ANALYSES AND DESIGN OF SCHEDULE FOR PARA-TRANSIT OPERATIONS IN AKURE METROPOLIS, ONDO STATE, NIGERIA.

BY

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MAY, 2011

CERTIFICATION

(a) BY STUDENT: This work to the best of my knowledge has not been presented elsewhere for the award of a degree or other purpose.

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DEDICATION

This Thesis is dedicated to:

- The *"most High God that rules in the kingdom of men, and gives it to whomsoever He wills"*, to Him be glory forever and ever.
- My Husband who created a conducive home environment to make this research possible.
- My children; Aderinsola, Adekoya, Adetutu and Adeyeni for their maximum tolerance accorded me during the period of this research.
- All the few women who found themselves in this noble profession.

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ABSTRACT

This research was aimed at appraising the operational characteristics of Para transit modes in Akure metropolis with a view to designing a well coordinated system. Data on the cogent indices of metering operations attributes of operators and patrons were collected and analysed and analysed.

Some of the striking findings are that operators of motorcycles (Okada) are mainly young and inexperienced, hence, the reason why safety/accident records show that they are most prone to accident. It was also discovered that operators of Para-transit modes in the study area are mainly semi-literate; some of them had been either an apprentice in one skill or the other like bricklaying, welding, auto mechanic and auto businesses. Despite reasonable gain that accrues to the operators, only few of them would like to transfer the business to their children, they rather wish they pursued their education. Hence the sustainability of operations is suspect. The results of this study have been used to design a schedule for Para–transit operation in the metropolis. The design was based on ten – year –projected volume of person trips and Travel Demand analysis applying the Detroit Growth factor method of trip distribution. The schedule has eliminated motorcycle (okada) and tricycle (keke NAPEP) on the main trunk or express way in the metropolis, rather they are to serve as feeders through conveyance of commuters from suburbs to the nearest terminals, where they can access other modes for their trips.This work provides a data base on operational characteristics of Para – transit modes in the study area, which could be extrapolated to cover similar cities in the developing world. The operational schedule designed can also be used as a model for other cities.

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CHAPTER ONE

1.1 INTRODUCTION

Operations of Para –transit modes (also known as informal transport) is a global phenomena. Plying the streets of cities of Africa, Asia, North America, South America, Europe, Australia and Antarctica are fleets of these small, low performance vehicles driven by private operators that serve low income neighborhoods and even sometimes elitist settlements.

Para transit is an alternative mode of flexible passenger transportation that does not often follow fixed routes or schedules. Typically vans or mini buses are used to provide Para transit services, but also shared taxis and Motor cycles are important providers(Cevero, 2000). Para transit services may vary considerably on the degree of flexibility of services they provide to their customers. At their simplest they may consist of a taxi or small bus that will run along a more or less defined route and then stop to pick up or discharge passengers on request (Fouracre et all, 1992). At the other end of the spectrum, the most flexible Para transit systems offer on-demand, call-up, door-to door service from any origin to any destination in a service area. In most urban centers of the developing world,two wheeled motorcycles and three wheeled tricycles' para transit operations are thriving in spite of insinuation of high accident risks. This is also the case in Akure, Nigeria. The use of this category of informal mode has demonstrated that para transit services can appreciably complement those of the conventional ones in urban centers. Perhaps the greatest advantage of this category of para transit is ride – to door service it offers to commuters and its availability (Oseni, 1999).

Tables 1A –1D illustrate varieties of Para transit modes around the world, From the Tables, it is noticeable that the modes are known by different names in different countries. For easy understanding, the author has grouped them into five, taking into consideration passenger capacities and coverage. The five groups are modes with passenger capacities of 1-2; Those with passenger capacities of 2-4;modes with passenger capacities of 4-6; Those with passenger capacities of 8-10 and modes with passenger capacities of 10-25.

The dominant modes under various groups from group one to five respectively are: Cycle/ Contract carriers and Shared ride taxi, Favelas, Moto-dub, Motor-Conchos, Tuk-Tuk Samlor, Pedicab, Bajaj/ Minicar, Motorcycle, Going, Achaba, Express and Onanga,Tricycle, Motorized scooter, shared taxi, Black taxi, Horse cart, Taxi collective, Sherut, Tap-Tap, Gbaka, Kabukabu and Keke Napep, Wagons, RouteTaxi, Microbus, Matatu, Jeepney, Opelet, Mikrolet and Danfo.

Trucks, Public light bus, Mini bus, Vans, Bus collective/ Stage Taxi, Kamunny, Tro- tro, Fulafula, Gbaka, Molue, Bolekaja and Gongoro.

Details of the Country / city in which the modes are used, Vehicle capacity, Method of operation in terms of routes, stops, fares and coverage are illustrated in tables 1A – 1D.

TABLE1A: SUMMARY OF PARA-TRANSIT MODES IN CITIES OF THE WORLD

MODE	Country/City where modes are used	Vehicle Capacity	Method of operation.			Coverage
			Routes	stops	Fares	
Shared ride Taxi	Indonesia	1	Variable	Demand	Negotiate	Within the town
Contract carriers	Jamaica	1 or more	Variable	Demand	Negotiate	Varies
Motorcycle, Going, Achaba, Express, Onanga	Nigeria	1-2	Variable	Demand	Negotiate	Within the town
Ojek (Motor cycle)	Indonesia	1-2	Variable	Demand	Negotiate	On the Streets
Bicycles	Indonesia	2	Variable	Demand	Negotiate	2KM
Calesa	Philippines	2	Variable	Demand	Negotiate	Fairly Large.
Becacks	Indonesia	2	Variable	Demand	Negotiate	3.5KM
Helikak	Indonesia	2	Variable	Demand	Negotiate	
Motocycle taxi (favelas)	Brazil, China	2	Variable	Demand	Negotiate	On the streets
Motor – dub (Motorcycle)	Cambodia	2	Variable	Demand	Negotiate	Within the streets
Trishaw	Los Angeles, U.S.A	2	Variable	Demand	Negotiate	Within the streets
Tongas	India	2	Variable	Demand	Negotiate	On the streets
Motor Conchos	Dominican Republic	2	Variable	Demand	Negotiate	Within the streets

Source: Maunder et al (1981) Case & Latchford (1981) Newton (1994) Hudgens & Rischard (2000) Cevero (2000)Burke (2002) Owolabi (2004)

TABLE1B: SUMMARY OF PARA-TRANSIT MODES IN CITIES OF THE WORLD

MODE	Country/City where modes are used	Vehicle Capacity	Method of operation.			Coverage
			Routes	stops	Fares	
Bajaj / Minicar	Indonesia	2 – 4	Variable	Demand	Negotiate	5KM
Cycle Rickshaw	Bangladesh, Mid East, Asia	2 – 4	Variable	Demand	Negotiate	2KM
Tricyle	Philipines; Nigeria	2 – 4	Variable	Demand	Negotiate	Local Market
Tuk – Tuk	Thailand	2 – 4	Fixed	Fixed	Fixed	Local Market
Auto Rickshaw	Delhi, India	3	Variable	Demand	Negotiate	27KM
Pedicab	Havana, Cuba	3	Variable	Demand	Negotiate	4KM
Samlor	Thailand U.S.A, Canada	3	Variable	Demand	Negotiate	3KM
Texxi	U.K, Europe Northern Bedforshire, England	4	Fixed	Demand	Varies/Fixed	On the Streets
Sherut	Israel	4	Fixed	Fixed	Fixed	Weekends / Holidays
Motorized Scooter	China	4	Fixed	Fixed	Fixed	Wide Coverage
Shared Taxi	India, Niamey	4	Fixed	Fixed	Fixed	Fairly large
Horse Cart (Gbaka)	Zaire, Indonesia	1 – 6	Fixed	Fixed	Fixed	Wide Coverage
Kabukabu	Nigeria	4 – 5	Fixed	Fixed	Fixed	Within the city
Black Taxi	Northern Ireland	4 – 6	Fixed	Fixed	Fixed	5KM

Source: Maunder et al (1981) Case & Latchford (1981) Newton (1994) Hudgens & Rischard (2000) Cevero (2000)Burke (2002) Owolabi (2004)

TABLE1C: SUMMARY OF PARA-TRANSIT MODES IN CITIES OF THE WORLD

MODE	Country/City where modes are used	Vehicle Capacity	Method of operation.			Coverage
			Routes	stops	Fares	
Tap – Tap	Haitti	5	Fixed	Fixed	Fixed	Both within & outside the cities
Tro – Tro	Ghana	5	Fixed	Fixed	Fixed	Within the cities
Wagons	West African & Central Africa	5 – 7	Fixed	Fixed	Fixed	Worse Areas & Remote Area
Matatu	Kenya Nairobi	8	Fixed	Fixed	Fixed	On the Street
Route Taxi	Jamaica	8	Fixed	Fixed	Fixed	Large Coverage
Jeepney	Phillipines	8	Fixed	Fixed	Fixed	
Micro bus	Soweto, Johhannesbung, South Africa Indonesia	8 – 10	Fixed	Fixed	Fixed	8 KM
Danfo	Nigeria	9 - 10	Fixed	Fixed	Fixed	Within the cites
Taxi Collectiff	Canada, Algeria Mexico	4 – 9	Fixed	Fixed	Fixed	Local Transit
Opelet	Phillipines	9	Fixed	Fixed	Fixed	Remote Areas
Mikrolet,	Indonesia	15-Oct	Fixed	Fixed	Fixed	5KM
Trucks	Indonesia	15 – 20	Fixed	Fixed	Fixed	On the Street
	Cuba					
	Congo	15 - 20	Fixed	Fixed	Fixed	On the Street
Fulafula						

Source: Maunder et al (1981) Case & Latchford (1981) Newton (1994) Hudgens & Rischard (2000) Cevero (2000)Burke (2002) Owolabi 2004)

TABLE1D: SUMMARY OF PARA-TRANSIT MODES IN CITIES OF THE WORLD

MODE	Country/City where modes are used	Vehicle Capacity	Method of operation.			Coverage
			Routes	stops	Fares	
Mini Bus	Malaysia Thailand, Vietnam Central Africa, Philippines U.S.A, Canada Indonesia Nigeria	12 -14	Fixed	Fixed	Fixed	8 – 15 Km
Gbaka	Cotede Ivoire	13	Fixed	Fixed	Fixed	Varies
Vans	Bangkok Egypt Jamaica	12 14 -16	Fixed	Fixed	Fixed	Varies
Bus collective	Domican Republic / Mexico	12- 24	Fixed	Fixed	Fixed	Within the cites
Stage Taxi	Jamaica	11 - 40	Fixed	Fixed	Fixed	Large Coverage
Kamuny	Uganda	25	Fixed	Fixed	Fixed	Within the Streets
Molue (Bolekaja, gongoro)	Nigeria	25 – 50	Fixed	Fixed	Fixed	Within the Streets
Kamuny	Uganda	25	Fixed	Fixed	Fixed	Varies
Bus	Indonesia Turkey, Nigeria	30 20 - 30 20 - 30	Fixed	Fixed	Fixed	5KM

Source: Maunder et al (1981) Case & Latchford (1981) Newton (1994) Hudgens & Rischard (2000) Cevero (2000)Burke (2002) Owolabi (2004)

1.2 AIM AND OBJECTIVES OF RESEARCH.

The aim of this research is to appraise the operational characteristics of Para transit mode in Akure metropolis with a view to designing a well coordinated transit systems.

The specific objectives of this research work are to:

- collect data on the cogent indices of metering operations, attributes of operators and patrons of Para transit modes in Akure metropolis.
- evaluate the data using appropriate computer software and mathematical methods such as SPSSVER10, S PLUS2007 professional, MS excel et cetera.
- design operational schedule for Para- transit mode in the metropolis to facilitate commuting.

1.3 JUSTIFICATION.

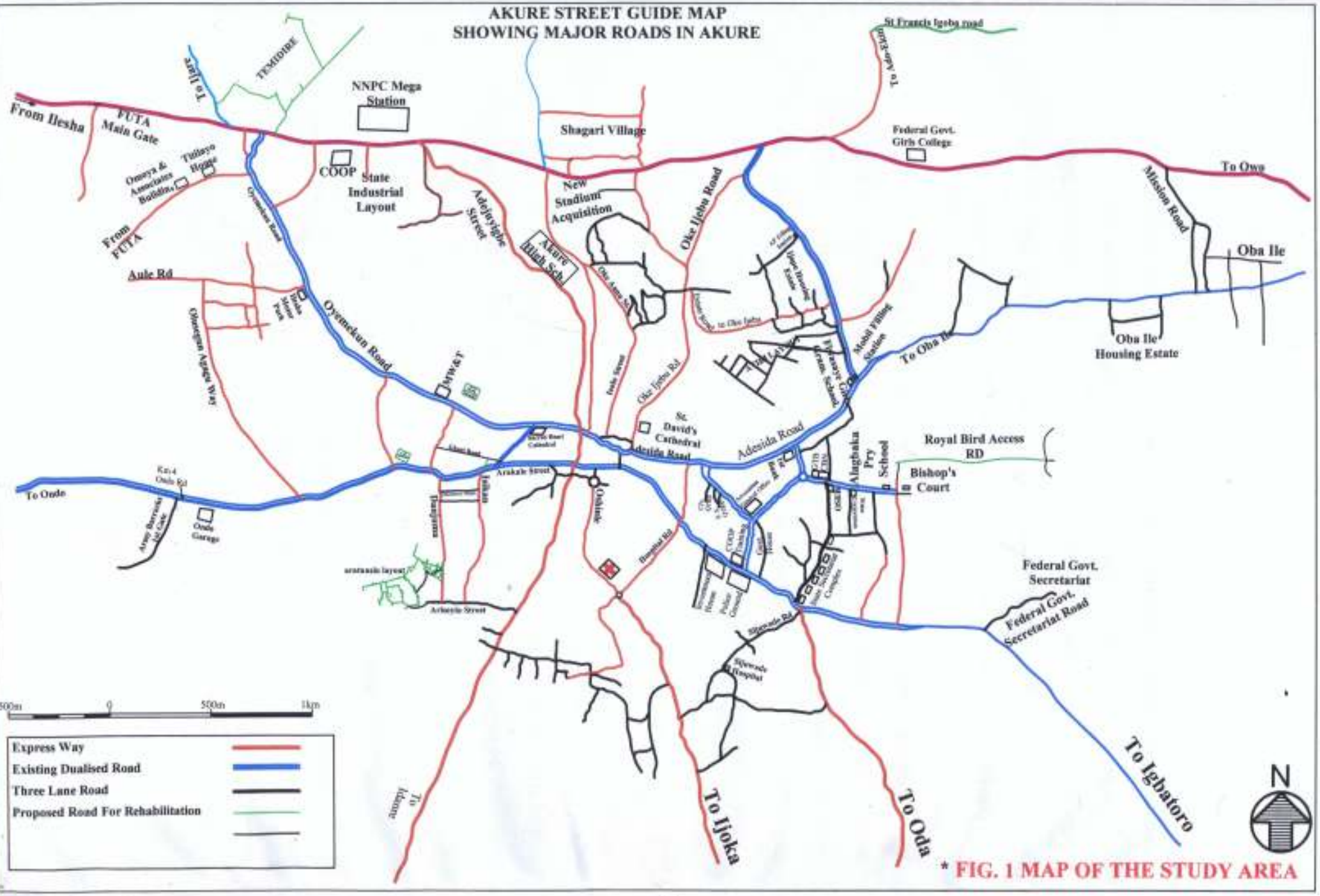
The operations of para - transit modes in Akure presently are not coordinated on a global scale. Each para – transit mode operates separately but this could partially solve part of commuting problems in the metropolis. Coordination of the entire system is germane to efficient and effective commuting in order to ameliorate mobility problems in the metropolis. This study lends credence to this challenge.

