MOST SIGNIFICANT CAUSES OF TRAFFIC CONGESTION IN PORT HARCOURT METROPOLIS, NIGERIA

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ABSTRACT

There is a growing concern about vehicular traffic congestion in Port-Harcourt metropolis. This necessitated the need to investigate the most significant causes of vehicular traffic congestion in the metropolis with measures for mitigation. In examining the most significant causes of congestion in Port Harcourt metropolis, the city was zoned into 13 study area by using land-use activity centers. 2601 questionnaires were administered which represents 0-24% of the population. 78 commuters were interviewed whilst vehicular traffic counts were conducted at 13 locations for the period of 6am-6pm from Monday – Sunday. Information about the causes of traffic of congestion was obtained from the questionnaires, field observations, measurements and commuters' interviews. Pie and bar charts were used to display graphically the variation in vehicular density and congestion in the affected areas. The multiple linear regressions in ANOVA SPSS were used to determine and rank the most significant causes of vehicular traffic congestion in the metropolis. This is to enable the State government prioritize its congestion reducing interventions.

Keywords: Causes; Most; Significant; Urban; Traffic.

INTRODUCTION

Vehicular traffic congestion occurs when urban road networks are no longer capable of accommodating the volume of vehicular traffic that use them thus leading to delays in journey time (Knowles, 1993). There are two types of such delays; fixed delay and operational delay. Fixed delays occur mainly at road intersections and such are usually unavoidable (Ogunsanya, 1985). Operational delays are those caused by vehicle's inefficiencies, parking problems, accidents and maneuvering of vehicles on the road. Vehicular traffic congestions are characteristic features of most urban centres of Nigeria. In most cases, the demand for road space is usually greater than the supply. If a road that is designed to accommodate 3,000 number of vehicular traffic per hour attracts more volume of traffic, this will result in vehicular traffic congestion (Specialist Konsult, 1973).

Vehicular traffic congestion is widely viewed as a growing problem in many urban areas because the overall volume of vehicular traffic has continued to grow faster than the overall capacity of the transportation system. The resulting vehicular traffic delay are caused by variety of factors and have a wide range of negative effects on people and the business economy, including effects on air quality, mobility and accessibility. Average trip time per person is 65 minutes in Port-Harcourt metropolis compared to some developing cities. For example, in Algers (Algeria), Caracs (Venezuela), Mexico city (Mexico), Sao Paulo (Brazil) the travel times in minutes, which comprise in-vehicle and waiting time, shows an average of 43 minutes in Algers (Algeria), 45 minutes in Caracas (Venezuela), 43 minutes in Mexico city (Mexico) and 42 minutes in Sao Paulo (Brazil) (CMSP, 1998; Connolly, 1999; Eduardo 2001). The reasons for higher average travel time in the study area are over-dependence on

low-capacity vehicle, lack of bus-stop spacing and comparative poor qualitative transport infrastructural supply amongst others.

In Port-Harcourt metropolis, the effects of vehicular traffic congestion on mobility and accessibility ranging from longer transit time, loss of man-hour productivity amongst others are existing critical problems. Consequently, the ability to move and ease of reaching a desired destination because of long waiting time at bus stops and in-vehicle time are impaired. Various transport schemes had been put in place to ensure that the urban residents in Port Harcourt metropolis have access to adequate public means of transportation and improved mobility and accessibility. Some of the schemes include:

i. In 1988, the Federal government through the Federal Urban Mass Transit Programme allocated 20 buses to the Rivers State Government but through the states' efforts, additional 37 buses were added in 1990 (Obialo, 1992).
ii. In 1992, the Rivers States government acquired about 250 14 seating capacity buses for mass transportation (RSG, 1992).
iii. The establishment of King Jaja Foundation; This Foundation's primary duty was to control vehicular traffic and decongest the metropolis in 2000 [RSG, 1992].
iv. The construction of Rumuola flyover, Woji/Slaughter Bridge in 2001 and Boricamp road in 2005 in order to improve vehicular traffic flow.
v. The 2005 N100m palliative measures from the Federal government to cushion the effect of increase in petrol pump price on the movement of the urban residents.
vi. In 2012, the Federal through the Subsidy Re-investment Programme allocated about 100 buses to River State to alleviate the challenges of mobility

Despite the various decongestion schemes implemented in Port-Harcourt metropolis, the urban commuters still experience vehicular traffic congestion, long waiting time at bus stops, long in-vehicle time and inadequate means of public transportation. This situation calls for intensive research.

