

Using Geographical Information System (GIS) Techniques in Mapping Traffic Situation along Selected Road Corridors in Lagos Metropolis, Nigeria

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Abstract

Moving from one point to another in any city in the World is an endurance test, regardless of income or social status, the conditions under which people travel is becoming more and more difficult. The traffic situation in Lagos Metropolis is no different. In this paper, effort has been made to map out traffic situations along selected corridors in Lagos Metropolis, Nigeria using Geographical Information System Techniques. The data used in this study were obtained from Lagos Metropolitan Area Transport Authority (LAMATA) agency, topographical and road map of Lagos metropolis from Lagos state ministry of Land s and Survey and Lagos state ministry of Transport. In addition, primary data include the geographic coordinates of the selected traffic corridors using GPS (Global Positioning System), observation of the nature of vehicular traffic congestion and traffic counts along the corridors. The data obtained was entered and used to developed traffic situation information system (TSIS). Data retrieved and spatial analysis from attributes were shown using ArcGIS 10. The results were presented in map format which makes for easy interpretation and quick decision-making. Geographic Information System is an effective tool to display different levels of congestion and vehicular volume along digital traffic corridors. This will be very useful for agencies in charge of traffic situations planning and management in Lagos state and Nigeria at large.

Keywords: Geographical Information System (GIS), Lagos metropolis, Traffic Congestion, Traffic Corridors.

1. INTRODUCTION

Transportation is inherently central to development of nations as it is not only a necessity of life but have a resultant effect on all aspects of our existence (Oyesiku, 2002). Oni (2004) described transport as the life wire of any urban environment. Without transport, life as it is today would be inconceivable; as it is central to the flow of knowledge, information and commercial goods. Transport is particularly crucial in the existence of a city and cities over the world remain the focal point in an economy where people come together primarily to exchange goods and interacts. Cities over the years, witness an exploding rate of growth (World Bank, 2006).

The continued alarming growth of urban population is one of the major factors partly contributing to the rate of physical development in Nigerian cities (World Bank, 2006). Indeed, the transportation sector all over the world is generally recognized as being in a state of crisis, particularly Nigerian cities have continued to expand in recent time and transport supply falls below the demand. Despite the opportunities in cities, however Nigeria is experiencing increasing rate of urban mobility problems (Oyesiku, 2002). Ogunsanya (1983) noted that urban transportation problem started with increasing urbanization and population leading to urban transport problems such as traffic congestion.

Traffic congestion is a major transportation problem of Nigerian cities. It occurs when urban road network is no longer able to accommodate the volume of traffic that uses them; it increase travel cost and causes physical and psychological discomfort (Jaco, 2008). The chaotic situation is observable in virtually all the major streets in Lagos Metropolis. Lagos is now one of a number of rapidly growing cities in Nigeria and the world at large with the World Bank report categorizing Lagos among the Mega cities, with a population of 10.287 million in 1995, 17 million in 2006 and a projected population of about 25 million by 2015; (World Bank, 2006) and for a population of such magnitude it is traditionally right to expect a high rate of travel demand. Consequently, all over the major roads in Lagos Metropolis, large number of people and vehicles are seen crawling along the roads. More so, the roads are often in bad shape, hence, the persistence of traffic congestion. There is no free circulation of vehicle, mobility is inhibited and there is much discomfort on the road, also much time is wasted on the road during intra-city and inter-city movement, and this no doubt has profound effect on the state economy. It is therefore important to make effort to stem this problems through informed decision –making. However, making informed decision in many areas including road traffic situations often involves complicated processes. For optimal decision-making, information from various sources is required such as spatial information, which is essential to curb essences of traffic congestion and its effects (Burrough and McDonnell, 2002).

