



An Assessment of the Effects of Traffic Congestion on Man Hour and Productivity in Gwagwalada Town, Abuja, Nigeria

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ABSTRACT

The research work attempts to investigate the traffic flow pattern as it affects man-hour and productivity in Gwagwalada. It examines the traffic situations at different junctions within the study area. The characteristics of the intersection that predispose them to congestion problems and the spatial pattern of traffic congestion at the junctions were identified; data on traffic volume and composition were collected through direct field observation at the junctions. The areas studied were SDP junction, Park Road, Area Command junction, CIPB Road junction, and Demonstration Road Junction. The statistical test used in verifying the stated hypothesis was Analysis of variance (ANOVA). The result shows that there is significant difference in traffic flow taken at different time, but there is no significant different in the traffic flow taken at different sampling points. It was also observed that the time wasted on the holdup has effects on the Man-hour which in turns reduced productivity. Based on these findings, the study therefore recommends that the road junctions be signalized and vehicle parking at the junctions be strictly prohibited to reduce traffic congestion. There are also urgent needs to upgrade and expand certain roads in the study area.

Keywords: traffic congestion, man-hour, vehicles, productivity, Gwagwalada town, traffic flow

INTRODUCTION

Productivity is a company's output per unit of labor input. Man-hours measure labor input. It is the number of employees multiplied by the number of hours worked. Businesses may lose productivity due to several reasons, including equipment downtime and malfunction, information technology failures and employee sick days, workers lateness at work. Lost productivity leads to higher costs and lower profits. Calculate the cost of lost productivity to understand how and where to improve operating efficiencies. Gwagwalada town is the industrial zone of Federal Capital Territory (FCT). The existence of University of Abuja and convergence of some government parastatals has made it the life blood of commerce and administrative in the Federal Capital Territory (FCT). This has consequently ushered in some traffic congestion problems during the peak periods (morning, afternoon evening and on market days). These traffic problems in Gwagwalada town could be studied by looking for ways to make the existing traffic control devices more effective and to employ more appropriate traffic management techniques that will guarantee a free-flow of traffic.

The final relocation of Federal Capital Territory from Lagos to Abuja in 1991 brought about a massive influx of people into Gwagwalada town, which created a lot of developmental problems (pilot survey 1991). Transport problems remain one of the most nagging problems in urban transportations today. All over the world, attempts have been made to tackle the problems, yet the situation seems to get worse. Cities are centres of economic, social, cultural and intellectual activities. These activities result in the

drift of the population from rural to urban centres and these congregations have caused cities to expand without control in many areas, causing congestion, environmental and social problems, (Aderamo, 2000). One of the most significant urban transport problems is traffic congestion. Many dimensions of the urban transport problem are linked with the dominance of the automobile. (Okpala, 1981) The problem of traffic congestion in urban areas is worse at road intersections. Indeed, there is no other point on cities roads that can be greatly congested as road intersections. As defined by Flaberty, (1997), intersections, i.e where two or more roads meet, are points of vehicle conflict. Similarly, (Mchsare, W.R. et al, 1998) noted that at no other location within the street and highway systems are so many potential and actual conflicts than at road intersections. This is because at intersections, vehicular flows from several different approaches making either left- turn, through and right-turn movements seek to occupy the same physical space at the same time. In addition to these vehicular flows, pedestrians also seek to use this space to cross the street and thereby worsening the already bad traffic situation.

Urban traffic problems are further exacerbated by the concentration of most of the working places in the same areas (usually in the city centres), so that traffic is essentially unidirectional during the morning and evening peak periods (Okpala, 1980; Onakomaiya and Ekanem, 1981). It is this later problem which results in spatial variation of congestion in urban areas that prompted this study. It is in view of the above, that this research intends to assess traffic flow as it affects man-hour and productivity within Gwagwalada town.