The Study Area

The study is centered on Port Harcourt metropolis in Rivers State, which is one of the thirty-six states of the Federal Republic of Nigeria .Port Harcourt metropolis comprises Port Harcourt Local Government Area and Obio-Akpor Local Government Area. The location of the place under study is on the following geographical graticles; latitude $4^0 45'$N – $4^0 55'$N and longitude $6^0 55'$E – $7^0 5'$E. It has an estimated land area of 664 square kilometers. The metropolis is bounded in the North by Ikwerre and Etche

L.G.As, in the South by Okirika L.G A, in the West by Emuoha L.G.A and in the East by Eleme L.G.A. Port Harcourt metropolis is located close to the Bonny River, and possesses a deep-water port. Port activities contribute greatly to the earning power of the city and the state with revenue from oil mining concerns.

METHODOLOGY

Roadside interviews were used to extract information from commuters at the bus stops about the in-vehicle and waiting time from trip origin to destination. 6 commuters were randomly interviewed in each zone at the bus stops. Consequently, 78 commuters were interviewed orally at the bus stops in the 13 zones in February 2005. The small number of commuters randomly selected was based on the nature of the bus stops and the hasty manner with which commuters depart from the bus stops. However, from the number selected, we were able to derive useful and meaningful data for our findings.

We also used measurements to secure the physical width of the road networks under study. To identify the congested area along the network, major roads as wide as 14-28 metres were measured to determine their expected designed capacity against the actual vehicular traffic flow. Points that recorded higher number of vehicular traffic above their designed capacity are regarded as congested points (Kelvin, 2000). Oral interviews were used to complement the use of questionnaires method in obtaining needed data. Interviews were also used to extract undocumented data from the State Ministry of Transport, Urban and Regional Planning, and the Port Harcourt City Council concerning government policies and programmes towards improving urban transportation service and mitigating the negative effects of vehicular traffic congestion in Port Harcourt metropolis.

Demarcation of Traffic Zones

Zoning was first applied in Germany in 1884 and spread through Europe before it was adopted in the United State (Papacostas, 1987). Zoning is a method by which Physical Planning Authority regulates land-use by segregating land-use into residential, industrial, etc. in the public interest (Brain, 1987). The first comprehensive zoning code in the United States was enacted by the city of New York in 1916 (Papacostas, 1987). Consequently, studies in urban transportation in developed countries have relied on zoning system enacted in such countries. Monanu (1976) used the zoning system in the study of journey to work patterns in Edmonton, Canada. Papacostas (1987) adopted the zonation of Chicago in the Chicago Area Transportation study. Papacostas (1987) used the zoning system in the US National Personal Transportation Survey. However, in the developing countries particularly in Nigeria, zonation of land-uses is still new and do not exist in some urban area Port-Harcourt inclusive.

Onokala (1981) suggested that urban centres in Nigeria should be divided into standard traffic zones to be recognized by the various city planning offices in the urban centres. Data should then be collected for these traffic zones on a regular basis in order to build up an adequate database for transportation planning and study in the cities. In 1973, zonation of Port-Harcourt was attempted by Specialist Consult (1973) but was not sustained because of uncontrolled development.

