The Factors For Free Flow Speed On Urban Arterials – Empirical Evidences From Nigeria

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ABSTRACT: Many generic factors of the weather, environment, vehicles (machines), fixed facilities (roadway) characteristics, humane (driver) and traffic streams either singly or in combination influence the free flow speed. The quantitative measures of these factors are desirable for reliable system design, analysis and evaluation for effectiveness, especially as reflect the typical humane-machine-environment system prevailing in Nigeria. This paper therefore presents the outcome of the quantitative evaluation of the influence of some factors on the free flow speed on an arterial in a medium sized urban settlement in Nigeria with a view to determining the probable analytical values for towns of similar hierarchy in Nigeria. Instantaneous speeds of forty test vehicles were observed in-vehicle at lull periods on the 7.1km Offa Garage-Emir's Market urban Road, Ilorin with simultaneous collection of data on age of driver, age of vehicle, passenger occupancy, roadside packed vehicles and businesses. The geometric properties of the arterial ware earlier established and segmented to four uniform sections. The data were computed using the category and statistical analysis approach. The results of the study indicated that the three factors of the environment (weather), humane and roadway geometry have negative influences on the free flow speed on an urban arterial. Estimates of the reduction of the various factors were detailed in the paper which was recommended for adoption for design and analysis of traffic stream in Nigeria and other medium sized towns in Nigeria.

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Keywords: Free flow, instantaneous speed, lull period, roadway geometry, environment, in-vehicle data**,** time speed and traffic stream.

INTRODUCTION

Free flow speed can be defined as the drivers' desired average space mean speed in a low volume traffic stream when the density and flow theoretically tend to zero as mathematically represented by the fundamental traffic equation; $q = U_sD$, where q is flow (veh/hr), D is density (veh/km) and U_s is space mean speed (km/hr) (Agent et al (1998) and Dixson et al (199)). It occurs when no obstructions to flow either in terms of operational delays (congestion) or other adverse conditions prevail. Three principal factors of (a) roadway geometry and condition (b) drivers attributes and (c) environment have been reported to influence the values in the American urban traffic streams and highways (Kyte et. al. (2000) and Lamm et. al. (1990)). These authors showed from different studies that the percentage reduction due to the environment in the free flow speed are 8, 14, 15 and 17 – 18 respectively for wet pavement, high wind (greater than 24 km/ hr), low visibility (less than 0.28km) and rains; with a combined effect of all in the range of 30-38%. Lamm et al (1990) additionally observed that drivers also adjust speeds by as much as 10km/hr less during heavy rains when visibility becomes substantially obstructed, while Dowling et al (1997) equally identified drivers attributes and vehicle characteristics as the major factors in the free flow speed in the urban traffic. Younger drivers (in age), level of passenger occupancy, age of vehicles and trip purpose have impacted higher values on the speed while horizontal / vertical alignments and parked vehicles along the road impacted negatively on free flow speeds; (Blake, 1989).

The free flow speed is very important in traffic stream analysis for incidents and bottlenecks and hence the factors influencing its value should attract equal, if not higher attention because it is the source and not the effect. Besides it shall be helpful in sensitivity analysis. No wonder the Highway Capacity Manual (HCM 2000) underscores the importance of the various factors as pertaining to lane width/lateral clearance, the number of lanes and the driver's lateral wander etc. Indeed, Liang et al (1998) presented a chapter of detailed analysis of the effect of human factors (drivers') on the free flow speeds in the premise of person-machine control system. The phenomenon of perception-reaction time, control movement time responses to movement of other vehicles, handling of hazards in the roadway and the peculiarities of the different segments of driving population were examined, while the evolving formulation were tested with the American traffic situations and various models. Two of such models are the (a) Hick-Heyman's law for perception-response time and (b) Fit's law of braking inputs.

