

## Public Transport Innovation: The Impact of BRT on Passenger's Movement in Lagos Metropolitan Area of Nigeria

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**Abstract:** Efficient, effective, reliable and inexpensive public transport provision remain the lifeline of economic, social and environmental wellbeing of increasing urbanization of cities all over the world in the face of globalization and world economies integration. The public transport concept of BRT had been successfully implemented in some developed countries cities and emerging industrialized cities centres as a cost effective option of a modern public transport technologies as metro, light rail and tram service capabilities. This innovation had just been implemented in the Lagos metropolitan area of Nigeria. It is in this light that this study examines the impact of BRT in the passenger's mobility in the largest metropolitan area of Nigeria. The methodology used in this study is self completion survey method; data were collected on variables of BRT passenger's mobility effectiveness, efficiency and impacts on problems of mobility in Lagos metropolis. The correlation, pair sample t-test were use for the hypothesis testing, univariate analysis of variance (ANOVA) for subjects interactions effects and multiple regression analysis were tested on the dependent and the independent variable dataset. The study revealed that there is a significant impact of BRT to the passenger's mobility in Lagos metropolis and highlights the passenger's constraints while accessing BRT service in Lagos Metropolis.

**Key words:** Mobility, public transport, bus rapid transit, infrastructure, accessibility, urban, para transit

### INTRODUCTION

Cities all over the world are functional heartbeat of economic, social, political and environment livability occupying a pride of place in policy formulations, of cities administrator and policy makers. More importantly, the movement access to education, recreational, business, work and other land-uses is paramount to the continued existence of the city (Litman, 2002; Ogunkoya, 2003; Kenwothy and Newman, 1999). Indeed, the transportation challenges often faced in many cities of the world attracted research efforts by the academic, institutional agencies and world socio-economic organizations to long lasting solution to this regards.

Indeed studies have been carried out in public transportation in developed countries urban centres (Texas Transportation Institute, 2007; Muller, 1995; Dueker and Bianco, 1999), similarly in a developing country like Nigeria (Onakomaiya, 1979; Adeniji, 1985, 1987; Ogunkoya, 2003). These studies have propounded innovative and dynamic strategies towards combating the multifarious urban mobility problems and challenges confronting the urban public transport sub sector in both the developed and the developing countries and in particular Nigeria's urban public transport sub sector.

Until now, public transport in Lagos metropolis have been largely dominated by para-transit and intermediate mode with absence of formal public transport technologies as light rail transit, trams, underground metros, elevated rail transit, suburban rail, bus ways and etc. The Lagos metropolitan area of Nigeria is known to have the highest density of vehicles per square kilometer in Nigeria, 224 vehicles km<sup>2</sup>, compared to average of 15 per km<sup>2</sup> in other states of the federation (The Sun Newspaper, March 17, 2008). But with intervention of the World Bank granting the state a facility worth \$US100 Million dollars to Lagos Metropolitan Areas Authority for institutional reform, road rehabilitati on and bus operation improvement to revamp and modernize the public transportation in Lagos through the Lagos Urban Transport Project (LUTPO), establishing an independent agency to plan, chart new direction for public transportation in Lagos State (World Bank, 2002).

The aftermath, which led to institutional establishment of Lagos Metropolitan Transport Authority (LAMATA) and adopting Bus Rapid Transit as reliable, cost effective option when compare to other public transport typologies such as metro line, light rail, tram and etc. Whilst studies have been carried out on the impact and role of intermediate transport in Nigeria, yet there still

exist knowledge gap in literature on the impact of Bus Rapid Transit in urban passengers movements in Nigeria. In this light, this study tends to examine impact of Bus Rapid Transit on the urban passengers movements in Lagos metropolis. Moreover, that this is a new innovation in the urban public transport fabric of Lagos metropolis.

Though the impact of BRT on passenger mobility in Curitiba, Bogota and other developed cities is extant in literature (Hidalgo, 2003 a, b; Ardila-Gomez, 2004; Rodriguez and Targa, 2004; Vuchic, 2007; Banister, 2005). However, since the commencement of Lagos BRT operation in March 2008, research studies on the impact on the mobility of passengers pattern is lacking in literature. It is therefore, deemed fit to fill this research gap and contribute to literature on the impact of bus rapid transit on passengers' movements in Lagos metropolis.

