PLANNING FOR BICYCLE AS A MODE OF URBAN TRANSPORTATION IN MAIDUGURI AND A DESIGN PROPOSAL FOR A PART OF THE CENTRAL AREA

BY

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DECEMBER, 1989

DECLARATION

I hereby affirm that this thesis has been composed by myself and that it is the outcome of my research work. It has not been presented before any examiner for the award of a higher degree. All sources of information are specially acknowledged by means of references.

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CERTIFICATE

This thesis entitled "Planning for Bicycle as a Mode of Urban Transportation in Maiduguri and a Design Proposal for a Part of the Central Area" by Adam Abdullahi meets the regulations governing the award of the degree of Master of Science, Urban and Reginal Planning of Ahmadu Bello University, Zaria, and is approved for its contribution to knowledge and literary presentation.

Chairman, Supervisory Committee — 15th March '90 Date

Member, Supervisory Committee — 7th May, 1990 Date

Head of Department — 7th May, 1990 Date

Dean, Post Graduate School — 30-5-91 Date

DEDICATION

INNA LILLAHI WANINNA LILLAHI RAJIUN

This thesis:

is in memory of Baba Gana Adam
B.Sc, M.Sc. (Arch, ABU)

A brother that left us behind at a very tender age.

May the Glory of Allah be with him. Amin.

ACKNOWLEDGEMENT

It is indeed a human tradition for one to thank others for their contribution to ones work. Therefore, I wish to express my profound gratitude to all members of staff and students of the Department of Urban and Reginal Planning, especially those who have made my stay here in Zaria worthy, lively and memorable.

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Finally, I am most grateful for the Almighty Allah.

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ABSTRACT

The efficiency of a city's transportation system is enuntiated by its level of functional effectiveness. Today, in most cities of developing countries, a peculiar but more fundamental problem of transportation is for the majority of the people to get access to a more viable, efficient and cheap means of Urban commuting. The same situation is also obtained in Nigeria. In most Nigerian Urban Centres, due to lack of comprehensive planning for all modes, public transportation efforts and programs have not yielded the expected result.

This study explores the possibility of the use of bicycle as a mode of Urban transportation in Maiduguri by looking at the opportunities and constrains available in Maiduguri. It's main emphasis is on improving bicycle traffic situation, so as to create opportunities for more bicycle users. The study found out that bicycle is a household possession in Maiduguri and about 70% of people are willing to use bicycle under safe and better traffic conditions. Lamentably, transportation planners and policy makers however, have not sought of improving the cyclists condition. The experiences of some countries such as Britain, India, Sweden have been very successful. Better bicycle traffic planning have not only improved the bicycle traffic condition but also the general transportation situation in these areas.

The number of cyclists have increased considerably in Maiduguri in the last few years and the trend may likely continue for some years in future.

The high volume of bicycle traffic, coupled with its peculiar characteristics, no doubted provides, the need to plan for a better bicycle traffic in Maiduguri. The study revealed there is a future in planning for bicycle in Maiduguri.

The physical characteristics of Maiduguri, its climate, topography vegetation and soil favours the use of bicycle. While over 75% of household population earn of less than N3,500 the modest means of transportation for short distance trip available is bicycle. Being dependable, handing and verstatile and because of its low initial cost and insignificant maintenan charge, it has been reported to be the most viable mode for the low income in Maiduguri. Furthermore, existing pattern of landuse development in Maiduguri emphased on medium distance movement between work centres and residential areas. This situation that calls for best utilization of bicycle for most o the trips are found to be of either short or medium distance.

The study recommended that a comprehensive cycleway networ system, that includes repairs depots and hire service facilitie be planned developed for Maiduguri. This system would be achie ed through the recommended principles, concepts and standards. Fi ally, as part of the recommendations the study also came with design proposal for part of the central area process of implementation of the design proposal is also included.

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CHAPTER ONE

1.0 INTRODUCTION

Transportation plays a key role in the existance and survival of any Urban Community, for it forms the basis of interaction of work, leisure and residential activity components. Indeed traffic as a medium is a direct consequency of landuse potentials and transport opportunities. The problems of traffic and transportation in Urban Centres have manifested into various dimensions in greater proportion. Despite huge investment, cost of Urban mobility especially in developing countries is increasing high and unbearable. This situation is partly due to lack of effective and intergrated approach to Urban transportation planning and development. In addition,there is a general lack of opportunity for the Urban population to own and use a modest and viable means of transportation.

Although transportation planning and development have remarkably been successful in developed nations as characterised by high rate of vehicular Ownership however associated problems such as congestion, pollution, parking space, high cost of fuel e.t.c. continue to persist. Perhaps, this development is as a result of high priority accorded to automobile oriented Urban transportation system for some previous years at the expense of neglecting other forms.

However, in realisation of the importances of other modes, the policies in those countries have shifted and now stresses the limited use of antomobile by advocating for the use of other viable alternatives such as bicycles, especially for short distance trips.

In most developing countries including Nigeria, the deficiency of well - intergrated, efficient and economically viable Urban form of transportation is evident. The situation has advocated for individualised form of transport for the previalaged class which includes cars, taxis and motor cycle, while majority struggle for the grossly inadequate public transportation means that suppliments the bicyclist and the pedestrain class in general. The situation in effect is further compounded by lack of comprehensive planning for all the modes, which is largely responsible for the present unbalanced state of mixed traffic in our Urban Centres. Regrettably, such situation has posed a serious challenge to our Urban transportation planning and development due to the fact that potentially viable, more reliable modes such as the bicycles are being edged out by the superior modes such as the cars. The dominance of bicycle in our Urban roads, its significance and peculiarities calls for a planning attention as Adio-Moses rightly observed that the creation of separate pathways for the greater safety of Cyclist

In fact there is no comprehensive policy that ensures balanced traffic development effort. No definate program for the protection of the cyclist from other modes that often infringe on their rights.

The Physical Planning tool currently guiding physical development efforts in Maiduguri is the Master Plan report(1976). It has not however,made any comprehensive effort for improvement of the welfare of the cyclist. In view of its peculiarities which includes the need of the rider to require a balance while in motion, human energy requirement, bicyclist need a planned direct route from residential place of origin to destination of high bicycle trip attraction.

The cost of commuting is increasing due to the high cost of motor vehicles; such as cars (or taxi) and buses due to expensive spare parts and fuel. The less priviledged one is left with no option than to contain with the inadequate service of the public buses of 'Borno Express Cooperation' or resort to either trekking or use bicycle where available. As a result of the declining income - per - capita, people that are not opportuned to use the expensive taxis and inadequate buses are now using bicycle more than ever before.

But regretably, bicycle facilities are either generally very poor or lacking. Improved bicycle

facilities is a pre-requisite for encouraging a healthy bicycle traffic condition. Subsequently a general improvement of the traffic situation that enhances transportation development is a well though idea.

Unfortunately, the existing traffic situation is a mixture of both fast and slow moving modes unfavourably competing for roads spaces. This is as a result of the disregard of the safety requirements of different modes. The situation however, culminates into undesirable conditions such as congestions, accidents e.t.c. often involving the bicyclist. The fact that bicyclist constitute people of all ages makes it mandatory for a call for special attention that garantees the safety of the cyclist on Urban roads.

Indeed, some of the landuses have high potentials of bicycle trip generation enough to justify the provision of bicycle facilities such as packing, cycleways e.t.c. There is the need to provide such facilities for the cyclist in these areas in order to adequately protect there interest and safety. Due to lack of adequate facilities for bicyclist in public and semi-public areas, congestions, obstruction and other unsafe conditions may prevail as a result of haphazard parking.

This situation could be curtailed by mandating public institutions to provide parking facilities for bicycles.

Lack of comprehensive cycleway network has militated against better bicycle traffic and cycle usage in Maiduguri. The absence of organised repair deports, bicycle hire facilities and service centres have contributed to slow development of bicycle as a means of transportation.

In view of the problems highlighted, planning for a better cycle traffic for Maiduguri is an issue that requires immediate planning attention that this research intends to focus.

1.3 AIM

The aim is to review the general traffic situation in Maiduguri with a view to providing planning proposals to improve bicycle traffic situation for Maiduguri and a design proposal for a part of the Central area.

OBJECTIVES

(i) Highlight case studies and the theoretical perspectives of better bicycle traffic planning in Urban Centres.

(ii) Review the existing traffic situation and assess the role of bicycling in Maiduguri.

(iii) Highlight the opportunities and constrains for a better bicycle traffic under the previaling Physical, Social and Economic conditions in Maiduguri.

(iv) Suggest principles and concepts for planning for a better bicycle traffic in Maiduguri.

(v) Provide planning recommendations for a better bicycle system and a design proposal for the part of the central area.

(vi) Recommend strategies and program of implementation of the design proposal.

1.4 SCOPE AND LIMITATION

The research intends to explore the existing potentials of bicycle use as a mode of commuting in Maiduguri. The term 'facilities' refers to all infrastructure meant for the use of the bicyclist such as stands, under passes, cycleways e.t.c. The 'central area' is a defined by Maxlock report on Maiduguri as the City centre district (Report : 1976 page 1.1.11), which includes the Monday Market area, Hausari, Bula-Bulin part of shehuri South, Secretariat area and Bank area (fig. 1.2) while the 'part of the Centre' should include two major bicycle traffic attractors within the central area and the bussiest strip of road.

The research is exploratory and, therefore, it is limited to making a broad planning recommendations on bicycle system in Maiduguri, rather than a detail planning proposal. A selected part that is identified to have deserved the immediate planning and design attention would be use to demonstrate the planning recommendations.

1.5. METHODOLOGY OF THE RESEARCH

The methodology employed for this research is adopted within the framework of policy oriented research as emphasised in science and its broken into the following sub-headings which includes the research question, research approach, the conceptual framework, method of Data collection and method of data analysis.

1.5.1 RESEARCH QUESTION

Would the planning for better bicycle traffic facilitate the use of bicycle and as a result improve the general transportation situation?

1.5.2 RESEARCH APPROACH

The approach to this research is exploratory and it intends to answer the problem in question. The finding is therefore likely to influence public action in terms of policy measures, program planning, participation, physical planning and implementation in the study area.

1.5.3 The Conceptual Framework

As illustrated in figure 1.0, the conceptual framework involves the defination of the problem clearly. The analysing the problem by reviewing approaches of the past experiences and solution of others. Identifying the theoretical approaches to the solution of the problem which will lead to understanding the existing situation in the study area as it's related to the problem. Here, both the dependent and independent variables are assessed. The result provides a framework for the formulation of planning parameter that would be used to develop the planning and design proposals.

1.5.4 Method of Data Collection

The bed-rock of any sound and objective research findings is a relevant and up-to-date data. For the purpose of this study, this indepensible part of research scheme is broken into the following:

(1) Primary Data

HOUSEHOLD SURVEY: Questionnaires were administered to 500 Household heads representing 0.5% of the estimated total of 100,000 in the study area. Information gathered from this survey includes, socio-economic status, mode owned and used, mode used by children, information on bicycle transportation, cost of transportation etc.(APPENDIX I)

CONCEPTUAL FRAMEWORK

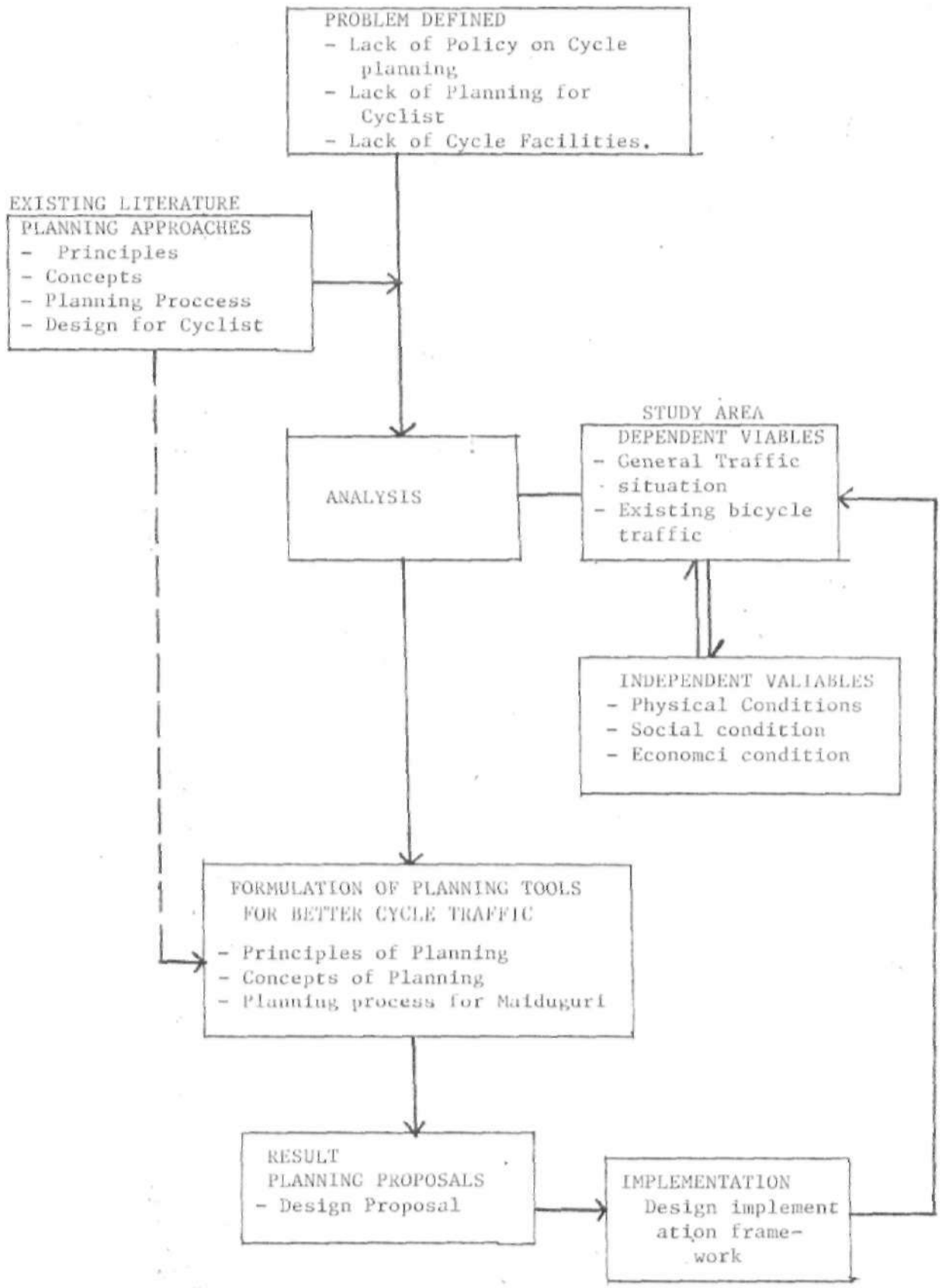


FIG. 1.1

50 questionnaires were used for each of the ten administrative districts of Maiduguri. (Fig. 1.2).

TRAFFIC SURVEY: 10 strategically located points were selected as points where previous observation indicated as high traffic volume. And for three days between the hours of 6.00a.m. - 6.00p.m. traffic counts were conducted. The effort was to establish the estimated traffic volume, traffic flow and frequency of mode used at different time intervals. (APPENDIX III)

The same survey was also done for the Monday Market road and Yerima road (Fig. 1.2).

BICYCLE USERS SURVEY: 100 questionnaires were administered on commuter bicyclist respresenting 0.25% of the estimated total number of about 53,000 bicyclist in the study area. (APPENDIX II) The survey was to establish the nature and purpose of trip, the socio-economic characteristics of the users. Their problems, aspirations and suggestions on the use of bicycle in Maiduguri. The location of bicycle traffic survey is shown in figure 1.2.

BICYCLE REPAIRER SURVEY: A repairer in each of the 10 administrative districts of Maiduguri was randomly picked. They gave information on the level of services rendered, number of potential customers, their problems and suggestions.

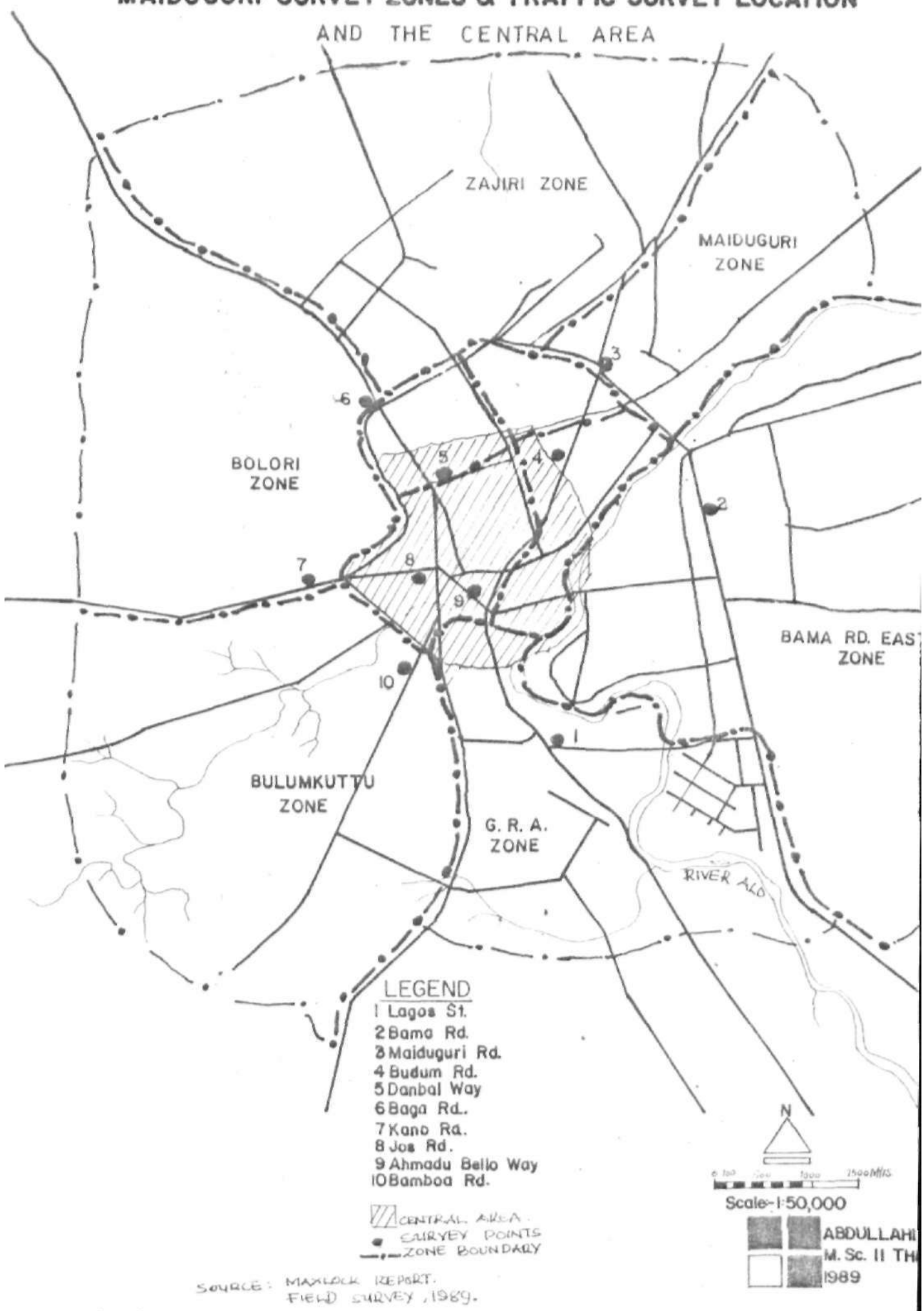
OPINION SURVEY: Informal discussions were also held with heads of transportation Organisations and other related bodies, such as the General Manager of Borno Express Corporation, Directors of Planning, Civil Engineering of the State Ministries, Transport Union Officials, Police etc. Thus, to incorporate their views from a wide spectrum of opinion, understanding and line of thinking on key issues related to their fields of profession and the position of Government.

(ii) SECONDARY DATA

Data collected from secondary sources including published and unpublished materials were basically from Masterplan report of Maiduguri, Borno State Statistical year books, records from Maiduguri Motor Licence Office, Journals, daily papers, research materials and works, and other academic materials.

OBSERVATIONS

Observations and photographs form substantial part of this work. The fact that some traffic aspects such as congestions, delay studies, movement patterns need an elaborate survey which requires a detailed research, observations and photographs were made in order to satisfy the purpose of study.



SOURCE: MAXLOCK REPORT.
FIELD SURVEY, 1989.

Fig. 12

This is largely restricted to the Central area where the design proposal would be made. The observations and photographs so far made however significantly reflects the nature and condition of the existing circumstances as related to this study within the study area.

1.5.5 Method of Data Analysis

With the aid of basic statistical methods of presentation, all data collected were analysed and presented in form of Pie-charts, bar graphs, percentages etc. The volume of passengersis expressed in a standard value of passenger car unit P.C.U; a weight use for vehicles of different category expressed on a standard car passenger unit. The volume of vehiclesis expressed in their absolute number. Except otherwise stated, cost-benefit analysis is employed to weigh viables.

1.6 STRUCTION OF THE THESIS

The thesis is divided into six chapters. The first chapter accounts for the introduction, which contains the statement of problem, aim and objectives, scope and limitation, methodoly of the research and the structure of the thesis.

Chapter two highlight bicycle planning in Bangalore; India, Peterborough; Britain and vasteræ;

Sweden and also accounts for theoretical approaches to planning for better bicycle traffic in Urban Centres.

The third chapter accounts for understanding the existing transportation characteristics in relation to bicycle traffic situation and the role of bicycle in the general transportation system.

Chapter four assesses the dependent and independent viables that influence bicycle traffic in Maiduguri. It spelts out clearly the impact of physical, social and economic factors that affect bicycling in Maiduguri.

Chapter five highlights the principles and concepts used for planning for bicycle traffic in Maiduguri. It also provides the general planning recommendations and the design proposal for a selected area.

Chapter six offers the strategy and program component of implementing the design proposal and conclusion.

1.7 BICYCLE AS A MODE OF TRANSPORTATION

Bicycle is among the premier inventions of the industrial revolution and first appeared in Western Europe in the 1750s. Ever since then bicycle has been developed and transformed into an effective transportations means.

Over the years other forms of transportation have emerged which are faster and motorised, but then the position of bicycle as stable and dependable mode still remains largely unthreatened.

Bicycle: It occupies a unique position among the different modes of transportation in so far as it's benefits are concerned:

> Because of its low initial cost, insignificant maintenance charge, light weight and easy manoeuve rability gives the bicycle the reputation of a dependable, handy and versatile vechicule (Rishinath L.R. et al, 1983.

Thus, a major significant characteristics of bicycle is its portability and flexibility. It's essentially a handy mode that could easily be carried around corridors, along path, etc. It therefore, has the ability to reach the door step and be reliably used on multi-functional and multi-stop trips. Bicycle has also the ability of high manoeuverability which means it can easily be used to avoid traffic congestion because it could be moved between motor vehicles. It has a slow speed and therefore very convinient for short distance trips.

However, because of its peculiar characteristics and its structural dimensions which include the use of two wheels that require balance; its

Hand bar width : 0.6m

length : 1.75m

Pedal clearance : 0.15m

Vertical space requirement : 2.5m.

Bicycle require a smooth surface to operate.

BICYCLING: The act of using a bicycle is refered to as bicycling. Bicycling is a preferred act by many people and it uses the human energy to drive. The fact that human energy could be exhausted. direct route with plain smooth surface is required that makes cycling trip not only of the shortest possible distance but also comfortable and convinient.

There are indeed some factor which affect cycling. These are *climatic-extreme hot, cold, windy showy and rainy condition* either directly affect the effort of riding or makes the bicyclist and surface condition hostile to cycling. The fact that the bicyclist is not protected from the atmospheric condition make it veneral to be influenced by extreme weather. Another factor that affects bicycling is the topography, where the surface condition is covered with sands, snows, rocks, this makes the balance required to operate bicycle hard to achieve

Bicycling is a good form of recreation and sports beside its notable role of transporting people.

Bicycling has been successfully used and encouraged to keep people fit and healthy. It has also been used to reduce accidents by encouraging people to take up bicycling. It reduces congestion, parking problems for cars and has been a cheap and efficient form of transportation for all ages.

BICYCLIST: Bicyclist are found among all age group. However, a small number of bicyclists are found amongst the aged. Bicyclist, are also found among all the high, low, and medium income groups. However, the social characteristics and perception of bicyclist differ significantly as it is obtained in the developed and developing countries.

CHAPTER TWO

2.0 REVIEW OF SELECTED CASE STUDIES AND THEORETICAL PERSPECTIVE TO BICYCLE PLANNING

One of the recent phenomena that brought a new dimension into Urban transportation planning is the growing concern and interest in planning for a better bicycle system in Urban centres. Within the last two decades over 900 references on works related to bicycle planning have been made all over the world as noted from a comprehensive Bibliography compiled by Hugh Mc Clintock (1989). Most of these works were extensively done in Urban Centres of Europe and America as a result of the dramatic increase in bicycle activities that spurred considerable efforts to develop facilities for cycle utility. Inspite of the remarkable success however, detailed theoritical framework that suggest conceptual approach to comprehensive cycle planning is yet to emerge. Indeed, significant number of bicycle facilities in some Urban Centres have been provided and placed in use mostly based on "incomplete knowledge state of current technical knowledge in the field of bikeway planning and design and the fact that most work to date has been dependent on the intuitive judgement and

sensitivity of the individual planner and designer responsible and that each undertaking has been an independent trial-and-error experience "(Daniel T.S et al 1974). As such most cycle planning programs are complementary piece-meal project to Urban transportation planning. Adequate placement of the bicycle planning within the general frame-work of Urban transportation planning has been sortfully advocated by cycle enthusiasts.

2.1 PARAMETER FOR SELECTING CASE STUDIES

A lot of work has been done notably in Europe and America to improve cycling condition of the cyclist. Similar efforts have also been done in India, China and some few countries of the developing world. But most of these experiences are hardly exposed to the international communities. The fact is that bicycle facilities planning is rather a local affair and often contributions for better cycling therefore appear in local languages. Dearth of information on comprehensive effort and experiences of other societies have limited the selection of the case studies. The level of attention and recognition given to cycle planning in India, Britain and Sweden and the fact that these are different countries with different geo-political set-up have led to the selection of the case studies.

2.2 CASE STUDY ONE

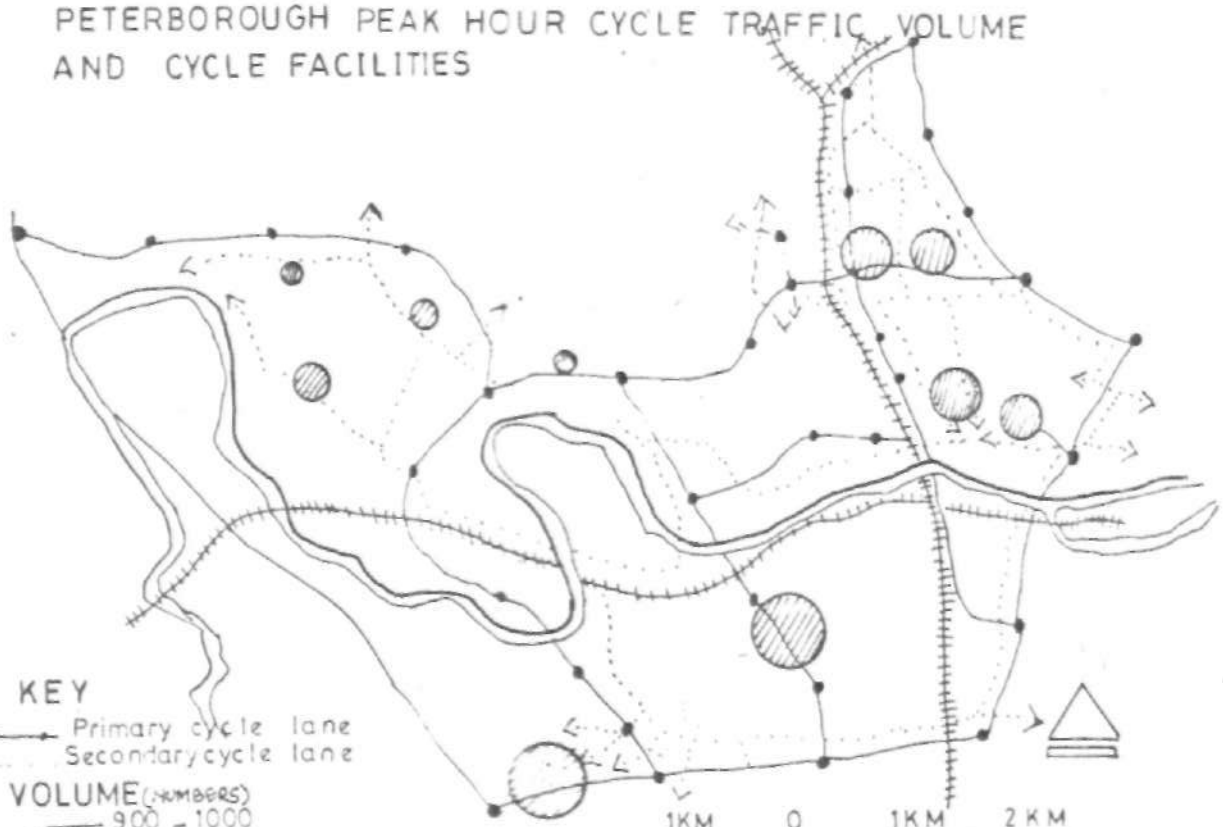
PETERBOROUGH - GREAT BRITAIN

The revival of cycle planning started with the energy crisis of the early 1970's. This officially marked the labour government's concern for planning Urban bicycle traffic with the transportation white paper of 1977, which recognised the importance of cyclist and announced the introduction of the department of transportation innovatory cycle planning scheme budget to encourage local authorities to adopt innovatory cycling facilities. This commitment was restated and expanded in 1981 with a consultation white paper and the 1982 statement of cycling policy (Hugh McClintock 1989).

Prior to the national government policy statement of 1977, the Greater Peterborough county council and City development cooperation acknowledged the need for planning for cycle system as contained in the Greater Peterborough Master Plan of 1971. The City development cooperation in its cycleway report had a special point of interest, a clear enuciation of the linkage between the planning of landuses and the use of low energy forms of transportation:

> 'The majority of cycle journey to work, shop and school are less than one and half miles and the planned distribution of township and employment areas will allow this to be a continuing feature of travel pattern. Work journey trip length will increase in line with national trend but the

PETERBOROUGH PEAK HOUR CYCLE TRAFFIC VOLUME
AND CYCLE FACILITIES



ABDULLAHI.A.
Msc II THESIS
1989

FIG 2.1

Source: planner (1974) VOL 50

> Opportunities will always exist in Greater Peterborough for people to live with easy cycling distance to their work places. (Terence Bendixson 1974).

Peterborough is a small town with an estimated population of 185,000 (1985) situated on the banks of Nene river on coast of the North Sea has a humid climate.

2.2.1 BICYCLE PLANNING IN PETERBOROUGH

The Greater Peterborough City Council built 34 miles of main cycleways at the cost of £1,700,000 in 1971 on the recommendation of the Great Peterborough Master Plan Proposal of the year. The proposal also included a 72 miles network system for 1974 (Planner 1974). For the implementation of a network system, two conceptual approaches were developed, the desire line concept and the primary road network system concept. However at the end, the elements of the concepts were fussed together and developed an effective system. The entire network system was comprised of cycle facilities such as cycleways, cycle stands, underpasses and cycle traffic control measures. Tremendous benefits were achieved including reduction in accidents, an estimated reduction of 10% of total car parking at peak hour parking and an increase in the number of bicycle users for journey to work and School. The bicycle network system of Peterborough is in Fig. 2.1.

