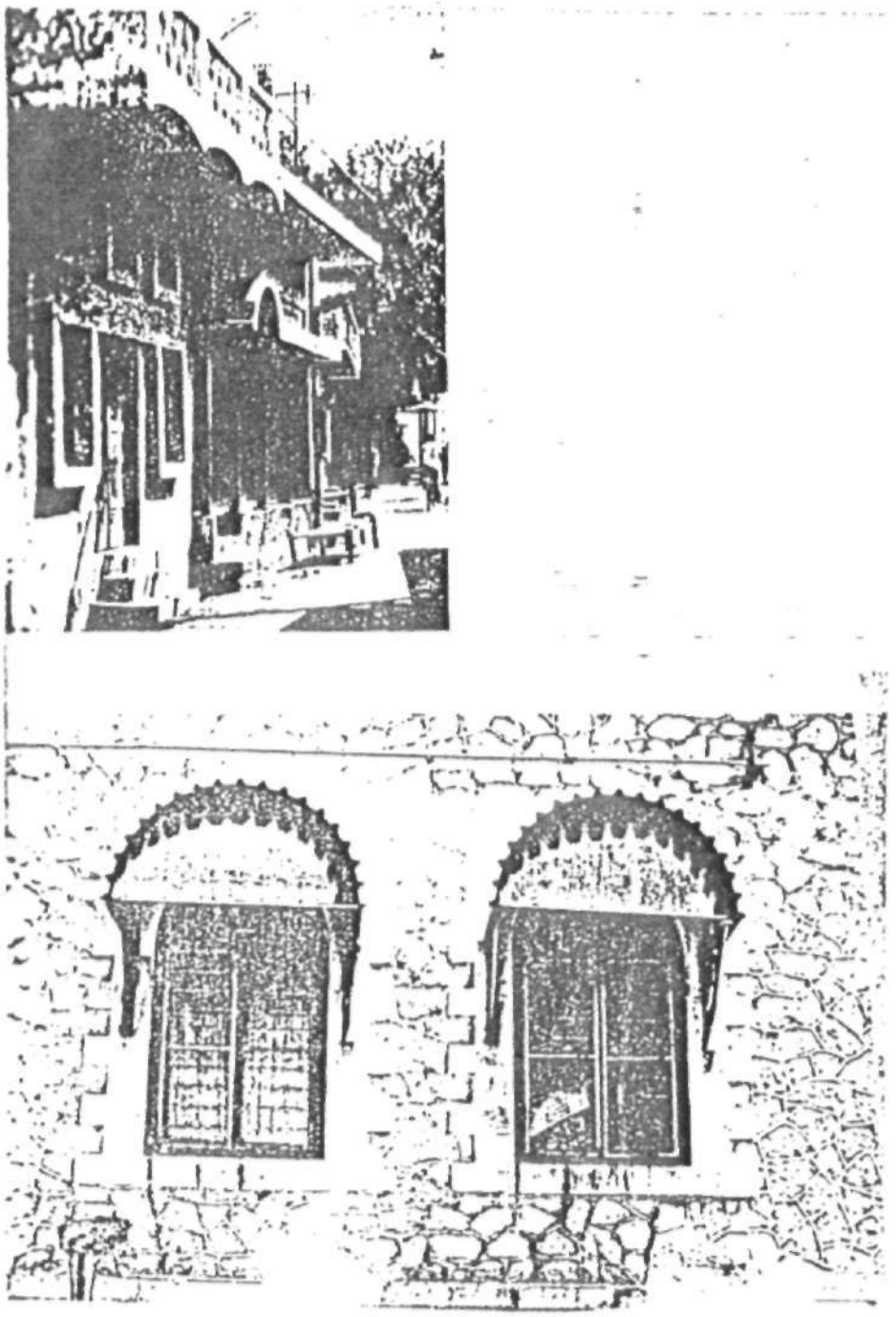
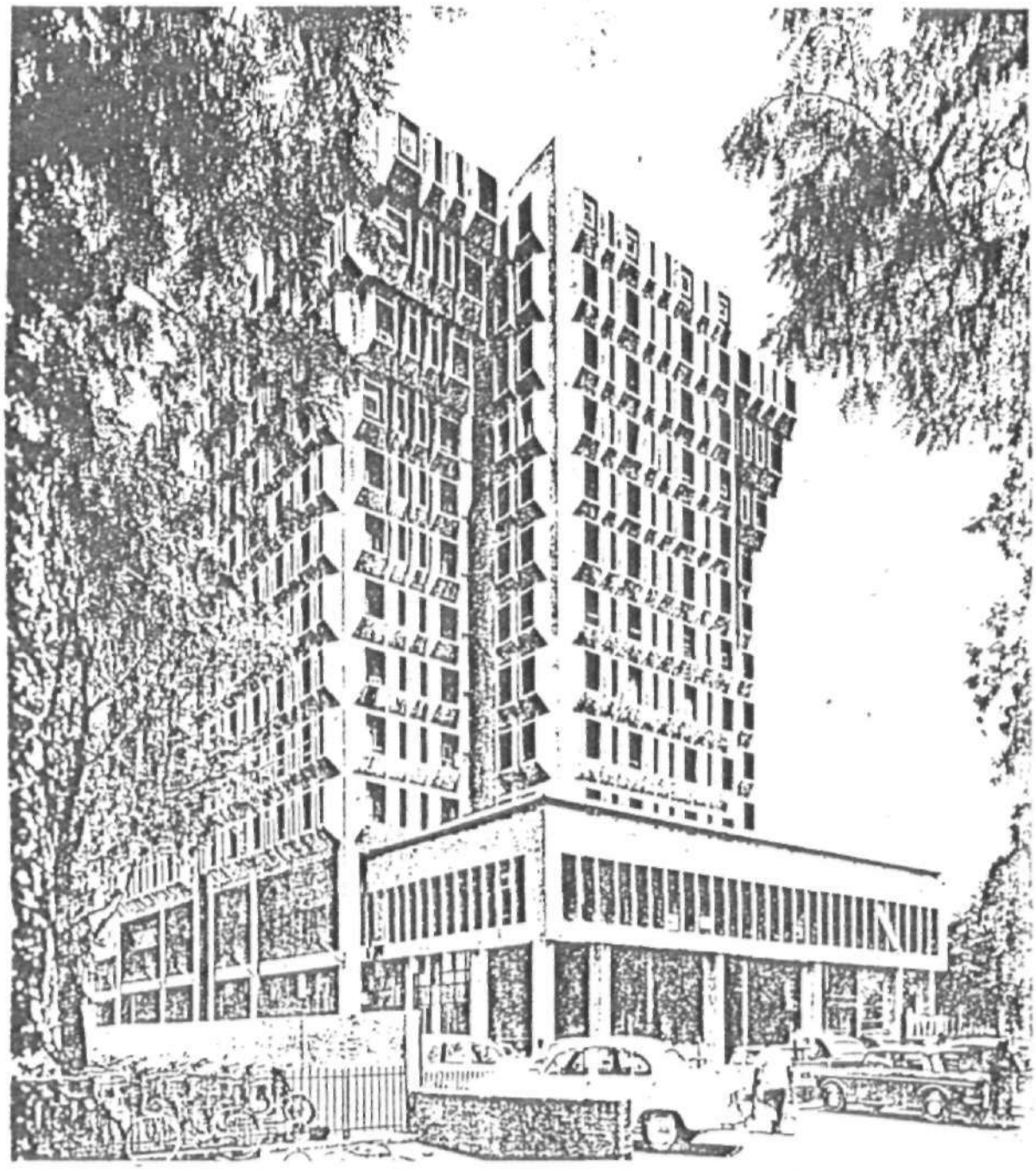


PLATE 8

Use of Roof or balconys and Sunshade over openings (made of corrigated Iron sheets. This also shows evident consideration of climate in the Design.



