Spatial Planning and Updating of Transportation Infrastructure: A Recurrent Expenditure

Joseph O. OLUSINA and Dr. James B. OLALEYE, Nigeria

ABSTRACT

Spatial planning entails the physical organisation of space according to an overall strategy that will be tailored towards a balanced regional development. Various regional/city planners and other experts are involved in the physical design and policy formulation in order to plan a settlement for further development. Many cities, especially in the developing countries do outgrow the spatial plan and development designed for them over years as a result of many factors.

Lagos, being the commercial nerve centre of Nigeria is not an exception. Concerned about unprecedented growth of Lagos and its attendant problems, this paper considers the need to revisit the designed plan and policy on urban transportation vis-a-vis the need to have a separate transportation routes for motorcycle riders in the State that will be integrated into the existing road network.

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1.0 INTRODUCTION

There are different definitions of spatial planning. Wikipedia (2008) defined **spatial planning** as the methods used by the public sector to influence the distribution of people and activities in spaces of various scales. Spatial planning includes all levels of land use planning such as urban planning, regional planning, environmental planning and national spatial planning. Numerous planning systems exist around the world.

Land use planning entails planning that associates human activities with specific piece of land i.e. a plan on the use to which a given piece of land is being put to. Land use information is not only essential for the planning and management of activities concerned with the surface of the earth, it also serves as a major input for any program on energy conservation, for monitoring environmental hazards and for the enhancement of equitable distribution of resources. Such statistical data has also been found to be of great importance in the political administration of many countries. For urban spatial planning, land use may be for commercial, residential, industrial, recreational or transportation purposes.

Transportation is a key instrument for rapid national or state development. Lagos is the economic and financial capital of Nigeria and the most populous conurbation with more than 9 million people. It has suffered a lot of socio-economic losses as the main mode of transportation, road, has witnessed a lot of constrictions and congestions. The traffic management agency has implemented different traffic reduction methods such as: Odd and Even Plate Numbers, Tricycles, Park and Ride, Ferry Service, Laissez-faire allocation and recently the Bus Rapid Transit (BRT). Despite these methods, traffic congestion is still prevalent on the roads. The use of motorcycles, popularly called Okadas, and tricycles has become the order of the day in order to overcome the perennial congestions on the road in spite of its attendant risks. Therefore, contending with traffic congestion has become part of the reality of life in Lagos and this call for urgent multidirectional solutions.

Existing transportation policy which allows automobiles and motorcycles or tricycles to compete for the aged, narrowly constructed roads needs to be revisited. This paper reviews some of the identified spatial planning problems arising from the use of Okadas and proffers some solutions that could assist in minimizing the auto-motorcycle crashes in Lagos Metropolis. Using Geomatics technology, bimodal transportation system was created to integrate motorcycle and motor vehicle routes in a seamless manner. This means that the new Okada routes will serve as feeders to the auto or bus routes. It is believed that reviewing transportation policy in Lagos State based on some policies recommended in this work and proper implementation of the integrated system, the socio-economic life of Lagosians and visitors will be improved upon.

1.1 STATEMENT OF THE PROBLEM

Transportation systems in Lagos have been a multimodal one with congested roads, an epileptic suburban trains and ad-hock ferry services. Highways are always congested because road transport is the most efficient. Potholes, bumps, narrowness, are some of the features of Lagos roads. Due to the strategic location of Lagos as a gateway to the sea, it has the largest and most active seaport in the Country. Road transportation in Lagos suffers as a result of the following phenomena:

a. Heavy duty trailers and tankers often park on the highways and also compete with other smaller vehicles on the narrow roads.
b. Non-motorized mode of travel has been forgotten e.g. pedestrian walkway, the disables lane, etc.
c. Volume of vehicles on the road exceeds the designed capacity,
d. Poor state of the road (e.g. potholes, poor markings, poor drainage system and poor surfacing)
e. Inefficient traffic management and control resulting in illegal parking, breaking down of poorly maintained vehicles, overloading of passenger vehicles, boarding and alighting from vehicles at wrong locations, street trading, and so on.
f. Traffic-reducing alternatives such as the use of telephone and postal services are in deplorable conditions and still relatively expensive.
g. Armed robbery through the use of motorcycles (i.e. Okadas) while in traffic congestion
h. One-way traffic offenders.
i. Indiscipline attitude of drivers, both private and public
j. Bus-stops and parks need to be reviewed in terms of locations and capacities.
k. Excessiveness of the commercial motorcycle riders (Okada) such as wrong overtaking, overloading, hooliganism, and so on.
l. Abuse of regulations by the law enforcement agents such as illegal check-points, extortions, etc.
m. Lack of cooperation and co-ordination among the various government agencies responsible for physical planning, transportation planning and overall governance of the city.
n. Wrong location of facilities without adequate parking spaces (e.g. banks, petrol stations, schools, and so on).

A situation where most of the commuter's time is spent in traffic congestion resulting in fatigue, ill-health, wear and tear, loss of job, failure to keep appointments, loss of life, destruction to the environment and armed robbery while in traffic jam will not sustain any meaningful urban development and control.

1.2 SIGNIFICANCE OF STUDY

Transportation has great impact on economic development and quality of life. With the present economic loss due to congestion in Lagos which is estimated to be about =N= 25 billion per annum (Lagos State Ministry of Transport, 2005) if no drastic action is taken, the

economic future of the state will be jeopardized. The characteristics of Lagos roads mentioned earlier have made the roads unsafe for the commuters. The congestion arising from these causes has hindered commuters from getting to their destinations on time even at emergency periods. On some occasions in Lagos, the traffic seizure may last for twelve (12) hours from the peak period to free flow period.

It is our belief that the proposed solutions in this paper will assist the Lagos transportation system in several areas such as:

1. Reduction in congestions along the existing highways and major roads,
2. Reduction in the transit time from an origin to a destination,
3. Safer movement of people within the metropolis,
4. Reduction in the carnage on our existing highways and major roads as a result of Okada collision.
5. Proper spatial planning that will bring about ecological, cost-effective, and socially balanced bimodal transportation development.
6. Environmental improvements by reducing pollutions as a result of reduction in congestion on the existing highways and major roads.

1.3 THE STUDY AREA

Geographically, the city of Lagos lies in south-western Nigeria and lies approximately on longitude 3° 24' E and latitude 6° 27' N. It covers an area of 3,577sq.km. The Metropolitan Lagos extends over sixteen (16) of the twenty (20) Local Government Areas of Lagos State, and contains 88% of the population of Lagos State (Figure 1.1).

From the early 70s, Lagos has been experiencing a population explosion that has resulted in untamed economic growth and unmitigated rural migration. Lagos is Nigeria's most prosperous city, and much of the nation's wealth and economic activity are concentrated there.