1.4 DESCRIPTION OF STUDY AREA.

Akure metropolis, which was used as the study site, is the capital city of Ondo State in Nigeria. It is within the tropical rain forest belt of the southwestern part, this area has a temperature ranging from 27°C to30°C and a rainfall approximately 1450mm per annum with Latitude 7°15″ and Longitude5°10″East(Figure1). It has an area of approximately 30.02 square

kilometers. Population within Akure Local Government area was estimated at 353,211 people according to the 2006 Census. This consisted of 175,495 (49.68%) male and 177,716 (50.32%) female. It is one of the fast growing urban settlements in southwestern Nigeria with influx of people of diverse occupation from many parts of the Country. Majority of inhabitants of Akure are civil servants, self-employed, businessmen and women and traders. The traffic situation in Akure is similar to what obtains in other urban settlements in Nigeria. There is a fairly good network of roads consisting of main distributors and collector streets. The main arterial, Oyemekun- Oba Adesida road (Figure1) has virtually all modes of land transport plying on it. Akure had its traffic problems increased when it was made the capital of Ondo State in 1976, necessitating the dualization of Oyemekun – Oba Adesida road to accommodate more traffic, the road was constructed in 1983, but traffic problems were still being encountered along the road which led to the design, and continuation of dualizing the road to link up with Ilesa - Owo express junction that was constructed and commissioned in July 2006. General problems encountered in the metropolis include traffic congestion, during the peak periods, obstruction to traffic due to Illegal Street trading, on street parking and illegal bus terminals and inefficient traffic control mechanism among others.

These problems require a lasting solution in order to facilitate interaction, movement of goods and persons, economic and industrial development within the metropolis.



* FIG. 1 MAP OF THE STUDY AREA

CHAPTER TWO

LITERATURE REVIEW

2.1 PARA TRANSIT OPERATIONS IN NIGERIA.

Transport in Nigeria takes place mainly by road. Informal transport services thrive in all Nigerian cities to some degree. Para transit mode is being recognized as main mobility server in Urban areas (Akure inclusive) hence the need to study its operational characteristics. It has been established that about 97% of the population in Akure depend on public transport (Owolabi, 2004).

This huge demand exerts a great strain on available facilities and because of institutional & funding constraints, conventional transit systems are not presently available. Hence some unconventional Para-transit public transport modes like motorcycles and private vehicles not registered as taxis known as "Kabukabu" came into act as supplements. Incidentally in majority of urban centers of Nigeria, these Para-transit modes serve as the only public transport modes. Thus the study is of relevance to all urban centers of Nigeria.

Nigerian experience has been that conventional public transport systems do not survive for long because of poor management. For most cities, Akure inclusive, there is no well-organized transit system and public transport trips are undertaken with assorted types of Para-transit vehicles. Hence, any study aimed at ameliorating problems faced by commuters in Akure must take into

cognizance the dominance of the Para-transit modes. Traffic congestion is pandemic throughout the country having steadily worsened since oil boom years of the 1970s. Passenger transport operators throughout Nigeria struggle to cover operating costs while passengers face escalating fares for increasable scarce services. The few public buses that run are invariably filled to the brim and increasing number of Nigeria's city dwellers must resort to walking and any other possible means of getting around. Also, working in favour of illicit transport services have been skyrocketing vehicle ownership costs. This has mainly been tied to Nigeria's faltering economy (cevero, 2000).

Passenger transport needs in cities of Nigeria are satisfied by a variety of modes, but the majority of people use collective transport, mainly public & private buses. Declining performance and reliability of public buses together with on-going economic reforms has contributed to substantial increase in the use of private buses. The demand for private bus services is even higher when public buses offer a cheaper price for the same trip (Wikipedia, 2007).

As previously discussed, existing public transport systems in Nigeria is usually unreliable and uncomfortable which require improvement and expansion for overall effectiveness. Nigeria's fastest growing form of informal transport services has been the motorcycles (motorcycle). The motorcycle's niche market is passengers needing lifts from the suburbs to main transport roots and terminals. An estimated 70 percent of Nigerian cities rely solidly for intra-city public transport services. (Owolabi, 2009). In the Country's commercial centers (Lagos and Abuja) motorcycles help shed some of the excess demand from larger modes by serving many short distance commute trips and

excursion to the urban fringes and other inaccessible locations due to the shortage of passengers car, motorcycles in all Nigeria cities are oversubscribed, with operators carrying as many as three passengers per trip. Motorcycle riders normally pick up customers at major congregation points around the city and deliver them to their front door. (Cevero,2000). Because of escalating private car prices a steady stream of used imported old cars and mini buses have been introduced into the services as unconventional and unregistered urban carriers locally called kabukabu.

In the early 1990s, Lagos's kabukabu consisted of some 2,500 molue truck – like vehicles with wooden or metal bodywork that carry about 25 passengers, 2,500 danfo minibuses,21,000 shared ride taxis and far more numbers of motorcycles. These numbers have since steadily risen (Cevero, 2000). Because of Nigerian's faltering economy and the consequent costs in public bus services, demand for kabukabu services far exceeds supply. Queues are exceedingly long at terminals and stops and the stampede to board vehicles can be terrifying knowing they can always fill their vehicles; owners have little incentive to share them up. Most vehicles are old, dilapidated, poorly maintained and routinely overloaded.

There are no official sanctions against kabukabu services and lacking the resources to change the situation, government officials have accepted them as a "necessary evil". kabukabu fills a market void left by a dearth of public bus service(Yearseley,1989).

2.2 PARA TRANSIT TERMINAL FACILITIES.

A given share taxi on fixed routes usually starts and finishes in central locations known as taxi parks, lorry parks, motor parks, garages, autogares, gares routieres, or paragems. These are usually located near the center of a town or near a major market. Larger towns often have several taxi parks, one for each road out or for each major destination. Other towns have no centralized taxi parks, with taxis departing from the roadside. There will also be smaller taxi parks in the suburbs of large towns, which serve as the terminus for urban share taxis to that destination. When passengers arrive at a taxi park, they are often assailed by people known as touts, coti- men, or taxi scouts, whose job is to persuade travelers to use their specific vehicle or taxi company with efforts that range from praising the comfort of their vehicle to promising a quick journey or grabbing baggage and throwing it into the boot of their car.

Nevertheless, most share taxis only leave the taxi park after all possible seats have been occupied, whether that be a matter of minutes, hours, or days. Taxis headed to more popular destinations thus generally have lower wait times; though more than one company often services such locales(Metropolitan, 1988). Travelers often opt for the car with the more passengers, leading some companies to sit employees in cars to make them seem fuller than they really are. The cars sometimes follow a loose schedule, though this is seldom made public (Wikipedia, 2007). In some towns and villages, taxis are not affiliated with any particular company and several privately owned cars queue up to travel. Despite the fact that they are all in effect competitors, drivers still wait for other cars to depart before they begin to fill up their own vehicles.

Informal services contribute to traffic congestion by queuing and stopping for customers near critical road intersections. While tremendous amounts of public resources go to finance road improvements for "formal" services, including everything from pricey metros to cloverleaf interchanges for the car-owning minority, surprisingly few resources go to upgrade the operations of minibus and pedicab services (which relieve public authorities of the very need to invest resources in expanded public transport services) Even when governments lean on private entrepreneurs to mount mass transit services, they cannot abdicate the responsibility to basic infrastructure and management support to the private sector (Cevero, 2000).

Some modest efforts have been made in recent years to provide basic infrastructure for private carrier. In Metro Manila, local governments have designated areas, usually along side streets, as Pedicab terminal. Several have been financed through general fund allocations. In most instances, however, operators must still rely on curbsides to queue for customers. In Bangkok and other Asian cities, Informal operators pay a form of site rent to local police officers and neighborhood "protectors" for the very right to occupy key street corners. This is money that rightfully should go to government coffers for purposes of financing off-street parking and terminal facilities.

The absence of any formal government program for such purposes means the funds end up lining the pockets of civil servants instead. In Brazil biggest cities, clandestine vans and kombi microbuses routinely queue up inside off- street terminals, paying daily or per-entry parking fees to private landholders- fees that get passed on to customers, raising the price of informal transport fares in

Rio de Janeiro, Sao Paulo, and Brasilia to among the highest in the world. Providing basic infrastructure to informal operators is not an act of charity or good will. These are improvements that they are owed. By paying taxes on fuel, equipment, and earnings in addition to licensing and registration fees, informal operators contribute significant sums to public treasuries. They deserve a return on investments. Just as private motorist receive high-speed lanes and synchronized signal systems for monies they contribute, informal operators should receive at the very least off-street parking and staging facilities (Cevero, 2000).

In most of the cities of the country, these terminals are available for operation while officials of National Union of Road Transport Workers (NURTW) are always at work to see to easy operations of these modes at their different parks/ terminals (Bolade, 1993). Taxis on flexible route don't have a central park, they carry about 4-5 passengers at a time with on line loading and dropping.

Buses and Motorcycle operates from central park, most of them leave the park after all possible seats have been occupied, whether that be a matter of minutes, hours or days.

2.3 REGULATION AND CONTROL OF PARA- TRANSIT ACTIVITIES.

Most formal transportation organizations are vertically integrated, involving neatly layered hierarchical arrangements for the production of services, an executive level, below which lies a management structure, below which lies field supervisors, and below which lies operators and field personnel. Informal transport services are nowhere near as vertically or tidily organized. Indeed,

service production often lies at the hands of a single individual – the owner-operator.

Informal transport represents among the purest examples of vertically disintegrated transportation. In contrast to regional transit authorities and formal franchise arrangements, the industry is held together in a loose, horizontal fashion, dependent upon carefully cultivated linkages and nurtured relationships among stakeholders, including fellow operators, parts supplier, local police, creditors, and street hustlers, among others. Thus, rather than relying upon intra-firm relationships and collaborations for the production of services, the informal transport sector depends upon inter-personal and inter-operator linkages and fellowship.Route associations exist at all levels of privatized transport services in the developing world, whether legitimate and formal or illegitimate and informal. Because the business of route associations is the same regardless how legitimate services are (Cevero, 2000). Associations also go after renegades, quick to alert the police of interlopers or bandit operators who encroach on their territories. In wealthier countries, associations also provide financial services, such as access to credit and group discount purchases of insurance, equipment spare parts, fuel, and lubrication.

Some hire "plants" whose jobs are to stake out areas where police officers are present and issuing citations, radioing the information to a central depot. Associations also lobby for the rights of their members. On legislative matters they often side with initiatives that promote market-bases approaches toward setting fare and services levels. Association leaders are usually democratically elected, chosen among the ranks of most senior and represented fellow

operators. In many countries, such as Mexico, Brazil and Kenya, association leaders belong to umbrella organizations, which lobby for members' interests in local, state, and national political arenas. In Rio de Janeiro the umbrella organization of informal van operators publishes a newsletter and routinely stage events for press coverage in an all-out campaign to cast the clandestine van industry in a positive light (Hathway, 1985).

Mexico City's largest associations elect full-time presidents and governing boards, and maintain administrative offices, central dispatchers (for vehicles equipped with short-wave radios), and service garages. In addition to routine maintenance and repairs, associations stockpile vehicle parts that are made available to members at discounts. Keeps track of who is driving and when, chases away illegal operators, and maintains "peace" with local police officers. In Argentina, where urban transportation services are largely privatized, route associations have, as in Mexico, historically been leaned upon to internally organize and manage services. Until the formal concession of urban transport services in the early 1990s, private, collective, minibuses were operating illegally. During this era, route association played prominent roles, selecting and employing operators and setting and assigning schedules for the cities privately owned brightly colored collectives (Maunder et al, 1981).

Route associations were the glue that kept the entire system running efficiently. For a number of years, owners turned their earnings over to their associations, which in turn divided proceeds according to an agreed-upon formula. Besides coordinating time tables and routes, associations also organized local manufacturing of minibuses using imported truck chasses, set

up body and repair shops, and run insurance companies that write policies to cover their fleets. The carros por puestos minibus of Caracas are organized by voluntary associations, each which counts anywhere from 10 to 300 vehicles. Members pay dues in return for the right to operate in a particular district without fear of reprisal from local police. As elsewhere in Latin America, route association perform such functions as, securing authorization for new routes; allocation work stints among driver members; assisting owner-members in obtaining commercial loans for vehicle purchases; settling of accident claims; and representing members in dealing with government officials.

Most Para transit services in metro Manila involve several levels of intuitional arrangement. At the most basic level is the relationship between the vehicle owner and driver. In the case of jeepneys, the vehicle owner, if he does not drive the vehicle himself, employs a driver who rents the vehicles on a daily basis for a set boundary fee. As noted earlier, the driver pays for fuel and keeps all proceeds over and above the boundary payment. They maintain the vehicle and pays for the licenses and insurance (Maunder et a, 1981). Most vehicle owners, as legal franchise-holders and drivers have joined a route association. By Philippine law, all associations must register with the national Securities and Exchange Commission. In the Philippines, large passenger-carrying modes that follow fixed routes fall under the jurisdiction of national regulators. Controls over smaller, flexibly routed vehicles are left to local authorities (Cevero 2000).

In Nigeria, responsibility for urban transportation affairs lies largely with local governments. In practice, route assignment are ignored thus, Lagos kabukabu

services are for all practical purposes are as unregulated as those of other Nigerian cities.

In 1996, the central government did step- in in a concerted effort to curb mounting emissions problems of Increased importation of old vehicles, mainly throw- aways in most Nigerian cities. In response, an age ceiling of 8 years from the date of manufacture was placed on all "tokunbo' ' vehicles imported into the country. Because this further inflated cost of cars, the government caved into political pressure, removing the restrictions two years later. This opened the floodgates to a new round of tokunbo imports. Today, governments at all levels have pretty in the absence of official regulation, informal regulation occurs instead through associations, what Nigeria call ``UNIONS``. Union members share terminals; with each terminal typically having around 100 operators each assigned his own parking space. Union coordinates one another through city branches, state councils and an umbrella association of the national union of road transport workers (NURTW).

Unions originally serve as social network for kabu kabu operators, but with time expanded into areas like transport driver-owner relations, remuneration and job security. They also assist members by acting as guarantors for loans on vehicle purchases or repairs, and by mediating in disputes between members and other parties. Furthermore, they set rules that aim to eliminate touting and disorderly conduct at terminals. Unlike government authorities, they are fairly effective at enforcing their rules due to the constant presence of NURTW officials at terminals. While union have improved working conditions for their members, they have largely ignored matters of concern to the broader public,

such as safety, vehicle keep up and the coordination of routes and schedules. They operate mainly on the principle that members are free to do as they wish as long as they do not encroach upon the right of fellow members.

2.4 PARA-TRANSIT OPREATION IN AKURE METROPOLIS.

Para- transit operation in Akure is similar to what obtains in other cities in Nigeria. The modes within the metropolis are motorcycle, tricycle (Keke Napep), shared taxi for flexible route, kabukabu taxi for fixed route and bus. From an operational point of view, Para-transit operations in Akure are in two categories namely, those that function mainly as feeders and span short distances, for example,Keke Napep, Motorcycle, Kabukabu and those that provide long haul or mainline connections and load at designated terminals. The loading points are shown in Figure 2.

