PHYSICAL PLANNING PROPOSAL FOR THE CENTRAL AREA OF GOMBE

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DECLARATION

I hereby declare that this thesis has been composed by me and that it is the outcome of my own research work. It has not been accepted in any previous application for higher degree. All quotations are distinguished by quotation marks and sources of information are appropriately acknowledged by means of referencing.

Signature: .....

Date: 14/01/2020

CERTIFICATION

This thesis entitled "physical planning proposal for the central area of Gombe" by Japhet Musa meets the regulations Governing the award of the degree of Master of Science, Urban and Regional planning of Ahmadu Bello University, Zaria, and is approved for its contribution to knowledge and literary presentation.

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DEDICATION

To Mr. and Mrs Musa Kaskuma

Mrs Nayayi Mahdi

Mrs. Afiniki Halilu, Charity, Tabitha, Blessing.

Stephen, Barak

ACKNOWLEDGEMENT

I wish to express my thanks to GOD for sustaining me throughout my period of study in Ahmadu Bello university, Zaria.

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My sincere and unalloyed gratitude go to my parents Mr and Mrs Musa Kaskuma, my Aunties Mrs Panninah Abubakar and my Sister Mrs Afiniki Halilu. my sincere gratitude go to my younger Brothers, Stephen, Barak and Sisters,Charity, Tabitha,Blessing for understanding and standing by me at the trying moments.

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May Almighty GOD bless you all.

ABSTRACT

The efficiency of a city's spatial organization is determined by the organization of its central, area. Today, in most cities of developing countries, a peculiar but more fundamental problem of central area development that affect majority of the people and the town's growth is lack of efficiency due to poor locational pattern and functional linkages.

This study explores the possibility of using the trends in the development of the central area functions in Gombe as a basis for effective planning of the town's central area. The main emphasis is on improving the pattern of central area development. It first discuses the concept, growth and approaches to central area planning. This is followed by a detailed study of the development pattern of the central area functions from 1963 to 1998. The nearest neighbour analysis give a value of 0.374 for 1963, 1.060 for 1973, 1.080 for 1983 and 1.20 for 1998. The study found out that the emerging pattern is dispersed. The dispersal is significant at 0.05 level in 1998.

Therefore, a realistic planning approach is recommended to create order in the development of the central area. As part of the recommendations, the study also came out with design proposal for one of the proposed sites of the central area of Gombe.

TABLE OF CONTENTS

Title		Page
Declaration		i
Certification		ii
Dedication		iii
Acknowledgement		iv
Abstract		v
Table of Contents		vi
List of Tables		xii
List of Figures		xiii
List of Appendices		xv
	CHAPTER ONE	
1.0	Introduction	1
1.1	The research problem	2
1.2	Aim and objectives	3
1.2.1	Aim	3
1.2.2	Objectives	4
1.3	Statement of hypothesis	4
1.4	Scope and limitation	4
1.5	Data collection	4

1.5.1	Primary sources	5
1.5.2	Secondary sources	5
1.6	Analysis method	5
1.7	Definition of terms	6
1.7.1	Central area	6
1.7.2	Traditional central area	6
1.7.3	Modern central area	6
1.7.4	Dual central area	6

CHAPTER TWO

THEORETICAL FRAMEWORK

2.0	The concept and growth of central areas	7
2.1	The concept of central area	7
2.2	The growth of central area	8
2.3	Approaches to central area planning	13
2.4	The spatial and growth pattern of central areas in Nigeria	15
2.4.1	Pre-colonial period	15
2.4.1.1	Pre-colonial cities of Northern Nigeria	16
2.4.1.2	Pre-colonial cities of Western Nigeria	17
2.4.2	Colonial period	18

2.4.3	Post-colonial period	19
2.5	Types of central area	20
2.5.1	Modern central areas	20
2.5.2	Traditional central areas	21
2.6	Planning central areas in Nigeria: problems and prospects	21
2.6.1	Problems	21
2.6.2	Prospects	22
2.7	Conclusion	23

CHAPTER THREE

STUDY AREA

3.0	Introduction	24
3.1	Physical characteristics	24
3.1.1	Location, relief and drainage	24
3.1.2.	Geology and soil	25
3.2	Socio-economic characteristics	26

CHAPTER FOUR

THE CENTRAL AREA OF GOMBE

4.0	Method of analysis	28

4.1.1	Then nearest neighbour analysis	28
4.1.2	Significance test	30
4.2	Spatial expansion and growth of the central area of Gombe	31
4.3	Gombe in 1963	33
4.3.1	The pattern of the central area in 1963	35
4.3.2	Analysis of the spatial pattern of central area functions, 1963	35
4.4	Gombe in 1973	36
4.4.1	The pattern of the central area in 1973	38
4.4.2	Analysis of the spatial pattern of central area functions, 1973	38
4.5	Gombe in 1983	39
4.5.1	The pattern of the central area in 1983	41
4.5.2	Analysis of the spatial pattern of central area functions, 1983	41
4.6	Gombe in 1998	42
4.6.1	The pattern of the central area in 1998	44
4.6.2	Analysis of the spatial pattern of central area functions, 1998	44
4.7	Composite growth of Gombe (1963-1998)	45

CHAPTER FIVE

PLANNING PROPOSAL

5.0	Introduction	48
5.1	Planning intervention	48
5.1.1	The planning options	49
5.1.2	Selected planning option	50
5.2	Selection of existing locations	50
5.2.1	The criteria	50
5.2.2	The ranking	54
5.3	Existing and required central area functions at the selected locations	56
5.3.1	Standard adopted	56
5.3.2	Schedule of requirements	57
5.4	Proposal for effective linkage between the central areas	59
5.4.1	Roads to be improved	59
5.4.2	New roads	60

CHAPTER SIX

DESIGN PROPOSAL

6.0	Introduction	61
6.1	Design proposal for site 'A'	62

6.1.1	Site condition	62
6.1.2	Landuse	62
6.2	Design concepts	62
6.3	Planning concept	63
6.4	Design elements	64
6.4.1	Grouping of buildings and voids	64
6.4.2	Cultural elements	64
6.4.3	Public and semi-public elements	65
6.4.4	Commercial elements	65
6.4.5	Circulation	65
6.4.6	Infrastructural services and utilities	66
6.4.7	Greenspaces and hedges	66
6.5	Conclusion	66
	Bibliography	68
	Appendices	71

	LIST OF TABLES	PAGE
3.1	Population Growth	26
4.1	Landuse pattern of Gombe, 1963	33
4.2	Landuse pattern of Gombe, 1973	37
4.3	Landuse pattern of Gombe, 1983	40
4.4	Landuse pattern of Gombe, 1998	43
4.5	Landuse changes in Gombe, 1963-1998	46
4.6	Nearest neighbour indices for central area functions in Gombe, 1963-1998	47
5.1	Weight of central area functions according to importance	51
5.2	Weight of central area functions according to land availability at existing site	52
5.3	Weight of central area functions according to its distance to users	52
5.4	Weight of central area functions according to the distance to its nearest neighbour	53
5.5	Weight of central area functions according to compatibility with adjoining uses	54
5.6	Ranking of the locations of central area functions	55
5.7	Planning standard for central area functions	57
5.8	Required central area functions at the selected locations.	58

	LIST OF FIGURES	PAGE
2.1a	The concentive zone model	10
2.1b	The Sector model	11
2.1c	The multiple nuclei model	12
2.2a	Some pre-colonial cities	16
2.2b	Central areas of some indigenous Hausa-Fulani cities.	16
2.2c	Structure of the focal point in Yoruba cities (Hypothetical).	17
2.2d	Dual nature of central areas	18
2.3	The central area of Abuja	20
3.1	Geology of Gombe	25b
3.2	Map of the Study area	27b
4.1	Landuse map of Gombe, 1963	33b
4.2	Location of central area functions in Gombe, 1963	35b
4.3	Landuse map f Gombe, 1973	36b
4.4	Location of central area functions in Gombe, 1973	38b
4.5	Landuse map of Gombe, 1983	39b
4.6	Location of central area functions in Gombe, 1983	41b
4.7	Landuse map of Gombe, 1998	42b
4.8	Location of central area functions in Gombe, 1998	44b
4.9	Trend in the development of central area functions in Gombe	47

5.1	Proposed central areas	56b
5.2	Proposed linkages	59b
5.3	Sections of existing, and proposed roads	60b
6.1	Existing site condition	62b
6.2	Design concepts	63b
6.3	Proposed central area (A)	64b

	LIST OF APPENDICES	PAGE
i	Kulshrestha's classification of urban centres	71
ii	Formula and table of critical values	73
iii	Analysis of locational pattern of central area functions in Gombe, 1963	75
iv	Analysis of locational pattern of central area functions in Gombe, 1973	76
v	Analysis of locational pattern of central area functions in Gombe, 1983	77
vi	Analysis of location pattern of central area functions in Gombe, 1998.	78

CHAPTER ONE

1.0 INTRODUCTION

The term central area refers to where central functions that serve a town's population are concentrated. These include administrative, cultural and commercial facilities and services. It is a dynamic part of the city, not only in the sense that its activities constitute definable system, but also because the relative importance and the spatial extent of these activities change with time.

Central areas fundamentally perform the function of satisfying the social (such as cinemas, theatres, meeting halls, libraries); political (administrative; such as offices, local, state and federal government secretariats etc); and economic (commercial, such as shops, markets, banks, post offices etc.) needs of the town and to some extent that of the city region.

As the heart of the city, the central area has come to be identified with some physical problems like congestion and poor spatial organization due to the pressure of urban growth. Attempt to solve the problem created by the pressure led to the upgrading of some central areas like that of Jos and Gombe (Doxiadis 1975; Kassem 1976; Max Lock 1973); the design of new central areas to ease pressure on the existing one as in Sokoto (Musa 1985); while in some towns attempt to contain the pressure in the existing central area led to the dispersal or decentralization of central area functions as in Bauchi.

However, effective planning may not be successful without understanding the pattern of growth and development of central areas. In many towns in developing countries, pressure of market forces and unco-ordinated government actions have dictated the re-organization of the central area functions which lead to poor organization of space and functioning of the town as a whole. However, since central functions form the core around which development takes place, their planning is necessary for effective functioning of towns as a whole.

1.1 THE RESEARCH PROBLEM

Changes in the pattern of development of central areas is as a result of expansion of central functions caused by the spatial growth of cities. The reason for the rapid spatial growth include socio-economic changes, increase in population and changes in administrative status. The inevitable consequence of expansion of central areas is lack of functional relationship between the central functions, poor spatial linkages and poor location of central functions in the urban areas/cities.

In planned towns, the central areas are located in such a way that they are conceptually central to the life of the town. Owing to good linkage and location, there is effective utilization of the central area and the level of services provided is maximized.

However, in Nigeria, most towns have grown without the influence of modern planning. The location of activities is based on the indigenous setting and principles. Central area functions take different location once the locational decision is made, which is not on the basis of long term

planning. Therefore, where there is a sudden change in the status of the town (for example, from a local government headquarter to a state capital), the growth of central area becomes rapid and the functions are dispersed leading to the emergence of a new pattern of development.

When planning intervention is taken for these towns (State Capitals), the practice has been to designate and design new central area. However, the experience is that the economic conditions do not make it possible for the new central areas to be developed.

Similarly, the central area of Gombe developed to form a unifocal central area which has been adequate for the town as a local government headquarter. However, with the recent change in the status of the town from a local government headquarters to a state capital, there has been an increasing pressure on the central area. This led to the proposal (by the Planning Division, Department of Land and Survey) for the relocation of the central area to a new site. The experience of other towns reveals that this ideal intervention achieves little or no success. There is the need to examine the reality of what is happening to the central area to determine a viable and realistic planning action. This can only be achieved by identifying the recent trends in the development pattern of the central area in Gombe and to use this understanding in planning the central areas of Gombe. This shall require finding answers to the questions: How is the central area of Gombe growing? Must there be only one central area for Gombe and what is the realistic approach to planning for the development of the central area?

1.2 AIM AND OBJECTIVES

1.2.1 AIM

The aim of this study is to establish the trends in the development of the central area of Gombe

with the view to making a proposal for the planning of the central area.

1.2.2 OBJECTIVES

1. To examine the physical characteristics of Gombe central area and its problems.
2. To examine and analyse the trends in the development of central area and functions in Gombe.
3. To recommend viable principles and make planning proposal for the development of the central area of Gombe.

1.3 STATEMENT OF HYPOTHESIS

HO : The pattern of central area function in Gombe is random.

H1 : The pattern of central area functions in Gombe is not random.

1.4 SCOPE AND LIMITATION

This work studies the physical characteristics and development of Gombe and its central area. Therefore, special attention is given to the locational pattern of central area functions that evolved over the years.

This work does not cover the delineation of the traditional central area; a detailed assessment and comparison of the cost involve for implementing each of the planning option; and implementation policy.

1.5 DATA COLLECTION

Data for the study is collected from the following sources:-

1.5.1 PRIMARY SOURCES

Survey of the existing situation of the central area was conducted. The survey include the landuse, location of the central area functions.

- The landuse survey was conducted with the help of land use maps acquired from the planning department and updated through field work.

Interview was conducted with officials of the state population commission to obtain the population figures. Similarly, officials of planning division in the department of land and survey were interviewed to obtain the relevant information about the existing landuse and the development plan for Gombe town.

1.5.2 SECONDARY SOURCES

The theoretical background of the work was obtained by the review of relevant literature. Other source of secondary data include maps such as, map showing the geology and the landuse. The master plan by Max Lock (1973) provide information on past plan for the development of the central area of Gombe.

1.6 ANALYSIS METHOD

A statistical technique is employed in the analysis of the data. Beyond visual observation, the statistical technique gives the measure of concentration or dispersal of the central area functions in quantitative terms. The nearest neighbour analysis was used. The data is presented in tabular form.

1.7 DEFINITION OF TERMS

1.7.1 CENTRAL AREA:

The term central area refers to where central functions that serves a towns population are concentrated. These functions include administrative, cultural and commercial activities.

1.7.2 TRADITIONAL CENTRAL AREA:

Is the heart or focus of pre-colonial towns that develop organically. The major functions that concentrate in the centre include the palace, central mosque, and traditional market.

1.7.3 MODERN CENTRAL AREA:

Is the centre that developed during and after colonial period, normally located outside the traditional city, where such exist. They are characterized by the central area functions like modern market and administrative functions.

1.7.4 DUAL CENTRAL AREA:

The state of existence of two central areas that emerge at different points in time in a city, mostly traditional and modern central areas existing side by side.

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CHAPTER TWO

THEORETICAL FRAMEWORK

2.0 THE CONCEPT AND GROWTH OF CENTRAL AREAS

2.1 THE CONCEPT OF CENTRAL AREA

The conception of central area vary from one country to another. In Britain, Keeble (1969) defined the central area as "The area in which the commercial and administrative life of the town take place in their highest and most complicated form, and in which the most important central services supplied by the town are made available" (pg 99). Similarly, Gibberd (1967) defined the `town centre' as "the chief administrative business, entertainment and cultural centre of the town as a whole" (pg 67).

In the United States, the term `Core Area' and `Heart Area' are common. Gruen (1965) defines the heart of the city as "the most highly urbanized area, which ideally should contain a complete range of the highest productive use and the most significant urban functions not only in the fields of business and civic administration, but also in cultural, recreational, social and spiritual activities as well, and residential quarters of high quality and density" (pg 47). The use of `central Business District' and `Down Town' are also common.

All these terms used in Britain and the United States mean the same thing. They refer to where administrative, commercial and cultural activities are concentrated in a town. The central area is defined by each country according to the perception of the people.

According to Karimu (1984), in Nigeria, the conception of central area is in relation to functional

centrality not necessarily geographical centrality. It refers to the core of the city which has greatest concentration of activities such as civic, economic, socio -cultural, religious as well as recreational. The importance of each of these categories will vary with each town Vis-a-Vis its historical background.

From the foregoing, an exact definition of central area which can be applied to more than one city in time and space has not yet been evolved and as noted by Juchnowicz (1978), the censuses of most developing countries, including Nigeria, do not give many precise definition of central area. According to Juchnowicz (1978), certain key words such as central services of the highest order, services which are used by the population of the town as a whole and the greatest concentration of activities tend to characterize definitions of central areas of the developed countries.

Therefore, the concept of the central area by Karimu (1984) is adopted for this study. In addition to that, any of the functions located in isolation can be referred to as a central area function, if the services and goods it renders affect large number of the populace and have significant linkage in terms of activity with other central area functions.

2.2 THE GROWTH OF CENTRAL AREAS

Research on the growth of central areas can be traced to the classical models of urban land use. The first model was developed in Chicago by Burgess(1923) known as the concentric zone model. According to Burgess, as city grows, its landuse and density are arranged in concentric

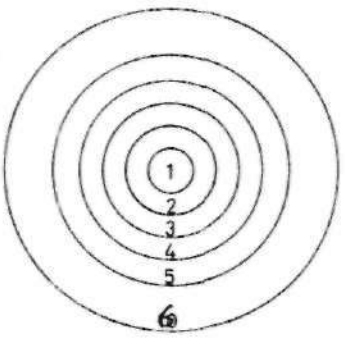
pattern. As the city grow, it expands radially from its central area to form a series of concentric zones. He identified five concentric zones. Beginning with the city centre which occupies the inner most part of the city, this zone is devoted to higher order commercial activities.
The next zone is that of transition which consist of an outer belt of residential deterioration mixed up with a deteriorating factory district in the inner belt.

This is followed by the zone of independent working men zone. This zone is characterized by the 2 flat apartments. Here, there was a change in the growth of the type of people and the housing, the housing density is lower than in the second zone.

The fourth zone is a zone of better residences, here lives the great middle class in single family residences. Within the zone were located business centres which Burgess termed as satellite central business district.

The fifth zone is a commuting zone. It comprises of high quality housing Density is extremely low and infact constitute the major attraction in this area. It is now clear that the farther one moves away from the central area, the better the quality of the housing as well as the higher is the socio-economic status of the people in the area.

The assumptions underlying this model include a city with a single centre, a mixed industrial and commercial base, economic competition for the highly valued but very limited central place, and uniform decline of accessibility, land value and transport cost in all direction. (See fig. 2 1a).



1. *Central Business District*
2. *Whole sale light manufacting*
3. *Low-class Residential*
4. *Medium-class Residential*
5. *High class Residential*
6. *Commuters' zone.*

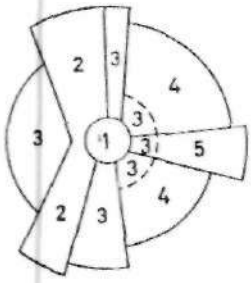
Fig. 2.1a: CONCENTRIC ZONE MODEL

At this point one might argue that the model is based on the experiences of developed countries. In the developing countries the cities are not industrial and commercial centres but rather political and administrative centre. Therefore, the functions in the central area are not purely commercial. The pattern is almost reverse of that proposed by the concentric zone model with the rich cluster near the central area while the poorest are pushed to the outer edge of the city.

