JOURNEY TO WORK IN MAKURDI URBAN AREA. PROBLEMS AND PHYSICAL PLANNING SOLUTIONS.

BY

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DEPARTMENT OF URBAN AND REGIONAL PLANNING
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DEDICATION

Dedicated with affectionate thanks to

Fatima Joy Ameh (Mrs),

Omeyi Serah Ameh (Miss)

and

Une Racheal Ameh (Miss)

for their patience and endurance and

for remaining cheerfully oblivious of

the whole silly business.

DECLARATION

I hereby affirm that this thesis has been composed by myself and that it is a record of my research work. It has not been accepted in any previous application for a higher Degree. All the sources of information are specifically acknowledged by means of references.

December, 1988

_____ Date _____

Signature

CERTIFICATION

This Thesis entitled "JOURNEY TO WORK IN MAKURDI URBAN AREA: PROBLEMS AND PHYSICAL PLANNING SOLUTIONS" by AMEH, Paul Onuminya meets the regulations governing the award of the Degree of Master of Science (Urban and Regional Planning) of Ahmadu Bello University, and is approved for its contribution to knowledge and literally presentation.

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THESIS ABSTRACT

In many of our Nigerian Urban centres, workers face problems of long travel time and high cost of travel in their worktrips.

The Study is aimed at examining the characteristics of Journey to work in Makurdi, identify the problems with a view to planning effectively for it.

Data was collected from Primary and Secondary Sources. In Makurdi, Journey to work was found to be associated with problems of high cost long travel time, inconveniences and strains. The low income earners spend more than *26%* of their monthly income and travel for longer distances than high income earners in their worktrips. Less than 22% of the workers were observed to own private vehicles (Cars, bicycle, motor-cycle, etc) of their own. Unfortunately, the public transport system is inefficient, overcrowded and their services are not accessible to a large part of the Urban area. These problems are due to the poor Urban growth with respect to the distribution of residences and workplaces, the poor roadnetwork and the present economic recession. Forcasts of landuse and worktrips shows that these problems may be worse by the year, 2005.

Proposals for achieving an effective journey to work based on short term curative measures and long term preventive measures were advanced. The short term curative measures were directed at solving the problems of existing flows. These include proposals on improvement of road network, organising the present public transport system and traffic management schemes. The long term preventive measures include proposals on distribution of residential areas and workplaces to minimise distance and ease movement to work, mass transit system, utilising the train services by 2005, planning for pedestrians, motorcyclists and organised parking system.

The proposals are expected to be implemented in 17 years. The phases of implementation are 1988-1990 (Short term), 1991-1995 and 1996-2005 for long term proposals. There are also recommednations on sources of finance and administrative framework for the implementation.

It is hoped that if the Physical Planning solutions advanced were implemented, the problems of journey to work in Makurdi would be solved.

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CHAPTER ONE

BACKGROUND TO THE STUDY

1. 0 INTRODUCTION

There are many problems associated with urban travels for residents of most of our Nigerian cities today. These problems include high cost, long travel time, inconveniences and strains. These problems have been aggravated by our present state of economic predicament. The astronomical rise in prices of vehicles and spare parts has made urban travels costly, time consuming and frustrating. The removal of oil subsidy in April, 1988 led to a hike in transport fares. Because of the importance of transport in economic activities, the upward review in transport fares have automatically translated into a general hike in the entire economy.

Urban travel purposes include journey to work, journeys to school, shopping, recreational and social activities. Planners have given work trips some special consideration in most of their transportation studies because they are the most important category of journeys made from home and they tend to be redistributed unevenly through the day, mostly being concentrated into a few peak hours. It is also the major cause of the chaotic traffic situation being experienced in most of our cites today.

The inadequacy of public transportation for workers has been a major concern for the present government. As a panacea to the problem, a sum of ₦700 million was allocated for purchase of buses under the special reflaction package in 1987 budget at a moment of grave difficulty. But this is a narrow way of looking at the problem since the fall in the number of vehicles have not solved the problem of urban congestion in most of our cities. Other problems of urban travels are overloading of routes and facilities, the overlong trips, difficulty of parking, overcowded buses, long distance separation of residences and work places which affects the productivity of workers. These are problems that arise not only out of the sheer size of our cities but also out of the organisation of their landuses, the rythm of their activities, the balancing of the public services with private right of access and movement, and the tastes and preferences of their citizens with respect to mode of travel, route, comfort and cost (Dyckman, 1971).

Journey to work which accounts for a large part of urban traffic problem is a product of a comparatively free choice of residence and place of work. In the early industrial centres of the western countries workers were grouped in dwellings close to their respective places of work (Dyckman, 1971). Residence

were located within walking distance from work places because of the low level of transport technology. Improvements in living standards have contributed almost as much as the growth of cities to contemporary comfort and convenience, as well as the ability to sustain higher costs, have affected the choice of both residence and mode of travel. The transportation plight of cities is a condition people have themselves brought about by taking advantage of individual opportunities.

Deliberate individual and collective decisions on the whole question of quality of urban life must first be made if changes are to be achieved in the present condition of transportation. The problem of urban transportation is one of city layout and planning as well as one of transportation technology. Different types of landuses generate different or variable traffic flows. The shift in emphasis from the study of flows themselves to the study of the landuses that give rise to the flows underlies the basic city planning proposition that traffic can be manipulated by controlling and rearranging the landuses that represent the destinations and purposes of transportation. There is need to study landuse patterns within our cities in order to relate these uses to transportation demands.

1.20 STATEMENT OF PROBLEM

Makurdi has been growing very rapidly in size and population as a result of influx of civil servants and businessmen to the town since it was made the capital of Benue State in 1976. The rapid growth, coupled with physical constraints (drainage, topography, soil) to urban development has led to hapharzard development of landuses. The lack of balance between employment and housing is due to the location of work areas far away from the main residential areas. The low income groups are more affected by this long distance travel than the high income groups since high residential densities are farther away from the work areas than low residential densities.

The present economic recession has made it difficult for the low and middle income groups to dream of owning vehicles. This means that a very large number of workers in Makurdi daily depend on the available public transport system for their basic means of journey to work. Unfortunately, the existing public transport system (Motorcycles, Minibuses) are inadequate in their operation and services. They charge very high fares and their services do not cover a large section of the population. This makes workers to change mode several times before reaching their places of work. This change of mode not only "erodes" worker's lean income but long travel time is associated with it.

The problem has been exacerbated by inadequate transportation facilities like the poor road network, lack of horizontal separation of vehicular traffic and lack of bus stops which causes traffic delays on the roads.

The problems associated with the landuse, the road network, the mode of movement and social economic characteristics of workers has led to high cost of travel, long travel time inconveniences and strains to workers in Makurdi.

There is therefore a need for curative and preventive physical planning measures to solve the problem of journey to work in Makurdi. This is through landuse and transportation planning to minimise residence to workplaces distance separation. Also a need for an efficient mass transportation system operations, ensuring that the fare structure is within the affordable means of the workers income, planning for effective road network and traffic management schemes. This will be a panacea to high travel time and high cost of journey to work in Makurdi.

1.30 AIM AND OBJECTIVES

Aim

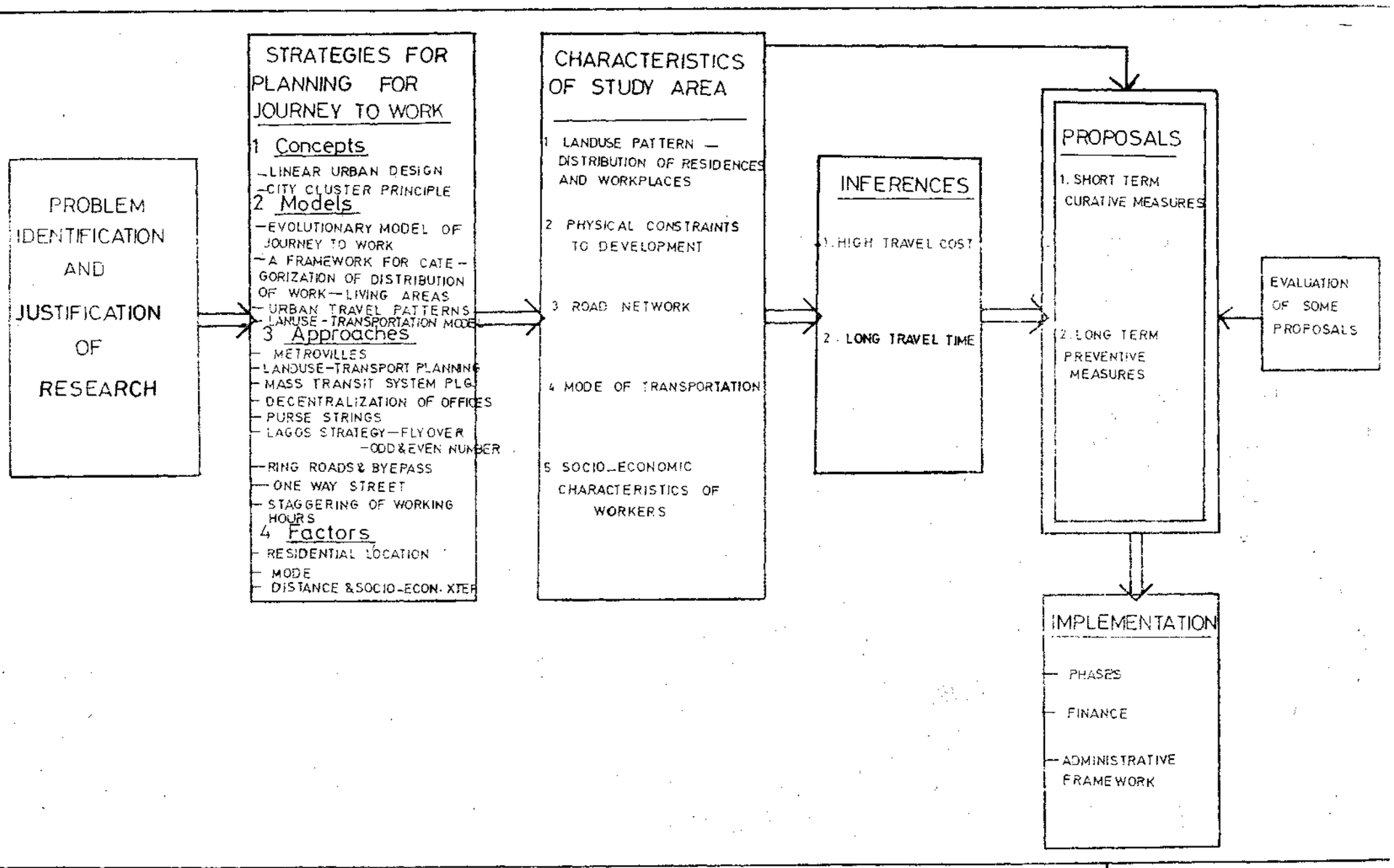
The aim of the study is to examine journey to work in Makurdi Urban Area with a view to making planning proposals for achieving an effective system.

Objectives

1. To review concept, models, approaches and strategies and factors used in planning for journey to work.
2. To analyse the Makurdi landuse and establish the locational relationship of residences and workplaces.
3. To examine the nature of journey to work and identify socio-economic characteristics of workers.
4. To identify the problems associated with journey to work in Makurdi Urban Area.
5. To forecast journey to work patterns based on the trend of development.
6. To suggest physical planning proposals for an effective journey to work system in Makurdi.
7. To suggest implementation policies for the proposals towards achieving effective journey to work in Makurdi Urban Area.

1.40 SCOPE AND LIMITATIONS

The study limits itself to only workers resident in Makurdi. Only major workplaces are considered. The activities of informal sector (Hawkers and service oriented) which provides moving employment, and whose work location covers a large area are not considered. This is because their journey to work cannot be determined.



(7)

FIG. 1.1 CONCEPTUAL FRAMEWORK OF THE THESIS

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1.50 RESEARCH METHODOLOGY

The methodological framework of the study has been grouped into stages: Conceptual Framework, Data Collection, Data Analysis and Data Forecasting.

1.51 Conceptual Framework:

The conceptual framework has been illustrated in Fig. 1. The first aspect was concerned with problem identification in which goals and objectives were formulated.

Existing strategies for achieving goals and objectives were reviewed and analysed for their use in the study area. This was discussed under concepts, models, approaches, strategies and factors used in planning for journey to work.

The third stage was the analysis of the characteristics of journey to work in Makurdi and inferences were derived.

The stage of planning proposals follows. This has been grouped into curative planning measures for short term planning and preventive planning. Some of the proposals were evaluated before the selection of the alternatives. The implementation stage was discussed under phasing, financing and administrative framework.

1.52 Methods of Data Collection

Data was collected from primary and secondary sources. Data from primary sources were based on the components of journey to work. These include the distribution of residences and workplaces, the road network, the modes of movement and the socio-economic characteristics of workers.

(a) Home Interview Survey

The home interview survey was conducted by means of questionnaire (appendix I). It was thought that the size of the sample needed depended principally upon the total population, degree of accuracy desired and the density of population in the survey area.

The adequacy of various sample sizes has been tested by the United States Public Administration Service (1957), and from the results of these tests the following table, based on population, was compiled to aid in determining the size of sample needed.

Population of Area	Recommended Size of Samples
Under 50,000	1 in 5 dwelling units
50,000-150,000	1 in 10 dwelling units
150,000-300,000	1 in 15 dwelling units
300,000-500,000	1 in 20 dwelling units
Over 1 million	1 in 25 dwelling units

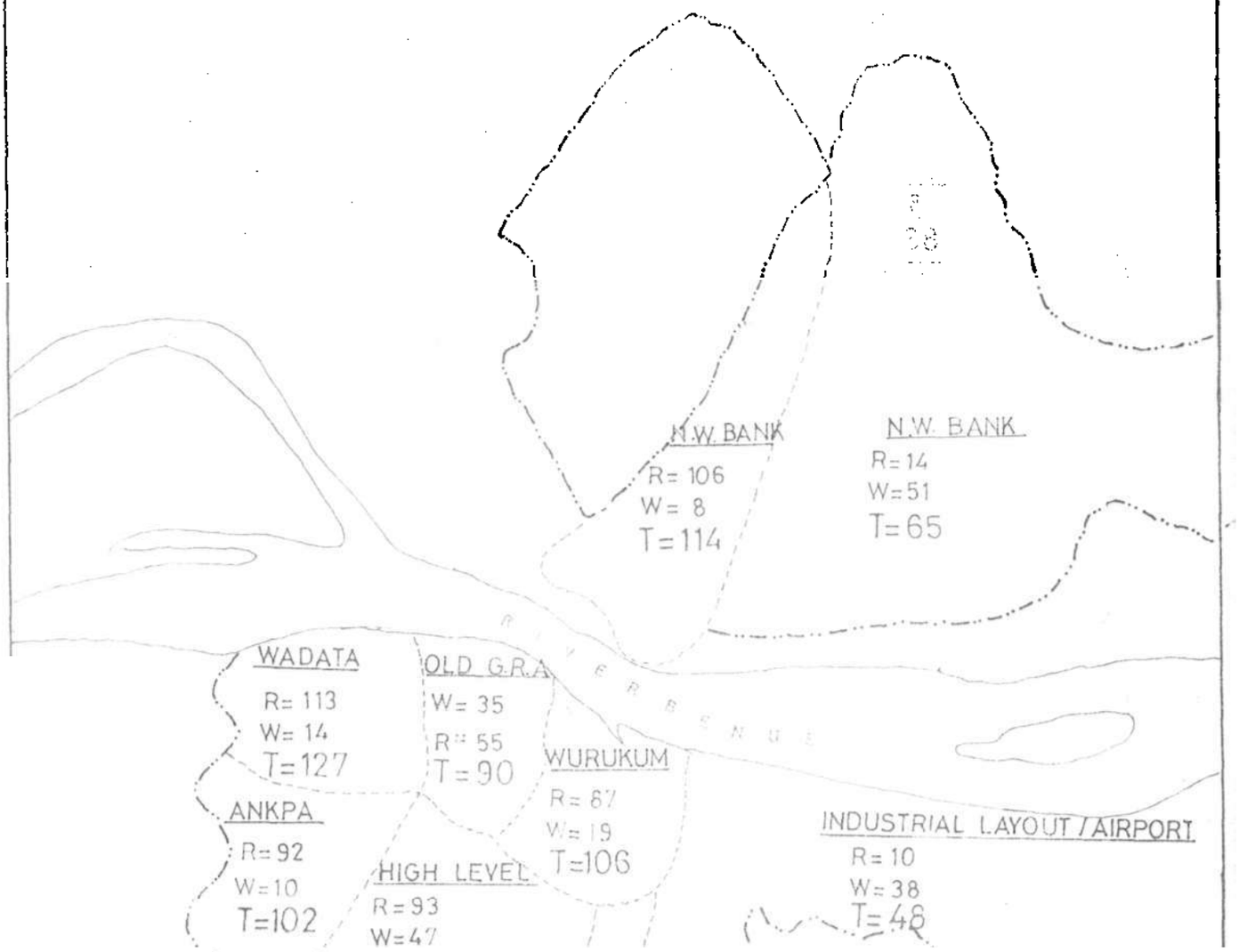
Table 1.1: Recommended Size of Sample.

Source: Public Administration Service (U.S) 1957

Since the population of Makurdi fell between 150-300,000, it would mean sampling in every 15 dwelling units. This was considered too expensive. It was thought that a sample will be representative if the persons included are distributed geographically throughout the survey area in the same proportion as the whole population is distributed. The technique of sampling is more important and determines the accuracy of sampling than the sample size.

The quota sampling method was therefore used. This was done by dividing Makurdi into the present ten functional zones for purposes of data collection. The quota sampling is easy in administration because there is no problem of non response. It is independent of existence of sampling frames and may be the only practicable method of sampling a population for which no suitable frame is available.

To ensure a more even coverage of the population, the systematic samplying technique was used in each of the zones. A one in 40th household was selected for inclusion in the sampling. This gives a 2½% sampling of households. If the members of the 40th household were not in, or did not co-operate with the enumerators, they were instructed to try the 38th or 39th household. Afterwards counting would continue from the 41st household. Thirty trained interviewers were used. A total of 650 questionnaires was administered and 610 was collected (Fig. 1.2).



TYPE OF INTERVIEW	Nº OF QUESTION ADMIN.	Nº COLLECTED	%RESPONSE
HOME	650	610	93·8%
WORKPLACE	318	257	80·8%
TOTAL	968	867	89·5%

R = HOME INTERVIEW SURVEY
W = WORKPLACE INTERVIEW SURVEY
T = TOTAL FOR EACH ZONE

SOURCE : FIELDWORK JAN. 1988.

FIG 1.2 ADMINISTRATION OF QUESTIONAIRE IN ZONES

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(b) Workplaces Interview Survey

The same questionnaire used in the home interview survey was also used for workplaces interview survey. A list of major workplaces was compilled and selection was made by random sampling, by means of random numbers (Appendix II). A 12.5% sampling was employed to select workers from the selected major workplaces, that is, 10 workers out of every 80 workers. What constitutes a major work place in the study is an establishment employing up to 80 workers. The Federal Government guideline is that an establishment employing up to 10 workers should provide housing for her workers. This implies that an establishment employing 10 workers constitute a major workplace. It was thought in this study that 80 workers would have more significant effect on the flows, moreso that the same interview was conducted on the workers home. This is a type of sampling with replacement.

Three hundred and eighteen questionnaire were administered and two hundred and fifty seven questionnaire were collected given an 80.8% response (Fig. 1.2) and (Appendix II).

When the residence/workplace interview survey were combined, it gave a total of 968 questionnaire

and 867 questionnaires were collected giving a response rate of 89.5%.

(c) Road Inventory

Road inventory was carried out on some of the major roads. Informations on the conditions of carriage ways, traffic control devices, widths of roads, availability of bus stops and parking facilities, and road junctions were recorded on prepared sheets.

(d) Traffic Survey

Mannual traffic count was carried out on some major roads in order to determine the volume of traffic passing a road at peak periods for comparison with other variables. The peak hour periods were 7.00-8.00 a.m, 3.15-4.15 p.m, 6-7 p.m in the morning, afternoon and eveningrespectively.

(e) Running and Journey Speed

Journey speed is the distance travelled by a vehicle divided by the total time taken to complete the distance (speed = m/s). The total time includes both the running time - when the vehicle is in motion and the stopping time enroute. Information on journey speed is useful in measuring traffic congestion, the performance of traffic on roads and predicting future traffic behaviour. It is a criteria on which to base decisions regarding the diversion and assignment of traffic to new and improved highway facilities.

Running and journey speed was measured by the registration number method. Observers with synchronised watches were stationed at both ends of the road test section. As the vehicle passes an observer, its registration number and time of passage were recorded. At a later time the registration number was matched and individual vehicle time determined. Knowing the distance over which the vehicle has travelled, the mean running speed of traffic was determined after carrying out such observation.

(f) Delay Studies

Delay studies enables one to pin point locations where conditions are unsatisfactory and reasons of delay. It is also used for road improvement. There are two types of delays: one is fixed delays which is the result of fixed road way conditions and can occur irrespective of the traffic congestion. These include railway crossing, road intersection, roundabout, stop signs, etc. Secondly, operational delays caused by parking and unparking vehicles, pedestrian crossing, turning vehicles, internal friction with traffic streams.

The moving observer method was used for measuring delays. A survey log was prepared. A car was started along a test station with the aid of a stop watch, all locations and times of stopping and starting were noted as well as ancilliary data.

(g) Secondary Sources of Data Collection

These include literature, landuse maps, Makurdi Master Plan, vehicle registration office, Government Statistical records, National Union of Road Transport Workers (NURTW).

1.53 Methods of Data Analysis

The workplace and home interview survey data were analysed by means of percentages, bar graphs, line graphs, and pie charts. In the analysis of work trips, the number of questionnaire on home interview survey and workplaces interview survey were multiplied by their correction factors which were 40 and 8 respectively. Their products were then summed up to get the total work trips for each zone.

The traffic counts were expressed in qualitative terms in passenger car unit (p.c.u). The p.c.u. was calculated based on the assigned weights to different types of vehicles (Table 1.2). A car is assigned a value of one and other vehicles are based on this, hence, other types of vehicles are equivalent to "x" passenger car units.

Table 1.2: Passenger Car Units Equivalents.

Type of Vehicle	Value
Bicycle	0.33
Motorcycle	0.75
Private Car!Taxis	1.00
Minibuse/Pick up Van	2.00
Bus/Trailer/Truck	3.00

Source: Road Research Laboratory (1965).

1.6: STRUCTURE OF THESIS

Chapter one is the background to the study. Chapter two deals with conce pts, models, approaches and factors of journey to work. Chapter three gives a background information on study area.

Chapter four examines the characteristics of journey to work in Makurdi. Forecasts of landuse and worktrip were examined in chapter five.

Chapter six presents physical planning proposal for achieving effective journey to work, while chapter seven deals with the implementation of proposals and conclusion.

CHAPTER TWO

2.00 JOURNEY TO WORK: LITERATURE REVIEW

This chapter attempts to review some of the existing concepts, models, approaches, strategies and factors affecting journey to work. The characteristics of journey to work in developed countries and developing countries will also be compared.

2.10 CONCEPTS USED IN PLANNING FOR JOURNEY TO WORK

Journey to work here refers to the trip made by a worker from his house to his place of work and the reverse trip from work back home after the day's work. A concept refers to a set of ideas derivwd from a set of principles. It is an idea or general notion underlying a set of things.

2.11 Linear Urban Design Concept

New concepts of urban design that help us visualise how existing cities might be redesigned and further urban growth guided to create more satisfactory living environments that are also transportation efficient have been introduced by the planned cities of the world, granted their short comings. The lessons are provided by the successes and failure of British new town of Singapore, Brasilia, Chandigarh, Tema in Ghana and many others (Owen, 1978).

If some of the best features of these planned communities were combined, urban development in the future would result in a rearrangement of housing, services, with neighbourhoods free from the intrusions of traffic, and housing accessible to jobs (Owen, 1978). Mobility is one way of making things accessible, but accessibility can also be achieved by the way things are located and arranged. A series of clustered activities that provide easy access by local transport or pedestrian pathways to nearby employment opportunities seem preferable to a planless urbanization that uses transportation to compensate for disorder (Owen, 1978).

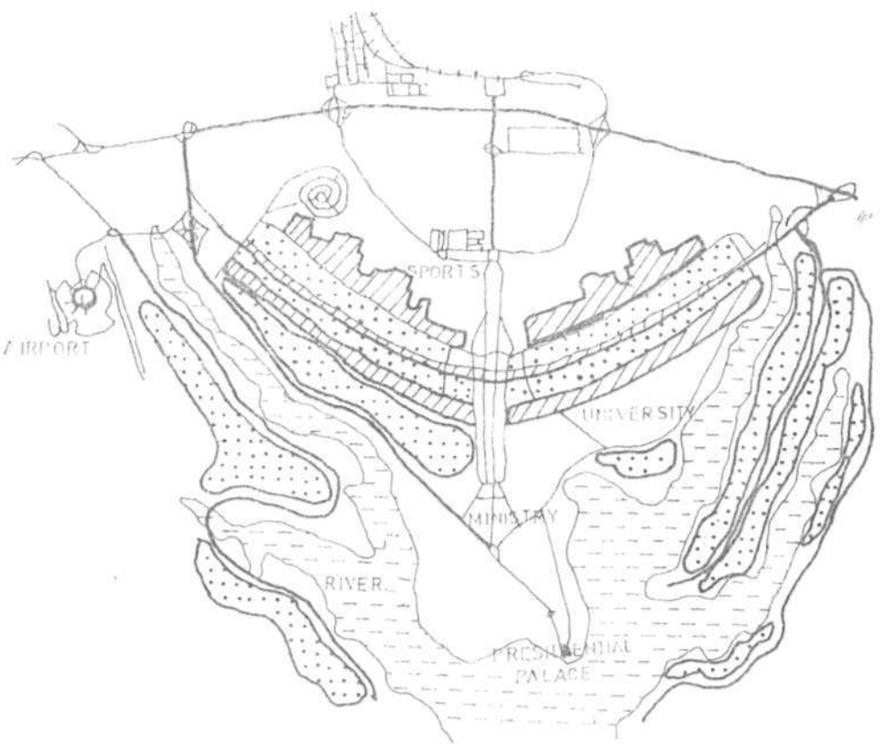
The plan of Jarvafaltet in Sweden is an example. Instead of the usual town centre and clustered neighbourhoods, this Swedish new town is being laid out with a single linear employment and service area seven kilometers long and one kilometer wide (Owen, 1978). Two strips of housing are being built parallel to this employment strip, each about one kilometer wide. It is recognized that housing and workplaces need to be close together, but that it is undesirable to have large industrial plants intruding into housing areas. Housing was therefore insulated from the factory strip, but was made readily accessible to it by a short trip to the linear work area, at which point a shuttle service will provide longitudual travel. Jarvafaltet is also being designed with all bus streets, reserved

buslanès on express ways, and drive through underground utility tunnels (Dergalin, 1973).

This design has been carried out in Maxico's new city of Cuautitlan Izcalli, 25 kilometers from Mexico city. The city is being built in parallel strips of housing, commercial establishments, and industrial development, using the main limited access highway as the major structural component of the linear community (Owen, 1978). The attraction of such a design from the standpoint of transportation is that expansion can take place by extending the development and housing strips, thus avoiding long commutter trips through built-up areas from distant suburbs to a city centre (Owen, 1978).

The plan of Brasilia (Fig. 2.1) also illustrates this linear urban design concept. Lying in the north-south direction is the residential axis about 13 km long. Employment areas were also planned in this linear form. To facilitate a free flow of traffic, there is a central highway of eight lanes, which are fed by access roads from the neighbourhoods and the business district (Benna, 1976). In the planning of circulation system, there was a conscious effort of segregating motorised traffic and pedestrian transit.

The problem of applying this linear urban design concept to urban centres is that, studies have shown (Simon, 1984) that it is not possible to segregate



RESIDENCES

WORKPLACES

ROADS

1 0 1 2KM

SOURCE: BENNA, (1976)

	FIG 2.1	BRASCILIA: AN APPLICATION OF THE LINEAR URBAN DESIGN	AMEH PO M.SC. THESIS 198

landuses in our urban centres because they display a characteristic of mixed landuses. In Nigeria, it is not possible to segregate residential from public or commercial uses.

2.12 City Cluster Principle

Another urban design concept used in planning for journey to work is the city cluster principle of urban design. As an alternative to mass transportation and more radical national solutions of decentralisation of offices, it is urged that serious study be given to the urban design variously known as "cities within cities" or a metropolitan area made up of a cluster of compact, walkable, planned communities of sufficient size to be true cities (400,000-500,000) in developing countries), Curie (1978). The major characteristics of urban cluster design is that each unit in the cluster can be completely planned from the begining in terms of landuse, density, height of buildings, open spaces, shopping areas, workplaces and transport systems. The objectives are walkability and minimising of movement by mixing residences, working areas and facilities all within walking distance or very short bus rides. All that is required is that care be taken to ensure not only a matching of jobs with housing and with shops, schools and recreational facilities, but also matching the type of housing with the anticipated income levels resulting from the job competition (Curie, 1978).

The existing city will be improved by upgrading, renovation and regrouping of activities. The objective should be to make it more difficult and incovenient for the residents of the new cities to commute to work areas outside the cities. The new cities should be distant from the traditional cities. This ensures that it pays people who live there to work there, and people who work there to live there.

Issues in planning cities within cities are that it is of high density. There is no dream of a "house of one's own", or a house standing on its own grounds surrounded by lawns and gardens. Secondly, the houses are rented and not sold. There is also a mixing of income groups to obtain a good social mix (Curie, 1978). In the new city designed in Columbia (Salitre in Bogata), only 8% of the area was devoted to roads and parking areas. The city was deliberately designed in the preliminary work to be both self contained and walkable, having all the attributes of a complete city of 500,000 (playfields, industries, a University) all within a little over 1.61 km from the main commercial centre (Curie, 1978).

The advantages of this design are that peak hour commutting, will be greatly reduced and there will be a great reduction in the urban transport facilities. It is proposed that the new city internal transport needs to be served by a continuous bus way so that all

apartments will be within 152 metres of the line, that only narrow access streets be provided, mainly for commercial vehicle use for deliveries, and that few parking areas be provided and those on the fringes. Since fuel for personal car use will become increasingly expensive, the savings involved in reducing the need for personal car use will become significant. There will be savings in roads and maintenance of roads and parking areas, which have a hidden cost in the competition for scarce space.

If it is feasible to channel future growth of large urban centres into a cluster of compact, walkable cities, the combined future annual savings in transport in comparison with expenditure resulting from expansion of the existing design will be sufficiently large to make possible a significant modification in life styles.

However, the transfer to such a design would be a difficult and costly undertaking for us in Nigeria. The issue of high density will pose a problem of refuse, sewage, etc because of our low level of technology. Also because there is no dream of a house of one's own and houses are sold and not rented shows that it is not workable in Nigeria and is based on the western housing market situation.

2.20 MODELS OF JOURNEY TO WORK

A model is simply a way of expressing significant casual or structural relationship stripped of the irrelevances and complexities of the real world so that they may be more readily understood (Wingo, 1961). Models are of different types; physical models like the globe, conceptual model and mathematic models. A mathematical model is a set of quantitative relationships expressed in the language of mathematics and describing the interraction of phenomena.

2.21 Evolutionary Model of Journey to Work

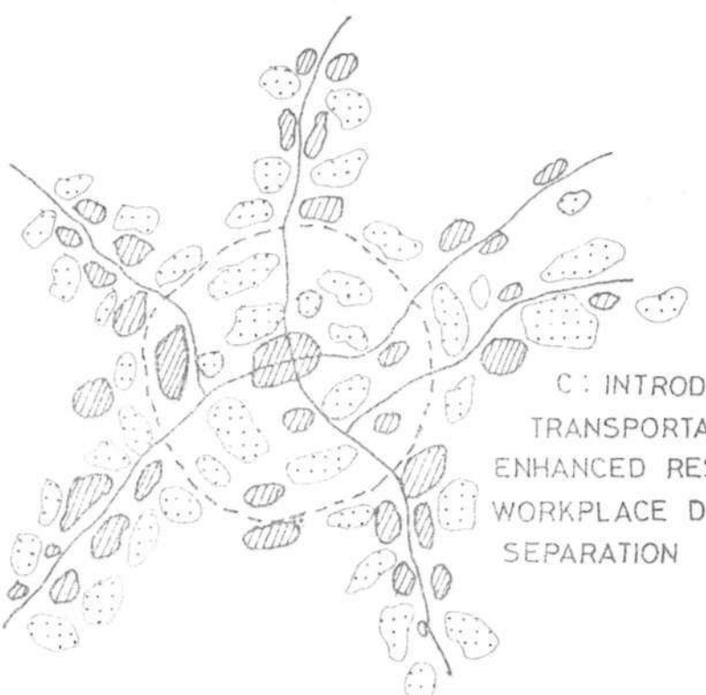
Vance (1960) postulated a sequential model of the changing pattern of employment catchment areas through changes in transportation technology. The relationship between workplaces and residences, according to him, may be explained only in terms of historical development. He postulated an original zone which is an initial site of an urban area (Fig. 2.2). An increase in economic activity at this stage will lead to an increase in the labour force employed until it can no longer be accomodated by the site itself. The community at this stage divides into two distinct zones: a zone in which work is performed or the zone of conflux and another one in which those who perform the work reside or the zone of dispersion (Fig. 2.2b).



A: RESIDENTIAL AREAS & WORKPLACES CONTAINED WITHIN THE INITIAL BOUNDARY



B: THERE IS EXPANSION BEYOND INITIAL BOUNDARY



C: INTRODUCTION OF TRANSPORTATION NETWORK ENHANCED RESIDENCE WORKPLACE DISTANCE SEPARATION

RESIDENTIAL AREA ZONE OF DISPERSION

WORKPLACES ZONE OF CONVERGENCE

INITIAL BOUNDARY

ROADS

SOURCE: VANCE (1960)

	FIG 2.2	EVOLUTIONARY MODEL OF JOURNEY TO WORK	AMEH P O M SC. THESIS 1988

The increasing population itself attracks further industry and commerce which unable to locate at the periphery. This later increases the total employment of the area and provides for secondary zone of conflux at the outer perimeter of the growing urban area (Fig. 2.2b). Vance, (1960), also stated that the changing locations and dimensions of the zones of conflux and dispersion are a function of changing transportation technology (Fig. 2.2c). While in the early stages, workers travelled to work mostly on foot, the introduction of automobile and railway results in expansion of labour catchment areas located beyond walking distances.

This simple evolutionary model of journey to work seems to explain the situation in most of our precolonial urban centres like Ibadan, Kano, Ilorin and Zaria (Fig. 2.4). These cities are characterised by the "dual city" concept. It is the tendency for the development of "cities" side by side usually one had existed for long before the other. The dual city concept is a form of multinuclei model whereby the two centres result from the interraction between two histories of urbanisation, a precolonial and pre-industrial urbanization, and a colonial quasi-industrial urbanization. For example, Zaria City grew up around a Walled City (Birni) about the 11th C. Its growth was due to the transaharan trade route through caravan

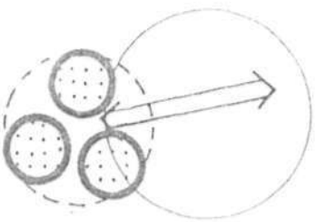
roads from Kano and Katsina to Tripoli. It has an Emir who is an administrative leader. A motor way cuts through the city to the market area, the Emir's Palace and Friday Mosque form the focal points of the city. When the walled city could no longer contain more people, Tudun Wada, Sabon Gari, G.R.A. and Samaru grew up outside the city wall later as workplaces and residential areas for Hausa speaking non-indigenes, strangers from Southern Nigeria, colonial masters and University town respectively.

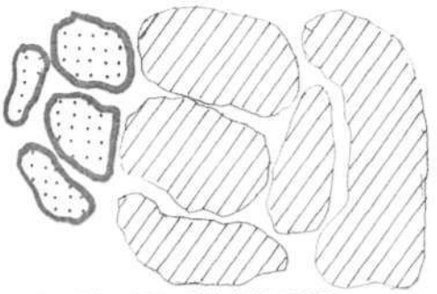
2.22 A Framework for Categorization of Distribution of Work-Living Areas

A simple framework or categorisation of the distribution of homes and workplaces has been put forward by Wolforth, (1965). They are:

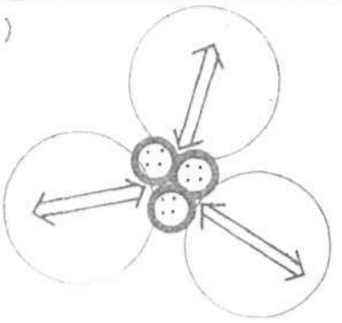
(a) Residences Concentrated, workplaces concentrated in central intermediate or periphery of the city (Fig. 2.3). The settlements with this pattern have in most cases work trips originating and terminating at a very few points. The average distance between residences and workplaces is always the longest. An example of a Nigerian town having this pattern is Sokoto (Fig. 2.4).

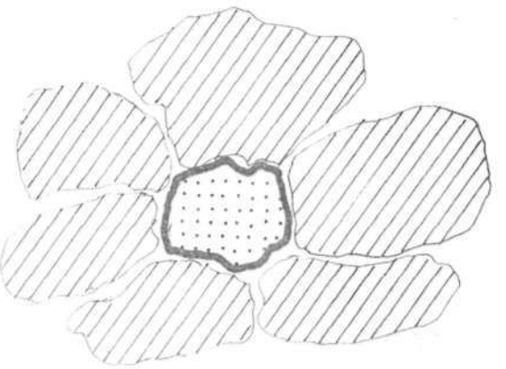
(b) Residences scattered, workplaces concentrated in central, intermediate and peripheral locations (Fig. 2.3). This is a situation where most work trips originate at several points and terminate at a very few points. The average distance between residences



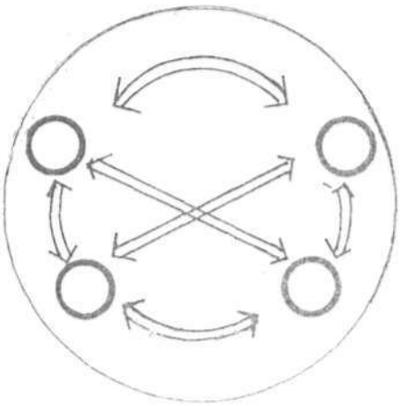


RESIDENCE CONCENTRATED
WORK PLACES CONCENTRATED



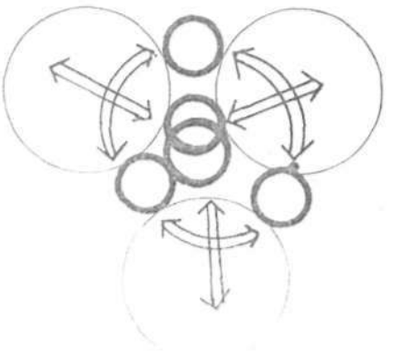


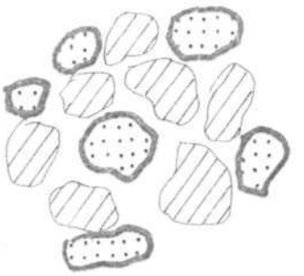
RESIDENCES SCATTERED
WORK PLACES CONCENTRATED





RESIDENCES CONCENTRATED
WORKPLACES SCATTERED





RESIDENCES SCATTERED
WORKPLACES SCATTERED



RESIDENCES



WORKPLACES

WORKTRIPS

Source. WOLFORT (1965)

FIG. 2.3 A FRAMEWORK OF THE DISTRIBUTIONAL PATTERN OF RESIDENCES & WORKPLACES AS REGARDS WORKTRIPS.

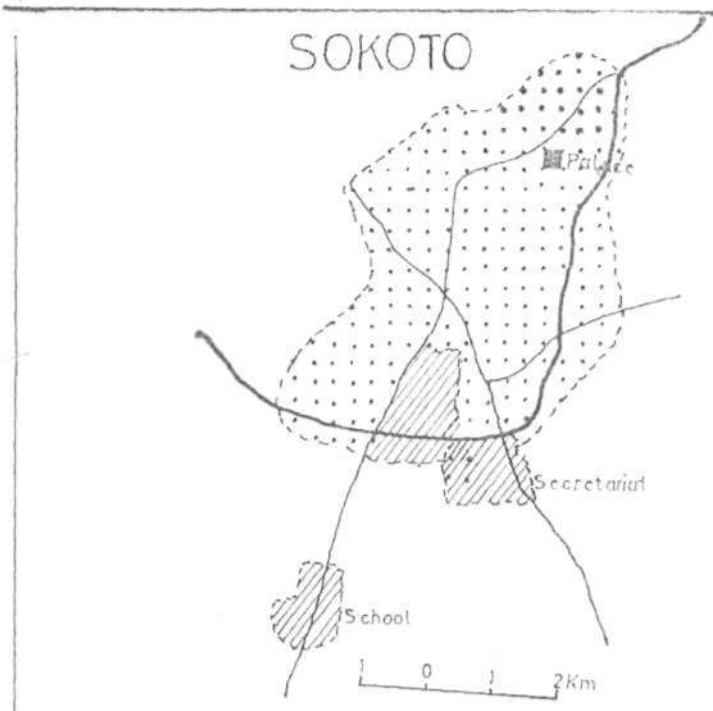
Ameh Paul O.
Dept. of U.R.P.
A.B.U.

and workplaces is always medium (Khanna, 1988). Examples are Universities, Airports or heavy industry which has a peripheral work site location in one zone drawn from wide scattered residences. To use Leipman's (1944) terminology, "it could be said that these represent the strong conflux in a zone of workplaces from a region wide zone of distribution". An example of a Nigerian town having this pattern is Enugu (Fig. 2.4).

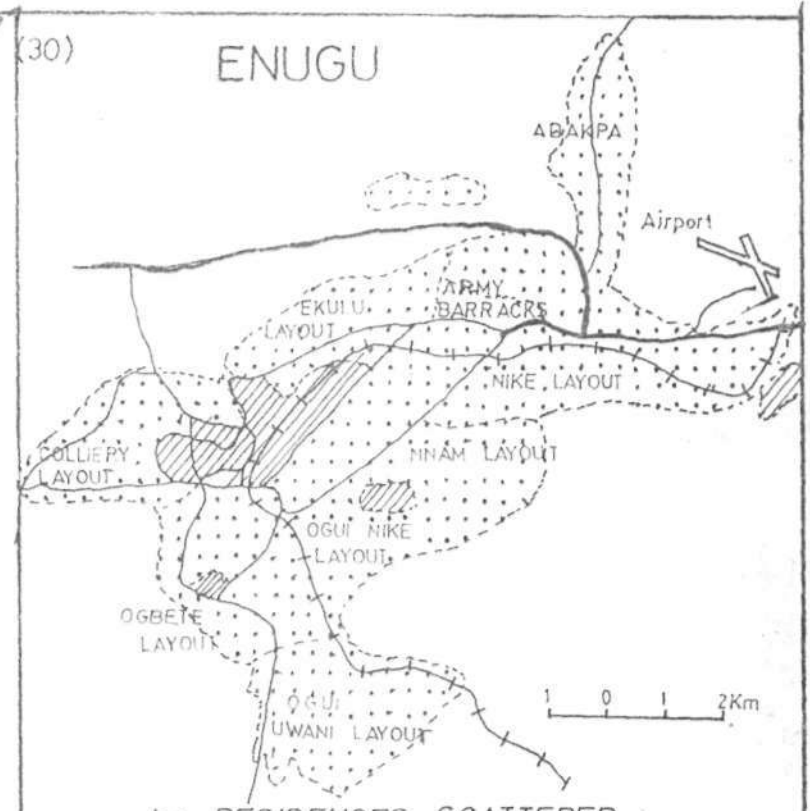
(c) Residences concentrated, workplaces scattered (Fig. 2.3). Where professional classes are residentially concentrated, for instance, their workplaces are fairly scattered. This is characterised by most work trips originating from a very few points and terminating at several points. The average distance between the workplaces and residences is always medium (Khanna, 1988). An example of a Nigerian town having this pattern is Ibadan (Fig. 2.4).

(d) Residences scattered and workplaces scattered (Fig. 2.3). In this case most work trips orginate and terminate at several points. The average distance between residences and workplaces is always the shortest. An example of this type is Zaria (Fig. 2.4).

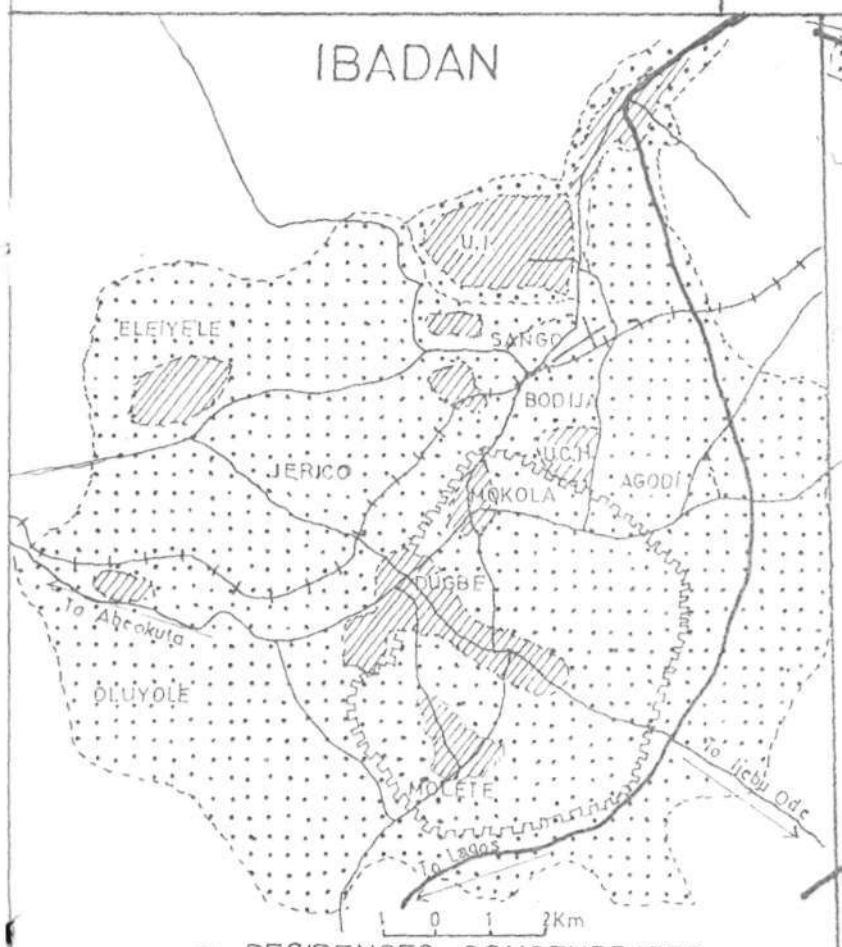
As Eliot (1970) puts it, "mean work-residence seperation will be least when residence and employment both evenly distributed with workers seeking employment at the place of work closest home. On the other hand, mean length of the journey to work is at a



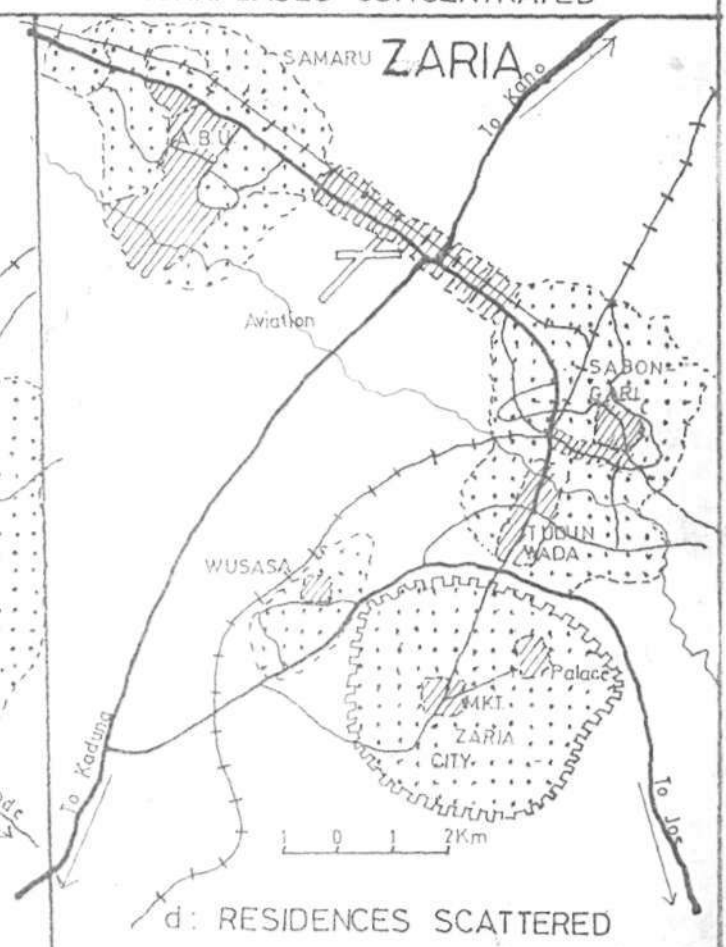
a: RESIDENCES CONCENTRATED
WORKPLACES CONCENTRATED



b: RESIDENCES SCATTERED
WORKPLACES CONCENTRATED



c: RESIDENCES CONCENTRATED
WORKPLACES SCATTERED



d: RESIDENCES SCATTERED
WORKPLACES SCATTERED

RESIDENTIAL AREAS

WORK AREAS

RAILWAY

ROADS

N

FIG. 2.4 DISTRIBUTIONAL PATTERNS OF RESIDENCES AND WORKPLACES IN SOME NIGERIAN URBAN CENTRES

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maximum when employment is concentrated and residence of workers dispersed, of course it would also be at a maximum if the reverse pattern were found".