An office building showing an elegant facade treatment for sun protection. The outside open area is smaller than the actual window glazed area's thus reducing direct sun penetration.

and detailed. Fibrous materials together with suitable sealants can be used to fill the expansion joints.

6.6.1.2 Walls: In hot dry areas where heavy walls are called for, various types of claystone and brick have been traditionally used but have in many places been replaced by concrete or concrete blocks.

The simplest solution for the tropical zone is to follow tradition and to use the thickest suitable walls.

6.6.1.3 Roofs: Because of its orientation, comparatively, a large area and the difficulty of shading it from itense solar radiations, the roof is often a major source of heat gain in a building. It should, therefore, absorb, little radiant heat as possible and offer good resistance to heat from outside to inside.

Whatever the roof type, the use of reflective upper surface is important. The light weight roof construction, thermal insulation with a reflective upper surface at ceiling level is without doubt the most effective way of reducing room temperature.

As heat is transferred downward from its roof covering mainly by radiation and a convention plays a minor role, many researchers feel that natural ventilation of the roof space does not have much value. This does not mean that ventilation of roof space is unnecessary. It is, in fact, essential under certain climatic conditions to minimise the possibility of condensation and inside of the roof covering.

As a conclusion, it is very necessary for a designer to analyse various building materials available to find out the most suitable for a given environment and it is hoped that this chapter will serve the designer as a useful guide to achieve this aim.

CHAPTER SEVEN

EVALUATION OF DESIGN HYPOTHESIS

7.1 PROBLEMS SYNTHESIS

7.1.1 INTRODUCTION

In analysising the problems eminent in the design and the various solutions possible with available materials, a good solution will be systematically and schematically be arrived at.

This chapter aims at outlining the implications, on the design, of the problems drawn from the various analyses from the preceeding stages. It is from here that the zoning relationship can be established, which should not conflict, but compromise at least, if not agree with the functional relationship, and the form concept and planning techniques.

7.1.2 DESIGN IMPLICATIONS DRAWN FROM PRECEEDING STAGES

From the collected data on climatic conditions, one can deduce that the uncomfortable nature of the weather demands a careful choice of materials and construction methods with special emphasis on ventilation and orientation of buildings. A major design constraint here is the need to achieve a thermal comfort.

The impedence of heat loss from the human body and the subsequent inhibition of evaporative cooling caused by high humidity and temperature should be in consideration all through the stages of the design.

a. RAINFALL

Rainfall in Makurdi is often torrential with strong wind-storm, hence the need for a well designed drainage system for

the site. This should also include measures to prevent moisture from gaining entry into the interior and removal of any already inside.

Run-off from roofs over walls could increase the relative humidity of the interior or even damage walls and foundations. Introduction of roof gutters and high pitched roofs for speedy removal of water, and reduce if not prevent completely these damages. Rain carried almost horizontally by wind can be prevented from gaining entry by the avoidance of louvres. Projecting window sills can also aid drain off of such water.

Damp raising by capillary action from the ground increases interior humidity. provision of good damp-proof course (DPC) is very important.

b. TEMPERATURE

The temperature in Makurdi is well above the comfort values during peak periods. High temperatures cause thermal discomfort both within and outside buildings. Measures to be taken to control heat include:

1. USE OF SHADING DEVICES to prevent direct rays of the sun from gaining entry into the building.

2. THE PROPER LANDSCAPING of the ground and surroundings to keept the temperature low, provide shade and reduce glare. Grass covers can also lower temperatures by evaporative cooling effect and trees can cut the sun's rays from falling directly on buildings.

3. GOOD ORIENTATION of the buildings, openings away from the sun path, reduces possibility of direct entry of the sun's rays.

4. LIGHT COLOURS EXTERNAL FINISHES to eliminate or reduce heat gain by reflection.

5. A CAREFUL SELECTION OF MATERIALS which retard heat and are good insulators, can improve thermal comfort. Also minimal wall area should be considered all through the design stages.

c. SUNSHINE

Sunshine is synonymous with clear sky. In Makurdi, solar radiation is reflected from the sky and/or clouds due to high solar radiation and the presence of water vapour which traps the sun's rays and cause glare. Good landscaping in the form of lawns, meticulous planting of trees and good use of sola reflective materials can reduce the effects of solar radiation. Large openings should be avoided, but where not avoidable, the use of low overhanging eaves or wide verandahs are advisable, but care should be taken not to compromise day-lighting of the spaces. In effect, small but carefully positioned windows are preferred.

d. RELATIVE HUMIDITY

The relative humidity values for Makurdi exceed the comfort range especially during the season's transitional periods.

Maximum possible openings between 20 - 40% of walls surfaces for free flow of air is recommended to induce air movement within the interior. air movement is important for proper ventilation and circulation. Air in motion can remove undesirable odours, reduce excess heat internally generated. Good ventilation thus reduces high humidity values and eliminate fungal growth.

e. WIND

Since Makurdi experiences occasional thunderstoms and squalls, there is the need to control the wind to protect the site. Physical features - trees, walls, shrubs, etc. could help break wind speed. Vegetations are most preferable as they allow controlled air to pass through them.

Wind velocity is usually reduced towards the ground level, therefore, it is advisable to have low rise structures so that minimal effect of wind is possible. Spatial arrangements could also allow for proper channelling of wind/air. Care should be taken, however, not to block airflow within the building.

Roof designs should also be made to withstand excessive lateral thrusts of wind.

f. SOUND/NOISE

The site is protected from vehicular noise pollution by virtue of its distant location from high ways; but noise generally other than that could be reduced or prevented by:

1. Landscaping to create buffer zone of trees to muffle the very occasional noise.

2. Special construction - odours, or small openings could be adequately sealed with rubber strips, or

3. Zoning of functional spaces.

g. GEOLOGY

It is not known as at the time of this study if scientific soil tests have been done on the site, but available data show that the site is predominantly sandstone. This soils and subsoils are mainly ferrallic comsoil and loamy sand of weak struction, slightly acidic and marshy especially along the river bank. Slab foundation is therefore recommended as the possibility of ground movement is minimal and considering the materials of construction.

h. TOPOGRAPHY

The site slopes towards the North and North-east. The gradient is low hence there is no cause for alarm as far as soil threat is concerned. The river Benue could be used for boating and fishing, but not for leisure swimming.

The developed bank of the river could be valuable for picnics and other riverside activities. The gently sloping nature of the land offers a natural drainage that could be further rehabilitated into the design.

i. CIRCULATION

Effective vehicular and pedestrain circulation within the site will be given special attention in the proposed

design. Pedestrain ways would be free of vehicular interference and clearly marked out to connect all functions on site.

Where necessary, pavements that are well shaded will enclose lawns which should be protected from tresspass by planting of shrubs, which also will reduce the effect of heat that will result from solar radiation on the pavements.

j. ORIENTATION

Suitable orientation of the components of the centre and adequate openings are essential to allow for free movement of air.

Orientation of the building should expose maximum length to direction of wind flow, and widely adequate openings should be provided. Orientation is best in the North-South direction in this respect.

7.1.3 ZONING RELATIONSHIP

Prior to evolving a concept for the proposed multi-purpose centre design, major activities which will take place within the centre have been identified and zoned accordingly. Such zoning is governed by such parameters *as noise, privacy, similarity of functions etc.*

It is important to identify for clarity such areas that should fall under public semi-public, administration and services or private areas.

7.1.4 FUNCTION RELATIONSHIP

The functional relationship show that general functional organisation, that is, low spaces relate to

each other in order to achieve a good flow pattern.