The second model was put forward by Homer Hoyt (1939). He analysed the distribution of residential neighbourhood of various qualities in term of rent value and found that they were neither randomly distributed nor distributed in a concentric circle as suggested by Burgess. According to Hoyt, area of similar qualities tended to be located in one or more pie-shaped sector and did not form a complete circle round the city. Growth along any of the sector tends to be characterized by similar type and quality of land uses; resulting in the star-shaped pattern of the city with different types and quality use radiating along different sectors from the central area to the periphery.

Hoyt like Burges assumes a single city centre but takes into consideration the direction of growth

and so avoids over simplification of uniform decline of accessibility, land value and transport cost in all direction. (See fig. 2.1b).



1. *Central Business District*
2. *Whole sale light manufacturing*
3. *Low-Class Residential*
4. *Medium-Class Residential*
5. *High-Class Residential*

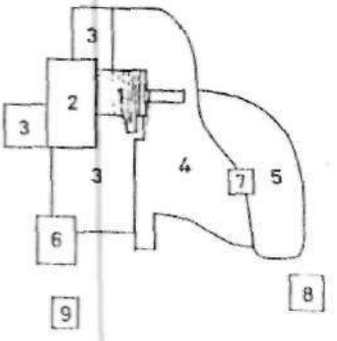
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Fig. 2.1b: SECTOR MODEL

It is clear that neither the concentric zone nor the sector model say much about the location of central functions other than housing. The location of these central functions play important role in the spatial organization and growth of cities. Most of the assumptions held by the models are only tenable in pre-colonial cities of Nigeria. For example, the emerging central areas are multi-nuclei, not based on a single dominant central area. The concentric and sector models are unrealistic to Nigeria because there is deliberate allocation of particular area of the city to certain uses. Thus, the place and cultural activities may occupy an extensive area in the central area for reasons other than economic.

The third model is the multiple nuclei model. It is made up of a number of separate nuclei as proposed by C.D Harris and E.L Ullman (1945). It was conceived as a further move away from

the massive generalization towards reality. It is an observed fact that many towns do not grow simply about a single central area but are formed by the progressive integration of a number of separate nuclei into the urban fabric hence the suggestion of a multiple nuclei model. These nuclei may have existed from the establishment of the city or develop as the growth of the city stimulates migration and specialization (see fig. 2.1c)



1. *Central Business District*
2. *Wholesale Light Manufacturing*
3. *Low-class Residential*
4. *Medium-class Residential*
5. *High-class Residential*
6. *Heavy Manufacturing*
7. *Outlying Business District*
8. *Residential Suburb*
9. *Industrial Suburb*
10. *Commuters' Zone*

Fig. 2.1c MULTIPLE NUCLEI MODEL

The pattern in the growth of central areas in Nigeria has changed with increase in automobile ownership and rapid urban growth. Mabogunje (1968) identified the growth of twin central district in Nigerian cities, each of which has its own centre of intense activity. Mabogunje, demonstrated the importance of the Idea of multiple nuclei as fundamental in understanding the nature of Nigerian cities. Therefore, this model serve as a valuable tool in studying the trend in the development of central areas in Nigerian cities.

It is clear that the studies on the growth of central areas are limited to the description of the activity patterns and the forces behind their emergence. However, they have not utilize the

knowledge of the activity patterns in making planning proposals for the central areas to ensure proper functioning of the town seeing that the central area form the core around which development takes place.

2.3 APPROACHES TO CENTRAL AREA PLANNING

Town planners interested in urban problems have highlighted the problems facing the central areas, and have proposed solutions for their effective functioning. This group of researchers (Gibberd 1967; Grebler 1964; Osborn and Whittick 1963) are those that attempt to solve the immediate problems of the central areas. The literature on the approach to central area planning can be classified into three main groups; which are, those concern with central area design, those concern with central area redevelopment/renewal and those concern with design of central areas in new towns. These approaches, which deal in principle with the same problem, have placed emphasis on different aspects of the problem.

Of particular interest to the design of central areas of cities is the work of Gibberd (1967). Having made a distinction between planning and design, Gibberd gave guidelines to a successful design of central areas. The guidelines include:-

1. The required functions for the centres which are administrative, business and commercial, light industries, recreation and cultural functions.
2. The conventional solution of the ring road by-passing the centre as the most effective way of solving the traffic problem.
3. The use of the concept of pedestrian precint in central areas.

Other studies suggested renewal of the central areas in order to ease their problem. Typical in this group of work is that presented by Grebbler (1964). The main objectives of these (His) proposals include:

1. The revival of the economic basis of these centres.
2. The expansion of existing centres or direct enlargement of the areas through projects pushing into the surrounding gray areas, often in association with major traffic improvement.
3. Conservation and restoration - the preservation of a cultural heritage.

The literature on British new towns; Osborn and Whittick (1963), Rodwin (1956) form another class of literature on the central areas. They outline the elements that a central area should contain, the achievements of actually implemented examples of new city projects, such as those of Stevenage, Crawly, Welwyn etc.

These studies attempt to solve the problems of central areas without considering the dynamic nature of urban areas, that is, the nature or type of relationship between city growth and central area development. Those approaches view the central areas as static, centrally located component of the city because they do not based their proposal on intensive study of the relationship that exist between city growth and central area development. There is the need to understand the dynamic nature of urban areas and its effect on the development of central areas in Nigeria and the study area in particular, and utilize the understanding in planning for the central areas. Therefore this study sets out to explore the relationship between city growth and central area

development as the most viable way of planning the central areas. It differ from the above studies significantly and will serve as a good tool for developing countries.

2.4 THE SPATIAL AND GROWTH PATTERN OF CENTRAL AREAS IN NIGERIA.

Urban growth in Nigeria dates back to the pre-colonial period, providing a good situation for studying the dynamics of urban growth as well as examining response of growth to social, economic and spatial (locational) change. The evolution process of Nigerian central areas is in three stages, that is the pre-colonial, colonial and post-colonial period.

2.4.1 PRE-COLONIAL PERIOD

The distribution of pre-colonial cities in Nigeria is limited only to two regions, northern and western Nigeria. In these regions existed a tradition of urbanism dating back to pre-colonial times which continued to the present time. Each region had developed a network of settlements, many of which attained and still possess significant sizes to qualify them as `urban' under the existing system of settlement classification in Nigeria.

The central areas during this period developed from the inception of the settlements forming unifocal central areas. The force responsible for the emergence of unifocal central areas is purely socio-cultural. These central areas have been known to be the hub of political and religious activities. Generally; imposing buildings dominated the centre, symbolizing power both spiritual and political. (See fig. 2.2a).

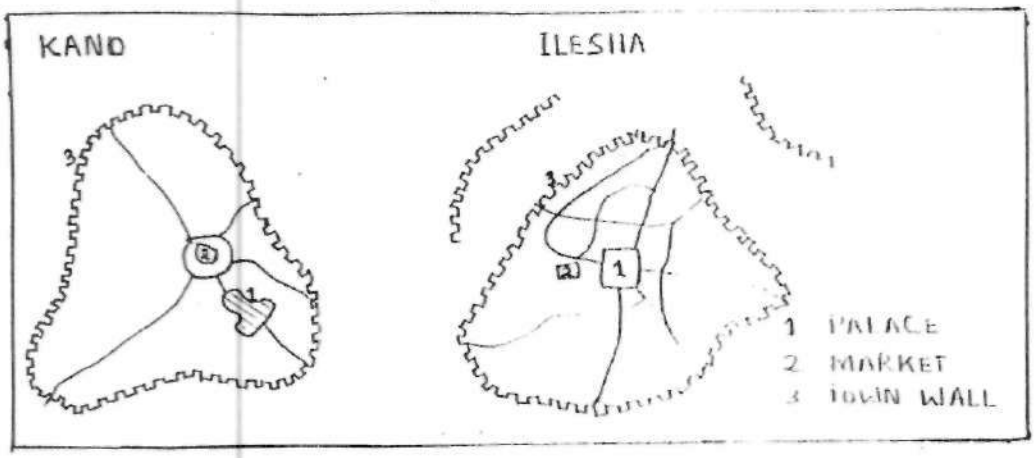


Fig. 2.2a: SOME PRE-COLONIAL CITIES

2.4.1.1 PRE-COLONIAL CITIES OF NORTHERN NIGERIA

The central areas of the traditional cities of northern Nigeria are characterized by a distinct pattern of the central elements. The important elements are the Emir's palace (Fada), the central market (Kasuwa), central mosque (Masallaci) and open space (Dandali). Their location generally tends towards the centre of the city with the palace most centrally located. (See fig. 2.2b).

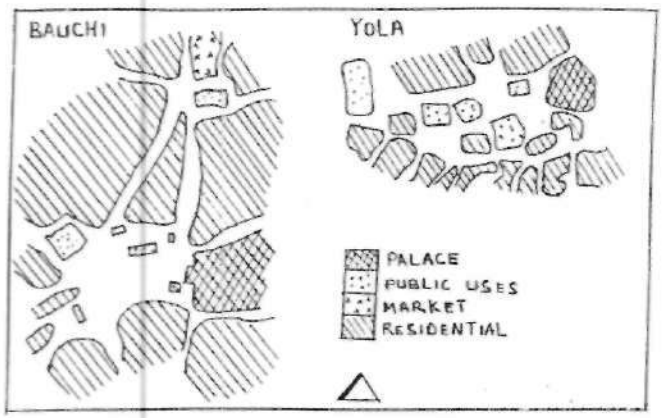


Fig. 2.2b: CENTRAL AREAS OF SOME INDIGENOUS HAUSA FULANI CITIES

The place is the seat of administration containing the emir's residence, that of his servants and

relations, and offices. The palace is always located to the east to signify allegiance to Mecca, with the central open space (Dandali) in the frontage which is the principal venue for various cultural activities like the celebration of sallah and for general recreational purposes. The central mosque is located close to the palace, an indication to the importance of the Emir as both administrative and religious head. The central market serves as the economic activity nerve of the city, featuring trade in locally produced and imported wares including craft and agricultural produce. The central areas are characterized by narrow streets that developed radially to other parts of the towns.

2.4.1.2 PRE-COLONIAL CITIES OF WESTERN NIGERIA.

In western Nigeria, the key focal points are the palace, places of religious assembly, open space and market (Oja Oba). The palace is located centrally, occupying considerably extensive area containing the palace buildings and large open space for public assembly and for recreation. The central market of the city is located close to the Oba's palace. The market in the western cities is conceived as a direct symbol of power justifying the location near the palace. Roads radiate from the central area giving the cities their famous wheel-shaped structure (See fig. 2.2c).

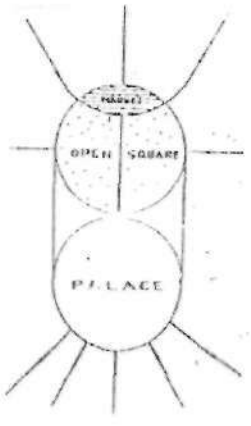


Fig. 2.2c ***STRUCTURE OF THE FOCAL POINT IN YORUBA CITIES (HYPOTHETICAL)***

2.4.2 COLONIAL PERIOD

The traditional cities have been the forbearers to the growth of urban centres in Nigeria. A new set of cites have been added to these traditional cities during the colonial period. The new set of cities are administrative, mining and commercial cities like Kaduna, Jos, Enugu and Onitsha. Similarly, new roles were imposed on the traditional cities which culminated into the emergence of new urban elements like the `Sabon Gari' and its central area, often existing side by side with the indigenous elements. In some cities, the new development in central functions are accommodated in the old central areas (for example, Bauchi).

During this period, the colonialist made a deliberate effort to physically segregate themselves from the indigenous population. With this establishment came two opposing patterns of physical development of the cities (Kaltho, 1982). This led to the development of bi-focal or dual central areas, the indigenous city maintaining its core while the colonial township focussed on the market in the `Sabon Gari' which became the new core for commerce and industry (Mabogunje, 1968.) The major force behind the pattern was that of colonial segregation. This was the beginning of dispersal of central area functions. (See fig. 2.2d).

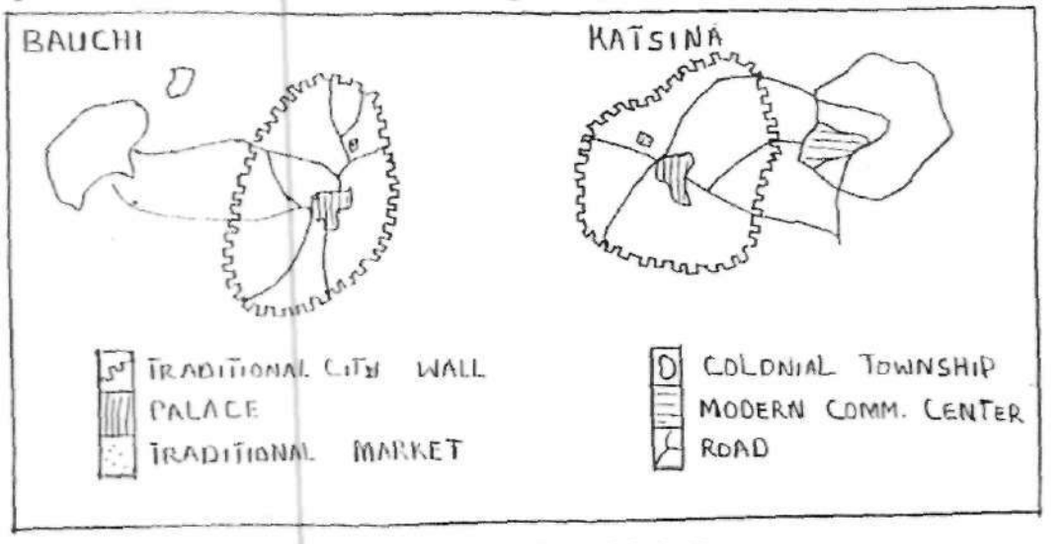


FIG. 2.2D: DUAL NATURE OF CENTRAL AREAS

New developments in central area functions characterized by commercial and administrative activities were introduced during the colonial period. They are mostly separated from the traditional centre, with a well planned grid iron pattern. However, in some towns, the new developments in central areas are accommodated in the traditional centre.

2.4.3 POST-COLONIAL PERIODS

The graduating of some towns to regional and later state capitals introduced a new force in shaping the development patterns of central areas of these towns. The new forces responsible for the development of these capital cities and their central areas is related to the change in administrative functions. This is the prevailing city transforming force in recent years as more towns are made state capitals, signifying a change from the past city transforming forces of culture and colonialism. These administrative cities are characterized by multi-focal central areas. This force is operating in lower administration settlements such as local government headquarters, though to a lesser degree as compared to state capitals. Many major cities in Nigeria whose expansion is due to this new force have expanded to over twenty times their previously built-up area, with no effective control or plan for their central areas as it relates to the organization of the overall growth pattern of the cities. This rapid growth of the cities and their central area is a crystallization of the process that was started during the colonial period, that is, the policy of segregation of residential areas which led to the dispersal of central area functions.

2.5 TYPES OF CENTRAL AREA

2.5.1 MODERN CENTRAL AREAS

Two types of modern central areas can be identified in Nigeria.

The first type are the modern central areas found in cities of colonial creation. They are characterized by grid iron layout pattern. The major elements in the central areas are commercial and administrative. They lack the traditional elements found in the central areas of pre-colonial cities. Examples of these new colonial towns include Kaduna and Enugu.

The second type is based on comprehensive plan. A typical example in Nigeria is the central area of Abuja. The general planning concept of the central area of Abuja reflects the Nigerian tradition with the use of formal open spaces and the relationship of major activities to reflect a mixture of historic Nigerian practice, for example, the location of the presidential villa, socio-cultural and commercial activities within the central area. (See Fig. 2.3)

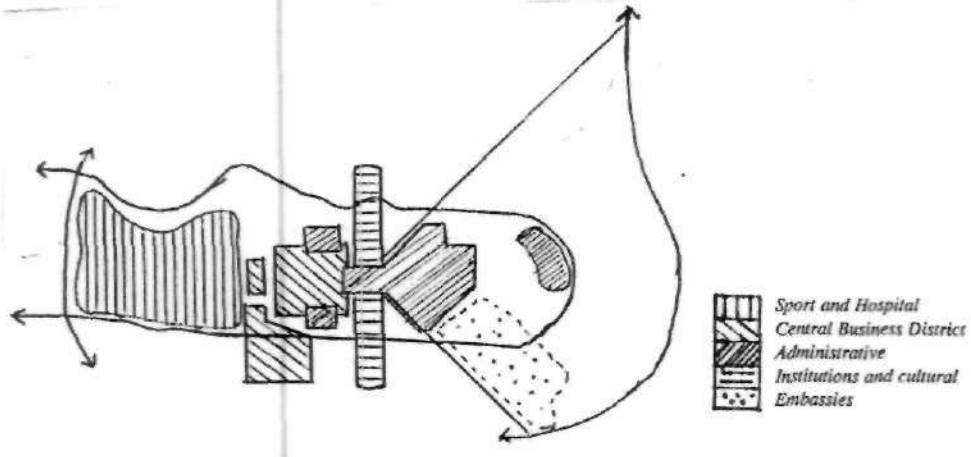


Fig. 2.3: THE CENTRAL AREA OF ABUJA

The planning concept of the central area of Abuja was based on locational principles which include centrality of location, accessibility, compatibility with plan, minimizing environmental

constraints and reflecting Nigerian tradition. The functional principles include, acknowledgement of Abuja as a seat of government, symbol of unity, arrangement of land use to promote efficiency and accessibility, adaptation to incremental growth, simplicity in circulation and parking system.

2.5.2 TRADITIONAL CENTRAL AREAS

This type of central areas are located based on traditional principles of planning. However, they have not been able to accommodate modern development in central area functions. This lead to the ad hoc location of central area functions dictated by the pressure arising from rapid growth of these cities. Most of the central areas in Nigeria fall into this category, for example, Kano, Bauchi, Ilorin, Ibadan, and Gombe. The planning concept used for new development of commercial, semi-public and public activities in these cities is that of optimum location. (See Fig. 2.2b & c).

The traditional character of these cities is based on the principles of grouping of like functions, and centrality of location to ensure accessibility and linkage with different communities.

2.6 PLANNING CENTRAL AREAS IN NIGERIA: PROBLEMS AND PROSPECTS

2.6.1 PROBLEMS

The central areas have their own problems. The understanding of these problems is necessary to serve as a guide in planning central areas of fast growing towns. These problems are generally those that arise from lack of foresight or the needs for which the centres were designed. This is especially so in the traditional central areas. Very often, road capacities and the provision of car

parking space have become grossly inadequate in some of the central areas because the designed space did not fully anticipate the growth. Therefore, accessibility is generally poor.

