ACCESSIBILITY TO LAGOS BUS RAPID TRANSIT (BRT LITE) BUS STOPS: AN EMPIRICAL STUDY

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Accessibility to Lagos Bus Rapid Transit (BRT LITE) Bus Stops: An Empirical Study

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Abstract

The introduction of Bus Rapid Transit (BRT) on March 17, 2008 in Lagos, Nigeria has attracted several comments and studies from the media and academic world. Most of the studies focused on the impact of BRT on users' mobility and traffic congestion in the city of Lagos. The purpose of this paper is to examine the level of accessibility of users to BRT bus stops in terms of distances, travel time and waiting time at the BRT bus stops. The study is based on a randomly selected set of 200 users of BRT in Agboyi-Ketu area of Kosofe LGA of Lagos state. The findings showed that, with respect to user's proximity to BRT bus stops, the average distance walked to BRT bus stops is 0.36km. The analysis of modal choice to the BRT bus stops showed that 36.5% of the sampled commuters commute by motorcycles, 24.5% trekked to the bus stops, while 39% of the samples commute to BRT bus stops by other modes of transportation. Further analysis shows that significant variations exist between the travel time to and waiting time at the BRT bus stops and frequency of patronage of BRT. The study concludes that the introduction of BRT is the first step towards integrated transport and development in the city of Lagos. Further steps are necessary to: increase the number of BRT bus stops; to regulate and improve the service deliveries of other modes of transport for effective interdependence between the BRT and other modes.

Keywords: Bus Rapid Transit, Accessibility, Bus Stop, Travel Distance, Travel Time and Waiting Time

1. Introduction

Transportation all over the world is linked to all aspects of urban life: leisure, education, business and industry. Transportation provides a key to understanding and operation of many other systems at many different scales and is an epitome of the complex relationships between social and political activities and the level of economic development (Onokala, 2001). Ensuring a resilient urban transport system is therefore necessary to avoid large and costly disruptions of urban life in cities like Lagos, Nigeria, where the state of urban transport system, over the years, has been characterized: by inadequate and inefficient public transport; long waiting time; high cost of intra-city mobility; extremely congested highways ; the preponderance of the use of motorcycles as a mode of urban passenger transport; and

where the available public transport services are of very poor quality and delivered mostly by individual bus operators (Fagbemi, 1989, Ogunsanya,1997, Okanlawon, 2007 and Mobereola, 2009). The growing public transport patronage in the form of strong demand for efficient public urban mass transit system remains a high challenge in terms of socio-economic development of cities in Nigeria, especially a city like Lagos. Consequently, Lagos government finds solutions to problems associated with moving the urban masses in the Bus Rapid Transit (BRT). Rodríguez and Targa (2004) defined BRT as "a variety of bus-based applications involving coordinated improvements in operations, technology, infrastructure and equipment to improve the level of service of bus-based mass transit options." Some of the most advanced and widely heralded BRT services in the developing countries today are found in Latin America, such as Curitiba and São Paulo, Brazil, Bogotá and Cali, Columbia, Santiago, Chile, and Lima, Peru (see LAMATA, 2009; Estupiñán and Rodríguez, 2008).

On March 17, 2008, Lagos Metropolis joined the ranks of world-class BRT service-providers with the introduction of BRT-Lite system under the management of the Lagos Metropolitan Area Transport Authority (LAMATA). Although BRT lies at the heart of solving problems facing urban commuters in Lagos; improved accessibility to socio-economic facilities, reduces the amount of emission from the use of personal cars as modal choice in the metropolis, little attention has been paid specifically to the assessment and improvement of the level of commuters' accessibility to the BRT bus stops. The relative importance of improved access level to BRT bus stops has serious implications for transport policy and BRT utilization in the state. In many transport studies conducted in the rural and urban areas of developing countries, transport constraints, such as long distance to facilities, poor road network and transport services have been shown to reduce utilization of services (Okafor, 1990, Bour, 2003).

It is therefore of importance to understand the relationship between distance to BRT bus stops and the utilization of BRT services. If not, public investments in the provision of BRT services are not likely to produce the desired results such as reduction in the use of personal cars within the metropolis; reduction in quantity of emission from personal cars; free traffic flow; the provision of cost effective means of moving the urban masses in the Lagos metropolis and the enhancement of socio-economic wellbeing of the urban population.

This study therefore examines the access level of BRT users to BRT bus stops in Agboyi–Ketu development area in Kosofe Local Government Area of Lagos metropolis. The study is guided by two hypotheses. First, that there is an inverse relationship between distance to BRT bus stops and patronage of BRT services. Second, that distance is interrelated with travel time in influencing frequency of patronage of BRT services. The justification for this study stems from two perspectives. First, the fact that the utilization of BRT services depends on the level of accessibility of the commuters to BRT bus stops and secondly, the expected reduction in the use of personal cars to commute within the metropolis so as to reduce cars' emissions also rely not only on quality of services provided but also on the access level of car owners to BRT bus stops.

