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Spatial and Temporal Perspective on Road Traffic Accident Variations in Lagos Mainland, South-Western Nigeria

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Atubi, Augustus O. - Department of Geography and Regional Planning, Delta State University, Abraka, Nigeria
E-mail: atubigrp@yahoo.com
Tel. 08037450078

Abstract

The research work uncovered the fact that the problem of road traffic accidents in Lagos Mainland more often than not occurs due to irresponsibility shown by road users and failure of the designated authorities and organizations to carry out their responsibilities. Analysis of variance (ANOVA) technique was employed in the examination of the statistical significance of the variation in the categories/degree (fatal, serious, minor) of accidents. Again analysis of variance technique was employed in the examination of the statistical significance of variance in the degree of accident over time (1998-2007) in Lagos Mainland. The result shows that there is a significant difference in the degree of accident overtime in Lagos Mainland. The study used mostly secondary Data, accident records and vehicular situation which was obtained from Nigerian Police Force and Federal Road Safety Commission. The data was obtained for a period of ten (10) years. The need for re-orientation of the land use pattern in the study area, better road network characteristics, Government should set up more police patrols for the highways in order to enforce road traffic regulation including speed limits and the need to establish Federal Road Safety Corps

archive where accident records will be kept, collated and processed are desirable.

Keywords: Lagos Mainland; traffic; Road, accident, variations

Introduction

The study of transportation is multi-disciplinary, involving various disciplines, each in a strict sense, with its own area of emphasis. For instance, whereas pricing and regulation are the main areas of focus of economics, transport systems analysis is usually the interest of the engineer (Ikporukpo, 1998). It is generally recognized that the geographer's interest is essentially the spatial perspective (see, for instance, Hoyle and Knowles, 1992; Knowles, 1993, Toiley and Turton, 1995). Indeed, Eliot-Horst (1973 p. 163) has argued that "transportation is a measure of the relations between areas, and therefore, is essentially geographical". In spite of these disciplinary boundaries it is increasingly becoming clear that the study of transportation is best approached through an interdisciplinary perspective.

Ogunsanya (2002) recognized this when he said, "although the process of spatial economic development of any country is a complex one involving several variables, transport stands out as a catalyst in the process of change in its development. Its role in agriculture, industry, commerce, health, education, tourism, among others, is recognizable".

Transportation enables consumers to enjoy the availability of goods which are not provided or produced in their immediate locality because of climate or soil condition, the lack of raw materials, utilities or labours or the cost of production. Such a system allows consumers a choice of goods which would not otherwise be available (United States Department of Transportation, 2000 and 2004; Kruger et al, 2001; Atubi and Onokala, 2003; and Rodrigue, 2004).

Transport plays a crucial role in the sustenance and expansion of the ancient civilization in the circumnavigation of the globe and the conguest of the new world, land in social, economic, political and military spheres of human life (Onokomaiya, 1988). The road transport sub-sector accounts for more than 90 percent of internal passenger and freight movement in Nigeria (Adeniji, 2000). This is because it is the most accessible and affordable mode to the populace and it affects the life of nearly everybody; hence the outright pressure on highway in terms of volume of traffic.

In addition to the many environmental hazards, that threaten transportation systems, transportation itself present hazards to people, property, and the environment. Road traffic accidents are the most common example, and the majority of transportation causalities in most countries can be attributed to road accidents. The contributing factors for road accidents are typically classified into those associated with the driver, vehicle, and the environment. Contributing factors associated with the driver include error, speeding, experience, and blood-alcohol level. Factors associated with the vehicle include its type, condition and center of gravity. Environmental factors include the quality of the infrastructure, weather, and obstacles. The majority of road traffic accidents are attributed to driver factors (Evans, 1991), and this holds for many other modes such as boats (Bob-Manuel, 2002), bicycles (Cherington, 2000) and Snow mobiles (osterom and Eriksson, 2002).