Of particular interest for Nigerian situation are the age of drivers, age and condition of vehicles, the roadway geometry and pavement condition. It is an open secret that majority of vehicles on Nigerian roads are old and second hand that have already operated on the streets of country of manufacture before being imported to this country. Obviously, the enumerated models can not completely address the Nigerian situation because Nigerian drivers must have, at least characteristic vehicle handling practices, which must reflect on the traffic stream operation.

Traffic stream analysis and design in Nigeria presently apply either the American or British values which are empirical evidences of the operation in the developed countries. Hence the assessment of the influence of some of these factors to reflect the traffic operation in Nigeria shall be a worthwhile exercise, in that the closeness of the prevailing values to those usually borrowed from other countries' traffic situation, environment and humane (driver) attributes, shall offer the desired confidence and reliability when used for Nigeria traffics. It will appropriately reflect on Nigeria's peculiarities, her drivers' characteristic behaviors behind the wheels, the vehicle conditions/age, passengers' perceptions of trip purpose and other latent issues or combined effects.

The aim of this study is therefore to establish both quantitative and qualitative measures of the influence of the roadway factors (geometry), pavement condition, human (drivers) and the environment; on the free flow speeds on a typical Nigeria urban arterial. The specific objectives include (1) determination of traffic volume trend on different sections of a typical urban arterial in Nigeria, the Offa Garage – Emirs road, (2) determination of the inventory and geometric characteristics of each section of the arterial, (3) determination of the respective free flow speed at different weather conditions, (4) comparison of the free flow speed at each section, at different weather conditions and level of various factors, (5) to catalogue the various factors responsible for the prevailing free flow speed at each section and hence (6) postulate how the different factors influence the free flow speed on the Murtala Muhammad road in Ilorin, a medium sized urban centre in Nigeria or other Nigerian towns with the same political, historical and transportation hierarchy. Actually one would need to examine more than fifty geometric parameters for an attempt at comprehensive summation evaluation of the effects of factors on any parameter for traffic such as the free flow speed. This study is however limited to a few roadway environment (wet/dry condition), roadway geometry and vehicles (carriageway, roadway shoulder and width, lane width, number and obstruction, vehicle age and passenger occupancy); and driver' age.

MATERIALS AND METHODS

Studied Arterial

The studied arterial is 7.1km in length with the last 5km dualised. It originates from the Offa Garage and terminates at the Emir's palace, Ilorin, the Kwara State capital in the central western part of Nigeria. The road traverses four distinct sections; in terms of different levels of the road way characteristic, land use (road side development and business) and traffic volume. The respective partitions are designated as sections A, B, C and D.

Section A: Offa garage to Gaa Akanbi Junction, which is the section without median, Section B: Gaa Akanbi Junction to "A" Division which is a section with isolated and dedicated educational or public buildings which is not densely populated and thereby having a low level of activities, Section C: "A" Division to Post Office, which is a central business district of the town and Section D: Post Office to Oja-Oba, the predominantly market and indigenous area of the town which is densely populated and thereby highly characterized by a high level of activities. Figure 1 presents the diagrammatic sketch of the studied arterial.

Study Methods and Test Data

1. Road and Traffic Characteristics.

The influence of the three factors of roadway characteristics, drivers (human) and environment were studied using the manual observatory approach for the road inventory, traffic volume and drivers characteristics at different weather conditions. The lull period was established in order to determine the timings for the speed measurement. Table 1 presents the geometric properties of the studied arterial while Table 2 presents the probable measurement timings of free flow speed for the various days of the week.