The land-use map, which described the characteristics of the zones in the study area, was obtained from the Street Guide of Port Harcourt 2001.
To understand the vehicular traffic pattern of movement and traffic density, the study area was divided into 13 traffic zones based on similar contiguous, multi-functional, land-use types comprising residential, commercial, industrial etc. with population size of 65695 upwards because it is least population in the zone

Table 1: Pattern of questionnaires Distribution in the Zones

Zones	2006 population	Number of questionnaires distributed	Number of questionnaires returned	Percentage of total returned
Rumukwrushi	65695	160	158	6.07
Orogbum	84920	207	130	4.99
Rumuodara	75957	185	103	3.96
Bodo	79792	194	109	4.19
Amatagwolo	122463	298	166	6.38
Eligbolo	87171	212	144	5.54
Mgbuoba	68319	166	108	4.15
Rumnekpirikom	72,958	177	98	3.77

Elekahia	77856	189	149	5.73
Mgbuosimiri	80396	196	144	5.54
Bori camp	85239	207	137	5.27
William Jumbo	60400	147	102	3.92
Golf corse	108143	263	99	3.81
Total	1,069,282	2601	1647	63.32

Source: Author's Fieldwork.

Causes of Vehicular Traffic Congestion in Port Harcourt Metropolis

The causes of vehicular traffic congestion in Port Harcourt metropolis as identified through the questionnaires reflect the vehicular traffic congestion matrix in an urban centre. There are variables that separately or collectively act to cause vehicular traffic congestion. The causes of vehicular traffic congestion are many and varied from one urban area to another.

From the urban traffic studies carried out in Bangkok (Thailand) by Daniere (1995), Cairo (Egypt) by Abras (1999), Santa Cruz (Bolivia) by Figueroa and Pizarro (1999), the causes of vehicular traffic congestion were identified as increased private car motorizations and poor enforcement of traffic rules. Urban vehicular traffic studies carried out in Singapore (Asia), Curitiba (Brazil) by Hans (2002) identified urbanization and problem of inadequate land area as the causes of vehicular traffic congestion. Vehicular traffic study conducted in Lagos identified over- concentration of land-use activities, population growth, road infrastructural problems as the causes of vehicular traffic congestions (Alli, 1998). In Akure, increase volume of traffic, ribbon development, improper structural land-use pattern were identified as the causes of vehicular traffic congestion (Owolabi and Ojuri, 2004). In Beijing (China), the causes of vehicular traffic congestion were identified as population growth and over concentration of land-use activities (Yinghing 2006).

In Port-Harcourt metropolis, the critical causes of vehicular traffic congestion as identified from the questionnaires are inadequate means of public transportation, wrong parking, bad road, poor traffic signalizations, road-side trading/markets and road capacity (See Table 2). Other causes of vehicular traffic congestion identified include Alcoholic effects, burial ceremonies, poor road geometries, queuing for fuel at filling station, abandonment of broken down vehicles, over population, dumping of waste, non-integration of land-use planning, use of heavy-duty vehicles, poor drainage etc. Because the respondents scored some of the factors very low and their inclusions in the analysis will not contribute to explaining the causes of vehicular traffic congestion in Port-Harcourt metropolis, they were therefore expunged.

The Most Significant Causes of Vehicular Traffic Congestion

From the questionnaires, six principal factors viz: inadequate means of public transportation, wrong parking, poor state of roads, road-side markets, poor signalization, and inadequate road size capacity were identified as the causes of vehicular traffic congestion.

In examining the most significant cause of vehicular traffic congestion, the causes of vehicular traffic congestion in the study area were used as the independent variable X. This was measured by summing up the identified causes of vehicular traffic congestion. The total number of vehicular traffic in each zone made up the dependent variable y (See Table 2). In running the regression analysis, the independent X variables are plotted with the dependent y variables in the ANOVA SPSS. The variables used are:

Y = Aggregated vehicular traffic

X^1 = Inadequate means of public transportation
X^2 = Wrong parking
X^3 = Poor state of road
X^4 = Poor traffic signalization
X^5 = Roadside market
X^6 = Road size capacity.

