THE INTERNATIONAL JOURNAL OF HUMANITIES & SOCIAL STUDIES

Evaluation of Traffic Management Techniques on Major Roads in Port Harcourt, Rivers State, Nigeria

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Abstract:
Urban transportation system in most developing countries is faced with increasing pressure due to increase in vehicular ownership and use. With rapid increase in population, household income, and poor land-use planning, traffic management has become an intractable problem in most urban centres in Nigeria. This study was an assessment of the efficacy of traffic management techniques in Port Harcourt. The study adopted the passive observational research design. Data for the study came from both primary and secondary sources. Analysis of traffic count on sampled roads shows both spatial and temporal variations. Of the 7 days survey period of vehicle density along Port Harcourt-Aba express road (12th- 18th, March 2018), the highest average hourly traffic volume per week was recorded on Monday with 88,461 Passenger Car Units (PCUs), and the lowest was on Sunday 22,305 PCUs. The weekly average hourly volume of traffic was highest between 6pm-7pm 63,950 vehicles, while the lowest was between 1pm-2pm with 9,170 PCUs. For Ikwerre road, the highest average hourly traffic volume per week was recorded on Wednesday with 57,257 PCUs, and the lowest was on Sunday with 25,472 PCUs. The weekly sum and average hourly volume of traffic was highest between 6pm-7pm with 47,561 PCUs, while the lowest between was recorded between 1pm-2pm with 10,974 PCUs. The weekly average hourly traffic volume was highest between 6pm-7pm with 6794.43 PCUs and lowest between 1pm-2pm with 1567.71 PCUs. The highest daily traffic volume of different modes of vehicles was 57,257. On the efficacy of traffic management techniques, most respondents (65.3%) rated the traffic management techniques as 'effective'. Since traffic management requires a high level of political will, institutional and human resource commitment, the study advocates for the resuscitation of the Rivers State Traffic Management Agency (TIMARIV) to instill sanity among road users in the area. There is also the need to install close circuit television (CCTV), sensors and smart traffic devices on major roads for traffic monitoring and data collection to enhance effective control of traffic congestion. Overall effective land use planning in Port Harcourt is a panacea for curbing traffic challenges in the area.

Keywords: *Traffic management, traffic count, land use planning, traffic volume, passenger car units, urban transportation*

1. Introduction

Increase in level of urbanization as noticed in all urban centres in the developing world has brought about the upsurge in the various forms of transportation and its influence and pressure on the urban environment. The increasing rate of human population and vehicular traffic has been one of the various problems of African cities (Sule, 2006). Nigerian urban centres are facing similar situation in terms of traffic congestions as a result of the growing rate in population of the cities and the functions provided by urban centres which has exacerbated the current trend in rural-urban migration.

Traffic congestion is a condition on road networks that is characterized by slower speeds, longer trip times, and increased vehicular queuing (Rodrigue, Comtois, and Slack (2006). According to Downie (2008) traffic congestion occurs when the volume of vehicular traffic is greater than the available road capacity, a point commonly referred to as saturation. Downie (op cit) describes a number of specific circumstances which cause or aggravate congestion most of are concerned with reduction in the capacity of road at a given point or over a certain length, or increase in the number of vehicles required for the movement of people and goods.

Urban transportation system in most developing countries is faced with increasing pressure due to increase in motor vehicle ownership and use, growing at a faster rate than population, with vehicle ownership annual growth rates of between 15% and 20% (World Bank,2001). More so, the average distance traveled per vehicle has been on the increase in most cities of the world. Rapid increase in population, increase in household incomes and its resultant increase in the level of car usage, coupled with poor land-use planning, poor transport design and planning, traffic management has become an intractable problem in urban centres in Nigeria (World Bank,1999).Ironically, these growths in traffic have continually

exceeded the capability of authorities in developing countries to increase road space, hence the consequential impediments to the efficient working of the economies of most cities in developing countries World Bank, (op cit).

The United Nations Centre for Human Settlements (UNCHS) (1998) asserts that travel speeds in cities are decreasing and the travel environment for pedestrians and people-powered vehicles are deteriorating in developing countries, due to the inefficiency of the entire road transport system. The urban transport services cover a range of important social and economic services such as leisure trips; business journeys; commuting; shopping; trips to places of education and freight distribution. Business activities depend on urban transportation systems to ensure the mobility of its customers, employees and suppliers. Effective urban transport fulfils the demand for accessibility within cities (Okoko, 2006).

Port Harcourt, one of the largest crude oil exploration and industrial centers in Nigeria is characterized by traffic congestion problems. As an oil and gas city, Port Harcourt has witnessed spatial expansion and phenomenal increase in human population. The influx of both firm and people into the area has also led to the construction of new roads and expansion of old ones by successive administrations all of which has never quite ameliorated the traffic congestion problem in the area. Traffic congestion is observable virtually along major roads in Port Harcourt Municipality with attendant negative implications to residents of the city. Some of the effects of traffic congestion in the area include delay in movement, man-hour lost in travel time and economic returns, social, psychological, and health problems, air and noise pollution, breeds criminal activities.

As the population of Port Harcourt increase, the challenges posed by road traffic congestion is, also expected to aggravate. The matter is made worse given the weak regulatory land use planning regime in the area. To manage road traffic in Port Harcourt and curb the negative social economic problems associated with it, various traffic management techniques have been put in place. The effectiveness of these techniques in terms of ensuring efficient traffic system needs to be examined hence the present study seeks to x-ray the efficacy of various traffic management techniques on major roads in Port Harcourt Municipality.

2. The Study Area

Port-Harcourt was created by the British colonial administration of Nigeria between 1912 and 1914. It is located within latitudes 4o 44' 58.8" N and 4o 56' 4.6" N and longitudes 6o 52' 7.2" E and 7o 7' 37.7" E. (Fig 2). Port Harcourt experiences tropical humid climate with lengthy and heavy rainy seasons and very short dry seasons. The municipality is endowed with abundant sunshine and the temperature ranges between 25°C and 28°C (Ogbonna, Amangabara and Ekere, 2007). As of 2016, Port Harcourt urban area has an estimated population of 1,865,000, a sharp deviation from the 2006 figure of 1,382,592 (Wikipedia, 2018). Road construction in this area presents serious constraints in real terms due to its peculiar terrain. Port Harcourt is characterized by a low lying coastal plain, which geologically belongs to the sedimentary formation of the recent Niger Delta, with an elevation of less than 15.24m (Oyegun, 1999). The drainage of the study area is poor because of the presence of many surface water bodies' and heavy annual rainfall, which is between 2000mm and 2400mm (Mmom and Fred-Nwagwu, 2013). However, Bonny River, New Calabar River, creeks and streams drain Port Harcourt Municipality and all enter into the Atlantic Ocean through estuaries (Chiadikobi, et al., 2011).

