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An Investigation into Traffic Turning Movement at Jibowu

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ABSTRACT

This paper aims at understanding the behavioral pattern of traffic at Jibowu intersection with a view of using the results obtained as a model for understudying traffic movement at similar intersections in the Lagos metropolis. Consequently, an evaluation of the sampled intersections was carried out by employing a physical measurement of the layout, traffic volume at each turning point, and evaluating it against the back drop of traffic delays at the intersections. The paper reviews the traffic flow situation within the context of increasing motorization, poor infrastructural facilities and a continuous stream of traffic inflow. It highlights the problems with emphasis on the importance of signalization, land use, intersection design and traffic systems management. The paper concludes that most of the bottlenecks experienced at the intersection are man-induced. Rather than obeying traffic regulations, people act otherwise either out of ignorance or gross indiscipline. Secondly the paper posits that the land use allocation in the area should be reviewed especially with emphasis on discouraging the luxury bus operators from using the area as their base or Main Park. Although the paper did not fully measure the delay at the intersection, it has however set the stage for further investigations.

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KEYWORDS: Turning Movement, Junction, Traffic Jam, Survey, Delays, Lagos, Turning Points, Signalization

1. INTRODUCTION

There has been a significant expansion of traffic volume in Lagos over the past two decades due to the high urban population with a large number of vehicle owners and commuters who transact businesses from one part of the city to another. Consequently, there is an increasing traffic jams at intersections in the metropolis which leads to high man-hours wastage on roads (Wright, Gautain, Jovan and Vokanovic 1995; Vasarhelyi 1976). Since a significant fraction of workers whose company's head offices are in Lagos pass through the road intersection at Jibowu, the need to investigate into its traffic turning movement situation is important (Allsop 1977; Lan and Davis 1999; Sunkari, Charara and. Urbanik 2000). This would equip decision makers on the possible strategies and action plans to take in order to overcome traffic jams at intersections, particularly at Jibowu, Lagos. Also, due to the myriad of problems of fatal crashes, stationary traffic situations, delays, and the dominance of traffic in an area, the need to study the Jibowu intersection is further strengthened (Bonneson 1998; Fisk and Tan 1989; Yagar 1975).

The traffic intersection at Jibowu roundabout lacks amenities such as traffic signs, lighting columns, sewers, and other underground services. Unfortunately, this junction design was not made with regards to flow, speed, composition, distribution and future growth of the traffic (Keskinan Ota and Katila 1998 Yagar 1979; Dremer and Ludwig 1986). This renders previous efforts by traffic authorities in correcting the delay associated with the junction ineffective. The non-consideration for turning movement studies still makes the problem to continue. Efforts by traffic authorities result in a situation where high-density traffic is given a short life signal movement (SLSM) while low-density traffic enjoys a relatively long life signal movement (LLSM). The problem of smooth traffic control is compounded by situation of the adjacent land use which has created more delays and exposed other road users to accidents and other negativities like noise and exhaust fume pollution. Granted that turning movement refers to vehicular traffic movement within an intersection or intersections that are linked with one another, this traffic movement scenario is therefore created in order to avoid accidents, stationary traffic situation, delays and to reduce the dominance of traffic in the area.

A considerable amount of research has however been made in regulating vehicle movement through manual or automatic signalized facilities which translates into an orderly traffic flow. For example, Hancock, Wulf, Thrm and Fassnacht (1990) examine the behavior of car drivers during different driving sequences, in particular during left-turn maneuvers (see also 1990; Storr, Cooper and McDowell 1980). Results indicate that there were significant increases in head movements and mental work head during turn sequences compared to straight driving (see also Wulf and Fassnacht 1990). Wilson , Matthias and Betz (1974) developed and tested the load-node concept of traffic assignment, which reduces problems associated with high cost, cumbersomeness, and the serious limitations of traffic assignment models in urban transportation planning. The implication of this growing body of research is that the turn around time for buses and cabs will be improved and bus services will be more reliable than before. Another implication of this research outcome is that it permits a free, safer walking environment, and an opportunity of crossing the intersection at the street level rather than using footbridge. However, if this intersection is not managed well, it could create a conflict between cyclists and motorists. There is growing evidence in this respect. For example, it is reported that in the USA there were 2,721,000 intersection-related crashes in 2001 (Sunkari, Charara and. Urbanik 2000). This accounted for about 43% of the total crashes in the country with 8,490 fatal cases observed. Another reported case relates to Japan where more than 45% of all fatal crashes occurred at intersections.