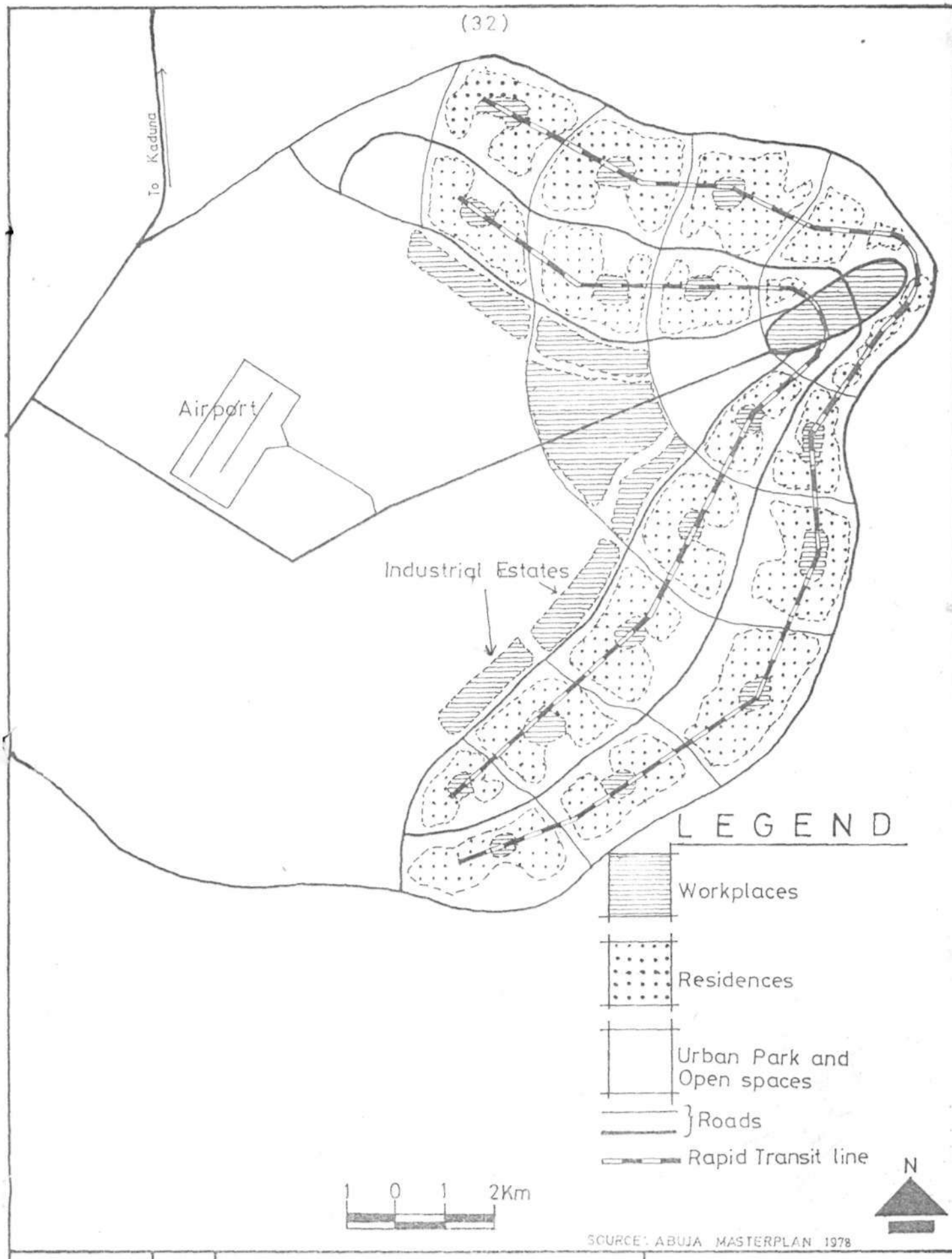
Studies carried out in Ilorin by Amuda (1986), revealed that residences and workplaces were concentrated. In order to solve the problem, he proposed the scattering of residences in the "New Area" where workplaces were concentrated and scattering of workplaces in the "Old Area" were residences were concentrated.

Table 2.1 shows the suggested solutions for the problem of distributional pattern of residences and workplaces in some Nigerian urban centres.

Table 2.1: Suggested Solutions to the Problem Arising from the Distributional Patterns of Residences and Workplaces in some Nigerian Urban Centres.

Pattern	Examples	Average Travelling Distance	Solution
Residence Concentrated, Workplaces concentrated	Sokoto, Maiduguri, Oyo, Badagry, Ilorin.	Langest	Scattering residences and workplaces
Residences Scattered workplaces concentrated	Enugu, Aba, Port-Harcourt, Benin.	Close to medium.	Scattering Workplaces.
Residences concentrated Workplace scattered.	Ibadan, Kaduna.	Medium	Scattering Residences
Residences scattered Workplaces scattered.	Zaria	Shortest	Maintain the pattern

ADAPTED: Source: Khanna, (1988), p. 18.



SOURCE: ABUJA MASTERPLAN 1978

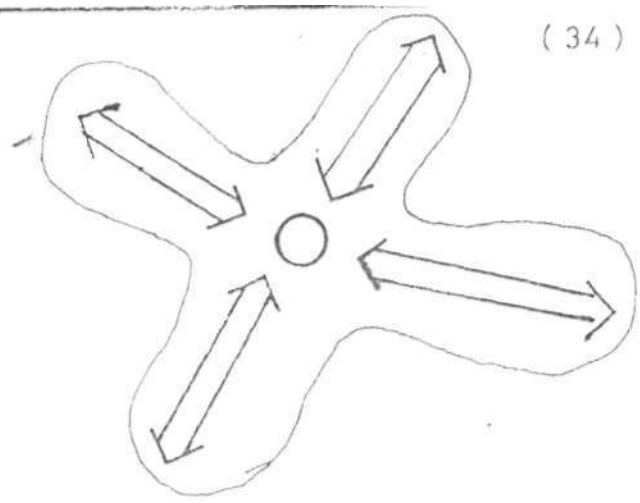
FIG. 2.5 PLAN OF ABUJA: WORKPLACES AND RESIDENCES SCATTERED WITH A MACRO LINEAR CITY - PLAN.

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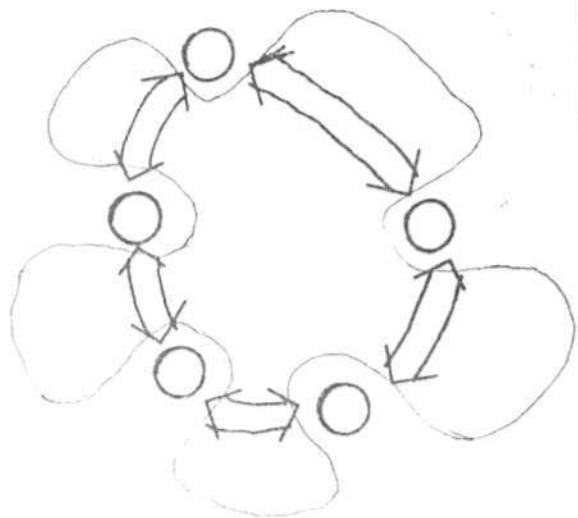
The proposals in Abuja Master Plan was structured to have residences and workplaces scattered in several locations (Fig. 2.5). It must have been the basic idea behind the problem of work trips resulting from the distance separation of residences and workplaces of these different patterns that led to the plan proposal for Abuja. In the plan of Abuja, public service employment was divided between the central area, the sector, district centres and industrial estates on the southern edge of the city (Abuja Master Plan, 1979). The basic strategy employed was to concentrate those public service activities in the central area which require regular and close communication and to decentralise the remainder so as to maximise the ease of accessibility to job from residential sectors and minimise central areacongestion. The decentralisation of the parastatals provides employment opportunities in dispersed locations convenient to employee residences (Abuja Master Plan, 1979). The plan also has dual transit spines forming the core of each development corridor permitting the majority of residents to be within walking distance of public transportation.

2.23 Urban Travel Patterns

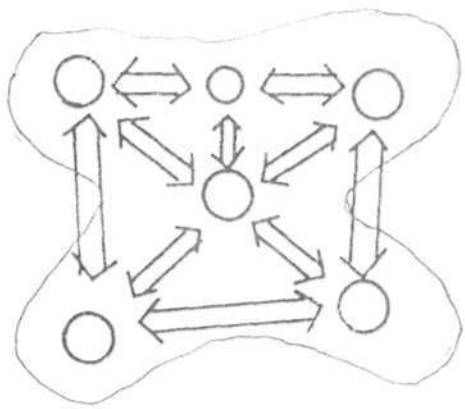
Urban travel demand patterns were classified by Hutchinson, (1974) into the following broad categories (Fig. 2.6).



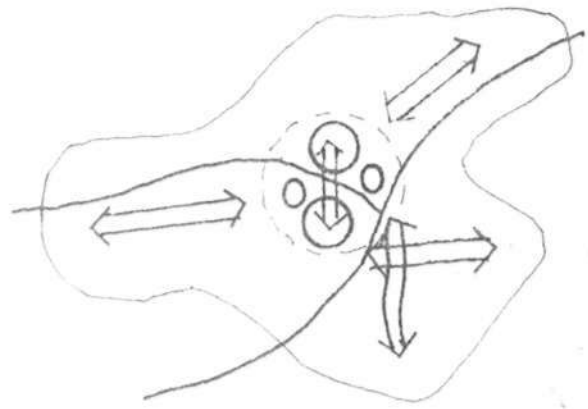
TYPE 1 RADIAL TRAVEL



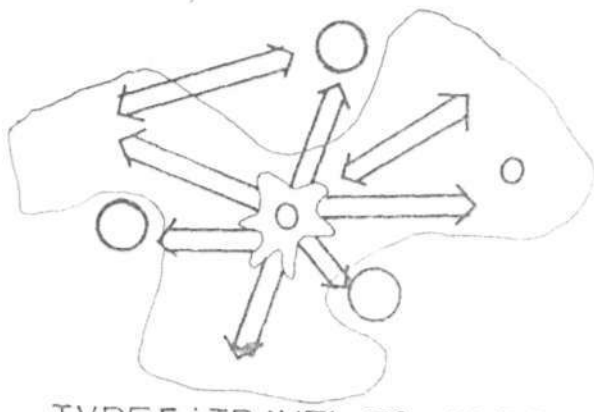
TYPE 2: CIRCUMFERENTIAL TRAVEL



TYPE 3: WITHIN RESIDENTIAL AREAS TRAVEL



TYPE 4: C.B.D. AREA TRAVEL



TYPE 5: TRAVEL TO OUTSIDE AREA ACTIVITY CONC

LEGEND

- Urban area
- Activity areas
- Travel patterns

SOURCE: KHANNA (1988)

FIG 2.6 URBAN TRAVEL DEMAND PATTERNS

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Type I is radial travel along corridors focussed on the Central Business District (C.B.D.). It is characterised by high intensity along definite corridors with concentrated peak movements. This needs high capacity system to provide the service. (Khanna, 1988).

Type II is the circumferential travel type between activities located in the suburbs of cities. This highlights the increasing trends due to the shift of work and residential areas away from traditional central areas and it needs low capacity systems to provide the service, (Khanna, 1988).

Type III is travel within residential areas. This type of travel might be between local area activities or longer trips within an urban area. This calls for careful attention to safety and environmental quality (Khanna, 1988).

Type IV is travel within the CBD. This travel might be between activities within the central area or to and from the terminals of regional transport facilities, focussed on the central area. It is characterised by high intensity, all day duration, for all purposes and of short trip lengths including walking which is a pre-dominant mode. It is the result when transport capacity is minimum and network is obselete.

Type V is travel to and from major activity concentrations not located within the central areas such as airports, Universities and recreational areas.

This classification of travel enables better understanding of the needs and appropriate matching of modal system, (Khanna, 1988).

2.24 Landuse and Transportation Model

Wingo, (1961) developed a model of landuse and transportation and concerned himself with the cost and programming of transportation in a city. The model provides the following:

The concept of transport demand based on characteristicsof the labour force and of the journey to work; a systematic general description of the transport functions; a general transport cost functions; a system of location rents which results from the transport cost function; and the manner in which a household demands space and the way in which supply is equated to demand (Moha, 1979).

We shall describe in some detail the derivation of the transport cost function since it forms the core of the model and takes into account the complexities of transport.

Wingo assumed the journey to work to be the most important transportation function and proceeded to analyse its cost. He observed that the journey to work is both spatially and temporarily concentrated; consequently, these peaks in demand results in saturation of a given capacity. Other demands on the transportation system can be excluded and the journey to work analysed.

The costs can be broken into two components: the time costs incurred and the actual transportation costs. Both involve a prior characterization of technology of the urban transportation system. To simplify his analysis he assumed that travellers and carriers are homogenous, in his case, the automobile (Mohan, 1979).

The calculation of time in the journey to work is done by the function

$$T = T(u, v, n, c), \quad (1)$$

where, u is distance travelled, v is velocity; n is number of workers; and c is a measure of capacity of the transport system (Wingo, 1961). Time is cost when demand (n) exceeds capacity (c). If t_n is defined as the time loss to the n^{th} unit entering the transport system at peak time,

then: $t_n = \frac{n-1}{c}$ (2) and

$$t = n\,\frac{(n-1)}{2c} \quad (3)$$

is time lost to all units in queue.

This is proportional to the square of demand.

Capacity of a system is also determined technologically:

$c = c(v, v^{\beta}, \ell_v)$, where

ℓ_v is the length of the carrier,

β is approx 2 - 2.5 for automobiles the exact specification of the function clearly depends on the mode of transport used, the condition of the roads, and so forth (Mohan, 1979).

The value of time spent on journey to work is derived from the marginal value of leisure function: the supply function of labor. Although a worker is paid according to time spent at work, Wingo argued that the wage rate subsumes the time costs of the journey to work.

In figure 2.7, OP is the time spent at work and PQ is the journey to work. The worker needs to be compensated for OQ hours at hourly wage QJ. He gets paid, however, for OP hours only, hence his actual wage rate may be PH (that is W_2) to give him the same income. His purse wage is then W, and $W_1 W_2$ is compensation for time spent in travelling. $W_1 KHW_2$ provides a measure of the value of the time spent on the journey to work.

The actual transport cost (money cost) have 2 components: those which vary according to distance travelled, and those which vary according to the number of trips made. The sum of these plus the time cost yields the total cost of transport for an individual.

The rest of Wingo's model states that, all workers are paid the same wages so the differences in transport cost incurred by each account for the differences in land rental. Land near the centre of the city commands a higher rent, the difference being equivalent to the excess transport incurred in living at a distance from the centre. A household's demand

for land depends on the rental value of land; the elasticity of demand is constant. Wingo's condition for locational equilibrium is that the saving in transport cost is equal to the increase in outlay on residential land.

Wingo's model has been subject to criticism because it is based on the American urban experience and might not be applicable to developing countries. This is because of the history of urbanization in Nigeria. They exist within a value system that respects the preservation of cultural features such as the centrally located Emir's Palace whose central location are not based on capitalist landuse monopoly.

The valuation of transport costs involves knowledge of the technological relations of the particular transport system and of the workings of the labour market. While the assumptions about homogeneity of carriers and travellers are justified at this level of abstraction for developed countries, they are not so for the developing countries. The modes of transport in the latter are far more mixed, from walking to bicycles to trains.

Wingo made the point that valuing time with money implies fungibility, and this is only valid for markets that are operating well. If time and money are not exchangeable, a person may behave as though the scarcity of his time or his money were governing his behaviour. Money and time constraints are probably

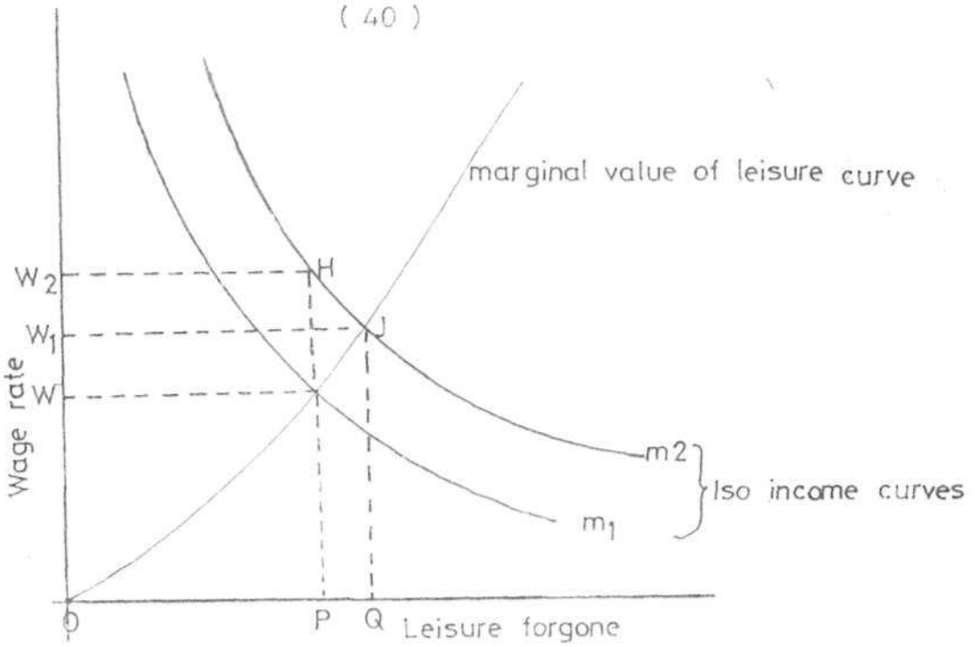


FIG2.7.VALUING TIME SPENT ON THE JOURNEY TO WORK

SOURCE: WINGO

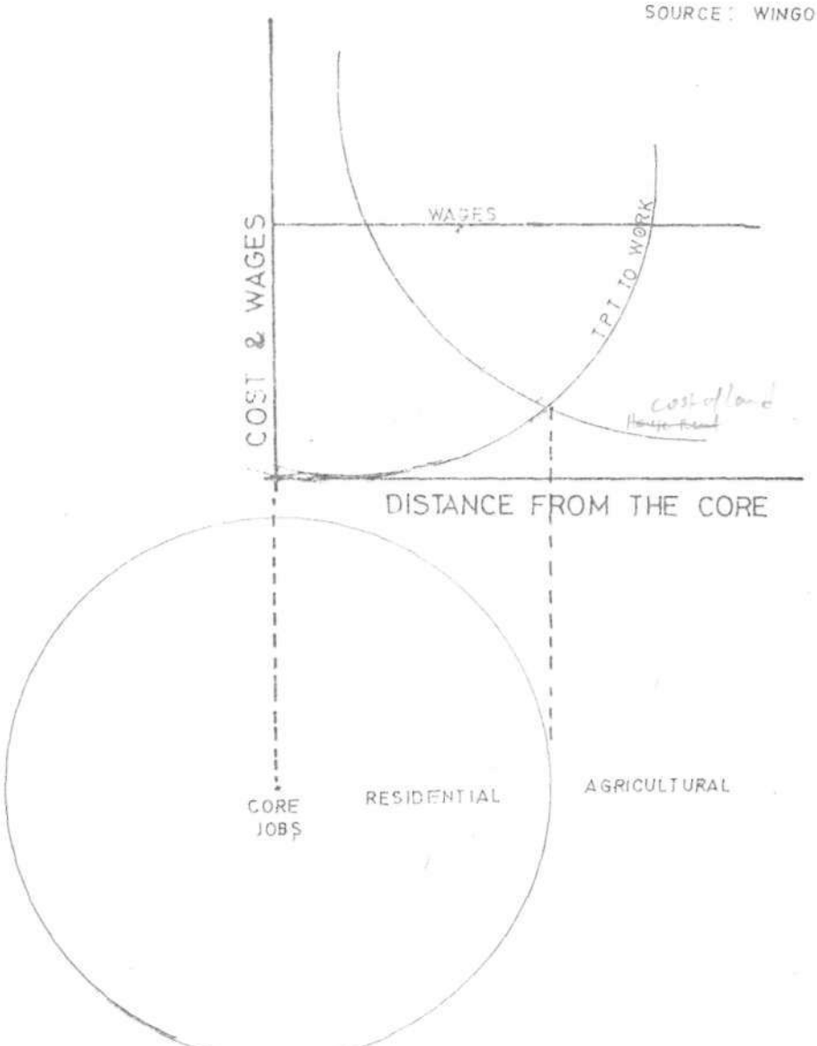


FIG2.8 DISTANCE & COST IN A CORE DOMINATED CITY

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distributed among the population in accordance with income levels. Money is more likely to be the binding constraints for low income groups; time, for upper income groups. Such a consideration can go along way towards the explanation of location patterns in cities of developing countries.

2.30 APPROACHES AND STRATEGIES USED IN PLANNING FOR JOURNEY TO WORK.

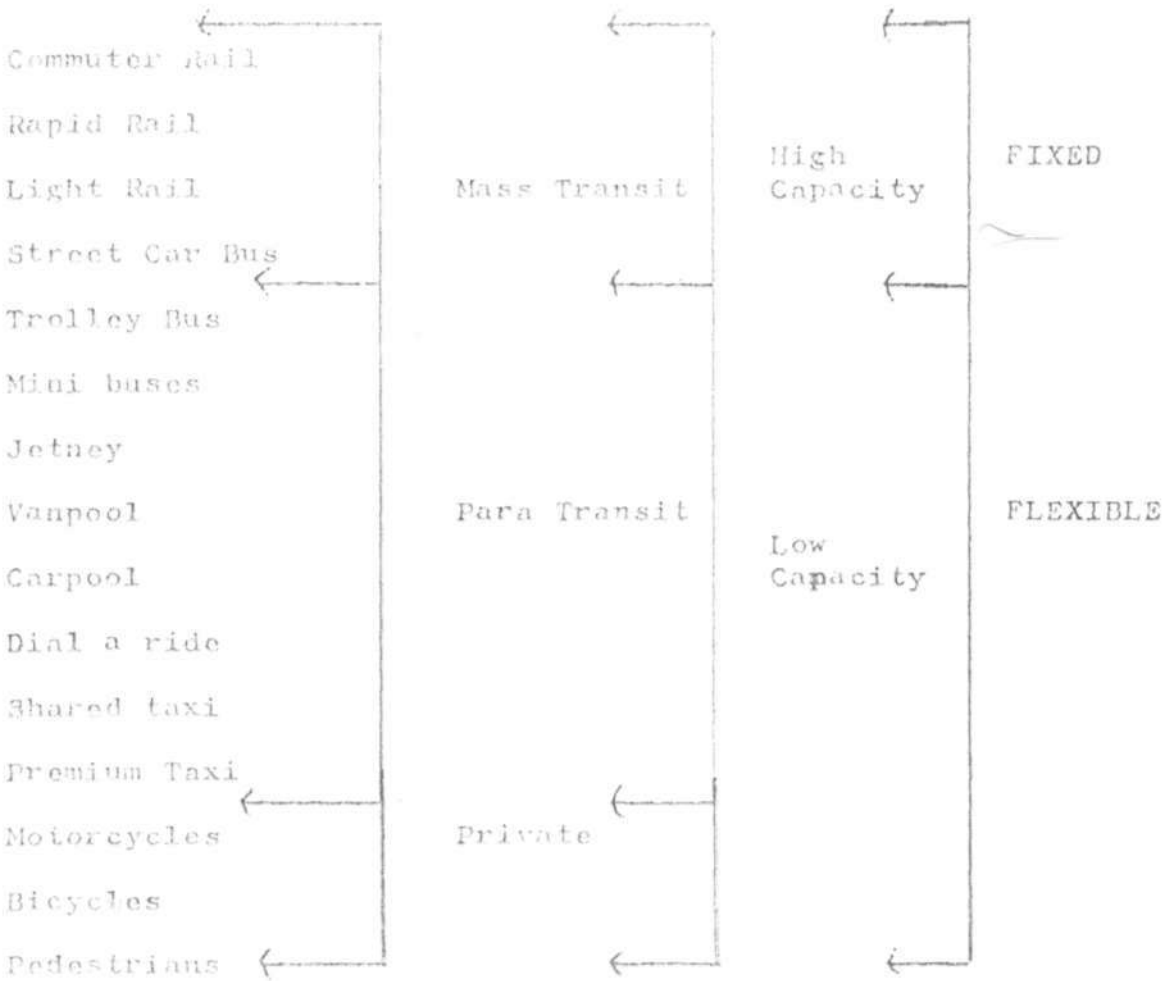
Any study of the problems of journey to work has to take into account the distribution of the population in relation to the distribution of employment centres. This is with the view to finding out how much their distribution and relationship contribute to the problems of journey to work. Studies in Karachi (Pakistan) indicates on a smaller scale how planned community growth can serve to minimise local transportation problem. There, a growth plan financed through the United Nations Development Programme has recommended the creation of a series of "metrovilles" or compact communities of 40,000 to 50,000 people, focussing on self-help housing and on public programmes and of street systems, close by schools, clinics, markets and bus depot and light industry capable of employing large volumes of local labour (Owen, 1978). The growth strategy creates an orderly growth process designed to conserve resources, avoid unnecessary transportation, and reduce the distances between homes and workplaces.

— Landuse and transportation planning approach could be used for analysis of movement and landuse. Since different landuses generate or attract different and variable traffic flow. Techniques should be applied to develop alternative landuse plans, to estimate the future pattern of movement associated with the landuse plans, develop and evaluate alternative network proposals. The hustle and bustle characteristic of a city has to be systematised. Information is needed on the origin pattern, traffic variability at different times, and, as a result, the importance of the journey to work. It is important to find out from the population how much travelling costs, time, inconveniences an employee suffers in journey to work. It is a fundamental aim of planning to provide most people with the opportunity to live reasonably close to their place of work, in the interest of personal convenience and economy and in order to relieve urban congestion (Keeble, 1969). There will always be cases of people living at zone (A) and working at zone (B) while others work at similar jobs at zone (A) and live at zone (B). Nevertheless, it is essential that sufficient information should be available to ensure that development proposals, both of residential and work areas, shall not inevitably bring about crazy, general post, cross-town journeys to work for substantial numbers of people. The method used for collecting the necessary information is from

the Ministry of Labour or from employees. A map is prepared showing the total number of workers employed in each community, subdivided into different kinds of employment. Where important changes in employment structure appear feasible in pursuance of planning policy or inevitable in the light of economic exigencies, such additional surveys may, however, be of great importance in helping to redistribute employment with as little upset as possible (Keeble, 1969).

Another approach is to study and plan the transportation modes in a town. Attention is paid to the types of mass transit systems. Urban transportation includes a large family of modes of different characteristics and compactibility. These modes offer a spectrum of transport services ranging from the highly flexible service of taxis and motorcycles to a rigid fixed route, fixed schedule service of rail rapid transit system. These have been categorised in Table 2.2

Table 2.2: Urban Transportation System



Source: Hutchinson, (1974).

A prerequisite to considering transit options for a city is a review of the existing systems to determine both their deficiencies and their potentials for improvement.

Whether or not new rail rapid - transit systems offer solutions commensurate with the costs is a question still unresolved for cities in developing countries (Owen, 1978). On the positive side, the speed, comfort and safety of new subway facilities are

impressive, and they permit greater efficiency of movement for considerable numbers of people under high density conditions (Owen, 1978). The reasons given for doubts about rapid transit include its initial cost, its often unnecessarily high capacity, the inflexible nature of its fixed locations, the fear of early obsolescence, the relatively limited percentage of total urban trips accomodated, and the fact that low income families are generally unable to afford rapid transit (Owen, 1978). Fares on rapid transit systems are likely to be higher than bus fares, and for short trips typical of travel needs in the inner city the bus is likely to provide a better service (Owen, 1978).

The equipment for bus system is relatively the easiest and simplest to procure, operate and maintain of all the other mass transit systems (Okpala, 1977). It carries more people at a time than cars.

Para transit like mini buses, taxis motorcycles serves those travel needs that a mass transit system cannot effectively meet (Khanna, 1988).

As a strategy for minimising traffic congestion during the journey to work in urban centres in Britain, offices were decentralised and relocated at the surburbs (Daniels, 1973). On the average, each employee was saving at least an hour of "working" time every day. This led to the conclusion that time savings were valuable and strongly justified the move from London (Daniels, 1973). But at the lowest level

of local physical planning, the impact of decentralised offices were negative. Apart from the increased demand for housing, education and shopping facilites, additional traffic is generated (Daniels, 1973).

Another strategy is the application of constraints to the use of private cars through the purse strings. This is because, no mode can compete with the private car due to its comfort, convenience, and flexibility. The purse strings is done by imposing charges (Parking, etc) on the use of the car rather than on "car ownership". In that case, if a person owns a car but does not use it on the road during the working day traffic rush hours, such a person would not be subject to these charges. In its extreme form, "The Robin Hood Principle" can be used to reduce number of cars during rush hours. "The Robin Hood Principle" says, let him drive and park his car, "tax him heavy" and with the proceeds from such taxes and charges, build-up a mass transit fund with which to build-up the level of service of the mass-transit modes (Okpala, 1977). This is to "rob" car users and with the "loot" subsidise mass transit users.

Other low cost remedies for traffic congestion include the banning of automobile traffic in limited areas of the city and the dedication of the streets to

pedestrians and transit vehicles. There is also the avoidance system, such as designing urban activity systems that reduce the need for vehicle movement (Thompson, 1972).

One of the strategies used in Lagos was the Flyover system. As a Federal Capital, Lagos exerted full gravitational pull on all parts of the Federation in the early 1970s which led to traffic congestion. In 1973, the government constructed flyovers to accomodate the increased capacity (Shodiyan, 1987). The effect was that no sooner than the flyover were constructed than they were strained to their limit.

The second strategy used in Lagos in 1975 was to legislate for the use of odd and even number plate cars on alternate days in order to curtail the problem (Shodiyan, 1987). But many people have more than one car and could buy extra number plates for their cars. Traffic situation in Lagos could be lessened by catering for public transport vehicles, the needs of pedestrians and cyclists instead.

Other strategies to be used include diverting motorists making "thorough journeys" to ring roads to avoid city centres. Traffic patterns at central business district should be radial. Some streets could be designated one way streets.

In the developed countries, there is staggering of working hours or shifting system. This reduces the peak hour volume of traffic by redistributing it over a longer period of the day.

2.40 FACTORS AFFECTING JOURNEY TO WORK

Factors like residential location, choice of travel mode and socio-economic status of workers affect journey to work.

2.41 Transport Cost and Residential Location

It is generally believed that work trips are determined by residential choice among workers. Caroll, (1952) suggested that the costs incurred in this work travel are major determinants of residential location, and that therefore most workers attempt to minimise the length of the journey to work. In his study of factory workers, Caroll came to conclusion that most of them live close to work and that beyond 2 or 3 kilometres, the proportion of workers decreases as the distance from the factory increases. Some of the causal factors involved in this observed pattern according to him are costs, time, chances of hearing of job openings, and location of rental housing.

This relationship of transport cost and residential location has been illustrated by Shreiber (1976) as shown in Fig. 2.8. The wage curve is horizontal (wages do not vary with distance). The transportation to work cost curve is upward sloping as distance from the core increases. The compensating savings in cost of residing further from the core, (otherwise, the houses of workers would all have been closely clustered near the core) is that the price of land decreased

with distance from the core. Workers would pay more for land for their housing closer to the core, because they incurred lower transportation to work costs. Therefore, the land cost curve is downward sloping as distance from the core increases. The key idea in these models is that there exists a relationship between land values and travel cost. If there is a single employment centre and if housing units each occupy the same amount of land, a commuter has the choice of living closer to his job and paying more for rent or living farther out and paying more for transportation and less for rent.

This model is based on the character of the United States Housing Market for such a transplantation to developing countries. The model assumes a monocentric city where workplaces are concentrated at the centre. It has not been able to tackle the problem of multiple workplaces. However, it gives us an idea of residential choice of workers as being determined by journey to work. Most recent work indicates that residential choice locations is in fact an oversimplified explanation, and that many factors, sociological and economic, enter into the work journey decision. The most important thing is that workers tend to minimise the distance between their residences and workplaces.

2.42 Modal Choice

The cost of the workers' final choice of mode in time, comfort, convenience, and money will depend on how much residential space he consumes and what levels and types of transit services are available at home and work (Meyer, 1963). The mode of travel used by employees for the daily journey to work affects the characteristics of trip time and trip length (Daniels, 1973). Trips by private transport, with the exception of trips on foot are generally faster per unit of distance than public transport, particularly buses, because of the waiting times and stopping times in the journey to work. Given these differences in travel mode choice and related trip efficiency, it becomes clear that travel mode has an important influence on travel time. Conversely, trip length influences choice of travel mode in that most of the longer work trips must be made by private transport becuase a viable public transport alternative does not exist in most instances (Daniels, 1973).

2.43 Socio-Economic Status of Workers

Office jobs performed by an individual employee will be reflected in his earnings and this, in turn, will determine how much time and how far he can afford to travel to work. Higher income groups normally have longer trip lengths than lower income groups. The high status occupation group command high incomes and this permits a wider choice of residential location as well as the ability to accomodate higher commutting costs.

Several authors have tested the hypothesis that commuting distance increases as occupational status rises, but the results of these studies range from acceptance through no meaningful relationship to an inverse relationship (Wheeler, 1967). These mixed findings have led more than one investigator to conclude that work trips behaviour is individualistic and varies with time and place. Peterson (1961), concludes: "The one general conclusion that can be drawn from previous studies is that commutting patterns are highly unique and vary widely from place to place and from time to time".

Nevertheless, the growing number of major metropolitan transportation studies has added considerable evidence that those in the high status occupations generally travel farther to work than those in low status categories.

2.44 Characteristics of Journey to Work in the Developed and Developing Countries (Nigeria) Compared

In most European and American monocentric towns, the lower income groups generally reside in the older, poorer quality housing close to the C.B.D or industrial and commercial area. This choice of location within a free market system is largely a function of rental costs and increasing transport costs with distance from workplace.

In most developing countries (Nigeria), the reverse is the case, for the general tendency is for

the poorest section of the population to be faced with an ever longer journey to work which he can ill afford

The developed countries have efficient mass transit system especially the rail system. The capacity of these modes of transportation makes it possible for workers to move over long distances within a very short period of time and provides flexibility of residential location. New York for instance, is an urban centre with a highly centralised urban economy. More than one third of the workers in the metropolitan region find their living in Manhattan (Daniels, 1973). The modes also operate at reasonable fares in these developed countries.

Buses, mini buses, taxis, private cars, motorcycles, bicycles, foot, railway and ferry to some extent in Lagos, are the most popular modes of transport in journey to work in most developing countries. Evidence from Delhi shows that, excluding walking, 42% of the commutters used bicycles and about 37% use public transport. At least 35% of the work trips were walking trips for people with low incomes as against 25% for middle income people (Sarna, 1975). In Nigeria, motorcycles have become a popular means of transport in journey to work in Makurdi, Zaria, etc. Journey to work in many Nigerian urban centres is characterised by long duration. For instance, in Makurdi, some workers have to change from one mode (mini buses) to another (motorcycles) before getting

to their workplaces. The modes operate at high fares relative to the income of workers.

Cities in the developed countries experience transport problems like heavy traffic congestion during peak hours. Most Nigerian urban centres have poor road networks, non-vehicular segregation, inadequate spacing of bus stops, road intersections (vehicular conflicts) and parking problems. This results in long period of vehicular congestion and timewasted in journey to work.

Analysis of cities in developing countries is therefore more complex than western cities because of the coexistence of different kinds and level of technology (Mohan, 1979). Analysis of transport system in western cities, needs to consider a limited number of modes that should be modelled. There is coexistence of different levels of technology in cities of developing countries. This makes the demand structure of the rich quantitatively different from that of the poor in a manner more pronounced than that in European cities at similar levels of incomes, example, bicycle and aeroplane. The coexistence of low incomes and high technology produces great problems for the model builder in this area.

CHAPTER THREE

3.00 THE STUDY AREA

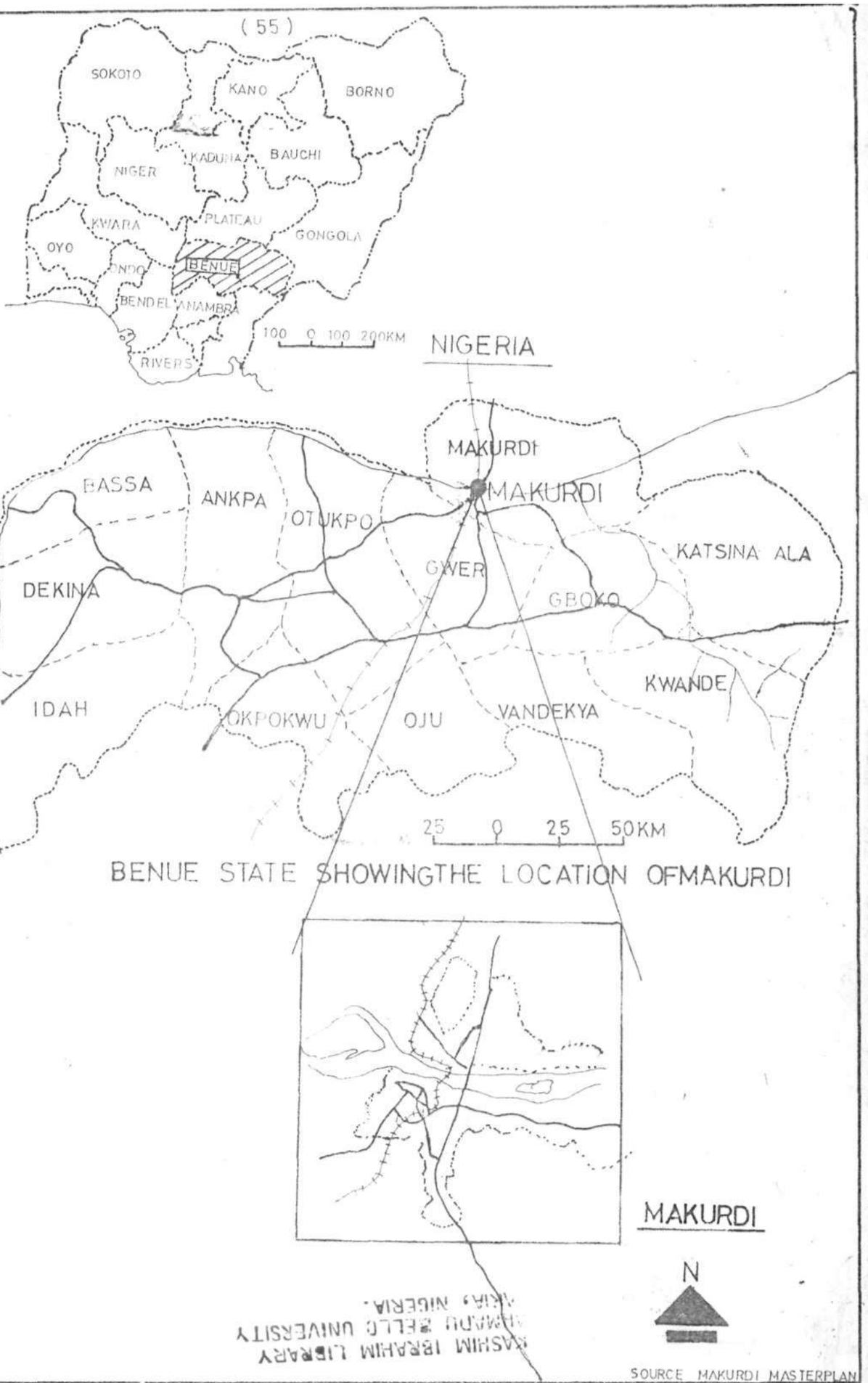
3.10 GEOGRAPHICAL LOCATION

Makurdi is located on latitude 07° 44" N and longitude 08° 32' E. It is the capital of Benue State, which is bounded in the North by Plateau State, in the South by Anambra and Cross Rivers, in the East by Gongola State and Cameroun Republic, in the West by Kwara and Bendel States (Fig. 3.1).

The original settlement was known as Lobi. The construction of railway line and bridge in 1927 led to the change in name to Makurdi and the transfer of the headquarters of the former Benue Province from Abinsi to Makurdi.

3.20 PHYSICAL FEATURES

Makurdi is drained by a number of streams like Demekpe, Urudu, etc. The River Benue divides the town into two. The whole region slopes towards the river according to the direction of the tributaries. The southern area is generally undulating with some low hills. In the north east region, hills rise up to 600m (Makurdi Master Plan, 1978). The town lies within the lowland area and is made up of sedimentary rocks. Makurdi belongs to the lower Benue valley. Very thick marine, dark, grey shales, silt stone and subordinate limestones were deposited in the middle/lower cretaceous/age (Makurdi Master Plan, 1978).



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FIG. 3.1 MAKURDI: NATIONAL & BENUE SETTING

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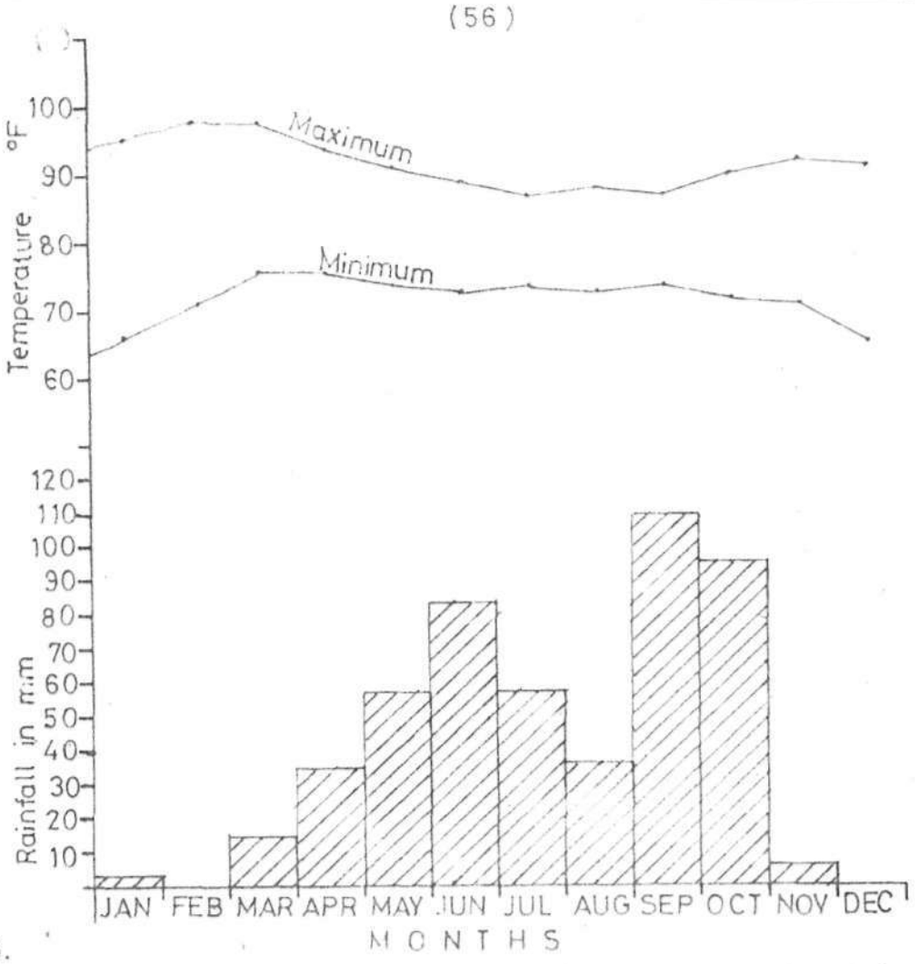


FIG. 3.2. MEAN TEMPERATURE AND RAINFALL GRAPH, MAKURDI, 1977-87

SOURCE: MET. OF AGRIC, MAKURDI.

MONTHS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
MAX.	80	74	82	88	92	94	94	94	95	95	94	90
MIN.	29	28	41	53	62	67	69	71	69	65	50	51

TABLE 3.1. PERCENTAGE RELATIVE HUMIDITY, MAKURDI

MAKURDI CLIMATIC CHARACTERISTICS

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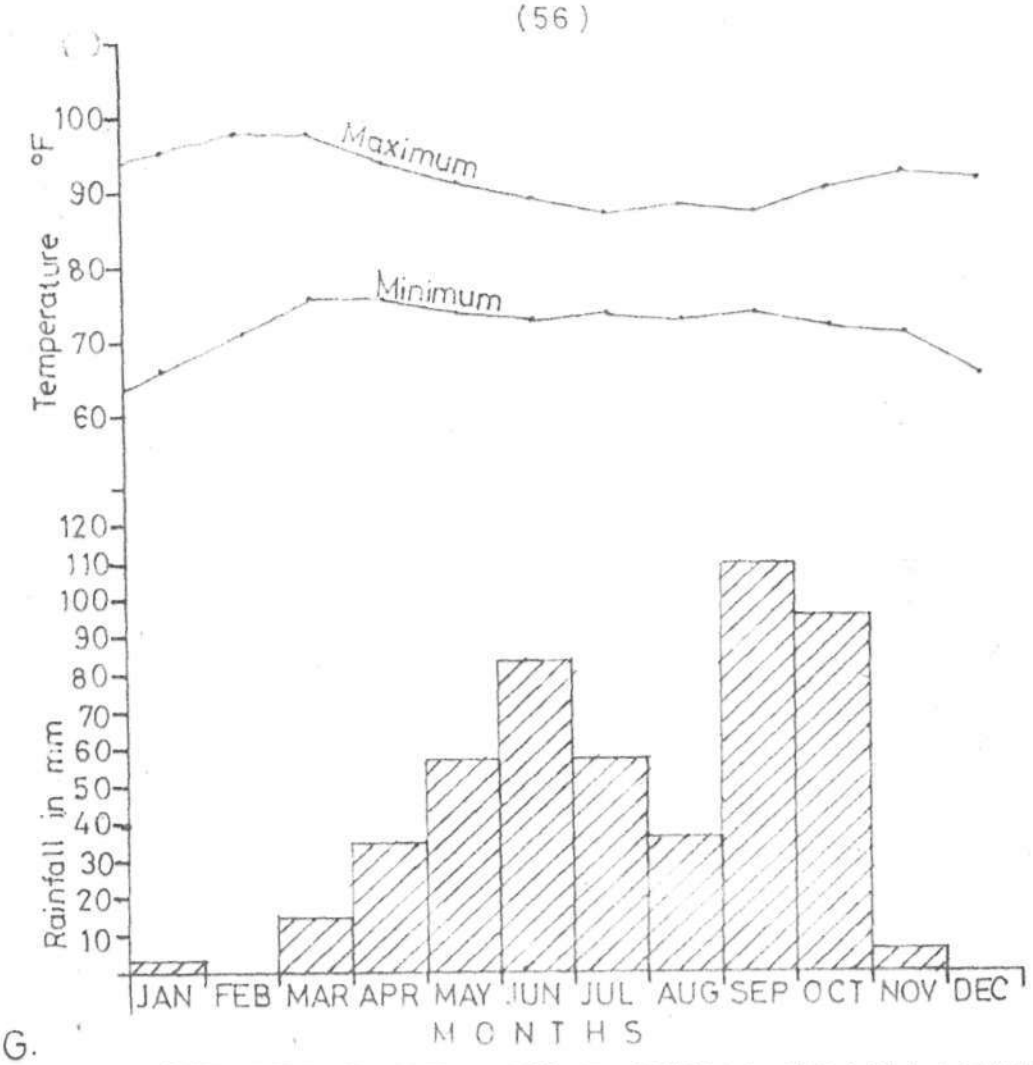


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TABLE 3.1. PERCENTAGE RELATIVE HUMIDITY, MAKURDI

MAKURDI CLIMATIC CHARACTERISTICS

AMEH PO
M SC. THESIS 1988

3.30 CLIMATE AND VEGETATION

Makurdi lies within the hot, humid climatic zone. Mean monthly temperatures are high, varying from 77°F in December to 86°F in March. Days are generally hot during the dry season with temperatures ranging from 91°F in November to 97°F in April to 88°F in October. Mean annual rainfall is about 1,377mm. The rainfall is particularly heavy and lasts for about 7-8 months with a peak in September (Fig. 3.2).