Functional considerations are integral to the overall success of the design. A good analysis of the utilisation functional relationship is therefore very important. This will give an idea of how various spaces relate to each other and possibly identify the best functional relationship all other things being equal. For best results, activities are grouped in accordance with similarities in activity.

7.1.5 FORM, CONCEPT AND PLANNING

In order to be consistent and in harmony with the zoning character of the design, the form concept and planning should emcompass the arrangement of respective functional spaces in an rticulate manner in harmony with the site.

It is also important to refer to and use standards of space requirements from, established authorities like the Architects Data, the Metric Handbook, and so on, on design of public houses so as to ensure that the evolved form not only save space but also ensure uniformity in internal arrangement.

The immediate buildings around the site are all rectangular forms, the site is rectangular, which led to the adaptation of the rectangular forms which also agrees with the outcome of the research which advocate for rectangular concept with big courtyard for this tropical climate to allow for air flow.

The design concept is a hybrid of site const human needs and cultural identity. There is an attempt

to employ the concept of the indigeneous tradtional planning concept of having the 'Ate' (common room) at the centre while other things surround it. This is also used to bring people together.

7.1.6 SUMMARY AND CONCLUSION

This section of chapter seven has identified design implications from the analysed data so as to achieve thermal comfort if properly integreated into the design. Most important of course is the climatic data analysis.

With this in mind, the site was zoned so as to achieve a good relationship between functional spaces, and grouped as per similarity of functions so as to achieve harmony between immediately adjacent spaces and the overall design.

7.2 PROBLEM SOLUTION

7.2.1 INTRODUCTION

The design of Multi-purpose Centre, Makurdi, is intended to be an avenue for conferences, relaxation, recreation etc. for all categories of the pople in Makurdi town and their guests. It should provide a refreshingly pleasant and attrative environment for all users and above all, it should challenge the author (designer) to, inspite of the harsh climatic conditions of Makurdi, achieve an appreciable amount of success in the design, so as to remedy if not completely conquer these conditions. The centre should not only be aesthetically pleasing, but also very functional.

7.2.2 GENERAL DESIGN PARAMETERS

To achieve a suitable design of the centre, a number of design criteria were established. This includes the analysis of the functional/activity systems to be accommodated and the determination of the kinds, amounts and criteria of space corresponding to function. The following basic factors were considered.

a. CIRCULATION

Circulation systems facilitate linkage between activities in different spaces. Traffic flow, parking facilities and pedestrain flow are essential part of the design. Design must reduce conflict and avoid unnecessary interference.

It should be noted that pedestrains usually follow the line of least resistance, hence deliberate movement demands safe, functional access between activities. Hence the need to separate the pedestrain and vehicular circulation.

b. ACCESSIBILITY

The site of the Centre is very accessible to users both within and outside Wadata area. But an important consideration of planning control is the potential risk of traffic congestion and obstruction. Pedestrain and vehicular access to the centre need to be determined and resolved at the earliest possible stage of the design.

This was achieved in the design of this Multipurpose Centre.

e. FLEXIBILITY

Flexibility in the use of spaces both external and internal should be a priority consideration during the planning stage. Spaces should be able to accommodate changing needs of the people using the Centre. This will keep cost low with regards to modification or possible future changes to facilitate expansion as may be required from time to time.

f. IDENTITY OF LOCALITY

The overall design should reflect the socio-cultural life of the locality, available technology, materials and climate. This image will be enhanced by:

- use of, where possible, indigenous building materials.

- application of decoration to reflect the culture and social life of the people, and

- landscaping with indigenous trees, shrubs etc.

g. FUNCTIONAL SPACE REQUIREMENTS (SPACE STANDARDS)

The allocation of the right amount of space to each and every activity, and function in the design determines to a large extent, the quality and efficiency of the design. Space standards in the design of this mess were got from established standards[1] for functions covered, Some of the standards were however revised or modified during the detailed design stages to enhance efficiency and functionality of space. The

c. COMFORT

This is the most important consideration in the design considering Makurdi's harsh climatic conditions, and is achieved by reasonable compromise of the conflicting environmental factors. This is possible by ensuring adequate cross ventilation, damping of excess heat in the interior and the protection of the interior from noise pollution and masking depending on the activity. The material selection has also helped to achieve this comfort.

In the Centre, in particular, air movement is very essential and should be facilitated. since humidity values for Makurdi' is very high, there is the need to include the air movement within the interior by providing wide openings. This induced air speed will promote cooling by evaporation.

d. ORIENTATION

Orientation of building with respect to the West sun is paramount and important in the design. Openings should be avoided or minimised in the west direction, where it is inevitable; it is mandatory to shade such openings from solar radiation.

North-south orientation poses little or no threat as regards solar penetration of interiors. At noon, the sun is directly overhead and the roof system should be properly designed to buffer the effects of heat. Shading devices, if used, for west and east should be such that they cover openings and at the same time allow for free air movement.

following are some of the space standards used in determining the required spaces of such functions:

a. Entrance hall - 2.0m^2/person.

b. Parking - 20m^2/car.

c. Waiting Area - 1.0m^2/person.

d. All Circulation Space- 2.5m^2/person.

e. Conference/Theatre - 0.6m^2/person.

f. Bar/Lounge - 1.2m^2/seat.

g. Offices - range between 9m^2 - 20m^2/office.

h. Dining - 1.8m^2/seat

i. Food/Liquor Storage - 0.24m^2/seat or 20% of Banquet space.

j. Banquet - 1.2m^2/seat

k. Kitchen - 1/3 of Dining space.

l. Changing Rooms - 0.1m^2/user.

m. Indoor Games - 1.5m^2/person, etc.

7.2.3 ARCHITECTURAL INTERPRETATIONS

This is the overall design implications drawn from the designs and climatic factors outlined from the outset of this study. This among others imply:

a. RURAL SETTING is presumed and so landscape designated by green spaces must be reflected in the overall design, especially in the choice of materials and colours.

b. SPECIAL ATTENTION should be given to land configuration and so the design should be integrated into the landscape, that is, in harmony with the physical environment.

c. CLIMATIC FACTORS of the site demand that attention should be focused on the roof form, opening characteristics, choice of building materials and environmental comfort.

d. IT IS PREFERRED that international style be used, but tampered with regional character. Buildings should be functional and properly integrated. Flexibility should be given adequate attention as this will enhance maximum space utilisation in the event of an unforeseen but necessary spatial adaptation.

e. SHADING DEVICES should be used, and if possible with shading walls. Prevailing wind directions should influence the positions and sizes of openings to guarantee cross ventilation. Roofs should adequately drain water effectively at critical periods - July to September.

f. THE SITE'S MICRO-CLIMATE demands that the design should be such as not to allow for excessive penetration of solar radiation. Windows should therefore be effectively shaded. They could be recessed with walls providing shades. Overhangs could also be employed to provide shades.

7.2.4 LANDSCAPE

Landscape design is the conscious planning of all the space outside the building. This is not only to enhance the beauty of the surrounding environment, but also to channel views and movement in the outdoor spaces and improve on the climatic conditions of the site.

Green spaces should be deliberately created in front of and behind the buildings. Landscape will be used prominently to harness buildings together which should flow from inside to outside. Flexibility should be borne in mind to enhance spatial adaptation and maximum space utilization in the unforeseen circumstances.

7.2.5 SUMMARY AND CONCLUSION

In design, the architect aims at conquering by reconciliation and compromise, the environmental factors, prevailing culture and available technology, besides harmonising functions with activities and spatial adaptation/organisation.

In this particular case, the design of this Centre, there is a deliberate attempt to improve existing environmental conditions and correct very glaring design mistakes in previous project of similar nature.