Motorcycle: Popularly called "Motorcycle" operates in all routes in the metropolis. They are flexible and render door – step services. About four thousands riders have registered in the Amalgamated Commercial Motorcycle Owners and Riders Association of Nigeria (ACOMORAN). They carry one at most two passengers at a time. Motorcycle has the highest coverage; an motorcycle could be found almost everywhere. The services of Motorcycle could be enjoyed to most remote area within the metropolis either on major roads or minor roads. Motorcycle complement the services of other modes on routes where they could not be found, their fare is negotiable and varies between minimum fare of N30 and N100 depending on the distance. Some of the motorcycles complements taxis in their operation, some operation, some load at designated terminals which are spread over around the metropolis,

they convey passengers to neighborhoods and suburbs where taxis do no often reached. Their terminals are also shown in the figure 2.

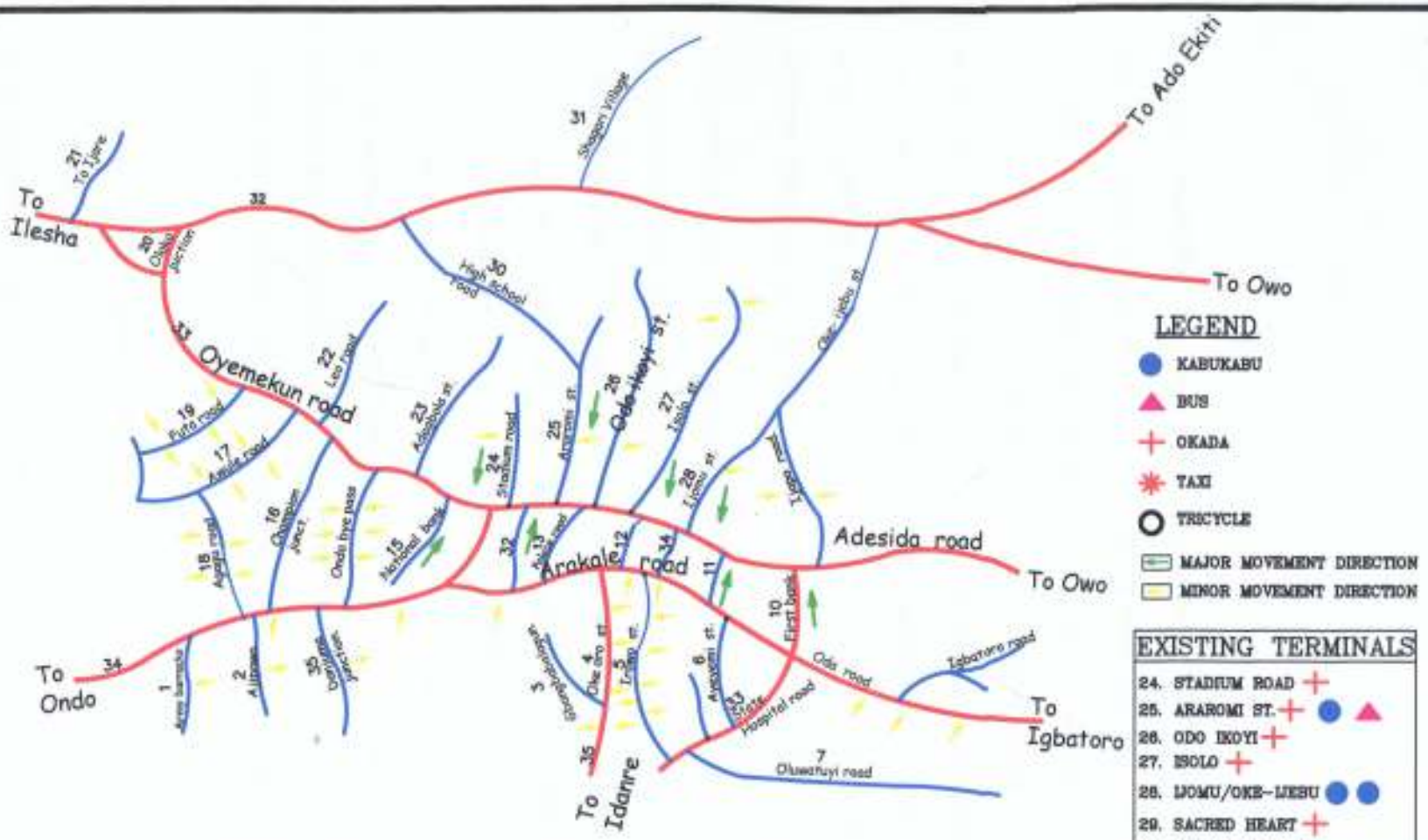


FIG. 2 ROAD PATTERN AND EXISTING TERMINALS OF PARATRANSIT MODES IN AKURE METROPOLIS

Keke Napep : Government introduced tricycle in 2005 popularly refered to as keke Napep they are painted with color green and can carry four people at a time excluding the driver. They are less than ten in the city operating mainly from NEPA to Federal Secretariat/ Igbatoro road. They have partially the same attributes as commercial motorcycle. They have a low capital cost, a low running cost and a lower level of service because speed is slow, the fare is lower than that of taxi, it costs N20 per trip.

Shared Taxis: operate on variable routes along the major roads where commuters easily access them. Most of the times, the first occupant normally determines the destination of movement and other passengers heading in the same general direction are picked up en-route". The coverage of taxis is quite wide but mostly along the major roads. A drop of taxi is about 3km to 4km after which an extra fare may be charged. Though there are lots of taxis operating within Akure metropolis the coverage is less than that of Motorcycle but far more than that of bus, kabukabu and tricycle. A taxi could travel up to 12km or more single trip. It has a fixed fare of N30 per drop(Akomolafe,2004).

Kabukabu: Commercial Private car known as "Kabukabu" for fixed route in Nigeria has the same attributes as taxi. The difference is that they are on fixed route and they are not necessarily painted with the traditional Ondo State public transportation colour. They carry the same passenger as taxi. Kabukabu, which operates on fixed route, load at their designated terminals and convey passengers to location within the metropolis along routes not often plied by taxi.This mode has a big influence on the public transportation within the city. They operate on all routes within the town and are registered with the

appropriate union. The number of registered taxis in the metropolis is about three thousand five hundred (NURTW, 2007). The passenger carrying capacity range between four and five passengers at time with on line embarking and disembarking. The extent of the services of kabukabu spread across the metropolis, they have about fifteen terminals as shown in Table 2 below:

TABLE 2: TERMINALS FOR FIXED ROUTE TAXI (KABUKABU) IN AKURE METROPOLIS.

ROUTES	FARE	NO OF VEH. IN FLEET	COVERAGE
Oke Ijebu	N30	58	Oke ijebu – Express, Benin Garage
Araromi	"	18	Araromi – Onyearugbulem
Oloko	"	24	Road block-Benin garage
Arakale/ Okearo	"	15	Oke Aro -Idanre garage
Arakale/Ondo road	"	14	Arakale - Ondo road
Nepa /Oda	"	14	Nepa -Oda
Nepa—Igbatoro	"	12	Nepa- Igbatoro
Oja Oba	"	24	Oja Oba –Danjuma
Odo-Koyi	"	11	OdoKoyi –Plaza, Osukoti
Oda	"	14	Nepa –Secretariat
Igbatoro	"	12	Oda –Cocoa Board
Oja Oba – Ijoka	"	15	Oja Oba – Ijoka
Old garage	"	24	Old garage—Idanre road
Odopetu	"	12	Odopetu – Odojoka
Total		**267**	

SOURCE: Field Survey, 2009.

Mini Buses: Operates only on fixed routes, there is no particular colour mandated for them. At specific locations in the city they have garages or loading terminals where they load passenger; some carry between 14 and 18 passengers at a time they are often shared ride among the patrons. They also are registered with the union. The coverage of Buses is less than that of Taxi and Motorcycle but far more than that of tricycle. There are about 8 loading terminals of buses scattered within the town covering between 5km to 9km along various routes. A good number of buses operate from route loading to suburbs; it has a fixed fare of N20 except for Oba –Ile route that has a fixed fare of N50 per trip, the terminals are illustrated in Table 3 below.

TABLE 3:TERMINALS FOR MINIBUSES IN AKURE METROPOLIS.

ROUTES	FARE	NO OF VEH IN FLEET	COVERAGE
Post office	N20	7	Post office – Lafe inn, Oke ogba
Post office	"	9	Post office- Futa
Odo-Koyi	"	12	Odo-Koyi- Shagari – Radio
Araromi	"	8	Araromi – High School
Oja Oba	"	9	Oja Oba – Oke Aro
Oja Oba	"	13	Oja Oba – Danjuma
Oja Oba	"	8	Oja Oba - Ijoka
Texaco	50	12	Texaco – Oba Ile
Total		**78**	

SOURCE: Field Survey, 2009.

Despite the fact that nearly all these buses are old and not road worthy, patrons due to the bad state of economy of the nation still patronize them because they are cheaper and are easily available at their terminals.

Four out of five modes except kabukabu have their plate numbers in red indicating commercial vehicles. They serve the community in the provision of transportation for the general populace.

2.5 ORGANIZATION AND REGULATION OF PARA TRANSIT MODES IN AKURE METROPOLIS.

Para transit sector in Akure appears well co-coordinated and from information obtained it was deduced that four organizations are responsible for the activities of various modes operating within the metropolis, they are:

- National Union of Road Transport Workers (NURTW)
- Amalgamated Commercial Motorcycle owners and Riders Association of Nigeria (ACOMORAN)
- Road Transport Employer Association of Nigeria (RTEAN)
- Taxi driver Co –operative Multipurpose Union (CMU)

NATIONAL UNION OF ROAD TRANSPORT WORKERS UNION (NURTW)

This body acts as the representative of the operators using buses and taxis before the government. They attend meetings with the government to voice the mind of the operators and their shortcomings. They also discipline the operators when they err. Registration of new Taxi or buses going into operation within the city is done with the union. At present we have over 3000 registered taxi and 2000 registered buses. Registration cost is N2500 and some stickers (for the Local Govt) Identity card is between (N300 &N500). It

varies yearly but depends on the Union. Temiyemi branch sticker costs N400 & N500 yearly. A compulsory ticket of N150 is issued to operators every day. The Union is divided into three phases namely, the National, the State and the Units. The buses are not operating within the metropolis, but between the state & neighboring states.

AMALGAMATED COMMERCIAL MOTORCYCLE OWNERS AND RIDERS ASSOCIATION OF NIGERIA (ACOMORAN)

Their function is similar to the NURTW. They represent operators using motorcycle as a public transport mode. It cost N2500 to register a motorcycle in the union. A compulsory daily ticket of N30 is issued to operators daily. They have four different zones in the metropolis and they are as follows-

1. Akure South zone with its headquarters at Ayelabola Street.
2. Oyemekun zone with its headquarters at Iro
3. Ala zone with its headquarters at Fanibi
4. Alakunre with its headquarters at Ideal guest house.

There are 54 units around the metropolis, their overall headquarters is at No 20, Ayetoro street, Akure, Ondo state. The number of Motorcycle in the metropolis increases by almost 100% between 1998 and the increments is from about two thousand in 1998 and almost 4,000 in 2009 (Acomoran 2009.)

ROAD TRANSPORT EMPLOYER ASSOCIATION OF NIGERIA (RTEAN)

This organization complements NURTW in their operation. They deal with licensed taxi and buses plying fixed route within the metropolis. Their headquarters is at no 67, Oyemekun road Akure. Registration with this body cost the same as for the NURTW. Their daily receipt costs N150 at times it

varies from one route to another, their operation is usually between 7a.m and 6p.m. after which operators are free to operate at nearby junctions or streets to pick passengers.There are about eight and fifteen routes for buses and taxis on fixed route respectively in the metropolis as earlier shown in tables 2

and 3.

TAXI DRIVER CO –OPERATIVE MULTIPURPOSE UNION (CMU)

This body represents both taxi and bus operators at the Government Level but most of their buses operate on inter-city routes, which are outside scope of this research. The union assists operators to purchase buses / taxi by giving operators / owners the opportunity to join a co-operative society that is organized and controlled by the union. After proper registration and agreement is reached by both parties, membership continues for at least six months or more depending on the response of the new member towards the union's activities such as attending meetings as at when due, payment of dues, payment of shares e. t. c. The union would purchase a taxi on behalf of the member, the taxi is released to the member (under close monitoring) for operation within the metropolis. Repayment will be instalmentally along with a certain percentage of interest. As long as the operator has not finished the repayment, the union will be in control of the taxi with their name boldly written on it but as soon as full payment is made the name will be removed and the operator/owner becomes the bonafide owner, he is free to register with NURTW and resumes operation according to the rules and regulations of NURTW. However, as at the time of collecting this information, about 530 taxis

were operating and being controlled by this Union. The number of taxis varies from time to time.

2.6 ACCIDENT/SAFETY RECORDS IN NIGERIA.

In many developing countries, accident record shows that public concerns over transportation safety are well founded. Nigeria daily newspaper recorded the following incidences between March and April 2011:

- A middle aged man lost his life in early morning of 9th March, 2011;
- A two vehicle collision at bus stop, killing 15 passengers;
- An accident in which a loaded molue plunged into a river, killing 50 people;
- A road crash which killed 37 people;
- An accident where by a pedestrian was killed by a molue;
- An accident at a bus stop killing 4 people and injuring 62 people; and
- A molue car-crash at a bus stop killing 7 people.(Cevero2000).
- Fourteen passengers in a commercial bus lost their lives along Benin – Ore road, on 9th of May 2011.
- Nigeria crime news (May edition) recorded that eight persons were killed in three road accidents in Lagos state.
- One person died while eight others sustained serious injuries.

when a truck fell into a river at Abaji, along the Abuja- Lokoja highway

• Twenty people including University students were burnt to death in Asaba,Delta State along Benin-Asaba road. It occured at Enuhu village, close to Umunede.

However, table 4 shows the accident record between 1960 and 2006 in terms of the road traffic crashes data as recorded by the Nigerian Police Force/ Federal Road Safety Commission.

