PUBLIC PATRONAGE OF HIGH CAPACITY BUSES IN THE FEDERAL CAPITAL TERRITORY ABUJA, NIGERIA

By

Chibueze Daniel OKERE, B-Tech (FUT Minna) 2010
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A THESIS SUBMITTED TO THE SCHOOL OF POST GRADUATE STUDIES, AHMADU BELLO UNIVERSITY, ZARIA NIGERIA, IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTER OF SCIENCE IN TRANSPORT MANAGEMENT

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DECLARATION

I declare that the work in this thesis entitled **Public Patronage of High Capacity Buses in The Federal Capital Territory Abuja, Nigeria** has been performed by me in the Department of Geography under the supervision of Dr. I.J Musa and Professor J.A Ariyo. The information derived from the literature has been duly acknowledged in the text and a list of references provided. No part of this thesis was previously presented for another degree or diploma at this or any other Institution.

OKERE CHIBUEZE DANIEL

....

Name of Student Signature Date

CERTIFICATION

This thesis titled **"Public Patronage of High Capacity Buses in The Federal Capital Territory Abuja, Nigeria"** by **Chibueze Daniel OKERE** meets the regulations governing the award of the degree of Master of Science (Transport Management) of the Ahmadu Bello University, and is approved for its' contribution to knowledge and literary presentation.

Dr. I.J Musa
.... Date.....
Chairman, Supervisory Committee (Signature)

Professor J.A Ariyo
.... Date.....
Member, Supervisory Committee (Signature)

Dr. I. J. Musa
.... Date.....
Head of Department (Signature)

Prof. A. Z. Hassan
.... Date.....
Dean, School of Postgraduate Studies (Signature)

DEDICATION

To God Almighty for His unexplainable grace that has made me thus far and His help in making this research a reality.

To Elder Henry O. Okere (my dear father) and memory of Late Mrs. Joy Okere (my loving mother)

To my wife, Mrs. Agnes Okere

To God's Dear Princess, Sarah Consolation Ima-Obon Chimereya CHIBUEZE (Our daughter)

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ABSTRACT

The study examines public patronage of high capacity bus services in the Federal Capital Territory as provided by two licensed operators (Abuja Urban Mass Transit Company and FABREM). Four routes were selected representing three external and one internal bus route. The study was conducted by using two set of questionnaires: one for the heads of operations of the operators and the other for the commuters. A total number of 395 questionnaires were used for the study, as completed by the commuters selected randomly on the four routes. Data were analyzed using descriptive statistics, correlation and principal component analysis. The study revealed that 54.9% of the commuters depend on public high capacity bus services daily to meet their mobility need of which 37.9% use the service mostly in the mornings and evenings. That despite the phobia to board high capacity buses as a result of the security challenge in bus parks the volume of passengers at most times outweighs the offered seat capacity. Correlation analysis reported frequency of bus service ($r=.439$, $p > .05$), and bus provide short travel time ($r=.455$, $p>.05$) are the top two service variables that correlate with patronage. This was further subjected to principal component analysis which revealed that accessibility to bus services, in bus comfort and availability of bus services explained 61.8% of the total variance. The study concluded that accessibility to public high capacity bus services has a strong influence on commuters' patronage and need a higher attention to improve, given the residents dependence on public high capacity bus services.

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CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Transport makes possible an increased spatial interaction for the purpose of exchanging ideas and goods which increase productivity (Solanke, 1994). The desire of people to move between activity areas either regularly or occasionally at reasonable cost and time, as well as with some assured level of safety and comfort makes transport one of the most pervasive activities in any society or economy (Hoyles and Knowles, 1992). This gave rise to several mobility needs of the people which they seek to meet by public transport services. More also the ever increasing population in our urban centers demanding for this service has made the provision of public transport service a necessary programme of any government.

Public transport is therefore considered as a means for carrying passengers and goods either by private vehicles or public carriers, for hire to earn money (Adeniji, 1984; 1993; Badejo, 1993). It is a basic service which enhances spatial relation between locations which provide diversified activities, economic vitality, and socially sound conditions. Public transport is therefore crucial for a city to function efficiently. Public transit also called public transport, mass transit and urban transit includes various transport services available to the general public including vanpools, buses, trains, ferries, and their variations (Litman, 2010).

The advantages of public transport are many; amongst them are, its effective use of space, more energy efficient, emit less air borne pollutants, minimize the amount of land used for transport purposes including parking and generally result in better physical

environment in urban areas (Hilling, 1996). Banisten (1998) noted that it has also proved to be an effective tool in combating congestion. According to Lucas (2004); Currie, Stanley and Stanley (2007), public transport is increasingly recognized as a key contributor to improved social cohesion in cities. The provision of adequate public transport services is one of the most important components for the well-being of growing and expanding urban areas (Murray, Davis, Stinson, and Ferreira, 1998). Because of the numerous advantages of public transport, governments in various countries of the world invest heavily in public transport (Aderamo, 2010).

However, the mere provision of public transport service and infrastructure will not itself fulfill public transportation needs. Transit service is unlikely to be utilized as a mode of travel if there is lack of access to the service and the system is not available to potential transit riders. Therefore, access to transit service is an important measure in the study of transportation system (Mamun, 2011). Ross (2000) defines accessibility as the ease of reaching some destinations and may include real or perceived costs in terms of time or money, distance travelled, level of comfort, availability and reliability of public transport or any combination of these. Similarly, Hugh, Adrian, David and Kel (2010) identified some accessibility parameters of the transport service to include service quality like reduced travel time and walking distances, frequent and reliable services, comfort, appropriate fares which commuters demand.

Kittelson and Associates Inc. (2003) considered three primary component of accessibility to include (i) trip coverage – travelers would consider public transit accessible when it is available to and from their trip origin/destination, (ii) spatial coverage – travelers would consider public transit accessible when it is within

reasonable physical proximity to their home/destination, (iii) temporal coverage – a service is accessible when service is available at times that one wants to travel. He further identified another key aspect of public transit service to be comfort. As a result, there is need to assess and quantify public transportation access from passenger point of view considering the three aspects of transit accessibility- spatial coverage, temporal coverage and comfort/convenience (Mamun and Lownes, 2010).

The attempt to develop public transit accessibility index has been discussed in several studies since 1950s and continues to receive growing attention in transit sector (Schoon, McDonald and Lee, (1999). Among them is The Time-Of-Day tool developed by Polzin, Pendyala, and Navari, (2002) which considers both spatial and temporal coverage at trip ends. In addition to the inclusion of supply side temporal coverage, the tool explicitly recognizes and considers the demand side of temporal coverage by incorporating the travel demand time-of-day distribution on an hourly basis. The parameters considered by this tool include; service coverage, Time of Day, waiting time, service frequency and demographic data.

The transport system in Abuja, the Federal Capital Territory (FCT), caters to more than 1.5 million people and faces numerous and significant challenges, efforts of the federal government to improve the system notwithstanding (Ali, 2014). The complex and heterogeneous traffic pool, largely dominated by private vehicles, most of which are poorly maintained and inadequate enforcement of traffic rules in Abuja creates serious and unbearable congestion and heavy pollution of the city environment (Chung 2010). This situation is further compounded by the dwindling efficiency of service delivery of public high capacity bus transport services. To improve access to the public high

capacity bus transport system in Abuja, it is important to elicit insights from actual passengers of the system about changes they would like to see to better meet their mobility needs.

1.2 Statement of the Research Problem

Studies in the area of urban transportation confirmed that more than 75 percent of population in cities depended on public transport while about 25 percent depended on private transport system (Ogunbodede, 1990; Ogunjumo, 1986; Okpala, 1981 and Mrakpor, 1986). Abley, Chou and Douglass (2008), National Travel Survey reported that people travel to work by private transport because 48 percent feel that their vehicle is faster, 33 percent accounts for unavailable / inaccessible public transport while 26 percent that public transport is problematic. Similarly Jacylin (2010), noted that after the establishment of Rapid Kuala Lumpur and Rapid Penang in year 2004 and 2007 respectively, the two main commercial and industrial hubs in Malaysia to revamp the ailing public bus transport service that there is not much difference in the utilization rate and the public transport ridership for the entire nation is merely 16 percent. The Researcher further noted that the suspected reasons for the under - utilization rate are the poor performance and inaccessibility of services.

According to Olateru and Odufuwa (2007) in their study of the provision of public transportation services in tertiary institutions noted that it was often characterized by inefficiency, low quality and quantity, unaffordability, inaccessibility and unreliability. The culminating effects of these are: frequent overcrowding of available convectional public transport at peak periods, prolonged travel and waiting time by commuters and lack of safety in travel.

According to Niyonsenga (2012) the capacity of available buses for Public Transportation are becoming more and more inadequate in providing the required services in the face of growing demand, while Public Transport is the mainstay of most commuters. The Researcher further noted that due to the limited extent of public transport route network, newly developed parts of the city are deprived of public transport service, and people have to walk long distance to access bus stops.

Adetunji (2013) was of the view that due to acute shortage of transport services in the city especially early in the morning when commuters are commuting to work places and later in the evening when returning home, they struggle to board buses.

Nwaogbe, Ukaegbu and Ibe (2013) in their study of The Quality of Mass Transit Service in Abuja: An Analysis of Customers Opinions reported that 60 percent of the respondents said that urban mass is not available all the time, 32 percent get seat once in two trips while 43 percent waiting time for buses was more than 15 minutes.

The study of Nwaogbe, Ukaegbu and Ibe (2013), failed to examine the availability and capacity of public high capacity bus services against the rate of utilization during peak periods. Moreover the study was conducted when the total ban of mini buses along the major high traffic routes in The Federal Capital Territory has not been implemented which has further increased the commuters demand for public high capacity bus transport services especially at peak hours which often fail to cope with the demand.

However despite an increased interest in public high capacity bus transport services, it is surprising that so little empirical research has actually been conducted from commuters'

perspectives in Federal capital Territory and these knowledge gaps necessitated the need for this study.

1.3 The Research Questions

The research seek to provide answers to the following as regard the patronage of public high capacity buses by the commuters in Federal Capital Territory;

1. What is the nature of service operations of the various operators?
2. What is the volume of passengers that use the public high capacity buses against the service provided by the operators?
3. What is the service coverage of the bus routes network?
4. What is the passengers' view of the Public high capacity bus services dispatched in various routes?

1.4 Aim and Objectives of the Study

The aim of this study is to assess the public patronage of high capacity buses in Federal Capital Territory. The specific objectives are to:

i. determine the service coverage of the public high capacity bus service routes
ii. examine the nature of service operations of the licensed operators
iii. determine the volume capacity utilization of the public high capacity buses
iv. assess the user-perception of the quality of the service being rendered by the high capacity public buses.

1.5 Justification of the Study

Public transport is seen as a public service and should provide service levels that comply with the public demand (Sochodho and Nahry, 2006). The benefits of public transport will be realized by having an adequate public transport system which provides good service everywhere in a city at all times (Gwillian, 2002).

Olateru and Odufuwa (2007) noted that growing number of empirical studies have shown that public transport in Nigeria cities is not effective. Similarly, Aderamo (2010) noted there is general shortage of public transport service in Nigeria relative to the demand. As a result, much impact of the advantages of public transport system has not been felt.

Moreover, given the high population growth and rapid urban expansion in Federal Capital Territory, it becomes needful to provide better public bus transport service that meets the different mobility needs of commuters to all activity areas both during peak and off peak periods to maintain ridership. This is because commuters demand and expectations are changing in today's world. The findings of the study will suggest to public high capacity bus transport service operators for suitable strategies development in an effort to provide better service and maintain sustainable public transport system in the Federal Capital Territory.

1.6 Scope of the Study

The study covered the availability and capacity of public high capacity bus services in The Federal Capital Territory by the two licensed operators namely; AUMTCO and FABREM during the peak periods on the dedicated routes, the demand for the services, the operations of the operators and the passengers view point about the services

provided. The study was limited to peak periods because peak hour traffic study is particularly useful in that it provides most important information concerning maximum traffic loads imposed upon the bus services and as such relates to the capacity analysis and design for future services.

CHAPTER TWO

CONCEPTUAL FRAMWORK AND LITERATURE REVIEW

2.1 Introduction

This chapter focuses on literature review and conceptual framework related to accessibility of public transportation services for sustainable transport development; with the view of providing a framework for this study. It sheds light on the consideration of service coverage, service frequency and time of the day travel demand for public transport services and the improvement of public transport service resulting to increased accessibility and thus sustainable public transport.

2.2 Conceptual Framework

2.2.1 Concept of Accessibility

Accessibility is a slippery notion and one of those common terms that everyone uses until faced with problem of defining and measuring it, hence many definition from different backgrounds and inclinations (Makri and Folkesson, 1999). It is a commonly used concept in the field of transportation planning, urban planning and geography yet there seems to be no standard definition. Specifically even in the field of transportation, the definitions and uses of accessibility vary considerably. Murray, Davis, Stimson and Ferreira (1998) stated that accessibility is the suitability of the public transport network to get individuals from their system entry point to their system exit point location in a reasonable amount of time. Thus, accessibility encompasses the operational functioning of a system for regional service accessibility. Ingram (1971) stated that accessibility may be defined as inherent characteristics of a place with respect to overcoming some form of spatially operating sources of friction like time or distance. As a result it is not just ability to overcome space but the ease with which one reaches destination merit for its own sake (Tseu, 2006). Accessibility is the ease with which any land – use activity can be reached from a location using a particular transport system (Dalvi and Martin,

1976). According to Schoo, Mc Donald and Lee (1999), accessibility measure people's ease and convenience of reaching public transit services. Geurs' and Ritsema van Eck's (2001) opined that, accessibility consists of four components. The transport component is concerned with measures such as travel time, cost and effort of movement in space. The land use component measures the spatial distribution of activities or opportunities, and contains an assessment of the competitive nature of demand for activities at destinations, and of supply of potential users. The temporal component examines the time constraints users experience for their activity patterns, and the availability of activities or opportunities according to the time of the day, week or year. The individual component investigates the needs, abilities and opportunities of transport users and thus takes in socio-economic and demographic factors. Accessibility is one of the most important aspects of public transportation system studies (Mamun, 2011).

2.2.2 Public Transit Accessibility

Accessibility has been recognized as one of the most important factors that affects transit use. Similarly Larwin (1999) noted that to improve public transit usage both access and service quality have to be improved. In public transit planning, access to the service and accessibility provided by the service are two very important issues (Murray, Davis, Stimson and Ferreira, 1998). Access is the ease with which people can reach the transit stops while accessibility is the suitability of the transit system in helping people get to their destination in a reasonable amount of time. Transit accessibility refers to the ability of travelers to reach transit facilities including bus stops and/or rail stations (Zhao, Li, and Chow, 2002). Adetunji (2013) observed that many of the urban residents are less accessible to public transport services. Besides, the service delivery of public transport operators is less satisfactory to the urban commuters in Nigeria. Among reasons for improving the accessibility of public transport services includes; improved

perceived quality of service leading satisfied passengers and enable services for wider range of passengers at all times of the day. Considering accessibility indicators the purpose of a public transport system is not mobility per se, but rather access to activities by public transport (O'Sullivan, Morrison, and Shearer, 2000).

2.2.3 Public Transit Accessibility Measures

The increasing concern in the public transit sector has been the adequate assessment of access to transit service. Mamun and Lownes (2011) posited that measures of transit accessibility are important in evaluating existing transit services, allocating transportation investments, and making decisions on land development.