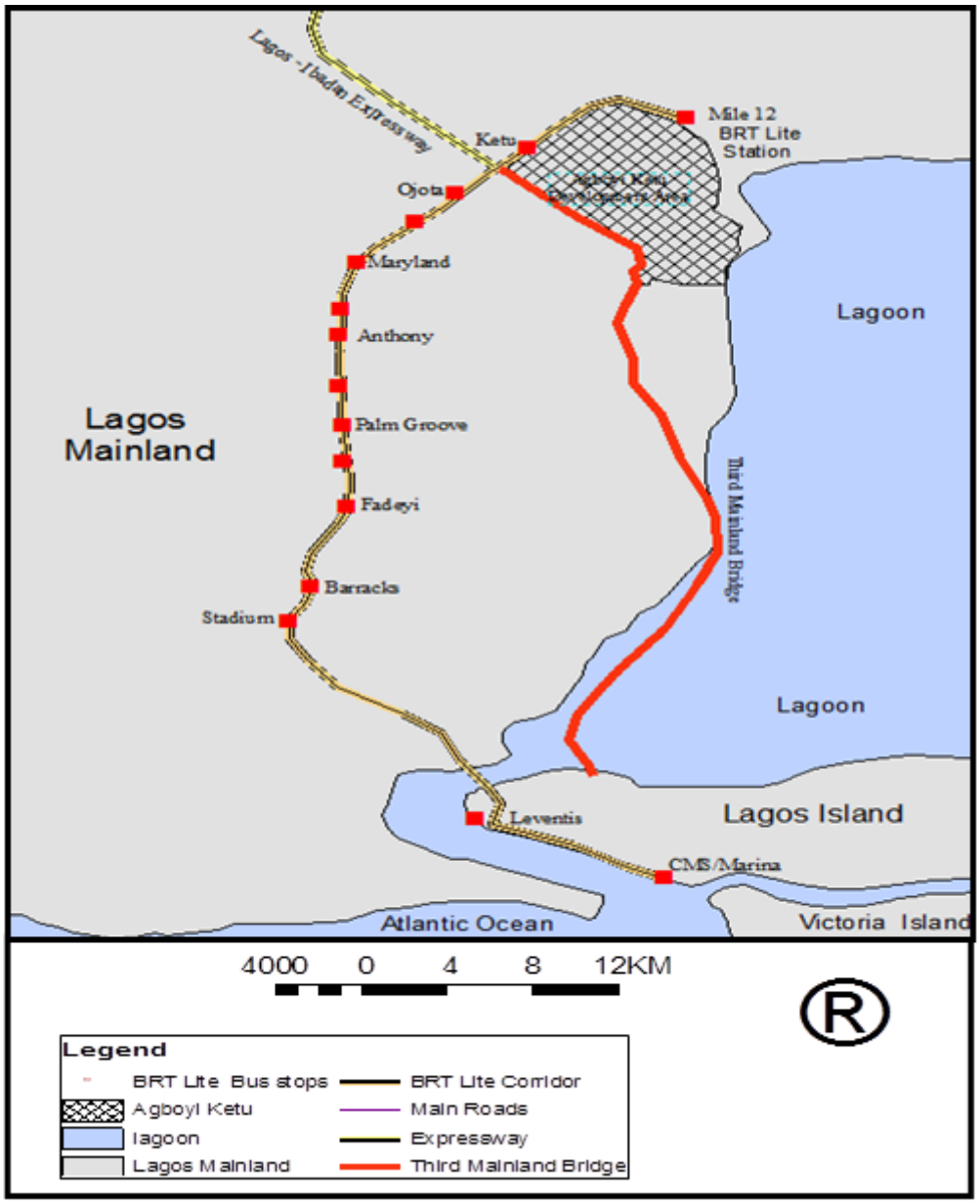
1.1 The Lagos BRT Light

Lagos as the commercial capital of Nigeria has a population estimated at between 15 and 18 million, and projected (conservatively) to grow to more than 25 million by 2025. Prior to the introduction of BRT on March 17, 2008, Lagosians relied for their mobility on a large fleet of 75,000 minibuses (Danfo), together with smaller numbers of midi-buses (Molue) and shared taxis (Kabu-Kabu). For local journeys, they employed motor-cycle taxis (Okada). "Danfo" and "Molue" are low quality modes of transport with variable fares, and are generally slow and uncomfortable. They favor short distances to maximize profit rather than to serve demand, and operators have a reputation of being aggressive (Mobereola, 2009).

The Lagos BRT system is the first of its kind in sub-Saharan Africa, and the only example of a comprehensive and integrated approach to improving public transport in Nigeria. The BRT-Lite

system operates along a 22-kilometer route of which 65 percent is physically segregated from the regular roadway and 20 percent is separated by road markings. The BRT-Lite system runs along Ikorodu Road, Western Avenue and Eko Bridge, a key radial highway that makes the 22Km connection between Mile 12 and Lagos Island (Fig.2). The BRT–Lite operates seven days a week, between 0600 and 2200 on weekdays and with reduced hours of operation on the weekends.