Relative humidity is generally high, rising up to 95% in the month of September and October (Table 3.1). The town experiences low wind speed, about 7.5m/sec., although with occassional storms of the speed of up to 30m/sec.

High humidity and high temperatures impedes heat loss from the body by evaporative cooling thus making the weather unbearable and uncomfortable for most parts of the year. Low wind speed reduces chances of effective cooling by evaporation. There is therefore the need for provision of public transport system which allows enough ventilation.

3.40 DEMOGRAPHIC CHARACTERISTICS

Makurid's population was estimated to be 53,967 by 1963 population census. The present population estimates has been based on the 1963

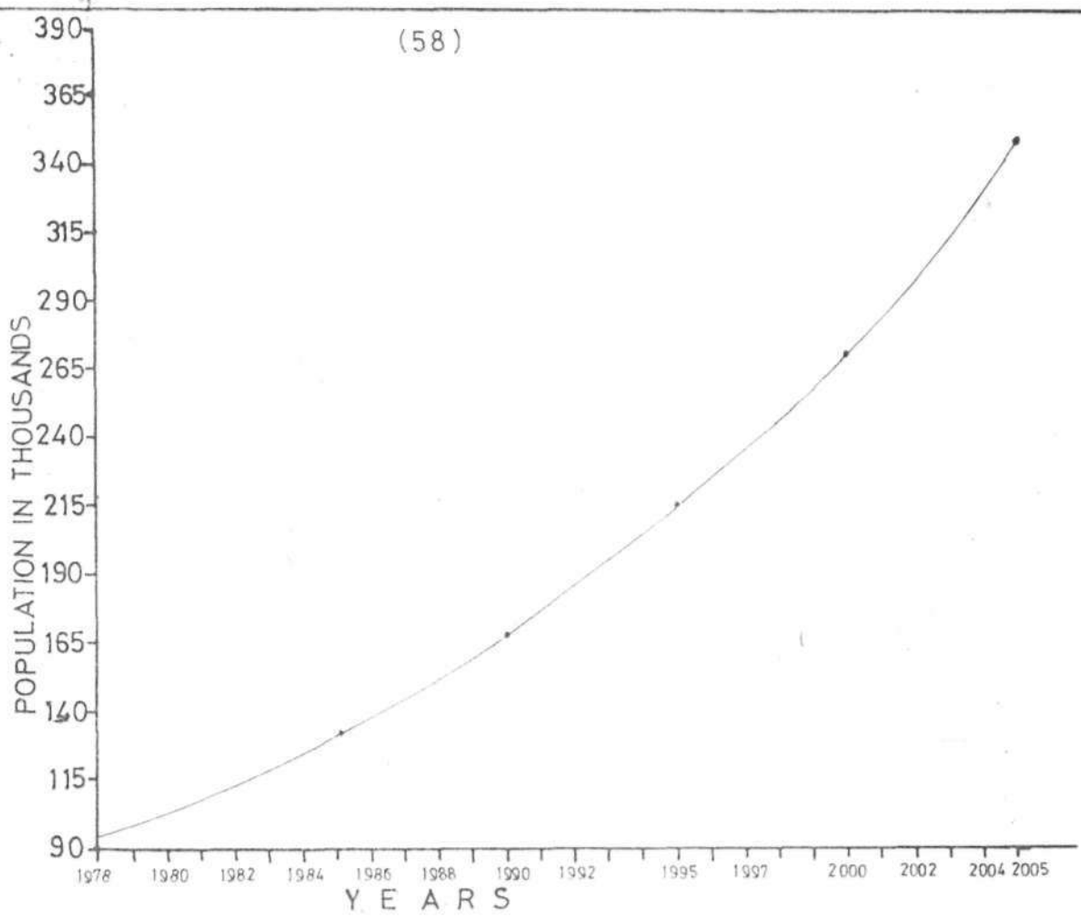


FIG3.3 MAKURDI POPULATION PROJECTION

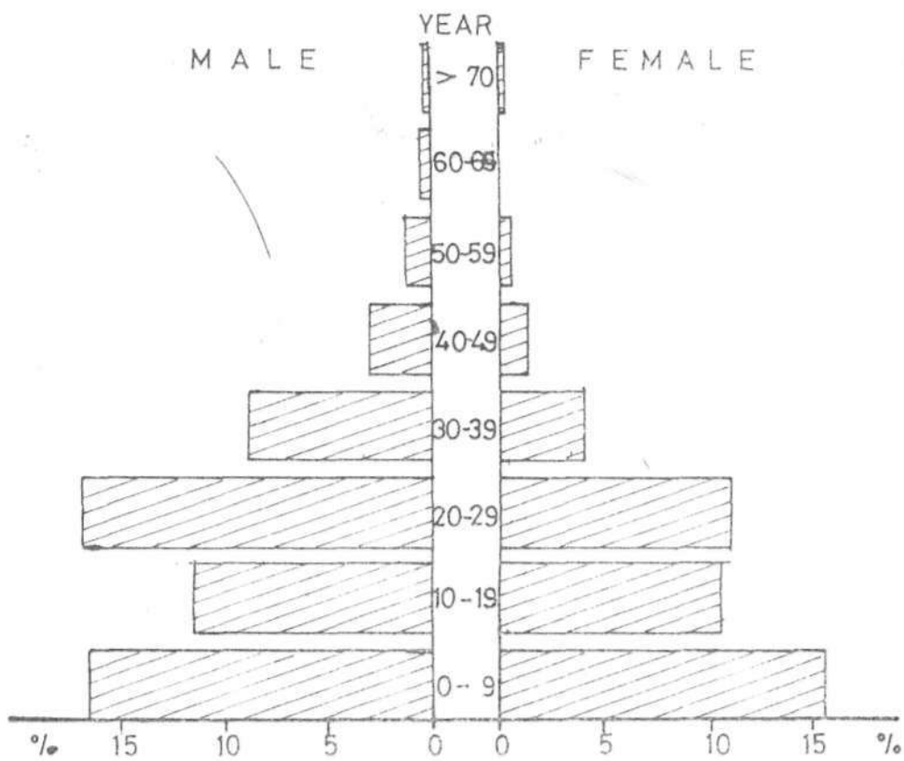


FIG3.4 AGE SEX STRUCTURE

SOURCE: MAKURDI MASTERPLAN 1978

MAKURDI POPULATION

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population figures because it has been the officially accepted population figure for Makurdi.

The Makurdi Master Plan projected population was based on two alternative growth rates of 5% and 3.5% per annum. The 3.5% growth rate gives population estimate of 132,600 for 1988. If based on the 5% annual growth rate, the population would be 153,100 for 1988. After considering the two alternatives and judging the size of Makurdi compared to other urban centres like Zaria having higher population figures, it was thought best to use the 5% growth rate. The projection upto the year 2005 is shown in Fig. 3.3.

Makurdi's age sex composition is influenced by immigration (Master Plan, 1978). As a result of this, the Male-Female percentage distribution is 57-43% (Makurid Master Plan, 1978). A considerable bulge in the age structure can be observed in age group of 20-29 years (Fig. 3.4), especially for males; a clear indication of a positive immigration - emigration balance, (Makurdi Master Plan 1978). In the age group 30-39, the male surplus drops (Fig. 3.4). This negative balance prevails in each subsequent age group both for males and females. It is an indication that the old age groups are affected also by a wave of emigration, more exactly by a flow back to the village of origin.

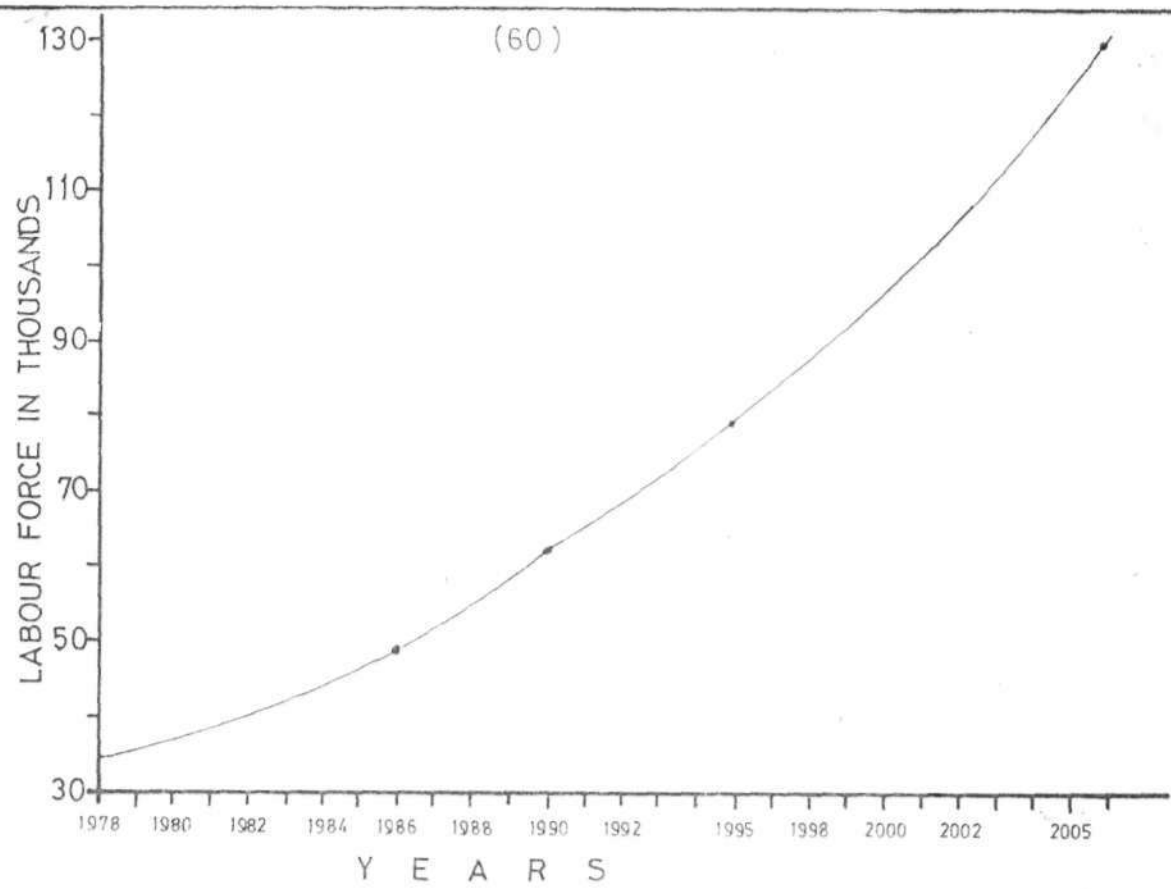


FIG3.5 MAKURDI LABOUR FORCE PROJECTION

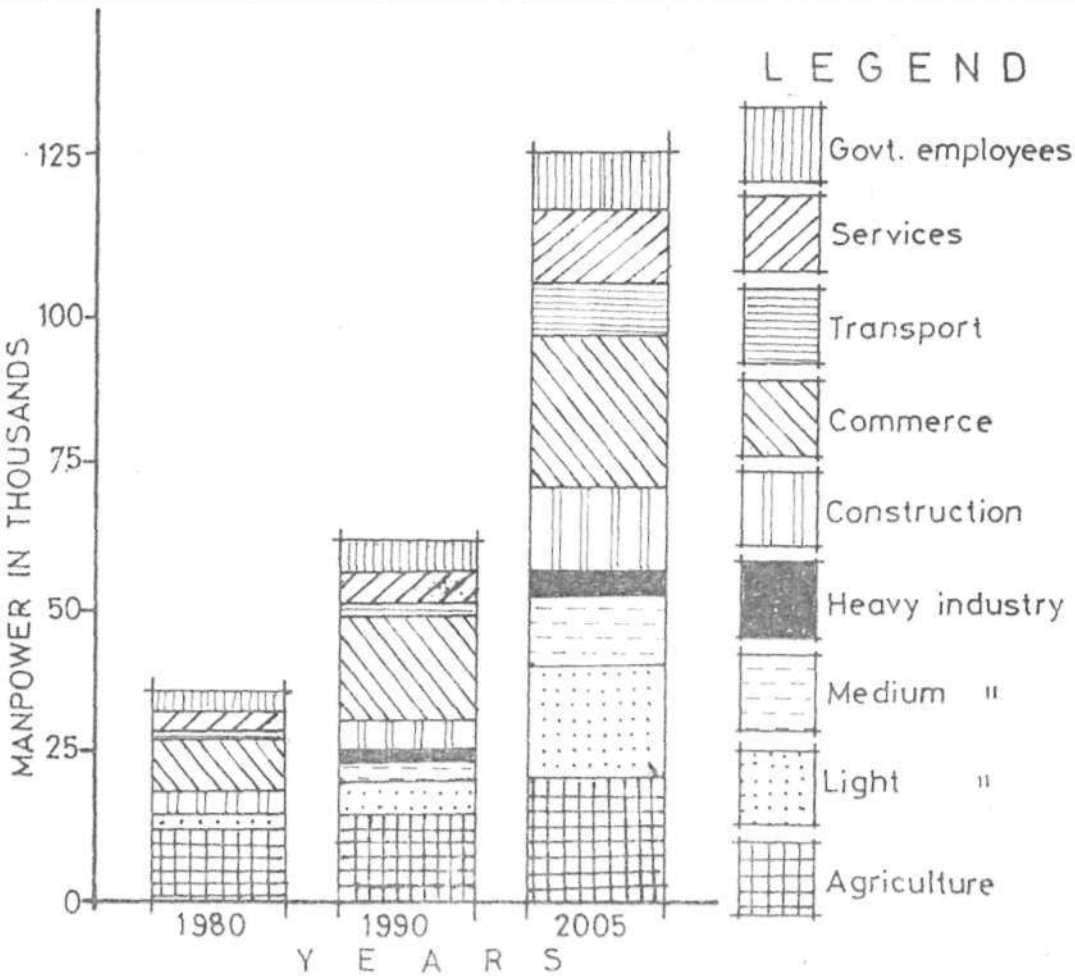
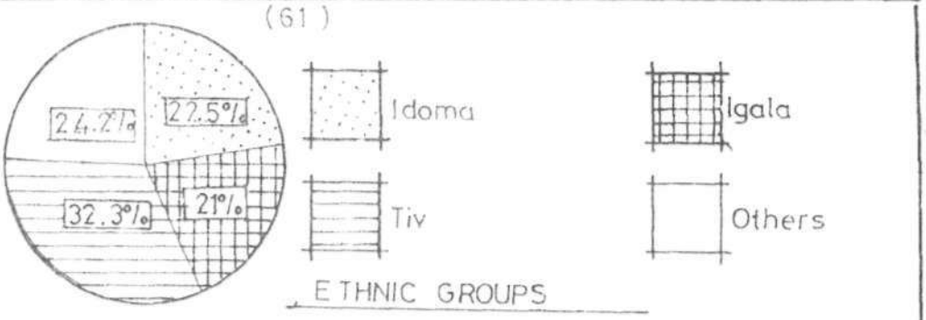


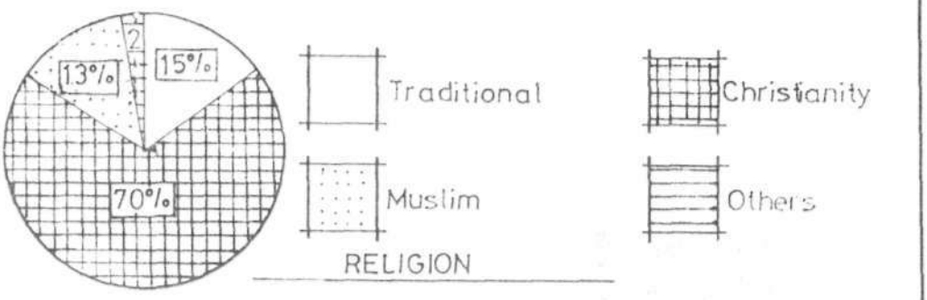
FIG.3.6 PROJECTED DISTRIBUTION OF LABOUR FORCE INTO SECTORS

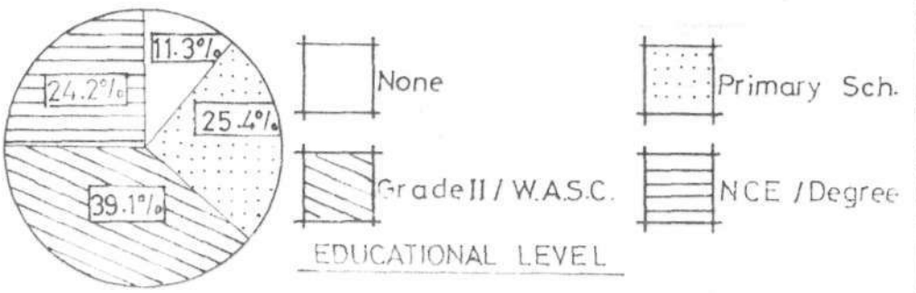
SOURCE MAKURDI MASTERPLAN 1978

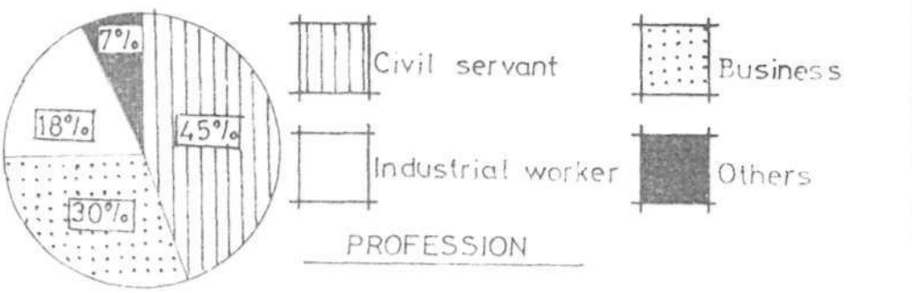
MAKURDI LABOUR FORCE

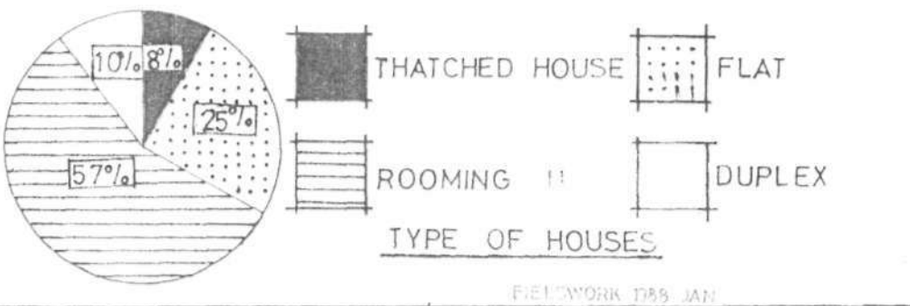
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	FIG 3.7	SOCIAL CHARACTERISTICS OF WORKERS	AMEH P O M. SC. THESIS 1988

Makurdi's labour force was also projected up to 2005 in the Master Plan (Fig. 3.5). It gives a general participation rate of 89.4% and a female one of 26.1% for the population over 15 years. Fig. 3.6 shows the projected distribution of labour force into sectors. By 1988, 22% of the labour force would have gone into agriculture, 28% into industry and 5% into service activities.

3.50 SOCIAL CHARACTERISTICS

The main ethnic groups are Idoma, Igala and Tiv (Fig. 3.7a). The workers are mainly Christians 70% (Fig. 3.7 b). Most workers have attained educational level of primary school (25.4%) and secondary school (39.1%) (Fig. 3.7 c). The workers are mainly civil servants (45%) and businessmen (Fig. 3.7 d). Most workers live in rooming houses (57%) (Fig. 3.7 e).

3.60 FUNCTIONAL BASE

Makurdi has been a centre of administration right from 1927 during the colonial period. At present, most of the Federal and State Government establishments in the state are sited in Makurdi.

Service activities include banking, insurance, hospitals, hotels, super markets, etc. Commercial and trading activities will remain an important economic activity. Makurdi has a lot of traditional markets for farm produce like yams, cassava, maize, beans,

guinea corn, fruits. It has an international market.

Light industries include block making, tailoring, bicycle reparing, saw milling. There are also construction companies, engineering and consulting firms. Industries include Agro Millers, Benue Bottling Company, TileyGyado Foods, UAC and Ferdinad Motors, Benue Publishing Company and the Mechanic Village.

3.70 MAKURDI LANDUSE

The Makurdi Master Plan defined Makurdi urban area as having a 10km radius from the post office (Fig. 3.8). However, this has been extended to 16km radius by the Ministry of Lands and Survey (Fig. 3.8). The area of the developed land is 3611.

The landuse types in Makurdi has been categorised into Residential (54%), Commercial (5.3%), Public and Semi-Public (16.9%), Industrial (2.6%) and Open Spaces (17.7%) (Table 3.2).

Table 3.2: Developed Area of Makurdi

Landuse Types	Area Coverage (Hactare)	Percentage of Total
Residential	1945	54
Public and Semi Public	610	16.9
Roads and Streets	128	3.5
Commercial	194	5.3
Open Space	640	17.7
Industrial	94	2.6
Total	3611	100

Source: 1. Calculated from Makurdi Landuse Map.
2. Field Survey, 1988.

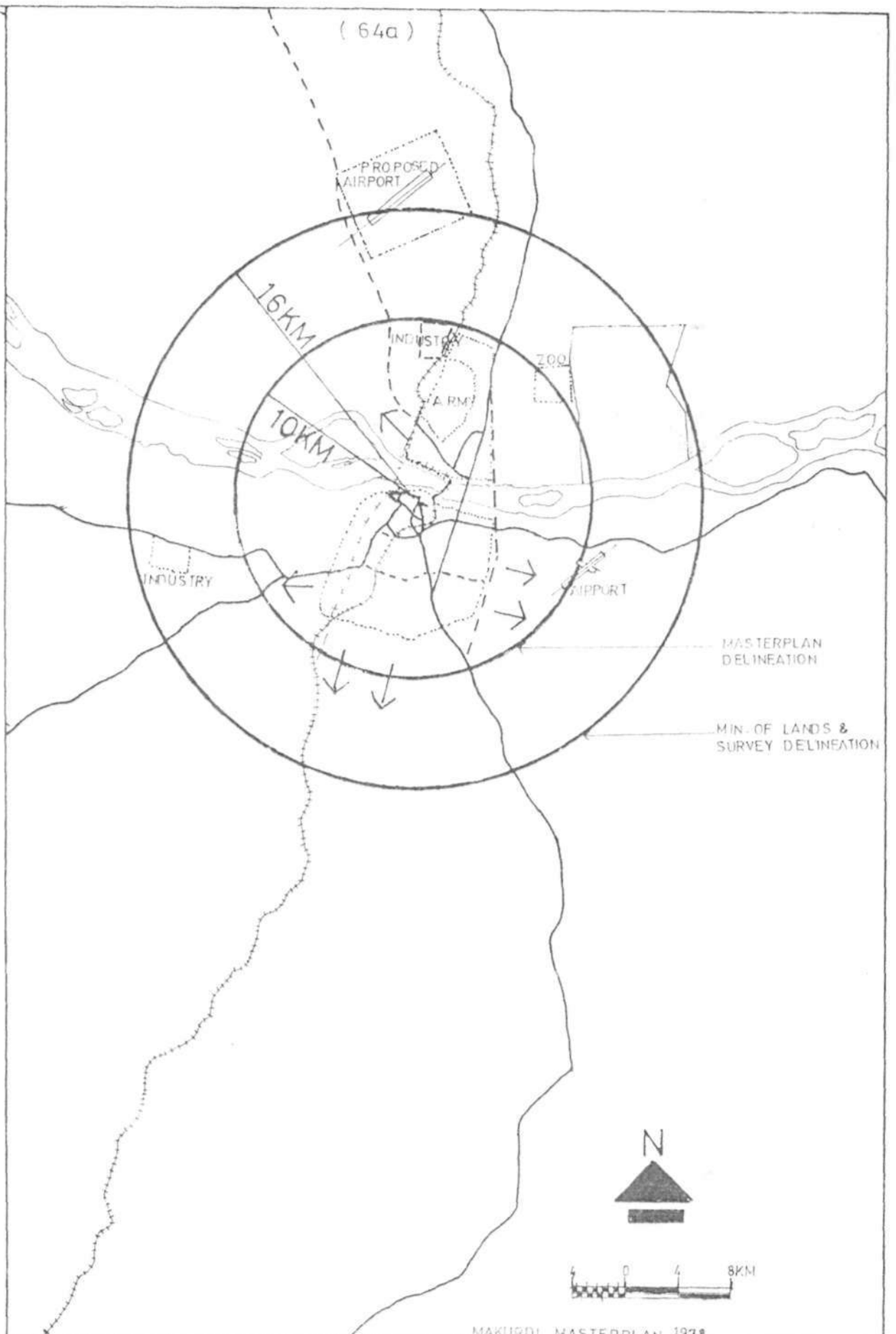


FIG 3·8 DELINEATION OF MAKURDI URBAN AREA

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3.71 Residential Landuse

The residential landuse covers about 54% of the total developed land. The North Bank which is the Northern portion forms a quarter of Makrudi's urban area. The layout for North Bank is less regular.

Makurdi South consists of the following residential areas; Wadata, Wurukun, High level, Ankpa Ward, Old and New GRA and Apir (Fig. 3.9b). The residential areas of Makurdi South are typical of "Sabon Gari" layouts of larger cities in the Northern part of the country. Wadata is characterised by a grid iron street pattern. It has a density of 270p/Ha with approximately 25 persons per plot (Makurdi Master Plan, 1978). The streets in High Level and North Bank are less regular. The plots are 500-600m^2. The New and Old GRA have high quality residential areas for people of high class. The Old GRA started during the colonial period as a result of the extension of railway line to Makurdi.

Makurdi has alot of government residential quarters like Quararafa, Clerk, Manor, Ankpa, Lobi, Hudco and Assembly Quarters, etc.

3.72 Commercial Landuse (Fig. 3.9b)

Commcercial activities take place in traditional markets like the Wadata Market, High level market, Wurukun market and North Bank Market. There is also

an International Market at Ankpa Ward. Commercial activities and shops are located along roads like Benue Crescent, Niger Crescent, Barracks Road, Railway bye-pass, Otukpo/Gboko Road, Onitsha road and Lafia road. Commercial banks are located along the New Bridge road.

3.73 Public and Semi Public Landuse (Fig. 3.9)

Most of the Federal and State establishments are found in the Old GRA, High level, New GRA. The Old GRA is the seat of government with many government establishments and Makurdi Local Government Headquarters. High level houses the Federal and State Secretariat, DFRRI, Staff Training Centre, etc. High institutions like University of Agriculture, Benue Polytechnic. and the School of Basic Studies are located at the North East Bank, while most of the primary and post primary institutions are scattered all over Makurdi. The office of the Benue River Basin Development Authority (BBDA) and the Agricultural Development Corporation are sited at Apir.

3.74 Industrial Landuse (Fig. 3.9)

Small scale industries like tailoring, bicycle repairing, saw milling are located mainly in the commercial areas. Large scale industries are located outside the main town. These include Agro Millers Limited in North East Bank, Benue Bottling Company and Benue Breweries, Tiley Gyado Foods (Pepsi),

Anamco Ltd are located in the industrial layout. The U.A.C. and Ferdinand Motors, Babcock Electrical Projects are located in the New G.R.A. The mechanic village is at Apir while the Benue Publishing Company is at High Level.

3.7½ Open Spaces

About 17.7% of Makurdi landuse is open and green spaces. Within the main town there are also marshy lands.

CHAPTER FOUR

4.00 CHARACTERISTICS OF JORUNEY TO WORK IN MAKURDI AND ASSOCIATED PROBLEMS

In this chapter, the characteristics of journey to work in Makurdi were examined under its growth and landuse pattern, physical constraints to development, the mode, the road network and the socio-economic characteristics of the workers. The problems of journey to work in Makurdi were also discussed.

4.10 MAKURDI URBAN GROWTH AND LANDUSE PATTERN

There has been a long spatial separation between worker's residential areas and workplaces due to Makurdi's rapid urban growth.

4.1.1 Makurdi Urban Growth

Makurdi which started as a settlement in 1922 has been experiencing fast growth which has affected the landuse pattern. The growth of Makurdi has been discussed under different periods; the colonial period (1922-1960), First Civil Rule (1960-1967), Creation of 12 States (1967-1976), Creation of 19 States (1976-1988).

(a) Colonial Period (1922-1960)

Makurdi started as a settlement under colonial rule as a result of construction of the railway. Originally at the same location was a rural settlement called Lobi. The railway line was constructed in 1922 (Makurdi Master Plan, 1978). It was soon discovered that the shifting riverbed and great differences between high and low water levels caused a lot of problems for ferry crossing. A rail and road bridge was completed in 1932.

In 1927 the colonial administration occupied the sandstone hill over the south bank bridge head now the old G.R.A. (Fig. 4.1a). In that year, the name Lobi was changed to Makurdi and the headquarters of the former Benue Province was transfered from Abinsi to Makurdi. The North Bank bridge head later generated commercial settlement (Fig. 4.1a). The present Wadata developed as settlement for Nigerian labourers. It was laid out in a grid iron-street pattern.

At this period, there was proximity of residences and workplaces because of minimal distance between them. Worktrips at this time might have been undertaken by foot. Not much of their earnings was spent on journey to work.

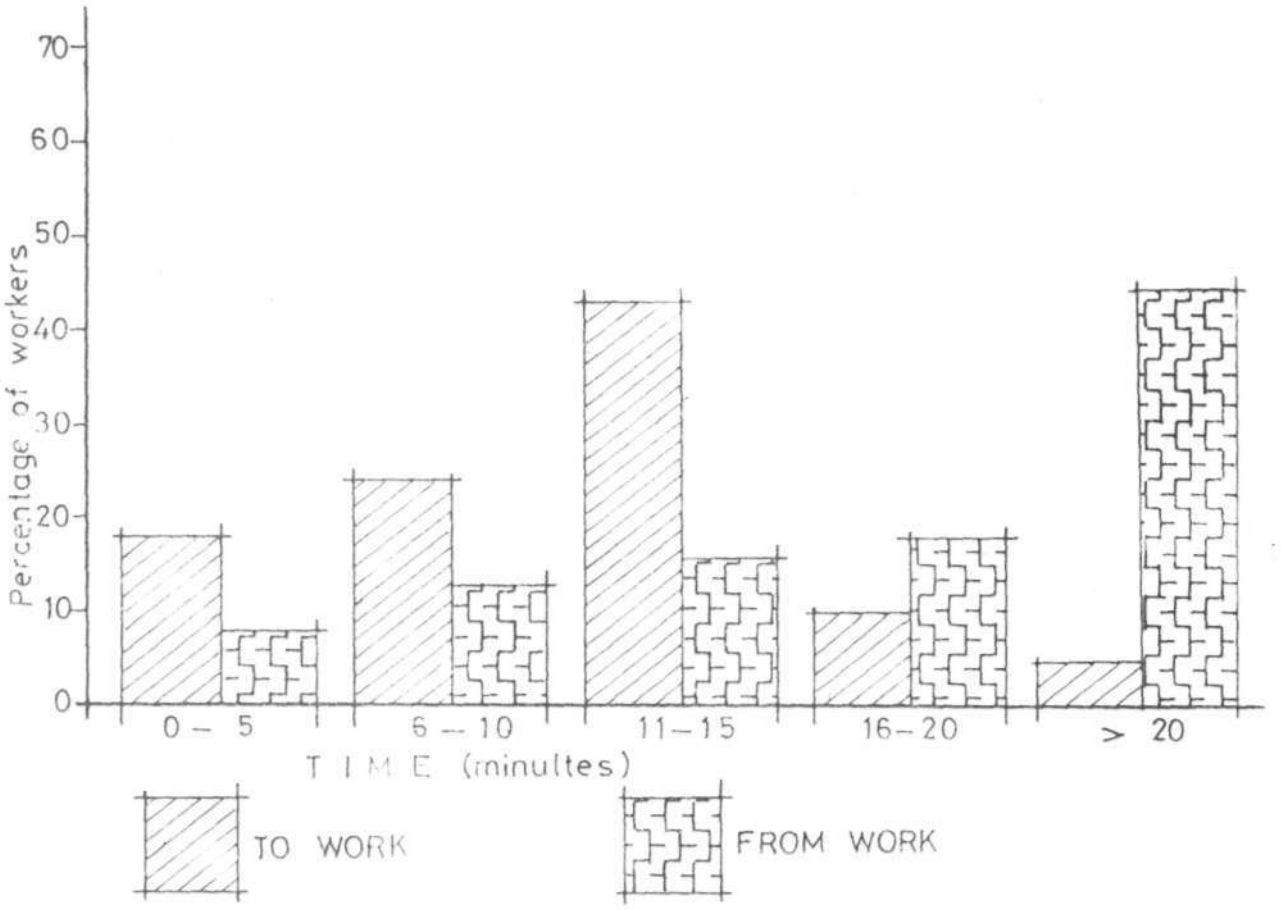


FIG4.14 WORKER'S MEAN WAITING TIME FOR PUBLIC TRANSPORT TO AND FROM WORK



PLATE 1. WORKERS WAITING FOR PUBLIC TRANSPORT ALONG OTUKPO ROAD
7.45am Jan 20 1988

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from work. Plate I shows workers along Otukpo Road waiting to take motorcycle ride to work in the morning. There is therefore the need for the supply of more public transport system so as to meet up with increasing demands.

4.3.3 Routing Structure

Public transportation in Makurdi is characterised by inadequate route densities (their services do not sufficiently cover the town areas), with the result that they are not easily accessible to many urban residents. Routes like Otukpo Road and Kashim Ibrahim Roads are not served by public transport system (Fig. 4.15). But these lead to major work areas in New G.R.A. and old G.R.A. However this problem is reduced by the presence of motorcycle transport (Plate IV) but who charge very high fares (80k and above) per drop campared to minibuses (50k). Motorcycle rides are prone to risks of accidents. Even at peak periods, these motorcycles are inadequate (Plate I).

It has been established that minibus is the main mode of journey to work in Makurdi (Fig. 4.9). But it is characterised by numerous problems. Fig. 4.16 shows that the services of minibus do not cover the town's areas. For example, from result of interviews, minibus do not extend their

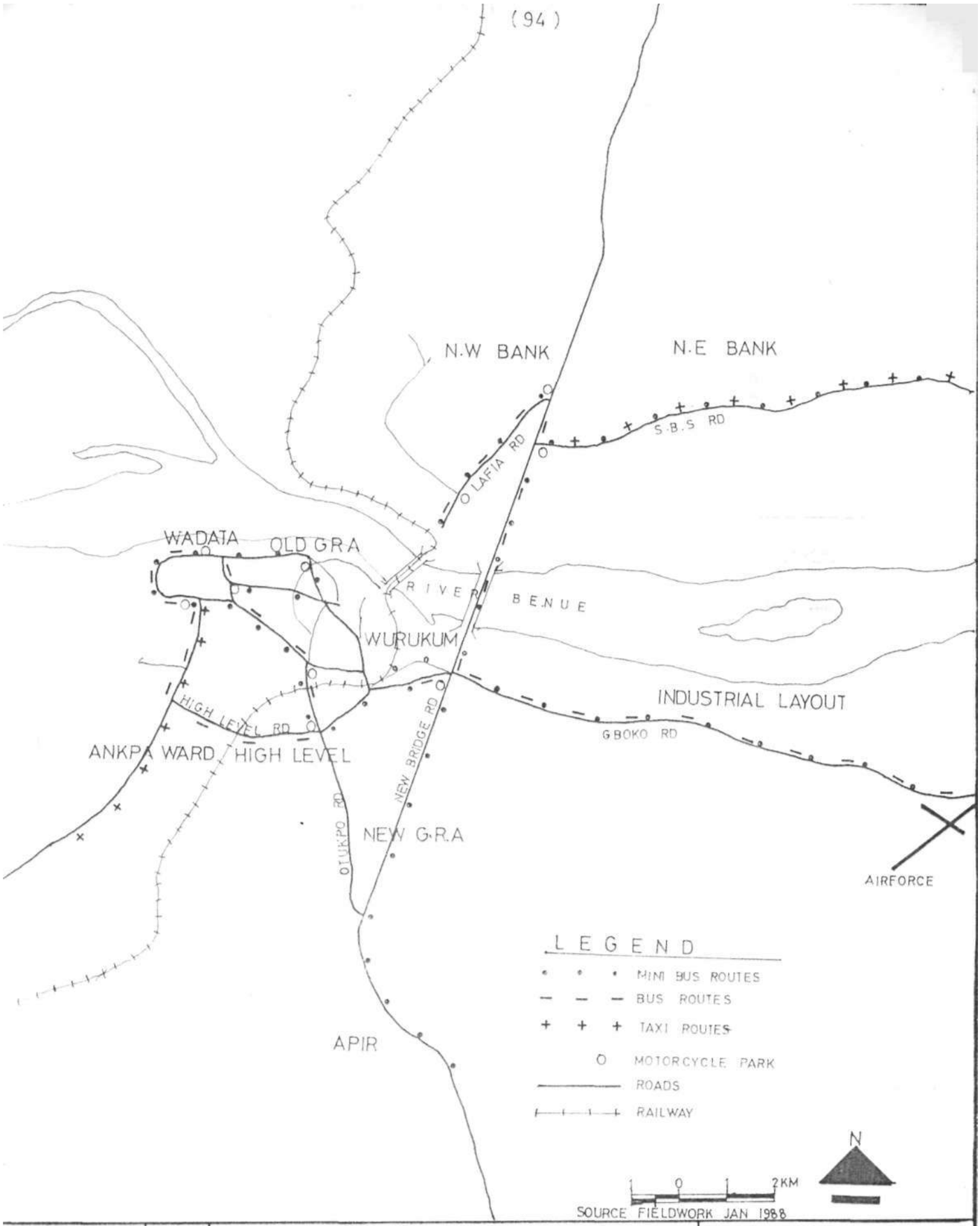


FIG. 4.15 PUBLIC TRANSPORT ROUTES, MAKURDI, 1988.

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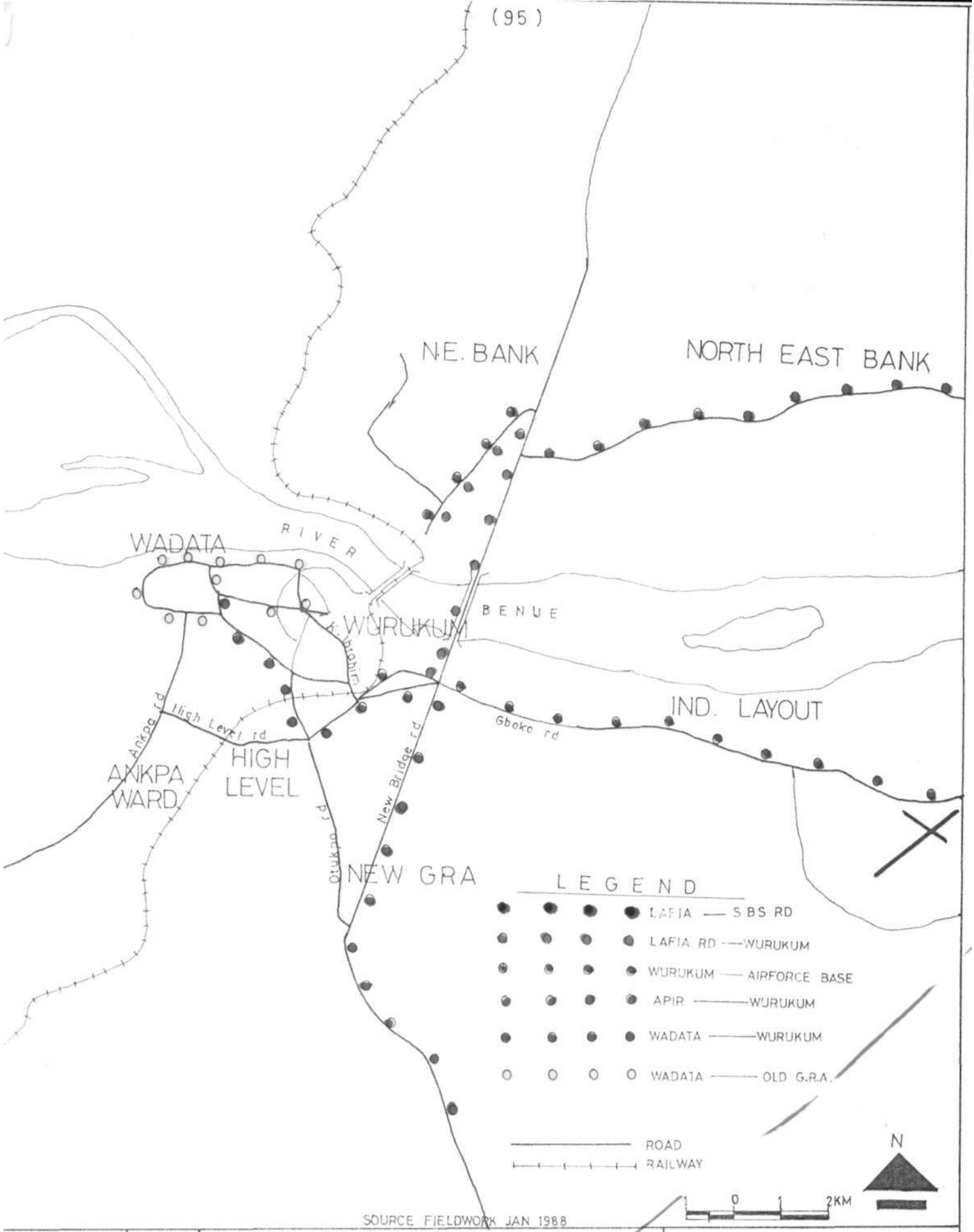


FIG 4.16	MINI BUS ROUTES, MAKURDI, 1988.	AMEH P O M.Sc. Thesis 1988

services to Otukpo Road because the drivers want to maximise their profits. If they carry workers in the morning along the Otukpo road, they will only drop passengers without taking in new ones on the return trips. They will also have to go empty to those workplaces after working hours before collecting passengers. This is a result of the poor growth pattern of Makurdi as earlier discussed. As a result of this, the services of the minibuses are mainly restricted to commercial streets where they are assured of high "turnover" of passengers all the time. Also, they are so used to their present routes that they follow them religiously. Most workers therefore walk for more than 11-15 minutes to the nearest public transport route (Fig. 4.17). Another cause of the poor routing structure and the increased importance of motorcycle transportation has been summed up by Shikoh, (1988).

> ... People's use of motorcycles in the town is based not as an act of preference because it is more exhorbitant to take a machine ride than a bus or taxi cab ride to one's destination within the town. The clear fact is that motorists in Makurdi town have porous sense of business operations. The problem of mass transportation of commuters in Makurdi revolves round this central fact that motorists in Makurdi refuse to convey passengers to their various destinations; they refuse to ply certain routes as well as take pleasure in cheating commuters.

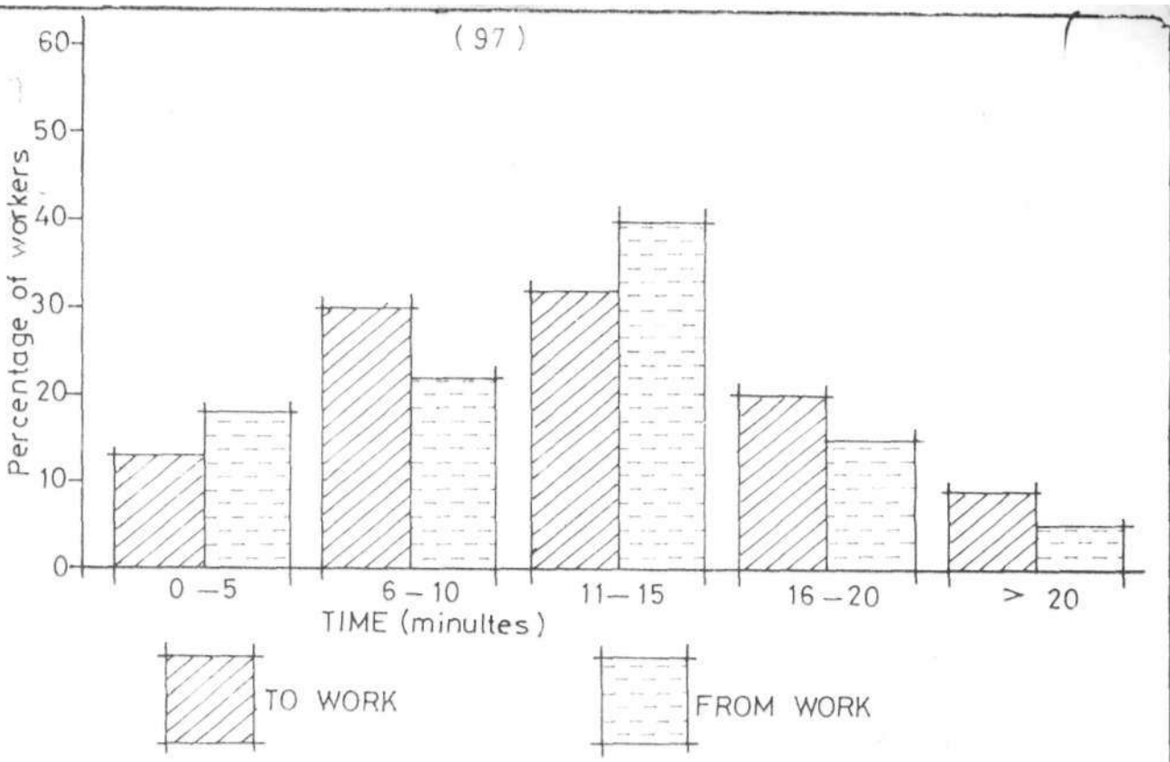


FIG4.17MEAN WALKING TIME TO THE NEAREST PUBLIC TRANSPORT ROUTE BY WORKERS

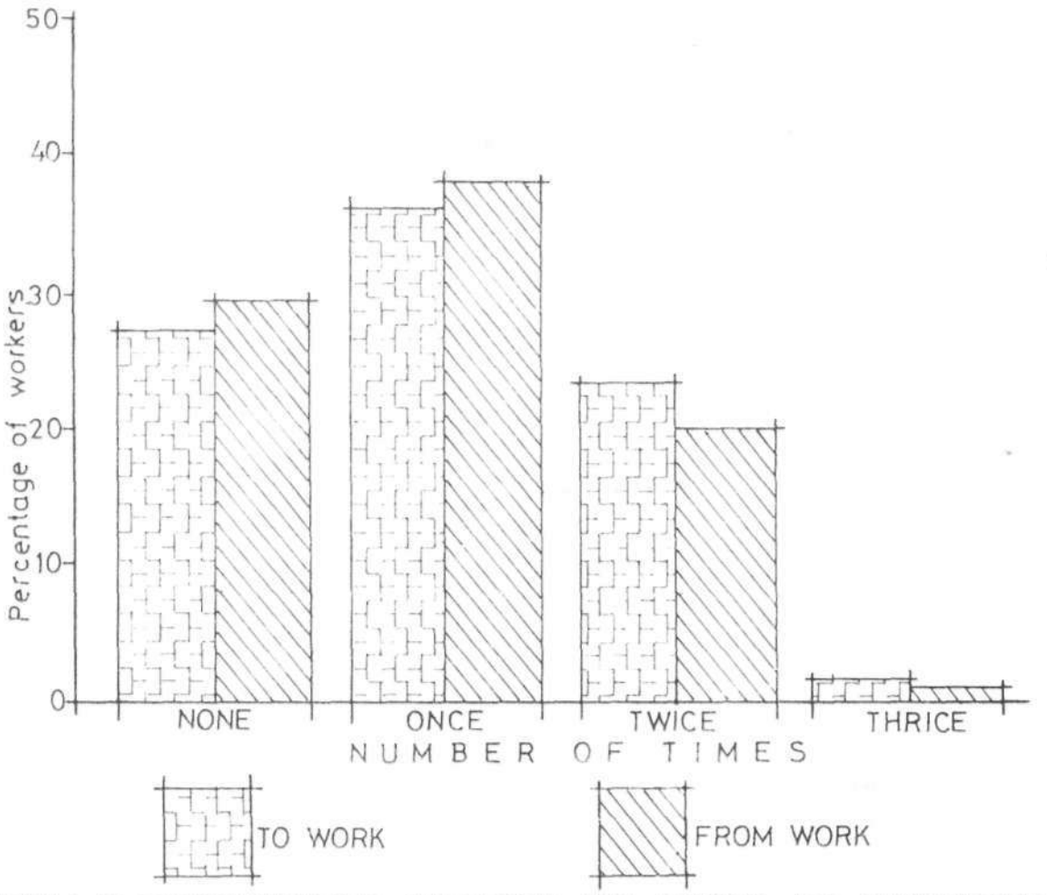


FIG4.18.PERCENTAGE CHANGE OF MODE BY WORKERS TO AND FROM WORK

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> Motorist refuse to convey passengers from Highlevel to establishments situated along the Otukpo road despite that there are many commutters from The Voice (Benue Publishing Company), The State Secretariat, Highlevel Police Post, Babcock Electrical firm (Benue Rural Electrification Board), Radio Benue, Housing Agency and the Benue Agricultural and Rural Development Authority (BNARDA). The experience of passengers wishing to go to these places has remained common to all; you either choose to trek or take a machine ride. If the motorcycle riders have come to the rescue, I think they should be given a pat on the back ..."
>
> - Shikoh, J.M (1988), The Nigeria Voice, June 21, 1988, p. 7.