According to Fu and Xin (2007) several past studies have made considerable progress on developing service indices to measure transit quality of service. Similarly, Mamun (2014) was of the view that many transit accessibility metrics exist reflecting the various perspectives of their developers and advocates. Generally these metrics are constructed from a combination of service characteristics and physical proximity to public transit service. To varying degrees they characterize the ease of access to the service with regard to spatial coverage and therefore have been recognized as an important tool for improving the quality of transit service. With respect to spatial coverage, a service is accessible when a large proportion of the population lives within a reasonable walking distance of a public transit station while with temporal coverage a service is accessible when its available at times customers want to travel.

Among the transit accessibility measures are; Rood (1998) developed an index called Local Index of Transit Availability (LITA). This index measures the transit service intensity or transit accessibility in an area by integrating three aspects of transit service,

as route coverage, frequency, and capacity. In other words, LITA is able to comprise spatial availability, temporal availability, and comfort and convenience at the same time. Hillman and Pool (1997) developed the Public Transportation Accessibility Level index to measure the access availability to the public transit network. Florida DOT introduced a new quality-of-service measure called Transit Level of Service indicator which is defined as the percentage of time that an average person can use the transit service (Kittelson & Associates and URS, Inc. 2001). All of these transit accessibility measures have been designed to reflect differing points of view. See 2.1

Table 2.1: Summary of Transit Accessibility Measures

Study/ Paper	Type of Measure	Reflecting Local Accessibility		Reflecting Network Accessibility	Incorporated Accessibility Measure(s)	Important Feature	Computational Complexity	Intended Users
		Spatial Coverage	Temporal Coverage					
Polzin et al. (2002)	Time-of-Day tool (Index)	Yes	Yes	No	Service Coverage, Time-of-Day, Waiting Time, Service Frequency, Demographic data.	Time-of-Day Trip Distribution	Transportation Specialist	Transit Planner
Rood (1998)	LITA (Grade)	Yes	Yes	Yes	Service Frequency, Vehicle Capacity, Route Coverage.	Comfort and Convenience	Little Technical Skill	Property Developer
Schoon et al. (1999)	AI (Index)	No	No	Yes	Travel Time, Travel Cost	Travel Cost	Little Technical Skill	Transit Planner Transit User
TCQSM (2003)	LOS	Yes	Yes	No	Service Frequency, Hours of Service, Service Coverage, Demographic data.	LOS Concept	Some Technical Skill	Transit Operator Transit User
Hillman and Pool (1997)	PTAL (Index)	Yes	Yes	Yes	Service Frequency, Service Coverage	Agg. Travel Time between O-D pairs	Transportation Specialist	Transit Planner Transit Operator
Fu et al. (2005)	TSI (Index)	Yes	Yes	Yes	Service Frequency, Hours of Service, Route Coverage, Travel time components	Weighted Travel Time	Some Technical Skill	Transit Operator
Ryus et al. (2000)	TLOS	Yes	Yes	No	Service Frequency, Hours of Service, Service Coverage, Walking Route, Demographic data	Availability & quality of Pedestrian Route	Transportation Specialist	Transit Planner Transit Operator
Currie et al. (2004)	Supply Index & Need Index	Yes	Yes	Yes	Service Frequency, Service Coverage, Travel time, Car Ownership, Demographic data.	Transport Needs Measure	Some Technical Skill	Transit Planner Transit Operator Property Developer
Bhat et al. (2006)	TAI & TDI (Index)	Yes	Yes	Yes	Access distance, Travel time, Comfort & parking, Network Connectivity, Service Frequency, Hours of Service, Vehicle Capacity.	Transit Dependency Measure	Transportation Specialist	Transit Planner Transit Operator Transit User

Source: Adapted From Mamum and Lownes, 2011.

However, Mamun and Lownes (2010) were of the view that a customer demand-oriented methodology incorporating the three important categories of accessibility measures (i.e., trip, spatial coverage, and temporal coverage) might be the best for

measuring the quantity and quality of service. Therefore, a public transit performance measure which integrates trip coverage with spatial and temporal coverage provides a more powerful and practical description of transit quality of service (Mamun, 2014) which The Time-of-Day tool is one of the measures that considered the above.

2.2.4 Time of the Day Accessibility Tool

The Time-of- Day-Based Transit Accessibility Analysis Tool developed by Polzin, Pendyala and Navari (2002) is an example of a transit accessibility measure that incorporates temporal and spatial coverage into a single measure. This study suggested that both the supply and demand dimensions of temporal coverage are important for evaluating transit accessibility. The supply side of temporal coverage measures includes service frequency, time span of service, service headway, etc., while the demand side measure of temporal coverage considers the importance of service provided in each time period of the day. Service frequency (vehicle runs per hour) is used to measure the supply side and the time-of-day travel demand distribution is incorporated to measure the demand side (Mamun, 2014).

2.2.4.1 Bus Service Coverage

One of the main problems in designing bus transit services is to provide appropriate service coverage, and particularly to determine how far outward to extend transit routes into low density suburbs (Lazar, Maria and Athanassios, 1993). System availability was explained in terms of service coverage, which measures the area within walking distance of transit service. Coverage exists if transit service is provided at the transit

stop level. Service coverage is a measure of the area within walking distance of transit service. It is solely an area measure and it does not provide a complete assessment of transit availability. At the transit stop level, coverage exists if transit service is provided at that location. According to Mistretta, Goodwill, Gregg, and DeAnnuntis (2009), service coverage measures the extent to which the defined service area is being served. Service coverage is commonly measured by the percentage of the population that resides within ¼ mile walking distance of a bus stop. It is generally accepted that a user will walk a ¼ mile to reach a bus stop to use the service.

TCQSM defined the area covered by a particular route as the air distance within 400 m of a bus stop or 800 m of a busway or rail station. Similar to the previous, the transit level-of-service (TLOS) indicator developed by Ryus et al. (*2000*) assumes that people within a 5 minute or ¼ mile walk of a stop/station have access to that stop. According to Grava (2002) one can expect a local bus service to attract travelers within a ¼ mile of a bus stop, whereas light rail can attract travelers within ½ mile. Polzin, Pendyala and Navari (*2002*) used a ½ mile buffer around a transit route, rather than the location of the transit stop, to calculate the service area. Although accessible transit service with shorter access distance (more stops) is an important means for increasing transit ridership (Mamun, 2014). Determining transit service coverage is one of basic studies on fixed-route transit service availability in system.

2.2.4.2 Bus Service Frequency

According to TCQSM, transit stops availability was measured in terms of average headway, which is the inverse of the average service frequency. A current definition of service frequency is how many times an hour a user has access to the transit mode,

assuming that transit service is provided within acceptable walking distance and at the user wished times. From the user's perspective, service frequency determines how many times an hour a user has access to the transit mode, assuming that transit service is provided within acceptable walking distance (measured by service coverage) and at the times the user wishes to travel (measured by hours of service).

Mistretta, Goodwill, Gregg, and DeAnnuntis (2009), stated that there are three different aspects to consider when setting headways for transit: headways based on policy, headways based on demand, and headways based on the clock-face.

i. Policy headways are headways that are defined by transit system policy and are usually modified by time of day or day of the week. They are typically used when passenger loads are light enough to require time intervals in excess of 10-15 minutes between vehicles to conform to loading standards. Time of day is a predominant factor in determining varying headway intervals. The common practice is to have more frequent service during peak hours and less frequent service during off-peak hours. Widely used policy headway is 30 minutes during peak hours and 60 minutes during off-peak hours. Headways for night, Saturday, and Sunday service usually match the off-peak headways or may be even longer. Some sources state that 30-minute peak service is the minimum level at which urban transit provides an adequate level of basic mobility in a dense urban area. Service levels below 30 minutes (i.e., longer than) are generally unacceptable from the perspective of the passenger and are not enough to develop a solid, consistent, base of ridership. Base, evening, and weekend service should not exceed 60 minute headways.

ii. Demand-based headways are established to provide a sufficient number of trips to accommodate the maximum passenger volume within the loading standards. Demand-based headways are typically used only when service demand requires less-than-30-minute service intervals. Overcrowding of buses on a route is a sign that either larger vehicles need to be used or demand-based headway should be instituted to increase the overall capacity of the route.

iii. Clock-face headways refer to setting headways to intervals that divide evenly by 60. For example, 12- or 15-minute schedules are used, but 13 or 17 minutes are not used. For use with policy headways, it is highly recommended and common practice to use clock-face headways. However, using clock-face headways in conjunction with demand-based headways at intervals greater than every 10 to 12 minutes is somewhat controversial in the transit industry. Clock-face headways help passengers better predict bus arrival times at stops and eliminate the need for complex schedules, thus allowing passengers to be less dependent on time-tables. User-friendly clock-face headways are more attractive to riders; however, from the cost-accounting viewpoint; it may be more expensive to write schedules around this criterion.

2.2.4.3 Bus Service Span

Span of service is another measure that relates to the capacity of the system. It defines the extent of time over which service is provided. This includes both hours of service during the day and days of service over the week. Similarly Mistretta, Goodwill, Gregg, and DeAnnuntis (2009) noted that Span of service is the number of hours and days when service operates, i.e., the start of the service day until the end of the service day, as well as weekdays, Saturday, and/or Sunday. The longer period of time that service is

available, the greater is the capacity of the system. The span of service will usually vary by route depending on service type, the day of the week, and route performance. Generally, high-performing routes will have longer service spans, and weekday spans of service are longer than for Saturday and Sunday.

2.2.4.4 Bus Waiting Time

Travel time, including waiting time at bus stations, is one of the most important quality and effectiveness measures of public transportation as an alternative to the automobile. Estimating and optimizing bus-transit passenger travel times have several applications in demand estimation, planning, scheduling and operating public mass-transit systems (Mir-Davood and Randy, 1999). Koppelman and Kpmh (1999) asserted that waiting time is the most undesirable part of transit passenger travel time, because it increases total trip times, and transit users generally regard it as lost time. The value of wait time is typically much higher than value of in-vehicle time. This is most likely due to the unproductive nature of wait time in most urban travel situations. Indeed, wait time before scheduled departure time is mainly a function of bus arrival headways and passenger travel behavior, while wait time after scheduled departure time is generally related to schedule reliability. The waiting time for public transport is related to the frequency of the service as well as the threshold for tolerable waits for potential riders (Polzin, Pendyala and Navari, 2002).

2.2.5 Sustainable Public Transport

Brundtland Commission report (1987) brought global attention to the concept of sustainable development of which scholars and policy professionals have worked to

apply its principles in the urban and metropolitan context. According to Bruntland (1987), sustainability is defined as economic development that meets today's generation needs without compromising the opportunity and ability for future generations. Transport is an inevitable factor in sustainability discourse (Beella and Brezet, 2007).

Overtime it is accepted that sustainable development, specifically, sustainable transport, implies finding a proper balance between (current and future) environmental, social and economic qualities (WCED, 1987; Beatley, 1995; Litman, 2003; RIVM, 2005). Although various attempt were made to define sustainable transport (Steg, 2007 and Litman, 2008). The term sustainable transport came into use as a logical follow on from sustainable development, and is used to describe modes of transport, and systems of transport planning, which are consistent with wider concern of sustainability. Without major changes of sustainable development definition, this can be extended to sustainable transport which may be defined as transport that satisfies the current transport and mobility needs without compromising the ability of future generations to meet these needs (Black, 2010).

As a result Peter Wiederkehr at the Organisation for Economic Cooperation and Development (OECD) in 1994 led a small International working group of transport planner that agreed that a new policy approach was needed to place environmental criteria in transport issues on the front burners along with other policy goal of sustainable development. The Organisation for Economic Cooperation and Development thus began to chart a path towards environmentally sustainable transport. This culminated in The International Conference toward sustainable transport in Vancouver, Canada in 1996 and The Vancouver principles towards sustainable transportation (Newman and Kenworthy, 1999).

The Centre for Sustainable Transportation in Canada (2003) states that a sustainable transportation system is one that:

i. allows the basic access needs of individuals and societies to be met safely and in a manner consistent with human and ecosystem health, and with equity within and between generations;

ii. is affordable, operates efficiently, offers a choice of transport mode, and supports a vibrant economy; and

iii. limits emissions and waste within the planet's ability to absorb them, minimizes consumption of nonrenewable resources, reuses and recycles its components, and minimizes the use of land and production of noise.

In appreciation of this fact, sustainability supports a change in transportation planning and management. In the view of Litman (2008) initially, physical movement over space is often used to evaluate in transport, in recent time; it is evaluated in terms of accessibility – peoples or individual ability to satisfy their basic demands and services.

Sustainable transportation refers to the movement of people and goods in a municipal or urban area in a manner that minimizes environmental degradation, system costs, traffic safety problems and traffic congestion, while ensuring access even of the poor to meet their mobility needs (Akinbamijo, 2008).

Public transit is considered a key component of a sustainable transportation system that creates livable communities and provides travelers with greater opportunity, choice, and access to a variety of economic and social activities. More interestingly, sustainable public transport according to World Bank, (1996) is one which ensures that:

i. Transportation- related pollution levels are maintained at levels below those human beings can safely tolerate and the environment carrying capacity can allow;

ii. Financial expenditures for operators, maintenance and carrying charges are not higher than what the users can pay; and

iii. Each member of the society is provided with the means to achieve fundamental social, cultural, educational and economic objectives.

Therefore sustainable public transport system is that which meet the mobility and accessibility needs of people by providing safe and environmentally friendly modes of transportation.

Mamun (2011) considered Public transit system as an important means of sustainable and social transportation alternative in creating livable and sustainable cities. Therefore, public transport planning has to ensure and improve accessibility to achieve sustainable public transport.

2.3 Literature Review

2.3.1 Overview of Public Transport

Transportation plays a pivotal role in facilitating and regulating the essential links between residence and employment, and between producers and users of goods and services, without which all meaning interactions will be greatly reduced (Wang and Leh, 1993). It is vital in the development of a city (Gwadabe, 2012). The provision of access and mobility is very essential for the efficient organization and functioning of an urban centre of both developed and developing nations of the world. For most urban centres in developing countries, however, it is becoming increasingly difficult for the

existing transport infrastructure and services to cope with the growing transport demand (Ndikom, 2013). Badejo (1993) observed that it is pertinent to note that the inequality in mobility needs of the commuters necessitated the pursuance of affordable means of mobility. Thus, public transportation enables people without access to private transport of their own to satisfy their economic and social needs which cannot be fulfilled within walking distance.

Moreover, the rapid population growth and urbanization, coupled with increasing economic activities and opportunities in Sub – Saharan Africa cities, result in rapidly growing travel demand both for private as well as public transport (Niyonsenga, 2012). According to Vuchic (2005), experience has shown that Public Transport has a great significance in reducing traffic congestions, offering alternative means of travel, and contributing greatly to the quality of urban life. Public transportation systems provide the most efficient means of moving large number of people especially in density populated urban centres. Public transportation by definition connotes the act or the means of conveying large number of people "en masse" as opposed to conveyance in individual vehicles carrying very few people at a time. In other words, public transport or mass transit is a system in which a greater number of people are moved at a time along principal corridors (Ogbazi, 1992, Wikipedia, 2009). Public transport refers to a collection of modes of transport which are available to the public irrespective of ownership (White, 2002). Public transport system is that system that is designed to manage and cater for a large number of passengers, from their place of origin to a given destination, where they are valued more or where their relative economic importance is greater. It is a system for moving passengers ranging from eighty and above for a developed country or 50 and above for a developing nation like Nigeria (Ndikom, 2013).

