REDEVELOPMENT OF TELEVISION VILLAGE BUS TERMINAL, KADUNA.

(AN ARCHITECTURAL REDEVELOPMENT PROPOSAL TO NEW TRENDS IN SOCIO-ECONOMIC DEVELOPMENT)

BY

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DECLARATION

I, AKHIDENO, OSOSESE FRANCIS, of the Department of Architecture, Faculty of Environmental Design, Ahmadu Bello University, Zaria, hereby declare that this research work has been a personal academic undertaking executed under the supervision of my mentors at the deparment. All quotations and information utilized and their sources have been duly acknowledged.

_____

Student's signature

CERTIFICATION

This thesis report entitled "BUS TERMINAL REDEVELOPMENT, TELEVISION VILLAGE, KADUNA, by AKHIDENO, Ososese Francis, meets the regulation governing the award of the degree of Master of Science in Architecture and is approved for its contribution to knowledge and literary presentation.

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Dean, Postgraduate School	Date

DEDICATION

This work is dedicated to the almighty God for his ever guiding strength and presence.

To my mother who would have loved to witness this day.

To my father who had always pre-figured this day.

And to my dearly beloved.

May the almighty that has led us this far lead us from here hence fort.

QUOTABLE QUOTES

- The world is all about 'how people feel' and not about reality: The ability to sway people's opinion keeps the world in a 'predefined order'.

  Sese Akhideno (2002).

- However certain our expectations, the moment foreseen may be unexpected when it arrives.

  Thomas,

  Murder in the Cathedral.

- 'When I design, my object is to show what I have found and not what I am looking for'.

  Babatunde D. O. (1998).

- 'To do better; we must have some way of distinguishing better from worse'.

  Rivlin A. M. (1971).

- We have come a long way, but we still have a long way to go; if you cannot run walk, if you cannot walk crawl, but by all means keep moving.

  Martin Luther King Jr.

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ABSTRACT

The gateway into any city is the circulation terminals where humans, vehicles and goods interact usually in large numbers all year round. This interaction may be harmonious or chaotic depending on how well organized the activities in these terminals are. Being the gateway into the city such terminals should speak well of the cities they serve.

Bus terminals being what they are, handles a large number of humans and vehicles that are to transit. Such humans, goods and vehicles are usually heterogeneous in nature and require also diverse services. The diverse requirements usually lead to a chaotic interaction which only proper organization help to ameliorate.

This project seeks to develop a modern bus terminus, taking into consideration the mode of circulation (traffic) of these commuters and their conveyors in order to achieve harmonious movement in clear and easily identifiable direction which is the main activity and for that matter the only activity in the terminus they are all involved in. An efficient and safe mode of circulation so achieved will go a long way to enhance the efficiency of such terminals which are not just gateways in to the city but more so play a prominent role in directing and distributing the activities of the cities they serve. In the final analysis such terminal will generate more revenue for the city. It also provides a source of livelihood for many and for that matter some live out their lives in the terminal.

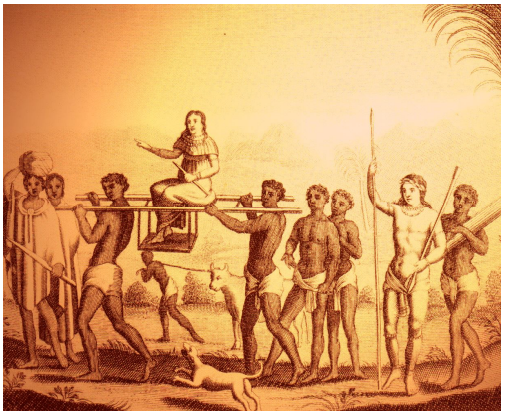
CHAPTER ONE

INTRODUCTION

1.0 INTRODUCTION

Transportation is one of the oldest forms of communication known to man, which involves the continuous relocation and distribution of goods, humans and services from one place to another. It evolved as a complete system when man was still a wanderer with all the elements of the system in place i.e. the need to relocate from one particular point of origin to another point of destination in the process relocating goods and services from one place to another. These early forms were basically on foot with man as the vehicle. The route required needed not be so defined; neither did his destination as he wandered. Transportation then was based on instincts and necessity and traffic was sparse.

As man's existence developed from wandering into communities and then cities, so did he continue to re-invent this very important aspect of city life, which holds in place and continues to nourish the human community. These developments were from man's basic movements as a wanderer to the human portal system, to the use of beasts of burden.



Human portal system.



Cart driven by beasts of burden.

These could be laced with charts or caravans, and the use of boats and ships through waterways. These forms were further revolutionized by technological advancements into more sophisticated forms of transportation vehicles, such that it depended on human effort (bicycles) or use fuel (trains, buses, ocean liners, planes). The mode of movement became more diverse and specific, movement became swifter, the density of objects to be moved became much more than ever before and the need for movement more critical. The routes as a necessity became more defined and developed to be wearing to accommodate the heavier traffic and form of vehicles. The points of origins and destinations too became more defined to meet the needs of the users.

In the present day, world transportation has become much more specialized to meet the various demands of its patrons. The most favored mode being the road transport system, especially in Nigeria. Such reasons are not far fetched; man being a terrestrial animal, the road winds from his door step to his destination and even if other forms are to be used, he still gets to them by road. In essence the landform of transportation affords him interconnectivity between the other forms of transportation.



Modern day urban center serviced by intra-city buses.

In Nigeria, advancements from human portal/beasts of burden forms came with the coming of the Europeans to this part of the world. First to be developed across the country was the rail system. In the 1930s there was a mass importation of automobiles, which actually became more prominent in the 1970s and began to take over from the rail system as it became more flexible and profitable to its investors. More roads were to the existing stock on the part of government in the 1970s and '80s to encourage the industry. Terminals became more prominent, though they were not more developed than motor parks.

Private investors also came into the sector being cheaper to invest in than the rail form of transportation such as the Mid-West/Ames Line later to be known as Bendel Line, Ekenedili Chukwu, Chidi Ebere etc. The federal government in 1978 launched the Federal Urban Mass Transit Program and the state and local governments were encouraged to follow suit. The flexibility and importance of road transport has by far surpassed other forms of transportation in Nigeria to the extent that virtually every thing in Nigeria moves by road as the most efficient and cheapest form of transportation.

1.2 PROBLEM DEFINITION

The terminal as it is, is located in the suburb at the southern end of the city on an axis connecting Kaduna to Abuja on the southward direction and Kafanchan/Jos in the eastward direction. The bye-pass provides an access to the northern cities. This makes its location very strategic as a sub-urban/inter-state terminus with easy access to major routes.

The terminal is presently the property of Kaduna South Local Government. Development within it had been largely unplanned. Initially parking sheds were provided for bus berthing which is presently in ruins and can hardly accommodate the present vehicular traffic. Later on unauthorized private developers built shops in cellular form along the periphery of the terminus to provide for eating and shopping spaces; this also is presently in squalor and hardly fit for inhabitation.

On the whole, the terminus is unsurfaced and when it rains pools of water gather making movement within difficult. There is hardly any protection from weather elements for the users, especially the passengers. The circulation pattern is mixed up and travelers, except those used to the terminus can hardly tell where to get what the want.

There are no maintenance facilities for vehicles within the terminus and no fuel dump such that after take-off from the terminus, fueling has to be done outside, and in doing so more journey time is lost. There is no provision made for driver/passenger lodging, the only such facility being used at the moment is by private developers around the terminal.

The object in the redevelopment of Television Village Bus Terminal is to upgrade it to modern standards, to make it more adaptive to its functions, establishing a chaos free circulation pattern inside and outside the terminus. The under listed areas should be well considered;

i) Provision of a terminal building

ii) Traffic segregation

iii) Support facilities

iv) Traveler's convenience

v) Protection from weather elements

1.3 AIM

The aim of this thesis is to produce an architectural design proposal with provision for adequate facilities that will cater for the needs of passengers through effective planning and space organization.

1.4 OBJECTIVES

i) To provide a comfortable environment for passengers

ii) To encourage security of use among passengers

iii) To protect users from the elements of whether

iv) To provide avenues for effective transportation monitoring

v) To provide an adequate landmark for the purpose

1.5 MOTIVATION

The importance of transportation to the development of the Nation cannot be over emphasized, therefore it is important to continuously monitor and develop this sector to meet this ever developing and pressing demand. There is therefore a need for its proper planning and improvement to meet these demands.

1.6 METHODOLOGY OF STUDY

In conducting this research, data shall be collected both from primary and secondary sources. Oral interviews and observations at the existing terminals, bus stations and motor parks, as well as reading published and unpublished news papers, magazines journals, text books etc., case studies of similar places shall also be carried out.

1.7 SCOPE AND LIMITATION

This thesis work is going to be based on the desire to alleviate the problems existent within our parks and bus stations. It has obviously been noted that our parks are chaotic, unattractive and filthy. The passenger traffic at the park will serve as the basis for arriving at the figure to be designed for, though provisions would be made for future expansion, as this kind of facility must be flexible to meet growing needs and demands. Considerations will also be made for those making local trips (intra-city buses). It will center mainly on buses and considerations would be given to taxi cabs.

CHAPTER TWO

AN OVERVIEW OF TRANSPORTATION

2.1 BACKGROUND OF TRANSPORTATION

During the early stages of development, transportation was quite modest without any side or consequential effect. It was either on foot, on animal back or drawn charts. But over the years, through advancements in technology and thoughtful innovations, mechanical and electrical means have emerged, thereby coming along with problems associated with these discoveries. To his advantage man has been able to transverse longer distances and carry heavier loads without sacrificing his comfort through his discoveries over time. These discoveries led to the invention of bicycles, motorcar, train, the ship, airplane and other modes of transportation with the unprecedented advancements in technological innovations in transportation system. Along side these came the problem of congestion within the urban centers leading to unnecessary delays and consequential lowering of the economic growth rate. Also there were problems of pollution, noise and fumes, thereby reducing the quality of life within the urban environment. In order to improve and restore the quality of life, it is imperative to have a well-planned transportation system with good supporting facilities within urban centers as well as between them.

2.2 TRANSPORTATION IN DEVELOPED COUNTRIES

In the advanced countries, the problem of coordination and integrated development of a unified system of transportation has been delved into. In order to tackle these problems effectively, they were carefully identified with much emphasis given to urban transportation problems, which is the big ‘bottle-neck’ in many of these countries. They are as follows;

i) The inter- relationship between the development levels of industries and transportation.

ii) The relationship between various modes in the general transportation system.

iii) Investigation of cost effectiveness of capital investments in transport development from the viewpoint of the national economy.

iv) The classification of transport routes.

v) The principles of the formation and development of an integrated transport system including terminals.

The resolutions reached are;

i) Integration of the planning and management of transport system, as a condition for a real comprehensive urban development policy and planning.

ii) Integration of transportation should as much as possible cut down independent transportation and coordination of existing ones. For proper integration, both technical, organizational and other measures must be utilized.

2.3 TRANSPORTATION IN UNDERDEVELOPED COUNTRIES

The problem with this continent is similar to that of other parts of the developing world. Inadequate and shortage of facilities. And one of the causes is lack of finance for rapid development of infrastructures and not having a recognizable continuous system of either railways or highway network; which is partly attributed to the low level of our technological development and deficient transport policies by the concerned governments.

In the case of railway networks, the absence of links between different systems is accentuated by the fact that adjacent systems are frequently of different track gauges, which makes interconnection more difficult and costly. Nevertheless, in parts like North and South Africa, railways and road systems have been greatly developed.

There is urgent need for transport coordination within the continent for the promotion of trade, economic development and social interaction, at least starting with regional links of the continent. The progress of industrialization lies solely in transport system serving converging markets of many nations. The required transport networks, therefore, will have to be conceived on a larger than purely national scale and will require planning and operation, close coordination and harmonization of plans and policies between countries in a group. This can be done through the formation of permanent transport committee on a sub-regional basis. For example, within the formation of Economic Community of West African States – This is a part of what they intend to achieve. But the question arises on how cohesive, articulate and economically buoyant these states are to embark on this economically viable venture and the unification of the continent by means of 'go-to-places and meet people'. This is a question that will probably stand long to be answered by the various governments of Africa.

2.4 URBAN TRANSPORTATION

Urban transportation is a problem in search of a solution. The problem is inherent in almost all urbanized world cities. A problem taking continuous grievous position in developing countries, as can be manifested in cities like Lagos, Manilla, Mexico City, etc.

Though the variety of urban services required, indicates that sources of urban problems go beyond inadequate transport facilities. One of those and the most obvious is shifting population. There had been outward migration in developed countries and the direct reverse in the case of developing countries. The new trends in either case have caused many more domestic problems – unemployment, congestion, and inadequate public facilities.

It should be noted that transportation improvements often represents an indirect attack on these problems, at best, on the basic problems of cities. It is a common belief that such improvements will solve or ameliorate even the knottier urban problems.

Proposals now abound for improving urban transportation facilities. They take variety of forms, but with considerations more for new public transit facilities to make them more attractive. Mass transportation should have adequate share as well as freight and passenger transport needs.

Change in city population and densities are largely attributed to the lack of good, or at least up-to-date mass transit facilities.

Of note should be made the problem of moving mass passengers into and out of cities during the peak or rush hours. It is this problem that task the capacity of existing urban transport facilities and create the congestion and delays that most people now know as ‘for better for worse’ of the urban transportation problem.

There is a continuing need for new transportation capacity in urban areas. All over the world cities are growing through migration from rural areas and natural population increase. With rising incomes and higher standards of living and more leisure hours, the urban resident demands more and better urban services, including improved levels of transportation service. A rising trend in family incomes and increased automobile ownership has created a corresponding trend towards low-density development in the suburbs. This trend along with decentralization of industrial, commercial and retail activity, has resulted in an increase in travel generally, and especially by private automobile.

However, there is, also a need to plan the response to major changes in economic and environmental conditions. Cities developed in an era of plentiful land and cheap energy. Urban spatial development and the concomitant transportation systems reflect this history. However, both land and energy are rapidly becoming scarce resources. While broad transportation goals may remain relatively unchanged – the provision of mobility adequate for a high standard of urban living – the means to achieve such goals may shift away from an emphasis on providing new facilities towards one of maximizing the use and efficiency of existing transportation networks.

The objective of urban transportation planning, therefore, is to develop orderly programs under which an integrated transportation system can be fully developed and its operation and management can be optimized. This includes the highway and mass transit networks and their terminal facilities. Such planning must consider present and projected land uses and the resultant travel requirements for the movement of persons and goods during the next 20 to 25 years at levels of service acceptable to and within

the financial resources of the community. The plan must conform to the goals of the region and to the policies of the state and nation.

The need for continuing comprehensive planning was first recognized by the U.S. Government in the Federal Highway Act of 1962 and the Mass Transportation Act of 1964, and is now required for federal aid applications in urban areas of more than 50,000 population.