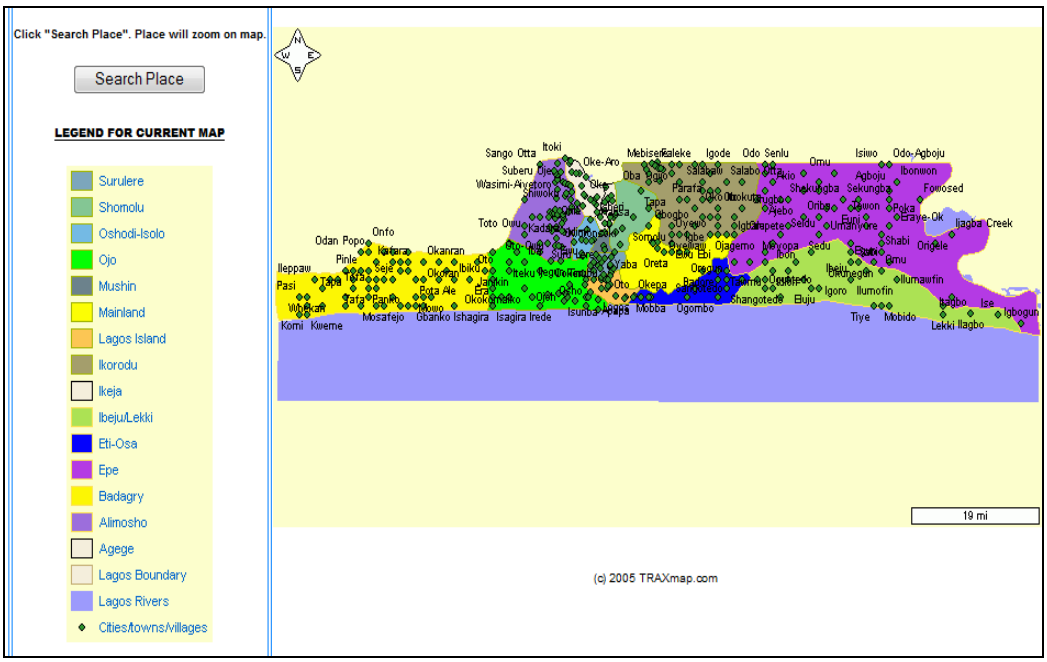

Fig. 1.1 Lagos State Map showing some Local Governments in the State.

(http://www.traxmap.com/maps/nigeria/LagosRoute/csearch.asp, 2005).

2.0 OKADA AS A MEANS OF TRANSPORTATION IN LAGOS

Motorcycle, popularly called "**Okada**", is used for commercial transport and was adopted in Lagos to complement the overstretched regular system. Okada riders can be classified into two, the private riders who use their motorcycles for private transportation and services e.g. courier services, etc. and the commercial/public riders who use their motorcycles to transport people and goods for a fee. The more dangerous riders are the commercial or public riders who are blithe and slipshod about law, properties and lives.

Virtually all states, in Nigeria, where Okada operation has been allowed have tried many policies to curb the excesses of the commercial Okada riders and make their operation safe. These include prohibition from some major roads, restriction to some hours of the day to outright banning of their activities such as in Port-Harcourt.

As a way to regulate the operations, the Lagos State Government has registered two groups of riders under the auspices of, the Motorcycle Operators of Lagos State (MOALS) and All Nigeria Autobike Commercial Owners and Workers Association (ANACOWA). Similarly, the use of Rider's Card was introduce to determine the number of authorized riders, but the implementation and sustenance of this policy has been jeopardized and flouted by the large number of unexpected entrants into the Okada business. Precisely January 1st 2009 marked the beginning of the introduction and enforcement of the use of protective gadgets (i.e. wearing of crash helmets) to reduce carnage of Okada riders, passengers, and other road users but some riders still violate this rule.

BENEFITS OF THE USE OF OKADA FOR COMMERCIAL ACTIVITIES

Several reasons have been adjudged for the use of motorcycle "Okada" as a means of commercial transport. They include:

1. The fact that due to the economic downturn, motorcycle has become an affordable vehicle for conveying goods and services because of its low cost of purchase.
2. In the absence of personal car, Okada has become a good means of transportation of goods and services.
3. With little or no education, people ride Okadas in Lagos for commercial activities.
4. Very time conscious individuals (business men, school children, government workers, etc.) often abandon their cars or public buses for Okadas to meet urgent appointments.
5. Okada is fuel efficient, therefore, while vehicles queue for days during fuel scarcity Okada often becomes the only available mode of transport.
6. Tricycle called "Keke NAPEP" was introduced by the Federal Government as a means of assisting the poor in getting employment. The attitude of the riders are not better than the Okada riders as they also manoeuvred their ways indiscriminately through the Lagos congested roads. Till now, this programme is yet to solve poverty/employment problems.
7. Recuperation of capital invested into Okada business is fast since the riders must deliver between =N= 500.00 - =N= 700.00/day depending on route plied and type of Okada.

THE DISADVANTAGES OF THE USE OF COMMERCIAL MOTORCLE

The characteristics of the commercial Okada riders have made this mode of transportation a dreadful monster. Some of the characteristics include:

1. Egocentric attitude and no regard for other road users.
2. Many artisans have nobody to train and take over from them because it is easier to run Okada business.
3. In Lagos, vehicle drivers especially commercial minibus drivers popularly called "Danfo" and Okada riders have constituted laws to themselves thus making the roads a lawless system. This lawlessness mostly on the part of the Okada riders has resulted in the loss of many lives and properties. Okada riding in Lagos is like signing a death warrant or buying a ticket for a bed space in the hospital by the riders, their passengers or other road users.
4. Since Okadas occupy smaller space, in design, than cars or buses on the roads they are flexible to
   - be manoeuvred within a short radius and can navigate from left or right or front or back quickly
   - through congestion to get to their customer's destination. This has resulted in a lot of avoidable
   - accidents (Figs. 2a and 2b).
5. The already polluted environment as a result of lack of control by the government agencies in charge of the environment, is now more polluted by the voluminous ramshackled Okadas on the roads.
6. Sometimes they do, on their own, experience self-caused congestions as a result of no regard for law.

7. Just like their senior partners, the Danfo drivers, maintenance of these Okadas is not a priority to the riders but to put it on the road for money making.
8. Once Okada plies a route, the lives of the pedestrians are at stake. Many pedestrians have been knocked down as a result of wild riding attitude of the Okada riders.
9. Patience to observe, read, understand and to obey road signs (i.e. highway codes) is not part of their watchwords.
10. In congestions, reduction of speed is not in their dictionary. That is, they try to maintain their high speed even on congested roads.
11. The use of high blaring trailer horns and car stereos while on the move are common ways of recognizing them on the roads.
12. The Okada riders intimidate other road users and once they have a head-on-collision with a motorist, especially private car owners, they pounce on such motorist like a bee, beat the motorist and most often set his car on fire whether they are at fault or not.
13. The touts who often collect tax from them at bus stops have become a nuisance to Okada customers by forcing them to stop abruptly. This has resulted in Okada customers sustaining injuries, killing them or losing their properties.
14. The roads are in poor state. Their initial design never had plan for accommodating motorcycles for commercial purpose.
15. Increase in armed robbery, kidnapping for ritual purposes, and hired assassinations in Lagos have been attributed mostly to the use of Okadas for commercial purposes.
16. Overloading, either of passengers or goods, has caused a lot of accidents on the roads.
17. The alcohol and Indian hemp sellers at the bus stops are the usual supplier of stimulants to most of the Okada riders and commercial minibus (Danfo) drivers.
18. Taking bribe by government transport officials from the Okada riders or Danfo drivers has made them to lose their respects and to condone traffic misdemeanours from this category of road users even when they have belligerently break traffic rules.
19. The use of Okada for commercial purposes was to augment the use of commercial buses to convey goods and services at an affordable cost, but charges by the Okada riders have become astronomical, sometimes twice that of commercial buses, that an average Lagosian cannot afford.
20. Road infrastructures are not safe on Okada plying routes as a result of their recklessness.

Figures 2a and 2b show typical Lagos Okada riders.

Fig. 2a. Okada riders contending with Motor Vehicles for road space.

Fig. 2b. Okada riders queuing in front of a Motor Vehicle.