Among all the public transportation systems, buses are the most popular and commonly used because of their inherent flexibility, adaptability to changing employment and residential patterns and low capital costs (Baskaran and Krishnaiah, 2011). Today, experiences show a need for a greater variety of public transport modes, but buses are choice of a majority of the communities and are the only means of mobility that can be afforded by the poor in developing countries of the World (Armstrong-Wright, 1993). The bus system is the transportation system that uses buses that may have a range of passenger capacities and performance characteristics, and may operate on fixed routes with fixed schedules, or may be flexibly routed (Smerk, 1974). Bus system has the potential of being used as a policy tool to reduce the number of cars on urban roads and so reduce traffic chaos in the city. It has also the potential of extending transportation services to a greater proportion of urban residents who do not have private cars, and cannot afford frequent taxis fares (Andeleeb, Mohmadul and Ahmed, 2007). They have the potential of being used as policy tools to reduce the number of cars on urban roads and thus reduce traffic chaos in cities. Despite the vital role that buses are able to play in any urban area, their services in Nigerian cities are frequently insufficient to meet demand, and the services provided suffer from low output (Ali and Onokala, 2009).

2.3.2 Bus Route and Bus Services

According to Francis (2013) buses are allocated to routes in order to meet the demand for their services along given route and also to reduce or control the over concentration of buses on a particular route to the neglect of the other bus routes in the city which may probably be due to unprofitability of such route. Babalola (1993) identified the various types of public transport services which the bus can provide to meet the mobility needs of public passengers to include:

i. Stage Carriage: this is the usual bus services which involve stopping of the bus at designated intervals known as bus stops. This is aimed at allowing passengers in and out of the bus over the whole bus route.

ii. Limited Stops: this is a faster service than the stage carriage. It also involves stops at designated intervals, however, not as frequent as that of the stage carriage. It is a sort of semi-fast bus services.

iii. Express Services: this is the service in which in most cases does not involve stop at intervals. It is an origin-destination type of non-stop bus service. However, recently it is common to observe bus operating an express service stopping at number of intermediate stops. Despite the intermediate stops, the service can still be regarded as an express bus services.

iv. Local or Feeder Bus Services: this is a short distance bus services covering a small particular geographical zone or locality connecting with longer distance bus or rail services in a district center. The sphere of operation of this type of bus service is normally very small and limited. Such bus service play complimentary and supporting role to the overall transport of the city.

v. Contact or Charter Bus Service: this is a specialized or specific bus services which is normally not available to the general public. It may be used to provide service for schools (as school bus), establishments with large work force, promote tourism etc depending on the contract.

vi. Dial-a-bus or Community Bus: this is bus service on demand particularly in low population density areas. It is more common in United Kingdom, United State of America and Canada.

Similarly, Odumosu (2002) also classified bus services based on their periods of operation to include;

1. Basic all day bus service: this is the regular bus service. In the cities of the developed nations such bus operates throughout the day and week. However, the frequency and timing of bus may vary according to time of the day especially during weekend. In developing countries like Nigeria, the period of bus operation seems to differ.

2. Peak period only: this is a period of maximum demand. It refers essentially to commuter which include journey to work, school, business etc. It is possible to identify peak periods in some cities and their duration varies. In The Federal Capital Territory morning and evening peak periods were identified.

3. Off peak only: this refers perhaps to trips that does not involve journey to work or school because of the time of the day. This service is usually carried out when there is less traffic on the road which is the period between morning and evening peak.

4. Night service: this service is outside normal day time periods of operations. It takes place during the night.

5. Limited time service: this is related to shift time of work, schools, including recreational journey.

6. Occasional service: this serves specific purpose, such as market days or hospital visiting.

However, bus network may comprise any or all of these categories depending on particular needs of the area, which may be determine by the land use pattern and topography.

2.3.3 Bus Stop Location

It is expected that buses should discharge passengers as near as possible to their final destination as result allowing them disembark at convenient points along the route. The extent to which a bus stop can meet the passengers and bus operators' objectives is dependent upon the scale, density of the area and its layout in relation to the route network. As a result a bus stop being a collection point for buses and passengers has to have a location relationship with the area so that passengers' convenience and operating efficiency are not impaired.

According to Addenbrook (1981) spacing of bus stop will necessarily involve a compromise. Obtaining high operating speed can be achieved by placing stops within an acceptable working distance of traffic generators and attractors. Where road side development is not intense, bus stops are spaced farther apart than areas where there is high concentration of population adjacent to the bus route. Odumosu (2002) opined that based on safety grounds, bus stop on opposite sides of a single two way carriage way should be staggered so that buses stop tail to tail and move off away from each other. Where bus stops are located in layout housing areas, they need to be located as near as possible to junctions with side road, since these are the route of the foot ways to other parts of the local areas.

Babalola (1993) explained that the location of bus stops affect road way capacities. Thus, traffic engineers are charged with the responsibility of designing such locations, taking into consideration the geometric pictures, street light system, and traffic control

devices on each routes. It is considered a standard practice to locate curb side bus stops as ‘near side’ or ‘far side’ of an intersection or ‘mid-block’ between intersections. The author also reported that studies have also shown that near side bus stops are common in residential areas, while far side bus stops are more prevalent in arterial. On the other hand, mid blocks are always adjacent to major traffic generators such as shipping centre and parks. A curb side bus stop consists of three segments, vis-à-vis, pull in taper; and storage and pull-out taper.

Francis (2013) was of the view that bus stop for express operations are often located near the ramps as an integral part of the highway development. They are also expected to have informatory and regulatory signs in addition to pavement, making it easy to assist drivers, users and non-user of the facility. Bus shelters are provided at selected bus stop to shield transit passengers from harsh weather condition and increase patronage as an important marketing tool, to fleet bus operators. In some cases, especially in developed countries, the shelters are often equipped with benches, lighting facilities and food, drink, vending machine and telephone booth are also available. Bus schedule and timetable are also provided.

The number, capacity and locations of bus garage in bus operation according to Babalola (1993) are influenced by the following:

(i) Route network figuration;

(ii) Deadheads;

(iii) Bus dispatching policies;

(iv) Land availability and cost;

(v) Bus operation cost;

(vi) Construction, maintenance and operating cost of bus garage;

(vii) Environmental impact.

2.3.4 Development of Urban Public Bus Transport in Nigeria

Ndikom (2013) opined that modern modes of transport, as they are known today, were developed during the industrial Revolution in the late 18th century. At this period, people left the rural areas en-masse for urban areas due to rapid urbanization. Adeniji (1987) noted that the major mode of transport during this period was the railway. Therefore, the railway was the first major form of public transport. The introduction of public transport system in Nigeria (in form of rail transport system) was in 1896 in Lagos which is over a century.

Due to the fact that, the cost of providing railway services was very prohibitive as at the time, there was the urgent need to evolve alternative modes of public transport for the conveyance of people and goods (ibid). The use of Bus services was originated from a barber, who had a carriage designed for his business in Omnes later; a bus was designed to carry people from place to place. Shortly after this, he introduced fares and subsequently expanded his business all over Paris. With time, this bus was replicated all over Europe and, by early 20th century, general motors' in America started the mass production of buses (Adeniji, 1987).

Prior to the introduction of the Mass Transit Programme in 1988, public sector involvement in urban passenger transport services was very negligible (Aworemi, Abdul-Azeez and Olaogun, 2009). The public involvement dates back to the easily 1930s when the native authority in Kano provided bus services around the city. Later on, the Lagos City Council set up the Lagos Municipal Transport Service (LMTS) in 1958, while the Ibadan City Council started the City Bus Service in 1964. This was later

operated as a joint venture with the Oyo State Government (Adeniji, 1983). In the early 1970s, there was, for the first time, more public sector involvement in the running of both intra-urban and inter-urban bus services. Several state governments established their own bus undertaking, which included Bendel Line, Kaduna State Transport Authority, Kwara Line, Water Line, Lagos State Transport Corporation, North East Line, Plateau State Transport Corporation, among others (Adeniji, 1983; Filani, 1991 and Adesanya, 1994). Unfortunately most collapsed by the late 1970s or early 1980s. The few municipal bus undertakings that survived until 1988, when the mass transit programme was introduced, included Water Line, Bendel Line, Borno Express, Kaduna State Transport Authority and the Lagos State Transport Corporation (LSTC), although many of them were actually running skeletal service at that time (Adesanya, 2002).

The introduction of the Urban Mass Transit Programme in 1988 by the Federal Government due to the serious urban mobility crisis, occasioned largely by the depressed Nigerian economy, created a situation in which virtually all state governments established their own bus undertaking for direct bus service delivery (Bolade, 1989 and Adesanya, 1994). The main objectives of the Urban Mass Transit Program introduced in 1988 were to moderate the national urban transit system, alleviate the problems of urban commuters and the general masses and lay the foundation for organized mass transit in Nigeria. The introduction of this program served to reduce the overriding gap between the increasing public transport demand and the decreasing supply in the transport market. To date, almost all states in Nigeria and the Federal Capital, Abuja have benefited from the Federal Urban Mass Transit Program (Aderemo, 2010).

CHAPTER THREE

STUDY AREA AND METHODOLOGY

3.1 The Study Area

The Federal Capital Territory popularly called Abuja is the administrative headquarter of Nigeria. It covers an area of about 8,000 km^2 and is bordered on all sides by four states: Kaduna State to the north, Niger State to the west, Nassarawa State to the east and Kogi State to southwest (Dawan, 2000). The area lies between latitude 8^0 $25^{'}$ and 9^0 $20^{'}$ north of the equator and longitude 6^0 $45^{'}$and 7^0 $39^{'}$ east of Greenwich meridian. The Territory is currently made up of six local councils comprising the city of Abuja municipal and other five namely; Abaji, Gwagwalada, Kuje, Bwari and Kwali (Ali, 2014). See to Figure 3.1

The Federal Capital Territory falls within the guinea forest savanna mosaic zone of the West African sub-region with patches of rain forest. This occurs in the Gwagwa plains, especially in the rugged terrain to the southeastern parts of the territory where a landscape of gullies and rough terrain is found. The rainy season begins from April and ends in October, when daytime temperature reaches 28^0C to 30^0C and at night lowers between 22^0C and 23^0C. In the dry season, daytime temperature can soar as high as 40^0C and in the night dips to 12^0C (Wikipedia, 2014).

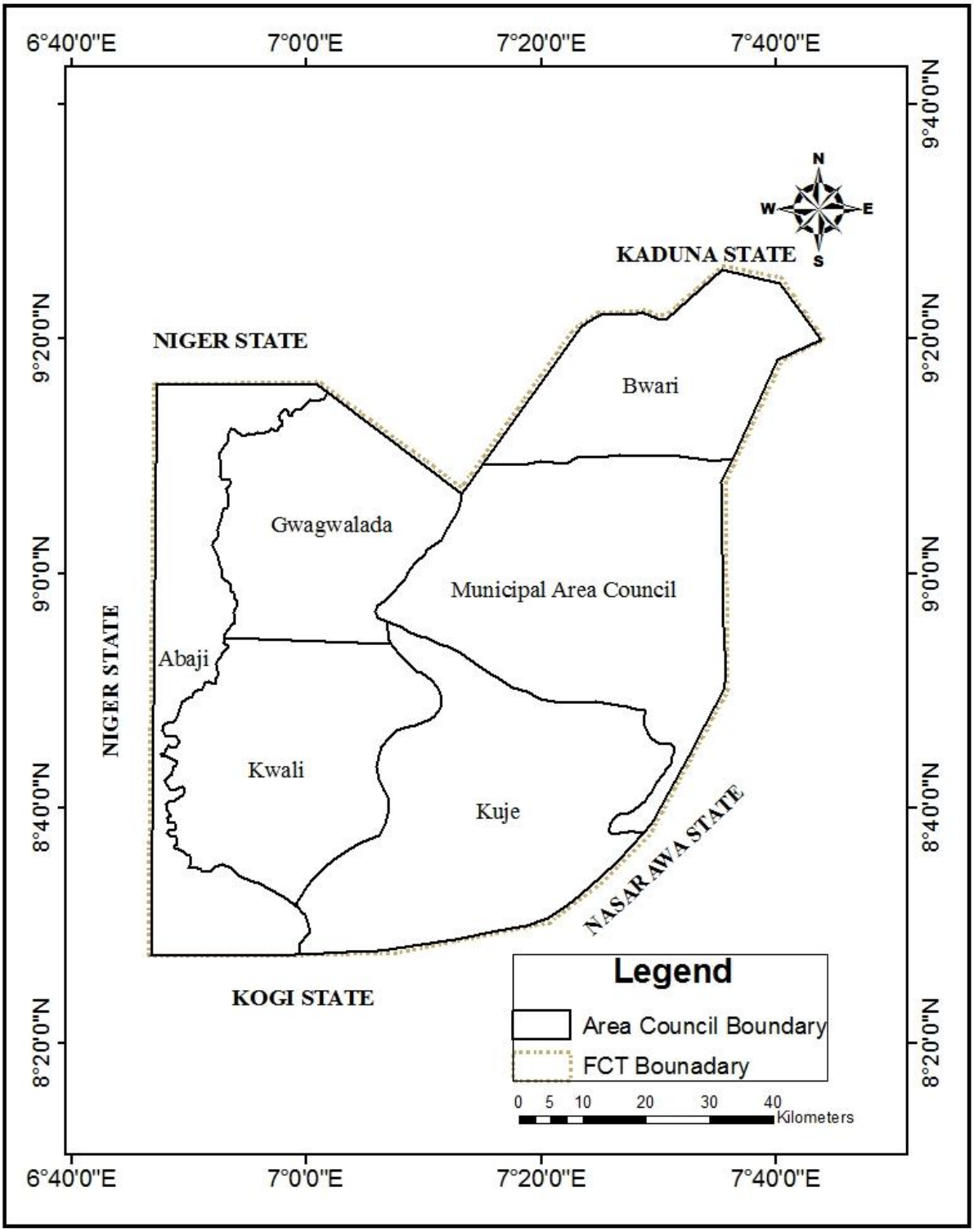

Figure 3.1: Abuja (FCT) showing Area Councils
Source: Adapted from the administrative map of The FCT

The Federal Capital Territory had a population of 1,406,239 in 2006 (National Population Commission, 2009) with a population density of 192 people per square

kilometer but given the daily influx of people into the territory, the population today could be well over 8 million people as quoted in Samaila (2012). See Table 3.1. This growth has led to the emergence of satellites towns such as Karu, urban area, Suleja, Gwagwalada, Lugbe, Kuje and smaller settlements to which the planned city is sprawling (Wikipedia,2014).

Table 3.1: Population Distribution of FCT and its Area Councils

Area Councils	**Headquarters**	**Population**
Abaji	Abaji	58,642
Bwari	Bwari	229,274
Gwagwalada	Gwagwalada	158,618
Kuje	Kuje	97,233
Kwali	Kwali	86,174
Municipal	Abuja	776,298
Total		**1,406,239**

Source: National Population Commission (2009)

Different modes of public transport services are available in The Federal Capital Territory to enhance the movement patterns of its residents. These include motorcycles, tricycles (keke), taxis, commercial mini buses otherwise called araba or danfo and high capacity buses with different categories of routes. The commercial mini buses ply feeder routes, the area councils and the satellite towns while the high capacity buses and taxi ply the major entry and exit routes of the city center as well as the major roads within the metropolis. The tricycles transit within designated housing estates and satellite towns. There is no specific operation schedule, these services wait to fill up before

setting off from the terminus, then pick up and drop off frequently en route. The Federal Capital Territory public high capacity bus systems are owned and operated mostly by private operators.

3.2 Methodology

This section covered the study population, sample size and technique, method of data collection, method of data analysis and presentation of collected data.

3.2.1 Reconnaissance Survey

A reconnaissance survey was carried out, during which seven licensed public high capacity bus operators were identified. These include Abuja Urban Mass Transport Company Ltd (AUMTCO), National Union of Road Transport Workers Nig. Ltd (NURTW), FABREM Ltd, Shaanxi Nig. Ltd, SECDA Nig. Ltd, RTEIN Mass Transit Nig. Ltd and Auto Star Nig. Ltd out of which only two offers organized services presently. Also identified were twenty – four dedicated public high capacity bus routes (Table 3.2).

