

An Assessment of Public Transport Security and Safety: An Examination of Lagos Bus Rapid Transit (BRT), Nigeria

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Abstract

This paper aims to assess the security and safety of public transport in the context of Bus Rapid Transit (BRT) in Lagos Nigeria. This study takes into cognizance the BRT routes with the operational facilities cum public perception of the public transport security and safety. The study entails exposition of risks and challenges of public transport as part of literature. It examines the risks and challenges in public transport as it relates to passengers experience in respect with the state of BRT in the study area. The focus of this study is the examination of Lagos BRT, the study of the Mile 12 – Tafawa Balewa Square (TBS) corridor.

A total number of 153 respondents participated in the survey. From the survey, over 110 respondents which is more than 70 per cent has not been victim or witness the various incidents either in BRT bus. A Correlation Analysis test is used to test the relationship in the Use of BRT for trip made and other choices. The P value is 0.523, which is greater than 0.005 ($P > 0.05$) and the decision is to accept H_0 . Also, the test result shown that there is positive linear relationship between distance from the BRT bus stops from offices/homes and threat in BRT bus stops as the P value is 0.629, this is greater 0.05 ($P > 0.05$). However, after observing the p value(s) for ‘Occurrence’ between the rate of being attacked and being threatened, it is clear that the two groups do not differ ($p > 0.05$). P value gives conclusive evidence that there is no difference in rate of being attacked and being threatened.

Based on this study, there is need to address the risks and challenges identified, this would pen-ultimately posit Lagos BRT to overcome some of these forces that are undermining its safety and security challenges. The recommendation on the real time devices must be adopted and implemented, this would redefine the entire Lagos BRT as a means of public transport.

Key words: Public Transport, Security, Safety, Lagos BRT

1. Introduction

Public transportation provides a mobility service to the user and exerts a wide impact on the urban system. Consequently, it should be operated in such a way as to achieve an efficient and effective transportation system. To achieve this, there is a need to measure the quality of service as a way to evaluate its performance (Joewono et.al, 2005). The issue of transport security and safety is gaining momentum globally. Safety remains a prerequisite for mobility, therefore in the context of the road transport system usage, every citizen has the right to life and health (ECMT 2003).

There is global and renewed attention on the vulnerability of critical infrastructure to major events such as terrorism, abuse and public assaults. Various measures are being put in place to support the activities of public transportation systems to plan for and respond to major security threats and emergencies. There is need to lay emphasis on the importance of developing critical relationships, strategies and policies preparation, and setting training and funding priorities. This is to provide guidance for planning effectively, spending wisely, and making the public transportation infrastructure safer (FTA, 2003).

The inherent attributes of public transportation systems make them vulnerable and attractive in terms of attacks. It is attributed to the U.S. Department of Transportation’s Office of Intelligence and Security that in 1909s, an estimation of 20 to 35% of attacks worldwide target on the transit. This high percentage could be as a result of the mode since transit is a transportation mode that is vast, open, and widely available to the general public. It remains the urban transporst mode that help in conveying commuters in crowded urban areas on a daily basis. Transit vehicles “containerize” and enclose transit riders in a limited space. Platforms and waiting areas at passenger terminals are usually enclosed areas where large numbers of passengers congregate. Getting access to the transit system anonymously is easy, and leaving the system is just as easy. Nevertheless, all these equally it susceptible to attacks and threats (TRB, 2007).

The safety is not the sole responsibility of the management of the owners of public transport operators. Protecting critical transportation infrastructure and operations is essential for security, public health and safety, economic vitality, and way of life from the national to the local level. There is a worldwide understanding that attacks on transportation infrastructure and operations could significantly disrupt the functioning of government and business alike and produce cascading effects far beyond the immediate location of the incident (Lofgren, 2008, Brachman, 2009).

The very nature of public transport networks makes them vulnerable as they are accessible to all by many points of entry and integrated through a vast range of interchanges. Given its unique nature, it is essential that any system of security reflects this operational perspective. A balance of technology, procedures and staff is the key. Investing in technology is pointless if there are no or inadequate procedures in place to support it, or staff trained to use it (UITP, 2009).