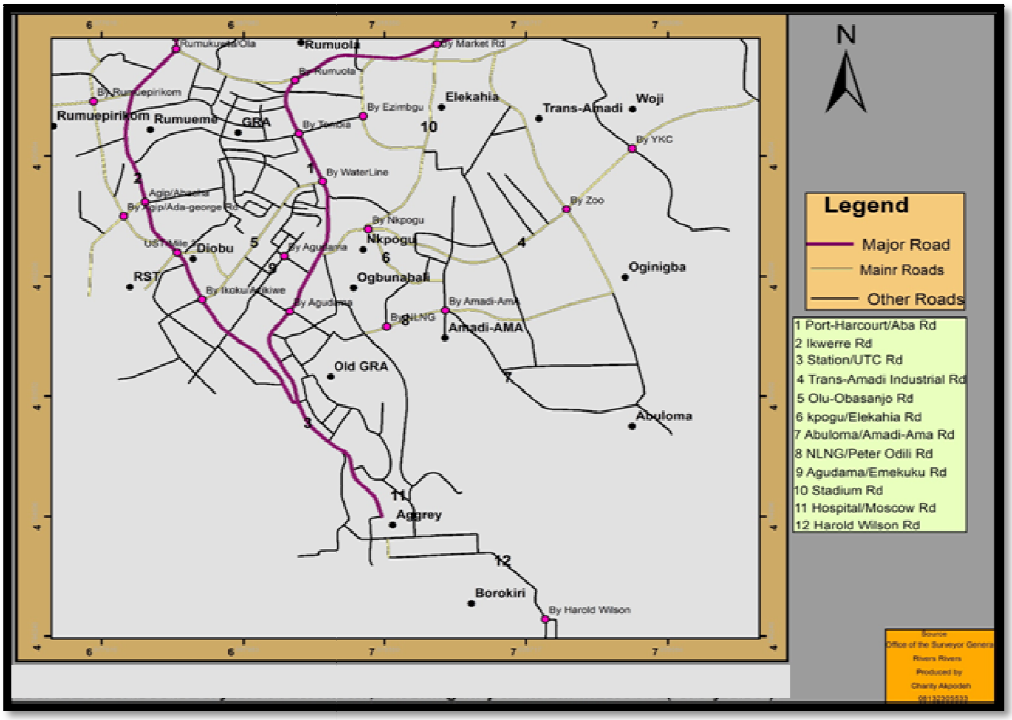

Figure 1: Street Map of the Port Harcourt Showing Study Routes
Source: National Research Development Agency, (2016)

Economically, Port Harcourt the capital of Rivers State plays important role especially as the in terms of its contribution to the nation's Gross Domestic Product (GDP). In 2007 alone, the Rivers State ranked 2nd nationwide with a gross domestic product (GDP)of $21.07 billion and a per capita income of $3,965. (Wikipedia, 2018). The state is famous for its vast reserve of crude oil and natural gas. It was perhaps the richest and most important section of the African zone of the British Empire. Rivers State major oil refineries, two major seaports, airports, and various industrial estates spread across the land. More than 60% of the country's output of crude oil produced in the state. Other natural resources found within its boundaries are silica sand, glass sand and clay (Wikipedia, 2018). Transportation within Rivers State is land and water-based. Apart from roads and waterways, there are functional airdromes that provide out of state transport. The sea ports contain harbors where ships can dock and transfer people and cargo to or from land. Taxicabs, buses and ferries dominate public transport. They are usually inexpensive and are often used for multi passenger pickups. Both domestic and international flights are available from Port Harcourt International Airport.

3. Conceptual Orientation and Literature Review

3.1. The Concept of Traffic Management

The term 'Traffic Management' comprises a variety of techniques for dealing with highway traffic related issues. As a concept, it is a process for planning and operating a system of urban highway and street network. It arises from the need to maximize the capacity of existing highway networks with a minimum of new construction. More recently, the emphasis of the process has spanned beyond simple capacity improvement to accident reduction, demand restraint, public transport priority, environmental improvement and restoring the ability to move around safely and freely on foot and by pedal cycle. Thus, traffic management may be considered as a means of optimizing the available highway network in account with specified objectives as dictated by the prevailing local issues (Adebisi 2004).

Traffic management is the influencing element of traffic situation by variety of techniques with the target of harmonizing the traffic demand and supply of all transportation modes (METRASYS, 2012). Traffic management represents a wider concept and is concerned with the comprehensive management of the road-based transport system and deals with policies and techniques for the entire urban transport system (John, 2000).

3.2. Traffic Management Techniques

Traffic management techniques are set within a defined traffic and regulatory policy framework and are most likely included in comprehensive packages which vary in type and extent in accordance with the function of the relevant road in the hierarchy (John, 2000). Traffic management is one of the major objectives of transportation planning to ease the movement of commuters and goods on urban roads. However, in many towns and cities all over the world, there is an undesirable level of traffic congestion on urban roads. The provision of new roads is often expensive and most municipal governments usually consider the option of widening existing roads and this sometimes involves the demolition of houses. However, the widening of roads and the demolition of buildings are not necessarily the panacea to controlling traffic congestion on roads (Fadare, 1998). Consequently, attention is now being focused all over the world on the use of traffic management techniques, which strive to utilize existing transport facilities with a view to minimizing cost (both social and economic) while at the same time maximizing benefits. A traffic management technique according to Adebisi (2004) involves a package of actions designed to optimize the available highway network in a well focused manner. The package of actions involves a variety of techniques for the management of traffic and other related issues.

3.2.1. Typology of Traffic Management Techniques

3.2.1.1. Traffic (Light) Signals

Traffic signal is a management technique that is highly valuable in controlling traffic on major roads and intersection. A signalized major road and junction relies on electronic gadget to control traffic from various streams. Traffic signal equipment usually allocates the right- of-way to different streams of traffic, based on pre-determined information stored in the memory of an electronic computer (Okoko, 2006). Wright and Ashford (1989) noted that intersections that carry large vehicular volumes could not be controlled safely and satisfactorily without the use of traffic signals. It is observed that the installation of power-operated traffic signals at an intersection could separate effectively all or conflicting flows thus bringing about a degree of orderliness and safety.