Table 3.2: Public High Capacity Bus Routes

S/N	OPERATOR	ROUTE	ROUTE CLASS
1	AUMTCO SHANNXI AUMTCO	Nyanya-Bullet-Herbert Macaulay-Berger junction Nyanya-Dantata-Gudu Road About-Area1 Nyanya-Yakubu Gowon Cres-Sheu Shagari-Rab Dikko-Ahmadu Bello Way-Eagle Square	External
2	AUMTCO	Jabi-Berger Junction-Herbert Macaulay-Eagle Square	Internal
3	AUMTCO	Area1-Area3-Tafawa Balewa-CBN-Eagle Square	Internal
4	FABREM	Area1-Moshood Abiola-Olusegun Obasanjo-Sultan Abubakar-Berger Junction	Internal
5	AUMTCO	Area3 Junction-Tafawa Balewa-Mosque Junction-Herbert Macaulay-Berger Junction	Internal

6	AUMTCO	Kubwa-Murtala Muhammed-Maitama Avenue-Eagle Square Kubwa-Berger Junction-Area1	External
7	FABREM AUMTCO	Mpape Junction-Berger Junction-Area1 Mpape Junction-Maitama Avenue-Eagle Square	Internal
8	AUMTCO FABREM AUMTCO	Gwagwalada-Area1-Ahmadu Bello Way-Eagle Square Gwagwalada-Berger Junction Gwagwalada-Lugbe	External
9	FABREM AUMTCO AUMTCO	Lugbe-Citec-Jabi-Berger Junction Lugbe-Galadimawa-Games Village-Gudu Market Lugbe-Area1-Ahmadu Bello Way-EagleSquare	External
10	AUMTCO	Jabi-Berger-Area1-Gudu Market	Internal
11	AUMTCO	Jabi-Citec-Galadimawa-Apo Mechanic Village	Internal
12	AUMTCO	Zuba-Berger Junction-Area1	External
13	AUMTCO	Zuba-Murtala Muhammed-Maitama Avenue-Eagle Square	External
14	AUMTCO	Kuje-Area1-Ahmadu Bello Way-Eagle Square	External
15	AUMTCO	Life Camp-Parkway-Eagle Square	Internal
16	AUMTCO	Life Camp-Mabuchi-Berger Junction-Area1	Internal
17	AUMTCO	Gudu Market-Eagle Square-Banex-Gwarinpa	Internal
18	AUMTCO	Gudu-Apo Junction-Area3-Area1-Berger Junction-Jabi	Internal
19	AUMTCO	Gudu Round About-Area3-Area1-Berger-Mabuchi Junction-Tipper Garage	Internal
20	AUMTCO	Gudu Round About-Yakubu Gowon Cres-Murtala Muhammed-Mpape-Tipper Garage	Internal
21	AUMTCO	Deeper Life Junction-Sheu Shagari-Eagle Square-Nicon Junction	Internal
22	AUMTCO	Berger Junction-Herbert Macaulay-Kashim Ibrahim-Nicon Junction	Internal
23	AUMTCO	Eagle Square-Ahmadu Bello-Adetokumbo Ademola-Aguiyi Ironsi-Aminu Kano Cres-Banex Junction	Internal
24	AUMTCO	Galadimawa-Area1-Berger Junction	Internal

Source: FCT Transportation Secretariat, 2013.

3.2.2 Types of Data Required

Among the data required for this study include;

i. Location of bus routes
ii. Capacity of buses
iii. Volume of passengers
iv. Travel time
v. Waiting time
vi. Distance to bus stops
vii. Bus service frequency
viii. Number of bus trips
ix. Hours of bus services
x. Number of buses dispatched on each route.

3.2.3 Sources of Data

The study required data from both primary and secondary sources.

3.2.3.1 Primary Source of Data Collection

The primary source of data was obtained through the administration of both closed and open ended questionnaire to the passengers and operators respectively. The close ended questionnaire elicited information on travel time, waiting time, and distance to the bus stops, safety, comfort and convenience while data on capacity of the buses, span of bus service, and number of buses dispatched daily on each route and bus frequency were derived from structured interview. Also hourly passenger on board count was conducted.

3.2.3.2 Secondary Source of Data Collection

The secondary source included records on the number of bus trips made daily, number of passengers moved on each trip and the bus service route map. Other secondary sources include document materials such as journals, research reports and textbooks on public bus transport service which gave background to the research.

3.2.4 Method of Data Collection

This study adopted purposive sampling for the public high capacity bus route selection and random sampling technique for the administration of well structured closed ended questionnaire to the passengers. This was supported with administration of structured interview to the Heads of Operation and Planning of the various public high capacity bus service operators. This choice was because they are the one saddled with the responsibility of day to day operations of the bus services. Hourly bus frequency arrival count pro form, the number of buses arriving in each of the sampled public high bus routes was collected by the stationed investigators as well as the volume of passengers moved on hourly basis for a period of three days. The survey was conducted on two weekdays and one weekend day in June 2014 during the Am and Pm peak periods (approximately 6:00 – 11:00am and 3:00 – 8:00pm).

3.2.5 Study Population and Sample Size

The study identified two study populations. These were the public high capacity bus routes and the passengers that use the services provided. Purposive sampling technique was used to select four dedicated public high capacity bus routes; three external (satellite towns) and one internal (within the city center) route. The choice of three external routes was because they serve as entering points to the city center; hence they

carry large number of passengers to the city while one internal route was to capture the movement within the city centre. Random sampling technique was for the passengers. A number of models have been developed to estimate sample size. Yamane (1967) provides a simplified formula to calculate sample size with 95% confidence level and 5% sampling error assumption.

$n = N/1 + N(e)^2$

n= Sample size

N= Population size

e= Sampling error

The study used the above formula to obtain a total of 395 respondents of the volume of passengers moved daily by the various operators on the selected routes to be administered questionnaire. To determine the proportion of the respondents, Yamene (1967) sampling method for determining of respondents was also be used, i.e

n× 395/N

Where:

n = daily volume of passengers moved on each route

N = total number of volume of passengers moved on all the selected routes.

The distribution of the questionnaire to the passengers is shown in the Table 3.3 below.

Table 3.3: Distribution of Questionnaire to the Respondents

Route	Route Class	Number of Passengers Moved in July, 2013	Average Daily Passengers Moved	Number of Respondents	Percentage
Gwagwalada	External	71,082	2,293	28	7.1
Zuba	External	13,6991	4,419	55	13.9
Nyanya	External	643,200	20,748	257	65.1
City Center	Internal	137,773	4,444	55	13.9
Total		989,046	31,904	395	100.0

Source: Compiled By The Author From Licensed Operators, 2013.

3.2.6 Data Analysis

Both descriptive and inferential statistics test were used in the analyzing the data for this study. The descriptive statistics was used to summarize data gathered and presented using tables, percentages, figures and plates. Correlation analysis was used to describe the relationship between the bus service quality variables while Principal component analysis was used to identify the underlying service variables. Statistical analysis was carried out using SPSS version 16 Statistical Programme and Microsoft Excel 2007.

CHAPTER FOUR

DATA ANALYSIS AND INTREPRETATION

4.1 Introduction

This chapter analysed the data collected in the field. Each set of questionnaire was analysed separately. A total of 395 bus passengers were administered questionnaire as respondents with a structured interview conducted for the Heads of Planning and Operations of High Capacity bus operators in The Federal Capital Territory. The collected data were analysed according to the objectives set for this study.

4.2 The Service Coverage of Public High Capacity Bus Service Routes

4.2.1 Public High Capacity Bus Routes

Bus routes are important to the effective and efficient operation of public bus transport, especially when seen in terms of their spatial or geographical coverage, attempt at meeting the demand for public transport and reducing over concentration of buses on a given geographical zone. In the study area, Figure 4.1 shows that certain were demarcated both for high capacity bus and mini bus public transport services. This is to ensure proper coordination among the various means in meeting the mobility needs of the people.

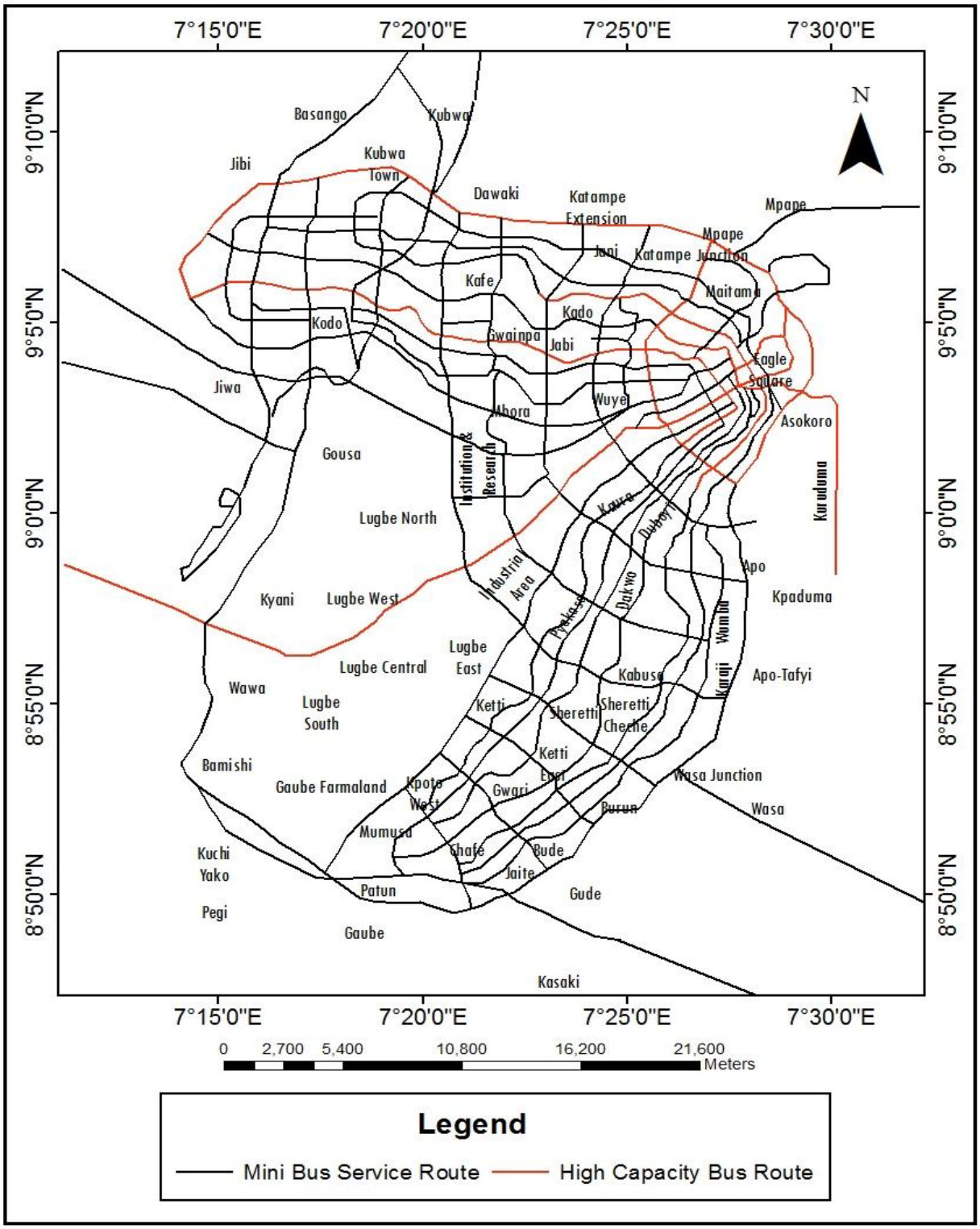

Figure 4. 1: High Capacity Bus Routes

Source: FCT Transport Secretariat, Abuja.

Plate 4.1 Taxi on High Capacity Bus Route

4.2.2 Public High Capacity Route Characteristics

The network of routes with their stops represents the principal infrastructure component of each public transport system (Vuchic, 2005). Table 4.1 shows the identified routes names within the selected high capacity bus routes in the Federal Capital Territory.

Table 4.1 Bus Route Characteristics

Route	Route Name	Route Length(km)	Number of Bus Stop
Gwagwalada	Lugbe-Area1	18	7
	Gwagwalada-Area3	55	12
	Gwagwalada-Berger	-	15
	Lugbe-Berger	-	7
Zuba	Zuba-Area1	51.5	25
	Bwari-Area1	45.5	24
	Kubwa-Wuse	19	-
Nyanya	Nyanya-Berger	17	18
City Center	Jabi-Area1	14	8
	Circular	28	27
	AYA-Nicon junction	11	15
Total			158

Source: Author Field Survey, 2014.

Table 4.1 indicated that the circular route within the city center has the highest number of bus stops though with a lesser route length when compared with the external routes. This could be as a result of the dense nature of physical development within the city center.

4.2.3 Frequency of High Capacity Bus Service

Table 4.2 shows the passengers frequency of high capacity bus transport services ranging from daily, twice and thrice weekly, weekends and others representing occasional/ rare use.

Table 4.2 Passengers Frequency of Bus Service Use

Response	Route Name				Total
	Gwagwalada	Zuba	Nyanya	City Center	
Daily	8 (29.6%)	31 (54.4%)	139 (54.9%)	35 (64.8%)	213 (54.9%)
Twice weekly	3 (11.1%)	9 (16.7%)	38 (15.0%)	6 (11.1%)	56 (14.4%)
Thrice weekly	5 (18.5%)	5 (9.3%)	34 (13.4%)	3 (5.6%)	47 (12.1%)
Weekends	4 (14.8%)	4 (7.4%)	10 (4.0%)	3 (5.6%)	21 (5.4%)
Others	7 (25.9%)	5 (9.3%)	32 (12.6%)	7 (13.0%)	51 (13.1%)
Total	27 (100%)	54 (100%)	253 (100%)	54 (100%)	388 (100%)

Source: Author Field Survey, 2014.

From Table 4.2 the results that 54.9% of the respondents use the public high capacity bus services daily while 14.4%, 12.1%, 5.4%, and 13.1% patronize the services twice , thrice, weekends and others respectively. This shows the high dependence of the commuters on public high capacity bus transport services in the Federal Capital Territory.

4.2.4 Time of Bus Service Use

The analysis confirmed the different time of high capacity bus services use by the passengers in the study area. The categories of time of use are shown in Table 4.3

Table 4.3 Passenger Time of Bus Service Use

Response	Route Name				Total
	Gwagwalada	Zuba	Nyanya	City Center	
Morning	1 (3.7%)	9 (16.7%)	51 (19.9%)	17 (32.0%)	78 (20.0%)
Afternoon	4 (14.8%)	4 (7.4%)	17 (6.6%)	2 (3.8%)	27 (6.9%)
Evening	2 (7.4%)	3 (5.6%)	14 (5.5%)	2 (3.8%)	21 (5.4%)
Morning & Afternoon	8 (29.6%)	13 (24.1%)	46 (18.0%)	9 (17.0%)	76 (19.5%)
Morning & Evening	8 (29.6%)	20 (37.0%)	99 (38.7%)	21 (39.6%)	148 (37.9%)
All times of the day	4 (14.8%)	5 (9.3%)	29 (11.3%)	2 (3.8%)	40 (10.3%)
Total	27 (100%)	54 (100%)	256 (100%)	53 (100%)	390 (100%)

Source: Author Field Survey, 2014.