The principle of good access include safety (Olowosegun and Okoko, 2012), and safety is a urban necessity not a luxury. However, the appraisal of infrastructure using conventional methods of cost-benefit analysis tend to make it appears like a luxury except the benefits of improved safety are properly valued (World Bank, 2002). It is in this light that this study looks at an assessment of public transport security and safety by examining Lagos BRT operation.

2. Overview of BRT in Lagos, Nigeria

The Africa's first Bus Rapid Transit Scheme in Lagos, Nigeria became operational on the 17th March 2008. It is not of the highest specification such as Transmilenio in Bogota or the Brisbane South East Busway both of which cost in the region of \$6 million per kilometre. It is a new form of BRT focused upon delivery a system to meet key local user needs, with the aim of improving quality of life, economic efficiency and safety within a clearly defined budget. The implementation programme of the BRT, which saw conception to operation collapsed into a 15month timeframe together with its delivery at a cost of \$1.7 million per km make its development unique and as such its experience is relevant to the many cities throughout the world seeking to develop BRT. The mission of the Bus Rapid Transit (BRT) in Lagos State is to combine the flexibility and low implementation cost of bus service with the comfort, efficiency, cost-effectiveness, land use influence and versatility of Light Rail Transit (LRT) which is still on the pipeline of the second phase of the Lagos Urban Transport Project (LAMATA, 2009).

BRT-lite is now carrying almost 200,000 people per day despite a capacity that does not allow it to satisfy all forecast demand. After 100days the system had carried 4.7 million passengers and within its first 6 months of operation had carried a total of 29 million.

The BRT lite in Lagos State consists of a 22km route that is 65% physically segregated and 20% seperated by road and markings but its success is not purely down to its infrastructure but a holistic approach that involved re-organisation of the bus industry, financing of new bus purchase, creating a new institutional structure and regulatory framework to support it, together with the training of personnel to drive, maintain enforce and manage BRT (LAMATA, 2009).



Figure1: Lagos BRT Route from Mile 12 Bus-stops to TBS Bus Terminal
Source: Prepared by the Authors using Google Earth (2014)

3. Risks and Challenges in Public Transport

A mass passenger transport network seeks to deliver an affordable and accessible system for the masses, irrespective of location and time. Therefore any enhancement to security has to be balanced against the need for the efficient provision of service. Any security enhancement that impacts negatively on numbers travelling,

scheduling times, access and exit to the system and passenger throughput must be fully considered before implementation. Furthermore, security enhancements should not unnecessarily erode the liberties and individual human rights of the travelling public (UITP, 2009).

Public transport is an integral part of community infrastructure, providing access to mobility for both business and social purposes. Media has created negative perception of facilities and operations which cumulated into fears in the hearts of the users; there is over exaggeration of incidence of crimes against users and belongings. As a result of these people tend to make less use of public transport, and in extreme cases have to cancel journeys they might have made or often arrange for more expensive and less convenient modes of transport (Easteal and Wilson, 1991; World Bank, 2002).

Meanwhile, most cities in the developing countries have high incidence of transport related injuries, this can be classified into safety problem (accidents) and the security problem (criminal behavior). As a result of these problems, closely 1 million people are killed per year in road accidents, of which about 85% are in the developing and transitional economies and half in urban areas. In addition, between 25 and 35 million people are injured in road accidents world-wide, of which up to 75% are in urban areas. However, the quantification of the security problem is less well quantified or recognized which is more prevalence with pedestrians and cyclists, as well as people in cars and public transport vehicles (Gwillian, 2003).

The security problem is less well quantified or recognized. In most attentions are giving in particular to affected by pedestrians and cyclists, but also affects people in cars and public transport vehicles. In extreme cases, such as the injuries or deaths of passengers in the South African minibus “wars,” there is some record of the occurrence of events. More often the acts of personal violence or harassment especially sexual harassment in public transport vehicles do not get recorded. The prevalence of such is demonstrated by social surveys in Latin America (Gomez 2000, World Bank, 2002).