3.2.1.2. Grade Separation

Grade separation management techniques allow traffic to be segregated in such a way that it can flow unimpeded through the intersection at levels. One stream of traffic can flow over the ground (flyover) and another stream can flow under the surface (underpasses). Grade separation can be used for a particular type of vehicular traffic or for a combination of different types of traffic. One major advantage of this type of technique is that it provides for an efficient flow of traffic. Moreover, it reduces the incidence of pollution at junctions because there is no idling of engines due to long queues of vehicles. Another technique of grade separation is the use of overhead bridges. Overhead bridges are normally constructed for pedestrians. It is important that they are strategically located at places that attract the greatest pedestrian traffic. Overhead bridges are common in most Nigerian cities (Okoko, 2006).

3.2.1.3. Speed Breakers

Speed breakers are colloquially referred to as "bumps" or "sleeping policemen". They are low–lying ridges constructed across the road to slow down the speed of vehicles approaching the intersection. This management technique assumes that motorists will behave rationally, and obey traffic regulations (Okoko, op cit).

3.2.1.4. Traffic Signs

Traffic signs are the commonest and oldest management techniques to control traffic (Wright and Ashford 1989). Traffic signs help to control the movement of vehicles, to reduce hazard of traffic operations and to improve the quality of flow. In 1944, the United Nations convened a Conference of Road and Motor Transport in Geneva on the need for international standardization of traffic signs. As a result, a protocol on road signs and signals was signed. The use of traffic signs is predicated on the assumption that people are literate enough to read and obey road signs (Okoko, 2006).

3.2.1.5. Manual Signal (Traffic warden)

This is a situation where traffic wardens are used at road intersections. They control traffic by waving to indicate right-of-way to some streams of traffic. It is a crude technique of traffic control compared to the traffic light signals. This method is common in Nigerian towns where the wardens are colloquially referred to as "yellow fever". The major problem with this system is that accidents can occur due to human error on the part of the traffic warden. Another problem is that impatient drivers can knock down the traffic warden, and more often than not, motorists fail to obey the traffic warden's signals (Okoko, 2002).

3.2.1.6. One-Way System

One-way streets are those streets where traffic movement is permitted in only one direction. It is a traffic management technique, which aims at improving traffic flow thereby reducing delays. One-way streets serve as the least expensive method of alleviating traffic conditions in a busy area. The major utility of the one-way traffic management technique is that it removes conflict between two opposing streams of traffic (Okoko, 2006). One major advantage of the one-way street is that it reduces the number of points of conflict at junctions, thus promoting traffic safety, and reduction of accidents and delays. The one-way traffic management technique ensures about 50 percent efficiency in traffic flow, reduces the rate of accidents, and increases the overall journey speed on affected streets. Since it discourages congestion, it inevitably reduces the rate of air pollution arising from fumes from exhaust pipes of vehicles (Okoko, 2006).

3.2.1.7. Pedestrian Safety Measures

Some of the notable pedestrian safety measures include zebra and pelican crossings. The disadvantage of zebra crossing is that it can cause accidents where motorists are impatient. Pelican crossing is a traffic management device with a button attached to it. By pressing the button, red light shows on the opposite side of the road, stopping vehicular traffic. Within the interlude, pedestrians are free to cross the road. Other pedestrian traffic management measures include overhead bridges and underpasses. Overhead bridges are usually located at a point where there is a sizeable concentration of pedestrian traffic so that they do not have to trek for a long distance before they could have access to it (Okoko, 2006).

3.2.1.8. Route Restriction

Route restriction has been a common practice for long time. This method restricts vehicles to certain routes and, in particular, does not allow them to travel through residential areas. This is easily enforced on buses. Similar restrictions are becoming increasingly demanded for heavy goods vehicles. The maximum dimensions of goods vehicles have been permitted to grow, in order to reduce road haulage cost. An alternative arrangement is to permit the heavy vehicles to use only specific routes in the urban area, known as lorry routes (Michael, 1972).

3.2.1.9. Prohibition of On-Street Parking and Road Marking

This traffic management technique frowns at the idea of parking vehicles along the sides of the road or street. This is so because cars that are so parked take up whole lanes on either side of the road. Thus, a four-lane road could be reduced to a two-lane road due to on-street parking. Road markings are integral parts of the road system and are designed to guide road users with evidence of traffic regulations such as waiting and loading restrictions, pedestrian crossing, box junction, 'keep clear marking' and level crossings. They convey important information to drivers on the directions and the driving rules. It is not possible to overestimate the importance of road marking as part of the road system. The success of the scheme relies upon the visual messages emanating from the road markings (e.g. mini-roundabouts are often implemented by road marking alone, supplemented by a few traffic signs (Slinn, Guest, and Matthew, 2005).

A number of studies have been conducted in Nigeria and elsewhere concerning traffic congestion its causes and management. According to Institute of Transportation Engineers (1987) traffic congestion is viewed from two perspectives. The first perspective sees it as an indicator of economic growth and secondly as an indicator to deterioration of urban life. Economic measure such as congestion pricing is important for free flow of traffic. It is a levy on road infrastructure imposed on all drivers and it comprises road tolls (development levies) and congestion pricing (congestion levy) (Hon, 2005). Where the revenues raised are channeled into transport investments, congestion charging can help provide funds for undertaking priority transport investments (e.g. in public transport, ITS infrastructure or road expansion) (ECMT, 2007). Traffic congestion is sometimes the result of urban development, housing, employment and cultural policies which cause people to live and work relative to one another in close proximity (OECD, 2007).

Urban traffic congestion could be due to factors such as rapid increase in urban population, economic growth, increase in employment opportunities, increase in number of cars and number of people using cars, low capacity of transport infrastructure, road layout, under investment in road infrastructure, poor traffic management, shortage of street parking, signal and equipment failure, non-adherence to traffic regulations, poor urban planning or poor urban development control, rapid expansion of city boundaries, poor public transport, increased use of private cars, car accidents, special events gatherings, road works, and bad weather (Osoba, 2012, Kiunsi, 2013).