Documentation relating to intersections shows that several agencies are developing programmes and methodologies to improve the conditions of intersections. These methodologies concerns improvement based on accident data and construction cost. However, a shortcoming of such methodologies is the non-incorporation of operational factors such as delay and level of services, which is the major concern of this paper (Lu, Pernia and Brett 1998; Adeniji 1987).

A major feature of these categories of roads is the high level turning and crossing movements. Jibowu intersection accounts for one of the highest distribution of turning movement in the metropolis and due to its unsignalized movement, hold ups are very common and sometimes may last for up to 30 minutes, which translates to many loss of man hours. This paper examines the density and type of vehicular movement within the intersection in the a.m. and p.m. peak periods. It shows the delay time and causes of the delay. It highlights a proper institutional arrangement on how an uncoordinated arrangement may affect free flow and the implications.

2. PROBLEM STATEMENT AND SITE DESCRIPTION

2.1 Problem Statement

Junction designs should have regard for the flows, speed, composition, distribution and future growth of traffic (Harnen, Umer, Wong and Hashin 2003). Allowances should be made to accommodate traffic signs, lighting columns, sewers, pedestrian walk ways and other underground services. Unfortunately Jibowu round –about lacks these amenities. Several remedial actions have been applied in the past at correcting the delay associated with the junction without carrying out a proper turning movement survey. This translates to a situation where high density traffic is given a Short Life Signal Movement (SLSM) while low density traffic enjoys a relatively long life signal movement (LLSM). This Situation coupled with the adjacent land use has compounded the problem by creating more delays and thus exposing other road users to accidents and other negativities like noise and exhaust fume pollution. This research work is carried out to evaluate the volume of traffic on each of the legs of the intersection and the main contributors to delays especially with the nature of the land use along the different legs of this intersection.

2.2 Site Description

Jibowu is located within the Yaba part of Lagos Metropolis. The Jibowu intersection has 16 turning points. It is a major junction linking three primary distributors in the metropolis. The intersecting roads are Herbert Macaulay, Agege motor road and Ikorodu road. Ikorodu road started as a ten-lane road from the metropolis as far as Mile 12 and terminates at Ikorodu town as six- lane road, making it one of the longest roads in the metropolis. Herbert Macaulay is a 6-lane road that extends from Ebute-Metta to join Agege motor road which is also a 6 lane road that extends from Ojuelegba to Agege. These three roads which form the spine of the primary network are of the grade A Federal express constructed to link major settlements and designed for a high load. They carry most of the long distance traffic to and from within the metropolitan center and together they account for one of the highest turning movements in the metropolis.

The Ikorodu road which emanates from Yaba, a major commercial center in the metropolis has a ramp to allow traffic move over the intersection in order to avoid delay. On the two lane space to Yaba on both sides are short Shoulders that link Ikorodu with Herbert Macaulay for traffic joining Agege motor road on the right and for traffic coming from Herbert Macualay to Ikorodu road on the left respectively. The same design is repeated on the other side of the road.

Figure 1 shows the road matrix at Jibowu round about. The land use of the area is purely commercial which serves mostly as a terminal for some luxury bus operators on both sides of the intersection. There is a filling station on the right hand side to Yaba, a church and some big Government agencies and private offices. One of the most remarkable land uses in the area is the railway line. Cars are often expected to stop when a train is crossing this may last up to 5 minutes, while the effect lingers a little longer.

Figure 1: Road at Jibowu round about

3. METHODOLOGY

The methodology adopted, basically a screen-line counting approach, assists in achieving three primary objectives of the work: (i) to evaluate traffic volumes, (ii) to identify the causes of delay at the junction, and (iii) to study the effect of the land use of the area on travel time. In carrying out the analysis, 16 turning points in Lagos metropolis were identified, and data collected on the type and volume of vehicular traffic, traffic signal timing, inter sections traffic control, causes of delay, and intersection condition. A four-day-8-hour count was carried out with screen lines placed at the 16 identified turning points. Two enumerators were placed at each turning point to take inventory of each vehicle type, with the seven vehicle types identified shared among them. For effectiveness of counts and error minimization during counting, the periods of counts were segmented into two: 6am – 10am and 4pm – 8pm. These counts spread through 4 days (Monday, Thursday, Friday and Saturday).