### **Conceptual and theoretical framework**

#### **Concept of BRT and other public transport typologies:**

The concept of Bus Rapid Transit (BRT) is one of the many public transport technology options available for the movement of passenger in many cities of the world. It is bus based technology typically operating on exclusive right-of-way lanes at the surface level; in some cases underpasses or tunnels are utilized to provide grade separation at intersections or in dense city centers (ITDP, 2007). In other words, it encompasses all forms of transportation system which through upgrade to infrastructure, vehicle primp and scheduling dynamism in combination to bus to provide a service that is of a better standard and quality than the mere bus ways system.

Wright (2003) propounds that BRT is high quality, customer-oriented transit that delivers fast, comfortable and cost effective urban mobility. Similarly, Levinson *et al.* (2003) posit that BRT is a flexible, rubber-tired rapid transit mode that combines stations, vehicles, services, running ways and Intelligent Transportation System (ITS) elements into an integrated system with a strong positive identity that evokes a unique image. Also, Thomas (2001) viewed the BRT is a rapid mode of transportation that can combine that quality of rail transit and the flexibility of buses. In this light, all these propositions and definitions above gave an awesome insight into the concept of BRT that set it apart from the conventional bus travel system, but share some nuances with higher level public transport typologies such as metro line, LRT and etc.

This makes the BRT concept to become increasingly adopted in most cities of the world and of which Lagos metropolis is one, because it provides for a speedy, effective, efficient and cost effective option of moving the people above that of Para transit and the intermediate mode. The cost advantage of BRT is 4-20 times less than a Light Rail Transit (LRT) system and 10-100 times less

than a metro system, but essentially close up the performance and amenities characteristics of a modern rail-based transit system but at a title of the cost (ITDP, 2007).

Aside the concept of BRT, other public transport typologies often employed in the provision of meeting mobility needs in the cities of the world are Light Rail Transit (LRT), trams, underground metro, elevated rail transit, suburban rail, personal rapid transit (PRT). All these public transport concepts are briefly discussed in this study because they are germane to the understanding of the principles of the public transport typologies and mainstream BRT concepts within the wider public transport typologies and help assist decision makers on the options to be adopted relative to the needs in capacity and costs.

**Concept of Light Rail Transit (LRT):** The Light Rail Transit (LRT) as defined by ITDP (2007) is the electric rail based technology operating either as a single rail car or as a short tram of cars, typically on exclusive right-of-way lanes at the surface level with overhead electrical connectors. This concept can be in vagaries such as at grade, elevated and tunnel. This form of public transport typologies in provision is expanding rapidly in the industrialized economies (World Bank, 2002). The benefits of light rail transit over that of bus way is that they have a less local air pollution impact, offer a more long lasting commitment to public transport and have an image that triggers support for complementary measures, which buses may find difficult to achieve (World Bank, 2002). The cost of providing a light rail transit which is between \$US10-\$US30 million put the choice away for many developing countries cities of the world, except for Tunis and Cairo in Africa and relatively wealthy cities-such as Hong Kong, China; Singapore and Kuala Lumpur and in some high income developments such as Tren de la Costa of Buenos Aires.

**Concept of trams:** Similarly, according to ITDP (2007), Trams can also be considered a type of LRT, but typically utilize smaller-sized carriages and may share road space with other forms of traffic. The concept of Tram may not be significant option of public transport in the Nigeria's and most developing countries milieu because of the cost implication in provision and in terms of the carriage capabilities in meeting the needs of the customers. Trams and smaller LRT carries less than 12,000 passengers per hour per direction pphpd. Whereas the TransMilenio BRT in Bogotá carries as many as 45,000 pphpd (ITDP, 2007).

**Concept of underground metro:** Also describes, by ITDP (2007) as a heavy rail transit system operating on grade separated tracks that are located principally underground.

It is one of the capital intensive rail investment and cost \$US45 million to \$US350 million km<sup>-1</sup>. Cities that presently boost of this infrastructure include the following: London, Madrid, Shanghai, Caracas, Bangkok, Hong Kong and Beijing etc. It has both the advantage of speed and capacity, it is known to have carried 80,000 pphpd (World Bank, 2002).

**Concept of elevated rail transit:** According to ITDP (2007), a rail transit system operating on grade separated tracks that are located principally on an aerial structure; elevated systems can also be considered a form of metro. This is also a form of heavy rail infrastructure, the cost range \$US40 million to \$US100 million km<sup>-1</sup>. Similarly, like the metro, it combines the advantage of speed and capacity. This concept of public transport is currently being adopted in Kuala Lumpur and Bangkok and has proven to be a reliable option of public transport typologies.