Table 2: Most significant causes of vehicular congestion in Port Harcourt Metropolis

Zones	Variable Y	Inadequate means of public transportation X^1	Wrong parking X^2	Bad road X^3	Poor traffic Signalization X^4	Roadside market X^5	Road Size Capacity X^6
OilMill	305114	11	67	23	12	16	29
Garison	181695	9	55	19	10	13	24
Artillery	259732	7	44	15	8	01	19
Waterline	128915	8	46	16	8	11	20
Diobu	48436	12	70	24	13	17	30
Rumuokoro	53446	10	61	21	11	15	26
Choba	44637	8	46	16	8	11	19
Whimpey	43519	7	42	14	7	10	18
Trans-Amadi	52448	11	63	22	11	15	27
Agip	53872	10	61	21	11	15	26
Rumuola	136468	10	58	20	10	14	25
Willam Jumbo	50693	7	43	15	8	10	19
Lagos street	49098	7	42	15	8	10	18

Source: Fieldwork, 2005.

Presentation of Results on the Most Significant Causes of Vehicular Traffic Congestion

The regression equation of the most significant causes of vehicular traffic equation is shown thus:

$$Y = -226723.9 - 85371.440_{x1} + 107792.89_{x2} - 61721.102_{x3} - 33815.878_{x4} - 258777.5_{x5} + 4534.689_{x6}$$

(-1.194) (-738) (-1.243) (-.479) (-.366) (-1.792) (.046)

't' values are in parenthesis.

Table 3: Model Summary

					Change Statistics				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.707[a]	.500	.000	9432.19848	.500	1.001	6	6	.500

Table 4: Ranking Tabulation

Variable names	Parameter Estimate	t-statistic	Rank based on parameter estimates
Inadequate means of public transportation (X_1)	-85371.440	-0.738	4th
Wrong parking (X_2)	107792.89	1.243	1st
Badroad (X_3)	-61721.102	-0.479	5th
Poor traffic signalization (X_4)	-33815.878	-0.366	6th
Roadside market (X_5)	-258777.5	-1.792	3rd
Road size capacity (X_6)	+4534.689	0.046	2nd

Source: ANOVA SPSS,11.0

From the above table, the parameter of estimate for wrong parking (X_2) of 107792.89 and t-statistic estimate of 1.243 ranked first as leading factor causing congestion. This is followed by road size capacity (X6) with parameter estimate of +4534.689 and t-statistics estimate of 0.046. The third factor contributing to vehicular traffic congestion in the ranking order is roadside market (X5) with a parameter estimate of -258777.5 and t-statistics estimate of -1.792. Inadequate means of public transportation (X1) with a parameter estimate of -85371.440 and t-statistics estimate of -0.738 ranked as the fourth factor causing vehicular traffic congestion while bad road (X5) with a parameter of -61721.102 and t-statistics estimate of -0.479 and poor traffic signalization (X4) with a parameter estimate and t-statistical estimate of -33815.875 and t-statistics of -0.366 are ranked to be the fifth and sixth causes of vehicular traffic congestion respectively.

The F ratio of 1.001 exceeds the significance level of .500, which means that the overall model of regression has the significance of explaining the variables. It also means that the model can be depended upon to seek explanations on the most significant cause of vehicular traffic congestion in the study area. The regression mean square of 8005231002.8, which is higher than the residual mean square, indicates that the model accounts for most of the variation in the dependent variables.

The R value of .707, which is the multiple correlation coefficients, reveals a strong positive relationship between vehicular traffic congestion and the independent variables. The causality in the relationship between the dependent variable y and independent variables x show that increase or decrease in any or combination of the independent variables will correspondingly increase or decrease the level of vehicular traffic congestion. The R^2 value of .500, which is the proportion of variation, shows that 50% of vehicular traffic congestion is attributable to the explanatory variables. These independent variables have positive explanatory capacity with respect to vehicular traffic congestion. With 50% of the predictors explaining their relationship with vehicular traffic congestion, it shows that 50% of the causes of vehicular traffic congestion is not explained by the predictors and therefore, can be attributed to

variables outside the framework of the model. Other possible variables that could have positive relationships with the causes of vehicular traffic congestion are poor connectivity, lack of staggering of work and school hours etc.