3.0 METHODOLOGY ON BIMODAL TRANSPORTATION

3.1 DATA COLLECTION

Most data used in this study were secondary. They were obtained from General Specialist Hospitals, the Police and the FRSC. Data collected include:

1. Lagos State Road Accident Data (1989-2007).
2. Accident rate based on vehicular classifications (1989-2007).
3. Lagos State University Teaching Hospital (LASUT) Accident Victims Records (2003 – 2007).
4. Lagos State University Teaching Hospital (LASUT) Death Records (2003 – 2007).
5. Causes of Motorcycle Crashes in Lagos State (2008).
6. Educational Qualification of Riders in Lagos State (2008)
7. Registered Motorcycles and Motor Vehicles in Lagos State (1998-2007)
8. Reasons for Choosing of Okada (2008)

These data are graphically shown below:

1. Lagos State Road Accident Data (1989-2007):

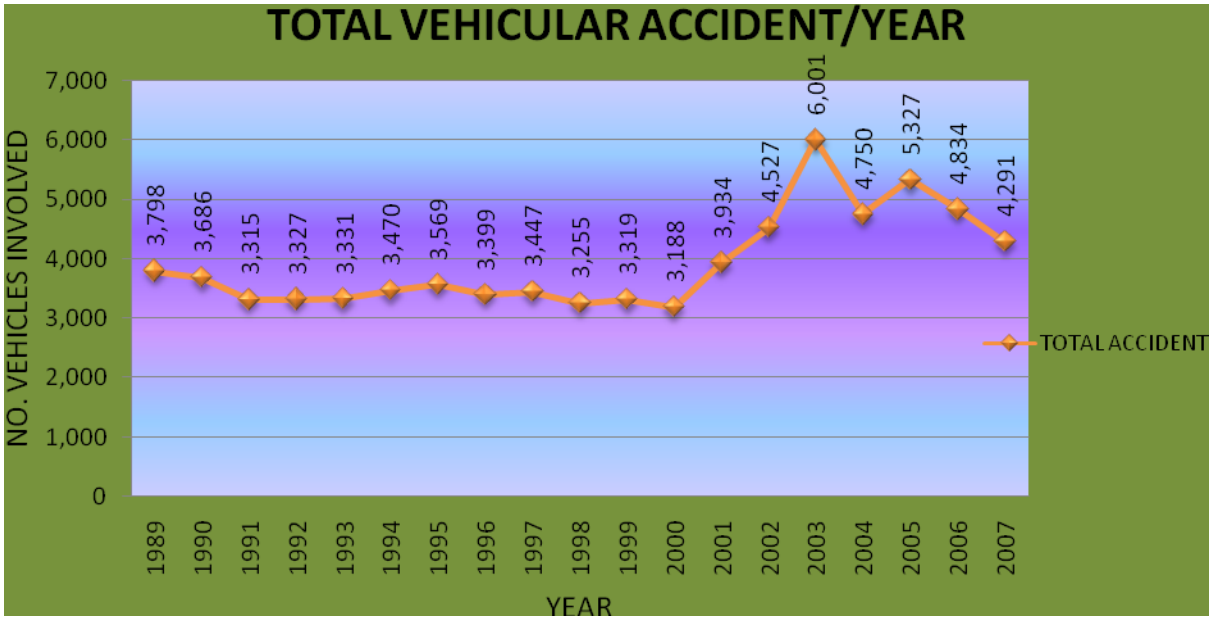

Fig. 3a. Total Road Accidents in Lagos State. (NPF/FRSC, 2008).

Vehicles were classified as: Taxi Cabs, Private Cars, Buses, Lorries/Trucks, Kit Cars, Motor Cycles (i.e. Okada) and Pedal Cycles.

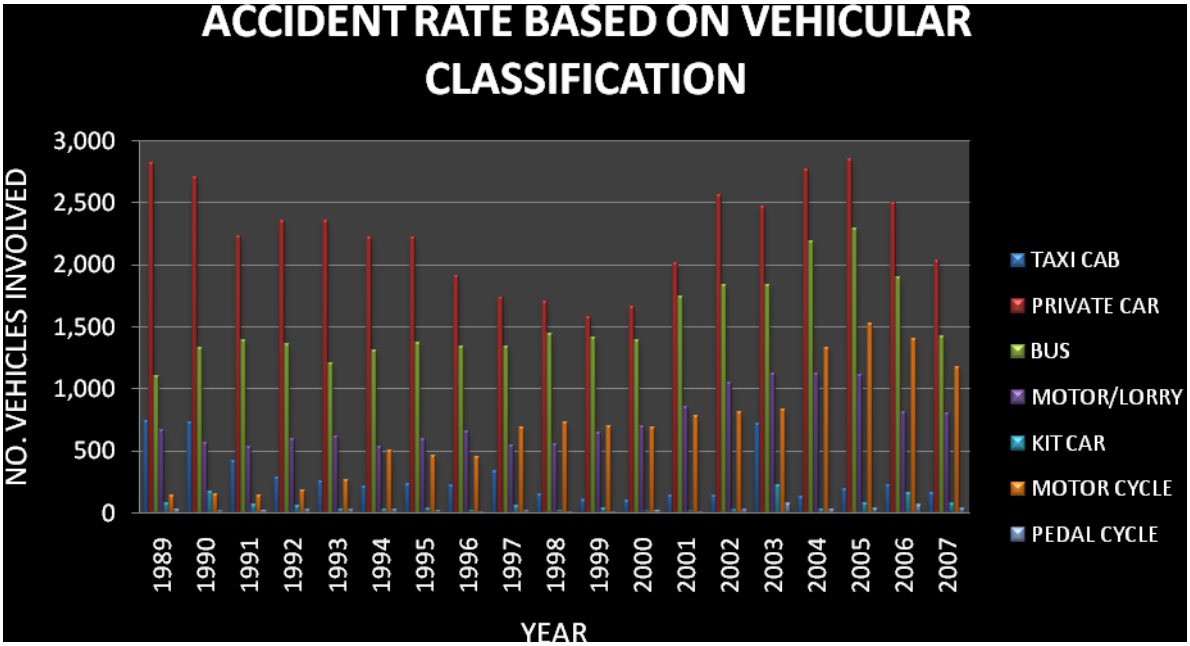

Fig. 3b. Road Accident Rate based on Vehicular Classification in Lagos State. (NPF/FRSC, 2008).

2. Lagos State University Teaching Hospital (LASUT) Accident Injured Victims Records 2003–2007. Classified into: Motor Vehicle Victims and Motorcycle Victims.

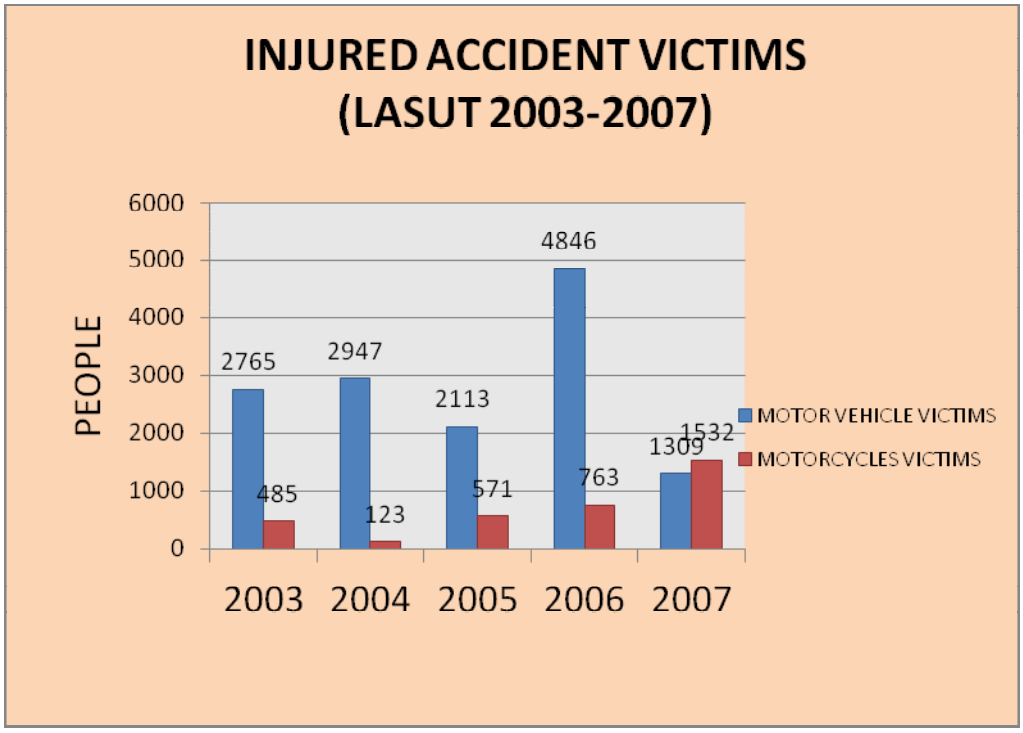

Fig. 3c. LASUT Accident Injured Victims Records. (Lagos State University Teaching Hospital- Ikeja, 2008).