Traffic Congestion and Productivity

Any area that is developing and is economically dynamic and vibrant will readily experience traffic congestion. Congestion has become an inevitable part of everyday life and that it is the development controls that have to devise policies to help control the congestion in order to relief commuters of the difficulties imposed by traffic congestion. According to May and Marsden, 2007, Yildirim 2001, there is little consensus on the type of policies that can be used to trade congestion in cities, and that it is unsure that congestion has any clear cut solution. Indeed people living in town and cities have come to accept traffic congestion as part of city dynamics and therefore have become used to getting along with it. They continue to argue that traffic congestion in cities is a symbol of a successful socio economic development-improved business activities, increase in employment and improved culture. These are factors that motivate firms to operate in cities to benefit from economic gains.

May and Marsden (2007), however argue that congestion impairs us from moving freely and that it disrupts business activities in cities and reduces productivity. Congestion affects speed and smooth traffic flow. This affects a wide range of activities, services, goods, markets opportunities in the cities which can best be delivered through transport mobility. The report continues that congestion also reduces productivity through increased inventory holding by manufacturers and retailers as a result of unreliable travel conditions within cities. Business activities depend on timely delivery of logistics. However, freight movement in cities is impaired by traffic congestion, thus making productivity suffer.

Weisbrod et al. (2003) reinforce this assertion by saying that increased traffic congestion imposes cost upon commuters and affect business operations. They further affirm that businesses that have high needs for incoming deliveries are mostly affected by traffic congestion and thus reduce productivity. Thus traffic congestion increases the cost of businesses operations. For instance delay in delivering time-sensitive logistics can impose additional inventory and logistics cost. Indeed, congestion affects lean management system like just -in-time, making businesses less responsive.

Weisbod et al (2003) conclude that congestion leads to reduced productivity through reduced worker access to job and shopper access to stores as a result of excessive delay in traffic. According to Crowther et al (1963), cutting traffic congestion by half will bring huge economic benefit to economies. This statement lends credence to the fact that traffic congestion has negative impact on productivity. Indeed in August 2010, Habee, one of the provinces of China experienced what is considered the world worst traffic jam ever, as traffic congestion stretched more than 100km from August 14 to 26 (Hickman 2010) . Such situation has obvious implication on productivity and the socio economic development at large. Lewis

(2008) and Downie, (2008) further delineate that although the digital revolution enables twenty 21st Century industries to adopt just – in –time production, distribution and inventory management system, the challenges in the transportation system such as congestion, makes it difficult for them to be up to the task of ensuring reliable just in-time deliveries for enhanced productivity and competitiveness. Poole (1998), and Eddington, (2006) argue that economic cost of congestion takes the form of time wasted through travel delays and unreliable transportation conditions, extra fuel, the environmental damage and related cost to Human health.

METHODOLOGY

Gwagwalada town is located between latitude 8°57' and 8°55'N and longitude 7°06'E with a population of about 23,114. (Gwagwalada master plan).Gwagwalada is the largest satellite town and third largest urban centre in the FC. It is a nodal town within the national, regional and local roads networks. It is located on route A2, Kaduna-Lokoja road and is about sixty kilometers West of Federal Capital City (FCC). It shares boundary with Kwali to the South and Kuje to the Southeast.

Gwagwalada Area Council was created on the 15th October, 1984. With a population figure of 150,000 people. The relocation of the seat of Government from Lagos to Abuja in 1992 and the demolition of illegal structures within the Federal City Centre brought a massive influx of people into the Area Council, being one of the fastest growing Urban Centre in F.C.T. The population of the Area Council has grown to over 1 million people, Balogun, (2001) other factors that lead to the increase in the population of Gwagwala town include some important Federal Institutions such as University of Abuja, Specialist hospital, Custom, Immigration and Prison Pension Board, Sharia Court of Appeal, FCT school of Nursing etc. and ten branches of commercial banks operating within the Area Council. All these contributed to the massive influx of people in the study area with the resent population of over 1.5 million people (NPC 2006).