The choice of these days is justified as follows: Monday, being the first working day of the week is usually road-busy, with many workers trying to report at work before engaging on official assignments which may take them outside their working place. Thursday is chosen since it is a calm day, particularly in the morning when the traders at the Yaba market which is close to the traffic junction engage in weekly market sanitation that takes place from 7am to 10am. This suggests that not many people move around at that time. Friday is chosen since it is the last working day for government officials and many private organizations. Saturday is chosen to capture traffic activities during the weekend.

4. DATA ANALYSIS

The 16 identified turning points at Jibowu are indicated in Table 1 with the respective traffic volumes. These turning points are primarily links. Mosalasi has links to Yaba, Ikorodu and Jibowu, and are stated as serial numbers 1, 2, and 3 respectively. The turning point of bridge ascending is on serial number 4.

Table-1: Turning points at Jibowu with traffic volumes

No.	Traffic direction	Code	Morning peak	Evening peak
1	Mosolasi-Yaba	A1	726	757
2	Ikorodu-Mosolasi	A3	2140	2654
3	Jibowu-Mosolasi	B1	2855	2752
4	BridgeAscending	B2	5488	2717
5	Jibowu-Ikorodu rd.	B3	2694	2517
6	Ikorodu rd-H/Macaulay	B4	1635	1656
7	H/Macaulay rd-Ikorodu rd	C1	397	730
8	H/Macaulay rd-Ikorodu rd right	C2	2758	2715
9	H/Macaulay rd.-Ikorodu rd	C3	2323	2267
10	H/Macaulay Road-Yaba	C4	4618	5021
11	Mudashiru Awe- H/Macaulay road	D1	3010	3297
12	H/ Macaulay-Ikorodu road	D2	82	174
13	H/Macaulay-Mudashiru Awe str	D3	89	294
14	H/Macaulay-Edmund	E1	603	228
15	H/Macaulay-Edmund right	E2	1011	447
16	Yaba-Edmund	F1	681	56
	Total		31158	28392

The links Jibowu-Ikorodu road, and Ikorodu road–H/Macaulay are listed as serial numbers 5 and 6 respectively. Serial numbers 7 to 15 show links of H/Macaulay to Ikorodu road (C1), Ikorodu road right (C2), Ikorodu road (C3), Yaba (C4), Mudashiru Awe (D1), Ikorodu road (D2), Mudashiru Awe (D3), Edmund (E1) and Edmund right (E2). Item 16 is the Yaba-Edmund link (F1) (Table 1). The survey shows that the heaviest traffic was recorded on the ramp, which is a one-way, 2-lane bridge used by motorists going to Yaba, Oyingbo and Lagos. The morning (am) volume of all the vehicle types is 5,488, while the evening volume (pm) is 2,752. The morning traffic volume seems higher than the evening traffic volume because it is the corridor to the Islands where about 64% of corporate offices are located.

Traffic from Herbert Macaylay leading to Yaba (C4) is low during morning peak period mainly because commercial buses from Bariga, Sabo, Unilag and Lagos use the lane. The volume increases during the evening peak period because it is the route used by returning workers, from Lagos and other institutions around Yaba (Table 1).

Observations from the Table 1 shows that the turning points where morning traffic volume figures are high are routes used by workers to work. Examples are B1, B2, B3, C2 and C3. The values obtained for the evening traffic is relatively low, and are routes used by workers on their way back home. Although one would have expected figures for both morning and evening to be almost equal but they are different since at the close of work people usually avoid the intersection because of traffic jam which usually last for up to 45 minutes on a daily basis. Thus, workers seek for alternative routes which take them off the area. An important consideration in this analysis is the determination of the causes of delay at the Jibowu turning point considered here. In all, seven main reasons could be advanced for the delay of vehicles at the junction. These are: (i) illegal turning, (ii) rail crossing on Herbert Macaulay, (iii) luxury buses interception, (iv) illegal parking, (v) non-signalised intersection, (vi) on-street trading and (vii) conflicting signals by traffic wardens.

