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Urban road and on-street parking in Niger Delta Region of Yenagoa, Bayelsa State, Nigeria

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This study is a survey of urban roads and on-street parking in Niger Delta Region- Yenagoa, Bayelsa State. The study generated data with the aid of physical measurements, traffic and volumetric counts. Descriptive and inferential statistical tools were utilized for the data analysis. The results showed that road widths were narrow and could not accommodate on-street parking. Tested hypotheses confirmed that the width of roads and the number of parked vehicles were strongly correlated (r=0.73, P<0.01). The volume of traffic counts and the number of parked vehicles were also strongly correlated (r=0.89, P<0.01). The study therefore recommended traffic management techniques such as vehicle parking regulations and control, and the provision of off-street or multi-storey parking facilities.

Key words: Traffic management, road congestion, vehicle parking, parking facility, volumetric count, Niger Delta.

INTRODUCTION

Parking is an essential component of the transportation system. Vehicles must park at every destination (Litman, 2013). With the dramatic increase in automobile use, parking has become an integral part of the modern urban setting and an important land use, and that is why parking spaces are noticed when absent on roads (Manville and Shoup, 2005). The reason why parking in general is an absolute necessity for planning a road network is because urban roads and streets are places where people meet, walk, do their shopping and engage in a diverse array of social and recreational activities (Dumbaugh and Gattis, 2005).

However, on-street parking is associated with urban roads (Still and Simmonds, 2000) and most urban roads in Nigeria cities are narrow, lacking pedestrian lanes and there are cases of double parking alongside illegal street parking along these narrow roads thereby affecting traffic flow in the city. This is due to lack of off-street parking facilities along the transportation routes coupled with inadequate traffic management (Asiyanbola and Akinpelu, 2012; Olurunfemi, 2013).

Parking space for vehicles is a major challenge in cities and has been increasing in both developed and developing countries because it links the urban transportation infrastructure, land administration, land-use management and urban planning (Rodrigue et al., 2016). In some cities, vehicles looking for on-street parking (cruising for parking) have created mobile queue of cars that are waiting for curb vacancies (Shoup, 2006). Shoup (2006) describes cruising as invisible and most transport economists and planners have neglected it as a source of congestion. Car users are more likely to drive

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around and look for an on-street parking space, instead of off-street parking because on-street parking space could be cheap while off-street parking space could be expensive (Shoup, 2006).

In Yenagoa, the capital city of Bayelsa State Nigeria, urban roads are expected to be traffic routes whose primary function is to convey traffic within the urban area and also provide ample spaces, which have already proved insufficient. The indiscriminate parking along streets within the urban core is a serious impediment and there is indication of lack of adequate attention to this aspect of transportation. Therefore, this study surveys urban roads and on-street parking in Yenagoa, Bayelsa State of the Niger Delta region in Nigeria with the objective to assess the adequacy of urban road width to accommodate on-street parking and also assess the impact of on-street parking on urban traffic flow.

THEORETICAL FRAMEWORK

The theoretical framework for this study (Figure 1) is based on urban land-use theories, and location of activities such as residential, commercial, industrial, administrative and recreational centres. The volume and direction of traffic flow to this location of activities varies because of its functions for example commercial, industrial and administrative area will generate more traffic than residential and recreational area. Each type of urban activity has its own mobility requirements that are serviced by urban transport infrastructures (Newman and Kenworthy, 1999).

The location of activities influences the volume and direction of traffic flow thereby resulting in the increase of vehicles on urban roads along those areas where activities are located. Since very vehicle must park at its destination, the demand for parking now comes to play, and this raises the question of adequacy of urban road width to accommodate on-street parking and the impact of on-street parking on urban traffic flow to those location of activities. On the basis of the above discussed it is traffic volume and the number of parked vehicles.

MATERIALS AND METHODS

The study area is Yenagoa capital city of Bayelsa State, Niger Delta region of Nigeria which comprises of 20 communities (Figure 2). The cross-sectional survey design was adopted in this study. This includes descriptive, explanatory and exploratory design to describe each of the many variables necessary for the study. The population for household survey comprises the head of households along the 120 roads within the 20 communities in Yenagoa. Out of the 120 roads in Yenagoa city, only 40 are arterials. To get the required number of roads for sampling in the study, Yamane (2007) simplified formula was used, Equation 1.

$$n = \frac{N}{1 + N(e)2} \quad (1)$$

n = the sample size, N= the population size, e= the level of precision.

By using 20% precision and 40 identified arterial roads in the study area using Equation 1, we have approximately 16 arterial roads. Therefore, by simple random sampling technique sixteen urban roads (arterial roads) were selected from the selected communities. A sampled size of 10,688 parked vehicles was determined through volumetric count from the sixteen randomly selected arterial roads.