It has been estimated that over 300,000 persons die and 10-15 million persons are injured every single year in road traffic accidents throughout the world. Detailed analyses of global accident statistics indicate that fatality rates per licensed vehicle in developing countries are very high in comparison with the industrialized countries. Moreover, road traffic accidents have been shown; to cost around 1% of annual gross national product (GNP) resources of the developing countries, which they can ill-afford to lose. Hence it is necessary to incorporate steps, which can reduce road traffic rates and implement mitigating actions, which can be taken to reduce the number and severity of road traffic accidents (Baguley et al, 1994; Kalga and Silanda, 2002).

In addition to common traffic accidents, there are also low-probability high-consequence transportation events that place risks on people and environmental resources in proximity to transportation corridors and ports. Rail, road, pipeline, and marine hazardous materials transport is the prime example in this area because it places considerable involuntary risks on people (and resources) who do not perceive much benefit to the transport of hazardous materials. Hazardous materials have been studied from a number of perspectives for many materials and modes, so there are numerous frameworks for analysis (Bonvicini, et al, 1998; Cassini, 1998; Erkut and Ingolfsson, 2000; Fabiano et al, 2003; Helander and Melachrinoudis, 2002; Jacobs, and Warmer dom, 2003; Klein, 2003).

Following the events of the September 11th 2001, transportation security has become a national research priority led by the Transportation Security

Administration recently reorganized under the Department of Homeland Security. This situation merely points out the fact that just as transport is the engine of growth of the nation's economy, it can also constitute a significant means of loss to a nation's human and economic resources when misused (U.S. Department of Transport, 2001).

The most traditional definition of road traffic accident risk states that the relationship between the number of collisions (e.g. by type, severity, etc) and the amount of exposure on a transportation facility (e.g. kilometers driven, traffic flows, etc) is linear with a zero intercept (Wolf, 1982; Chipman, 1982; Hauer, 1982; Garder, 1989; Janssens, 1999). This relationship has been used extensively in various studies, such as comparing various geographic areas, drivers on highways, or the prediction of accidents through traffic conflicts counts. Examples of such applications can be found in (Hauer and Garder, 1986; Trinca et al, 1988; Garder, 1989; Wilson et al, 1992; and NSC Accident Facts, 2000).

Accident risk has also been recently employed for intelligent transportation systems (ITS) applications. The goal is to find the safest routes for an individual vehicle within a given network aimed at re-routing traffic to routes with low lrisk with the help[of dynamic rout guidance system (Al-Deek et al, 1993; Lord et al, 1999; Look and Abdulhai, 2001) have applied accident risk on urban networks in corporating ITS technology.

Road traffic injuries are a major cause of morbidity and mortality worldwide, but especially in low-and middle-income countries. The World Health Organization estimates that more than 3000 people are killed everyday in road traffic accidents globally, with at least 30,000 others injured or disabled. This adds up to over 1 million people killed and between 20-50 million injured or crippled in road traffic accidents each year (Krug, 2002). Low-and middle-income countries account for more than 85% of the deaths and up to 90% of the disability-adjusted life years lost globally (Murray et al, 2001). At the current rate, it is projected that road traffic disability-adjusted life years lost will move from being the ninth leading cause of disability-adjusted life years (DALYS) in 1999 to the third leading cause by 2020 (Krug, Sharma and Lozano, 2000).

In another development, the rising trend in morbidity and mortality rates due to road traffic injuries in low-and middle-income countries has moved some to declare road traffic injuries an 'epidemic' (Nantulya and Reich, 2002) describing it as a 'war on the roads' (War on the Roads, BMJ, 2002).

Ademiluyi and Solanke (1996) observe that a lot of accident occurs on Nigerian roads daily. Some of which are preventable with a little more care or patience on the side of the drivers. Onakomaiya (1991) stressed "the human as the most difficult and yet the most necessary to understand with regard to urban traffic planning". Emphasis is laid on the human factors because of the fact that psychological effects include frustration, anger and aggressive action detrimental to health which may lead eventually to lose of life.