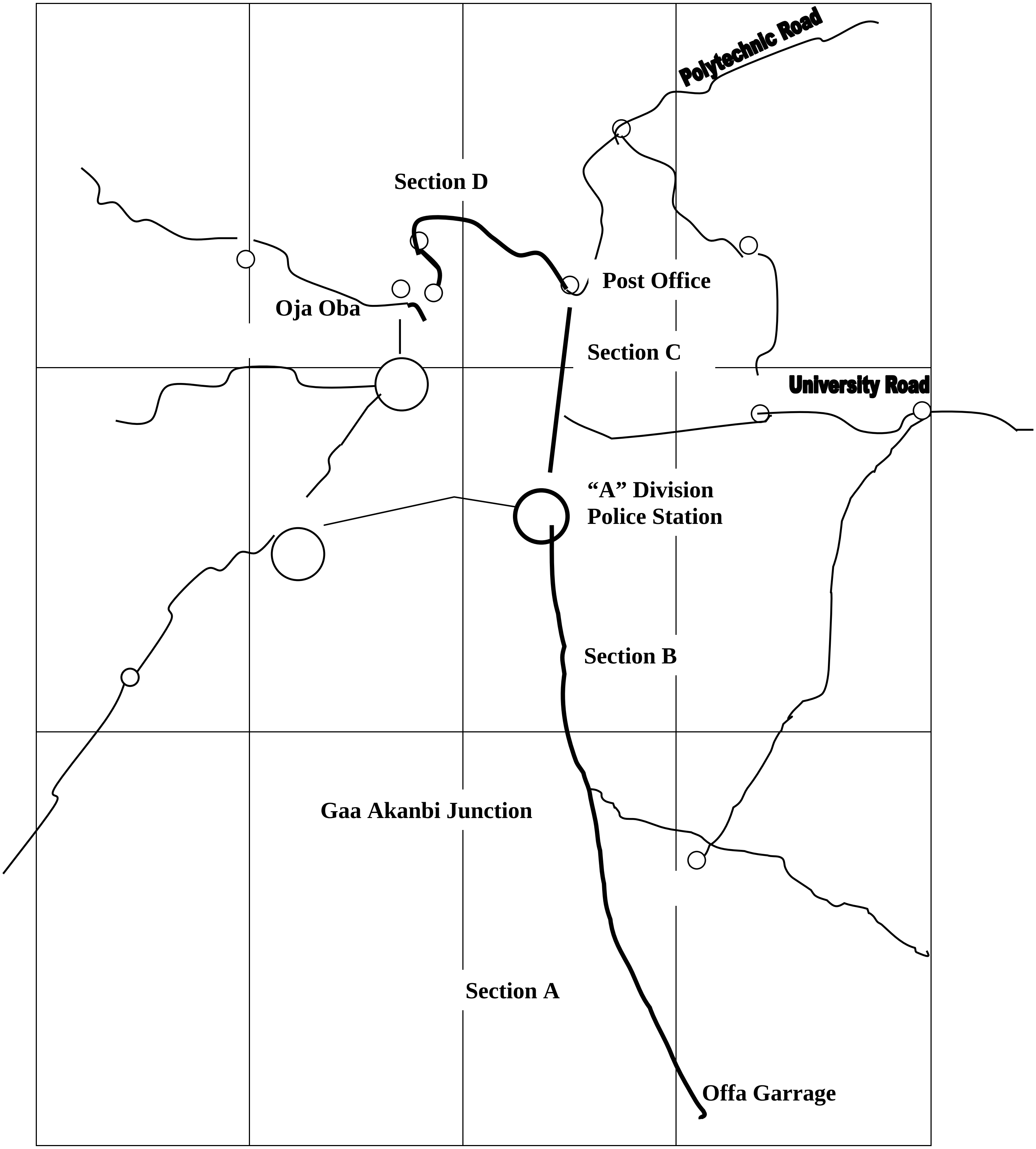

Figure 1: Geographical Presentation of Study Area

Table 1: Geometric Characteristics of the studied Arterial

Section	A	B	C	D
Length (km)	2.3	1.5	0.9	2.4
Overall width (m)	20.8	29.2	28.6	19.5
Roadway (m)	8.10	10.7	10.7	7.10
Shoulder (m)	2.3	3.0	2.70	2.20
Median (m)	1.8	1.8	1.8	1.5
Number of lanes	2	3/2	3/2	2/2
Number of intersections	11	9	5	15
Number of traffic controls	1	-	1	1