2.6.1 TABLE 4: ROAD TRAFFIC CRASHES DATA

SUMMARY OF REPORTED ROAD TRAFFIC CRASHES TRENDS IN NIGERIA (1960-2006)

YEAR	FATAL	SERIOUS	MINOR	TOTAL CASES	NO. KILLED	NO.INJURED	TOTAL CASAULTY
1960	826	9065	4239	14130	1083	10216	11299
1961	193	9982	5788	15963	1313	10614	11927
1962	1263	9159	5895	16317	1578	10341	11919
1963	967	6918	11950	19835	1532	7771	9303
1964	911	7371	7645	15927	1769	12581	14350
1965	1029	7762	8113	16904	1918	12024	13942
1966	1680	5600	6270	14000	2000	13000	15000
1967	1560	5200	6240	13000	2400	10000	12400
1968	459	5865	5839	12163	2808	9474	12282
1969	1559	5199	6230	12998	2347	8804	11151
1970	1999	6666	7991	16666	2893	13154	16047
1971	129	8098	8518	17745	3206	14592	17798
1972	2782	9275	11130	23187	3921	16161	20082
1973	2981	9275	11925	24844	4537	18154	22691
1974	3467	11557	13869	28893	4992	18660	23652
1975	2834	9446	11331	23651	5552	20132	25684
1976	905	17352	19624	40881	6761	28155	34916
1977	4242	14140	17334	35351	8000	30023	38023
1978	4333	14444	17334	36111	9252	28854	38106
1979	3513	11708	14050	29271	8022	21203	29225
1980	1856	14855	15427	32138	8736	25484	34220
1981	4053	13510	16214	33777	10202	26337	36539
1982	4451	14838	17805	37094	11382	28539	39921
1983	3853	12844	15412	32109	10462	26866	37328
1984	4467	10557	13868	28892	8830	23861	32691
1985	3597	11991	14380	29978	9221	23853	33074
1986	3022	10075	12091	25188	8154	22176	30330

2.6.1 TABLE 4: ROAD TRAFFIC CRASHES DATA CONTD.

SUMMARY OF REPORTED ROAD TRAFFIC CRASHES TRENDS IN NIGERIA (1960-2006)

YEAR	FATAL	SERIOUS	MINOR	TOTAL CASES	NO. KILLED	NO. INJURED	TOTAL CASUALTY
1987	3385	11286	13544	28215	7912	22747	30659
1988	607	885	680	2172	9077	24413	33490
1989	612	690	452	1754	8714	23687	32401
1990	6140	8796	6998	21934	8154	22786	30940
1991	6719	8982	6845	22546	9525	24508	34033
1992	6986	9324	6554	22864	9620	5759	15379
1993	6735	8443	6281	21459	9454	24146	33600
1994	5407	7522	5275	18204	7440	17938	25378
1995	4701	7276	5053	17030	6647	14561	21208
1996	4790	6964	4688	16442	6364	15290	21654
1997	4800	7701	4987	17488	6500	10786	17286
1998	4757	7081	4300	16138	6538	17341	23879
1999	4621	6888	4356	15865	6795	17728	24523
2000	5287	6820	4499	16606	8473	20677	29150
2001	6966	8185	5379	20530	9946	23249	33195
2002	4029	7190	3325	14544	7407	22112	29519
2003	3910	7882	2572	14364	6452	18116	24568
2004	3275	6948	4051	14274	5351	16897	22248
2005	2299	4143	2620	9062	4519	15779	20298
2006	2600	5550	964	9114	4944	17390	22334
TOTAL	151557	411308	399935	967618	292703	866939	1159642

Source: Nigeria Police/Federal Road Safety Commission

Nigeria`s poorly safety record is partly due to chaos on the street. Kabu kabu operators compete with motorists, motorcyclists, trucks, pedestrians and food vendors for scarce poorly marked road space. Conflicts occur everywhere, at all times. In operative traffic signals and missing road signs both common occurrence, do not help matters. Part of the problems also lies with escalating prices and because of shrinking real income, the reluctance (and often inability) of vehicle owners and operators to pay for basic maintenance and up

keep. As a result, over 90 percent of Nigeria's vehicle inventory is mechanically un sound –often, brakes are worn, tires are bad, turning signals don't work, headlights are burnt out, roof leak, spear tyres are missing, and muffler don't muffle. Most vehicles on the road have multiple defects. Everyone agrees that the main contributor of accident, however, is aggressive and unruly driving. Most motorcyclist and kabu kabu operators have little or no driving training. Traffic laws are routinely ignored and rarely enforced. Pedestrians and cyclist have virtually no rights. And compared to Asia and Latin America, there is relatively little internal organization or rationalization of services—queuing is disorderly as is passenger loading and unloading. Accidents occur also because many operators use drug to immunize themselves from the sun and rigors of hard work.

2.7 ACCIDENT/ SAFETY RECORDS OF PARA TRANSIT MODES IN AKURE METROPOLIS

In Akure metropolis between January2006 and July 2007 it was reported from the six stations/ unit in the metropolis (State MTD, A division, Oda division, Ijapo division and Okuta Elerinla division) on road accident.

Table 5: FREQUENCY/ PERCENTAGE OF ACCIDENT RECORD IN AKURE METROPOLIS

MODE	FREQUENCY	PERCENTAGE
Taxi / Kabukabu	24	23.26%
Private Car	29	29.07%
Buses	6	5.81%
Lorries	14	13.95%
Motorcycle	28	27.91%

Source : Ondo State Police Headquarters, Akure (2009).

Causes of Accident.

Record from Ondo state Police Headquarters, Akure shows that causes of road accident vary from excessive speed, inattention, confusion, lack of judgment, improper overtaking/ cutting in and intoxication. It is observed that motorcycle popularly known as Motorcycle is most prone to road accident due to the earlier mentioned causes, 23.26% were taxi, 29.07% were private cars, 5.81% were Buses, 13.95% were lorries and 27.91% were motorcycle. The safest modes are buses while motorcycles are the most prone to accident.Majorly, inexperience on the part of many drivers of private cars, and competition for passengers by drivers of the Para-transit modes which often results in reckless, aggressive driving and ill maintained vehicles are some of the reasons for occurrence of accidents (Owolabi, 2004).

Table 6: ACCIDENT RECORD IN RELATION TO PARA TRANSIT MODES ONLY.

MODE	FREQUENCY	PERCENTAGE
Taxi / Kabukabu	20	40.82%
Buses	5	10.20%
Motorcycles	24	48.98%

Source : Ondo State Police Headquarters,Akure (2009).

When only the para transit modes, which are just within the scope of this study, are considered as further illustrated in table 5, it is observed that buses are the safest of all the modes while motorcycles are the least safe. It should be noted that this information is based on reported accident only (Not all accident are reported to the appropriate authority for proper documentation).

2.8 SPATIAL INTERACTION SYSTEM

For planning and engineering purposes, what is of, direct relevance is the response of the trip making population to the transport system as it exists. This response is reflected in the demand for travel. It is the demand for travel within the transport system that facilities should be planned and engineered to accommodate.

In the analyses and forecasts of urban travel demand, it has become fashionable to adopt either one of zonally based techniques or the behavioural modeling.

Originally, direct demand models with a demand function of the form

$q = f(P, t)$ (where q = quantity of movement P = price t = travel time)

which was used extensively for inter city travel. As time went on, the flaws in the model were discovered namely:

- the implication that those who travel do so more because they can afford it rather than because they want to take advantage of the opportunities at the trip ends.
- besides, it was recognized that the direct demand models conceal many of the important structural dimensions of trip makers' behaviour. For instance, the interdependencies between land use and travel characteristics is not duly accounted for.(Burton, 1985).

Later on, the derived nature of travel demands was realized, hence the sequential modeling techniques evolved. Thus, trips classified into two, namely

- Non choice/business trips i.e. those affected by available opportunities at the trip ends and
- Choice/recreational trips.

The non choice/business trips are modeled using the sequential techniques discussed in subsequent sections, while the choice/recreational trips are modeled using the direct demand models. For the sequential techniques, demand analyses are undertaken in for sequential steps involving:

- Trip Generation
- Trip Distribution

- Modal Split
- Traffic Assignment

2.8.1 TRIP GENERATION

Trip generation analyses trips originating or terminating in specific parts of the urban area. This is generally facilitated by use of mathematical models examples of which are discussed below:

Trip-end generation models are concerned with the estimation of the number of trips into and out of various traffic zones. They are derived from the principle that land use generates trips, and that, for example, both the numbers and types of 'from home' trips are influenced by (a) socio-economic variables such as car ownership or availability, household income and size, occupational status, household composition (e.g. number of workers per household) (b) location variables such as population or residential density, rate able value and distance of household from the town centre, and (c) public transport accessibility variables. (This last variable is of particular importance if the modal split is to be included as part of the trip generation model; in the following discussion the modal split will be treated separately from the generation stage.)

As may be gathered from the above, the number of variables considered to exert a causal effect on trip generation can be very many. The purpose of the trip-end modeling process is to identify those, which are meaningful determinants of trip-making behaviour, and express their effects in a mathematical way so that they can be used with confidence as a predictive

tool. In general, the traffic analyst has the choice of three main methods of developing trip-end models, namely:

1. Expansion Factor method.
2. Regression Analysis method.
3. Category Analysis method.

The Expansion Factor method is mentioned here primarily to emphasize that its use is now generally out-dated in relation to trip generation in fast-changing complex urban areas. Methods of this nature, which simply place reliance upon past growth rates as a means of predicting future trips, should be confined to short-term forecasting in rural areas.

The Multiple Regression Analysis method is probably that which has been used in the majority of transport demand studies in the past. The extensive use of the 'best fit' least square method, which involves developing a linear equation of the form

$$Y = b_0 + b_1 X_1 + b_2 X_2 + \ldots\ldots\ldots\ldots b_k X_k \qquad \text{---------- (1)}$$

is primarily due to the increasing accessibility of sophisticated computer programs which, automatically and speedily, can carry out the extensive calculations required by the process. The following example from Cardiff illustrates the applicability of the method:

$$Y_w = 0.097\ X_1 - 351\ X_2 + 0.773\ X_3 + 0.504\ X_4 - 43.6 \qquad \text{---------- (2)}$$

where Y_w = zonal work trips by all modes

X_1 = population of zone

X_2 = number of households in zone

X_3 = number of employed residents in zone

X_4 = number of cars owned in zone

and -43.6 = constant

Similar equations for other types of trips were also developed so that when the various Y-values were combined $\sum Y$ gave the total number of trips associated with each zone for the year of the study. On the assumption that the relationships expressed by the various Y-equations remain stable, the future numbers of zonal trips were estimated by substituting appropriate future estimates of the independent variables.

It may be noted that the use of regression equations derived on a zonal basis has been rigorously criticized on the grounds that the models may not be stable and transferable from one area to another. Instead, it is recommended that regression equations should more properly be derived initially on a household rather than on a zonal basis; that household regression models provide a more meaningful description of the factors underlying trip-making behaviour, and yet can be easily expanded to provide zonal trip and estimates as required. Because such models are behaviorally based, their results are transferable to places with similar level of development.

In an attempt to free the traffic analyst from many of the assumptions and problems inherent in the use of multiple regression techniques, another trip-end modeling method – Category Analysis – has been developed which considers the household as the fundamental analysis unit, but assumes in this

instance that the number of trips from a household is a stable function of three main parameters: household income, car ownership or availability, and family structure. In all, the following 108 different categories of household have been defined, and each associated with a trip rate. (Table 7). The 108 different categories were obtained by variously combining the elements in each column of the table.

Table 7: HOUSE CLASSIFICATIONS ASSUMED FOR CATGORY ANALYSES OF TRIP GENERATION

Income classes, £/annum (as reported in 1967)	Ownership, cars/household	Family structure, persons/household
≤ 500	0	0 workers + 1 non-employed adult
501 – 1000	1	0 workers + ≥ 2 non-employed adults
1001 – 1500	2+	1 worker + ≤ 1 non-employed adult
1501 – 2000		1 worker + ≥ 2 non-employed adults
2001 – 2500		≥ 2 workers + ≤ 1 non-employed adult
>2500		≥ 2 workers + ≥ 2 non-employed adults

Source : (O' Flarherty, 1974)

Category analysis has some appeal as a method of predicting trip generation and/or attraction. One obvious reason for this is that it is intuitively appealing to categorize households in a given zone, both now and in the future, and associate each with an expected trip-making behaviour. More important is the fact that its usage cuts down very considerably on the amount of current home interview data which need be gathered and analyzed, since the household information required for any given urban area can be obtained directly from National Census data, while trip rates are available from previous studies (and only require sample checks in the area being considered).

2.8.2 TRIP DISTRIBUTION

Trip distribution is the process wherein generated and attracted trips distribute (i.e. find destinations) from each zone to any other zone. Three main models have so far evolved for distributing these trips. These are:

1. Growth Factor methods.
2. Gravity methods.
3. Opportunity methods.

All of the models assume that travel between any two zones is a function of both the attractiveness of the activities in the destination zones, and the resistance to travel (expressed in travel distance, time, or cost) between the generating and destination zones.

2.8.2.1 Growth Factor Methods.

Four different types of growth factor model have been developed. These are the Uniform Factor, Average Factor, Fratar, and Detroit methods.

The Uniform Factor method involves the determination of a single growth factor for the entire survey area; all existing interzonal trips are then multiplied by this factor in order to get the future interzonal flows. The expansion factor used is the estimated ratio of the total number of future trip ends to the existing total.

The Average Factor method is derived from the fact rates of development in zones are normally different from the rate for the urban area as a whole. Thus, in this version of growth factor the average growth expected at each pair of origin and destination zones is used. As might be expected, this method, as described, will not give total future flows originating and terminating in a given zone which agree with the figures derived from the trip generation model. To overcome this problem an iterative process, based on revised interzonal growth factors, must be used until an acceptable balance is achieved.

The Fratar method of successive approximations is perhaps the most widely known version of the whole lot. More complicated than the Average Factor method, it gives more rational answers, albeit at the expense of a considerable amount of computer time. A variation of the Fratar method which requires considerably less computer time is known as the Detroit method. This latter model is easiest described mathematically, viz:

$$T_{ij} = t_{ij} \frac{F_i F_j}{F} \qquad \text{---------- (3)}$$

where T_{ij} = future trips from zone i to zone j

$F_i = \underline{T_i}$ = future total trips originating at zone i

t_i existing total trips originating at zone i

$F_j = \underline{T_j}$ = <u>future total trips originating at zone j</u>

t_j existing total trips originating at zone j

$F = \underline{T}$ = <u>future total trips in the entire survey area</u>

t existing total trips in the entire survey area

and t_{ij} = existing trips from zone i to zone j = $t_i\left(\frac{t_j}{t}\right)$

Although relatively easy to understand, the Growth Factor methods are now rarely used except for short time updating of data. Major weaknesses of all the methods are that they completely underestimate growths in existing zones which are at or near zero, (even though land use may change significantly as, for example, in a growing town), while they assume that the resistance to travel between zones remains a constant into the future (even though, for example, a new motorway might be opened).

2.8.2.2 Gravity Model

The Gravity model, as an approach to trip distribution, is actually an adapted tool, having been developed in other fields, notably the telephone industry and, to a lesser extent, sociology. Its utilization is based on the premise that all trips starting from a point are pulled by various traffic generators or land uses, and that the degree of pull from each 'magnet' varies directly with the attraction of the generator and inversely with the friction (i.e. distance or travel time) over which the attraction is generated.

The general form of the gravity model used today is:

$$T_{ij} = \frac{G_i A_j F_{ij} K_{ij}}{\sum_{j=1}^{n} A_j F_{ij} K_{ij}} \qquad \text{----------} \qquad (4)$$

where T_{ij} = future number of trips from zone i to zone j

G_i = total number of trips generated in zone i

A_j = total number of trips attracted to zone j

F_{ij} = empirically derived travel friction factor, calculated on an area-wide basis

K_{ij} = empirically derived zone-to-zone compatibility factor which takes account of other socio-economic influences not included in the model (not usually necessary in towns with less than 100,000 population).

Existing-year data are used to calibrate the model, i.e. to determine appropriate values for the F- and K-factors

The Gravity model is by far the most widely used trip distribution process. As well as recognizing the gravitational 'pull' of different land uses, and changes in travel time, it can also take account the influences of differing trip purposes and responses to policy changes. What used to be its main disadvantage, the relative complexity of the iterative calibration process, is now largely overcome as a result of the development of well-established standard routines.

2.8.2.3 Opportunity Model

A major criticism often leveled at the Gravity model is that it does not take direct account of individual behaviour patterns. An opportunity model, which is derived on the basis of probability theory, assumes that as trips which are generated in zone i move away from that zone, they incur increasing

opportunities for their purposes to be satisfied at any zone j, and therefore there is an increasing probability that they will not proceed beyond zone j. Two forms of opportunity model have been well developed; the Intervening Opportunity model and the Competing Opportunity model. The difference between them relates to the manner in which the probability function utilized in the distribution equation is calculated, viz. the Intervening model requires trips to remain as short as possible and they only become longer if suitable destinations cannot be found closer to zone i, whereas the Competing model assumes that the probability of a trip from zone i stopping in zone j is independent upon the ratio of the trip destination opportunities within a given time boundary.