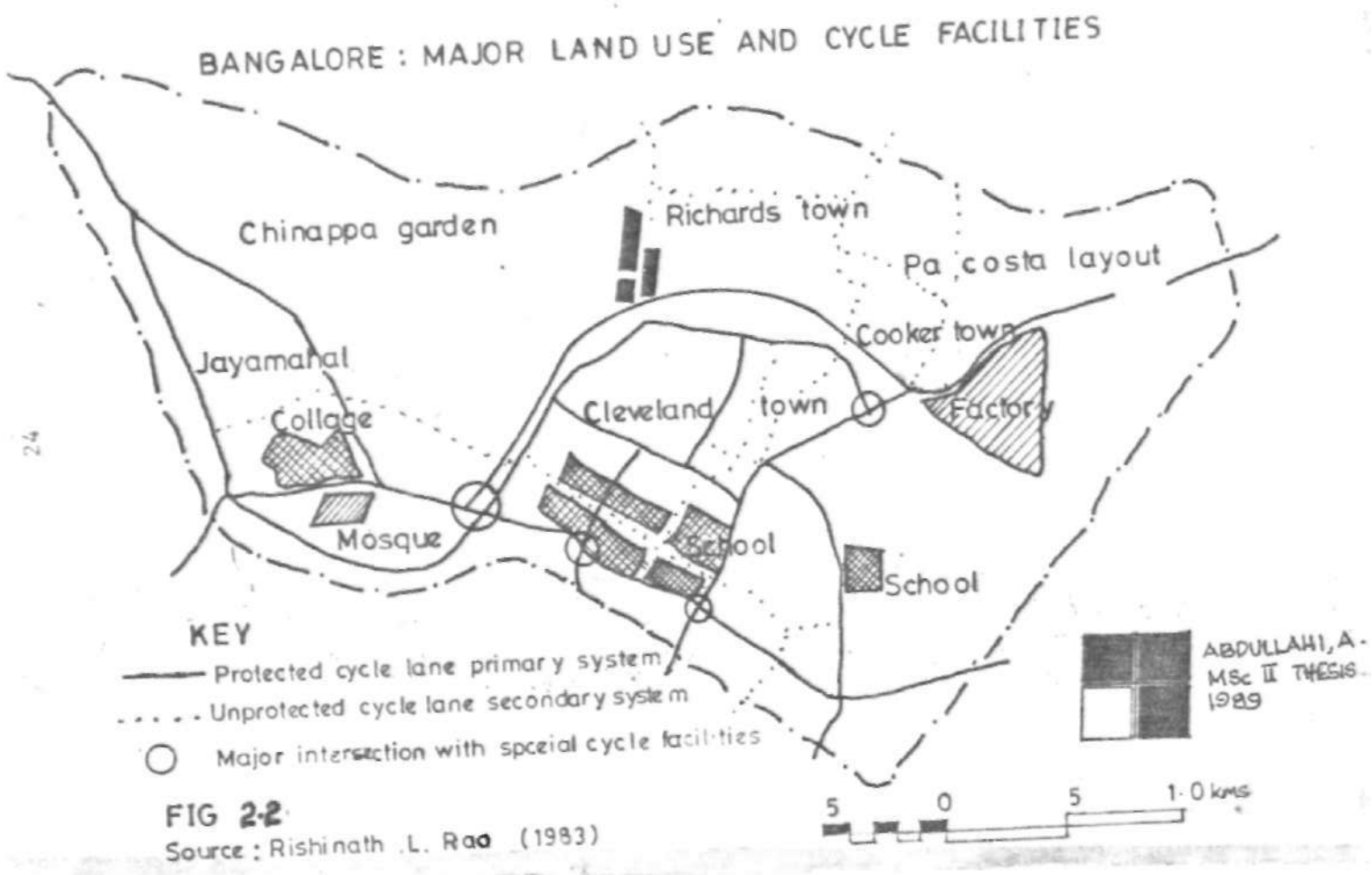


FIG 2.2
Source : Rishinath .L. Rao (1983)

2.3 CASE STUDY TWO

BANGOLORE - INDIA

In Indian cities bicycle constitute the highest proportion of the total Urban modes of transportation. In fact it occupies a unique position among the different modes of transportation and is regarded as a popular mode of conveyance in so far as common people are concerned. As a policy of the `Indian Road Congress', bicycle system is an intergral part of the Urban transportation system. Although no detailed guidelines are available on planning for bicycle in Indian cities, a manual on 'Recommended practise for the design and layout of cycle tracks' prepared by the Indian Road Congress is used for bicycle system planning for Indian Cities (Rishinath L.R. et al 1983).

Bangalore is the fifth largest city in India with a population of 3.91 million people (1988). The metropolitan region covers over 205 square kilometres. The city is located on a ridge top which runs through the middle of Mysore Plateau at an average elevation of 900 metres above the sea level. Bangalore has a Humid tropical Climate. About 200,000 bicycles use the total length of 720 kilometres of road (1981). Bicycle remains the principal and dominant mode of transportation, although public transportation service is available but it is grossly inadequate and inefficient.

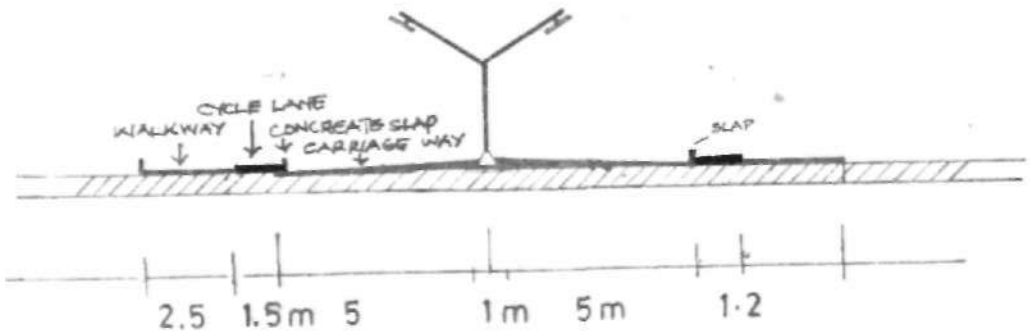
2.3.1 BICYCLE PLANNING IN BANGALORE

The dire need for planning for bicycle in Bangalore stem up as a result of the Bangalore City cooperation concern for the safety of the teaming cyclist population and the unique role of bicycle as its occupies an important posi.ion in daily commuting of the majority of the people. According to survey conducted by Rishinath L.R. et al(1983), 47% of the total population use bicycle for various trip purposes, while 33% of the car users and 70% of Bus commuters also make use of the bicycle too.

In planning for a better bicycle traffic for Bangalore Rishinath L.R. et al (1983) developed a process of bicycle planning. The Planning process involves organisation of the planning, taking inventory and development of strategy, selection of plan and implementation. The final outcome of the strategy plan they came up with was a primary system consisting of on-road 'protected' lanes and a secondary system consisting of on-road 'unprotected' lanes for Bangalore bicycle traffic. (Fig. 2.1). The protected lane provides for four - feet width of cycleway on either side of the road, with physical barrier from curbs, while the unprotected lane also provides for four - feet width of strip marking (Fig. 2.3).

CYCLEWAY FOR BANGALORE

1 SECTION OF PROTECTED LANE 4 Feet (1·2 m)



2 SECTION OF UNPROTECTED LANE 4 Feet (1·2) Strip

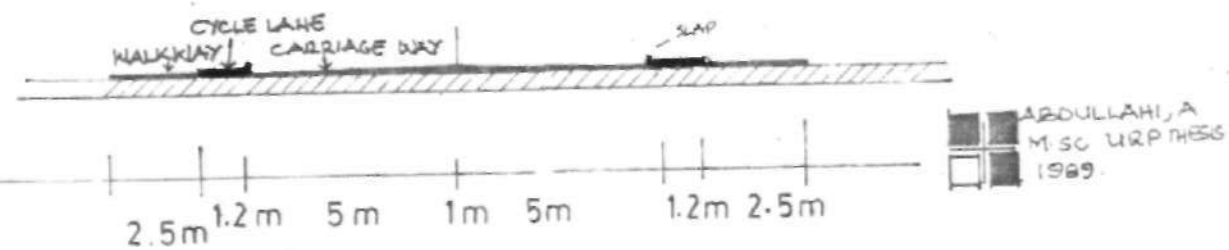


FIG: 2·3

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SOURCE: Rishinath et al (1993)

The scheme also included restriction for parkings and lowering of speed as part of the improvement efforts.

2.4 VASTERAS SWEDEN

Vasteras is a small town located in Central Sweden and has a temperate climate. In 1975 it had a population of about 100,000. It has the two largest Engineering firms in Sweden; ASEA and Suenka Metallverken. Wages are high and car ownership is above national average. Nevertheless, the proportion of people cycling to work in 1966 was 25% but by 1971 it has gone up to 30%, and up to a distance of three miles bicycle is the most popular mode used.

This development was as a result of the creation of over forty-five miles of cycleways in 1971 including routes and underpasses leading to the City centre where the two leading firms were located. This effort was as a result of the need to reduce the heavy congestion being experienced in the City centre.

2.5 BICYCLE PLANNING : NIGERIAN EXPERIENCE

Planning has contributed alot for the success of Urban transportation development in Nigeria. Bicycle as a mode of Urban transportation has featured prominently and contributed positively to the development of Urban transportation system.

Lack of Effective Planning for Cyclists in Nigerian Urban Centres.



Cyclist moving along Aminu road in Zaria
Plate I

Over the years, efforts to improve the efficiency of Urban transportation paid little or no attention to welfare and interest of the Nigerian Urban Cyclist. It is pertinent to note that there is no single Urban centre that has a comprehensive development plan program for the cyclist. This could be attributed to the sheer lack of fore-sight and interest to cater for the need of the less priviledged. Most of the Master Plans that have made mention of cyclist's need such as that of Master Plan report of Maiduguri by Maxlock (1976) was mere recommendation without any detail program or study. However, another research effort that had made mention of provision of separate cycleways for the cyclist was Ameh P.O. (1988) in his work on Makurdi recommended separate cycleways for the cyclist in view of their high number and veneralibility to accidents. In his study on Makurdi, he observed that 40.2% of vehicles owned by workers are bicycles, yet no attention has been given to the improvement of cycling condition. From observation, this situation is very true for all the Urban centres, despite the high number of bicycle users. Although this constitutes the highest proportion of the existing total modes, no attention has been paid to improve bicycling condition. (Plate I)

Lack of cycle facilities in Urban centres is a problem that has concerned the immediate attention of planners, and therefore programs for its provision need not to be over emphasised.

Most of the Urban centres in Nigeria require bicycle facilities for the cyclist, in all facets, there is little or no constrain for their provision. In fact the issue is lack of commitment from part of the planners and lack of political will to improve the condition of the Urban cyclist.

2.6 THEORETICAL PERSPECTIVE TO BICYCLE PLANNING

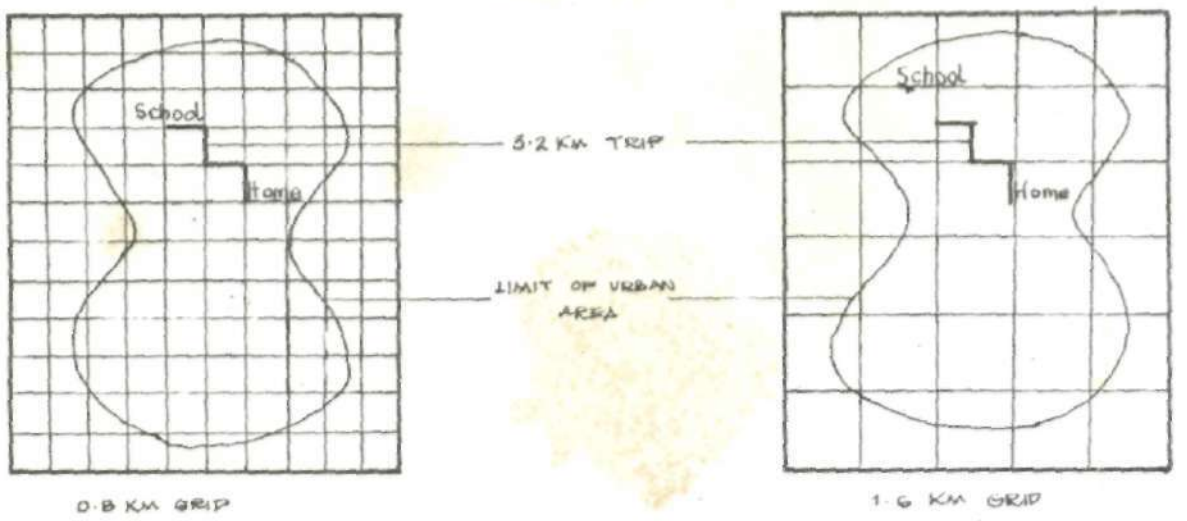
Literatures on bicycle planning insofar lacked the theoretical base for an acceptable methodology for bicycle planning. And therefore, most studies emphasised on practical solutions to problems of bicycle traffic condition. However, some interesting issues and observations in some of the literatures are very fundamental to bicycle planning in Urban centres.

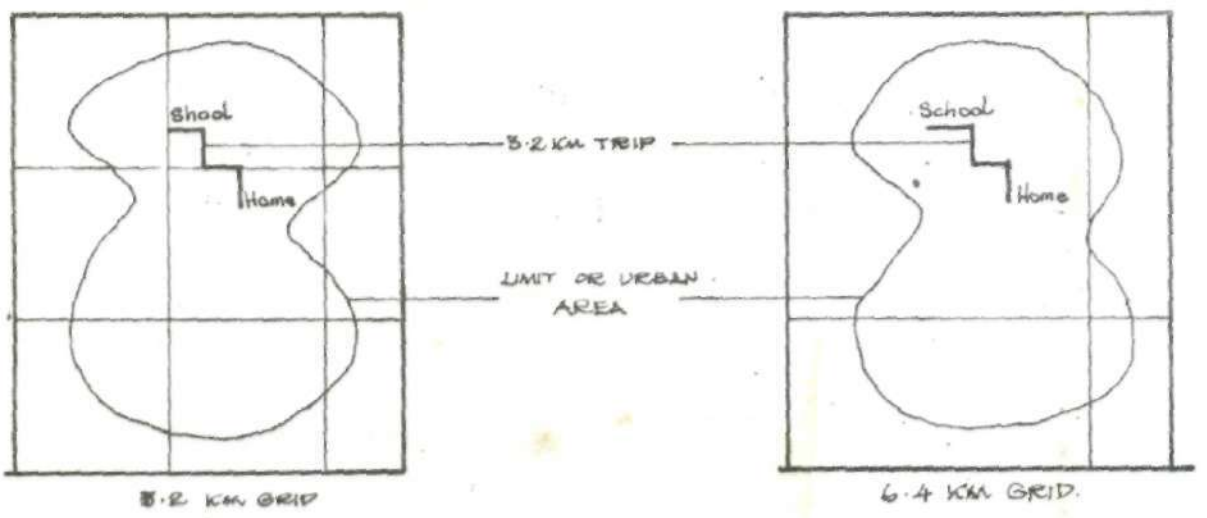
2.6.1 PRINCIPLES OF BICYCLE PLANNING

The fact that bicycle planning was motivated by various reasons, there is hardly a single well accepted principle.

(i) Network Density Planning

The criteria generally adopted for the entire Urban cycle network system emphasised the hypothetical grid network density of 0.5 kilometre to 0.8 kilometre as a recommended network system comprising of the primary, secondary and tertiary routes forming a system (Fig. 2.4).





SOURCE : (C. CARL ET. AL, 1974)

FIG. 2:4 - HYPOTHETICAL CYCLE FACILITY GRID

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From the figure its clear that maximum utilization potential of 100% is achieved for 3.6 kilometres Home - School trip on the 0.8 kilometre grid network. The 1.6 kilometres network grid has 50% utilization potential for 3.6 kilometres school/ Home trip, while 3.2 kilometres network grid has as low as 25% utilization potential. However no potential for utilization is achieved on the 6.4 kilometere grid (Carl et al, 1974).

(ii) Cycleway Planning

Cycleways on their own are right-of-ways entirely used for cycling and should only come in compromise with other traffic and traffic facilities ininevitable areas for crossing . A standard cycleway should at least be 1.2 metres in width in order to accommodate the cyclist. There are five typesof cycleways as shown in Figure 2.5.

BIKE ROUTE: A route for cycle which follows streets with low traffic volumes. Cycles have priority over road users except pedestrain.

BIKE LANE : UNPROTECTED: A clearly marked lane on the carriageway of the road separated from lane used by other traffic by painted or dotted lines.

BIKE LANE : PROTECTED: A lane for the cyclist beside the carriageway of the road divided by either a protruded slap of at least six inches in hight or an iron bar completely

BIKEWAY TYPES

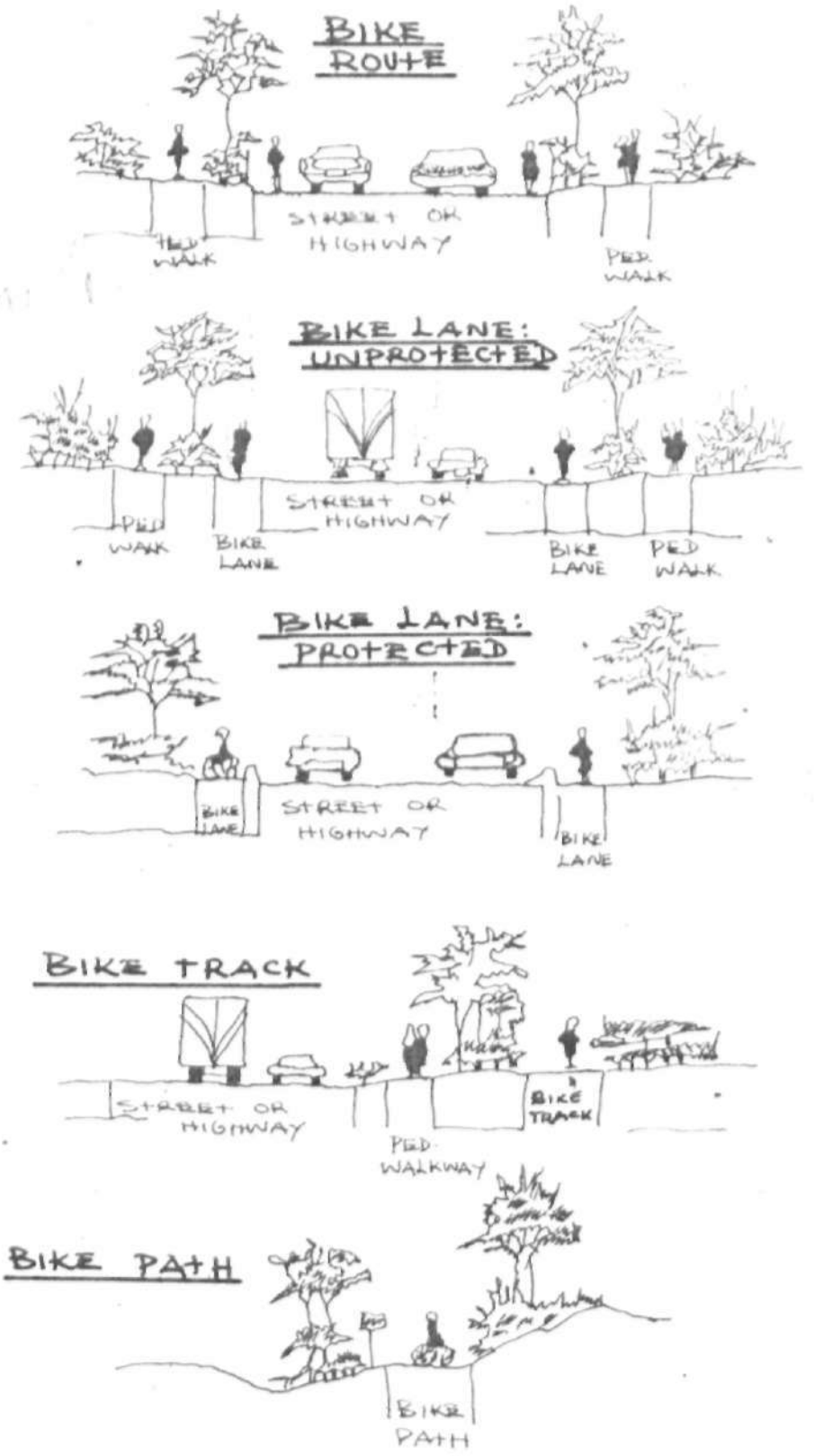

FIG 25

SOURCE : CARL ET AL (1974)

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protecting and isolating the cyclist from the other vechicular traffic.

BIKE TRACKS: Cycleways along a primary or a secondary road system completely independent from the carriageway but within the road reservation.

BIKE PATH* These are cycleways that do not necessary follow the road system but through a route with sign-post usually linking major cycle trip generators to major cycle trip attractors.

Generally, the provision of cycleways depends on the width of the road, the volume of traffic and potential users, the street furnitures including utility poles and drainage mains, the cycle track is to follow the same direction with the road but must not necessary be kept parallel to the carriageway (Jim McCkiskey, 1979).

2.5.2 Concepts of Bicycle Network Planning

The cycleways report of 1973 for Greater Peterborough Development Cooperation suggested or highlighted two concepts to be used for bicycle planning for a cycle network system (Figure 2.6). The desire line route concept and the primary road network system concept.

(i) The Desire Line Route Concept

This concept emphasised that main strategic routes should follow desire line movement to major trip attractors and generators both within and between local areas. By providing a direct link between major trip generators and major trip attractors the distance is reduced to minimum due to the direct linkage. However, in order to achieve such a system, high design and safety standards would be required due to conflict with local roads and pedestrain facilities. And obviously centres of high traffic attraction had to contain with traffic not necessary destined to them.

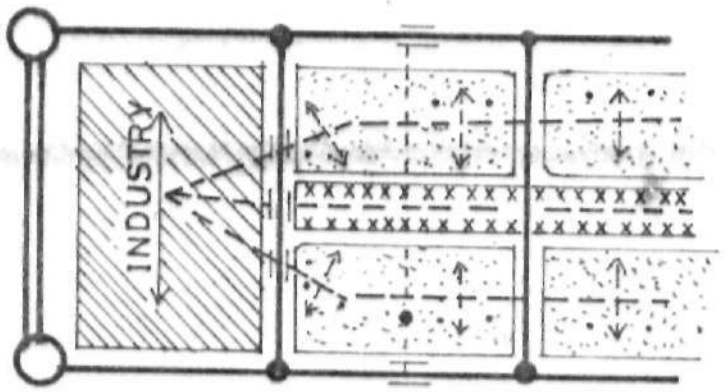
(ii) Primary Road Network Route Concept

Advocates for cycleways should follow the existing primary and secondary road network system so that it should serve as a comprehensive and complimentary network to the whole Urban network system. Since they follow the major road network little interference with local facilities and therefore high design standard can be achieved easily. High volume and long distance movements will bye-pass local centres which they have no business or reason to go through. A general network link would also be easily achieved. But then the travel time will be longer because there is hardly any direct link between high traffic attractors and generators and therefore

CYCLEWAY NETWORK CONCEPTS FOR PETERBOROUGH

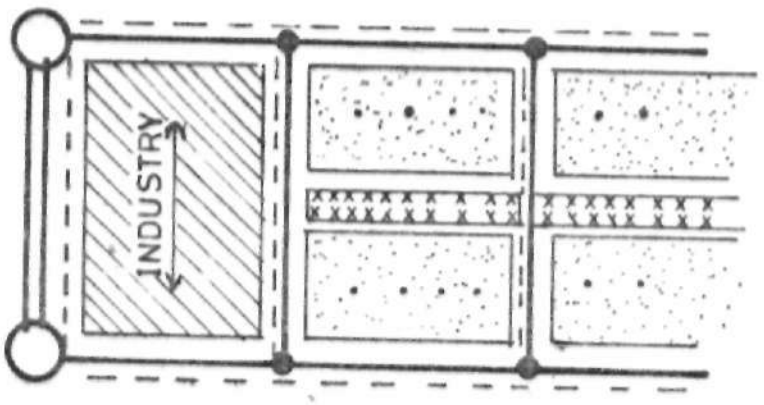
CONCEPT I

— Desire line routes system



CONCEPT II

Major strategic routes system



— — Main cycleways tracks
– – Secondary routes tracks
● Local facilities Primary school local centres etc.
Commercial Institution
Residential

N

FIG 2-6

source planner (1974) VOL 60

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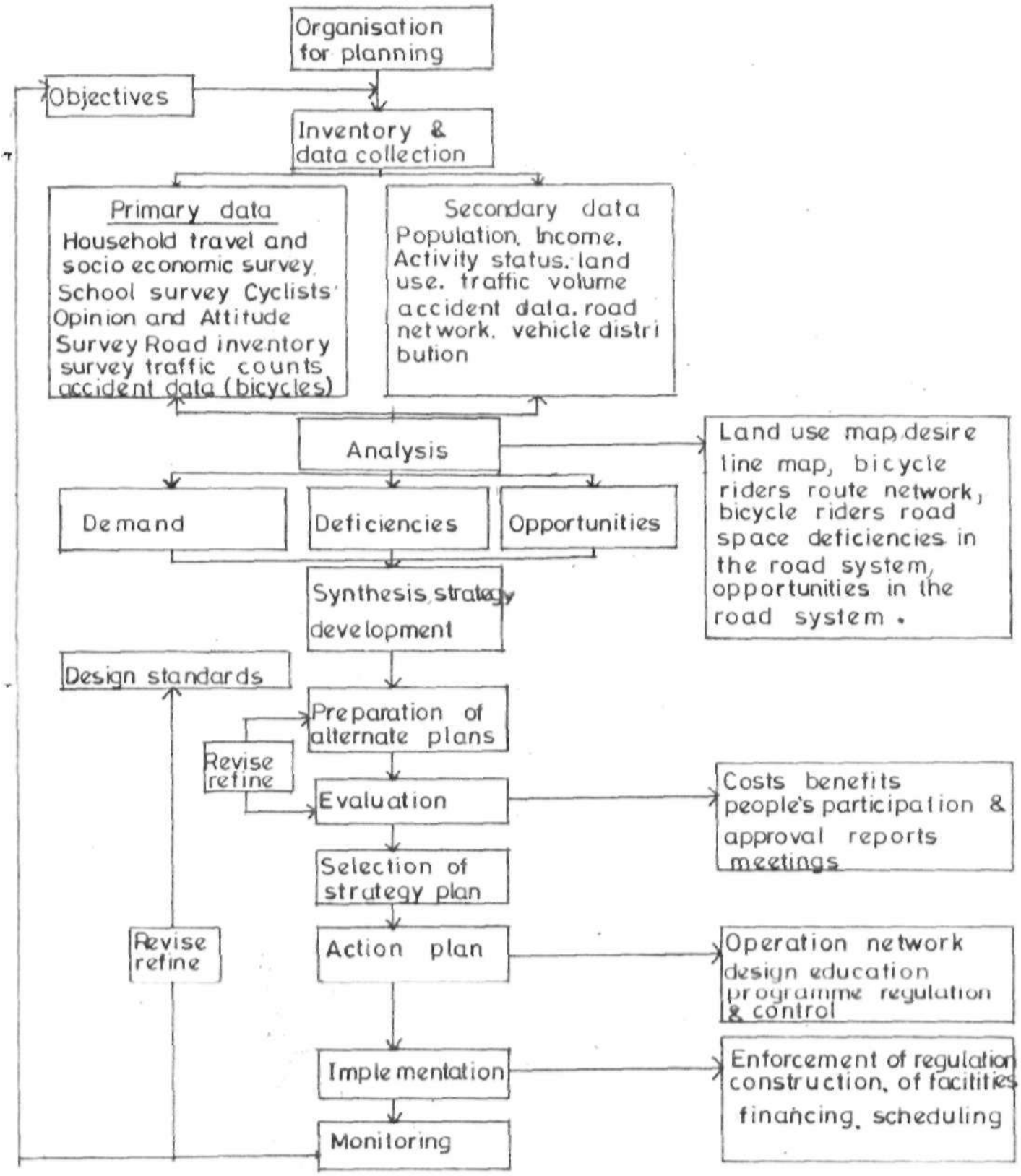
local facilities would be poorly accessible from primary routes.

2.5.3 BICYCLE PLANNING PROCESS

There has been a divergent opinion on a suitable methodology approach to bicycle system planning in the Urban Centres. A compromising opinion that intergrates bicycle system into the general Urban transportation with an ultimate goal to improve the cycling condition is need. The process that require techniques that improve safety of the cyclist compartible with other safety measures provided for all other road users. In order to achieve a successful planning program, a process had to emerge as a framework that guides planning for the cyclist. In fact its obvious that without adequate planning for bicycle system in Urban centres, mere provision of cycling facilities would ultimately be a failure. Rishinath et al developed a planning process based on studies from Australia and USA and came up with a planning process that could be used for other urban centres. They contended that without adequate planning, bicycle facility provision is likely to be a failure. Therefore the planning process is a prerequisite for bicycle planning for any urban centre. The process as illustrated in Figure 2.7 is a flow diagram and a circlic process. The process emphasised on first identification of the problem, then collection of data.



Th bicycle system planning process

FIG 27

SOURCE : RISHINATH ET. AL (1983)



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Collected data is analysed and synthesised leading to the formulation of strategy and action plan. And finally, implementation and citizen participation forms the last stage of the process. The review of the process could be made in order to adjust certain elements within the frame-work so that problem identified gets required solution.

2.5.4 PLANNING CONSIDERATIONS

The success of any bicycle planning scheme is the extent to which the bicycle scheme would be effective based on some standards and requirements. While planning the following should be considered:

(i) There should be a defined primary and secondary routes for cyclist that could not only be used for bicycle as a transportation mode but also should serve as an attractive place for recreational cycling.

(ii) Cycle facilities should be located at a sufficient proximity to centres for utility; sports leisure etc so as to justify resources devoted.

(iii) Natural cycleways should be an intergral part of un-interrupted cycleway network.

(iv) Practical planning is a function of existing cycling situation and land use mixed-up in an area and therefore network is reached through stage manage construction.

(v) Provision should be made for storage, repair facilities near or in major trip attractors such as schools, markets, shops and public institutions etc.

(vi) Cycleways should avoid step gradient for cycling requires a continues human energy supply and balance.

(vii) Provision of shades and wind breakers, should be an essential part of planning for cycle facilities. Indeed shading of cycleways enhances conducive atmosphere for cycling by reducing the impact of some hostile climatic elements on the cyclist.

2.7 OBSERVATIONS

Experiences in cycle planning all over the world has been very successful. The achievement was due to awareness of the role and importance of cycling. In Nigeria, there is no policy, program or a comprehensive planning effort for bicycling. Bicycle commuting in Maiduguri is a hazardous exercise and yet no concrete effort have so far been made by planners to improve the situation. Plate II shows the hazardous conditions bicyclists are subjected to in some parts of Maiduguri.

Bicyclist exposed to Hazardous conditions in Maiduguri.



A typical bicycle moving condition along Jos Road
Plate II

MAP OF NIGERIA SHOWING BORNO STATE



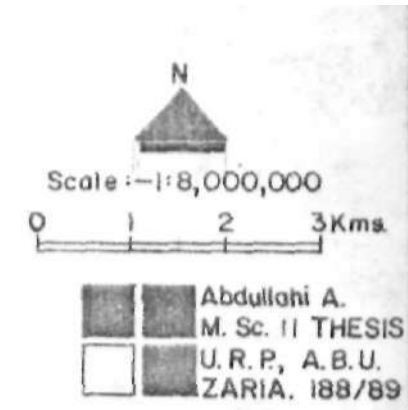

Fig 3-1

Souce : Maiduguri Master Plan (Maxlock)

CHAPTER THREE

3.0.0 GENERAL TRANSPORTATION SITUATION IN MAIDUGURI

3.1.0 BACKGROUND AND DEVELOPMENT OF MAIDUGURI

Maiduguri developed as seat of the traditional authority, the Borno Native Authority, in 1900. Since then it has developed to be the most influential city in the North-Eastern Sub-Region of Nigeria. During the last ninety years or so, Maiduguri has undergone a tremendous change in population and landuse development.

3.1.1 Location

Maiduguri is located on latitude 11½ degrees East and longitude 13½° north of equator. It lies on the Western part of the greater Chad Basin plain, about 130 kilometres west of the present shore of Lake Chad. (Figure 3.1). Before its present status as a Capital of Borno State, Maiduguri had served as the Capital of Borno Privince, State Capital of North-Eastern State and as well headquarter of the Borno Emirate Council at different times. The present spatial area of Maiduguri covers over 172.778 square kilometres. Today Maiduguri is both commercial and Administrative centre of the North-Eastern sub-Region.

3.1.2 Population

The 1989 estimated population of the city is 767,360, the growth of the population is synonymous to its spatial

development. According to the 1953 census the population was 63,000 within a spatial area of about twelve square kms or four kilometres radius largely comprising of landuses within the present central area. By 1963 the figure rose to 139,965 within about six kilometre radius from the Shehu's palace. With the spout of Migration after independence and accelaration in natural increase rate due to the expanding social and economic opportunities, the population growth rate of Maiduguri increased considerably. The estimated figure of Maiduguri based on the 1963 census and the national growth rate of 5% stood at 767,360 for the year 1989.