2.5 QUALITIES OF TRANSPORT SERVICES

Each nation requires a comprehensive and efficient transport system to move goods and people within its national boundaries. For the transport of goods, the services should have the qualities of speed, safety, adequacy, frequency, regularity, responsibility and acceptable cost. For the transport of people, the additional quality of comfort is required. All these qualities are important to the user in determining what form or method of transportation is most suitable to him. The relative values of the qualities may change from movement to movement and from place to place. The constant problem is the selection of the qualities, which are more important than others in each particular distance.

Speed

In the transport of goods, speed in transit has the following advantages:

a) Shorter transit time reduces the amount of deterioration between production and consumption of perishable foods.
b) Speed reduces the financial cost attached to goods in transit. The money value of the goods represents an investment bearing interest charges or claims of profit, and the locking up of the investment for

the duration of the transport delays the investment being converted to other uses.

c) Investment on transport facilities is put to greater use within the defined period.

d) Fast transport services may reduce or totally avoid the necessity to provide storage facilities near consumers because demand for goods may be met directly from the producer without any significant delay.

The more relevant aspects of speed in the carriage of people are that;

a) People who suffer disorders by long confinements have the time under stress reduced.

b) In business travels, the time saved reduces business costs.

c) In travel for pleasure, a greater amount of ground can be covered within the time available.

d) The cost of travel may be reduced by greater use of transport facilities.

e) People can live in areas at some distance from their place of work.

Safety

Adequate provision must be made not only for protection of persons and property carried on the transport system, but also for the persons and properties of others. The goods must be protected against deterioration theft pilferage fire and the action of the elements of weather (especially for the carriage of persons). Highest possible safety standards should be adhered to and strictly enforced.

Capacity

The transport facility must have capacity adequate for all reasonable demands. For goods the facilities must be related to the maximum demand at any time. Seasonality impose a peak demand on the transport system, and the movement at such times requires a quantum of facilities greater than that required to handle traffic at other times of the year. For passenger transport, total carrying capacity must be related also to maximum demand at any one time. There are the peak hours each day in cities and towns to be coped with.

Frequency

Except for movements by pipelines and conveyors, transport is not continuous. The movements are regular or irregularly spread, and the interval of time between the movements may be long or short. In relation to goods transport, frequency of movement has the following advantage;

a) It reduces the necessity to accumulate goods in storage before and after storage.
b) In a two or more phased transport service, loss of time at storage points where journey is broken is less.
c) The dispatch of goods required unexpectedly but urgently can be expedited.
d) The number of places where stocks are held can be reduced provided that the frequency of transport services can meet the demand of buyers.

For people, frequency of transport service means less waiting time and the possibility of a greater amount of travel within a limited time when a journey is to be made in two or more stages.

Regularity

Regularity of transport service means that the movements are either at evenly spaced intervals or at known times. Modern life turns largely on the clock, and the certainty that transport facilities will be available at specific intervals or at specific times, enable people to organize their personal movements and activities accordingly.

Responsibility

People who employ others to carry themselves or their goods expect safe carriage or compensation for loss or injury caused by act of omission of the transport undertaking. Responsibility in this regard is a desirable quality in a transport service but may be conditioned by the legal liability of the undertaking and its financial ability to meet a proper claim for compensation.

Comfort

The physical and mental fragility of human beings makes personal comfort an essential quality in the transport of people. Physical comfort involves suitable sitting ventilation, temperature control, refreshment and sleeping accommodation on over night journeys. Enjoyment of travel is related also to culmination of conditions, which bring various phobias into operation, and provision of means of viewing the passing scene.

Acceptable cost

The cost of transport must be reasonable to attract traffic, and any reduction in the real cost will be reflected in greater demand. With lower transport costs, personal travel will increase, because travel is limited mostly by the amount that people can afford for such purpose.

CHAPTER THREE

ROAD TRANSPORT SYSTEM

3.1 ORIGIN AND GROWTH

The first bus for public transport came into being about 1900 when an 'Orion' chassis with a 16 h.p. (horse power) engine was fitted with a double decker horse-bus body carrying twenty-six passengers. Twenty years after French and German chassis were used. In 1910, the London General Omnibus Company produced the famous 'B' type bus, it seating for thirty-four people, eighteen outside and sixteen inside. In 1920, passenger capacity was increased to forty-six in the 'K' type in which further development was to place the engine beside the driver instead of in front of him. A year later the 'S' type increased the capacity again to fifty-four. In 1925, the 'NS' covered top type appeared, seating fifty passengers with added comfort of pneumatic tires. In 1927, the 'LS' six-wheeler gave a capacity of seventy passengers.

In seating capacity 'LS' marks the peak. Development since then for standard double deckers has been, in fact, in the direction of a slight reduction of capacity but at the same time development to improve comfort, safety, economy and rush hour capabilities. Though double decker is more of British development and not extensively copied abroad.

The double decker is commonest there because their attitude is the notion of seated travel; as this type provides more seating capacity than the single decker. In other countries, standing travel for which the single decker has advantage, for there is manifested objections to standing passengers on an upper deck.

The single decker was introduced later, especially for country bus services. It became used after the war of 1918. The form common then was the multi-sitter coach

used mainly for tours and especially excursions, whilst the bus remained utilitarian in its equipment, the motor coach has developed with a distinctly luxury flavor known sometimes as the 'poor man's motor car', the coach has indeed come to offer standards of comfort for surpassing those of the cheaper cars.

3.2 COMPONENTS OF ROAD TRANSPORT SYSTEM

3.2.1. VEHICLE

The vehicle is a mobile conveyance. The transportation industry cannot function as a system without a vehicle, but the vehicle can be used without other components. However, there is a need for proper roads and regular servicing.

A vehicle could be a bicycle, motor cycle, motor car, bus, truck, railway engine, airplane, ship, etc. however this thesis is limiting itself to the use of cars, minibuses and buses as the common mode of vehicles. In each of these cases of vehicle types most commonly used in the country, generalization shall be made for the largest size so as to accommodate other types.

For the car/minibus type, they are mostly used during the day both as inter-city vehicle (minibuses) and inter-city vehicles. The cars which is about 4.8 meters in length, 1.8 meters wide and 1.35 meters high. It seats by design 6 passengers and a driver. The minibus which seats 10 passengers, is about 4.5 meters in length, 1.8 meters wide and 1.8 meters high, are of different makes; liteace, Mitsubishi, etc. They are mostly used as minibuses though fairly larger ones are also used with higher carrying capacities of 14 and 18 sitter capacity.

For the bus type, most commonly used in Nigeria, especially for long, over night journeys are the Volvo and Mercedes Benz types, which are about 12 meters in length, 2,5 meters wide and 3.15 meters high. They seat 52 passengers comfortably.



One of the commonly used bus types for mass transit.

3.2.2. ROAD TYPES

This can be described as any specially prepared vehicle circulation route. It can be of earth road, gravel road or tarred road.

The condition of a road is very vital to the performance and durability of a vehicle. It is of paramount importance for a road to have an all weather high performance. It is an established scientific fact that, the regular alternating heating of the sun and cooling at night affects construction elements adversely. In fact it is the major reason for oracus in tarmac and eventual development of potholes.

The performance of tarmac can however, be improved by the use of soil-element base for the roads. Even though, it is a high cost operation, it however, improves the standards of our roads.

3.2.3. OPERATIONAL CONTROL SYSTEMS

There are various equipments invented to make motoring easier. Categorization of an area such as this is not easy, but it is perhaps helpful to think of the applications as;

a) Those that provide the driver with strategic information on which to make decisions.
b) Those that give the driver specific information related to a particular aspect of the driving task.
c) Those that actually take over some part of the driving task.

In the first category are the various route guidance systems and systems that inform the driver about external events – anything from congestion on the route ahead to obstructions on the road. For example route guidance mounted at dashboard level, do offer much more than the selection of an appropriate route. Real-time traffic news, especially of congestion is a feature of obvious importance; they also incorporate features as location of motorway services, hotels, local attraction etc.

The second category includes devices that improve vision in darkness or poor visibility, those that help with maneuvers such as reversing, parking, and collision avoidance systems. The reversing aid is an example of a system designed to help with particular driving maneuvers. They are useful in detecting objects moving across path of a reversing vehicle, a small child for example.

The third category covers some of the more advanced systems such as autonomous intelligence cruise control and external control of vehicle speed. The autonomous intelligence cruise control (AICC) or the 'automated highway' involves system control over the speed and headway distance of vehicles on the road, with the system and not the driver using the throttle and break.

Other forms keep the driver informed and in contact with the base terminal like the radiotelephone, mobile phones, etc. With these, the driver can keep in touch with the base station informed on the progress of the journey and any new information can be passed on to him.

3.2.4. TERMINAL

The bus terminal can be defined as a place for assembly, discharge or transfer of passengers at a limited number of points on a route. The size and character of other facilities at these points, depends on the volume of traffic and frequency of services. The range largely from designated stopping points, for example, bus stops to large buildings with provisions for rest, refreshment, personnel comfort and the service and maintenance of vehicles.



An ultra-modern bus station.

BUS TERMINAL TYPES

a) **Inter-city bus terminal:** Usually found in the central core of the town and directly accessible by autos, taxis, local transit, etc. it differs, in that it handles

long hauls in excess of hundred route movements and provide for a much greater number of bus movements. Usually expansion is vertical due to the cost of land. More comprehensive 'package facilities' are provided in the inter-city terminal and a greater concessional and rental space is provided to defray cost of construction and operation.

b) **Airport-city bus terminal:** Primarily to cater for airline passengers from urban centers to the major airport it serves. Usually, it is located at the center accessible by the local transit system, taxis and autos. Oriented towards arriving and departing flights. Provisions are made for arriving and departing information and pre-ticketing and check-in facilities.

c) Urban-sub-urban bus terminal: May be located in the downtown core for central passenger collection and distribution node or may be located at the periphery of the core, as a rapid transit station. Characterized by diversified bus route structure and high turnover commuter type bus operations. Accessibility is important. Separated access by underpass or overpass connections and exclusive bus lanes will be describable to main town schedule efficiency.

d) Sub-urban-interstate bus terminal: Peripheral type, designed to avoid traffic congestion and the heavy unrest associated with the central city and/or airport terminal facilities, usually located close to adjoining interstate high way connections or regional airports and in many cases serves the increasing outlying 'Urban sprawl' areas. It also services commuter type functions where the daily journey to work in the central city may take as much as two hours. Sometimes referred to as 'park and ride' terminal, usually accessible primarily

by auto, provisions for open, paved, parking spaces is necessary, investment is normally minimal.

3.3 FLEXIBILITY OF THE TRANSPORTATION SYSTEM

3.3.1. INFLUENCE ON TOWN GROWTH

Motor vehicle led to the building of ties that in previous times had tended to cause towns to be compact for simple convenience of communication and defense purposes. The motor vehicle has broken away the bondage attachment of business and industry to the railway. Therefore the provision of this equivalent urban facilities gave people choice of leaving places (e.g. suburbs). These caused changes in the disposition and make up of towns. Though towns have been expanding but the general growth method was concentric up to the time of the railway, except where there had been natural obstruction. After the industrial revolution, proximity to a railway station served as a factor, affecting choice of location of a town.

The electric train came into being, its advantages over the train - rapid acceleration, better suited for short haul, frequent suburban traffic stations. This lead to ease in suburban dwelling in the open country. Here, the railway became a dispersal agent.

With more sophisticated innovations in the motor vehicle, a new and more powerful dispersal agent came into existence enabling the indiscriminate spread of urban development. Flexibility of the motor vehicle led to deeper penetration of urban activities. Also provided means of escape from towns with increasing populations, industrialization, decay and congestion.



Urban center density, sustained by transportation.

3.3.2. RECREATIONAL MOTORING

Formation of motor cycling clubs conducting active programs of rallies, trials, hill climbs and scrambles stunts, etc. The contribution of cars and cycles to recreation and indeed education – ability to go to places, is widespread. Initially it was 'touring' – that was the great attraction; the chance to free and independent excursion. There is invaluable use of cars for business and domestic purposes, its supreme function is for convenience, pleasure and recreation.

3.3.3. CARAVANING

The problem of finding satisfactory accommodation and the love for motor camping motivated the idea. There are clubs with large number membership. It is used as a means of permanent living by some and for touring, having a fascinating pastime, especially after a long spell at the wheel.

3.3.4. FOREIGN TRAVELS

With the opening of home horizons to many travelers, it also affords the opportunity (to thousands) to foreign travel usually holidaying abroad.

The growth of holiday motoring is not only our index of increased car ownership; it is partly accounted for by the large number of people now taking holidays away from home. Though this is applicable mainly to the western world.

3.3.5. URBAN SPRAWL

Here again, it is the flexibility of motor transport services that enabled these suburban expansions to spread and sprawl. There is high concentration in towns with heavy dependence on motor transport to work, school, market, etc. The sprawl in the suburban areas resulted in comparatively good houses in the suburb but paradoxically poor in towns.

The recent trend is increasing peripheral housing, and increasing commercial concentration at the center. Which is one fundamental cause of the acute congestion of all kinds that afflict the town centers.

3.3.6. LIFE IN THE COUNTRY

The rural areas are continually experiencing “depopulation” realizing that lack of amenities in the rural areas, job opportunities and access to urban pleasures as major causes of this. The motor vehicle with its versatility has played an important role in the country life, has served in the partial reversal as a “dispersal agent”.

There is a quiet revolution presently taking place in schooling. Schools seem to be slowly disappearing and being replaced by lesser number of larger schools at selected centers. This has been possible because of the motorbus service as conveyor.

Young people use the bus to work; this process has transformed many villages within the neighborhood to towns.

3.4. CONSEQUENCES OF TRANSPORTATION

3.4.1. CLASH AND FRICTION

The most generous consequence is the toll of accidents and there is continuous struggle for space between vehicles, pedestrians and cycles on the highways. Crush and congestion is becoming very severe in towns that its effect of delays and exasperation is almost defeating the purpose of utilizing motor vehicle. To further complicate the whole problem, the unpleasant physical consequence of noise, fumes, vibration and smell adds to it all. The abrasive function of motor traffic, directly or indirectly is grinding away all the amenities and pleasantries of the roads.

3.4.2. ACCIDENTS

The number of casualties is on the increase and it is noted that pedestrians suffer more next to cyclists and their passengers. Though that does not mean motorcycles are more involved in accidents than other vehicles, but the rider and passengers are vulnerable. In fact more than 80 percent of accidents are caused by motor vehicles including motorcycles.

Usually the locality of accidents are those subject to 50 km/h. That is to say in built up areas – more than half the cases. Though open road injuries are generally more severe than those in built up areas owing to greater speeds.

More than three-quarters of accidents occur in the daylight. From observations, weekends claim substantially more victims than other days. In the time

of the year, the peak is between July-August and it attains another peak in December during Christmas week through to the next year.