The basic Intervening model is expressed as

$$T_{ij} = G_i\left[e^{-LD} - e^{-L(D+D_j)}\right] \qquad \text{----------} \qquad (5)$$

where T_{ij} = future number of trips from zone i to zone j

G_i = total number of trips generated in zone i

D = total number of destination opportunities closer in time to zone i than are those in zone j

D_j = number of destination opportunities in zone j

L = probability that any given destination opportunity will be selected

The opportunity model approach has been rigorously tested in three studies in the United States, and it has been shown that, in general, the intervening opportunity model can give results of a reliability equal to that of the gravity model.

2.9 MODAL SPLIT

The general purpose of the modal split analysis is to mathematically model for the proportion of total trips that use or is expected to use each of the various modes of travel available. So far, two basic analysis approaches have been developed, viz. Trip-end and Trip-interchange models. The main difference between these two is that trip-end models are normally applied before the trip distribution phase of the study, and often as part of the trip generation process, whereas trip-interchange models allocate person-trips to different transport modes after the trip distribution process.

Trip-end models assume that the principal factors which affect modal split are the socio-economic characteristics of the traveler, e.g. income and car availability, family size and composition, etc. Regression or category analysis procedures are then used to predict the number of trip by the various modes, in a manner similar to that described for trip generation studies. Thus, for example, in the study previously described, the 108 household classifications were increased to 108 x 6 by assigning each zone a low, medium or high accessibility index which reflected its ease of access to bus or rail facilities, viz.

$$I_{Bus} = \frac{\sum_i (N_{ij})^{1/2}}{(0.39A_j)^{1/2}} \text{ and } I_{Rail} = \frac{\sum_i (N'_{ij})^{1/2}}{0.39A_j} \quad \text{----------} \quad (6)$$

where N_{ij} = off-peak frequency of buses on route i and passing through zone j

N'_{ij} = Number of trains during the off-peak period stopping at station i in zone j

and A_j = area of zone j, km^2.

In effect, trip-end modal split models assume that users are captive to the mode used.

Trip-interchange models assume that the levels of service provided by the transport systems are also major factors affecting modal split and that mode users rationally choose mades. Proxies for level of service, which have been used in various studies, include relative travel times, excess travel times, and travel costs.

A typical travel time ratio is

$$R_{TT} = \frac{t_1 + t_2 + t_3 + t_4 + t_5}{t_6 + t_7 + t_8} \quad \text{---------- (7)}$$

where t_1 is the access time (i.e. spent walking to, say, the bus stop at the trip origin); t_2 = waiting time at bus stop; t_3 = time on bus; t_4 = time spent changing from one bus to another; t_5 = egress time (i.e. spent walking from bus stop to destination); t_6 = time spent driving car; t_7 = time spent parking car at destination; t_8 = time spent walking from parked car to destination.

A typical excess travel time ratio is

$$R_{ETT} = \frac{t_1 + t_2 + t_4 + t_5}{t_7 + t_8} \quad \text{---------- (8)}$$

where t_1, t_2, t_4, t_5, t_7 and t_8 are as defined above.

A representative travel cost ratio R_{TC}, is given by

$$R_{TC} = \frac{n_f}{c_1 + c_2} \quad \text{---------- (9)}$$

where n = average car occupancy; f = fare by public transport; c_1 = cost

of fuel (petrol and oil) for car trip; and c_2 = parking cost. (Note that road tax, insurance, or maintenance costs are not included in the R_{TC} formulation as they are not taken into account by a motorist when deciding about the mode for a particular trip.)

Whichever of the above ratios (for other combinations) is selected in a particular study, the end result is the preparation of a series of multiple regression equations or diversion curves which incorporate the relevant variables and are used to predict the number of public transport trips between each pair of zones. Perhaps, the most complex modal split model so far developed involves progressing through a series of diversion curves incorporating relative travel times, relative travel costs, relative excess travel times, income of the traveler, and trip purpose, in order to determine the modal split. Another important procedure has extended regression techniques to separate groups of trip-makers into different mode users by utilizing probability techniques based on a combination of variables which related to both the journey characteristics and characteristic of the trip maker. The main advantage of the 'pure' trip-end type of model is its simplicity; its weakness is its insensitivity to the effect on the future modal split of, for example, improving specific inter-zonal travel corridors. In contrast, the trip-interchange model is much more sensitive to adjustments in the inter-zonal network, but at the cost of losing sensitivity to the effects of the trip generation characteristics. It is for these reasons that recent models have tended to try and incorporate both sets of variables in their formulations.

Another major criticism of present-day modal split models is that they are based on current levels of service, and these have a built-in bias in favor of

the private car. Thus, future estimates of public transport usage could err significantly on the low side should, for example, the bus service be significantly improved by the provision of reserved track ways in combination with a stringent parking or road pricing policy.

2.9.1 TRAFFIC ASSIGNMENT

The next stage in the travel demand analysis process is the assignment of the various modal trips to the different highway (or rail) routes within the survey area. A typical urban network assignment process might first involve an initial assignment by means of an All-or-Nothing procedure (i.e. whereby the total trips between any two zones are assigned to the path, or 'tree' with the minimum travel resistance – usually specified in terms of travel time), or by a proportional diversion procedure and then use one of a number of iterative Capacity Restraint procedures to re-distribute the traffic volumes until the situation is reached where the travel speed assumed in the calculation for each link of the network is relatively unaffected by the assignment process.

The general approach is easiest illustrated by considering the iterative procedure utilized in the Detroit Area Traffic Study. In this study, traffic was first assigned to the various links of the proposed network using the all-or-nothing approach; the speed assumed for initial assignment purposes was the free (or unrestrained) flow speed. Obviously, traffic on a network will not always operate under free flow conditions, and the speed on each link is affected by the flow; hence, each link's travel time was modified as follows:

$$T_A = T_0 e^{(v/c-1)} \qquad \text{----------} \qquad (10)$$

where T_A = adjusted travel time.

T_0 = original assigned travel time (a function of the desired operating speed, or the travel time on a link)

v = assigned volume

and c = computed capacity

The second iteration was accomplished using the new travel times to determine a new series of minimum paths or trees. The volumes so determined were then added to the results of the previous iteration, and the average link load determined. Successive iterations recalculated the T_A-value based on the model using the average link volume for the v-value until a balanced network was obtained.

Realism in traffic assignment has been an ideal long sought after by highway and traffic engineers. As with other aspects of the transport planning process, this ideal became more practical with the advent of digital computers of sufficient size to manipulate the large arrays of data required by all assignment techniques. The Detroit Transportation Study in 1958, noted above, is generally considered to be the first technique to depart from the traditional procedure of using only diversion curves. Since then a number of different techniques have been developed, each of which has some particular advantage over others. Even so, the results or answers from a traffic assignment program still require considerable examination and judgment before being applied.

In real life, a motorist selects his journey route for a variety of reasons e.g. time, distance, monetary cost, convenience, comfort and safety. In theory,

there exists in each situation an optimum route which offers the driver the best combination. Whilst much progress has been made, it cannot yet be stated with surety that the procedures available at this time are able to fully interpret the complexities of human behaviour and the dynamic ever-changing events that take place in an urban area.

CHAPTER THREE

3.1 METHODOLOGY

An inventory / assessment of existing transport terminals in Akure metropolis was undertaken to facilitate objective attainment of the study. Figure 2 shows the layout of terminals in the study area, which was used for insitu data collection. Data were collected on operational characteristics, Operators and Patrons of Para transit modes. Data relating to Operational characteristics include time of commencement, time of break, time of closing, coverage, cost of operation, cost of maintenance, sustainability of operation, profitability, accident / safety records, Government involvement in the operations. Other information on operational characteristics includes the body / association that control each mode, roles of each association, roles of government, the type and nature of assistance required from government.

In situ data collection complemented by domiciliary interviews through questionnaire was adopted. To achieve this, information cards, which were completed under interviewers' supervision, were given to operators, Organizations and the law enforcement agents. The questionnaires employed are in the Appendices. The in situ assessment made it easier for interviewers to obtain some facts that were not on the information cards but also useful for the research.

Information obtained from operators include their age, sex, marital status, educational background, professional Status, nature of vocation, years of experience, daily income, ownership of modes and the number of operators per mode.

Personal interview, roadside interview were adopted for obtaining information from operators, this was done at their terminals and garages. For Taxis on flexible routes which do not have fixed loading terminals, In- vehicle interview and domiciliary interview were resorted to.

Data collected from Patrons include their Residential address, Place of work, Sex, Age, Occupation, Employment Status, Income, Trip origin and destination, Time of making the trip, Purpose of the trip, mode used in making trips, Reason(s) for choice of the mode, modal preference and the service rating. Some patrons especially of taxis on a fixed route, Keke Napep and buses were interviewed personally while some prefer the use of information cards, these methods were found more appropriate because there was sufficient loading time for the interviewers to obtain information.

However, for Patrons of Motorcycle and taxis on flexible route, domiciliary and workplace interview were used, the reason for this approach was that most of the patrons were better interviewed at leisure in their home or during break time in their offices when they were less busy.

3.1 SAMPLE SIZE

Bureau of Public Roads (1954) and O'flaherty (1974) suggested sample sizes for conducting home – interview Origin – Destination (O-D) Studies. The recommended sample sizes are shown in Table 8.

TABLE 8: **RECOMMENDED SAMPLE SIZE FOR CONDUCTING HOME-INTERVIEW O-D STUDIES**

Urban Population	Sample Size
< 50,000	1 in 5 dwelling units
50,000 - 150,000	1 in 8
150,000 – 300,000	1 in 10
300,000 - 500,000	1 in 15
500,000 - 1000,000	1 in 20
> 1000000	1 in 25

SOURCE: (O'FLAHERTY, 1974).

Using the 2006 population figure of 353, 211 and a growth rate of 4%, the projected population of Akure for year 2016 was estimated as 522,838. This was assumed to be the population of patrons, The projected population of operators based on data collected at the terminals and union office is approximately 26,000(which is less than 50,000). The estimation was based on equation (11), (Barclay, 1958).

$$P = P_0 (1 + r)^n \quad \text{----------} \quad (11)$$

Where

n = number of years of projection

r = (assumed as 4% per annum)

P_0 = population size at time zero

P = projected population at a time, n years later

Considering the projected population a sample size of 1 in 5 i.e. (5%) was adopted for the operators, while 1 in 10 i.e. (10%) was adopted for the patrons to ensure wider coverage, since the projected population was at the lower limit of the 1 in 15 sample size range (Table 8).

3.3 SAMPLING PROCEDURE

In order to achieve the sample size of 1 in 10 dwelling units for patrons information on the number of households in land use areas of the study site was obtained.

Table 9 gives the breakdown of the approximate number of households in the land use areas (zones) of Akure metropolis and the number of households interviewed. Every 10th household on each street was interviewed in all the zones. Out of approximately 22,760 households in Akure metropolis (Lucas, 1999, Owolabi, 2004), 2276 households were interviewed.

In order to achieve the target sample size, repeated visits had to be made to some of the households.

The administered questionnaires were retrieved and sorted for the purpose of summarizing and analyzing the information obtained.

TABLE 9: APPROXIMATE NUMBER OF HOUSEHOLDS IN LAND USE AREAS OF AKURE METROPOLIS

LAND USE AREA	APPROXIMATE NUMBER OF HOUSEHOLDS	GROWTH FACTOR	APPROXIMATE NUMBER OF HOUSEHOLDS	NUMBER OF HOUSEHOLDS INTERVIEWED
Low residential	1200	3	3600	360
Medium residential	4974	1.5	7461	746
High residential	4197	1	4197	420
Commercial	2478	1	2478	248
Transport/Recreation	986	1.5	1479	148
Educational	697	1.5	1046	105
Industrial	738	2	1476	148
Military	228	1.5	342	34
Public	448	1.5	672	67
TOTAL	**15946**		**22760**	**2276**

(SOURCE: LUCAS, 1999)

coverage,operation cost, cost of maintenance and daily profit are shown in figures 4, 5, 6 and 7 respectively for the modes.

TABLE 10: OPERATIONAL CHARATERISTICS OF PARA TRANSIT MODES IN NIGERIA

MODES	TIME OF COMMENCEMENT	TIME OF BREAK	TIME OF CLOSING	TIME OF BREAK
Motorcycle	5-6.30 a.m.	2-3 p.m.	7-8 p.m.	2-3 p.m.
Keke Napep	7-8 a.m.	When not in turn	6-7 p.m.	When not in turn
Kabukabu	5-6 a. m.	When not in turn	7-8 p.m.	When not in turn
Taxi(Flexible)	5-6 a.m.	1-2 p.m.	8-9 p.m.	1-2 p.m.
Buses	5.30 a.m.	When not in turn	7-8 p.m.	When not in turn

Field survey 2009.