Geographic information systems (GIS) can play major role in the management of mapped or spatial data prior to, during and after traffic congestion. Geographic Information System (GIS) is a computer system for capturing, storing, querying, analyzing and displaying geographic data (ESRI, 2006). GIS represents a new

paradigm for the organization of the information and the design, the essential aspect of which is the use of concept of location as the basis of structuring of information systems. The advancement of GIS can be put to effective use to map and analyze road traffic situations using tools like linear referencing, spatial analysis and query which can be easily performed, enhanced by graphical representation. Road characteristics, vehicle origin and destination, vehicular traffic congestion nature and volume data can be integrated to enhance analysis of road traffic situation along road corridors.

1.1 AIM AND OBJECTIVES

The aim of this study is to map out the traffic situations along some selected major traffic corridors within Lagos metropolis, Nigeria. The specific objectives are;

- i. To identify the nature of vehicular traffic congestion in the study area.
- ii. To assess the volume of traffic flow along the selected corridors.
- iii. To generate database for the purpose of decision making, planning and effective measures by concerned agencies that will help to improve the vehicular traffic flow along the selected corridors.

2.0. MATERIALS AND METHODS

2.1 STUDY AREA

Lagos lies in south western Nigeria, on the Atlantic coast in the Gulf of Guinea, west of the Niger River delta, located on longitude $3^{\circ}24'$ and latitude $6^{\circ}27'N$ on this stretch of the high-rainfall West African Coast. Lagos is the most densely populated city in Nigeria also the most urbanized. Road network in Lagos can be classified into three broad types namely the expressways, major arterial roads and other roads which serve as access and collector road. The complex network of bridges on the Lagos Lagoon connect various parts of the Island to mainland with the most important line being Eko Bridge which connects the Apongbon end of the Island to Apapa, Ijora to Surulere. The Carter Bridge links the commercial core of Idumota on the Island to Oyingbo in the Mainland. Lagos –Ibadan Expressway is in the northern boundary of the metropolis, it serve as the major link of vehicular traffic out of Lagos to other parts of Nigeria. Lagos is nodal point of all transport modes air, water, road and rail.