Ogunbodede (n.d.) studied traffic congestion in Akure, Nigeria using GIS approach. It was argued that traffic congestion is as a result of the increasing growth in motor vehicles without a corresponding improvement in transport facilities such as road network, traffic management techniques. The study also highlighted illegal roadside parking and lack of geospatial information necessary to tackle the spatial problem as other causes of traffic congestion. Bashiru and Waziri (2008) studied the problems of intra-urban traffic in Lagos, Nigeria obserced that 57% of commuters and motorists spend between 30 to 60 minutes on the road due to traffic congestion. Their study indicates that the worst traffic congestion occurred on Mondays. This finding conforms to similar findings by Agbonika (2011) for Abuja City. Similarly, Aworemi, et.al (2009) studied traffic congestion in Lagos Metropolis. Their study identified the following as major causes of traffic congestion: poor road condition, inadequate road infrastructure, accident, inadequate traffic planning, drivers' behavior and lack of integrated transport system.

The problem of traffic congestion at road intersections in Ilorin Nigeria has been examined by Aderamo and Atomode (2011). Road intersections which forms major component of urban roads are generally prone to traffic congestion. Aderamo and Atomode (op cit) argued that the fundamental theory of traffic flow to underscore the importance of traffic flow characteristics such as flow, density and velocity to the planning, design and operation of urban roads. Momoh (2011) argues that poor planning of transportation system in Nigeria has led to over dependence in motor vehicles resulting in too many vehicles with its accompanied problems including traffic congestion.

In a study by Agbonika (2011) in Abuja Nigeria it was found that only 18.57% of the sampled commuting population lived within the city centre. This indicates that the location of major government offices with respect to the spread of residential areas, where this is not properly considered in town planning and development of master plans for major urban cities, can cause serious congestion problem due to mass movement within the same period as in the case of civil servants moving to and from work around the same period of time.

4. Materials and Methods

The study adopted the passive observational research design (Cook and Campbell, 1979) since the data were collected as a one -time survey of the subjects without experimental manipulation. Both primary and secondary sources of data were used. The target populations for this study were the commuters, private car owners and public operators and key informants that ply the Port Harcourt-Aba Express road and the Port Harcourt Owerri Road (Ikwerre road). Convenience/accidental sampling technique was used to select our respondents for easy accessibility since it was not possible to determine the exact numbers of the elements in the target populations.

The sampling size was 150 selected randomly from each of the identified sub-groups of road users (commuters, private car owners and public operators). Interview were also granted to key informants one (1) each from the three selected government agencies including Rivers State Ministry of Transport (RSMOT), Federal Road Safety Commission (FRSC) and Nigeria Police Force (NPF). The roads studied are federal and state roads that crosses different part of the state such as: Port Harcourt-Owerri Road (Ikwerre Road) and Port Harcourt-Aba Expressway. Traffic volumetric survey was carried out on the two major roads; Port Harcourt-Aba Expressway and Ikwerre Road (Port Harcourt- Owerri Road) this involves the physical counting of vehicles plying the two roads on hourly bases from 7am to7pm daily to ascertain the volume of traffic, and the hourly variation of vehicle intensity.

5. Results and Discussion

5.1. Socioeconomic Profile of Respondents

5.1.1. Gender of Respondents

Figure 2, shows the sex of respondents in the study area. The pie chart reveals that 76% of sampled respondents were male, while 24% of the respondents were female.

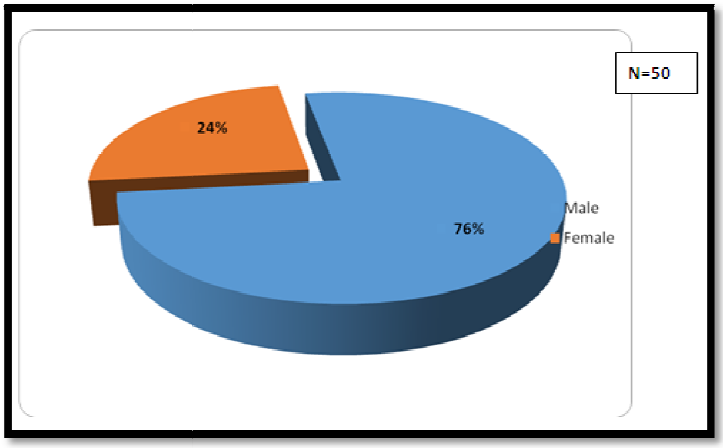

Figure 2: Sex of Respondents
Source: Researcher's Field Survey, 2018

5.2. Age of Respondents

As can be seen in Table 1, the modal age category among respondents was 31-40 years, accounting for 43% of distribution. Following closely was the 21 – 30 years' age category (22. 4%). The 41-50 years, less than 21years and 51years and above age category accounted for 16.3%, 12.2% and 6.1% of the distribution, respectively.

Age	N	%
Less than 21 years	6	12.2
21 - 30 years	11	22.4
31 - 40 years	21	43
41 - 50 years	8	16.3
51 and above	3	6.1
Total	49	100

Table 1: Age Distribution of Respondents
Source: Researcher's Field Survey, (2018)

5.3. Educational Status of Respondents

Figure 3 is the distribution of educational status of respondents. This reveals that 67.1% of the respondents had completed university education, followed by those that had completed secondary education (24.4%), while 6.0% had primary education. No formal education accounted for 2.5%.

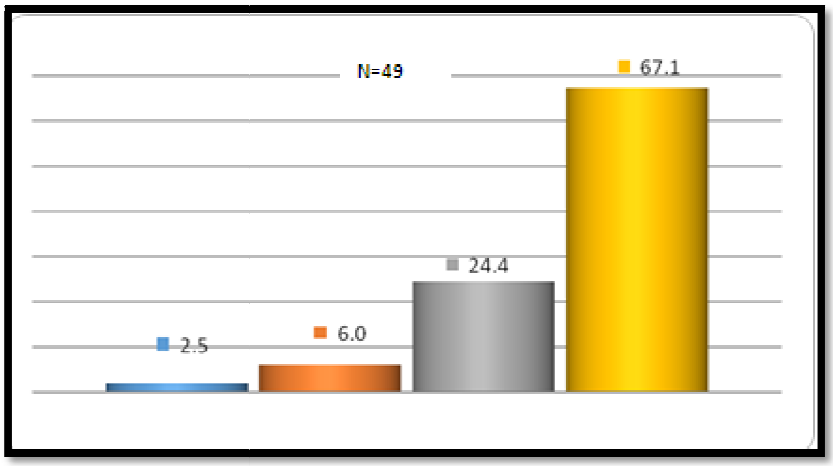

Figure 3: Percentage Distribution of Educational Status of Respondents
Source: Researcher's Field Survey, (2018)

5.4. Ownership of Driver's License

Majority of respondents (53.1%) reported that they did not own driver's license while 46.9% reported that they owned driver's license. Furthermore, respondents were asked if they owned vehicles. Figure 4 shows the distribution. Those who did not own vehicles represented 67.3%, while those who owned vehicles represented 32.7%.