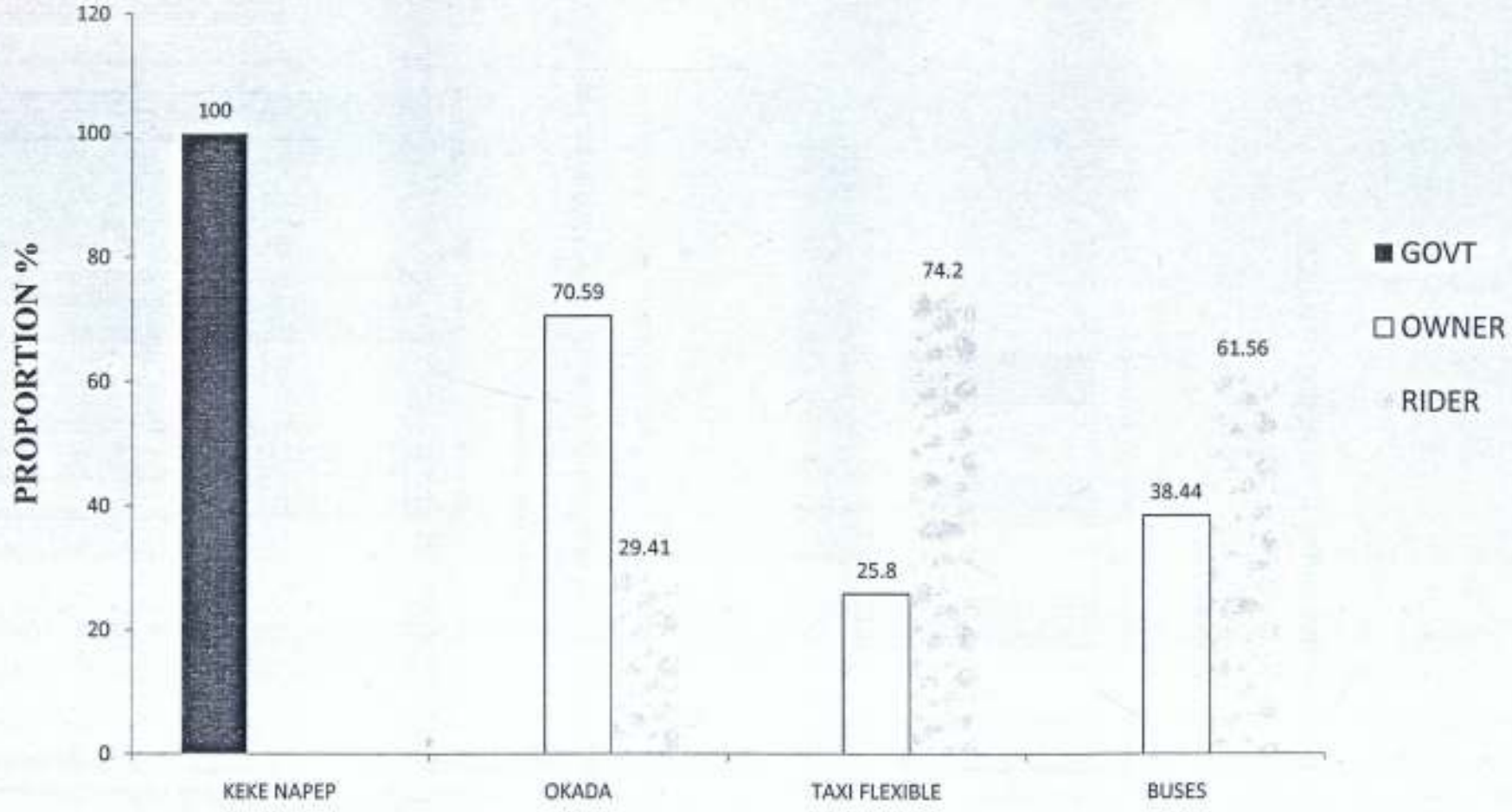


FIG 3: OWNERSHIP OF PARATRANSIT MODES

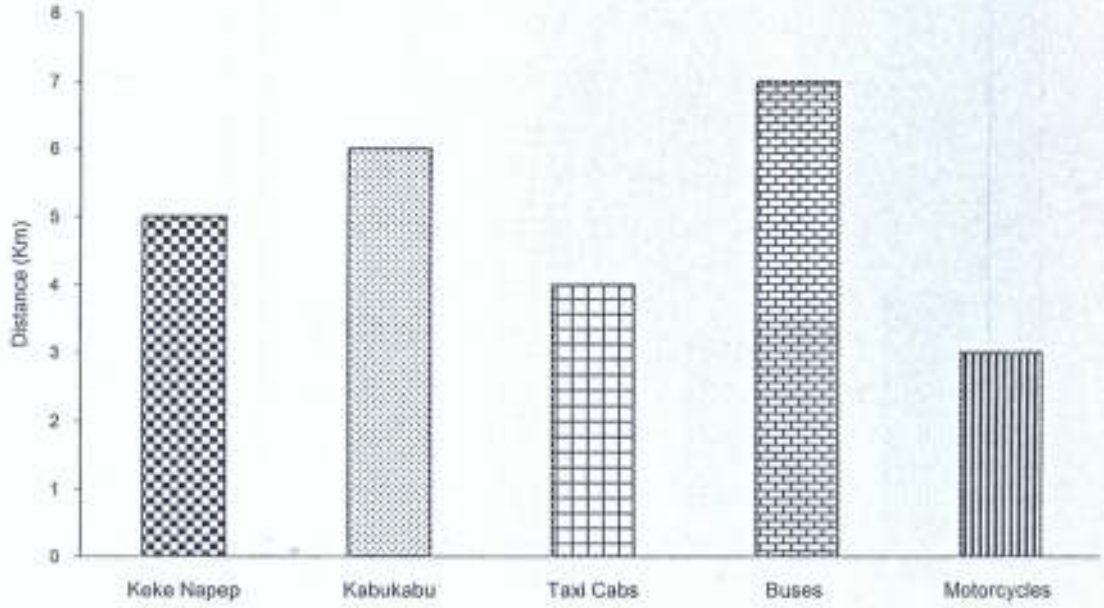


Figure 4: Average Coverage

Buses cover the longest distance of 8km, while the coverage for motorcycles, taxi cabs, keke napep and kabukabu are 3km, 4km, 5km and 6km respectively.

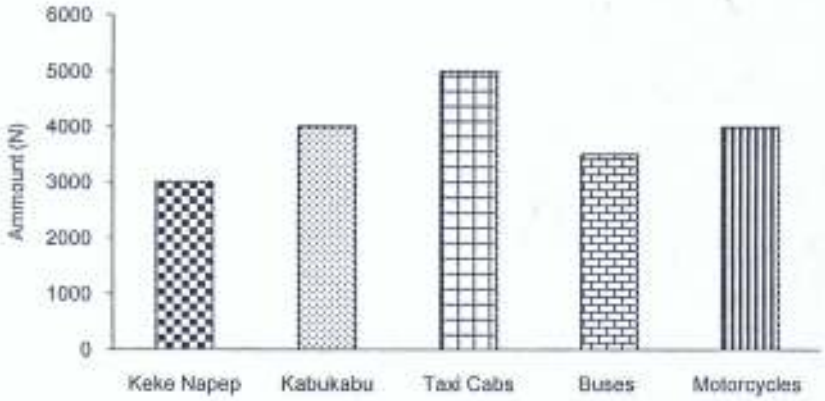


Figure 5: Operation Cost

Operational cost for these modes ranges from N3000 to N5000.

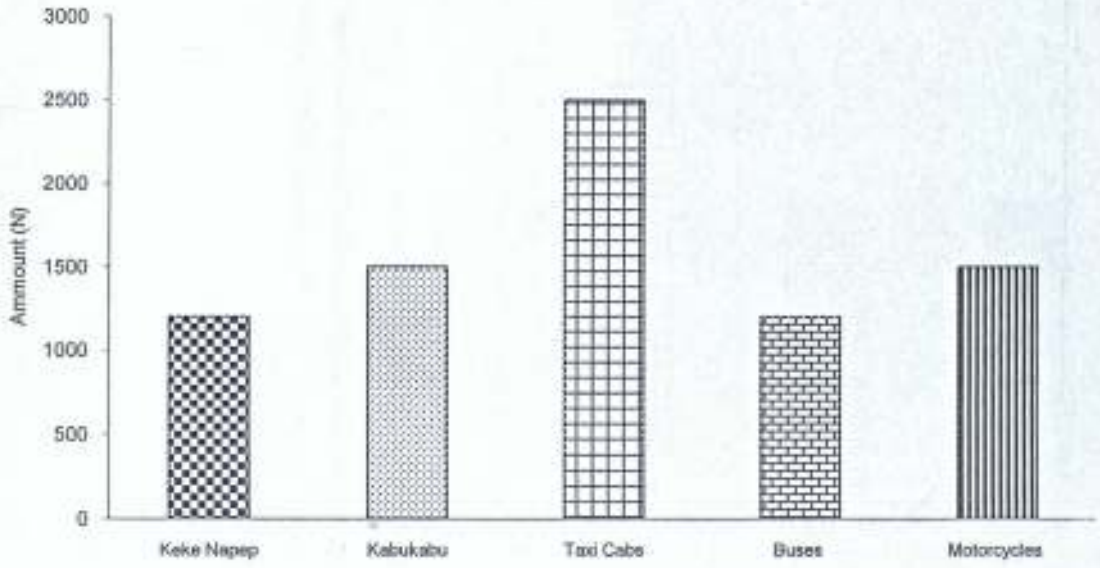


Figure 6: Cost of maintenance

Average cost of maintenance of taxi cabs is ₦2500, while those of motorcycle, keke napep, buses and kabukabu are ₦1500, ₦1200, ₦1200 and ₦1500 respectively.

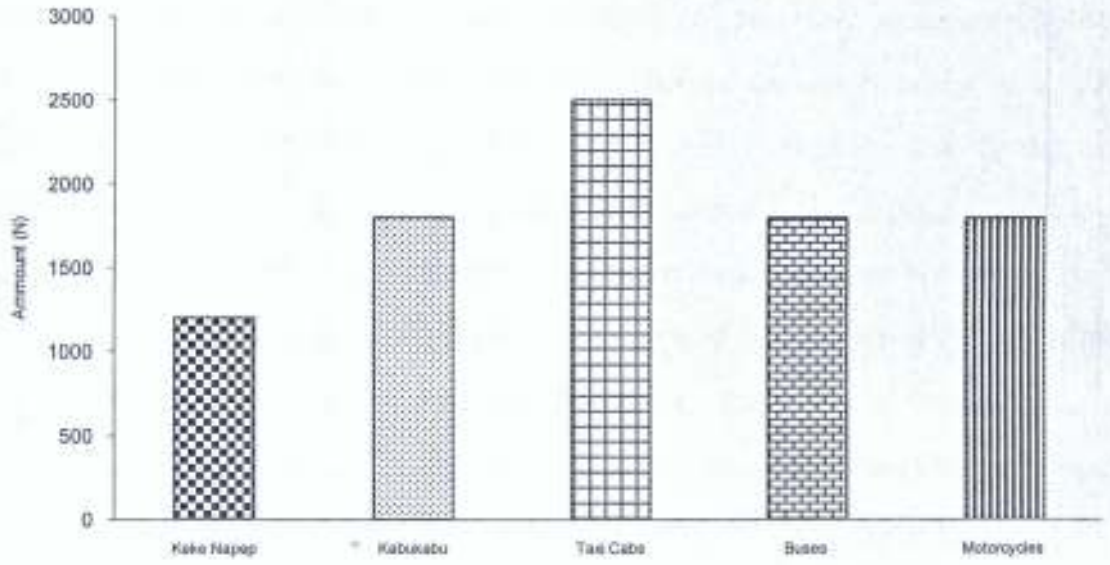


Figure 7: Daily Profit

Average daily profit for taxi cabs is ₦2500, while those of kabukabu, buses, motorcycle are N1800. On the other hand, average daily profit for keke napep operation is N1200.

4.2 CHARACTERISTICS OF OPERATORS OF PARA - TRANSIT MODES IN AKURE METROPOLIS.

Operators of para-transit modes in Akure are all male who joined the business in order to either earn a living or supplement their income. Motorcycle and taxi operators on flexible route are mostly young people, while most kabukabu and buses' operators are older people. Some operate on full time while others operate on part time basis (the part time operators include those that resumes operation after government work), a higher percentage of both Kabukabu and buses operates on full time, because most of them don't have any other means of survival. Operators of buses' are the most experienced among others, while

operators of taxi cabs and kabukabu are quite experienced. However operators of motorcycle were found to be majorly inexperienced. Hence, the reason why safety / accident record show that Motorcycle is most prone to accident. Effective hours per operator are generally between 5 and 8 hours. Since there are taxi on flexible route, operators that are depending on this vocation for their living, have a mutual agreement for handing over which is mostly 1.00pm or as otherwise agreed upon by the operators. Operators of these modes are semi – literate as shown in the table, some of them had been either masons (bricklayers), welders, auto mechanics, or involved in auto businesses e.t.c . Socio- economic attributes like age, gender, marital status, professional status and educational status has an effect on the operational characteristics of these modes.

From the survey, more young people find commercial motorcycles business attractive. Despite reasonable gain that accrues to this job, only few of the operators would like to transfer transport business to their children, they rather wish they pursued their education. These characteristics are further illustrated in the table 11 below.

TABLE 11: CHARACTERISTICS OF OPERATORS OF PARA-TRANSIT MODES IN AKURE METROPOLIS

MODE	SEX	MARITAL STATUS		AGE				NATURE OF VOCATION		YEARS OF EXPERIENCE						OWNERSHIP OF MODE			NO OF OPERATOR	
	MALE	SINGLE	MARRIED	20-30	30-40	40-50	50-60	FULL TIME	PART TIME	<1	1-2	2-4	4-5	5-10	>10	GOVT	OWNER	RIDER	ONE	TWO
OKADA	100	60.7	39.28	60.71	28.6		10.7	47.1	52.94	29	11.8	41.2		17.6			70.59	29.41	82.4	17.7
KEKE NAPEP	100		100		70	30		60	40		40	60				100			80	20
TAXI FLEXIBLE	100	29.03	70.96	32.26	51.6	16.1		74.2	25.8	9.7		48.4		25.8	16.12		25.8	74.2	58.1	41.9
TAXI FIXED	100		100	2.78	42.8	47.2	7.22	81.1	18.89	2.2	20.2	37.8		19	20.83		21.85	78.15	77.4	22.6
BUSES	100	10.66	89.23	18.31	39.5	28.6	13.6	82.3	17.73	1.5	3.33	19	2.5	11.5	62.18		38.44	61.56	60.7	39.3
	EDU. BACKGROUND AND PROF. STATUS																			
	PRY SCH.	SEC SCH.	MODERN SCH.	TECH	N.C.E	B.Sc	REWIRE	MECHANIC	P. BEATER	OTHERS										
OKADA	15.38	15.38		7.69	15.4	11.5	1.26	10	2.62	20.75										
KEKE NAPEP	35.4	28.57	14.29				9.38	10.57	1.79											
TAXI FLEXIBLE)	12.5	42.5		2.5	12.5	7.5	2.5	5		15										
TAXI FIXED	15.88	18.76	16.17	2.86			2.7	7.23	1.59	34.81										
BUSES	28.69	34.87	8.42	1.79	2.5	2.5		11.19		10.04										

Source: Field data: 2007.

4.3 CHARACTERISTICS OF PATRONS OF PARA – TRANSIT OPERATION IN AKURE METROPOLIS

Table 12 illustrates the characteristics of patrons of para – transit modes in Akure metropolis. From the table, it is observed that female patronize these modes more than male, the main reason for the higher percentage is that most of the male patrons go about their business in their private cars and most senior civil servants gets to work by means of their Private cars, hence the reason why overall percentage for the senior civil servants is relatively low. However, for para transit modes with fixed stops, and terminals e.g. Buses and Kabukabu, all categories of the partrons do make use of them because they are easily available and cheaper, more importantly because there are no alternatives. Those who patronize motorcycles do so because of its ability to penetrate suburbs where other modes would not reach, despite the fact that motorcycles at times is costly and is the most unsafe of all the modes patrons still make use of them because it is readily available and that there are no alternatives for them. Patrons of taxicabs that plies flexible route do patronize them also because it is easily available and comfortable. On the overall, majority of the patrons of all these modes do so either because they are readily available, comfortable and cheaper, due to lack of alternatives, most of their patrons do not consider safety in choosing the mode perhaps because there is no alternative.

TABLE 12: CHARACTERISTICS OF PATRONS OF PARATRANSIT MODE IN AKURE METROPOLIS

MODE	SEX		AGE					OCCUPATION						
	M	F	<20	20-30	30-40	40-50	50-65	Traders	Student	Private workers	Jnr. Staff	Snr. Staff	Farmers	Others
Okada	33.33	66.67		8.33	71.67	20		54.99	21.67		15.00			8.34
Keke Napep	41.67	58.33		25	33.33	25	16.67	25.00	31.25		31.25		11.11	1.39
Taxi (Flexible route)	16.67	83.33	10.15	36.10	28.21	23.08	2.46	33.05	21.40	11.61	19.64	11.61	1.49	1.20
Taxi (fixed route)	33.20	66.80	5.92	23.54	39.96	28.36	2.22	20.91	21.46	1.59	34.45	1.58	3.44	16.57
Buses	22.78	72.22	20.00	13.33	40.00	26.67		55.56	16.67	16.67	5.56			5.54

FACTORS AFFECTING CHOICE OF MODE

	Income / Mouth					Reasons for Choice						Mode Preferred			
	<3,500	3,500-5,000	5,000-10,000	10,000-20,000	>20,000	Readily Available	Cheaper	Safer	Faster	Door step services	Comfortable convenient	Okada	Taxi	P. car	K. Napep
Okada	26.67	38.33	23.33	11.67		5.01	1.67	13.32	25.00	51.67	3.33	33.33	33.33	15.16	18.18
Keke Napep	30.00	37.00	33.00			66.67	33.33					36.36	20.53	43.11	-
Taxi (Flexible route)	18.85	4.95	59.10	15.95	1.15	31.40	2.47		35.70	-	30.43		26.92	73.08	-
Taxi (fixed route)	23.74	26.87	34.92	13.28	1.19	60.21	18.86	14.50	4.58	1.85		10.53	46.83	42.64	
Buses	25.35	24.78	33.33	15.22	1.32	31.25	62.50	6.25	-	-	-	-	60.00	40.00	-

SERVICE RATING

	Time of making Trip				Service Rating			
	Morning	Evening	Not regular	Not Specific	Excellent	Good	Fair	Not sure
Okada	46.44	49.99	3.57	-	3.33	51.67	3.33	41.67
Keke Napep	37.50	50.00	12.50			9.10	90.90	
Taxi (Flexible route)	41.74	45.22	13.04	-		61.54	38.46	
Taxi (fixed route)	35.27	26.38	38.35	-	6.83	19.31	73.86	
Buses	44.44	44.44	11.12	-		71.43	28.57	

Source: Field Data.