**Concept of Personal Rapid Transit (PRT):** According to ITDP (2007), a rail-or-wheel based system carrying passengers in small Automatic Guided Vehicles (AGV); PRT typically operates on exclusive right-of-way lanes that may also be grade separated. Personal Rapid Transit

(PRT) is relatively a new option for lower density developed cities. It makes use of Automatic Guided Vehicles (AGV), which makes it driverless, thus, assist developed cities to reduce their relatively high labour costs in public transport operations. It may either be rubber tyre or railed based and relatively small in size with each vehicle carrying in the range of 2-6 passenger. The idea is to combine the flexibility of taxi services with the automation of fixed track systems (ITDP, 2007).

**The multiple regression concepts:** The multiple regression analysis was used in this study for the variance between the dependent and independent variables as well as the univariate analysis of covariance for both bifurcate variable set.

The multiple regression equation is written thus:  $y = b_1x_1 + b_2x_2 + \dots + b_nx_n + c$ . The b's are the regression coefficients, representing the amount the dependent variable y changes when the corresponding independent changes 1 unit. The c is the constant, where the regression line intercepts the y axis, representing the amount the dependent y will be when all the independent variables are 0. The standardized versions of the b coefficients are the beta weights and the ratio of the beta coefficients is the ratio of the relative predictive power of the independent variables. Table 1 showed the correlation

Table 1: The correlation coefficient between the dependent variable and the Independent variables

	Correlations						
	BRTSMOBPROB	BRTEERMOB	BRTVSOMODE	BRTRATINGS	TBRT 30 days	PURINTRA	BRTIMOB
<b>BRTSMOBPROB</b>							
Pearson correlation	1.000	0.362**	0.007	0.190	-0.118	0.141	0.231*
Sig. (2-tailed)		0.001	0.945	0.072	0.260	0.163	0.021
N	100.000	82	99	91	93	100	100
<b>BRTEERMOB</b>							
Pearson correlation	0.362**	1.000	0.258*	0.227*	-0.100	0.220*	0.415**
Sig. (2-tailed)	0.001		0.020	0.045	0.391	0.047	0.000
N	82	82.000	81	78	76	82	82
<b>BRTVSOMODE</b>							
Pearson correlation	0.007	0.258*	1.000	0.096	-0.082	0.069	0.052
Sig. (2-tailed)	0.945	0.020		0.367	0.437	0.498	0.611
N	99	81	99.000	90	92	99	99
<b>BRTRATINGS</b>							
Pearson correlation	0.190	0.227*	0.096	1.000	-0.180	0.001	0.170
Sig. (2-tailed)	0.072	0.045	0.367		0.101	0.994	0.108
N	91	78	90	91.000	84	91	91
<b>TBRT 30 Days</b>							
Pearson correlation	-0.118	-0.100	-0.082	-0.180	1.000	-0.023	-0.080
Sig. (2-tailed)	0.260	0.391	0.437	0.101		0.829	0.448
N	93	76	92	84	93.000	93	93
<b>PURINTRA</b>							
Pearson correlation	0.141	0.220*	0.069	0.001	-0.023	1.000	0.210*
Sig. (2-tailed)	0.163	0.047	0.498	0.994	0.829		0.036
N	100	82	99	91	93	100.000	100
<b>BRTIMOB</b>							
Pearson correlation	0.231*	0.415**	0.052	0.170	-0.080	0.210*	1.000
Sig. (2-tailed)	0.021	0.000	0.611	0.108	0.448	0.036	
N	100	82	99	91	93	100	100.000

\*\*Correlation is significant at the 0.01 level (2-tailed). \*Correlation is significant at the 0.05 level (2-tailed). Variable denotation and meaning: BRTSMOBPROB-BRT active ability to meet all intra-city mobility needs in Lagos metropolis, BRTEERMOB-BRT effectiveness, efficiency and reliability on mobility, BRTVSOMODE-BRT effectiveness compare to other mode of intra city transport, BRTRATINGS-BRT ratings in Lagos metropolis, TBRT30 days-Trips made with BRT in the last 30 days, PURINTRA-Purpose of intra city trips with BRT, BRTIMOB-BRT and improvement in intra city mobility