Smith and Cornish (2006) identify five different types of crime clusters in crime and disorder on public transport. These clusters include anti-social behaviour; crimes against users; crimes against employees of transit systems; line-of-route related offenses; graffiti and vandalism. Problem-oriented policing (POP) approach was adopted for the analysis of each of the crime-cluster which was developed by Goldstein in 1990 (Goldstein, 1990; Smith and Cornish, 2006; Smith, 2008). This approach is equally used to large extent in the various guides developed by the Center for Problem- Oriented Policing (Smith, 2008). While the Scanning, Analyzing, Responding and Assessing (SARA) method permits for examination by the researchers to identify the commonalities and differences based on the following: settings, methods, crime targets, and preventive measures for each crime cluster (Eck and Spelman, 1987; Smith, 2008).

Maintaining an attack or threat reduced on public transport system is at a cost. Cost is a legitimate criterion in designing security, safety and preparedness measures. A number of security measures recommended by federal, state, and local systems have been accredited to contribute to the efficiency of public transportation operations (vehicle locating systems, multimodal communications), passenger safety (design and materials used in station and coach construction). This makes the systems to be more convenient and attractive to passengers because there is provision of good lighting, clean interiors, timely information on system status, visible presence of staff, and to reducing ordinary crime there are closed-circuit television (CCTV), high-profile and undercover patrolling (FTA 2003).

4. Methodology

This study is based on the data drawn from a target population which is Lagos BRT users; the sample size is based on published tables (Israel, 2013), using the number of BRT fleets in operation and their capacities. There are 245 buses in the fleet with an average capacity of 44 passengers. This gives a sample frame of 10780 passengers and the sample size is drawn from this population. The sample size of 153 respondents out of 10780 at Precision Level of 8.5 percent where Confidence Level is 95 percent and P value is 5. The administration questionnaire is based on the peak and off peak periods. Sixty questionnaire each were administered in morning and evening peaks respectively while 33 questionnaire were at noon. The survey sample size was administered based on the ratio of the interval between the bus stops along the BRT corridors, table1 shows the breakdown of the distribution of the questionnaire and bus-stop interval and bus-stop names. While figure1 shows the spatial spread and extents of the bus-stops and study area. The study survey was designed with parameters to realise the level of patronage of Lagos BRT as integral part of public transport and examine its security and safety. Descriptive statistics is used to show the accessibility to BRT services and incidents of threat and attacks. While, correlation analysis between distance from house to nearest bus-stop and feeling of attack and multivariate test is used to ascertain the occurrence of being threatened and being attacked.

Table 1: Bus-stop Locations and Survey sample

Bus-stop	Location		Bus-stop Interval (km)		No. of Questionnaire administered
	Latitude	Longitude			
Mile 12	6°36'28.66"N	3°23'37.98"E	Mile 12 Terminus	-	-
Ketu	6°35'53.11"N	3°23'10.62"E	Mile12 - Ketu	1.38	10
Ojota	6°35'16.10"N	3°22'43.59"E	Ketu- Ojota	1.42	10
Maryland	6°34'31.43"N	3°22'10.64"E	Ojota - Maryland	1.71	12
Idiroko	6°33'50.94"N	3°22'1.26"E	Maryland - Idiroko	1.31	9
Anthony	6°33'31.35"N	3°22'1.14"E	Idiroko - Anthony	0.61	4
Obanikoro	6°32'48.70"N	3°22'0.40"E	Anthony - Obanikoro	1.31	9
Palmgroove	6°32'29.79"N	3°22'2.64"E	Obanikoro – P/groove	0.58	4
Onipanu	6°31'58.62"N	3°22'2.97"E	P/groove - Onipanu	0.96	7
Fadeyi	6°31'40.12"N	3°22'1.40"E	Onipanu - Fadeyi	0.57	4
Barracks	6°30'16.27"N	3°21'49.49"E	Fadeyi - Barracks	2.70	19
Stadium	6°29'54.64"N	3°21'42.47"E	Barracks - Stadium	0.71	5
Costain	6°28'51.62"N	3°22'8.48"E	Stadium - Costain	2.20	16
Lenventis	6°27'18.23"N	3°22'52.48"E	Constain - Lenventis	3.36	23
CMS	6°26'54.59"N	3°23'28.95"E	Lenventis - CMS	1.32	9
TBS	6°26'37.41"N	3°24'11.97"E	CMS - TBS	1.74	12
			Total	21.88	153