Another problem is that their routing is not well structured thereby covering short distance (Fig. 4.16). Workers therefore change vehicles many times before getting to and from their workplaces (Fig. 4.18). Fig. 4.18 shows that most workers change vehicles at least once to their workplaces and back. This change in vehicle consumes time and "erodes" workers "lean" income and time.

The State Government's newly acquired buses (Benue links) were meant to ply these routes not served. Unfortunately, they are too few and not well organised yet. There is therefore a need to restructure the routes to ensure a direct journey to work without change of modes by workers.

4.3.4 Comfort

Most of the minibuses are old, worn out and dirty. They emit thick smoke because of lack of

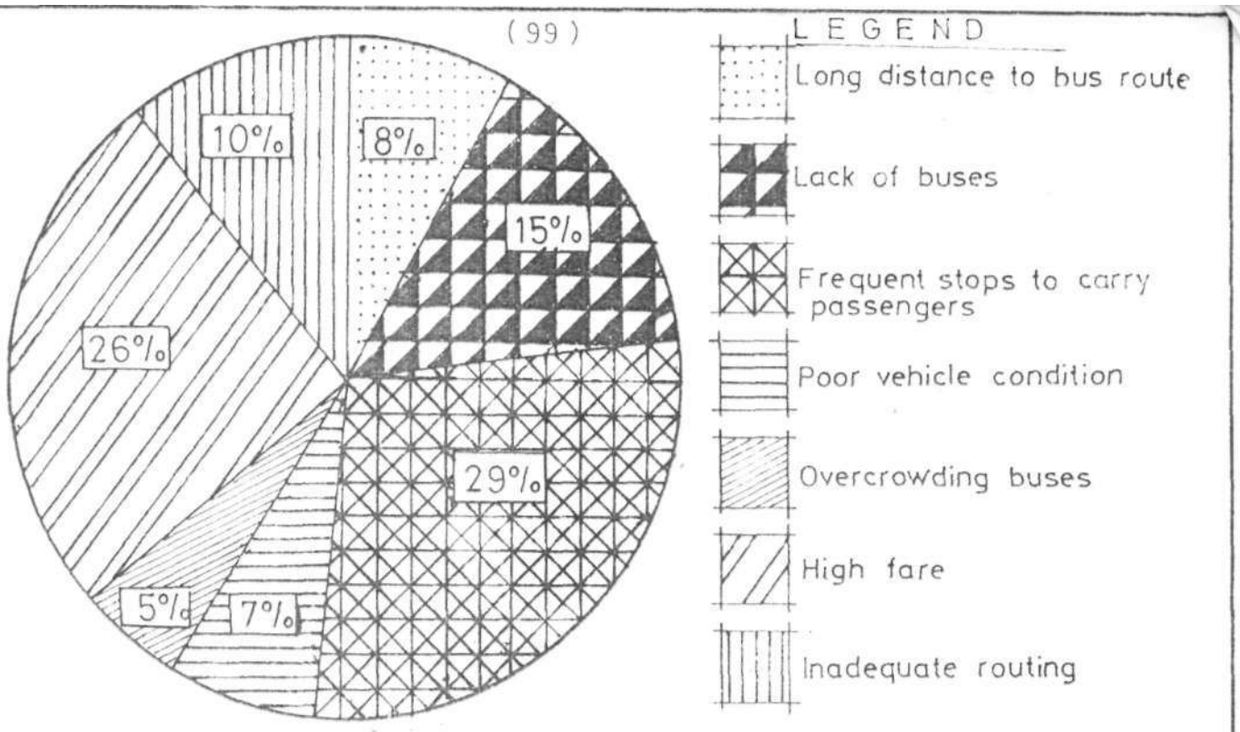


FIG4.19 PROBLEMS ASSOCIATED WITH MINIBUSES AS IDENTIFIED BY WORKERS

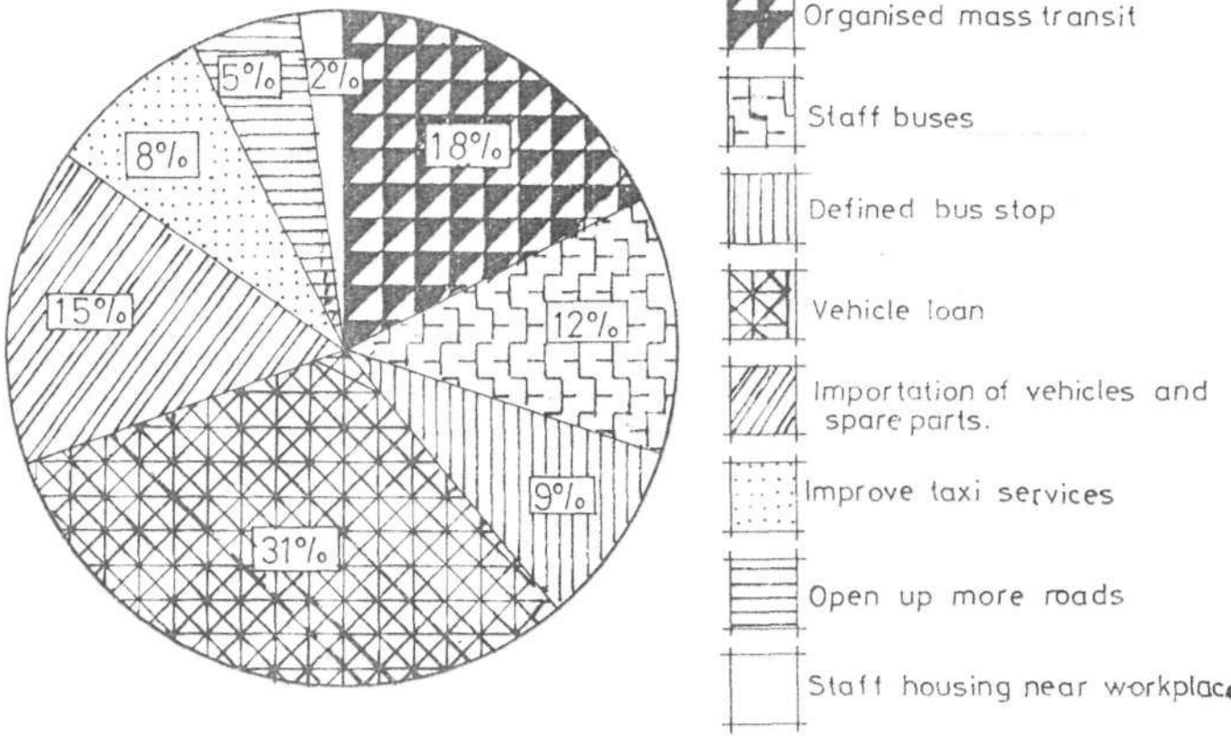


FIG4.20TENTATIVE SOLUTIONS TO PROBLEMS OF JOURNEY TO WORK BY WORKERS.

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4.4 THE ROADS LINKING RESIDENCES AND WORKPLACES

Makurdi has a poor road network, lacking in facilities like bus stops, parking and vehicular segregation. This has led to serious traffic delays on the road as a result of excess demand of traffic above the capacity of the constricting road network. This has led to valuable lost of time in journey to work.

The condition of the roads and Streets linking residences and workplaces is important since it influences the type of mode to be used by workers, speed of movement and time cost.

4.4.1 The Road Pattern

Makurdi has a poor road network (Fig. 4.21). Workers do not journey through direct route to their workplaces. This has been made worse by the many untarred streets which has hindered the operation of taxi services in Makurdi. Most houses in residential areas like Wadata, Ankpa Ward and Wurukum are inaccessible. This has also led to the restictive operation of minibus services to the few tarred roads.

Results of analysis of work trip assignment in Fig. 4.22 shows that most of the work trips are concentrated on roads like Benue Crescent, Barrakcs road, Railway Byepass, Otukpo/Gboko road, New Bridge road and Lafia road.

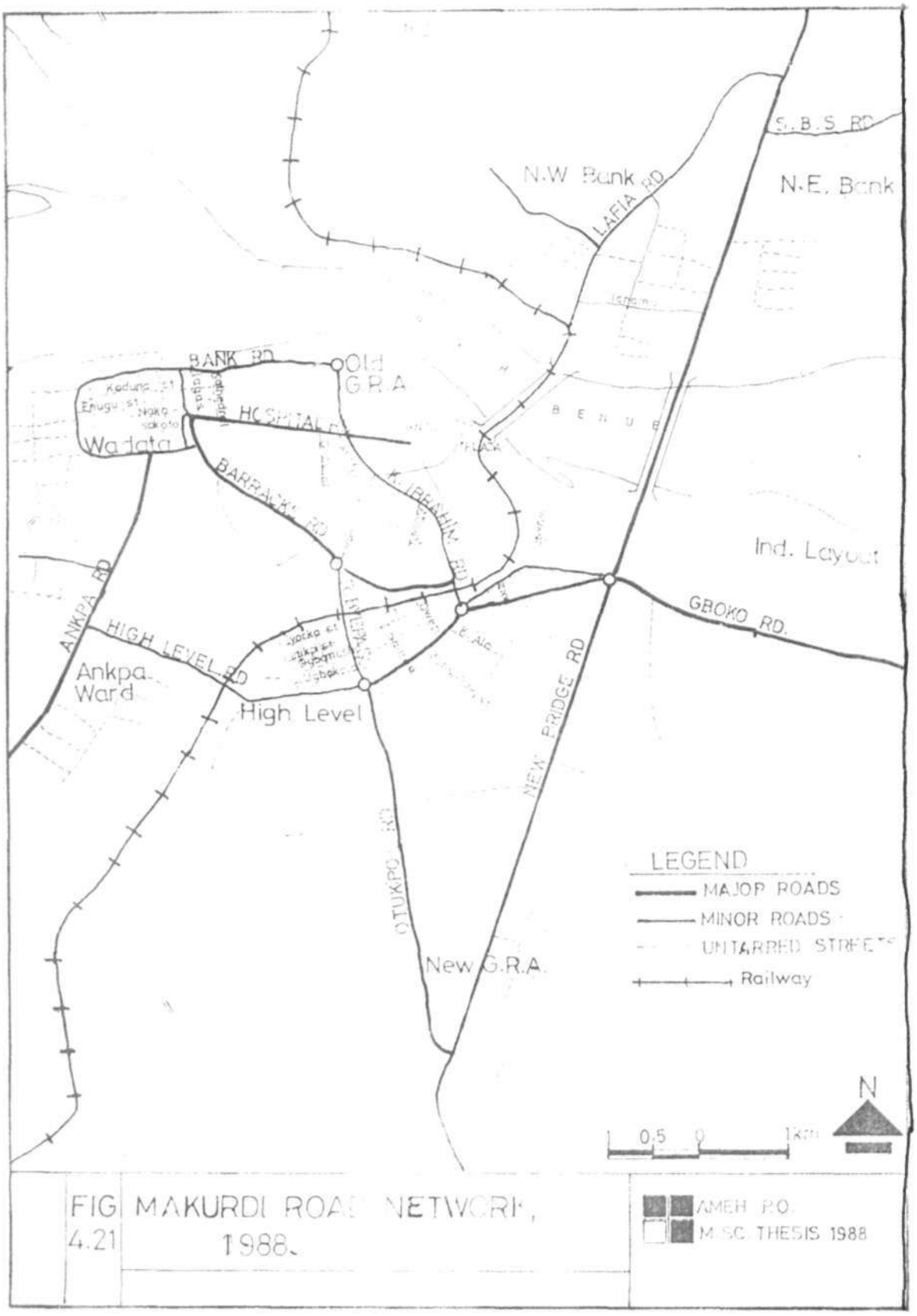


FIG 4.21 MAKURDI ROAD NETWORK, 1988.

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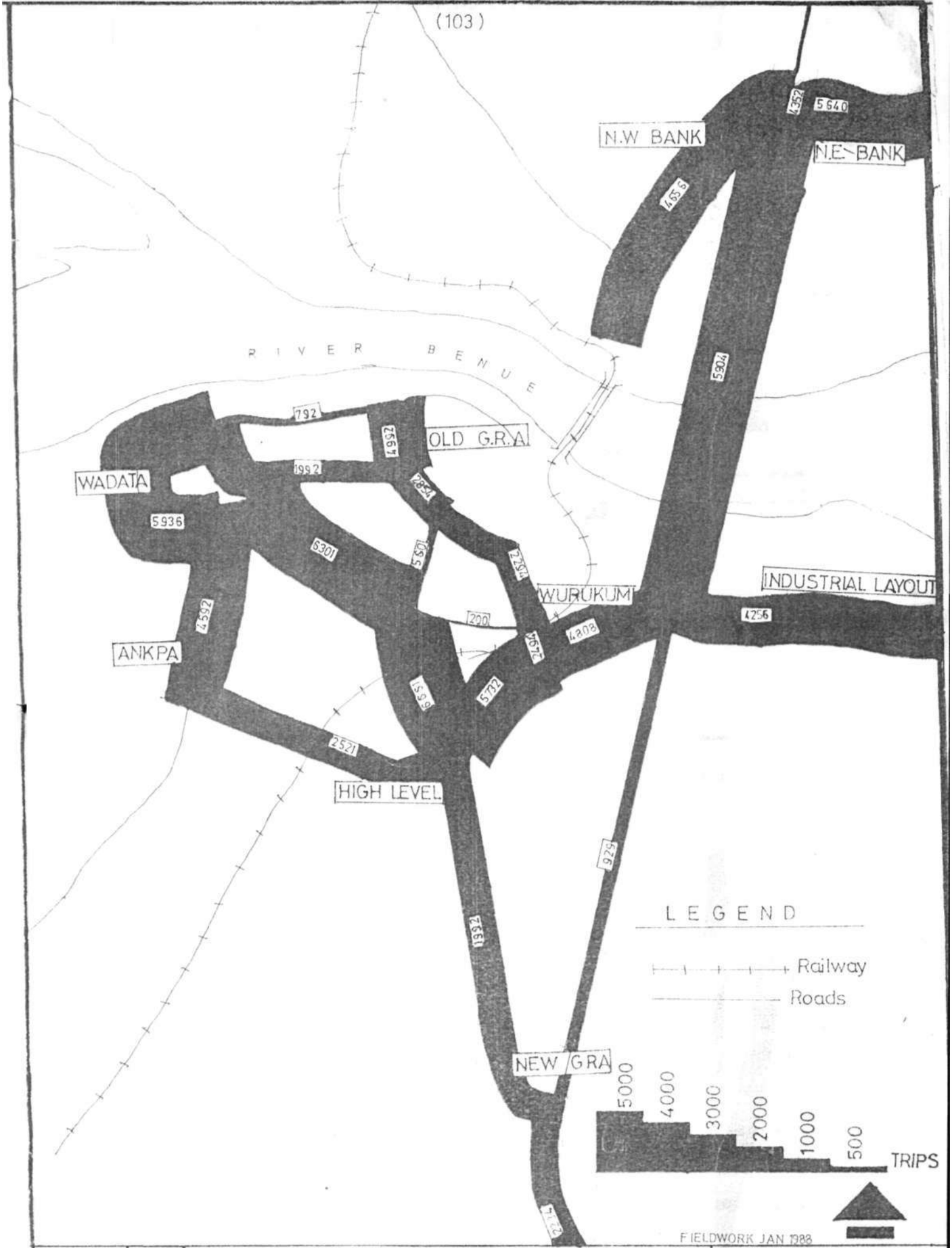


FIG 4.22	WORK TRIPS ASSIGNMENT VOLUME, MAKURDI, 1988.	AMEH, P.O M.Sc. Thesis, 1988.

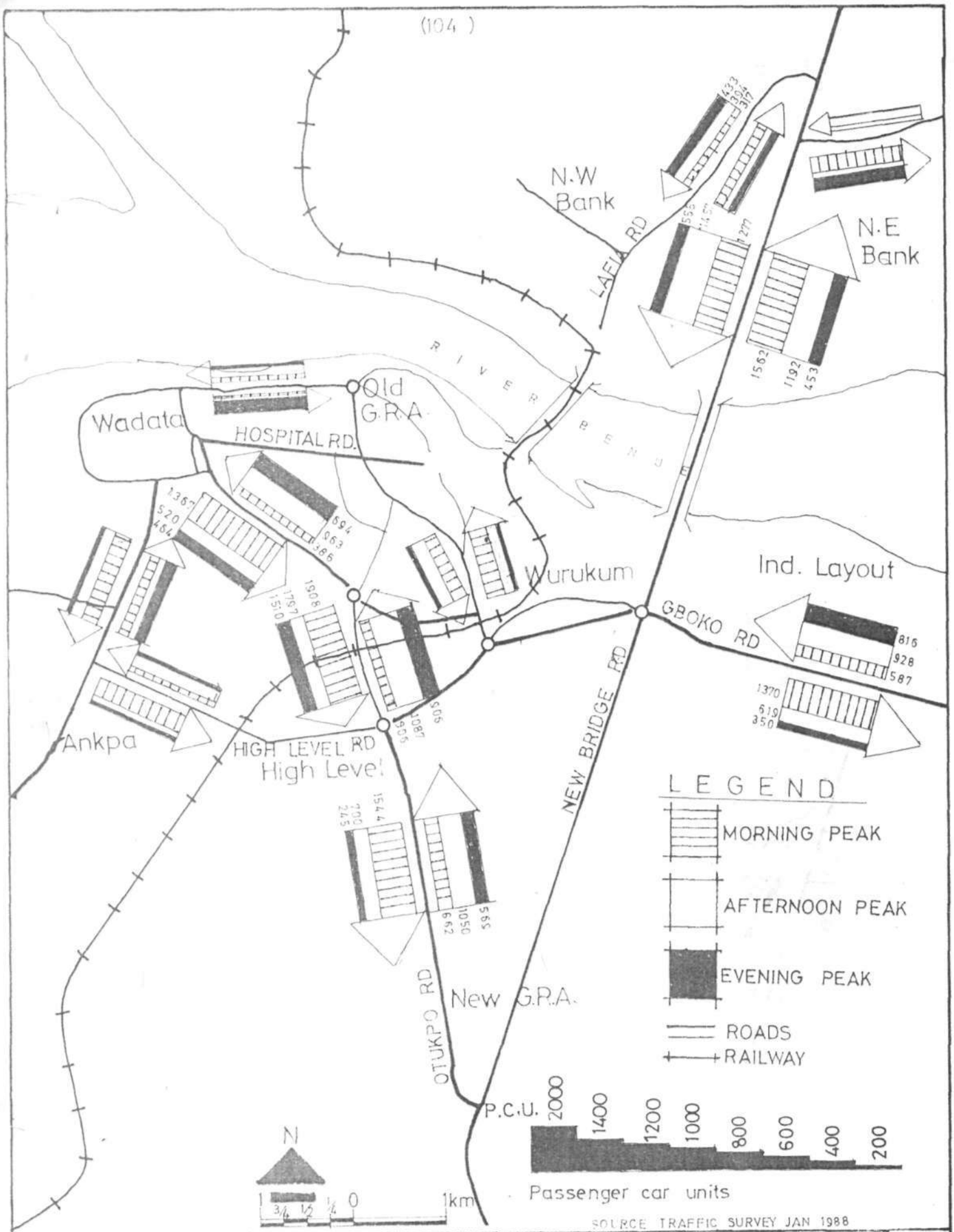


FIG 4.23 TRAFFIC FLOW FOR MORNING, AFTERNOON AND EVENING PEAK PERIODS

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TABLE 4.5 : MEAN TRAFFIC VOLUMES (P.C.U.) DURING PEAK PERIODS ON SOME ROADS.

Roads	Type	Morning peak (7–8am)	Afternoon peak (3.15–4.15)	Evening peak (6–7pm)
NEW BRIDGE	MAJOR ARTERIAL	2840	2649	1008
LAFIA	MINOR ARTERIAL	705	717	944
S.B.S.	"	862	687	91
GBOKO	DUAL CARRIAGE	1958	1548	1167
OTUKPO	"	2206	1750	815
R/WAY BYE-PASS	MINOR ARTERIAL	1908	1797	1510
BARRACKS	DUAL CARRIAGE	1754	1484	1159
K. IBRAHIM	MINOR ARTERIAL	1549	1169	241
BENUE CRESCENT	"	822	607	501
BANK	"	790	528	264
ANKPA	DUAL CARRIAGE	1204	882	609
HIGH LEVEL	MINOR ARTERIAL	1173	744	226

Source : Traffic Survey, Jan/Feb. 1988.

TABLE 4.6 : STANDARD VOLUME OF TRAFFIC.

Type of road	P.C.U. values per hour
DUAL CARRIAGE	1200 – 3600
MAJOR ARTERIAL	1200 — 3600
MINOR ARTERIAL	500 — 1200
COLLECTORS	500 — 1200

Source : Makurdi Masterplan, 1978.

4.4.2 Road Traffic Volume

Traffic flow in p.c.u. values for morning, afternoon and evening peak periods for some roads are shown in Fig. 4.23. Morning peaks are generally higher than afternoon and evening peaks. Also traffic flow on the roads tend to be highest towards the directions of work areas mostly in the morning and the reverse in the afternoon and evening peak periods.

There is concentration of vehicular traffic on some few roads causing traffic problem at peak periods. Table 4.5 and appendix III shows the mean passenger car unit per hour (p.c.u.) on some roads.

By comparing the volumes of traffic at the peak periods with the standard giving in the Makurdi Master Plan (Table 4.6), it was found that the volume of traffic in p.c.u. on railway byepass, Kashim Ibrahim, Lafia, Benue Crescent, and Highlevel roads have exceeded their designated traffic capacity especially at peak periods. There is therefore the need for improvement of these roads and construction of new roads for alternate traffic assignment for an effective journey to work.

4.4.3 Main Road Inventory

In order to determine the adequacy or otherwise of these roads in coping with the present and expected

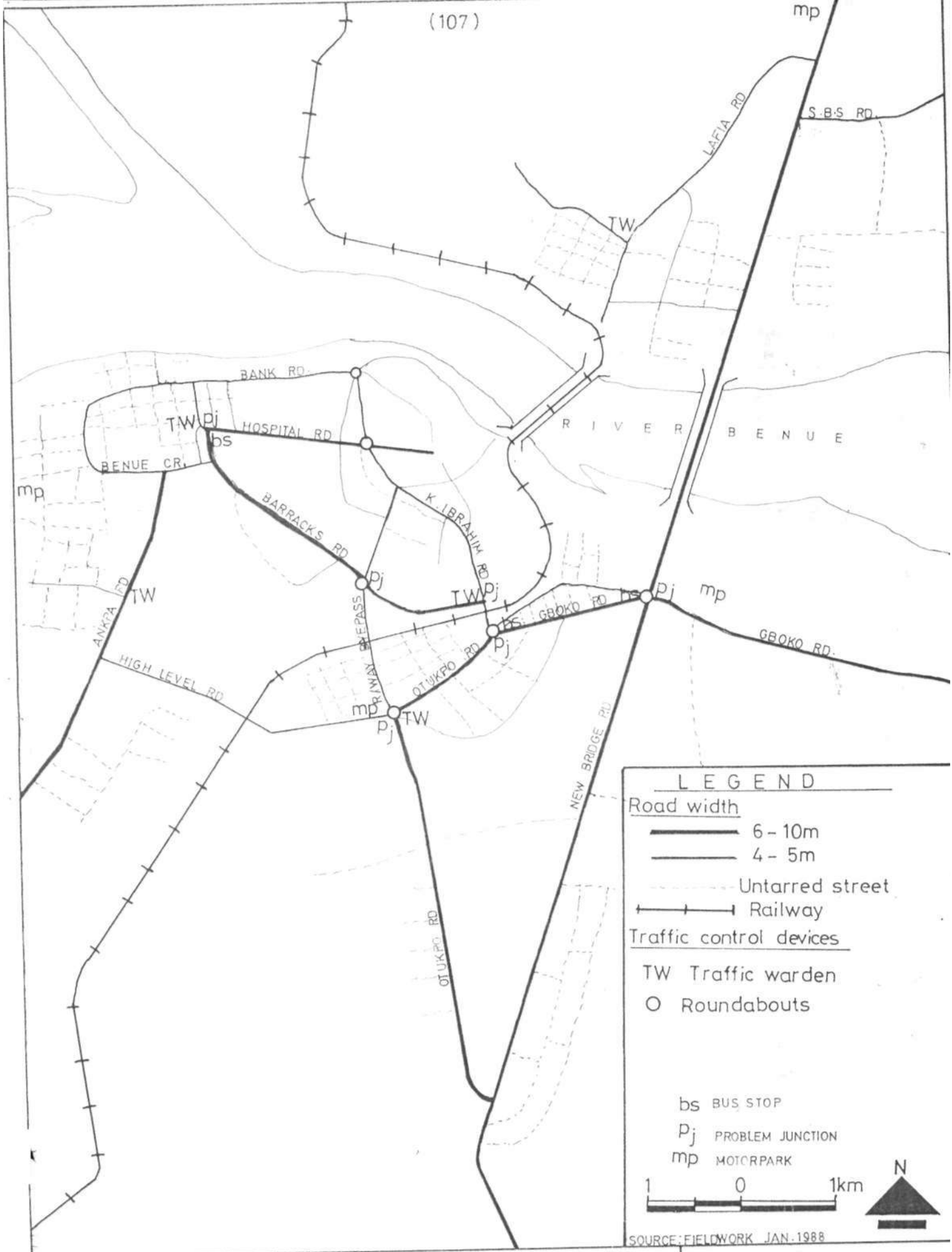


FIG 4.24 MAKURDI MAIN ROAD INVENTORY AND TRANSPORTATION FACILITIES.

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TABLE4.7. MAKURDI URBAN ROAD INVENTORY

ROADS	Surface of carriage-way	Condition of carriage-way	Effective width of road	Condition of drains	Types of of sidewalk	Traffic control devices	Number of bus stops
NEW BRIDGE	ASPHALT	GOOD	6m	N.P	NOT PAVED	C H	—
LAFIA	ASPHALT	GOOD	4m	N.P	N.P	T.W.	—
S.B.S.	ASPHALT	GOOD	4·5m	N.P	N.P	—	—
GBOKO	ASPHALT	GOOD	9m	N.M	PAVED	CH	2
OTUKPO	ASPHALT	GOOD	9m	N.M	NOT PAVED	C H + T.W.	—
K.IBRAHIM	ASPHALT	GOOD	5m	N.M	NOT PAVED	R.C. SIGNS +CH+ T.W.	—
RAILWAY BYEPASS	ASPHALT	GOOD	4m	N.P	NOT PAVED	R.C. SIGNS	—
BARRACK	ASPHALT	GOOD	9m	N.P	NOT PAVED	C H + T.W.	1
HIGH LEVEL	ASPHALT	GOOD	5m	N.P	N.P	R.C. SIGNS + T.W.	—
ANKPA	ASPHALT	GOOD	8·5m	N.M.	NOT PAVED	CH	—
BANK	ASPHALT	GOOD	4m	N.M.	N.P	CH	—
BENUE CRESCENT	ASPHALT	GOOD	4m	N.M	N.P	—	—

N·P. = NOT PROVIDED
N.M. = NOT MAINTAINED
C H = CHANNELIZATION
T.W. = TRAFFIC WARDENS
R.C. = RAILWAY CROSSING

Source : Fieldwork, Jan. 1988

travel demand, an inventory of the road facilities was made (Table 4.7) (Fig. 4.24). Although all the major roads are in good condition, there is problem on the hierarchy of roads. There are cases where a first order road suddenly "runs into" a second order road. For example, Ankpa Road which is a first order road joining the Benue Crescent which is a second order road. Others are Railway Byepass which is a second order road joining first order road like Barracks road and Otukpo road. This creates "bottleneck" effect. It is obvious that this affects smooth traffic flow.

From the result of the road inventory (Table 4.7), the traffic control devices are limited to channelisation, roundabout, traffic wardens. There is lack of road signs in Makurdi apart from the Railway level crossing sign. There is also absence of "pedestrian zebra" crossing and pedestrian flyovers.

Inventory of drainage facilities on major roads were conducted since drainage is an important factor in future quality of road surfaces, for without proper water run off, surface deteriorate quickly. Out of the twelve roads surveyed only six have drainage facilities (Table 4.7), but all lack maintenance. Six other roads do not have drainage facilities (Table 4.7). The conditon of drainage facilities on Makurid roads are generally poor.

4.4.4 Factors of Delay

Traffic delay on Makurdi roads are caused by several factors. These are, lack of bus stops and parking facilities, non catering for pedestrian traffic, road intersection and level crossing, accidents and road conditions (Fig. 4.25).

Makurdi roads do not have bus stops and organised off street parking facilities. This has led to indiscriminate stopping of mini buses along the road. They pick up and drop off passengers anywhere along the road. There is obstruction to free flow of traffic in some of the roads with commercial activities like Lafia Road, Railway Byepass, Barraks road and Benue Crescent as a result of lack of parking facilities and designated bus stops. Double parking of vehicles is a common thing along these roads. This has caused alot of traffic delay along these roads (Fig. 4.25). Unfortunately, most work trips are undertaken through these roads (Fig. 4.22). Traffic hold up is a common occurence along these roads especially at peak hours.

Makurdi roads do not have pedestrian sidewalks. This has led to the use of the available

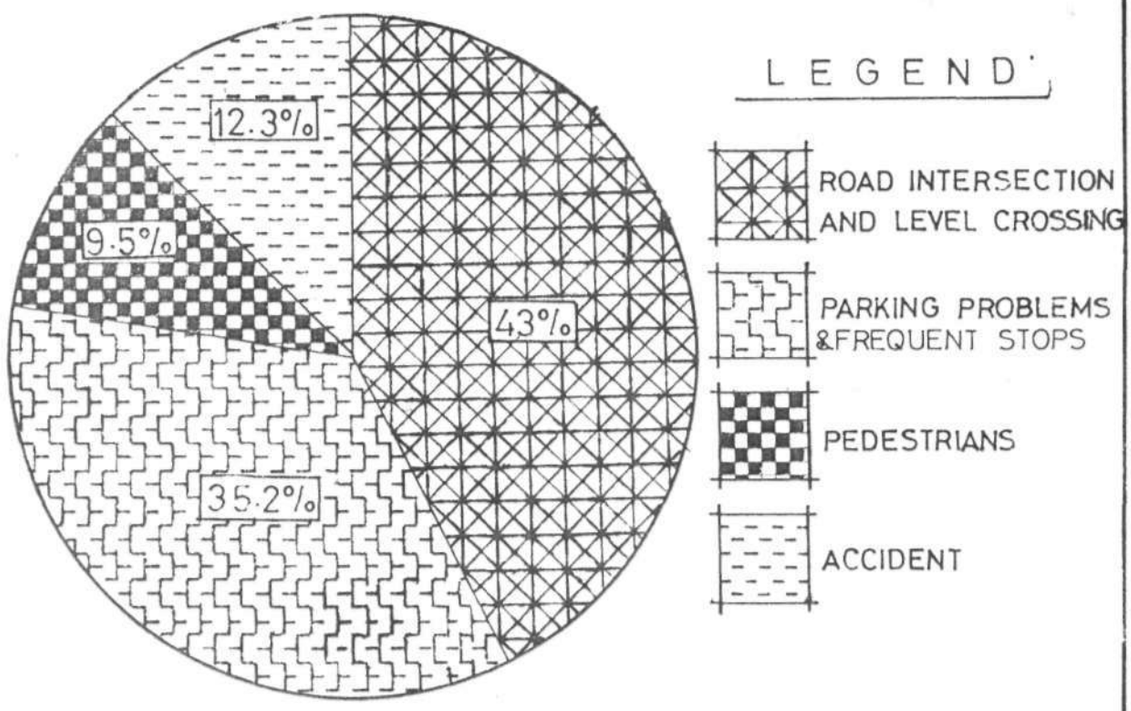


FIG.4.25 FACTORS OF DELAY ON SOME ROADS

ROADS	LENGHT OF ROAD (KM)	ROAD INTERSECT	PARKING	PEDESTRIAN CROSSING	ACCIDENT	TOTAL
LAFIA	3.5km	32	92	18	15	157
GBOKO/OTUKPO	3KM	174	46	16	23	259
K.IBRAHIM	3km	166	24	12	27	229
RAILWAY BYEPASS	1.5	64	121	26	32	243
BARRACKS	3	45	28	14	25	112
BENUE CRESCENT	3.5	18	96	24	21	159
TOTAL		499	407	110	143	

TABLE4.8. MEAN PEAK HOUR DELAY TIME (seconds) ON SOME ROADS

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roadspace by the workers who make work trips by foot and the vehicles. This pedestrian vehicle conflict is not safe for the pedestrian. It has the effect of reducing the available roadspace. Pedestrian crossings like "zebra crossings" and pedestrian flyovers are also not provided. Delays due to the activities of pedestrians constitute about 9.5% (Fig. 4.25).

Delays on these roads are also caused by closely spaced junctions and level crossing (Fig. 4.25) (Table 4.8). Plate II shows traffic delays on the junction of Kashim Ibrahim road to the Gboko road. Some delays are due to turning vehicles. The railway level crossings on railway byepass road, highlevel road and the Kashim Ibrahim road has been a major cause of delay due to oncoming train. Secondly, the Makurdi railway station is very close to these roads. In an effort to rearrange wagons, the train crosses these two roads very often. This causes considerable delay to traffic.

The Makurdi Master Plan has recommendation on the usa of flyover on these roads, albeit, this has not been implemented. Unfortunately, these two roads carry the bulk of worktrips and traffic from the core of the town.

Occassionally, accidents occur along these roads. This is mainly as a result of reckless driving among motorcycle and motor vehicle drivers.



Plate: II: TRAFFIC DELAY ON K.IBRAHIM ROAD AND GBOKO ROAD JUNCTION

SOURCE: FIELDWORK JAN. 15 1988

Table. 4.9: AVERAGE MOTOR OPERATING SPEED ON SOME ROADS AND THEIR DESIGN SPEEDS

ROADS	Average Width (m) *	Average Speed (km/h) *	Design Speed (km/h) **
LAFIA	4m.	14.7km/	50—70km/h
GBOKO/ OTUKPO	9m.	35km/h	60—100km/h
K.IBRAHIM	5m.	20.6km/h	50—70km/h
RAILWAY BYEPASS	4m.	11.6km/h	50—70km/h
BARRACKS	9m.	46km/h	60—100km/h
BENUE CRESCENT	4m.	13.5km/h	50—70km/h

SOURCES * FIELDWORK, JAN. 1988

** MAKURDI MASTERPLAN, 1988

In their bid to make more money and due to their belief of ability to manourve through traffic stream, the motorcycle riders run at "breakneck" speed. They often do this without proper attention to vehicles from both directions. Some motorcyclists keep to the left of the roadway while others keep to the right, making the motorist go in a zig-zag manner along the road while trying to pass motorcyclists. Accidents and traffic delays are often the result of this action.

There is therefore a need for improvements on Makurdi roads to meet the required geometric standards in terms of width, vehicular segregation, sidewalks, parking facilities and drains.

These factors have led to delays along these roads during journey to work. Table 4.9 shows the average operating speeds of vehicles and their designed speed. The table shows that the vehicles that ply these roads operate far below the designed speed of the road.

4.50 SOCIO-ECONOMIC CHARACTERISTICS OF WORKERS AND ASSOCIATED PROBLEM

In Makurdi, most workers earn very low income. contrary to expectations, the low income earners travel longer distances and spend more on journey

to work than the high income group. This problem has been aggravated by the present structural adjustment programme and the removal of oil subsidy. The removal of oil subsidy which has led to an upward review in transport fare have automatically translated into a general hike in the entire economy.

Socio-economic characteristics of workers generally, have an influence on their choice of mode, distance from work and residential location. We shall discuss the socio-economic characteristics of workers under their income levels, expenditure pattern, distance and modal choice.

4.5.1 Income Level

Most workers in Makurdi are low income earners. Based on monthly earnings (Fig. 4.26) and on income groups (Fig. 4.27), 47.7% of the workers are low income earners, 38.2% middle income earners, and about 13.5% high income earners. This may be due to the functional base of the town which is administrative. Most workers in Makurdi are civil servants. This is unlike what happens in towns with commercial and industrial functional base where workers are expected to earn high incomes.

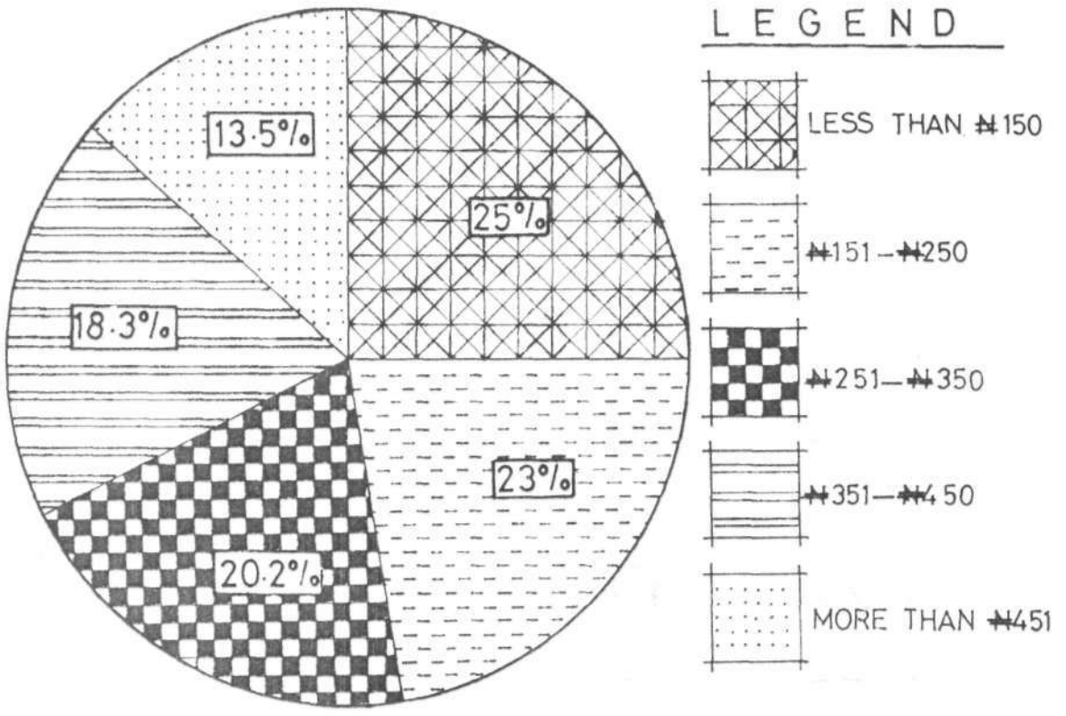


FIG.4.26 MONTHLY INCOME DISTRIBUTION AMONG WORKERS, MAKURDI, 1988.

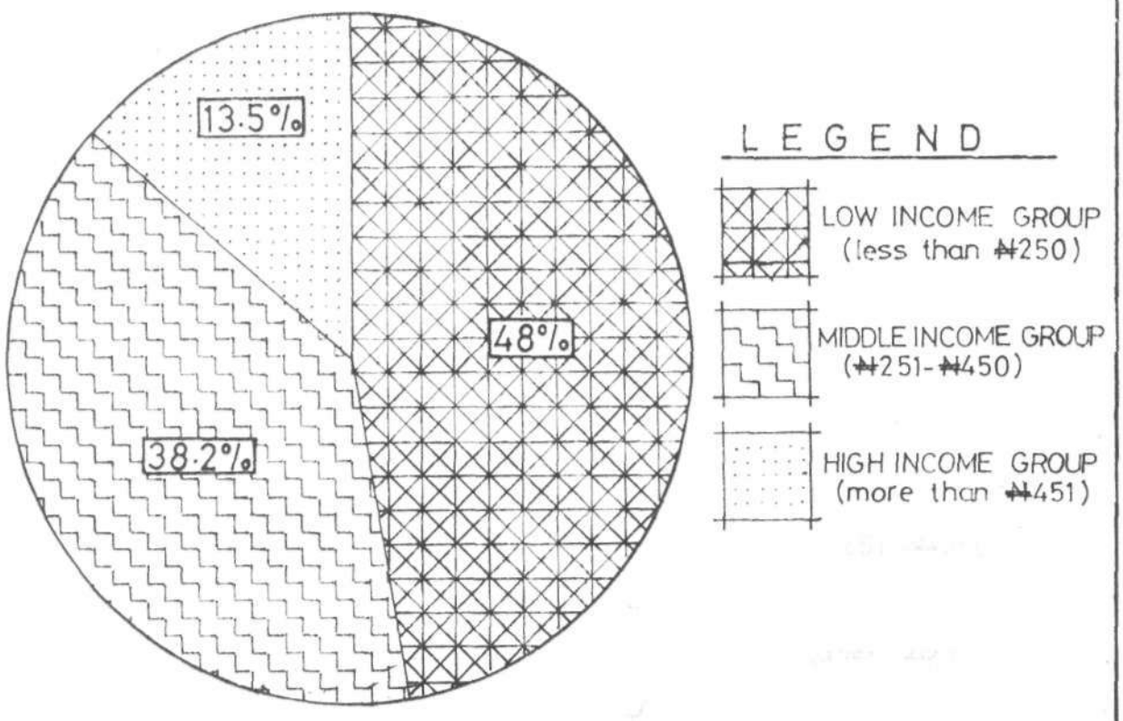
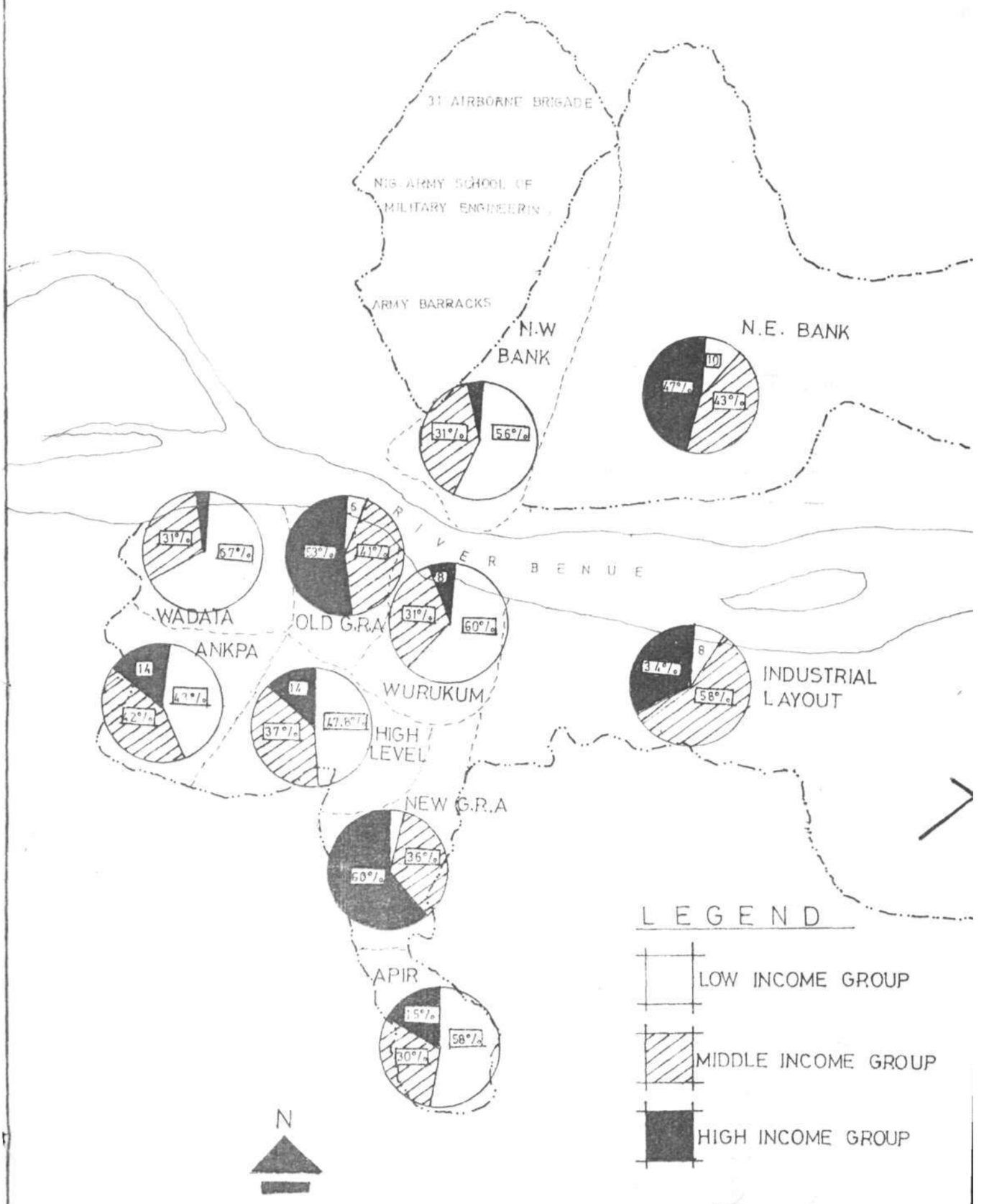


FIG.4.27 CLASSES OF INCOME GROUP

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FIG 4.28 ZONAL DISTRIBUTION OF INCOME GROUPS, MAKURDI, 1988.

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4.5.2 Residential Location

There are concentrations of low, middle and high income groups in specific zones (Fig. 4.28). Most high income groups reside in N.E. Bank, industrial layout, New G.R.A. and old G.R.A. (Fig. 4.28). As we saw earlier in Fig. 4.7, most workers in these zones travel very short distances to their workplaces. The low income groups are concentrated in Wadata, Wurukum, N.W. Bank, Ankpa Ward and Highlevel (Fig. 4.28). Unfortunately as we saw in Fig. 4.7, apart from Wurukum, most workers in these zones travel longer distances to their workplaces. Result of analysis in Fig. 4.29 shows that low income groups travel for longer distances than the high income groups. The product moment correlation coefficient computed for income and distance to work among workers gave the value of -0.80 (Appendix IV). This means the higher the income of workers the shorter distance they travel to work. This was not expected since the more earnings one has will be the longer distance he can afford to travel to work. This might be due to the spatial locational characteristics of residences among income groups.