Umeano (1991) in his contribution listed the causes of accidents on the roads as:

(a) Impatience on Nigerian road;
(b) Lack of maintenance of Nigerian roads;
(c) Unqualified drivers ;
(d) Health problems of the road users; and
(e) The bad state of Nigerian roads.

Again, Onakomaiya (1991) compared the Nigeria situation with that of the developed countries and concluded that the RTA (Road Traffic Accident) rates in Nigeria are as much as 20 times those of Europe and North America. He stated further that, "indeed, Nigeria in the eighties was in a far worse RTA situation than Europe and North American in 1930, Botswana, Niger, Kenya and Sirilanka in 1980".

Ovuworie (1991) classified the major causes of road traffic accident under the following sub-headings:

(i) Vehicle-related factors; (ii)Road-related factors; (iii) Ignorance of Highway code; (iv) Driving under the influence of alcohol or hard drugs (v) Uncorrected eye sight (vi) Incompetent maneuring (vii)Wrong overtaking (viii) Refusal to use seat belts (ix) Inability to handle emergencies (x) Over-speeding (xii) Anxiety (xiii) improper parking (xiv) Incompetent handling of portholes.

Supporting the above, Ademiluyi and Solanke (1996) noted that, in the causes of road traffic accident, it is deduced from the work of Onakomaiya (1988, 1990), Oyesiku (1992), Bolade (1991) Onokala (1995) Atubi and Onokala (2005) among others, the human factor, particularly the driver is responsible for about 85% of all road traffic accidents leaving less than 20% to road mechanical accident causes. This shows that improvement in drivers'

performance on the road could go a long way to bring the much-desired sanity on the highways.

Materials and Methods

The data used in this research are sourced from both secondary and primary sources. However, the bulk of information used in this study is from secondary sources. These were obtained from Lagos State Police Command. Subsequently, the primary sources involves oral interview. The sector commander of the federal Road Safety Corps as well as the District Police Officer (DPO) was interviewed on road traffic accident situations in Lagos.

In this study, series of data collected were presented through data presentation method such as percentages and line graph. Also analysis of variance techniques was used to test for the significance of the variability in the road traffic accident in the study area. Time series and Trend analysis was also used to show the trend pattern of the reported traffic accident over the period of study (1998-2007).

Results

Reported Traffic Accidents in Lagos Mainland

The reported road mishaps in Lagos Mainland from 1998-2007 is shown in Table 1.

As revealed in the table, the total number of reported accidents for the period of study was 15,226. However, the occurrence of accident in Lagos Mainland varied both in time as well as space. For instance, the spatial pattern of the accident revealed that the year 1999 recorded the highest number of traffic accident in the duration of ten (10) years with a total of 2,720 representing 17.86% of the total reported accidents. This might not be unconnected with extremely large volume of vehicle traffic that enters Lagos mainly on a daily basis. This is followed by the years 2000 and 2004 with recorded accident of 2,580 and 2,164 respectively which represent 16.94% and 14.26% of the total traffic accidents reported. Other years such as 1999,2003,2005,2002 and 1998 have similar records of traffic accidents with little difference for the period of study. The reported numbers of accidents in these years are 1,357, 1,520, 1,460 and 1,187 which represents 8.91%, 9.98%, 9.59%, 9.37% and 7.80% respectively.

This is followed by the years 2007 and 1998 with the total accidents reported at 452 and 360 representing 2.97% and 2.36% respectively. Therefore, the least number of accidents occurred in the year 2006 (see table 1).

Reported Number of Fatal, Serious and Minor Accidents

In this study, attempt was made to examine the seriousness of motor accidents in Lagos Mainland for the period of study. This is discussed under fatal, serious and minor accidents in the study area. As shown in Table 2, there are no significant variations in the seriousness of accidents between 1998 and 2007 in Lagos Mainland. In the study area, 43.95% of the recorded accidents are fatal, 29.42% serious and 26.61% minor. An observation from table 2 shows that the highest proportions of traffic accident in Lagos Mainland are fatal. These suggest the worsening traffic accident situation in Lagos Mainland.