3.1.3 Landuse Development

Maiduguri started as an administrative centre in 1900 in the area around the present Shehu's Palace and consisted dominently of residential landuse. The Shehu being the symbol of authority with the Palace as the centre for both institional and cultural functions. The 'Dandal', an open square and the central mosque located beside the Palace, this unit formed the central activity area until the advent of the colonial resident officer in the 1920's. The dominant mode of transportation was foot, donkey and horse and as such most of the roads were narrow. Before the independence, Maiduguri was a small town with a spatial area of less than twenty-five square kilometere which was dominated by residential landuses.

It consist of central area that performed the cultural and local administrative functions which was located around the Shehu's Palace. The Monday market area formed the commercial area which the institutional functionaries were located beside the commercial landuse and the government reservation area. (Fig. 3.2). These were the dominant landuses before the independence. However, after the independence and as a result of the rapid population growth, the town developed rapidly to inlcude other landuses such as industrial, educational and large transportation development. Within its present spatial area of 172.778 square kilometres the landuse is consisted of 50% residential, commercial 10% institutional 15%, public 8%, transportation 12% and open spaces 5% (survey 89). This fairly rationed landuse allocation is mixed-up into a pattern that has dictated to the emergence of the existing transportation system. The landuse distribution could generally summerised as a function to the existing transportation. Maiduguri has a centrally located high commercial activity centre, with a ring of high density residential development. Patches of High density residential development could also be found in the suburbs which also have some district commercial centres. However, the institutional and educational landuses are evenly distributed. (Figure 3.3)

MAIDUGURI GROWTH AND DEVELOPMENT.

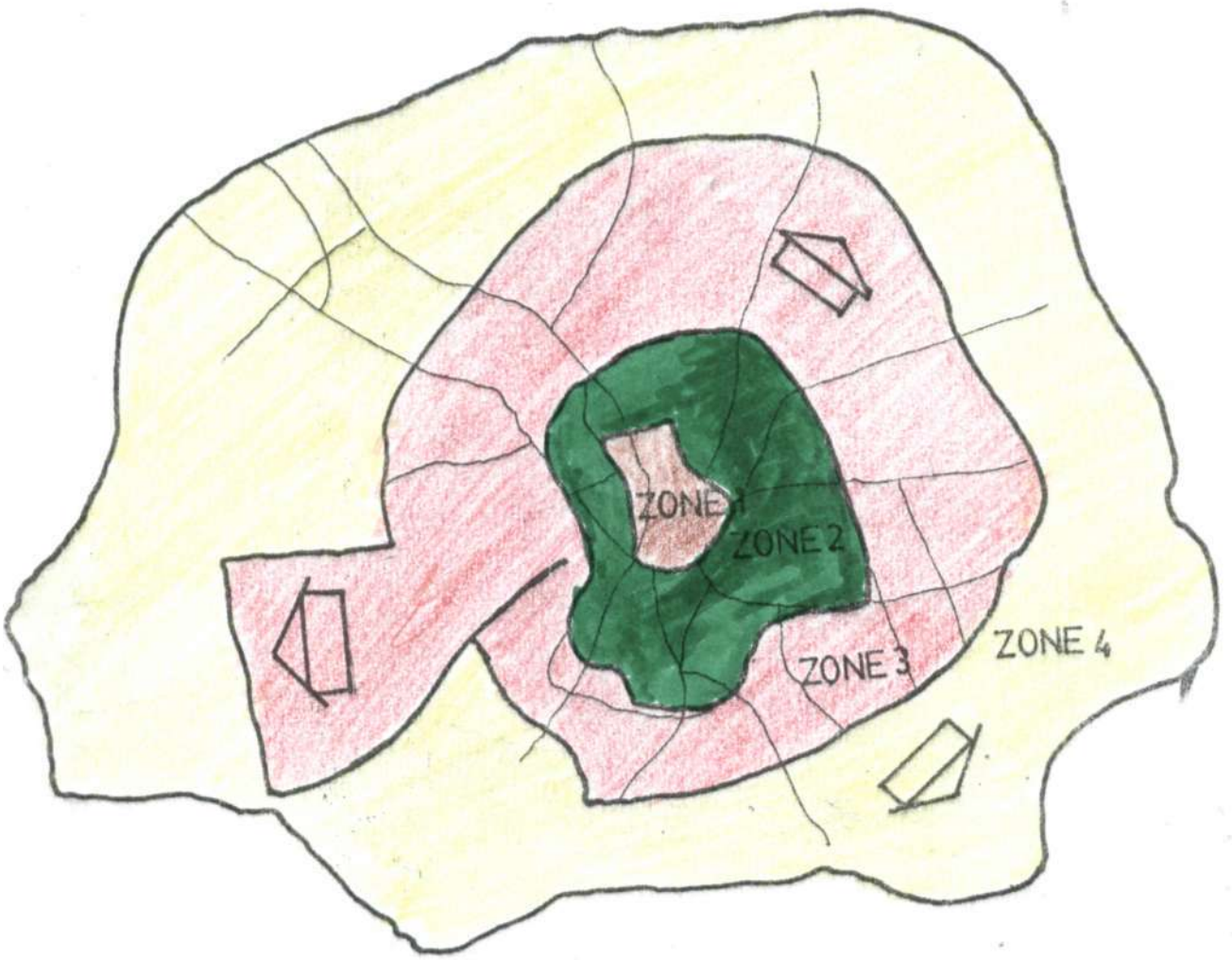

FIG. 3.2

- ZONE I CBD-ANCIENT SETTLEMENT-BEFORE 1960
- ZONE II POST INDEPENDENCE (1960-1986)
- ZONE III DEVELOPMENT FROM (1987-1989)
- ZONE IV DEVELOPING AREA

SOURCE: SURVEY (1989)

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EXISTING LANDUSE MAP : 1989

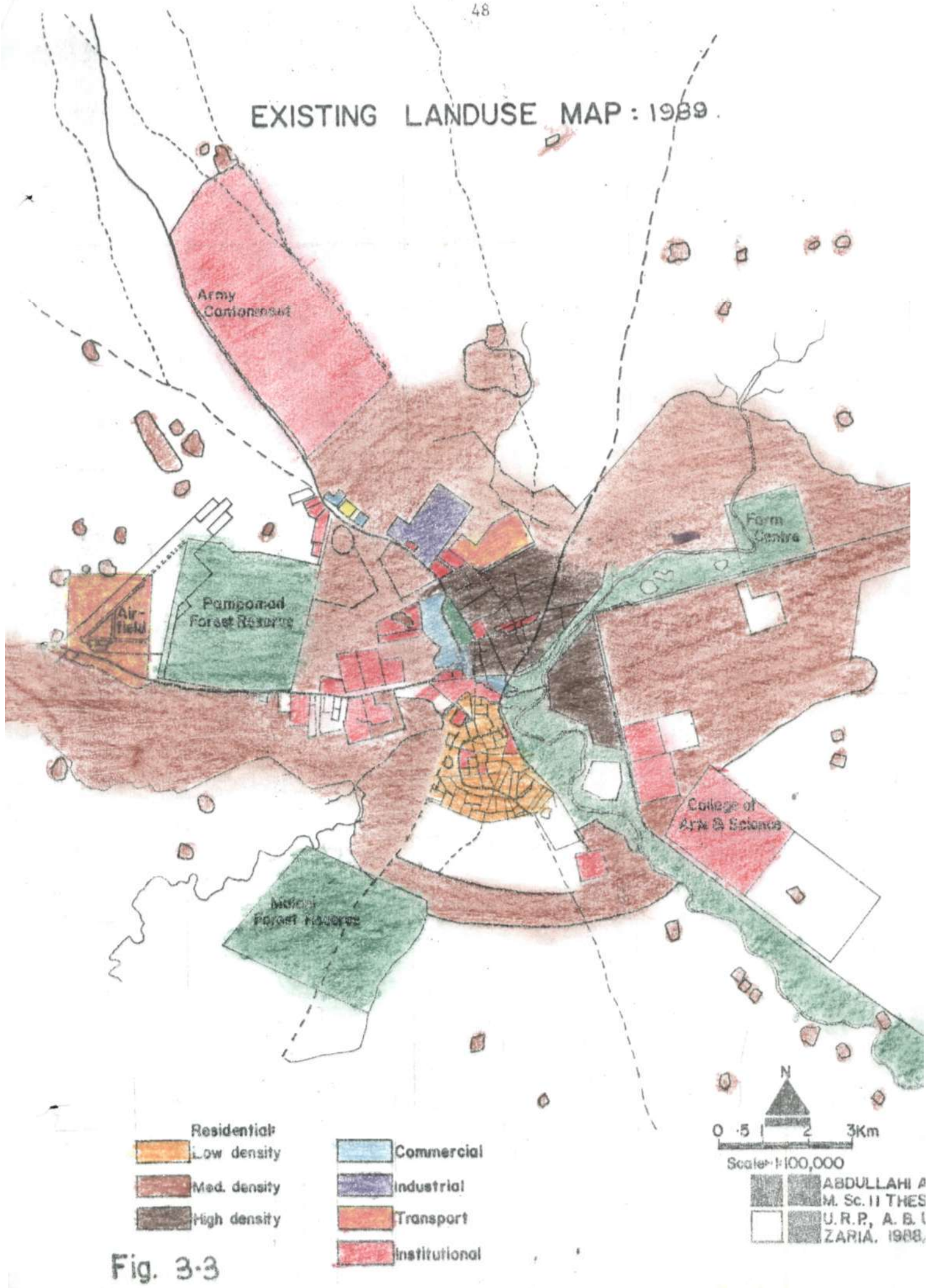


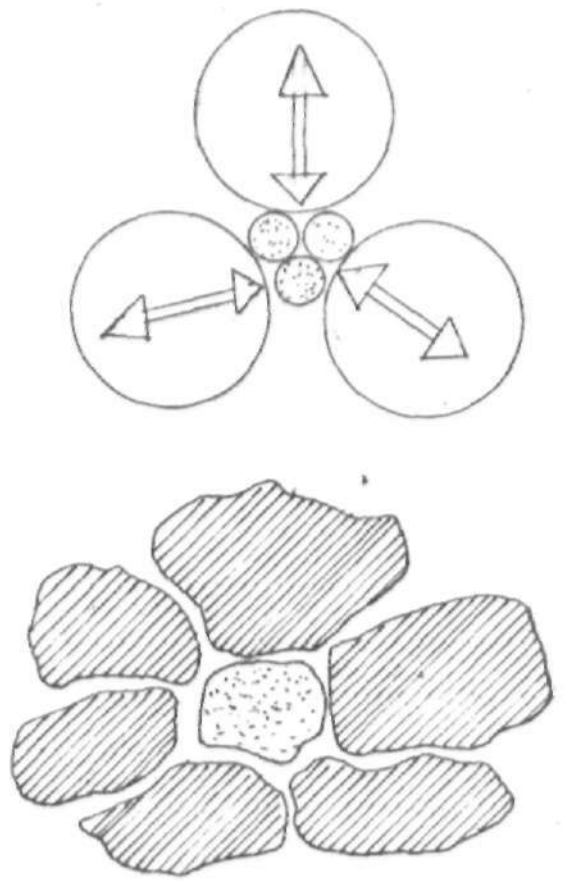
Fig. 3-3

Thus ,interaction of traffic within those landuses is a daily activity kept in functions.

The Residential Landuse mainly dominates the Urban land comprising of low, medium and high densities, which are mainly divided into administrative districts. The old Yerwa forms the nucleus of the city is the oldest high density residential layout. And to the South of Yerwa District lies the Government reservation area (GRA), a dominantly low density residential area, exclusively seggregated landuse that was introduced and developed by the colonialist but currently used by the elite and the privileged class. Beside the low density there are medium density layouts which includes Bolori, 'Abuja' layout, Gamboru and Mari housing the medium income groups. The outskirts are suburb housing of High density category such as Bulumkuttu, Gwange, Zajiri and Maiduri.

Conceptually, Maiduguri has a residential scattered and workplace concentrated in Central, intermediate and peripheral locations. (Fig. 3.4a). This is a situation that encourage multiple residential originated work trip terminating in few workplace areas. As best described by Hutchinson (1974) as radial classification type, where the travel demand pattern is radial and focuses on the Central Business district. The average distance between

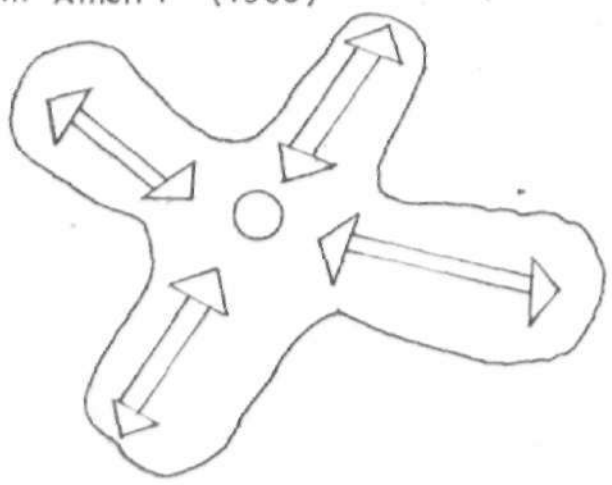
(a) WORK PLACE MOVEMENT AND LAND USE RELATIONSHIP IN MAIDUGURI



RESIDENCES SCATTERED WORK PLACE CONCENTRATED

source: adopted from Ameh P (1988)

(b) TRAVEL DEMAND PATTERN



RADIAL TRAVEL

SOURCE: KHANNA (1968)

KEY

RESIDENCE

WORK PLACE

FIG 3·4

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workplace is alway medium (Khanna, 1988) (Fig. 3.4b). The medium distance relationship between workplace and residential favours the use of bicycle as a mode to place of work. This important aspect of the relationship advocates for the planning for bicycle in Maiduguri more than any other mode so as to improve the transportation situation.

The commercial landuse is mainly restricted to the central market or Monday Market area and its immediate neighbourhood, an area of high concentration of commercial activities. However, Maiduguri has other sub-centres at the district levels. These are located within the districts. The Gamboru Market, Baga Motor Park, Bama Motor Park and Bullum Kuttu Market are few examples.

The public landuses are scattered all over the urban area, however, the most dominant single landuse observed to be the highest traffic attractor is the state secretariat which is located in the central area of Maiduguri very close to the central commercial area.

Institutional landuses are not centrally located either. The University is found along Bama road, while most of the other post primary institution are located along Kano road. The Primary Schools are located at neighbourhood level.

The allocation for space for transportation service was generous, occupying 12% of the total built up space.

Most of the transportation land were part of the Maiduguri international airport and the Nigerian Railways Corporation. The existing primary and secondary roads also use quite a significant proportion of space allocation for transportation. This indeed was due to foresight of the planners for the envisaged need for provision of wider road reservations. Most of the primary roads have at least sixty metres width.

3.2.0 Transportation in Maiduguri Since 1960

It is worthy to trace the development of transportation in Maiduguri prior to 1960, for the fact that not until after independence, Maiduguri was merely a small provisional town, and the problem of transportation had not assume any significance. Ever since then, however, it had not drawn any planning attention and concern. Infact prior to independence, dominant mode of transportation was by foot and bicycle within about 2 kilometres radius area. Although the first car arrived as early as 1917, extensive use of automobile started after the independence. This be perhaps explained by the improvement in living condition of an Nigerian as a result of the social and economic development. The pace of development accelarated population growth which was translated into changes of various landuses, especialiy commercial and industrial development and change in traffic characteristics and behaviour became self-evident.

By 1965, taxis have began operation and two years later the state government introduced the public bus services. However, bicycle remained as one of the modes that provided significant commuter services to the people up to the 1970's. According to survey report by Maxlock, the average bicycle ownership in Maiduguri in 1975 stood at 80 per 1000, ranging from 55 per 1000 in Zongo to 123 per 1000 in Shehuri North. (Table 3.1) when this figure is compared with that of other vehicles ownership for example with that of the car 14 per 1000 and motor cycle 22 per 1000, indeed, it suggest highest ownership rate for bicycle out of the total 119 per 1000 vechicular ownership rate. (Maxlork report, 1976).

COLAR

VEHICULAR OWN ERSHIP RATE IN MAIDUGURI (1975) BY WARDS

(Percentage population)

Ward	Bicycle	M/Cycle	Cars	Vans	M/Bus	Other	Total
Bullatin	5.5	1.8	0.4	0	0.1	0.3	8.1
Fezzan	7.6	2.3	0.7	0	0	0.3	10.9
Gamboru	10.0	1.1	1.4	0	0	0	13.7
G.R.A.	11.2	2.0	10.6	0.2	0	0	23.1
Gwange	7.6	3.7	0.2	0	0	0.1	9.9
Hausari	5.0	1.9	1.0	0	0	0.4	13.1
Lanisula	8.0	1.6	0.8	0.1	0	0.4	11.2
Limanti	7.5	1.5	0.0	0.1	0	0.4	7.6
Maiduni	10.5	1.5	0.7	0	0	0.2	12.7
Maiduri	10.0	2.1	0.0	0	0	0	11.1
Sheuri North	7.5	3.1	1.3	0.3	0	0.1	12.3
Shehuri South	12.3	1.7	0.7	0	0	0	14.7
Zongo	5.5	0.9	2.3	0	0	0.3	9.0
Elsewhere	5.8	0.4	3.6	0.4	0	0	10.2
Average	8.0	2.2	0.4	0.1	-	0.2	11.9

Table 3.1

Source: Maxlock Report 1976.

MAIDUGURI

TRAFFIC VOLUME FLOW: 1975

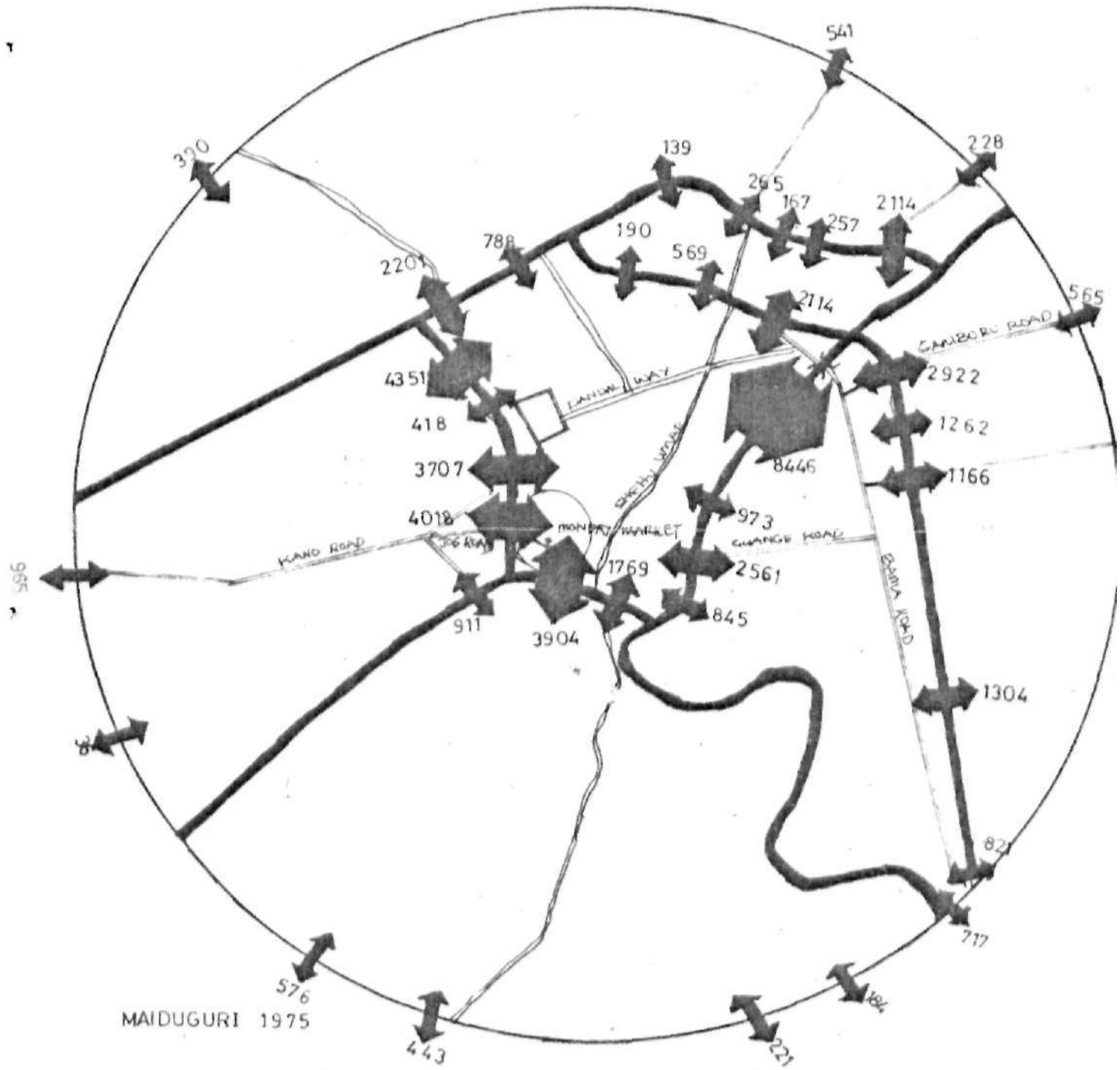

FIG 3.5

8000+ 4000-5000 3000-4000 2000-3000 1000-2000 1000

SOURCE: MAXLOCK MASTER PLAN (1974).

N

Scale 1:50 000

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1989

Considering the above averages for the different modes and with the estimated population of 170,000 for 1975, the total number of vehicle within Maiduguri in 1975 was 17920 comprised:

13,5000 bicycles - 8% population

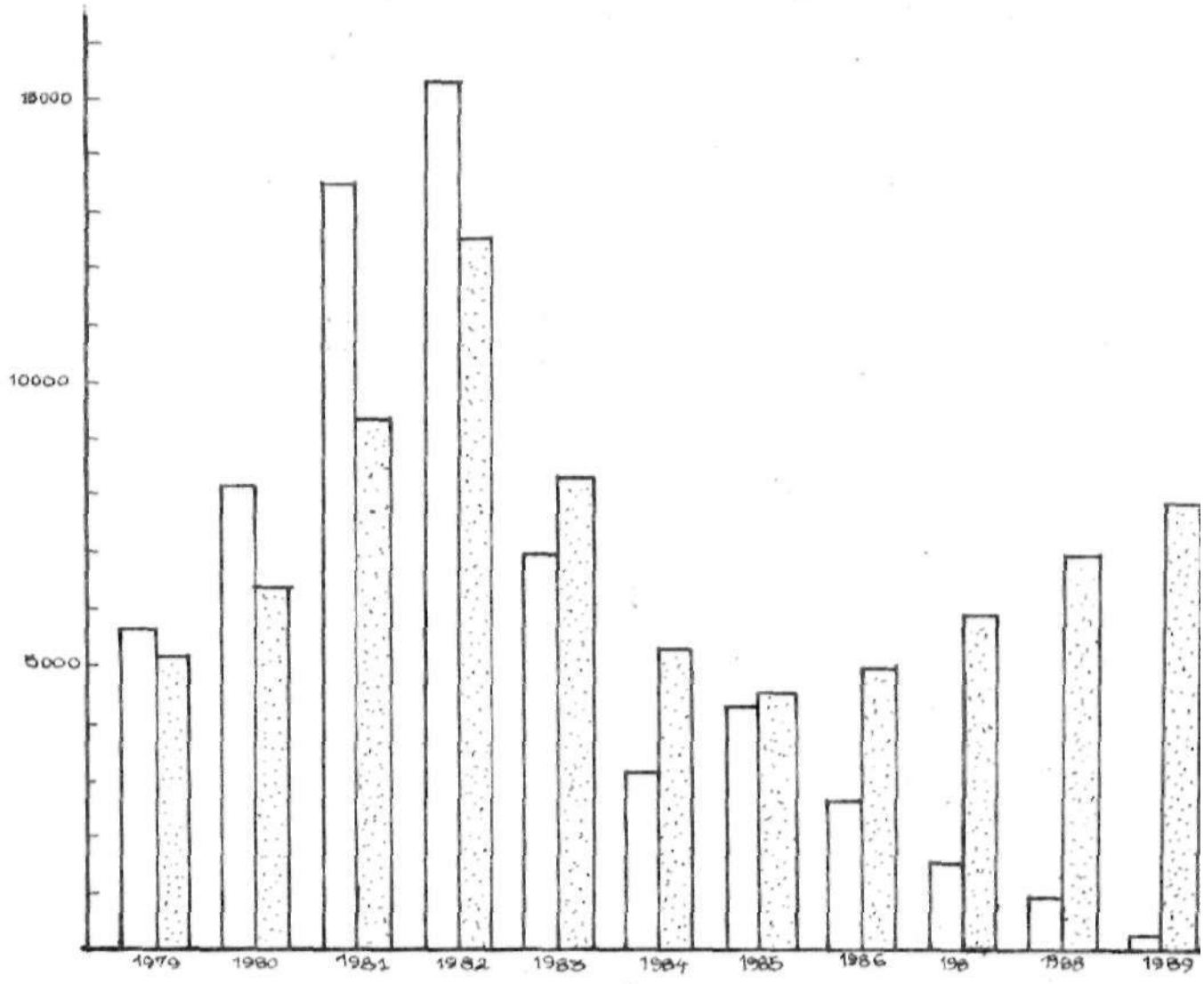
3,740 motor cycles - 2.2% population

and 680 private cars - 0.4% population

some few hundred motor vehicles of different category in addition to the above total of 17,920 daily fly in Maiduguri as at 1975. The pattern of traffic was suggesting highest flow on the custom bridge 8446 PCU while the next heavy flow was 5700 PCU per day. Jos road had 4018 PCU flow volume. Most of the traffic flow were directed towards the two predominant landuses namely the Monday Market and State Secretariat. (Fig. 3.5). The same report gave the average daily traffic flow of the post office roundabout as 15792 PCU per day and that of the El-Kanemi roundabout at 18893 PCU per day as at 1975.

The trend of vechicular increase in Maiduguri continued at a rapid pace into the early part of the 1980's. This unprecedented growth was curtailed by the economic situation of the country since the recession of 1982. The registration of new vehicles in Maiduguri for the year 1979 stood at 3843 whereas at the same period the number of bicycles sold stood at 5320.

FIGURE SHOWING TREND OF MOTOR VEHICLE REGISTRATION AND BICYCLE SELL BETWEEN 1979 - 1989



ESTIMATED NUMBERS OF BICYCLES SOLD

NUMBERS OF NEW REGISTERED MOTOR VEHICLES

SOURCE : FIELD SURVEY (1989)

ABDULLAHI.A.
M&a THESIS,
URP, ABU ZARIA
1989.

The trend in the rate of growth continued to increase until 1982, when for that year, the total number of bicycle sold reached a climax of 12600 and that of vechicular registration at 15462. From then, registration of vehicles started to drop sharply from 7109 in 1983 to 1744 in 1987, the figure for July 1989 stood at a record level 262 new registrations. Although bicycles sold also droped to 8500 in 1983 and then to 4670 in 1985, by 1986 a considerable increase in sells was recorded at 5220. Since then sells for bicycles continued to increase. The estimated sells to the year 1989 would reach 8220 (survey 1989).

The figure 3.6 shows the trend of vehicles registration against bicycles sold between 1979 to 1989. The figure indicates a positive growth in number of bicycles in Maiduguri suggesting more people are now using bicycle ever than before. While the number of car registration is decling indicating that car ownership is also declining, suggesting that opportunities for using motor vehicles is also equally declining.

3.3.0 EXISTING TRAFFIC CHARACTERISTICS AND BEHAVIOUR

No recent comprehensive study has been made on the transportation situation in Maiduguri. Nevertheless, this should not offer a constrain for an adequate assessment of the situation. According to the survey, Maiduguri is estimated to consist of the following number of vehicular traffic.

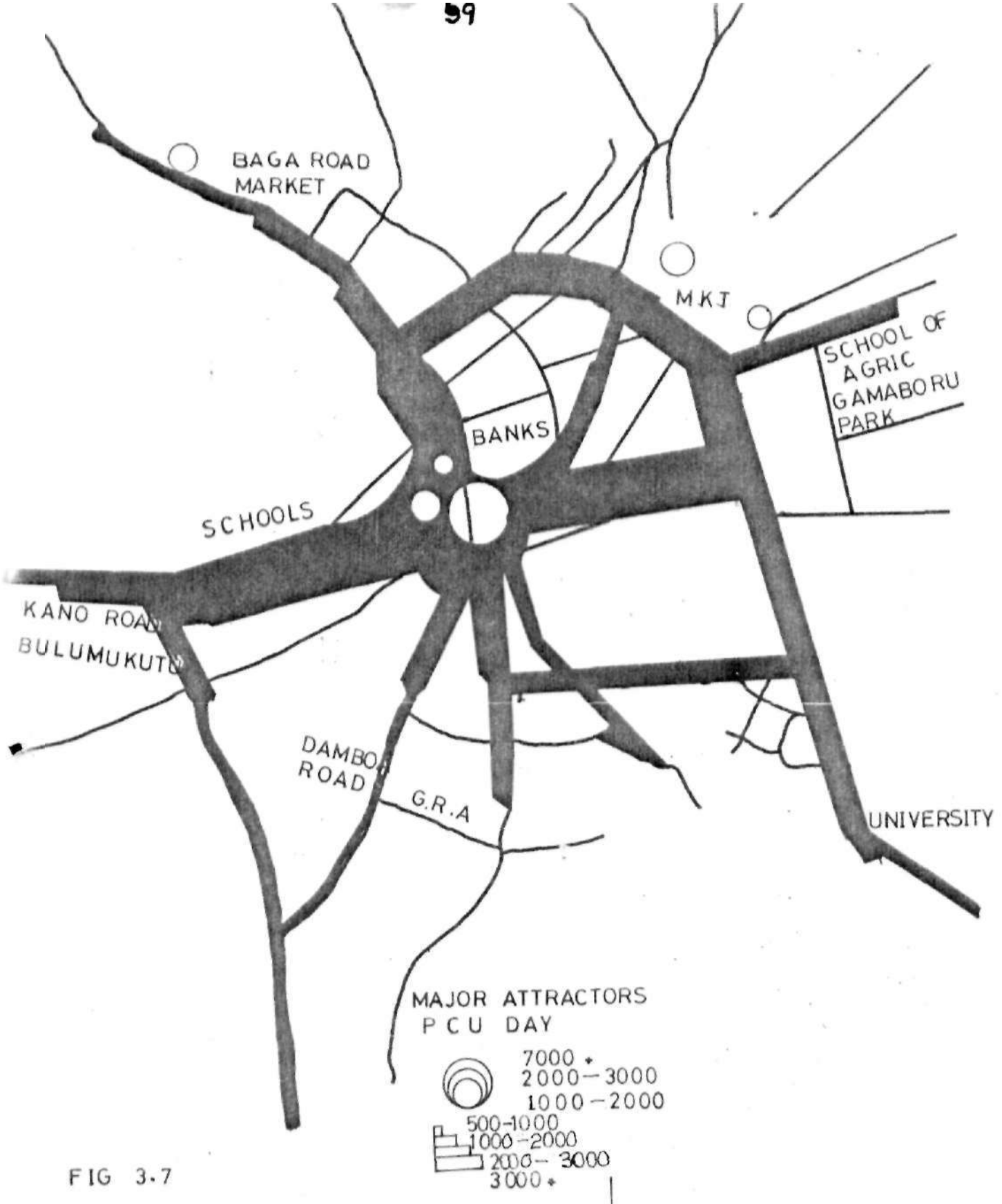


FIG 3.7

MAJOR TRIP GENERATORS

AND TRIP VOLUME DESIRE LINES

SOURCE: FIELD SURVEY (1989)

ABDULLAHI A
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U R P 1989

Bus Traffic Generation near the Monday Market. Note the traffic congestion on the Post Office roundabout.



Plate III
Lack of Organised Bicycle facilities in Maiduguri.





Far above is a picture showing unorganised parking in the State Secretariat and above is unorganised parking along Jos Road.

