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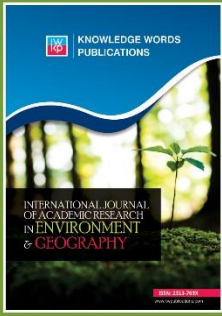
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Traffic Counting Along the Major Roads of Gariki Residential Area of Enugu State Nigeria

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Abstract

The study focused on traffic counting along the major roads of Gariki residential area of Enugu State, Nigeria. The data for the study was collected from the three Zones which include Agbani Road (1), Ebony paint road (Zone 2), Amaechi road (Zone 3), Amagu Ugwu road (Zone 4) in 2019. A survey research method was adopted. Both qualitative and quantitative data collection methods were used. Collection of quantitative data was through oral interview and non-participant observation while quantitative data was collected using unstructured questionnaire and secondary sources such as books and journal articles. The result of the study indicated that the rate of private car remain the highest from 6-8am to 2-6pm in the zone follow by Taxi and bicycle remain the lowest. This study recommends that Urban Road Traffic Development Control; Agency (URTDCA) be created, the creation of such body will bring about development programme in the area.

Keywords: Traffic, Counting, Road, Gariki, Residential Area, Enugu.

Introduction

Traffic congestion is a condition on transport that as use increases, and is characterized by slower speeds, longer trip times, and increased vehicular queueing. When traffic demand is great enough that the interaction between vehicles slows the speed of the traffic stream this results in some congestion. While congestion is a possibility for any mode of transportation, this article will focus on automobile congestion on public roads (Andrew, 2008)

As demand approaches the capacity of a road (or of the intersections along the road), extreme traffic congestion sets in. When vehicles are fully stopped for periods of time, this is colloquially known as a traffic jam or traffic snarl-up. Traffic congestion can lead to drivers becoming frustrated and engaging in road rage.

Mathematically, congestion is usually looked at as the number of vehicles that pass through a point in a window of time, or a flow. Congestion flow lends itself to principles of fluid dynamics (Andrew, 2008)

Mathematical Theories

Some traffic engineers have attempted to apply the rules of fluid dynamics to traffic flow, likening it to the flow of a fluid in a pipe. Congestion simulations and real-time observations have shown that in heavy but free flowing traffic, jams can arise spontaneously, triggered by minor events ("butterfly effects"), such as an abrupt steering maneuver by a single motorist. Traffic scientists liken such a situation to the sudden freezing of supercooled fluid Duranton, et al (2011)

However, unlike a fluid, traffic flow is often affected by signals or other events at junctions that periodically affect the smooth flow of traffic. Alternative mathematical theories exist, such as Boris Kerner's three-phase traffic theory.

Because of the poor correlation of theoretical models to actual observed traffic flows, transportation planners and highway engineers attempt to forecast traffic flow using empirical models. Their working traffic models typically use a combination of macro-, micro- and mesoscopic features, and may add matrix entropy effects, by "platooning" groups of vehicles and by randomising the flow patterns within individual segments of the network. These models are then typically calibrated by measuring actual traffic flows on the links in the network, and the baseline flows are adjusted accordingly Science Daily (2019)

A team of MIT mathematicians has developed a model that describes the formation of "phantom jams," in which small disturbances (a driver hitting the brake too hard, or getting too close to another car) in heavy traffic can become amplified into a full-blown, self-sustaining traffic jam. Key to the study is the realization that the mathematics of such jams, which the researchers call "jamitons," are strikingly similar to the equations that describe detonation. In recent articles, percolation theory has been applied to study traffic congestion in a city. The quality of the global traffic in a city at a given time is by a single parameter, the percolation critical threshold. The critical threshold represent the velocity below which one can travel in a large fraction of city network. The method is able to identify repetitive traffic bottlenecks¹Critical exponents characterizing the cluster size distribution of good traffic are similar to those of percolation theory Science Daily (2019)

Economic Theories

Congested roads can be seen as an example of the tragedy of the commons. Because roads in most places are free at the point of usage, there is little financial incentive for drivers not to over-use them, up to the point where traffic collapses into a jam, when demand becomes limited by opportunity cost. Privatization of highways and road pricing have both been proposed as measures that may reduce congestion through economic incentives and disincentives. Congestion can also happen due to non-recurring highway incidents, such as a crash or road works, which may reduce the road's capacity below normal levels Science Daily (2019)

Economist Anthony Downs argues that rush hour traffic congestion is inevitable because of the benefits of having a relatively standard work day: In a capitalist economy, goods can be allocated either by pricing (ability to pay) or by queueing (first-come first-served); congestion is an example of the latter. Instead of the traditional solution of making the "pipe" large enough to accommodate the total demand for peak-hour vehicle travel (a supply-side solution), either by widening roadways or increasing "flow pressure" via automated highway systems, Downs advocates greater use of road pricing to reduce congestion (a demand-side solution, effectively

rationing demand), in turn plowing the revenues generated there from into public transportation projects.