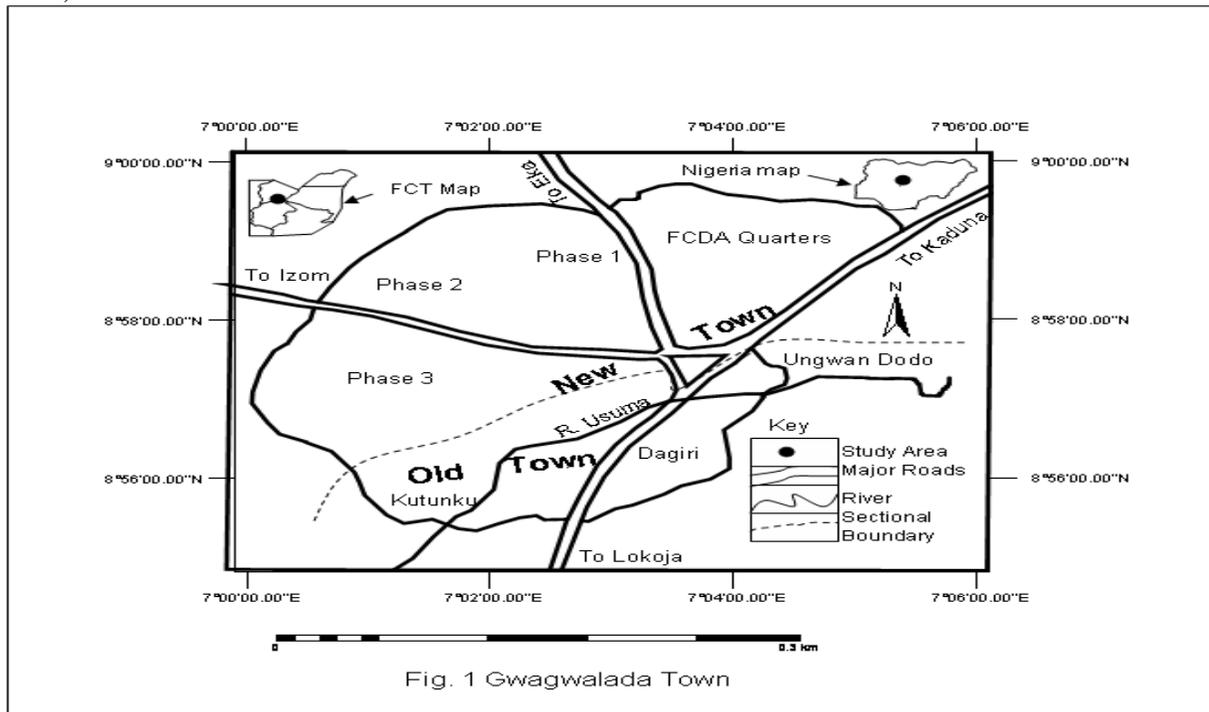


Figure 1:Map of Gwagwalada Township

Two major sources of data were used in gathering information. They include the primary and secondary sources. The primary source of data are information sourced directly from the field, these include Reconnaissance Survey field counting among others, while the secondary sources, are information sourced from published and unpublished materials, textbooks, as well as relevant government agencies. The major traffic junctions in the study area were identified. The trend, pattern and composition, of the traffic were studied at different» times, different places through the week days. The speed of the vehicle was also determined. These junctions are SDP junction, Park Road junction, Demonstration junction, CIPB junction, and Market road junction.

Table 1: Junction’s Characteristics and Associated Land Use

Intersection	Type of Intersection	land use characteristics
SDP junction	3-legged	Commercial motor park, retailing shops, mechanics workshops, filling stations to mention a few.
Park Road junction	3-legged	Commercial motor park, commercial centre, retailing shops, supermarkets, banks road side retailers.
Demonstration junction	4-legged	School, retailing shops, institutional, commercial centre, hotels and so on.
CIPB junction	4-legged	Institutional, commercial banks, residential houses.
Market junction	3-legged	Commercial banks, motor mechanics, retailing shops, police command, bock industries, coca cola mini deport.

Field survey 2016

The researcher with the help of five research assistants monitored at the designated sampling points took records of the number and types of vehicles that passed through the junctions. At such times the speed of the motorist on the road was also calculated and recoded. The statistical technique used in verifying the hypotheses is the Analysis of Variance (ANOVA). The results were presented in table and chart.