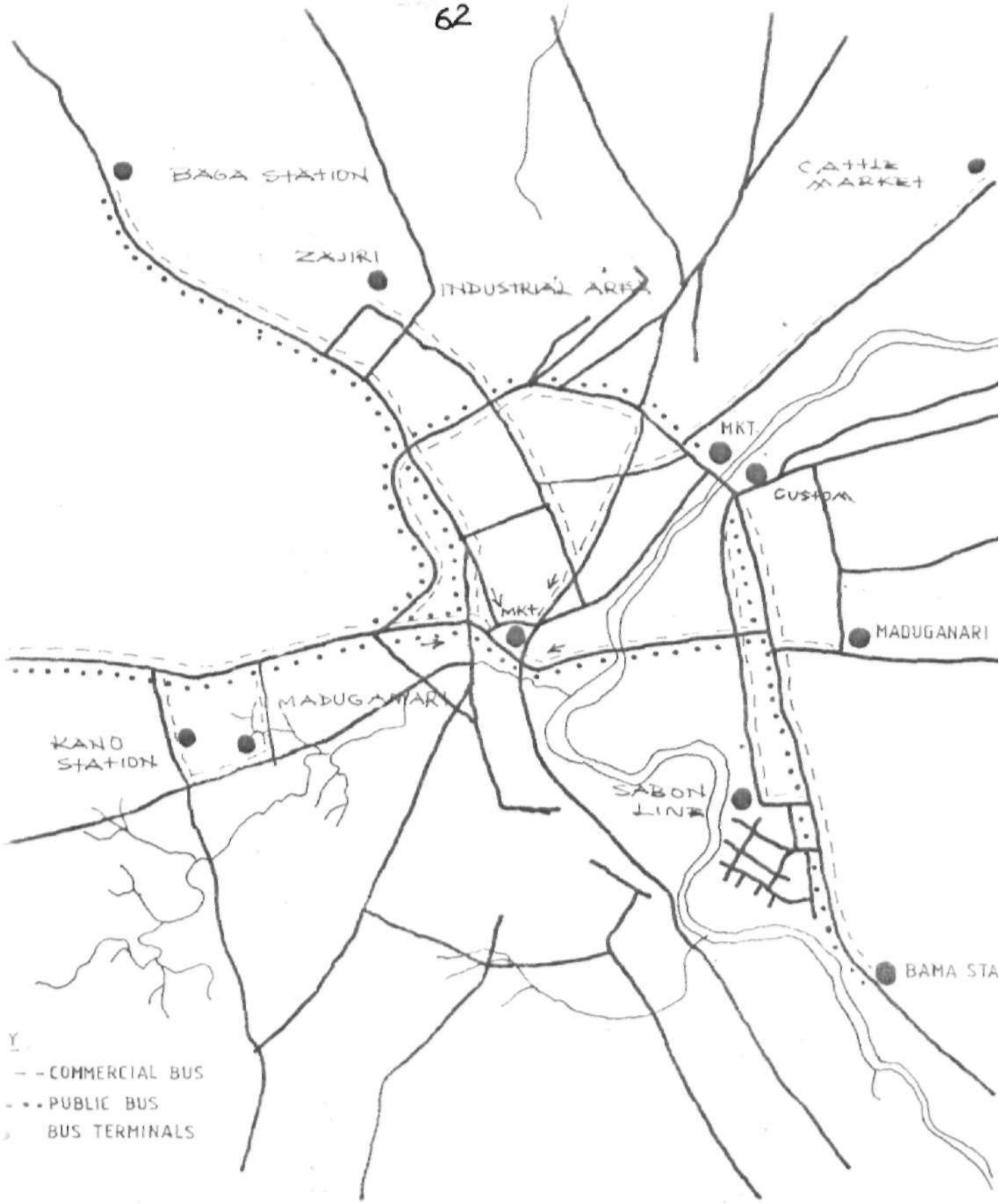
Plate IV

	Vehicular type	Estimated Number
i.	Private and Public Motor vehicles	14,700
ii.	Commercial motor vehicles	12,600
iii.	Motor cycles	10,716
iv.	Bicycles	53,960

Source: Motor Licence Office, Household Survey 1989.

3.3.1 *Existing Traffic Flow*

The radial urban form of Maiduguri with dominant activity area centrally located and spokes of primary roads spreading out chained by a network of ring road, comfirms the consistant 'Star Form' of urban landuse development. These major arteries serve as links for the traffic flowing from the periphery to the dominant activity area, while through traffic is directed along the network of Sir Kashim road, Bama road, Lagos Street, Magaram road and Mai Ibrahim road to link with peripherial landuses. From observation and the survey, the dominant activity area of Maiduguri is around the Monday Market. The current estimated traffic flow into the Monday Market is more than 7,000 PCU day volume of traffic generated from different parts of the towns. (fig. 3.7). As a result of this high volume of traffic attraction bus trips originate from the Monday Market to the other parts of the town. (plate III) Figure 3.8 shows the existing bus routes that serve the population of Maiduguri. The routes network depicts the provision of services along the major primary roads that linked the peripheral high density area to the central activity areas.



EXISTING BUS ROUTES

FIG 3·8
SOURCE : FIELD SURVEY (1989)

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1989

The areas that serve as bus terminus includes Zajiri, Kusuwan Shehu Bultumbutta, Mari and Umaruri located at the periphery of the city.

The existing direction of flow of the traffic indicates centre periphery relationship. According to the survey, Ahmadu Bello way is the most busiest road with the highest modal flow of 10,262 modes per day. The total PCU volume of traffic per day is 9333. The Kano road and Bama road have also relatively high volume of modal flow. (table 3.2) Ahmadu Bello way, Kano road and Bama road are the most strategic roads that linked suburbs to the central area of Maiduguri. These are dual carriageways with high capacity and design standards that enhanced easily mobility and direct access to the neighbourhoods.Figure 3.5 shows the estimated volume of modal traffic and PCU/day flow along the ten major strategic roads in Maiduguri. According to the traffic survey conducted, roads leading to the Monday Market and state secretariat have the highest volume of modal traffic flow. (table 3.2). These high volume of traffic flow towards the central area is as a result of the location of dominant commercial activities and the dominant institutional activities that attract such a high frequency of traffic.

Table 3.3 shows volume of traffic according to modal types and the total PCU/day capacity of the 10 surveyed primary roads.

NUMBER OF VEHICULAR TRIPS ALONG 10 MAJOR PRIMARY ROADS IN MAIDUGURI.

Road	Buses	Taxi	Cars	M/cycle	Bicycle	Total
Baga road	1209	806	1070	891	941	3976
Kano road	1114	742	1201	561	1300	4873
Damboa road	721	721	816	200	541	2999
Lagos Street	814	814	1166	563	601	3958
Jos Road	1846	1846	1519	1212	1516	7775
Ahmadu Bello	2413	2413	1763	1551	1892	9233
Maiduri road	491	514	491	816	891	3203
Bidun road	490	488	490	627	700	2795
Dandal road	866	1011	866	532	1261	4536

Table 3.2

Source: Field survey, 1989

MAP OF MAIDUGURI SHOWING MODAL TRAFFIC VOLUME

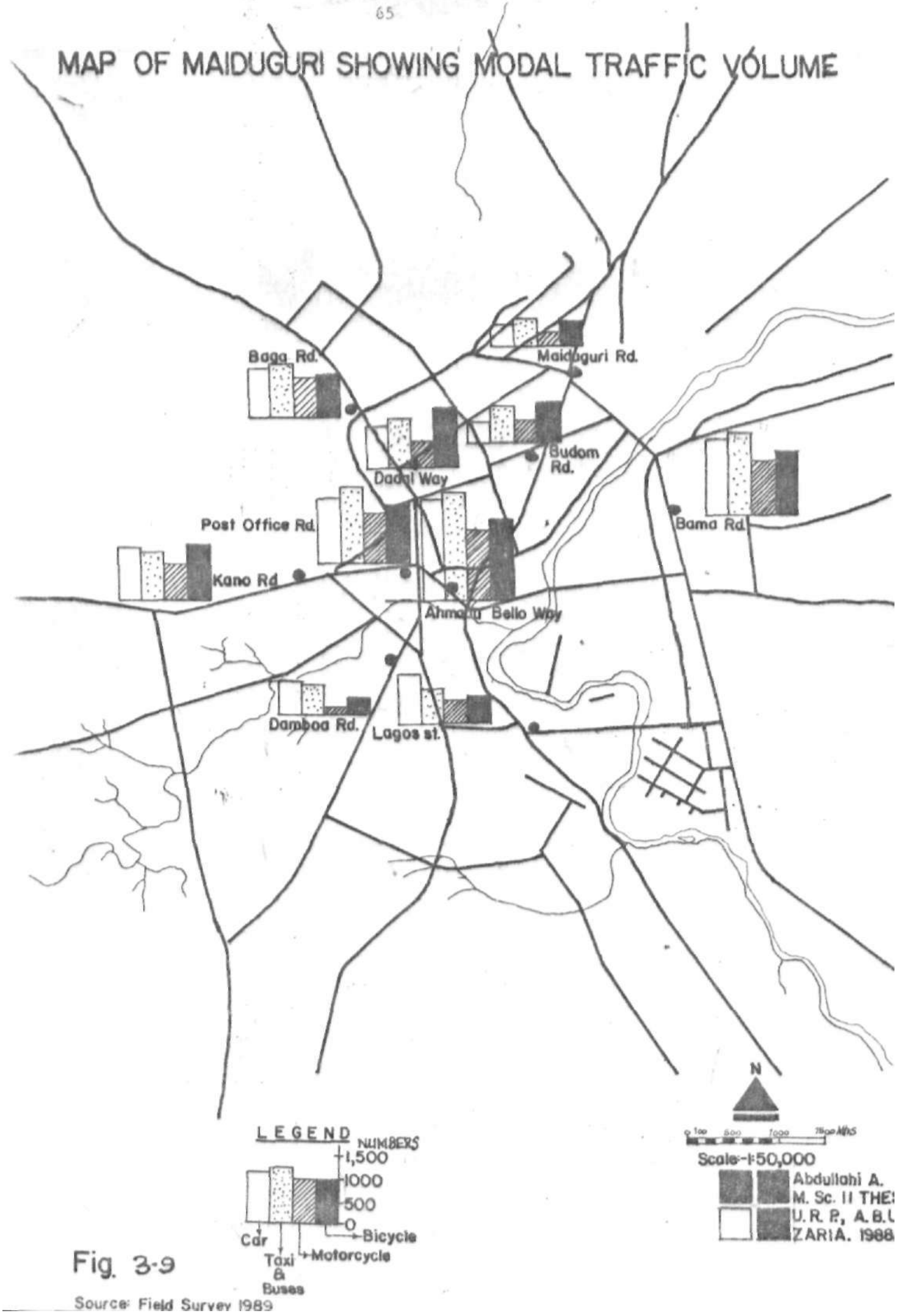

Fig. 3-9

Source: Field Survey 1989

3.4.0 BICYCLE TRAFFIC SITUATION

Bicycle constitutes about 55% of the total number of modes in operation in Maiduguri remaining as the most popular mode of transportation. According to the survey, it accounts for 25% of modes used for work trips, 9 % of primary school children and 30% of secondary school students use it for their journey to school.

Bicycle ownership varies considerably within the various wards of Maiduguri. The existing ownership situation shows that a low ownership of 53 per 1000 for GRA to 135 per 1000 in Zajiri area. The average ownership is 71 per 1000. Although the figure is slightly lower than that of 1975 estimate, in absolute terms, the number of bicycles in Maiduguri has increased considerable. The figure estimated for this year is 53,960 (survey 1989) which indicate at least a three fold growth from the figure of 14110 of 1975. (Maxlock 1976).

3.4.1 Bicycle Traffic Flow

Despite their peculiar characteristics and popularity, bicycle users have not received adequate attention from both the planners and agencies responsible for urban development and transportation management in Maiduguri. As a result, they are exposed to hostile situations by relentlessly competing with other superior and high speeding modes for road spaces.

They often become the victims of constant harassment from reckless drivers, accidents and congestion as a result of lack of planning for their safety. Bicyclist in Maiduguri are very much concerned about their safety because they are usually regarded as inferior modes by other vechicular modes in operation . It was observed that the flow of bicycle is mainly directed to two major areas in Maiduguri.

(i) The central area, which includes the Monday Market and the state secretariat. According to the survey conducted, these two major landuses account for 2500 PCU/day and 1300 PCU/day volume of bicycle traffic respectively.

(ii) The second area is along Kano road comprising of the two post primary institutions that attract a considerable number of bicycle traffic. Each of these institutions generate noting less than 1200 PCU/day bicycle traffic.

Besides, these two areas considerable flow of bicycle traffic could be accounted along the major primary roads. In fact the flow on the ten major primary roads suggest that the volume of traffic flow on those roads warrant the provision of cycleways along these roads.

VOLUME OF BICYCLE PCU/ DAY A LONG
TEN MAJOR PRIMARY ROADS AND MAJOR
BICYCLE TRIP ATTRACTORS AND GENERATORS



LEGEND

A MONDAY MARKET AREA
B STATE SECRECTARIAT AREA
▨ MAJOR BICYCLE TRIP GENERATORS
○ MAJOR BICYCLE TRIP ATTRACTORS

Fig. 2 ABDULLAHI, A.

Figure 3.10shows the major landuse that attract bicycle trips in PCU/day and their location. It is evident from the figure that bicycle trips are mainly directed towards the institutional landuses within the central area of Maiduguri.

3.4.2 Bicycle Trip Types, Length and Duration

Essentially bicycle could be regarded as an individualised form of transportation that could be use for all trip purposes. However, according to the finding of the bicycle users surveys a greater number of the population use it for journey to work and school. Bicyle users are found among all the age groups, but most of the users fall between the ages of 15 to 35 years.

Infact majority of the people interviewed showed their concern for unsafe bicycling conditions. Although over 70% of the households interviewed showed interest in using bicycles under a better and safer conditions, yet refused to recommend bicycle for their children especially of primary age. Bicycle is most frequently used in the day time between the mornings and evening hours. The peak cycling hoursfor Maiduguri are between 7.00 to 8.00 am and between 3.00p.m. - 4.00p.m. suggesting that there is indeed a high occurance of work trips and Educational trips within these two hours.

Bicycle trip length ranges between 2 kilometres to 10 kilometres, some trips often extend more than 10 kilometeres. But such trips are generally seldom and occasionally made.

Regular bicycle trip length in Maiduguri stood between 6 kilometres to 8 kilometres. The figure 3.11 shows the percentage of bicyclist that cover an average number of kilometres in a trip.

The table 3.3 shows summary of average number of bicyclist in percentage against average distance covered.

Distance of trip	percentage of users
Less than 2 km	7
2 km to 4 km	10
4 km to 6 km	14
6 km to 8 km	43
8 km to 10 km	26
	100%

Table 3.3

Majority of the people travel between 4 to 8 kilomietres at at speed of about 15 kilometres per hour. This shows that most people take less than 30 minutes to reach their destination under a normal conditions.

Source: Field survey 1989.

Figure 3.11 shows a histogram for percentage of bicycle users in relation to the average distances covered per single bicycle trip in Maiduguri.

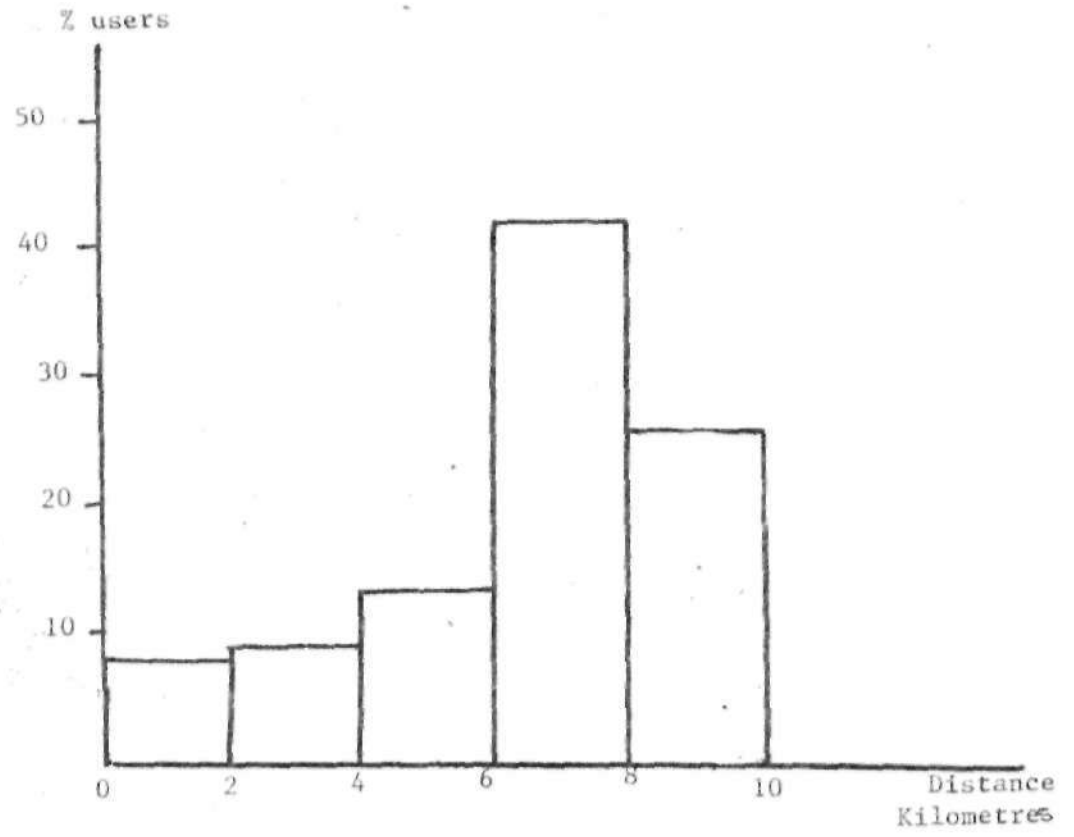

Figure 3.11

Source: Field survey 1989

3.4.3 Bicycle Services and Facilities

Bicycle sales, repairs and hire services is presently a growing and booming business in Maiduguri. However, the needs and interest of these people have not been effectively catered for by the planning Authority. Lack of the organised place for their services has posed a serious challenge to the planners. They are found scattered along the major roads and constitute an eyesore. However, despite this urgly situation

they provide essential services to the majority. The estimated bicycle hire service has more 10,000 bicycle within Maiduguri. But for fact that no recognition and attention were given, bicycle hire servfces have been a neglected business. Yet the number of bicycles users are ever increasing, future improvement in cycling condition, hire service seem to be very bright.

In Maiduguri, there are generally no bicycle parking facilities. As revealed by Plate IV. bicycle are parked along the major highway sometime on piles indescriminately constituting an eyesore to the environment. There is also luck of cycleways for the cyclist and therefore bicyclist had to compete for the road space with other modes. This situation often leds to hostility and accidents. Plate V shows the extent to which independent pathway for use are needed

3.4.4 Bicycle Cost and Production

Like the other modes the cost of bicycle has also been increasing over the years. But when compared with the rate of increase in cost of other modes, bicycle cost increases at much slower rate than any other mode. In 1979, the average cost of bicycle was N100, but by 1985 it has reached almost N620. The current price figure is around N1000.00. However, when compared to the price of a car over the same period, the cost of car has increased by more than 30 folds.

against the ten folds for that of the bicycle (survey 1989).

This increase in the cost of bicycle over the years has also been contributed by our inability to produce bicycles in the country. Most bicycles in the country are imported from India, China and Japan. Although the Nigerian Market was at one time dominated by England, today India has assumed the responsibility of the major importer. Table 3.3 shows number of bicycles imported and locally assumbled bwteen 1977 to 1982 and the cost and number of bicycles sold in Maiduguri between 1979 to 1989.

Table on cost and number of bicycles sold (estimated) in Maiduguri between 1979 - 1989, and number imported to Nigeria between 1979 - 1982.

Year	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Cost(N)	100	135	200	220	330	535	620	675	750	860	980
Imported and Assembled (1000)	587	488	413	438	-	-	-	-	-	-	-
* No Sold	5320	6440	9206	12600	8500	5400	4670	5220	6110	7332	8220

Number imported per 1000 to Nigeria (source, Business time 7th February, 1982).

* Source: Field survey, Bicycle sellers interview 1989

Table 3.3

3.5.0 OBSERVATIONS

Huge investment for the development of facilities for urban transportation improvement is going on in Maiduguri but most

of these programs doesn't offer any consensus to bicycle system planning. While cost of urban mobility is increasing daily, the existing subsidised public transportation program is grossly inadequate and unrealiable, more so practically incapable of solving the commuters need in Maiduguri. The Policy of providing mass transit service for urban centres in Nigeria has not been successful because of the capital cost, high maintenance cost and our travelling habit. As such Government would hardly seem to cope with adequately running the program. The existing travel habit is characterised by multiple individualistic and short distance trips. This constitutes a serious challenge to the efficiency of the services provided. Maiduguri is a medium city with a scattered residential area that encourages short and medium distance trips. The efficient mode of transportation that would cater for the needs of the short distance short distance trips made more than any other mode is the bicycle. Unfortunately, bicycle facilities for healthy and comfortable cycling have not been provided in Maiduguri.

The present social and economic predicament affecting the people of Maiduguri as reflected by the countries economic situation has made more people of Maiduguri to use bicycle. The increasing number of bicyclist (Table 3.3) calls for a greater attention for their safety.

It has also been observed that bicycle traffic is highest in the Monday Market area and the state secretariat but facilities for bicyclist use is lacking. Indeed the safety of the cyclist is most threatened by other Vehicular road users in this area. The need for an immediate planning attention should not be over emphasised. A situation of this nature calls for an immediate and intergrated approach to solve the problem. The solution that will not only improve the condition of the bicyclist but also reduce the problem of other traffic as well.

Fig. 4·1

However, rainfall is shared both day and night and it is not always that its accompanied by sheer winds. As such rainfall which does not usually last for more than two hours does not constitute a major constrain for cycling. The level of water vapour in the air has also a significant effect on cyclist. Although usually unnoticed, with evaporation the body temperature of the cyclist is kept low. High humidity suffocate the lungs while cycling and is likely to occur in the months of July, August and September.

(ii) TEMPERATURE

Maiduguri experiences extremes of temperature condition, both diunal and annual ranges are wide. The coolest month of November, December and January is characterised by often hazy cold weather, with poor visibility as a result of the fine dust in the air. This situation creates a very difficult condition for the cyclist because of the cold weather and the poor visibility especially in the morning and the late evenings. However, the impact of the weather is usually reduced with heavy clothing. The succeeding month of April, May and June are the hotest month with temperature exceeding 110°F in the afternoon. This period is however also not comfortable for cycling especially in the afternoon. But the fact that some of the roads in Maiduguri are lucky to have trees, and the shade usually serve in reducing the impact of the hostile climatic condition.

MAIDUGURI SHOWING DRAINAGE SYSTEM

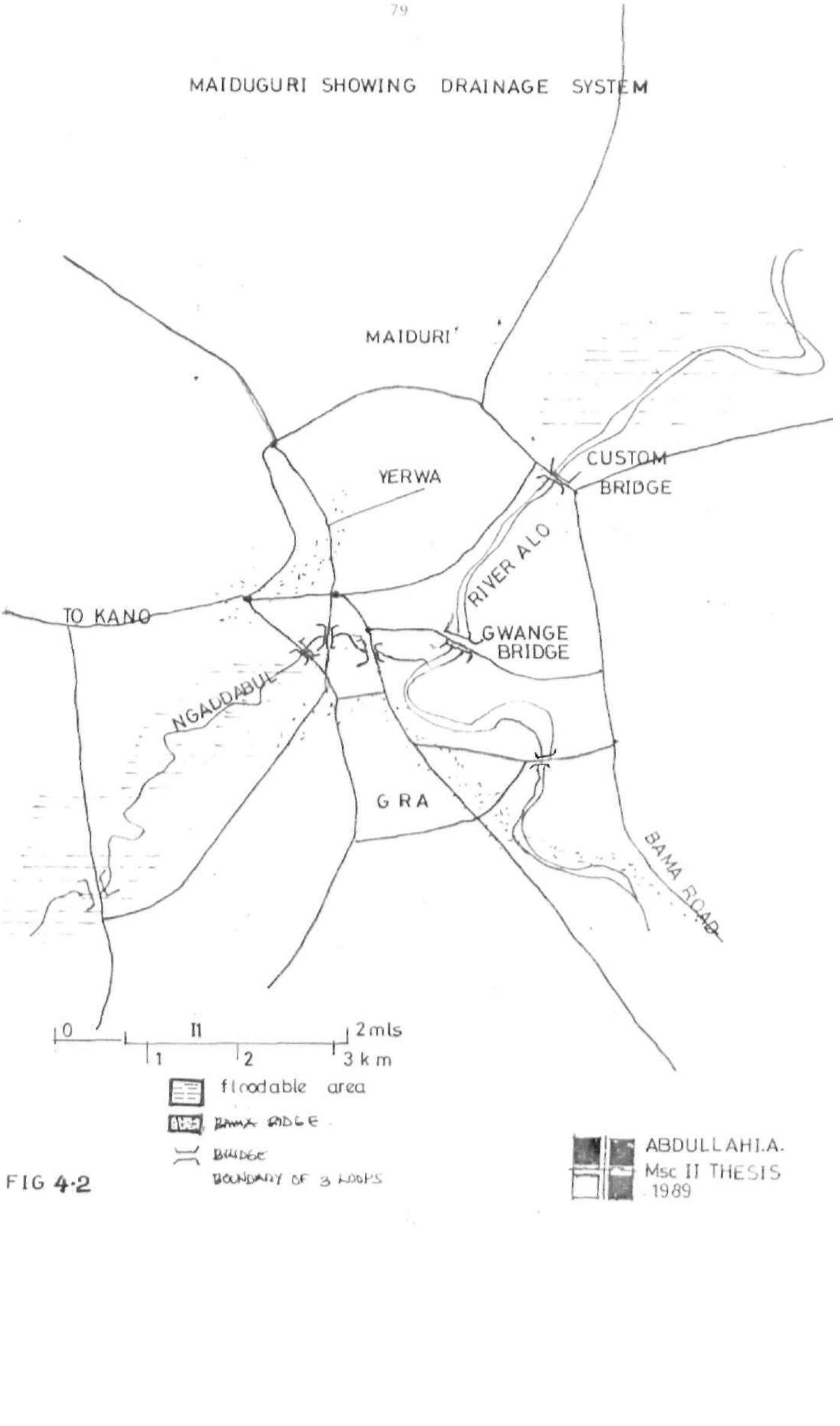

FIG 4·2

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(iii) WIND

Wind is another climatic factor that has a great impact on cycling. Infact there are two dominant trade winds, the North-East trade wind from the Sahara and the South-West trade wind from the Atlantic. The wind speed in Maiduguri is dominated by a soft breeze of less than 10 knots accounts for nearly 80% of yearly record (Maxlock, 1975). However strong winds of arou'd 20 knot often associated with squall and storms and highly destructive winds seldom previal. Strong winds have a great effect on cyclist for where wind is against the movement of cyclist it retards his efforts. However, wind breaker in form of trees greatly reduces its impact.

4.1.2 Relief and Drainage

Maiduguri lies relatively on a flat terrain which form part of a large undulating plain that slope gently towards Lake Chad. Its gentle and rather featureless surface is virtually unbroken and the entire built-up area of the city is located within the vast stretch of lowland. Toward the confluence of the Alo and Ngaddabul rivers the landscape assumes undulating and rolling features as it comes encounter with the Bama ridge (Fig. 4.2). The general topographical feature is characterised by less than 5% slope and therefore constitutes little are no constrain to bicycling. However the natural drainage course of river Ngadabul and river Alo with a confluence at virtually in the centre of the town dissected the city into three loops

There by imposing a constrain to tranport routes except through the major bridges. Therefore travel from one part of the loop to the other involves using at least one of the bridges.Indeed due to the energy source, bicycle requires direct and safe routes which is not practically possible, for cyclist must have to use the bridge and also struggle with other modes for space for crossing. While the slope and topography of Maiduguri does not pose a constrain to cycling, indeed the natural drainage system of the city has a significant influence on existing structure of the general transportation system and bicycling as well.

4.1.3 Soil

Maiduguri has a loamy soil and on both paved and unpaved roads and during rainy and dry condition it does not pose a constrain to effective cycling or provision of cycle facilities.

4.1.3 Vegetation

Maiduguri is consist of Secondary vegetation along its major roads. Although in recent years most of these trees have been cut down due to expansion of roads, patches of the remaining are still available. The existance of secondary vegetation notably the neem trees along the roads positvely contribute to reducing the impact of wind, rain, sunlight and temperature on the cyclist. Since trees influence the micro climate of an area there is the need to grow more trees in Maiduguri, so as to further reduce the impact of the hostile wind and temperature condition.

PART OF CENTRE AREA SHOWING THE DOMINANT ACTIVITY AREA.

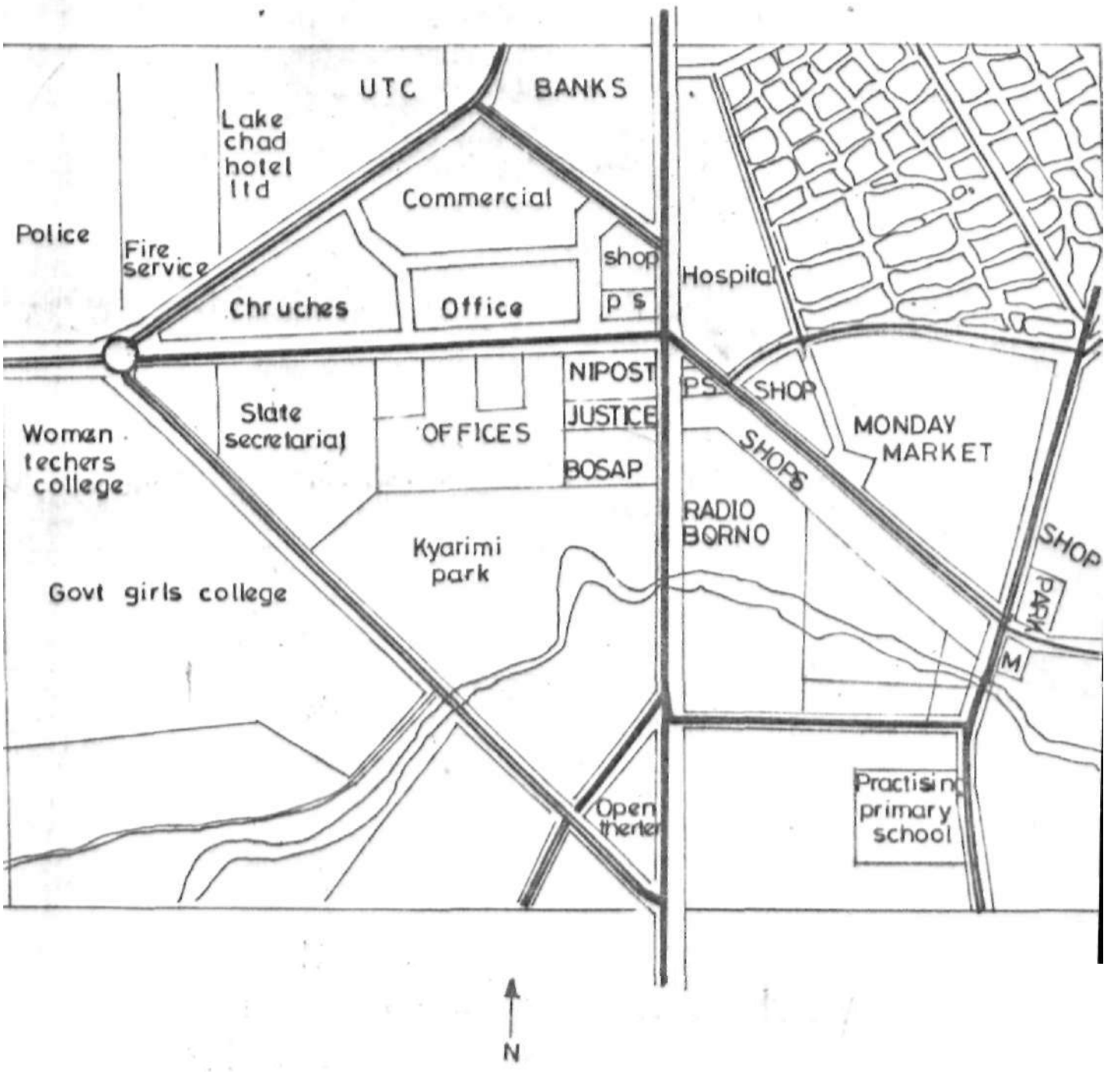

FIG. 4.3

scale 1:10,000

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4.1.4 Landuse and Road Network System

The current or existing landuse pattern of Maiduguri is a function of the road network system. The growth of Maiduguri has been observed to follow the primary road system and this helps to explain where Maiduguri has a'Star form' of Urban structure. The road network system comprises of spokes of primary road stretching from the central area (near the market) to the peripheral residential developments. With a radial network ring road co-ordinating these primary routes in a ring form a direct linkage between the peripheral development and the centre and an excellent through system emerged. The central area of Maiduguri is the dominant Commercial area with the central market, the banks and most of the shops located, the residential centre is everyday giving way to commercial activities. Infact the central area where most of the traffic are daily attracted constitute the most dominant activity area of Maiduguri. FIG. 4.3 (Maxlock, 1975).