2011 study in the American Economic Review indicates that there may be a "fundamental law of road congestion." The researchers, from the University of Toronto and the London School of Economics, analyzed data from the U.S. Highway Performance and Monitoring System for 1983, 1993 and 2003, as well as information on population, employment, geography, transit, and political factors. They determined that the number of vehicle-kilometers traveled (VKT) increases in direct proportion to the available lane-kilometers of roadways. The implication is that building new roads and widening existing ones only results in additional traffic that continues to rise until peak congestion returns to the previous level.

The Study Area

Gariki residential is located in the southern part of Enugu. It is situated under Enugu south local government area. Bounded in the southern and northern part of Enugu south local government area by Enugu- portharcourt express way and Awknanaw area. By East are Amachi and Akwuke communities. Notable roads within the study are are Ebony paint road, Amagu Ugwu road, Gariki/ Agbani and Amachi road. The population of Garki as stated by the 1991 census figure was 2,924. The population was projected to 1996 to get 3,388 and 2001 to get 3,929 with 464 increases within 5 yrs Ogbazi (1992). The table below shows population interval of Gariki. The base year figures were projected to 2011 as stated above. The formula below was used to project the population for 2006 and 2011.

P_x = population of the target year

P_0 = population of base year

$r/100$ = growth rate at 3.0%

n = number of years.

I = constant. Yamane, T. (1967)

Land Use Pattern

Land use pattern in the area is classified into those that are located within the right-of-way, those that are not within the right-of-way as well as the land use of the immediate neighbourhoods served by the major roads in the study area. Commercial and industrial land use almost proportional and accent for about 80% of the entire land uses comes in diverse forms ranging from service, metal or construction woodwork, paper mill and block industry on the other hand the outstanding commercial land use are kiosks, stores, car parking areas, Garki park, Garki market is the prominent commercial land use which abuts the right-of-way. There is also army barrack and some institution in the study area which abuts the right-of-way. Frankly speaking land use that are abutting on the right-of-way are mostly commercial. However some buildings have mixed uses for commercial, religious and residential uses as well as about 98% of the catchments area is occupied by residential building including roads. The few prominent commercial and industrial land uses that engulfed by the residential building are Ebony paint industry (Ugwu & Umar, 2018)

The Impact of Socio-Economic Pattern of the Communities in the Study Area

Three social strata are identifiable in the study area: High, medium and low. The high and medium income are proportionately large, accounting more than 75% of the entire population while the low income classes is found in an isolated area mostly in Uwani, Ugwu and Amaechi, most of them are commercial farmers who sell in large quality of their farm produce in the major market located in the area respectively. The activities of these people in the major markets have immensely compromised the right-of-way they displace all manners of farm produce in a way that the carriage way virtually reduces to one lane during the day (Ugwu & Umar, 2018)

The impact of Afor market is heavily felt in the area, its ability to draw large number of vehicles from within the catchments area and beyond has resulted to traffic problems in the area, sometimes, due to inadequacy of parking spaces, drivers who used the mark are forced to park indiscriminately along the road space. This usually extends hundreds of meters, precisely from army barracks main gate to Akwuke road, this unplanned manner of parking makes the section impossible and constitutes visual intrusion, finally the fact that about three (3) out of five (5) households of the high and medium income classes in the catchments area possess at least one type of vehicle or the other, this has large impact in the major roads (Ugwu & Umar, 2018).

Relief and Drainage

The entire area is located at a fairly level land with a degraded terrain at average height of about 60 meters above sea level. A close study of the area indicates that about 70% of the area slope towards Awkunanaw. While the topography of the area is fairly level or hilly and the soil is generally loamy, sandy which is fertile for some of the crops produced in the area, the soil generally is brownish in colour (Ikechukwu, 1996)

Vegetation

The study area falls within the board vegetation region of the most lowland forest there are three distinctive layers which occur at varying heights which include 10-16 meters, 17-40 and 41-50 meters. Species of the emergent forest include cashew and mango trees (Ikechukwu, 1996)

Research Method

Survey research design was adopted. Both qualitative and quantitative data collection was used. Collection of qualitative data was through oral interviews and non-participant observation, while quantitative data were collected using structured questionnaire and secondary sources such as books and journal articles. The oral interview targeted key commuter user. Interview was conducted based on questions drawn from prepared interview guide and recorded manually. The non-participant observation data were derived using observation schedule and photographic material during several visits made to the site. Due to the constraints, study avoided inclusion of residents and visitors to the scheme in the interview schedules for passengers to ascertain and confirm the observed data and inferences.

Research Findings

Traffic Count along the Major Roads of Garki

It was observed that there were a lot of traffic movements along major road of Garki, especially the peak hour (in the morning and evening)

The researcher takes traffic count in these zones in order to know and ascertain the number of vehicles that ply in each peak period.

Since 60 seconds equal to 1 minute

60 minutes equal to 1 hour

Therefore 6x12 hour = 720 minutes this means that the total of 720 minutes was spent on traffic count on each Zone for each consecutive day.

From table 2.0 below, shows that at early hour of the day, vehicle number tends to increase up till 10am in the morning and tends to be low at 12pm hour. It was such that private car accounted for 1,126 vehicles that use the road to that of mini bus and motorcycle.