In most of the central areas, increase in central functions create the pressing need for more space. However, due to lack of flexibility in the traditional central areas, these new developments are not accommodated leading to their dispersal on the basis of ad hoc locational decisions.

This raises a question about the functionality of these central areas which is always the most important feature any central area is expected to achieve without,which it is said to be a failure. This makes the central areas unattractive and unable to create any aesthetic effect on the perception and appreciation of the people about the beauty of the urban environment.

Despite the fact that central areas are needed in our cities as the core around which healthy urban growth originate, the uncoordinated dispersal of central area functions prevent them from serving their purposes.

2.6.2 **PROSPECTS**

The emerging pattern of central areas presented by cities in Nigeria have its desirable aspects because it gives a better understanding of the planning principles that give rise to the concept of the central areas. The pattern of growth from pre-colonial to post-colonial period indicate how man has consciously or unconsciously played a great role in shaping the pattern of central areas.

The modern central areas show how Nigerian traditional principles can be utilized in modern design. It is an improvement because it combines traditional and modern concepts to produce a

more functional central area, providing a sound basis for understanding how Nigerian traditional concept can be integrated with modern ideas to produce a central areas that unique.

In the same vein, understanding the traditional central areas makes the central areas of younger towns in terms of the present conditions and the forecast for their future growth possible. It also points out to the source of such growth especially in recent times and the conditions that are necessary for its emergence.

Thus, a proper understanding of the emerging patterns, planning concepts and the principles behind them serves as a guiding principle for effective planning in the case of central areas of other towns where similar conditions exist.

2.7 CONCLUSION

Gombe started as a traditional town with one central area during the precolonial period. However, recent trends in the development of the town and its central area create the need for a new concept of its central area which do not his on unifocality but multifocality.

This is the reason why the previous planning approaches are not applicable to Gombe and the renewal proposed by Max Lack (1973) is grossly inadequate because they are on the basis of a unifocal central area.

Therefore, both the old principles and emerging new ones will serve as a basis for evolving a better strategy for solving the problem of the central area of Gombe.

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CHAPTER THREE

STUDY AREA

3.0 INTRODUCTION

The emirate of Gombe dates back to about 1804 at the time of the Fulani jihad. The first Emir, Buba Yero, had been born about 1762 near Mada, in the Numan division. Buba Yero established his base in old Gombe where he is said to have built the walls of the town in seven days and seven nights. By the time the British arrived in Gombe in 1902 the emirate had been through troubled times, with internal struggles for power. Gombe was upgraded to a first class chiefdom in 1955. This and the coming of the railway in 1962 has made Gombe a much more thriving town.

The present town of Gombe was chosen in about 1920. The town had previous locations at Gombe Aba and Nafada before relocating to its present site at a village called Doma in Ako district. The site was chosen for its greater proximity to Bauchi, the provincial headquarters. The town has grown in form of roughly square street blocks containing walled compounds, which surround the Emir's palace at the centre. The pattern of development could be attributed to the influence of culture (knowledge, art and custom) and colonialism at the time of location.

3.1 PHYSICAL CHARACTERISTICS

3.1.1 LOCATION, RELIEF AND DRAINAGE

Gombe with an area of 18.4 Km2 is located on latitude 10^{o} 15' north and longitude 11^{o} 10' east and had a population of 217,418 in 1998 (projected from 1991 census figure). The town is located on the scarp slope of the Ako escarpment.

Gombe is located on a scarp slope that slopes gently eastwards. The highest part of the built-up area of the town is 486m above sea level. The lowest part is 426m above sea level.

All the rivers that form the drainage system take their sources from the western section of the town or from the Kerikeri uplands further West and flows to the east to join the Gongola river down stream. All the rivers are seasonal.

Gombe is faced with some rather serious geomorphological problems.

The very prominent feature of the huge rock outcrop (Liji hill) constitute a constraint to eastward expansion of the town, and the long gradual slope of the Ako escarpment on the western side constitute another problem. The effect of which is serious, as water runs down the Ako escarpment in torrents and washes through the town causing havoc such as gully erosion and flooding. The streams gully into deep ravines and large area of flat land flood.

3.1.2 GEOLOGY AND SOIL

Gombe is situated over three geological formations. These are the pindiga formation, yolde formation, and Gombe sandstone, all of which are late cretaceous deposits. The marine rock strata are overlain by 300m of estuarine and deltaic sandstone, shale and ironstones. They are largely composed of siltstones and sandstones (see fig 3.1).

The hill complexes in Gombe region are dominated by rock outcrops, rubble accumulations and very shallow stony soils. Much of the colluvial material is derived from the near by occurrences

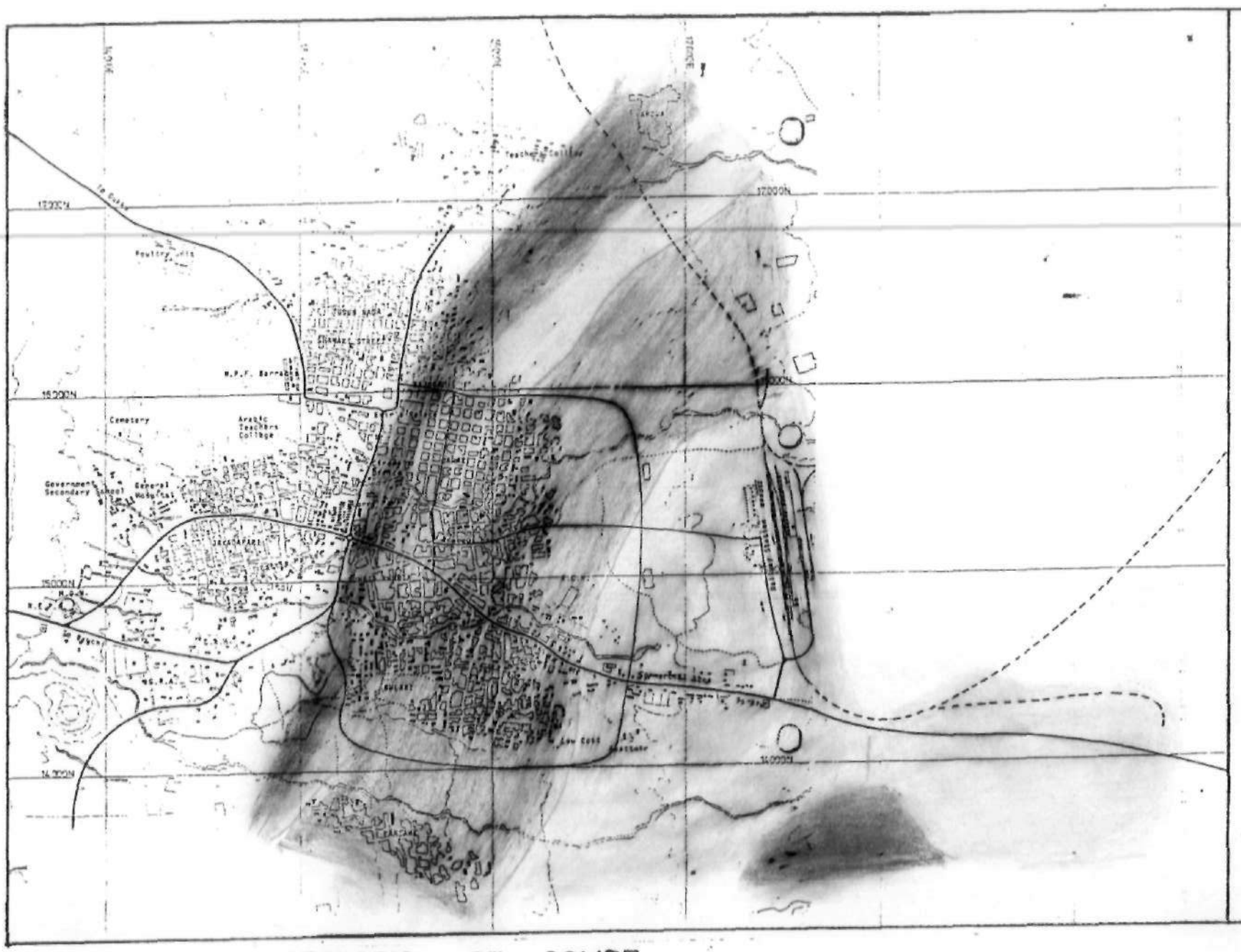


FIG 3.1 GEOLOGY OF GOMBE

SOURCE Geological survey of Nigeria plate 13 records 1956

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of kerikeri sandstone. They are sometimes underlain by shale and they normally remain moist for a considerable time in the dry season.

The geological evidence indicates that expensive clays underlie greater part of the town east of the centre of the town known as Pindiga shale. Analysis of the clay-shale suggests that it is one of the montmorillonite group which is noted for its water sensitive high expansive properties. This type of clay or clay-shale attracts water intensively and keeps it with an overall increase in volume. The effect of an expansive clay absorbing water beneath overlying materials and structures is an expansion pressure which can be very high. The result is usually severe cracking and tilting of walls and cracking of floors.

3.2 SOCIO-ECONOMIC CHARACTERISTICS

Gombe has grown in population from 47,265 recorded by the 1963 census to the present estimated population of 217,418 (projected from 1991 census). See table 3.1. In recent times, the town has been receiving numerous migrants from within the state and other parts of the country for the purpose of employment, education and commerce resulting to the spatial expansion of the built-up area of the town.

TABLE 3.1 POPULATION GROWTH

YEAR	1963	1973	1983	1991	1998
POPULATION	47,265	62,560	83,265	169,898	217,418

Sources: 1963 census, Max Lock Survey in 1973, 1991 census figure and Gombe state population commission for 1998 projection.

The growth of Gombe in recent years has been related to its new administrative role and subsequent increase in its central area activities. The town, like other indigenous Hausa-Fulani cities started as an emirate capital which fell under a wider administrative system of the British during the colonial period.

The town retained its traditional position as a centre of authority when it was made a provincial headquarter in 1962 and local government headquarter in 1976. This was further enhanced in 1996 when it was made the capital of Gombe State. From that time, the focus of authority and development has been on Gombe as state capital (See fig 3.2).

Urban - based economy was introduced with colonization. Emphasis was immediately placed on agriculture and in particular the production of cash crops (such as cotton and groundnuts) for export to Europe. This development was intensified after independence. Accordingly, the cash economy and the consumer society that was introduced with colonization graduated into a sophisticated one.

However, when petroleum export reached its boom, farming for cash declined, commerce became very important in Gombe. Presently, the mainstay of Gombe's economy are commerce, agriculture and its position on the national trunk road network (the road leading to Bauchi, Yola, Biu and Potiskum).

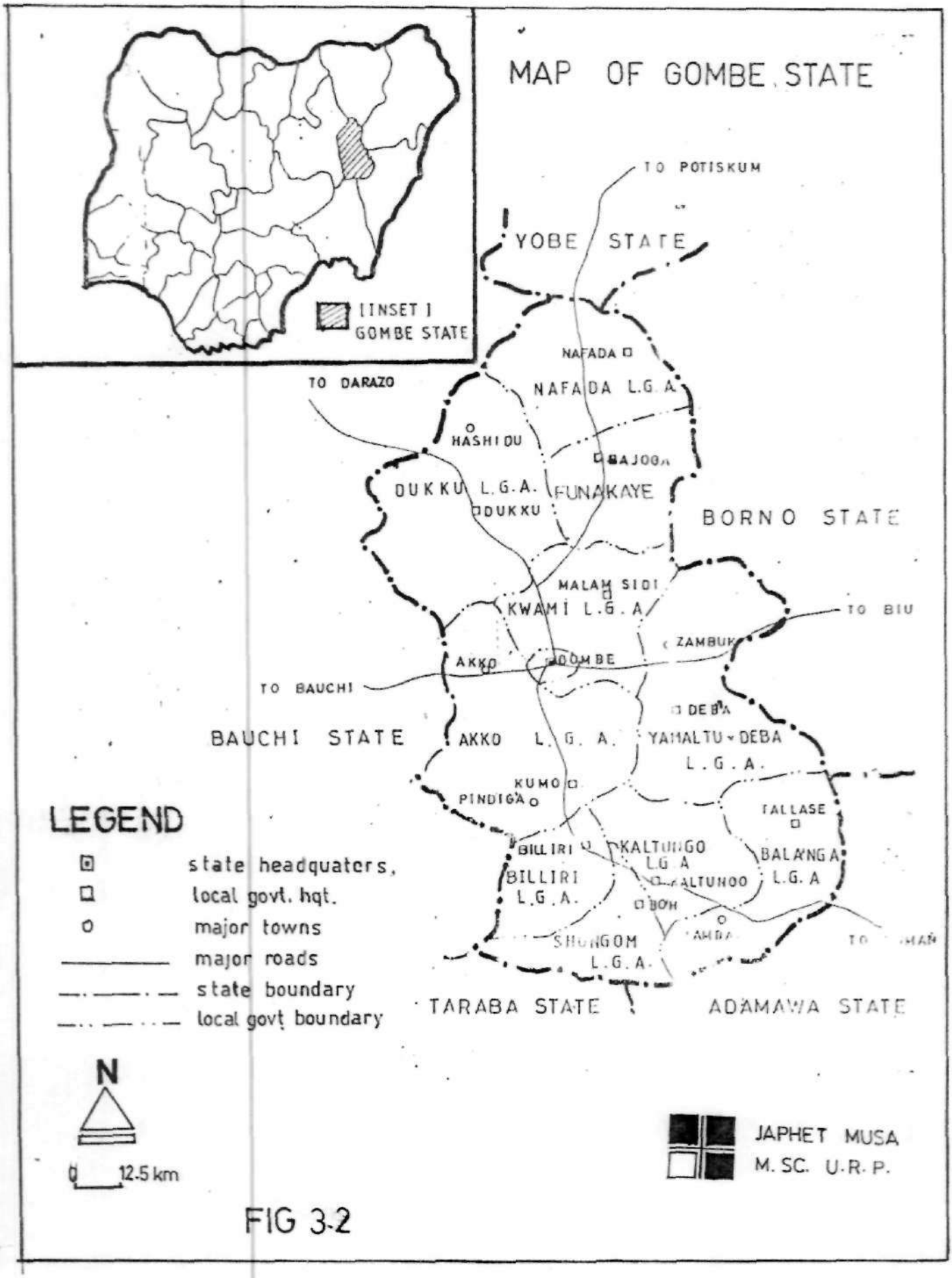

MAP OF GOMBE STATE
[INSET]
GOMBE STATE
TO POTISKUM
YOBE STATE
NAFADA
NAFADA L.G.A.
TO DARAZO
HASHIDU
BAJOGA
DUKKU L.G.A.
DUKKU
FUNAKAYE
BORNO STATE
MALAM SIDI
KWAMI L.G.A.
TO BIU
ZAMBUK
AKKO
GOMBE
TO BAUCHI
DEBA
BAUCHI STATE
AKKO L.G.A.
YAMALTU-DEBA L.G.A.
KUMO
PINDIGA
TALLASE
BILLIRI
KALTUNGO L.G.A.
BALANGA L.G.A.
BILLIRI L.G.A.
KALTUNGO
BOH
SHONGOM L.G.A.
TARABA STATE
ADAMAWA STATE
LEGEND
state headquaters,
local govt. hqt.
major towns
major roads
state boundary
local govt boundary
N
0 12.5 km
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FIG 3.2

CHAPTER FOUR

THE CENTRAL AREA OF GOMBE

4.0 METHOD OF ANALYSIS

4.1.1 THE NEAREST NEIGHBOUR ANALYSIS

The nearest neighbour analysis is a technique developed by Clark and Evans (1954), which is specially designed for measuring pattern in terms of the arrangement of a set of points in two, or indeed three dimensions. In essence the technique is quite straight forward. It involves calculating the mean of the distances between all points and their nearest neighbours. It does not matter what these points represent, although it will become apparent that the interpretation of nearest-neighbour analysis depends very much on the phenomenon under consideration. In some cases, two points form a reflexive pair, that is, each one is the nearest neighbour of the other.

The technique is based on a comparison of the observed mean first nearest-neighbour distance (d), calculated with respect to an actual point pattern, and the expected mean first neighbour distance (d), derived under the assumption that the point pattern was generated by a spatially independent random process.

Once the nearest neighbours have been identified, the nearest-neighbour distance for each point can be measured, and the mean nearest-neighbour distance found. The number of nearest-neighbour distances is always the same as the number of points.

$$\bar{d} = \frac{\Sigma_i \min d_{ij}}{n}$$

The theoretical, or expected, mean nearest-neighbour distance for a random arrangement can be calculated from the following equation.

$$d = \frac{1}{2\sqrt{\lambda}}$$

Where d is the expected mean nearest-neighbour distance for a random arrangement of points, λ is the density of points per unit area (the number of points divided by the area).

The area must be calculated in the same units as the nearest-neighbour distances.

The nearest-neighbour index provides a more concise measure of pattern in terms of a single value. The nearest-neighbour index is simply the observed mean nearest-neighbour distance divided by the expected mean nearest-neighbour distance for a random arrangement.

$$R = \frac{\bar{d}}{d}$$

Where R is the nearest-neighbour index, $\bar{d}$ is the observed mean nearest-neighbour distance and d is the expected mean nearest-neighbour distance for a random arrangement of points.

The nearest-neighbour index can have a value between 0.0, indicating a completely clustered pattern, and 2.146, indicating a completely dispersed pattern. A random arrangement is indicated by a nearest-neighbour index of 1.0.

4.1.2 SIGNIFICANCE TEST

It is possible to apply a significance test to nearest-neighbour analysis to decide how probable it is that the observed arrangement of points occurred by chance. The null hypothesis is that the observed arrangement is the result of points being located at random within the study area.

The test statistic used is based on the difference between $\bar{d}$ and d, and is very similar in form to student's t.

$$Z = \frac{\bar{d} - d}{SE_{\bar{d}}}$$

Where z is the test statistic, $\bar{d}$ is the observed mean nearest-neighbour distance, d is the expected mean nearest-neighbour distance for a random arrangement, and SEd is the standard error of the mean nearest-neighbour distance.

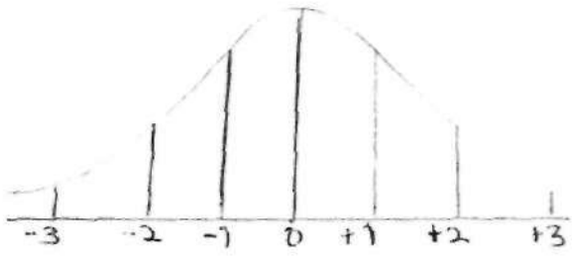
The standard error of the mean nearest-neighbour distance is exactly analogous to the ordinary standard error of the mean.

$$SE_{\bar{d}} = \frac{0.26136}{\sqrt{n\lambda}}$$

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Where n is the number of points and λ is the density of points per area.