In so doing, that is by the careful consideration of such factors as circulation, accessibility, comfort, orientation, flexibility, etc. together with consultation of data on standard space requirements, a successful design is possible.

Landscape is given prominence, as the importance cannot be over emphasised, so as to be used as an instrument of integration of the building into the site.

REFERENCES

1. TUTT, P. & ADLER, 1979, New Metric Handbook, pages 164, 170 and 324.

2. Life Project Brief of 1991, Dept. of Arch. A.B.U., Zaria, page 3.

7.3 CONSTRUCTION MATERIALS AND TECHNOLOGY

7.3.1 INTRODUCTION

The building is a physical embodiment of a number of necessary related, co-ordinated, and integrated system in form of components - walls, floors, roofs, structural framework, etc. In any project, the design and construction are not necessarily one and the same but compliment one another. An understanding of how these components fit together and the construction techniques is necessary during both the design and construction stages. This will in no small measure help to define, organise, and reinforce the perceptual and conceptual elements of the (design) building.

Building materials on the other hand, have distinct properties of strength, stiffness, elasticity, density or hardness, resistance to wear (caused by physical or chemical action), fire resistance and thermal conductivity.

In this chapter, a brief outline of the chosen materials for construction and technology will be given so as to make the design of the Multipurpose Centre more appreciable. It should be borne in mind that the following methods are not rigid, but variations during construction are acknowledged in line with the factor of flexibility, but such variations should not be such as to tamper with the original design proposal.

7.3.2 THE FOUNDATIONS

The foundation system of any building, its sub-structure, is a critical link in the transmission of building loads down to the ground. Bearing directly on the soil, the foundation system must not only distribute vertical loads so that the settlement of the building is either negligible or uniform under all parts of the building, but also has to anchor the uper structure of the building against uplift and racking forces.(2)

The most critical factor in determining the foundation system of a building is the type and the bearing capacity of the soil to which the building loads shall be distributed.

Due to the soil characteristics of the site, it will be advantageous both economical and otherwise to choose the pad foundation type. Here, the structure is supported on isolated piers or concrete supporting reinforced concrete ground beams, in turn supporting walls, rather than excavating deep trenches and raising walls off strip foundations, some depth below the ground.

This is because the subsoil has poor bearing capacity for some depth below the surface.

Due to the slightly acidic nature of the soil, special cement, especially the rapid hardening type, would be used. This is to enable the concrete to set and harden before any damage is done to the wet concrete. In addition, the foundation footings will be insulated with bitumen to avoid contact with the

soil. The isolated concrete pad foundations are spread in the base of the excavation, of which columns of concrete are raised to ground level to support reinforced concrete ground beams off which the walls are raised. The thickness of the concrete is either at least equal to the projection of the pad on each side of the pier or the pad foundations is reinforced. The spacing of the piers or columns is on 6m grid.

7.3.3 FLOORS

The floor system of any building should satisfy the functional requirements of stability, strength, prevention of moisture passage, durability, fire resistance, thermal properties and resistance to sound transmission and absorption.

The ground floors will be constructed solid with hardcore, oversite concrete and a dampproof course on which the floor finish will be laid, e.g. is the multipurpose hall where you have timbe floor finish.

For stores and parking spaces, the finish top surface of the oversite concrete is to be used as the floor surface to save cost of an applied floor surface or finish. For other floor finishes, screeds are to be applied except for kitchen, laundry area, water closets and other similar surfaces proned to water, where terrazzo precast floor tiles or pvc tiles are to be applied, because of initial low cost and ease of cleaning and maintenance.

7.3.4 WALLS

The walls should be of durable materials and finishes should not attract frequent maintenance. In fact, burnt or ceramic brick, mud bricks will be used where possible to reduce the harsh effect of climate in Makurdi and should be married in unison with the green environment to perfectly stimulate a typical Nigerian village setting. In other words, burnt bricks, ceramic bricks and mud bricks will be used for wall as materials to compliment the landscape. By all means, walls facing the east and west should be of these local materials - bricks, stone or polished granite - for their good thermal properties.

7.3.5 ROOFS

It is important to note that different roof characters given to a building that retains all its other features will impose different outlook. Roofs should therefore be seen as balancing elements and roof characters should be explored for effects. The roofing of the Centre therefore be of shingles or coloured long-span aluminium roofing sheets.

High pitched roofing is strongly recommended and emphasised, even if for speedy drainage of rain water. Rain water gutters should be of adequate sizes and properly designed to facilitate drainage.

In this Centre, parapets have been used to prevent roofs being blown off by the heavy windstorms of Makurdi.

7.3.6 FINISHES

In any structure, exterior wall surfaces must be weather resistant, durable, and relatively maintenance

free. Interiors should be wear resistant and cleanable. Floors should be safe (non-slippery) and durable against traffic wear, and ceilings should be maintenance free. The strength of a finish material depends on its stiffness and/or bristleness and the rigidity of its backing. Its accoustic, thermal and fire resistance values may also be important considerations in their uses.

For visual appearance, all finishing materials should be considered in terms of their colour, texture, pattern, scale, modular characteristics and their jointing and edge conditions.

PLASTER: For masonry walls, plaster may be applied directly to surfaces. These surfaces should be sufficiently rough and porous to allow for absorption and a good bond. Where there is a possibility of moisture or condensation getting into the wall, plaster should be applied over furring.

Exteior plaster should be used for both exterior and interior walls and slab surfaces. The plaster should be applied in layers, the number of which depends on the type and strength of the base.

3-COAT PLASTER: If a 3-coat plaster of cement mortar is to be applied, the followings are recommended:

1. Scratch Coat: must be strong to adhere firmly to the lath and raked to provide a keyed foundation for the following coats.

2. Brown Coat: also known as the levelling coat (brought out to the grounds or screeds) that acts as a base for the finish coat.

3. Finish Coat: This is the visible plaster surface, a coat of some fire-grained material, spread and trowelled smooth to a thickness of 5mm.

7.3.7 STRUCTURE

The structural system of a building supports the building's loads against the pull of gravity and enables it to resist the forces of wind pressure, shock or impact loads, vibrations or even earthquake.

In coountering these internal and external forces, a structural system will naturally impart a specific form to that building.

In selecting a structural system, one must therefore consider in addition to building stability, function and economy of means, the image and definition of a specific structural system will tend to impart on the building's external form and internal spaces.

A rectangular structural grid system of 6m spacing of columns is used in this design. Where a clear span of 18m or more is required, like over the multipurpose hall, dining areas, bar, lounges etc., a portal frame structural system, to enhance the required large volume of space is used.

7.3.8 SUMMARY AND CONCLUSION

The main structural material is reinforced concrete with masonry mud bricks for all non-load bearing wall. Concrete bricks are also used in some places where necessary. All walls and panels are finished with sand-cement plaster and rendered in emulsion paint to desired colours.

All windows are aluminium horizontal sliding types for public areas like the hall and the bar/ restaurant, lounge, and projecting windows, for other private and semi private areas. All internal doors are formica-finished plywood flush doors. Other doors especially at entrances to public spaces are aluminium frame double horizontal swing doors.

In summary, the Multi-purpose Centre should have a unique character as below:

a. Semi-urban setting.

b. International style with localised tampering.

c. Durable construction materials and materials to reduce the harsh effect of climate of Makurdi.

d. Properly integrated into the landscape and the physical environment.

e. Use of special shading devices preferably, vertical with horizontal recesses and overhangs.

f. Window design and positioning should allow for cross ventilation from the prevailing winds.

g. External walls built of exposed brick with sporadic use of plaster.

h. Roofs should be highpitched of shingles or coloured long-span aluminium roofing sheets.