Source: Authors 2014

5. Analysis and Discussion of Findings

5.1 Demographic Distribution

A total number of 153 respondents participated in the survey. Some of the important summary statistics in respect to the survey sample is shown in Table 2. The higher numbers of the sample drawn was female (57.50%) of which 85.60% of the overall respondents have formal education with 11.80% have no formal education. Some 69.90% were age 35years and below, 45.10% were singles and 43.10% were married in status while the rest percentage of the sample is shared between divorced and widows.

Table 2: Demographic Statistics of the Sample

Gender	Male	65	42.50%
	Female	88	57.50%
Age	18-25	47	30.70%
	26-35	60	39.20%
	36-55	31	20.30%
	56-above	15	9.80%
Marital Status	Single	69	45.10%
	Married	66	43.10%
	Divorced	6	3.90%
	Widowed	12	7.8%
Ethnic Group	Yoruba	76	49.70%
	Igbo	52	34.00%
	Hausa	25	16.30%
	Others	0	0.00%
Religion	Christianity	96	62.70%
	Islam	41	26.80%
	Traditionalist	12	7.80%
	Others	0	0.00%
	No Response	4	2.60%
Level of Education	Primary	19	12.40%
	Secondary	24	15.70%
	Tertiary	88	57.50%
	No Formal Education	18	11.80%
	No Response	4	2.60%

Source: Authors' Field Survey, 2012

5.2 Patronage and Accessibility Statistics

Table 3a and 3b show the distribution of respondents that live around BRT corridors and the distance of sample respondents' house/office to the nearest BRT bus-stop. Ninety respondents which is about 58.8% live around BRT corridors while 63 respondents amounting to 41.2% do not live around BRT corridors, this is shown in table 3a. The study reveals in table 3b that 44 respondents (28.8%) have their houses/offices to be less one kilometre in distance to the nearest bus-stop which is reasonably normal if one would consider the coverage of the BRT service itself and the marginal walking distance for such service. Twenty-eight respondents which is 18.3% of the respondents have their houses/offices with distance between one kilometre and three kilometres, this is quite high, which may require another connecting mode of transport before BRT service could be accessed. A high percentage of respondents, 46.4% amounting to 71 respondents have their houses/offices above 3Km to the nearest BRT bus-stop. This implies that this set of respondents definitely need another connecting mode of transport to access BRT service. They have to face other challenges such as time constraint because it takes longer time to access the service.

Table 3a: Live around BRT Corridors

	Frequency	Percent
Yes	90	58.8
No	63	41.2
Total	153	100.0

Table 3b: Distance of sampled respondents' house/office to nearest Bus-stop

	Frequency	Percent
No Response	10	6.5
<1Km	44	28.8
Btw 1and 3Km	28	18.3
Above 3Km	71	46.4
Total	153	100.0

Table 3a shows that only 90 which is about 58.8 per cent of the respondents live around BRT corridor while 63 respondents amounting to 41.2 per cent do not live around BRT corridor. Table 3a shows the distance of the sampled respondents' houses/offices to the nearest BRT bus stop. The table indicates that about 28.8 per cent (44 respondents) has their houses/offices to be less than 1km from the nearest BRT bus stop, 28 respondents which is about 18.3 per cent have their houses/offices between 1km and 3km distance to the nearest BRT bus stop while 71 per cent (71 respondents) has their houses/offices above 3km distance to the nearest BRT bus stop. This implies that BRT is on the average, moderately accessible.

Table 4: Frequency of Use

Response	Frequency	Percent
No Response	36	23.53
Daily	45	29.40
Twice a Week	39	25.50
Once a Week	21	13.71
Once in 2 Weeks	9	5.90
Once a Month	3	1.96
Total	153	100.0

The frequency of use of BRT by the sampled respondents is shown in table 4, 36 respondents (23.53%) of 153 respondents did not respond to the question while 45 respondents which is 29.40 per cent of the sample use BRT on daily basis, 39 respondents (25.50 per cent) use BRT service twice a week, 21 respondents (13.71 per cent) use once in 2 weeks while 3 respondents use BRT service once in a month.