Principal Findings

The foregoing results show that all the regressors do not have equal explanatory capacity or do not contribute to vehicular traffic congestion equally. With reference to the't' statistical value and its corresponding values to the estimated parameters, it is found that some of the independent variables are not statistically significant. For instance, comparing the 't' statistical value with the required value of significance for the independent variables, the significance value of X_1 (inadequate means of public transportation) which is .488 with the 't' statistical value of -.738; X_2 (wrong parking) which is .260 with 't' statistical value of 1.243; x_3 (Bad road) which is .649 with 't' statistical value of -.479; x_4, (poor traffic signalization) which is .727 with the 't' statistical value of -.366; X_5 (roadside market) which is .123 with the 't' statistical value of -1.792; x_6 (road size capacity) which is .965 with the 't' statistical value of .046, it shows that it is only variable x_2 that recorded a higher 't' statistical value of 1.243 against the significance value. Therefore X_2 (wrong parking) with a higher 't' statistical value is the highest contributing variable to vehicular traffic congestion in Port-Harcourt metropolis.

Vehicular Traffic Congestion Matrix

The congestion matrix comprising physical, human and institutional matrices helps to identify the interrelations between the various factors affecting the traffic composition or causing congestion separately or collectively (Adenle, 1981).

Table 5: The Vehicular Traffic Congestion Matrix in urban centres

	Physical (environments)	Human (drivers and other road users)	Institutional (policy makers)
Physical	Port Harcourt metropolis physical configuration	Poor road geometries. Dumping of waste Bad road Roadside furniture Inadequate bus stops	Cost of developments. Lack of pedestrian walkways
Human	Alcohol-effect on physical environment Roadside traders	Lack of road courtesy, burial ceremonies, parking loading and unloading of passengers, accidents alcohol-effect on man abandonment of broken down vehicles	Disregard to law enforcement agencies and other traffic control
Institutional	Non-integration of transportation planning and land use planning, Massive developments without considering traffic implications, concentration of employment centres, increase in population	Poor accessibility of road and poor traffic sanitization control facilities, Inadequate and inefficient public transport services, Use of heavy duty trucks	Lack of coordinated efforts in traffic control planning, Poor drainage, police checkpoints, Siren of government officials, Locating of motor parks by the road.

Source, modified from Adenle, 1981:384

CONCLUSIONS AND RECOMMENDATIONS

Wrong parking has been identified as the most significant causes of traffic congestion in Port-Harcourt metropolis. Commercial activities like the Oil Mill market attracts huge number of vehicular traffic for which adequate facilities are not provided. As result of inadequate or formalized parking facilities, cars owners are compelled to park indiscriminately thereby jamming the freeway for easy access. As result, vehicular traffic movements become as slow as 10kmph. This reduced speed is protracted to a saturated point of vehicular bunching on major roads like Port-Harcourt – Aba road and Ikwere road. The second most significant causes of vehicular traffic congestion in the metropolis is adequate mass transit system. As a result of inadequate means of mass transportation, private motorization with individual car ownership is high. This is accompanied with poor traffic management, poor condition of roads amongst others. Vehicular traffic congestion in Port-Harcourt metropolis could therefore be addressed through the followings:

Parking Management

Parking management is the term that describes the variety of parking policies and strategies that can be employed by city Authorities to alleviate parking and other related transportation problems. The following parking management measures are recommended for Port-Harcourt metropolis:

- Parking Charges
- On Street Parking
- Enforcement and adjudication
- Off Street parking
  - within the activity centre
  - fringe and corridor parking

Implementation of one or combination the above strategies on Aba Road would reduce the challenges created by wrong parking and its implications on road space reduction. The outcome of enforcing parking a management measures would be parking orderliness and freer road space for vehicular movement amongst others.

Development of Mass Transit

In order to reduce the traffic congestion effects of private motorizations, there is the need to develop and invest on rail and bus mass transit on major and high trafficked corridor. Such corridors that command high traffic and connect residential places to commercial and industrial centres are Aba road, Ikwerre road, Trans-Amadi road and East/West road. These roads would require mass transit implementation to reduce private motorization. Other means of public transport could be re-organized on other roads to serve as feeder to the major traffic corridors.