Illegal turning is one of the major causes of traffic build-up at Jibowu round about. The traffic coded C1 with morning and evening volume of 397 and 730 respectively is illegal, indicating the traffic coming from Herbert Macaulay and turning right to Ikorodu road. This traffic volume code C1 obstruct traffic C2 which has morning volume of 2,768 and evening volume of 2,715 respectively. Traffic volume marked C3 with morning and evening traffic volumes of 2,716 and 2,267 has no proper signal, and sometimes obstruct traffic volume marked B3. Unfortunately, the issue of illegal turning may take sometime to resolve since it seems that the traffic policemen in the area are not aware of the right configuration of traffic flow. The railway crossing at the Moshalashi end (A2), which terminates at Iddo disrupts the free-flow of traffic A3. This usually takes about 5 minutes, and it would require another 10 minutes for the traffic to flow properly. Unfortunately, several accidents have been recorded in the past when some motorists speed across the rail line. Some traders who trade on the rail line have lost their lives and in a bid to beat the approaching train, some people have been crushed to death.

Interstate luxury buses have their terminal at Jibowu, and constitute a major part of the landuse in the area. They park indiscriminately, usually blocking part of the road, thereby reducing the road capacity and disrupting traffic flow from volume traffic B2. This activity causes delay on the road that joins Herbert Macaulay with Ikorodu road. It may take about 10 minutes to 12 minutes for the traffic to flow properly. Private car owners illegally drop people at the terminal, park their vehicles, and thereby constituting a major nuisance in the area. The worst culprits are taxis and small buses, especially the 14-seater buses which block traffic flow when they take part to pick passengers. This narrows down the width of the road and the resultant effect is congestion. The area does not have any lay-byes for stationary traffic. All the intersections do not have automatic traffic signals, which makes motorists to overtake one another at the intersection. In most cases, this results to minor accidents that usually keep the traffic to a stand-still for more than 30 minutes. The existing signals are damaged due to old age and when motorists collide with them.

Street-trading and beggars' activities usually slow down traffic when they move in-between moving traffic. The resultant effect is a gradual build-up of vehicular traffic. Field observations reveal that a delay of 50 seconds may slow down the traffic for about 5 minutes and degenerates into a queue. This queue extends into Herbert Macaulay way and Ikorodu road. The scenario is made worse when motorists and cyclists try to overtake by riding on pedestrian walkways, thereby compounding the already-worse situation. This situation takes place almost on daily basis.

The inability to coordinate signals by the different traffic wardens sometimes causes confusion when two opposing traffic are signaled to pass at the same time. The reason for this is that the traffic wardens stationed here seem not to know which turnings are actually illegal. Also, since they do not have a means of quick communication, wardens sometime give conflicting signals which result in accidents.

5. CONCLUSION

Traffic control at intersections in Lagos poses great challenges to stakeholders in terms of control of accidents, delay of vehicles due to traffic jam, etc. In this paper, an investigation has been made to study an important traffic junction in Lagos, which shows problems faced in vehicle control in such locations. It is therefore concluded as follows. The deficiency associated with the site location of Jibowu intersection is partly responsible for the incessant traffic jam associated with this area during the peak periods. Secondly, the landuse distribution in the area constitute a major hiccup to traffic flow. Heavy-duty vehicles owned by transport companies do street-parking and street-reversing. These unwholesome activities build-up traffic in the area, which calls for re-location, especially the luxury bus terminal.

The filling station, the private secondary school, the church of Latter-day Saints, and some other smaller activities generate traffic in the area. Their relocation should be given serious consideration. Fourthly, the junction is poorly signalized, which relates to the absence of traffic wardens, especially at night, when the junction becomes uncontrollable. Therefore, the need to reactivate the electric traffic signals is important for better traffic handling of the area. In the alternative, more traffic wardens should be drafted to this area to monitor traffic flow since the Power Holding Company of Nigeria (PHCN) is still epileptic in its performance, and continued supply of electricity for electronic traffic signals could not be guaranteed. Fifthly, illegal turns constitute one major cause of congestion in the area. Therefore, stiffer penalties should be given to people who do illegal turns by making them pay heavy monetary fines.

