
AN ANALYSIS OF TRAFFIC FLOW AND NETWORK CHARACTERISTICS IN LAGOS MAINLAND, NIGERIA

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ABSTRACT

This paper aims at determining the contribution of the road network characteristics to traffic situation in Lagos Mainland. The analysis via the graph theory revealed that the road network of Lagos Mainland is not well connected and this also has some effects on the traffic situation. In determining the overall contribution of the road network characteristics, the multiple correlation statistics was used. From the analysis, it was observed that 82.81% of the traffic situation in the area can be attributed to the road network characteristics leaving 17.19% to other factors. Based on the findings recommendations were proffered.

Keywords: Traffic flow; network; characteristics; Lagos Mainland; analysis.

INTRODUCTION

Empirical facts clearly show that all faces of public transportation in Nigeria – railway, water, road and air transportation – are to day in varying degrees of degeneracy. Nothing, perhaps reveals the extent of the problem better than the situation in Lagos, where commuters daily engage in struggles in which only the fittest survive (Atubi and Onokala, 2004b; Atubi, 2012g). There is no doubt that both the Federal and State Governments have over the years; invested enormous funds in public transportation. However, a growing economy requires a comprehensive and efficient transport system to move its goods and people to and from and within its boundaries. Sada (1970), examined the role of political politics influencing transportation facilities in metropolitan Lagos. He maintained that politics had more than desired influence on the city network and this is irrational to objective planning of transport network in such a large city. He also said that until the city was given a new dimension such as planning and reversing some existing policies, the traffic problem in Lagos would continue to be in existence. Onakomaiya (1978) and Atubi (2007a; 2008d; 2008f; 2009b), suggested that transportation planning in a rapid growing city like Lagos should take into consideration the forces influencing the growth of urban traffic such as the growing population, the narrow roads and increase in car ownership. Banjo (1989), in his study of the characteristics of the transport problems of Nigerian cities, found out that the key characteristic of the transport problems of Nigeria's major cities is the chronic traffic congestion arising from inadequate road network and misuse and abuse of those provided. These have given an insight to the traffic situation in some urban centres in Nigeria and thus have helped in directing efforts at easing and understanding congestion in these areas. Population growth as well as commercial growth at different locations stimulates the growth of transportation network and in this way the spatial interaction between nodes is apparent. Put in another way, both population and commercial activity increase stimulate increases in access routes to quicken the link or connection of these places with one another (Atubi and Ali, 2006; Atubi, 2009b).

Wallace (1958), further expanded this observation when he stated that the level of traffic density be it freight passenger is a reflection of and the general characteristics of human occupancies of an area. Only those towns that are best blessed with a network of roads will experience rapid growth than those not so well served. Traffic flow has been a serious problem in Lagos Mainland. In this place, traffic jam, which is an extreme case of traffic congestion whereby vehicles are fully stopped for a length of time before moving again, is common. It occurs as a result of continuous increase in road space, utilization by vehicles and it is characterized by lower speed, longer vehicle queues and increase journey time (Atubi and Onokala, 2004a and 2004b; Shopade, 2010; Atubi, 2012g and 2012h). According to Odeleye (2001), the menace of road traffic congestion across the globe seems to defy immediate solution and like a dreadful monster it stares gallantly and ridiculously at erudite urban planners and administrators in industrialized and developed countries of the world. While the industrialized countries continue to use new technology such as the intelligent transportation system to exterminate the unpleasant negativity, most developing countries adopt absolute technology such as expansion and construction of more roads in cities which are not likely to be the solution to these bottleneck problem in most cases.

STUDY AREA

Three bridges mainly the Carter, Eko and Third Mainland bridges connect the Mainland Local Government Area to the Island (See Fig. 1). Lagos Mainland Local Government Area is one of the 20 Local Government Areas of Lagos State. Prior to 1967, the Mainland carried the bulk of the residential buildings and thus its public functions in turn attracted other clientel functions like banking service, commercial industries and engineering firms.