Analysis of data on the reasons for worker's choice of residence in Fig. 4.30 shows that the main

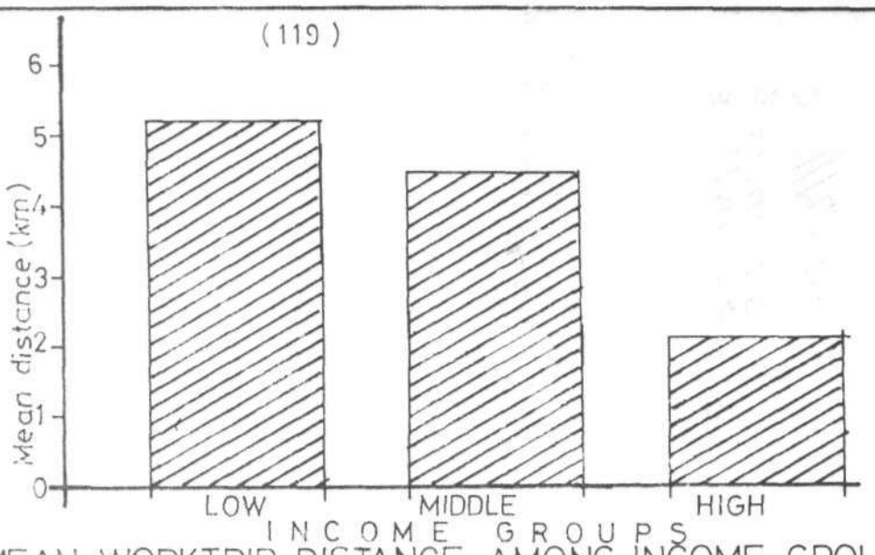


FIG4.29MEAN WORKTRIP DISTANCE AMONG INCOME GROUPS

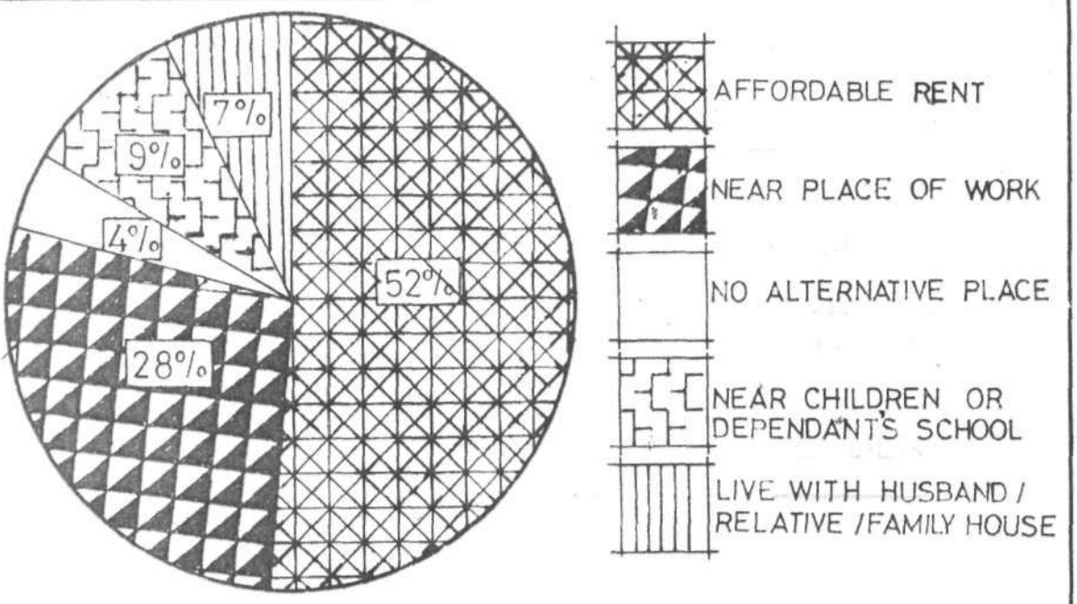


FIG.4.30REASONS FOR WORKERS CHOICE OF RESIDENCE

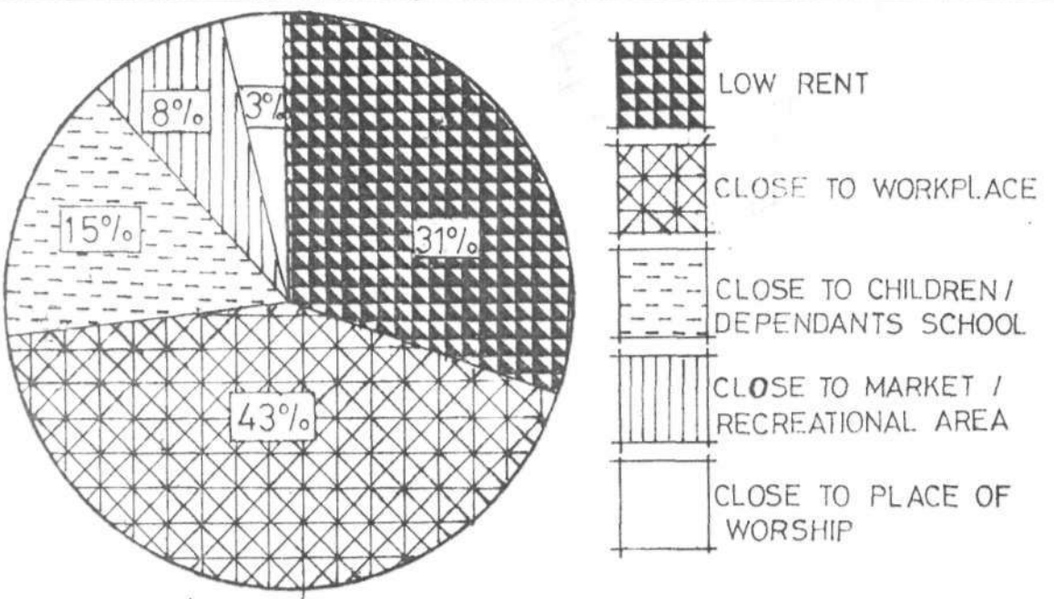


FIG.4.31WORKER'S CHOICE OF RESIDENCE UNDER NORMAL CIRCUMSTANCES.

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reasons for worker's choice of residence is affordable rent (28%). But under normal circumstances, workers would prefer to live close to workplace (43%), while affordable rent plays secondary importance (31%) Fig. 4.31.

4.5.3 Expenditure Pattern

Analysis of data on monthly expenditure on journey to work and rent among workers in different zones in Fig. 4.32 shows that workers in N.W.Bank, Wadata, Ankpa Ward spend more on journey to work than rent. As we saw in Fig. 4.28, these are areas inhabited by low income earners and they make longer worktrips. Workers in N.E. Bank, old G.R.A. and New G.R.A. spend more on rent than on journey to work. As we have earlier seen, these are areas inhabited by high income earners (Fig. 4.28), and they make shorter work trips.

Product moment correlation computed for income of workers and their monthly expenditure on journey to work (Appendix IV) shows a low positive correlation of 0.16 which was not significant at 95% confidence limit. There is a strong positive correlation of 0.88 between workers monthly income and expenditure on rent. This was statistically significant at 95% confidence limit. This was expected since income determines the amount spent on rent.

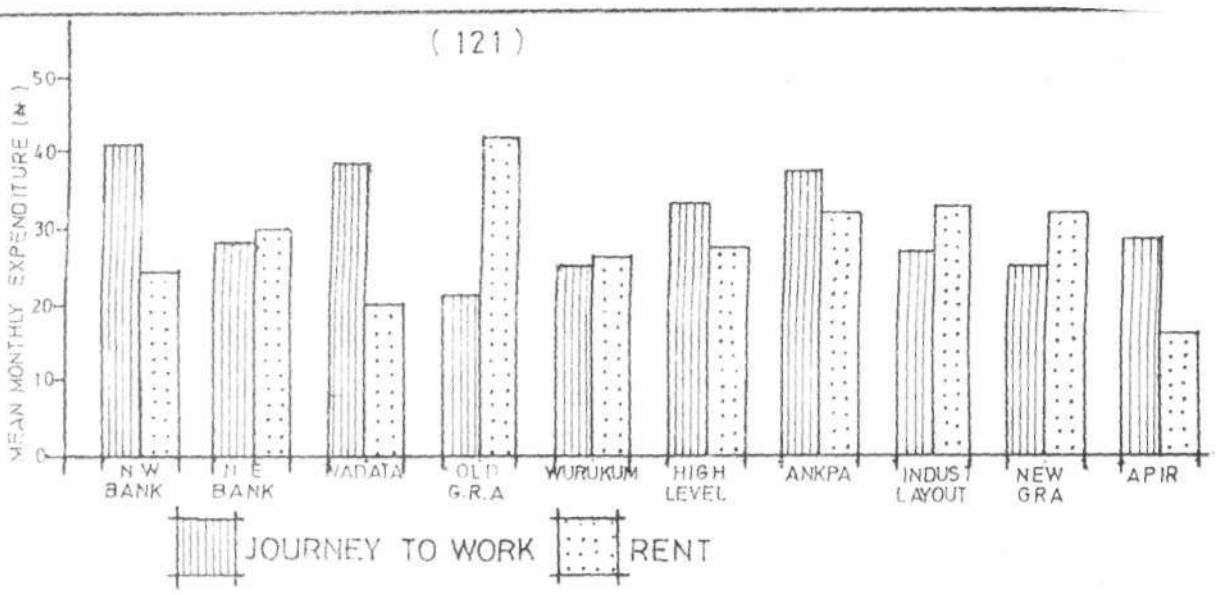


FIG4.32WORKER'S MONTHLY EXPENDITURE ON JOURNEY TO WORK AND RENT IN ZONES.

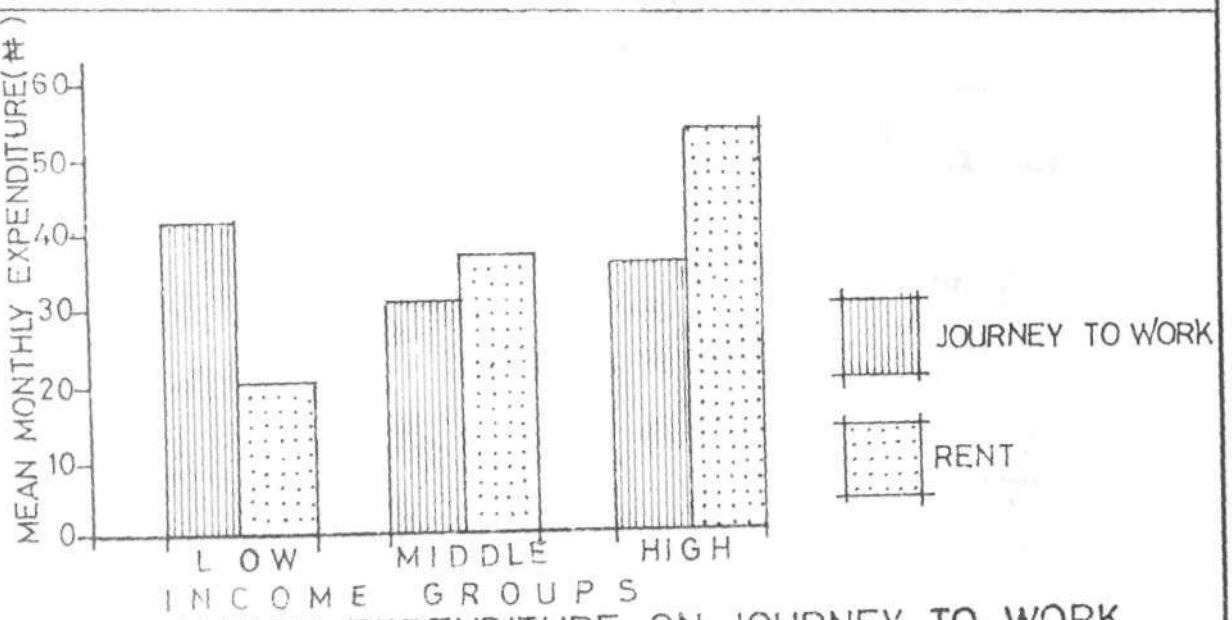


FIG4.33MONTHLY EXPENDITURE ON JOURNEY TO WORK RENT AMONG INCOME GROUPS.

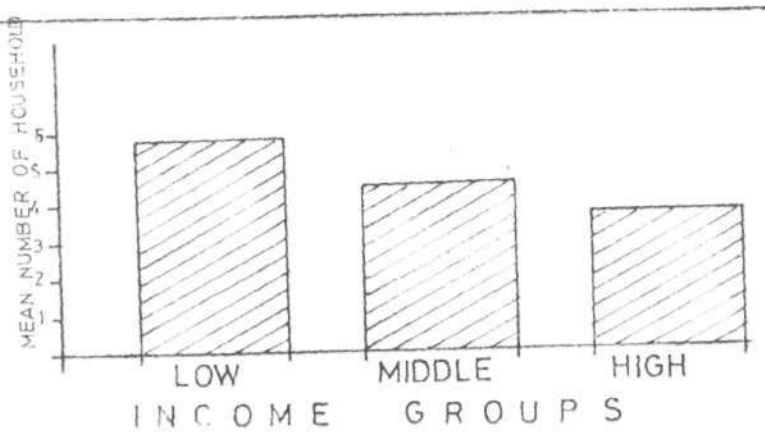


FIG4.34MEAN HOUSEHOLD SIZE AMONG INCOME GROUP

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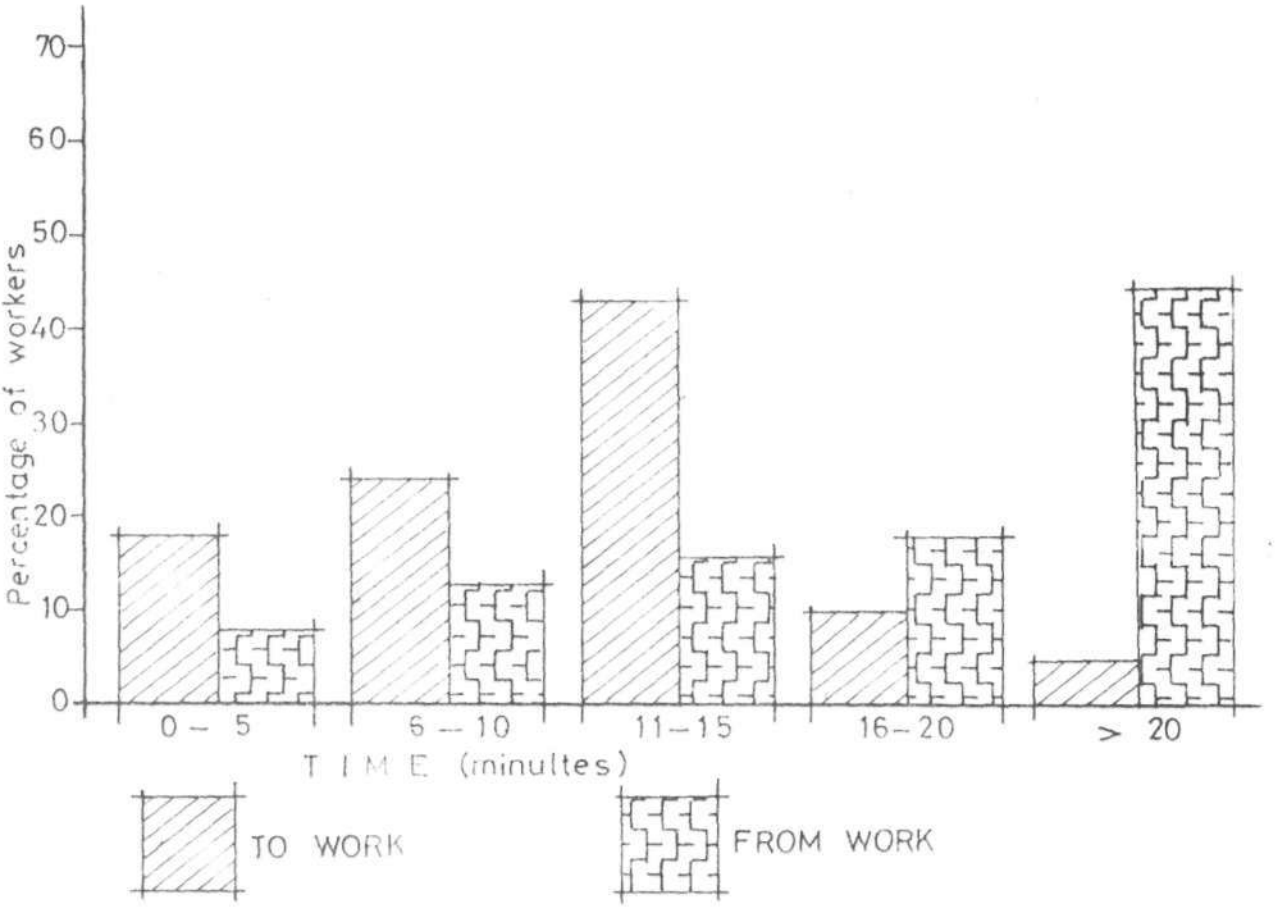


FIG4.14 WORKER'S MEAN WAITING TIME FOR PUBLIC TRANSPORT TO AND FROM WORK



PLATE I. WORKERS WAITING FOR PUBLIC TRANSPORT ALONG OTUKPO ROAD
7.45am Jan 20 1988 FIELDWORK JAN 1988

When the income groups were compared with each other on the basis of expenditure on journey to work and rent (Fig. 4.33), low income groups spend more on journey to work but pay lower rent, while the high income groups pay more rent and spend less on journey to work. This may be due to the factor of income influencing residential location and the fact that lower income groups live far away from their workplaces and higher income groups living closer to their workplaces.

An analysis of data on the household size among income groups (Fig. 4.34) shows that the lower income groups have more family size than the high income groups. This is expected as in the Nigerian situation. This means the low income group will have to spend more because of their family size.

For the workers who use public transport modes in their worktrips, the mean values of the percentage of their monthly income spent on journey to work based on income groups is shown in Fig. 4.35. The low income groups spend about 26%, the middle income groups about 18% while the high income groups spend about 10% of their monthly income on journey to work.

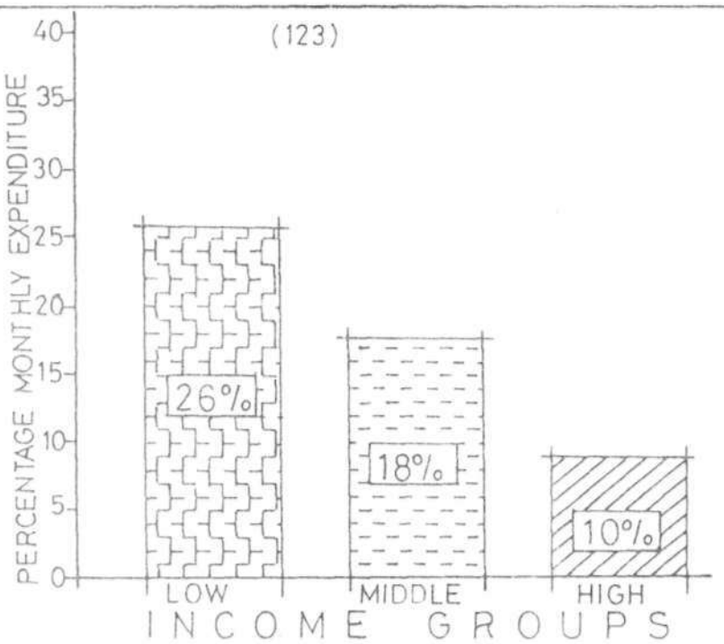


FIG. 4.35: PERCENTAGE OF WORKERS MONTHLY INCOME SPENT ON JOURNEY TO WORK

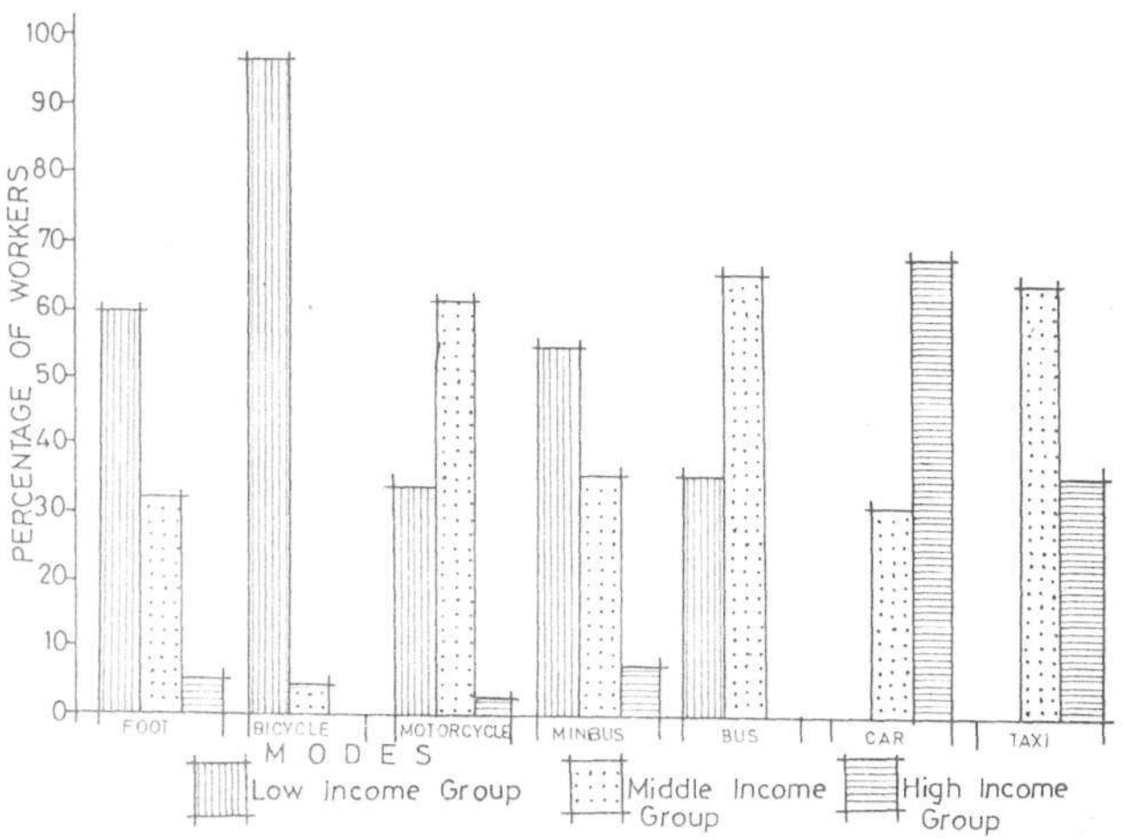


FIG. 4.36. MODAL CHOICE AMONG INCOME GROUPS.

SOURCE: FIELDWORK, JAN. 1988.

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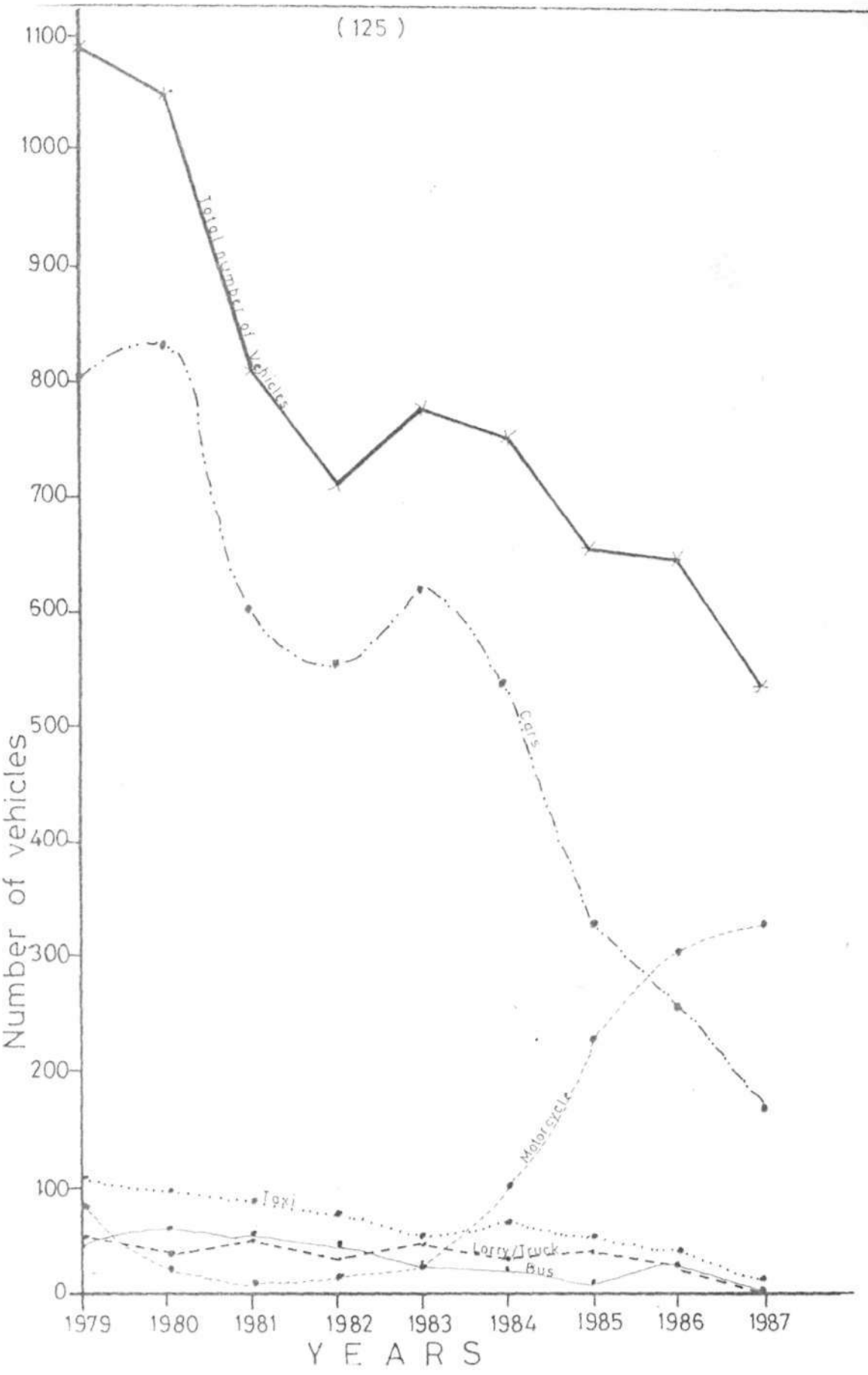
4.5.4 Modal Choice

Socio-economic characteristics of workers affect their modal choice. Result of analysis on the choice of mode among the income groups in Fig. 4.36 shows that the low income groups travel more by foot, bicycle and minibus. The middle income groups travel more by motorcycle, bus, taxi and minibus. The high income groups travel more on cars to work. This was expected since income determines choice of mode. The low income groups cannot afford cars for themselves so do not travel by private car unless given a lift or is a driver to some one.

4.5.5 Effect of the Economic Recession and the Removal of Oil Subsidy on Workers

It is important to mention the effect of the present national Structural Adjustment Programme on the population.

With the astronomical rise in car prices and spare parts, it has become extremely difficult for workers to own cars. There has been a fall in the number of registered vehicles in Makurdi (Fig. 4.37) over the years. But motorcycle transportation is gaining increasing importance as a public transport system (Plate III). The observation is



SOURCE: MIN. OF FINANCE, MAKURDI

FIG. 4.37 TREND IN THE NUMBER OF VEHICLES REGISTERED IN MAKURDI FROM 1979 – 1987

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that the motor car will play a limited role in Makurdi and most people will depend on walking, cycling and public transportation for journey to work. Already motorcycle transportation has been recognised as a legal public transportation system because they pay taxes to the government and since, "it is supplementing the absence of taxis because of its flexibility in providing door to door services" (General Manager, BUDB, 1988). In some Benue towns like Otukpo, Gboko, etc, the tricycle has been introduced as a public transport system (Plate IV). The prognosis is that within the next few months the tricycle will be introduced in Makurdi also.

The removal of oil subsidy had an effect on transport fare hikes, since transport is very basic to all economic activities, the upward review in the transport fare has automatically translated into a general hike in the entire economy. At present, workers pay 50k perdrop on minibus, 40k per drop on Benue links bus, and 80k and above per drop on motorcycle transport in Makurdi.

The effect of the economic recession and removal of oil subsidy is a reduction of vehicle ownership rate. In this case, majority of the people will have to depend on public transport. As an alternative, people will be constrained to live near

their workplaces so as to make worktrips by foot or cycle. Squatter settlements may develop. There is therefore the need to curtail the rate of urban expansion and reduce the scale of the city so as to reduce commutting distance. There is also a need for an organised mass transit system in Makurdi and planning for motorcycle transportation in Makurdi.

An analysis of data on those wishing to change from their present worktrip mode to mass transit is shown in Fig. 4.38. Apart from those using car (which are mainly high income earners) more than 50% of those using other modes wish to change to mass transit system if introduced. Based on the mean amount affordable by the different income groups per drop on mass transit, the low income groups prefer to pay 22k, middle income 30k while the high income groups 40k (Fig. 4.39). If we take the amount proposed by the middle income group as ideal, it will coincide with the amount paid per drop 3 years ago. This is more feasible.

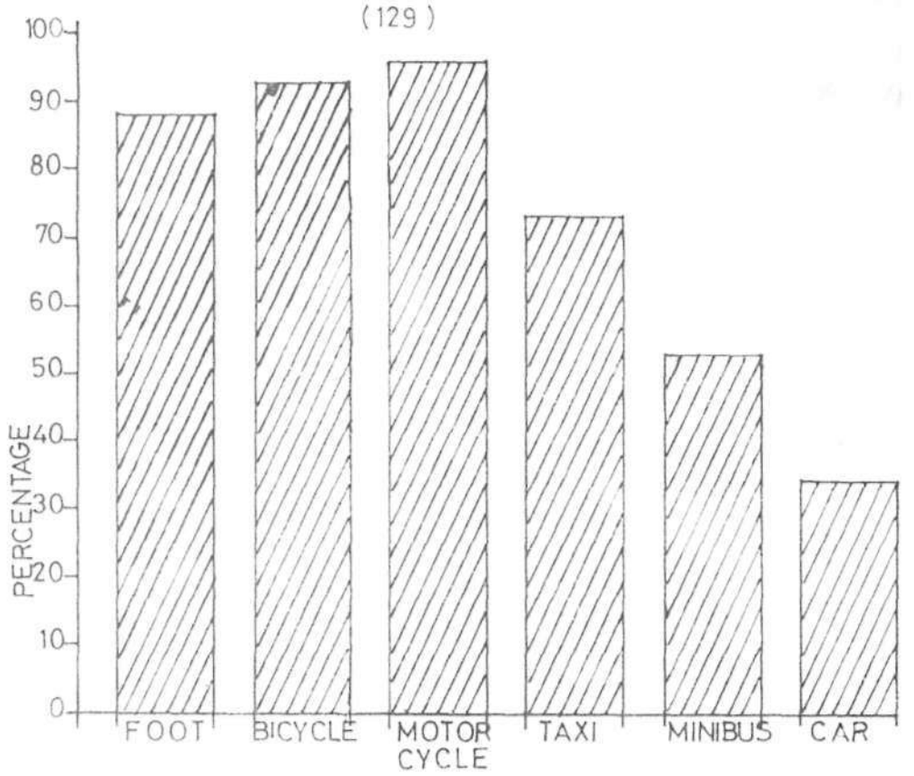


FIG4.38PERCENTAGE WISHING TO CHANGE THEIR PRESENT MODE TO MASS TRANSIT

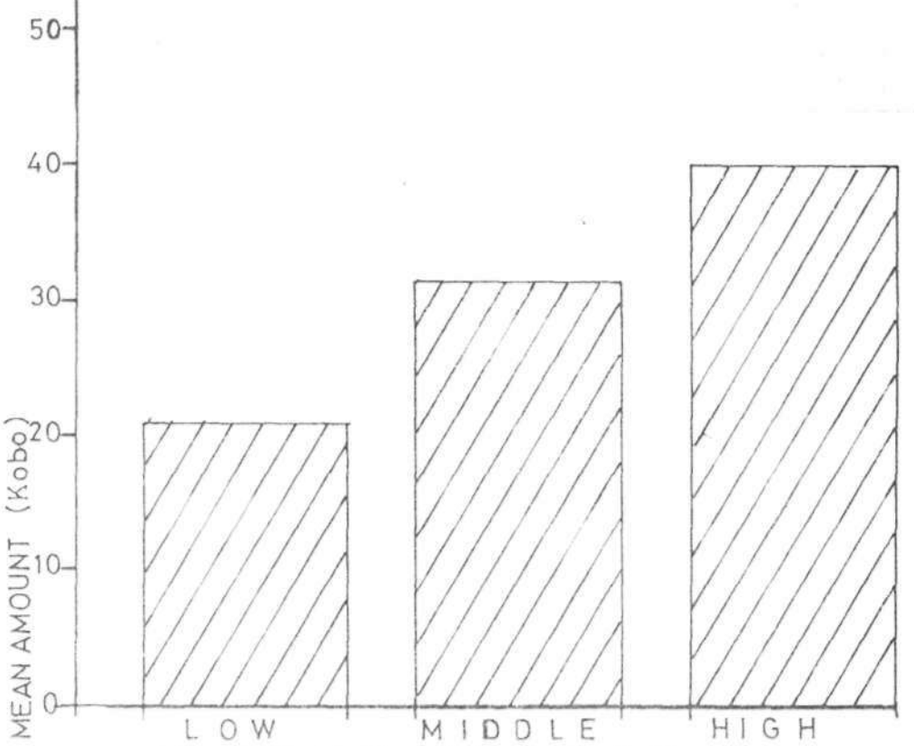


FIG439AMOUNT AFFORDABLE PER DROP ON MASS TRANSIT BY THE INCOME GROUPS.

FIELDWORK JAN 1988 AMEH, P.O.
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4.60 PROBLEMS OF JOURNEY TO WORK IN MAKURDI URBAN AREA

The main problems of journey to work in Makurdi are long time journeys, high cost of journey to work and inconveniences and strains (Table 4.10). These vary depending on the socio-economic status of the worker. To the high income earner who owns a vehicle, time is likely to be the most important. To the low income earner who joins public transport, money is likely to be the most important. The price of the transportation service offered by a public carrier is a fare, but the cost of a worktrip in a private automobile is more diffuse: Marginal trip costs would increase among other items the costs of fuels and lubricants and mileage related maintenance costs. However this will not be quantified in this study.

The World Bank's Water supply and Urban Development Department has provided some relevant indicators for assessing urban transport in terms of travel times, degree of overcrowding and fares for developing countries (Urban Edge, 1986).

4.6.1 Long Travel Time

Travel time according to World Bank can be considered excessive when a door to door trip of

6km consistently takes 40 minutes, 10km trip takes 60 minutes. The trip is assumed to include walking and waiting time, as well as time spent on board vehicle. Overcrowding is based on the number of loaded buses that pass a bus stop without allowing people to board. If more than two or three buses, or 15 minutes pass before boarding is possible, the system is overcrowded at that location at that time (Urban Edge, 1986). Based on past studies of a similar nature by Ayeni (1979) in Jos, Amuda (1986) in Ilorin, Ojumu (1979) in Lagos, we find that the World Bank criteria is reasonable.

Analysis of the time spent on journey to work at various distances by workers in Fig. 4.40 shows that workers spend much of their time in travelling to work when the World Bank criteria is used. When the mean travel time of workers among various modes was computed, (Fig. 4.41), the workers that go by minibus, bus and workers that travel by minibus but change to motorcycle in their worktrips all spend above 40 minutes in their journey to work.

The excessive travel time is due to the following causal factors (Table 4.10): One is the hapharzard distribution of major landuses caused by Makurdi rapid urban growth and physical constraints

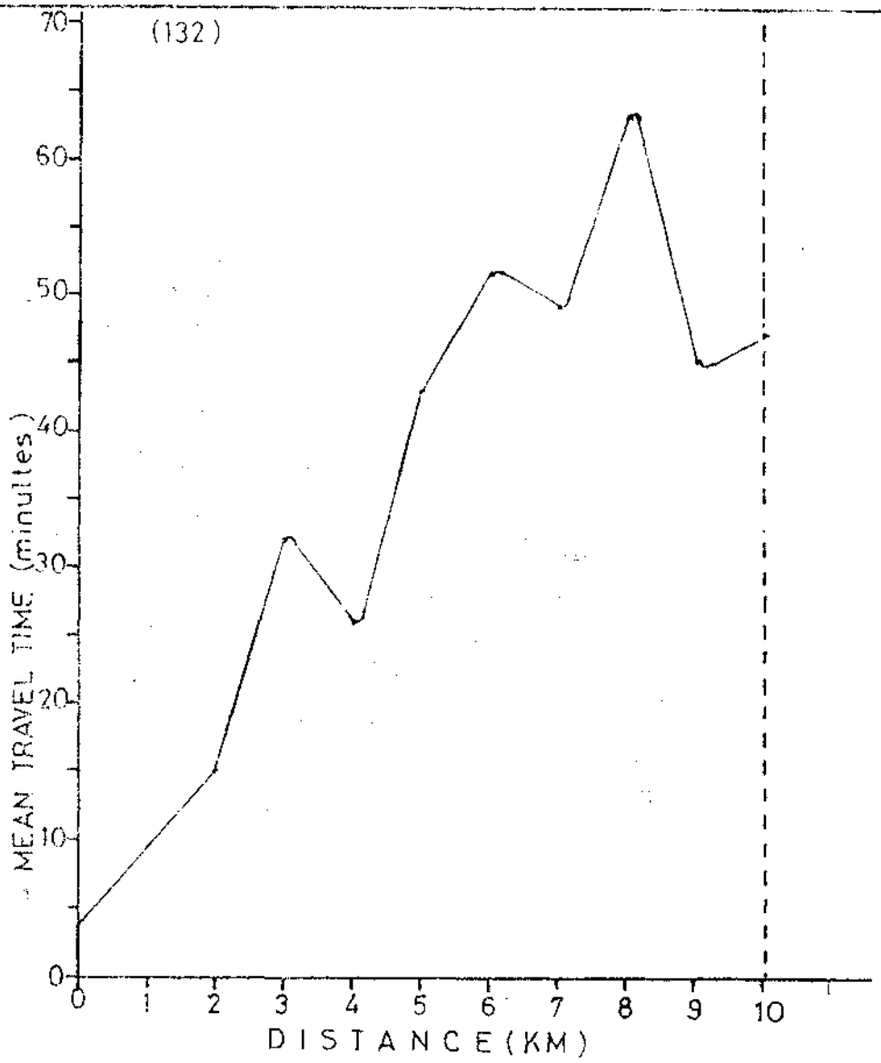


FIG. 4.40 RELATIONSHIP OF DISTANCE TO TRAVEL TIME OF WORKERS IN MAKURDI, 1988.

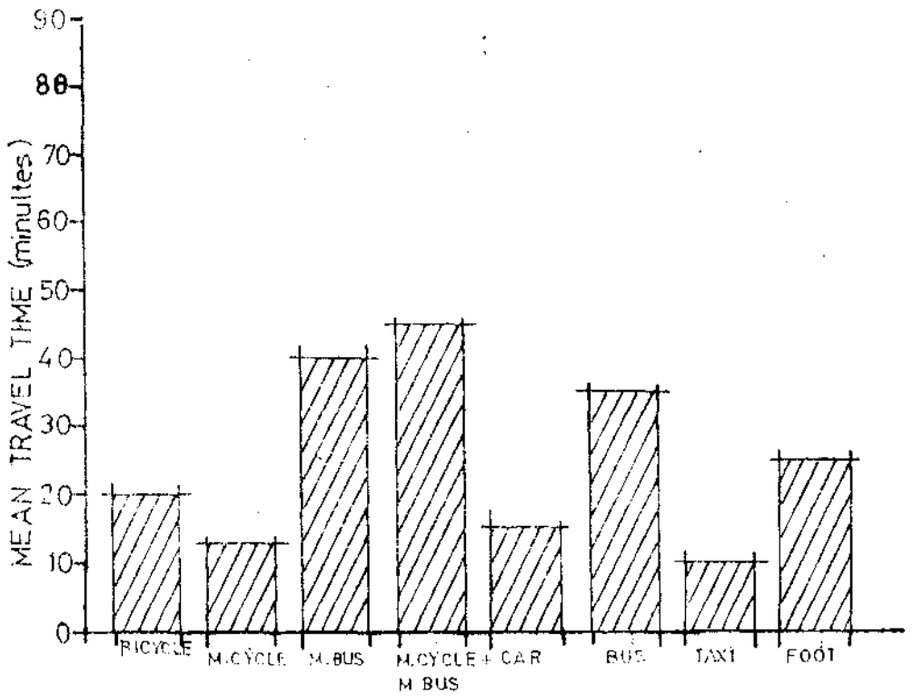


FIG 4.41 REPORTED TRAVEL TIME OF WORKERS BY MODES

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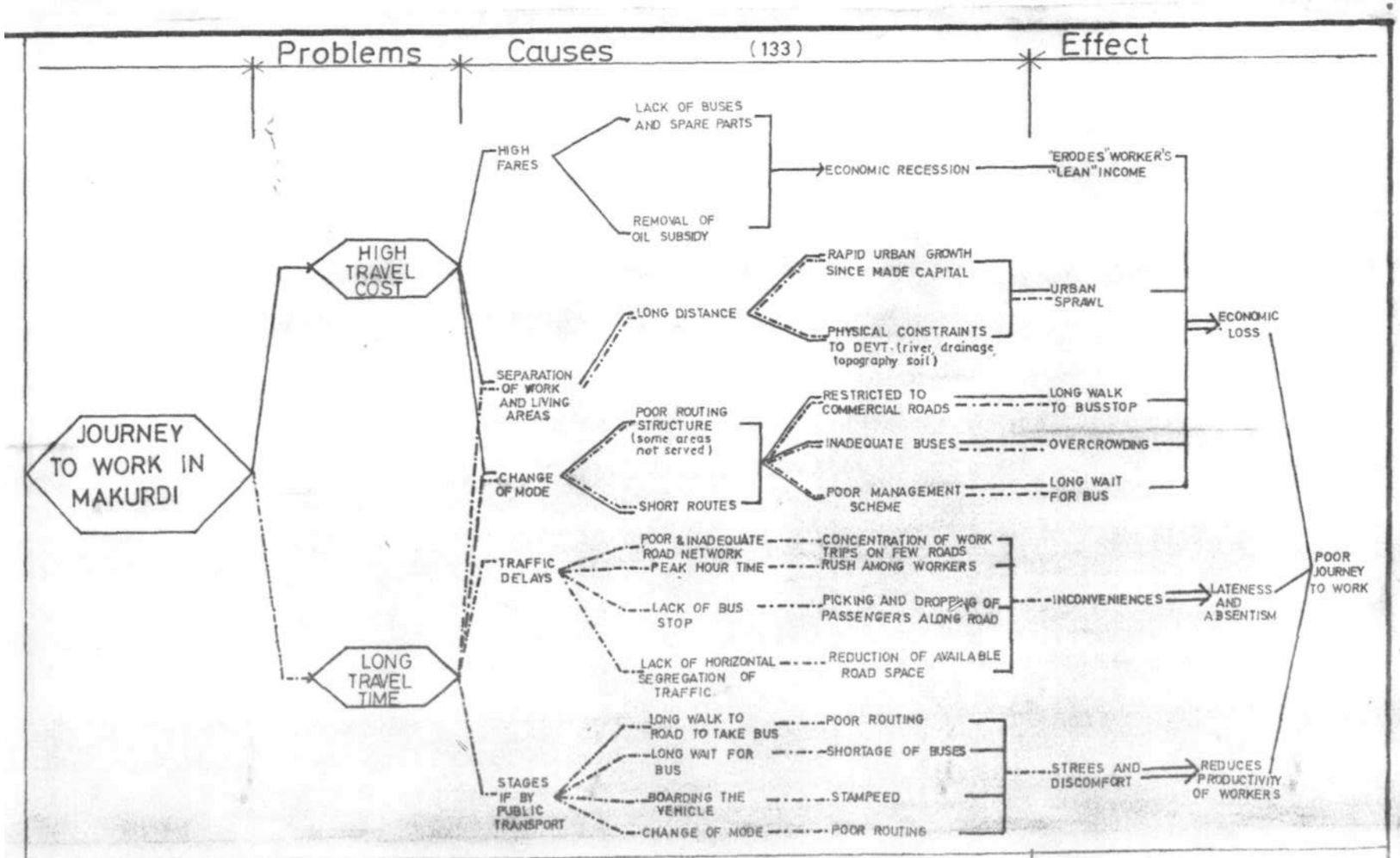


TABLE4.10 PROBLEMS OF JOURNEY TO WORK IN MAKURDI.

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to development. This has led to the development of major workplaces far away from the residential areas leading to the long travelling distances of workers to work.

Secondly, traffic delays is a common feature on some roads like Railway Byepass, Kashim Ibrahim road, Lafia road and Benue Crescent. Traffic delays arises when the demand for right of way backed up by vehicle ownership is greater than the network provided thereby slowing down movements. Traffic delay in Makurdi is caused by inadequate and poor road network. Most streets in Makurdi are untarred. There is not enough and direct connection between the residential areas and the work areas. Workers do not travel directly to their work areas and this has led to long travel time.

The lack of designated bus stops and parking problems along these roads leads to the slowing down of movement by the minibus drivers since they pick up and drop off passengers anywhere, having no designated stops. They threaten and disrupt smooth traffic flow by constantly blocking the road.

There is insufficient management of the public transport system and this contributes to long time travel. Most buses are concentrated in certain

areas regardless of the distribution of the population. This leads to changing of vehicles many times by the workers even along the same straight routes and long waiting time at bus stops.

Another cause of the long travel time in Makurdi is the various stages to follow if the public transport system is to be used by workers. This includes long walk to the road to take bus, long waiting for bus, boarding the vehicle which requires struggling, change of mode and long walk to work from the road.

The use of various modes of transport to work like cars, motorcycle, bicycle, minibus and walking without horizontal or vertical segregation. This helps to reduce the capacity of the road which leads to delay.

The working hour period is another factor. Most workers resume duty almost at the same time in the morning and close at the same time in the evening. This has led to the high peak volumes.

Other elements of long time journeys in Makurdi include delays due to police check on vehicles, accidents, railway crossing on some roads, vehicle turning at road junctions.

4.6.2 High Travel Cost

Another major problem associated with journey to work in Makurdi is the high cost of travel. According to the World Bank's criteria for assessing urban transport in developing countries,

> "... a fare structure descriminates against low income workers when costs makes it impracticable for them to use the bus. A reasonable criterion is the cost of a week's transit fares for trips to work as a percentage of the total weekly household income. Costs exceeding 10% of income for more than 15% of the population can be considered discriminatory service. Lack of service to low income neighbourhood is another obvious form of discrimination" (Urban Edge, 1986).

This is a reasonable criteria and since it was based on studies in urban centres in many developing countries. It is therefore adopted in this study.

As we earlier saw in Fig. 4.28, the low and middle income groups form about 48% and 38.2%. Also in Fig. 4.36, the low income groups spend about 26%, the middle income spend about 18% while the high income groups spend about 10% of their monthly income on journey to work in Makurdi. Consdering the World Bank's criteria, we conclude that the fare structure descriminates highly against the low income groups in Makurdi.

One of the causes of the high travel costs is due to high fare charges by the public transport system in Makurdi. This is due to the lack of buses and spare parts and the removal of oil subsidy. These are as a result of the economic recession.

Another factor of this high travel cost is due to the distant location of workplaces from the residences of workers especially the low income groups who live in Wadata, Ankpa Ward and N.W. Bank. This is because the low income groups cannot afford the high rent near the work areas.

Another factor is that workers change modes several times before getting to their work areas. This is as a result of the poor routing structure of buses, which does not cover some part of the town. Also the buses operate short routes even along the same road. This has led to high cost of travel for workers.

4.6.3 Inconveniences and Strains

Another problem of journey to work in Makurdi is inconveniences and strains on workers. If the journey is made by public transport, it will involve four stages: walking to the bus stops, waiting at the bus stop, changing the vehicle and walking from the bus stop to the work areas.

All these causes alot of inconveniences and strains which affects the productivity of the workers.

Secondly, the smoke emitted by unserviced minibuses and general heat in Makurdi causes stress and discomfort to people in the buses. The generally overcrowded condition of the buses causes stress to workers.

The long travel time, high travel cost and inconveniences faced by workers in their worktrips leads to poor journey to work, lateness and absenteesim, this affects the productivity of the workers, it is also an economic loss and it represents leisure time forgone. All these have the effect of retarding economic progress of the town (Table 4.10).

CHAPTER FIVE

5.00 EXPECTED URBAN DEVELOPMENT AND FORECASTS OF WORKTRIPS IN MAKURDI

5.10 EXPECTED URBAN DEVELOPMENT

Forecasts of landuse pattern with respect to residences and workplaces is important in determining future worktrip production and attraction patterns. An analysis of the existing urban structure of Makurdi and the trend of development with respect to Master Plan projection forms a basis for determinig the future landuse pattern in this study.

The proposed landuse pattern for Makurdi by the Master Plan is shown in Fig. 5.1.

5.1.1 Residential Areas

According to the proposals of the Master Plan, there will be high development of residential land by the year 2005. The town is proposed to have four districts (Fig. 5.1). The first residential district is central Makurdi which includes the Old G.R.A., Wadata, Wurukum, Ankpa Ward and Highlevel. The development in the North Bank as of 1978 was to be maintained at a fourth of the whole town (Fig. 5.1). Thirdly, the southern residential district which will cover the wide land below the depression crossing

(140)

SITE FOR FUTURE DEVELOPMENT

ARMY

H

E

PR

P

C

RIVER BENUE

SP

E

F

H

SW

CC

T

DC

C

C

C

PR PRISON
CC CITY CENTRE
DC DISTRICT CENTRE
C CEMETRY
E EDUCATIONAL
H HOSPITAL
P PORT
SP SPORTS FIELD
ST STATION
SW SEWAGE TREATMENT PLANT

1 0 1 2Km

LEGEND

RESIDENTIAL

COMMERCIAL

PUBLIC AND SEMI-PUBLIC

INDUSTRIAL

SPECIAL AREAS (Military)

PUBLIC GREEN (with special function)

PROTE GREEN

RESER

MAJOR

MINOR

RAILWA

AIRPORT

MAKUR

FIG 5.1 MAKURDI MASTERPLAN: 2005

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Otukpo road down south. Residential developments were also proposed on the large parcel of land on the eastern side of the New Bridge southern approach road which was to be known as Makurdi East.

5.1.2 Work Areas

Proposals on the distribution of work areas in the Master Plan, shows that, commercial landuses will be located in subcentres in each of the districts (Fig. 5.1). Thecity centre will be located in the central Makurdi district. Heavy idustrial area has been proposed along the western part of Makurdi (Fig. 5.1). The public and semi-public landuses will have to be concentrated mainly in the secretariat which will be the city centre area.