Within this area as observed the rate of traffic congestion is very high. The Post Office roundabout and the Elkanemi roundabout both located on the two ends of Ahmadu Bello way are known to have the worst traffic congestion which is visible throughout the most part of the day. As observed cyclist had to fight keenly with other modes for a space on the road (Plate V

Accidents are therefore very frequent. Although there is little statistical evidence to give the magnitude of the accidents and the frequency of occurance.

A typical site condition of the bicycle hire and repair services.



Unorganised bicycle hire site near the Maiduguri Metropolitan Secretariat along the Dandal way.

Plate V

The central area as suggested by the traffic Police department has the highest rate of accidents in Maiduguri. The market roundabout, the Ahmadu Bello way, the post office roundabout and Jos road formed the artery with the high frequency of accidents (Fig. 4.4).

The bicycle services providers including the repairers the second hand sellers and hire service are also unorganised. They occupy a substantial part of the road and provide daily services to the cyclist. However, they dirty most of the areas they use. There is the need to relocate them within the builtup area. (Plate VI).Figure 4.5 also shows the major primary and secondary routes as detailed in table 4.1. Figure 4.5 and 4.6 show detail sections of some of some of the roads mentioned in table 4.1.

Table showing the summary of the road inventory along the major primary and secondary roads in Maiduguri.

Road system Name/type	Carriage Length	Carriage Width	Type	Funitures	Road reservation width
Primary Road	400m	15m	Double Lane	Poles/ Swedish	40m
Kano Road	41cm	26m	Double Lane	Trees, Electricity Pole & Tele Poles	60m
Sir Kashim Road	6km	25m	Double Lane	Walkway tress poles	40m
Bama Road	81cm	26m	Double Lane	Trees Poles Drain	90m
Dandal	11km	18m	Double Lane	Drain Trees Poles	80m - 40m
Shehu Kyari		13m	U/C Double Lane		40m
Shehu Laminu	6km	13m	U/C Double Lane	Trees Poles	60m
Baga Road	8km	15m	U/C Double Lane	Poles	90m
Mai Ibrahim	1.3	18m	U/C Double Lane	Poles	40m
Jos Road	850m	13m	U/C Double Lane	Poles	40m
Ahmadu Bello	700m	18m	Single	Drain, Poles	30m
Damboa Road		18m	Single	Elect. Poles Walkway Tele: Pole	60m

U/C - Under construction
Table 4.1(a)

SECONDARY ROADS

Road System Name/Type	Carriage Length	Carriage Width	Type	Funiture	Road Reservation Width
Waziri Kyari	4km	13m	Single	Trees Drain, Poles	40m
Shehu Umar	21cm	13m	U/C Double	Drain Poles	40m
Nimeri Road	3.5km	9m	Single	Drain Poles	30m
Limisula Road	2.5km	9m	Single	Drains Poles	25m
Baban Layi	1.8km	13m	Single	Drain Poles	25m
Mafoni Road	1.3km	13m	Single	Drain Poles	20m
Zakaria Maima lari	2.2km	9m	Single	Drain Poles	30m
Gamboa	2.4km	13m	Single	Trees Poles	40m
Gamboru/Ngala Rd.	5km	15m	Single	Trees Poles	60m
Farin Layi	4km	13m	Single	Drain Poles	40m
Yerima Road	600m	7m	Oneway	Drain Poles	20m

*Road carriageways that are currently under expansion.

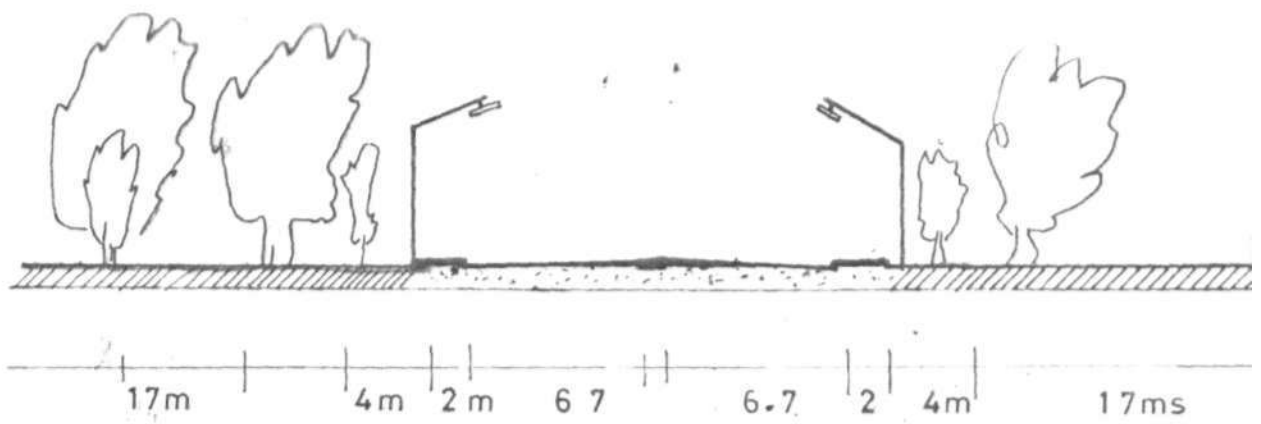
Tertiary distributors estimated over 120 kilometres not included.

Source: Ministry of Works and Housing, Maiduguri.

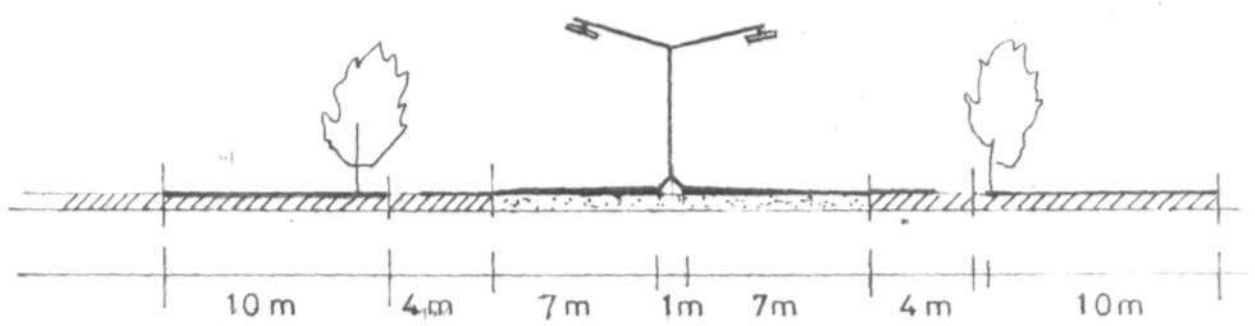
Table 4.1 (b)

SECTIONS OF SOME ROADS IN MAIDUGURI

SHEHU LAMINU ROAD



SIR KASHIM ROAD



DANDAL WAY

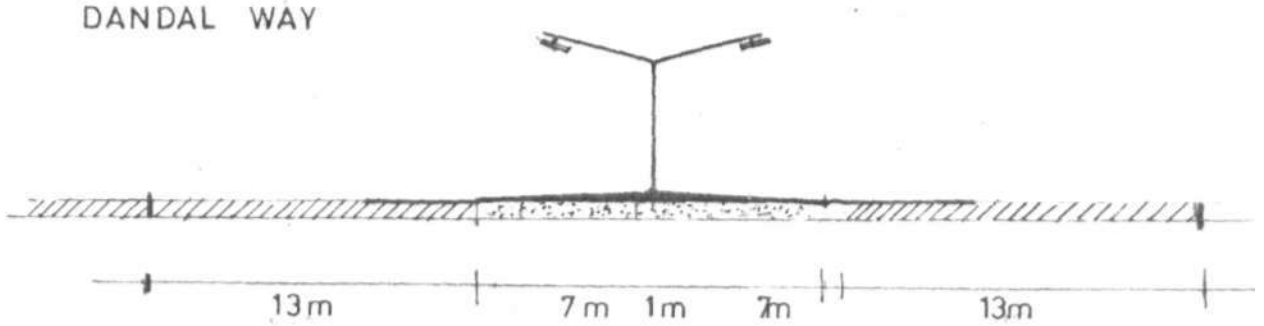


FIG. 4.4a

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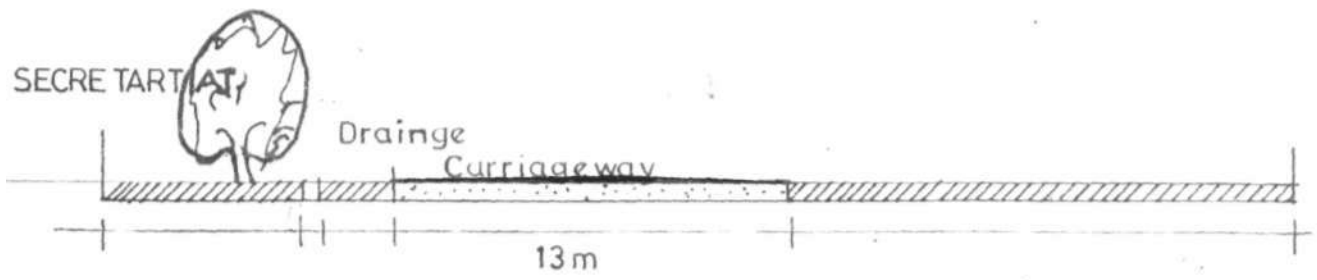
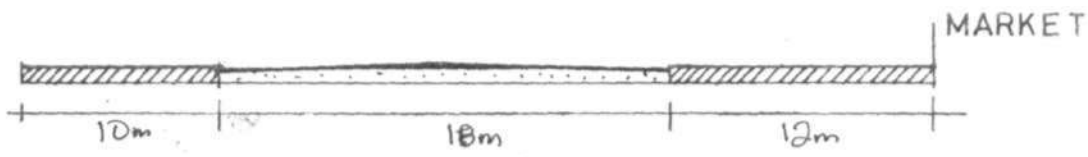
EXISTING PROFILE OF ROADS

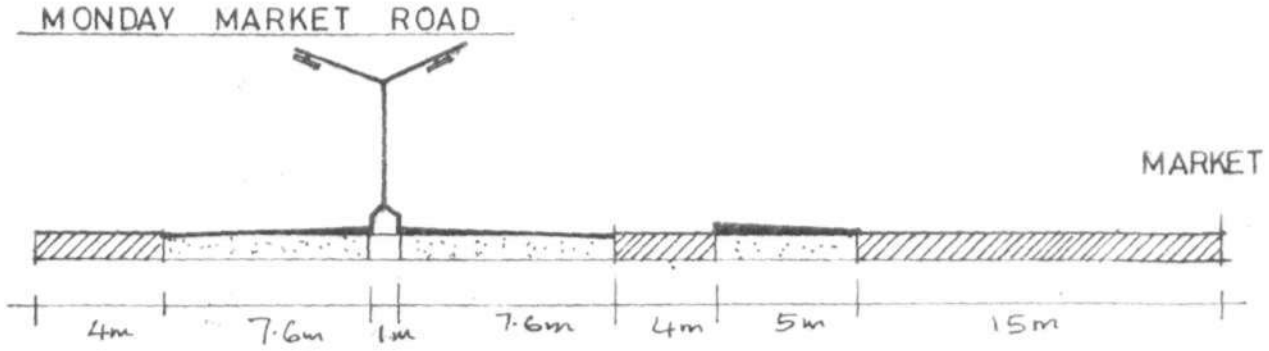
JOS ROAD



AHMADU BELLO WAY



MONDAY MARKET ROAD



YERIMA ROAD

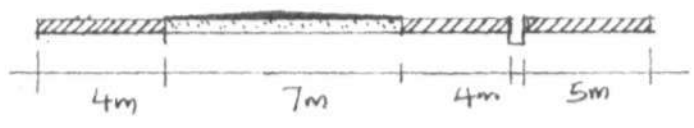


FIG 4·4(b)

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Bicyclist Competing Keenly for Road Space in Maiduguri.



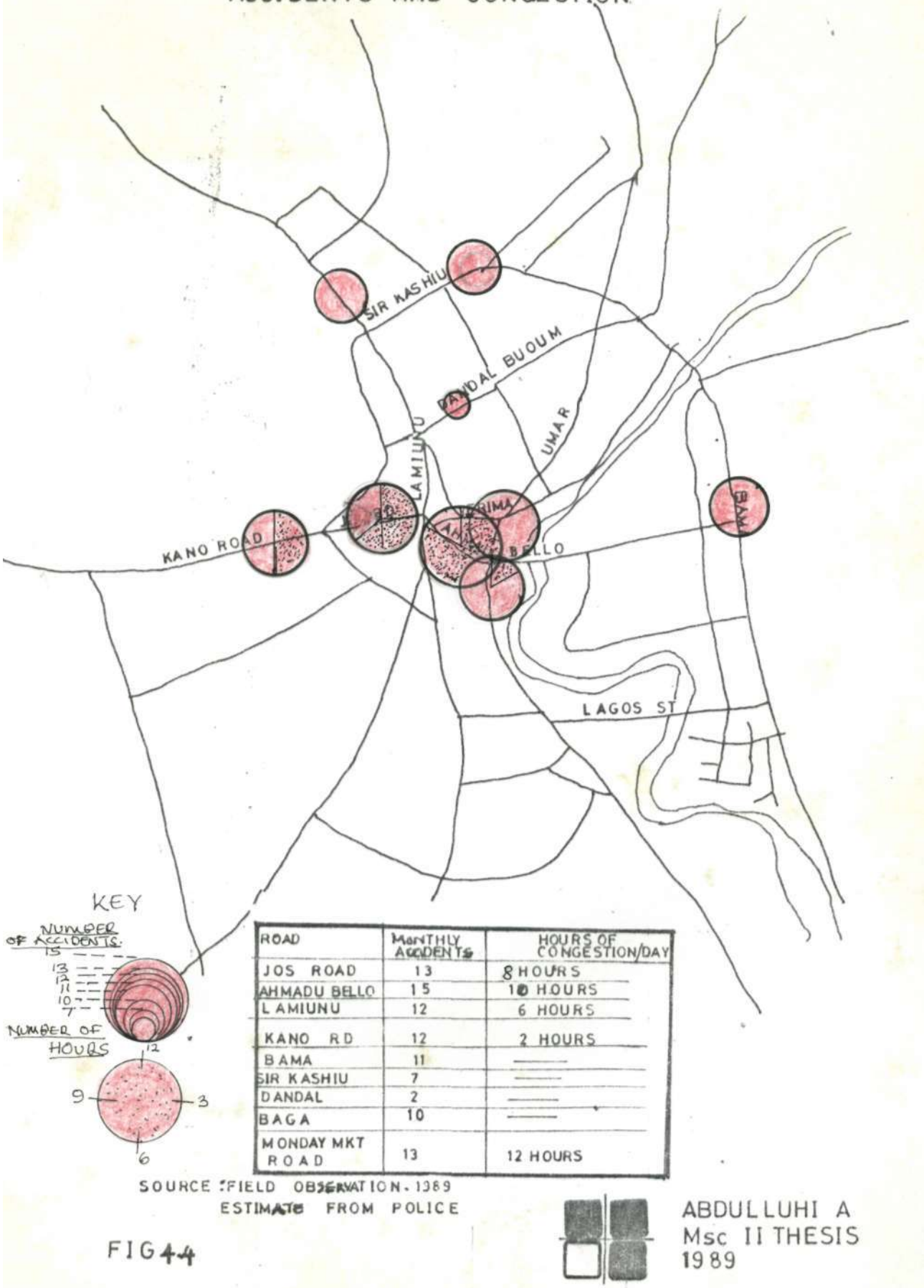
(a) A typical example of the condition of the Cyclist on the Post-Office Road about.



(b) The Bicyc[illegible] at a cross road a situation along Sir Kashim Road sho[illegible] lack of crossing facility for the cyclist.

Plate VI

MAIDUGURI SHOWING ROAD WITH HIGH ACCIDENTS AND CONGESTION



KEY

NUMBER OF ACCIDENTS

NUMBER OF HOURS

ROAD	MONTHLY ACCIDENTS	HOURS OF CONGESTION/DAY
JOS ROAD	13	8 HOURS
AHMADU BELLO	15	10 HOURS
LAMIUNU	12	6 HOURS
KANO RD	12	2 HOURS
BAMA	11	——
SIR KASHIU	7	——
DANDAL	2	——
BAGA	10	——
MONDAY MKT ROAD	13	12 HOURS

SOURCE: FIELD OBSERVATION. 1989
ESTIMATE FROM POLICE

FIG 44

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4.1.5 Street Furniture

Streeting furniture by defination is the existing structural elements along the road corridor. It include drains and mains line, utility poles, stalls, road shoulders advertisement and sign posts etc. The fact that bicycle facilities program usually constitute addition of infrastructure to the existing street furniture, hence there is the likelyhood of affecting the existing street furnitures. Within the limit of such an exercise, i.e. provision of bicycle facilities, relocation of street element should be planned and reduced to the bearest minimum. This study has however taken into consideration the expansion program currently taking place on these major roads namely, Jos road, Shehu Laminu, Mai Ibrahim and Baga road. As such this study has recognised such development and considered its importance as it may affect some of the proposals.

4.2.0 SOCIAL CHARACTERISITCS

The population of Maiduguri for the year 1989 is estimated at 767,360 with an the average household size is 7.5 people.

Annual income varies considerably among the population, 12% of the household population earn N5,000 and above. 18% earn between N5,000 and N3,000 annually while the other 70% earn less than N3,000. However, mean annual income is N3,500. The occupational status is 25% formal and 75% informal employment within the later greater percentage of it includes house wivies, servants, unemployed hawkers etc. who cannot support themselves with their earnings.

Vehicular ownership for bicycle is highest with 71 per 1000.

However, commercial vehicles ownership including taxis and buses in 20 per 1000, while car ownership is at a low level of 16 per 1000 and the lowest ownership rate is that motorcycle which is 13.3/1000 (survey 1989).

4.2.1 Social Characteristic of Bicycles Users

Bicycle users are found among all the age groups although it was found out that a very negligible percent of the female population use bicycle. Infact female constitute less than 2% of the total potential bicycle users in Maiduguri and these are found within the 9% of the primary school children using bicycle to school. Majority of the bicycle users are found within the age group of 15 to 35 years accounting for about 53% of the total interviewed users. There is a very low percentage of user under the age of 15 years. This is attributed to the fact that most of the parents consider the safety of their children and asserted that they are not only generally careless but also often ignore traffic laws and signs. However another reason advanced was that bicycle would tempt children to roam and play around instead of going to school. However more than 70% are willing to provide bicycle for use under a safe condition for their children.

Bicycle ownership is not also limited to age groups, however high ownership is found between the ages of 15 - 35 years.

Bicycle is an individualised form of transportation which has a high ownership rate, about 67% of the total users are owners, while 23% either hire it or borrowed. The ownership of bicycle in Maiduguri would certainly increase especially where there is a fall in the price of bicycle. Moreso, the high cost of transportation from one part of the town to the other and the multi functional nature of bicycle transportation would inevitably attract more users especially with better cycling condition as suggested by majority of the people interviewed.

4.3.0 ECONOMIC CHARACTERISTICS

The number of bicycle users in Maiduguri is considerable at least six out of every 100 people use bicycle. Majority of bicycle owner fall into either low income or the dependent population. Infact only 5% of the bicycle owners are either found in the medium or high income group (survey 1989).

The cost of bicycle is very high presently, but then it still remains as the cheapest and most viable mode of transportation. Over the last ten years or so the cost has steadily rose from about N150.00 (1979) to almost N1,000.00 in 1989. Indeed the price of the remaining other modes have also rose in both proportionate and absolute term far more than that of the bicycle. Nevertheless, bicycle becoming a vanguard point of restort because the income of the people is generally declining, alternative available seems to see light in the future of bicycle.

Bicycle repairs and maintenance does not cost much compared to other modes . The average cost of maintenance remains as low as N10 monthly. Majority spend the amount on spare parts. The cost of maintenance range considerably from N5 to N25. Since bicycle in Maiduguri as revealed by the survey is used for multiple trip functions. The cost of repairs is a well deserved venture for the cyclist. Most of the spare parts of bicycle as imported and very scarce. Genuine parts have an exhorbitant price which it very difficult for most users to purchase. Bicycle licence is N5 but most cyclist flout the yearly registration fee. The market for second hand bicycle is also very strong and irrespective to cost of depreciation second hand bicycles command a high price in 1989. According to the survey, a well maintained, good four to five year old bicycle would fetch at least price that was being brought when it was new.

4.4.0 Observations

The general transportation system lack comprehensive development approach, planning is done in piece-meal and construction and management were done on ad-hoc basis. The issue is that Maiduguri need a comprehensive approach to its transportation problem through which a healthy development that ensures a comprehensive bicycle traffic system would be achieved.

The behaviour of some of the road users, with care free and attitudes sometimes inconsiderate ^ for the welfare of others and often contravine traffic regulation and rules especially in mixed-up situations should be discouraged. They psychologically depress the bicyclist by infusing insecure and unsafe condition, which have a negative repurcussions.

From observations, poor maintenance of roads provides unsafe condition for the bicyclist. Bicyclist require balance and eligic to bumps and potholes. Roads surfaces that are covered by sand bumps and pot-holes require regular maintenance so as to provide a safe and convenient condition for the cyclist (Plate VII).

It is also observed that there are indiscriminate expansion of roads and as a result many trees that provide shade for bicyclist have been pulled down. However, expansion is to improve the traffic situation but special provision of bicycle facilities have not been made despite the recommendation of Maiduguri Masterplan report for it.

Maiduguri has an unorganised distribution of bicycle repairers. They are seen on the major road reservations and constitute an eye-sore to the aesthetics. There is the need to organise them.

Road furnitures are indiscriminately located regardless of any planning standards and aesthetic values.

Dirty roads with Potholes not convinient to the cyclist



(a) Sand enchronched Shehu Laminu road. Vilotile situation for the cyclist.



) Cyclist along Sandy Jos Road.

Plate VII

Most cycle facilities would certainly affect the location of some street elements. Planning for bicycle system would therefore require the participation of other functionnaires that are responsible for the provision of some of the street furnitures so as to co-ordinate their activities for a better and planned location.

The Maiduguri Masterplan recommended separate bicycleways for Maiduguri (Page 9.3.8) but due to lack of Political will this aspect of the transportation program has not been implemented. The recommendation was not based on a sound comprehensive transportation planning proposal. As such, it failed to come up with policy and program which should have enhanced better bicycle traffic for Maiduguri as a part of transportation planning report package.

Majority of the cyclist in Maiduguri, about 98% of the adult class use it for transportation. Although bicycle is used by children for recreation in Maiduguri, the primary function of bicycle is transportation and children are usually discouraged to use it for recreational purpose. Organised sporting and exercise on bicycle is seldom.

Bicycle is the cheapest contemporary mode of transportation but due to low income level, the majority could not affort it easily. However both the high and low income groups suggested loans, subsides would be required to encourage more people to own bicycle.

In addition, local production will reduce the price and more people will be opportuned to own it. Thus, increasing the number of potential users. A call for a better cycling condition is necessary.

4.5.0 SELECTION OF PART OF THE CENTRAL AREA

Various methods have been employed to select an area for design amongst others. There are standards, criteria, reasons advanced for such efforts. However, in selecting an area for demonstrating the proposals in physical terms, there is the need to consider an area where such an effort is paramountly desired to solve the existing problem.

The Physical, social and economic factors are considered very essential in planning design of an aspect of an area. The desired objective is achieve a scheme that would be useful and implementable. This study revealed that the existing traffic characteristic and behaviour has not so much changed from that of the 1975 as reported in the Maidugurin Planning report. Thus, the central area still constitutes the heavy traffic generation area. However, while the Monday market has expanded and subsequently maintained its status as the highest traffic generator, other uses have also emerged around it to enhance the high traffic generation. The construction of the state secretariat which is the second highest generator of traffic in close proximity to the market. Due to high traffic flow, the magnitude of traffic congestion and other problems are dominant as highlighted in chapter three.

These two major traffic generators are being served by Jos road, Monday Market road, Ahmadu Bello way and Yerima road. The traffic flow on these roads are also very high. Infact the Ahmadu Bello way and the Monday Market road have the highest daily traffic flow. These two generators with these four roads are the areas selected for design within the central area. The selection was based on the capicity of bicycle traffic generation and the role of these landuses to the growth and development of traffic within the central area. (Fig. 4.5). and Figure 4.6)

Therefore detailed study of the area was done in order to achieve a meaningful design proposal for bicycle in the area. However, the general planning recommendation which would made for the whole of Maiduguri also included the central area.

MAIDUGURI INSET SHOWING LOCATION OF THE PART OF CENTRAL ARE

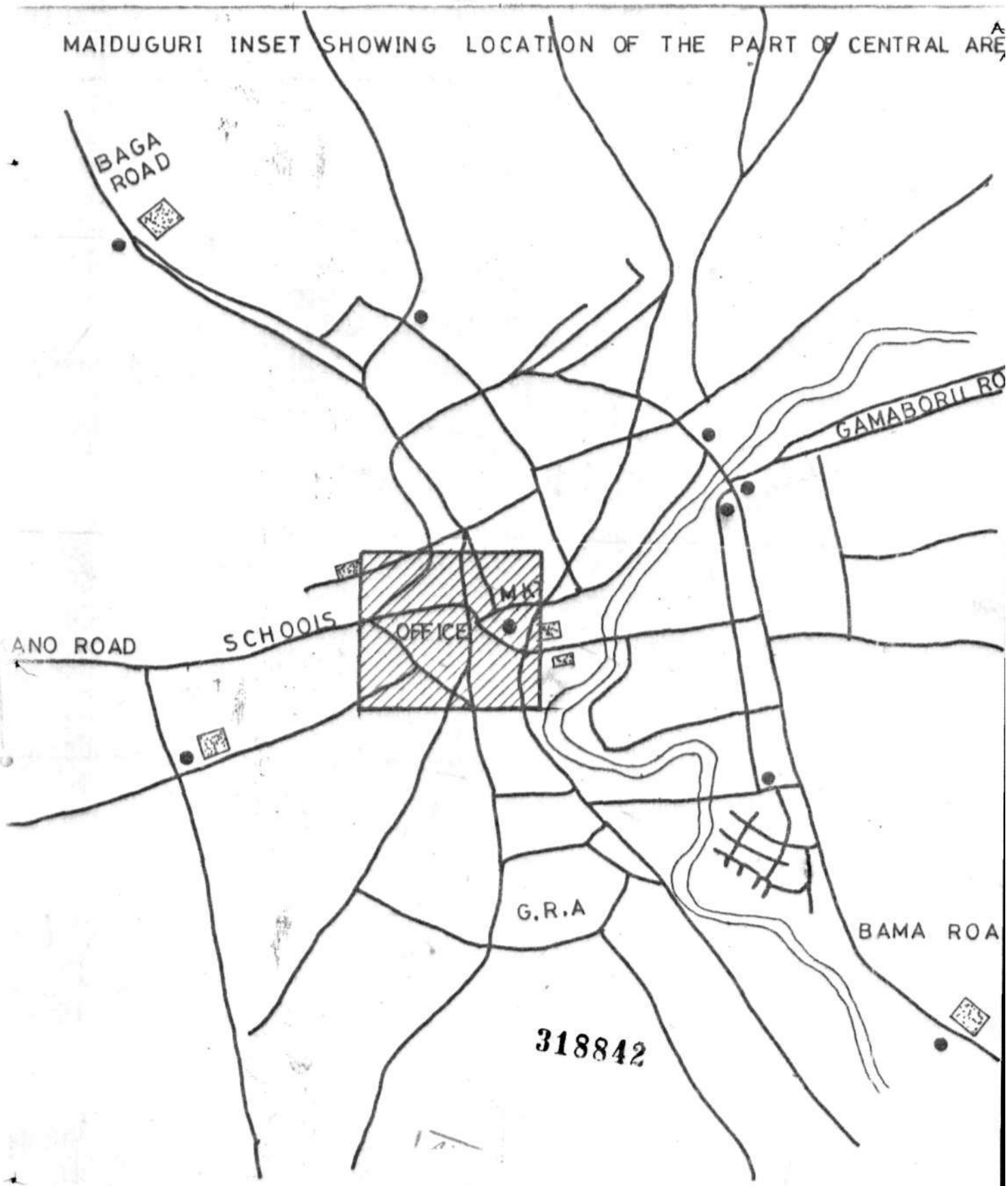

FIG 4.5

KEY

MAJOR PRIMARY ROAD
SECONDARY ROADS
BUS/TAXI STATIONS
BUS TERMINALS

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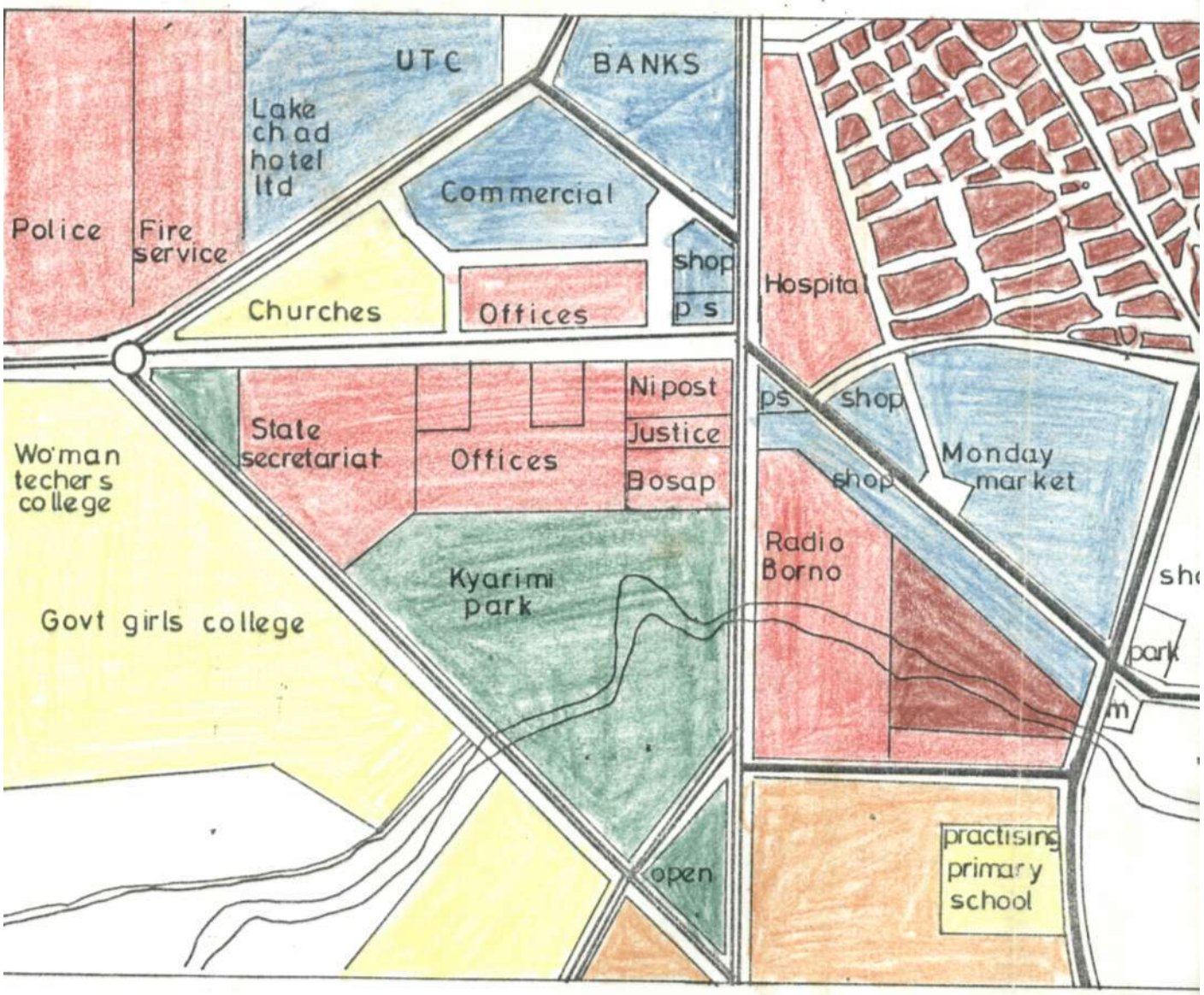
PART OF CENTRAL AREA SHOWING LANDUSES



KEY

- LOW DENSITY
- HIGH DENSITY
- COMMERCIAL
- INSTITUTIONAL
- PARKS
- SCHOOLS / CHURCHES.