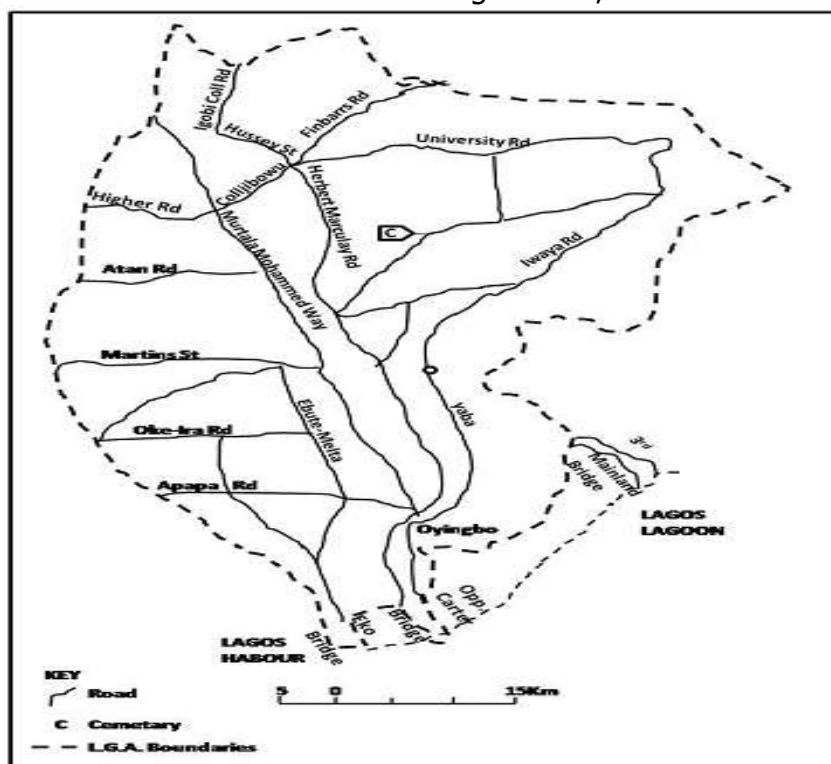


Fig 1: Map of Lagos Mainland Local Government Area

RESEARCH METHODOLOGY

Hagget (1979) said “the flow of activities between two regions is directly related to their sizes and inversely related to the distance between them”. It is then on the basis of this that a base map of the area was produced showing the selected nodes and links. The first of the analysis include the analysis via the graph theory. An analysis was also done via the multiple correlation statistics where the combined effects of the network characteristics were computed.

DISCUSSION OF RESULTS/FINDINGS

Figure 2 shows a map of Lagos Mainland showing the distribution of the nodes and links in graph form. The nodes are defined as the major activity centres in the Mainland area with a volume of employment of nothing less than 500 people. The links on the other hand are defined as the routes connecting two nodes. The major bus stop’s in the activity areas has aided their location and a sample size of thirty four was chosen (See Appendix 1)

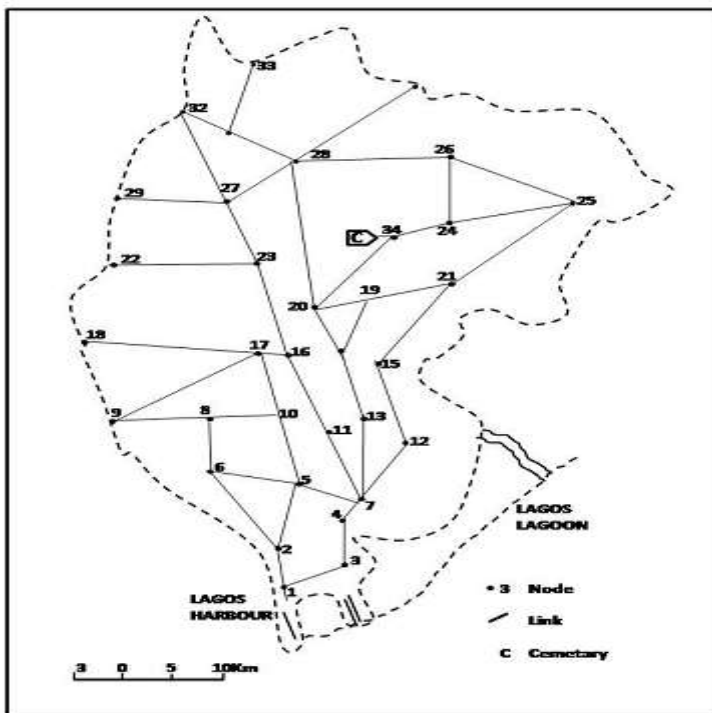


Fig. 2: Roads on Lagos Mainland Showing the Nodes and Links between them in Graph Form

To determine and establish the degree of association between the road network characteristics and traffic flow along the links the correlation statistics was used. Analysis was done on only three out of the four road network characteristics and these include the width of the road, the geographical alignment of the routes and accessibility of the routes. The fourth one – surface quality was left out due to the fact that all the roads considered in Lagos Mainland are tarred. The multiple correlation statistic is used to ascertain the strength of the relationship between a dependent and a set of independent variable s which may be two or more. However, the multiple linear regression would have been used but we found that in most cases, the unexpected variables was too large. Appendix 2 contains the details of the calculations and the value obtained between the variables

(route orientation (x_1), width of the roads (x_2) and accessibility indices (x_3), is 0.91. The percentage in variation of traffic flow along the routes which can be determined by the 3 road network characteristics is got by squaring the multiple correlation value thus:

$$\begin{aligned} R^2 &= (0.91)^2 = 0.8281 \\ &= 0.8281 \times 100 \\ &= 82.81\% \end{aligned}$$

However, from this we can see that 82.81% of the variations in traffic flow along the routes in Lagos Mainland can be explained by the road network characteristics leaving 17.19% to other factors such as the large number of cars in the area, the landuse pattern and the under developed nature of the road network.