5.3 Incidents and Infrastructure

The respondents statistics of incidents reveals that there are minimal incidents of actual attacks and threats inside BRT bus and BRT bus stops in Lagos, Nigeria. Figure 1 shows the statistics of incidents using four variables, these are observed person/felt threatened, observed attack, been threatened and been attacked. Out of the 153 respondents, over 110 respondents which is more than 70 per cent has not been victim or witness the various incidents either in BRT bus or BRT bus stops. Forty three respondents (which is about 28 per cent of the respondents) have been attacked in either BRT buses or BRT bus stops of which 41 percent of the attack is

occasionally, 59 per cent rarely happened. Experience of being threatened shows that 31 respondents (20.2%) have been threatened in either in BRT buses or BRT bus stops. And 32.3 per cent of the experience of being threatened is occasionally and 67.7 per cent of being threatened incidence happened rarely. The incidents of observed attacks and observed person/ felt threatened are 18.3 per cent and 24.2 per cent respectively, the details statistics of incidents is shown in figure 2.

It is important to note that the survey reveals that none of the BRT buses and BRT bus stops has CCTV and monitoring devices that aid in creating psychological impression to disabuse the minds of users against crime and the actual monitoring of unforeseen incidents for the safety of operators and users. To this end there is no way this can be displayed graphically and of course no further analysis can be carried out on this because it is totally absent.

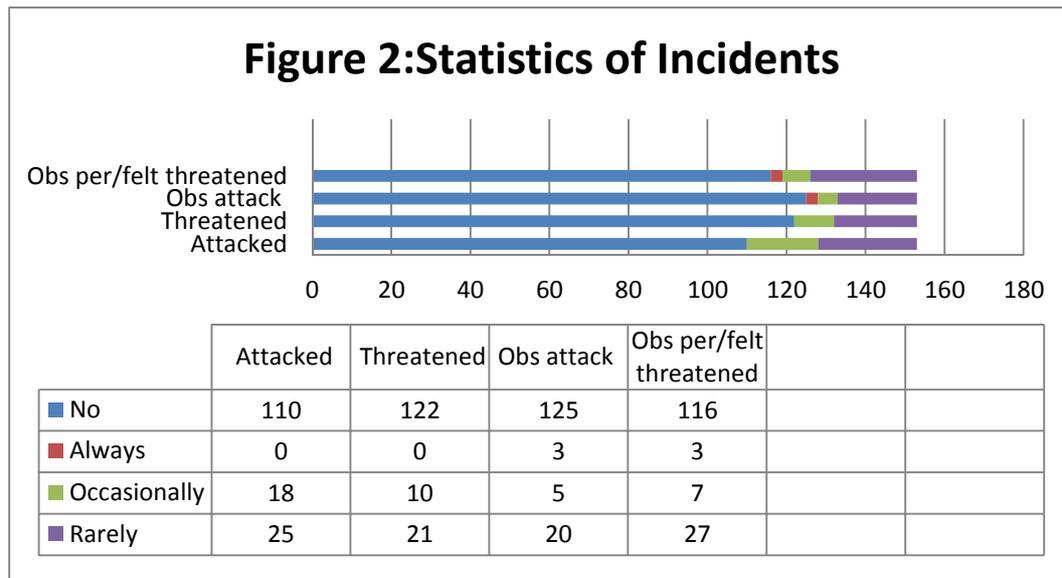


Figure 2: Statistics of Incidents

Out of the total respondents, 5 respondents (5.4%) considered it “Very Unsafe” and 12 respondents (12.9%) considered it “Unsafe” while 55 respondents (59.1%) considered it “Safe” and 9 respondents (9.7%) considered it “Very Safe”. Figures 3 and 4 shows the details of how safe people boarding BRT feel and the time it is “Unsafe and Very Unsafe” respectively.