Reported Number of Deaths from Road Traffic Accidents in Lagos Mainland

Table 3 shows the reported number of deaths from road traffic accidents. It is observed from the table that the highest number of deaths was recorded on the year 2001 with a total of 862 representing 16.11% of the total death from traffic accidents. This is followed by the year 2006 with 840 deaths representing 15.70%. Incidentally as shown in table 3 below, the year 2006 has the least number of traffic accident and the highest number of deaths.

The years 1998, 1999, 2000, 2002, 2003, 2004, 2005 and 2007 recorded 357, 671, 750, 520, 520, 544, 100 and 175 deaths and a percentage of 6.67%, 12.54%, 14.02%, 9.72%, 9.27%, 9.27%, 10.17%, 1.87% and 3.27% respectively. An observation from the above shows that the years 2000 and 2001 recorded the highest number of accidents while the years 2001and 2006 recorded the highest number of deaths from road traffic accidents.

Reported Number of Injuries from Road Traffic Accident in Lagos Mainland

Table 4 revealed the reported number of injured people from traffic accidents in Lagos Mainland. As shown in table 4, the year 2001 accounted for the highest number of injured persons in the duration of ten (10) years (1998-2007). The number was 1003 representing 21.19% of the injured during the period of study. This is followed by the year 2000 with a total number of 870 representing 18.38% of the total. This is followed by the year 2003 with a total number of 644 representing 13.61% of the total. The years 1998 and 2002 are of the same range with a total of 469 and 462 representing 9.91% and 9.76% respectively.

The years 1999 and 2004 are also of the same range with a total of 389 and 350 representing 8.18% and 7.39% respectively. This is followed by the year

2007 and the years 2005 and 2006 which are also of the same range. For the year 2007, the total number of injured is 206 representing 4.35% of the injured during the period of study, while 2005 and 2006 had the total of 180 and 162 representing 3.80% and 3.42% respectively.

The observations in table 4 showed that the years 2000 and 2001 had the highest number of injured in the study area. These two years emerged as the ones with the highest accident records. All these showed that the year 2000 and 2001 was notorious for road traffic accidents and associated consequences such as deaths and injuries.

Number/Make of Vehicles Involved in Accident in Lagos Mainland

The analysis of the number and type of vehicle involved in road traffic accidents as shown in table 5 provided important information. In the table, a total of 22,997 vehicles were involved in accident. This comprises of 4,252 (18.49%). Taxi, 5404 (23.50%), Private cars, 4066 (17.69%) Buses, 4290 (18.65%), lorries and motorcycles 5205 (22.63%).

This showed that private cars and motorcycles are more prone to accident in Lagos Mainland.

Variability in Accident in Lagos Mainland

From table 5, the reported traffic accidents and its associated consequences vis-à-vis the number of death, number of injured, number of fatal, serious and minor among others have been discussed. The study established pattern or variation of the traffic accident in Lagos Mainland.

Analysis of variance technique (ANOVA) was employed in the examination of the statistical significance of the variation in the categories/degree (fatal, serious and minor) of accident (see appendix I). The result however showed that the variation in traffic accident as well as its associated characteristics in Lagos Mainland is not statistically significant. Moreover, from the means of each variable (X_1, X_2 and X_3) representing the values 669.3, 448 and 405.3 respectively, there is no significant difference or variation. This also shows that there is no significant relationship on the degree/categories of accidents in Lagos Mainland.

Again, analysis of variance technique (ANOVA) was employed in the examination of the statistical significance of the variation in the degree of accident overtime (1998-2007) in Lagos Mainland (see Appendix II). The result showed that the variation of traffic accident overtime in Lagos Mainland is statistically significant. Therefore, there is a significant difference in the degree of accident overtime in Lagos Mainland.