3. Lagos State University Teaching Hospital (LASUT) Death Records 2003–2007. Also Classified into: Motor Vehicle Victims and Motorcycle Victims.

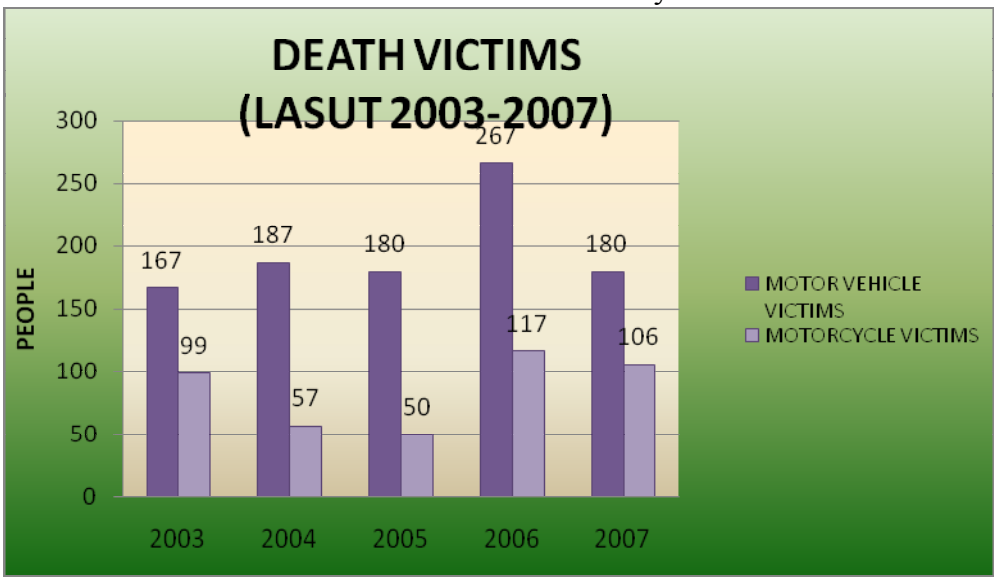

Fig. 3d. LASUT Death Records. (Lagos State University Teaching Hospital-Ikeja, 2008).

Injured and death victims records were also collected from National Orthopaedic Hospital, Lagos and University Teaching Hospital, Lagos (LUTH). Total motorcycle accidents recorded by these hospitals between 2003–2007 are shown in Fig. 3c.

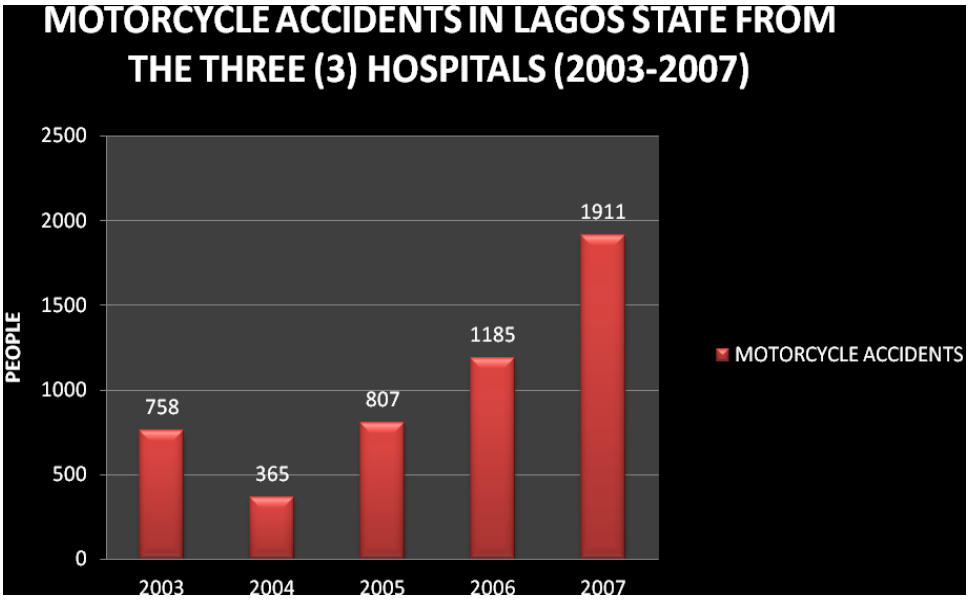

Fig. 3e. Total Accident Rates from the three Specialized Hospitals. (LASUTH, Orthopaedic and LUTH, 2008).

4. Causes of Motorcycle Crashes in Lagos State (2008).
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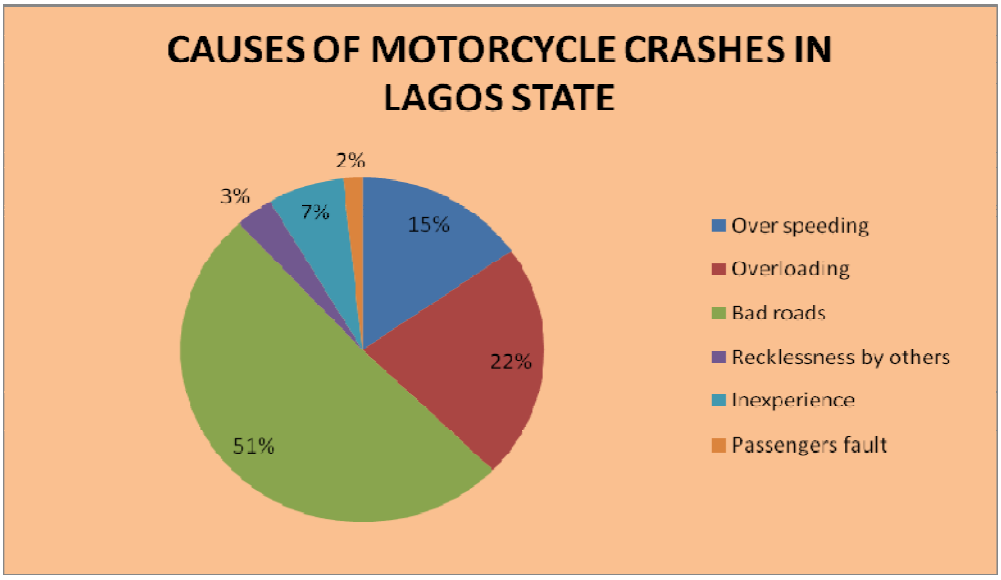


Fig. 4. Causes of Motorcycle Crashes in Lagos State. (Olagunju, 2008).