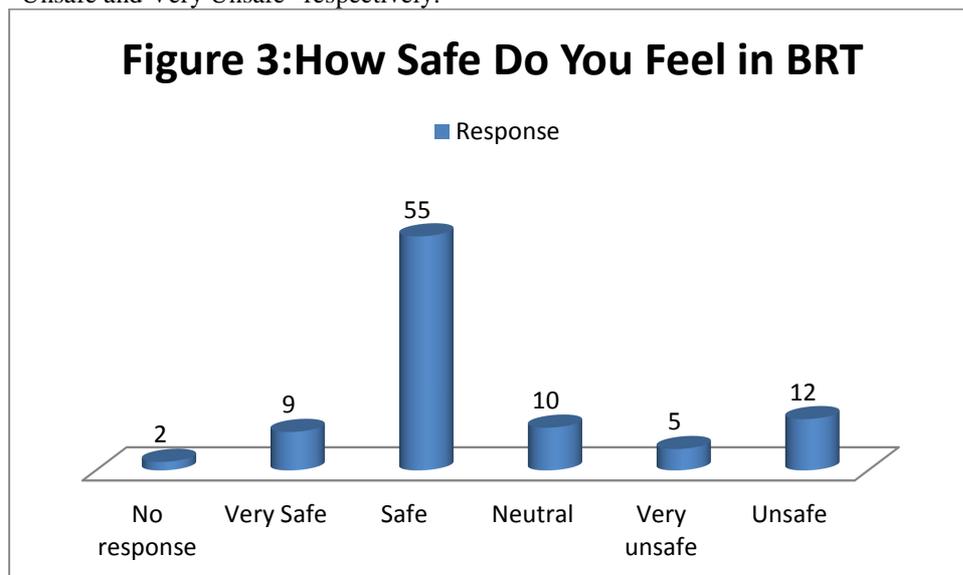


Figure 3: Level of BRT Safety Feeling

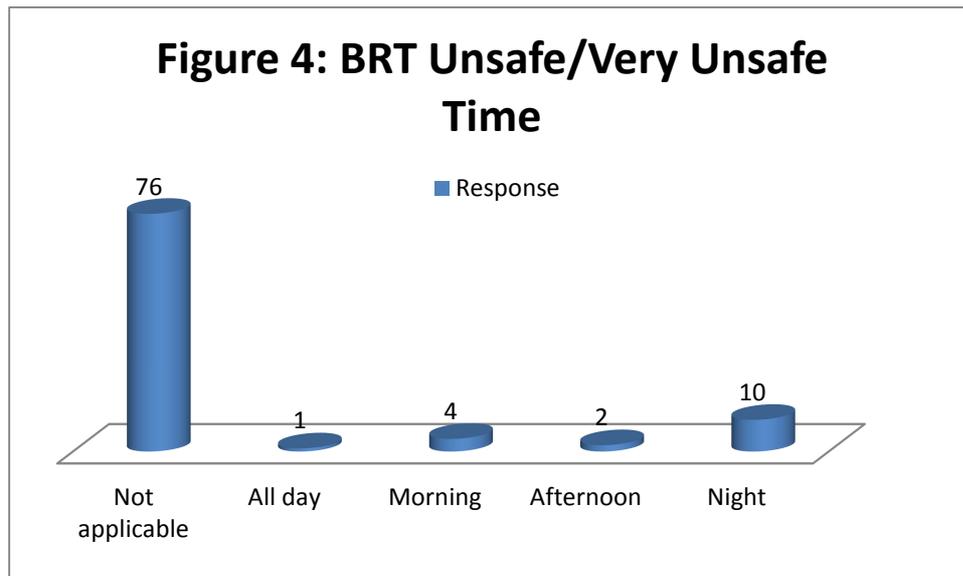


Figure 4: BRT Unsafe/Very Unsafe Time

Figure 5 shows the responses of the various safety and security organs to incidents of threats attacks and fire as part of safety and security measures in the operations of BRT in Lagos Nigeria. Forty-four respondents (47.3%) and thirty-six respondents (38.7%) considered response to incidents by police and mobile clinic to be “fairly effective” respectively, figure 5 shows the details.