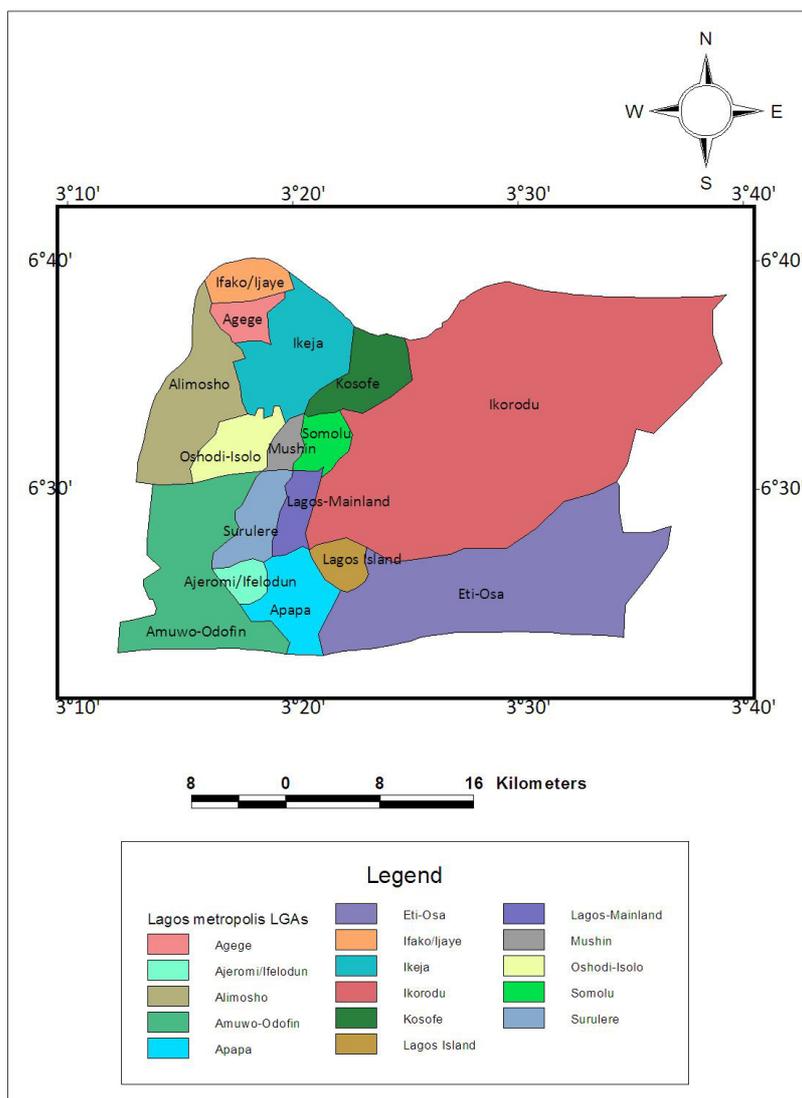


Figure.1: Map of Lagos State showing the sixteen (16) LGAs within the metropolis
 Source: Lagos state ministry of Lands and Survey, 2012

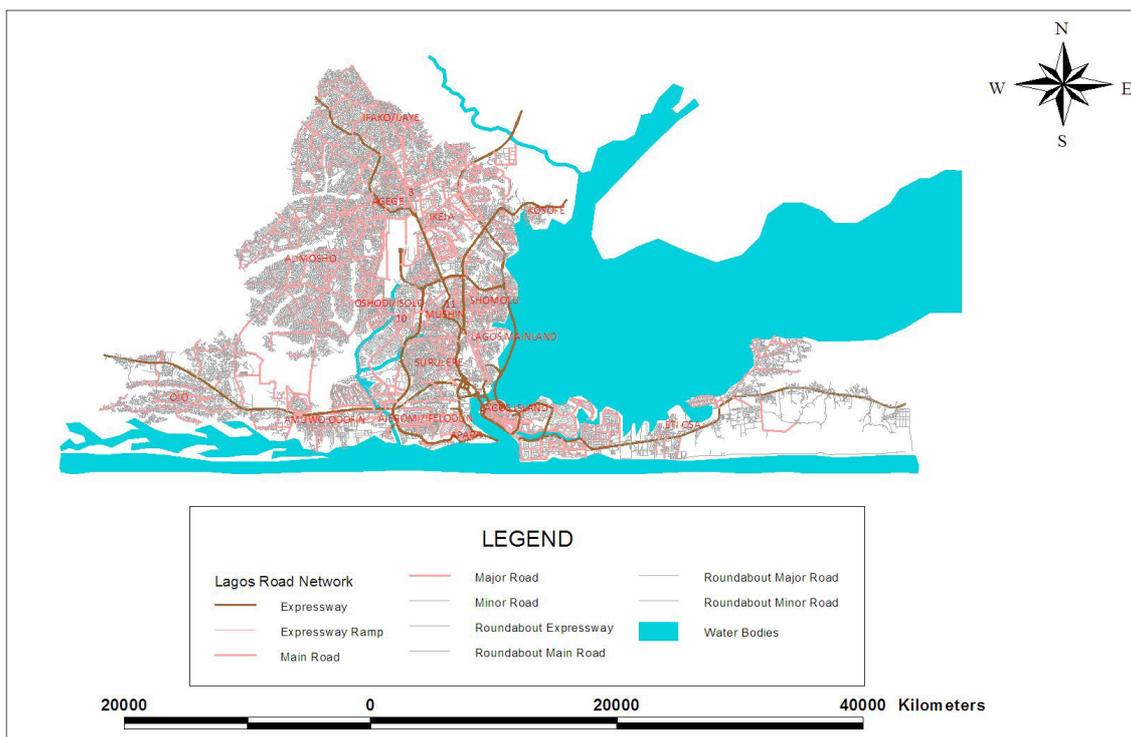


Figure.2: A digital map of the study area showing road network and water bodies

2.2. METHODOLOGY

2.2.1. Data

The data used involve two sources, the primary and secondary data sources. The primary data source involves direct collection of information on the field using GPS (Global Positioning System) and observations. The data collected from primary source include; the geographic coordinates of the selected traffic corridors, nature of vehicular traffic congestion and traffic count along the corridors.