Volumetric count and physical measurement survey

Volumetric count was carried out to obtain information on the number of parked vehicles on the street and for two-way traffic volume of the following vehicle types namely: cars, minibus, trucks, sport utility vehicle, pick-ups and vans on a daily basis for sixteen weeks. Physical measurement of road width of the sixteen arterial roads/streets was carried out to obtain the width of each of the roads/streets under study. The count for both parked vehicles and traffic volume was done between the hours of 7 - 9 am, 1 - 3 pm, and 5 - 7 pm on a daily basis for the sample sixteen arterial roads/streets for the period of sixteen weeks. The widths of each roads/streets under study were measured using meter rule as the instrument for measurement (Figure 3).

RESULTS

Variation in the number of parked vehicles and traffic volume count

Table 1 reveals the number of parked vehicles and traffic volume counts per day for one week for all the roads/streets under study. For parked vehicle count, Azikoro, Imgbi, Osiri, Winners and Inec roads had the highest numbers of parked vehicles with 972, 917, 801, 739 and 717, respectively. This is due to the fact that religious worship centres, government and private schools, mechanic workshops activities that are found along such road/street attract people on a daily basic. Measurements on Azikoro, imgbi, Osiri, Ogbia, Green villa roads showed very high volumetric counts. Roads/streets with high number of parked vehicles were also associated with high volumetric counts. Roads/street such as Chief limel oku street, Nepa road, and Aritaeline road with number of parked vehicles 534, 483 and 492 have 2985, 2187 and 2411 volumetric counts respectively had low number of parked vehicles with low number of traffic count. This implies that such road has fewer activities centres that attract more people there.

It was hypothesized that the increase in traffic flow into a street will result to the increase in high number of parked vehicles in that street. Therefore, the number of parked vehicles on each of the roads/streets was run against the traffic count on each roads/street using correlation analysis to check for a relationship between the two variables. Table 2 shows that the Pearson product moment correlation coefficient is significantly strong and positive correlation ($r= 0.89$, $P<0.01$) which means that there is a direct relationship between number of parked vehicle and that of traffic count. This result

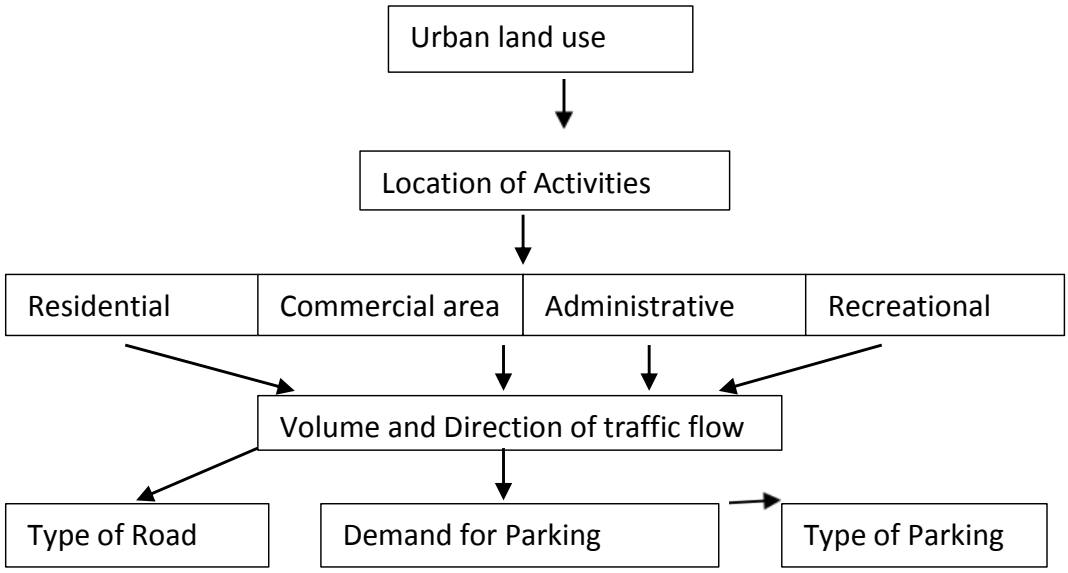

Figure 1. A typology of urban road and on-street parking theoretical framework.