The sampling distribution of the test statistic z is in fact the normal distribution. In other words, z is a standard normal deviate, positive values denote a dispersed pattern and negative values a clustered one. Since z behaves like any other standard normal deviate, there is a probability of 0.682 of obtaining a value of z between -1.0 and +1.0, a probability of 0.945 of obtaining a value of z between -2.0 and + 2.0, and 0.997 of obtaining a value of z between -3.0 and +3.0.



The significance of z can be checked by reference to tables of critical values of a standard normal deviate (See Appendix II)

In this study, a two-tailed test will be used since the test is being used to determine whether or not the pattern can be considered to be random.

This technique has been applied to study the spatial distribution of retail and service activities in Readings by Guy (1976). The activities he studied include sub-post offices, news agents, medicine (dispensary), dry cleaning etc. Getis (1964) use the technique to study changes in grocery store locations in Lansing, Michigan, over the 1900 to 1960.

4.2 SPATIAL EXPANSION AND GROWTH OF THE CENTRAL AREA OF GOMBE

Gombe is located on its present site in about 1920, as an administrative settlement. From then, the town rapidly grew at an unprecedented scale owing to its consolidation and consequent attraction of people. The town assumed the status of a commercial centre as it was situated on the trade route linking Hausa land with other towns.

There is no clear physical separation in form of wall between the traditional and modern

developments in Gombe as is the case in other Hausa-fulani cities of northern Nigeria due to its comparatively recent relocation. However, the colonial and post-colonial developments are distinguishable.

The traditional central area of Gombe is centrally located in relation to residential development following the principle of centrality and it served as the nucleus of growth. The changes and subsequent increase in central area functions like administrative, economic and socio-cultural functions were manifested by the spatial expansion of the town over the years. This spatial growth has been rapid, especially in the last few years.

The adjustment of the city's spatial forms and structure in response to these changes was through both government and the direct action of individuals. For these actions have an infinite capacity, recognizable or imperceptible to transform or change some essential characteristic of city form and structure (Mabogunje, 1980). Therefore, the growth of central area functions has been accompanied by rapid response of the town as a whole.

The study of the growth of Gombe and its central area can be classified into 4 periods. This classification is based on the availability of base maps for these periods, which form essential basis for an objective spatio temporal analysis of the evolution of the town. However, the period before 1963 is not included because of lack of base map. The periods included in the study are:-

4.3 GOMBE IN 1963

The 1963 pattern is strongly tied to the history of the town. The Emirs palace, which was centrally located, forms the central core, which exerts a lot of influence on residential areas which were located around it. Thus the spatial pattern of urban growth in Gombe began with this small compact core.

Fig 4.1 shows the spatial extent of the town. Around 1963, the core is still distinct, with the Emir's palace, mosque, court, market and post office as its elements giving rise to one central area.

Table 4.1 depicts the landuse pattern of Gombe in 1963. The total built-up area of the town was 430.75 ha in 1963.

TABLE 4.1: LANDUSE PATTERN OF GOMBE, 1963

LAND USE CATEGORY	AREA (HA)	PERCENTAGE OF TOTAL AREA
Residential	360.80	83.8
Commercial	6.90	1.6
Public and semi-public	36.40	8.4
Transportation	15.40	3.6
Recreation and open space	11.05	2.6
Total	**430.75**	**100.00**

Source: 1959 Air Photograph, compiled by Fairey Air Survey Ltd.

The pattern shows the predominance of residential landuse over other uses in the town during this

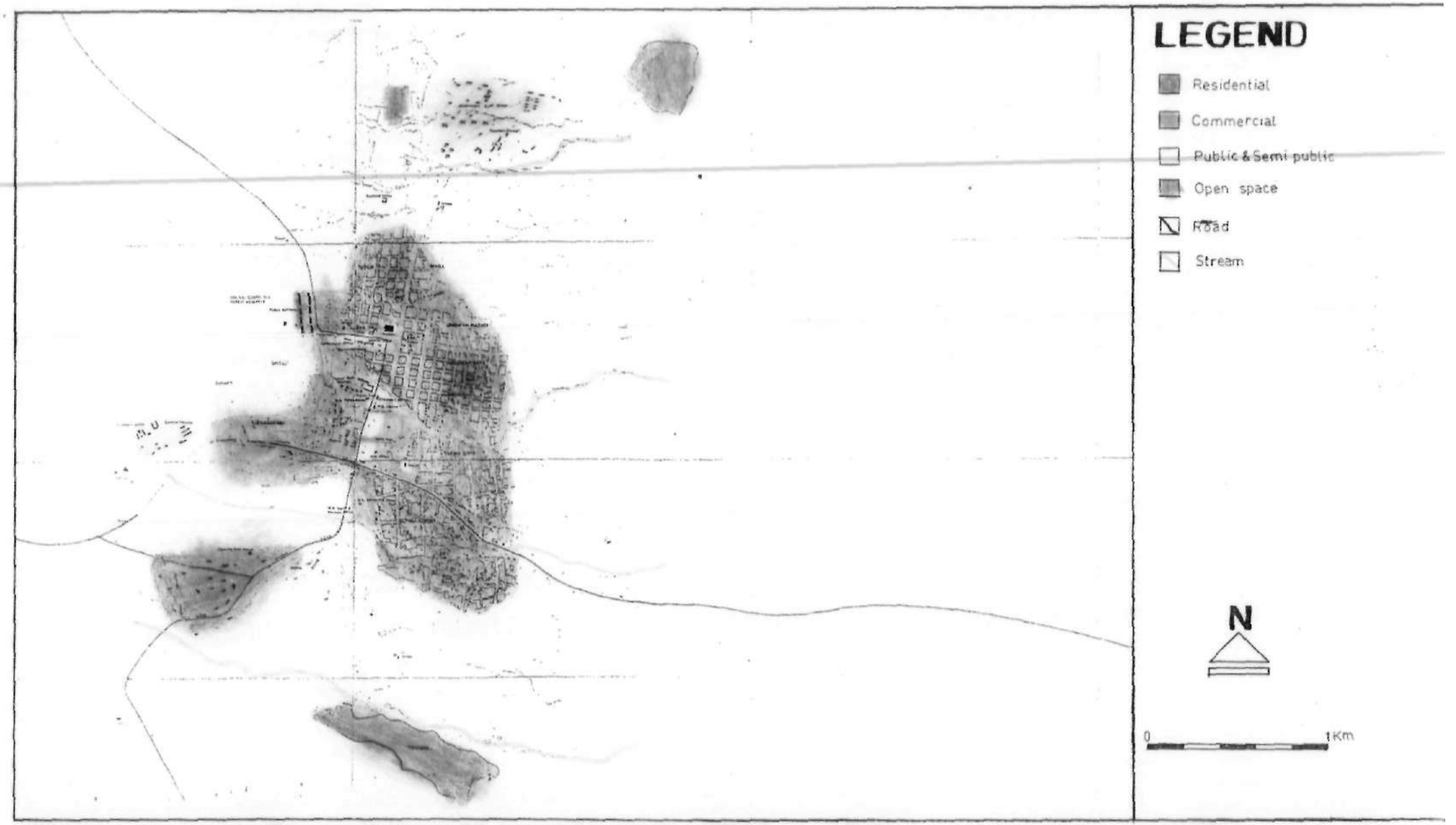


FIG 4.1 LAND USE MAP OF GOMBE , 1963

SOURCE 1959 Air photograph, compiled by Fairey Air Survey Ltd, drawn by Northern Nigerian Surveys, Kaduna .

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period. This exceeds the 53-60 percent in the classification of land use by population size by Kulshretha (1970) see appendix 1. The population of Gombe was 47,265 in 1963. Residential areas are distributed all over the town which include old and newly developed areas like the Government Reservation Area.

The commercial land use covered the market and other commercial areas of the town. This land use category constitutes 1.6 percent of the built-up area, which is below the 3-4 percent in the classification.

The Public and semi-public landuse cover areas devoted to educational use, hospitals, post office and motor parks. The 8.4 percent of the total land area devoted to this use is below the 9-10 percent in the classification.

The transportation landuse, which consist of the main arteries for both internal circulation within the city and the main arterial linking Gombe with the rest of the country constitute about 3.6 percent. This is below the recommended 12-14 percent.

The open spaces and recreational uses could be found within the built-up areas and as organised playgrounds in the town. This constitutes 2.6 percent of the total area, which is just slightly below the 3-5 percent recommended.

Analysis of the landuse pattern of 1963 show a great imbalance in the proportion of the land area devoted to different uses in Gombe. This could be attributed to the fact that the development of

the town before that time was not based on comprehensive plan and the improvement in the economic base of the people which led to increase in residential area.

4.3.1 THE PATTERN OF THE CENTRAL AREA IN 1963

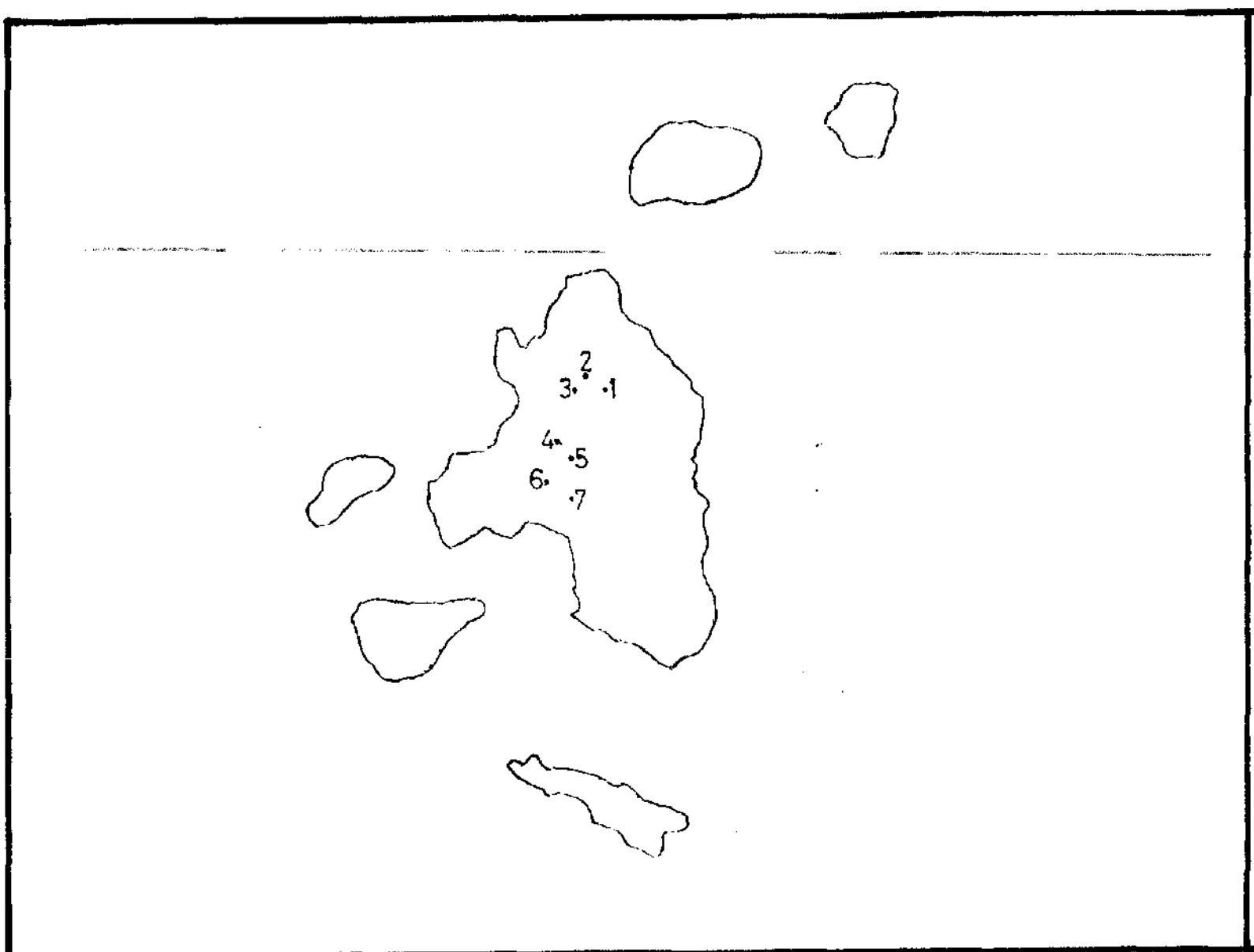
The colonial period saw the development of Gombe as a distinct town in which there is no development of Sabon Gari district and it's central area to form dual central areas as in some cities of Nigeria. The introduction of then native authority arm of administration and the new organs of maintaining law and order required buildings, offices, police station and prison yard. These new functions were accommodated in the central area of the town to form one central area. This led to the encroachment of Dandali- the traditional ceremonial space while the traditional market continue to serve the commercial function required.

The result of this, was the achievement of spatial functional relationship as (Urquhart 1977) noted, that the difference in the spatial confrontation of particular functions in the traditional and colonial society and economy and the close physical juxtaposition of the two types was to produce a new and infinitely more complex urban form and organization.

4.3.2 ANALYSIS OF THE SPATIAL PATTERN OF CENTRAL AREA FUNCTIONS 1963

The central area during this period was located as can been seen from Fig 4.2. See appendix III for the distances between the central area functions in fig. 4.2 and details of the calculation.

The nearest neighbour index calculated with respect to central area functions located during the



LEGEND

1 [illegible]
2 MOSQUE
3 OFFICES
4 POLICE STN.
5 LIBRARY
6 MARKET
7 POST OFF.

N

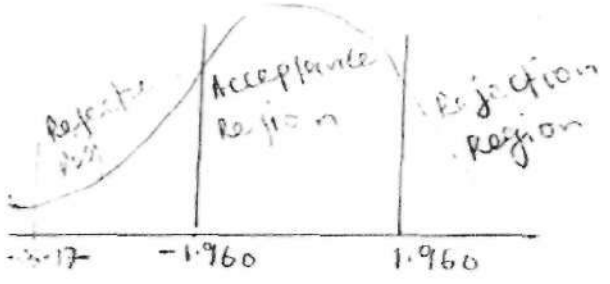
0 1km

FIG 4.2 LOCATION OF CENTRAL FUNCTIONS IN GOMBE ,1963

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colonial period up to 1963, give a value of 0.374. This shows a high level of clustering of the central area functions during that period as well as good linkage and close proximity in terms of distance between the central area functions.

The test statistic gives a value of -3.17. The appropriate critical value for a two-tailed test assuming a significance level of 0.05 is -1.960 and 1.960. Since the calculated value is less than the lower critical value, the test for this period therefore shows that the null hypothesis can be rejected at the 0.05 level. That is, the locational arrangement shows a significant clustering at the 0.05 level.



4.4 GOMBE IN 1973

By 1973, the growth of the town had intensified along Bauchi and Biu roads because of the increase in commercial activities. The town attracted people who migrated to take advantage of the commercial activities taking place in the town. The increase in commercial activities could be attributed to the oil boom, which had a similar impact on other towns in the country. A lot of physical expansion had taken place in all directions of the town, which is evidenced by such developments as the new industrial area in the eastern part of the town and the railway station in 1967. Fig 4.3 shows the built-up area of Gombe by 1973 while table 4.2 shows its land use pattern.



FIG 4.3 LAND USE MAP OF GOMBE, 1973

SOURCE 1970 Air photograph by African Aero Services Ltd
Compiled by Max Lock Group Nigeria 1973

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TABLE 4.2: LANDUSE PATTERN OF GOMBE, 1973

LANDUSE CATEGORY	AREA (HA)	PERCENTAGE OF TOTAL AREA
Residential	391.56	67.6
Commercial	29.10	5.0
Public and semi-public	97.54	16.8
Industrial	28.70	5.0
Transportation	21.40	3.7
Recreation and open space	11.20	1.9
Total	**579.50**	**100.0**

Source: Air photograph by African Aero services Ltd. Compiled by Max Lock group Nigeria (1973)

The Landuse pattern for 1973 shows the growth of Gombe from 430.75 ha to 579.50 ha, giving an increase of 148.78 ha (34.5 percent). Residential landuse had increased in the town from 360.8 ha to 391.56 ha, constituting 67.6 percent of the total built- up area which shows a decrease in proportion compared to that of 1963 which is 83.8 percent. However, the percentage is still above the standard percentage of 42-45 percent based on population of 62,560. The increase in activity system was as a result of the oil boom and increase in economic activities.

Commercial activities had by this time intensified along the main roads in the town while the traditional market remained the dominant commercial centre of the town. Thus, the area under commercial landuse increase to 29.10 ha, constituting 5 percent of the built-up area, which is higher than the standard 3-4 percent.

Public and semi-public landuse has also increased tremendously to 97.54 ha by 1973, constituting 16.8 percent of the built-up area, which is above the standard 12-14 percent.

However, industrial landuse constitute only 5 percent of the built-up area, which is below the standard 9-10 percent.