The secondary data source involves sourcing information from existing records. Such data include s: traffic situations reports from Lagos Metropolitan Area Transport Authority (LAMATA) agency, topographical and road map of Lagos from Lagos state ministry of Land s and Survey and Lagos state ministry of Transport.

2.2.2. Data Processing

The road map acquired was scanned into GIS environment. Geo-referencing was done by used of tied- points. The geo-referenced map portrayed information as to where the area respresented on the map fit on the surface of the earth. Digitization was carried out to create spatial data from existing hard copy maps. The geo-referenced map of road network of Lagos metropolis was digitized using Arc GIS 10 by the process of on-screen digitization. Road networks of the study area were digitized as line features and locations of selected corridors were plotted as point features by using spatial analyst tool.

The data from primary source were then structured in a format for implementation in the GIS environment and were linked to the digitized features as their attributes.

3.0. DATA ANALYSIS AND DISCUSSION OF RESULTS

The traffic situation maps in this study as shown below were generated by creating a digital database of all the selected variables as listed and mapped below. The software used was Arc GIS 10. Both overlay technique and unique tool in the legend editor were used for the analysis. The result of the analysis showed heavily, highly, very and fairly nature of congestion of the selected traffic corridors as shown in figure 8 below. Likewise the technique explained above was also employed to create heavily, highly, very, less and voluminous level of the selected traffic corridors as shown in figure 7. Furthermore, figure 5 and 6 depicted levels of traffic congestion along the selected corridors.

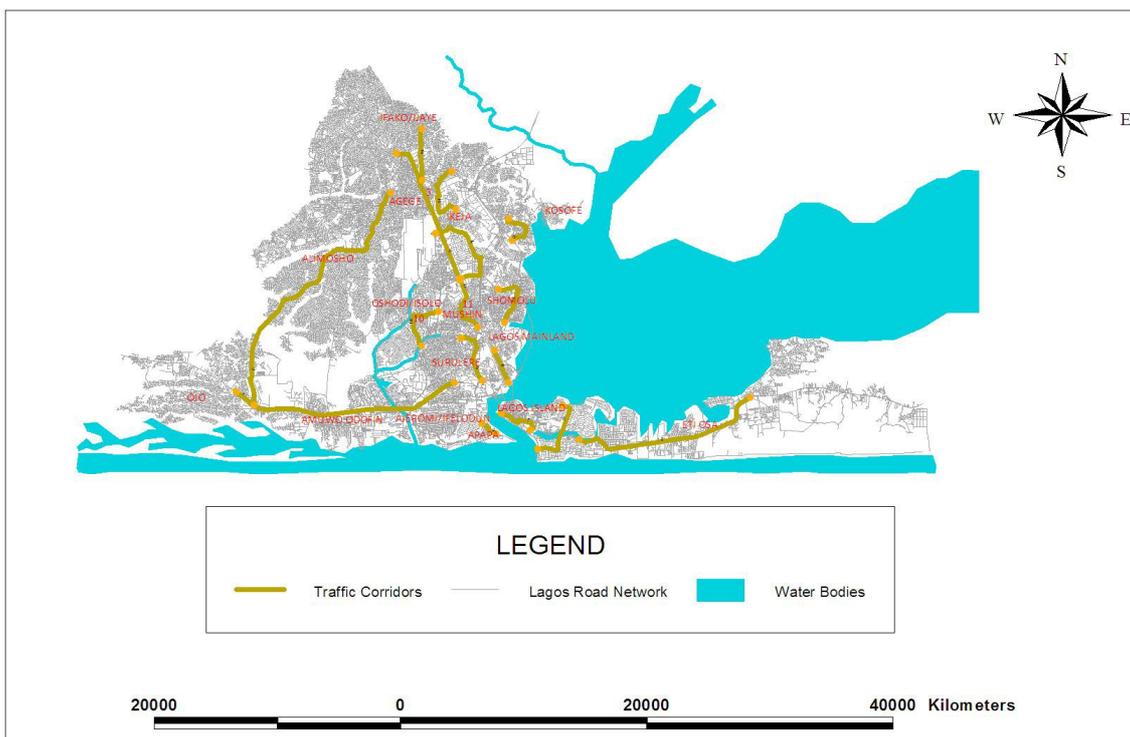


Figure.3: A digital map of the study area showing the selected traffic corridors.