Table 2: The paired samples t-test

Paired samples test	Paired differences			95% confidence interval of the difference		t-test	df	Sig. (2-tailed)
	Mean	S.D.	S.E. mean	Lower	Upper			
BRTSMOBPROB-BRTIMOB	0.28000	0.56995	0.05700	0.16691	0.39309	4.913	99	0.000
BRTEERMOB-BRTVSOMODE	0.13580	0.44026	0.04892	0.03845	0.23315	2.776	80	0.007

Unianova BRTSMOBPROB by BRTEERMOB, METHOD = SSTYPE (3), INTERCEPT = INCLUDE, CRITERIA = ALPHA (0.05), DESIGN = BRTEERMOB

which is a bivariate measure of association (strength) of the relationship between combinations of 2 variables in the variable set to test for significance. The levels of significance of the association are also showed in the Table 1 and 2 shows the pair samples t-test for validation and hypothesis testing all shown below in the analysis section of this study. The study which shows the analysis of the variance (ANOVA), which is used to test the main and interaction effects of categorical variables on a continuous dependent variable, controlling for the effects of selected other continuous variables which interact with the independent variable. It shows both the main effects and the interaction effect of both the dependent and independent variable.

**Hypothesis testing**

**Ho:** There is no significant difference in BRT impacts on passengers’ movement patterns of Lagos Metropolitan residents.

**Hi:** There is a significant difference in BRT impacts on passengers mobility patterns of Lagos Metropolitan residents.

**MATERIALS AND METHODS**

**The study area:** The study, sequel to months of successful launch of operation of BRT services along designated corridor in Lagos metropolis, in Lagos state, Nigeria (Fig. 1). Lagos metropolitan area is located in south western part of Nigeria. It is the largest metropolitan area in Nigeria (Ayeni, 1979; Ogunkoya, 2008). Lagos metropolis lies generally on lowlands, with the density of 24,182 km<sup>2</sup> and urban population of 7,937,932 (Federal Government of Nigeria, 2006). A Lagos metropolitan area is made up of 16 LGAS, which includes the Islands of the former municipality of Lagos and mainland suburbs. It is noteworthy to say, the study only cover sample of the municipalities who share in the first phase of BRT implementation in Lagos metropolis was data collected. The questionnaires were divided into 2 sections. The first section of the questionnaire elicits data on the socio-economic characteristics of Lagos metropolis using BRT and second section of the

questionnaire elicits information on the impact of BRT on the passenger mobility movement in Lagos metropolis which is the main focus of this study.

**The Lagos BRT:** The Lagos BRT is a dedicated interference free segregated lane with following objectives:

- It will reduce traffic congestion, improve air quality and the meet the mobility needs, particularly of the less privilege and poor Lagos metropolis.
- It is a roadway based system that looks and behaves like a subway, offering high capacity rapid transit services but on dedicated lanes.

**First phase of Lagos BRT:** The first phase of Lagos BRT which is in operation ran from mile 12 to through Ikorodu road and Funsho Willians Avenue to CMS. The system which carried up to 10,000 passengers per direction per hour. The LAMATA BRT corridor is about 22 km in length. The two operators, NURTW (National Union of Road Transport Workers) cooperative and LAGABUS, a Lagos state government owned asset management company are contributing about 180 high capacity buses for the implementation of the first phase operation. It runs 16 h operations running from 6:00 am to 10:00 pm, with assigned monitoring officers to monitor daily operational activities in the corridor.

**Data source:** The cross-sectional survey and self completion method were used for this study. It entails the use of questionnaire to gather information on the BRT impacts of passenger movements in Lagos metropolis.

The questionnaire was divided into 2 sections. The first section elicits information on the socio-economic characteristics of BRT trip makers in Lagos metropolis, while the second section elicits information relevant to the impacts of BRT on the passenger movement in Lagos metropolis. The latter part of the questionnaires is the major focus of this study.