N

FIG 4.6 scale 1:10 000

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CHAPTER FIVE

5.0.0 PLANNING RECOMMENDATION AND DESIGN PROPOSAL FOR A BETTER BICYCLE TRAFFIC

To make a comprehensive design for bicycle facilities for the entire Maiduguri will involve a detail statistical analysis on the pattern and behaviour of bicycle traffic in Maiduguri. Infact it will involve a complete study of the entire existing bicycle traffic system of which is not justified within the scope of this work. However, this study would provide a general planning recommendations for the whole of Maiduguri. And further justify the recommendations by demonstrating in physical term a design proposal for the central area. The planning recommendations could easily be adopted to improve the safety of the bicyclist within Maiduguri. While the design shows within the limit of the area under consideration, what types of facilities are to be provided, for what population, where should such facilities be laid and how should it be done.

5.1.0 RECOMMENDED PLANNIGN APPROACH

The approach should be based on a basic planning criteria. That involves planning principle, concept, considerations and planning process.

5.1.1 Principles

The principles that should be recommended for cycle system planning for Maiduguri should involve the systematic provision of

comprehensive of cycleways and cycle facilities system.

(i) Cycleways

Cycleways varies considerably in width, the following countries have these as standard for oneway cycle tracks.

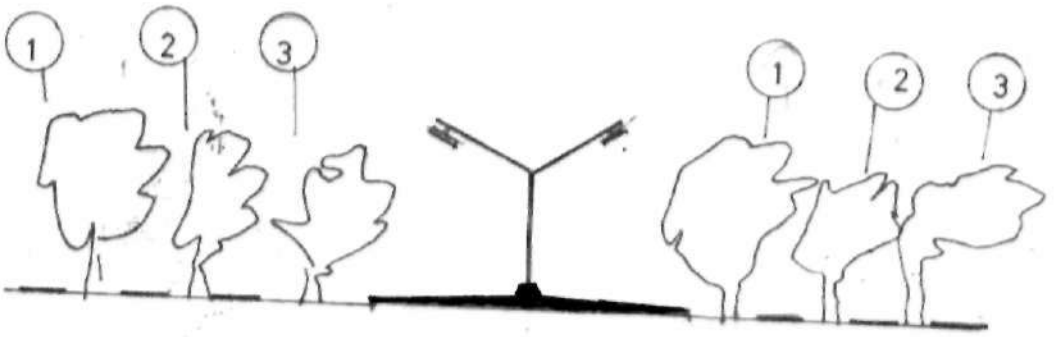
Country	Width	Max. Speed recommended
German	1m	10kph
U.S.A.	1.2m	16kph
India	1.3m	20kph

Recommended width of cycelway for Maiduguri should be at least 1.2 metres. Considering the cost of providing paved slap for cyclists the oneway width of 1.3m for India is not economical. But could be justified when bicycle number increases in future. However, the 1m width track is also too narrow because of our nature of dressing. The long gawn would pose a danger especially while over taking if enough space is not allowed between two cyclists moving the same direction and one is trying to overtake the other.

The direction of the cycleway should be the same to that of the carriage way. However, this must not necessaryly be kept parallel to each other because in event of other street elements laying along the parallel direction cycleway would be deviated to avoid conflict.

CYCLE PATH LOCATION IN ROAD WIDTH

ALTERNATIVES



Source : Jim Mcckiskey (1979)

FIG. 5.1a

SKETCH OF CYCLE PARKING FACILITY

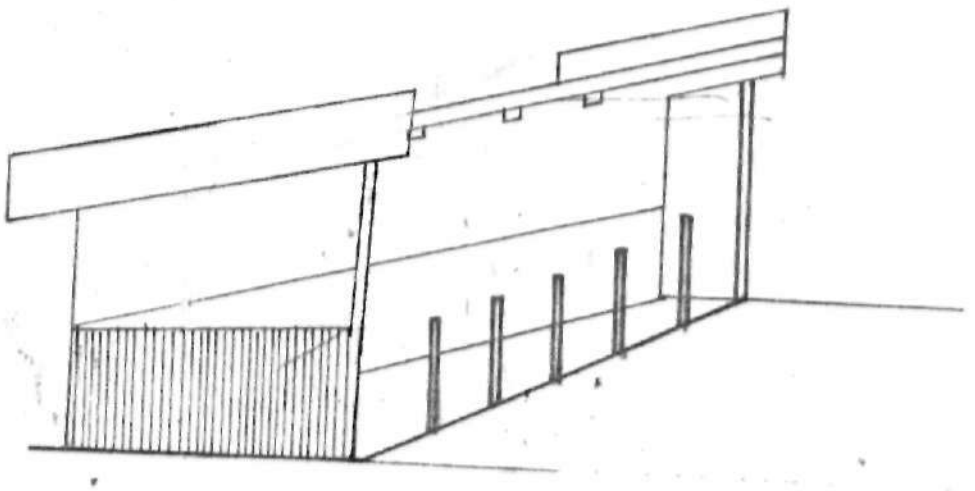


FIG 5.1b

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Roads should have trees or other facilities that would provide shelter to the cyclist using the cycleway. Therefore it should be with planted strips (Fig. 5.1a).

Paints strips, bars or concreate be used to define cycle-way from other facilities in order to avoid encroachment of other modes.

(ii) Cycle Facilities

Recommended guideline for the provision of cycle facilities for Maiduguri should be within the framework of planning needs of different landuses.

Institutions and public functionaries with high bicycle traffic such as the state secretariat, the schools and the Monday Market be mandated to provide cycle parks for the public use.

These parks and cycle stands should be sheltered and consist of safety measure or devices. (Fig. 5.1b).

Cycle facilities should be well located to enhance maximum utilization. The use of sign post and signals to guide cyclist should form part of cycle facility program.

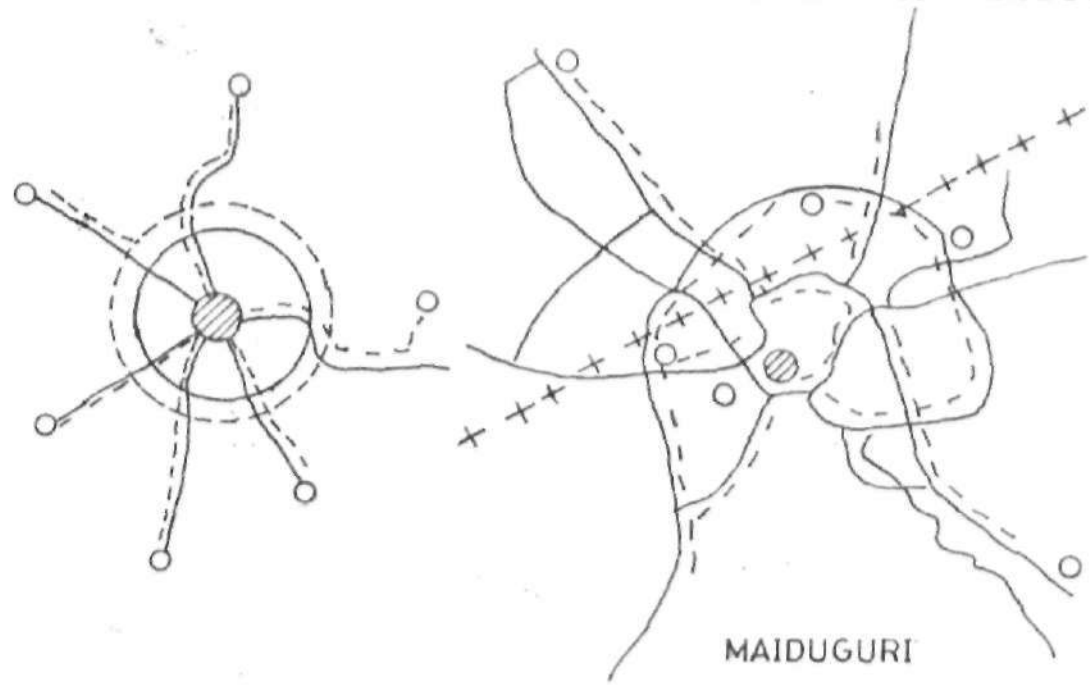
5.1.2 Conceptual Approach

In chapter two, two concepts on bicycle system planning were identified.

CONCEPTUAL BICYCLE NETWORK SYSTEMS FOR. MAIDUGURI

PRIMARY ROAD NETWORK CONCEPT
AS APPLIED ON THE STRUCTURE OF MAIDUGURI

(a)



(b) DESIRE LINE NETWORK SYSTEM
CONCEPT AS APPLIED TO MAIDUGURI

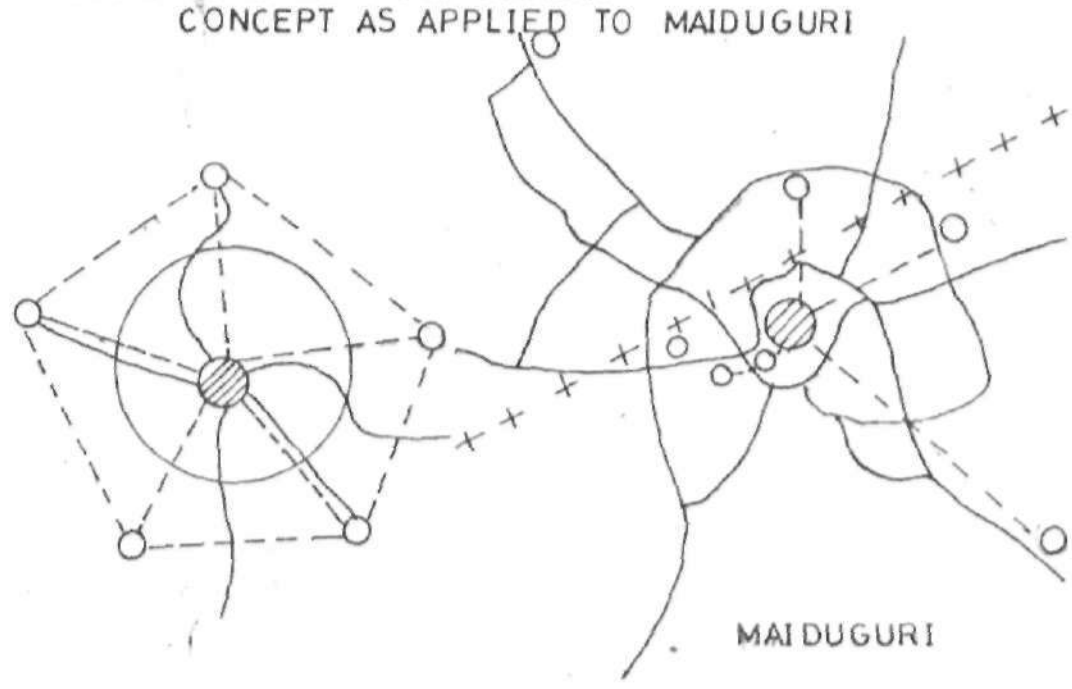
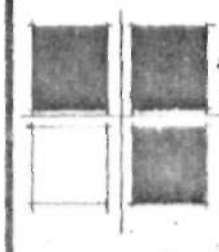


FIG 5.2

KEY
- C.B.D
- SUB-CENTRES
- PRIMARY ROAD
- CYCLEWAY
- RAILWAY LINE



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These are the bicycle way network system concept and the bicycle way network density concepts.

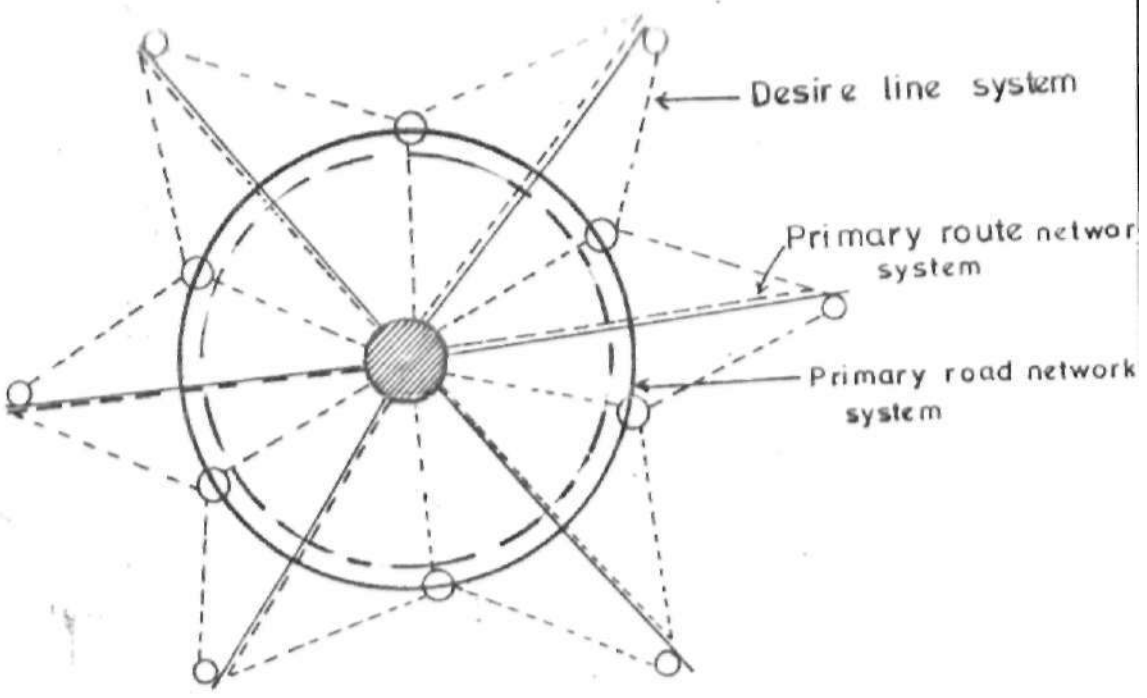
(i) Bicycleway Network System Concept

Two concepts namely the desire line network system concept and the primary road network system concepts were highlighted in the study of Petersborough. Based on the radial structure of Maiduguri, none of the two concepts would have an exclusive monopoly of advantage over the other in case of Maiduguri urban area.

As illustrated in figure 5.2a, the primary network system concept follow consistantly the primary network pattern. This allows for a poor link between the central area or the C.B.D. with the other scatered residential sub-centres. Thus, lengthening the medium distance movement characteristic between centres of different residential landuse. The centrally located workplace area is accessible through the existing opportunities of the primary road system.

Figure 5.2b also illustrates the concept of desire line on the urban structure of Maiduguri linkage of residential sub-centre to the central workplace area exibits medium movement characteristics. Direct link between scattered residential sub-centres and the C.B.D. enhances short and direct route. But then high design standards is required and ineffective through traffic movement would occur for trips emanating from one part of the perpherial centres to the others.

INTERGRATED CONCEPT



City centre
FIG·3a ___ Primary road system
--- Cycleway ways system
O Subcentres

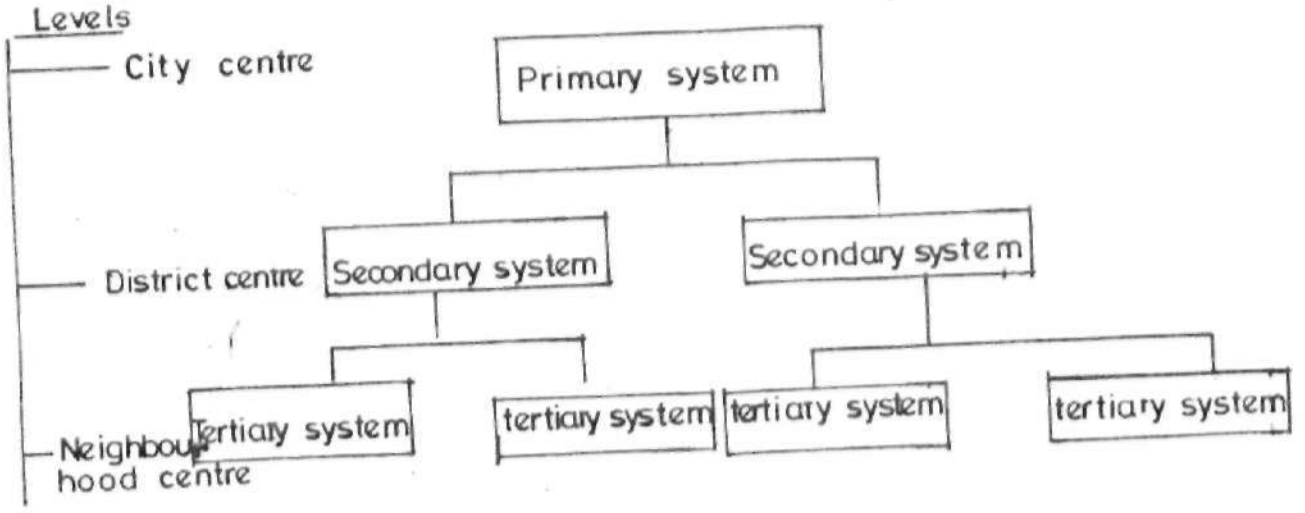


FIG 5.3b

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A compromise of advantages that eliminates the disadvantages on the urban structure of Maiduguri resulted in development of another but a new model, the 'intergrated' concept (Fig. 3.3a). The intergrated concept allows for the fussion of the advantages of the two concepts resulting in substantially reducing the disadvantages where the primary roads exist, primary cycleway system is introduced, but traffic nodes requiring desire line routesare also linked directly to each other by primary system. This preferred a direct link of primary network system along the major primary roads that spread out of the centre. And again desire line movement routes from the sub-centres to other centres.

The system should be in a hierrachy. At the city centre level where the traffic is high for all the areas around the market and the State Secretariat a primary system which is protected from other vechicular traffic should be provided. The primary system would extend to a secondary system at the neighbourhood level where the traffic is much less. The secondary system serves as a movement system that connects the primary system to the tertiary system; i.e. the city centres to the district centre and subsequently with the neighbourhood centre forming a network. (Figure 3.3b).

(ii) Bicycleway Network Density

The conceptual approach is to achieve a recommended network density by using the hypothetical network grid on the Maiduguri road network system. The exercise consist of constructing a grid over the entire area to assist in identifying opportunities and alternative existing routes for provision of bicycle facilities. The generally recognised grid for spacing bicycle facility should not be more than 0.8 kilomitre network.

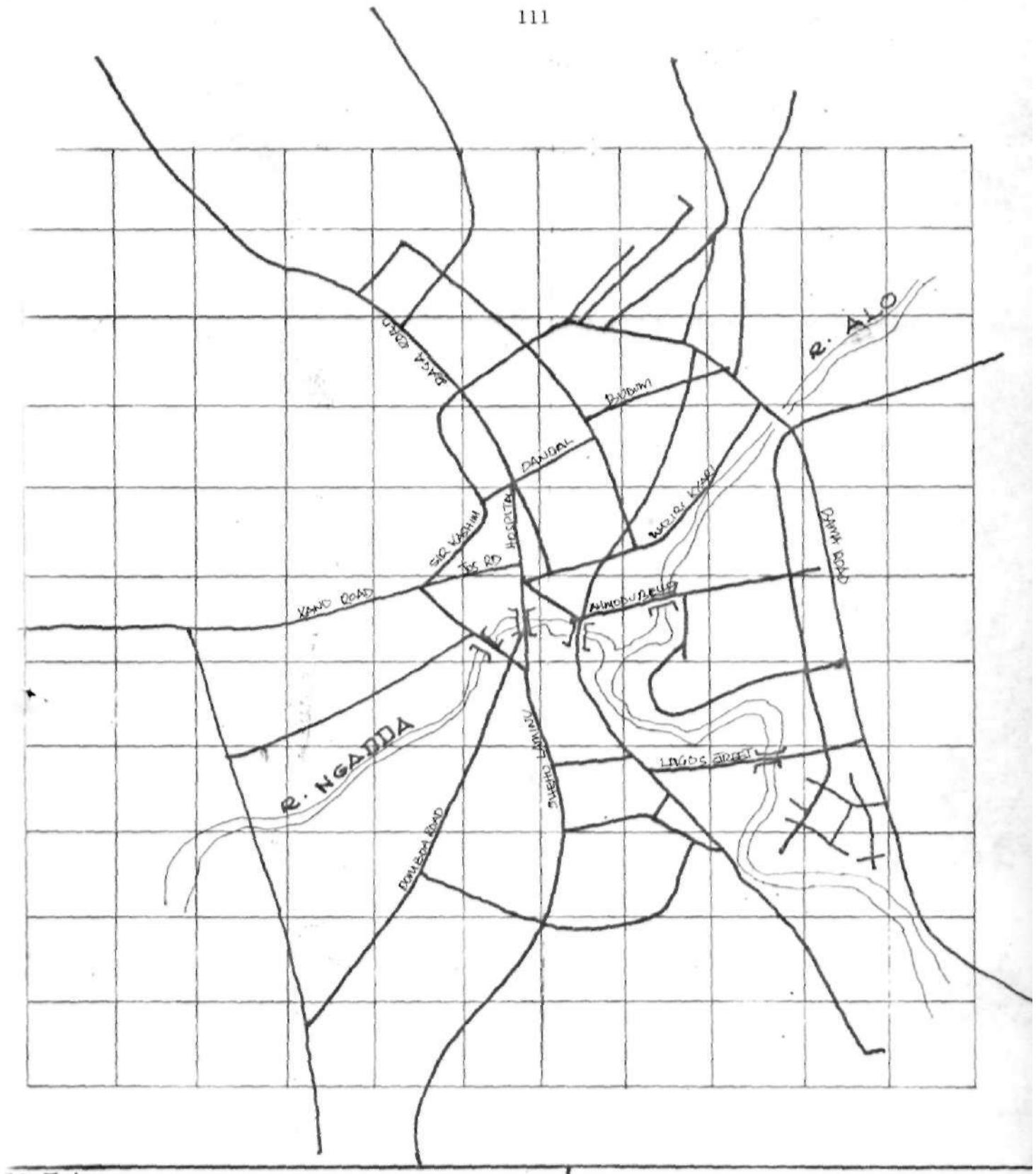

fig. 5.4 MAIDUGURI : HYPOTHETICAL GRID (0.8KM) IMPOSED ON ROAD NETWORK

RECOMENDED PRIMARY BICYCLE NETWORK SYSTEM
AND CYCLE PARKS

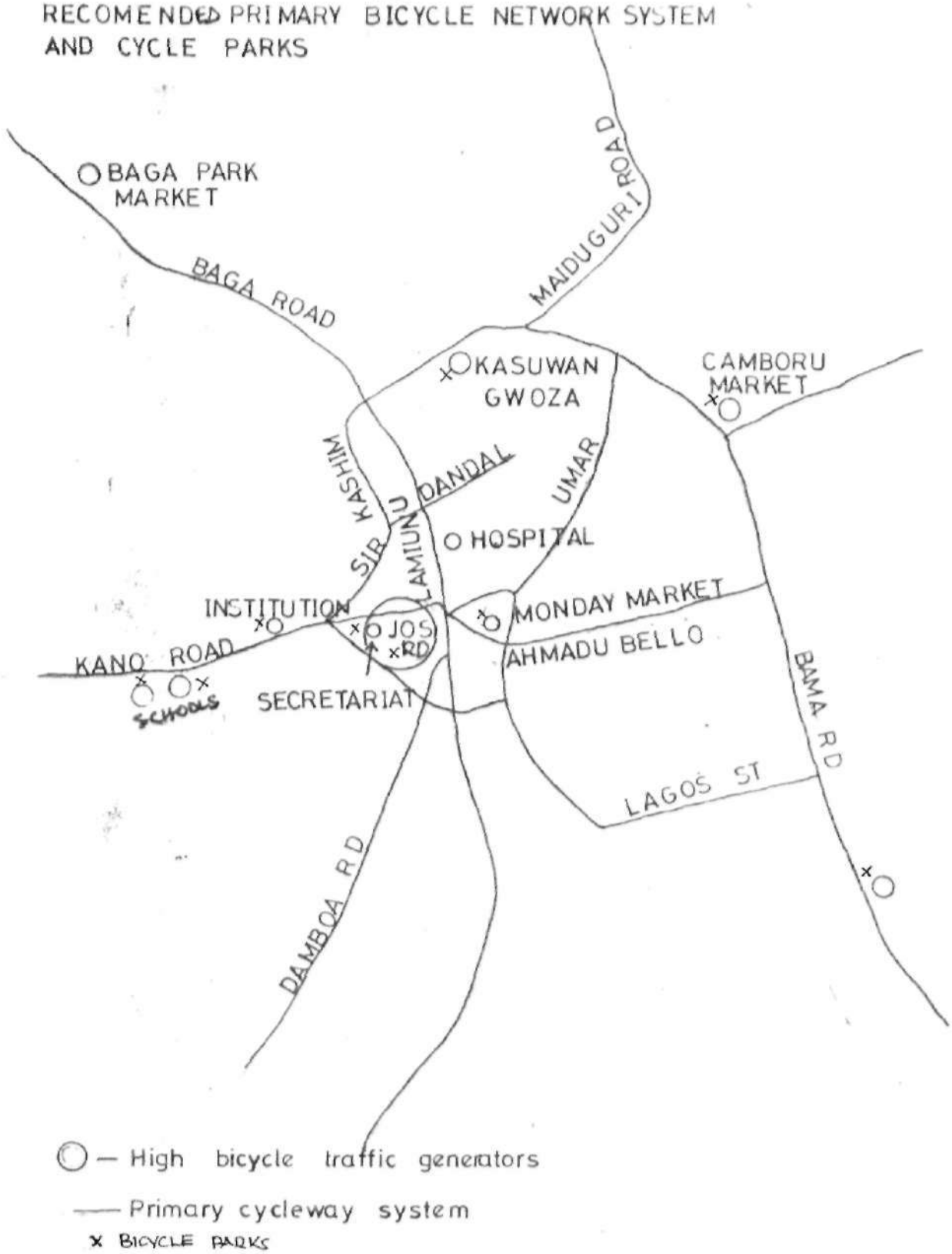

FIG 5·6

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Utilitarian bicycle system based on the hypothetical grid network on Maiduguri existing road network system is shown in figure (5.4). This rather close spacing is required because cycle trips generally tend to be short distnace. The outcome of this recommendation has principle advantage for the final outcome is reflected as a continuous system of bicycle facilities. Indeed system continuity is a very important criterion in designing of a bicycle system.

Based on the above idea, the following primary roads should have a primary cycleway system. These are, Kano Road, Baga road, Ahmadu Bello way, Dandal way, Bama road, Ganboru road, Damboa road, Kashim Ibrahim road, Jos road and Shehu Laminu road. While the other existing secondary roads should also have a secondary cycleway system. The state secretariat Monday Market, other district markets, namely Gamboru Market, Budun Market, Baga road market, the post primary schools along Kano road be provided with bicycle stands (Fig. 5.5).

5.2.0 RECOMMENDED POLICY MEASURE

The Federal Government should make a comprehensive policy on urban transportation planning and development. Such policy should recognise the bicyclist by improving bicycling condition in urban centres through effective planning for urban bicycle system. It should be an intergral component of the comprehensive transportation planning policy.

5.3.0 STRATEGY

The policy should spell out in broad term strategies to be

adopted for implementing the policy on better bicycle system in the urban areas.

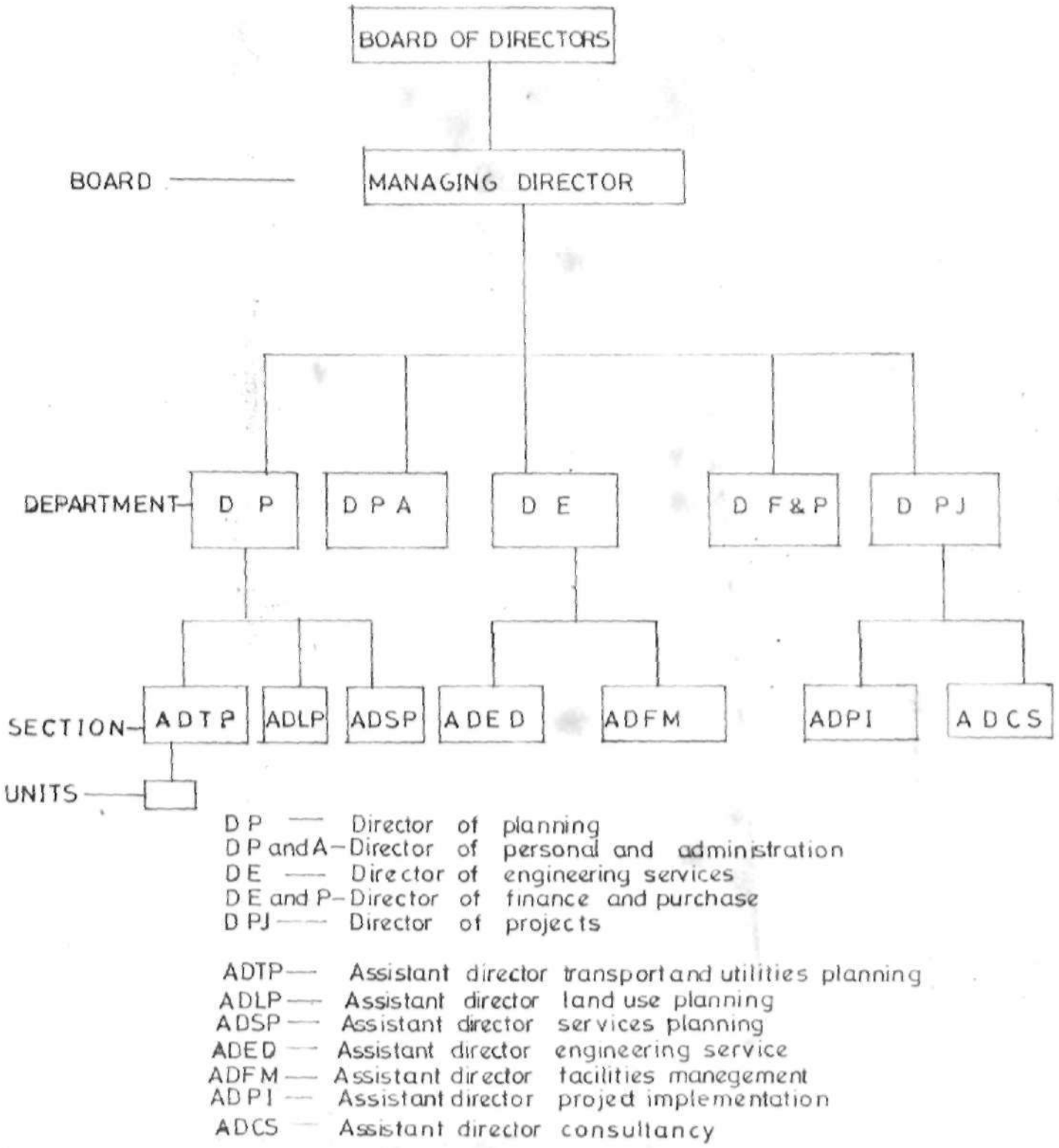
The Borno State Government should provide a legal backing for an institutional machinery, organisational and administrative framework that would take care of urban bicycle system planning in the State and for Maiduguri in particular.

5.3.1 Institutional Machinery

The existing institution responsible for all aspects of physical planning is within the planning department of the Borno State Ministry of Lands and Survey. While the role of implementing urban development programs including the provision of transportation facilities and infructracture is the Ministry of Works. None of these institutions have a comprehensive strategy for better bicycle traffic in Maiduguri. A manifestation of the fact that different institutions are responsible for planning and implementation of physical development plans. In order to curtail this short coming, a strategy of provision of comprehensive bicycle system for Maiduguri is to create an urban development board which will be responsible among other things for the planning and development of a comprehensive urban transportation system.