CHAPTER FIVE

5.1 DESIGN OF OPERATIONAL SCHEDULE FOR PARA- TRANSIT MODES.

5.1.1 Design of operational schedule for para- transit modes using projected volume of person trips.

Inventory of existing operational schedule was taken, as illustrated in table 13, which consist of existing loading terminals, modes having terminals within the route, origin of trip ,destination of trip, numbers of vehicles in fleet, other modes plying each of the route, existing time schedule, modes proposed for the route and proposed time schedule. Judging from existing travel demand, proposal has been made to cater for demand for goods and persons in the study Area. The proposed schedule has taken into consideration additional mode as appropriate alongside the number in fleet for each mode and the time schedule of operation.

Table 13: Operational Schedule for Para-transit Modes

S/N	LOADING TERMINALS	MODES	ORIGIN OF TRIP	DESTINATION OF TRIP	NUMBER IN FLEET	VOLUME OF PERSON TRIPS VOLUME = (C . T . N)	PROPOSED NUMBER IN FLEET $Pr = P_o(1 + r)^{Py}$	PROPOSED VOLUME OF PERSON TRIPS VOLUME = (C . T . Pn)	MODE PROPOSED FOR THE ROAD	PROPOSED TIME SCHEDULE
1	Army barrack junction	Okada	Barrack gate		27	540	40	800	27 okada 4 buses	5.30 a.m-7p.m 6a.m-7p.m
2	Ajipowo junction	Okada	Junction	All Ajipowo road network	35	700	52	1040	35 okada 5 buses	5.30 a.m-7p.m 6a.m-7p.m
3	Gbangbalogun	Okada	Gbangba-logun junction	To all Oke Aro surburbs, hospital road, oluwatuyi, NEPA, old garage.	27	540	40	800	27 okada 4 buses	5.30 a.m-7p.m 6a.m-7p.m
4	Ayeyemi/ Ayegunle	Kabu-kabu	Ayeyemi/ Ayegunle	Idanre Garage Ondo road	15 14	900 840	22 21	1320 1260	15 buses 7 kabukabu 14 okada	6a.m-7p.m ,5.30 a.m-7p.m 5.30 a.m-7p.m
5	Post office junction	Okada	From the junction	Oke-Aro	14	280	21	420	14 okada 2 buses	5.30 a.m-7p.m 6a.m-7p.m

C = Vehicular capacity, T = Number of Trips/ day, N = Number in fleet, Pr = Projected number, Po = Present number r = Growth factor, Py = Projected year, Pn = Proposed number in fleet

Table 13: Operational Schedule for Para-transit Modes

S/N	LOADING TERMINALS	MODES	ORIGIN OF TRIP	DESTINATION OF TRIP	NUMBER IN FLEET	VOLUME OF PERSON TRIPS VOLUME = (C . T . N)	PROPOSED NUMBER IN FLEET $Pr = P_o(1 + r)^{Py}$ FLEET	PROPOSED VOLUME OF PERSON TRIPS VOLUME = (C . T . Pn)	MODES PROPOSED FOR THE ROAD	PROPOSED TIME SCHEDULE
6	NEPA junction	Okada Kabukabu Bus Keke Napep	NEPA	Oda, federal secretariat, Igbatoro, Cocoa board, Ilado	68 12 14 12	1360 720 980 900	101 18 21 18	2020 1080 1470 1350	50 okada 30 buses 5govt mini buses 22 kabukabu 18 keke napep	6a.m-7p.m, 6a.m-7p.m 7 a.m – 9 a.m; &2p.m -6 p.m 5.30 a.m-7p.m 7a.m – 7 p.m
7	Bata	Bus	Post office, Oja Oshodi	Lafe inn, Oke-Ogba, FUTA	7 10	490 700	11 15	770 1050	11 buses 15 buses	6a.m-7p.m 5.30 a.m-7p.m
8	First bank Alagbaka junction	Okada	First bank junction	NEPA, Igbatoro, Alagbaka road network secretariat	32	640	48	960	30 okada 5 government mini buses	5.30 a.m-7p.m 7 a.m – 9 a.m; 2p.m -6 p.m

C = Vehicular capacity, T = Number of Trips/ day, N = Number in fleet, Pr = Projected number, Po = Present number r = Growth factor, Py = Projected year, Pn = Proposed number in fleet

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9	TEXACO (Iromu junction)	Okada Bus Kabukabu	TEXACO (Iromu junction)	Arakale, Odundun, Irowo youth centre, all the Arakale road network, Oba ile	28 12 12	560 840 720	41 18 18	820 1260 1080	25 okada 23 buses 18 kabukabu	5.30 a.m-7p.m 6 00a.m-7p.m 6a.m-7p.m
10	Adedeji junction	Okada Bus Kabukabu	Adedeji junction	Oke-Aro, NEPA,Danjuma, Isinkan, Idanre garage	40 13 24	800 910 1440	59 19 36	1180 1330 2160	30 okada 27 buses 24 kabukabu	5.30 a.m-7p.m 6 00a.m-7p.m 6a.m-7p.m
11	Isikan	Okada	Isikan market	Isikan,danjuma, Oba Adebobajo, Ondo road, health centre Danjuma	28	560	41	820	20 okada 6 buses	5.00a.m – 9p.m 6a.m-7p.m

C = Vehicular capacity, T = Number of Trips/ day, N = Number in fleet,. Pr = Projected number, Po = Present number r = Growth factor, Py = Projected year, Pn = Proposed number in fleet

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12	Champion junction	Okada	From the junction	Fanibi, Adinlewa, Tutugbua, Isikan, Ondo bye-pass	15	300	22	440	15 okada 3 kabukabu	5.30 a.m-7p.m 5.00a.m – 9p.m
13	Awule road	Okada	Ilesha garage	Lafe, Ondo road, Awule road network	14	280	21	420	14 okada 3 kabukabu	5.30 a.m-7p.m 5.00a.m – 9p.m
14	Agagu road	Okada	Ilesha garage Lafe inn	Oke Ogba,Aule, Ondo road, Oke Ogba road network	12	240	18	360	10 okada 3 kabukabu	5.30 a.m-7p.m 5.00a.m – 9p.m
15	Stateline junction	Okada Tricycle	From the junction	Stateline, Alaba road network	12 2	240 150	18 3	360 225	12 okada 3 buses 2 tricycle	5.30 a.m- 7p.m 7.00 a.m – 7p.m 6 00a.m-7p.m
16	Ijare road block	Okada Kabu-kabu	Road block	Orita-Obele, ilere,Oke odu Alejolowo, Ikota	14 7	280 420	21 11	420 660	10 okada 3 buses 7 kabukabu	5.30 a.m-7p.m 6. 00a.m-7p.m 6.00am- 7pm

C = Vehicular capacity, T = Number of Trips/ day, N = Number in fleet,. Pr = Projected number, Po = Present number r = Growth factor, Py = Projected year, Pn = Proposed number in fleet

Table 13: Operational Schedule for Para-transit Modes

S/NO	LOADING TERMINALS	MODES	ORIGIN OF TRIP	DESTINATION OF TRIP	NUMBER IN FLEET	VOLUME OF PERSON TRIPS VOLUME = (C . T . N)	PROPOSED NUMBER IN FLEET $Pr = P_o(1 + r)^{Py}$	PROPOSED VOLUME OF PERSON TRIPS VOLUME = (C . T .N)	MODE PROPOSED FOR THE ROAD	PROPOSED TIME SCHEDULE
17	Leo junction	Okada	From the junction	Adegbola, all road network	13	260	19	380	13 okada 2 buses	5.30 a.m-7p.m 6 00a.m-7p.m
18	Adegbola junction	Okada	From the junction	Adegbola,	15	300	22	440	13 okada 2 buses	5.30 a.m-7p.m 6 00a.m-7p.m
19	Stadium junction	Okada	Stadium junction	Oja oba, stadium,Isolo, Araromi, oja Oshodi e.t.c	15	300	22	440	10 okada 4 buses	5.30 a.m-7p.m 6 00a.m-7p.m
20	Oja Oshodi	Okada	Junction	Odo ikoyi, stadium road, isolo, Araromi	17	340	25	500	15 okada 3 buses	5.30 a.m-7p.m 6 .00a.m-7p.m
21	Araromi junction	Okada	Araromi junction	Maronu market, Araromi, high school, stadium road, Osukoti layout	56	1120	83	1660	25 okada 8 buses	5.30 a.m-7p.m 6 00a.m-7p.m

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22	Odo-ikoyi	Bus Kabukab Okada	Odo-ikoyi	Osukoti layout,Onyerug bulemu market, shagari village, high school	12 11 15	840 660 300	18 16 22	1260 960 440	20 okada 17 kabukabu 20 buses	6 .00a.m-7p.m 6 .00a.m-7p.m 5.30 a.m-7p.m
23	Isolo	Bus Okada	Isolo	Maronu round-about, new stadium,osukot	12 21	840 420	18 31	1260 620	18 buses 21 okada	6 .00a.m-7p.m 5.30 a.m-7p.m
24	Ijomu/Oke ijebu	Okada Kabukab	From the junction	Express, Oke-Ijebu,Abibiri, Ado garage, Ijapo road network	60 12	1200 720	89 18	1780 1080	30 okada 17 buses 12 kabukabu	5.30 a.m-7p.m 6 00a.m-7p.m 6 .00a.m-7p.m
25	Sacred heart	Okada	From the junction	Ondo road, Arakale, tipper garage	13	260	19	380	19 okada Buses	5.30 a.m-7p.m 6 00a.m-7p.m
26	High school vulcanizer	Bus Okada	Araromi junction	High school, express	8 87	560 1740	12 129	840 2580	50 okada 35 buses	6 .00a.m-7p.m 5.30 a.m-7p.m

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27	High school (express)	Bus Okada	Araromi junction	High school road express	6 29	420 580	9 43	630 860	22 buses	6 .00a.m-7p.m
28	Onyerugbulem	Okada	From the junction	Shagari village radio, Irese, new stadium	17	340	25	500	3 buses 5 kabukabu	6 .00a.m-7p.m 6 .00a.m-7p.m
29	Old garage	Kabu-kabu Okada	From the junction	Oke-Aro, Idanre road, Idanre garage, new town	24 21	1440 420	36 31	2160 620	30 buses 10 kabukabu	6 .00a.m-7p.m 5.30 a.m-7p.m
30	State hospital	Okada	From the hospital	Araromi, uloro, NEPA, Oluwatuyi, Idanre road, Oshinle	56	1120	83	1660	30 okada 15 buses	5.30 a.m-7p.m 6 00a.m-7p.m
31	First bank oja	Bus Okada	From the junction	Ijoka, Abusoro, Oluwatuyi, Davog, Sunday bus stop	8 13	580 260	12 19	840 380	8 buses 7 kabukabu	5.30 a.m-7p.m 6 00a.m-7p.m

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32	Danjuma	Okada Bus	From the junction	Oke-aro, Idanre road, oja oba, cathedral, Araromi, Gbangbalogun, Arakale road	17 13	340 910	25 19	500 1330	32 okada 20 buses	5.30 a.m-7p.m 6 00a.m-7p.m
33	Alakure junction	Okada	From the junction	Sijuwade, NEPA, Oluwatuyi, Ala quaters, Idi-agba	11	220	16	320	11 okada	5.30 a.m-7p.m
34	Fanibi junction	Okada	From the junction	Ondo road, Fanibi axis, Adinlewa, bye-pass	14	280	21	420	21 okada	5.30 a.m-7p.m
35	Tofas	Okada	Tofas	Inner axis of Danjuma	26	520	38	760	15 okada 7 buses	5.30 a.m-7p.m 6 00a.m-7p.m
36	Kolawole health centre	Okada	Junction	Arakale, Oke-aro titun, Isikan, Odole, Oke-aro	13	260	19	380	13 okada 2 buses	5.30 a.m-7p.m 6 00a.m-7p.m

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37	Odole	Okada	Odole	Idanre road, gbangbalogun, Oke-aro, Irowo, Arakale	44	880	65	1300	44 okada 6 buses	5.30 a.m-7p.m 6 00a.m-7p.m
38	Alafiatayo	Okada	Alafiatayo junction	Idanre road, Iloro market, all over surburbs of oke aro	21	420	31	620	20 okada 3 buses	5.30 a.m-7p.m 6 00a.m-7p.m
39	Oshinle	Okada	Oshinle junction	Oshinle, Olusoga, Dayo Ige, Igbo church	41	820	61	1220	30 okada 9 buses	5.30 a.m-7p.m 6 00a.m-7p.m
40	Oluwatuyi/Ijoka	Okada	Oluwatuyi Ijoka road	Sunday bus stop,Sijuwade, NEPA, Oshinle	56	1120	83	1660	30 okada 15 buses	5.30 a.m-7p.m 6 00a.m-7p.m
41	Odopo/Sunday	Okada	Ijoka road	Sunday b/stop, Sijuwade, NEPA, Oshinle	56	1120	83	1660	30 okada 15 buses	5.30 a.m-7p.m 6 00a.m-7p.m

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42	Alajeseku/ Abusoro	Okada	Ijoka road	Inner road network of Ijoka ,Sunday b/stop, Sijuwade, NEPA, Oshinle	41	820	61	1220	25 okada 10 buses	5.30 a.m-7p.m 6 00a.m-7p.m
43	Sijuwade road network	Okada	Sijuwade	Ijoka, Idi-agba titun investment, Oluwatuyi, Ala road network	14	280	21	420	14 okada 5 buses	5.30 a.m-7p.m 6 00a.m-7p.m
44	Ala	Okada	Ala	Ijoka, Ala all over the Oluwatuyi, Idi agba titun investment	18	360	27	540	20 okada 2 buses	5.30 a.m-7p.m 6 00a.m-7p.m
45	Secretariat	Okada	Alagbaka	Alagbaka/ Oda, Igbatoro	44	880	65	1300	25 okada 10 buses	5.30 a.m-7p.m 7 a.m – 9 a.m &2p.m -6 p.m

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45	Central bank	Okada	Alagbaka	Alagbaka, NEPA, Owo garage	18	360	27	540	18 okada Buses	5.30 a.m-7p.m 7 a.m – 9 a.m;
47	Oke-Eda	Okada		Alagbaka	21	420	31	620	20 okada 3 buses	5.30 a.m-7p.m 6 00a.m-7p.m
48	Oke-Aro/irowo	Okada	Irowo,Idanre road,Oke-Aro	Inner oke-aro,Araromi	38	760	56	1120	30 okada 7 buses	5.30 a.m-7p.m 6 00a.m-7p.m
49	Ibi-press	Okada	Health centre, Oke-aro	Arisoyin, fadaka,oba Adegbola	27	540	40	800	20 okada 6 buses	5.30 a.m-7p.m 6 00a.m-7p.m
50	Igbalaye	Okada	Idanre road	Igbalaye road network	50	1000	74	1480	30 okada 13 buses	6 00a.m-7p.m 6 00a.m-7p.m

C = Vehicular capacity, T = Number of Trips/ day, N = Number in fleet, Pr = Projected number, Po = Present number r = Growth factor, Py = Projected year, Pn = Proposed number in fleet

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51	Idanre garage	Okada	Idanre garage	Idanre road network, oba Afunbiowo	58	1160	86	1720	20 okada 18 buses	5.30 a.m-7p.m 6 00a.m-7p.m
52	Road block(Idanre road)	Okada	Road block	Oba Afunbiowo, Adofure etc	37	740	55	1100	15 buses	6 00a.m-7p.m
53		Okada	Oke arata	Gbangbalogun, Irowo axis, Arakale, Oke-aro	37	740	55	1100	20 okada 10 buses	5.30 a.m-7p.m 6 00a.m-7p.m
54		Okada	Igboliki	Arakale, NEPA, Oke-aro, hospital etc	20	400	30	600	20 okada 3 buses	5.30 a.m-7p.m 6 00a.m-7p.m

C = Vehicular capacity, T = Number of Trips/ day, N = Number in fleet.