RESULTS AND DISCUSSION OF FINDINGS

Temporal analysis of traffic flow

Figure 1 - 4 show the average traffic volumes in vehicles per hour at the studied junctions for morning, afternoon and evening peaks. Figure 4.1 present the results of the morning analyses. The highest traffic was recorded between the hours of 7am and 10am at SDP Junction with 994 vehicles per hour ((vph)); followed by Park road with 936 (vph), market Junction with 544 (vph), CIPB with 494 (vph) and 296 (vph).

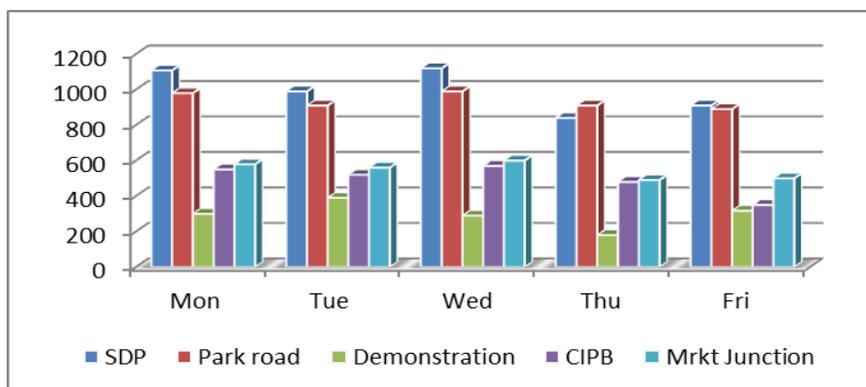


Figure 1: Analysis of Mornings (7-10) am traffic from Monday to Friday.
Source: Field survey 2012

The highest traffic was recorded on Wednesday with 3570 (vph), followed by Monday with 3517 (vph), Tuesday with 3370 (vph), 2967 (vph) on Friday and 2900 (vph) on Thursday. Due to the nature of the road that is one way. The army checks point near Demonstration junction attracts the major traffic holdup and some minor junctions all contribute to traffic congestion. The speed of the vehicle from SDP junction to UATH, Abuja University or Custom Staff training school is approximately 5km/hr. this is because there is heavy traffic hold up at all the junction before those points.

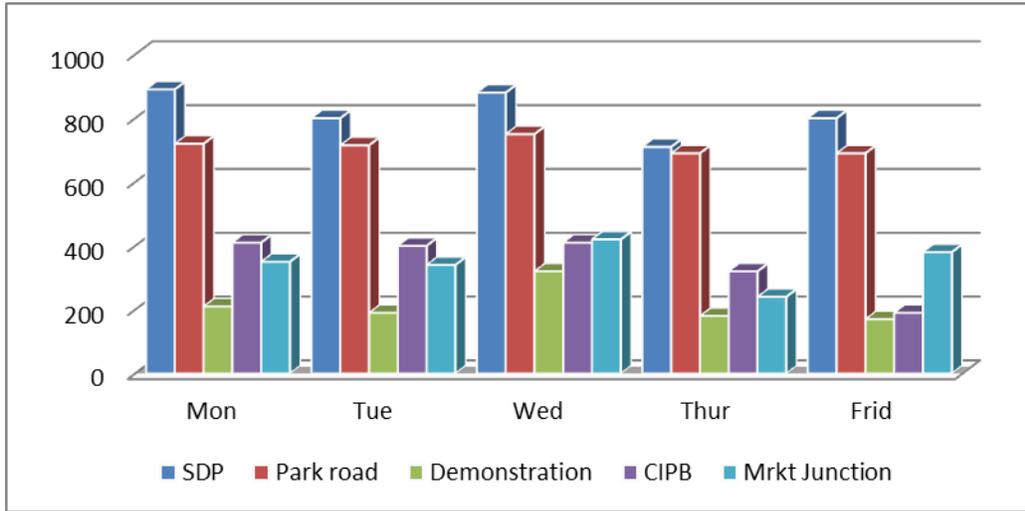


Figure 2: Analysis of Afternoon (12-2) pm traffic from Monday through Friday.
Source: Field survey 2016

Figure 2 present the results of the afternoon analyses. The highest traffic was recorded between the hours of 7am and 10am at SDP Junction with 816 vehicles per hour ((vph)), followed by Park road with 767 (vph), market Junction with 346 (vph), CIPB with 346 (vph) and Demonstration junction 214 (vph). The highest traffic was recorded on Wednesday with 2780 (vph), followed by Monday with 2580 (vph), Tuesday with 2445 (vph), 2230 (vph) on Friday and 2140 (vph) on Thursday respectively.