5.1.3 Trend of Development

Some proposals in the Master Plan have not been implemented and developments have rendered such proposals useless. The first is the proposal for the construction of a dam across the Benue about 3km from the new bridge road (Fig. 5.1). In that case, the water in the dam way to cover the large part of the N.E. Bank and the south - western part down to the Airforce Base. Information from the Ministry of of Lands and Survey stated that, if the dam is to be constructed at all, it will have to be in Abinsi which

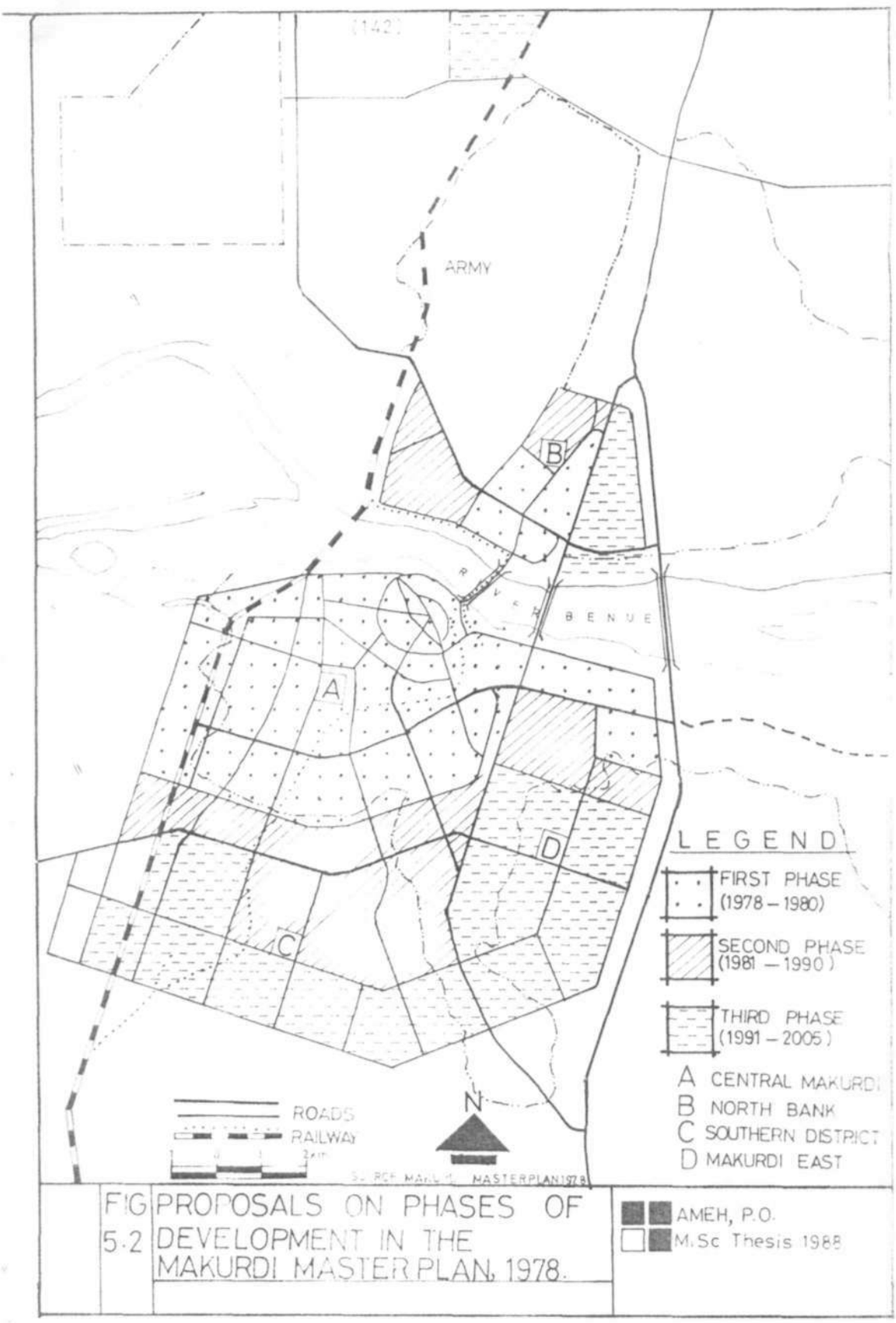


FIG 5.2 PROPOSALS ON PHASES OF DEVELOPMENT IN THE MAKURDI MASTER PLAN, 1978.

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FIG 5.3 STRUCTURE OF MAKURDI IN 1978

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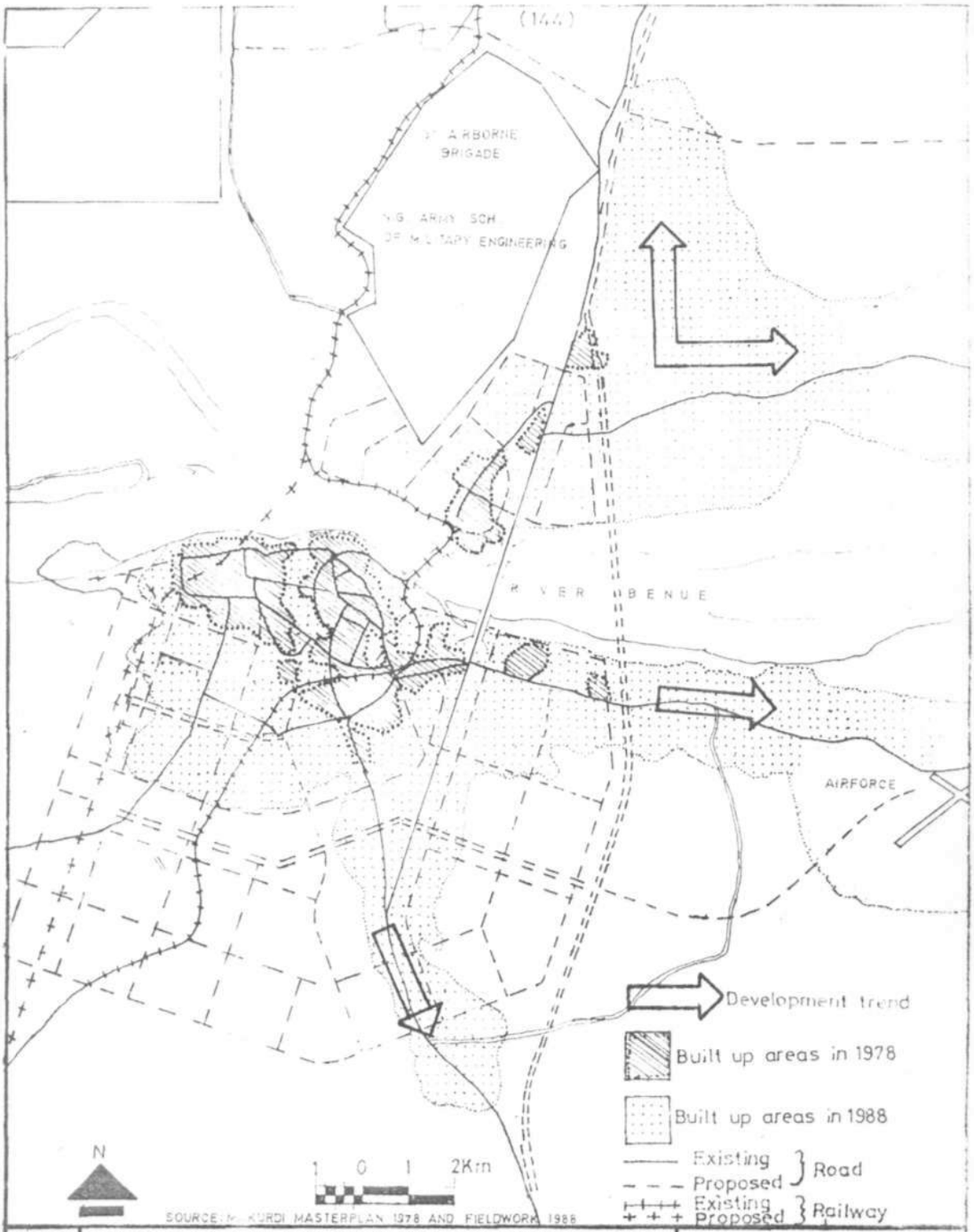


FIG 5.4 MAKURDI MASTERPLAN SHOWING THE BUILT UP AREAS IN 1978, 1988 AND DEVELOPMENT TREND

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is about 20km from Makurdi. Development has covered the area in which the water from the dam will occupy. Developments do not follow according to phases in the Master Plan (Fig. 5.2). Fig. 5.3 shows the extent of development of Makurdi in 1978 and areas under development as of 1978. When the landuse structure as of 1978 and 1988 are superimposed on the Makurdi Master Plan (Fig. 5.4), it was observed that the trend of development has been towards the N.E. Bank, the Eastern and South Eastern part of Makurdi.

At the N.W. Bank, there won't be much development because much of the buildable land has been allocated to the Nigerian Army which "houses" the Barracks, Nigerian Army School of Engineering, and the 31 Airbone Brigade. The rest of the area extending west has a deep gully and undevelopable land.

5.1.4 Proposed Road Network

Because of this trend of development, there is a need to propose a road network since it is not within the scope of the study to prepare a structure plan for Makurdi. The aim is to propose a road network that will facilitate efficient public transport



FIG 5.5 PROPOSED ROAD NETWORK FOR MAKURDI — 2005

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system in Makurdi for up to 2005.

The proposed road network has a curvilinear pattern (Fig. 5.5). The first hierarchy of roads are in a ring form enclosing a network of linear grid which are second and third order roads. It has potentials for operation of mass transit system and conforms with thepresent road network. It also conforms more with the proposals in the Makurdi Master Plan.

The proposal for the diversion of railway line is adopted and the railway bridge converted to vehicle use. The Old and New Bridge will be used to their full capacity by 2000, a new road bridge is proposed in the place of the proposed dam.

It is expected that by 2005, much of the N.E. Bank will be developed to cover up to the Federal University of Agriculture. The area towards the Airforce Base will be fully developed by the year 2005. The administration department of the Federal University of Agriculture should have moved to its permanent site. Residential developments will cover from the New G.R.A. to Apir.

5.20 WORKTRIP FORECAST

5.2.1 Work Trip Generation Forecast

The trip generation is the analytical process by which the number of trips which will originate or

terminate within each zone are projected, known respectively as trip production and trip attraction.

Trip production and attraction are dependent on the pattern of landuse: landuse densities and location of landuse activity. Other variables include, accessibility which is dependent on transport system characteristics and the socio-economic characteristics like household size, car ownership which influences the desire of households to make trips.

The multiple linear regression is the best technique used for analysing the worktrip generation. This model reproduces the existing volumes of travel demand between locations and forecasts these patterns for the future. This uses the formular

$$y = k + b_1 x_1 + b_2 x_2 + \ldots b_n x_p$$

where y = number of trips

x_1 to x_p independent variables such as number of cars in each household, household size,

b_1 to b_n = coefficients of the respective independent variables.

However, due to the paucity of information on annual growth rate of household variables, the expansion factor method was used instead. This was by estimating the growth factors for each zone and computing for the year 1995 and 2005 (Fig. 5.6 and Fig. 5.7).

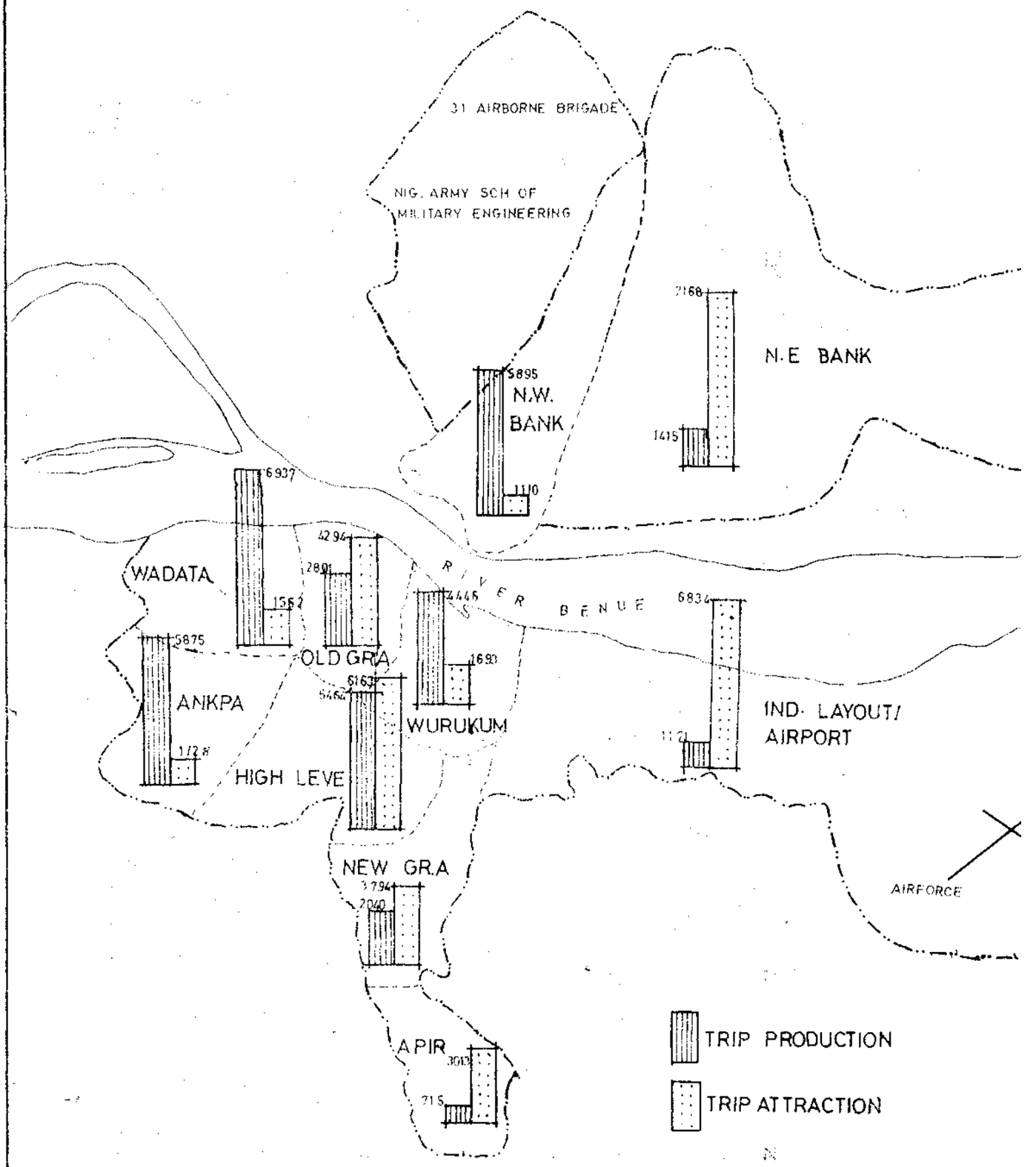


FIG 5.6 WORKTRIP GENERATION FORECAST FOR 1995, MAKURDI

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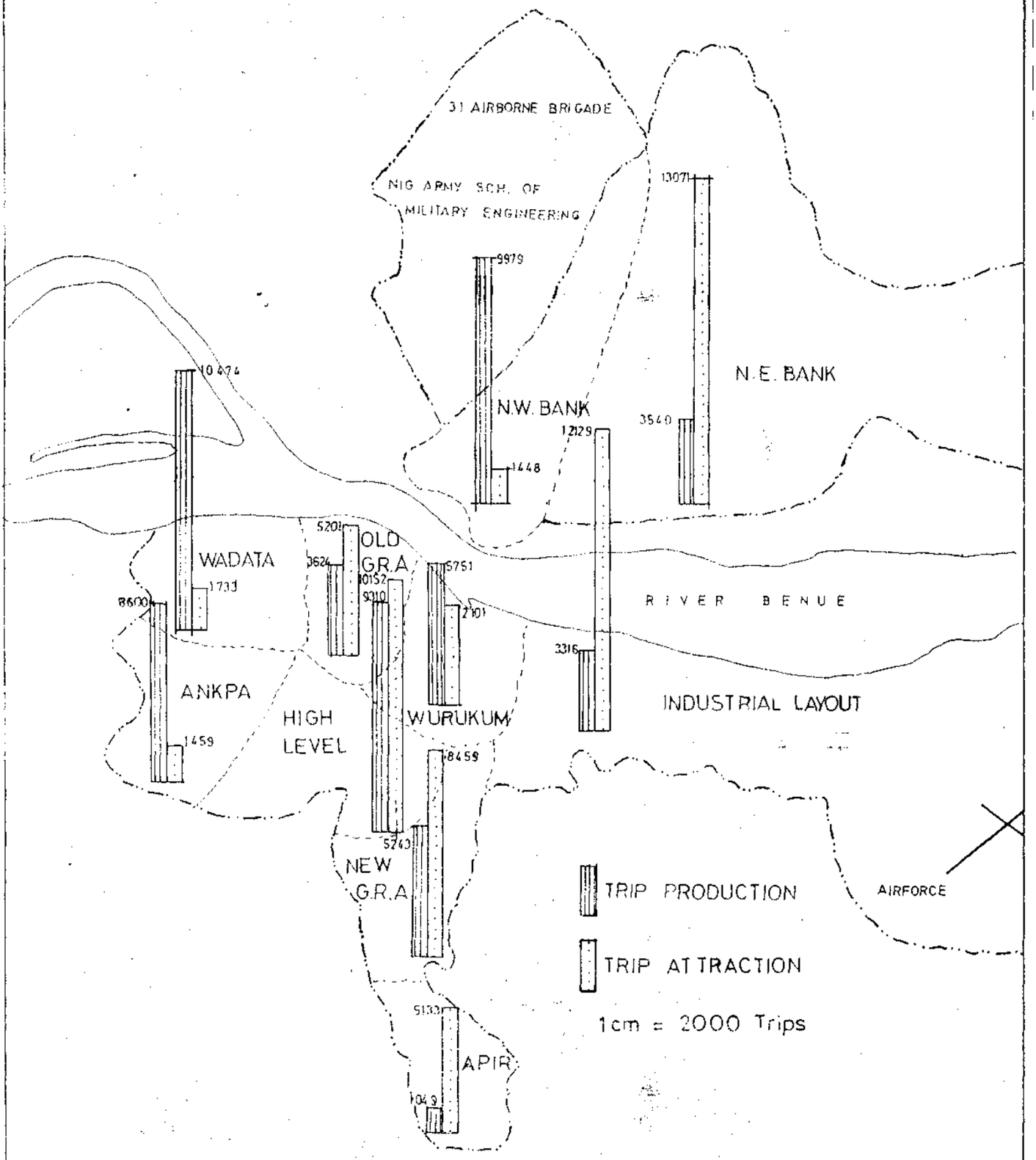


	FIG 5.7	WORK TRIP GENERATION FORECAST FOR 2005.	AMEH P.O M.Sc Thesis 1988

Result of analysis for work trip generation for 1995 and 2003 in Fig. 5.6 and 5.7 respectively shows that the pattern will be similar to the existing situation. Areas like N.E. Bank, Industrial Layout, New G.R.A., Old G.R.A., Highlevel and Apir will continue to be worktrip attraction zones while zones like Wadata, Ankpa Ward, Wurukum, N.W. Bank will continue to be work trip production zones by the years 1995 and 2005.

5.2.2 Work Trip Distribution Forecast

Trip distribution is that part of travel demand which is considered to be the transfer of trips between and within designated zones. It estimates how much of the future trip ends generated for particular traffic zone will go to each of other zones (Uyanga, 1981). Information from trip distribution is important for planning and provision of transportation facilities and services.

The techniques for analysing trip distribution includes anologue(growth factor) method, synthetic (theoretical) method and optimisation technique. The growth factor technique is more relevant to the data available and is therefore used. The underlying assumption in growth factor method is that future trip making pattern will remain

substantially as at present, except the volume of trips will increase according to the growth of the generating and attracting zones.

The growth factor technique includes uniform growth factor, Average Growth Factor and Detroit Growth Factor. The Detroit Factor has been used for the forecast because it has advantages over others. It introduces the assumption that although the number of trips generated in a zone, will increase as predicted by the appropriate growth factor F, these will be distributed to zone i, in proportion to the appropriate growth factor F_j divided by the growth factor for the area as a whole.

The equation is:

$Tijh = tijb \frac{(Fi.Fj)}{F}$, where

tijh = both directional future total trips between i and j

tijb = Existing trips from i to j

$Fi = \frac{Ti}{ti}$

Ti and Tj = Projected trip ends at i and j respectively.

ti and tj = Current trip ends at i and j respectively.

$F = \frac{T}{t}$ = Total trips for the urban centre.

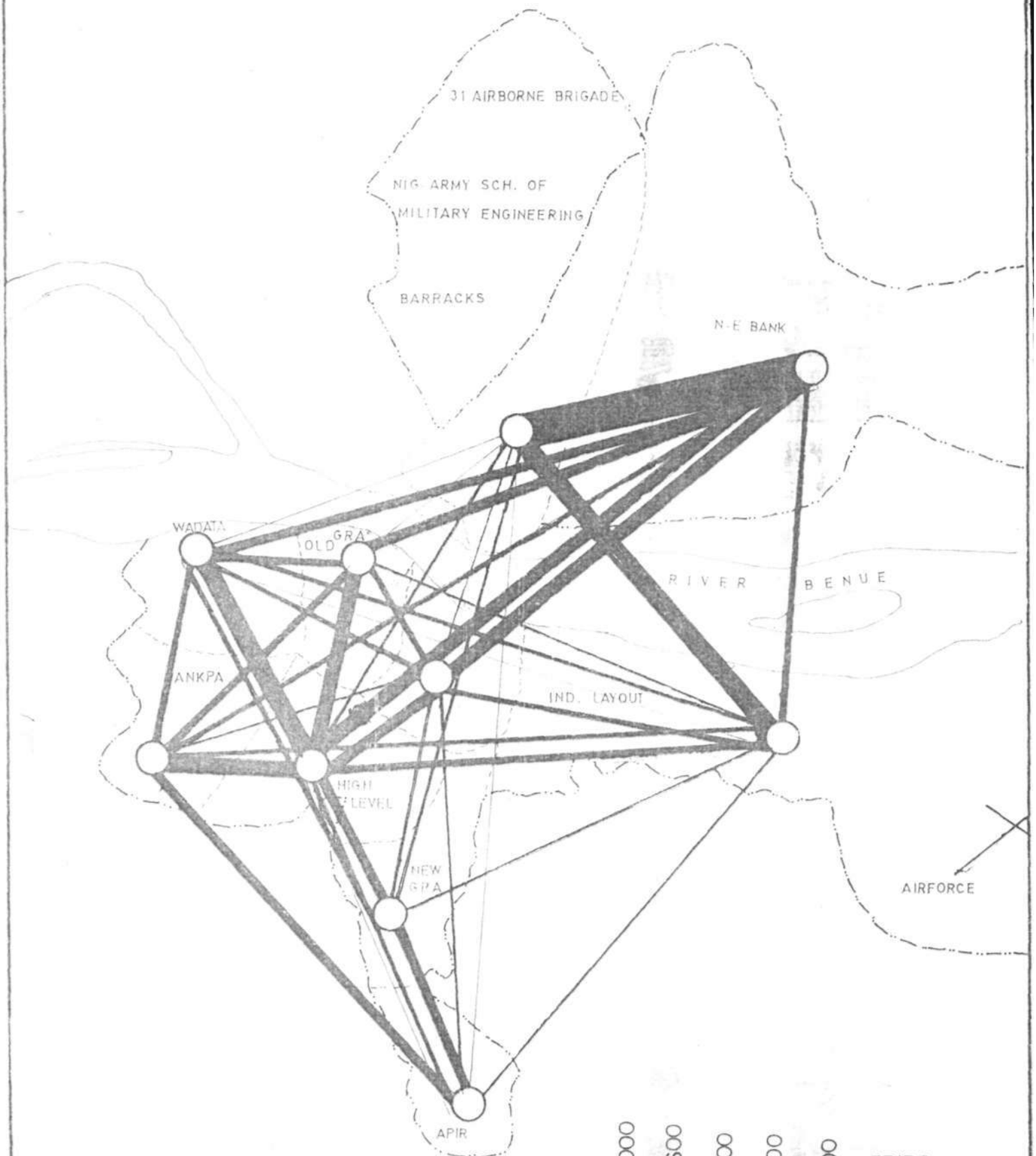


FIG 18 WORKTRIP DESIRE LINES FOR THE YEAR 1995, MAKURDI.

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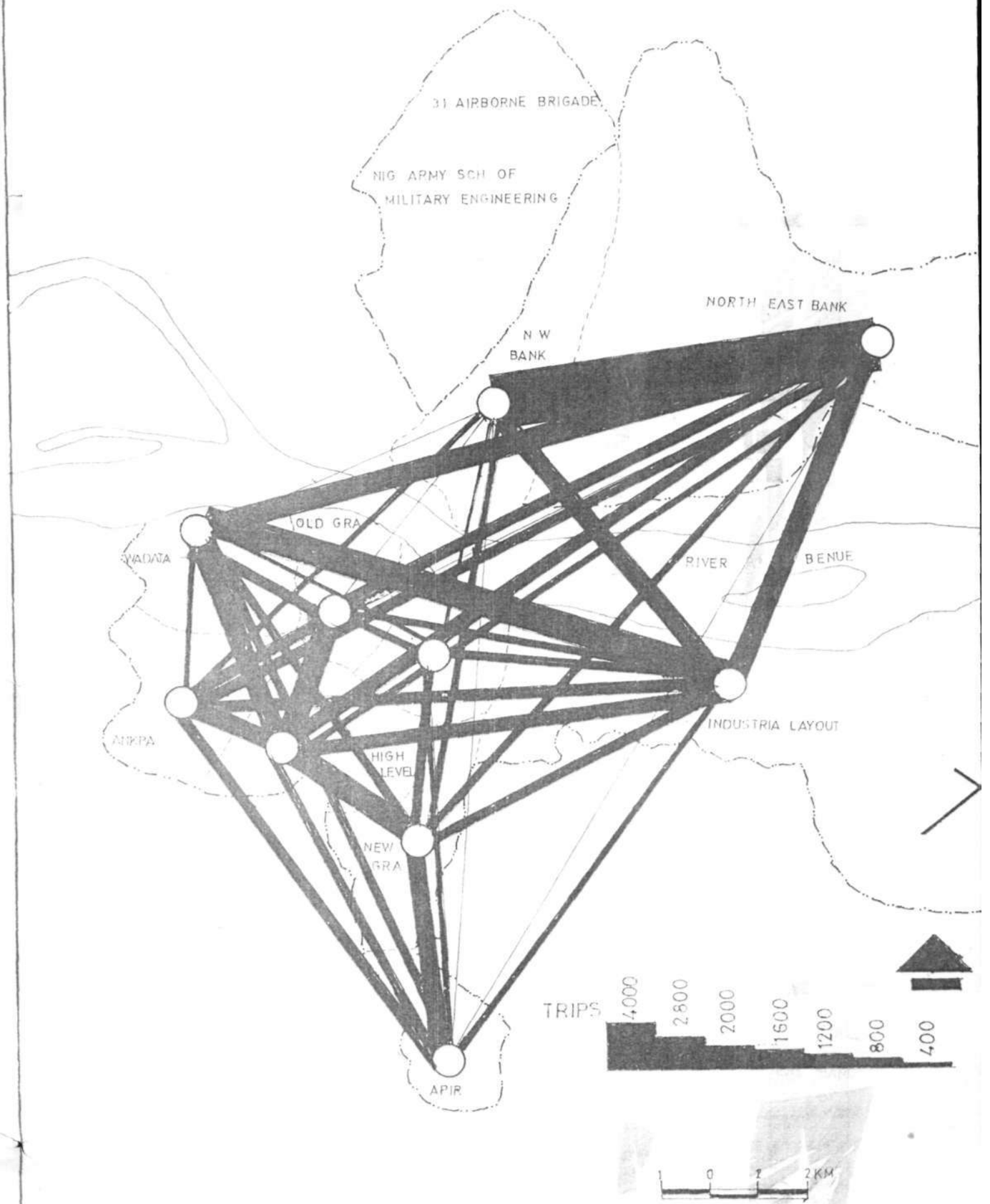


	FIG 5.9	WORK TRIP DESIRE LINES. FORECAST FOR 2005	AMEH, P.O. M.SC. THESIS 1988

TABLE 5.1: PROJECTED WORK TRIP DISTRIBUTION, 1995

ZONES	N.W BANK	N.E BANK	WAD-ATA	OLD G.R.A	WUR-UKUM	HIGH LEVEL	ANKPA	IND-LAYOUT	NEW G.R.A	APIR
N.W BANK	258	2427	124	166	294	405	38	1293	369	129
N.E BANK		266	822	922	1013	979	455	1768	505	0
WADATA			609	848	399	1759	661	1805	975	43
OLD G.R.A				1058	557	1564	111	300	78	0
WURUKUM					681	1195	411	505	464	199
HIGH LEVEL						1987	1311	514	943	485
ANKPA							319	1152	388	780
IND.LAYOUT								212	285	193
NEW G.R.A									528	797
APIR										410

TABLE 5.2: PROJECTED WORKTRIP DISTRIBUTION, 2005

	N.W BANK	N.E BANK	WAD-ATA	OLD G.R.A	WUR-UKUM	HIGH LEVEL	ANKPA WARD	IND-LAYOUT	NEW G.R.A	APIR
N.W BANK	164	4226	88	149	440	408	27	2150	518	138
N.E BANK		1271	1676	2262	2046	2694	918	1949	254	0
WADATA			478	843	327	1965	541	3588	1518	51
OLD G.R.A				1335	579	2216	1157	701	156	0
WURUKUM					583	1394	352	877	756	245
HIGH LEVEL						3159	1529	1350	2091	812
ANKPA							273	2221	632	955
IND.LAYOUT								922	1045	499
NEW G.R.A									2062	1575
APIR										721

TABLE 5.3 PROJECTED WORK TRIPS MODAL SPLIT

YEARS		PERSONAL CARS	BICYCLE	MOTORCYCL	FOOT	PUBLIC TRANSPORT
1988	Work trips	2930	2558	1608	3414	17946
T.Trips 28456	Percentage	10·3%	8.99%	5·61%	12%	63·1%
1995	Worktrips	2930	2867	1985	4043	24996
T.Trips 36759	Percentage	7·9%	7.8%	5·4%	11%	68%
2005	Worktrips	2930	3470	2739	5236	46456
T·Trips 60886	Percentage	4.9%	5.7%	4.5%	8·6%	76·3%

In defining the first set of growth factors for each of the zones, we considered that areas like North East Bank, New G.R.A. and Industrial layout have fast growth. Apir and High level have average growth while the rest of the zones have saturated growth. The formular for first set of growth factors:

$$F_{fast} = (1 + .075)^y$$

$$F_{average} = (1 + .05)^y$$

$$F_{saturated} = (1 + .025)^y$$

where y = number of years.

Result of analysis of the trip distribution for Makurdi is presented in form of desire lines for the years 1995 and 2005 in Fig. 5.8 and 5.9 (table 5.1 & 5.2) respectively. The result also confirms the findings of trip generation in Fig. 5.7 and 5.8 in terms of residences concentration zones and workplaces concentration zones.

5.2.3 Forecasts of Worktrip Modal Split

The modal split analysis is the proportionate division of the total number of person trips between different modes of travel. The aim of the captive modal split analysis phase is to establish relationships that allow the trip ends estimated in the trip generation phase to be partitioned into "Captive" transit riders and "Choice" transit riders (Hutchinson, 1974). The many studies of modal transport

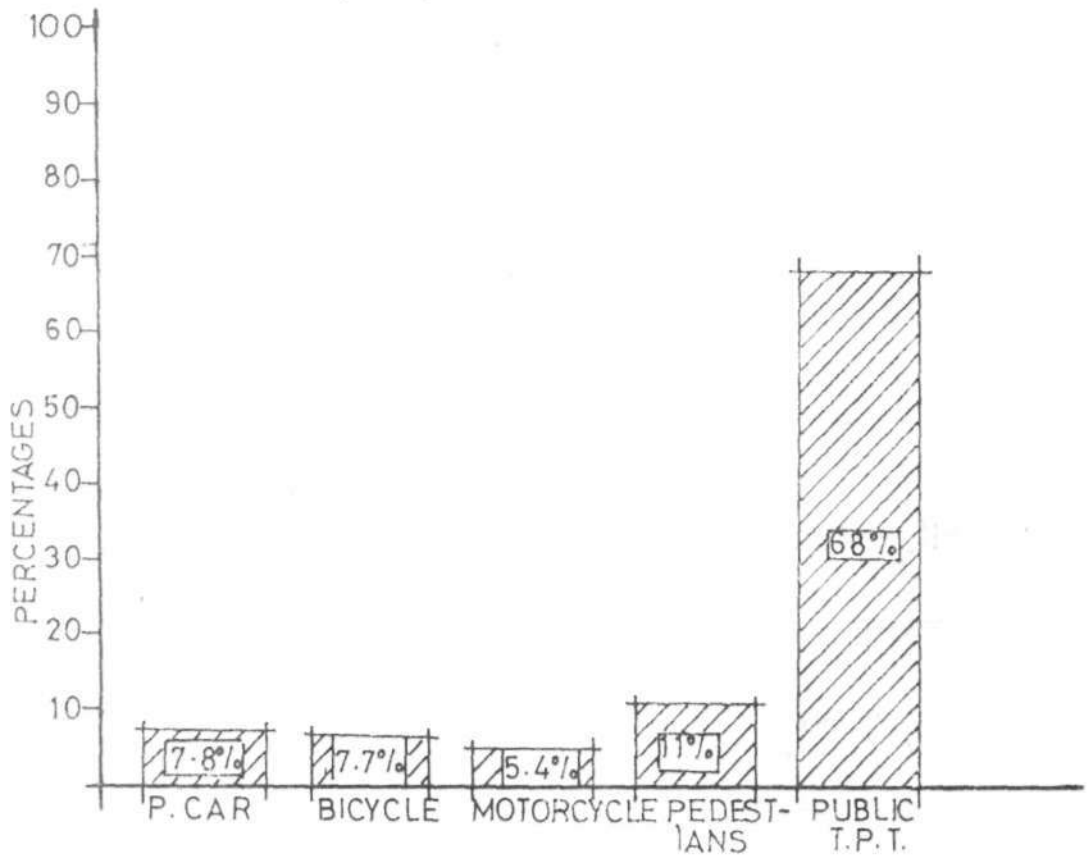


FIG5.10 WORK TRIP MODAL SPLIT FOR 1995

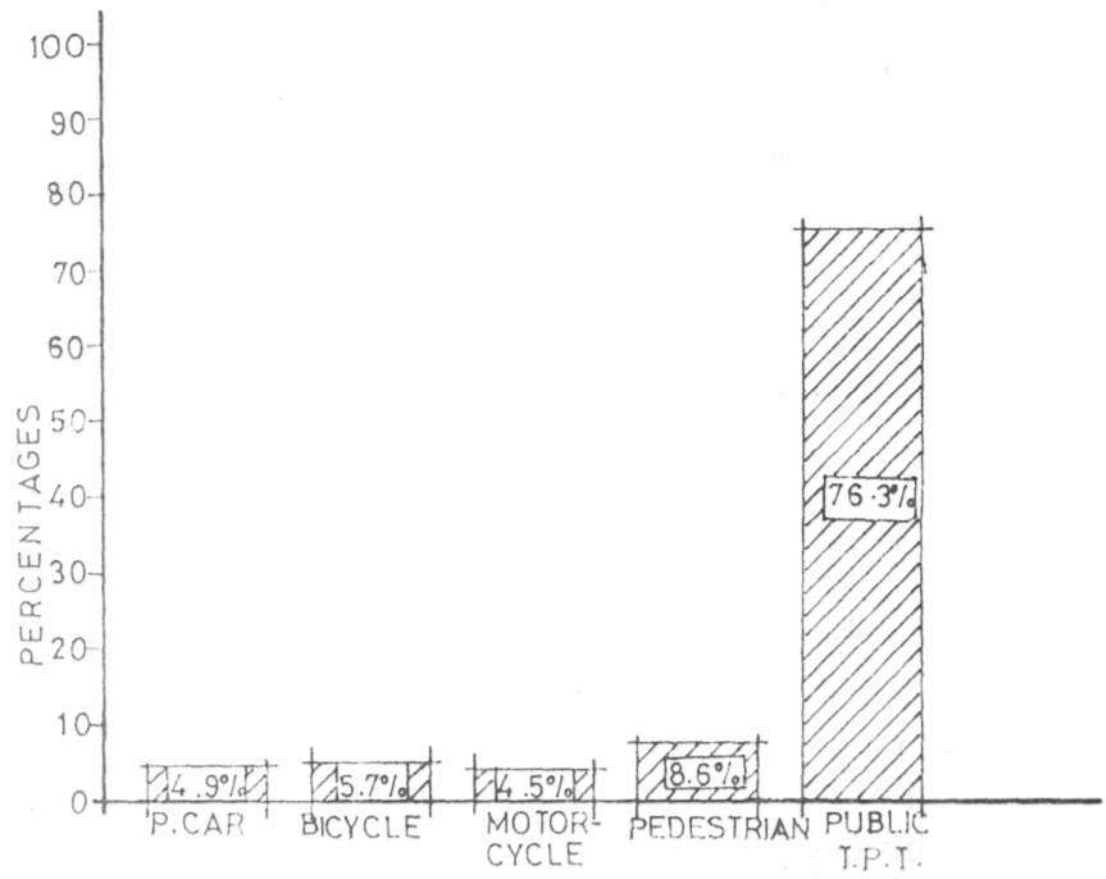


FIG5.11 WORK TRIP MODAL SPLIT FOR 2005

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choice have demonstrated that the major determinants of public transport patronage are: socio-economic characteristics of trip makers, and the relative cost and service properties of the trip by car and trip by public transport (Hutchinson, 1974).

The two types of modal split models commonly used are:

(a) Trip end modal split model which allocates total person movements to alternate modes of travel before the trip distribution stage of the process.

(b) Trip interchange model which allocates movements to the alternate modes after the total movement have been distributed between zones of origin and destination.

The idea of calibrating orthodox modal split model was dropped and percentage distribution of worktrips to different modes was estimated. This is because these modes are only useful in large urban areas where transit plays an important part in satisfying the overall transpot demands. In Makurdi, there are several modes.

The modal split model was therefore estimated by using crude estimates of annual growth of each mode among workers bearing in mind the present economic situation.

Total trips (now) = Personal cars + Motorcycle + Bicycle + Foot + Public transport

Total trips (future) = The same for personal cars + 4% annual growth for motorcycle + 2% annual growth for bicycle + 3% growth for walkers + (public transport + extra growth).

The projected worktrip modal split for 1995 and 2005 is shown in Fig. 5.9 and 5.10 respectively and in Table 5.3. By 1995 and 2005, the number of workers that will follow public transport will increase from the present 63.1% to 68% and 76.3% respectively.

CHAPTER SIX

6.00 PHYSICAL PLANNING PROPOSALS FOR AN EFFECTIVE JOURNEY TO WORK

The planning proposals are discussed under curative and preventive proposals. Curative proposals are short term solutions which will solve the problem of worktrips. The preventive planning proposals are long term solutions for landuse planning and future worktrip.

6.10 CURATIVE PLANNING PROPOSALS

This involves the improvement of the road network, organising the present mass transit programme, the use of school and staff buses.

6.1.1 Improvement of Road Network

There is the need to improve the poorly developed road network and construction of few new ones. The poor road network makes workers not to journey direct to work.

The streets to be tarred include Bishop Murrary Street, Kenshisha Street, Balewa Street, Ugbokolo, Enugu and Kaduna Streets. This will create alternative routes for vehicles and reduce the heavy traffic on the major roads (Fig. 6.1).

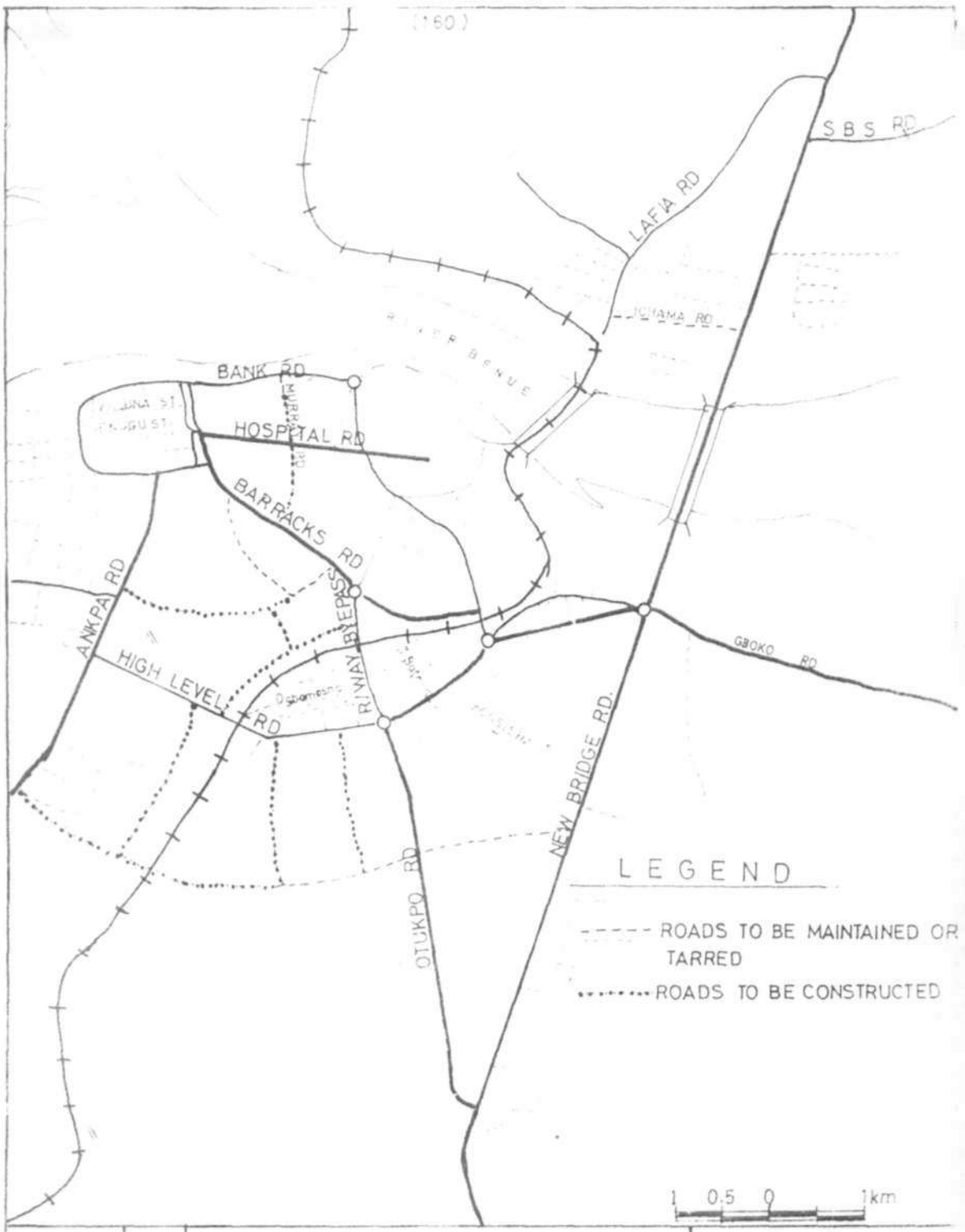


FIG 6.1 PROPOSED IMPROVEMENT ON MAKURDI ROAD NETWORK

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The new roads to be constructed include: Highlevel Road to join Railway Byepass (Fig. 6.1). Much of the worktrips from old G.R.A. to the Secretariat will be assigned to this route. Secondly, Ankpa Road is to be linked to the New Bridge road (Fig. 6.1). This will connect the Secretariat and other workplaces. Thirdly, a road linking Ankpa road to Barracks road. This will connect the Ministry of Education.

Improvements are expected to be made on the poorly designed intersections, construction of sidewalks and improved pavings.

6.1.2 Organising the Mass Transit Programme

In view of the great demand for mass transit modes of transportation, the low car ownership ratio in Makurdi, and in view of the serious traffic delays caused by too many cars for the available urban road space, the strategy to be used is to improve the mass transit system. This is through ensuring adequate supply of mass transit buses, ensuring greater frequency and reliability of their services, making them clean, decent and fairly comfortable, and ensuring a wide coverage of the

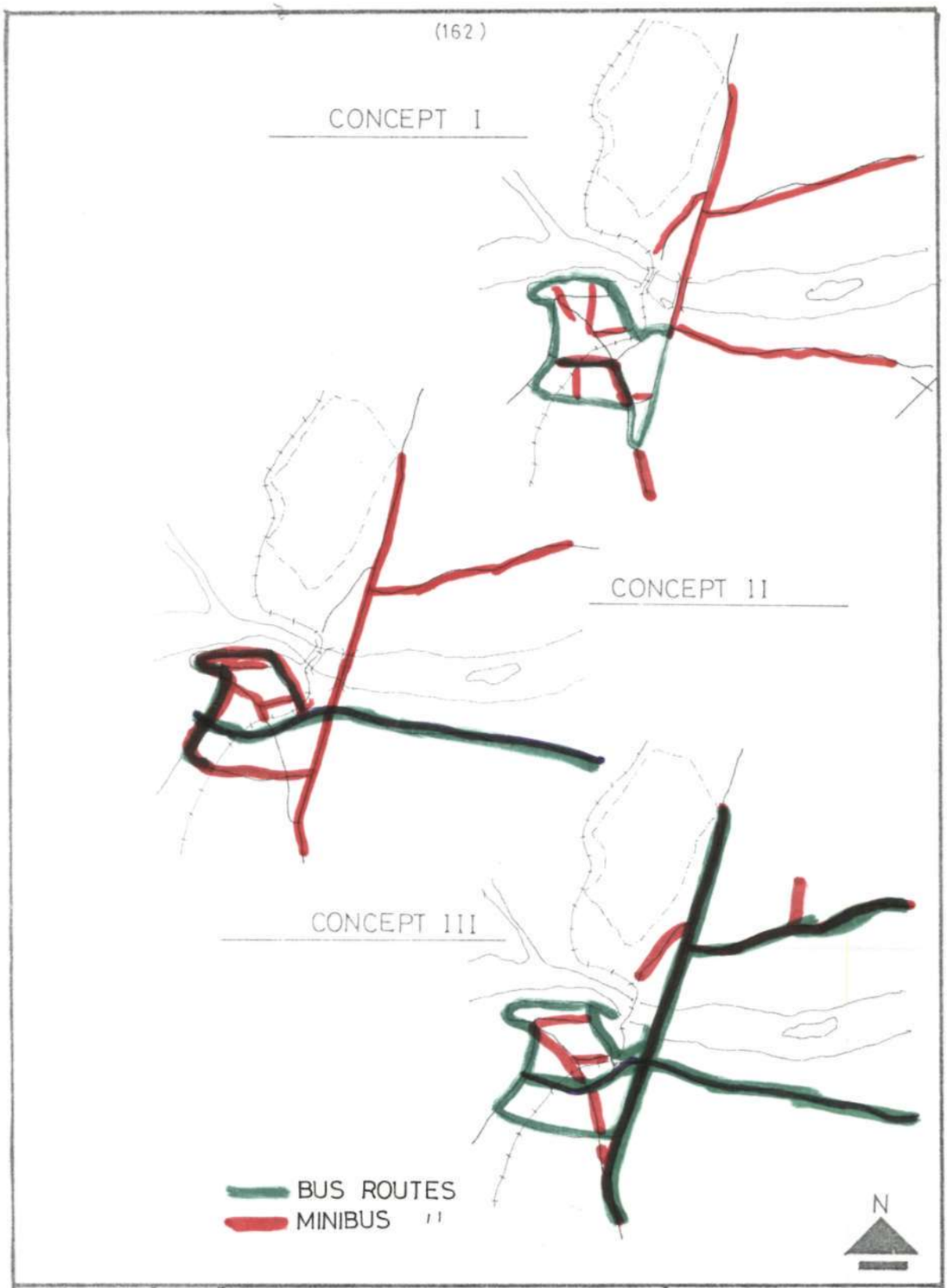


FIG. 6.2 ALTERNATIVE CONCEPTS: PLANNING FOR THE PRESENT MASS TRANSIT PROGRAMME.

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city areas in their operations. This will help in inducing car owners from the use of their cars during peak hours. The proposal will involve an integration of the bus, minibus and taxi services because of their greater flexibility in door to door services.

Alternative Concepts for Bus Routing

Concept I (Fig. 6.2a)

This concept advocates that the buses should operate on the roads enveloping the main core of the town. In that case, workplaces like the international market, the State Secretariat, New and Old GRA will be served (Fig. 6.2a).

Minibus and taxis are inward looking in their operation in that their services are restricted to the areas enclosed by the bus routes, areas in the industrial layout and North Bank. They are to filter traffic within the urban area to the bus routes.

It is expected that movement from residences to workplaces will be quick, reliable, and accessible to most workers.

Concept II

This concept calls for the operation of the bus services in form of a cross (6.2b). Bus services will cover North-South and East to West of the town.

In that case, workplaces in industrial layout, New G.R.A., International Market and N.E. Bank will be served.