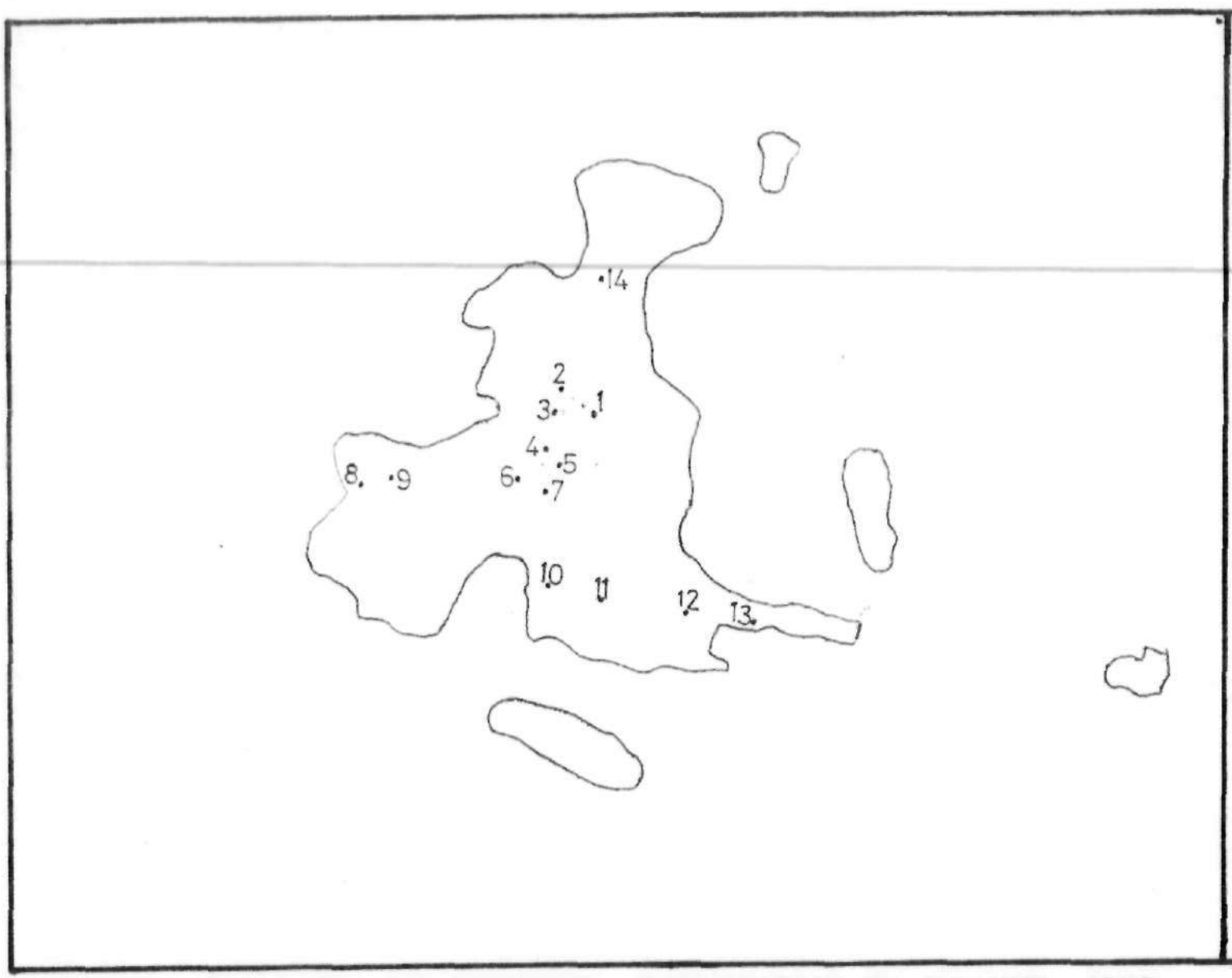
Similarly, the transportation landuse constitute 3.7 percent while recreation and open space constitute 1.9 percent. Both fall below standard of 13.14 percent for transportation and 7-8 percent for recreation and open space.

4.4.1 THE PATTERN OF THE CENTRAL AREA IN 1973

The increase in the growth of central area functions during the colonial period was easily accommodated within the town's traditional central area. However, independence brought about increase in government establishments and other central area functions. New public buildings like the cinema, bank, and church were located in other parts of the town to increase the number of central area functions by 1973.

4.4.2 ANALYSIS OF THE SPATIAL PATTERN OF CENTRAL FUNCTIONS, 1973.

The emerging central area pattern during this period is quite different from that of the 1963 period. The point location of the central area functions for 1973 are shown in fig. 4.4. The nearest neighbour technique is employed to analyse the spatial pattern for this period. The minimum distances between the central area functions and details of the calculation are presented in appendix IV.



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4 POLICE STN.	11 MOSQUE
5 LIBRARY	9 CINEMA
6 MARKET	12 BANK
7 POST OFF.	14 COURT

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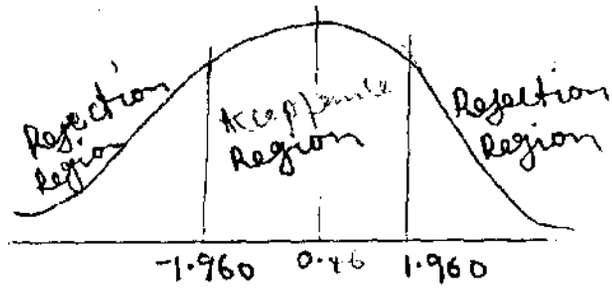
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FIG 4.4 LOCATION OF CENTRAL FUNCTIONS IN GOMBE , 1973

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The nearest neighbour index calculated with respect to central area functions located in Gombe by 1973 give a value of 1.06. This shows a tendency towards dispersal during that period. This marks the beginning of the dispersion process.

The test statistic gives a value of 0.46. The appropriate critical value for a two-tailed test assuring a significance level of 0.05 is -1.960 and 1.960. Since the calculated value is greater than lower critical value and lower than higher critical value, the test for this period therefore show that the null hypothesis can be accepted at the 0.05 level. That is the locational arrangement show that the emerging dispersion process is not significant.



4.5 GOMBE IN 1983

By 1983, a lot of physical expansion had taken place in all directions of the town. These were evidenced by such developments as the army barracks, the state low cost housing, the Federal College of Education (Technical) campus, and new industrial developments located to the east of the town. Fig 4.5 shows the built-up area of Gombe by 1983 while table 4.3 shows the land use pattern.

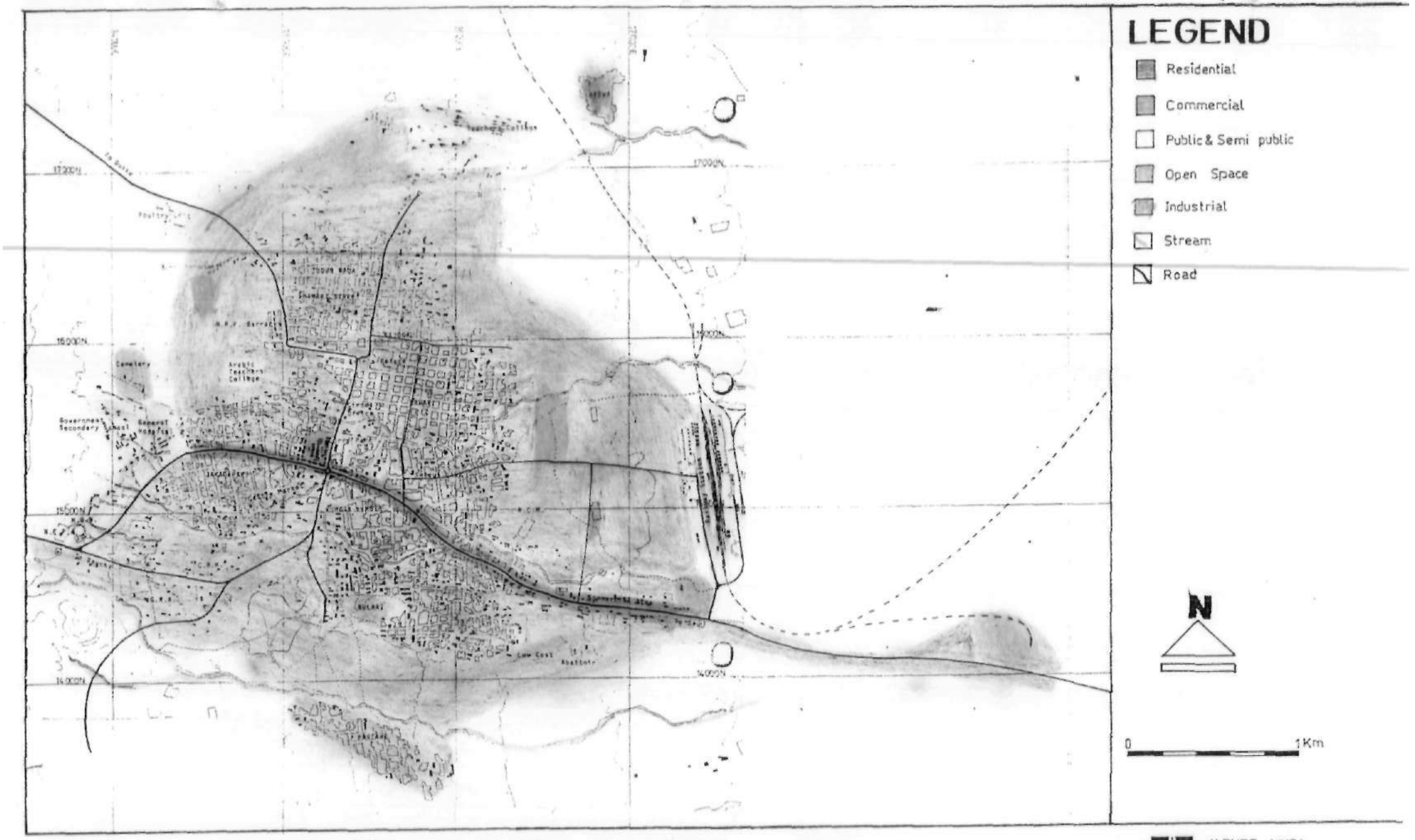


FIG 4.5 LAND USE MAP OF GOMBE, 1983

SOURCE Max Lock Master Plan Report 1973.
Updated by Planning Dept Min of Works, Gombe, Bauchi State.

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TABLE 4.3: LANDUSE PATTERN OF GOMBE, 1983

LANDUSE CATEGORY	AREA (HA)	PERCENTAGE OF TOTAL AREA
Residential	602.10	64.7
Commercial	61.90	7.5
Public and semi-public	158.90	17.1
Industrial	56.20	6.0
Transportation	27.80	3.0
Recreation and open space	16.00	1.7
Total	**930.90**	**100.0**

Source: Max Lock master plan report (1973 Updated by Planning Dept. Min of works Gombe, Bauchi State.

The population of the town had reached 83,265 by 1983. The trend in the landuse for 1983 indicate high proportion of residential area (64.7 percent). This could be as a result of further provision of residential housing by both public and private agencies. The percentage is higher than the 42.45 percent in the classification.

Similarly, commercial landuse had increased significantly with the expansion of the town, accounting for 7.5 percent of the built-up area, which is higher than the standard 3-4 percent.

However, other landuses like industrial, transportation, recreation and open spaces with 6 percent, 3 percent and 1.7 percent respectively remained below the standard 9-10 percent, 13-14 percent and 7-8 percent.

Public and semi-public land use (17.1percent), on the other hand is above the range of 12-14 percent in the standard.

4.5.1 THE PATTERN OF THE CENTRAL AREA IN 1983

The traditional recreational life of Gombe which was largely indoors or in small spaces was de-emphasised by 1983, leading to the location of modern sports and recreational facilities like stadium and cinema house. Similarly, increase in commercial functions during this period is evidenced by the location of additional market and bank. Other functions include the new local government secretariat, Church and Mosque.

4.5.2 ANALYSIS OF THE SPATIAL PATTERN OF CENTRAL FUNCTIONS, 1983.

The emerging central area pattern during this period is just slightly different from that of 1973. There is the evidence of increase in central area functions as can be seen in fig. 4.6. The minimum distances between the central area functions is presented in appendix V.

The nearest neighbour index calculated with respect to central area functions located in 1983 give a value of 1.08. This value shows increase in the dispersion process.

The test statistic gives a value of 0.67. Assuming a significance level of 0.05, the critical value for a two-tailed test is -1.960 and 1.960. Since the calculated value is greater than the lower critical value and lower than the higher critical value, it falls within the acceptance region. That is, the locational arrangement shows that the emerging dispersion process is not significant.

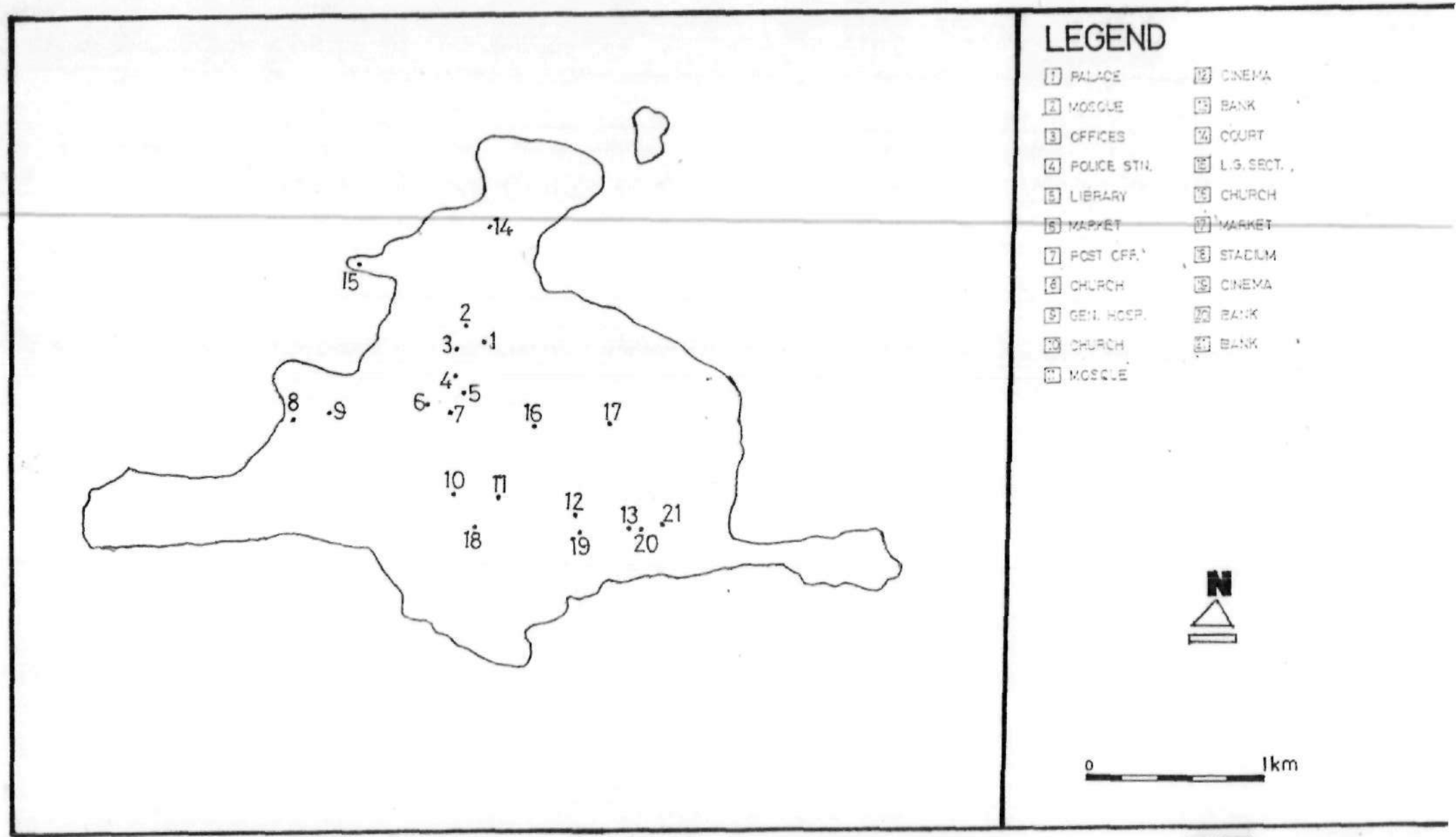
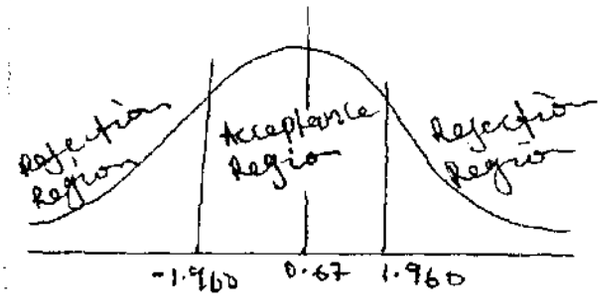


FIG 46 LOCATION OF CENTRAL FUNCTIONS IN GOMBE , 1983

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4.6 GOMBE IN 1998

By 1998, Gombe had witnessed more physical expansion resulting in the town engulfing some of the small settlements surrounding it. This trend is as a result of the rapid development of the town when it became the state capital in 1996. The city attracted people who migrated into take advantage of the various opportunities opened up by the new state capital. With this administrative status other complimentary services were attracted and the city expanded at rapid rate. This time, the sprawl of the city could be prominently noticed along intercity roads such as Gombe-Biu and Gombe-Bauchi road.

Fig 4.7 shows the built-up area of the city by 1998 while table 4.4 shows the landuse pattern.

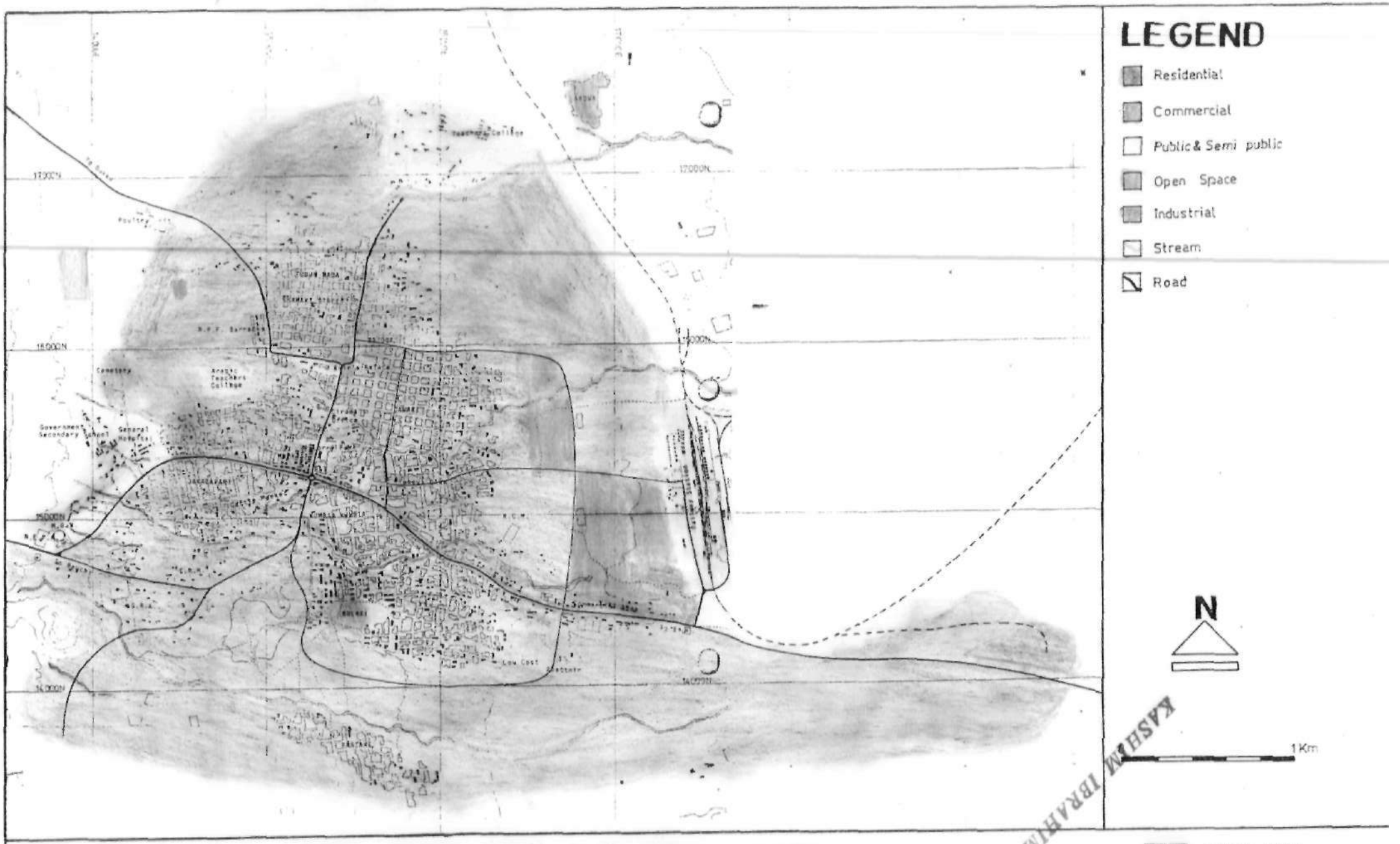


FIG 4.7 LAND USE MAP OF GOMBE 1998

SOURCE Max Lock Master Plan Report 1973
Updated by Planning Division Dept of Land & Survey Gombe State (1997)
Updated by field survey 1998

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TABLE 4.4: LANDUSE PATTERN OF GOMBE, 1998

LANDUSE CATEGORY	AREA (HA)	PERCENTAGE OF TOTAL AREA
Residential	1214.82	65.9
Commercial	186.31	10.1
Public and Semi-public	268.76	14.6
Industrial	56.20	3.0
Transportation	79.12	4.3
Recreation & open space	37.80	2.1
Total	**1843.01**	**100.0**

Source :Max lock master plan report (1973); Dept. of land and survey, Gombe State (1997); field Survey (1998).