The proposed body should be a body cooperate with perpetual seccession. It would sue and be sued, and should be responsible for all planning matters. Since there is no zoning regulation requiring public institution to provide cycle facilities for cyclist within their premises.

ORGANISATIONAL FRAMEWORK OF THE BOARD



D P — Director of planning
D P and A — Director of personal and administration
D E — Director of engineering services
D E and P — Director of finance and purchase
D PJ — Director of projects

ADTP — Assistant director transport and utilities planning
ADLP — Assistant director land use planning
ADSP — Assistant director services planning
ADED — Assistant director engineering service
ADFM — Assistant director facilities manegement
ADPI — Assistant director projed implementation
ADCS — Assistant director consultancy

FIG 5.7

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there is the need for such and its enforcement would be the responsibility of the board.

5.3.2 Organisational Machinery

Since the implementation of the Policy is to be vested in the State an institutional machinery is hereby recommended, there should be an organisaional machinery for effective functioning of the board including successful planning and development of bicycle system for Maiduguri.

The board should have a board of directors responsible for policy decision. The daily function of the board would be the responsibility of the managing director. There will be the departments of finance and purchase, adaministration and personnel, town planning, architecture and engineering, and project. (Fig. 5.7). All these department are to be headed by professionals in the fields except the project department that could be headed by either a planner or engineer. Bicycle system planning will be the responsibility of the planning department, while detail design will be the responsility of the engineering department. Bicyle facilities implementation is done by the project department.

5.3.3 Administrative Framework

As earlier stated the daily administration of the board will be in the hands of the managing director who should also be a professional planner.

(i) Finance

Financing transportation planning and development projects should be part of the commitment of the board. From its numerous sources which will include state subvention, development charges, demolishing fee, contravention fee, execution fee, consultancy services, sign board fee, betterment charges and some other. Specifically in additional to the allocation to comprehensive improvement of transportation projects for Maiduguri, the Federal Government should provide fund for improvement of bicycle transportation in urban centres from the proceeds of the oil subsidy removed which is used for financing mass transportation programs. In addition licence fee realised for bicycles and bicycle park fees should also be used directly for the development of bicycle projects.

5. .4 Program Component

Bicycle system designs are translated into detail programme for implementation. Based on the existing bicycle traffic situation and the structure of the road network system of Maiduguri, the recommendation for the provision of cycelways along the primary road network system is a la dable program. The conclusion from the conceptual approach to network design and network density favour this development.

Another programme is the detail design of the part of the central area. The high bicycle traffic flow along Jos road and Ahmadu Bello way, coupled with the high bicycle traffic attraction by the monday market and the state secretariat, suggest the need for an immediate improvement of the cycling condition for these roads and landuse. A design proposal will therefore be made as a program for implementation within the context of the general planning recommendation.

5.4.0 DESIGN PROPOSAL FOR A PART OF THE CENTRAL AREA

The design proposal for bicycle facilities in the selected areas is to demonstrate the effectiveness of some recommendation for planning for bicycle traffic highlighted. It's therefore aimed at improving the condition of existing traffic in these areas.

An asessment of the requirements for the design for cycle facilities, characteristics of these elements and their relationship with the other part of the town need to be analysed.

5.4.1 Characteristics of the Elements

Figure 5.4 shows the location of the elements for which bicycle facilities would be designed. These are the STate Secretariat, the Monday market, Jos road, Ahmadu Bello way, Monday market road and Yerima road. Inventory of the existing situation is summaried on the table 5.1. and 5.2.

ROADS INVENTORY

	Length	Road Width	Carriage way	Funitures	Volume Unit
Jos Road	850m	40m	13m	drains poles trees	1212
Ahmadu Bello way	700m	30m	15m	Utility Poles	1557
Market Road	405m	40m	15m	Utility Poles	1704
Yerima Road	612m	20m	7m	Single Drains	1218

Source Field Survey 1989.

Table 5.1

INVENTORY FOR THE MONDAY MARKET AND STATE SECRETARIAT

	Size	PCU/day Bike Traffic	Facility	Space REquirement
Monday Market	5.6.Hac	2800	2 stands	Available outside
State Secretariat	11.2 Hac.	1300	2 stands	Available outside

Table 5.2

Source: Field Survey

5.4.2 Space Requirement for Facilities

The assessment of space requirement for the design depends on the type of facilities and the number of potential users. For this study, the criteria of design would be based on standard used by John E.B. et al (1976) adopted from the 'Bikeway planning criteria' UCLA (1972).

(i) Bikeways

Bikeways as a function of number of bikeway lanes with minimum effective width (Table 5.3).

Number of Lanes	Specification (ft)	Manevering allowance at 10 mph speed
1	3.3(1m)	3.3(1m)
2	5.3(1.6m)	6.4(2m)
3	8.5(2.6m)	10.9 (3.3m)

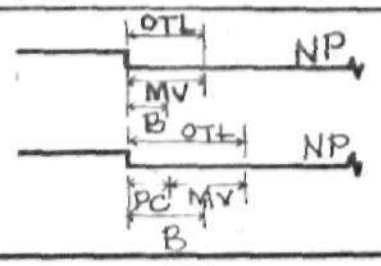
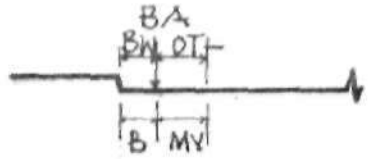
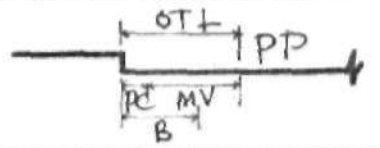
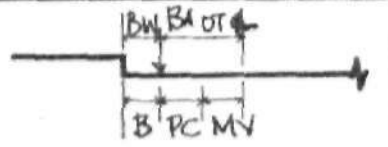
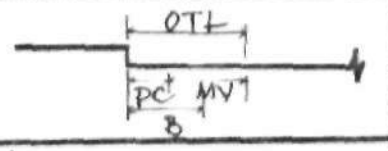
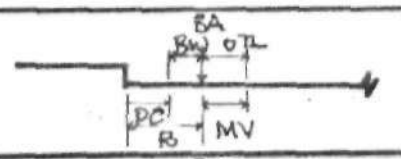
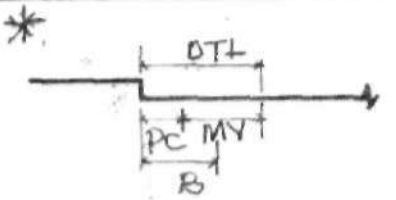
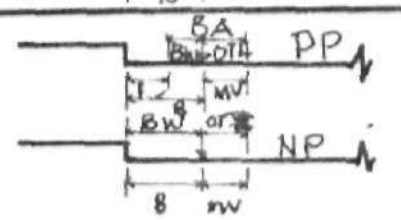
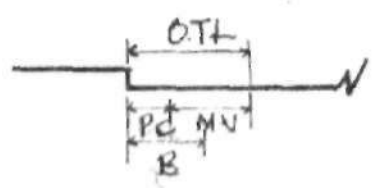
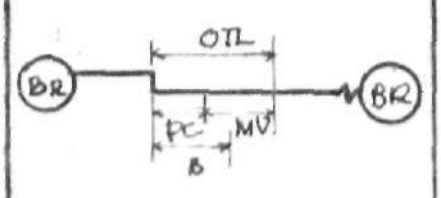
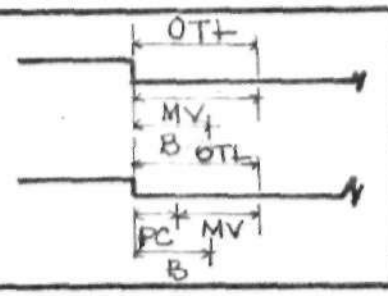
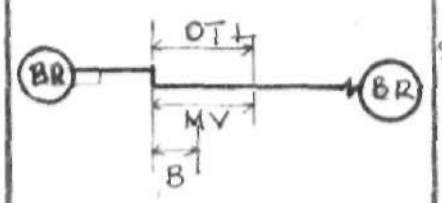
Table 5.3

Source: John E.B. et al (1976).

The minimum effective width of 1 metres (John 1976) is not idle for cycleway in Maiduguri because of dressing habit of the people. However, for future use, in case of 2 and 3 lane cycleways this specification on table 5.3 could be used.

Minimum recommended clearance to obstacle is:

RECOMMENDED ARRANGEMENT OF VECHICLAR TRAFFIC

ALTERNATIVE	EXISTING SITUATION	RECOMMENDED ARRANGEMENT	EXAMPLES
1			JOS ROAD SECRETARIAT SIDE. AHMADU BELLO WAY.
2			MARKET SIDE OF MONDAY MARKET ROAD.
3			BAGA ROAD OTHER NEW PRIMARY ROAD.
4			PROPOSED RING ROAD
5			JOS ROAD CHURCH SIDE
6			SIR KASHIM IBRAHIM ROAD KANO ROAD.

B – BICYCLE
PC – PARKED CAR
PP – PARKING PERMITTED
NP – NO PARKING.
OTL – OUTSIDE TRAFFIC LANE.
MV – MOVING VEHICLE
BA – BARRIER.
BR – BICYCLE ROUTE.
* – PROPOSAL FOR BOM ROAD.

SOURCE: ADOPTED FROM JOHN, B.E. 1976.

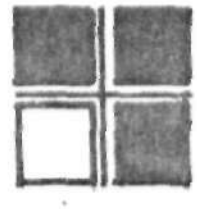


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FIG. 5.9

Description	Minimum clearance (ft)
Clearance to curb drop off	1.5 - 2.3 (0.5 - 0.7m).
Clearance to curb raise	1.6 (0.5m)
Slope edge drop off (2:1)	1.0 (.3m)
Horizonal clearnace to obstacle	0.8 - 1.6 ft (0.2 - 5.)

Table 5.4 Source : Adopted from John E. et al (1976)

Four alternatives for placing bicycle ways (lane protected and route) as shown in Fig. 5.9 should have barriers. Striping is easily encroached either voluntarily or unvoluntarily by bicyclist and motor vehicles. Recommendation in this study is for physical barrier which includes, islands, fence or bars that would serve an delination.

Bicycleway route could be located along the road at any distance if it will not come in direct conflict with pedestrain and vechicular traffic facilities.

(ii) Storage Facilities

In designing bicycle storage facilities to bikeways and users destination consideration should be given to location and proximity, storage lot identification and accessibility, orientation of storage space, type of storage racks, lot boundary screening and protection and provision of locking devices for protection from thives.

These storage facilities are basically categorised into three classes. Bicycle stores and depots, are areas or facilities where bicycles are kept for a long period of time. Bicycle stands are covered alots meant for the use of the public. Bicycle parks are space curved out for the parking or keeping of cycles usually for group of people for a particular landuse.

Depending on the need all the above storage types are recommended to be provided within Maiduguri.

The lot layout normally consists of stalls 0.6 x 1.8m at 90° to aisles of a minimum width of 5ft (1.5m). Generally, the must successful method of preventing stealing of parked bicycle consist of weaving a case - hardened steel link chain (7.9 to 9.8mm) in diametre through the frame and hooked togethe with the rack by double lock. Smaller compact bicycle storage lots are more preferable because bicyclist cluster around mos desirable location. In order to achieve maximum screen of improper movements 3 feet dense hedge or fencing is found to be effective (John E. et al 1976).

(iii) Bike Crossing

Bicycle conflict with other traffic at inter-section is inevitable, the most desirable way to elimate the conflict is through grade separation.

Underpass are best recommended for bicycle crossing. Where this is not possible due to cost or space required channelization should be considered unless low traffic exist and if only small percentage of the vehicles make a nearside turn across the projected bikeway alignment.

(iv) Bicyclist and Bicycle Use

The characteristics of the bicycle and average dimension pertinent to minimum design standard are:

Hand bar width 1.99 (ft), 0.6m

Cycle length 5.75 (ft), 1.75m

Pedal clearance 0.5 (ft), 0.15m

Vertical space occupied by cyclist is 7.4 ft(2.5m).

Mean measure separation between handbars of two drivers riding a breast at a velocity of 10 mph is given as 2.5 feet. (John E. et al 1976).

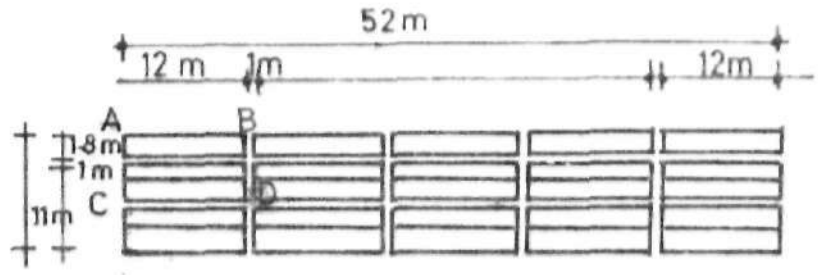
5.5.0 DESIGN OF BICYCLE STORAGES

(i) State Secretariat

The estimated number of bicycles owners in the State Secretariat is 715. While at least 100 regular trip makers by bicycle is expected at any time within the premises. Hence 815 spaces for bicycle storage is required. In addition some few spaces may be required for other trip maker that may not be regular users. Based on at least 1300 PCU/day trip generation, but since not all park at the same time, the state secretariat would require about 1000 bicycle parking spaces.

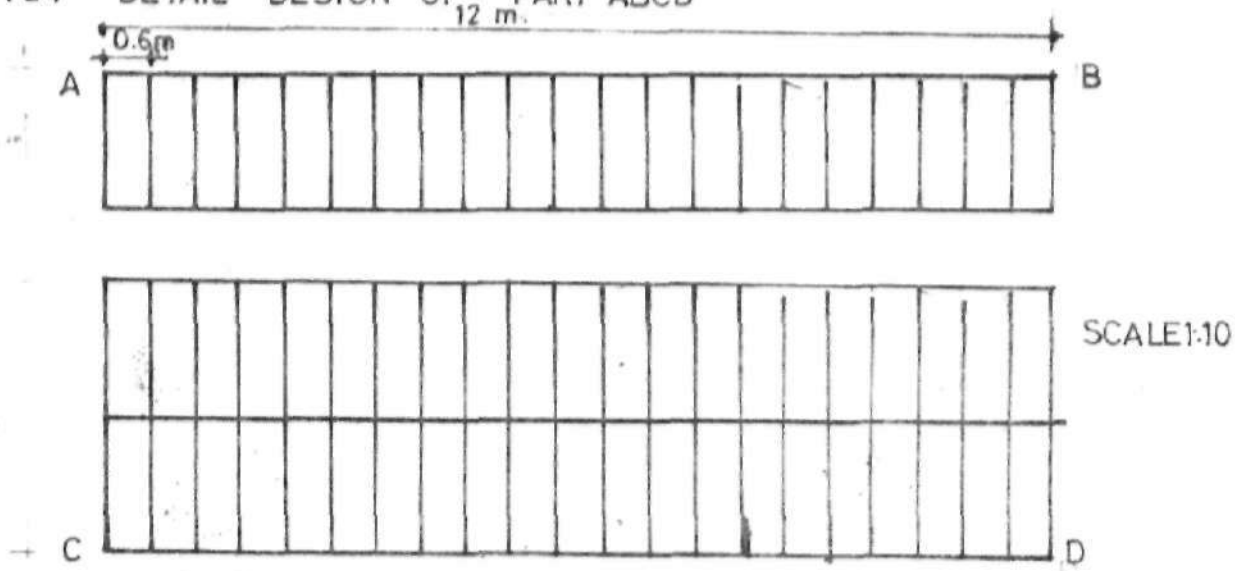
DESIGN FOR CYCLE PARK FOR THE STATE SECRETARIAT

(1) LAYOUT DESIGN



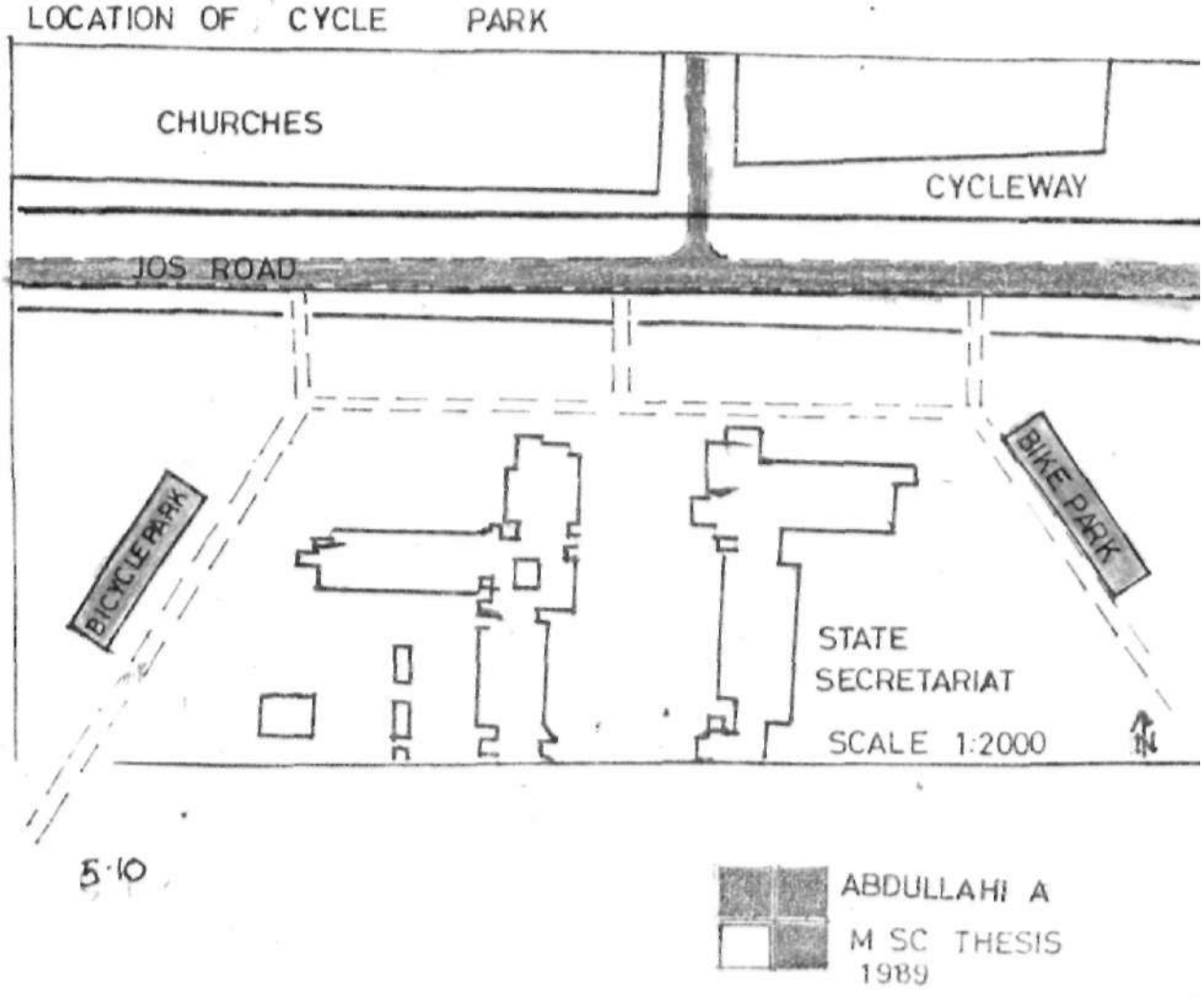
SCALE 1:75

(2) DETAIL DESIGN OF PART ABCD



SCALE1:10

(3) LOCATION OF CYCLE PARK



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Given by dimension of space requirement for a bicycle which is 0.6m x 1.8m.

The required 1000 bicycles spaces is 0.6m x 1.8m x 1000 (excluding space for movement).

Total area is therefore 1080 square metres.

Figure 5.10 shows the layout design and location of the cycle facility in the secretariat. The area is a vacant land and has not been proposed for any use, presently it serves as jank yard for car scraps. Its proximity to the major Jos Road is of good advantage.

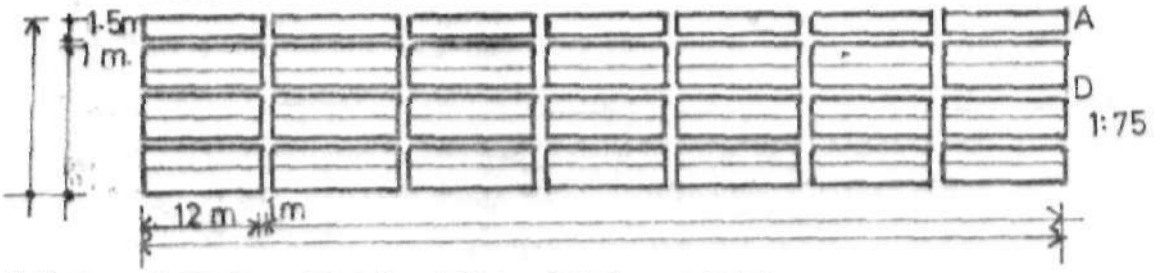
5.5.2 Monday Market

The estimated volume of bicycle traffic to the monday market is 2000 PCU/day. Regular hourly trip makers was put at least 500 bicyclist. Considering the regular storage users in addition to the total of about 4,500 estimated non regular trip markers, at least a storage capacity of 1500 would be required. Land requirement for the total space needed for the parking of 1500 bicycles is given by

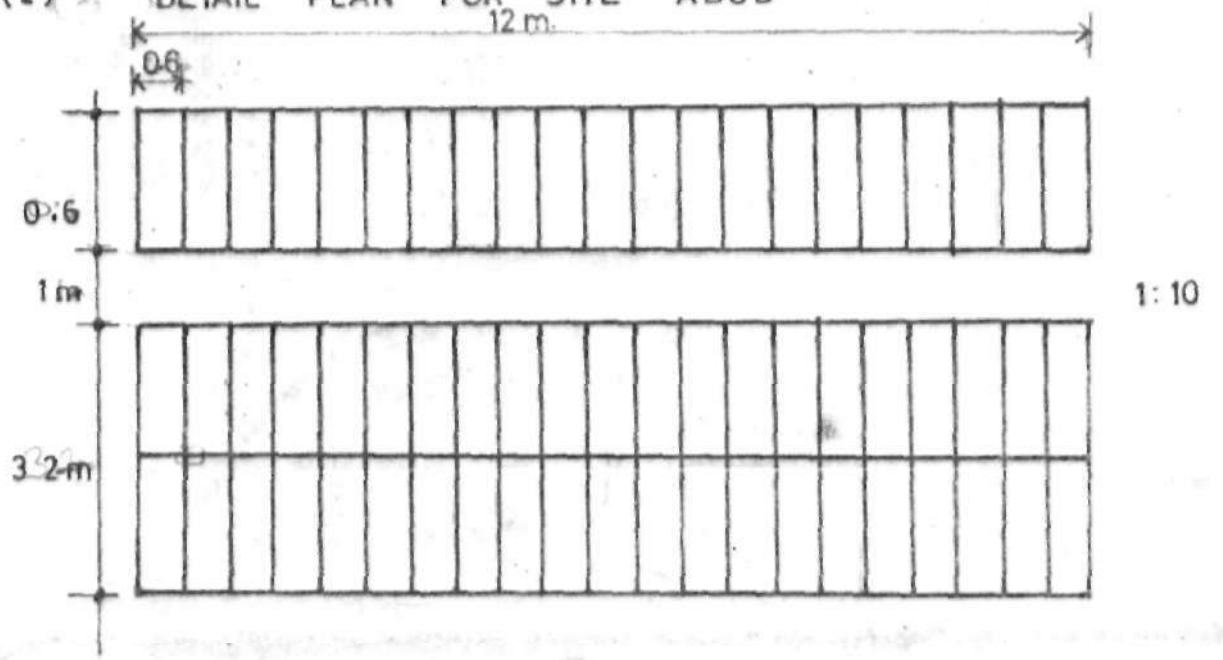
1500 x 1.8m x 0.6m (excluding the space required for movement is 1620 square metres.

It is not easy and practically not suitable to locate the parking lot at a single place. Therefore the most convinient places available are the road reservation along the Monday Market road which is to provide the 980 bicycle spaces of 1059 square metres (Fig. 5.11).

(1) LAYOUT PLAN FOR 980 BICYCLE PARK ALONG MONDAY MARKET ROAD



(2) DETAIL PLAN FOR SITE ABCD



LOCATION OF PARK

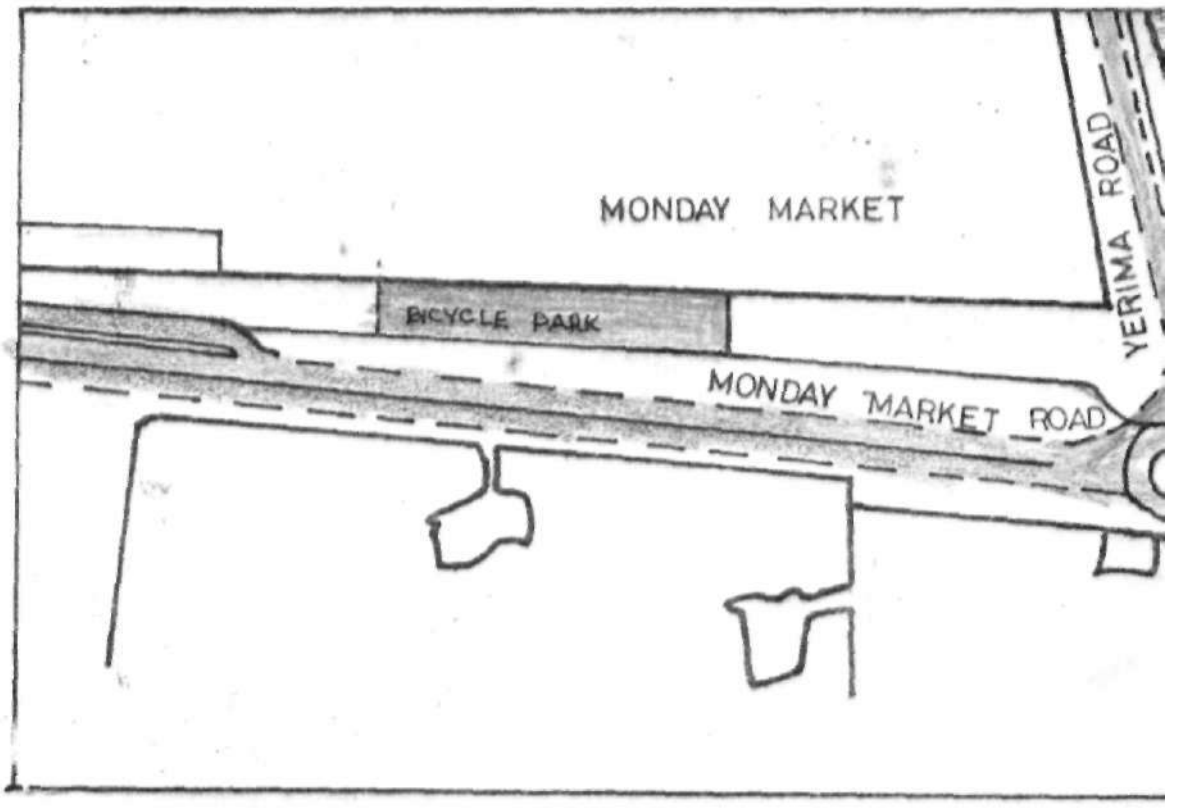


FIG 5.11

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location is suitable in view of the fact that it adjacent to the market and moreso it would easily be served by the proposed double lane protected cycleway 2.4 metres width.

The second parking lot for the bicycle is proposed for the present site on which chicken sellers are located. They could be easily removed and relocated near the fish sellers and the area be used. (Fig. 5.12). This parking lot is accessible from Ahmadu Bello way which has a very high bicycle traffic flow.

5.6.0 DESIGN FOR CYCLEWAYS

5.6.1 Jos Road

The capacity of bicycle traffic along Jos road is about 1300 PCU/day. Considering a regular use of about 500 bicycle trips at peak hours and for a substantial part of the day, for this high volume of traffic, an independent cycleway is recommended.

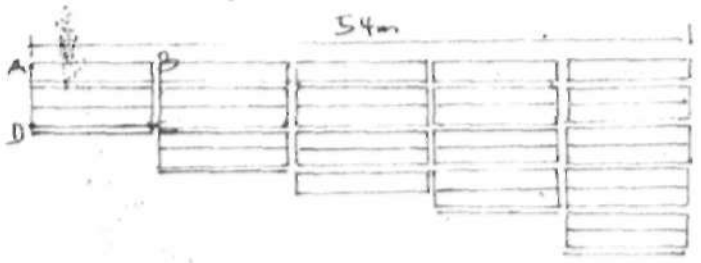
(i) Protected cycle lane of 1.2 metres on the main carriageway on the side of the state Secretariat.

(ii) Cycle track of 2.4 metres demarcated by a white strip color.

The protected cycle lane of 1.2 metres is recommended along the edge of Jos road on the side the state secretariat because of the non availability of space. The road reservation is less than 6 metres at most areas and it has been observed that there is a very high pedestrain traffic sharing the road reservation with other modes.