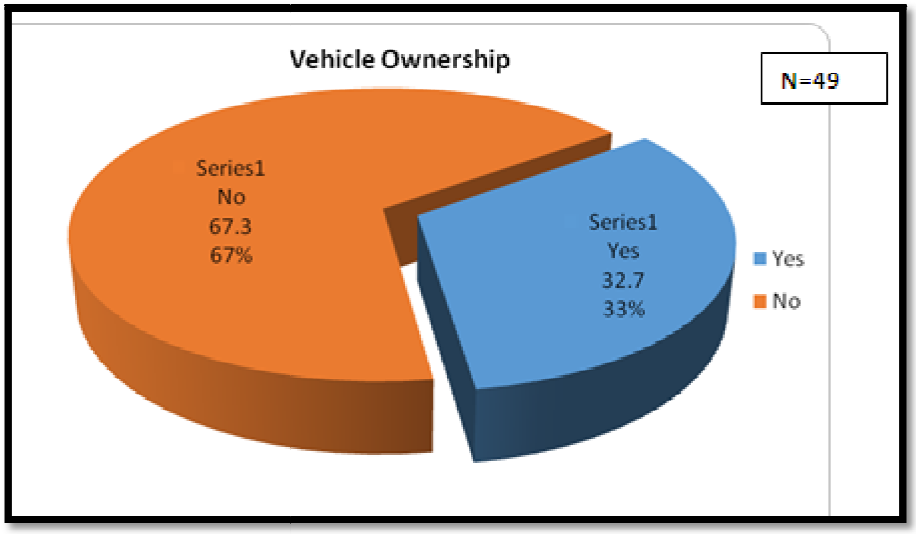

Figure 4: Percentage Distribution of Vehicle Ownership amongst Respondents
Source: Researcher's Field Survey, (2018)

5.5. Driving Experience of Respondents

Furthermore, respondents were asked how long they had been driving. The modal category was 1 – 3 years, accounting for 35% of respondents. Figure 5 shows details of the result of driving experience of respondents.

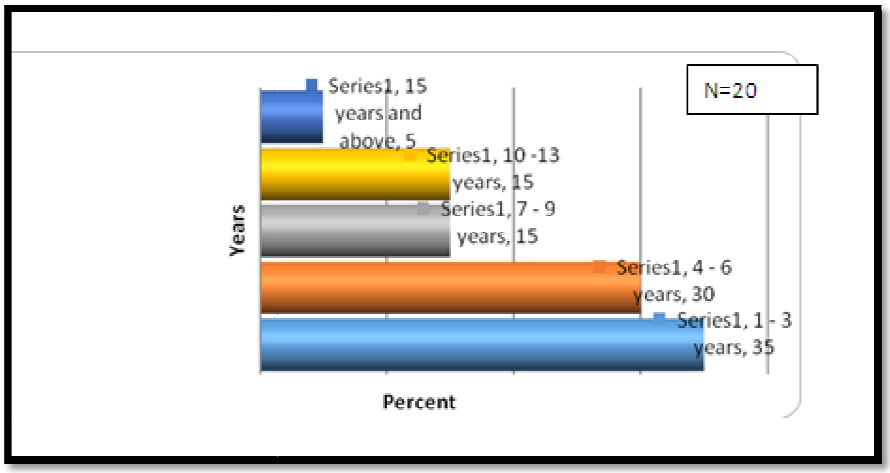

Figure 5: Percentage Distribution of Driving Experience of Respondents
Source: Researcher's Field Survey, (2018)

5.6. Volumetric Analysis of Traffic in Port Harcourt -Aba Express Road

To determine the volumetric flow, traffic counts were conducted in selected major routes in the study area as shown in Tables 5, and 6 and Figs 7 and 8 respectively. The result reveals the 7-days survey period of vehicle density along Port Harcourt-Aba express road (12th_ 18th, March 2018), the highest average hourly traffic volume per week was recorded on Monday – 88,461(vehicles) Passenger Car Units (PCUs), and the lowest was on Sunday – 22,305 (vehicles) PCUs. The weekly sum and average hourly volume of traffic was highest between 6pm-7pm – 63,950, while the lowest between 1-2pm-9,170. The weekly average hourly traffic volume was highest between 6pm-7pm with 9,135.71 PCUs and lowest between 1pm-2pm with 1,310 PCUs

The highest daily traffic volume of different modes of vehicles was 88,461 (Private cars-50,101, buses-30,570, trunks-557, and motocycle-233). The lowest was 22,305. The survey also reveals that traffic volume is most prominent on Monday (88,461) and on Thursday (81,844), this was due to activities taking place in the area which are offices, hotels, shopping complex and commercial activities there is high demand for transportation on Mondays because it is the first day of the new week.

N/S	Time Interval (Hourly)	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Weekly Sum of Vehicles	Weekly Average of Vehicles
1	7 – 8am	11,454	9,234	8,843	10,441	9,267	2,035	1,497	52,771	7,538.71
2	8 – 9	13,208	12,021	10,221	13,211	10,341	2,022	2,211	63,235	9,033.57
3	9 – 10	12,292	10,214	8,023	11,001	7,492	1,200	1,622	51,844	7,406.29
4	10 – 11	8,301	8,642	5,210	7,342	5,242	1,040	924	36,701	5,243
5	11 – 12	5,222	5,200	3,215	5,344	2,241	984	421	22,627	3,234.43
6	12 – 1	4,880	2,034	1,921	2,063	1,300	835	361	13,394	1,913.43
7	1 – 2pm	2,143	1,232	1,258	1,490	1,627	803	617	9,170	1,301
8	2 – 3	2,243	1,864	1,340	2,214	1,873	1,607	821	11,962	1,708.86
9	3 – 4	4,003	2,142	3,215	4,003	2,276	2,020	1,501	19,160	2,737.14
10	4 – 5	5,211	5,220	6.231	5,231	3,299	3,047	2,147	25,155	3,593.57
11	5 – 6	8,211	8,149	8,243	8,211	6,244	4,324	4,934	48,316	6,902.29
12	6 – 7	11,923	10,001	11,435	11,293	9,432	5,247	5,249	63,950	9,135.71
	Total	88,461	75,953	79.155	81,844	60,634	26,164	22,305		