The target population for this study, which is the complete group from which data was collected. The elements of this group include the various groups of the Lagos metropolis trip makers which make use of BRT

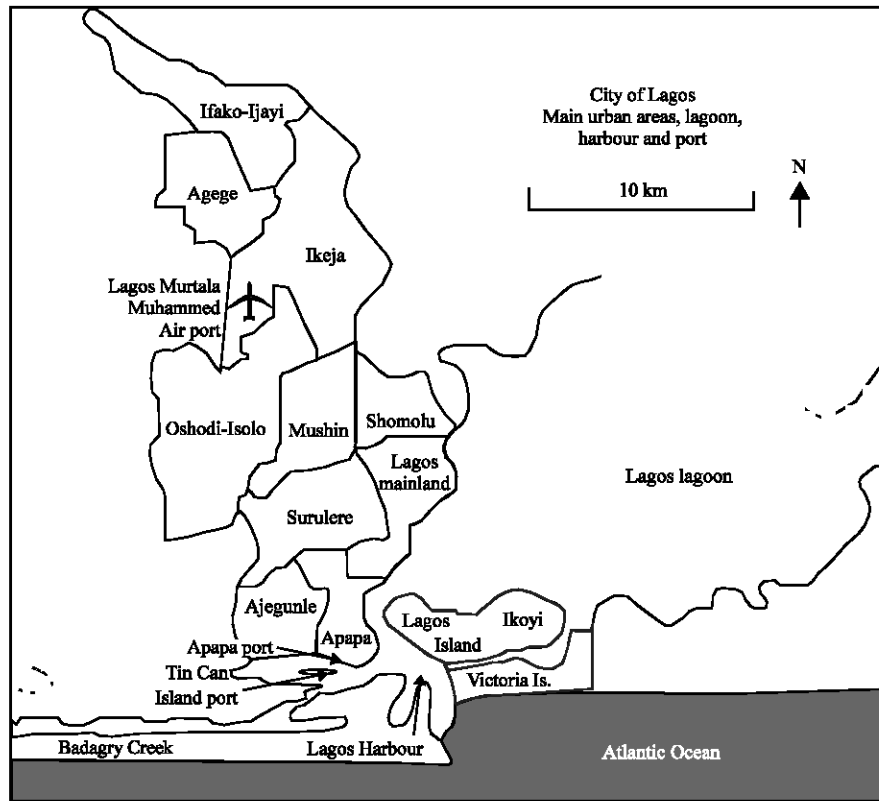


Fig. 1: The Lagos metropolitan areas. Source: Wikipedia on Lagos metropolitan area

buses for daily commute, which cut across different occupational strata. The sampling units include the urban workers, market women, university students, artisans and etc. making use of the BRT buses. The sampling frame includes all estimated 1 million residents that fall into above identified groups of daily commuters along the corridor implemented in the first phase of BRT implementation in Lagos metropolis. A simple random sampling method technique was adopted for this study and a total of 100 questionnaires were administered to the respondents which represent 1% of the total sampling frame. This in line with Bruton (1975), who recommended a sample size of 10% for population of area under 50,000 and 1% for areas having 1,000,000 people and above. Similarly, the cost of procuring survey material and skilled staff for the survey was also responsible for this choice.

In the analysis, which shall be discussed afterwards, the correlation, pair sample t-test, ANOVA and regression analysis were employed on the datasets of dependent and the independent variables for the analysis of the impact of BRT on the passenger movement in Lagos metropolis.

## RESULTS AND DISCUSSION

Table 1 shows the correlations between the dependent variable and the independent variables used

for the analysis. It shows the strength of relationships between 2 variables correlated together and was significant which explains the impact of BRT on passenger movement in Lagos metropolis at both the 0.01 level (2-tailed) and 0.05 levels (2-tailed). The correlation co-efficient of BRT tendency to improve passenger mobility being the highest at 0.415 between BRT tendency to improve intra city mobility and BRT ability to create effective, efficient and reliable intra-city passengers' mobility. This in actual fact shows the importance and the significance of BRT in improving the intra city movement in Lagos metropolis. Similarly, the variables such as BRTEEMOB and BRTSMOBPROB were significant at 0.01 level (2-tailed), BRTMOB and BRTSMOBROB, significant at 0.05 level (2-tailed). BRTRATING and BRTEEMOB, significant at 0.05 level (2-tailed) and BRTVSOMODE and BRTEEMOB, significant at 0.05 level (2-tailed). The impulse of these results is that variables whose correlations were significant reveal the covariance were positive in the magnitude and dispersion. Invariably, the impacts of BRT in the intra city movement were enormous, which follow the pattern of earlier studies in Bogotá and Curitiba as well as other developed cities in literature (Hildalgo, 2003 a, b; Ardila-Gomez, 2004; Vuchic, 2007; Banister, 2007).