Two types of classification is employed for analysing the data presented in the table showing the 1998 pattern. These are the classification by population size and function.

By 1998, the population of Gombe is 217, 418. The trend shows that residential landuse (1214.82 ha) still have the highest percentage (65.9 percent) of the total built-up area of the town which is above the standard 46-51 percent. This increase in the land area covered by residential landuse could be attributed to the absorption of small settlements surrounding the town and the creation of state which led to increase in housing provision in all parts of the town.

Similarly, the area devoted to commercial landuse (10.1 percent) is more than the standard 3-4 percent.

However, industrial, transportation, recreation and open spaces with land area constituting 3 percent, 4.3 percent and 2.1 percent fall below the standard 7-9 percent, 12-13 percent and 7-8 percent, while public and semi-public landuse (14.6 percent) is within the recommended standard of 14-17 percent.

A similar pattern can be observed using the functional classification, under which the town is classified as a state capital. However, public landuse fall below the standard 18-20 percent according to this classification.

4.6.1 THE PATTERN OF THE CENTRAL AREA IN 1998.

By 1998, the number of central area functions had increased tremendously with the location of another post office, market and theatre in different parts of the town. Similarly, administrative functions were located in different parts of the town.

4.6.2 ANALYSIS OF THE SPATIAL PATTERN OF CENTRAL FUNCTIONS, 1998

The emerging central area pattern during this period show significant increase in the number of central area functions in the town. The minimum distances between the central area functions is presented in appendix VI.

The nearest neighbour index calculated for 1998 give a value of 1.20. This show an increase in the dispersal of central area functions.

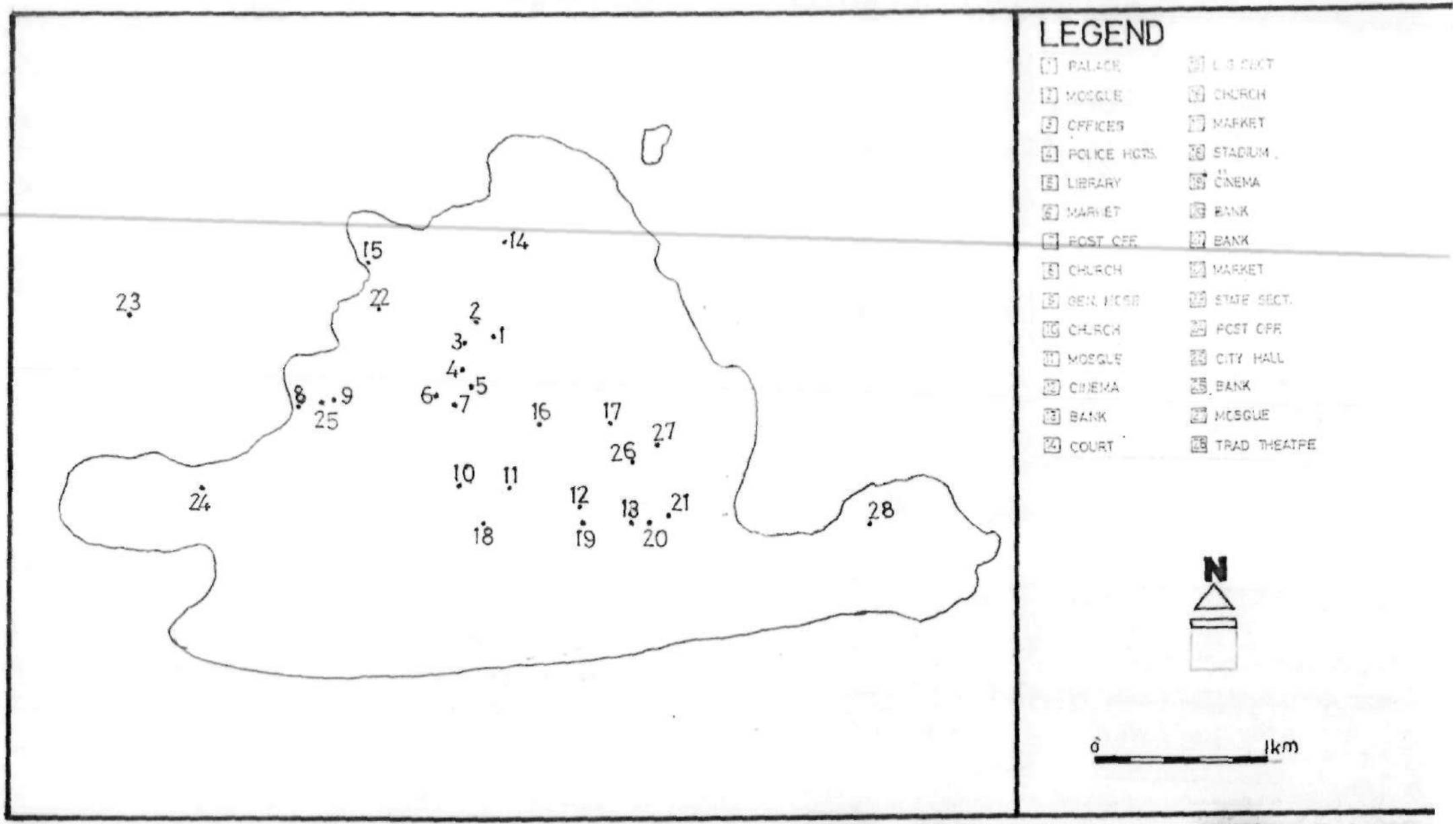
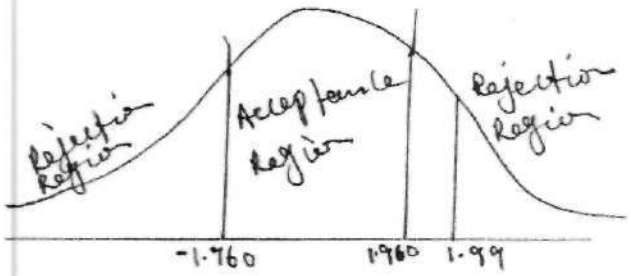


FIG4.8 LOCATION OF CENTRAL FUNCTIONS IN GOMBE , 1998

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M. SC. U. R. P.

The test statistic give a value of 1.99. Assuming a significance level of 0.05, the appropriate critical value is –1.960 and 1.960. Since the calculated value is greater than the higher critical value, the test for this period therefore show that the null hypothesis can be rejected at the 0.05 level. That is the locational arrangement show a significant dispersion at the 0.05 level.



4.7 COMPOSITE GROWTH OF GOMBE (1963 - 1998)

The foregoing show that Gombe has developed significantly over the years. The recent rapid growth of the town could be attributed to its graduation from a local government headquarter to a state capital in 1996. As in many other urban centres in Nigeria with similar experience, the town began to receive influx of people from all spheres of life (the Job market is gradually expanding and attractive for the skilled), consequently centripetal forces of urban expansion came into play. The town began to experience growth in its areal extent due to residential development, road development and public buildings. The growth of Gombe is attributed to the change in political status as well as the economic base of the town.

Table 4.5 shows the expansion of the built-up area of Gombe over the years.

TABLE 4.5: LANDUSE CHANGES IN GOMBE (1963-1998)

YEAR	TOTAL AREA (HA)	ABSOLUTE CHANGE	PERCENTAGE CHANGE	RATE OF CHANGE
1963	430.75			
1973	579.50	148.75	34.5	3.5
1983	930.90	351.40	60.6	6.1
1998	1843.01	912.11	97.9	6.5

Source : Analysis of data by the Author, (1998)

The table shows a continuos increase in the rate of growth from 3.5 to 6.5. This trend in the towns growth could be attributed to the expansion of the economic base and the new administrative status of the town.

The landuse analysis on the other hand indicate significant imbalance in the proportion of land area devoted to various uses throughout the period of analysis.

The analysis of the locational pattern of the central area functions during this period revealed a steady increase in the nearest neighbour index. The value calculated for 1973 is 1.06.
This is higher than the 0.374 obtained for the 1963 pattern, indicating the period the dispersal of central area functions had began. The trend continued, with even more intensification of the dispersal process in the 1998, which give a value of 1.20. This trend will continue as more central area functions are added to the town. Table 4.6 show a summary of the analysis.

TABLE 4.6 NEAREST NEIGHBOUR INDICES FOR CENTRAL AREA FUNCTIONS IN GOMBE, 1963-1998.

YEAR	NUMBER OF CENTRAL FUNCTIONS	NEAREST NEIGHBOUR INDEX (R)	Z. VALUE
1963	7	0.374	-3.17
1973	14	1.060	0.46
1983	21	1.080	0.67
1998	28	1. 20	1.99

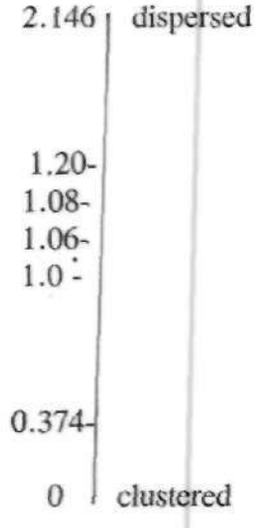


Fig. 4.9: TREND IN THE DEVELOPMENT OF CENTRAL AREA FUNCTIONS IN GOMBE

CHAPTER FIVE

PLANNING PROPOSAL

5.0 INTRODUCTION

The analysis show a change in the pattern of central area functions in Gombe, from a mono-polar locational pattern in 1963 (Concentration in the traditional centre of agglomeration) towards a more multi-polar locational pattern in the 1990's.

Though new central area functions in Gombe have been spatially accommodated at various parts of the town, the locational process and the resultant physical forms are not all suitable to the development of the town. The emerging pattern, which was largely due to uncoordinated government actions, constitutes a poor spatial organization. This is associated with lack of functional cohesion.

The emergent pattern is characterized by poor linkages between related functions, which further reduce the functional relationship between them, creating a system with little harmony in spatial relationship. Hence, there is the need for planning intervention not only to regulate physical form but also to creatively plan to channel changes and create order within the urban environment.

5.1 PLANNING INTERVENTION

The critical question to answer while evaluating various planning options is: what is the realistic approach to planning for the development of the central area in the present circumstances?

5.1.1 THE PLANNING OPTIONS

There are three possible lines of action to be considered:

The first option is the Do Nothing Approach. This is to allow the process of dispersion to continue. This approach has the disadvantages of allowing the problems identified with the pattern to remain unchecked. Example is the poor spatial linkages and functional relationship as well as lack of order in the location of the central area functions.

The second option involves creating a single new central area as is the practice in master planning practice in Nigeria. This option is not realistic because most of the central area functions are well established in their present locations. The approach ignores the relationship that exists between city growth and central area development as identified in the analysis, which do not favour mono-polarity.

This option may involve creating a unifocal central area by enlarging the existing traditional central area to accommodate more functions. It can be argued that this will improve the functional relationship between the central area functions. This is associated with disadvantages. In addition to those identified for the new central area, the average travel distance to the central area from residential areas will increase tremendously; and it can easily result in congestion as all the central area functions are located in one site.

The third option involves improving the existing pattern in terms of linkages, location of new central area functions in few selected locations to form a network that will bring functional unity

rather them spatial unity in the central area of Gombe. It will reduce walking distance as the central area functions shall be closer to the residential districts; reduce the congestion common to unitary central areas; and ensure minimal cost in terms of land acquisition and upgrading of some locations where central functions exist currently.

5.1.2 SELECTED PLANNING OPTION

From the above evaluation, the third option is the most realistic. This promotes a multi-nuclei town structure and town centre, which is necessary to ensure efficient functioning of the town. That is, the most viable option for the planning of the central area of Gombe, given the existing situation, is to improve upon the existing pattern to bring about order and harmony in the relationship between the dispersed central area functions and the towns sectors. The cost of development is lower than that of the other option. The locations to be upgraded are to be determined through ranking of the central area functions using the following criteria.

5.2 SELECTION OF EXISTING LOCATIONS

5.2.1 THE CRITERIA

The selection of the locations to be upgraded as units of the central area is necessary. It is to ensure that few viable locations are used to evolve a system of central areas that would function as a unity to serve the town. The criteria used include:

1 **Importance of the central area function.**

Based on the relative importance of the facilities and the cost of construction, they have been weighted as shown in table 5.1 below. The weight ranges from 0 to 2.

TABLE 5.1: WEIGHT OF CENTRAL AREA FUNCTIONS ACCORDING TO IMPORTANCE

FUNCTIONS	WEIGHT
Palace, national and state library museum, central mosque, city hall, state and federal secretariat, central market, stadium, General hospital	2
market, mosque,church, theatre bank, court, shops, offices, police station, fire station, cinema, swimming pool.	1
None	0

2 **Land availability**

Since the aim of the planning option adopted is to have a realistic approach to central area planning that will utilize the existing situation with minimal cost, the availability of land at the existing sites of central area functions is important. Therefore, location of existing central area functions that do not have land around them that will accommodate new central functions are not suitable for the proposed central areas (they have weight of zero). Those with inadequate land have weight of one while those locations with adequate land have a weight of 2. See table 5.2

TABLE 5.2: WEIGHT OF CENTRAL AREA FUNCTIONS ACCORDING TO LAND AVAILABILITY AT EXISTING SITE

LAND AVAILABILITY	WEIGHT
Adequate	2
Inadequate	1
Not available	0

3. **Proximity to Users**

The central area functions are meant to serve the population of the area where they are located. Therefore, those that are located in or close to residential areas serve the people more than those located else where because of close proximity. It reduces the travel distance for the users of the central area functions. Therefore, the functions with good proximity to users are good locations for the development of the proposed central areas. The weighting ranges from zero for locations that are not within walking distance to Two for location within walking distance. (See table 5.3).

TABLE 5.3: WEIGHT OF CENTRAL AREA FUNCTIONS ACCORDING TO ITS DISTANCE TO USERS

DISTANCE TO USER	WEIGHT
Within close walking distance	2
moderate walking distance	1
not within walking distance	0

4 **Closeness to the nearest central area function**

Central area functions that are closer to each other have better functional relationship than those widely apart. Such location will ensure quick take-off of a new central area at such locations. Therefore, the clustering of the central area functions is very important. Based on this criteria, any function that is more than 201m away from its nearest neighbour have a weight of zero while those that are between 1-100m apart have a weight of 2. (See table 5.4)

TABLE 5.4: WEIGHT OF CENTRAL AREA FUNCTIONS ACCORDING TO THE DISTANCE TO ITS NEAREST NEIGHBOUR

DISTANCE (M)	WEIGHT
1 – 100	2
101 – 200	1
201 and above	0

5. **Compatibility with adjoining uses**

The compatibility of each central area function with its adjoining landuses is very important to ensure the suitability of the location for the development of a new central area. Based on this criteria, central area functions that are not compatible with its adjoining landuses have a weight of zero, those that are compatible have a weight of 1, those that are very compatible have a weight of 2. (See table 5.5)

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TABLE 5.5: WEIGHT OF CENTRAL AREA FUNCTIONS ACCORDING TO COMPATIBILITY WITH ADJOINING USES

DISTANCE (M)	WEIGHT
Very compatible	2
Compatible	1
Not compatible	0

5.2.2 THE RANKING

Therefore, based on these criteria, the existing sites of location of central area functions are ranked and those with the highest total score are selected as the most suitable potential locations to plan and develop as the proposed central areas. However, the existing traditional central area is to be retained as it is already viable in its own right. The result of these ranking is given in table 5.6.

TABLE 5.6: RANKING OF THE LOCATIONS OF CENTRAL AREA FUNCTIONS

LOCATION	CRITICAL					TOTAL SCORE
	IMPORTANCE	LAND AVAILABILITY	PROXIMITY TO USERS	CLOSENESS TO USERS	COMPATIBILITY	
8	1	2	1	1	2	7
9	2	0	1	1	1	5
10	1	0	2	0	1	4
11	1	0	1	0	1	3
12	1	0	2	0	1	4
13	1	1	1	2	2	7
14	1	1	1	0	1	4
15	1	2	0	0	1	4
16	1	0	2	0	1	4
17	2	2	2	0	2	8
18	2	2	2	0	2	8
19	1	0	2	0	1	4
20	1	1	1	2	2	7
21	1	0	1	0	1	3
22	1	2	0	0	1	4
23	2	2	0	0	1	5
24	1	2	0	0	1	4
25	2	0	1	1	1	5
26	1	0	1	0	1	3
27	1	0	2	0	1	4
28	1	1	2	0	1	5

See fig 4.8 for the function at each location

Based on this ranking, location of central area function with a score of seven (7) and above are

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165.5

taken as viable for the location of additional central area functions. There are five (5) potential sites for the location of new central area functions. However, since the aim of this approach is to improve the existing highly dispersed pattern at minimal cost, the availability of land at the potential location is a critical factor in deciding the location that is most suitable among the five (5) with score of up to seven (7). Therefore, location number eight (8), seventeen (17) and eighteen (18) are selected as the most suitable ones because of the availability of land.

There will be a total of four (4) central areas including the traditional central area. Other locations with lower total score are to be upgraded to form lower order centres. However, this is not within the scope of this study.