The Table above show that morning and evening use of public bus services has the highest with 37.9% while 20%, 6.9%, 5.4%, 19.5%, and 10.3% of the respondents use the bus services in the morning only, afternoon only, evening only, morning and evening, and all times of the day respectively.

4.2.5 Means to the Bus Stop

Modal access to bus stop constitutes part of the journey that is made by commuters. The study identified five main means of access to the bus stop in The Federal Capital Territory as shown in Table 4.4

Table 4.4 Passenger Means to Bus Services

Response	Route Name				Total
	Gwagwalada	Zuba	Nyanya	City Center	
Walking	10 (37.0%)	18 (33.3%)	57 (22.3%)	25 (48.1%)	110 (28.3%)
Taxi	9 (33.3%)	10 (18.5%)	36 (14.1%)	16 (30.8%)	71 (18.3%)
Bus	3 (11.1%)	9 (16.7%)	50 (19.5%)	5 (9.6%)	67 (17.2%)
Motorcycle	5 (18.5%)	16 (29.6%)	86 (33.6%)	6 (11.5%)	113 (29.0%)
Tricycle	0 (0.0%)	1 (1.9%)	26 (10.2%)	0 (0.0%)	27 (6.9%)
Others	0 (0.0%)	0 (0.0%)	1 (0.4%)	0 (0.0%)	1 (0.3%)
Total	27 (100%)	54 (100%)	256 (100%)	52 (100%)	389 (100%)

Source: Author Field Survey, 2014.

The Table 4.4 shows that majority of the respondents access the bus stop using motorcycle with 29%. Also 28.3% do walk mostly in the city center route, 18.3% use taxi, while 17.2%, 6.9%, and .3% use bus, tricycle and other means to the bus stops respectively. This reveals the uncoordinated nature of intermodal transport in FCT unlike in developed countries where park and ride schemes are used.

4.2.6 Distance to the Bus Stop

The presence or absence of transit service near one's origin and destination is a key factor in one's choice to use transit. Ideally, transit service will be provided within a reasonable walking distance of one's origin and destination. The World Bank (1987) explained that in reasonable well served urban areas, passengers are expected to find bus stop within 300-500m from their home or workplace which was used in this study.

Table 4.5 Passenger Distance to Bus Stop

Response	Route Name				Total
	Gwagwalada	Zuba	Nyanya	City Center	
< 0.5km	4 (16.0%)	9 (17.3%)	53 (21.3%)	9 (17.6%)	75 (19.9%)
0.5-1km	8 (32.0%)	12 (23.1%)	57 (22.9%)	12 (23.5%)	89 (23.6%)
1-2km	4 (16.0%)	9 (17.3%)	49 (19.7%)	12 (23.5%)	74 (19.6%)
2-3km	5 (20.0%)	10 (19.2%)	35 (14.1%)	8 (15.7%)	58 (15.4%)
Above 3km	4 (16.0%)	12 (23.1%)	55 (22.1%)	10 (19.6%)	81 (21.5%)
Total	25 (100%)	52 (100%)	249 (100%)	51 (100%)	377 (100%)

Source: Author Field Survey, 2014.

The Table above revealed that most passengers walk a distance of between 0.5-1km to the bus stop which represents 23.6%. This is followed by above 3km walk distance with 21.5%, 19.9% of the respondents agreed to walk less than 0.5km, 19.6% and 15.4% walked 1-2km and 2-3km respectively.

4.2.7 Walking Time to the Bus Stop

Figure 4.2 clearly reveals the different passenger walking time to the bus stop across the various routes in the federal capital territory.

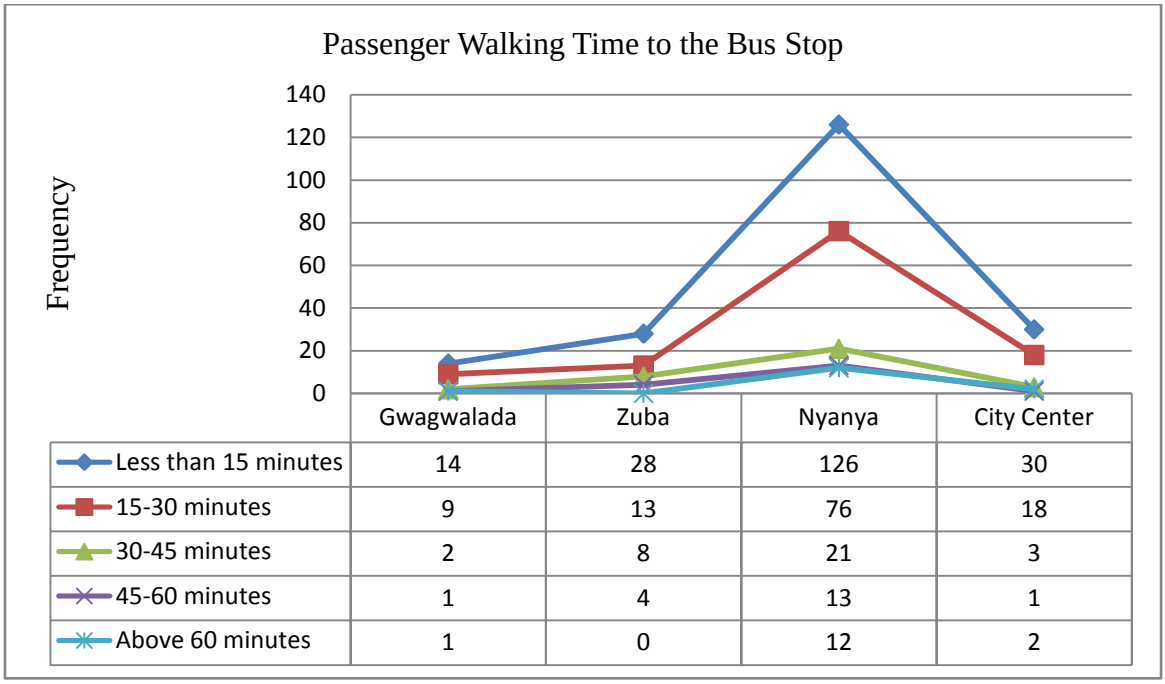

Figure 4.2: Passenger Walking Time to the Bus Stop

The Figure 4.2 above shows that majority of the respondents walking time to the bus stop were less than 15 minutes followed by 15-30 minutes , 30-45 minutes , 45-60 minutes and above 60 minutes walk time respectively. This suggests the convenience of passengers to bus services.

4.2.8 Passenger Bus Service Waiting Area

Figure 4.3 shows different areas of waiting for bus services in the study area to include bus stop with shelter, bus stop without shelter and along the road.

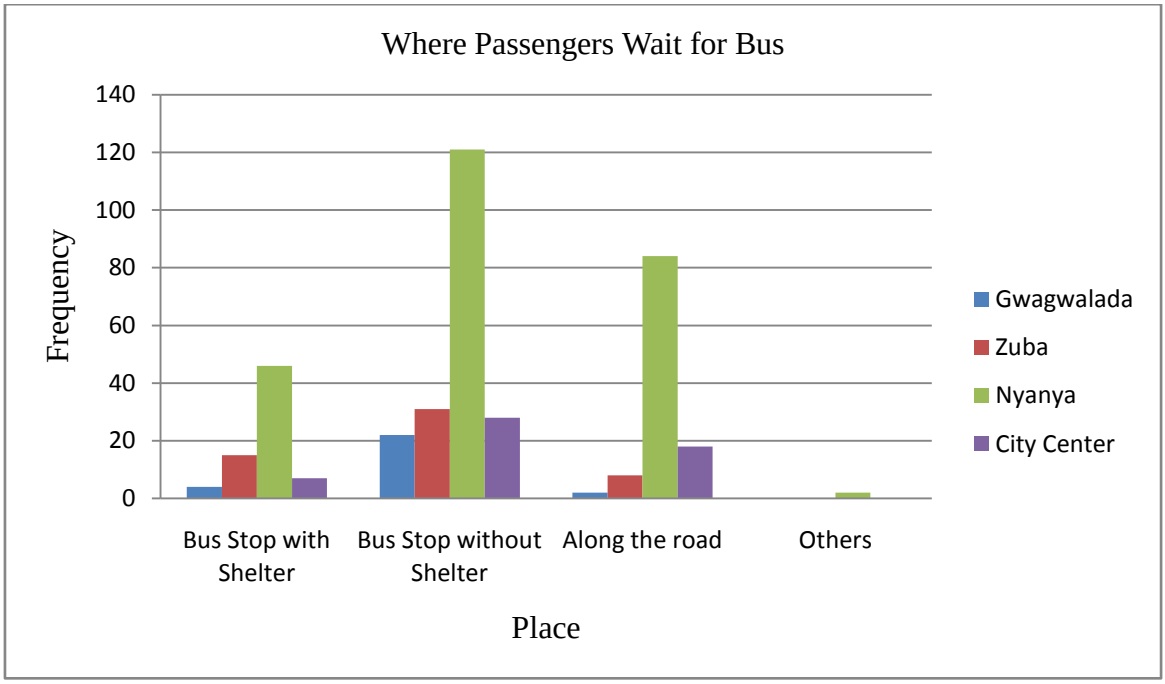

Figure 4.3 Where Passengers Wait for Bus

The Figure above shows that majority of the passengers wait for bus services in bus stop without shelter across the various routes. The implication of this is that there is no standard bus stop with infrastructures in the study area.

Plate 4.2 Bus Picking Passenger along the Road

Table 4.6 How Often Passengers Get Seat inside the Bus

Response	Route Name				Total
	Gwagwalada	Zuba	Nyanya	City Center	
Every trip	19 (76.0%)	40 (75.5%)	155 (68.0%)	31 (64.6%)	245 (69.2%)
Once in two trips	5 (20.0%)	9 (17.0%)	53 (23.2%)	10 (20.8%)	77 (21.8%)
Once in Five trips	0 (0%)	2 (3.8%)	9 (3.9%)	2 (4.2%)	13 (3.7%)
Never get seat	0 (0%)	0 (0%)	2 (0.9%)	0 (0%)	2 (0.6%)
Others	1 (4%)	2 (3.8%)	9 (3.9%)	5 (10.4%)	17 (4.8%)
Total	25 (100%)	53 (100%)	228 (100%)	48 (100%)	354 (100%)

Source: Author Field Survey, 2014.

From the Table above 69.2% of the respondents reported to always get a seat in every trip, once in two trips with 21.8%, once in five trips with 3.7%, never get seat with 0.6% and others with 4.8%.

4.3 The Nature of Bus Service Operations of the Licensed Operators

4.3.1 Frequency of High Capacity Bus Service

Polzin, Pendyala and Navari (2002) opined that the temporal aspect of public transport availability is important because a service within walking distance is necessarily considered as available if waiting times beyond a certain threshold level are required. This waiting time is related to the frequency of bus services. The study defined waiting time as time a passenger spent at the bus stop between arrival at a bus stop with the intention of catching bus and the time the bus he/she eventually boarded departs from the bus stop. World Bank (1987) noted that average of 5-10 minutes indicates high quality of bus services, 11-20 minutes indicating moderate quality of services and above 20 minutes indicates poor quality of bus services. Again, care must be taken in

accepting the frequency of bus services estimated by the respondents in this study given the phobia to board high capacity bus services as a result of insecurity. Table 4.7– 4.10 shows the waiting time of bus service across the routes at different times of the day.

Table 4.7 Passengers Bus Service Waiting Time in the Morning (Weekday)

Response	Route Name				Total
	Gwagwalada	Zuba	Nyanya	City Center	
< 15 minutes	8 (36.4%)	27 (55.1%)	103 (50.7%)	22 (48.9%)	160 (50.2%)
15-30 minutes	13 (59.1%)	14 (28.6%)	67 (33.0%)	14 (31.1%)	108 (33.9%)
30-45 minutes	0 (0%)	3 (6.1%)	22 (10.8%)	5 (11.1%)	30 (9.4%)
45-60 minutes	0 (0%)	1 (2.0%)	10 (4.9%)	2 (4.4%)	13 (4.1%)
Above 60 minutes	1 (4.5%)	4 (8.2%)	1 (0.5%)	2 (4.4%)	8 (2.5%)
Total	22 (100%)	49 (100%)	203 (100%)	45 (100%)	319 (100%)

Source: Author Field Survey, 2014.

As shown in Table 4.7 most of the respondents wait for bus services less than 15 minutes. Those that do wait for bus services between 15-30 minutes, 30-45 minutes, 45-60 minutes and above 60 minutes constituted 33.9%, 9.4%, 4.1% and 2.5% respectively.

Table 4.8 Passengers Bus Service Waiting Time in the Evening (Weekday)

Response	Route Name				Total
	Gwagwalada	Zuba	Nyanya	City Center	
< 15 minutes	5 (26.3%)	11 (36.7%)	65 (44.2%)	9 (36.0%)	90 (40.7%)
15-30 minutes	6 (31.6%)	7 (23.3%)	42 (28.6%)	5 (20.0%)	60 (27.1%)
30-45 minutes	4 (21.1%)	5 (16.7%)	24 (16.3%)	5 (20.0%)	38 (17.2%)
45-60 minutes	1 (5.3%)	5 (16.7%)	10 (6.8%)	6 (24.0%)	22 (10.0%)
Above 60 minutes	3 (15.8%)	2 (6.7%)	6 (4.1%)	0 (0.0%)	11 (5.0%)
Total	19 (100%)	30 (100%)	147 (100%)	25 (100%)	221 (100%)

Source: Author Field Survey, 2014.

Table 4.8 shows that 40.7% of the respondents wait for bus services in the evening less than 15 minutes, followed by 27.1% that wait between 15-30 minutes, 17.2% for 30-45 minutes, 10.0% accounted for 45-60 minutes while 5.0% waited above 60 minutes for bus services.

Table 4.9 Passengers Bus Service Waiting Time in the Morning (Weekend)

Response	Route Name				Total
	Gwagwalada	Zuba	Nyanya	City Center	
< 15 minutes	7 (36.8%)	20 (80.0%)	58 (48.7%)	12 (54.5%)	97 (52.4%)
15-30 minutes	5 (26.3%)	4 (16.0%)	37 (31.1%)	9 (40.9%)	55 (29.7%)
30-45 minutes	3 (15.8%)	0 (0.0%)	12 (10.1%)	0 (0.0%)	15 (8.1%)
45-60 minutes	2 (10.5%)	0 (0.0%)	9 (7.6%)	1 (4.5%)	12 (6.5%)
Above 60 minutes	2 (10.5%)	1 (4.0%)	3 (2.5%)	0 (0.0%)	6 (3.2%)
Total	19 (100%)	25 (100%)	119 (100%)	22 (100%)	185 (100%)

Source: Author Field Survey, 2014.

Table 4.9 shows the extent to which passengers wait for bus services in the morning during weekends. It revealed that 52.4% of the respondents claimed to wait for bus service less than 15 minutes, 29.7% between 15-30 minutes and 17.8% of them agreed to wait beyond 30 minutes.

Table 4.10 Passenger Bus Service Waiting Time in the Evening (Weekend)

Response	Route Name				Total
	Gwagwalada	Zuba	Nyanya	City Center	
< 15 minutes	5 (31.2%)	15 (53.6%)	61 (57.5%)	7 (38.9%)	88 (52.4%)
15-30 minutes	4 (25.0%)	7 (25.0%)	19 (17.9%)	9 (50.0%)	39 (23.2%)
30-45 minutes	4 (25.0%)	2 (7.1%)	16 (15.1%)	1 (5.6%)	23 (13.7%)
45-60 minutes	1 (6.2%)	2 (7.1%)	9 (8.5%)	1 (5.6%)	13 (7.7%)
Above 60 minutes	2 (12.5%)	2 (7.1%)	1 (0.9%)	0 (0.0%)	5 (3.0%)
Total	16 (100%)	28 (100%)	106 (100%)	18 (100%)	168 (100%)

Source: Author Field Survey, 2014.