Fig.1: Map of Lagos Metropolis- showing BRT-Lite Corridor (From Mile 12 to CMS/Marina)



Source: LAMATA, 2009

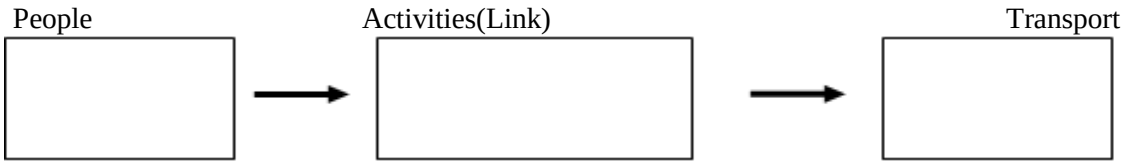
2. Conceptual Framework and Literature Review

2.1 Conceptual Framework

Accessibility is closely related to mobility. The term "accessibility" expresses the ease with which landuse activities (socio-cultural and economic activity centres, health and educational facilities, etc)

can be reached using a transport service (Adeniji, et al., 2000); or in other words, the amount of effort made by a person to reach a destination or the number of activities which can be reached from certain location (Geurs and Van Erick, 2001). In another perspective, Handy (2004) viewed accessibility as the ability to get what you need, ideally with a choice of destination and using a choice of modes.
In a study of rural accessibility / transport in East Anglia, Moseley (1979) has argued that the basic notion of accessibility consists of components as shown in fig.2. The diagram suggests that accessibility reflects attributes of person (age, sex, economic role, etc.); the transport (mode, and attributes e.g. frequency, cost, time etc) and the activity (workplace, school etc).

Fig. 2 Components of Accessibility (Source Moseley, 1979, Page 7)



In this study, public transport accessibility is associated with a certain number that is related to walking distance or walking time. The numbers of 400 to 800 meters of walking distance or 10 to 15 minutes of walking time are often accepted as moderate walking distance and time to transit points (Grava, 2004). Inaccessibility or poor accessibility of public transport means that the distance or time to walk to public transport terminal is longer than the acceptable standards. In this study, the attributes of the components of accessibility identified by Moseley (1979) and the acceptable walking distance and time will provide a framework for the achievement of the aim of the study.

2.2 Literature Review

Evidence from studies in advanced countries suggests that certain characteristics of the built environment are related to people's travel behaviors. Behaviors such as trip-making frequency, distance and time traveled have been studied for a variety of land use patterns and, street networks in different built environments (rural and urban). In particular, walking and using transit has been related to the presence of mixed uses of land (Moudon et al., 1997 and Crane, 2000) and improved street connectivity (Boarnet and Crane, 1998). The ways on which the urban form affect particularly non-motorized modes has been also documented emphasizing the importance of short blocks, topography, and perceptions of safety, drawing evidence from San Francisco (Cervero and Duncan, 2003), Neighborhood studies have also shown that the share of pedestrian and transit trips is higher in non-auto neighborhoods and that auto trips are shorter (Cervero and Gorham, 1995; Cervero and Radisch, 1996, and Rodriguez, et al., 2006).

In addition, extensive research has also been carried out on accessibility to social and economic facilities in developing countries. Many of the studies treated accessibility as a sub set of travel characteristics and behaviour (Maunder, 1984; Oyesiku, 1995 and Olatubara, 1995). Results from such studies suggest that walking is the most natural and important mode to access public transport (Cervero, 2001). For instance, Oyesiku (2001) in a study of mobility characteristics in Nigeria has observed that on the average 95% of trips are made by road, rail and water – based mode. Walking accounted for the remaining 5%. Of the trips made by vehicles, 70% were by public transport, which is dominated by private sector operators. According to Oyesiku, in 1975 alone, more than 95% of all urban public transport journeys in Nigeria were provided by private operators using mainly taxis and para-transit buses.

In developing countries, studies show the role of distance in reducing access level to and use of socio-economic facilities. For instance, Okafor (1984) in a study of accessibility to general hospitals in Rural Bendel State in Nigeria, found that distance was a discouraging factor in their utilization. In a similar study, Okafor (1990), in a survey of the spatial dimensions of accessibility to general hospitals in rural Nigeria concluded that residents from longer distances from a health institution utilized health services less.

Distance traveled to access facilities closely interrelates with two factors: travel time and transport cost. A longer distance would involve higher travel time and transport cost. Adesanya et al., (2002) examined the mobility characteristics of urban poor in six geo-political zones in Nigeria particularly in Yobe (Adamawa), Lagos (Lagos state), Port Harcout (River state), Onitsha (Anambra state), Jos (Plateau state) and Kaduna (Kaduna state). The survey revealed that accessibility characteristics of urban poor to the various social and economic opportunities are very low (that is, the ease with which activities can be reached from a specific point in space). According to them the distances and locations to different activities centres have significant bearings on urban commuters. Adesanya et al., (2002) reported that a sizeable number of schools (primary and secondary), pipe borne water points, primary health centres and dispensaries were located within one kilometre of residence of 42% of the respondents in all the states studied, while hospitals were considerably far from the residences of many respondents. It was reported that 25.1% of the respondents travel beyond nine kilometers in order to get to the nearest hospitals. They also reported that income of the urban residents play a dominant role on the frequency of trips to hospitals. According to them, low income earners make less frequent visit to hospitals because of cost of transport and treatment charges.

A study of the supply of transport infrastructure in Lagos metropolis found that most urban road networks are not only poorly developed with feeder street grossly inadequate, but also these inadequacies more often than not forced vehicles to concentrate on the primary roads with serious implications on commuters modal choice and mobility patterns especially along the same urban transport corridor (Ogunsanya, 2004). In a similar study, Ipingbemi (2010) observed that the roads in the city of Ibadan "are bad and lack ancillary facilities such as road shoulders and walkways. On most of the road sections there are no road signs and where they are available they are in deplorable condition. Pedestrians compete with moving traffic for the use of roads due to the absence of pedestrian facilities. This puts pedestrian safety at risk. Similarly, because there are no public parking facilities vehicles are parked indiscriminately on road shoulders (where available) and carriageway causing traffic disruption and congestion". The poor nature of the roads brings in its wake high transport costs and long travel times.