Figure 5.1 shows the location of the units of the central area for Gombe.

5.3 EXISTING AND REQUIRED CENTRAL AREA FUNCTIONS AT THE SELECTED LOCATIONS

5.3.1 STANDARD ADOPTED

Standards for central area functions vary from place to place. This is because standard is being determined by so many factors. The factors could be cultural background, level of development, population and space availability. The standard adopted for this study is shown in table 5.7.

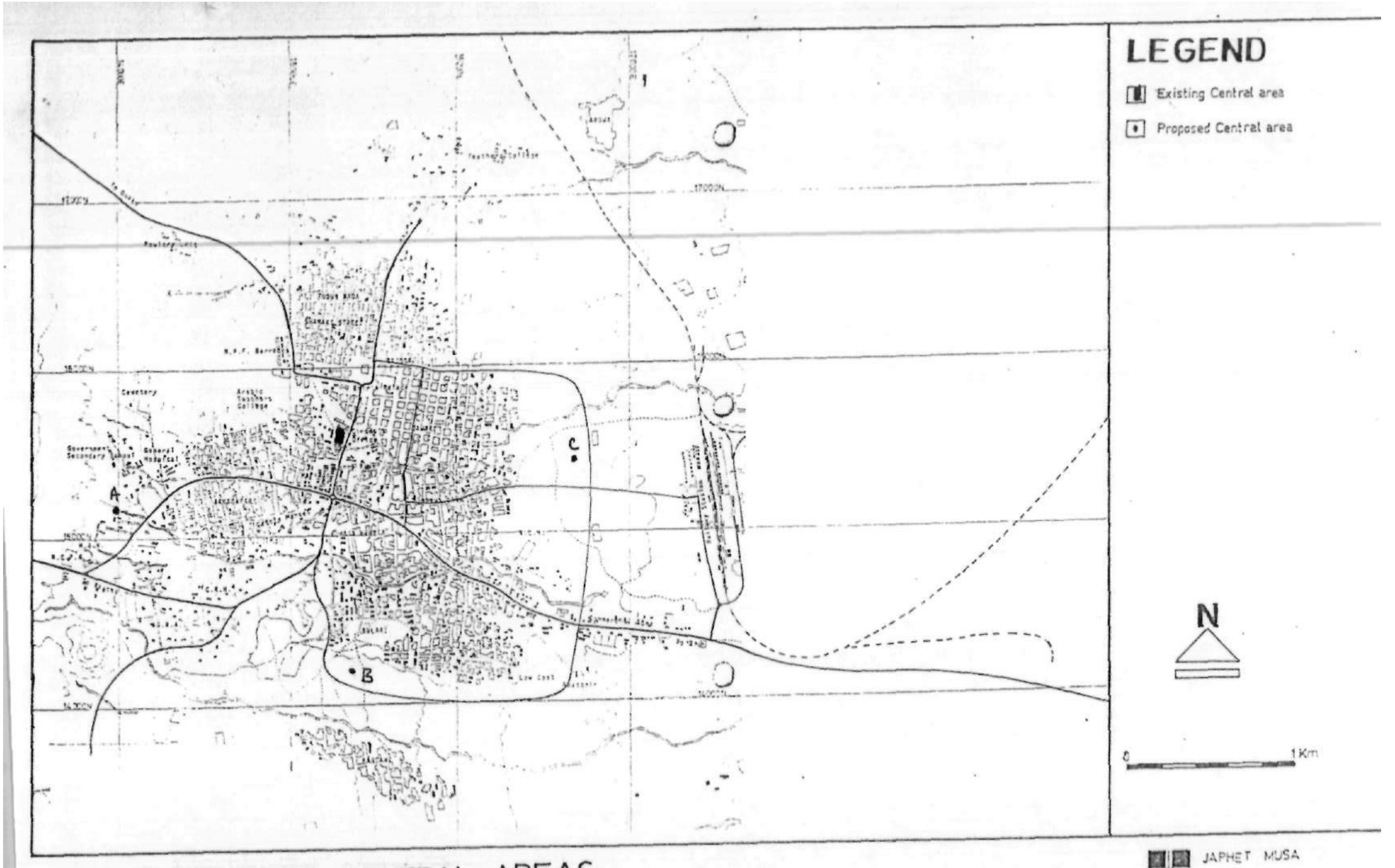


FIG 5:1 PROPOSED CENTRAL AREAS

TABLE 5.7: PLANNING STANDARD FOR CENTRAL AREA FUNCTIONS

ELEMENT	AREA (HA)	POPULATION
City hall	.2-1	120,000
Museum	.2-1	whole city
Library	.4-.8	120,000
police station	.5-1	120,000
post office	.5	40,000
fire station	.25-1	50,000
Theatre	.8-1.5	120-128,000
Bank	.4	40,000
Cinema	.2-1.5	60,000
Market	-	1 stall/150 pers.
Stadium	2-5	whole city
Palace	1-3	whole city
Church	.5	15-50,000
Mosque	.5	15-50,000
L.G. Secretariat	2-3	whole city
State Secretariat	3-5	whole city
Federal Secretariat	2-5	whole city

5.3.2 SCHEDULE OF REQUIREMENS

The outcome of a careful analysis of the existing central area functions in Gombe reveals that some principal elements are missing, while most of those available are inadequate. The schedule of requirement for the selected locations to be upgraded are as follows:

TABLE 5.8: REQUIRED CENTRAL AREA FUNCTIONS AT THE SELECTED LOCATIONS

FUNCTION	TRADITIONAL CENTRAL		CENTRAL AREAL (A)		CENTRAL AREA (B)		CENTRAL AREA (C)	
	EXISTING ha	PROP ha	EXIST (ha)	Pro (ha)	exist (ha)	pro (ha)	Exist (ha)	Pro (ha)
Palace	2	-	-	-	-	-	-	-
City hall	-	-	-	-	-	1	-	-
Mosque	.3	-	-	.5	-	-	-	-
Market	2.5	-	-	1.4	-	1.4	3	-
Post office	.2	-	-	-	-	.3	-	.3
Library	.2	-	-	1	-	1	-	-
Police station	.5	-	-	.5	-	-	-	.5
Theatre	-	-	-	1	-	-	-	1
Fire station	-	1	-	1	3	1	-	1
Stadium	-	-	-	-	-	-	-	-
Church	-	-	.5	-	-	-	-	-
Cinema	-	-	-	.5	-	.5	-	.5
Bank	-	-	-	.4	-	.4	-	.4
Museum	-	1	-	-	-	-	-	-
Offices	-	-		.2	-	.2	-	.2
Total	5.7	2	.5	6.5	3	5.8	3	3.9

The proposed central area functions for the traditional central area are to replace the existing lorry park located there, which is a landuse that is not in conformity with the idea behind a central area and its healthy functioning because it generates much traffic and cause serious

problem in the central area as trucks move in and out of the park. Therefore, it is to be relocated and new central area functions are to be located at the site.

5.4 PROPOSAL FOR EFFECTIVE LINKAGE BETWEEN THE CENTRAL AREAS

The basis for an effective functioning of the proposed central areas is a network of good linkages between them. However, the condition of the existing linkages between the selected locations of the new central areas in Gombe is highly inadequate to ensure their proper functioning. There is the need to improve the existing road structure and propose new ones in such a way that it will foster and promote easy circulation and safety between the central areas for both vehicular and pedestrian traffic.

In order to ensure smooth traffic flow and segregation of pedestrian and vehicular traffic, adequate road reservations are proposed at the city level. The road reservation provided for is between 12 - 15 metres.

Therefore, to achieve good linkages between the central areas, some of the existing roads are to be improved and new ones constructed.

5.4.1 ROADS TO BE IMPROVED

For most part, the existing linkages could be used but with improvement in terms of widening. Pedestrian walkways are to be provided alongside the improved roads. The roads to be improved are as follows:

i) The improvement of the road linking central area C (from its northern part) to the traditional central area.

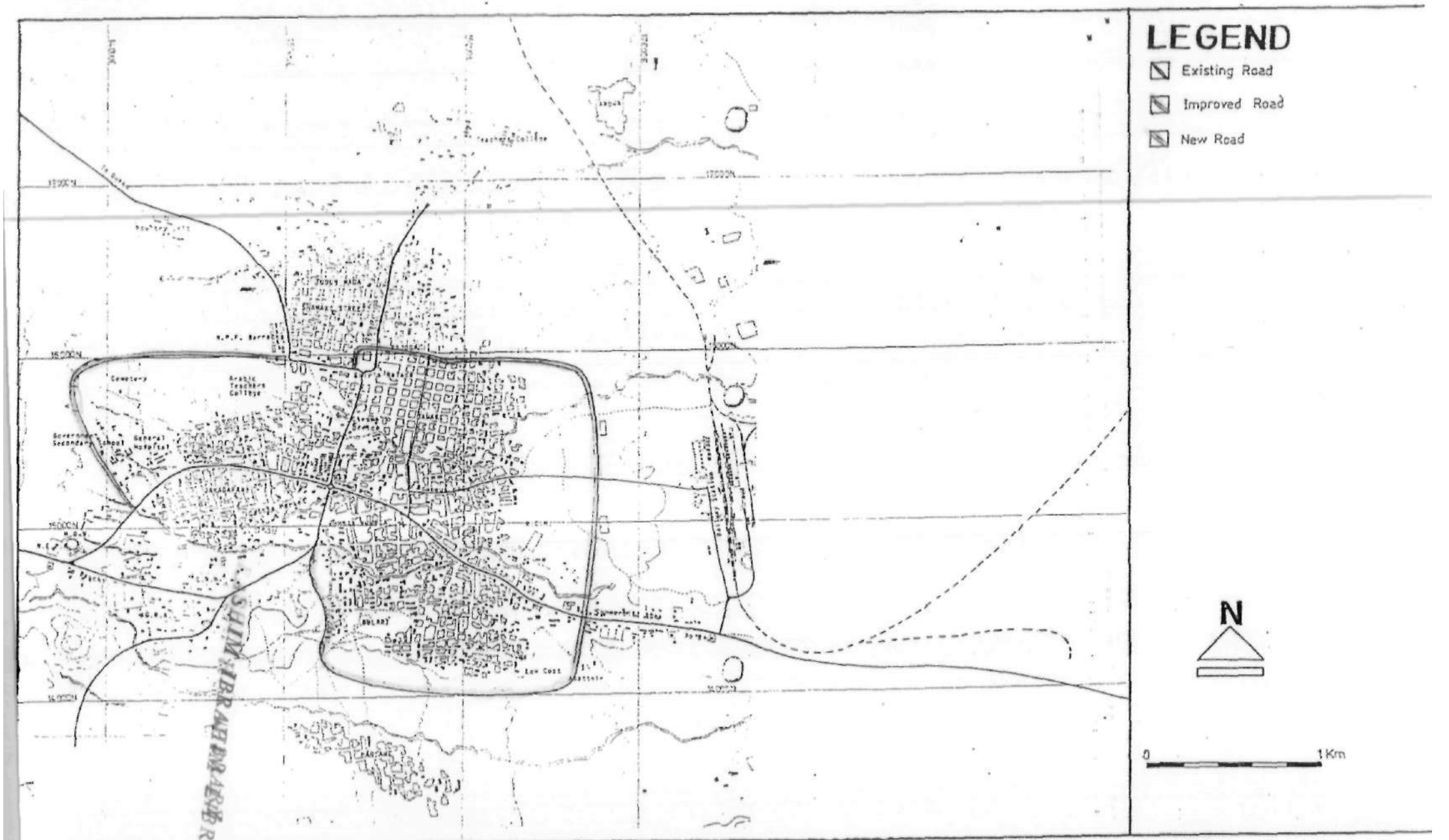


FIG 5.2 PROPOSED LINKAGES

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ii) The improvement of the road that goes southward from central area C to link central area B.

iii) A new road is proposed to link central area B to the Traditional central area.

5.4.2 NEW ROAD

These would be of the same width with the improved roads and pedestrian walkways are to be provided alongside the new roads. The new roads proposed are as follows:

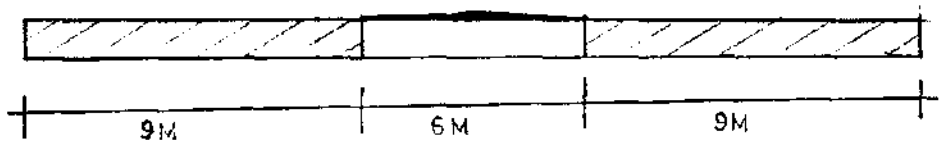
i) The extension of the road that link central area C to the traditional central area to central area A.

Fig 5.2 show the proposed linkages while fig 5.3 show sections of the existing and proposed roads. The proposed linkages will enhance the functional relationship between the central areas by creating a system with smooth flow of goods and services. The road improvement/construction will bring positive improvement in the movement of pedestrian and cyclist and reduce the rate of accident since they are separated from vehicular circulation. This improvement in linkages bring functional harmony between the central areas.

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EXISTING ROAD CONDITION

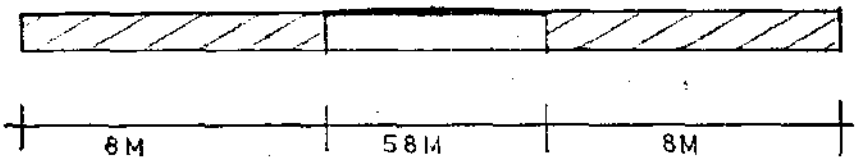
DAWAKI ROAD



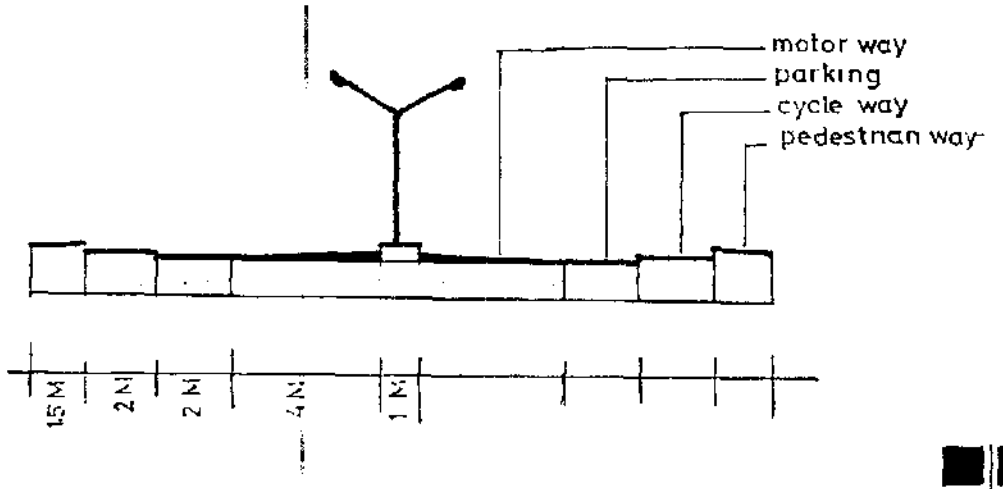
MARKET ROAD



BOLARI ROAD



PROPOSED ROAD



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FIG5.3

CHAPTER SIX

DESIGN PROPOSAL

6.0 INTRODUCTION

The design of the indigenous central area result in a number of problems that bring about lack of proper functioning due to lack of foresight at that time. There is the need to provide a suitable guideline for the design of the proposed central areas to prevent the occurrence of future problems like congestion. This is achieved by utilizing both indigenous and modern design principles to produce healthy central areas. Therefore, the following guidelines are recommended for the design of the proposed central areas in Gombe:

1. The traditional central area and its elements are to be preserved for historic and aesthetic reasons.
2. The principle of functional grouping of like central elements is to be used in design of the central areas proposed.
3. The design principle of monumentality of important buildings should be employed in the design of the central area functions like the community mosque, churches, theatre and library.
4. The construction of high rising buildings are to be avoided, more especially in the traditional central area, proposed central area (B) and central area (C) because of the geological problem identified (see section 3.2.2)
5. The central areas are to be provided with adequate parking facilities. Multi-story parking facilities are to be avoided because of the geological problem.

6. The central areas of Gombe should not be penetrated by motor ways. Therefore, the idea of pedestrian precint is to be employed in the circulation system and provision of parking.

6.1 DESIGN PROPOSAL FOR SITE 'A'

6.1.1 SITE CONDITION

The proposed site for the central area slopes gently from west to east. The slope does not constitute any problem for the location of the proposed central area functions and the provision of parking facilities.

Therefore, the site is generally good for the central area functions proposed and the development of the central area. The site covers 11.30 ha. (see fig 6.1)

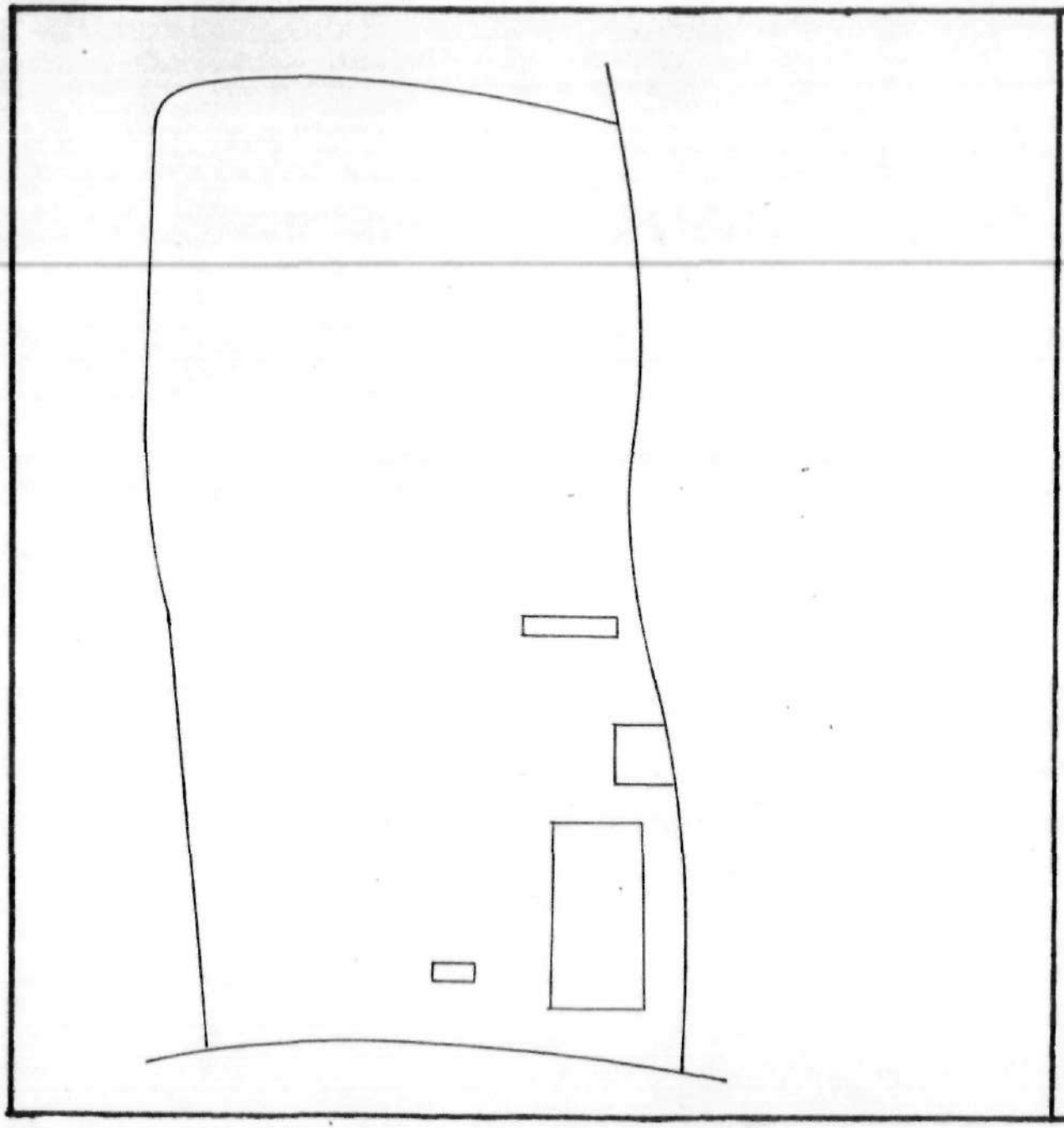
6.1.2 LAND USE

The existing church is the dominant central area function located at the site. This function is retained and incorporated into the deign. Another function to be retained is the row of shops located very close to the church.