In Table 4.10 , it is shown that 52.4% of the respondents wait for bus services less than 15 minutes, (23.2%) 15-30 minutes, (13.7%) 30-45 minutes, (7.7%) 45-60 minutes and (3.0%) above 60 minutes.

4.3.2 Hour of High Capacity Bus Services

Hours of service, also known as "service span," is simply the number of hours during the day when transit service is provided along a route, a segment of a route, or between two locations. It plays as important a role as frequency and service coverage in determining the availability of transit service to potential users: if transit service is not provided at the time of day a potential passenger needs to take a trip, it does not matter where or how often transit service is provided the rest of the day.

Table 4.11 Hour of Bus Service

Operator	Weekday		Weekend	
	Bus Push out Time	Bus Push in Time	Bus Pull out Time	Bus Pull in Time
AUMTCO	5:00am	9:00pm	5:00am	9:00pm
FABREM	5:00am	10pm	7:00am	10:00pm

Source: Author Field Survey, 2014.

Table 4.11 explains the bus push out time from the depot to the various routes for services and bus pull in time. The table indicates that average of seventeen hours of bus services is offered by the two operators during the weekdays while sixteen hours bus service during the weekends. The implication of this result is that hour of service is static regardless the nature of demand in a given route at any particular time.

4.3.3 High Capacity Bus Service Operation Challenges

Bus service is a life blood of any city in mobility provision and access that is critical to most activities, but many bus services is threatened by the nature of service and problems encountered. The interview conducted with the Heads of Operations reveals that among the problems include high operational cost due to subsidies to fare, lack of enforcement of transport policies on the part of the Government, one sided direction flow of passengers, phobia to board high capacity buses as a result of insecurity especially at bus parks and lack of basic infrastructure like standard bus stops and priority bus lane.

Plate 4.3 Buses Waiting for Passengers

4.4 The Volume Capacity Utilization of the Public High Capacity Buses

4.4.1 Volume Capacity of High Capacity Bus Service

According to Bhat *et al*. (2006) measures of capacity are candidates for measuring service availability and service delivery. Capacity addresses the number of people and/ or public transport buses that can be served consistently in a given amount of time. The low service capacity of public transport is likely the most source of inadequacy of a public transport system (Niyonsenga, 2012). In this study service capacity of public transport system is determined based on offered services by the high capacity bus system. Figure 4.4 - 4.13 was used to indicate passenger volume-capacity of the various routes.

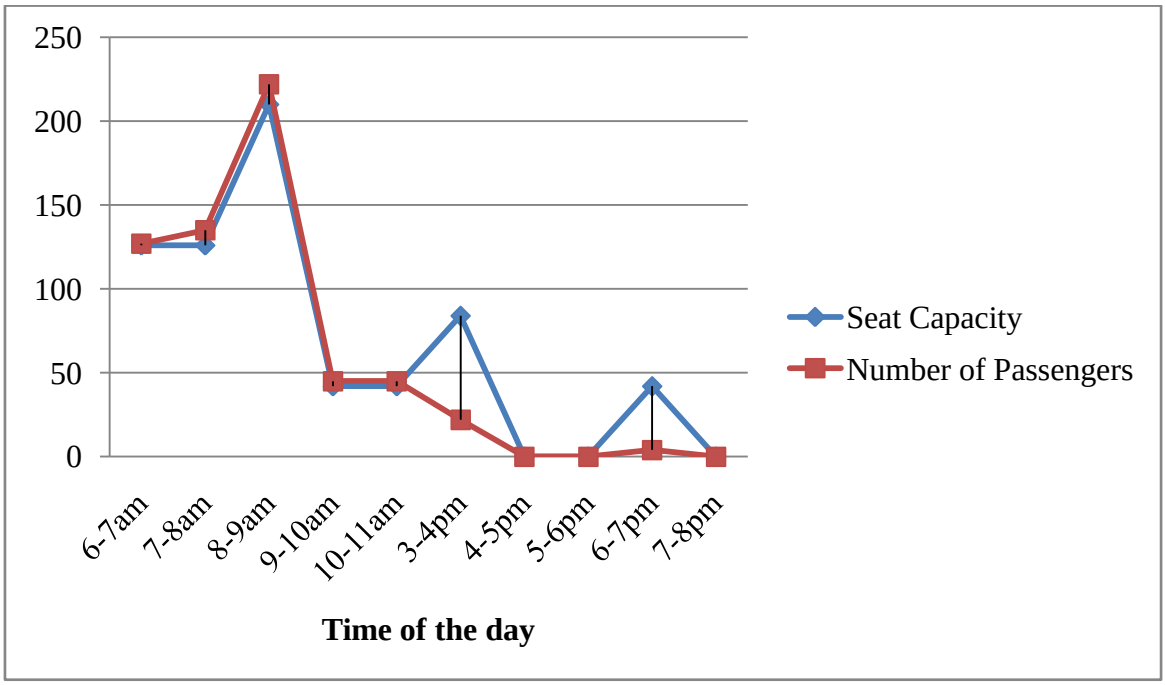

Figure 4.4 Passenger Volume-Capacity Gwagwalada Weekday (AUMTCO)

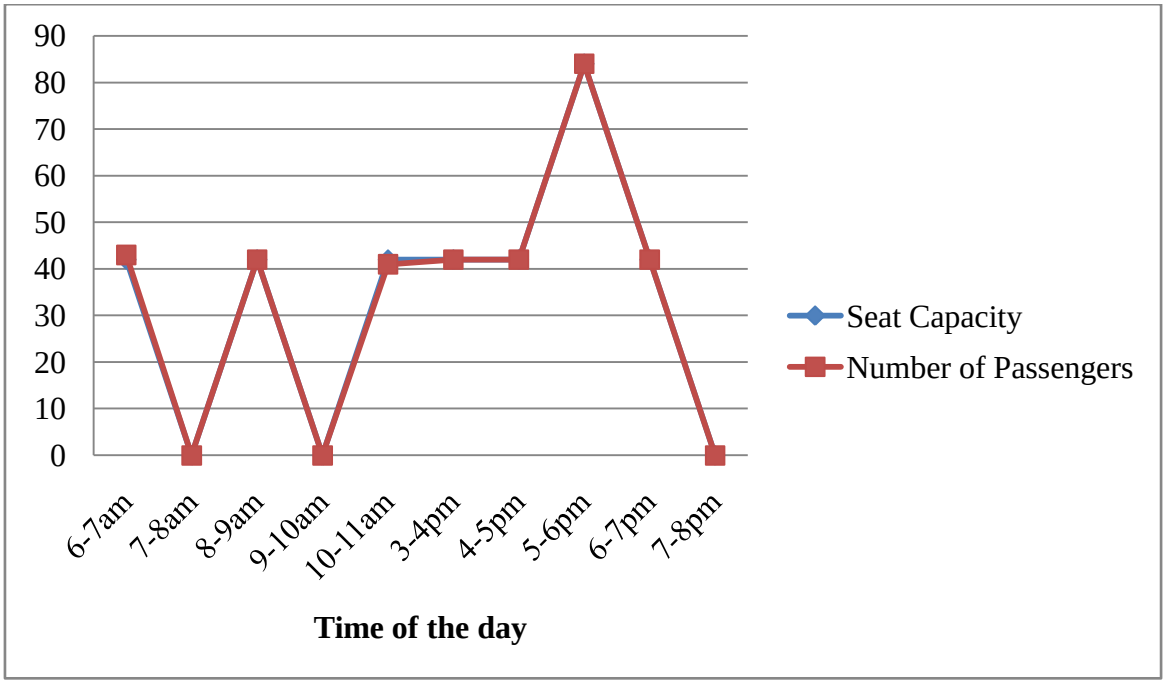

Figure 4.5 Passenger Volume-Capacity Gwagwalada Weekend (AUMTCO)

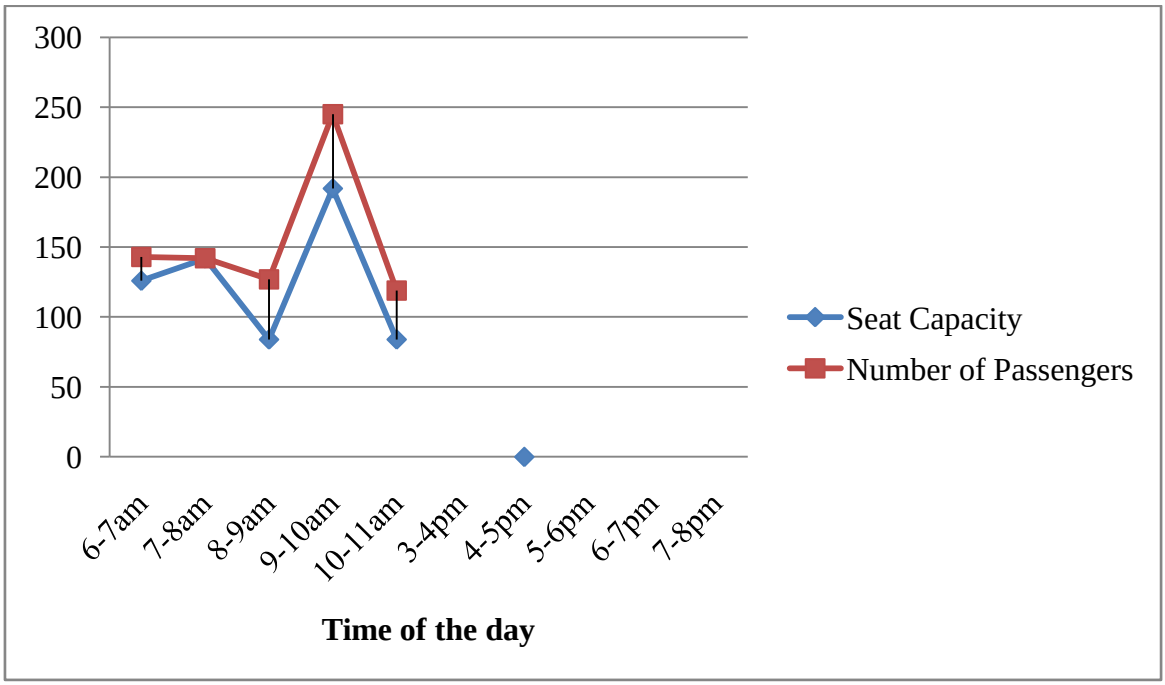

Figure 4.6 Passenger Volume-Capacity Zuba Weekday (AUMTCO)

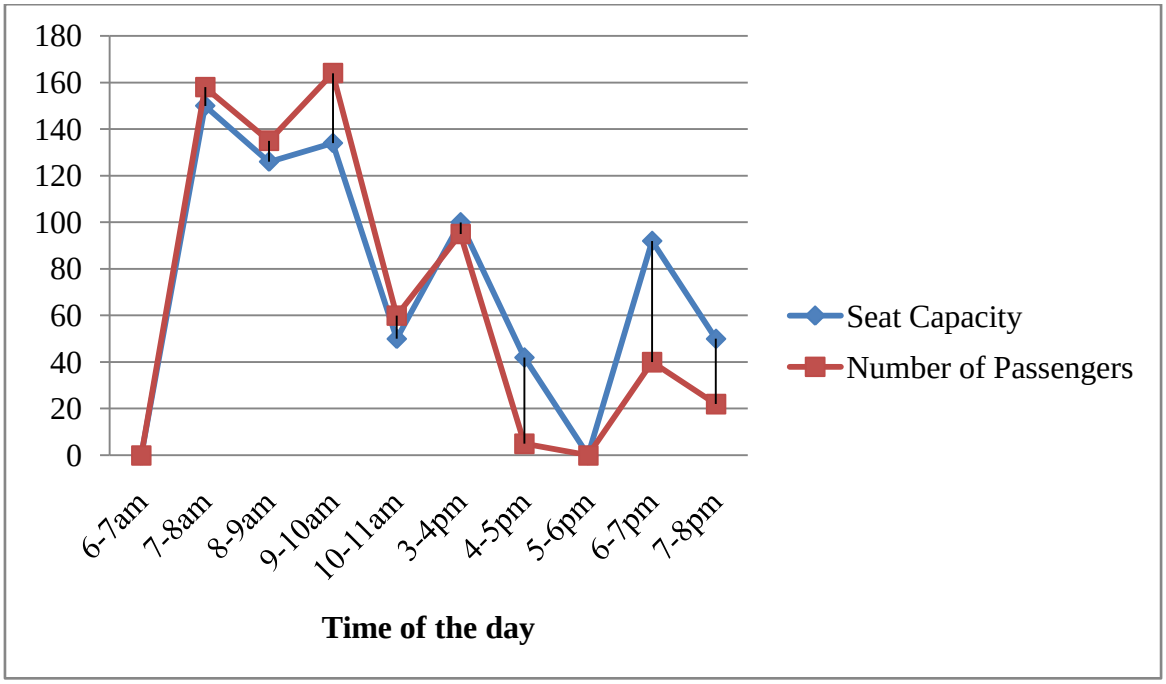

Figure 4.7 Passenger Volume-Capacity Zuba Weekend (AUMTCO)

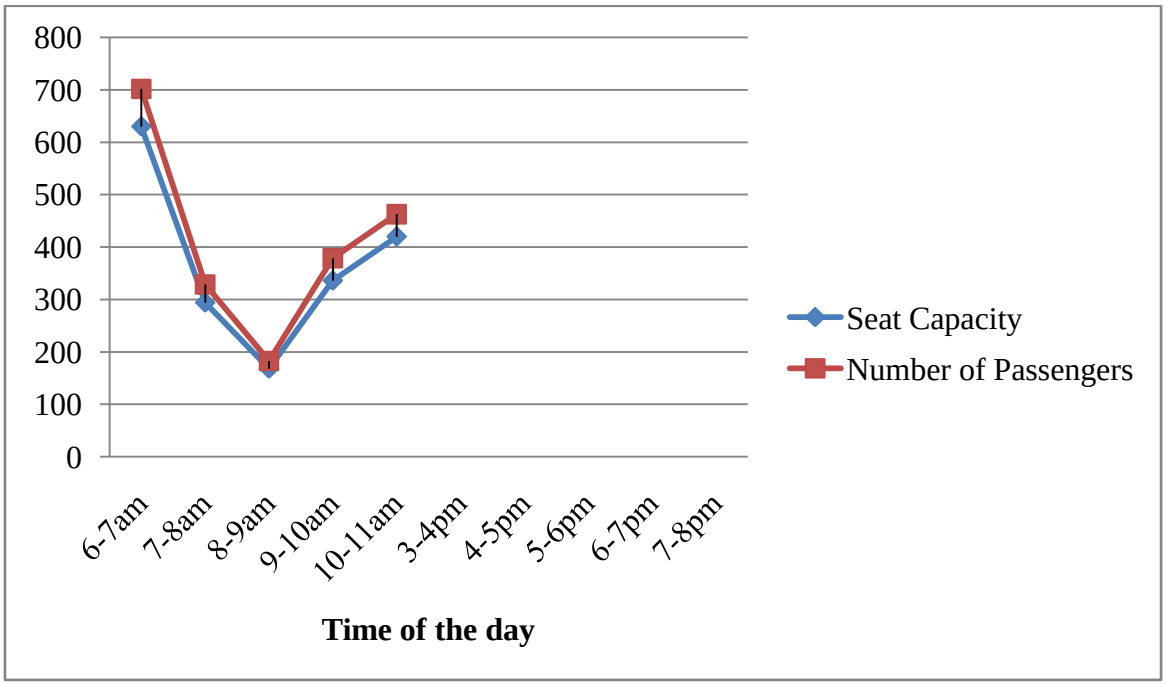

Figure 4.8 Passenger Volume-Capacity Nyanya Weekday (AUMTCO)