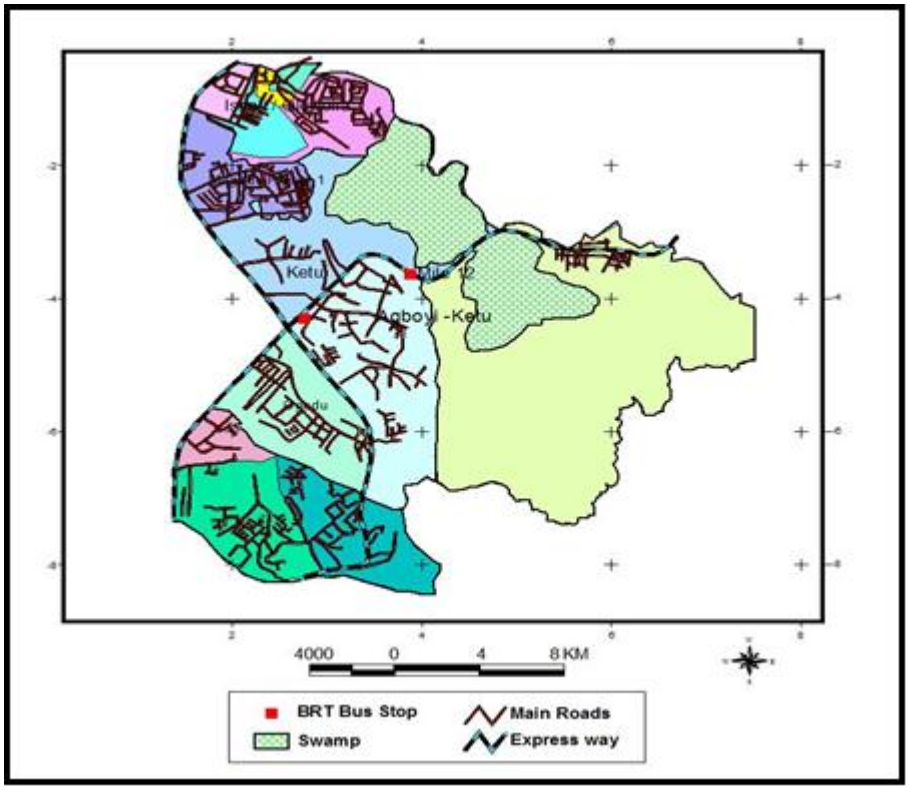
The review of empirical literature presented here has indicated that though several studies have been carried out to examine various components of Moseley's concept of accessibility as it relates to travel behaviour, mobility characteristics and the level of accessibility to socio-economic infrastructure in developed countries and in both rural and urban areas of Nigeria, little or no research has been done to investigate the level of accessibility of urban commuters in Lagos State to BRT bus stops and its utilization. Consequently, this study is important as it will provide the required insight to the level of accessibility to BRT bus stops on one hand and the relationship between accessibility level and utilization of BRT services in the Lagos metropolis on the other hand.

3. Data Source and Analysis

The survey was conducted in Agboyi-Ketu, a Development Area in Kosofe Local Government Area of Lagos State, Nigeria (Fig.3). The data used for this study were collected from primary source and were supplemented by secondary data. Primary data were collected from a questionnaire survey of 200 randomly selected passengers waiting to board or actually on board BRT buses at BRT stations at Mile 12 and Ketu. The number of commuters interviewed represents a subset of a larger survey on BRT conducted in Kosefe LGA. The data were collected in first and second weeks of the month of June 2010. The questionnaires were administered between 7.00am and 6.00pm.

The questionnaire was divided into three parts. Part one probed into the socio-economic background of the respondents. The second part consists of questions on patronage of BRT, distance, and mode to access BRT terminus. The third part consists of variables on waiting time and quality of services at BRT bus stops. Secondly, data were obtained from relevant literature and archival sources. Simple descriptive statistics were used to analyze the data. The product moment correlation analysis was used to examine the relationships between travel distance, mode, travel time and waiting time at BRT Bus stops on one hand and utilization of BRT on the other.

Fig. 3: Map of Kosofe LGA Showing Agboyi-Ketu



4. Results and Discussion

4.1 Socio Economic Characteristics of the Sampled Population

The need for people to make use of facilities located in space is responsible for the spatial movements of commuters in cities. The extent of and by what means, the movement is effected is a result of complex interaction among the attributes of the components of accessibility as identified in the literature (Moseley 1979). This information is vital to this study as it facilitates the understanding of the interaction between accessibility components and utilization of BRT services.