REFERENCES

1. CHING, F. D. K 1975, Building Construction Illustrated, Van Nostrand Reinhold, New York, Pages 2.0 and 2.5.

2. Ibid, page 3.0

3. Ibid, page 2.6

4. MISZEWSKI, M 1977: The Quality of Life, Murray and Stravant Group, Cape Town, page 116.

Building materials chosen were not necessarily the most suitable, but were chosen because they are locally available.

CHAPTER EIGHT

8.0 THE DESIGN BRIEF DEVELOPMENT

Community Centres are designed to enable members of the community to have the advantage of physical and social contact. This is the basis of African ways of life; all activities are encompassed in the traditional space (courtyard). Efforts would be made to enhance this community interest in the design proposal for Makurdi Town, while the advancement of science and technology influence on the urban dwellers would not be overlooked to have a modern centre people would identify with. The basic facilities provided for are from the response from the literature review, case studies and the social survey of the town.

DESIGN POPULATION

As shown in the chapter of analysis of the site location, Makurdi has a population of about . The centre would be designed to cater for this population as well as those nearby towns. The site is large enough for future expansion to be able to meet the final population projection for the town when the master-plan is fully implemented.

FUNCTIONAL UNITS

In order to meet the requirements of the people across age groups and sex, the following facilities would be provided in the Centre.

ADMINISTRATIVE SECTION

The administrative organ is a small manageable section to manage, plan, execute, educate the community, as well as to supervise all activities of the Centre on behalf of the State Government and the Resident Associations.

The space provided for in the administrative block includes:

Director's office

Secretary's office

Manager's office

Accountant's office

Board Room

General office

Guidance and Counselling office

Community Development office

Social Mobilization office

Coffee Room, Stores, Lobby and toilets.

EDUCATION

The education section is provided for to help and make the youths in the town that form the largest percentage of the population, a productive part of the society. Presently, there is no facility for a library in this part of the town. A community library is provided to take care of the children and adult lending. To prevent multilation of the rate books, a stack room is provided for which is not accessible to the readers. Books are obtained from here by the use of catalogues and request is then made. As a component of education unit, an adult

education section is provided. This is an informal educational system. It is hoped that the Directorate of Road, Food and Rural Infrastructural programme (DFRI) for the youths could be implemented through this unit.

LIBRARY

Librarian office

Circulation desk (control desk)

Research

Adult Reading space

Children Reading space

Stack Room

Toilets and storage.

ADULT EDUCATION

Offices

Exhibition

Sewing Workshop

Arts and Craft workshops

Home Economic Workshop

Lecture Rooms

Photographic Room

Toilets and Stores.

SOCIAL CULTURAL

The facilities provided here would enable members of the community to carry out the social activities like

conferences, drama, dancing, political activities etc.

Spaces provided include:

Open air theatre

Multipurpose hall.

RECREATIONAL

The recreational area would take care of activities like sports and indoor games, disco, parties, club meetings. The spaces provided include:

Multipurpose hall

Club rooms

Disco hall

Bar and Restaurants

Outdoor sport areas and picnic area

Toilet and Stores

Central Changing (Male/Female)

WELFARE

The welfare section includes the clinic and the child day care centre. The clinic is basically to provide first aid facilities for the visitors and workers in the Centre. However, it could serve as a supplementary consulting clinic for the residents living closed to the Centre.

8.1 THE SITE

The site analysis revealed that the required services are available to be tapped in the site which is the Wadata Former Market site and beyond. These include electricity, water supply, sewage line and storm water drainage system. All these services are underground systems and centrally located.

It was observed from the analysis that Makurdi town required a model approach to design. The people there have no much difference in their political and cultural background.

The site water table is high and the advantage of the water body by the site could be utilized for recreative purposes.

8.2 SITE SELECTION CRITERIA:

ZONING

The site is properly zoned away from other activities like administrative and industrial parts of the town as this solves naturally the problem of pollution and noise by distant location.

ACCESSIBILITY

The site of the proposed centre is easily accessible from the town without difficulties. There is a good motorable road (the main road in the town) which passes by the southern end of the site.

SLOPE

The area of land selected is relatively flat with a gentle gradual slope of about 4% gradient, with excellent views towards the river Benue and beyond that the other side of the view. There is drainage possibility of draining water into the river Benue.

SIZE OF AVAILABLE LAND

There is enough land area which makes possible room for expansion as the land extends to the river, beyond the former market limit.

UTILITIES

Electricity, water supply, and telephone services are available to the site at the shortest distance.

LOCATIONAL ADVANTAGE

For the fact that the site was a business place before, makes it more prone to high patronage by the same community.

8.3 SCHEDULE OF ACCOMMODATION

Spatial analysis is the process of determining what the dimension of a space should be, in order to serve a particular function of activity.

There are usually two methods of assessing the area of a space - the objective rationalization of standards and the activity analysis (the anthropometric approach). This thesis employed the two approaches where applicable to arrive at the optimum sizes of the space.

SPACE REQUIREMENTS

FUNCTION	AREA (M^2)	REMARKS
ADMINISTRATION:		
Director	24	
Secretary	12	
Manager	15	
Accountant	12	
Board Room	80	
Social Mobilization Office	24	
Cuidance and Counselling	20	
Concourse	18	
Coffee Room	12	
Store	12	
Toilets	24	
General Circulation (20% of total area)	50	This includes passages and stair lobbies.
	303	

	FUNCTION	AREA (M^2)	REMARKS
I	Multipurpose hall	520	$0.8M^2/P$ (820 capacity)
	Stage	96	
	Back stage	104	
	Toilets	102	
	Control Room	24	
	Changing (Male/Female)	54	
	Projection Room	10	
	Kitchenette	12	
	Store	12	
	Game Office	12	
	Total	946	
	General Circulatio 20%	189	
		1135	
II	Amphi theatre	670	$0.5M^2/P$ (1300 capacity)
	Back stage	16	
	Toilets	36	
	Kiosks	72	
	Ate (Common Room)	144	
	Sculpture Garden	200	
	Theatre Control Room	21	
	Suya Pavillion	36	
	Total	1195	

	FUNCTION	AREA (M^2)	REMARKS
III	RECREATION (OUTDOOR GAMES):		
	Volley ball 2	624	
	Lawn Tennis	646	
	Children Playground	406	
	Total	1676	

EDUCATIONAL FACILITIES

I	LIBRARY:		
	Librarian office	12	
	Circulation Desk	12	
	Reference Room	32	$3.15M^2/P$ (10 capacity)
	Adult Reading	72	$1.2M^2/P$ (70 capacity)
	Children Reading	80	$1.2M^2/P$ (80 capacity)
	Store	20	
	Toilets	16	
	Reserve Books Room	15	
	Assistant Librarian	6	
	20% General Circulation	56	
	Total	321	

	FUNCTION	AREA (M^2)	REMARKS
II	ADULT EDUCATION:		
	Offices	72	
	Sewing Workshop	96	40 students
	Arts/Crafts	96	40 students
	Homes Economics	96	40 students
	Kitchen	20	
	Stores	48	
	Reception hall (1)	32	
	Common Room	48	
	Show Rooms (3)	60	
	Audio Visual	48	
	Toilets	48	
	Laundry	32	
	20% Circulation	140	
	Total	836	

WELFARE

I	CLINIC:	
	Waiting Area	64
	Pharmacy	12
	Records	12
	Doctor	12
	Treatment/Nurses	12
	Emergency	16
	Toilets	24
	20% Circulation	30
	Total	166