Institution

Transport activities in Port-Harcourt metropolis are currently carried out by different agencies. This however has resulted to over-lapping functions and duplication of efforts. To coordinate the various transport functions and modes of transport, in Port-Harcourt metropolis, a metropolitan Transport Authority should be established by law. The Authority would be responsible for planning, regulation, provision of infrastructure for all the transport modes as well as enforcement of traffic laws in the metropolis.

Public Private Partnership

In the drive towards implementing mass transit projects, private sector participation should be encouraged. This has become imperative as a result of different and yet important projects are demanding attention for public interests. The government of the metropolis should therefore concentrate on providing the enabling environment, provision of mass transit infrastructures, service standard setting amongst others whilst the private sector should focus on rolling-stock acquisition and management of the operations of the services. In Nigeria for example, in most urban cities like Lagos and Abuja, the operation of urban mass transit services is dominated by private sector.

REFERENCES

Adenle, J.A. 1981. Factors militating against the free flow of traffic in metropolitan Lagos. In Onakomanya, S. O. and Ekanen, N.F. (ed.), *Proceeding on Transportation in Nigerian National Development* 383 – 395.

Alli, A.O. 1998. *Traffic Management: A Study of parks in Lagos Island, Unpublished B.Sc. Project*, University of Lagos.

Abras, K. A. 1999. Estimation and assessment of costs allocation models for main transport systems opening in Caro, *Transport Reviews* 19(4):353 – 375.

Brain, G. F. 1989. Integrated land-use and transport planning – the example of Singapore's mass rapid transit system in Margaret, J. H. (ed.), *Developing World Transport, Grosvenor*, UK 149 – 152.

Connolly, P. 1999. Mexico city: our common future. *Environment and Urbanization* 11(1):*53-78.*

Cmsp-Cia Metropolitan Sao Paulo 1998. Travel: Origin- Destination. *Sao Paulo.*

Daniere, A. G. 1995. Transportation planning implementation in cities of the Third World: The case of Bangkok, *Environment and Planning, Government and Policy* 13:25-45.

Eduardo, A.V. 2001. Urban Transport, Environment and Equity: The case for Developing Countries. *Earthscan*, London.

Figueroa, O. and Pizarro, A. 1999. Santa Cruz and Sierra-Leon Urban public transport system in *freeman and Jannet (ed), Urban Structure and Network Restructuring,* Balkema, Netherlands.

Hans, O. 2002. Urban traffic and transport. *Building Issues Journal* 12(2)23.

Knowles, R. 1993. Research agenda in transport geography for the 1990 *Journal of Transport Geography* 1(1).

Kelvin, E. 2004.Traffic Jam in Garden City: The Pain continues. *The Guardian* 20(9)235:12.

Monanu, P.C. 1976. Journey to work patterns in Edmonton. *Unpublished M.Sc. Thesis*, University of Alberta, Edmonton, Canada.

Ogunsanya, A. A. 1985. Road development and urban sprawl: the case of Ilorin, *Conference Proceedings by Institute of Town Planners*, Ilorin.

Obialo, D.C 1992. Finding Mass Transit Programme in Nigeria. *Unpublished M.Sc. Thesis,* Federal University of Technology, Owerri.

Owolabi, A. O. and Ojuri, O.O. 2004. An analysis of traffic volume and parking in the Central Area of Akure, *International Journal of Transportation Studies* 1(2):40-47.

Papacostas, C.A. 1987. Fundamentals of Transportation Engineering. *Prentice Hall*, USA.

Rivers State Government. 1992. First national rolling plan State Ministry of Finance.

Specialist Konsult. 1973. Sociological survey. *General survey analysis,* Port Harcourt

Yingling, L. (2006): "Rapid transit line transforms Beijing's worsening road congestion. *The Guardian April 24* (147)

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