Table 2 shows the paired sample of the variables BRTSMOBPROB and BRTIMOB with a t-test value of 4.913 and is significant at 0.000 at 0.05 level of significance and the pair sample of BRTEERMOB and BRTVSOMODE with a t-test value of 2.776 which is significant at 0.007 at 0.05 level of significance. In other words, this shows that there is a significant difference in the impacts of BRT in the passenger's movement patterns of Lagos Urban residents. Therefore, we reject the null hypothesis and accept the alternative hypothesis indicating a positive impact of BRT in the passenger's movement of Lagos urban residents.

Table 3 and 4 are showing the between-subject effect and univariate analyses of variance (ANOVA), for the dependent and the independent variables. Table 4 showing the analysis between three groups of the dependent and the independent variables. The dependent variable was BRTSMOBPROB and the independent variables are BRTEERMOB and BRTRATINGS. From the Table 4, which show the overall analysis of the model with the input of the criterion and the predictors, it shows the model is significant at 0.41. The independent variable BRTEERMOB is significant at 0.15, which means that BRT have been efficient, effective and reliable form of mobility provision for the Lagos metropolis, while the other variable use in the model BRTRATINGS and the interaction between the predictors BRTEERMOB and BRTRATINGS is not significant. However, the variance of the overall model and intercept, which is the dominant effect of the independent variable on the dependent variable when it is zero is significant at 0.000, in other words, the impact of BRT in the passenger movement of the Lagos metropolis is positive. Though, more still need to be done for optimum passenger satisfaction and wellbeing. Also, the  $R^2$  is 0.146 and the adjusted  $R^2$  which show the amount of variance accounted for by the actual predictors use in the overall model is 0.87 which is still well off very positive indication of the significance of the predictors use in the model.

Table 5 shows the analysis of variance of the regression analysis, the dependent variable is BRTMOBPROB, which is the BRT ability to solve the mobility problems in Lagos metropolis and the independent variables are BRTVSOMODE, BRTEERMOB and BRTIMOB. The F-ratio of the regression model is 5.590. And as, we can see from the Table 5 the overall model is significant at 0.002 i.e., the variance for the predictors in the model is significant. In other words, the impact of BRT in the passenger movement for intra mobility in the Lagos Urban metropolis is significant and therefore, support the earlier studies on the impact of BRT in studies conducted in some industrial transition cities and developed countries cities on the use of BRT

(Hidalgo, 2003 a, b; Ardila-Gomez, 2004; Bannister, 2007). Table 6 showing the model summary revealed that the  $R^2$  for the amount of variance in the regression table is 0.179 and the adjusted  $R^2$  for the number of predictors added in the variable in the variance 0.147, which is still positive and significant which still corroborate the significance BRT in mitigating against the problem of mobility in the urban environment as Lagos. Similarly, the coefficients of the dependent and independent variable in the regression analysis revealed that the independent variable BRTEERMOB and the model constant, which shows the overall effects of the independent variables on the dependent variable when y is zero is very significant. In Table 7, showing the coefficients of the individual contribution of the independent variable to dependent variable in the model shows that some independent coefficient variable seems not to be very significant; however, the impact of the overall independent variable on the dependent variable is very significant. Invariably, BRT impacts on passenger movement in Lagos metropolis is very positive and as such increased the level of mobility in Lagos metropolis.

Table 3: Between-subjects factors

		N
BRTEERMOB	1	61
	2	17
BRTRATINGS	1	10
	2	35
	3	33

Table 4: Tests of between-subjects effects

Source	Type III sum of squares	df	Mean square	F	Sig.
Corrected model	2.803 <sup>a</sup>	5	0.561	2.464	0.041
Intercept	59.452	1	59.452	261.380	0.000
BRTEERMOB	1.427	1	1.427	6.273	0.015
BRTRATINGS	0.243	2	0.121	0.533	0.589
<b>BRTEERMOB*</b>					
BRTRATINGS	0.203	2	0.102	0.446	0.642
Error	16.377	72	0.227		
Total	180.000	78			
Corrected total	19.179	77			

<sup>a</sup> $R^2 = 0.146$  (Adjusted  $R^2 = 0.087$ ); Dependent variable: BRTSMOBPROB

Table 5: Analysis the analysis of variance of the regression analysis

ANOVA <sup>b</sup>						
Model		Sum of squares	df	Mean square	F	Sig.
1	Regression	3.555	3	1.185	5.590	0.002 <sup>a</sup>
	Residual	16.322	77	0.212		
	Total	19.877	80			