- Educational Qualification of Riders in Lagos State (2008)

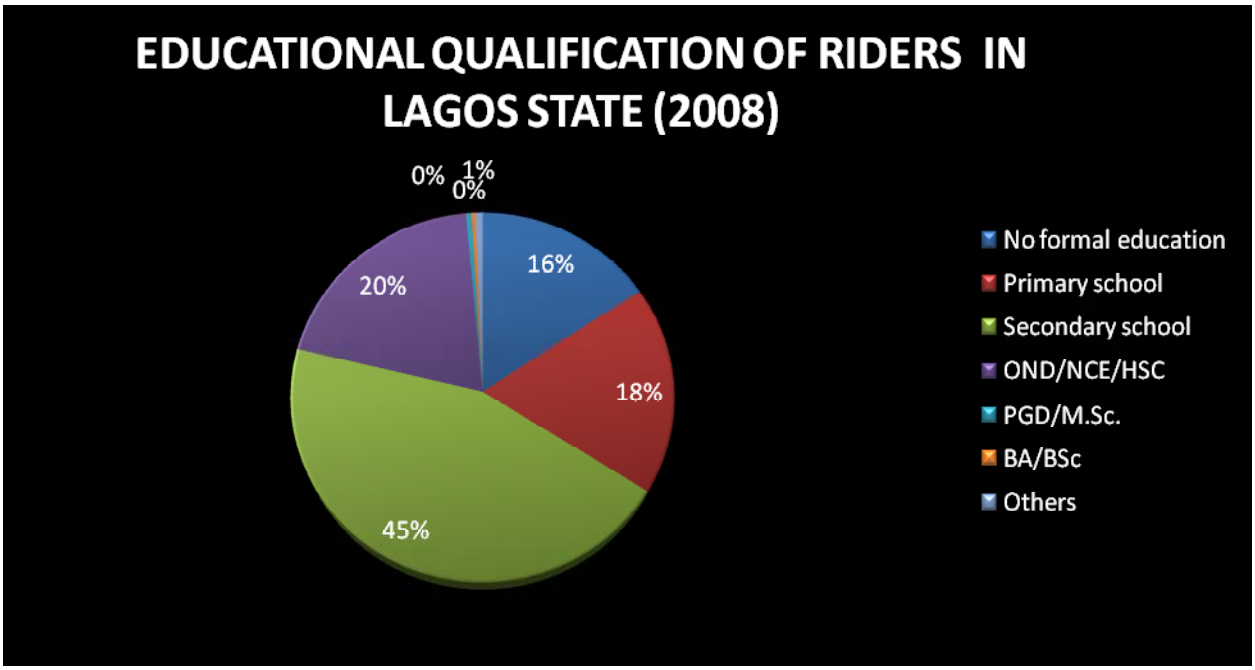


Fig. 5. Educational Qualification of Riders in Lagos State. (Olagunju, 2008).

- Registered Motorcycles and Motor Vehicles in Lagos State (1998-2007)

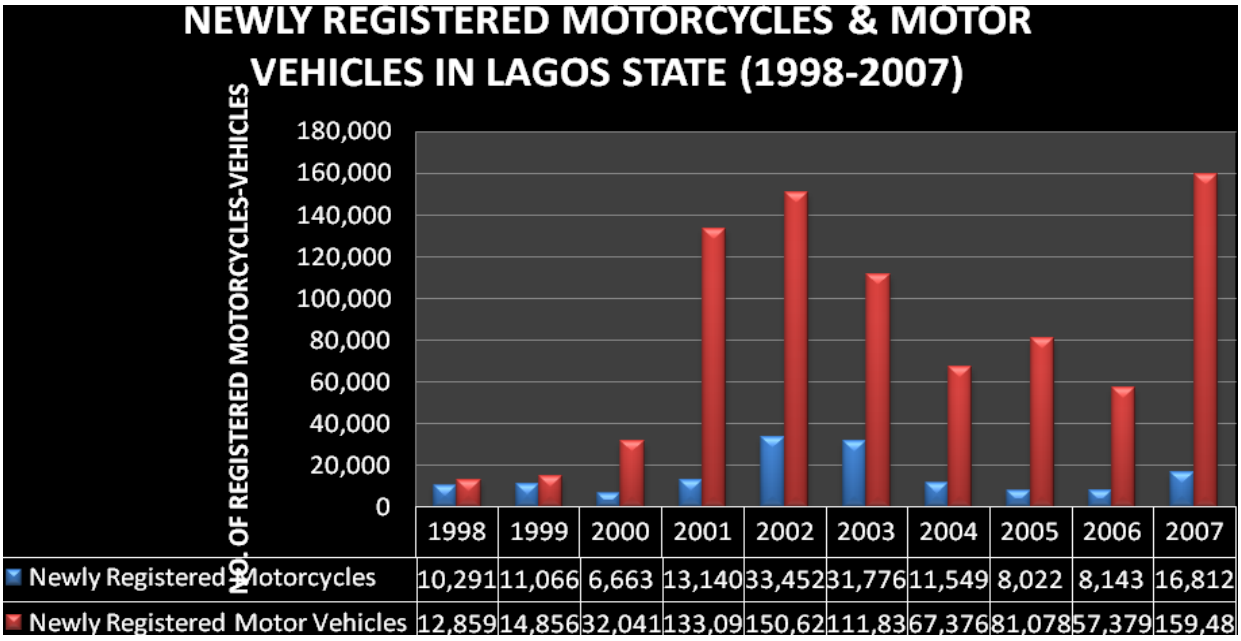


Fig. 6. Registered Motorcycles and Motor Vehicles in Lagos State.
(Lagos State Licensing Office of Statistics (MEPB) Ikeja & FRSC, 2008).

- Reasons for Choosing of Okada (2008)

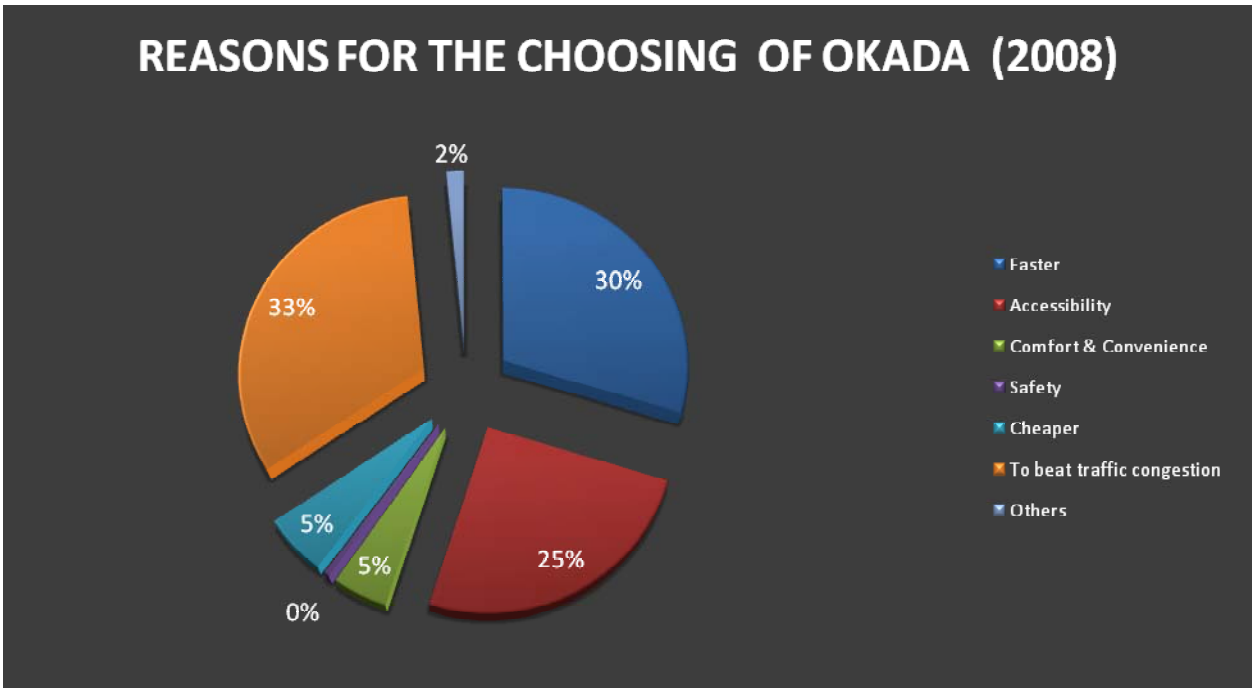


Fig. 7. Reasons for Choosing of Okada. (Olagunju, 2008)