	FUNCTION	AREA (M^2)	REMARKS
II	CHILD CARE:		
	Reception	12	
	Play Room	20	
	Sleeping Room	9	
	Class Room	64	
	Kitchenette	9	
	General Office	12	
	Matron	12	
	Toy Store	9	
	Toilets	18	
	20% Circulation	34	
	Total	199	
III	BAR:		
	Seating Area	144	$1.5M^2/P$ (110 capacity)
	Outdoor Drinking	520	$2M^2/P$ (230 capacity)
	Cold Store	6	
	Dry Store	9	
	Servery	10	
	20% Circulation	140	
	Total	829	

	FUNCTION	AREA (M^2)	REMARKS
IV	RESTAURANT:		
	Eating Area	144	1.7-2M^2/P (102 capacity)
	Kitchen	36	$\frac{1}{3}$ of Dining Area
	Service Area	16	
	Store	15	
	Toilets	16	
	20% Circulation	46	
	Total	276	
V	DANCING:		
	Music Room/Store	16	
	Toilets	12	
	Servery	15	
	Discotheque	150	
	Circulation	40	
	Total	233	
VI	ACCOMMODATION:		
	Chalets (9)	430	
	Hostel Type (36)	216	
	Laundry	24	
	Ironing	12	
	Reception	20	
	Porter	12	
	Television Room	48	
	20% Circulation	144	
	Total	906	

CAR PARK

Using the objective rationalization standard of 3 cars per 100m^2 built-up area is used, we shall then have - Built-Up Area = 8800M^2.

Therefore, the total car parks required is 250 car parks.

CHAPTER NINE

9.0 CONCLUSION

9.1 RECOMMENDATIONS

The following recommendations are given for a successful implementation of this thesis proposal.

The Centre should be executed in three phases. The first phase should include the multipurpose hall as there is no conference centre in Makurdi presently. The second phase to include the educational facilities administration and the amphi theatre, while the final stage could include the welfares as we have such facilities though at different places in Makurdi presently.

The Centre should be managed by an independent body not under the bureaucratic control of the state government. Such body would make sure that the Centre is able to generate enough revenue for the day to day maintenance of the facilities.

The use of facilities like multipurpose hall, amphi-theatre, Disco hall etc. should attract payments.

On a more serious note, the river bank could be developed for fishing, boating, picnicking etc to bursh the activities of the Centre.

9.2 CONCLUSIONS

9.2a Communal space at what ever level of human settlements, all aimed at helping to improve on the socio-cultural standard of the inhabitants. This will in

the process bring people together and tend to improve harmonious relationship and brotherhood way of life.

This thesis has attempted to encourage human contact in all its diversification through physical environment and provisions for facilities at the community level. This was approached at various stages which include investigating those factors that enhance or encourage social interraction in the communal spaces. Makurdi was chosen as a testing ground for the research conclusions obtained during investigations.

The findings and the summary of the resident's social needs in the town, and other factors were analysed and synthesised to design an ideal architectural proposals. The design concept was evolved through the hybrid of site constraints and human needs within the framework of cultural identity. The functions are spatially organised in a hierachial principles around the 'ate' (common room) and courtyards system.

9.2.b. It is binding on every designer in the tropical environment and in fact other environment of the world to fully take into account all the necessary factors that greatly influence design. By so doing, he would surely come out with a final design that responds to both the physical and psychological factors of the people as well as the climatic conditions of the environment.

The subjective trial and error approach to architectural designs is very dangerous and intellectually unsound and should therefore not be allowed to continue. Architectural design must adopt the techniques of analytical reasoning to mature properly. A more benefiting and precise design can be arrived at through the creative and analytical approaches.

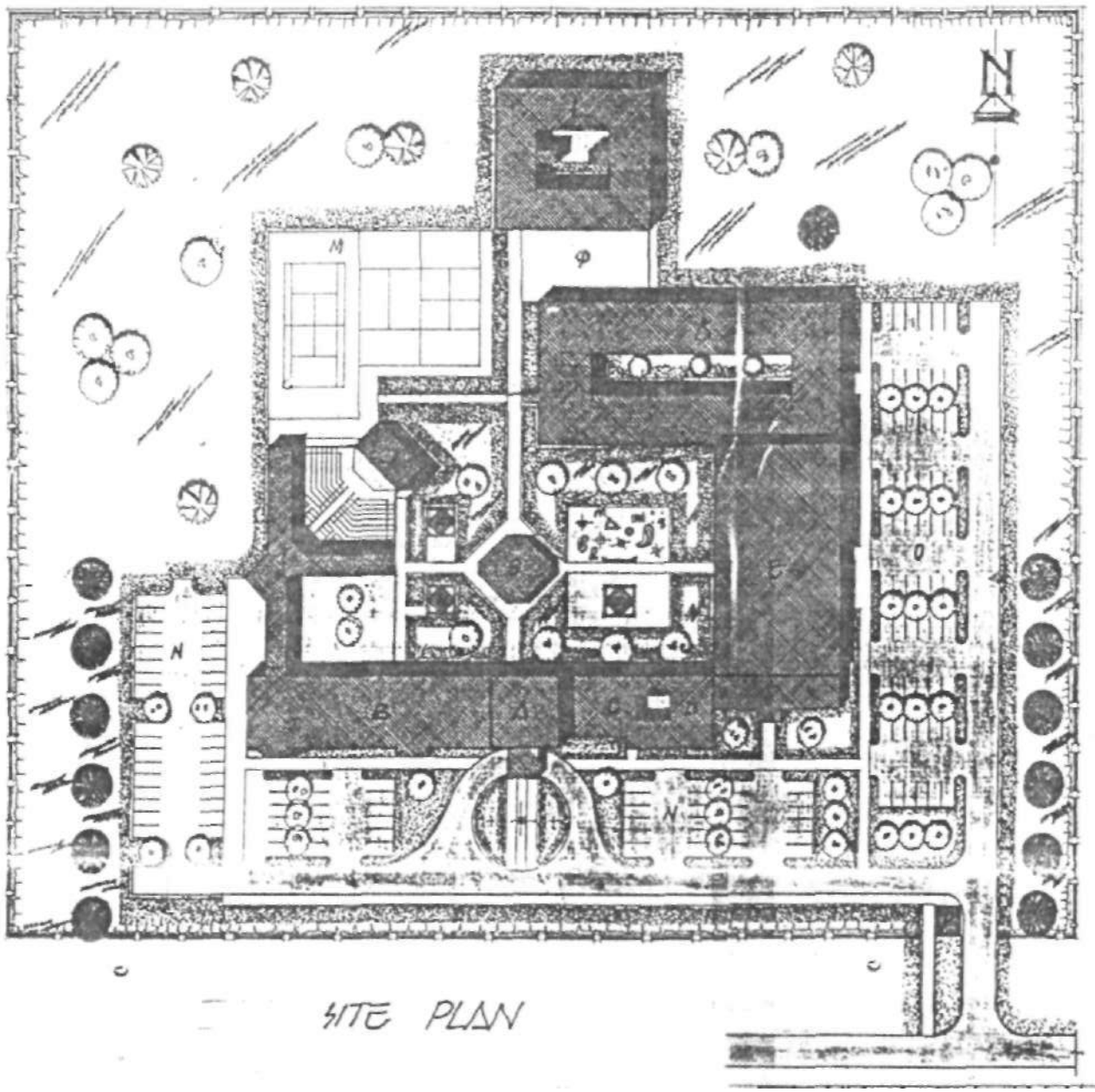
The mistake like the housing design done by a Lebanese in Sokoto - Nigeria, where all the roofs were blown off by a strong storm as a result of lack of proper consideration of design factors or the housing design in Abuja - Nigeria, where about 1000 houses got roof damaged by storm should never be allowed to continue by we the designers.

Building designs in the tropics require great care and though with due regards to environmental factors.