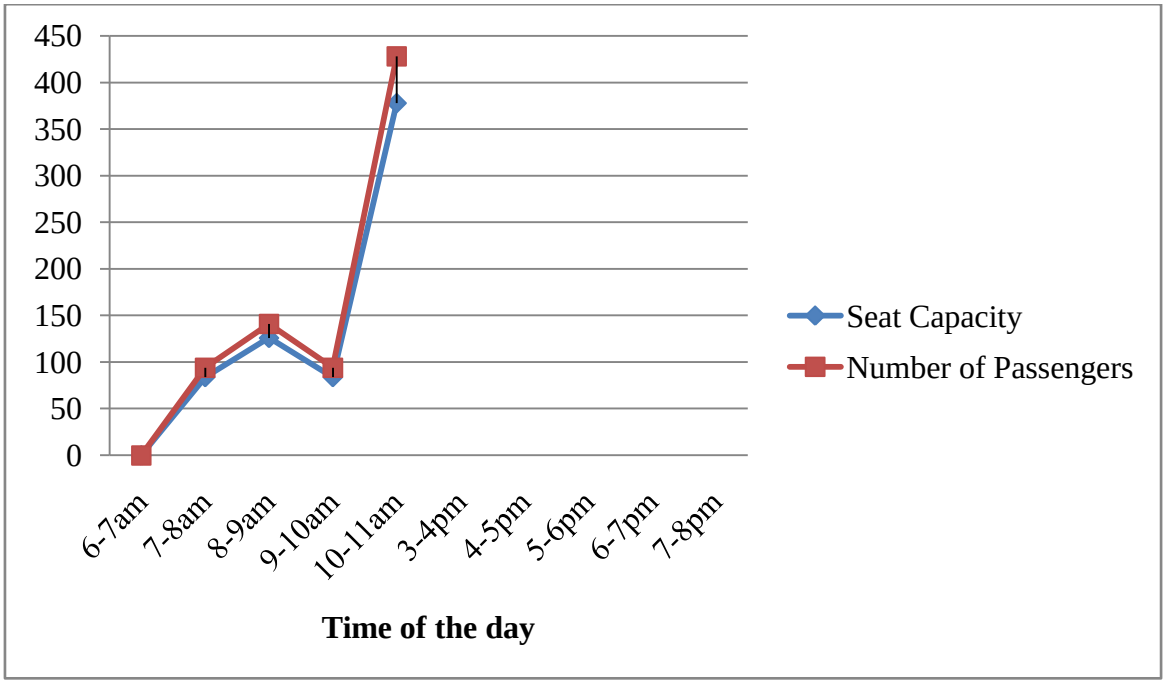

Figure 4.9 Passenger Volume-Capacity Nyanya Weekend (AUMTCO)

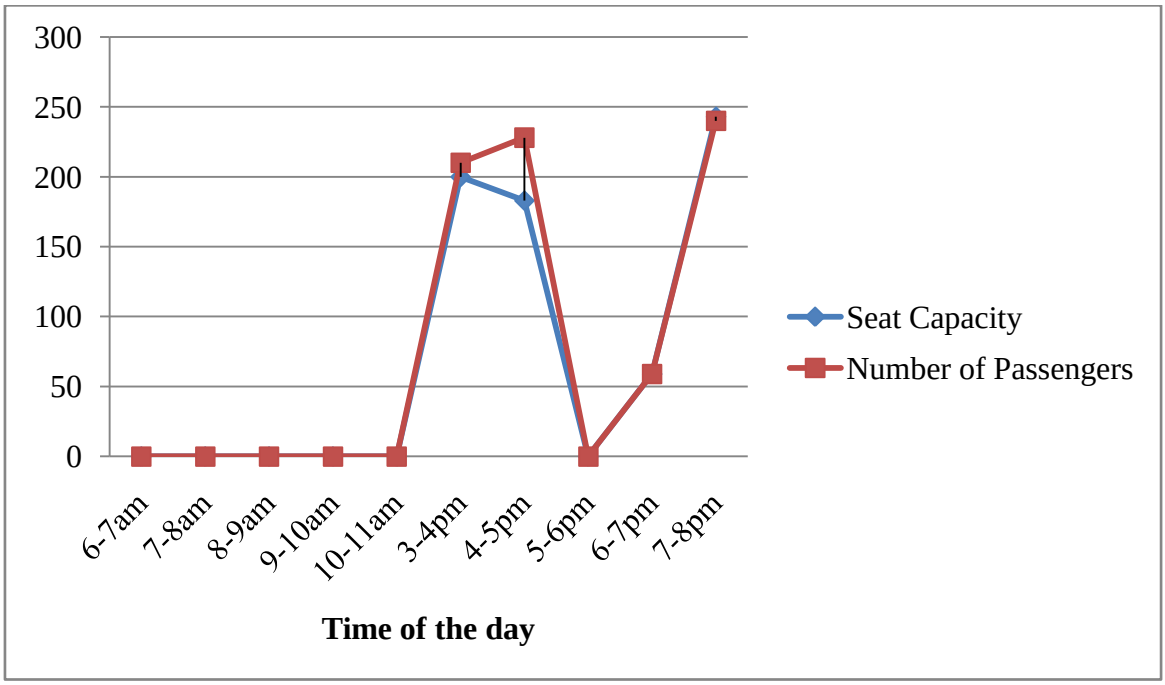

Figure 4.10 Passenger Volume-Capacity City Center Weekday (AUMTCO)

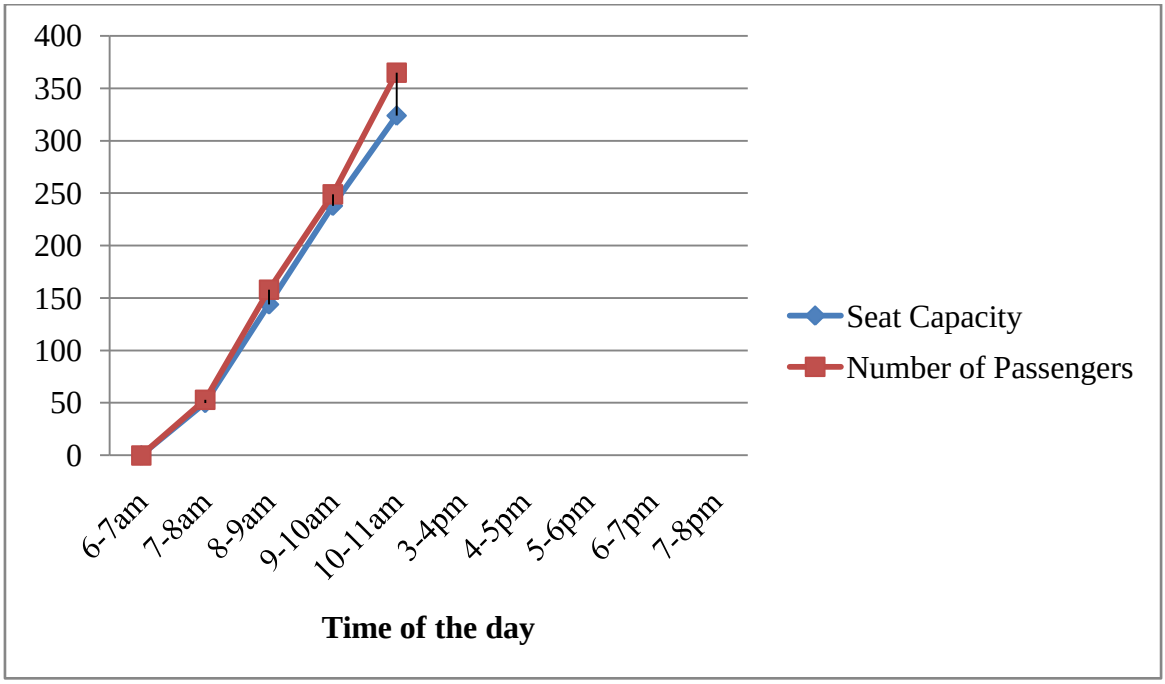

Figure 4.11 Passenger Volume-Capacity City Center Weekend (AUMTCO)

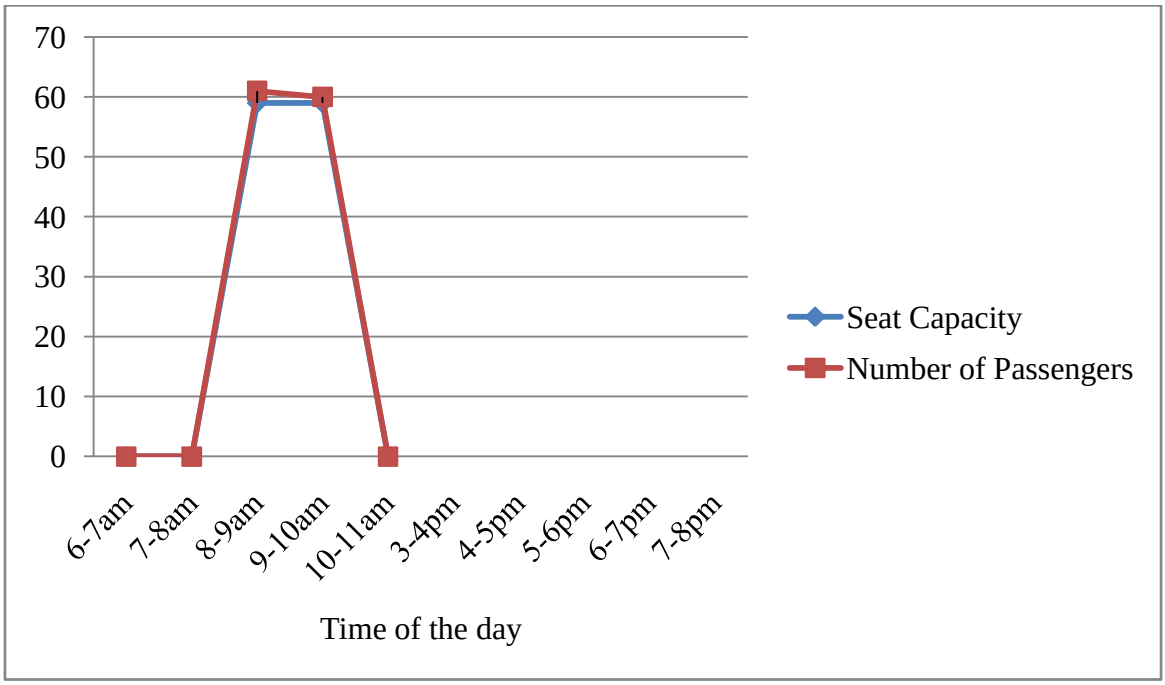

Figure 4.12 Passenger Volume-Capacity Berger-Lugbe Weekday (FABREM)

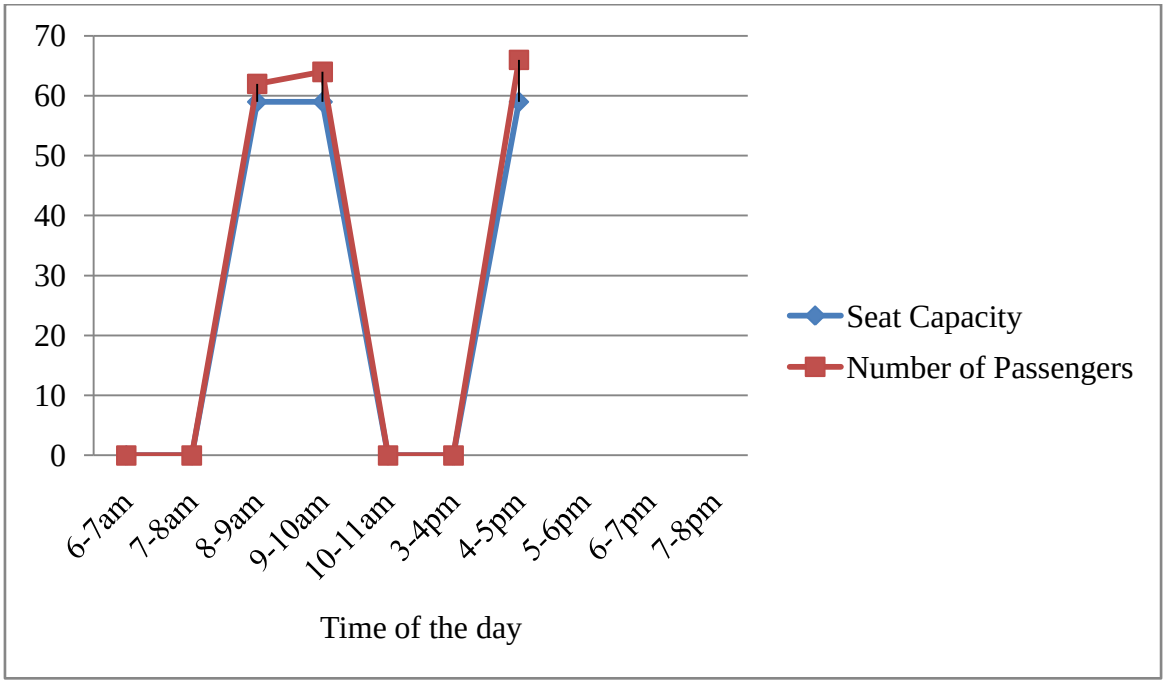

Figure 4.13 Passenger Volume-Capacity Berger-Lugbe Weekend (FABREM)

Figure 4.4-4.13 indicated one directional flow of high capacity bus services in most of the routes. This could be as a result of private cars and commercial taxi plying the high capacity bus routes which commuters prefer to bus services. From the Figures it can be inferred that at most times of the day in the various routes passenger volume outweigh the bus seat capacity.

4.5 The User-Perception of the Quality of Public High Capacity Bus Services

4.5.1 Passenger Bus Service Rating

Passenger rating of the public high capacity bus transport system in the study area was done using a five point likert-type scale with strongly adequate, adequate, undecided, inadequate and strongly inadequate at different time of the day across the various routes. This is indicated in Table 4.12 - 4.15

Table 4.12 Passengers Bus Services Rating in the Morning (Weekday)

Response	Route Name				Total
	Gwagwalada	Zuba	Nyanya	City Center	
Strongly adequate	6 (27.3%)	17 (34.0%)	31 (15.3%)	9 (20.5%)	63 (19.8%)
Adequate	9 (40.9%)	13 (26.0%)	80 (39.6%)	12 (27.3%)	114 (35.8%)
Undecided	2 (9.1%)	5 (10.0%)	13 (6.4%)	6 (13.6%)	26 (8.2%)
Inadequate	5 (22.7%)	13 (26.0%)	61 (30.2%)	13 (29.5%)	92 (28.9%)
Strongly inadequate	0 (0.0%)	2 (4.0%)	17 (8.4%)	4 (9.1%)	23 (7.2%)
Total	22 (100%)	50 (100%)	202 (100%)	44 (100%)	318 (100%)

Source: Author Field Survey, 2014.

Table 4.12 exemplified the perception of the passengers on the adequacy of public high capacity bus services. About 55.6% of the passengers described the services as adequate while 36.1% and 8.2% agreed that services are inadequate and undecided respectively.