The minibus and taxi services will then converge on the bus routes to serve the workplaces.

The cross-shaped bus services supported by the minibus services will ensure that workers are adequately served and workplaces are easily reached in good time and under comfortable conditions.

Concept III

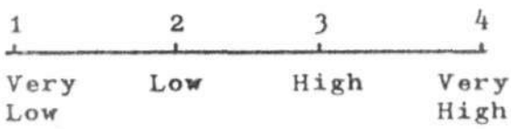
Concept III is a synthesis of concept I and II. It has a peripheral city bus services and a North-South and East-West routes (Fig. 6.2c).

Minibuses will then "feed" these bus routes. This concept combines the best features of the other two concepts.

Table 6.1: EVALUATION OF BUS ROUTING CONCEPTS

EVALUATION CRITERIA	Concept I	Concpet II	Concept III
1. Accessibility of Services to Residences and Workplaces	1	2	4
2. Travel time and speed	2	1	3
3. Minimising rate of change of mode	1	2	4
4. Capacity to redistribute worktrips	2	3	4
5. Cost of Construction of system facilities	3	4	1
TOTAL	9	12	16

Rating Scle



Based on the evaluation criteria and rating scale of all the concepts in Table 6.1, concpet I scored 9 points, concept II 12 points while concept III has 16 points. Concept III is therefore the accepted concept and is used in organising the mass transit system (Fig. 6.3).

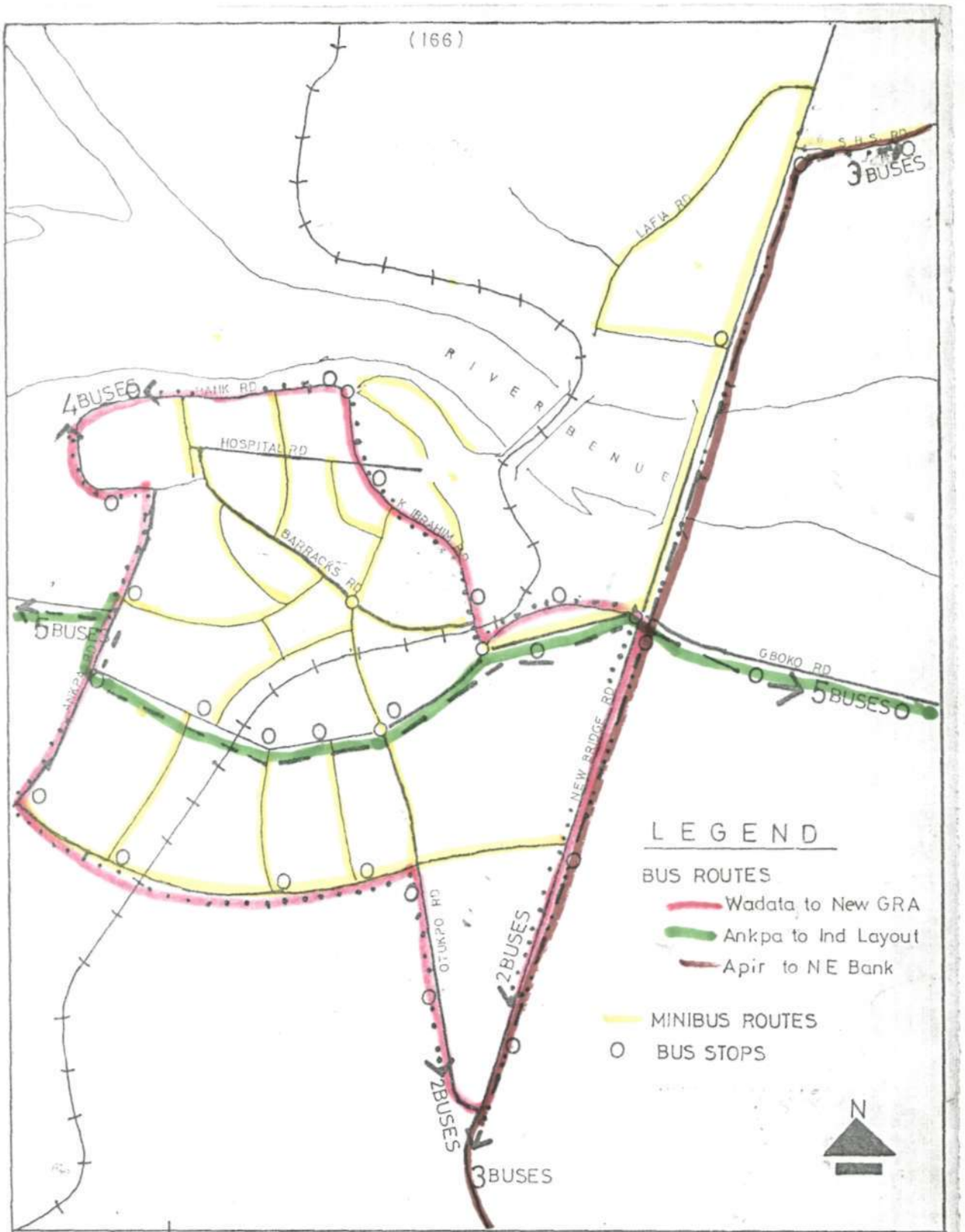


FIG 6.3 PROPOSED ROUTING STRUCTURE, ASSIGNMENT OF BUSES TO ROUTES, BUS STOPS AND TERMINALS-1988

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APPLICATION OF THE ADOPTED CONCEPT

(a) Size of Buses

The Benue links limited has twenty-two seater buses. This is adequate for the present considering the size of the town and the poor road network which will not allow for efficient operation of bigger buses.

The minibuses and taxis will continue to be used.

(b) Number of Buses and Taxis Required

The cpacity, travel time of the buses and worktrip demand are used as indices for calculating the number of buses that will cater for the worktrips within the hours of 7 a.m and 9 a.m.

Table 6.2: ESTIMATION OF WORKTRIP DEMAND FOR 1988.

Total Work Trips	Mode	% of Workers	No. of Workers	Number to be catered for.
28456	Foot	12	344	
	Bicycle	8.99	2558	
	Motorcycle	19.95	5676	4154**
	Minibus	30.4	8650	8650
	Minibus/ Motorcycle	14.3	4069	4069
	Private Car	10	2930	
	Taxi	3	854	854
	Bus	0.7	199	199
	Total	100	28456	17946

** Based on 14.6% that travel by commercial motorcycle.

Table 6.2 shows that about 17946 wortrips are to be catered for by public transport system.

Table 6.3: EXISTING PUBLIC TRANSPORT, CAPACITY AND ZONAL RETURN TRIPS.

Mode	Number	Zonal Return Trips in 2 Hours	Average Capacity	Total
Minibus	241	6 or 20 minutes a trip.	11	15906
Taxi	30	8 or 15 minutes a trip.	4	960
22 Seater Bus	5	4 or 30 minutes a trip.	22	440
				17306

Table 6.3 shows that the existing public transport system can cater for 17306 wortrips. By comparing the worktrip demand with the capacity of existing transport system we see that about 640 worktrips need to be provided with buses. About 7 more twenty-two seater buses are required to cater for 640 worktrips.

The commercial motorcycle transportation has not been taken into consideration because, in the first place, its introduction is as a result of lack of buses. They are highly proned to accidents because of recklessness. One motorcycle can only carry one worker and their operators charge higher fares than other modes. They also contribute

highly to traffic delays and there is not much control over them. However, they could be left to operate door-to-door services.

(c) Location and Spacing of Bus Stops and Terminals

The location and spacing of bus stops are influenced by travel time. The closer the spacing, the more stops, hence the higher travel time. On the other hand, excessive spacing of bus stop will increase the feeder trip time thereby outweighing the benefits of fast transit services.

Based on an assumption of a maximum distance of 500 metres which is about 10 minutes walk by an adult, a bus stop spacing of 400 to 500 metres is proposed. The location of bus stops and terminals are shown in Fig. 6.3.

(d) Assignment of the Buses to the Bus Routes

The work trip desire lines for 1988 is used in estimating the number of buses to be assigned to routes. This is from the zonal work trip distribution and taking into consideration the location of the low income groups who would use the buses more than high income groups. Figure 6.3 shows that out of the total 12 buses, 4 buses are assigned to Route I, about 5 buses to route II and 3 buses to route III. The 250 buses can operate on their own routes.

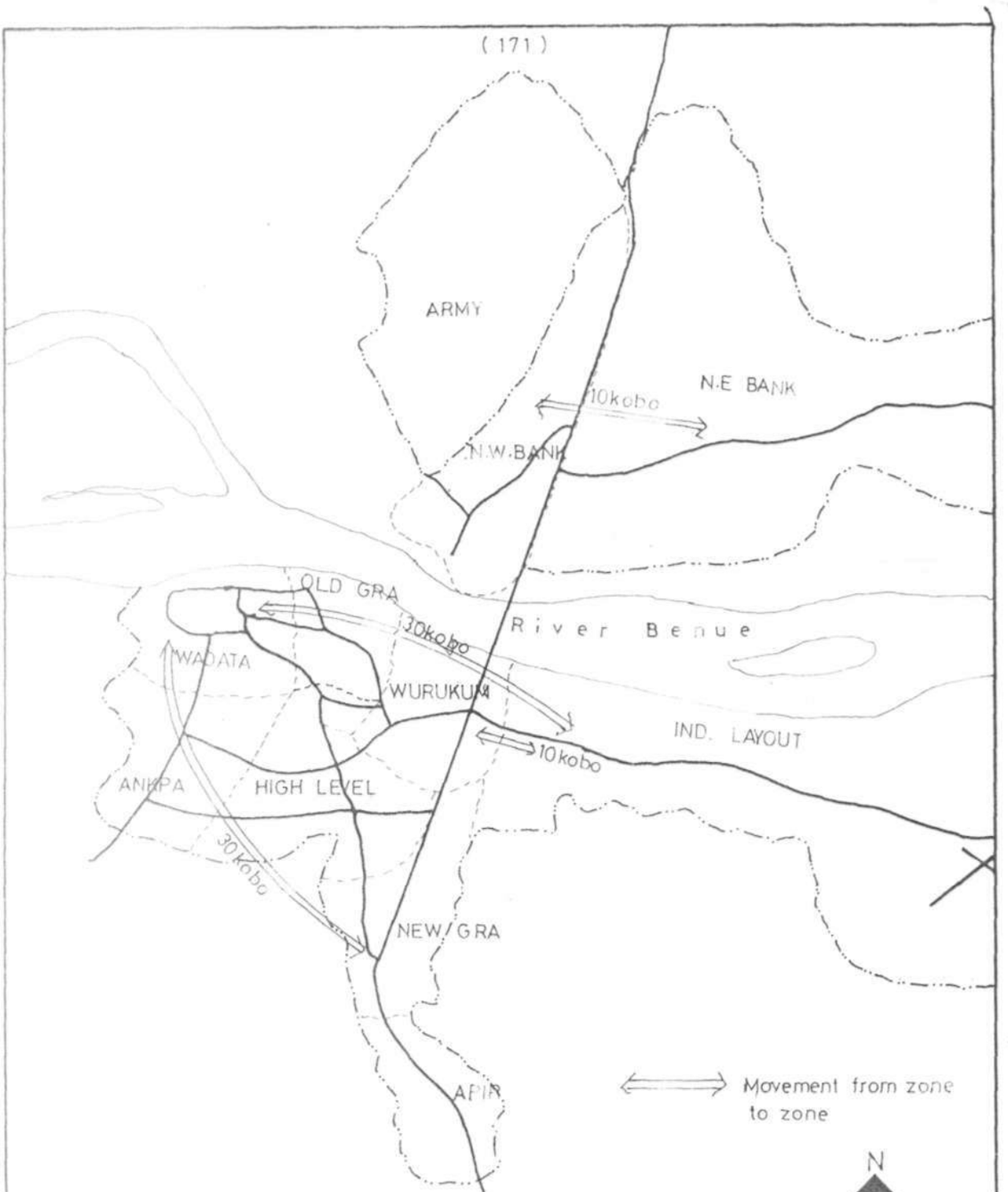


	FIG. 6.4	PROPOSED FARE LEVEL AND FARE STRUCTURE	AMEH P.O M. SC. THESIS 1988

(e) Proposed Fare Level and Structure

For the viability of the mass transit system, there is need for an effective fare level and structure. The fare level is the money value at which fares are charged while the fare structure refers to the way in which fares are paid.

The main options under the fare structure are:-

(i) Graduated fares, where the charge is related to the distance travelled (Amuda, 1986).

(ii) Flat fares, is when the distance is not considered but the same for all.

(iii) Zonal fares, in which the city zones are used. Trips within a zone could have a flat fare rate while inter-zonal trips entails extra charges.

At present the flat fare is used in Makurdi. This discourages passengers. The graduated fare is too sophisticated and could be subject to abuse. The zonal fare is recommended for Makurdi because it will encourage good ridership. A fare level of 10k per drop for travels between two adjacent zones is recommended. However, subsequent travels through other zones attracts extra charges of 10k per zone.

For example, in Fig. 6.4 a worker leaving Wadata to New G.R.A. pays 30k because he will pass through three zones.

6.1.3 School and Staff Buses

School authorities and employers should be encouraged to provide buses for their students and staff respectively. This will supplement the services of the mass transit programme.

Minibuses should be made to extend their services to schools at peak periods. This will discourage workers from going to carry their children during working hours and reduce the 12 noon to 2 p.m peak hour delays on the road

6.1.4 Traffic Management Measures

A package of measures is to be designed to deal with a combination of problems such as parking and stopping of vehicles on railway byepass road, Benue Crescent, Lafia road and Onitsha road (Fig. 6.1), zebra crossings should also be made along these roads.

6.20 PREVENTIVE PLANNING PROPOSALS

The preventive planning proposals will be long term plans directed at solving the problem of haphazard development of landuse and future work trips.

6.2.1 Proposals on Distribution of Residences and Workplaces

The ideal situation is to have the worker's place of residence within walking or cycling distance off his place of employment or within reach by a short bus journey. This calls for physical planning proposals for the distribution of residences and workplaces. The proposals calls for allocation of residential developments in workplaces concentration zone like Industrial Layout, N.E. Bank, New G.R.A. and High Level and allocation of workplaces in residences concentration zone like Ankpa ward, Wadata, N.W. Bank. The four alternative proposals are derived from the basic idea of Wolforth (1965) concept on the distributional patterns of residences and workplaces.

PROPOSAL A:

This proposal is directed towards concentrating residential areas in workplaces concentration zone and concentrating workplaces in residences concentrated zone (Fig. 6.5). Work trips will then originate and terminate in few locations or zone of conflux (Fig. 6.5a).

PROPOSAL B

This advocates for the decentralisation of residential developments in the workplaces concentrated zones and the decentralisation of new workplaces in residences concentrated zone (Fig. 6.5b). The worktrips will orginate from several locations and end in several locations (Fig. 6.5b).

PROPOSAL C

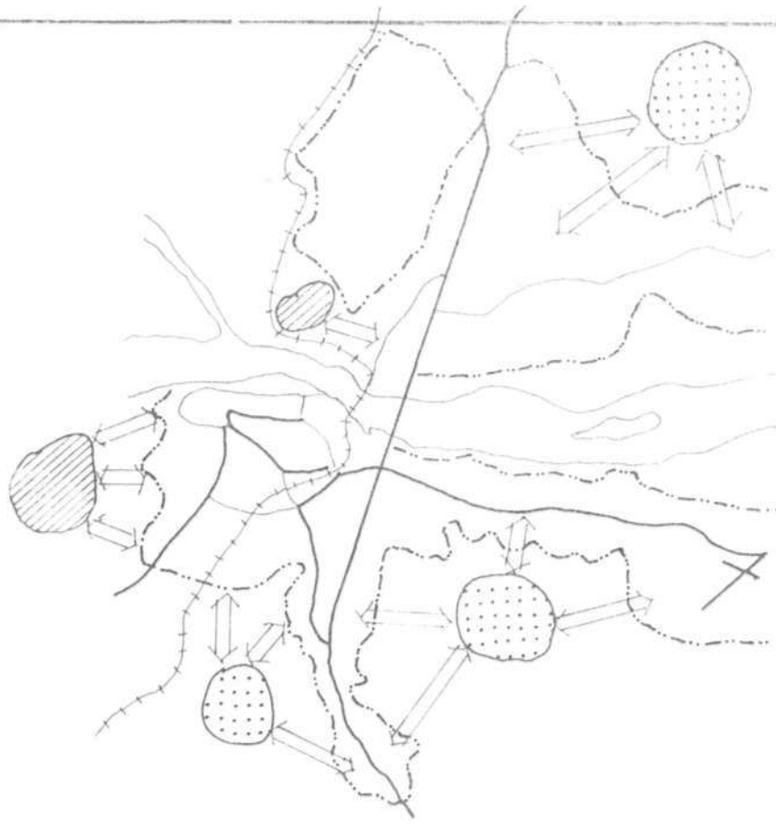
This calls for the decentralisation of residential developments in workplaces concentrated zone and the centralisation of workplaces in residences concentration zone (Fig. 6.6a).

PROPOSAL D

This proposal D advocates for the centralisation of residences in workplaces concentration zone and the decentralisation of workplaces in residences concentration zone Fig. 6.6b). In each zone, most worktrips will originate from a few locations and terminate in several locations (Fig. 6.6b).

EVALUALTION OF THE PROPOSALS

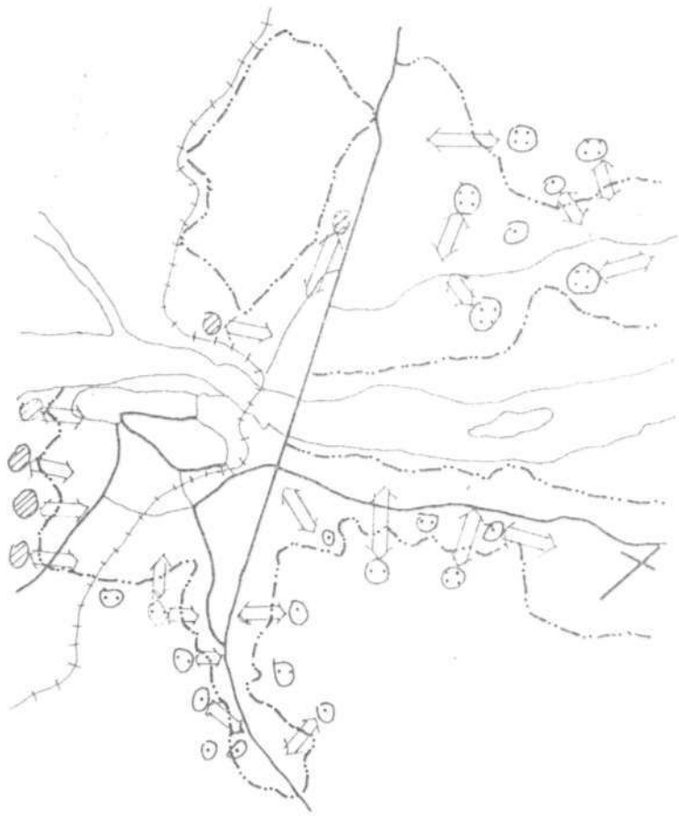
The goal achievement matrix technique is used in the evaluation of these proposals. This is based on some evaluation criteria which are assigned weights (Table 6.4). A rating scale is prepared with scores. Using the evaluation criteria, scores are assigned to each proposal. The scores are multiplied by the weights of each criteria. These are added up to give the total score for each proposal (Table 6.4).



PROPOSAL A

RESIDENCES CENTRALISED

WORKPLACES CENTRALISED



PROPOSAL B

RESIDENCES DECENTRALISED

WORKPLACES DECENTRALISED

LEGEND

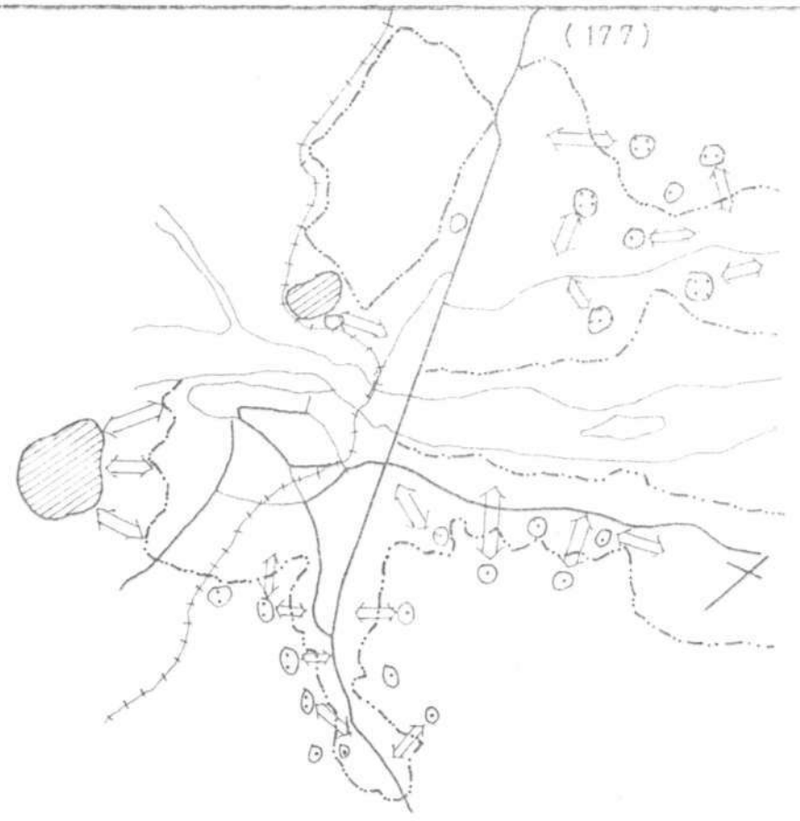
RESIDENCES

WORKPLACES

WORKTRIPS

FIG. 6.5 ALTERNATIVE PROPOSAL A & B FOR THE DISTRIBUTION OF RESIDENCES AND WORKPLACES

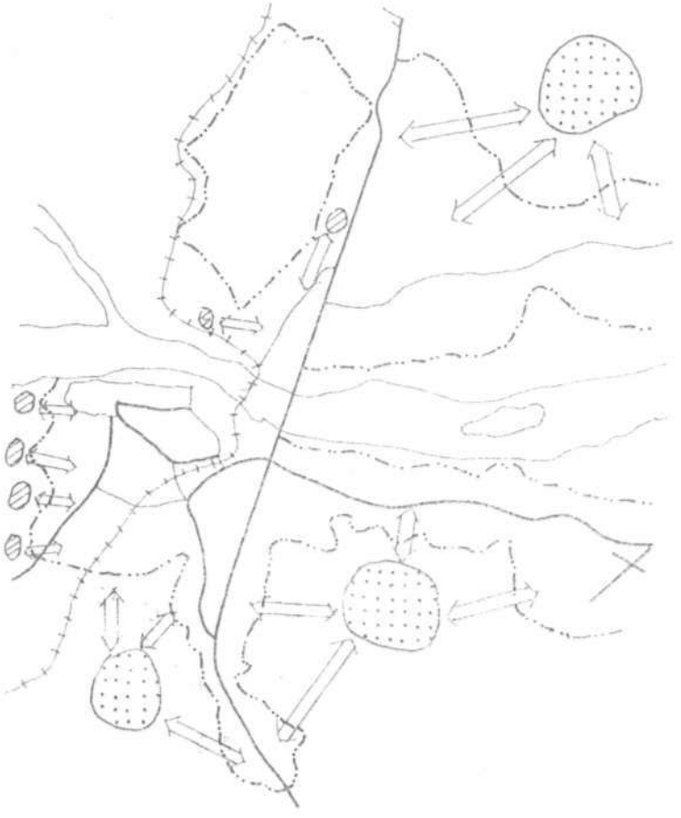
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PROPOSAL C

RESIDENCES DECENTRALISED

WORKPLACES CENTRALISED



PROPOSAL D

RESIDENCES CENTRALISED

WORKPLACES DECENTRALISED

LEGEND



FIG. 6.6 ALTERNATIVE PROPOSAL C & D FOR THE DISTRIBUTION OF RESIDENCES AND WORKPLACES

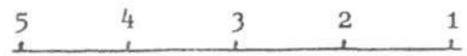
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Table 6.4: EVALUATION OF ALTERNATIVE PROPOSALS

EVALUATION CRITERIA	WEIGHTS	PROPOSALS							
		A		B		C		D	
		SCORE	TOTAL	SCORE	TOTAL	SCORE	TOTAL	SCORE	TOTAL
1. Reducing Distances between Residences and workplaces	4	1	4	5	20	2	8	2	8
2. Dispersing worktrip flows	4	1	4	5	20	1	4	3	12
3. Minimising Traffic delay	3	1	3	4	12	2	6	3	9
4. Minimising Travel Cost	3	1	3	3	9	2	6	2	6
5. Efficiency of mass transit system	2	5	10	1	2	3	6	2	4
6. Minimising Inconveniences and strains	2	1	2	5	10	2	4	3	6
7. Integration into existing development	1	1	1	5	5	3	3	2	2
			27		78		37		47

Rating Scale



Very High — High — Fair — Low — Very Low

Proposal B in Table 6.4 has the highest score. It is therefore the adopted proposal in distributing future residences and workplaces.

APPLICATION OF THE ADOPTED PROPOSAL

Makurdi is divided into 4 planning districts (Fig. 6.7). Instead of having district C on the Southern part of Makurdi as proposed in the Master Plan (Fig. 5.4), the North Eastern part is the proposed planning district C.

(a) Location of New Major Workplaces:

i. Heavy Industrial Areas: The proposal in the Master Plan for heavy industrial area on the south western part of Makurdi is accepted. This is favourable to the health condition of the people since it is on the leeward side of the north east trade wind. Noxious air from the heavy industries will not reach the town. It is also on the lower part of the drainage channel. It extends from Wadata to Ankpa ward which are low income residences concentration zone. Since it is in a linear form, it is more scattered and offers short distance travel for workers (Fig. 6.7).

ii. Government Offices and Establishments: New Government offices and establishments should be located at the North West Bank towards the army barracks. The area is residences concentration zone dominated by low income workers.

iii. Educational and Health Institutions: New health centres and educational institutions should be sited in all the planning districts. Their services will be closer to most urban dwellers as a result, the workplaces are scattered.

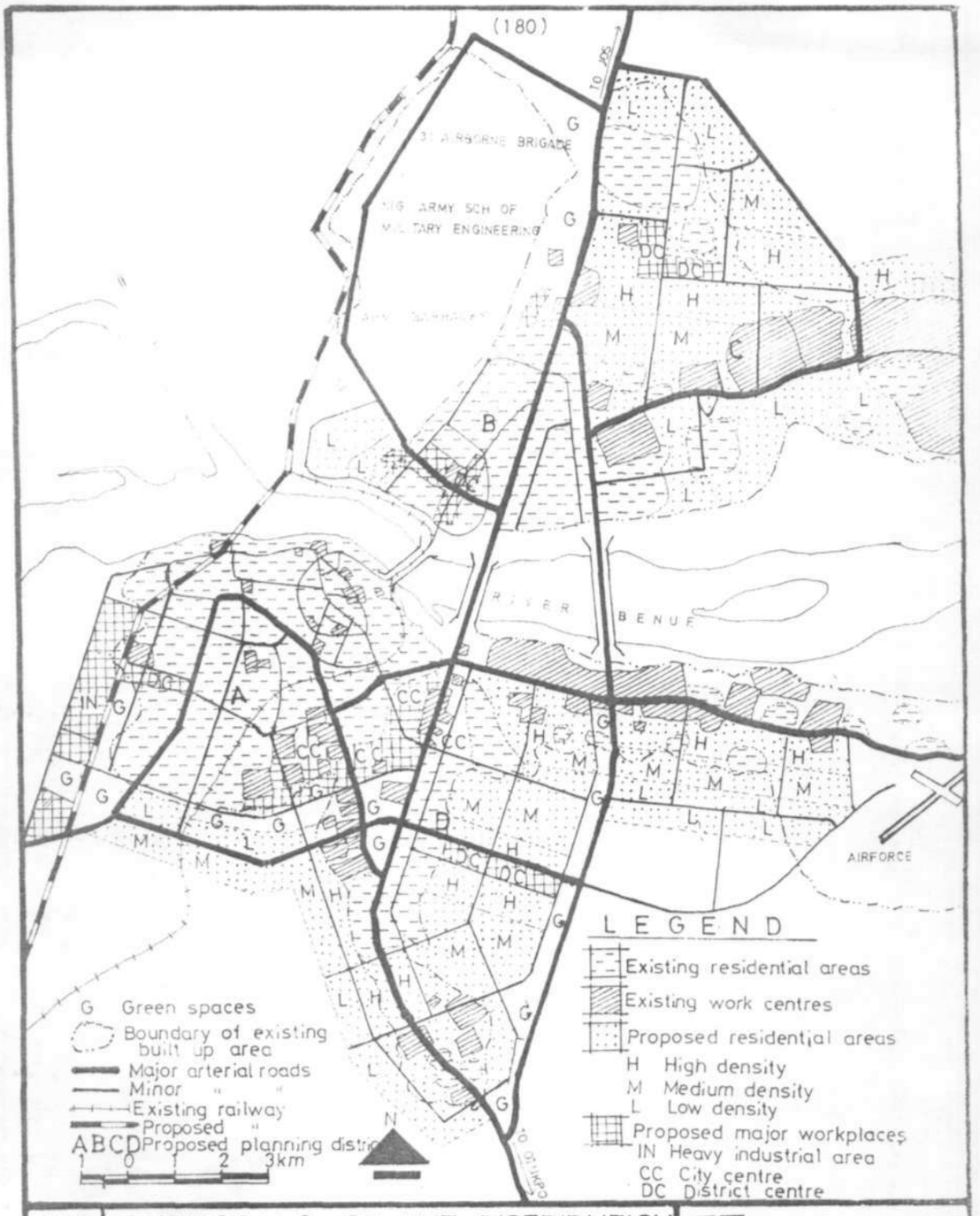


FIG. 6.7 PROPOSALS ON THE DISTRIBUTION OF RESIDENCES AND WORKPLACES IN MAKURDI — 2005

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iv. Commercial Areas: Commercial areas are expected to be located along arterial roads in each planning district. This will avoid the congestion of the narrow roads, because commercial areas generate alot of traffic. The problem will also be less since there is no concentration in one district.

(b) Location of New Residential Areas

The proposal aims at distributing residences of high, medium and low densities in each of the planning districts where each is lacking in a balanced manner to enable all the income groups have opportunity to live near their workplaces.

i. High Density Residential Areas: The North East Bank, New G.R.A. and Industrial Layout are low density residential areas. Many low income earners work in these places and houses there are not accessible to them. There is therefore the need to develop high residential density in these areas (Fig. 6.7). The low income earners will live closer to their workplaces since they suffer more in their worktrips. High density residential areas are therefore concentrated closest to all the district centres.

ii. Medium Density Residential Area: Medium density residential layouts are proposed to be located in industrial layout, New GRA, and North East Bank. This will ensure proximity to workplaces for middle income earners in these areas (Fig. 6.7).

iii. Low Density Residential Areas: Low density residential areas are to be developed on the southern part of Highlevel; industrial layout, North East Bank, Apir, Wadata and Ankpa wards (Fig. 6.7).

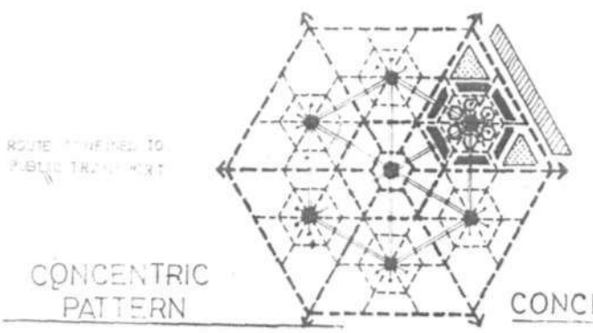
6.2.2 Suggestions on Concepts for Planning Future Residences and Workplaces in Relation to Road Network

There is a need to suggest a structure plan for future town district development in terms of relating road network to residential areas and workplaces. This is to create a physical and social community life with easy walking and cycling distances between residential areas and places of work. This calls for analysis of concepts with the aim of selecting the most suitable one.

Concept I: Concentric pattern (Fig. 6.8a). This has a hexagonal network with a dominant centre.

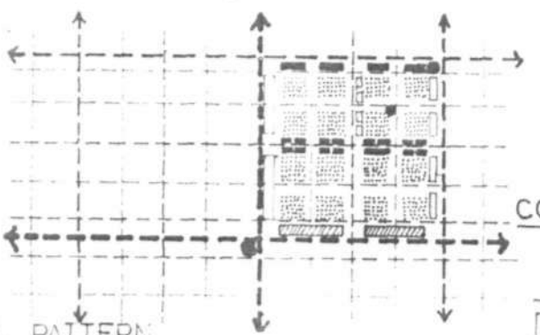
Concept II: GRID PATTERN (Fig. 6.8b) This has a series of rectangular cross junctions.

Concept III: LINEAR PATTERN (Fig. 6.8c) Workplaces and residences are located in a linear pattern.



CONCENTRIC PATTERN

CONCEPT 1



CONCEPT 2

GRILL PATTERN

LEGEND

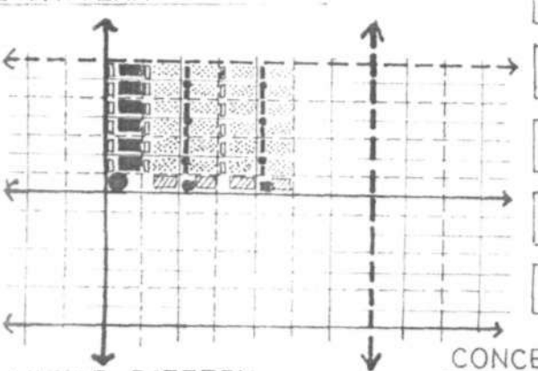
Jobs

Industry

Housing

Centres (shopping)

Open spaces



CONCEPT 3

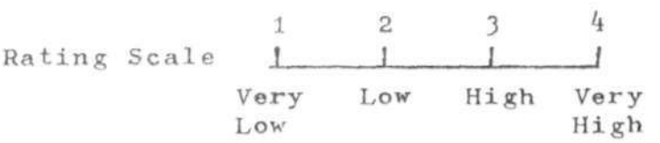
LINEAR PATTERN

FIG 6.8 ALTERNATIVE CONCEPTS IN PLANNING FOR RESIDENCES & WORKPLACES IN RELATION TO ROAD NETWORK

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Table 6.5: EVALUATION OF THE CONCEPTS

EVALUATION CRITERIA	CONCEPTS		
	I	II	III
1. Flexibility and Suitability for Transport Schemes	1	2	4
2. Adaptability and variety within the pattern for residences, workplace and transport network	1	3	4
3. Travel time and travel speed	1	4	3
4. Capacity to disperse work trip flows	1	3	4
5. Possibility of expansion without spoiling the pattern	2	3	4
6. Freedom of communication and association for the population	4	2	1
7. Cost of transport development	1	2	3
	11	19	23



Result of the evaluation shows that concept I scored 11 points, concept II 19 points and concept III 23 points. The concentric pattern is a rigid one and hardly allows for expansion. It is inflexible and essentially static. The rectangular grid pattern has no natural centre to act in a dominant role; it is unbalanced and does not provide the best conditions for public trnasport.

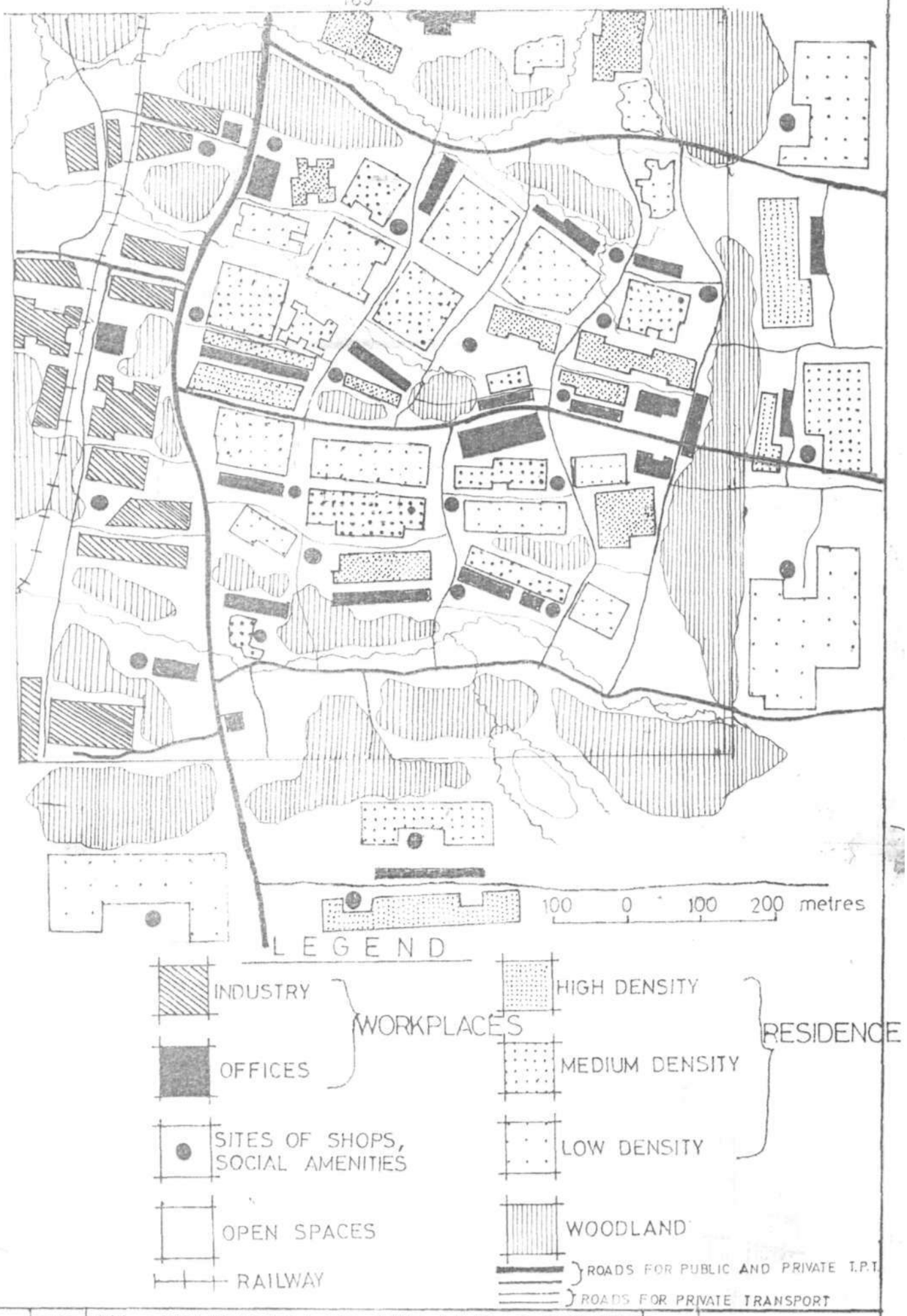


FIG 6.9 AN APPLICATION OF THE LINEAR CONCEPT TO A SECTION OF FUTURE PLANNING DISTRICT : A CONCEPTUAL ILLUSTRATION.

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The linear pattern is voted the best with its greater flexibility, adaptability and suitability for transport schemes. It is therefore the adopted concept.

APPLICATION OF THE LINEAR CONCEPT

Figure 6.9 shows the application of the linear concept to a section of the corridor scheme. The workplaces and residences are distributed evenly. The residential areas have variety of high, medium and low density. The high density residential developments are closer to the workplaces for low income workers. The roads are planned in three hierarchies. The spacing between the major junctions are more than 250 metres. Industries are sited on the western part because of the advantage of wind direction. Each corridor is separated from another by green spaces and forest.

The policy of application of this concept is that to obtain a house it is necessary to be able to give proof of a job in each of the future planning districts because the essential idea is a link between employment and housing. This policy is in the interest of forming a stable and self sufficient society with little movement of population and with an even distribution of workers.

6.2.3 Control of Development

In view of the present economic predicament, more people will have to depend on walking and cycling to work areas. There is therefore the need to curtail the existing trend of urban sprawl.

This is by planning for intensive development so that Makurdi becomes a compact town. This will help to conserve resources on transport development, fuel wastage andother infrastructures. With a well developed drainage system, the density of existing development will be increased. Encouragement should be given to high structure development.

6.2.4 Staff Quarters

Employers should provide staff quarters near workplaces for their employees. This will reduce transport cost, traffic delays and easy access to their places of work.

B. PLANNING FOR THE WORK TRIP FLOWS

In order to take care of future worktrip flows, there is a need to make planning proposals for the mass transit system in terms of the routing structure, number and size of buses etc.

(a) Routing Structure

Planning for the routing structure calls for alternative concepts in order to select the most appropriate.

Concept I Ring Concepts (Fig. 6.10a).

This concept is based on consideration of the proposed road network. The buses are to operate on a ring line on the peripheral areas of each of the planning district. The North and South Banks are then joined by

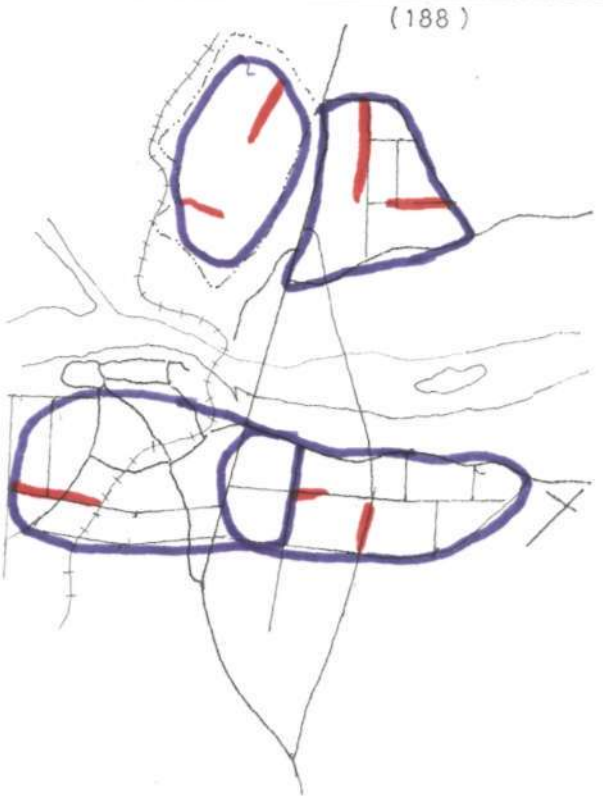


FIG 6.10 ALTERNATIVE CONCEPTS FOR FUTURE MASS TRANSIT SYSTEM

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another route. The minibuses and taxis can then filter traffic inwards to the centre of the rings to the activity areas.

Concept II: Linear "Spine" (Fig. 6.10)

This concept proposes a "spine" bus route for each of the planning districts. The minibuses and taxis can filter traffic between the parallel road spines to activity areas.

Table 6.6: EVALUATION OF THE CONCEPTS

		CONCEPT	
EVALUATION CRITERIA		I	II
1.	Traffic flow quality	3	1
2.	Capacity to redistribute traffic	2	1
3.	Travel time and travel speed	3	2
4.	Viability of the mass transit system	1	3
5.	Cost of construction of system facility	1	3
6.	Relationship of route to activity areas	3	1
TOTAL		13	11

Rating Scale 1 — 2 — 3

Low Fair High

From the above, concept I scored 13 while concept II scored 11 points. The margin of scares between the two concepts is relatively small. This means the two concepts are good Since they both ranked high, The adopted concept

is based on the phases of development and the construction of road network.

By 1995, with improved road network there will be 4 bus routes (Fig. 6.11).

By 2005, when most of the roads must have been completed, there will be 5 bus routes (Fig. 6.12). A new bridge is expected to have been constructed across the Benue River. Also the railway byepass and the new rail bridge must have been constructed. In this case the old rail bridge will be converted to bus route. Fig. 6.12 shows the 5 bus routes.

(b) Size of the Buses

There will be a need to introduce the 50 seater buses for use by the year 1995. At this period, the worktrips are expected to have increased with more workers travelling by public transport system and with the improved road network.

(c) Number of Buses

Table 6.7: PROJECTED WORK TRIPS AND PERCENTAGE USING PUBLIC TRANSPORT

	1988	1995	2005
Work trips	28456	36759	60886
% of Public Transport users	63.1%	68%	76.3%
	17946	25996	46456

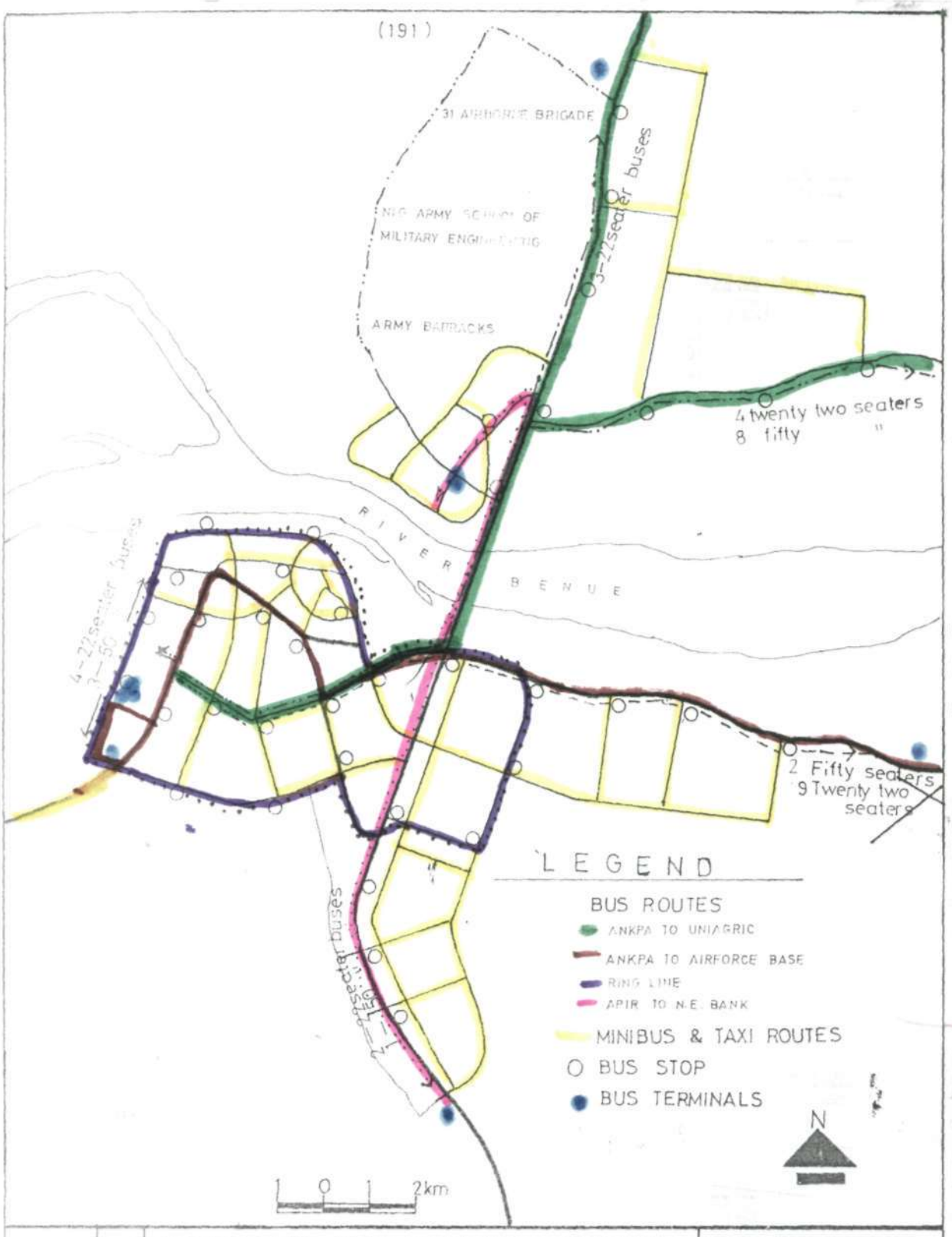


FIG 6.11 PROPOSED BUS ROUTES, ASSIGNMENT OF BUSES TO ROUTES, BUS STOPS AND TERMINALS–1995

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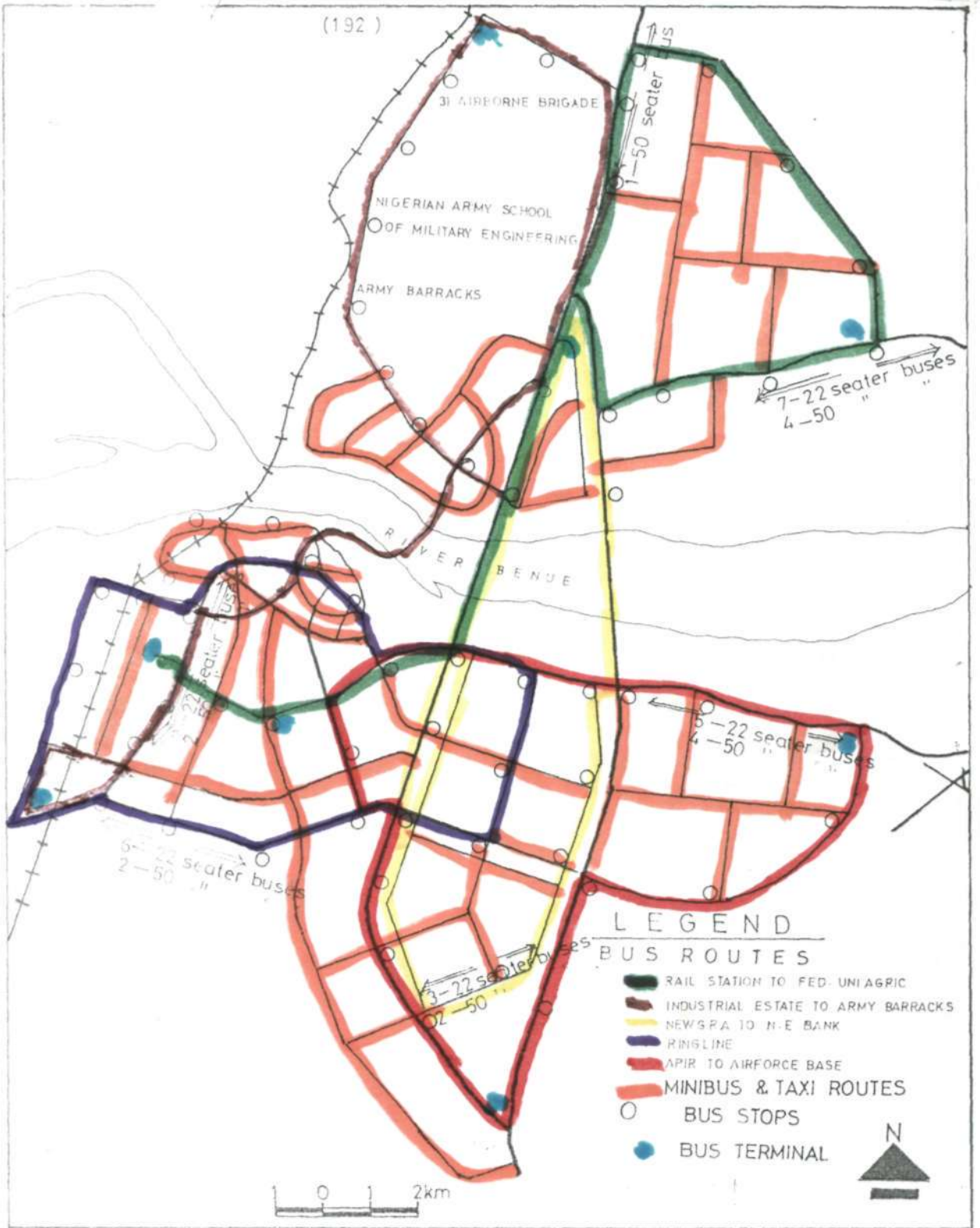


	FIG 6.12	PROPOSED BUS ROUTES, ASSIGNMENT OF BUSES TO ROUTES, LOCATION OF BUS STOPS AND TERMINALS– 2005	AMEH P O M. SC. THESIS

Table 6.8: ESTIMATION OF REQUIRED NUMBER OF BUSES

TYPE OF MODE AND NUMBER IN 1988	1995			2005			
	% annual growth	Number of buses	Work trips	% annual growth	Number of buses	Average turnover	Worktrips
Minibus (241)	1%	257	17028	0%	257	2	33924
Taxi (30	10%	51	1632	1%	56	2	3584
22 Seater Buses (12)	10%	21	2860	1%	23	2	4048
50 Seater Buses (0)		14	3476	1%	15	2	4900
			24996				46456

Table 6.7 shows the projected wortrips and number to provide public transport for in 1995 and 2005.