The cause of these accidents have different viewpoints, blames have differently been shared (especially between users). Motorists in some cases blame pedestrians; they too blame motorists as motorists cause most accidents. Another is road defection and probably those by the "acts of God". Though most of these would have been avoided if users were perfectly behaved, exercising care and restraints. Fundamentally, accidents mainly occur as a result of lapses from correct behaviour. Another viewpoint is the mixing of different users together on the road.

3.4.3. CONGESTION AND DELAY

Chocking of roads by throngs of vehicles. The delays and frustrations to some extent defeat the very utility of the motor vehicle. Congestion on main road in open country is comparatively phenomena. This is usually as a result of; too many vehicles for the width of the road or by obstructions of roads by bends, pinch points, awkward intersections, etc.

Congestion in towns is more complex with hindrance of through-driver by narrow streets, parked or waiting vehicles, blockages at intersections and constant and constant passage of pedestrians across his bows; the calling-driver suffers the added anxiety of being unable to find convenient places to stop; pedestrians find footways thronged to overflowing difficult to cross, the noise and the smell confusing and unpleasant, running the risk of being killed or injured. The cyclist runs the same risk, the bus passenger finds progress slow and rush-hour conditions inside the bus and waiting for it are unpleasant. Office workers and residents disturbed by noise and

vibrations; shopkeeper finds the hustle and bustle to trade advantage but ever in difficulties over goods timely delivery. The major trouble arises from through-traffic across the town. Also the towns are also generators and attractors of traffic. It should be noted that, the longer the town the less bye-passes may be relied on to relieve internal congestion. Also of note is that urban congestion is not only that of vehicles, but also too many pedestrians. Town centers ought to be safety areas and quiet where shopping, business, entertainment and cultural pursuits holds, but motor vehicle with its capacity of penetrating into nooks and crannies has destroyed all this.

3.4.4. NOISE, FUMES AND VIBRATIONS

The three by-products of the motor vehicle, increasing daily with its harmful effects not catching attention. The problem of noise in the context of a world that is constantly getting noisier – the helicopters, trains, motors and aeroplanes – noise becomes inevitable that it has to be accepted.

Noise nuisance, destroying rural peace and quietness and the intolerable in buildings coming from adjourning streets, contributes to the gradual removal of houses from town centers to the suburban areas. Other facilities like offices and hotels have suffered a great deal of noise discomfort. To cater for noise control usually incur more cost and alter other physical controls such as ventilation and heating systems in buildings thereby making it more expensive.

Exhaust fumes is of less concern in case of light traffic and matters even less on open roads with rapid dispersal. In contrast to congested areas, there are various types of poisonous fumes emitted daily. Medically these fumes have connections with some human diseases such as lung cancer. Unfortunately, diesel, which is less a

suspect, is not widely used. Added to these is the atmospheric pollution from tar dust caused by abrasion of road surfaces by traffic – the motorist is most likely to suffer most from the effects of this fumes.

Vibrations have declined with the disappearance of solid-tired heavy vehicle. Effects are most felt on buildings with close proximity to the road. The trolley bus is presently being abandoned; it is smooth in operation, silent and no fumes. It is alleged to obstruct traffic and efficiency of transport services by its inflexibility for a change of the noisier motor vehicle; therefore its virtues played no part in the decision.

3.4.5. THE GRINDING OF AMENITIES

The confused arrangement of ancillary facilities to the road usually gives incoherent and not satisfactory street design.

Impress of vehicles on objects with dirty habits, e.g. mud nuisance on a wet day caused by heavy traffic on street well treated. It is worse on soft grounds.

Abandoning and parking of stationary vehicles common in town and countryside; now on an increasing scale in housing areas. The breakdown of vehicles on carriageways at night endangering moving vehicles.

Motor vehicles taken individually could be exciting and beautiful objects, but when seen in a mass they invariably present an untidy and unpleasing spectacle. The accommodation of large parking spaces into town landscapes is very difficult as this is a profound alteration of traditional urban structure.

The roadside consequence of motor traffic – advertisements, cafes, hotels, and petrol stations. The catering for the refreshments of goods-vehicle drivers and crews has produced as ugly a crop of roadside excrescences. The refreshment of vehicles

with fuel and oil has been an even bigger menace to appearance than the roadside café.

3.5 A CASE FOR BUS TRANSPORTATION

As cities grow in size, so attention focuses on mass movement of travelers along major corridors. Developing cities exists today, which must provide for 10-15 million public transport trips per day; corridor flows can be in excess of 1 million passengers per day. To cope with this scale of demand, requires a high-capacity transit system.

Many developing countries have severe traffic problems, with bus services affected by congestion. A mass transit system can increase the attractiveness and quality of public transport. There are three main options for mass transit: metros, which has a high capacity, but is extremely high cost; bus ways; which have good carrying capacity, have flexibility and are cheap to install, but have poor image; Light Rapid Transit (LRT), thought by some to offer an intermediate solution with lower costs than a metro, but with a better image than a bus way.

Selection of the most appropriate mass transit mode can be difficult, and there are many pressures on civic leaders to favor a particular system. An examination of the technical advantages and disadvantages of mass transit options for developing cities is what is herein looked into.

Available options

The term mass transit as used here refers to any urban transport system carrying large volumes of people, usually along well-defined corridors connecting

suburbs to city-centers. The focus would be on mass transit systems that commonly use reserved right-of-way for some, or all of their rout length. This includes:

Metro: A metro is often referred to as an underground railway, but can be any grade-separated urban railway. The track and electric vehicles are similar to suburban railways, though with closer station spacing. Trains may have 6-8 cars, with a total capacity of up to 3,000 passengers.

Bus ways and bus lanes: Both include right-of-way for the exclusive use of buses, segregated by lines of physical means. A bus way transit system would include additional features like well designed bus stops, special operating methods (bus convoys or express operations), efficient fare collection methods, and clearly defined routes with names like “green line” or “circle line”. Bus ways have good carrying capacity, have flexibility and are cheap to install, but still suffer from poor image.

Light Rapid Transit (LRT): thought by to offer an intermediate solution, with lower costs than a metro, but a better image than a bus way. Some systems, including those of Manila and Istanbul, use exclusive tracts and high platforms similar to a metro. Other systems have at-grade crossing and low-level platforms. LRT trains may be made up of two or three cars, with a total carrying capacity of up to 750 passengers. Trams are a basic form of LRT that have limited rights of way, sharing road space with ordinary traffic for much (if not all) of their rout length. Trams are more likely to have lower capacity than LRT. The most usual categories for comparing mass transit options are cost, capacity and speed. However, there are also additional important considerations.

Costs

Out-turn cost data vary according to design standards, construction procedures, exchange rate variations, and so on. The overall capital costs for a complete system are estimated in the table below. The grade-separation, tunneling, use of heavy rolling stock and sophisticated control equipment, the higher the cost.

	Bus lane	Busway transit	Tram	LRT	Metro
a) Capital cost per route-km ($m)	< 0.5	2.0–10.0	5.0–15.0	10.0–30.0	40.0–90.0
b) Operating cost per passenger-km* (US cents)	3–8	8–12	3–12	12–15	15–23

* excludes depreciation and interest charges (extensive in the case of metro)
Note: includes rolling stock, except in case of bus lanes

Costs of mass transit schemes: in US$ millions (1993 prices).

Source: New World Transport (1995)

There is little doubt, then, that a metro is an order of magnitude more expensive than a bus way. A new scheme involving underground construction could easily exceed one billion US dollars. At such prices, city (and even national) economies could be affected.

Operating Costs

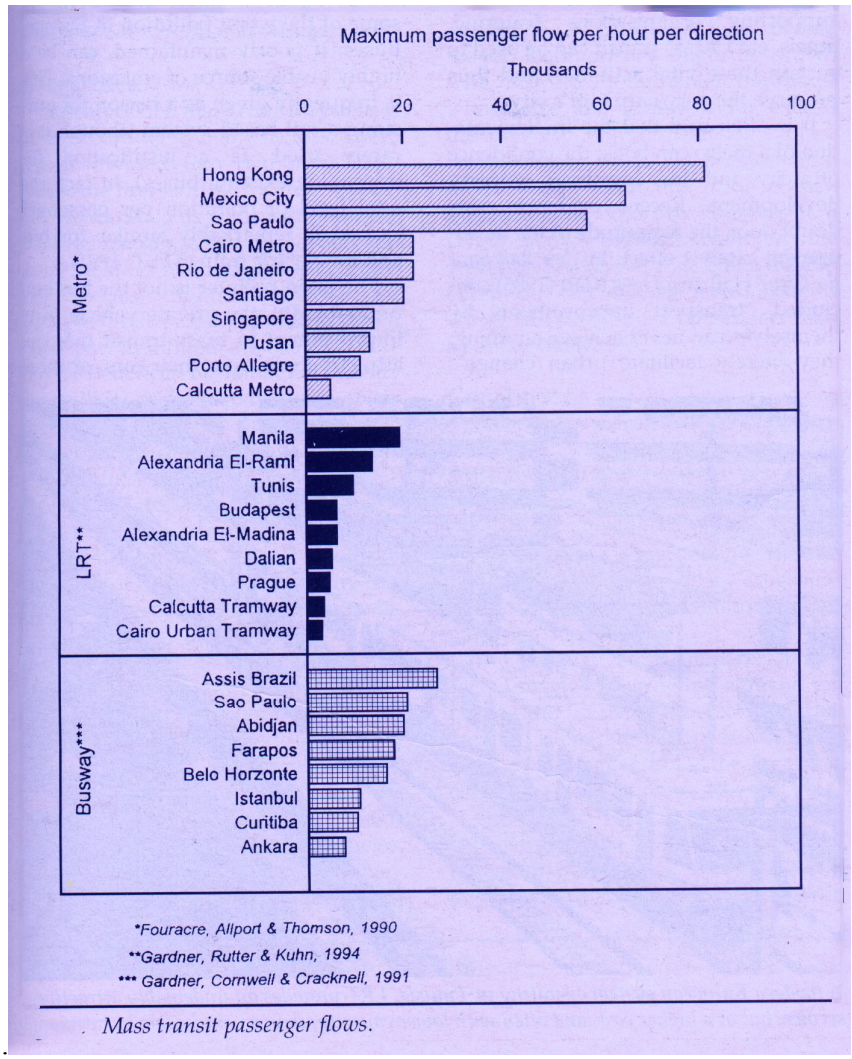
The key components of operating a transit system are labor, energy and replacement of materials. Estimates of operating costs per passenger-km are given below. These costs include depreciation and on equipment, but not on the initial infrastructure or any financial charges. Given that capital costs can equal operating costs over the lifetime of a rail project, it is clear that operating costs alone is not a good indicator of the price a city will pay.

Financial performance

Little is known of the financial performance of low-cost mass transit schemes. In the case of bus ways, the capital costs of the track are not included in bus company accounts. Some government authorities see the provision of bus priority measures as a means of providing subsidy to operators in a form, which does not reward inefficiency. Privately operated buses on bus ways can provide a service that requires no operating subsidy. In contrast, few, if any, public-sector bus or rail services are to rely on direct revenue alone – Armstrong-Wright, 1993. Very different results can be obtained from LRT and Metros according to the income of passengers, population density, and depending on the political decision of whether to maximize occupancy or minimize subsidy. Hong Kong, which is a very special case, has a fare box/operating cost ratio of 2.2, but two-thirds of the metros studied by Fouracre et al (1990) required an operating subsidy.

Capacities

The TRL research placed a high priority on fieldwork on-site at mass transit systems in order to judge the actual capacities, and the factors, which influence it. The results are shown on the table. It is clear that the two largest cities of the world (Mexico City an d Sao Paulo), and the highly densely populated Hong Kong, have conditions producing flows only a metro can carry. For many other cities, however, and for secondary corridors on the largest cities, alternatives are available.



Mass transit passenger flows.

Source: New World Transport (1995)

TRL research has questioned the generally accepted idea that LRT has a higher capacity than bus ways. In fact the opposite appears to be true. Even in Manila, where the LRT is operating under near-saturated capacity, and where there is full segregation from other traffic, passenger flows are less than on several bus ways. In order to attain high capacities, LRT needs short, regular headways. This requires a level of control and regularity that most developing cities find difficult, especially with on-street operations. In contrast, the bus way has unrivalled flexibility and appears perfectly suited to a range of conditions. Delays to a single bus affect only

one hundred people, and other buses can overtake, if necessary, to provide a continuous high-capacity service.

Speeds

An important consideration for an operator is the commercial speed. That is the average speed that can be achieved when allowance is made for passenger boarding, time at termini and for traffic control. This influences the service that can be provided for customers, but also determines the number of vehicles and drivers that will be needed.

	Bus in CBD mixed traffic	Busway transit	Tram	LRT	Metro
Commercial Speed km/h	10	18-26	12-16	19-29	29-36

Approximate estimated commercial speed for selected systems.

Source: New World Transport (1995)

The commercial speed is also related to the maximum speed of the vehicle, and to breaking and acceleration characteristics (Vuchic, 1981). It might thus be expected that electric trains would be significantly faster than buses. In practice, LRT field surveys revealed little difference and research using multiple regression analysis, to allow for factors such as station spacing, suggests that the inherent difference between bus ways and LRT is not statistically significant.

Comfort and convenience

There is little doubt that traveling in modern LRT on a newly constructed track is one of the most comfortable forms of land transport. Buses, in normal traffic,

are less comfortable, though segregation can improve both passenger comfort and vehicle wear and tear. However, many passenger surveys have shown that walking and waiting time is an important consideration. In this respect the bus scores more highly, as it can use ordinary suburban roads and thus provides almost a door-to-door service before joining the bus way.

Metros are often planned on the assumption that passengers will use feeder buses to reach stations. In practice passengers dislike interchange and prefer to use the same vehicle for the entire journey. Through-ticketing, as found in many Eastern European cities, provides a positive incentive to make an interchange, but is not always easy to implement.

Benefits for the city

In addition to the considerations for passengers, there can be benefits to a city for pursuing a policy that include some form of mass transit. The essence of a city center is that it is the most accessible point from both within and outside the city. This superior accessibility is important for many activities and, in particular, for those central functions that cover a wide area and/or need a wide labor market. This would include head offices, central government offices, legal and financial institutions, media centers, department stores, as well as their supporting organizations (catering, hotels, etc.). Mass transit can be used to sustain these vital activities, and thus preserve the very nature of a city.

It is often said that the implementation of a metro can boost the confidence of a city, and thus encourage property development. Recent evidence cast doubt upon the magnitude of the development catalyst effect. In *"Can Rail Save the City?"* Hall and Hass Klau (1985) concluded;

"Transport improvements by themselves can never achieve anything; they merely facilitate urban change".

Simpson (1989) reached a similar conclusion after studying metro and LRT systems in Europe and North America. He stated that;

"If there is interest in developing in the locality, urban railways usually attract development; if there is no interest, urban railways will not create any".