Lagos Mainland constitutes danger zones with respect to traffic accident. The menace of traffic accident therefore covers the entire Lagos Mainland and implies serious concerns for policy intervention.

Time Series and Trend of Reported Accident in Lagos Mainland (1998-2007)

In an attempt to examine the temporal pattern of road traffic accidents in Lagos Mainland of Lagos State, the time series and trend analysis of the accident statistics in respect of Lagos Mainland was undertaken. The result of this analysis is as shown in fig. 1. In fig. 1, the time series of traffic accidents for Lagos Mainland reveals a sharp decline in traffic accidents in the study area between 1998 and the year 2007. The time series reveals the least figure of 360 traffic accidents in 2006 and the highest figure of 2720 in year 2000.

From Fig 1, the time series analysis for traffic accident data for Lagos Mainland from 1998-2007 shows that traffic accidents fluctuated in Lagos Mainland over the years. Moreover, the trend analysis also revealed that traffic accidents occurrence was on the decrease in the study area over the period of study.

Policy Implication

1. **Re-Orientation of the Land Use Pattern**: The land use pattern in Lagos Mainland is business oriented as well as residential and thus it houses a substantial percentage of foreign and private establishments. These establishments in themselves are trip generators because they employ a great number of people living in the area. The effect therefore is for workers to troop to Lagos Mainland in the morning hours causing congestion on the streets and roads and also troop away from Lagos Mainland after the days work. Since the problem of congestion in the area lies in the mere fact that a substantial amount of establishments which employs a great percentage of the populace are located in Lagos Mainland, the most obvious thing to do therefore is to pass a law over further location of establishments in the area and distribute headquarters or branches of some establishments to some new sites.
2. **Better Road Network Characteristics**: To ease traffic flow along the routes in Lagos Mainland, better road network characteristics must be ensured. For example, the roads have to be better connected to improve

their accessibility; also roads have to be widened to more lands to increase their carrying capacity. Better road network characteristics would not only lead to a faster flow of traffic along the routes, it would also make for a well structured road network system and also a faster pace at curbing congestion and accident problems in Lagos Mainland.

3. Government should set up more police patrol for the highways in order to enforce road traffic regulation including speed limits while adequate attention should be paid to accident scenes and clearing of vehicles. It is important to say that the setting up of LASTMA (Lagos State Municipal Authority) as an additional law enforcement agents for the maintenance of the road, towing of broken down vehicles and those involved in accident are inevitable.

4. There is need to establish Federal Road Safety Corps archive where accident records will be kept, collated and processed. This will involve recording of accident scene in video which might be shown at road safety carnivals and at any workshop carnival period. The data will ensure regular publication of traffic accident and transport statistics as submitted by Federal Road Safety Commission (FRSC) and other government parastatals such as the Nigeria Police and LASTMA.

Conclusion

This study has examined road traffic accident situation in Lagos Mainland. The findings has shown that Lagos State particularly Lagos Mainland is notorious for road traffic accidents and this undesirable features is associated with adverse consequences bothering on life and deaths. The study further established the need for adequate accident monitoring and control programme to stem down the tide of road mishap in the city of Lagos.

A useful starting point for the reduction of accidents on the roads in Lagos Mainland is at the initial design and construction stage. A well designed and constructed road will minimize road accidents and promote sustainable development in the transportation system of Lagos.