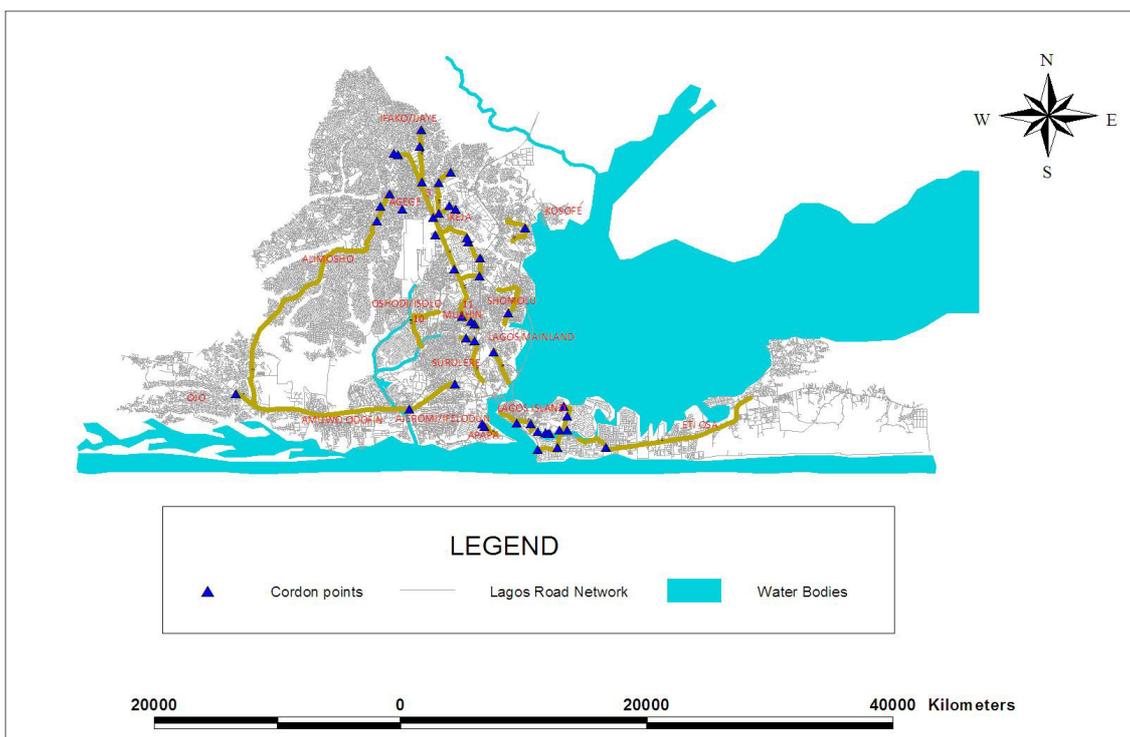


Figure.4: A digital map of the study area showing the cordon points of the selected corridors