Energy and environment

Energy and environmental issues have, rightly, become of increasing importance in recent years. The level of environmental impact of a mass transit system will depend upon the mode chosen. Two main vehicle types are used for mass transit; buses that are usually powered with diesel engines; and rail vehicles, which, for urban services, are normally electric powered. Electric vehicles have a major advantage in that the energy used for their propulsion is generated remotely. There are therefore no local emissions – though this does not mean (as in sometimes implied) that they have zero pollution. In Czech Republic, electricity for transport is generated using brown coal, which is responsible for some of the worst pollution in Europe. Buses if poorly maintained, can be a highly visible source of emissions. This is frequently given as reason for pursuing a rail-based system (though it is used as a justification for improving existing buses). In fact, the total level of pollution per passenger carried is remarkably similar for bus and for electric train (TEST, 1991).

The main polluter is not the bus but, undoubtedly, the private vehicle. Any improvement in mass transit that can attract people from their cars, or more

realistically, slows the growth in car use, will result in environmental improvements (and increased road safety) whatever the mass transit type.

Intangibles

The choice of a mass transit system is made according to many factors. These can be divided into two main categories; the first of these include "practical" issues, such as transport planning and engineering, while the second category includes institutional and "political" issues. Political effects, for example "civic pride", appear to play a major part in influencing choice. Mostly they will be difficult to quantify objectively, especially in financial terms. Occasionally, they may be not just unquantifiable, but intangible.

A rational decision regarding investment would be based upon sensible, reliable information. There are many examples of different reasons why this has not been so (although unfortunately they are rarely documented). Almost every system has its own peculiar factors that have influenced implementation. Some of these have been shown, with the passage of time, to be fortuitous; others have resulted in financial and economic hardship. Civic pride appears to have a major influence on decision-making policies. Rail systems in particular obviously have a very special place in the hearts of the men in control of the world's cities. A new metro can be a powerful symbol of a city's status, disproportionate to its function as a people mover. Comparisons might be drawn with historic monumental buildings, whose size and grandeur far exceed the practical requirements of a place for meeting or work. The problem arises for a city when this pride is misplaced. As the report by Fouracre et al (1990) shows, several cities in the world have suffered financial hardship because of introducing metro systems which still carry fewer passengers than a similar bus way.



Full segregation, such as with metro or elevated LRT

can increase capacity but at high cost.

Conclusions

When the research evidence is examined, the "best buy" would therefore appear to be the bus way. No other option comes close to it in cost-effectiveness or flexibility. The impact of bus ways on the environment, though not perfect, is acceptable, especially when compared to the alternative of mass use of private cars. The fact that recent experience has shown a strong and growing demand for metros and LRT suggests that the influence of intangible factors is as strong as, if not stronger than, the technical evidence presented here.

The critical choice for a city is between public and private transport. A transport policy that recognizes the importance of any form of mass public transport will bring benefits to a city. An ideal decision making process would allow consideration of these benefits, while screening out projects likely to cause severe financial hardship.

3.6 ROAD TRANSPORTATION IN NIGERIA

3.6.1 ROLE OF ROAD TRANSPORTATION IN THE ECONOMY

The road has a lion share in the public economy sector and it is the commonest mode of transportation. It has been brought to the forefront as a result of;

i) The air travel is more expensive.

ii) The sea and rail are less expensive and comfortable but have much more difficulty in operation.

The road system is flexible and easily adaptable. It is indispensable to the growth of a nations economy. It should be noted that where there is no transportation economic activity is reduce to subsistence level. The demand for transport varies with output and input in the economy.

The provision of transportation services is an important determinant of the pace and locational pattern of development.

3.6.2. PROBLEMS OF ROAD TRANSPORT IN NIGERIA

i) There is a strong relationship between transportation, location, volume and economic growth and because high benefits and costs are obtained, a long comprehensive range transportation planning policy is especially required, which has been lacking in the case of Nigeria.

ii) Right from the onset, its priorities where not explicitly outlined by the government. Usually the goals of planning are often vague.

iii) Transport is derived; goods transport planning implies accurate assessment of economic activities translated into traffic volumes along some routes, compared with impact investment along other routes. This will require a systematic approach that captures the basic workings of the economy.

iv) Heavy investment is required in the transport sector. Reliable forecast over long periods are required.

3.6.3. ROAD DEVELOPMENT

Before the coming of the British, the traditional way of traveling from one place to another was by footpaths created by man and beasts of burden.

Then there was no justification for road building for much of the activities were at or within the community. The coming of the British changed the situation. There was need for the movement of military wares and other equipments into the hinterland especially for administrative convenience and for linking up many towns with roads. They were made to avoid barriers and extremely narrow.

Immediately these roads went into use they were choked with vehicles – the capacity was saturated, and maximally loaded.

The roads play an important role in transporting people and goods etc. An indication that the roads obviously play an important part in the development of the country. Most of the roads then were laterite and few coated with asphalt and bitumen. Ever since there had been growing importance by a fast rise rate in mileage.

Roads were constructed to run through the length and breadth of this country. And these were regional roads designated trunk 'A' or 'B' roads. This was worked out in 1962 and still forms the basis of road development with little modification to date. Initially the trunk road system was to have nine inter-regional roads of a certain minimum standard of maintenance and construction. They were to be maintained by the Federal Government. The trunk 'B' roads were to link up provincial centers. The

feeder roads were to link up towns, villages and hamlets. The trunk 'B' and feeder roads are the responsibility of regional and local governments respectively.

Historical perspective of road development

The first trunk road was constructed in 1905 from Ibadan to Oyo. By 1930, rail construction had virtually stopped; during the next decade attention was directed more to road development.

The period of 1950 to 1974 had seen a great deal of active highway development. Among the best are; 160 kilometer road from Enugu to Umuahia; the Kano-Zaria-Kaduna road, Warri-Benin-Auchi road constructed in 1971, the first class are Ore and Ijebu-Ode – Ibadan roads.

Double carriage expressways, the first to be completed is the 170 million naira, 109 kilometer Lagos-Ibadan Expressway. Another is the Lagos-Benin Republic, opened in 1978. In the southeast, Port Harcourt to Enugu road was completed in 1980. A new expressway spanning from Kano-Zaria-Kaduna at 156 million naira has been approved for construction.

Ring roads are built in major towns to help the traffic situation. In Lagos, it is built over bridges and flyovers spanning marshes and reclaimed land, overlooking slums and traffic jams below, constructed to provide in and out movements to the town. In kaduna, the western bye-pass (Murtala Mohammed Way) is a very good example. The construction of the proposed Eastern bye-pass and linking with the western bye-pass will complete the ring road.

National road network

In 1975, there was 96,000 kilometers of road, 24,000 kilometers had bitumen cover and rest was of laterite or earth road.

The Y-shaped pattern of Benue and Niger rivers divides the country into three parts and it imposes four very important and strategic bottlenecks on the road network in the country. They are Onitsha-Asaba Bridge; Lokoja-Abaji Bridge; the Jebba and Makurdi bridges. The opening of Murtala Mohammed Bridge in 1979 and the new one at Jebba has eased the problem of traffic at Markurdi and Jebba respectively.

It is observed that network is densest and synonymous to most thickly populated parts of the country and these areas have been the sit of industrial and commercial development. In the south it is heaviest along Lagos-Ibadan and Port-harcourt-Aba-Onitsha-Enugu lines, while in the north heavy traffic lines radiate from Kano-Zaria-Kaduna and Jos. The main peak traffic period is October-January because it is holiday period, the harvesting period and also the time of accessibility on dry season (earth) roads.

CHAPTER FOUR

KADUNA IN PERSPECTIVE

4.1 LOCATION

Kaduna is a city in the bush surrounded by the savannah of Northern Nigeria. It is in most places fertile, yet this had little if anything to do with the location of the capital. Kaduna's position was fixed by Lugard in 1912 as the most strategic place for his administrative and military headquarters for the new protectorate of Northern Nigeria, - an area larger than France. Four attributes determined the choice of location;

i) It had water from Kaduna River – an important tributary of the Niger.

ii) Kaduna was only slightly north of the center of gravity of the thirteen emirates that made up the then Protectorate of Northern Nigeria that had by 1914 become fused with Nigeria as a whole.

iii) Kaduna was by then served by the newly constructed (1911) railway stretching from Lagos to Kano and was planned to be the junction between this arm linking the North with the West, and the line pushing northwards from Port-Harcourt in the East. Although this line was started in the coast in 1914 it did not reach Kaduna until 1927 when the branch line from Kafanchan to Jos was also opened. Kadoka's strategic advantage as envisaged by Lugard was then realized.

iv) Finally as a field administrative and military center, Kaduna set in pagan Gwari country in the heart of Zaria province, was isolated from existing towns and would therefore be free from local political complications.

Thus endowed with virtually unlimited supply of water – a central position in the country with basic land communication and with untrammeled freedom for growth, Kaduna developed fast from an army encampment to a center of colonial government for Northern Nigeria, then to a self-supporting commercial and industrial and market town; and form this to a State Capital of increasing importance whose present population expands at 9% per year.

4.2 PEOPLE OF KADUNA

Kaduna lies within the traditionally powerful emirate of Zaria. Until the coming of the British the local population around and to the south of the town was widely scattered, sparse and self-sufficient with virtually no communication with the outside, - descendants of those who were there even before the Hausa came in the 13^{th}-14^{th} century.

Now over half the population of Northern Nigeria are of tall Savannah Hausa stock. Believed to have originated in the upper Nile Valley of the northeast Sudan, they settled and established the seven kingdoms of Hausa land. In the early 19^{th} century, the Fulanis, of Hamito-Semitic extraction under Dan Fodio of Sokoto, swept across the high plains and conquered all of what is now Northern Nigeria except Bornu. These invaders came from the West Sudan – from Tekrur now part of Mali. The seven Hausa kingdoms were taken over as Fulani Emirates as also were Nupe and Yoruba territories further south.

But all these had little effect on the people around Kaduna except for occasional slave raiding upon them and the slow settling of Hausa farmers in the area to the north of the town. The Kaduna River and the tsetsefly was a formidable barrier to Zaria's southward expansion and influence. But the founding of Kaduna altered all

this, for the new township, in order to supply its growing needs, attracted a growing agricultural population of indigenous Gwaris, and other pagan tribes from the Plateau to the east, as well as a deeper penetration of Hausa settlers from the north.

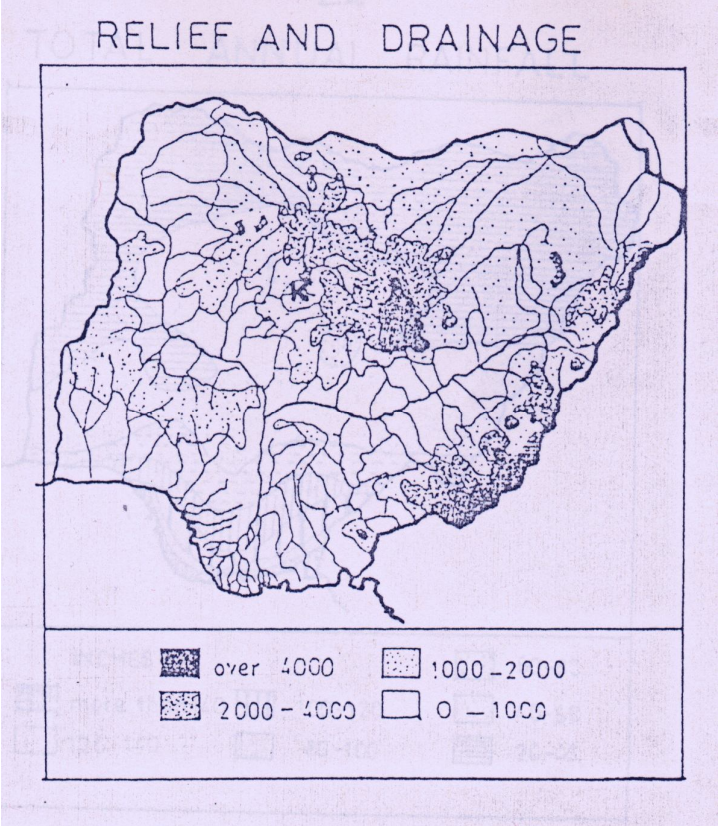
In the same that Nigeria is the crossroad of Africa, where numerous streams of language converge, so Kaduna has attracted a cross section of almost every tribal and linguistic group within Nigeria. In the city's population are found large numbers of many tribes from all regions. Numerically in order of importance they were Hausa, Ibo, Yoruba, Nupe, Fulani, Idoma, Tiv, and Kanuri. But Hausa is the chief spoken language of the city and its immediate sphere of influence. But in addition to this strong admixture of Nigerian peoples, Kaduna is a cosmopolitan city, as should be the capital of such a widely varied region.

For seven centuries the faith of Islam has been spreading and intensifying. Recently, the North, late in accepting missionaries, has opened the doors to Christian churches and schools, some of the more important being within the Capital Territory of Kaduna.

4.3 PHYSICAL CONDITIONS

4.3.1. TOPOGRAPHY

Kaduna's regional topography consists of a rolling park-like terrain with little relief situated about one hundred feet above and below the 2,000 feet contour line. Solid granite "inselbergs" rise sporadically and dramatically like great domes as much as a thousand feet above the general level of the plain, which to the east and southeastwards from Kaduna abruptly ends in the escarpment of Jos Plateau. Mature wooded streams flowing in broad, shallow valleys separated by inconspicuous watersheds cross the whole area.

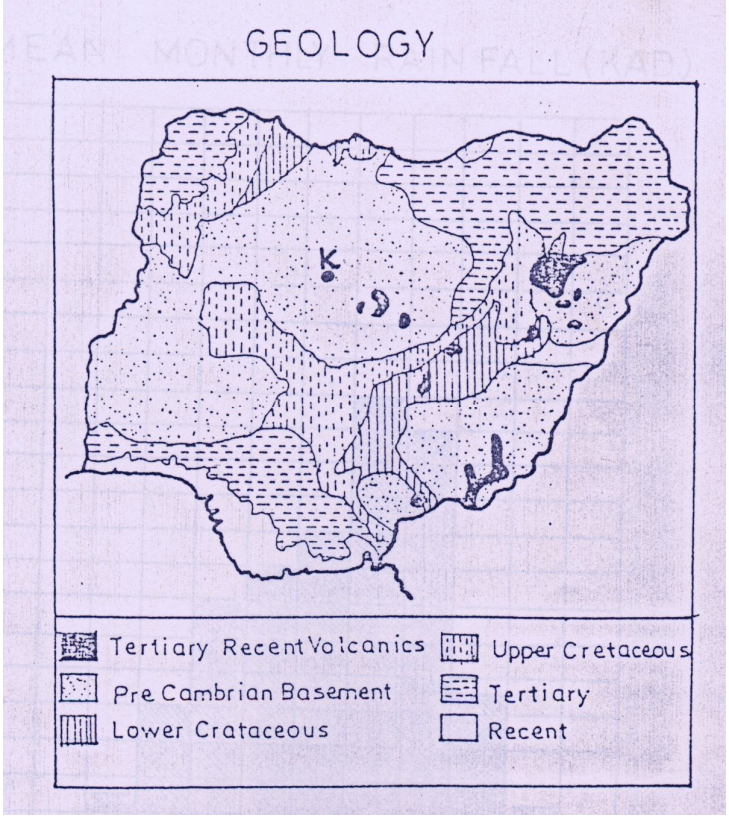


Source: Max Lock, Kaduna Master plan (1967)

4.3.2. GEOLOGY

The basic geological structure is magma tic of mixed streaky rocks, granite in parts with darker softer and much varied. Over most of the area the surface has decomposed to laterite. Erosion is mainly by small streams that cut deep gulleys leaving the residual laterite caps to be gradually eaten away at the edges by natural forces of rain, wind and vegetation. The water table in Kaduna is usually quite high and wells are sunk to a comparatively shallow bore depth of about fifty feet.