3.2 RESULT ANALYSIS

Deductions from existing data shown in Section 3.1 (i.e. Figures 2 - 7) on the use of Okadas for commercial purpose in Lagos have the following characteristics:

1. On road accident in the state between 1989-2007, year 2003 witnessed the highest rate of accident with 6,001 victims injured, followed by year 2005 with 5,327. In all accident rate has increased from year 2001, this may be due to rapid increase in vehicle ownership.
2. On accident rate based on vehicular classification for the same period (1989-2007), private cars have the highest with 2,847 in 2005 while pedal cycle had the least (i.e. 1) in years 1996 and 2001.
3. On accident injured victims, from 2003-2007, motor vehicle victims were more than motorcycle victims but in 2007, motorcycle victims were 17% more than motor victims.
4. On death victims, year 2006 witnessed the highest carnage on Lagos roads both in motor vehicle and motorcycle transportation. On average thirteen (13) number of people per day were admitted by the three highest rated general specialist hospitals in Lagos (i.e. Lagos State University Teaching Hospital (LASUT), National Orthopaedic Hospital and University Teaching Hospital [LUTH]) between 2003 – 2007, and if they stay for three months in the hospital because of the severity of the type of injury the hospitals, with limited capacity, will not be able to contain them.

5. On the causes of motorcycle crashes in Lagos State for year 2008, 51% of the respondents attributed the cause to bad roads, while 22% attributed it to overloading by the Okada riders and 15% was attributed to over-speeding.
6. On educational qualification of riders in Lagos State, 45% claimed to have secondary school certificate, 20% had OND/NCE/HSC, while No Formal Education was 16%.
7. Registered Motorcycles and Motor Vehicles in Lagos State had the same pattern over a decade, i.e. 1998-2007.

- Finally, on reasons for choosing Okada for public transport, statistics showed that 33% took Okada because of the desire to beat traffic congestion, 30% for being faster than vehicles in congestion cases, while less than 1% actually see it being safe.

3.3 OKADA ROUTE SELECTION CRITERIA:

Some of the factors considered in selecting alternative routes for motorcycles (okada) are:

1. The route must be adjacent to the highways and the major roads since motorcycles can serve as feeders to the public buses on the highways and major roads.
2. The route must be wide enough for motorcycle traffic on both ways
3. The route must be motorable i.e. in good condition for motorcycle comfort and safety
4. Bimodal intracity transportation is a must i.e. the integration of the motorcycle (Okada) and the motor vehicle routes must form a seamless transportation network.

3.4 CREATING ALTERNATIVE OKADA ROUTES USING GEOMATICS TECHNOLOGY

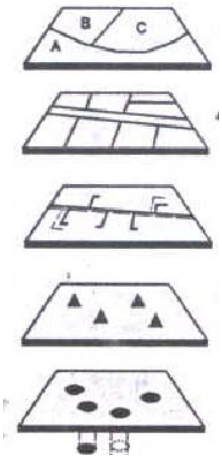
The five (5) components (hardware, software, data, people, and method) of Geomatics were used. Also, the three (3) interrelated subsystems of GIS were covered:

- *Data Acquisition*,
- *Database Management Systems*, and
- *Information Presentation*.

Topology and Database were created. These capabilities of Geomatics made this technology to be of great use in queries and analysis than Computer-Aided Design *CAD*.

3.4.1 Geographical Data Modelling

Geographic data models were created. Boundaries and locations of entities such as roads and settlements were defined. Apart from spatial components, attributes or properties of these entities such as number of motorcycles (okada) involved in accidents, reasons for choosing okada for transport, number of newly registered motorcycles in Lagos State, and so on, described in a unique way, were used in creating database files. These entities were modelled as vector models as shown in Figure 8.



Okada Alternative routes

Road Network

Drainages

Interchanges

Bus Stops

Fig. 8. Okada/Other Vehicles thematic layers

The following steps were carried out to achieve the creation of a seamless bimodal transportation routes:

1. Digital Lagos Street Map was created
2. Settlements/Locations were created (i.e. Settlements e.g. Oshodi, Isolo, Shomolu, etc.)
3. The roads were classified e.g. Expressways, Highways, Major roads, Minor roads.
4. Local Government Map was created
5. Identifying and Creating alternative parallel routes for the Okadas based on criteria stated in Section 3.3.
6. Identifying and Creating interchanges (crossing points) for the vehicle and Okada routes (Fig. 11).
7. Creating a Comprehensive Database.
8. Due to the fact that road and building land use patterns does not follow a regular layout pattern (Fig. 9), therefore the selection of alternative routes for motorcycles had to be done manually without any scientific pattern.
9. As much as possible, adjacent minor roads to the expressways, highways and major roads within local governments were selected for the motorcycle riders
10. Motorists residing along the minor roads selected for the motorcycles will be allocated part of the road for them to go out or come in. Therefore, such roads will become one-way for residing motorists, while the other lane of the same road will be divided for Okada's to and fro routes (Fig. 10).
11. These networks (motorcycle and motor vehicle routes) were integrated to form a seamless intracity transportation system (Figs. 12a and 12b).

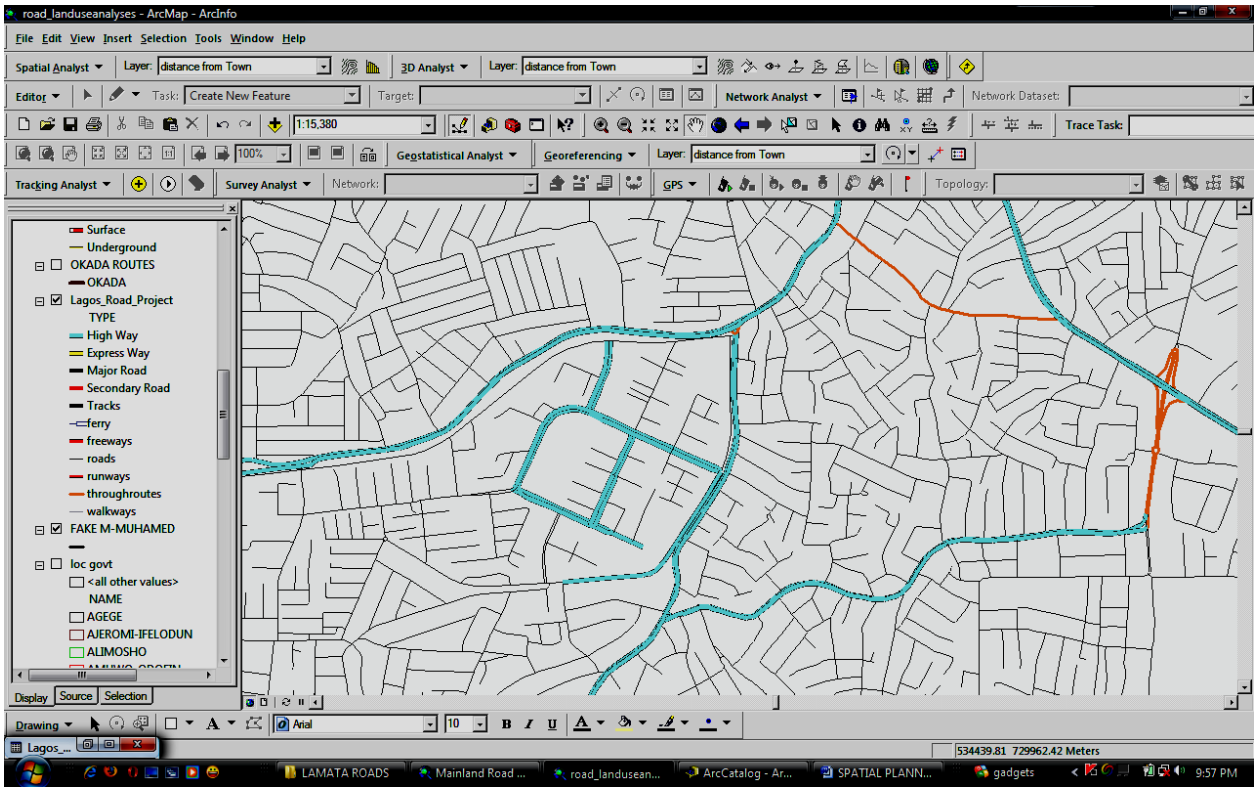


Fig. 9. Road and building land use patterns does not follow a regular layout pattern.