Table 2.0 Hourly Traffic Volumetric Census of Agbani Road (1)

Time	Private car	Mini bus	Taxi	Motorcycle	Trailer	Tricycle	Bicycle
6-8am	210	182	120	300	2	20	-
8-10am	346	210	50	260	3	12	1
10-12pm	103	117	20	180	-	7	-
12-2pm	97	164	15	60	1	5	-
2-6pm	370	200	7	80	-	8	3
Total	1,126	873	212	880	6	52	4

Source: Researcher's field survey, 2019

Table 3.0 below indicate that the rate of private car remain high with 1,014 while mini bus is 67 and taxi 120, trailer 9, lorry 5 and bicycle is the lowest with 4.

Table 3.0 Hourly traffic volumetric census of Ebony paint Road (Zone 2)

Time	Private car	Mini bus	Taxi	Motorcycle	Trailer	Lorry	Tricycle	Bicycle
6-8am	172	12	27	46	2	2	8	1
8-10am	212	19	33	62	4	-	15	-
10-12pm	75	7	18	12	-3	7	-	-
12-2pm	97	5	13	30	-	-	3	-
2-4pm	218	4	11	40	1	-	5	2
4-6pm	240	20	18	60	2	-	13	1
Total	1,014	67	120	250	9	5	51	4

Source: Researcher's field survey, 2019

Table 4.0 shows that a total number of three hundred and forty (340) cars move into zone three (3) this indicate that private cars makes use of their car for their individual activities, while 140 mini buses ply the zone because it only involved movement from Amaechi bus stop to top land/ Ebony paint junction.

Table 4.0 Hourly traffic volumetric census of Amaechi Road (Zone 3)

Time	Private car	Mini bus	Taxi	Motorcycle	Trailer	Lorry	Tricycle	Bicycle
6-8am	75	30	30	57	1	3	25	1
10-12pm	30	20	25	72	3	-	13	-
12-2pm	19	10	15	20	-	1	7	-
2-4pm	102	30	35	15	4	-	3	-
4-6pm	114	50	50	63	-	5	18	2
Total	340	140	155	227	8	9	66	3

Source: Researcher's field survey, 2019

From the table below indicated that various ways in which vehicle parked in Garki residential area, in zone 1, 15 vehicle parked on one side while 30 vehicle parked on both sides, while 30 parked on both side of the road in zone 2. 10 vehicle parked on one side while Table 5.0 indicate that private car is the highest with the total number of two hundred and ninety-two (292), while mini bus has 60 also indicated the rate of interval increase of time. However motorcycle accounted for 147, lorry 2 and trailer zero (0)

Table 4.0 Hourly traffic volumetric census of Amagu Ugwu Road (Zone 4)

Time	Private car	Mini bus	Taxi	Motorcycle	Trailer	Lorry	Bicycle
6-8am	30	7	4	17	-	-	-
8-10am	50	15	8	20	-	1	1
10-12	27	11	6	15	-	-	2
12-2pm	45	4	3	20	-	-	-
2-4pm	60	6	5	25	-	-	-
4-6pm	80	17	11	50	-	1	-
Total	292	60	37	147	-	2	3

Source: Researcher's field survey, 2019

From the table below shows the various ways in which vehicle parked in Garki residential area in zone 1, 15 vehicles parked on one side while 30 vehicles parked on both sides, also in zone 11 while 30 vehicle parked on both sides, also in zone 11, 10 vehicles parked on one side while 20 vehicle are parked on both side. In zone 111, 12 vehicles parked on one side while 26 parked on both side, zone 1v, 4 vehicle parked on both sides and zone v, 6 vehicles parked on one side while 12 parked on both side. However it implies that a total number of vehicles parked on side.

Table 6-0 incidence of double parking of vehicles and width of major road in Garki residential

Car	Zone 1	Zone 11	Zone 111	Zone 1V	Zone V
Parking	AgbaniRD	Ebony paint RD (width)	Amaechi RD (width)	Amagu Ugwu RD(width)	
Single parking	15(15)m	10(12)m	12(15)m	4(12)m	6(12)m
Double parking	30(15)m	20(12)m	26(15)m	9(12)m	12(12)m
Total	45	30	38	13	18

Source: Researcher's field survey, 2019

Recommendation/Conclusion

In term of efficient and effectiveness of traffic management, the government should recruit a lot of traffic management personnel who will stand in various junction were there traffic congestion and ensure there is free flow of cars secondly the researcher also recommends that the government should relocate along Ebony paint road in to decongest traffic along Gariki/ Agbani road.

Area for Further Research

However there is areas for further research that is available which could help the effective traffic management and counting in Gariki residential area, the researcher recommend that a body known as Urban Road Traffic Development Control; Agency (URTDCA) be created, the creation of such body will bring about development programme in the area.

Conclusively, there should be serious improvement of traffic management, carelessness of road users, contravention, indiscriminate parking of cars as well as inadequate standard of carriage way had brought the cases of traffic congestion, delay which requires effective management in the study area.

However, it is hope that by the time these recommendations are considered and strickly implemented, the goal of this study would have been achieved and the area would make more conducive for socio- economic development.

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