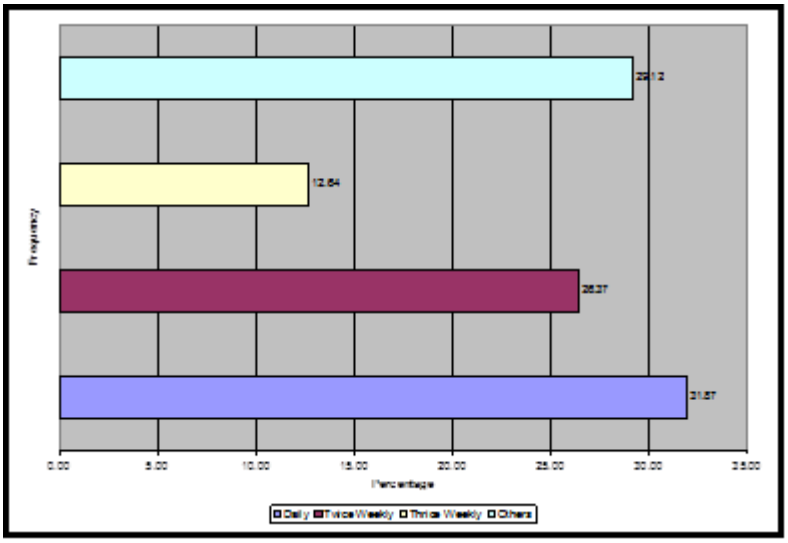
The socio-economic characteristics of BRT users are analyzed in terms of their sex, age structure, educational background and income level. 59.0% of the commuters were males. The age structure of the commuters showed that 28% of them were below 20 years, 63% between 21 and 40 years, 7% between 41 and 60 years. Those above 60 years old accounted for the remaining 2%. The educational attainments of the sampled population indicated that 0.5% had no formal education while those educated to the primary school level accounted for 4.5%. Respondents with secondary and tertiary level education are 10% and 85%, respectively. Monthly income analysis showed that more than 40.5% of the respondents earned less than N10, 000 monthly. Only 13% of them earned more than

N40, 000 per month. The prevailing economic situation in the country coupled with high level of unemployment explains why many of the educated respondents earned below N10, 000 monthly.

4.2 BRT Patronage Characteristics of Commuters

The BRT patronage characteristics of the respondents were analyzed in terms of patronage and frequency of patronage of BRT services. Analysis of data on patronage of BRT in the study area revealed that 91% of the respondents commute regularly within the Lagos metropolis by BRT. Small proportions (9%) of the respondents are occasional BRT users. In terms of frequency of patronage 31.9% of the regular users of BRT used it daily, 26.4% commute by BRT twice per week. The proportions of users BRT services, who used it three times a week are 12.6%, while 29.1% used it occasionally (Fig.4). The high proportion of BRT users in the study area is attributed to the quality of services offered by the BRT operators in contrast to the poor services provided by "Molue" and "Danfo" buses in the state.

Fig. 4: Patronage of BRT Services



4.3 Access to BRT Bus Stops

Accessibility characteristics of the respondents were analyzed in terms of distance to BRT stations, travel mode, travel time to and waiting time at BRT bus stops. Field observation revealed that there are only two BRT bus stops in the study area. The two bus stops are located along Ikorodu – Ketu section of the BRT corridor at Ketu and Mile 12 respectively.

Analysis of the data on distance traveled to the BRT bus stops in the study area showed that the mean distance traveled to the bus stops was 365 meters. The average distance traveled to access BRT bus stops in the study area falls within the acceptable walking distance of 400metres to transit or bus stops in major cities of the world (Grava, 2004). 35.5% of the respondents traveled a distance of less than 100meter to access BRT bus stops, 25.5% traveled between 101 meters to 200 meters to the bus stops. Those who traveled a distance of 201 to 500 meters are 14.5%. About 11% and 13% cover between 501 to 1000 meters and over 1000 meters to access BRT bus stops (figure 5).

Average distance traveled to access BRT bus stops, though may be moderate and falls within the acceptable walking distance, the impact of travel time, transport cost, waiting time and nature of road network on distance may affect access level to BRT bus stops and utilization of BRT services.