There is no evidence of any mineral wealth in the Kaduna region. However, there is laterite and granite on the hills and sand and gravel on the river bottoms in abundance for building.



Source: Max Lock, Kaduna Masterplan (1967)

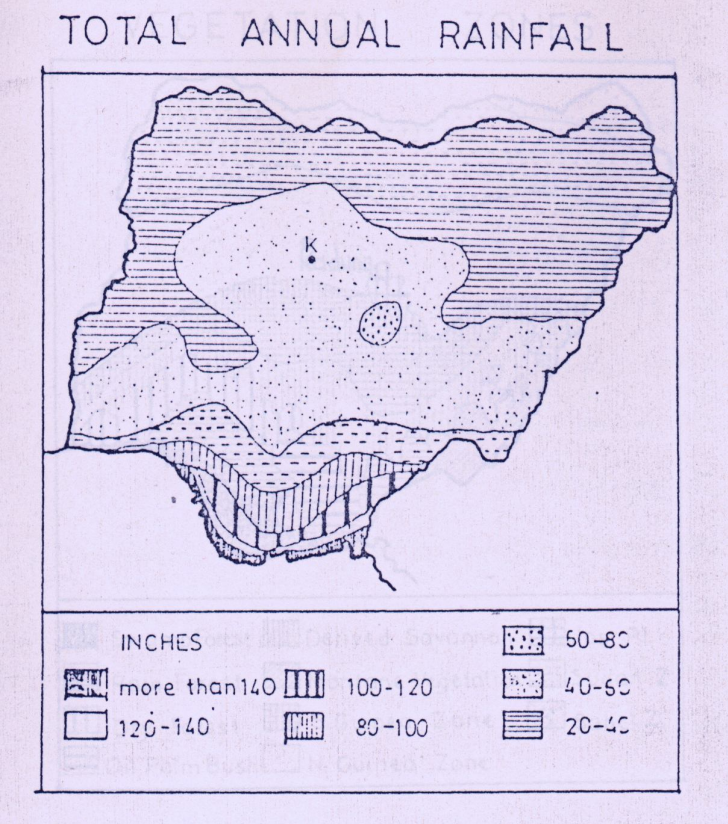
4.3.3. CLIMATE, RAINFALL AND WIND

During the dry season from November to March the dust laden Harmattan wind, dry, cold and often strong blows from the northeast straight off the Sahara regions. On the arrival of the first rains in April, the prevailing wind veers to the southwest and continues from May to October from the quarter.

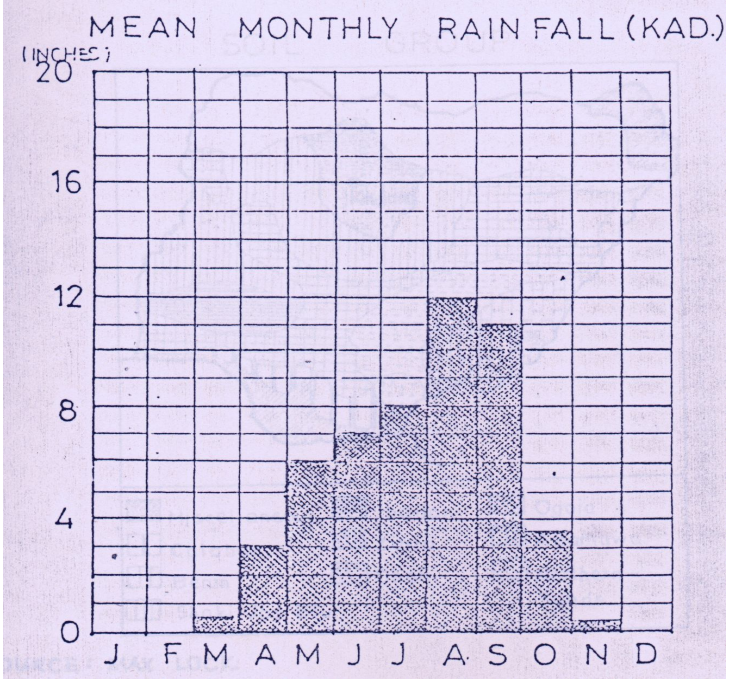
But paradoxically the rainstorms, usually violent with thunder and lightning, preceded by a driving wind, come from the north-east. And it is from this quarter that climatically speaking man needs the most protection through the year.

During the wet season Kaduna has some40-60 inches of rain, which rises to a peak from late July and into September. Considerable variation can take place from year to year both in monthly and annual totals. This mostly due to the high intensity

of many storms and the narrow front with which they sweep across the countryside. A storm causing local flash flooding in Kaduna South can leave the streets of Kawo only six or seven miles away in the north of the city dry and dusty. Generally these storms are interspersed with clear skies although in August and September there can be consecutive days that are dull and overcast. It is rare any rain to occur between November and February and for more than a total of one inch of fall from October to March. This invariable seasonal regimen of dry and wet exerts a major and permanent influence on agriculture as well as on man's habitation, the traditions of which would be perilous to ignore.



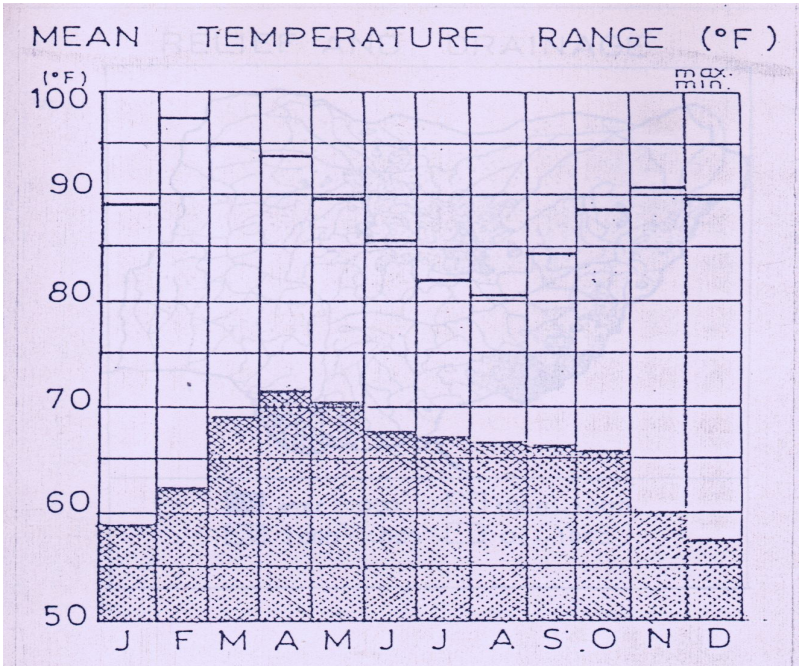
Source: Max Lock, Kaduna Masterplan (1967)



Source: Max Lock, Kaduna Masterplan (1967)

4.3.4. TEMPERATURE

The highest temperatures are in April and range between 95 and 105 degrees farenheit and the lowest are in January between 55 and 45 degrees farenheit. The mean range is greater than that found in the temperature climates and the extremes of hot and cold in a single day places a strain upon the inhabitants aggravated by considerable changes in humidity which in the dry season may well be below 10% in the afternoon and 30% at dawn. This causes lips and skin to crack and the fine dust blown by the Harmattan aggravates the nasal passages. Paper dries and curls and even seasoned wood warps and splits. Whereas in August, a relatively cooler month, because of the rains, the humidity at midday can be over 70% and at dawn 95%.



Source: Max Lock, Kaduna Masterplan (19670

4.3.5. VEGETATION

Across Northern Nigeria from east to west lie four distinct zones of vegetation;

i) At the north eastern extremity lies the Sahel semi-desert zone.

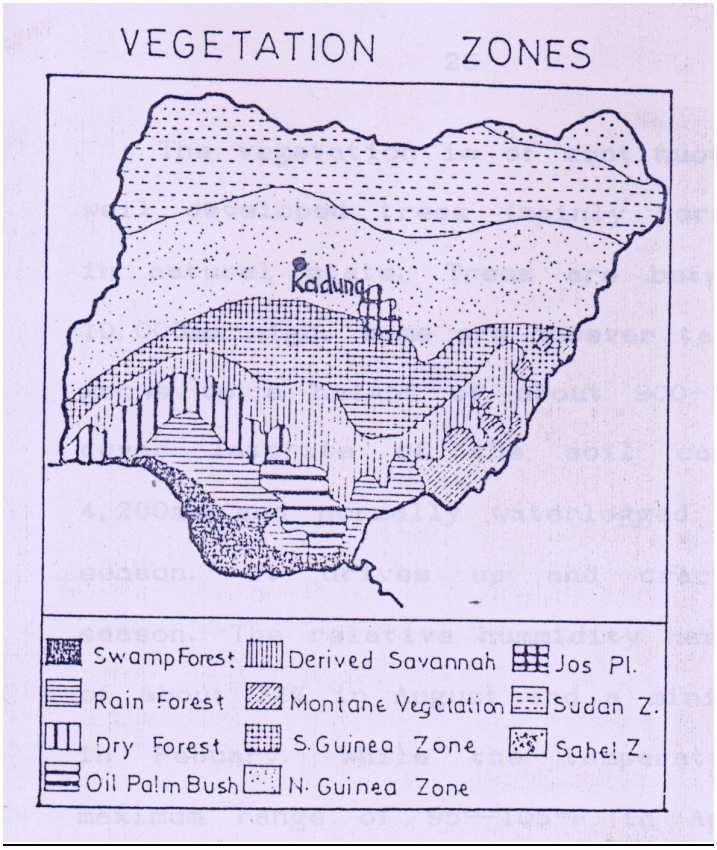
ii) The next zone the Sudan zone, stretches across the whole of the extreme north of Nigeria. This graduates southwards from a dry grassy land to a sparsely wooded area, which at the north of Zaria Province gives way to

iii) The slightly thicker wood and vegetation of the north Guinea zone, in which Kaduna is situated.

iv) Further south runs the band of South Guinea zone of densest vegetation.

Within the North Guinea zone, which takes in most of the Zaria Province, the vegetation, when unmodified by man, consists of "orchard bush", a continuous cover of well developed trees some 30-45 feet high which is often dense enough to suppress

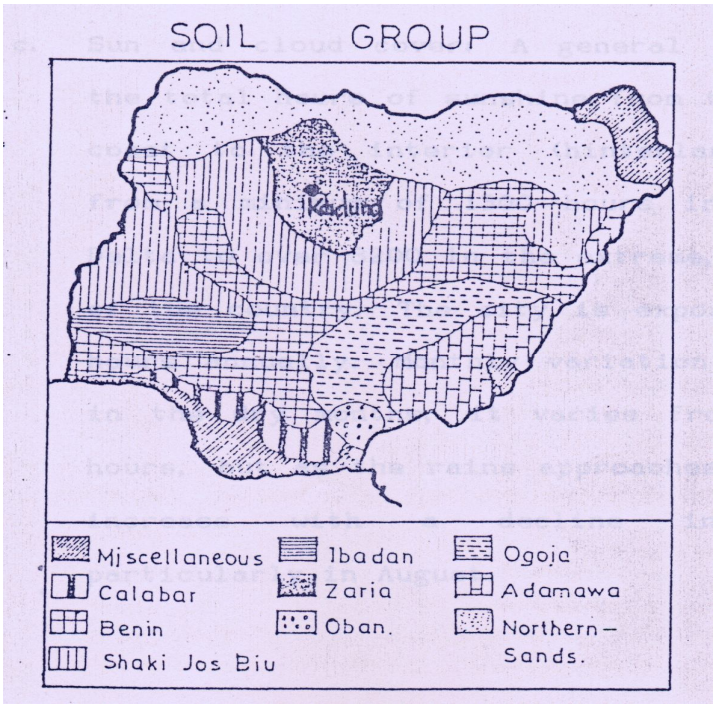
grass but as a result of much modification over the centuries by cultivation, burning and grazing has today become in most places open and park-like grass land. As would be expected around a large settlement like Kaduna the ever-diminishing forests and savannah woodlands outside of the forests reservations are denuded at a continually increasing rate for firewood. Trees tend eventually to disappear. In Kaduna one sees large quantities of faggots brought in daily from distances up to 15 or more mile away. But on the other hand this gradual clearance of the bush frees it from the menace of tsetse fly by depriving it of its breeding ground and this in turn, over a period of time, gradually in areas of agriculture, a type of farming, that with the help of manure and fertilizers can be stabilized and with the use of oxen and plough can become permanent and diversified, - but without care, can quickly turn into a desolation of leached soils and erosion.



Source: Max Lock, Kaduna Masterplan (1967)

4.3.6. SOIL

The soils over the Kaduna area are general over the northern plains and are of laterite formed from drift deposits which mantle the solid sedimentary and pre-Cambrian basement (granite) rocks. Kaduna lies within what is known as the "Zaria" soil group where the covering material my be up 14 feet in depth. Being of fine texture this soil is relatively difficult to work because it tends to become water logged with heavy rain and to dry out and crack during the dry season. This has favored the growth of cotton in Zaria Province, and cotton harnessed by the water resources of Kaduna has been responsible for the Capital's rapidly rising and flourishing textile industries.



Source: Max Lock, Kaduna Masterplan (1967)

4.4 SOCIO-ECONOMIC TRENDS

4.4.1 DEMOGRAPHY

Based on the 1963 census, the population of Kaduna stood at 149,910. The population projection for Kaduna from 1963 – 1984 is given below:

Year	Population	Natural & net Migration increase rate (%)	Amount	Adjusted population for the following Year
1963	149,910	4.9	7,345	157.255
1964	157,255	4.9	7,705	164,960
1965	164,960	4.9	083	173,043
1974	253,718	4.9	12,432	266,150
1975	266,150	7.0	18.630	284,780
1976	284,780	7.0	19.934	304,714
1977	304,714	7.0	21,330	326,044
1978	326,044	7.0	22,823	348,867
1983	457,292	7.0	32,010	489,302
1984	489,302	7.0	34,251	523,553

Source: Reviewed Kaduna Masterplan

The varying rates of growth used in the projections since 1963 have been based on changes in economic fortunes of the nation and their effects on the city of Kaduna. The oil boom and other activities created some more new opportunities socially, culturally, but especially economically. Those opportunities, mostly concentrated in the urban centers in the case Kaduna, attracted the influx of people into the city to avail themselves of the industrial, commercial and other opportunities created. The consequence was an upsurge in population. This was reflected in the number of industrial and commercial enterprises established between 1978 and 1980. The oil glut between 1979 and the early ‘80’s caused a slump in the economic activities. Also the rise of Abuja (some 1.5 hours drive from Kaduna) competes with Kaduna’s attraction and direct migration towards city.