<sup>a</sup>Predictors: (Constant), BRTVSOMODE, BRTEERMOB, BRTIMOB, <sup>b</sup>Dependent variable: BRTSMOBPROB

Table 6: The model summary of the regression analysis

Model summary <sup>b</sup>				
Model	R	R <sup>2</sup>	Adjusted R <sup>2</sup>	S.E. of the estimate
1	0.423 <sup>a</sup>	0.179	0.147	0.46040

<sup>a</sup>Predictors: (Constant), BRTVSOMODE, BRTEERMOB, BRTIMOB, <sup>b</sup>Dependent variable: BRTSMOBPROB

Table 7: The coefficients of the regression analysis

		Coefficients <sup>a</sup>				
		Unstandardized coefficients		Standardized coefficients		
Model		B	S.E.	Beta	t-test	Sig.
1	(Constant)	0.674	0.238	2.836	0.006	
	BRTIMOB	-0.160	0.168	-0.115	-0.951	0.345
	BRTTEERMOB	0.441	0.138	0.370	3.184	0.002
	BRTVSOMODE	0.371	0.197	0.210	1.883	0.063

<sup>a</sup>Dependent Variable: BRTSMOBPROB

**Accessibility problems of passengers and riders of BRT in Lagos metropolis:** Among the problems identified among the BRT passengers in Lagos metropolis include the following:

- Scarcity of tickets mostly on weekends and holiday periods.
- Long waiting time on the part of the passengers for the buses to come, this sometimes may be up to 20-25 min.
- Long queues while trying to access the bus.
- Lack of courtesy on the part of the bus crew.
- Poor customer service relationships.
- Dirtiness of the bus with litters strewn everywhere inside the bus.
- Inadequate buses on the corridor covered so far.

Table 3 and 4 are showing the univariate analysis variance between the dependent and the independent variables. Table 5-7 are showing the regression analysis model.

### CONCLUSION

Indeed, from the study the impact of BRT on the movement pattern of the residents of Lagos metropolis has been enormous and a significant contribution to literature, especially in a developing part of Africa with the highest of car traffic density per square kilometer and dominant informal, para-transit and intermediate public transport options. It has helped create a regime of modern public transportation era for the people in the area, creating ease of mobility access to public transport for the metropolitan residents. Similarly, the studies corroborated the effective, efficient and reliable traits of the concept of BRT as an effective concept of public transportation typologies for studies that has been carried out in developed and emerging industrial cities (Hidalgo, 2003 a, b; Ardila-Gomez, 2004; Rodriguez and Targa, 2004; Vuchic, 2007; Banister, 2005). From the analysis in this study, it can be seen that BRT has helped create a streamline, affordable and efficient public

transport regime. A major contribution to knowledge of this study is that it revealed that the concept of BRT introduction as an option of public transport typologies in Lagos metropolitan area has been very effective, efficient and reliable against other existing informal and para-transit mode of public transport and helped improve accessibility and mobility for the residents of Lagos metropolitan area, one of the largest urban conglomerations in Africa.

### REFERENCES

Adeniji, K., 1985. Urban transportation systems in Nigeria. ODU J. West Afr., pp: 81-89.

Adeniji, K., 1987. Par-Transit modes in Nigeria: Problems and prospects. Int. Quart. Urban Policy, 4: 339-347.

Ardila-Gomez, A., 2004. Transit planning in Bogota and Curitiba: Roles in Interaction, Risk and Change. Ph.D thesis in Urban and transportation planning at the Massachusetts Institute of Technology (MIT). Boston: MIT. [www.dspace.mit.edu/handle/1721.12879](http://www.dspace.mit.edu/handle/1721.12879).

Ayeni, B., 1979. Concepts and Techniques in Urban Analysis. 1st Edn. Groom Helm, London.

Banister, D., 2005. Unsustainable Transport: City Transport in the new century. 1st Edn. Published by Taylor and Francis. ISBN: 0415857829,978041537821.

Bruton, M.J., 1975. Introduction to Transportation Planning. 2nd Edn. Hutchinson, London, pp: 14-15.

Dueker, K. and M. Bianco, 1999. Light rail transit impacts in Portland: The first 10 years. Trans. Res. Rec., 1685: 171-180. [www.community-wealth.org/\\_pdfs/articles-publications/tod/paper-dueker-bianco.pdf](http://www.community-wealth.org/_pdfs/articles-publications/tod/paper-dueker-bianco.pdf).