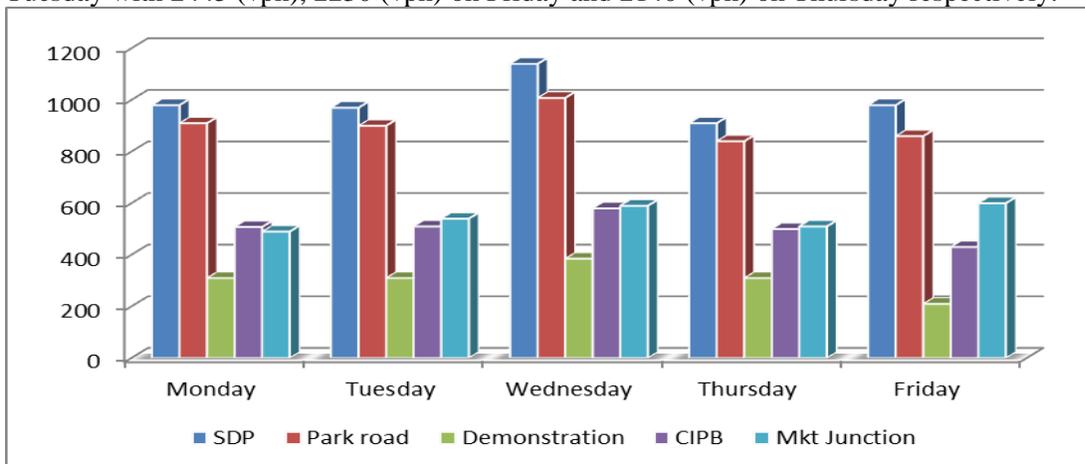


Figure 3 Analysis of evening (5-7) pm traffic from Monday through Friday.
Source: Field survey 2016

Figure 3 present the results of the evening analyses. The highest traffic was recorded between the hours of 7am and 10am at SDP Junction with 996 vehicles per hour ((vph)), followed by Park road with 904 (vph), market Junction with 546 (vph), CIPB with 506 (vph) and Demonstration junction.308 (vph). The highest traffic was recorded on Wednesday with 3703 (vph), followed by Tuesday with 3230 (vph), Monday with 3198 (vph), 3080 (vph) and 3070 (vph) on Friday and Thursday respectively.

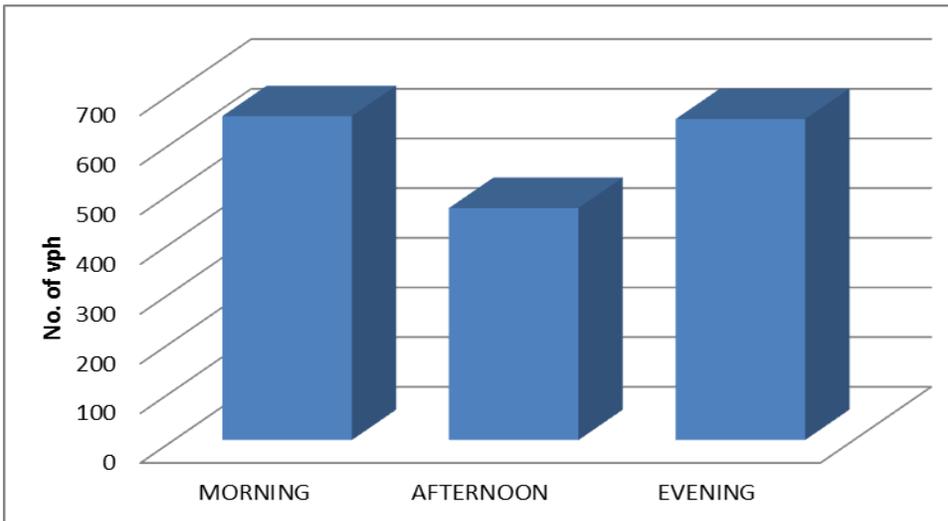


Figure 4 Mean value of Traffic flow in Gwagwalada
Source: Field survey 2016

Figure 4 presents the mean temporal variation in the traffic flow. It shows that high traffic (662vph) is always recorded in the morning followed by 467vph in the afternoon and 646vph in the evening. This implies that, study area is always very busy in the morning and evening.