Fig. 5: Distance to BRT Bus stops

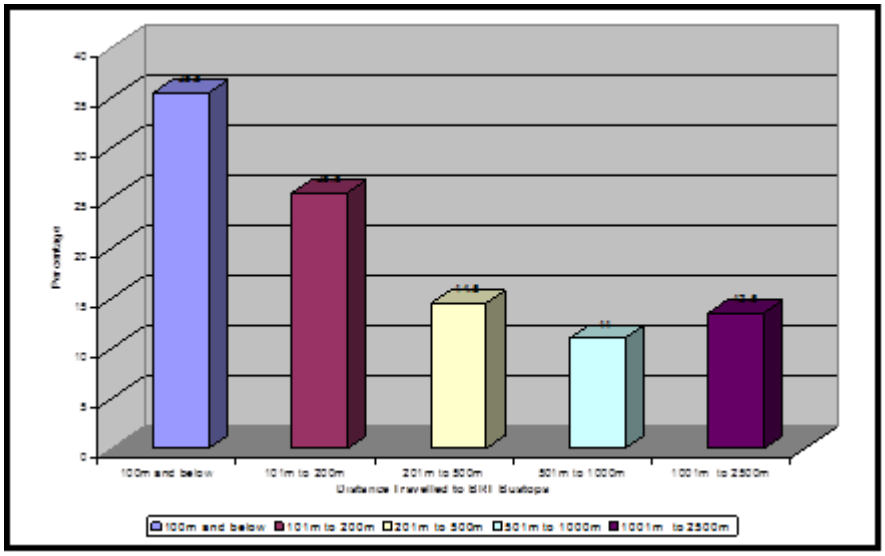


Table 1 showed that 36.5% of the sampled commuters commute by commercial motorcycles to the bus stops, 24.5% walk to the bus stops, while 39% of the sampled respondents commute to the BRT bus stops by commercial bus. The modal choice to BRT bus stop shows that, though the mean travel distance is below 400meters, BRT users prefer commercial motorcycles and buses to walking for various reasons. One of which is the poor nature of roads in the study area. The poor nature of roads, which has a direct effect on distance and travel time, could have a significant effect on accessibility to BRT bus stops and patronage of BRT services. In addition, the need to save time consumed in daily travel between origin and destination points; the desire for basic comfort, safety and avoidance of severe weather conditions make the use of commercial motorcycles and buses more attractive as means of accessing BRT bus stops than the walking mode. The implication of is that the government of Lagos State should not concentrate on the development of BRT system-BRT corridors and services, at the expense of other modes of transport and feeder roads that provide support service to BRT system in the city .

Table 1: Modal Split to BRT bus stop

Transport Mode to BRT Bus stops	Frequency	Percent
Walk	49	24.5
Motorcycles	73	36.5
Buses	78	39
Total	200	100

4.4 Traveling time to and waiting time at BRT bus stop

Table 2 revealed a variation in the time used to access BRT bus stops in the study area. About 11.5% of the respondents spent below 5 minutes as access time to BRT bus stops. This is more pronounced among those that walk to the BRT bus stops. Similarly, 39.5% and 26,5% of the respondents spent between 6 and 10 minutes and 11 and 20 minutes in transit between their residences and BRT bus stops respectively. Those that spent above 20 minutes are 22.5%.

In terms of waiting time at bus stops, 25% spent below 10 minutes at the bus stops. A large percentage of the respondents waited for between 11 and 20 minutes at the bus stops, 18.5% spent between 21 and

30 minutes waiting at the BRT bus stops either for the buses to come or to complete loading passengers. About 15% of the sampled population spent above 30 minutes at the BRT bus stops especially during off-peak periods (Table 3).

Table 2 Traveling Time to BRT bus stop

Travel Time To BRT stops	Frequency	Percent
Below 5 Minutes	23	11.5
Between 6 and 10 Minutes	79	39.5
Between 11 and 20 Minutes	53	26.5
Above 20 Minutes	45	22.5
Total	200	100

Table 3 Waiting Time to BRT bus stop

Waiting Time at BRT bus stop	Frequency	Percent
Below 10 Minutes	50	25
Between 11 and 20 Minutes	83	41.5
Between 21 and 30 Minutes	37	18.5
Above 30 Minutes	30	15
Total	200	100

4.5 Accessibility variables and frequency of patronage of BRT

Distance, mode of transport, travel time and waiting time were related to frequency of patronage of BRT to compare their impact and to test the validity of the study hypotheses. Table 4 shows a negative association between the distance and patronage of BRT. Longer distances to BRT terminal resulted in lower patronage of BRT buses. For instance, total patronage decreases from 35.50% for those who travel a distance of 100 meters and below to 13.50% for users of BRT living at a distance of 1001 to 2500 meters from BRT bus stops. Similar trend occurred between waiting time at bus stops and the frequency of patronage of BRT buses. The association was not consistent as the same could not be said about transport mode and frequency of patronage on one hand and travel time and frequency of patronage on the other, as shown in Table 5.

The correlation matrix (Table 5) showed the association between these variables and frequency of patronage. The correlation coefficient between the distance and frequency of patronage (-0.112), reflects the negative association between them. This implies that the null hypothesis of the first hypothesis– there exists a negative relationship between distance to BRT bus stops and patronage of BRT services in the study area, is accepted.

The correlation coefficient between travel time and patronage was 0.064, 0.036 for transport mode and 0.076 for waiting time at BRT bus stops. All three showed positive but weak correlations with frequency of patronage. A weak negative correlation (-0.014) also exist between road conditions leading to BRT stops and the level of patronage. Correlation is significant at the 0.01 level between: distance and travel time to BRT Bus Stops (0.212) on one hand and between travel time and waiting time at BRT bus stop (0.149). This shows that distance and travel time to BRT bus stops jointly influence the patronage of BRT services in the study area. Therefore, the null hypothesis of the second hypothesis– there exist a negative relationship between distance and travel time to BRT bus stops is rejected for the alternative hypothesis.