Federal Government of Nigeria, 2006. Population Census Official Gazette, Federal Ministry of Information and Orientation, Nigeria. [www.nigeriastat.gov.ng/connection/pop2006.pdf](http://www.nigeriastat.gov.ng/connection/pop2006.pdf).

Hidalgo, D., 2003a. The backbone of the mobility strategy of Bogotá: TransMilenio. Public Transport Int., 51: 28-30. [www.itdp.org/documents/part\(RGARI\)%202007%2009.pdf](http://www.itdp.org/documents/part(RGARI)%202007%2009.pdf).

- Hidalgo, D., 2003b. TransMilenio: A high capacity-low cost bus rapid transit system developed for Bogotá, Colombia. Presented at the 55th World Congress of the International Public Transport Union (UITP). 4th-9th, May, Madrid, Spain. [www.eprints.ucl.ac.uk/110/1/Wright\\_and\\_Montezuma,\\_Walk21\\_V,\\_Copenhagen,\\_Jun\\_2004.pdf](http://www.eprints.ucl.ac.uk/110/1/Wright_and_Montezuma,_Walk21_V,_Copenhagen,_Jun_2004.pdf).
- ITDP, 2007. Bus rapid transit planning guide, published by institute of transportation and development policy. New York, USA. [www.itdp.org/brt\\_guide.html](http://www.itdp.org/brt_guide.html).
- Kenworthy, J.R. and P. Newman, 1999. Sustainability and Cities. Published by Island Press, Washington D.C., pp: 442. ISBN: 1559636602,9781559636605.
- Litman, T., 2002. Evaluating transportation land-uses impacts. Victoria Transport Policy Institute. <http://www.vtpi.org/landuse.p&f>.
- Muller, P.O., 1995. Transportation and Urban Form, Stages in the Spatial Evolution of the American Metropolis. In: Hanson, S. (Ed.). The Geography of Urban, Transportation. 2nd Edn. New-York; Guilford, pp: 26-82. ISBN: 0898627753.
- Ogunkoya, A.O., 2003. The Impact of the use of Mobile Telephone on Trip Pattern of Urban Residents of Lagos metropolis (unpublished M.Sc. Thesis Olabisi Onabanjo University, Ago-Iwoye, Ogun-State, Nigeria).
- Ogunkoya, A.O., 2008. Cybernetics of Travels and Telecommunicaions Relationships: A case of urban Metropolitan city of Nigeria. *The Soc. Sci.*, 3 (3): 267-272.
- Onakomaiya, S.O., 1979. Through traffic in 3 cities: A Comparative analysis. *Nig. Geogr. J.*, 22: 14-19.
- Rodriguez, D. and F. Targa, 2004. The value of accessibility to Bogotá's bus rapid transit system. *Transport Rev.*, 24 (5): 587-610.
- Texas Transportation Institute, 2007. Urban mobility information: Annual Urban mobility Report [www.mobility.tamu.edu/ums](http://www.mobility.tamu.edu/ums).
- The Sun, March 17, 2008. Lagos Marks the official commencement of the Bus Rapid Transit (BRT) scheme in Lagos. *The Sun Newspaper Nigeria*.
- Thomas, E., 2001. Bus rapid transit presentation at the institute of transport engineers. Annual Meeting Chicago, August, 19-22.
- Vuchic, V.R., 2007. Urban Transit Systems and Technology: Systems and Technology. 1st Edn. Published by John Wiley and Sons. New Jersey. ISBN: 047175823X,9780471758235.
- World Bank, 2002. Cities on the move: A World Bank urban transport strategy review World Bank Publication, Washington, USA. [www.siteresources.worldbank.org/INTURBANTRANSPORT/Resources/cities\\_on\\_the\\_move.pdf](http://www.siteresources.worldbank.org/INTURBANTRANSPORT/Resources/cities_on_the_move.pdf).
- Wright, L., 2003. Bus Rapid Transit. In: GTZ (Deutsche Gesellschaft für Technische Zusammenarbeit). Sustainable transport: A sourcebook for policy-makers in developing cities. Eschborn: GTZ. [www.eprints.ucl.ac.uk/108/1/Lloyd\\_Wright,\\_Bonn,\\_Germany,\\_Transport\\_and\\_climate\\_change.pdf](http://www.eprints.ucl.ac.uk/108/1/Lloyd_Wright,_Bonn,_Germany,_Transport_and_climate_change.pdf).