Spatial analysis of traffic flow

Traffic flow at different sampled places were analysed and the results is presented on Figure 5.

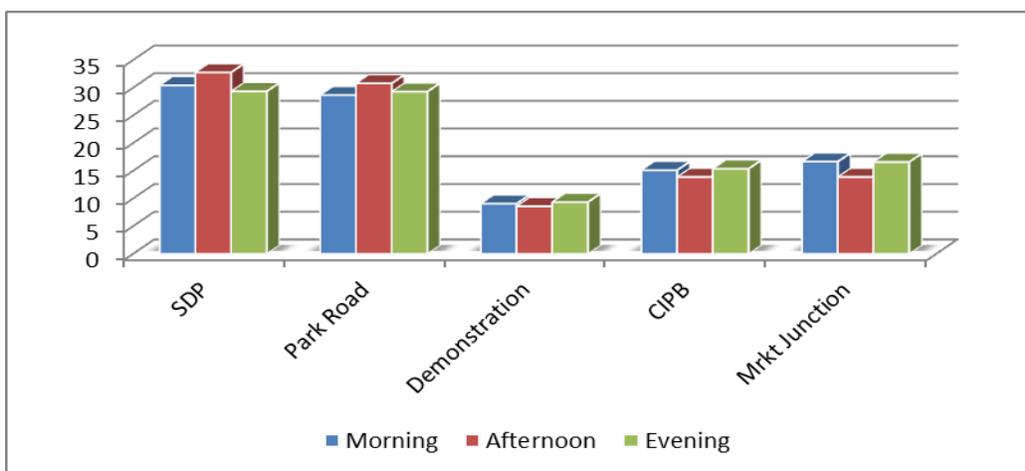
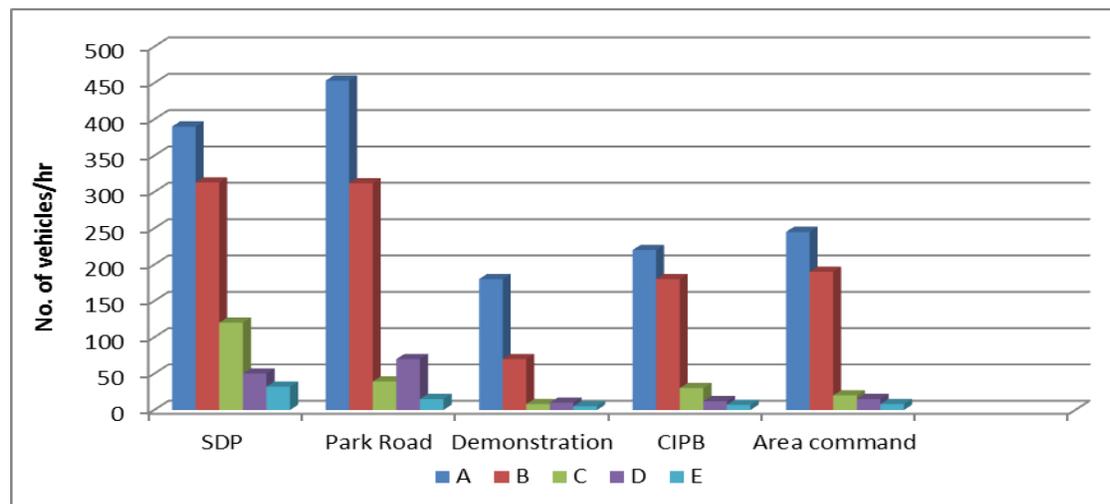


Figure 5 Average volume of traffic at the sampled junctions
Source: Field survey 2016