The observation at the Jibowu junction may be similar in characteristics when compared with other locations in Lagos. Therefore, activities of road traffic experts aimed at correcting the anomalies suggested above may greatly assist in controlling traffic problems in general, particularly in Lagos, Nigeria (Zhang and Forshaw 1997). A shortcoming of the work lies in the currency of the database. This weakness is partly due to the long period before which reporting of the work is made. Thus, future studies should be more extensive, and reports of investigations should be promptly published for the benefit of all stakeholders on traffic studies. This work hopefully stimulates useful discussions that would benefit the whole community of traffic investigators at large.

REFERENCES

Adeniji, J.A. 1987. *Infrastructural Planning and Policies: The Example of Transportation in Faniran, Urban and Regional Planning Policy Formulation in Developing Countries. Ibadan*: Heineman Publishers Limited

Allsop, R.E.1977. Treatment of Opposed Turning Movements in Traffic Signal Calculations. *Transportation Research*, 11(6):405-411.

Bonneson, J.A. 1998. Delay to Major-Street Through Vehicles due to Right-Turn Activity. *Transportation Research, Part A: Policy and Practice*, 32(2):139-148.

Fisk, C.S., Tan, H.H..1989. Delay Analysis for Priority Intersections. *Transportation Research Part B: Methodological*, 23(6): 453-469.

Hancock, P.A., Wulf, G., Thrm, D., Fassnacht, P. 1990. Driver Workload During Different Driving Maneuvers. *Accident Analysis and Prevention,* 22(3): 281-290.

Harnen, S; Umar.R.S; Wong.S.V; Hashin. W.I. 2003. Motorcycle Crash Prediction Model for Non-Signalised Intersections, *Journal of International Association of Traffic and Safety Sciences. (IATSS)*, 27(2): 58-65.

Keskinan, E., Ota, H., Katila, A. 1998. Order Drivers Fail in Intersections: Speed Discrepancies Between Older and Younger Male Drivers. *Accident Analysis and Prevention*, 30(3): 323-330.

Lan, C.J., Davis, G.A. 1999. Real-Time Estimation of Turning Movement Proportions from Partial Counts on Urban Networks. *Transportation Research Part C: Engineering Technologies*, 7(5): 305-327.

Lu, .J, Pernia J., Brett. P. 1998. A Procedure Developed to Prioritise Roadway Intersections for Safety and Traffic Improvements. *Journal of International Association of Traffic and Safety Sciences*, 22(2): 67-78.

Storr, A., Cooper, D.F., McDowell, M.R.C. 1980. Analysis of Gap Acceptance in A Complex Traffic Maneuver. *European Journal of Operational Research*, 5(2): 94-101.

Sunkari S.R., H. Charara, T. Urbanik. 2000. *Automated Turning Movement Counts from Shared Lane Configurations at Signalised Diamonds Interchanges.* 79th Annual Meeting of the Transportation Research Board, Washington D.C.

Vasarhelyi, B. 1976. Stochastic Simulation of the Traffic of an Uncontrolled Road Intersection. *Transportation Research*, 10(4): 255-261.

Wilson, E.M, J. S. Matthias and M. J. Betz. 1974. A Traffic Assignment Planning Model: The Load-Node Concept. Transportation Research, 8 (1): 75-84.

Wright, C., Gautain, D.J., Jovan, A., Vokanovic, R.S. 1995. Spatial Aspects Of Traffic Circulation: L. I A Review of Alternative Systems. *Transportation Research Part B: Methodological*, 29(1): 1-32.

Wulf, P.A.H., Fassnacht, D.T. 1990. Driver Workload During Differing Maneuvers. *Accident Analysis and Prevention*, 22(3): 281-290.

Wulf, P.A.H., Fassnacht, D.T. 1990. Driver Workload During Differing Maneuvers. *Accident Analysis and Prevention*, 22(3): 281-290.

Yagar, S. 1975. Minimising Delay at A Signalised Intersection for Time-Invariant Demand Rates. *Transportation Research*, 9(2-3): 129-141.

Yagar, S. 1979. Capacity of A Signalised Road Junction: Critique and Extensions. *Transportation Research*, 8(2):137-147.

Zhang, X., Forshaw, M.R.B. 1997. A Parallel Algorithm to Extract Information About The Motion of Road Traffic Using Image Analysis. *Transportation Research Part C: Emerging Technologies*, 5(2): 141-152.

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