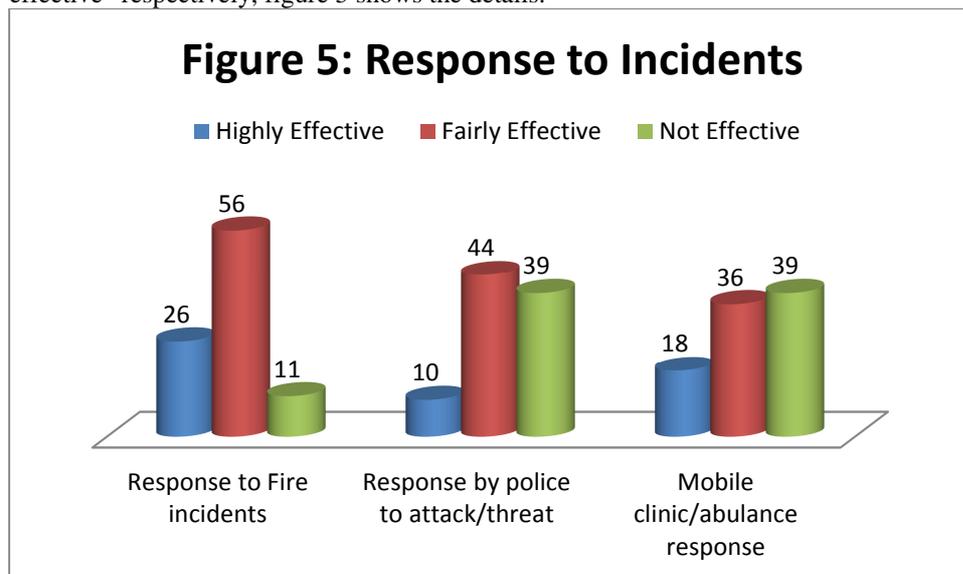


Figure 5: Response to Incidents

5.4 Test of Hypothesis

This section deals with hypotheses formulated for this study, the testing of the hypotheses and its interpretations.

- I. Ho: there is no significant relationship between the frequency of use of BRT and the frequency of use of other choices.

Table 5a: Other means of Transport use

Response	Frequency	Percent
Private	21	13.7
Taxi	42	27.5
Mini buses	51	33.3
Lag bus	24	15.7
Staff bus	15	9.8
Total	153	100.0

Table 5b: Frequency of use of other choice

Response	Frequency	Percent
No Response	3	2.0
Daily	90	58.8
Twice a Week	39	25.5
Once a Week	9	5.9
Once in 2 Weeks	3	2.0
Once a Month	9	5.9
Total	153	100.0

Test Statistics results on frequency of use of BRT and frequency of use of other choices of transport means.

Table 6: Correlation of use of BRT and frequency of use of other choices

		Frequency of Use of BRT	Frequency of Use of other Choices
BRT Use	Pearson Correlation	1	.052
	Sig. (2-tailed)		.523
	N	153	153
Other Choices	Pearson Correlation	.052	1
	Sig. (2-tailed)	.523	
	N	153	153

A Correlation Analysis test is used to test the relationship in the Use of BRT for trip made and other choices. The P value is 0.523, which is greater than 0.005 ($P > 0.05$). the decision is to accept H_0 .

- II. H_0 : there is no significant relationship between distance from house to nearest bus-stop and feeling of attack.

Table 7: Correlations between distance from house to nearest bus-stop and feeling of attack

		Distance from BRT B/stop	Threatened in B/stop
Distance from BRT B/stop	Pearson Correlation	1	.039
	Sig. (2-tailed)		.629
	Sum of Squares and Cross-products	154.680	7.556
	Covariance	1.018	.050
	N	153	153
Threatened in BRT B/stop	Pearson Correlation	.039	1
	Sig. (2-tailed)	.629	
	Sum of Squares and Cross-products	7.556	238.444
	Covariance	.050	1.569
	N	153	153

From the result of table 7 above, P value is 0.629, this is greater than 0.05 ($P > 0.05$) that is positive linear relationship between distance from the BRT bus stops from office/home and threat in BRT bus stops.