Again the effecting of rural development policy, thereby developing places like Zaria, Kafanchan alongside Kaduna will in future reduce the growth rate steadily.

Population Projection: 1984 to 2015

Year	Growth rate for period indicated (%)	Population Size
1963	-	149,000
1984	-	589,000
84-95	6.0	858,000
96-2005	5.5	1,660,000
2006-2015	5.0	2,388,000

SOURCE: Reviewed Kaduna Masterplan

ESTIMATED POPULATION FOR DISTRICTS

	RESIDENTIAL AREA OF CITY	% OF CITY POPULATION OCCUPIED	1991	2000 (YR)	2015
1.	Kawo	15	173,745	222,832	338,839
2.	Barnawa	14	162,162	207,942	316,250
3.	Kakuri	11	127,413	163,409	248,482
4.	Tudun Wada	10	115,830	148,554	225,893
5.	Unguwan Shanu	7.6	88,030	112,901	171,679
6.	Doka	7.0	81,081	103,988	158,125
7.	Unguwan Rimi	5.2	60,231	77,248	117,464
8.	Kabala East	5.0	57,915	74,277	112,946
9.	Tudun Wada	4.8	55,598	71,306	108,428
10.	Malali	4.0	46,332	59,421	90,357
11.	Makera	3.4	39,382	50,508	76,804
12.	Nassarawa	2.7	31,274	40,110	60,991
13.	Mando	2.5	28,958	37,139	56,473
14.	Badarawa	2.5	28,958	37,139	56,473
15.	Unguwan Television	2.5	28,958	37,139	56,473
16.	Kabala West	1.8	20,849	26,740	40,661
17.	Riga-Chikun	1.0	11,583	14,855	22,589
	TOTAL	100.00	1,158,300	1,485,544	2,258,928

Source:- The 1991 National Census Figures and its projections

From projections the population of Kaduna at present stands at over 1.5 million. At a steady growth rate of about 3.5% it is expected that the population will

increase to 2.259 million by the year 2015 based on the 1991 census figures, which correlates (though with some divergence) with the projections from the master plan.

4.4.2 INDUSTRIAL

The inception of industrial history started with the inception of Kaduna textiles limited in 1957, covering 20 hectares and rapidly had grown (employing about 7,000 persons in 1965).

Trends in industrial development in Kaduna 1965 - 1980

Year	Number of Industries
1961-1965	7
1966-1970	8
1971 -1975	18
1976-1980	25
Total	56

Source: Max Lock, Kaduna Masterplan (1967)

The growth in industrial development in Kaduna from 1965 – 1980: The trend in industrial development (establishments) changes with time, a reflection of the different stages of industrial development. 1971 – 1980 witnessed the establishment of many industries attributable to the viable economic condition, especially revenue from oil section. Also between 1976 and 1980 about 25 industries were established as against 7 industries established between 1961 – 1965.

Trends in Industrial Development in Kaduna: 1963 - 2015
(Estimate)

Year	Total Population	Work Force (64% of Total Population	No. of Workers (60% of Work Force	% of Actual Indus- trial Work Force	No. of Actual Indus- trial Workers	Indus- trial Workers per ha.	Indus- trial Covera- ge ha.	Trends in indus- trial growth
1965	161,000	103,000	61,800	17	10,500	20	480.1	7
1980	350,000	224,000	134,400	24	32,400	32	1010	25
1985	479,000	806,000	183,900	22	40,500	40	1011.7	22
1995	858,000	549,100	329,500	18	59,300	50	1186.4	35
2005	1,466,000	938,200	562,900	20	112,600	80	1407.5	40
2015	2,388,000	1,528.300	917,000	20	183,400	120	1528.3	46

Source: Reviewed Kaduna Masterplan

Based on the projected industrial activities, the estimate of industrial workers by 2015 is 183,400. The reduction in the projected percentage of industrial workers can be explained by two factors:

i. Poor economic situation.

ii. Possibility of seeking employment outside Kaduna.

4.4.3 COMMERCIAL

1965 – The actual population engaged in commercial activities cannot easily be quantified. Employment survey revealed that a total of 42,500 people were 'gainfully' employed. Commercial activities are basically of three types:

iii. Formal represented by the shops.

iv. Traditional, that centers on markets.

v. Informal type, engaging hawkers and other commercial activities in mixed land use.

1983 – The total figure for commercial employees stood at 43,989 workers, 33% constituted establishments engaging five or more persons. And those employing less than five persons are estimated at 48,000 persons. Hawkers constituted 12% of the commercial work force.

1985 – 2015: Using the method whereby the number of establishments employing five or more workers and for those employing less than five workers. The trend of commercial employees therefore, in Kaduna from 1985 – 2015 (projection) is given in table below:

Trends of Commercial establishment employing five or more: 1980 - 2015.

	1970				1975		1995		2005		2015	
Range of Employees	No. of Shops	No. of Workers	% of Total Workers	Average	No. of Shops	Workers	No. of Shops	Workers	No. of Shops	Workers	No. of Shops	Workers
5- 25	394	4,866	84.5	15	444	6,660	541	8,115	646	9,690	745	11,175
26-50	28	1,106	6.0	40	32	1,280	38	1,520	46	1,840	53	1,120
51-100	21	1,565	4.5	70	24	1,680	39	2050	34	2,380	40	2,800
100 +	24	6,840	5.0	312	25	7,800	32	9,984	39	12,168	44	13,728
Total	467	14,377	100	-	525	17,420	640	21,549	765	26,078	882	29,823

Source: Reviewed Kaduna Masterplan

4.5 MOTOR TRAFFIC TRENDS IN KADUNA

4.5.1. MOTOR TRAFFIC IN KADUNA

Kaduna experiences a predominantly north-south movement. The 'synthesis' for the whole city is summarized into a table below, which gives totals of the traffic demand for 1965. From that, it is clear that on-work journeys are frequent and

commercial traffic covers the furthest distances, thus the need for an efficient road traffic network to cater for the anticipated increase in demand.

Total traffic demand: 1965

Journey Purpose	Total trips p.c.u./day	Percentage	Average distance	Traffic demand p.c.u./m/day	%age
work journey	22,000	30	1,3	29,500	13,2
on-work journey	36,000	50	2,8	104,000	48,2
commercial traffic	15,000	20	5,5	84,000	38,6

Source: Max Lock Masterplan (1965)

4.5.2. VEHICLE OWNERSHIP

The vehicle growth rate are as shown in the table below. However, it fell back to about 7% after deducting the effect of the civil war and depression, though with the recent mass importation of used cars in the '90's the rate of car ownership has been rising steadily.

Predicited Vehicle Ownership Rate:

Type of vehicle	Ownership Rate (Vehicle/head) 1965	1970	1985
Bicycles	0.100	0.170	1.250
Private Cars	0.016	0.023	0.063
All cars + Taxis	0.023	0.032	0.089
Motor cycles	0.008	0.012	0.031
Commercial vehicles	0.005	0.007	0.019
All Motor Vehilcles	0.36	0.050	0.139

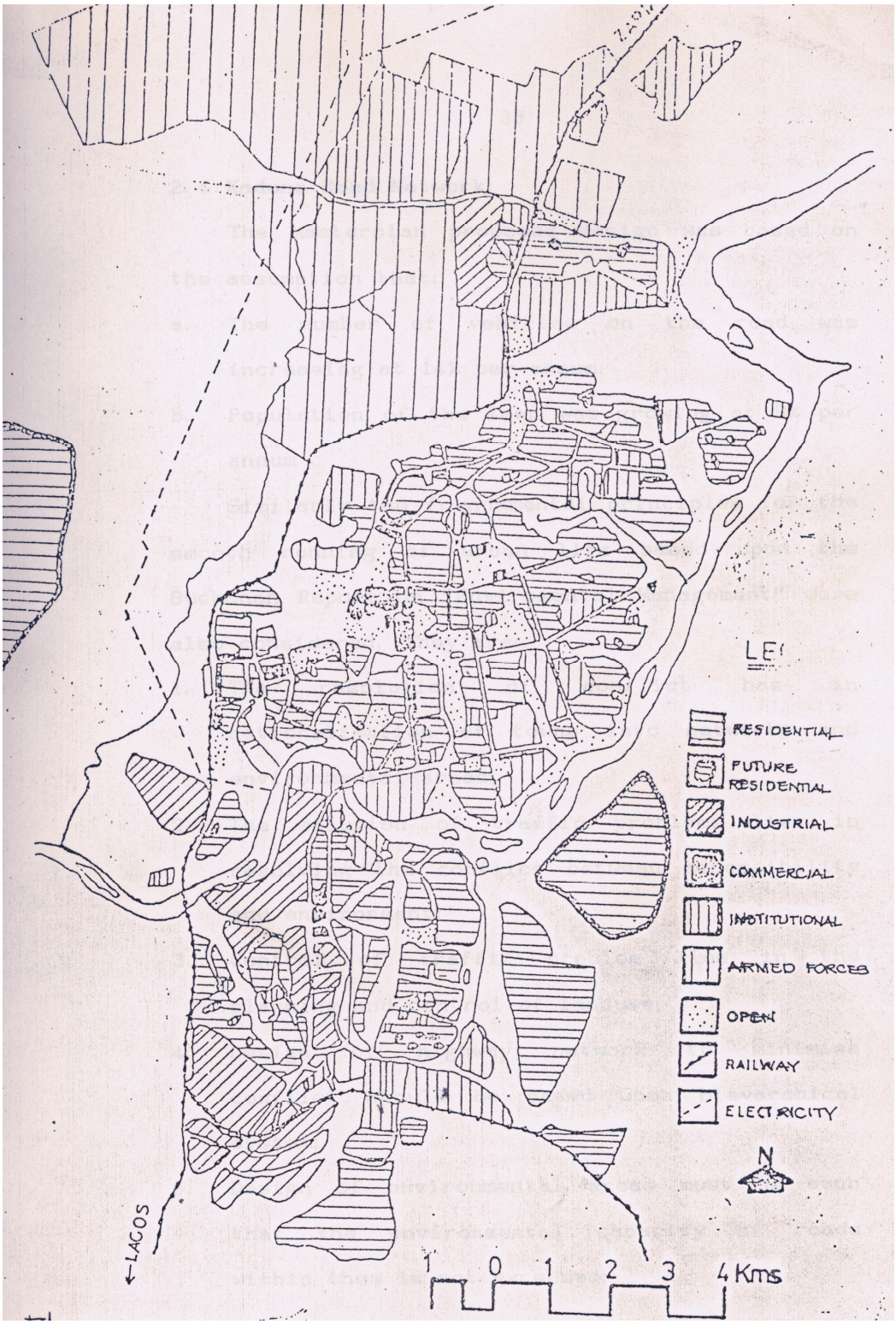
Source: Max Lock Masterplan (1965)

4.5.3. CHARACTERISTICS OF LAND USE IN KADUNA

Land use of Kaduna (1983):

The total area of Kaduna capital territory as provided for in the master plan has now been virtually used up. In addition to this, large parcels of land, which are outside the territory, have also been developed. Out of the 8,400 hectares, 59% was developed in 1966. Presently, the total area developed is 8,914 hectares. The industrial land use over the years had triple what was proposed for it (291%), followed by commercial land use (143%) and 60.5% for military. Therefore the master plan for 2017 land use projection can be seen not to be holding as already some land uses had so far exceeded their allocation of that year, (the industrial land use taking the lead).

The opening of large areas of undeveloped land in the western part of Kaduna by the new bye-pass gave rise to intensive residential, commercial and industrial developments, which had not been envisaged in the master plan. The residential areas stand at 3563 hectares, which is 73% of 2017 proposal. The open space remains the same with that of 1966. In 1965 the used area was 275 hectares, about 15.2% of the land was allocated for open spaces up to 2017. However, it has been observed that a mixed land use completely ignored had emerged as a land use of its own. This is the residential and commercial land use covering an area of about 90 hectares. Thus, the need to accommodate this land use in future. The table below gives a breakdown of land use distribution with the existing developments so far, as against the 2017 projections.



KADUNA MASTER PLAN; PROPOSAL FOR LANDUSE ('67-2017).

Source: Max Lock, Kaduna Masterplan

Landuse: 1983

Type of landuse	Area in Hectares		Existing development
	1983	2017	as % of masterplan
Armed Services	2027	3359	60
Govt. & industrial	1693	4159	41
Residential	5563	4892	73
Industrial	1010	346	291
Commercial	256	176	143
Open space	275	1800	15
Mixed landuse	90	-	-
Totals.	8914	14,735	60.49

Source: Reviewed Masterplan (1983).

Characteristics of land use in Kaduna:

The master plan projection for the various land use allocations have so far been exceeded. In addition large parcels of land outside the territory have also been developed. Thus, ***the master plan projection holds no more***.

A critical observation of the existing characteristics of Kaduna land use pattern reveals that:

a. The residential areas envelop the commercial areas.
b. The commercial areas are spread through out the urban space with the highest concentration in the central business district (i.e. center of gravity).

c. South of the city is predominantly an industrial area, while the outskirts houses most industrial developments.
d. Various land uses are spatially distributed throughout the urban spread.

Hence, it can be concluded that the spatial distribution of existing land use pattern does indicate that a physical barrier (distance) has been established between work places and the residential zone, thus the need for urban travels becomes indispensable. The theory of Robert Mitchell and Chester Rapkin in 1953 states that;

"Different land uses generate different and variable traffic flow".

4.5.4. TRAVEL DEMAND PATTERN

Generally, movement is a function of human activity and is usually directed towards concentrated areas of human activities. The data have been examined under the following headings;

i. Trip generation
ii. Trip distribution
iii. Modal split
iv. Traffic assignment

i) Trip generation:

Usually the first stage in travel demand analysis. The two kinds of data associated to this stage are;

a) Trip production referring to trips generated by residential zones.

b) Trip attraction referring to trips generated by activities other than residential areas such as employment or retail centers.