Table 2: Traffic Lull Periods on the Arterial

	Section A		**Section B**		**Section C**		**Section D**	
	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon
Monday	7-8am	6-7pm	7-8am	6-7pm	7-8am	6-7pm	10-11am	6-7pm
Tuesday	7-8am	6-7pm	7-8am	6-7pm	7-8am	6-7pm	7-8am	6-7pm
Thursday	11-12noon	1-2pm	7-8am	1-2pm	7-8am	3-4pm	7-8am	6-7pm
Friday	7-8am	5-6pm	7-8am	12-1pm	7-8am	6-7pm	10-11am	6-7pm
Saturday	7-8am	6-7pm	7-8am	12-1pm	7-8am	6-7pm	7-8am	6-7pm

2. Free Flow Speed Data and Factors

The free flow speed measurement data was carried out simultaneously with drivers' attributes data collection using the in–vehicle method at pre-determined lull periods with two observers. Forty (40) test vehicles were selected ensuring that the two predominant passenger commuting vehicles (taxis) and small buses ("turo–turo") on the township roads were sampled. Observer (1) noted the instantaneous speeds (the speedometer reading) at three spots, approximately third portion along the length of each section of the arterial, while simultaneously observer (2) recorded the numbers of parked vehicles along the roadsides and passenger occupancy of the test car. Thereafter both observers interviewed the drivers to obtain the relevant information about respective attributes of age, sex, vehicle age and condition and pavement condition. A category analysis of the mean speed with the various parameters or factors was carried out. A summary of the free flow speed with respect to various factors for section A is presented in the Appendix.

RESULTS

1 Free Flow Factors Relationship

Table 3 presents the matrix of the relationship between the average free flow speed and the driver's age for the four sections and subjected to further analysis. For instance, the average free flow speed for cars driving along section A and driven by drivers within the age range of 60 – 69 years is (61.7 + 66.7 + 60.0)/3 which equals 62.8km/h. The average free flow speeds for the other three sections under consideration were similarly found for each age range and summarized in Table 4. These average values were then plotted against their corresponding ages as shown in Figure 2 whose slope was computed to be 0.46 km/hr/yr.

Table 3: Matrix of Free Flow Speed against Driver's Age

Driver's Age	Section A	Section B	Section C	Section D
20-29	1, 8, 10, 11, 19 21, 30, 33, 35, 44, 46, 48	1, 2, 7, 8, 20, 32, 33, 36, 42, 43, 44	7, 8, 11, 14, 19, 22, 25, 26, 27, 34, 40, 42, 48, 49	9, 17, 21, 27, 32, 38, 39, 41, 49
30-39	2, 3, 5, 7, 9, 12, 18, 20, 24, 31, 32, 34, 36, 37, 41, 42, 45, 37	3, 4, 5, 6, 9, 10, 11, 16, 17, 19, 23, 24, 25, 29, 31, 37, 38, 45, 48, 49, 50	1, 2, 3, 9, 15, 17, 18, 23, 32, 35, 36, 41, 43, 44, 50	4, 8, 11, 12, 13, 14, 16, 19, 20, 22, 26, 33, 40, 44, 48
40-49	4, 6, 13, 14, 16, 17, 22, 23, 27, 28, 38, 40, 49, 50	12, 14, 18, 21, 22, 26, 27, 28, 30, 39, 40, 41, 46, 47	6, 10, 12, 13, 16, 21, 24, 28, 29, 31, 37, 45, 47	1, 5, 6, 7, 10, 18, 23, 25, 29, 30, 31, 34, 36, 42, 43, 45, 46, 47, 50
50-59	15, 25, 39	13, 15, 35	4, 5, 20, 33, 38, 39, 46	2, 15, 24, 28, 36, 37
60-69	26, 29, 43	34	30	3

Table 4**:** Average Free Flow Speed – Driver's Age

Driver's Age	Section A	Section B	Section C	Section D
20-29	77.9	78.9	74.3	64.4
30-39	73.1	75.9	67.9	59.8
40-49	73.3	77.9	77.0	55.9
50-59	52.8	66.1	68.6	52.5
60-69	62.8	46.7	46.7	48.3