Table 6.8 shows the required number of public transport for 1995 and 2005. Minibuses are assumed to have 1% annual growth in 1995 giving a total of 257. By 2005 there should be control on its growth. Taxis will increase by assumed 10% annual growth rate by 1995 to become 51. By 2005, the rate of growth of taxis will be 1% so that it will increase to 56. By 1995 the 22 seater buses will increase by 10% annual growth to become 21. By 2005 14 fifty seater buses will be added to the mass transit programme. By 2005 the assumed annual growth rate will be 1% and so increase to 15.

It was considered that residences and workplaces will be scattered by 2005. Workers will not be travelling for far distances. There will have to be twice average turnover of work trips enroute (Table 6.8).

(d) Assignment of Buses to Routes

The number of buses to be assigned to the different routes in 1995 and 2005 is shown in Fig. 6.11 and Fig. 6.12 respectively. It is based on the desire lines got from the values in the projected trip distribution.

(e) Supervision and Control of Bus Services

Supervisors are to be stationed along specific locations and to check the drivers and conductors against indiscipline and fraud. They are to communicate to their head office.

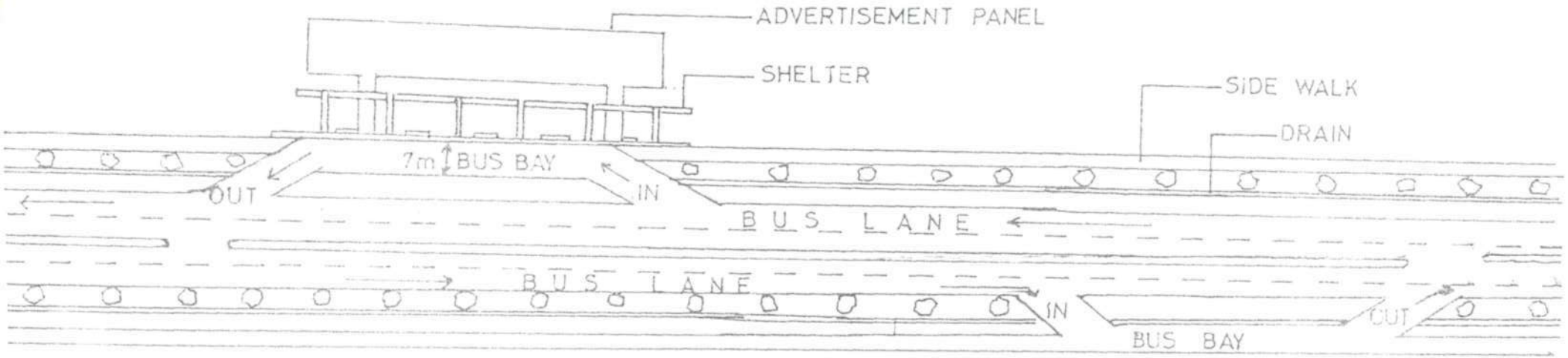


FIG 6.13 PROPOSED BUS LANES AT PEAK HOURS AND BUS BAYS ON MAKURDI ROADS

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(f) Reserved Lanes

Reserved lanes are to be provided for buses so as to enable them have speed (travel time) advantages over cars and other personal transport modes (Fig. 6.13 and 6.14). This would free them from traffic hold ups to which other modes are subjected to and its consequent gain in travel time might be a strong attraction to its use by even the car owners. This priority lanes may be operated only at traffic peak periods.

(g) Bus Stops and Bays

Preferably, the bus stops will be properly designed as bus bays with seats and shelter for passengers. Fig. 6.13 shows a typical bus bay.

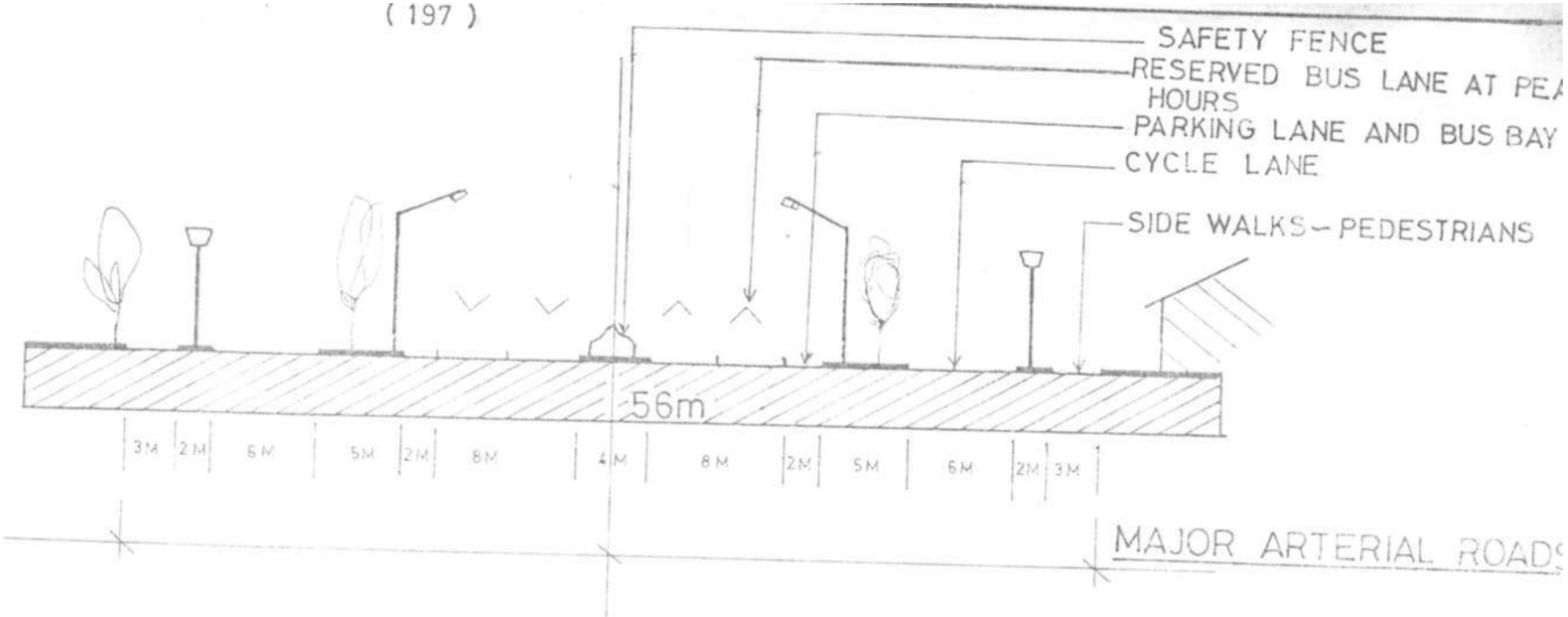
6.2.6 Rail Mass Transit

By 2005 when the rail byepass line must have been constructed, there might be a need to utilise the rail mass transit for journey to work.

6.2.7 Traffic Segregation - Planning for Pedestrians and Motorcyclists

In view of the increasing number of people making journey to work by foot andcycling and due to the high accident rate among them because of the non vehicular segregation, there is need to plan for pedestrians and cyclists.

In construction of any new major and minor arterial urban roads, the pedestrians and cyclists have to be considered at the same time, and attempts should be made to provide for their needs. Recently, Tricycle has been



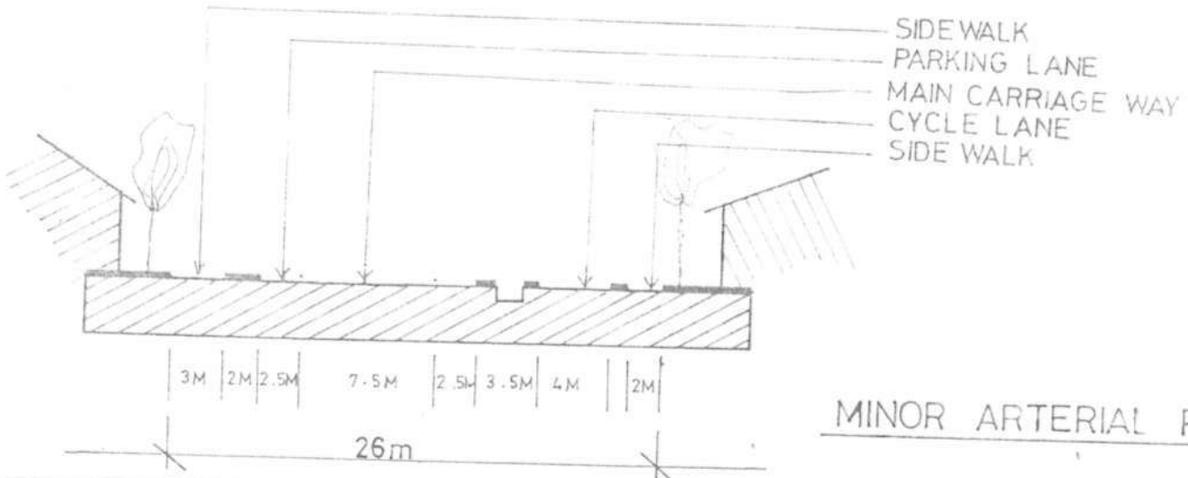


FIG 6.14 PLANNING FOR PEDESTRIANS, CYCLISTS AND BUS USERS: PROPOSED GEOMETRIC STANDARD FOR MAJOR AND MINOR ARTERIAL ROADS

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introduced in many Benue towns like Otukpo (plate IV) and Gboko and there is a possibility of it being introduced in Makurdi in future. The speed of a tricycle is slow and needs to follow cycle lane.

Fig. 6.14 shows typical road cross section for major and minor arterial roads showing cycling lanes, pedestrian sidewalks and reserved bus lanes.

There is also a need to make pedestrian overhead bridges and zebra crossings. The law is to be harsh on any driver who knocks down a pedestrian on "zebra" crossing.

6.2.8 Traffic Management Schemes

Electronic signals should be installed at road junctions and be programmed in a way to give priority to roads leading to major work areas in the morning and vice versa in the afternoon and evening periods.

In a cycle there may be repetition of traffic phases at signalised junctions. For instance if (A) represents a road leading to major work area and (B) and (C) represents other roads, we can have A,B,A,C. instead of A,B,C to accomodate the peak traffic requirements.

The electronic traffic signals should also be coordinated on the major roads. A vehicle leaving a green light should meet the next on green or amber ready for green.

Other traffic management schemesinclude provision of sign posts for junctions, bends and zebra crossing

6.2.9 Public Participation

Public participation is a major tool to use to enlighten the road users, both the pedestrians and vehicle users on the use of traffic signals and zebra crossings. This could be through media like radios, newspapers and sign post.

7.00: IMPLEMENTATION OF THE PROPOSALS

This chapter will discuss the phasing out of the implementation the propesals, the sources of finance and administrative framework for landuse and transportation administration.

7.10:PHASES OF IMPLEMENTATION

The proposals are expected to be implemented in 17 years These phases are divided into three:Phase I (1988-1990), Phase II (1991-1995) and phase III (1996-2005) (Table 7.1).

7.1.1: PHASE I (1988-1990)

All the short term curative measures will be implemented at this period. This includes the Construction and Maintenance of the following roads:

a) Ankpa road linking New Bridge road (fig 6.1)
b) High level road linking Railway Bye-pass road.
c) Ankpa road linking Barracks roads.

Streets like Konshisha, Bishop Murray, Balewa, Ugbokolo, Enugu and Kaduna (fig 6.1) are expected to be tarred so as to encourage private individuals to invest on taxi services.

The banning of on street parking from 6a.m. to 6p.m. on Railway Byepass road, Benue crescent, Lafia road is to be enforced. Bus stops are expected to be constructed in this phase.

There will be improvement on the mass transit services in order to arrest the deteriorating condition of their services. Seven new twenty two seater buses are to be purchased. The proposed routing of buses is expected to be followed.

7.1.2: PHASE II (1991-1995)

In this phase, the development of high density residential areas is to be given top priority in industrial layout, N.E.Bank,

About 14 of the fifty seater buses will be added to the mass transit programme. There will be an addition of 9 twenty two seater buses. About 16 new Minibuses and 21 new taxis are expected to be added to the mass transit programme. The four routing structure is expected to be adhered to (fig 6.11).

At this phase, the road construction is expected to be undertaken in line with the development.

(a) A road linking Wurukum to Airforce base parallel to Gboko road (fig 6.11).

(b) Apir to be linked to industrial layout by a second road (fig 6.11).

7.1.3: PHASE III (1996-2005)

All the residential developments are expected to be completed in this period. This will include high, medium and low density residential developments proposed (fig 6.7). The town is to be divided into four districts with all the district centres fully developed. The heavy industrial layout is expected to be fully implemented. The city centre must have been fully developed by this period.

New roads are expected to be constructed in line with the development.

(a) A new bridge will be constructed across the Benue River to ease traffic congestion on the present bridge (fig 6.12).

(b) New bridge road linking Airfoce base (fig 6.12).

(c) Army barracks ring road (fig 6.12).

(d) N.E, Bank ring road.

(e) The new railway bridge and railway line is expected to have been constructed thus by- passing the town through the proposed heavy industrial layout.

In this phase, the former railway/road bridge will be

converted to vehicle use.

About 2 new twenty two seater buses, one new fifty seater bus, 5 new taxis are expected to be added to the mass transit programme. There will be about 5 bus routes and they are to be followed.

Traffic signals are expected to be installed at road junctions. Table 7.1 below is the summary of the phases of implementation.

Tale: 7.1: PHASES OF IMPLEMENTATION

Phase I (1988-90)	Phase II (1991-1995)	Phase III 1996-05)
(1) Road Construction	(1) Road Construction	(1) Road construction
a) Ankpa Road to New-bridge road -6 km.	a) Wurukun to Airforce base (11 km)	a) New Bridge/ road to Apir 14 km.
b) High level Rd. to railway Bye pass (2km)	b) Industrial Layout to Apir (9 km)	b) New bridge road to Airforce base (11 km)
c) Ankpa Road to Baracks road (3 km)	c) Others in line with development	c) Army Barracks ring Road 15km
(2) Banning of an street Parking on some roads during working hours	(2) Residendial Developmt High density Industrial layout N.E Bank, New G.R.A.	(d) N.E. Bank Ring road 7km.
(3) Buses	(3) Buses	(2) Residential development High, medium and low
Purchase of 7 new 22 seater Buses	16 new minibuses 21 new taxis 9 new 22 seater buses 14 new 50 seater buses Bus routes = 4.	(3) Heavy industrial layout Wadata.
		(4) Buses 5 new taxis 2 new 22 seater buses 1 new 50 seater 5 new bus route
		(5) Traffic signal at junction

7.20: FINANCE

Journey to work is directly related to landuse, transportation facilities and the mode of movement. A major cause of worker's problems in not moving well to their workplaces stems from the inability of the Urban development Authorities in Makurdi to meet the objectives by which they were formed. This is as a result of low generation of funds by the authorities to implement their objectives.

7.2.1.: EXISTING SOURCES OF FINANCE

In Makurdi, like in every other town in Nigeria, the main sources of financing physical development activities is both public and private. The private sources are from individuals and organisation who undertake and finance various projects.

The public source is from the general annual budget estimate of the government revenue not necessarily accruing from phyiscal planning sources. Of the total of ₦564.912 million Benue State budget estimate for 1988, about ₦399.102m (70.65%) and ₦165.81m (29.35%) is expected from recurrent revenue sources and capital receipts respectively. The bulk of the government revenue is derived from Federation Account, ₦356.048 million (89.21%), while about ₦43.054 million (10.79%) is expected from internal revenue sources.

Other sources of public revenue are derived from income tax, General sales tax, fees from land allocation forms, Fines and fees,earnings and sales, rent on government property, Interest, Repayment and dividends, reinbursements, Motor vehicle Lincences and Registration, Certificate of road worthiness, Driving Lincences and learner's permit.

Much if the revenue accruing from these sources are not necessarily used for financing the relevant projects but diverted to State government as general revenue before government gives them allocation.

The amount giving to the urban Development Authorities is not sufficient to finance their physical development proposals. Out of the total sum of ₦318.89 million allolcated for capital projects in the 1988 budget, the environmental sector came third in allocation of ₦49.213 m (15.43%) after economic and social sector. The breakdown of allocation in table 7.2 shows that the Town and Country Planning is not well funded. While it asked for 6 million, only about 3.3 million was allocated to it.

Table 7.2: BENUE STATE CAPITAL EXPENDITURE ON ENVIRONMENTAL SECTOR

	1988 Estimated Allocation ₦(m)	Percentage of total Estimate
Town and Country Planning	3.3	1.63%
Water	37.583	11.79
Sewage and Drainage	1.100	0.34
Housing	5.25	1.64
Community Development	2.00	0.63
	Total₦49.213m	15.43%

Source: Benue State Estimates, 1988.

7.2.2: RECOMMENDED ADDITIONAL SOURCES OF FINANCING LANDUSE AND TRANSPORTATION

The State government is expected to vote higher amount of money to the planning authority to finance their recurrent and capital expenditure especially that of plan implementation. At present, the government gives the planning authority funds which it derives from the above mentioned sources, albeit the government has limited resources and cannot give the urban Development Authorities all their required funds.

The Urban Development authorities should also improve on their internally generated revenue. Capacity through reasonable increases in fees charged for services rendered and through the tapping of other sources of revenue. This can be achieved by increasing charges on plan proposals, more especially high income residential house plans and Estates, commercial and industrial project plans. The Benue Urban Development Board should raise funds by taxing people for refuse collection, the use of recreational parks and development control. The Ministry of Land and Survey should tax the people heavily for land allocation and layouts planning. The Ministry of works should make toll gates to collect tolls from drivers on specified highways. The Makurdi Local Government should generate her funds from motor parks, taxes on parking facilities, bus stops, taxes from sign boards, entertainment and betting tax. The Benue Housing Agency should derive her revenue

by taxing people in low residential density housing heavily and the high valued housing in the activity areas. This will be used to subsidise high density housing for low income groups. The Nigerian Police Force (NPF) should generate funds from penalties meted out to drivers for wrong driving and this could be used to manage the traffic effectively.

There is a need for prudent management of the financial resources of the Urban Development Authorities.

In order to induce the planning authority to generate more revenue, the government is expected to give incentive such as revenue derived from planning sources is to be used only for planning proposals. This is by making the board to keep the amount of revenue generated plus the board's revenue allocation. This has been practised in Kaduna State by the Kaduna State Urban Planning and Development Authority. The idea behind this is that if the government gives financial autonomy to the planning authority, they will strive hard to make more money. By taking the revenue generated to the state treasury and getting their subvention from this common pool will not encourage them to work as hard as when they are given financial autonomy.

If these bodies can generate funds from the above mentioned sources, it is hoped that there will be more bus stops, motorparks, well planned roads and effective

trafffc management. This will solve the problems of journey to work in Makurdi since there will be smoother traffic movement and well planned landuses.

7.3.0: ADMINISTRATIVE MACHINERY

For an effective journey to work, there is need for an efficient administrative machinery for landuse and transportation planning in Makurdi.

This calls for an evaluation of the present administr_ation of landuse and transporation.

7.3.1: EVALUATION OF THE PRESENT ADMINISTRATION OF LANDUSE AND TRANSPORATION IN MAKURDI

The main organisation responsible for landuse and transporation development planning in Makurdi are: The Benue State Urban Development Board (BUDB), Ministries of Lands and Survey, works, Benue Housing Agency, Makurdi Local Government, Individuals and private organisation.

The Ministry of Lands and Survey is responsible for land administration, prepares layout which is contrary to the provisions of the Town and Country Planning law Cap 130 of Northern Nigeria. The B U D B is responsible for refuse collection, street lights, recreational parks, development control and planning of development. The Ministry of work is responsible for construction of all the

major roads while Makurdi local Government prepares layout, constructs and maintains streets, access roads and motor parks. The Federal Ministry of works and Housing (URP) Department takes part in site and services scheme in Makurdi. The Benue Housing Agency is responsible for Housing. The activities of these bodies are not coordinated. There are at time conflict between them.

With regards to the movement of people , the Ministry of commerce and Industry is at present responsible for Benue Links Limited which is the mass transit programme of Benue State. The town service division of the Nigerian Union of Road Transport workers regulates the operations of taxis and minibuses.

The fundamental causes of these conflicts in landuse and transportation administration stems from the draw backs of the Town and Country Planning law cap 130 of Northern Nigeria, 1967 When considered against the background of existing planning theory and practice in Benue State. "These draw backs include the misconception of what planning itself is all about and as such what rules are required to regulate its operation; an ambiguous and authoritative procedure in plan preparation.." (Suleiman, 1988). The Law emphasises planning more on physical layouts only and fails to provide for policy aspect of planning, which include economic, social,

environemental, transporation, sewage, water, public utilities and for coordination between the different bodies in planning . The law has failed to provide any procedure for preparing the plan since it does not oblige the planning authority to consult with other relevant bodies to publish any facts found. Once the plan is prepared the process of public consultations are virtually non-existent.

"The consequences of the present system is that our plans are not accepted not even by other bodies and for less by the local governmentsand the public.."(Suleiman,1988).

We therefore recommend a system that will compel the Benue Urban Development Board which is the planning Authority to discuss her draft proposals with at least the local government, other relevant bodies and the Public to know their roles and responsibilities. If the draft plans goes through this process and approved, then it should be binding on all such authorities. This makes the implementation of the plan easier.

7.3.2: RECOMMENDED ADMINISTRATIVE MACHINERY FOR LANDUSE AND TRANSPORATION PLANNING IN MAKURDI

As earlier mentioned, journey to work is tied to landuse, transporation facilties and the mode of movement. Efficiency and good government can only come by if there is cordial relationship and effective coordination

between the different agencies concerned with the planning and execution of various public programmes. In order to harmonise the work of the different bodies responsible for the provision of these facilities, there is a need to propose an administrative framework for landuse and transportation administration for Makurdi.

In order to ensure public participation and remove areas of conflict, a committee to be called -The infrastructural development committee is to be formed. This will be under The Benue Urban Development Board and it will involve the participation of other bodies. The Chairman of the committee shall be the General Manager of Benue Urban Development Board, while the Chief town planning Officer of the State is to be the Secretary. The committee is to be made up of representative from Ministry of Lands and Survey, Ministry of Works, Makurdi Local Government, Ministry of education, Agriculture, Health, finance commerce and industry.

The function of the committee is to deliberate on all proposals on landuse planning in Makurdi before the final approval by the Governor. In this case, the work of the Benue Urban Development Board is made easier since the local government and all relevant statutory and other authorities are informed of the progress of the preparation of the plans and since it takes account of all the views expressed by such authorities through their representatives.

In this case, each authority knows its roles and responsibilities

in landuse administration.

This has been practised in Kaduna State by the Kaduna State Urban Planning and Development Authority and has been found to be very sufcessful.

The effect of any approval of the physical development plans by the government on any public authority and local government is that it shall be their duty to comply with the policies, proposals and programmes of the plan applying in the area of their jurisdiction in drawing up their own proposals for the development and improvement of land and facilities in their area and in exercising any of their legislative power. In this case, the Benue urban Development Board will be in charge of landuse planning, Development control, urban renewal, refuse disposal, street lights and recreational parks. The Ministry of lands and Survey will perform the function of land administration, land acquisition, resettlement, surveys and rural planning.

The Ministry of works will continue to construct and maintain major roads. The Makurdi local government will continue to be responsible for motor parks.

It must be mentioned that the Makurdi Local government does not have a physical planning department nor a professional planner but undertake physical planning functions.

The Federal Government has given it more autonomy from the state by the Scrapping of Ministry of Local Government in which funds go directly to it in the October 1st 1988 Independence Speech of the President. There is a need for the establishment of a physical planning department and employment of a phyiscal planner. In this case, we expect the Makurdi Local Government to perform physical planning functions as stated in the fourth schedule of the constitution of the Federal Republic of Nigeria, section 7 which includes: collected of rates, lincences, Establishment, maintenance and regulation of markets, motor parks and public conveniences; construction and maintenance of roads, streets, drains and other public highways, parks, open spaces, naming of roads and streets and numbering of houses, provision and maintenance of public conveniences and refuse disposal; control and regulation, of outdoor advertising and hoading, shops and Kiosks .

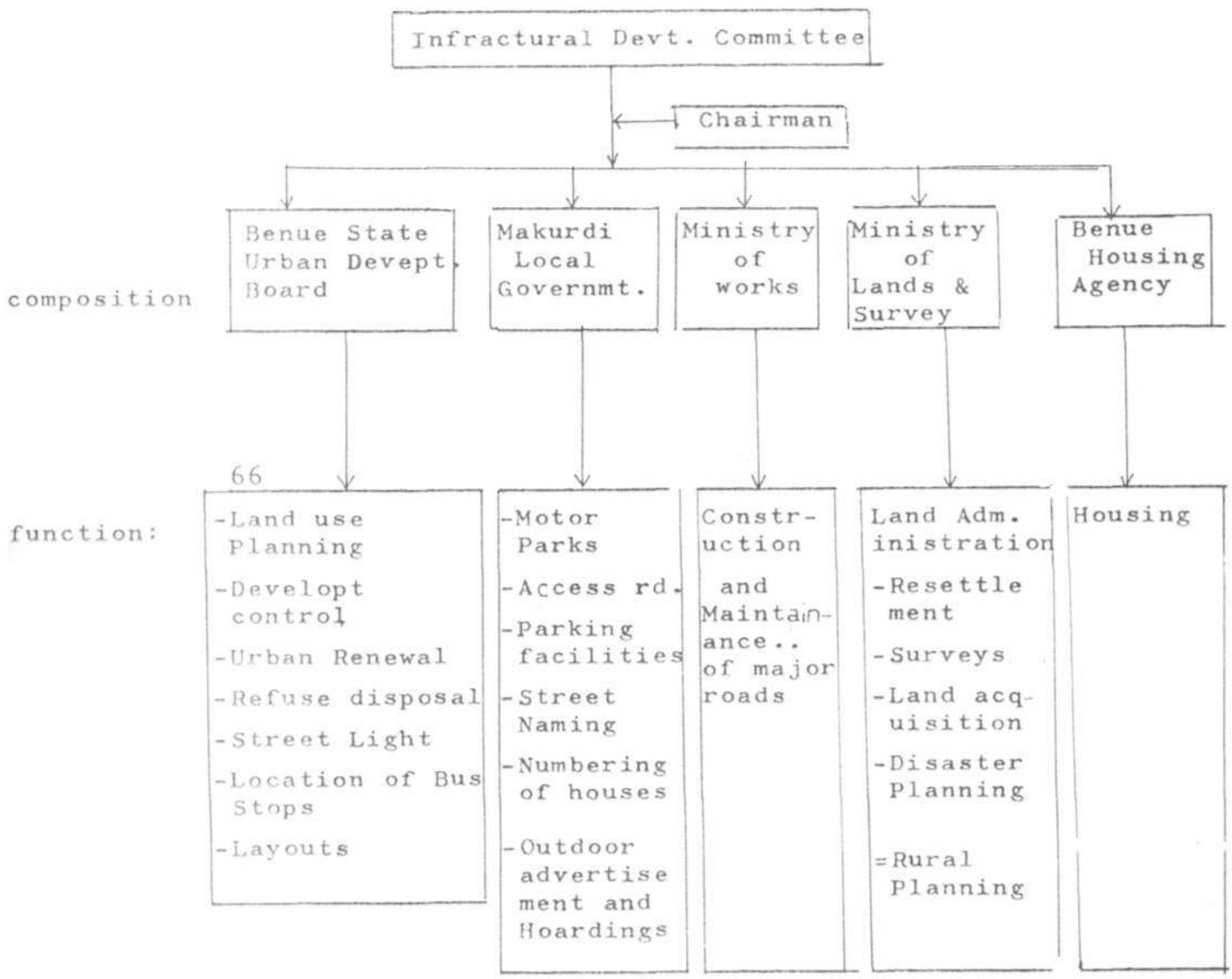
For this to be done, the landuse decree of 1978 which vests all land in the State on the governor is to be reviewed.

This is because the local government cannot plan on a land that does not belong to it.

In this case, the function of the State Government in physical planning will be reduced to formulation of policies on physical planning and coordination of the

activities of local planning officess

RECOMMENDED ADMINISTRATIVE FRAMEWORK FOR LANDUSE ADMINISTRATION



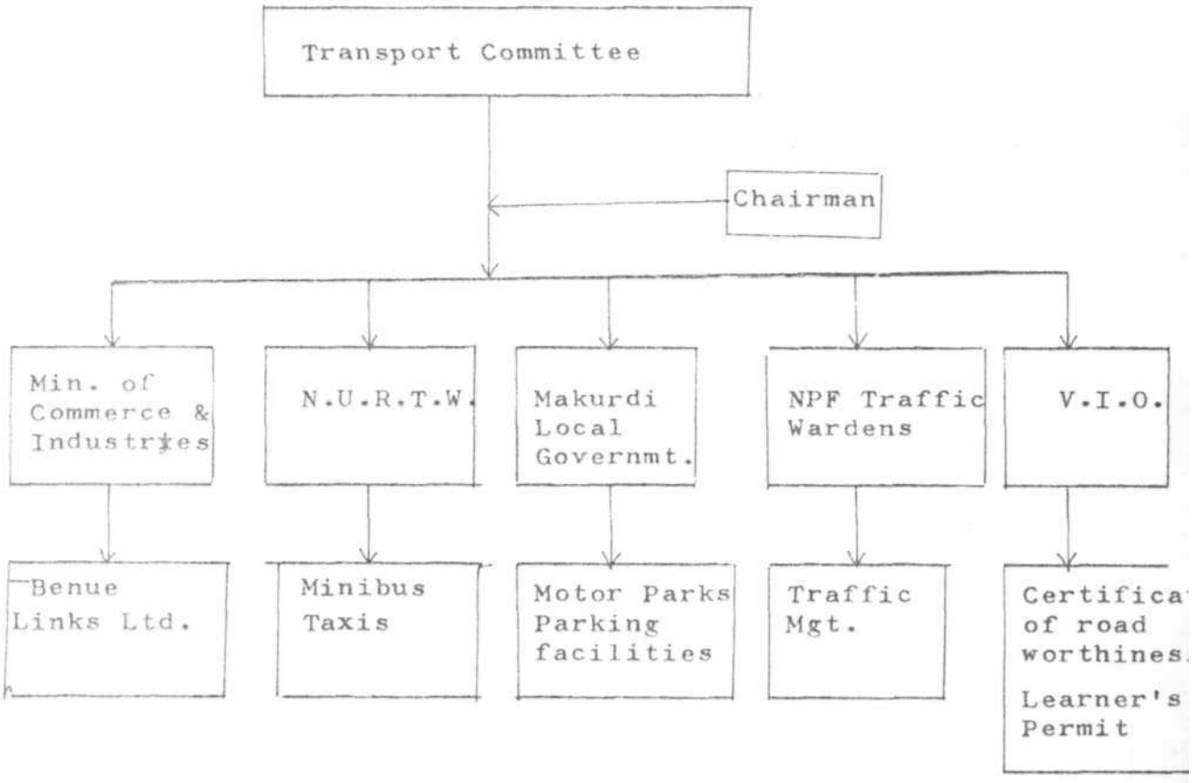
TRANSPORTATION ADMINISTRATION

Since landuse relates to transporation, another committee is to be formed by the Benue Urban Development Board Known as Transporation Committee. The Chairman of the committee is to be the General Manager of the Benue Urban

Development Board. The Committee shall be made up of representatives from Benue Links Limited, NURTW, the chief Town Planning Officer, The Makurdi Local Government, The Nigeria Police, Traffic warden and the V.I.O.

The function of the committee is to coordinate the activities of the town service division of the NURTW and the Benue Links Limited. Issues like the regulation of buses minibuses and taxis and the baring of street parking will also be deliberated upon.

RECOMMENDED ORGANISATIONAL FRAMEWORK FOR TRANSPORTATION ADMINISTRATION.



CONCLUSION

The study has been able to identify the problem of journey to work in Makurdi. This includes problems resulting from the spatial separation of workers' residentes due to the rapid urban growth and constraints to phyiscal development, problems associated with the modes, the road network and problems associated with the socio-economic characteristics of workers.

The study went further to advance proposals for achieving an effective journey to work in Makurdi. This includes short term curative measures and longterm preventive measures. It is hoped that if these proposals are fully implemented, the problems of journey to work in Makurdi will be solved.

Some of the proposals are drastic solutions to the acute problem of urban travels. The package put forward will be necessary if we take this problem seriously. It is believed that when the fuel situation worsens by the next 17 years, the sort of solutions put forward will become common place rather than revolutionary. Wouldn't it be splendid if just for once we anticipated events rather than be engulfed by them?

If the transportation problems of our Nigerian urban centres especially during peak periods are to be satisfactorily resolved, the location, densities and patterns

of urban activities cannot be ignored as elements in the picture. These elements are overlooked because existing transportation institutions require that transporation problems be resolved by transportation solutions (Owen, 1978). But efforts to ameliorate transportation problems cannot be divorced from the relentless addition to these problems created by urban growth. Transporation remedies do not lie exclusively in more buses and highways but must be found in locating job opportunities adjacent to housing developments, in efforts to clean up the environment, to permit more close in living, and in the design of structures for multiple uses including housing, shops, offices and recreation. Urban growth needs to be guided in ways that promote transport serving communities.

APPENDIX I: QUESTIONAIRE ADMINISTRATION

Dept. of Urban & Regional Planning
Ahmadu Bello University
Zaria

Dear Sir/Madam,

I am carrying out an M.Sc. research work on Journey to work in Makurdi. Kindly give your honest opinion to these questions.

Expecting a positive response from you, please.

Yours faithfully,

Ameh, Paul Onuminya

Tick or Write the Correct answers to the questions

A) Information on Residence/Employment

1. House number..... Zaria .....
2. Place of work ..... Zone .....
3. Occupation (a) Civil Servant (b) Business
   (c) Industrial worker (d) Others
4. Why do you choose to live in your present place of Residence?
   a) Affordable rent (b) Near Place of work
   (c) No alternative place (d) Near children/ Depedendant's School (e) Live with Husband/ Relative/Family House.
5. Where would you have wished to live if you were given a choice ?
   (a) where there is low rent (b) close to workplace (c) close to children/dependant's school (d) close to market/Recreational area (e) close to place of worship.

6 6. Rent paid for your house per month .....

7. Type of house (a) Thatched (b) Flat (c) Rooming house (d) Duplex

B) Information on your Journey to work

1. What time do you always leave home to work? .....
2. and what time do you come back?.....
2. Do you own a vehicle? Yes/No
3. If yes, what type of vehicle - (a) Private car (b) Bicycle (c) Motor-cycle (d) Tracter Truck/Bus/Mini Bus/Taxi
4. If no, how much time does it take you to walk from your house to take a vehicle?.....
5. What is your regular mode of transport to work? (a) Foot (b) Bicycle (d) Motorcycle (d) Minibus (e) Minibus motorcycle (f) Private Car (g) Taxi (h) Bus.
6. If your mode of transport is bus, how long do you wait at the bus stop when going to work?.....
7. How long does it take the vehicle to take you to yourplace work?.....
8. Do you change your mode of transport before going to your work/backhome?
9. If yes, how many times? To work..... Back home.....
10. What is the total time it takes you to leave home to work? .....
11. How much do you spend on transport fare to and from work everyday?.....
12. Are you satisfied with your present means of transport to work and back everyday? yes no..
13. If no, can you list the problems you face in getting to your workplace and back?..... (a)..... (b)..... (c) ..... (d).....
14. Suggest ways by which the problems can be solved? (a)..... (b) ..... (c)..... (d).....
15. If a well organised mass transit system is introduced, will you use it as a mode of journey to work? yes/no

C). Information on Socio-Economic Characteristics

1. Age (a) Under 20 (b) 20 to 39 (c) 40-59 (d) above 60 years
2. Size of Household and dependant relations .....
3. Religion (a) Traditional (b) Christianity (c) Muslim (d) others.
4. Ethnic group (a) Idoma (b) Igala (c) Tiv (d) others
5. Educational level (a) Primary School Certificate (b) Grade II/WASC. (c) NCE/Degree and above (d) none
6. Your monthly income .....(Strickly confidential)
7. Considering your monthly income, how much can you afford for the mass transit system per drop.....?

APPENDIX II: LIST OF RANDOMLY SELECTED MAJOR WORK PLACES AND NUMBER OF QUESTIONAIRE

	Zones	No. of Questionaire
1.	North West Bank	(8)
	Custom House	1
	Benue Investment Company	2
	Market	5
2.	North East Bank	(51)
	Agro millers company	17
	S.B.S.	6
	Benue Polytechnic	9
	Police C Division	1
	University of Agric.	13
	Benue State Housing Agency	2
	Dolphin Complex	2
	De Gandy Limited	1
3.	Wadata	(14)
	Market	6
	General Hospital	8
4.	Old GRA	(35)
	Benue State Urban Dev. Board	11
	WAEC	2
	Ministry of Local Government	3
	" " Lands and Survey	7
	Benue Scholarship Board	4
	Makurdi Local Govt. Sec.	8

5.	Wurukum	(19)
	Business companies	9
	Market	10
6.	High Level	(47)
	Staff Devt. Centre	2
	Teaching Service Board	3
	National Provident fund	1
	The Nig. Voice and BPPC	12
	Federal Secretariat	2
	Benue Secretariat	15
	D.F.F.R.R.I	3
	Water Board	6
	Police Headquarters	3
7.	Ankpa Ward	(10)
	Ministry of Education	4
	International Mnkket (Market)	6
8.	Industrial Layout	(38)
	Civil Service Commission	7
	Fed. Ministry of Internal Affairs	1
	Block Industries	2
	NITEL and NIPOST	1
	Benue Epidemology Unit	1
	Construction companies	2
	Univ. of Agric. (Admin.)	6
	Benue Bottling Company	4
	Tiley Gyado Foods	3
	BBL	7
	NAMCO Nig. Ltd.	2
	N.S.G.R.P.	1
	Fed. Dept. of Fisheries	1
9.	New GRA	(16)
	BNARDA	4
	M.O.W. (URP & Mechanic)	1
	" (Divisional Engineer)	3
	Radio Benue	1
	Phoenix Press	1
	Babock Electrical Projects Ltd.	2

APPENDIX III : TRAFFIC SURVEY ON SOME ROADS

ROADS	PERIODS	BICYCLE 0.33 VPH	BICYCLE 0.33 PCU	MOTOR-CYCLE 0.75 VPH	MOTOR-CYCLE 0.75 PCU	PRIVATE CAR 1.0 VPH	PRIVATE CAR 1.0 PCU	TAXI 1.0 VPH	TAXI 1.0 PCU	MINIBUS 2.0 VPH	MINIBUS 2.0 PCU	PICK-UP VAN 2.0 VPH	PICK-UP VAN 2.0 PCU	BUS 3.0 VPH	BUS 3.0 PCU	TRUCK/ TRAILER 3.0 VPH	TRUCK/ TRAILER 3.0 PCU	TOTAL VPH	TOTAL PCU
NEW-BRIDGE RD.	M	46	15.18	230	172.5	1363	1363	85	85	271	271	273	546	68	204	61	183	2397	2839.7
	A	38	12.54	187	140.2	1319	1319	49	49	273	273	299	598	34	102	52	156	2251	2649.8
	E	18	5.94	108	81	192	192	76	76	260	260	96	192	42	135	22	66	814	1007.9
LAFIA RD	M	26	8.58	109	81.75	116	116	2	2	176	352	41	82	10	30	11	33	491	705
	A	16	5.28	79	59.25	88	88	1	1	232	464	33	66	5	15	6	18	460	717
	E	30	9.9	127	95.2	129	129	3	3	273	546	43	86	12	36	13	39	430	944
S.B.S RD.	M	25	8.25	59	44.25	322	322	28	28	96	192	93	186	15	45	12	36	650	861.5
	A	17	5.61	56	42	253	253	36	36	60	120	85	170	14	42	6	18	527	686.6
	E	5	1.65	8	6	26	26	5	5	16	32	9	18	1	3	0	0	70	91.65
GBOKO RD.	M	35	11.6	140	105	526	526	14	14	207	414	304	608	48	144	45	135	1319	1957.6
	A	17	5.6	55	93	253	404	13	13	160	320	260	520	38	114	26	78	1042	1547.6
	E	12	4	81	60.8	462	462	18	18	113	226	156	312	13	39	15	45	872	1166.8
OTUKPO RD.	M	38	12.5	570	427.5	1027	1027	18	18	15	30	194	388	41	123	60	180	1963	2206
	A	21	6.9	596	447	657	657	7	7	20	60	108	216	13	39	39	117	1661	1750
	E	31	10.2	199	149.2	204	204	5	5	9	18	160	320	21	63	15	45	644	814.5
RAILWAY BYE PASS RD.	M	38	12.5	321	2407	550	550	8	8	234	468	244	488	16	48	31	93	1442	1908.2
	A	45	14.9	318	2385	524	524	4	4	231	462	232	464	12	36	18	54	1384	1797.4
	E	22	7.3	297	222.7	486	486	6	6	229	458	214	428	8	24	26	78	1288	1510
BARRACK RD.	M	46	15.2	290	217.5	573	573	17	17	206	412	180	360	13	39	40	120	1365	1753.7
	A	41	13.5	275	206.3	321	321	9	9	301	602	100	200	24	72	20	60	1091	1483.8
	E	25	8.3	215	161.3	291	291	16	16	108	216	140	280	17	51	45	135	857	1158.6
KASHIM-IBRAHIM RD.	M	29	9.6	535	401.2	536	536	5	5	3	6	260	520	10	30	14	42	1392	1549.8
	A	19	6.3	313	234.7	433	433	12	12	8	16	190	380	9	27	20	60	1091	1169
	E	27	8.9	70	52.5	75	75	4	4	1	2	30	60	2	6	11	33	220	241.4
BENUE CRESCENT	M	72	23.8	220	165	198	198	11	11	161	322	45	90	3	9	1	3	761	821.8
	A	48	15.8	163	122.3	144	144	3	3	101	202	36	72	12	36	4	12	561	607
	E	22	7.3	142	106.5	111	111	7	7	114	228	11	22	2	6	1	13	450	500.8
BANK RD.	M	43	14.2	192	144	293	293	2	2	94	188	49	98	11	33	9	18	693	790.2
	A	25	8.3	185	138.8	168	168	1	1	81	162	13	26	4	12	4	12	481	528.1
	E	23	7.6	95	71.3	43	43	0	0	46	92	18	36	3	9	2	6	230	264.9
ANKPA RD.	M	66	21.8	289	216.8	328	328	32	32	34	68	177	354	11	33	50	150	987	1203.6
	A	58	19.1	275	2063	200	200	16	16	26	52	142	284	5	15	30	90	752	882.4
	E	28	9.2	216	162	69	69	27	27	28	56	98	196	2	6	28	84	496	609.2
HIGH LEVEL RD.	M	68	22.4	523	392.2	377	377	5	5	7	14	124	248	22	66	16	48	1142	1173
	A	47	15.51	339	254.2	166	166	3	3	5	10	113	226	15	45	8	24	696	744
	E	23	7.59	98	73.5	57	57	1	1	3	6	37	66	5	15	0	0	220	226.1

M = Morning Peak (7.15 - 8.15 a.m)
A = Afternoon Peak (3 4 pm)
E = Evening Peak (6.00 - 7.00 p.m)

SOURCE : TRAFFIC SURVEY JAN. 1988
V.P.H = Vehicles Per Hour
PCU = Passenger Car Units

N.D.E.	1
Banks	1
NEPA (District Office)	1
Ferdinant Motors/UTC Motors	1
10. APIR	19
Mechanic Village	5
LBRBDA	8
A D C	4
N N P C	2

APPENDIX IV

Product-momment correlation for computing relationship between worker's income and distance, Rent, and expenditure on journey to work.

Income (₦)	No of workers	No. that Travel by Public Transp.	Mean monthly income (₦)	Mean monthly Expenses on Journey to work	Rent (₦)	Mean Distance km.
Less than ₦150.	217	157	₦125.50	₦35	₦24.50	7.9
₦151-250	199	125	195.00	34.00	27.60	7.60
251-350	175	14	315.00	38.00	26.40	8.20
351-450	159	118	397.00	32.00	32.00	6.50
Above ₦450	117	22	480.00	37.00	42.00	433
		867	568.00			

CORRELATION COEFFICIENT

	Mean monthly Income	T-test
Mean monthly expenditture on Journey to work	0.16	Not significant
Mean monthly expenditture on rent	0.88	Significant
Mean Distance	- 0.80	Not significant

Formular

$$r = \frac{(\Sigma xy) - (\Sigma x)(\Sigma y)/N}{(\Sigma x^2 - (\Sigma x)^2/N)(\Sigma y^2 - (\Sigma y)^2/N)}$$

To test the significance of r

$$t = \frac{r}{\frac{1 - r^2}{N - 2}}$$

t = value for 5% at 3df

where,

N = number of pairs of variables

Σxy = sum of the products of the x andy scores for each pair of variables

Σx = sum of x scores

Σy = sum of y scores

Σx^2 = each x score squared, and summed over all variables

$(\Sigma x)^2$ = sum of x scores squared

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