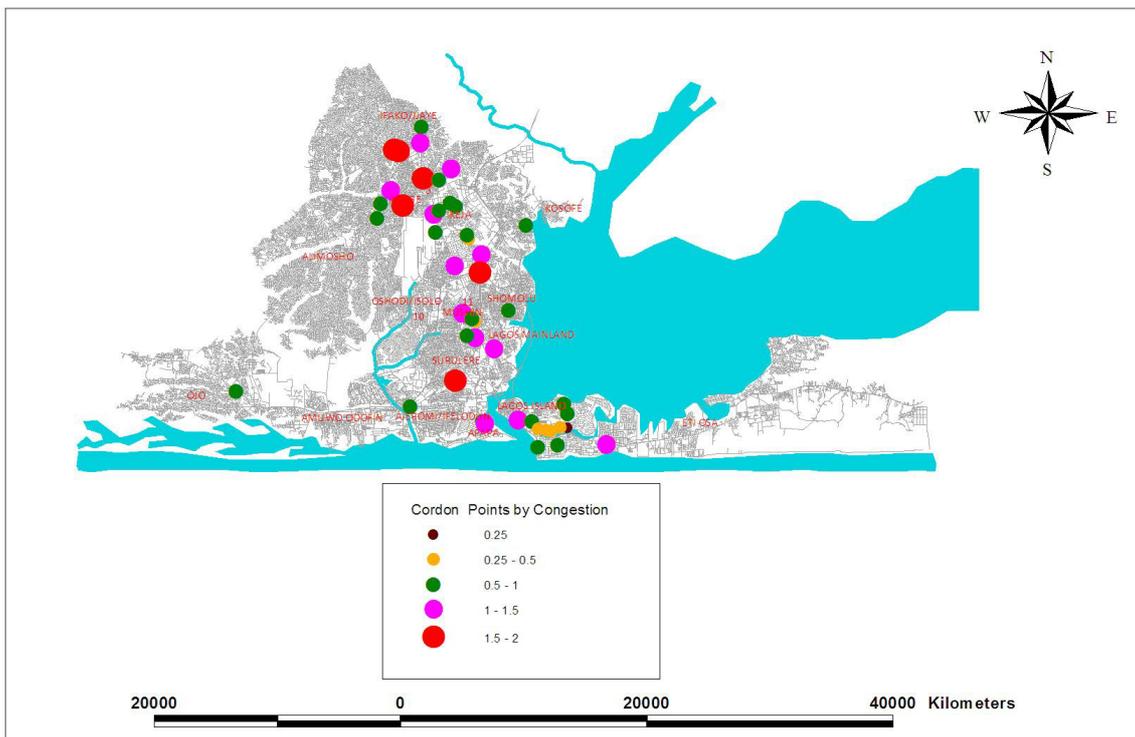


Figure.5. A digital map of the study area showing cordon points by congestion

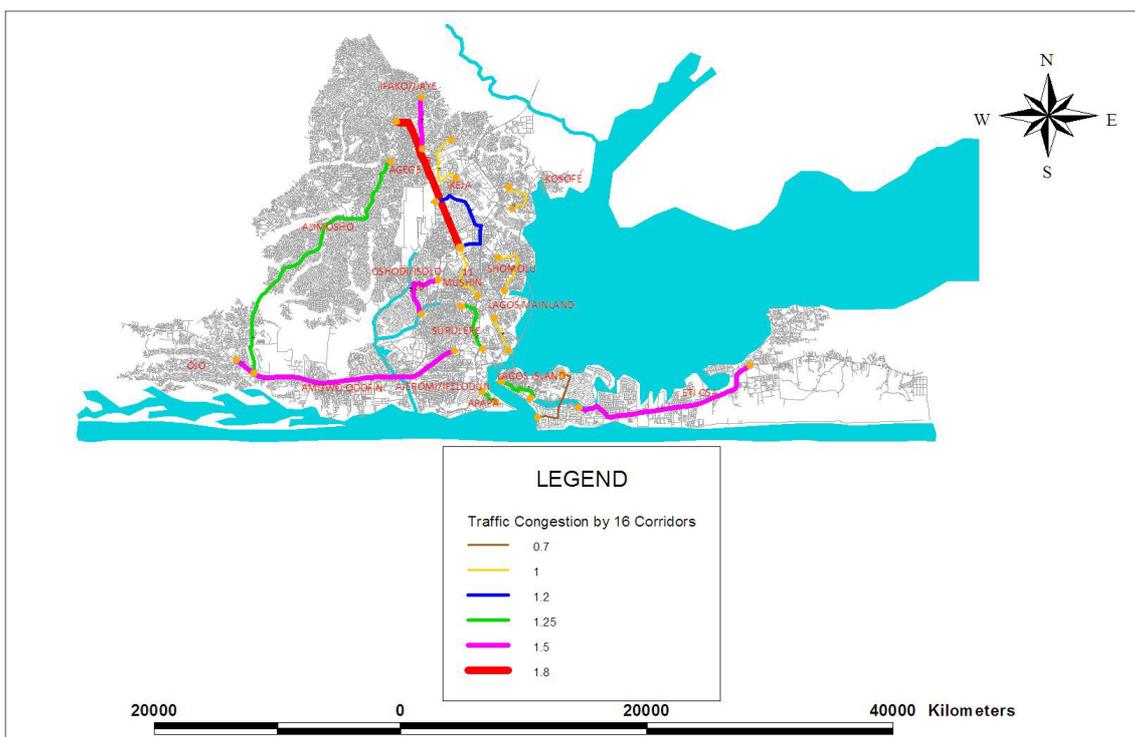


Figure.6: A digital map of the