Pr = Projected number, Po = Present number, r = Growth factor, Py = Projected year, Pn = Proposed number in fleet

The operational schedule have been designed to eliminate motorcycle and tricycle on the main trunk or express way in the metropolis, rather they are to serve as feeders to main trunk by conveying patrons from internal /suburbs to the nearest terminals available, where patrons can make use of other modes for their trip. More buses should be provided at Oluwatuyi/ Ijoka. Buses should be introduced at Odopo / Sunday,Alajeseku/ Abusoro,Sijuwade road network, Ala, Oke aro/ irowo, Ibi press, Igbalaye, Idanre garage and roadblock in order for it to cater for the needs of patrons.The number of buses to be introduced on each route has been indicated in Table 13.Buses are well suited for existing road network of these areas. It should be observed that some modes are introduced at some junctions e.g First Bank (serial number 8 on table 13) and Secretariat (serial number 45 on table 13), government mini transit buses have been recommended at the peak periods of the day because most patrons are civil servants who make their trip between 7 a.m to 9 a.m; and 2 p.m to 6 p.m . The schedule has shown clearly where there is need for additional, reduction or elimination of modes to existing number of vehicle in fleet. It should be noted that time frame stipulated above for the operation of these modes are the official time. Any operation after such time is at the operator's risk and discretion.

5.2 DESIGN OF PARA TRANSIT SCHEDULE USING TRAVEL DEMAND ANALYSIS.

The Detroid growth factor was used to design an alternative operational schedule. The study area was divided into eight zones. Inter-zonal person trips were estimasted,the design of schedule was based on the volume of trips between zones in the metropolis.Table 14 shows the interzonal volume of person trips within the metropolis.The study area was divided into eight zones

based on residential density to facilitate summary of data, the areas making the zones are as follows:

Zone 1: Leo, Adegbola, Oloko junction, Awule, Agagu, Ijare axis.

Zone 2 : Stadium road, Araromi, Odo ikoyi, Isolo,Oja osodi, Sacred heart, High school, Shagari axis, Onyearugbulem.

Zone 3: Ijapo road, Ijomu, Oke – Ijebu, Texaco, First bank (market) axis.

Zone 4: Futa road,Champion, Ondo bye –pass, National Bank, Owode, Stateline junction, Fanibi axis.

Zone 5: Isikan, , Old garage, Palace road, Bata, Adedeji road.

Zone 6: Nepa,Oda road,Ayeyemi/Ajegunle, State hospital, Odole, Alafiatayo,Oshinle, Secretariat,CBN,Oke eda.

Zone 7: Army barrack, Ajipowo, Danjuma axis, Gbangbalogun, Isikan, Tofas, Kolawole,Oke aro, Iro, Ibi press, Igbalaye, Idanre garage, Road block.

Zone 8: Oluwatuyi,Ijoka,Odpo/ Sunday,Abusoro/ Alajeseku, Sijuwade, Ala axis. (see figure 2)

TABLE 14 INTER ZONAL VOLUME OF PERSON TRIPS.

ZONES	1	2	3	4	5	6	7	8
$t_{ij}b$	110	727	445	56	641	589	513	185
F_i, F_j	1	2	1.5	2	2	2	3	3

Legend:

Using the Detroid growth factor method, $T_{ij} = t_{ij}b \times F_iF_j / F$.

T_{ij} = Projected volume of person trips,

$t_{ij}b$ = Volume of person trips for the base year,

F_i, F_j = Growth factor for each zone,

F = Average growth factor.

The volume of person trips were estimated based on the in- situ data collected at the terminals (Table 13, column 6;(number in fleet). Using the number in fleet and summing up for the areas covered by each zone, the summary is presented in table 14, which makes up the data for the base year. The table include growth factor for each zone which is based on the potential for development. Detriod growth method of trip distribution was used to thesis the volume of person trips. The result of projection is presented in table 15 alongside the required mode.

TABLE 15 INTERZONAL TRIP EXCHANGES AND PROPOSED MODES

From	1	2	3	4	5	6	7	8	∑ of ij
1	-	55 *2B*	55 *2B*	110 *2B*	55 *2B*	165 *2K,1B*	165 *3B*	165 *3B*	**770** *14B,2K*
2	364 *3 B* *3K*	-	364 *3B* *3K*	364 *3B* *3K*	364 *3B* *3K*	727 *3B* *3GB* *5K*	1091 *3GB* *5B* *9K*	1091 *3GB* *5B* *9K*	**4365** *9GB* *25B* *35K*
3	334 *2 B* *4 K*	223 *2B* *2K*	-	334 *2B* *4K*	223 *2B* *2K*	668 *5B* *6K*	668 *5B* *6K*	668 *5B* *6K*	**3118** *23B* *30K*
4	56 *2B*	28 *1B*	28 *1B*	-	28 *1B*	56 *2B*	84 *2B*	84 *2B*	**364** *11B*
5	321 *2B* *3K*	321 *2B* *3K*	321 *2B* *3K*	321 *2B* *3K*	-	962 *5B* *10K*	962 *5B* *10K*	962 *5B* *10K*	**4170** *23B* *20B*
6	295 *2B* *3K*	295 *2B* *3K*	295 *2B* *3K*	442 *3B* *4K*	295 *2B* *3K*	-	442 *3B* *4K*	884 *5B* *9K*	**2948** *19B* *29K*
7	257 *2B* *2K*	257 *2B* *2K*	257 *2B* *2K*	257 *2B* *2K*	257 *2B* *2K*	385 *3B* *3K*	-	770 *5B* *7K*	**2440** *18B* *20K*
8	93 *2B*	93 *2B*	93 *2B*	93 *2B*	93 *2B*	185 *1B* *2K*	278 *2B* *3K*	-	**2440** *18B* *20K*
∑i	**1720** *15 B* *15 B*	**1272** *13B* *10B*	**1413** *14B* *11K*	**1921** *16B* *16K*	**1315** *13B* *10K*	**3326** *20B* *28K* *3 GB*	**3690** *27B* *32B* *3GB*	**4624** *30B* *3GB* *41K*	**928** *13B* *5K*

Modes Legend

B = Bus, K = Kabukabu, GB = Government Mini Bus.

It would be noted that for all intra zonal trips, the motorcycle mode has been recommended to facilitate commuting where as the mode has been excluded from the main trunk connecting various zoning for safety reasons. This scheduling has adopted macro approach and versatile for global appraisal of transit operations in the metropolis, while the first method is micro and versatile for individual linkage.

CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS.

6.1 CONCLUSION.

The operational characteristics of para – transit modes in Akure metropolis had been analysed, the cogent indices of metering include: time of commencement of operation, time of break, time of closing, coverage, cost of operation, cost of maintenance, sustainability of operation, profitability, accident / safety records, Government involvement, body / association that control each mode, roles of government, the type and nature assistance required from government for operations. Age, Sex, Marital Status, Educational background, Professional Status, Nature of vocation, Years of experience, Daily income, Ownership of modes and the number of operators, Residential address, Place of work, Sex, Age, Occupation, Employment Status, Income, Trip origin and destination, Time of making the trip, Purpose of the trip, mode used in making trips, Reason(s) for choice of the mode, modal preference and the service rating.Results of analyses have been presented in tables and figures as previously discussed. The results and analyses have been used to design schedule for para – transit operation in the metropolis. This work provides a data base on operational characteristics of para – transit modes in the study area, which extrapolated to cover similar cities in developing world. The operational schedule can also be used as a model for other cities with related problems.

6.2 RECOMMENDATIONS.

The designed operational schedule aimed at ameliorating the problems of commuting in the metropolis undertaken in this work should be adopted and put to use by the relevant agencies.

Further to this work, comprehensive modeling of the operational characteristics of para – transit modes in the study area should be carried out beyond those exemplified in this work.

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APPENDIX I

Federal University of Technology, Akure
Department of Civil Engineering

Akinwumi D. O.
M. Eng. Research

TOPIC: ASSESSMENT OF OPERATIONAL CHARACTERISTICS OF PARA – TRANSIT MODES IN AKURE METROPOLIS

This is a questionnaire designed for a post graduate research on the above topic. All information shall be treated as confidential.

QUESTIONNAIRE

(A) To Be Answered by Operators of Para – transit modes

1. Location _____

2. Name of Respondent _____

3. Address (Residential) _____

4. Age range below 20 ☐ 20 – 30 ☐ 30 – 40 ☐ 40 – 50 ☐ 50 – 65 ☐ above 65 ☐

5. Sex Male ☐ Female

6. Marital Status Single ☐ Married ☐

7. Status / Educational Background
Primary School ☐ Modern School ☐ Secondary School ☐ Technical College ☐ National Diploma /NCE ☐
B.sc/HND and above ☐

8. Professional Status Artisan, Bricklayer ☐ Rewire ☐ Carpenter ☐ Panel Beater ☐ Welder ☐ Vulcanizer ☐ Tailor
Barber ☐ Others ☐

9. Nature of Vocation Part Time ☐ Full Time ☐

10. How many Operators use your mode including yourself One ☐ ☐ Two

11. Years of Experience of Operators Less than 1 year ☐ 1 – 2years ☐ 2 – 4 years ☐ 5years to 10 years ☐ Above 10 years ☐

12. Hazard associated with your job _____

13. Accident Experience / Records Date Location cause(s)

1.

2.

3.

4.

5.

14. Problems with Law Enforcement Agents _____

15. Ownership of modes Government ☐ Rider ☐ Client (Owner) ☐

16. Gross daily income Below N3,500 ☐ N3,500 –N5,500 ☐ N5,500-N7,500 ☐ N7,500-N10,000 ☐ N10,000-N15,000 ☐ N15.000-N20,000 ☐ Above N20,000 ☐

17. Net daily income (Excluding expenditure / delivery) Below N3,500 ☐ N3,500-N5,500 ☐ N15,500-N7,500 ☐ N7,500 - N10,000 ☐ N15,000 - N20,000 ☐ Above N20,000 ☐

APPENDIX II

Federal University of Technology, Akure
\Department of Civil Engineering

Akinwumi D. O.
M. Eng. Research

TOPIC: ASSESSMENT OF OPERATIONAL CHARACTERISTICS OF PARA – TRANSIT MODES IN AKURE METROPOLIS

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QUESTIONNAIRE

(B) OPERATIONS

1. Time of Resumption / Commencement_____
2. Time of break_____
3. Time of closing_____
4. Nature of Operation Full day ☐ Half day ☐ During Government Work ☐ After Government work ☐
5. Coverage(Origin – Destination) _____
6. Distance in Kilometer_____
7. Maintenance / Frequency of maintenance Daily ☐ Weekly ☐ bi-weekly ☐ Monthly ☐ Quarterly ☐ Annually ☐

8. Daily / Weekly running cost (Underline as Appropriate) Below N1,000 ☐ Between N1,000 and N2,000 ☐ Between N2,000 and N4,000 ☐ Between N4,000 and N5,000 ☐ N5,000 and above ☐

9. Cost of maintenance Below N1,000 ☐ Between N1,000 and N2,000 ☐ Between N2,000 and N4,000 ☐ Between N4,000 and 6,000 ☐ N6,000 to N10,000 ☐ N10,000 and above ☐

10 For how long do you intend to continue the job? 1year ☐ 2year ☐ 3 to 5years ☐ 6 to 10years ☐ for a life time ☐

11. Would you like to transfer the job to your children or relatives Yes ☐ No ☐

12. Do you gain, lose or break even during your daily Operations Gain Lose ☐ Break even ☐

APPENDIX III

Federal University of Technology, Akure
Department of Civil Engineering

Akinwumi D. O.
M. Eng. Research

TOPIC: ASSESSMENT OF OPERATIONAL CHARACTERISTICS OF PARA – TRANSIT MODES IN AKURE METROPOLIS

This is a questionnaire designed for a post graduate research on the above topic. All information shall be treated as confidential.

QUESTIONNAIRE

C) PATRONS

1. Where do you live? _____
2. Place of work (address) _____
3. Sex Male ☐ Female ☐
4. Age range Below 20 ☐ 20-30 ☐ 40-50 ☐ 50-65 ☐ Above 65
5. Occupation _____
6. Employment status Senior staff ☐ Junior staff ☐ Proprietor ☐ Others ☐
7. Income per month Below N 3,500 ☐ N 3,500- N5,500 ☐ N5,500- N7,500 ☐ N7,500- N10,000 ☐
   N10,000- N15,000 ☐ N15, 000- N20, 000 ☐ above N20, 000 ☐
8. Destination of daily trips _____
9. When do you make your trips? _____

10. Purpose of Trip Work ☐ Market ☐ Church ☐ Mosque ☐ Recreation ☐

11. By what mode (s) Taxi ☐ Private car ☐ Kabukabu ☐ Okada ☐ Keke Napep ☐

12. Reason (s) for choice of Mode Readily Available ☐ Cheaper ☐ Faster ☐ Renders door step services ☐

Comfortable/ Convenient ☐ Safer ☐

13. Which mode (s) do you prefer most? Taxi ☐ Private car ☐ Kabukabu ☐ Okada ☐ Keke Napep ☐

14. What is your rating of service delivery? Excellent ☐ Good ☐ Fair ☐ poor ☐ Not Sure ☐

APPENDIX IV

Federal University of Technology, Akure
\Department of Civil Engineering

Akinwumi D. O.
M. Eng. Research

TOPIC: ASSESSMENT OF OPERATIONAL CHARACTERISTICS OF PARA – TRANSIT MODES IN AKURE METROPOLIS

This is a questionnaire designed for a post graduate research on the above topic. All information shall be treated as confidential.

QUESTIONNAIRE

(D) ORGANIZATION AND REGULATIONS

1. Name of the Organization NURTW ☐ ACCOMORAN ☐ RETAN ☐ Ondo State Taxi Driver CMU ☐
2. Transport mode under your Organization Taxi ☐ Private Care ☐ Kabukabu ☐ Okada ☐ Keke Napep ☐
3. Roles of the Association _____
4. Roles of the Government _____
5. Motives of Association _____
6. Motives of Government (is it to help the Association/public or otherwise) _____
7. Opinion of Government on operation of Para transit mode in Akure metropolis? _____
8. Type & nature of assistance required from Government _____

(E) LAW ENFORCEMENT AGENTS

(1) Opinion of Law Enforcement Agent on Operation of Para transit mode in Akure Metropolis? _____