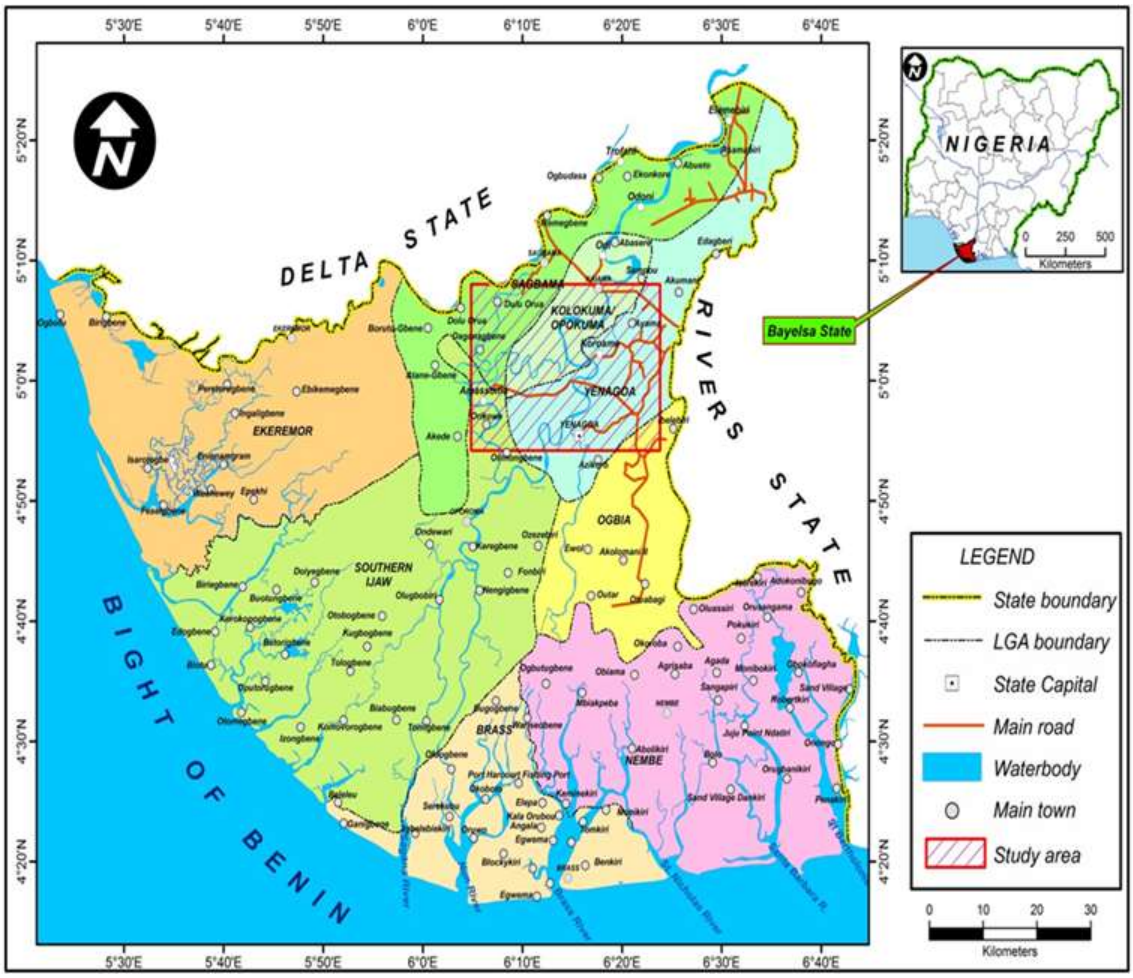

Figure 2. Niger Delta Region showing the study area.
Source: Adapted from a political map of Bayelsa State (Office of the surveyor general February. 2008 edition).

Figure 3. Picture illustrating how the width of roads under study was measured.

Table 1. Number of parked vehicles and traffic volume counts per day over week on roads/streets under study in Yenagoa, Bayesa State, Nigeria.

S/N	Roads/streets under study	Number of parked vehicles/day	Road width (m)*	Traffic volume counts/day
1	Winners academy roads	553	6	4244
2	Chief limel oku street	534	6	2985
3	Winners road	739	5	4120
4	Tenacious road	613	6	3663
5	Ogbia road	663	6	5607
6	Nepa road	483	6	2187
7	Green villa road	660	6	5013
8	Ebi's road	685	6	5774
9	Nikton road	623	6	4352
10	Inec road	717	6	4845
11	Azikoro road	972	15	11822
12	Osiri road	801	8	6513
13	Ebi's mechanic road	616	6	5941
14	Imgbi road	917	9	8055
15	Aritaeline road	492	6	2411
16	Oil mill road	615	8	2146
Mean		668	7	4980

Source: Owota, (2017:58) *Road width meters are to the nearest whole number.

shows that as one variable increases, the other also increases. In other words, roads/streets that have activities centres which attract people on a daily basis will experience high traffic flow and the demand for parking

Table 2. Correlations of the relationship between number of parked vehicles and traffic volume count.