study area showing traffic congestion level per corridors

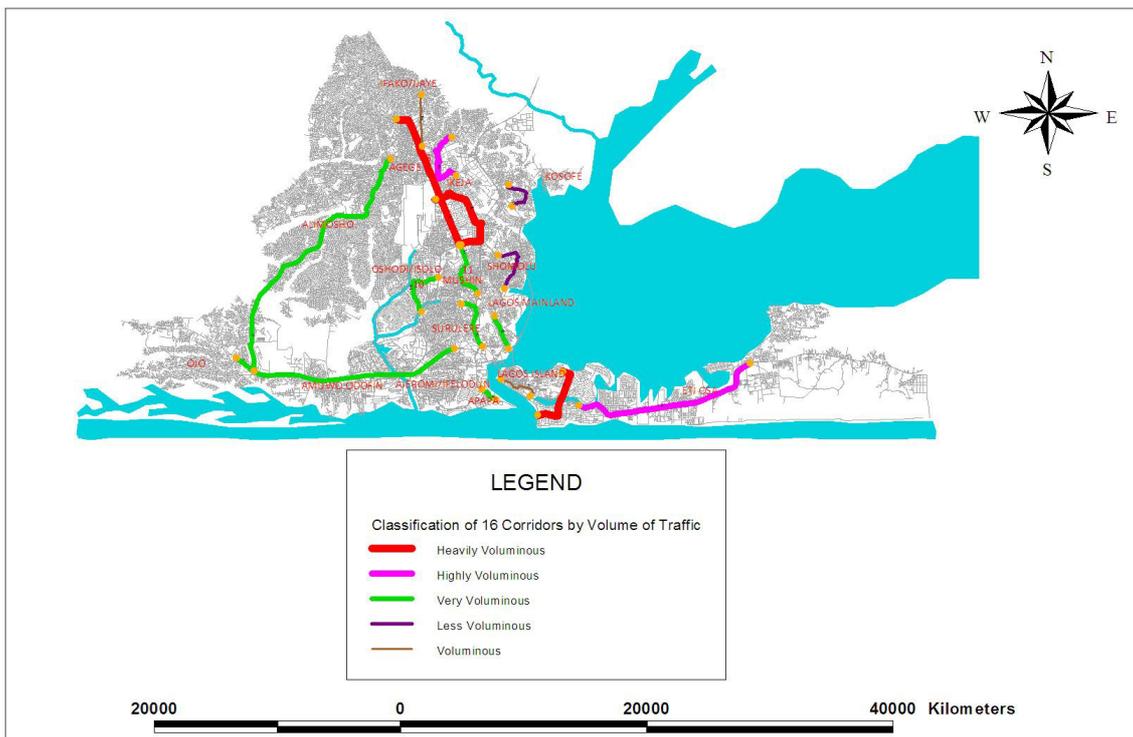


Figure.7: Digital map of the study area showing classification of corridors by vehicular volume