Other landuses include a block of a public school that extend into the site and a block of residential building. These are to be relocated.

6.2 DESIGN CONCEPTS

Three concepts are developed for the proposed central area:



EXISTING SITE CONDITION

LEGEND

- Public
- Residential
- Cultural
- Commercial

N

0 50 100 150 200m

FIG 6.1

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M. SC. U. R. P.

In the first concept, a road pass through the central area. The major disadvantage of this concept is that there is no total segregation of vehicular from pedestrian circulation and it could easily result into congestion since vehicular traffic pass through the central area.

In the second concept, the circulation pattern remain the same with that of the first concept. The arrangement of the landuses is however different. This concept has the disadvantage identified with the circulation pattern of the first concept, with improvement in the land use arrangement.

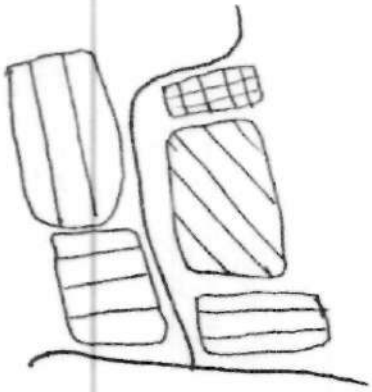
In the third concept, the idea of pedestrian precint is employed to segregate vehicular from pedestrian circulation. This will ensure smooth flow of traffic and lack of any congestion. This concept is therefore selected.

(See fig 6.2).

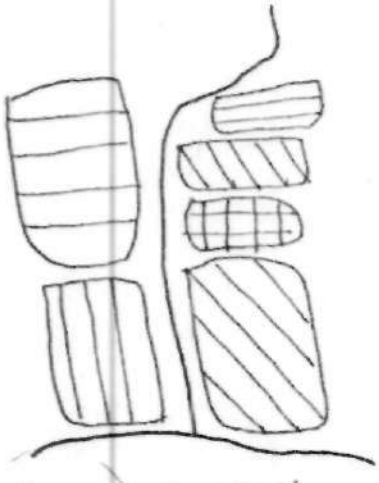
6.3 PLANNING CONCEPT

The concept developed for the central area is based on the understanding of the relationship between the different elements in the central area. The landuses for the proposed central area has been broadly divided into three: cultural, public and semi-public, and commercial.

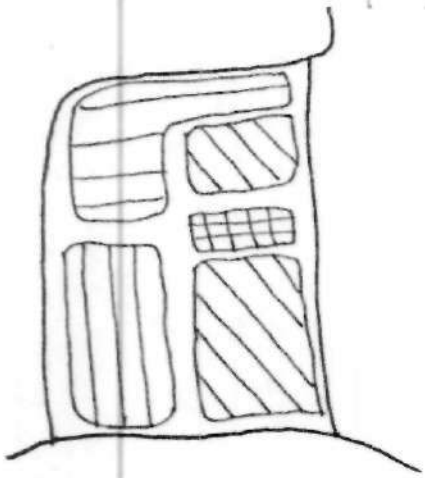
In this concept, functions that are related to each other are grouped together, for example, the theatre, mosque and church are located in one zone; the shops, market and banks are located in another zone; while the fire station, library and block of offices constitute a zone.



First Concept



Second concept



Third concept

LEGEND
- Cultural
- Commercial
- Public and semi public
- Open space
- Road

N

Japhet Musa
M.Sc. U.R.P.

Fig 6.2

The major advantage of this locational arrangement and the concept in general is that, precaution is taken to avoid future congestion by providing adequate parking spaces to serve each function (see Fig 6.3).

6.4 DESIGN ELEMENTS

6.4.1 GROUPING OF BUILDING AND VOIDS

The orientation and grouping of the building have been done in such a way as to relate to the light and ventilation requirement. Trees are to be planted to moderate the temperature.

The grouping of the buildings does not only relate to their conformity but also to give contrast in terms of mass and voids.

6.4.2 CULTURAL ELEMENTS

Theatre:

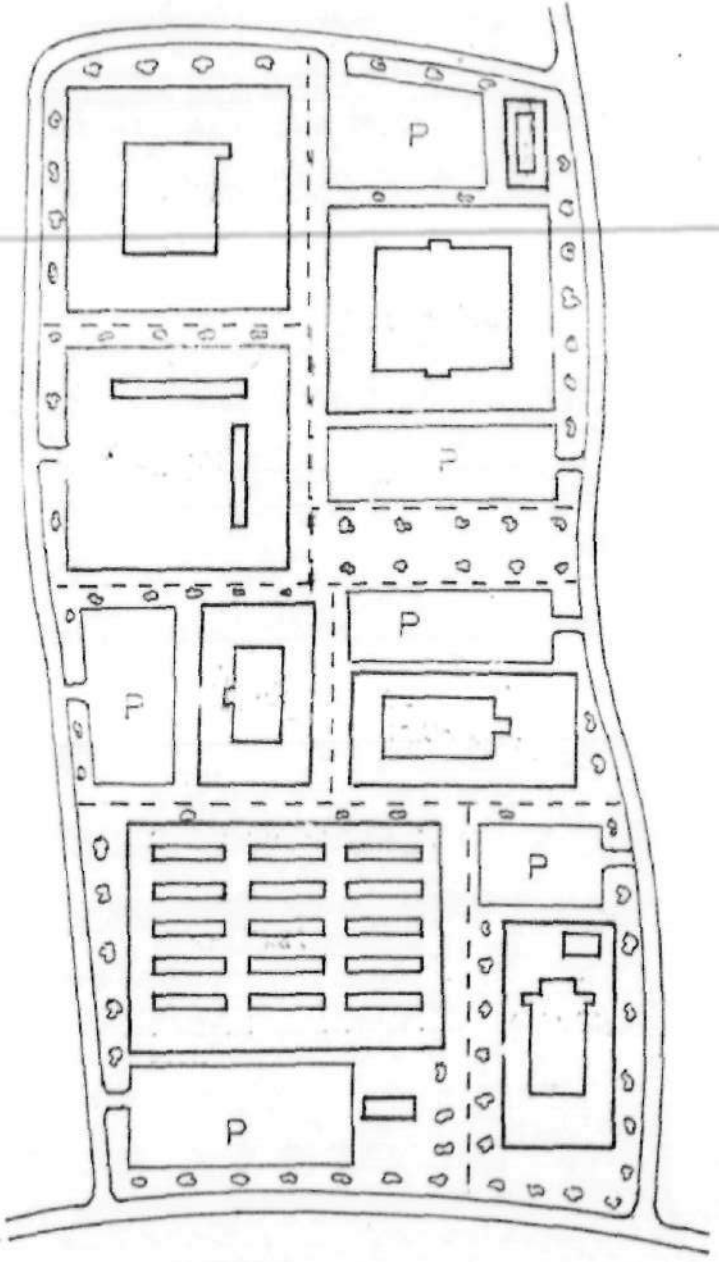
This is to form a focal point in the central area. It is such that it could accommodate very many people. It is adequately linked with pedestrian and vehicular road. The theatre may be used for cultural as well as social gathering.

Mosque:

This is another important element located in the central area. It will attract Muslims for Friday prayers and compliment the traditional central mosque.

Church:

This is an existing element that is retained and incorporated into the design. It will serve as a focal point for Christians, more especially on Sundays.



PROPOSED CENTRAL AREA [A]

LEGEND

- Existing Functions
- Proposed Functions
- Parking
- Road
- Walkway

N

0 50 100 150 200m

FIG 6.3

JAPHET MUSA
M SC U R P

6.4.3 PUBLIC AND SEMI - PUBLIC ELEMENTS

The dominant element of the public is the block of offices, library and fire station. The offices are to be used by professional bodies and government agencies. The library and the fire station are to serve the immediate community and the town in general.

6.4.4 COMMERCIAL ELEMENTS

Market:

It is proposed that the market be located close to the road and the shopping complex, with good parking space located to serve the two functions. The market and the shopping complex will provide higher order goods and they are designed in such a way that will prevent congestion.

Bank:

Another commercial element is the bank. Its location close to the market will ensure good functional relationship between them.

6.4.5 CIRCULATION

Vehicular:

Enclosed by four main roads, it has enabled the central area to be very accessible from any part of the town. Vehicular circulation is kept out of the central area in order to create a comfortable pedestrian environment.

Pedestrian Walkway:

The main corridors of movement are designed to maximise pedestrian access to main activity areas. The centre is purely a pedestrian precint. All buildings and parking areas are adequately linked with pedestrian paths.

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6.4.6 INFRASTRUCTURAL SERVICES AND UTILITIES

The electricity, pipelines, telephone should follow the pedestrian walkways and should be provided underground. The sewerage should follow the direction of the slope.

6.4.7 GREENSPACES AND HEDGES

Hedges and trees are planned to add to the aesthetic of the central area, regulate the micro weather and provide shade for pedestrians. Hedges have been used to provide boundaries of some landuses. Green space is also provided, all in an attempt to provide a natural environment.

6.5 CONCLUSION

The central area being the nerve of the town needs to be planned with all the attention it deserves. This planning proposal therefore, was based on sound planning principles and understanding of the nature of the problem with the central area of Gombe. This is in realization of the fact that once mistakes are made, it will have a far reaching consequences which may be detrimental to efficient functioning, of the town in general and the central areas in particular.

The difficulty of attaining an effective planning for the central area of Gombe is enormous because of the existing dispersed pattern of central area functions. However, efforts have been made to reduce the problem to has a minimum level. Functionality is attained by the proposal for effective linkage between the units of the central area of Gombe. This enhance the integration of the existing traditional central area with the proposed news ones.

The design proposal for the selected central area ensures that functionality is attained by grouping

of functions to provide maximum interaction between them. In order to ensure accessibility in the proposed central area, both vehicular and pedestrian circulation have bee greatly improved. The central area is a pedestrian precint.

Therefore, the proposal will ensure effective functioning of the central areas and a healthy growth and development of Gombe town as a whole.

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APPENDIX I

RANGE OF PERCENTAGES OF DEVELOPED AREA DEVOTED TO DIFFERENT LAND USE CATEGORIES IN CASE OF URBAN CENTRES CLASSIFIED BY POPULATION SIZE

LAND USE	1,000,000	100,000 - 1,000,000	50,000 - 100,000.	20,000 - 50,000	Below 20,000.
Residential	43-41	51-46	45-42	60-53	36-37
Commercial	4-5	3-4	3-4	3-4	2-2
Industry	6-8	7-9	9-10	5-8	34-30
Public and semipublic	17-19	14-17	12-14	9-10	11-11
parks and playfields	5-7	7-8	7-8	3-5	2-3
Roads and streets	16-14	12-13	13-14	12-14	12-15
other uses	9-6	6-3	11-8	8-6	3-2

RANGE OF PERCENTAGES OF DEVELOPED AREA DEVOTED TO DIFFERENT LAND USE CATEGORIES IN CASE OF URBAN CENTRES CLASSIFIED BY FUNCTION

LAND USE	INDUSTRIAL	MINING	TRANSPORT	PORT	COMMERCIAL	NEW INDUSTRIAL	STATE CAPITAL	MULTI FUNCTIONAL
Residential	45-42	42-35	51-47	53-50	49-46	26-28	45-44	57-51
Commercial	3.5-4	2-3	2.5-3	5-6	6-7	2-3	4-3	2-3
Industrial	12-14	18-24	8-8	7-9	7-9	21-19	5-6	3-3.5
Public and semipublic	11-12	10-11	19-20	12-13	13-14	10-12	18-20	10-11
parks and grayfields	8.5-9	5-6	3-5	5-7	4-5	24-19	5-6	6-6
Roads and streets	13-14	11-13	16.5-17	14-12	15-16	10-14	16-15	10-12
other uses	7-5	12-8	2-0	4-3	6-3	7-5	7-6	12-13

Source: ***Kulshrestha, S.K. (1970)***

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APPENDIX II

NEAREST NEIGHBOUR (FORMULA)

$\bar{d}$ $= \frac{\text{Eimindij}}{n}$

d $= 1/(2/\lambda)$

λ $= n/A$ Where n = number of points

R $= d/d$ A = Area

TEST STATISTICS

Z $= \frac{d-d}{SEd}$

$SE\tilde{d}$ $= \frac{0.26136}{\sqrt{n\lambda}}$

$/n\lambda$ Where n = number of points

λ = density of points

per unit area.

Source:Silk, J. (1979)

CRITICAL VALUE OF A STANDARD NORMAL DEVIATE Z

Significance level (one-tailed)

	0.1	0.05	0.01	0.005	0.001
Z	1.282	1.645	2.326	2.576	3.090
-Z	-1.282	-1.645	-2.326	-2.576	-3.090

Significance level (two - tailed)

	0.1	0.05	0.01	0.005	0.001
Z	1.645	1.960	2.576	2.813	3.291
-Z	-1.645	-1.960	-2.576	-2.813	-3.291

Source: Ebdon, D. (1977)

APPENDIX III

TABLE I INTERPOINT DISTANCE FOR CENTRAL AREA FUNCTIONS IN GOMBE, 1963.

LOCATION	NEAREST NEIGHBOUR	DISTANCE (M)dij
1	2	175
2	3	128
3	2	125
4	5	113
5	4	113
6	7	188
7	6	188

Σdij 1027

n = 7 A = 4307000m2

$\bar{d} = \frac{1027}{7} = 147$

d = 1/(2/71430700)
= 1/(2x0.001274857)
= 1/0.00255
= 392.2

$R = \frac{147}{392.2}$

= 0.374

$SE\bar{d} = 0.26136$

=======

/7x0.000001625 $= \frac{0.26136}{0.003375} = 77.4$

$Z = \frac{147-392.2}{77.4}$

$= \frac{-245.2}{77.4} = -3.17$

APPENDIX IV

TABLE II INTERPOINT DISTANCES FOR CENTRAL AREA FUNCTIONS IN GOMBE, 1973.

LOCATION	NEAREST NEIGHBOUR	DISTANCE (M) dij
1	2	175
2	3	125
3	2	125
4	5	113
5	4	113
6	7	188
7	6	188
8	9	375
9	8	375
10	11	450
11	10	450
12	13	586
13	12	586
14	2	1000

Σdij 4789

n = 14

A = 579500 m^2

$\sim \bar{d} = \frac{4789}{14} = 342.1/$

$\bar{d} = 1\backslash(2/14/579500)$

$= 1\ (2x0.001554308)$

$= 1/0.00311$

$= 321$

$R = \frac{342.1}{321.5}$

$= 1.06$

$SE\bar{d} = \frac{0.26136}{/14x0.000002415}$

$= \frac{0.26136}{0.005816}$

$= 44.9$

$Z = \frac{342.1-321.5}{44.9}$

$= \frac{20.6}{44.9}$

0.46

APPENDIX V

TABLE III INTERPOINT DISTANCES FOR CENTRAL AREA FUNCTIONS IN GOMBE, 1983.

LOCATION	NEAREST NEIGHBOUR	DISTANCE (M) dij
1	2	175
2	3	125
3	2	125
4	5	113
5	4	113
6	7	188
7	6	188
8	9	375
9	8	375
10	18	378
11	18	378
12	19	281
13	20	50
14	2	1000
15	2	1225
16	17	700
17	16	700
18	10	378
19	12	281
20	13	50
21	20	330

$n = 21$

$A = 9309000$ mz

$\bar{d} = \frac{7528}{21} = 358.5$

$d = 1/(2/21/9309000)$

$= 1/(2x0.001501959)$

$= 1/0.003004$

$= 332.9$

$R = \frac{358.5}{332.9}$

$= 1.08$

$SE\bar{d} = \frac{0.26136}{/21x0.000002255}$

$= \frac{0.26136}{0.006883}$

$= 38.0$

$Z = \frac{358.5-332.9}{38.0}$

$\frac{25.6}{38.0}$

$= 0.67$

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APPENDIX VI

TABLE IV INTERPOINT DISTANCE FOR CENTRAL AREA FUNCTIONS IN GOMBE, 1998.

LOCATION	NEAREST NEIGHBOUR	DISTANCE (M) dij
1	2	175
2	3	125
3	2	125
4	5	113
5	4	113
6	7	188
7	6	188
8	25	170
9	25	100
10	18	378
11	18	878
12	19	281
13	20	50
14	2	1000
15	22	495
16	17	700
17	16	700
18	10	378
19	12	281
20	13	50
21	20	330
22	15	495
23	24	1875
24	23	1875
25	9	100
26	17	408
27	26	450
28	21	2045

Σdij 13.569

$n = 28$

$\underline{A} = 16430100$

$\bar{d} = \frac{13569}{28} = 484.6$

$d = 1/(2/28/18430100)$

$= 1/(2x0.00123258)$

$= 1/0.00247$

$= 404.9$

$$R = \frac{484.6}{404.9}$$

$= 1.20$

$$SE\bar{d} = \frac{0.26136}{/28x0.000001519}$$

$$= \frac{0.26136}{0.006522} = 40.1$$

$$Z = \frac{484.6 - 404.9}{40.1}$$

$$= \frac{79.7}{40.1} = 1.99$$