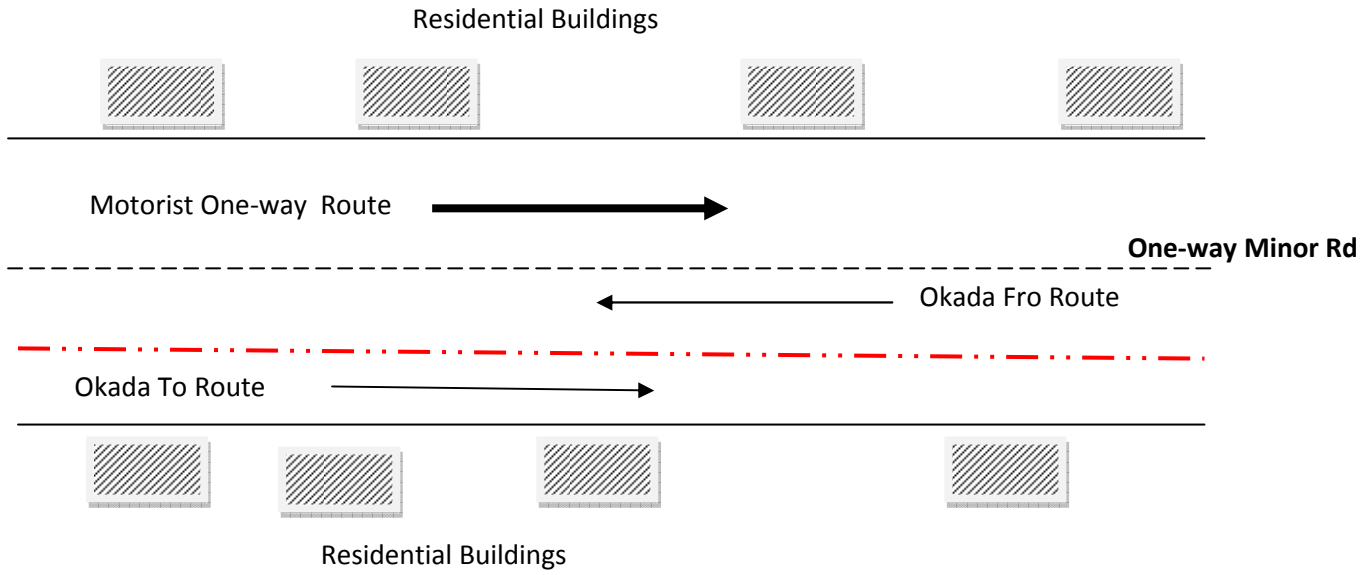


Fig. 10. A Typical Newly Created Okada Route.

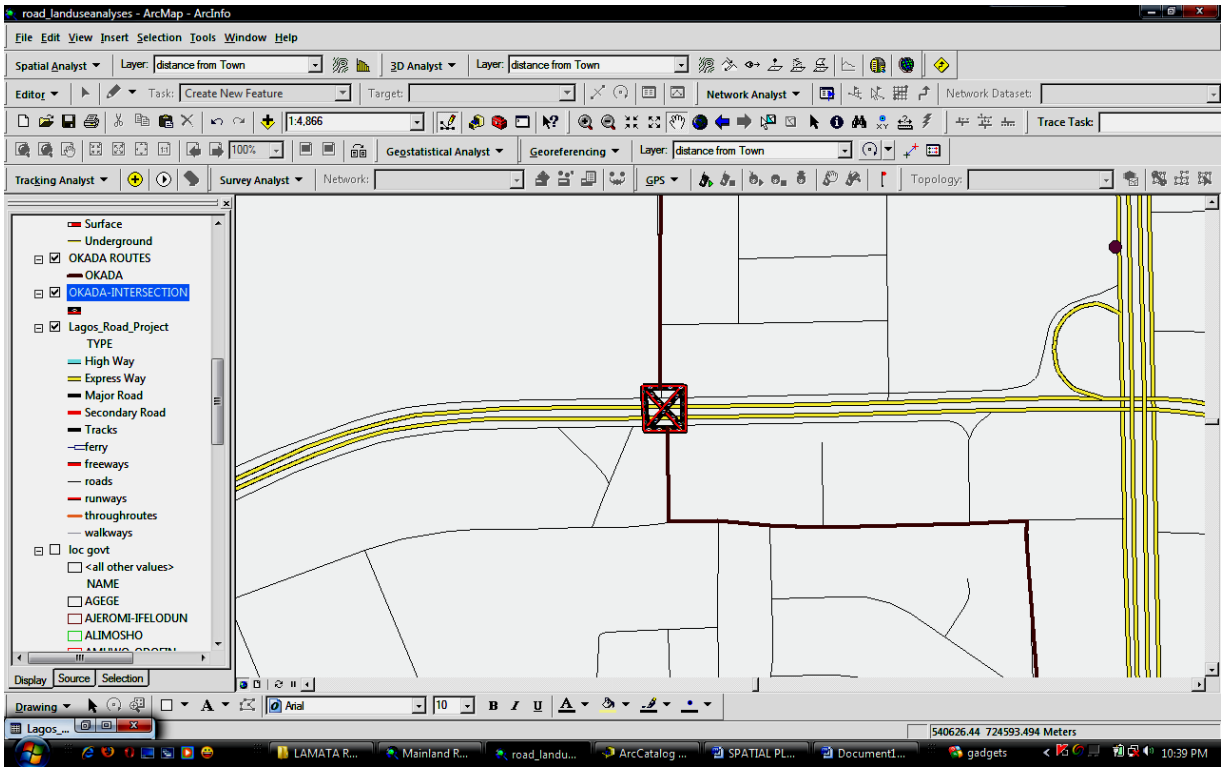


Fig. 11. Intersection of the Motorcycle Routes with Motor Vehicles Roads.