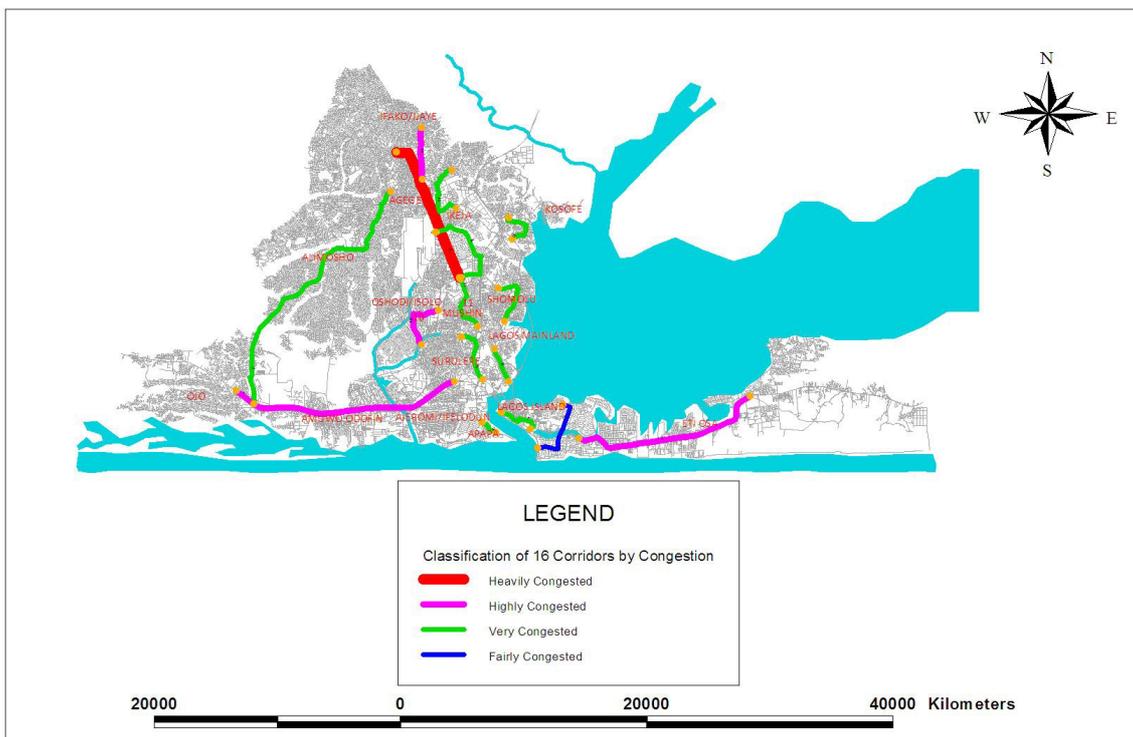


Figure.8: Digital map of the study area showing the congestion nature of the selected traffic corridors

4.0. CONCLUSION AND RECOMMENDATIONS

4.1. CONCLUSION

This paper demonstrated some techniques in digital mapping. It has shown that digital technology can be used in monitoring traffic situations and its efficiency in terms of speed, efficient accuracy, reliability and economy of the work

The paper gives an insight of the most congested and voluminous traffic corridors in Lagos metropolis,

Nigeria. It can also facilitate spatial data sharing within transportation agencies and between transportation department and other government agencies. This study equally showed that GIS Technology is able to handle mapping of traffic situations along traffic corridors. Case study was carried out along some selected traffic corridors in Lagos metropolis. The results were presented in map format which makes for easy interpretation and quick decision-making. Geographic Information System is an effective tool to display different levels of congestion and vehicular volume along digital traffic corridors. The use of GIS enables relevant traffic situations data to be quickly processed and displayed on a map. GIS has also been used as a tool to identify heavily congested and voluminous traffic corridors and these in turn will help to improve decongestions of heavily congested and voluminous traffic corridors with effective planning and management.

4.2. RECOMMENDATIONS

The outcome of this research is a digital map of traffic situation which can serve as a based map for other researchers in the future for the purpose of mapping out some other important features within Lagos metropolis by digital means. The study has also shown the benefit of digital mapping. This research work contains the information which is relevant for decision making and planning in the state. It is hope that all agencies that are involve in transport planning and management will find this study useful in identifying measures for improving traffic situations in Lagos state and Nigeria at large.

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