Personally, I conceive architectural problems resulting from differences in climates as something that can be best solved only when approached from the grassroot. I also think that afterthought solutions to tropical architectural problems are very inadequate and out of tune with our social and economic realities. An example is the use of mechanical means of room heating and room cooling in poor design instead of a natural and more convenient means which will eventually reduce cost and provide natural comfort.

One crucial component of the design is the building materials. It is necessary for a designer to make a careful study of the available building materials thereby arriving at the suitable materials to be utilised in his environment or even his site to achieve great comfort, durability of materials and also less cost and inconveniences of construction.

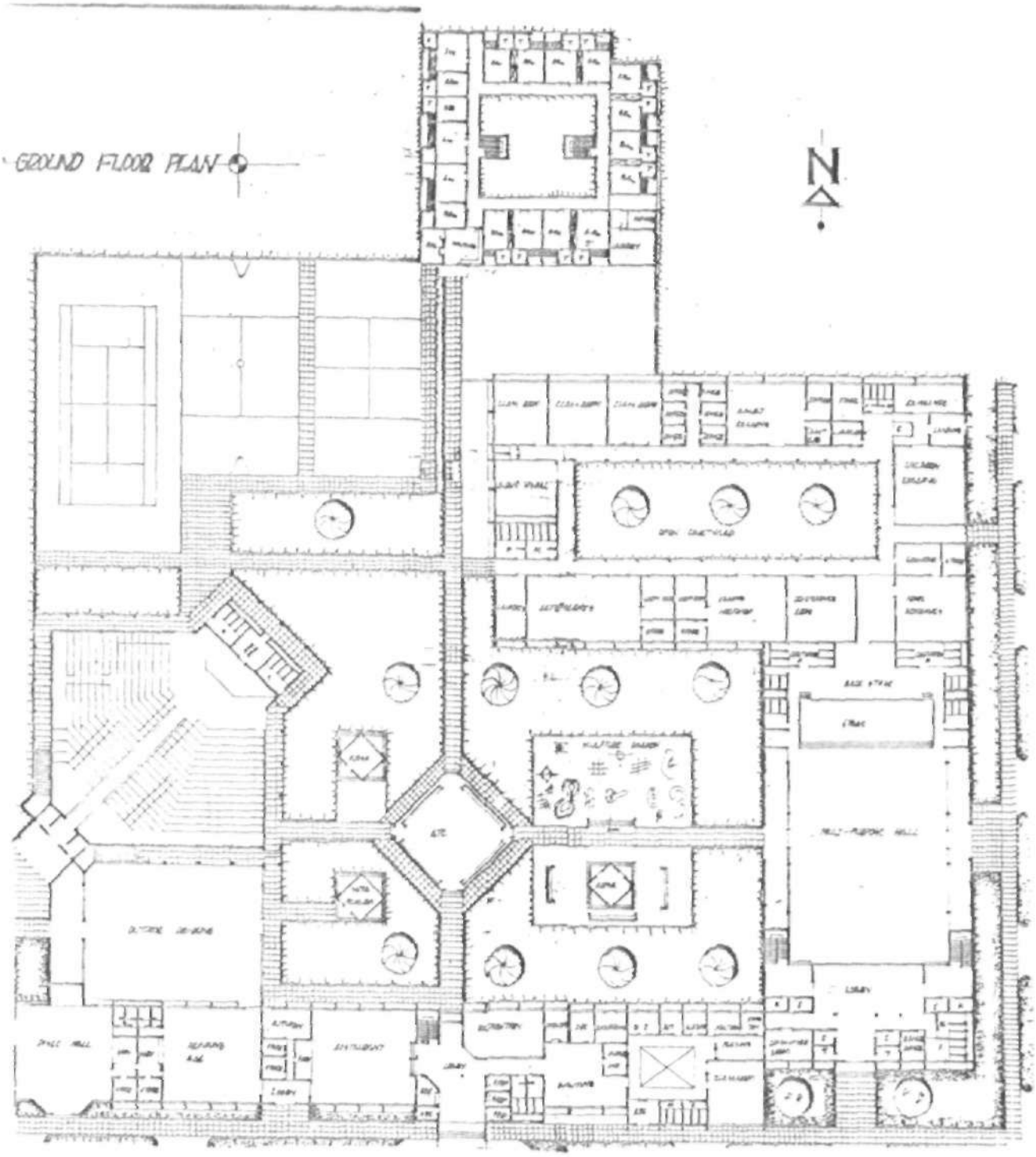
The performance of building materials vary and also the characters as a response to the natural effect of climate.

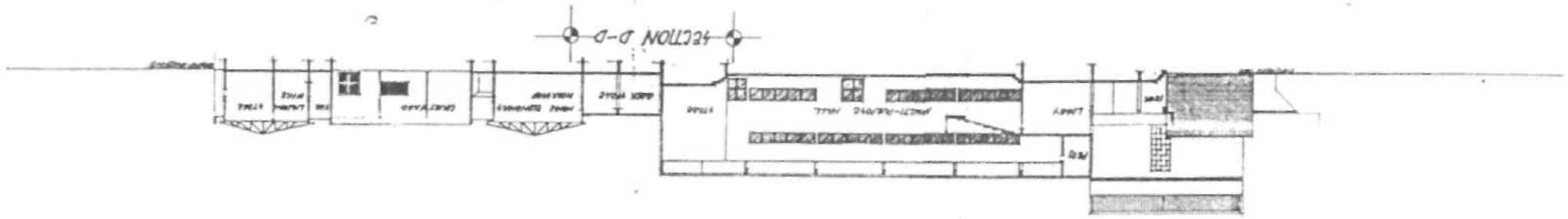


KEY	
A	ADMINISTRATION
B	WELFARE FACILITIES
C	CLINIC
D	CHILD DAY CARE
E	MULTIPURPOSE HALL
F	KIOSKS
G	ATE (COMMON ROOM)
H	YOGA PAVILION
I	SEMI-OPEN AIR THEATRE
J	CHANGING ROOMS
K	EDUCATIONAL FACILITIES
L	HOSTEL ACCOMMODATION
M	OUT DOOR GAMES
N	PUBLIC PARKING
O	CONFERENCE PARKING
P	GATE HOUSE
Q	CHILDREN PLAYGROUND
R	SCULPTURE YARD