Table 4: Accessibility variables and frequency of patronage of BRT

	Daily		Twice per Week		Thrice per Week		Occasionally		Total	
Distance	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Below 100 meters	23	34.33	24	48	7	29.17	17	28.81	71	35.5
101 to 200 meters	18	26.87	11	22	9	37.5	13	22.03	51	25.5
201 to 500 meters	10	14.93	8	16	1	4.17	10	16.95	29	14.5
501 to 1000 meters	7	10.45	4	8	5	20.83	6	10.17	22	11
1001 and 2500 meters	9	13.43	3	6	2	8.33	13	22.03	27	13.5
Total	67	100	50	100	24	100	59	100	200	100
	Daily		Twice per Week		Thrice per Week		Occasionally		Total	
Mode to BRT	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Trekking	13	19.4	13	26	6	25	17	28.81	49	24.5
Motorcycles	31	46.27	18	36	8	33.33	16	27.12	73	36.5
Buses	23	34.33	19	38	10	41.67	26	44.07	78	39
Total	67	100	50	100	24	100	59	100	200	100
	Daily		Twice per Week		Thrice per Week		Occasionally		Total	
Travel Time	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Below 5 Minutes	10	14.93	5	10	3	12.5	5	8.47	23	11.5
6 and 10 Minutes	25	37.31	24	48	4	16.67	26	44.07	79	39.5
11 and 20 Minutes	20	29.85	10	20	7	29.17	16	27.12	53	26.5
Above 20 Minutes	12	17.91	11	22	10	41.67	12	20.34	45	22.5
Total	67	100	50	100	24	100	59	100	200	100
	Daily		Twice per Week		Thrice per Week		Occasionally		Total	
Waiting Time	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Below10 Minutes	15	22.39	16	32	6	25	13	22.03	50	25
11 and 20 Minutes	30	44.78	21	42	9	37.5	23	38.98	83	41.5
21 and 30 Minutes	14	20.9	6	12	7	29.17	10	16.95	37	18.5
Above 30 Minutes	8	11.94	7	14	2	8.33	13	22.03	30	15
Total	67	100	50	100	24	100	59	100	200	100

Table 5 Correlation Matrix

Variables	Distance	Travel Time	Mode	Road Condition	Waiting Time	Frequency of Usage
Distance	1					
Travel Time	0.212**	1				
Mode	0.049	0.143*	1			
Road Condition	0.018	0.031	0.048	1		
Waiting Time	0.124	0.149**	0.032	-0.008	1	
Frequency of Usage	-0.112	0.064	0.036	-0.014	0.076	1

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

5. Conclusion

Lagos BRT-lite, first of its kind in Sub Saharan Africa, represents an important and distinctive attempt at enhancing urban interaction. Its success will in the long run influence the adoption of BRT in many mega cities not only in Nigeria but in the Sub-Saharan African countries. The examination of accessibility characteristics to BRT bus stops is crucial because of its implications for transport planning. This study specifically examined the accessibility of urban commuters to BRT bus stops in Agboyi-Ketu area of Kosofe LGA, Lagos, Nigeria. Its findings are also relevant to cities in developing countries particularly those in Africa.

Findings showed that average distance to BRT bus stops is 0.36km. In terms of modal choice to BRT bus stops, the study revealed that commuters prefer to commute to BRT bus stops by other modes besides walking. For instance, 36.5% of the sampled commuters commute by motorcycles, 24.5% walk to the bus stops, while 39% of the sampled respondent commute to BRT bus stops by other modes of transportation such as “Danfo”, “Molue and Tricycles. The two hypotheses were validated by the research. The first hypothesis confirms the reality of a negative relationship between distance to BRT bus stops and utilization of its services. The second hypothesis shows that distance to BRT bus stops correlates with travel time to influence the level of patronage of BRT services.

The study clearly demonstrates the impact of distance to BRT bus stops and the utilization of the services provided by the Lagos BRT-lite and makes the following suggestions.

Tackling the problems of urban mass movements and traffic congestions in Lagos metropolis should not be restricted to designing and implementing an environmentally-friendly mass transit system. An holistic transportation planning approach is needed, where both the BRT and the other existing forms of public transportation are given equal attention, planning and regulation.

Road infrastructure development and maintenance in the metropolis should embrace all parts of the metropolis, especially the high density residential areas, and not only the road network making up the BRT corridor. The viability of BRT depends on the masses that inhabit most of the high residential areas, where road network are poorly developed or in bad condition. These roads should be rehabilitated to maximize travel time to BRT bus stops. The use of other urban transport modes, such as taxi, tricycles and commercial motorcycles should be encouraged to serve as link modes between the residential areas and the BRT bus stops and not as alternative and competing modes to BRT system.

Nevertheless, the introduction of BRT in Lagos metropolis is the first step towards integrated urban mass transport and development in Nigeria. A balanced transportation system, accordingly, calls for a balance of resources, facilities and opportunities in every other part of the transport sub system of the economy. Therefore, further steps are necessary to expand the BRT network into a fully operational structure covering the entire state. To this end, there is the need to increase the number of BRT bus stops and to regulate and improve the service deliveries of other modes of transport. For effective interdependence between the BRT system and other modes, the condition of feeder roads especially in high density residential areas of the state needs to be improved.

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References

Adeniji, K., Akande, T., Akinbinu,B. Adeyeye, V., Roberts, F.O.N., Adesanya, S and Simbine, T., 2000. Rural Travel and Transport in South-Western Nigeria. Federal Ministry of Agriculture and Rural Development, Abuja and The World Bank , Abuja, Nigeria. P. 1

Adesanya, A., Adeniji, K and Daramola, .A.Y., 2002. Transport Perspective of Poverty in Nigeria in Ajakaiye, D.O. and Olomola, A.S. (Eds.) Poverty in Nigeria: A Multi– Dimensional Perspective, pp. 235-283

Boarnet, M. and Crane, R. 1998. Public finance and transit-oriented planning: evidence from Southern California, Journal of Planning Education and Research, 17 (30), pp. 206–219

Buor, D., 2003. Analysing the primacy of distance in the utilization of health services in the Ahafo-Ano South district, Ghana. International Journal of Health Planning and Management. 18, pp. 293–311

Cervero, R. and Gorham, R., 1995.Commuting in transit versus automobile neighborhoods, Journal of the American Planning Association, 61 (2), pp. 210–225.