Table 2: Average Hourly Traffic Volumes per Week along Port Harcourt–Aba Express Road, Port Harcourt (12/03/18 – 18/03/18) (Passenger Car Units)
Source: Researcher's Field Survey, (2018)

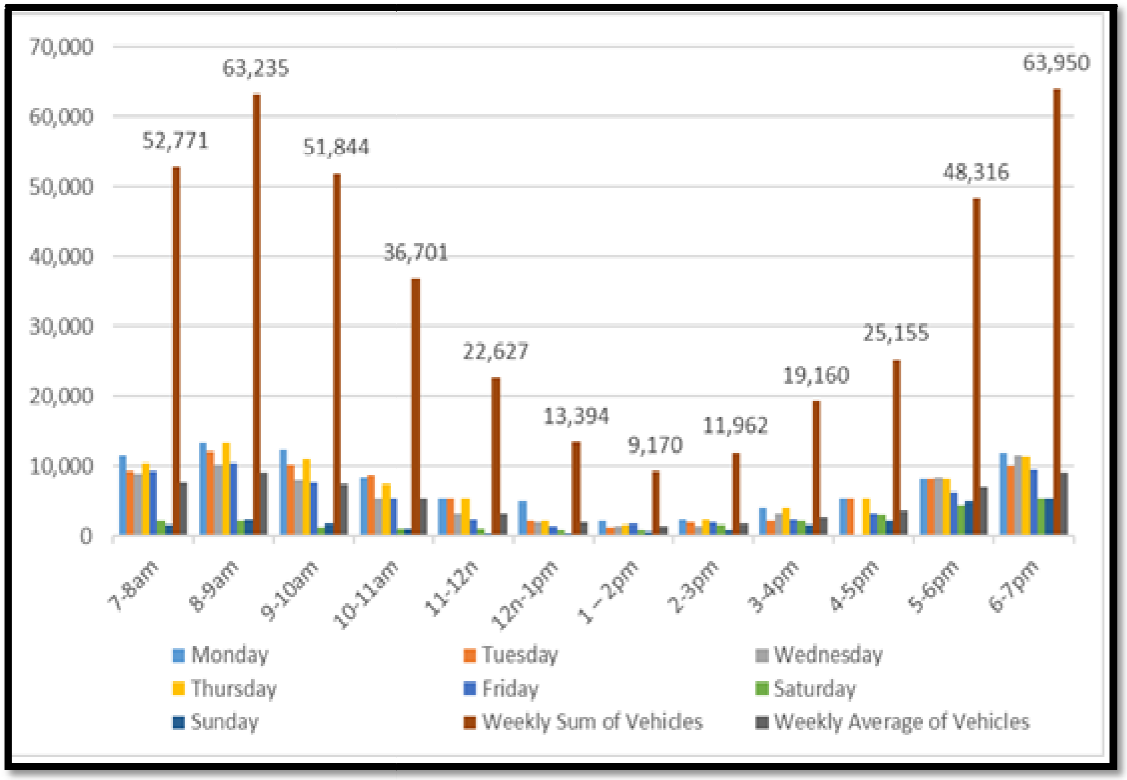

Figure 6: Weekly Sum and Average Hourly Traffic Volumes along Port Harcourt–Aba Express Road, Port Harcourt (12/03/18 – 18/03/18) (Passenger Car Units)
Source: Field Work (2018)

Time of Day											
7-8am	8 – 9am	9 -10am	10 –11am	11 - 12	12- 1pm	1- 2pm	2-3pm	3-4pm	4-5pm	5-6pm	6-7pm
7538.71	9033.57	7406.29	5243	3234.43	1913.43	1310	1708.86	2737.14	3593.57	6902.29	9135.71

Table 3: Weekly Average Hourly Volume (In Pcus) of Traffic along Port Harcourt – Aba Express Road, Port Harcourt (12/01/13 – 18/01/13)
Source: Researcher's Field Survey, (2018)

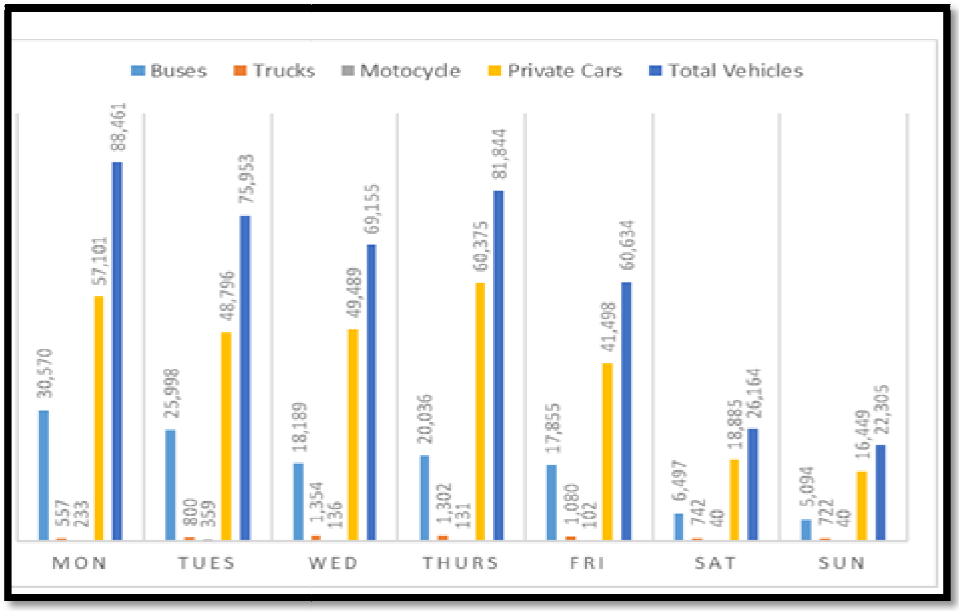

Figure 7: Daily Traffic Volume of Different Modes of Vehicles along Port Harcourt–Aba Express Road, Port Harcourt (12/03/18 – 18/03/18) (Passenger Car Units)
Source: Researcher's Field Survey, (2018)