From observation therefore, it was established that trip attractions are normally concentrated centrally while trip production envelope them. However, details on this are beyond the scope of this work.

ii) Trip distribution:

It is concerned with establishing links between numbers of zones for which attracting production calculations are made. It forms the basic data used for the construction of desire lines.

iii) Modal split:

Simply refers to trips made by different modes of travel and the determination of the choice of travel mode. It is a technical term applied to methods of estimating the number of travelers using different available modes of public and private transportation, e.g. taxi, buses, private cars etc. However, it is worthy of note that a significant number of people under the present situation of the country use mostly intra-city buses in getting around. Hence, the need for efficient, cheap, affordable and accessible mass transit system.

iv) Trip assignment;

It is usually the latest stage in travel demand analysis. It is a process, which allocates a given set of trip interchange to a specific transport network or system. It can be used to estimate the volume of trips on various links of the system for any

future situation or to simulate present conditions. The process requires an input of a complete data on existing transportation system and a matrix of inter-zonal trips. They are then fed into the computer, which attempts to choose the minimum path between zones, assign the estimated trips on each section of the route. This is however beyond the scope of this work.

The central spine axis (Ahmadu Bello Way) is the major congestion axis where many trips begin and are observed to pass through; hence, its chaotic and complicated state.

4.5.5. INTRA-CITY VEHICLE OPERATION IN KADUNA METROPOLIS

There are two major types of intra-city vehicles, namely;

i) Minibuses

ii) Taxis

The taxis are more flexible in operation and takes advantage of routes less plied by mini-buses. The have less capacity than the mini-buses and could be more expensive especially on routes not plied by the mini-buses.

Mini-buses as the current dominant means of mass transit system have contributed significantly to the movement of people and goods within the urban area. Specifically, they account for over 60% of the public transport carriage system currently.

Most trips are observed to start in the central business district (C.B.D.) and this strong concentration of trips in the C.B.D. has implications for the ease of movement of traffic in the area, particularly during peak hours. Trip destination is similar to that of origin. It is clear therefore, that is a strong focus of vehicular traffic in and around the C.B.D. in terms of trip origin and destination.

a) Mini-bus Routes:

The identified pattern of routing is observed to originate from residential zones through the commercial districts to work places and to residential zones. This is the most dominant routing system. Mini-bus routes in Kaduna metropolis are as follows;

1. Kakuri	-	Central Market*		
2. Sabo Tesha/Television	-	Central Market		
3. Television Village	-	Central Market*		
4. Tudun Wada	-	Central Market		
5. Kabala West	-	Central Market		
6. U/Rimi	-	Central Market		
7. U/Rimi	-	Central Market	-	T/Wada*
8. Central Market	-	T/wada	-	Rigasa
9. Central Market	-	Nasarawa		
10. T/Wada	-	Kawo		
11. Kawo	-	Central Market*		
12. Kawo	-	Mando		
13. Barnawa	-	Central Market*		

* *These are the more dominant routes*.

b) Location of stops:

They operate on stop and pick basis. Anywhere along these routes is used for the purpose of picking and dropping passengers. There are no agreed or spelt-out

locations of stops en-route, though some bus stops are observed along the central axis with shelter at some points. Generally, en-route stops are very frequent; hence average travel time is high. Many drivers express their preference for the provision of fixed stops along routes.

c) Peak periods:

Three peak periods are identified as follows;

i) The morning peak, between 7:00am and 9:00am

ii) The afternoon peak, between 12:00 noon and 2:30pm

iii) The evening peak, between 4:30pm and 7:00pm

These periods all coincide with the time for market trips and work trips. Hence, the peak periods are a reflection of occupational travel trip pattern as earlier discussed under land use pattern.

d) Fare structure:

A fixed fare structure is being operated. At few instances, bargain fare structure is put into use. Most drivers prefer the fixed type. The transport fare charged by operators is N20 per drop; N10 is normally accepted for half trips.

CHAPTER FIVE

CASE STUDIES

5.1 KAWO MOTOR PARK, KADUNA.

Location and size:

Found in the northern suburb of Kaduna, at the heart of the commercial area of Kawo along the central spine. It is accessible by an adjacent road to the central spine at northern-most node point in the city. The park covers an approximate area of 225m by 150m. The area is highly restricted in expansion for it is bounded on all sides by structures; the army barracks land and street roads on two other sides. This infringes its flexibility in growth and size.

Layout:

A marked layout of shops, warehouses, offices and stores bounding an open parking area. Although the most modern of all the motor parks, the layout concept follows that of the old ones. Built of permanent materials – bricks and galvanized iron roofing sheets are the most dominant. There is no defined separation of the parking spaces.

Traffic capacity:

Presently handles about 5200 passengers daily, though there is fluctuation as drivers choose the easiest way of getting passengers. It handles passengers on the following routes: Jos, Kano, Zaria, Funtua, Maiduguri, Gombe, etc. it serves as destination point for those coming into Kaduna from Lagos.

Traffic situation:

Due to the street road access, traffic circulation problem has been drastically minimized. Though some conflict does arise at the point of entry and exits, thereby, sometimes this infringes on the outside traffic resulting in jam and occasional congestion along the route. This case is peculiar to weekends and festive periods. The internal circulation is characterized by traffic jam, chaos and confusion. What is obtained here is uncoordinated parking.

Concessional areas:

Permanent shops – stationary stores, medicine stores, warehouses, union offices, local government offices etc, line the entire park fence wall. The local authority encourages this development to increase revenue generation.

Conclusion:

This is the most modern with facilities like warehouses for storage of lost properties and other luggage in transit. Offices like the union's office, local authority office is provided. Its sanitary conditions are in a very bad state and the facilities are beginning to dilapidate.

KAWO MOTOR PARK, SITE LAYOUT.



Administrative block for the National Union of Road Transport Workers, Kawo Motor Park.



Exit gate of Kawo Motor Park.



A second Mosque under construction within the motor park.



Traffic congestion within the park mainly due to lack of traffic segregation and passenger facilities.

5.2 KADUNA STATE TRANSPORT AUTHORITY BUS TERMINUS

Location:

It is adjacent the central spine axis (Ahmadu Bello way) a little off the city's central business hub. It is directly opposite the Katsina Road roundabout. Its centrality within the city is advantageous for its intra-city services.

Traffic situation:

Has one access for entry and exit, which is not directly to the central spine. The siting of a bus stop by it makes pedestrian access to site less complex. Vehicular traffic within is controlled, as the services are usually peak period oriented. They leave for their various routes in the early morning and the arrival of others around evening time. They are controlled out one after the other. Passenger traffic at the ticket purchasing area might look overcrowded and congested but usually during weekends and festive periods or some special occasions. Routes plied are: Okene, Katsina, Funtua and Lokoja.

Passenger facilities:

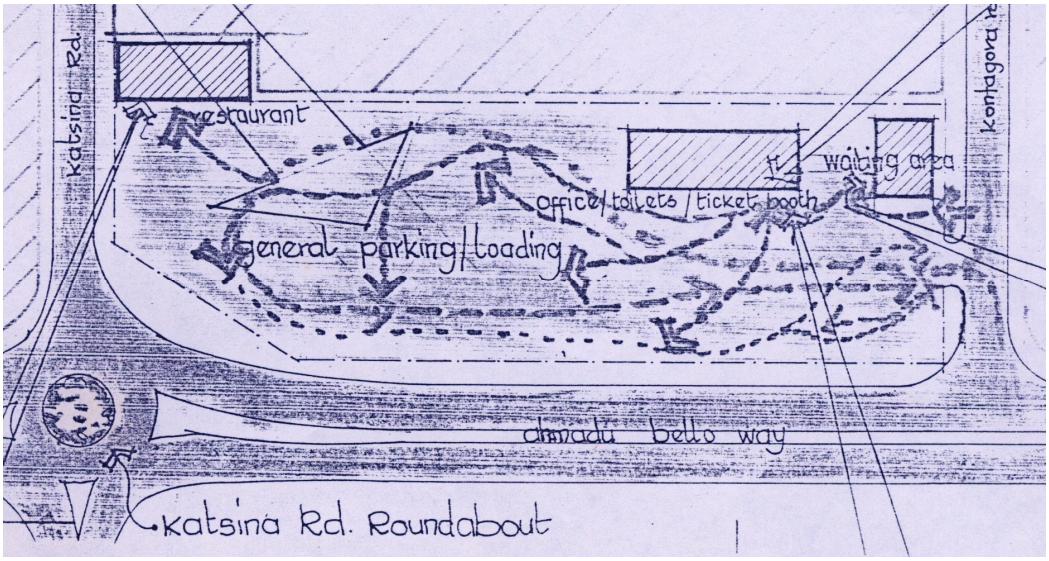
The facilities include; restaurant, waiting area, ticket-purchasing room with queuing conveniences demarcated with rails, toilets and an enquiry office.

Traffic capacity:

Handles about 320 passengers both of 'origins and destinations', both with luxury and mini buses.

Conclusions:

Basic comfort and convenience facilities are provided with permanent structures. Security provisions are to some extent satisfactory. The terminal has than capability of running mass transit operations except for the inadequate maneuvering space for the big vehicles. Also its location in the central area does not allow for the expansion of the site.



KADUNA STATE TRANSPORT AUTHORITY BUS TERMINUS, SITE LAYOUT.



K.S.T.A. terminal showing layout and the bus entry point.



Bus loading in the terminal, orderly but without cover from weather elements.



K.S.T.A. terminal building .



A view of the passenger waiting area within the terminal.

5.3 NEW YORK'S NEW UNION BUS TERMINAL.

Location:

The mighty terminal around the corner from times squares within the heart of Manhattan linked by the elevated ramp approaches to the Lincoln tunnel; through which 81 percent of bus traffic to midtown Manhattan passes. Within walking distance of many New York city's department stores and theatres and many of its principal office buildings. Bounded on the North avenue (lower concourse level) and Eight avenue (main concourse level) and 40th and 41st street (on the two other sides).

Size:

The block, of steel and brick structure occupies a site of 243.4m long and 60.9m wide and it is the largest terminal in the world at the time.

Traffic capacity:

At peak capacity, it is anticipated that there will be 750 bus arrivals and an equal number departing per hour. Every five seconds a huge intercity bus arrives at the terminal. It provides for 60,000 travelers daily, to the city's vast underground communication system and to surface transport system. The terminal has roof-parking area for 450 privately owned automobiles.

Traffic elements:

a) Have four different levels with interior bus roadways.
b) Loading and unloading platforms on two levels.
c) Long distance buses, 15 percent of terminal load – entry and exit on North avenue street level.

d) Suburban buses, 85 percent of the load, shuttles back and forth between the tunnel portals and the third floor level of terminal by means of ramps.

Analysis:

Maximum practical upward incline of the bus ramp from mouth of Lincoln tunnel to the terminal, establishes the floor elevation of suburban bus level at North avenue end of the building. At the entry and exit point of buses on the long distance level, which slopes downward, bus headroom is provided under the main waiting room. There is a swing under subway mezzanine from the entry side to exit side level.

Structural elements:

The terminal comprises of steel structure of straightforward column girder and beam type with allowances for sloping levels and some eccentric column spacing due principally to bus circulation lanes. There are three expansion joints in the 240-meter length of the building.

Services:

Heating: The road surfaces of the elevated ramps are treated with heating materials to prevent formation of ice.

Ventilation: This in the lower levels is done through bus access or exit point and expelled air from the roof is evacuated through vents located under subway mezzanine.

In the upper floor – continuous unglazed openings on both sides of buildings aids ventilation. There are six exhaust units in the roof long axis of the building concourses with 'pressurized' fresh to terminal fumes.

Equipments: Electronic indicators control and guide incoming long-distance buses to docks in use.

Finishes:

a) Internal:

i) Waiting rooms, concourses has marble warm coat 1.35m high, with enamel steel panels above to ceilings.

ii) Wearing surfaces, handrails, trim and concourse column are of trush aluminium.

iii) Floors are of terrazzo with non-slip aggregate on slopping surface floors.

iv) Suspended acoustical metal pan units with lighting features set to flush with ceiling.

v) Stairs are of terrazzo treads with abrasive strips.

b) External:

i) The exterior is of bricks with a 1.5-meter granite warm coat and limestone trum.

Passenger facilities:

Pedestrian paths are usually marked out and particularly so in areas of heaviest pedestrian traffic. They are easily accessible not causing inconvenience but at a standpoint of extra service and time saving. These facilities make the terminal very functional and a source of generating revenue (development of concessional areas). All these leads to the set up of shop fronts, restaurants, magazine and shoe shine stands.

Bus facilities:

a) The terminal provides for 104 loading positions for commuter buses; 72 on suburban bus level, 32 on new upper bus level.
b) There are 65 loading positions for long distance buses – 40 on the lower bus level and 25 on the new upper bus level.

5.4 MINORIES MOTORPARK

Brief:

The Minories Park is one of a ring of peripheral car parks planned by the corporation of London. The car park has 606 car spaces, 45 lorry spaces and 12 motorcycle spaces. It was intended to include offices in the development but was prevented by the control of offices and industrial development act of 1965. The city university became interested in the site, so super imposed halls of residence were a feature of the design from inception and structural consideration was given and provisions in the form of staircases and lifts were incorporated in the design.

The site:

The site is on 2.3 acres (0.92 hectares) and falls within the junction of Minories and Royal Mint Street. To the north, is the Fen church street railway viaduct. An axis of Tower Bridge runs through the site. The side neighbors are Royal Mint, the Tower of London and the new part of London Authority offices in St Katherine Dock House. It had been use as a car and lorry park for some years and it was known that structures existed there.

Planning aims:

The elements were combined – the car park, the lorry park, and the various provisions (structures, lifts and staircases). The first two have a common grid at 34ft by 25ft (10.37 x 7.62m). There are four floors for parking stalls (cars) and an additional height was necessary for lorry parking. The parapet height was controlled, so basement was necessary. Locating lorries in the basement would have eliminated the need for heavily loaded suspended floor slabs, but the necessary access route would have occupied too much space at ground level. Therefore, it was introduced on the ground for access convenience.

Internal ramps with split-level would have been more economical or continuous spiral parking. They were not possible because there had to be a horizontal lorry parks and a flat roof on which to build the communal areas for the halls of residence, the lorry access aisle precluded the central support. The load bearing wall units offered advantage of projecting free internal walls, integration of finishes and structure and a scale appropriate to the neighborhood Port of London Authority Building and Tower strongly influence the character of finish – concrete incorporating

flint aggregate covered slabs were used to save dead weights and appearance over solid slabs for the parking floors. The present eastern entry and western exit has complicated planning, with implementation of GLC road proposal, and a subsequent reversal of the entry pattern.

To minimize the control problem created by the insertion of lorry and coach parking on the ground floor, services provision was included during the contract for the control of kiosks at first floor level. Instead, the present ad-hoc and temporary control arrangements were introduced, reflecting the general uncertainty as to the effects of future traffic patterns in the area. The car park is larger in plan, though restricted in accommodation by a few floors on the account of the proposed halls of residences. In London, it is one of the few that much needed accommodation for lorries which is confined to the ground floor is fully utilized; other floors are poorly patronized by cars. Its proximity to docks provides customers for Lorry Park and that justifies its existence.