Cervero, R. and Radisch, C., 1996. Travel choices in pedestrian versus automobile-oriented neighborhoods, Transport Policy 3 (3), pp. 127–141

Cervero, R. and Kockelmann, K., 1997. Travel demand and the 3 Ds: density, diversity, and design, Transportation Research D 2 (3), pp.199–219.

Cervero, R., 2001. Walk-and-Ride: Factors Influencing Pedestrian Access to Transit. Journal of Public Transport, 7 (3), pp.1-23.

Cervero, R., 2002. Built environments and mode choice: toward a normative framework, Transportation Research Part D, 7 (4), pp. 265–284

Cervero, R. and Duncan, M., 2003. Walking, bicycling, and urban landscapes: evidence from the San Francisco bay area. American Journal of Public Health, 93 (9), pp. 1478–1483.

Crane, R., 2000. The influence of urban form on travel: an interpretative review, Journal of Planning Education and Research 15 (1), pp. 3–23.

Estupiñán, N. and Rodríguez, D.A., 2008. The relationship between urban form and station boardings for Bogotá's BRT. Transportation Research Part A: Policy and Practice. 42 (2), pp.296-306.

Fagbemi, A. A., 1989. Improving Urban Public Transportation: A case Study of Lagos State Transport Corporation. Unpublished M.Sc Thesis, Department of Geography, Obafemi Awolowo University, Ile-Ife Nigeria.

Geurs, K.T. and Van Erick J.R. (2001). Accessibility Measures, Review and Applications. Bilthoven, Rijksinstituut voor Volksgezondheid en Milieu (RIVM)

Grava, S., 2004. Urban Transport systems: Choices for Communities. The McGraw-Hill Companies. Downloaded from Digital Engineering Library @ McGraw-Hill Available at :http://www.digitalengineeringlib8rary.com [Accessesd 15 May 2011]

Handy, S. L., 2004. Travel Behaviour –Land Use Interactions: An Overview and Assessment of the Research. In Perpetual Motion. Pergamon

Ipingbemi, O., 2010. Travel Characteristics and Mobility Constraints of the Elderly in Ibadan, Nigeria . Journal of Transport Geography. 18(2), pp.285-291

Lagos Metropolitan Area Transport Authority (LAMATA), 2009. Lagos BRT-Lite Summary Evaluation Report. Lagos State Government, Ikeja, Lagos, Nigeria

Meyer, M.D. and Miller, E.J., 2001. Urban Transportation Planning, Second Edition,McGraw-Hill International Edition, Singapore

Mobereola, D., 2009. Lagos Bus Rapid Transit : Africa's First BRT Scheme. A SSATP Discussion Paper No 9 on Urban Transport Series.

Moseley, M. J., 1979. Accessibility: the Rural Challenge, London: Methuen.

Moudon, A.V., Hess, P.M., Snyder, M.C. and Stanilov, K., 1997. Effects of site design and pedestrian travel in mixed-use, medium-density environments, Transportation Research Record 1578 , pp. 48–55

National Population Commission (NPC), 2007. State Total Population for 2006 Census Provisional Result. Federal Republic of Nigeria Offical Gazette, Lagos, 94.

Ogunsanya, A. A.,1997. Moving the urban Masses: Two Steps Forward One Backwards. In Dange et al., (eds.) Issues in Transport Planning and Management. Nigerian Institute of Transport and Technology (NITT) Seminal Series No. 1 pp. 1-121

Okafor F.C.,1984. Accessibility to General Hospitals in Rural Bendel State, Nigeria. Soc. Sci. Med. 18, pp. 661–666.

Okafor F.C., 1990. The Spatial Dimensions of Accessibility to General Hospitals in Rural Nigeria. Socio-Econ. Plann. Sci. 24, pp. 295–306.

Okanlawon, K. R., 2007. Inter-modal Transport System: A Study of Lagos State. Journal of Environmental Research and Policies, 2(2), pp. 67-71.

Olatubara, C.O., 1995. Activity Patterns and Urban Residential Location Decision in Ibadan, Oyo State. Unpublished Ph.D. Thesis, Department of Geography, Obafemi Awolowo University, Ile-

Ife, Nigeria.

Onokala, P.C., 2001. Urbanisation and Urban Transportation Problems in Nigeria in Ezeani and Elekwa (eds) Issues in Urbanization and Urban Administration in Nigeria. Jamoe Enterprises Enugun, Nigeria

Oyesiku, K., 1995. An Analysis of the Demand for Inter-city Trip Generation Attributes of a Developing State in Nigeria. Journal of Transport Studies 1 (1), pp.17 – 28.

Oyesiku, O.K., 2001. City Poverty and Emerging Mobility Crisis: The Use of Motorcycle as Public Transport in Nigeria Cities. Paper presented at 9th World Congress of Transport Research Seoul, South Korea, 22nd – 27th, July.

Rodrı´guez, D.A. Khattak A.J. and Evenson, K.R., 2006. Can community design increase physical activity: evidence from a new urbanist and a conventional community, Journal of the American Planning Association 72 (1), pp. 43–56

Rodríguez, D.A and Targa, F., 2004. The Value of Accessibility to Bogotá's Bus Rapid Transit System, Transport Reviews 24 (5), pp. 587–610.