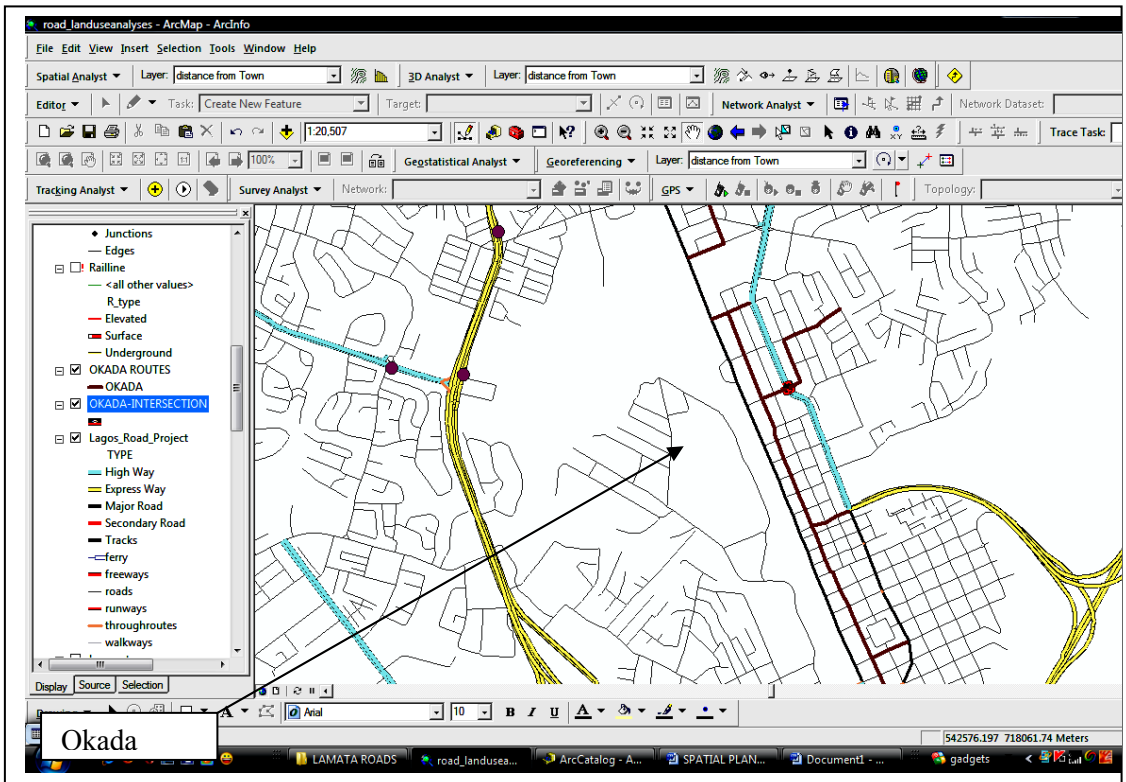


Fig. 12a. Newly created Okada Routes serving as Feeder to the Expressway, Highways,

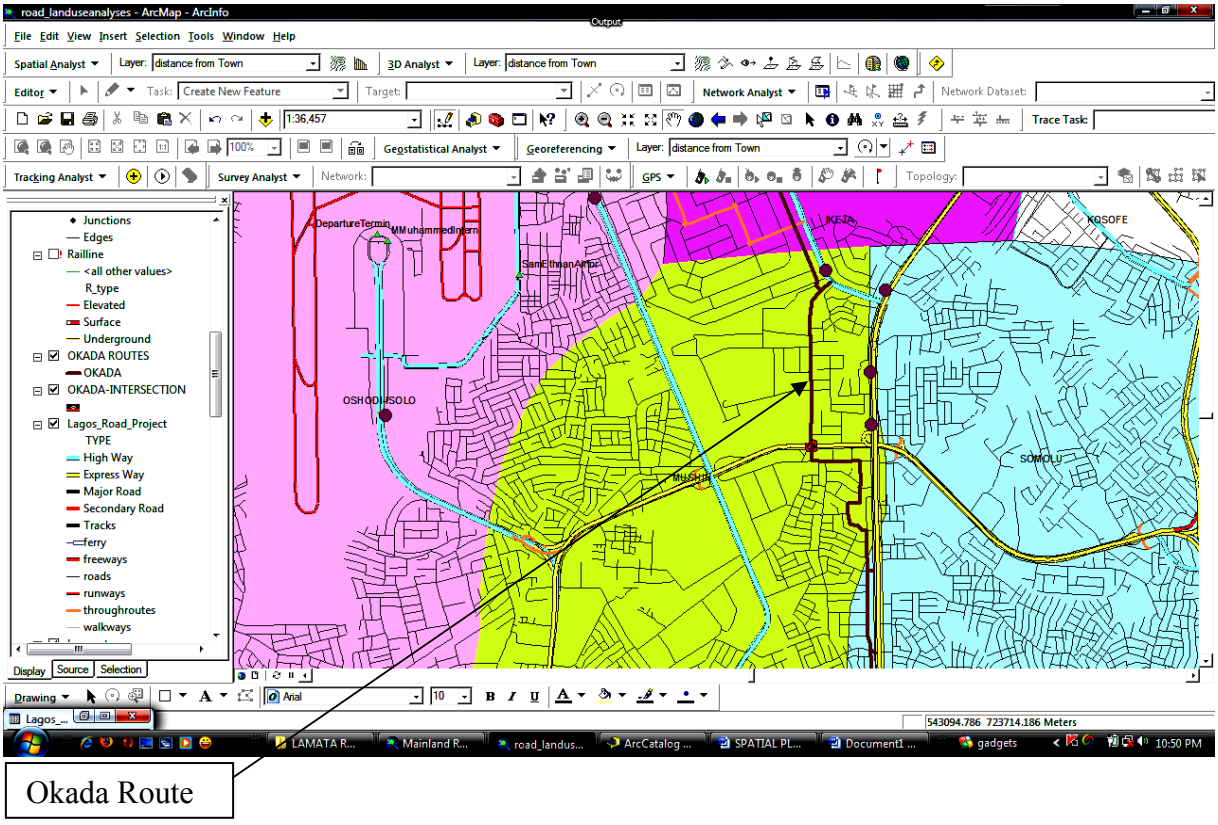


Fig. 12b. A Seamless Bimodal Transportation Network overlaid on the Local Government Map.

4.0 POLICY ISSUES ON BIMODAL (MOTORCYCLE-MOTOR VEHICLE) TRANSPORTATION IN A GEOMATICS ENVIRONMENT IN LAGOS STATE

Policies that will enhance the smooth implementation of this integrated transportation must be put in place. Some of these policies are briefly highlighted below:

1. Policy must identify, support and create alternative routes for the Okadas based on criteria stated in Section 3.3 from time to time to reduce carnage on the roads.
2. Lives of the motorcycle riders must be protected at the interchanges by allocating time to cross the other roads at the right time. This should be automated.
3. All motorcycle (Okada) riders must respect the rights of other road users.
4. Policy must be put in place for all Okada riders to attend a compulsory training education on the use of Okada for commercial purpose and highway codes under the new scheme.
5. Policy that will limit or localized their operations must be put in place e.g. limiting them to Wards or Local Governments Areas. It is believed that this will check their excesses, collusion rate, criminal tendencies and also to serve as feeders to the public buses.
6. Policy and enforcement on the use of protective gadgets must be put in place and enforced.
7. Policy on speed limit on the Okada routes must be put in place.

8. Creating Enlighten Programmes on radio/TV programmes and website/SMS messages for people to be informed must be backed up by policies and implementations. The gains in the new bimodal approach must be emphasized and the losses in the existing approach must be highlighted.
9. Policy on penalising Okada riders for violating traffic rules must be put in place.
10. Policy must be put in place for them to register at the Wards or Local Government Levels and be issued a Rider's Permit or Card. This can assist in automatic tax payment system.
11. Creating a comprehensive database based on (9) and its updating must be put in place.
12. Policy backing any information received from the public on violators must be put in place and the lives of the informants must be secured.
13. Policy must support phase implementation of the new scheme.
14. Policy must support assessment of performance of the new scheme and blocking all loopholes.
15. Provision and maintenance of the necessary infrastructure for the alternative Okada routes must be supported by necessary policies.
16. Periodic road worthiness check of the Motorcycles must be backed up by policies.
17. Policy on the coordination of all stakeholders must be put in place
18. Policy on maximum number of passengers and type/weight of load to carry at a time must be put in place

CONCLUSION

This work has revealed the operations of the motorcycle riders in Lagos Metropolis, their wildness, egocentricity, arrogance and flagrant disobedient of laws and orders. Many of the accidents recorded can actually be averted. Lack of education and necessary riding skills are grossly lacking.

A new approach has been recommended by designing and creating alternative routes for the motorcycle (Okada) operations separated from the motor vehicle routes using geomatics technology. Similarly, policies have been recommended for the new approach to bimodal (motorcycle and motor vehicle) transportation.

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