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Table 1: Reported Accident in Lagos Mainland 1998-2007

YEAR	NO. OF ACCIDENTS	%
1998	1187	7.80
1999	1357	17.86
2000	2720	16.94
2001	2580	9.37
2002	1426	9.98
2003	1520	14.21
2004	2164	9.59
2005	1460	14.21
2006	360	9.59
2007	452	2.36
TOTAL	**15226**	**2.97**

Source: Lagos State Police Command, 2008

Table 2: Showing the Reported Number of Fatal, Serious and Minor Accidents (1998-2007)

YEAR	FATAL	SERIOUS	MINOR	TOTAL
1998	437	280	470	1187
1999	500	480	377	1357
2000	1200	800	720	2720
2001	1000	860	720	2580
2002	620	440	366	1426
2003	1000	300	220	1520
2004	824	700	640	2164
2005	850	360	250	1460
2006	160	120	80	360
2007	102	140	210	452
TOTAL	**6693**	**4480**	**4053**	**15226**
%	**43.95**	**29.42**	**26.61**	**100**

Source: Lagos State Police Command, 2008

Table 3: Reported number of Deaths in Lagos Mainland

YEAR	NO. OF DEATHS	%
1998	357	6.67
1999	671	12.54
2000	750	14.02
2001	862	16.11
2002	520	9.72
2003	520	9.72
2004	554	10.17
2005	100	1.87
2006	840	15.70
2007	175	3.27
TOTAL	**5349**	**100**

Source: Lagos State Police Command, 2008.

Table 4: Reported Number of Injured From Road Traffic Accident

YEAR	NO. OF ACCIDENTS	%
1998	469	9.91
1999	387	8.18
2000	870	18.38
2001	1003	21.19
2002	462	9.76
2003	644	13.61
2004	350	7.39
2005	180	3.80
2006	162	3.42
2007	206	4.35
TOTAL	**4733**	**100**

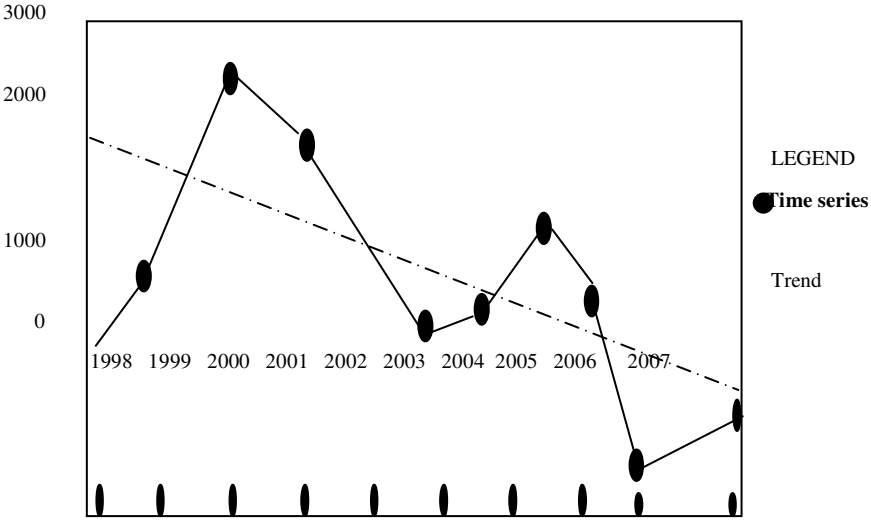
Source: Lagos State Police Command, 2008.

Table 5: Types of Vehicle Involved in Accidents in Lagos Mainland

YEAR	TAXI	PRIVATE CAR	BUS	LORRY	MOTOR CYCLE	TOTAL
1998	280	47	523	327	470	2017
1999	403	501	201	305	415	1825
2000	251	690	208	700	817	2046
2001	950	780	877	682	897	4186
2002	400	388	460	386	520	2154
2003	690	800	722	810	1000	4022
2004	1011	2002	897	900	860	5650
2005	92	61	54	39	63	319
2006	71	86	42	74	81	354
2007	104	69	102	67	82	424
TOTAL	**4252**	**5404**	**4066**	**4290**	**5205**	**22997**
%	**18.49**	**23.50**	**17.69**	**18.65**	**22.63**	**100**

Source: Lagos State Police Command, 2008.

Fig. 1: TIME SERIES AND TREND OF THE REPORTED ACCIDENTS IN LAGOS MAINLAND



Source: Based on data from Nigeria Police Command, 1998-2007.