5.6.1. Traffic Volumetric Analysis in Ikwerre Road, (Port Harcourt-Owerri Road)

Results of the volumetric count are shown in Tables 7, and 8 and Fig 9 and 10 respectively. The result reveals the 7-days survey period of vehicle density along Ikwerre road (12th_ 18th, March 2018), the highest average hourly traffic volume per week was recorded on Wednesday – 57,257 (vehicles) PCUs, and the lowest was on Sunday – 25,472 (vehicles) PCUs, the weekly sum and average hourly volume of traffic was highest between 6pm-7pm – 47,561, while the lowest between 1-2pm- 10,974. The weekly average hourly traffic volume was highest between 6pm-7pm -6794.43(vehicles) PCUs and lowest between 1pm-2pm-1567.71(vehicles) PCUs. The highest daily traffic volume of different modes of vehicles was 57,257(Private cars-38,521, buses-18,510, trunks-174, and motocycle-52). The lowest was 25,358. The survey reveals that traffic volume is most prominent on Wednesday (57,257) and also on Tuesday (54,967), this is due to activities taking place in the area which is the commercial (markets) activities there is high demand for transportation.

N/S	Time Interval	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Total Sum of Vehicles	Average Hourly Volume of Vehicles
1	7 – 8	5,742	6,247	7,267	4,742	5,741	2,035	1,321	33,095	4,727.86
2	8 – 9	8,349	7,831	9,341	7,349	7,349	3,022	1821	45,062	6,437.42
3	9 – 10	5,662	5,674	7,192	5,662	5,663	1,464	1,200	32,517	4,645.29
4	10 - 11	5,884	4,631	5,242	5,384	5,812	1,729	1,040	29,722	2,246
5	11 - 12	4,282	3,143	2,241	4,082	4,182	984	877	19.791	2827.29
6	12 – 1	2,999	1,234	1,300	2,699	2,699	1,272	835	13,038	1,862.57
7	1 – 2	1,174	2,550	1,627	1,104	1,164	2,552	803	10,974	1,567.71
8	2 – 3	1,426	2,432	1,873	1,326	1,423	2,672	1,607	12,759	1,822.71
9	3 – 4	2,214	3,433	2,276	2,014	2,314	2,020	2,942	17,213	2,459.00
10	4 – 5	3,629	4,422	3,299	3,529	3,624	3,047	3,221	24,771	3,538.71
11	5 – 6	5,247	5,749	6,244	5,147	5,217	4,324	4,219	36,147	5,163.43
12	6 – 7	6,831	7,621	9,355	6,617	7,369	5,247	4,521	47,561	6,794.43
	Total	53,439	54,967	57,257	49,655	52,557	29,415	25,358		

Table 4: Average Hourly Traffic Volumes per Week along Ikwerre Road, Port Harcourt (12/03/18 – 18/03/18) Pcus
Source: Researcher's Field Survey, (2018)

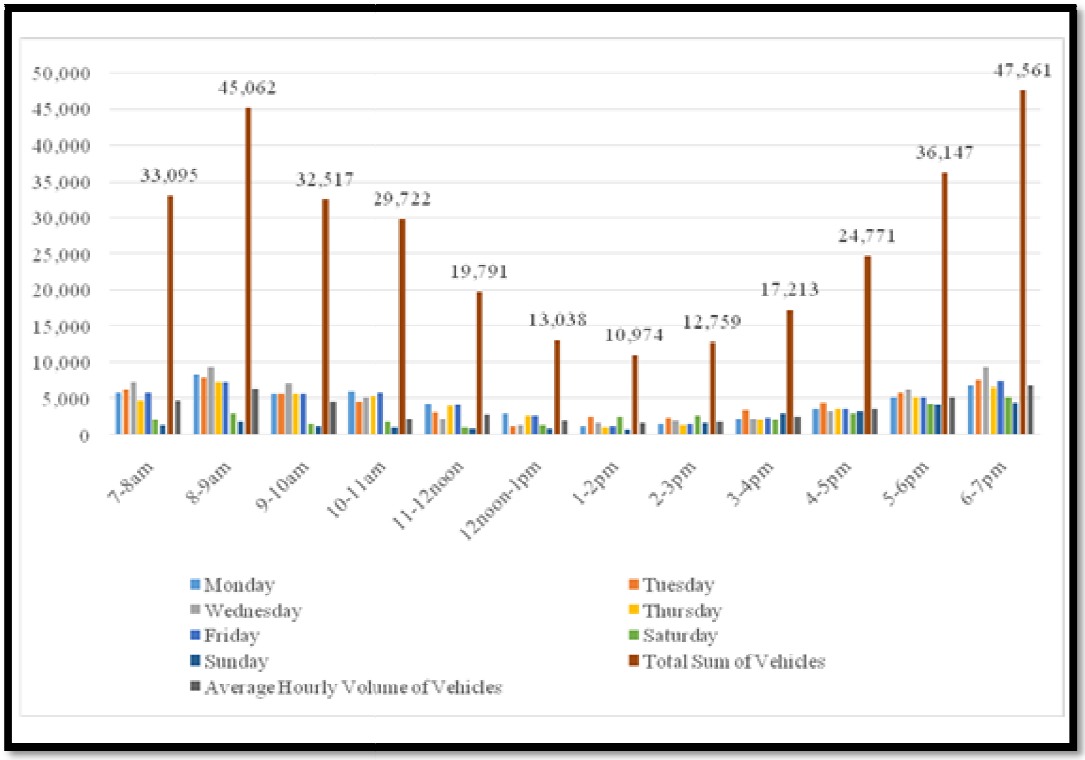

Figure 8: Weekly Sum and Average Hourly Traffic Volumes along Ikwerre Road, (12/03/18 – 18/03/18) (Passenger Car Units)
Source: Researcher's Field Survey, (2018)

Time of Day											
7am – 8	8 – 9am	9 -10am	10- 11am	11 - 12	12 – 1pm	1 – 2pm	2 – 3pm	3 – 4pm	4-5 pm	5 -6pm	6 -7pm
4,727.86	6437.42	4645.29	4246	2827.29	1862.57	1567.71	1822.71	2459	3538.71	5163.86	6794.43

Table 5: Weekly Average Hourly Volume of Vehicles (In Pcus) along Ikwerre (Port Harcourt-Owerri) Road, Port Harcourt (12/03/18 – 18/03/18)
Source: Researcher's Field Survey, (2018)