Figure 5 presents the average traffic for five days in the morning, afternoon and evening at the different sampling points. The SDP junction recorded the highest volume of vehicular traffic in the study area. There are 994 vehicles per hour (vph), representing 30.5%, 816 (vph) representing 33.0%, and 966 (vph), representing 29.4% in the morning, afternoon and evening respectively. This is followed by Park Road with 936 (vph) representing 28.7%, 767 (vph) representing 30.8%, and 964 (vph) representing 29.3% for morning, afternoon and evening peaks respectively. Area command junction rank third recording 544 (vph) representing 16.7%, 346 (vph) representing 13.9%, and 546 (vph) representing 16.6% for morning, afternoon, and evening peaks respectively. CIPB ranked fourth recording 494 (vph) representing 15.1% in the morning peak, 346 (vph) representing (13.9%) in the afternoon peak and 506 (vph) representing (15.4%) in the evening peak. Demonstration road rank the least with 296 (vph) representing (9.1%) in the morning peak, 214 (vph) representing 8.6% in the afternoon peak and 308 (vph) representing 9.4% in the evening respectively.

Analysis of Traffic Composition

Figure 4.6 show the average peak-hour traffic composition at the sampled intersections. The table shows that of all the vehicle types recorded at the sampled junctions, motorcycles had the highest number with an average of 298 (vph) representing 49.6% which is followed by private cars with an average of 213 (vph) representing 35.4%. Buses ranked third with 44 (vph) representing 7.3% while delivery vans was fourth with 32 (vph) representing 5.3%.



A = Motorcycles D = Delivery Vans B = Private cars E = trucks/Trailers/Tankers/Tipplers C = Buses

Figure 6: Traffic Compositions at the Studied Junctions

Source: Field survey, 2016

Other types of vehicles recorded at the sampled junctions are trucks, tractors, Lorries, tankers, tippers 14 (vph) representing 2.3%. The high volume of traffic flow at SDP junction exemplified the importance of the roads converging at this junction and the land use activities which made SDP junction to road serve as commercial motor parks, retailing shops and numerous commercial activities along the road. These activities account for the high volume of traffic at the junction. Park Road junction is another road experiencing high volume of traffic. Park road is one of the busiest commercial belts of the study area with Supermarkets, retailing shops, commercial activities, and Banks along it. These also contribute to the traffic volume at the junction resulting from commercial and institutional land use.

The volume of traffic flow at Area Command junction also explains the importance of the road in the study area, converging at the junction. The commercial banks, public and private motor parks, and retailing shops all these contributed to traffic volume at the junction. CIPB junction services commercial banks, institutions and residential land use. The road also accommodates commercial activities along it

which contribute to the traffic volume at the junction. Demonstration junction also services schools, retailing shops, institutions and commercial activities. These activities also account for the traffic volume at the junction.

Analysis of man-hour

Man-hour is the amount of work performed by the average worker in one hour. It is used in written "estimates" for estimation of the total amount of uninterrupted labour required to perform a task. Man-hours do not take account of the breaks that people generally require from work, e.g. for rest, eating, and other bodily functions. They only count pure labour. Managers count the man-hours and add break time to estimate the amount of time a task will actually take to complete. When time is planned and fixed for a particular exercise, a target is set for it. The average mandated number of working hours public and private workers spent at work is an average of eight (8) hours, but due to traffic holdup, some significant time is usually wasted on transit.

The traffic situation in the study area, especially in the morning hours is giving serious interruption to the road users. It was estimated that the speed of a vehicle is about 2.22km/hr. during peak periods. This implies that an approximate time of 45-60 minutes is wasted within this period of time which in turn influenced their productivity for the day. Where the traffic prolong, about one and a half of more is wasted, personnel having sensitive positions in their establishments, tend to extend the burden to others who depend on their services. This is also in line with the findings of Takyi et al, (2013), in their work titled "An Assessment of Traffic Congestion and Its Effect on Productivity in Urban Ghana" where they found out that their workers waste an average of fifty-two minutes and eight seconds (52.8) because they report late for work. This represents an average of 9.4% of work time per day. This is identified as a significant productive period wasted because of late arrival to work due to the transportation situation in the Kumasi metropolis.

Hypothesis Testing

This section verifies the two hypotheses earlier stated above.