Reservoir space, Circulation and Control:

A reasonable lead-in for vehicles is provided. Though long vehicles cause problems, thereby causing traffic build-up and interruption on the adjacent roads. The ramps are external serving the parking docks; the ramps do not serve as far as the ends of the building thus preventing continuous circulation when looking for vacant stalls. Except where interrupted by columns to take future structure the outside spaces are easy. The central spaces are easy although the longitudinal spacing of columns does provide for a minimum of three stalls. Untidy parking can reduce the spaces available.

One pedestrian lift provided to the advantageous use of those who find stairs difficult. It is reasonable for a three-story car park. The generosity with stairs keeps

exit within walking distances but makes security porous and one-stair discharges onto the basement ramp, which is highly dangerous. Based on the present road pattern (circulation), the park is presently operated in reverse with consequent problems of control and over manning. So it is difficult to comment on the final control system. A better ticketing is proposed with more effective way of diverting traffic, if Lorry Park is engaged.

Installations:

There are no bumper rails to prevent damage to cars, although the precast units can withstand a car force traveling at 10 mph (16km/h) equal to a static load of 15 tons. Heating is not provided for ramps and provision for salting was made. Insert railings protect the opening via the landings. They are inadequately spaced and the lack of bumper rail leaves doubt to the safety of children. Lighting is provided in two rows of trunking incorporating fluorescent fittings. The lighting presently caters for normal standards. It should be noted that unattended parking decks are vulnerable to theft. It should be reconsidered by design and that will bring about higher electricity bill. A sprinkler system is incorporated to meet fire regulations.

Signs:

The circulation is reversed, thereby confusing or not relating to the building. The present entrance (future exit) signs are fixed too high leading to users having to lean forward look upwards. The stalls are marked out in brief variable yellow lines.

Building form:

Lying in a dreary area except for Tower of London to the south. The ultimate massing of the building should be an attractive addition to the city. It will be more appropriate to assess the varied concrete finishes used externally. The waffle floor used reduces the overall floor depth but provides no recess for services and other installations. Therefore effective headroom is dictated by the services.

Review:

A multi-storey car park is a highly specialized building and should be looked upon virtually as a machine. Some design decisions are taken, knowing them to be wrong but looking at the overall picture of reputable car park. Many mistakes arise from ignorance of a specialist project. Careful thought are given to key points in appraising the building.

Location and site:

Survey for its demand was not carried out. This works out where no-sheet parking is prohibited, though in some cases, competition from parks is considered. Public planning generated most of the parks, only for few such as Minories Park are on very difficult sites. With the coming of this type of building based on commercial viability or theoretical planning based on desirability. Local authority policies must be enforced in strategic basis to ban on-sheet parking if desired.

Layout and security:

The Minories Car Park had numerous advantages, being sited on a well-proportioned plot but the layout could have been better. Poor layout seems to be

acceptable as a result does not come home to roost owing to lack of feedback and the unsophisticated method of operational set-up. Security problem is eminent in most parks because of fire fighting and escape. They are difficult problems to solve and should be looked into meticulously. It is observed that theft cases have been rampant in car parks more than from a bus. The control points must be made effective and motorists should be more enlightened of the dangers of carelessness. Also the minimum lighting level should be improved to serve as effective security lighting and also help to reduce the depressing interior appearance of many parks.

Equipment and execution:

Drainage connection should be sited away from where people walk as in Minories Car Park. Penetration from the open side part should not be under-estimated, also, run-off from cars including melting snow. There had been problem of satisfactory floor leveling and finish leading to collection of stagnant water. It is advisable to provide bumper rails for protection to cars but not the spring-loaded units, as the cost may not be justifiable. The provision of notices, signs and marking for entrances, check points, etc. should be given more time and thought as an integral part of the building in the early design stage.

Summary:

The rate of provision of multi-storey car parks is increasing and with it the importance of their effect on the town scene. The Minories Car Park is a development in its own right and will form, in the fully developed complex a high podium for the future.

5.5 TELEVISION VILLAGE MOTOR PARK, KADUNA.

Location:

The park is located in the southern part of Kaduna. The site is within the core of the commercial area of Kakuri. It is sited close to the central spine, just a few meters away from it.

Size:

The site is about 135m by 185m in length. Industrial and commercial activities, and streets bound it on all sides, which preclude room for expansion.

Traffic analysis:

There is easy access to the site as it just branches off the central spine, which is a double lane carriage through Kachia road leading to Sabo. However, due to the present traffic volume it handles and compounded by the rail crossing close to the point of entry/exit, especially during peak periods the entrance is characterized by chaos and congestion. Again, the pull effect of motor parks on commercial activities worsens the situation by overcrowding the entry/exit point with activities.

The traffic activities within the park are uncoordinated and at peak periods it is chaotic and congested. The traffic elements, bus and passenger facilities are completely non-existent. This area marked out as a motor park can be mistaken for an open field with stalls arranged around the periphery.

Traffic capacity:

The park handles about 2760 passengers both of origins and destination. The routes plied are mainly in the direction of the South-South and Southeast parts of the

country; also some Northeast and North-Central routes are also taken care of. These routes include: Abuja, Okene, Markudi, Enugu, Onitsha, Port-Harcourt, Benin, Jos, Kafanchan, Zaria, etc.

Concessional area:

The entire fence structure is aligned by shops to form a closed space. The local authority encourages the set up of this at an accelerated rate to make revenue and contrarily neglect the provision of facilities. The conveniences provided are in a bad state as a result of lack of maintenance, poor design consideration and poor construction. In fact it is lacking in almost all its needs and requirements. This characterizes most of the motor parks in the country. Its relevance is to look into the problem of this neglected sector of the economy in its entirety.

TELEVISION VILLAGE MOTOR PARK, SITE LAYOUT.



view of the entry/exit point and pedestrian influx.



Motor Park at peak periods showing total lack of traffic segregation.



Broken down bus; depicting a poorly organized maintenance section.



Motor park at peak periods; depicting a loosely organized vehicle berthing pattern.

5.6 CONCLUSIONS FROM CASE STUDIES

Based on the case studies both home and abroad the following conclusions have drawn up which shall form a design hypothesis and a basis for developing the design brief. These conclusions include;

Entrance congestion:

i) Entrances are congested due to neglect of traffic rules, bus turning and maneuvering at entry points, and the combination of entry and exit points. These could be avoided by proper planning, use of separate entry and exit points, and the enforcement of traffic rules and regulations.

ii) Entrance congestion could also be helped by de-emphasizing the main entrance point and use of separate entrances for other functions to reduce the traffic volume though due consideration should be given in terms of security.



Poor traffic segregation leading to entrance congestion

Facilities:

i) The motor parks are lacking in terms of terminal facilities such as; a terminal building, rest facilities, proper parking spaces, an organized maintenance section etc.

ii) There is a trend of heavy shop development within the parks, which provides for the lacking services to the ready market of travelers. This trend should be harnessed to offset the cost of construction.



A long row of shops at Kawo Motor park.

Traffic segregation:

i) Traffic segregation between pedestrian/vehicles, entry/exit, mini buses and cars/buses are not well defined for easy and safe movement within parks.

ii) The use of horizontal and vertical movement in the separation of traffic when well articulated helps in traffic segregation.

Construction materials:

i) Television Village Motor Park which was developed by private developers in most of its aspects, the cheapest construction materials and mode of construction were employed and are now degenerating.

ii) From the site configuration it seems that at some point in time some part of the site was cut out for other uses due to the pressure on urban land and the spread of Kaduna metropolis.



Some structures of good construction existing in Television Village Motor Park.

CHAPTER SIX

CONSIDERATIONS FOR DESIGN

6.1 SITE STUDY

As a pre-design investigation and basic design consideration to be fully utilized in the design; the existing site was studied to uphold or disapprove of its use.

Existing site:

The existing site at Television Village, Kaduna, is the property of Kaduna South Local Government and is located at the southern-most part of the central spine with a satisfactory access for intra-city buses. It is bound by Kachia Road (central spine – dual carriage way) to the western end of the site. The access to the site is on the road leading to Sabo and onwards to Kachia. It is bound by a street on the other side and a factory at the southern end of the site. This restricts the site from any form of further expansion, which is required in a facility like this for flexibility. The original size of the site seems to have been encroached upon by the former party house and factories sited at the western part of the site on Kachia Road.

The central spine supplies the required intra-city access from the urban center and its position in the city suburb affords it easy access to inter-city routes through the bye-pass to Abuja Road.

Site study criteria

The following are the basic criteria used in analyzing the site.

a. Land use provisions

b. Location with respect to regional routes.
c. Accessibility to intra-city bus services for maximum utilization of municipal bus service.
d. Proximity or linkage with areas of business prospects i.e. good connection with economic centers defining appropriate land use.
e. Traffic volume along the route.
f. Topography and other environmental conditions and essential services.
g. Separation of external traffic flow from internal intra-city traffic.

Advantages of site

a. The site is well located in relation to relation to regional routes, especially the south-south and south-east routes.
b. It is easily accessible from the urban center, which enables an easy and smooth inter-change from inter-city to intra-city.
c. The site slopes gently towards the rear and has a good bearing capacity for construction. Being with the industrial area of Kauri, it is well served with the required service facilities.
d. The existing motor park has already generated a lot of business interest in the area that will need to be harnessed.

6.2 BUS AND CAR GEOMETRY

Entails the physical dimensions and maneuverability of buses and cars to determine the width of roadways, shapes of platforms, column spacing and ceiling heights. The right side loading of vehicles will be considered to take off accident hazards. Based on the forgoing, the following will be analyzed:

a) Bus dimensions: The bus template is based on the dimensions of the standard type of buses used by the terminal. The chosen standard is the luxury bus, the bus with highest dimensions will be chosen. The recommended standard dimensions are as follows;

Length	=	L	=	12 meters
Width	=	B	=	2.5 meters
Wheel Base	=	WB	=	7.50 meters
Rear Overhand	=	RO	=	1.30 meters
Front Overhand	=	FO	=	0.8 meters
Outside Turning Radius	=	OTR	=	15.0 meters

Car dimensions: The car/mini-bus template is based on the dimensions of the standard type of car/mini-buses used by the terminal. The chosen standard is the mini-bus with highest dimensions. The recommended standard dimensions are as follows;

Length	=	L	=	4.8 meters
Width	=	B	=	1.65 meters
Outside Turning Radius	=	OTR	=	5.5 meters

b) Roadway width:

3.3 meters (eleven feet) lane is more appropriate to accommodate 2.5 meters wide vehicle on a single lane. Double lanes would be used some areas enabling standing buses to be overtaken by other buses. For the purpose of overtaking double lane bus ways of width of 6.6 meters would be used. For flexible operation, whereby a vehicle may pull out from a platform around a standing bus, the width of the bus way is related to the linear space allowance.

c) Loading pattern:

There are mainly two types;

i) The sawtooth loading

ii) The parallel loading

i) Sawtooth loading:

This can be categorized into;

a) Straight platform

b) Radial platform

The parking can either be of clockwise or anti-clockwise. The angle of parking is based on configuration of terminal building and spacing of each lot for access from sides. The analysis of the two types of sawtooth loading is as follows:

a) Straight sawtooth loading

i) Efficiently employed where lot is comparatively narrow and deep.

ii) Passengers have direct approach to loading door.

iii) Baggage truck can operate between buses for side loading.

b) Radial sawtooth loading

i) Very efficient for buses to swing into position along natural driving path.

ii) Space at front is minimum and wide at rear making access for loading/unloading and maneuverability easy.

ii) Platform loading:

They are categorized into;

c) Parallel loading

d) Right angle loading

a) Parallel loading

i) Requires an excessive amount of space.

ii) Buses most usually wait till first bus exits.

iii) Large terminals require pedestrian under/overpass facilities to separate and protect passengers while crossing lanes.

b) Right angle loading

i) Over swinging bus door forms a barrier around which passengers must pass.

ii) Maneuvering is more difficult.

6.3 TRAFFIC PLANNING

Traffic planning within the site is an integral part of planning the site and the surrounding area, as it would enhance the proper functioning and success of the terminal. The traffic is to be planned to serve the terminal and not the terminal to serve the traffic. The following are basic aims of traffic planning;

e. Easy traffic flow on surrounding roads.

f. Effective transfer of road traffic onto the site.

g. Even and effective distribution of traffic on site.

h. Convenient and efficient arrangement of car parks.

The following are the main objectives of internal traffic planning layout within the terminal;

i) Segregation as far as possible of pedestrian and vehicular traffic.

ii) Convenient and efficient vehicle parking arrangement to facilitate business potential of the terminal

iii) To link effectively the internal traffic within the terminal with that on the access road network.

6.4 PEDESTRIAN DESIGN CRITERIA AND ELEMENTS CONSIDERATION

This usually depends on the category of terminal and its pedestrian traffic pattern. Usually commuter passenger terminals with extreme but short peak traffic pattern and repetitive users can have lower standards of service than long-distance terminals where there is unfamiliar users and peak traffic levels may be on for hours. For studies, maximum capacity coincides with the most crowded pedestrian concentrations in pedestrian facilities.

The approach to the design of pedestrian spaces is the use of level of service concept. Based on this concept qualitative evaluation is made of human convenience at various traffic concentrations and this is translated into design parameters, for example occupancy rate and speed at corridors, stairs, etc. and human locomotion on stairs, convenience and comfort of pedestrian's waiting area.

Corridor design; minimum widths are based on the pedestrian traffic flow volume – less appropriate allowances for disruptive traffic elements such as columns, newsstands, etc. Maximum practical flow through a corridor is 25 persons per 300mm width of corridor per minute (PFM). For effective selection of normal walking speed and avoidance of traffic conflict it is equivalent to 7 PFM. This is more relevant to terminals that do not have severe peaking hours, and those with severe peaking hours, 10 to 15 PFM, with these the situation is almost normal and less traffic conflicts.

Entrance; maximum capacity for free swinging door is 60 persons per minute. This may be attained with frequent traffic disruptions and queuing at the entrance section. Ideally 40 persons per minute is representative of a busy situation. For a desired free flowing traffic 20 persons per minute should be adopted.

Queuing Area; The different types of terminals affect its functional design. For most linear queues occurs, particularly in places of tickets purchase and of boarding of buses. As such care must be taken so as not to affect other terminal functions. For a linear queue, the recommended standard is an average of 20ins (50cm) spacing per person – baggage has little effects on this. Bulk queues are found where bus arrives or other services. Where there is no circulation through the queuing space, area occupancy is about 5 sq ft/person. Where movement through the queuing space is essential e.g. waiting concourses, an average of 10 sq ft/person is required. Below 3 sq ft/person results in overcrowding, immobility and unsafe situation.

6.5 STAIRS

It is stylized and restricted and imposed by configuration, physical exertion and concerns for safety. Maximum practical flow on stairs is about 17 PPM in the upward or design direction. An average of 1.8 sq. meters per person is required before stair locomotion becomes normal and traffic conflicts with other pedestrians can be avoided. This is equivalent to 5 PPM. Rise heights in stair locomotion is important, lower height, 150-175mm increase pedestrian speed and improve traffic efficiency. This is also desirable to help the handicapped pedestrians.

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