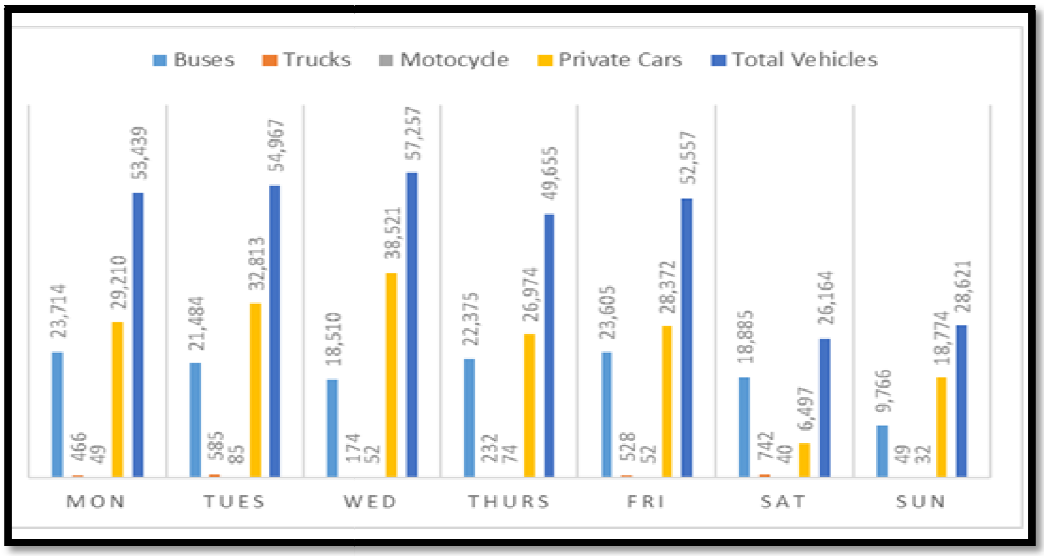

Figure 9: Daily Traffic Volume of Different Modes of Vehicles along Ikwerre Road, Port Harcourt (12/03/18 – 18/03/18) (Passenger Car Units)
Source: Researcher's Field Survey, (2018)

5.6. Evaluation of Traffic Management Techniques in Port Harcourt

Using a 5-point Likert Scale ranging from "Strongly Agree" to "Strongly Disagree", respondents were asked to agree or disagree with the adequacy or otherwise of traffic management techniques in the study area. From the table 72 per cent of the respondents strongly agree or agree that the traffic management techniques (traffic lights, traffic marking speed breaking, etc.) in place in port Harcourt are adequate, (Table 9). On the efficacy of the traffic management techniques, most respondents rated the traffic management techniques as 'Effective'. Their response in this survey clearly shows that traffic management has improved 65.3% percent said it is effective, 18% said ineffective. Conversely, only 2% of those surveyed rated the traffic management techniques as ineffective (see table 10).

Techniques	Strongly Agree	Agree	Don't Know/ Uncertain	Disagree	Strongly Disagree	Total
Traffic lights/signals	72.0*	18.0	6.0	2.0	2.0	100
Traffic signs	28.0*	54.0	8.0	4.0	6.0	100
Road marking	22.0	62.0*	12.0	2.0	2.0	100
One-way system	22.4	51.0*	18.4	6.1	2.1	100
Route restriction	16.7	35.4*	22.9	20.8	4.2	100
Speed breakers	36.7	49.0*	8.2	2.0	4.1	100
Grade separation	4.3	45.7*	30.4	17.4	2.2	100
Manual signals (traffic police)	50.0*	36.0	10.0	4.0	0	100
Prohibition of on-street parking	22.4	32.7*	16.3	26.5	2.1	100
Pedestrian safety measures	20.8	31.3*	16.7	27.1	4.1	100

Table 9: Assessment of Adequacy or Otherwise of Traffic Management Techniques
Source: Researcher's Field Survey, (2018)
Note: The Modal Responses Are Asterisked (*)

Rating	N	%
Very ineffective	1	2.0
Ineffective	9	18.4
DK/UC	6	12.3
Effective	32	65.3
Very Effective	1	2.0
Total	49	100

Table 10: Rating the Efficacy of Traffic Management Techniques
Source: Researcher's Field Survey, (2018)

6. Conclusion and Recommendation

This study is an assessment of traffic management techniques in place in major roads in Port Harcourt. From the analysis made in this work traffic congestion in Port Harcourt is the main obstacle for all activities whose attainment depends on road transport being public, government. The traffic congestion problems experienced in Port Harcourt municipality is attributed to road-side trading, unplanned parks/parking, traffic rule violation, inefficient traffic (police) wardens, and pedestrian crossings, condition of roads, accidents, loading and offloading of passengers on the road, shortage of infrastructure, unplanned refuse dump.

Others are environmental problems due to carbon monoxide emission from trucks and cars engines, such that traffic congestion induced effects on commuters were psychological/health, social and economic, stress, frustration, all of the above, anger, bad mood, while health effects are respiratory problem, lack of sleep, and heart problems. Economically, traffic congestion slow down business activities, causes delay in delivery of goods and extra cost of transportation. The traffic count reveals high volume of vehicles on two major roads (Port Harcourt –Aba Rd, Ikwerre Rd (Port Harcourt-Owerri).

The increase in vehicular density in the area was due to high number of cars plying the road on a daily basis, exacting pressure on the limited road capacity and this consequently result to traffic congestion. The research reveals some identified traffic management techniques in use in the study area include: traffic lights, manual signals (traffic police), speed breaker, traffic signs, one-way street, zebra crossing, road marking, route restriction, and grade separation. While there is high traffic in most roads studied, our respondents rated as effective the various traffic management techniques in use in the study area.

Most importantly, since traffic management requires a high level of political will, institutional and human resource commitment the State government should, as a matter of policy, resuscitate Rivers State Traffic Management Agency (TIMARIV) to instill sanity among road users in the area. This agency should be strengthened with innovative and responsive traffic management policies including legislative powers and funding needed to implement traffic management policies. There is need to install close circuit television (CCTV), sensors and smart traffic devices on major roads for traffic

monitoring and data collection to enhance effective control of traffic congestion. Overall effective land use planning in Port Harcourt is a panacea for curbing traffic challenges of the area.

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