		Number of parked vehicles	Traffic count
Number of parked vehicles	Pearson Correlation	1	0.89**
	Sig. (2-tailed)		0.000
	N	16	16
Traffic count	Pearson Correlation	0.89**	1
	Sig. (2-tailed)	0.000	
	N	16	16

**Correlation is significant at the 0.01 level (2-tailed).

Table 3. Correlations of the relationship between the width of road and the number of parked vehicles.

		Number of parked vehicles	Width of Road
Number of parked vehicles	Pearson Correlation	1	0.73**
	Sig. (2-tailed)		0.001
	N	16	16
Width of Road	Pearson Correlation	0.73**	1
	Sig. (2-tailed)	0.001	
	N	16	16

**Correlation is significant at the 0.01 level (2-tailed).

on such roads/streets will be high and it will be noticed on roads/streets that do not have off-street parking facilities with high number of on-street parking.

Physical measurements

A standard road width of 8 m is derived from vehicular access width of 5.5 m and a parking space of 2.5 m (Mannering et al., 2007; Parking Network, 2016). The width of the roads/streets under study was measured during the physical measurement (Figure 3). From Table 1, ten roads/streets have a width of 6 m while Osiri road and Oil mill road have width of 8 m each. Imgbi road is 9 m wide and Azikoro road which has a double lane is 15 m. Table 1 also reveals that roads/streets which widths are below 8 m do not have enough on-street parking space. Therefore, on-street parking of vehicles will cause traffic congestion. That is why it was hypothesized that there is a direct relationship between the width of roads and the number of parked vehicles.

The Pearson production moment correlation coefficient between the number of parked vehicles on each roads/street and the width of roads/streets, extracted from Table 1, is also significantly strong and positive ($r=0.73$, $P<0.01$) as shown in Table 3. Therefore, there is a direct relationship between the width of the roads/streets and the number of parked vehicles. In other words, as the number of parked vehicles increases the width of the road need to be increase.

DISCUSSION

The findings of the study reveal that roads/streets in most of Yenagoa urban areas are not wide enough to accommodate on-street parking since most of their width is less than 8 m which is the standard width of an urban road. This also revealed that the narrow nature of roads/streets in Yenagoa is as a result of poor construction and design coupled with inadequate set back from structure/building by developers. The findings also reveal the relationship between the width of the roads/streets and the number of parked vehicles, this implies that as the number of parked vehicles increase, the width of roads/streets need to increase to accommodate more parking space. If the width of the roads is not increased there will be problem of parking space as noted by Raji and Waziri (2008) in their research with the findings that says an increase in number of vehicles without adequate infrastructure (off-street parking facilities), has accentuated the problems of traffic congestion, traffic delay, parking problems, accident, and urban land use severance.

Sumaila (2012) carried out a study concerning the current and emerging transportation problems in Nigeria's

Federal Capital Territory and came out with the following results which include non-development of transit ways to major activity centres, emergence of illegal bus stations, poor parking system and absence of pedestrian walkways. This study confirms the result of the presents study. The findings of this study confirm that traffic volume and parked vehicles have a strong positive relationship that leads to traffic congestion. The parking vehicles on the roads/streets reduce the vehicular access for free flow of traffic, vehicles plying that route need to slow down especially when looking for where to park. There is a confirmation to this important finding by Downie (2008) which say that parking is another contributing factor to congestion. It is of the view that parking on the road, which consumes large amount of space has become a land issue that greatly inflates the demand for urban land, causing congestion in cities.

RECOMMENDATION

Owing to the findings of this study the following have been recommended:

(i) The state Government and local Planning Authority should specify and enforce the provision of parking space into any building (commercial, residential or administrative) before approval. This will reduce the currents challenges of on-street parking on urban roads and forestall future occurrences;
(ii) In Yenagoa city, most of the roads/streets are not up standard in width, which creates problem for easy vehicular movement. The government normally proceeds by road expansion whenever there is problem of traffic congestion caused by parked vehicles. For this present study, the adoption of traffic management techniques such as one-way traffic system, vehicles parking regulations and controls including the construction of off-street or multi-storey parking facilities will help in reducing the challenge of on-street parking along the roads/streets in Yenagoa.

Conclusion

In conclusion, the study is to survey urban roads and on-street parking in Yenagoa city, Niger Delta region of Nigeria. On-street parking on urban roads cannot be over emphasized. Decisions concerning parking space availability and the challenges on urban roads have larger implications and this study demonstrates the complexities of the subject.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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