III. Ho: there is no difference in occurrence of being attacked and being threatened.

a. Between-Subjects Factors

		N
Occurrence	Yes	36
	No	117

b. Box's Test of Equality of Covariance Matrices(a)

Box's M	1.685
F	.549
df1	3
df2	64864.895
Sig.	.649

Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.

a Design: Intercept+Occurrence

The assumption of equality of the variance –covariance matrices is tested by Box's M test. P is 0.649, therefore $P > 0.05$; this shows that this assumption is met.

c. Multivariate Tests(b)

Effect		Value	F	Hypothesis df	Error df	Sig.
Intercept	Pillai's Trace	.251	25.082(a)	2.000	150.000	.000
	Wilks' Lambda	.749	25.082(a)	2.000	150.000	.000
	Hotelling's Trace	.334	25.082(a)	2.000	150.000	.000
	Roy's Largest Root	.334	25.082(a)	2.000	150.000	.000
Occurrence	Pillai's Trace	.005	.347(a)	2.000	150.000	.707
	Wilks' Lambda	.995	.347(a)	2.000	150.000	.707
	Hotelling's Trace	.005	.347(a)	2.000	150.000	.707
	Roy's Largest Root	.005	.347(a)	2.000	150.000	.707

a Exact statistic

b Design: Intercept+Occurrence

After observing the p value(s) for 'Occurrence' it is clear that the two groups do not differ ($p > 0.05$). P value gives conclusive evidence that there is no difference in rate of being attacked and being threatened.

Levene's Test of Equality of Error Variances(a)

	F	df1	df2	Sig.
Ever been attacked	3.375	1	151	.068
Ever been threatened	1.965	1	151	.163

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a Design: Intercept+Occurrence

Tests of Between-Subjects Effects

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	Ever been attacked	.765(a)	1	.765	.601	.439
	Ever been threatened	.908(a)	1	.908	.577	.449
Intercept	Ever been attacked	44.948	1	44.948	35.329	.000
	Ever been threatened	75.104	1	75.104	47.743	.000
Occurrence	Ever been attacked	.765	1	.765	.601	.439
	Ever been threatened	.908	1	.908	.577	.449
Error	Ever been attacked	192.111	151	1.272		
	Ever been threatened	237.536	151	1.573		
Total	Ever been attacked	247.000	153			
	Ever been threatened	331.000	153			
Corrected Total	Ever been attacked	192.876	152			
	Ever been threatened	238.444	152			

a R Squared = .004 (Adjusted R Squared = -.003)

This table confirms that there are no differences in groups, they all have P values greater than 0.05.

6 Recommendation and Conclusion

6.1 Recommendation

Safety is vital, and therefore first in any process, the guidelines for efficient operation of public transport services should be adopted and implemented fully. There is need for proper timing of the buses to cater for the alarming population of passengers waiting for the services of the BRT. The bus should be equipped with full security gadget and the entire design of the buses must promote safety and comfort. The stops should be properly located following the guidelines to bring to minimum the risk at the interchange.

Periodic assessment of the BRT drivers, buses, stops and safety facilities should be carried out to assess the drivers' compliance with safety rules and procedures, and the functionality of buses, stops in respect of the safety facilities and other security gadgets available. It is important to introduce a real time monitoring devices to the services of Lagos BRT so that it can equal the standard of most developed worlds' BRT operations. It is important to Condon the BRT routes and the stops with camera and other security detective devices to allow for the emergence of more vibrant urban public transport system free of risks and negativities. Also, the operators, the health workers, social workers, road safety workers and the security agencies should work at tandem to achieve optimal result, because security and safety is a collective responsibility.

6.2 Conclusion

The importance of public transport in any society has chain of effects; this multiplier effect could be economical, social and environmental. That is why there is need to ensure adequate safety and security in the operation of Lagos BRT as major component of public transport in Lagos, Nigeria. The study has shown though an infinitesimal level of risks in the services provided nevertheless it has to do with human lives; base on this outcome there is the need to address the risks and challenges identified, this would penultimately posit BRT to overcome some of these forces that undermining its safety and security. The recommendation on the real time devices must be adopted and implemented, this would redefine the entire Lagos BRT as a means of public transport.

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