POLICY IMPLICATIONS/RECOMMENDATIONS

Staggering of office hours means the fixing of office hours at spaced intervals. This means that all workers would not leave for work at approximately the same time and the effect this has is to reduce the number of workers plying the roads during the peak hour and thus would lead to an easing of traffic conditions in the peak hours. In Lagos Mainland for instance, office hours for most workers ranges from 7.30am to 4.30pm. This often leads to a mad rush between the hours of 7.00 and 8.30am due to the fact that workers struggle to beat the office hours. This often leads to a chaos because each wants to be the first to get to the office and in their bid to be disorderly, traffic jams occur on the roads and this often stretches at times to way past 9.00am. it is hereby believed and advocated that if office hours are staggered over a longer interval, to some degree congestion during the peak hour could be reduced. To some degree, congestion along the roads of Lagos Mainland stem from the fact that the existing facilities are not effectively utilized. To make the good use of the existing facilities is obviously desirable especially in such traffic management measures as one-way working, junction control and parking control. On most of the roads and at junctions the traffic lights which are provided are not made use of and the absence of traffic wardens on such roads worsens the situation. The fact that this idea of using the traffic light has failed in some parts of the region is due to bad planning, and lack of responsibility on the part of the law enforcement agents. In some areas the lights are not programmed to meet the flow of traffic in all directions and thus leads to congestion.

From our analysis, we saw that the road network characteristics contribute a total of 82.81% to the traffic situation in Lagos Mainland thus leaving 17.19% to other factors which could include the large number of cars plying the routes, the mismanagement of traffic and the dominance of indiscipline drivers to mention a few. It then follows that to ease traffic flow along the routes, better road network characteristics must be ensured, for example, the roads have to be better connected to improve their accessibility, also roads have to be widened to more lanes to increase their carrying capacity and these are especially true for the routes headed to the mainland. Better road network characteristics would not only lead to a faster flow of traffic along the routes, it would also make for a well structured road network system and also a faster pace at curbing congestion problems in the area of study.

CONCLUSION

It must be stated that for an improved efficiency of the road system, recognition of the road network characteristics and decentralization of the landuse pattern must be effected to ensure a faster pace in curbing traffic congestion problem in the study area.

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APPENDIX 1

Names of the Nodes

1. Oto
2. Brickfield
3. Iddo
4. Olokodana
5. Franklin
6. Apapa road
7. Oyingbo
8. Abule-Nla
9. Oke-ira
10. Ebutte-metta
11. Moleneu
12. Montgomery
13. Clinic road
14. Yaba
15. Adekunle road
16. Second avenue
17. Barrack's road
18. Martins street
19. Sabo
20. Industrial road
21. Iwaya
22. Atan
23. Murtala Mohammend way
24. Tafawa Balewa
25. Oduduwa Drive
26. University Road
27. Jibowu
28. Herbert Marculat road
29. Higher college road
30. Hussy road
31. St. Finbarr's road
32. Owen
33. Igbobi college road
34. Lancaster

APPENDIX 2

Analysis via the Multiple Correlation Statistics

Below are values for route orientation (x₁), width of the roads (x₂) and accessibility indices of the roads (x₃)

x1	x2	x3
1	1	48.3
1	1	54.5
1	1	42.1
2	1	49.3
2	1	56.6
2	1	67.2
2	1	54.4
3	1	48.8
3	1	59.1
3	1	54.5
3	2	54.4
3	2	62.2
3	2	52.3
3	2	52.4
4	2	59.3
4	2	61.6
4	2	54.1
4	2	52.4
4	2	57.3
5	2	56.8
5	2	60.4
6	3	57.6
6	3	67.0
6	3	60.1
6	4	44.4
6	4	43.7

To compute the degree of association between route orientation (X₁), width of the roads (X₂) and accessibility indices (X₃) the following equation was used.

$$R_{1.23} = \sqrt{\frac{r_{12}^2 + r_{13}^2 - 2r_{12}r_{13}r_{23}}{1 - r_{23}^2}}$$

R₁₂ = 0.88

R₁₃ = 0.19

R₂₃ = 0.06

Substituting with the formular therefore the following calculation were undertaken:

$$R_{1.23} = \sqrt{\frac{(0.88)^2 + (0.19)^2 - (0.88)(0.19)(-0.06)}{1 - (-0.06)^2}}$$

$$\begin{aligned} &= \sqrt{\frac{0.77+0.04 -1.76 \times 0.19 \times (-0.06)}{1-0.00}} \\ &= \sqrt{\frac{0.81+0.02}{1}} \\ &= \sqrt{\frac{0.83}{1}} \\ &= 0.91 \end{aligned}$$

R1.23 > r12, r13, r23

R1.23 = 0.91

$R^2 = (0.91)^2$
 $= 0.8281$
 $= 0.8281 \times 100$
 $= 82.81\%$