Table 4.13 Passengers Bus Services Rating in the Evening (Weekday)

Response	Route Name				Total
	Gwagwalada	Zuba	Nyanya	City Center	
Strongly adequate	0 (0.0%)	5 (18.5%)	19 (13.5%)	1 (3.8%)	25 (11.8%)
Adequate	5 (29.4%)	7 (25.9%)	48 (34.0%)	7 (26.9%)	67 (31.8%)
Undecided	2 (11.8%)	4 (14.8%)	19 (13.5%)	3 (11.5%)	28 (13.3%)
Inadequate	6 (35.3%)	11 (40.7%)	40 (28.4%)	10 (38.5%)	67 (31.8%)
Strongly inadequate	4 (23.5%)	0 (0.0%)	15 (10.6%)	5 (19.2%)	24 (11.4%)
Total	17 (100%)	27 (100%)	141 (100%)	26 (100%)	211 (100%)

Source: Author Field Survey, 2014.

As revealed in Table 4.13, 43.6% of the passengers said that the bus service is adequate and 43.2% were of the view that bus services are not adequate leaving 13.3% undecided.

Table 4.14 Passengers Bus Services Rating in the Morning (Weekend)

Response	Route Name				Total
	Gwagwalada	Zuba	Nyanya	City Center	
Strongly adequate	5 (26.3%)	6 (25.0%)	31 (24.6%)	6 (25.0%)	48 (24.9%)
Adequate	7 (36.8%)	12 (50.0%)	60 (47.6%)	8 (33.3%)	87 (45.1%)
Undecided	1 (5.3%)	4 (16.7%)	12 (9.5%)	2 (8.3%)	19 (9.8%)
Inadequate	6 (31.6%)	2 (8.3%)	12 (9.5%)	5 (20.8%)	25 (13.0%)
Strongly inadequate	0 (0.0%)	0 (0.0%)	11 (8.7%)	3 (12.5%)	14 (7.3%)
Total	19 (100%)	24 (100%)	126 (100%)	24 (100%)	193 (100%)

Source: Author Field Survey, 2014.

Table 4.14 demonstrates that 24.9% of the respondents agreed that the bus services is strongly adequate, about 45.1% agreed to bus service adequacy while 9.8%, 13.0% and 7.3% represents undecided, inadequate and strongly inadequate respectively. The analysis therefore shows availability of public high capacity bus services.

Table 4.15 Passengers Bus Services Rating in the Evening (Weekend)

Response	Route Name				Total
	Gwagwalada	Zuba	Nyanya	City Center	
Strongly adequate	2 (12.5%)	4 (19.0%)	27 (22.1%)	5 (21.7%)	38 (20.9%)
Adequate	2 (12.5%)	11 (52.4%)	51 (41.8%)	6 (26.1%)	70 (38.5%)
Undecided	3 (18.8%)	4 (19.0%)	13 (10.7%)	1 (4.3%)	21 (11.5%)
Inadequate	7 (43.8%)	2 (9.5%)	18 (14.8%)	8 (34.8%)	35 (19.2%)
Strongly inadequate	2 (12.5%)	0 (0.0%)	13 (10.7%)	3 (13.0%)	18 (9.9%)
Total	16 (100%)	21 (100%)	122 (100%)	23 (100%)	182 (100%)

Source: Author Field Survey, 2014.

Table 4.15 as presented shows that majority of the respondents agreed to the adequacy of bus services representing 59.4% while 29.1% represents adequacy leaving 11.5% to undecided.

4.5.2 Passenger Bus Service Quality Perception

Quality of service is defined as the overall measured or perceived performance of transit from the passenger's point of view (May, 2000). Some of the bus service quality that affects passenger use of bus service is examined to note the most significant among them. The variables considered are short waiting time, frequent bus services, short walking distance, bus provide short travel time, cheap and affordable bus fare, better, clean and safe buses, polite behavior of drivers and its assistance, sufficient buses and comfort and convenience. Correlation analysis was performed in order to understand the perception of the specific service quality by the passengers. Correlation matrix between observed variable are presented in Appendix C. Observation from the correlation matrix shows that there are strong inter-correlations between the variables, which accounted for the existence of many redundancies among some variables. To remove the effect of these strong inter correlations, as well as include the contributions of the apparently redundant (weakly correlating) variables, Principal Component Analysis was employed to collapse the nine specific service quality variables of public high bus transport services.

Reliability test using KMO and Bartlett's Test of sampling adequacy was carried out to determine the strength of the correlated variables to allow for the analysis. The result .779 shows the sampling adequacy of the variables as stated by Cornish (2007) that result should be over .700.

Table 4.16 KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.779
Bartlett's Test of Sphericity	Approx. Chi-Square	459.374
	df	36
	Sig.	.000

Source: SPSS Computation, 2014.

Principal component analysis with VARIMAX rotation was carried out and the selection of components were based on the Kaiser criterion was carried out. The analysis resulted in three components solution, which explained 61.8% of the total variance. The component loading matrix for final solution is presented in Table 4.17

Component 1 has an eigenvalue of 3.22 and accounts for 35.8% of the total explained variance. The component has high positive loadings on buses provide short travel time, short waiting time, short walking distance to bus stop and frequent bus services. These variables describe access to bus services. Thus, component 1 is identified as "accessibility to public high capacity bus services". This finding is not surprising Pacione (2002) see transport as a means of providing accessibility, that is to say mobility is not important in itself as much as in its provision of access.

Component 2 has high and significant positive loadings for better, clean and safe buses (0.847), polite behavior of drivers and its assistants (0.757) and comfort and convenience (0.738). These variables describe conditions in buses. Component 2 is then identified as "in bus comfort" It has an eigenvalue of 1.22 and accounts for 13.5% of the total explained variance. This finding is in accordance with the Andaleeb *et al*. (2007) that comfort has an impact on passenger satisfaction.

Component 3 has positive loadings on cheap and affordable bus fare and sufficient number of buses S10 with an eigenvalue of 1.12, and it accounts for 12.49% of the total explained variance. Component 3 describes the availability of bus services facilities. It is, therefore, identified as "availability of public high capacity bus services".

Table 4.17 depicts the correlation among underlying components identified.

Table 4.17 Component Transformation Matrix

Factor	Accessibility to Bus Service	In Bus Comfort	Bus Service Availability
Accessibility to Bus Service	0.637	0.636	0.436
In Bus Comfort	0.761	-0.607	-0.226
Bus Service Availability	-0.121	-0.476	0.871

Extraction method: Varimax with Kaiser Normalization

From Table 4.17, there is a strong correlation between accessibility to bus service and in bus comfort. This shows some dependency between the two components. The results provide statistical evidence to support the identified service variables as accessibility to bus services, in bus comfort and bus service availability.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the discussion of the major findings in relation with the background and literature review. The researcher views are also included arising from statistical inference, observation and interpretation of situations encountered during the study. The conclusions are given based on the findings and consequently recommendations were made based on the conclusions. Other areas for further research have also been indicated at the end of this chapter.

5.2 Summary of Findings

The study made a number of deductions from the data analysis, which was discussed in ensuing paragraphs;

i. The study revealed that in the Federal Capital Territory there is dedication of routes to mini buses and high capacity buses transport services to ensure proper coordination among the various means of transport in meeting the mobility need of its residents. However the enforcement of this policy on the part of the government has been weak given that private cars, commercial taxis and mini buses still ply the routes dedicated to high capacity buses. This often times has resulted into one directional flow of high capacity bus transport services in the study area.
ii. This study has clearly shown the dependency of commuters on high capacity bus transport services in the study area given that most use the services daily

especially in the morning and evening to get the their places of work and residence. This agrees with Aworemi, Salami, Adewoye and Illori (2008) that majority of the urban population depend entirely on public transport for their mobility needs.

iii. Considering the available public high capacity bus transport services in the Federal Capital Territory, the study discovered that commuters travel long distance by walking to catch a bus especially at the city center, wait for long for bus services and often times the buses are crowded during peak periods. Similarly, the insecurity challenge especially at the bus parks has further made passengers develop phobia for high capacity bus transport services. This situation often made them prefer the services of private cars and commercial taxis to high capacity bus services hence most use bus services when there is no other alternative.

iv. As demonstrated in this study the correlation analysis conducted among the various bus service quality variables shows that there is positive relationship among the variables. This was further subjected to principal component analysis to reduce the correlated variables. The analysis revealed that accessibility to bus services, in bus comfort and availability of bus services are the variables commuters consider to be important in public high capacity bus transport services provision in the study area. This is in contrast to the findings of Ali (2014) where in bus comfort ranked first followed by accessibility to bus services. This could be explained by the ban of mini buses along the major roads in the study area.

v. Finally, the study found out that there is lack of basic infrastructures like priority bus lane and standard bus stops for the high capacity bus transport services in

the study area as majority of the passengers wait for buses along the road. This contrary to what is obtainable in the advance countries where bus stops are provided with shelters, often equipped with benches, lighting facilities , heating, paper, food, drinks, rending machine, telephone booths, bus schedules and time table are also provided (Addenbrooke, 1981).

5.3 Conclusion

High increasing motorization in Indonesia causes many problems in traffic congestion, a high level of pollution, a high consumption non-renewable energy resource, a threat to quality of life and a high number of traffic accidents. Public high capacity bus transport should become the solution for sustainable public transport in the future, which is the reason to increase commuters' satisfaction. High quality public high capacity bus transport not only keeps commuters to continue using the services to fulfill their travel demand but also attract potential commuters.

The accessibility to public high capacity bus services has a strong influence on commuters' satisfaction and need a higher attention to improve given the residents dependence on public high capacity bus services. The effort in this research is dedicated to develop an attractive and marketable public high capacity bus transport services in the Federal Capital Territory.

5.4 Recommendations

The following recommendations are made based on the researcher's findings, to point the way forward on the patronage of public high capacity bus transport services in the Federal Capital Territory.

i. The Transportation Secretariat of the Federal Capital Territory should put up a legal framework that institutionalize this route dedication and establish a monitoring and evaluation team who must be on these routes as field officers to

ensure strict adherence. They should also be empowered to arrest offenders and made to face the law.

ii. The Transportation Secretariat in conjunction with the operators of high capacity bus transport services through public private partnership should embark on construction of standard bus stops with modern facilities like public convenience, stands for newspaper, drinks and food vendors. The vendors should pay for operating their businesses at the bus stops which will assist in the maintenance of the bus stops.

iii. Bus parks should be properly located, fenced and provided with CCTV Cameras. To further enhance the security of bus parks, passengers should be screened with metal and bomb detectors at park entrance by the security.

iv. Public high capacity bus transport service operators should start to pay attention to increase accessibility to bus services by ensuring short waiting time for buses and that bus services provide short travel time especially at peak periods. This could be achieved by operators stationing their staffs at bus stops who communicate with the person in charge of bus deployment and drivers for redeployment of buses especially during the peaks and high capacity bus lanes should be created to avoid high congested road.

v. Finally, to reduce commuters walk distance to bus stops other means of transport like the tricycle, commercial taxis should be used by commuters at a fairly cheap fare.

5.5 Suggestions for Further Research

The researcher suggested the following areas for further research;

i. Access Time to Public High Capacity Bus Transport Services

ii. Operational Cost of Public High Capacity Bus Transport Services.

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APPENDIX A

QUESTIONNAIRE FOR PASSENGERS

DEPARTMENT OF GEOGRAPHY, AHMADU BELLO UNIVERSITY ZARIA, NIGERIA

Dear Passenger/ Respondent,

I am carrying out a study on "Public Usage of high capacity buses in FCT, Abuja". The study is an academic research leading to the award of Master of Science Degree in Transport Management in the above named Institution. Any information given will be kept confidential and used for the research only. Your kind gesture is appreciated.

Yours faithfully,

Chibueze Daniel, OKERE
(M.Sc/Sci/1485/2011-2012)

Instruction: Please tick ( ) your response in the space provided.

1. Name of the Bus Route
   ……

2. How often do you ply the Route

   Daily ( ) Twice in a week ( ) Thrice in a week ( ) Weekends only ( ) Other

   Specify ( )

3. By what means do you get to the Bus Stop

   Walking ( ) Taxi ( ) Bus ( ) Motorcycle ( ) Tricycle/KEKE NAPEP ( ) Others

   Specify ( )

4. Distance from your work place/ house to the bus stop

   Less than 0.5km ( ) 0.5 – 1km ( ) 1 – 2km ( ) 2 – 3km ( ) Above 3km ( )

5. How long do you walk to the Bus Stop

   Less than 15 minutes ( ) 15 – 30 minutes ( ) 30 – 45 minutes ( ) 45 – 60 minutes ( ) above 60 minutes ( )

6. At what time of the day do you mostly use bus services

   Mornings only ( ) Afternoons only ( ) Evenings only ( ) Mornings and Afternoons ( ) Mornings and Evenings ( ) All times of the day ( )

7. Where do you mostly wait for bus

   Bus stop with shelter ( ) Bus stop without shelter ( ) along the road ( ) other specify ( )

8. How long do you wait for buses

Day of the week	Time of the day	Less than 15 minutes	15 – 30 minutes	30 – 45 minutes	45 – 60 minutes	Above 60 minutes
Week days	Morning					
	Afternoon					
	Evening					
Week ends	Morning					
	Afternoon					
	Evening					

9. How often do you get seat inside the bus

   Every trip ( ) Once in two trips ( ) Once in five trips ( ) Never get seat ( ) other specify ( )

10. How would you rate bus services provided

Day of the week	Time of the day	Strongly adequate	Adequate	Undecided	Inadequate	Strongly inadequate
Week days	Morning					
	Afternoon					
	Evening					
Week ends	Morning					
	Afternoon					
	Evening					

11. Reason for using the bus mass transit services. Tick where appropriate

Service Quality Variable	Strongly agree	Agree	Undecided	Disagree	Strongly disagree
Short waiting time for bus					
Frequent bus services					
Short walking distance to bus stop					
Buses provide short travel time					
Cheap and affordable bus fare					
Better, clean and safe buses					
Polite behavior of drivers and its assistant					
Sufficient number of buses					
Comfort and Convenience					

Thank You.

APPENDIX B

QUESTIONNAIRE FOR PUBLIC BUS OPERATOR

DEPARTMENT OF GEOGRAPHY, AHMADU BELLO UNIVERSITY ZARIA, NIGERIA

Dear Respondent,

I am carrying out a study on "Public Usage of high capacity buses in FCT, Abuja". The study is an academic research leading to the award of Master of Science Degree in Transport Management in the above named Institution. Any information given will be kept confidential and used for the research only. Your kind gesture is appreciated.

Yours faithfully,

Chibueze Daniel, OKERE
(M.Sc/Sci/1485/2011-2012)

Instruction: Please tick ( ) your response in the space provided.

1. Name of the operator's company ……
2. Location of the company …….....
3. Ownership type of the company …….
4. Year of establishment …….
5. Date of commencement of service …….
6. Respondent designation …….
7. Duration of bus services

   Week days (Mondays – Fridays) ……..

   Weekends (Saturdays – Sundays) …….
8. Bus push out time from the depot

   Week days ……

   Weekends ……

9. Bus pull in time into the depot

   Week days ……

   Weekends ……

10. Minimum time required for passengers to get a bus at various bus stops

    Week days ……

    Weekends ……

11. Total number of buses in the depot ……

12. The number of buses in use ……

13. Do you receive any subvention from the FCT Transport Secretariat/ any other Government agency Yes ( ) No ( )

14. How often Weekly ( ) Monthly ( ) Quarterly ( ) Yearly ( ) other specify ( )

15. Reasons for the subvention

    ……..…….

    ……

    ……

16. What are some of the challenges you face providing bus services

    ……
    ……
    ……
    ……
    ……

17. What are the routes you ply and details

Route Name	Route Length (Km)	Total Number of Bus Stops	Number of Buses Allocated Daily			Capacity of the Buses
			Morning	Afternoon	Evening	

Thank you.