Hypothesis one	There is no significant variation in the traffic flow taken at different sampling points.				
Source of variation	Sum of square	d.f.	Variance estimated	F-ratio	F-critical
Between sum of square.	90588.796	2	45294.398	13.22	3.89
Within sum of square	41116.264	12	3426.36		
Total	131705.06	14			
Hypothesis two	There is no significant variation in the traffic flow taken at different time.				
Between sum of square.	76724.15	2	38362.075	2.11	3.89.
Within sum of square	974141.6	12	81178.47		
Total	1050865.75	14			

The data were subjected to statistical analysis, i.e. Analysis of Variance and the results of the first hypothesis revealed that the calculated value of F-ratio is 13.22 and the table value at 5% confidence level is 3.89, this is to say, the calculated value is greater than the table value, we therefore reject the null hypothesis and accept the alternative which state that "there is significant variation in the traffic flow taken at different sampling points" While the results of the second hypothesis revealed that the calculated value of F-ratio is 22.99 is greater than the table value at 5% confidence level is 3.89. That is the calculated value is less than the table value, we therefore reject the null hypothesis. This implies that there is significant spatial variation in the traffic flow taken at different time of the day.

DISCUSSION OF RESULTS

Results from Figure 5 shows that there is temporal variation in the flow of vehicles in the morning, afternoon and evening, even though statically the difference is not significant. The high traffic in the morning corresponds with people going to work and the school children. One interesting thing to note is that the traffic is one sided coupled with the width of the roads, little or no parking spaces. Some vehicles are parked by the road side reducing the width of the roads, coupled with the Army check points along SDP and Park road. Most people go to Abuja city for work and less number coming into Gwagwalada, while in the evening the reverse is the case. This high traffic always leads to people reporting late at work; students also reach their schools late. This implies that there is shortage Man-hour for the day, which in turns affects productivity. This problem will be mitigated if more exists were constructed to link to the main road.

Another observation is that some junctions attract less traffic; this might be due to less economic activities going on in those areas. The pattern of traffic flow is as follows in descending order: SDP, Park road, Market road CIPB and Demonstration junction. Statistically, the variation is significant. This implies that in some instances, one can avoid the traffic within the town by passing through the less congested areas. Most of the roads are bad with pot holes, whereas some are un-tarred. Within the old Gwagwalada town, there is problem of roads, most of the houses do not have access roads for vehicles, talk less of parking space. This problem cannot be solved except there is urban renewal which might affect so many people with little or no compensation.

Most vehicles do have accidents with each other and with motor cycles in attempt to compete for the little space. These problems are peculiar with vehicles passing through Park road, Kasuwan dare, one way and market road especially on market days.

CONCLUSION

The nature of traffic problems identified needed solution as quickly as possible. Though the traffic flow problem in Gwagwalada has not yet assumed the dimension of those of Lagos, Ibadan, Port-Harcourt and other bigger urban centres in Nigeria, signs of potential bottlenecks are already emerging (Aderamo, 1998). There is therefore the need to evolve more effective traffic management method for the city. As population increases and people become more affluent, traffic congestion problem becomes worse. With the high rate of growth of Gwagwalada, traffic problem should not be left until it deteriorates to the level of larger urban centres in Nigeria. It is believed that if the recommendations are carefully implemented, traffic problems in the study area would be highly reduced if not completely solved.

RECOMMENDATIONS

The volume of traffic on SDP Road and Old park road is heavy and sometimes they form more than two streams of traffic, consequently, making the roads congested especially during the festival periods. In the light of this it is recommended that traffic control devices must be provided on these roads.

On-street parking should be discouraged. Parking on two-way street should be completely disallowed. It is recommended that if there will be on-street parking, it should be on one-way streets of 9 metres carriage way and it should be a unilateral type of parking (parking at one side of the road).

There are two (2) main roads (Park Road and Market Junction) which attract a lot of pedestrian traffic because of the nature of the adjoining land-uses (commercial and education). It is recommended that a pedestrian crossing facing should be provided there.

In order to facilitate the use of these pedestrian facilities mentioned above, there is need for appropriate public enlightenment programme for the masses. This will open their level of understanding as per the usefulness of these facilities.

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