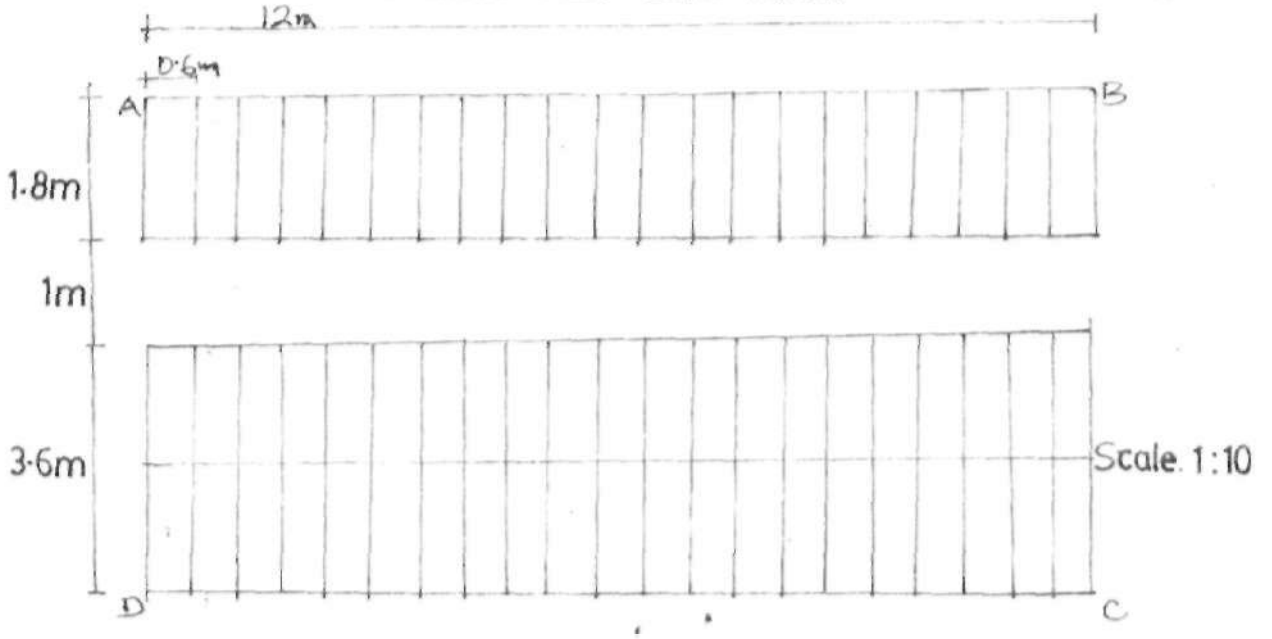
600 CYCLE CAPACITY PARKING FACILITY

LAYOUT DETAIL FOR SITE 'A' MONDAY MARKET



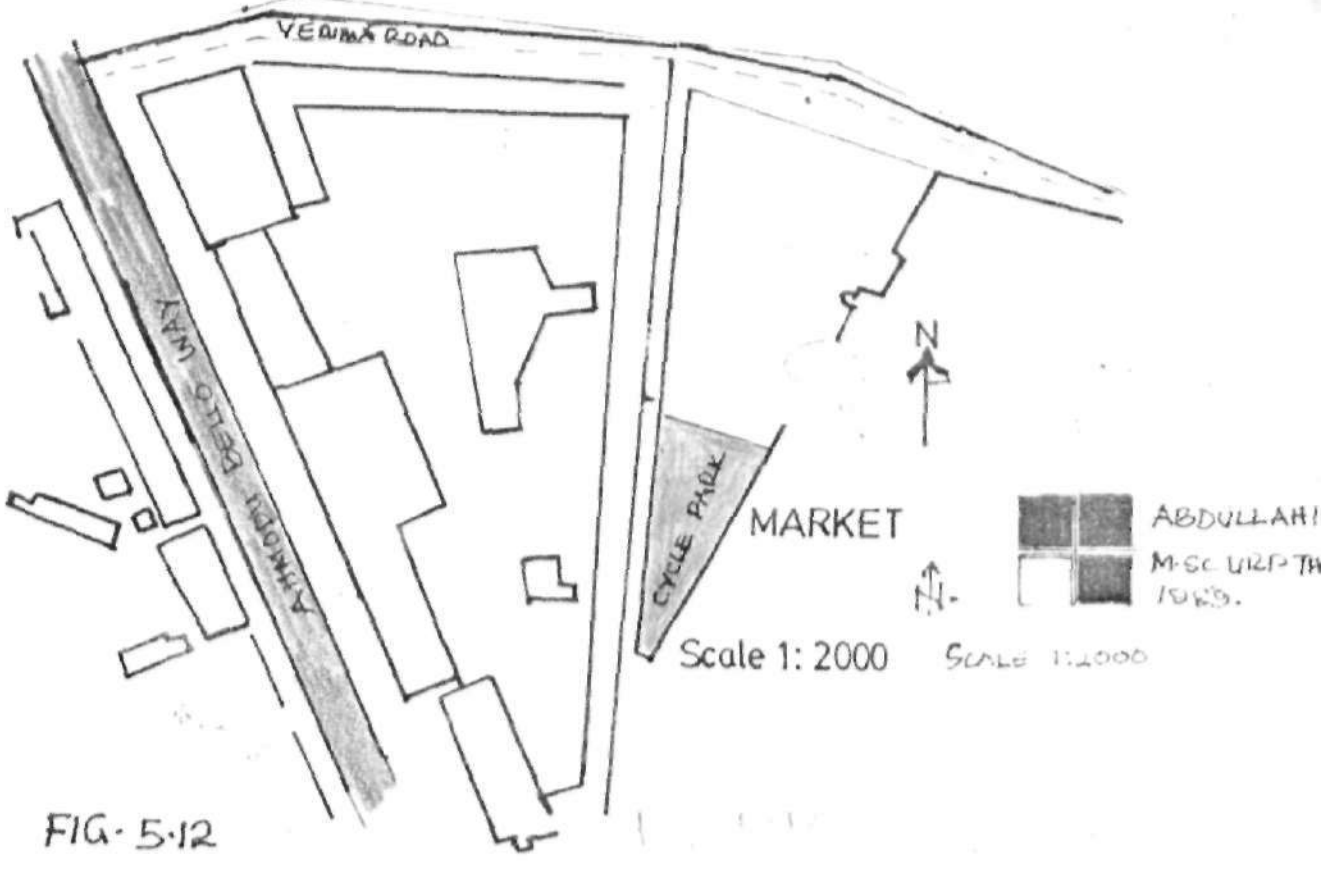
Scale: 1:75

DETAIL LAYOUT FOR SITE ABCD



Scale. 1:10

LOCATION OF CYCLE PARK



Scale 1: 2000 SCALE 1:2000

FIG· 5·12

A protected shoulder for bicyclist that ensures no parking along this side is therefore recommended (Fig. 5.13).

On the other side, a double lane of cycle track with at least 2.4 metres width is recommended. Since there is less pedestrain movement, parking could be allowed and the provision of track along the road will not affect parking conditions since the track would be at least 8 metres away from the carriage way. The double lane here is to ease the high demand of space during rush hours.

5.6.2 Cycleway Along Ahmadu Bello Way

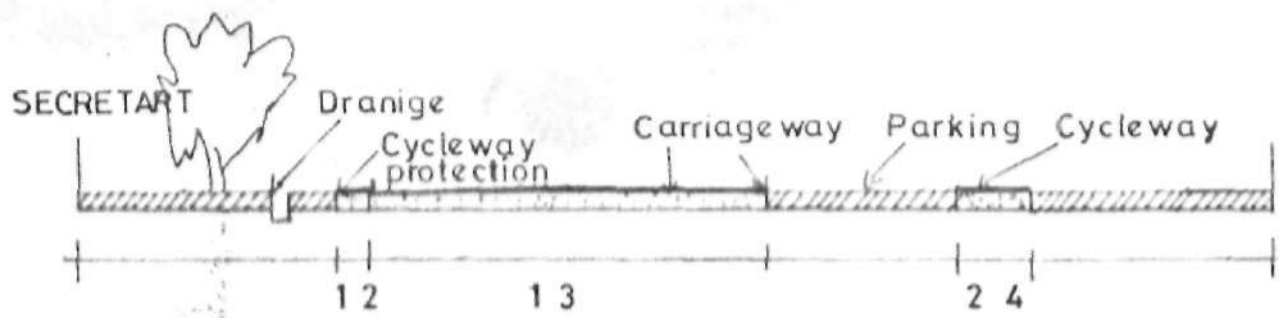
A protected lane of 1.2 metres is recommended on both sides of the carriageway. Since there is a parking space for cars along the road off street parking restriction should be continued. Specific areas recommended for on street parking is on the monday market side of the road just after the El-Kanemi roundabout and beside the petrol station near the post office round about. In these areas taxis and buses could be allowed to pick passengers. However, as shown on the (Fig. 5.13) the cyclelane avoids these parking areas and therefore metal bar would be used to deter defaulting motorist from encroaching into the cycle tracks at that point.

5.6.3 Cycleway Along Monday Market Road

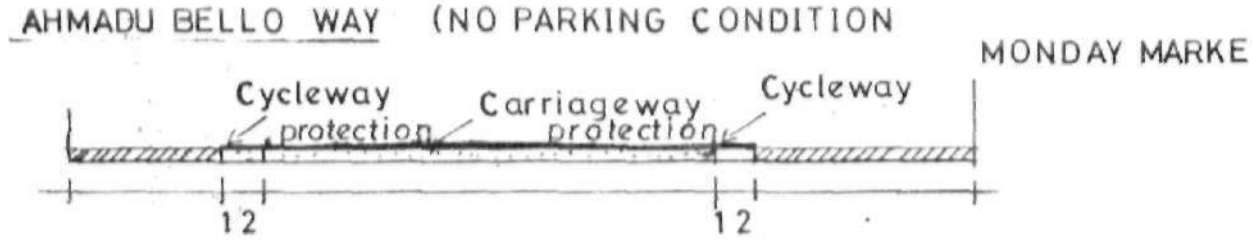
There are two different cycleways designed for this road. Along the edge of the carriageway on the opposite side of the market a single cycle lane protected by a concreate slap of at least 6 inches should be constructed. Opening could only be made for the street enterance (Fig. 5.13)

LOCATION OF CYCLEWAYS ON
THE FOUR ROADS

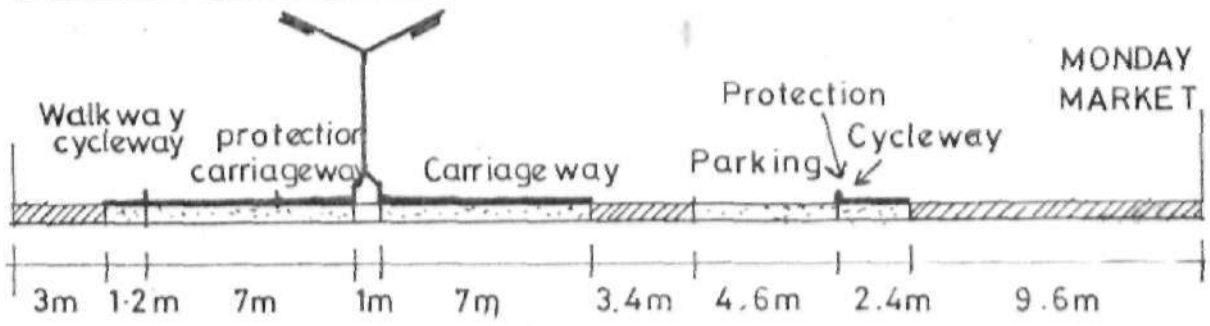
JOS ROAD RESTRICTED PARKING CONDITION



AHMADU BELLO WAY (NO PARKING CONDITION



MONDAY MARKET ROAD



YERIMA ROAD (ONE WAY WITH PARKING CONDITION)

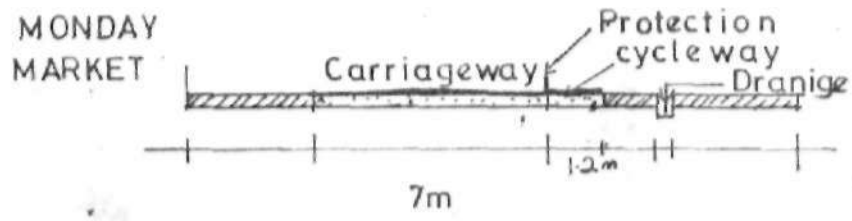


FIG - 5B

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However, on the adjacent side of the Monday Market, for the fact that the parking facility is located on the same side, the expected number of bicycles traffic is very high. Therefore double lane cycle track is recommended. To contain the pressure along the road towards the El-Kanemi road roundabout the track assumes a cyclelane and therefore a protection should be provided to discourage off-street parking that would enchroach to the road.

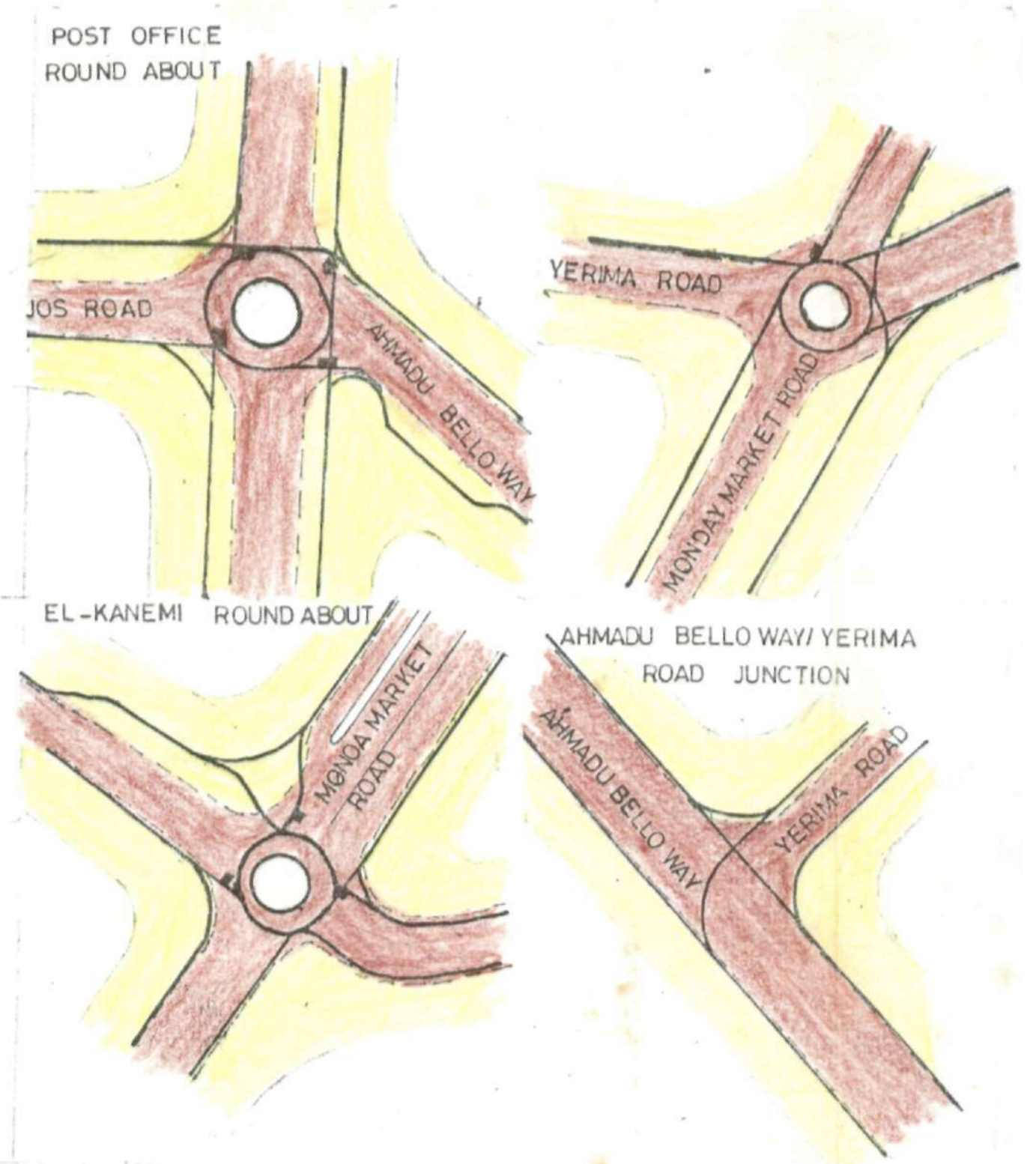
5.6.4 Yerima Road

Yerima road is oneway lane but also has a high traffic flow during the day time. Movement is restricted to one directions and therefore less bicycle traffic conflict is observed. A protected 1.2 metres cycle lane along the outer edge of the road is recommended. The protection should be made of slap and must be opened where the road is joined by a street. On street parking regulation should continue and for no any reason should there be off-street parking because it will voilate the bicycle movement arrangement recommended (Fig. 5.13).

5.7.0 MOVEMENTS ON MAJOR JUNCTION AFFECTED

For the design of cycleways along the four major roads four major junctions are affected. These are the post office round-about, the El-Kanemi road aroundabout, the monday market roundabout and the Ahmadu Bello/Yerima road junction. In these junctions bicycles and other modes had to compromise on use the road space and therefore the physical facilities and barriers for use of bicycle not be extended beyond 10 metres from the road junctions.

BICYCLE STRIP MARGIN ON THE JUNCTIONS



KEY

CYCLEWAY

ROAD

CYCLE

N

SCALE

FIG - 5.14

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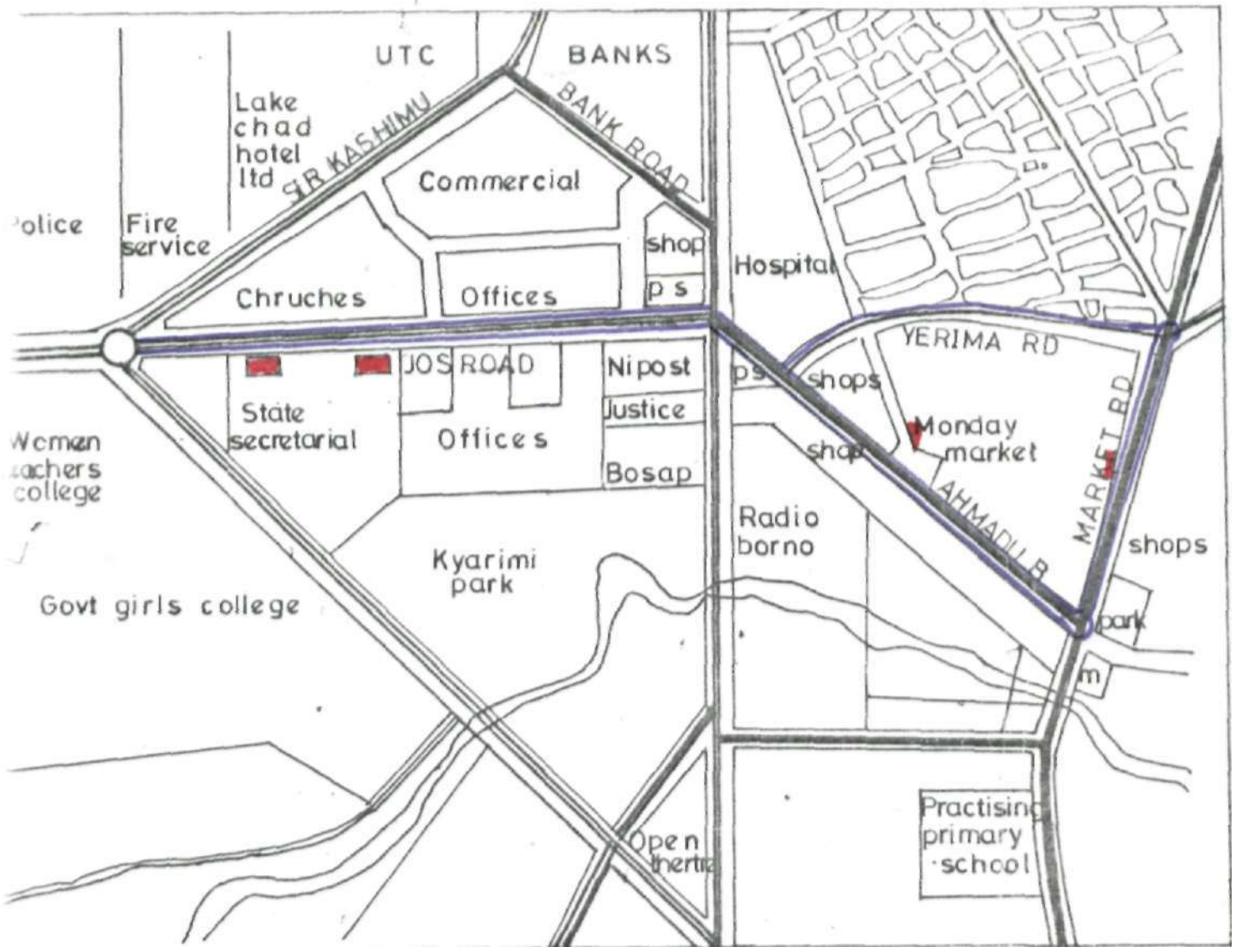
Indeed, the best recommendation is done to give a fair allocation of the road space to the bicyclist while of course other traffic also having right to share it. Physical barrier for bicycleways should discontinue at least 10 metres to the roundabout in order to achieve maveourability for all traffic using the roundabout. These strips of painted lines is designed to channelise the cycle traffic within a guided space that allows for streamlining other traffic movement Fig. 5.14.

Figure 5.15 shows detailed design of circleways and cycle parking facilities for Jos Road, Ahmadu Bello way, Monday Market road, Yerima road and Monday market and State Secretariat.

PART OF CENTRAL AREA SHOWING DESIGN PROPOSALS



IG 5.15

KEY

CYCLE WAY.

CYCLE PARKS.

N

scale 1:10,000

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CHAPTER SIX

6.0.0 IMPLEMENTATION OF THE DESIGN PROPOSALS AND CONCLUSION

6.1.0 IMPLEMENTATION

The plan implementation is an essential stage in any planning process, for the success of any plan is largely attributed to the level of effective translation on the physical ground. As a result of the magnitude of the traffic problem cyclist encounter in the central area, immediate planning action to contain the problem is inevitable and therefore most seriously be considered. Because of the much needed concern, the design proposal is referred to as an 'Action Plan' for the improvement of cycle traffic within some part of the central area. The fact that this proposal is part of the general planning recommendation, its implementation should be viewed as a first stage of adopting the general recommendation. It success also reflects the success of subsequent utilization of the recommendation. However, to achieve a meaningful degree of success, there should be a legal backing strategy and program.

6.1.1 Legal Backing

In the absence of an effective policy on intergrated transportation system and planning for Maiduguri, there is the need to evolve a policy specifically that addresses itself for the implementation of the project.

A legal support is therefore necessary for formal recognition of the plan by the Government so that the effective machinery of implementation would be evolved. Such a recognition will feature in form of policy statement spelling out the type of strategy and program that would be adopted. It should also ensure the support of the government by adict.

6.1.2 The Strategy to be Adopted

The strategy to be adopted as spelt out by the policy, must include the ways and means through which the plan is to be implemented. The institutional and organisational responsibilities should be clearly defined. A methodology of financing and management of the project should also be part of the strategy.

(i) Institutional Framework

In the absence of an urban development board which this study has however earlier on recommended for the physical planning and implementation of development project for Maiduguri, there is the need to create a 'Task Force' for the implementation of this design proposals.The head of the project must be a professional in the fields of achitecture, engineering or planning. Such a person must have the executive powers to manage the project. The Task Force should have at least a representative from the state Ministry of Works, Ministry of Land and Survey, the Monday Market Authority and the Governor's Office.

The name of the Task Force thereafter established should be 'Task Force on Bicycle System Implementation'.

The project Organisation, administration execution is the function of the Task Force. Since the task force would use the direct labour approach to project implementation, it should also liase with the Direct Labour Unit of the State Ministry of Works for some of its requirements. However, the role of other agencies that would be affected by the project namely, the Borno State Water Board, the National Electric Power Authority, the Nigerian Telecommunication Services, would also be co-ordinated by the task force to ensure an effective participation.

(ii) Financing

Projecting financing is an essential aspect of project implementation for without fund no project would be adequately implemented. Although idlely direct project beneficiaries are indeed normally the best sponsoring agents, however, in this case, the government should provide the funds. The State Government and the Monday Market Authority are to provide some of the funds. While the Monday Market Authority is to provide funds of about N250,000 for the construction of the parks , the State Government in addition to about N150,000 for the construction of parks within the State Secretariat should also provide about N750,000 for the construction of 1.2 metre width cycleways for Jos Road, Ahmadu Bello Way, Yerima road and the Monday Market road, totaling about 5.4 kilometres in length.

To ensure that the design standard is maintained during constructions funds meant for this project should be allocated and made available directly to the Task Force for an effective implementation. However, in order to recovered the cost of parking facility provided in the Monday Market area, the park should be provided with toll gates, and fee be collected from users. A token amount of 50 collected from users would be used for development of other parks and provision of essential security and maintenance services of the parks.

(iii) Management

The project management objectives is to achieve a high standard of implementation. For this reason a professional is required to head the Task Force. In addition other abled professionals are also cooped to assist and advice the head.

Bicycle traffic management within the project area is also part of the management process. The basic objective of the project design is to achieve a better bicycle traffic condition comparable with that of other road users through a required systematic flow of all traffic. In observation of the bicyclist right on stripe margin in conflict areas that is on the four junctions, namely the El-Kanemi road about, post office roundabout, the market roundabout and the Yerima/Ahmadu Bello way junction indeed require traffic management efforts. Traffic warders should be drafted to maintain smooth flow of traffic in these areas by enforcing traffic control measures and traffic regulations.

Other traffic measures such as parking control should also be observed. The no parking and restricted parking conditions enforced on Ahmadu Bello way and the Monday Market must be observed.

Bicycle parks must be fenced and shaded. A system of locking device in parks should also be observed. Bicyclist should use chain links for locking bicycle posted on standing poles in the park.

6.1.3 Program

The project should be started as soon as possible. Any time from 1990, the government is to use 1990 budgetary allocation for urban road development project to finance it. The best, approach is through'stage construction' and direct labour method. The government should make fund available and mandate the Monday Market Authority to provide the needed fund as soon as possible.

If fund is provided, the project will not take more than three month. However, the length of the time depends on commitment and number of work force.

The implementation of the design proposal is just an aspect of the general planning proposals. Therefore a continuity of the scheme is necessary in order to achieve an effective bicycle system for Maiduguri in future. As such the project implementation would be proceeded by the recommendation for the provision of primary network system for the bicycles on the major primary road system.

6.2.0 Conclusion

Urban transportation problem especially in the developing countires has largely been tied down to inadequate means of

commuting due to lack of opportunities brought about by high level of poverty. Maiduguri, like any other Nigerian towns, inspite of the economic, social and physical opportunities, thought not of planning for its most populus mode of transportation; the bicycle. The fact still remains is that, bicycle has always been useful not only in our towns but even in those of the developed countries.

But urban transportation development in Nigeria emphasises on an exclusive privilege for motorised form of transportation at expense of the welfare the bicyclist. This study opens up an opportunity for us to realise that the neglected bicycle means of urban transportation could be a viable option to our fast growing urban transportation problem.

The situation in Maiduguri revealed that opportunities for motorised commuting has been dwindling in the last few years. Government approach to solve it has been a failure. The public interest is in favour of providing safety for the bicyclist. The potential bicycles users has also increased in the last few years.

However, due to the long term neglect of the interest and welfare of the bicyclist on the roads, other vechicular modes have consistantly terrorised them by constantly creating hostile situations for them. The bicyclist inspite of their endangered situation seem to be confidently salvaging their commuting problem.

The Principle assumption of the study is how do we improve the general transportation situation of Maiduguri amist our present predication; is bicycle the possible alternative. The bicycle is indeed a salvation to the chronic problem of transportation in Maiduguri as revealed by this study. And the implementation of the project with the political will and support of the government could be the radial solution to the urban transportation problem. This dosage of the pills could be recommended for all the urban centres in Nigeria as well. The Federal Government as a matter urgency has to look inward for the development of bicycle systems in our urban centres.

Bicycle complements the transportation requirement of all people in term of providing alternative means. Maiduguri's transportation situation would definately improve with better bicycle traffic. The program calls for public participation in areas of usage of bicycle facilities, provision of the facilities itself, and maintenance. Education, enlightment, through the MAMSER directorate would be very essential. Bicycle clubs and enthutist should be involved in bicycle use promotions.

The planning recommendations suggested in this study should be used to improved the general transportation situation of Maiduguri as a matter of urgency.

REFERENCES

1. Ameh, P.O. (1988); Journey to Work in Makurdi Urban Area : Problems and Physical Planning Solutions. Unpublished M.Sc. (URP) Thesis A.B.U., Zaria.

2. Business Times : Important of Bicycle, 7th February, 1972

3. Daniel T.S. et al (1976) Planning and Design of Bicycle Facilities : Pitfalls and new Directions, Transportation Research Record, No. 570.

4. Desimore V.R. 'Planning Criteria for Bikeways' Transportation Engineering Journal Vol. 99, No. TE 3, August, 1973

5. Emmanuel Mansa, (1985), Planning for Mass Transportation in Metropolitan Jos. Unpublished M.Sc. (URP) Thesis, ABU Zaria.

6. Germano A.T. et al, (1976) "The Emerging needs of Bicycle Transportation" Transportation Research Record No. 270.

7. Hanson S and Hanson P, (1976) Problem in Intergrating Bicycle into Urban Transportation Planning Process Transportation Research Reocrd No 570.

8. Hanson, S.K. et al, (1974) Intergrating Bike Travel into the Urban Transportation Planning Process, Transportation Research Record.

9. Hankina G.J. (1973) Finding Europes Sideroads Bicyclist XIV

10. Hugh McClintock (1989). Cycle Planning : A comprehensive Bibliography, International experience, Vol. 2. University of Nottingham.

11. Hugh Mc Clintock (1989). Lessions Ansing from the experience of Urban Bicycle Planning in England and some current issues, Institute of British Geographers, Conference, Coventry Polytechnic.

12. John, E.B. at al (1976)., Transportation and Traffic Engineering Handbook. Institute of Transportation Engineers, U.S.A.

13. Hutchinson, B.G. (1978) Principles of Urban Systems Planning Scripla, Washingon.

14. Khanna, G.P. (1988) : Mass transportation system in Urban areas : Problem and Proposal A paper presented at the first National Seminar on Mass Transportation (URP) ASSUTECH Enugu.

15. Konski J.L. (1973) "The Bicycle Anarchy" Transportation Engineering Journal Vol. 101, No. TE4.

REFERENCE

16. Kraft W.H., et al (1975), "Planning and Development of Bicycle Facilities : Implementation Planning", Proceedings on the fourth National Seminar on Planning and Pdestrain Facilities, American Society of Civil Engineers, NewYork

17. Maxlock (1976)., Maiduguri : Surveys and Planning Reports for the North Eastern State Government of Nigeria.

18. Ohru E.C. et al (1974)., A framework for Investing in Urban Bicycle Facilities Transportation Engineering Journal Vol. 101 No. TE3.

19. Reporter : Call for the problem of the cyclist of October, 1989.

20. Rishinath L. Rao, et al (1983)., Planning for Better Bicycle Traffic in Indian Cities. A Case of Bangalore : Human settelements Division Asian Institute of Technology Bangakole, Thailand.

21. Terence Bendixson (1976)., Instead of Cars, Oxford Press, England.

APPENDIX I

DEPARTMENT OF URBAN AND REGIONAL PLANNING
AHMADU BELLO UNIVERSITY, ZARIA

(HOUSE HOLD QUESTIONNAIRE)

1. Name of the Household head ..... No.....

2. Place of Residence ..... Occupation .....

3. Age ..... Sex: Male (_) Female (_)

4. Number of Children .....

5. Income per month ..... per annum .....

6. What type of Mode to you use for your transportation.

   (a) Bicycle

   (b) Taxi

   (c) Motor Cycle

   (d) Car

   (e) Bus

   (f) Other specify .....

7. Where is your place of work .....

8. What is the amount of money you spend daily/monthly ..... on transportation to

   (a) Work place

   (b) Market

   (c) Visits

   (d) Schools

10. Would you use bicycle to go to work:

Yes/Reason .....

No/Yes (Safety .....
(Slow .....
(Tideous .....
(Cost .....

11. What is your perception on the use of bicycle in Maiduguri .....

.....

12. If bicycle would be provided with separate safe routes from other vehicular traffic would you use it for your daily transportation, yes/no : Why.....

13. Would you allow and encourage your children to use bicycle with such improvement ..... yes/no .....

.....

14. Would you say the effort of the State and the Federal Government in solving the transportation problem in Maiduguri is

(a) Excellent

(b) Good

(c) Not Encouraging

(d) Not successful

15. What is the average distance to which you can conviniently use bicycle:

(a) 2km - 4km

(b) 2km - 6km

(c) 4km - 8km

(d) Up to 10 km.

16. Do you think to cost of bicycle maintenance would not be very high. Yes/No. If yes, what are your suggestion to reduce the cost of bicycle maintenance .....
.....

17. Would you afford to maintain bicycle as your transportation mode.

18. What would you suggest for the government to do to improve the transportation situation in Maiduguri .....
.....

19. Would you suggest the government to give:

    (a) Loans for bicycles .....
    (b) Provide tracks and parks for bicycles ...
    (c) Subsideis
    (d) Repairs and Spare part Depots
    (e) Others .....

20. Dδ you think with safety measures and some forms of assistance from the government more people would prefer using bicycle. Yes/No.

    What percentage of the present number:

    (a) 50%
    (b) 100%
    (c) 200%
    (d) or more ....

Thank you sir.

APPENDIX II

DEPARTMENT OF URBAN AND REGIONAL PLANNING
AHMADU BELLO UNIVERSITY, ZARIA

QUESTIONNAIRE FOR BICYCLE USERS IN MAIDUGURI

1. Location of Residence ..... Age .....

2. Ownership Category (i) Owned ..... (3) Income/Monthly ..

(ii) Hired .....

(iii) Borrowed ...

4. Average distance covered with bicycle per day

5. Do you use it for the following journey:

(i) Working place

(ii) Market

(iii) School

(iv) Recreation

6. How long have you been using bicycle in Maiduguri .....

.....

7. What is the cost of the bicycle.

8. How much does it cost you monthly for maintenance .....

.....

9. What are your problems for using bicycle in Maiduguri

.....

10. What are your suggestions for improving the use of bicycle in Maiduguri .....

APPENDIX III

DEPARTMENT OF URBAN AND REGIONAL PLANNING
AHMADU BELLO UNVIERSITY, ZARIA.

1. Location .....

2. Number of People Employed .....

3. Average number of Bicycles repaired daily .....

4. Number of years of bicycle repair on iste .....

5. Number of bicycle for hire service ..... 1986 .....

1987 .....

1988 .....

1989 .....

6. Number of bicycle repaired as a result of damage due to accidents .....

7. Do you sell second-hand bicycles Yes/No.

If yes how many in 1986 ..... 1987 .....1988 .....1989 .....

8. Do you have some problem with bicycle users, mention .....

.....

PURCHASE OF BICYCLES IN MAIDUGURI

Location ..... 2. Where the consignment is obtained

.....

Type	1981 No	Price	1982 No	Price	1983 No	Price	1984 No	Price	1985 No	Price	1986 No	Price	1987 No	Price	1988 No	Price	1989 No	Price
Adult bike																		
Secondhand bike																		
Total																		