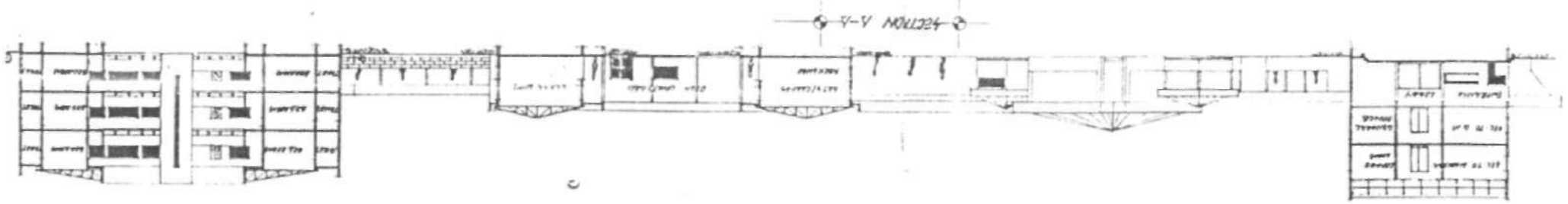
SITE PLAN

GROUND FLOOR PLAN



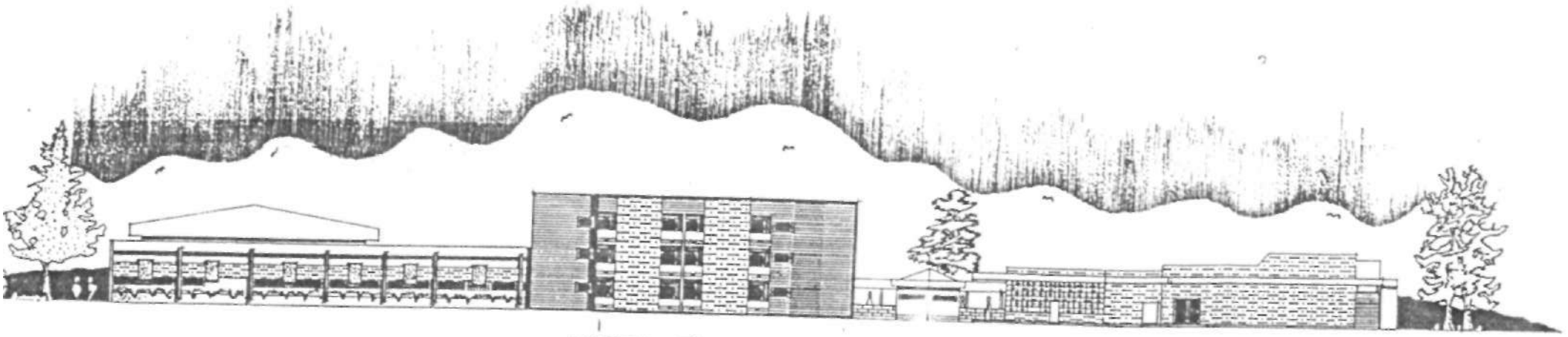

SECTION D-D


SECTION C-C
SECTION B-B


SECTION A-A



APPROACH (SOUTH) ELEVATION



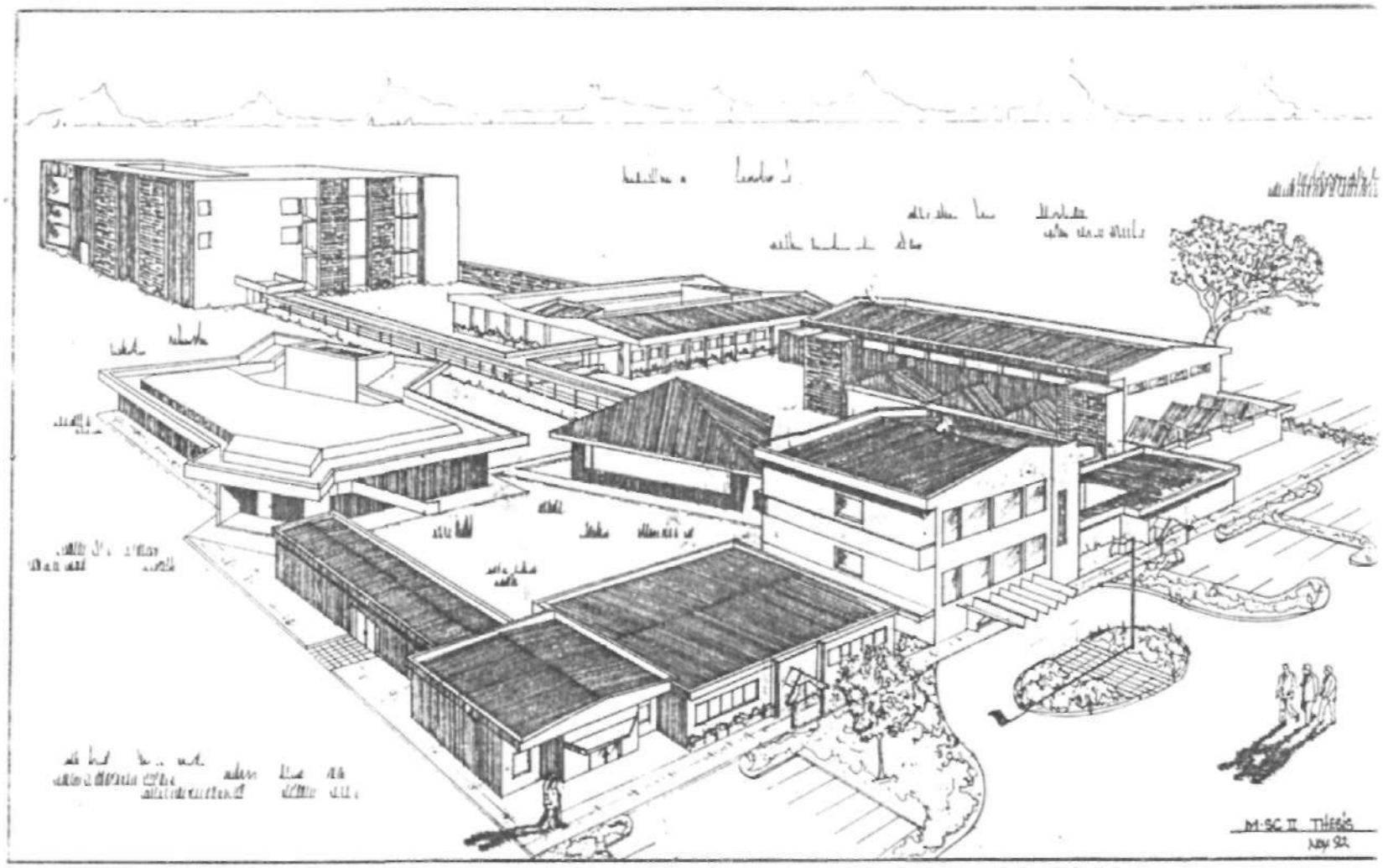
NORTH ELEVATION



EAST ELEVATION



WEST ELEVATION



AERIAL PERSPECTIVE

BIBLIOGRAPHY

1. Adesiyan, J.O. (1980) Open-space System and Environmental Quality of Urban Area. Unpublished M.Sc (URP) Thesis, Ahmadu bello University, Zaria.

2. Adebiyi, A.J. (1990) Community Centre for Festac Town, Lagos. Unpublished M.Sc (ARCH) Thesis. Ahmadu Bello University, Zaria.

3. Adesina, S.O Site and Environmental Planning in Architecture. An Educational Publication.

4. Allan Konya Design Primer for Hot Climates

5. Ali, John (1991) Nigerian Army School of Military Engineering Officers' Mess, Makurdi. Unpublished M.Sc (Arch) Thesis. Ahmadu Bello University, Zaria.

6. Chalkley, J.N Thermal Environment for the student of Architecture. The Architectural Press, London.

7. Gupta Mridula (MIss) (1988): Multipurpose Square for Ahmadu Bello University, Zaria. Unpblished M.Sc (Arch) Thesis, Ahmadu Bello University, Zaria.

8. Kureja, C.P. Tropical Architecture.

9. Kyado Godwin (1990) Effect of Climate on the Design of Library. Unpublished M.Sc (Arch) Thesis, Ahmadu Bello University, Zaria.

10. Moh'd Bashir Ibrahim (1986): Basic Design Considerations for the Tropical Environments. Unpublished B.Sc (Arch) Thesis, Ahmadu Bello University, Zaria.

11. Paul Oliver (1971) ed: Shelter in Africa, Barrie and Jenkins Ltd., London.

12. Patricia Tutt and David Adler (1979) ed: New Metric Handbook The Architectural Press, London.

13. Post Graduate School (1984) Guidelines for the preparation of project Reports, Thesis and Dissertations, Ahmadu Bello University, Zaria.

14. Safiyan, A.Y. (1989) Community Centre for Kotangora. Towards a Multifunctional use of space. Unpublished M.Sc (Arch) Thesis, Ahmadu Bello University, Zaria.

15. Victor Olgyay Design with Climate