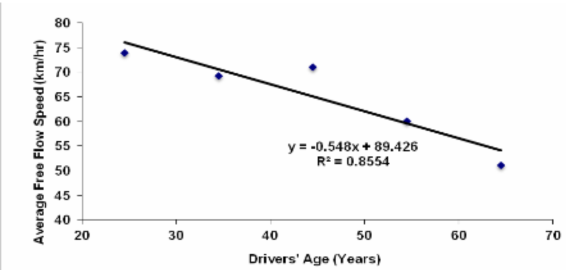

Figure 2: Graph showing Relationship between Average Free Flow Speed and Drivers' Age

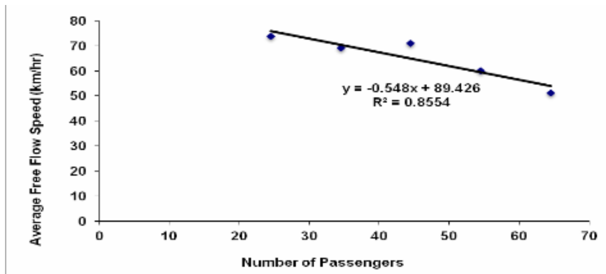

Fig. 3. Graph showing Relationship Between Average Free Flow Speed and Number of Passengers in the Car

Table 5: Average Free Flow Speed – Number of Passengers in Cars Relationship

No of Passengers	Section A	Section B	Section C	Section D	Average free flow speed
2	76.5	71.8	66.8	52.6	66.9
3	74.1	71.3	71.7	56.5	68.4
4	67.9	75.5	71.5	60.2	68.8
5	62.2	82.5	71.7	61.0	69.4
6	71.3	80.8	81.6	66.0	75.0

This procedure was repeated for the other factors of j number of passengers in the car, car age and number of parked cars along roadsides with corresponding results as represented in Tables 5, 6 and 7. The results were correspondingly displayed in Figures 3, 4 and 5. From the graph of average flow speed against number of passengers in car as shown in Fig. 3, the slope value in km/hr/passenger is -0.548. From the graph of average free flow speed against car age shown in Figure 4, the slope in km/hr/yr of age of car is -1.59. The graph of average free flow speed against number of parked cars is shown in Figure 5. The relationship is of quadratic form with peak at about 25 parked cars.

Table 6: Average Free Flow Speed – Car Age Relationship

Car Age	Section A	Section B	Section C	Section D	Average urban arterial free flow speed (AUAS)
1-2	77.1	80.5	77.0	57.4	73.0
3-4	73.0	77.2	70.5	56.5	69.3
5-6	62.0	77.1	67.2	62.3	67.2
7-8	53.3	69.3	72.7	48.3	60.9
9-10	54.2	58.4	66.7	65.9	61.3

Table 7: Average Free Flow Speed – Number of parked Cars Relationship

Number of parked Cars	Section A	Section B	Section C	Section D	Average urban arterial free flow speed (AUAS)
10-19	73.6	74.2	76.4	-	56.1
20-29	69.8	83.0	73.0	61.7	71.9
30-39	76.3	72.5	65.2	59.0	68.3
40-49	67.5	-	66.7	56.5	47.7
50-59	-	-	-	52.7	13.2

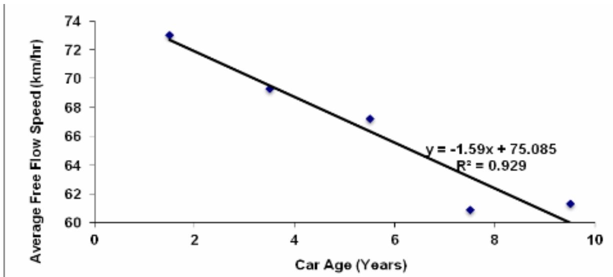

Figure 4: Graph showing Relationship Between Average Free Flow Speed and Car Age

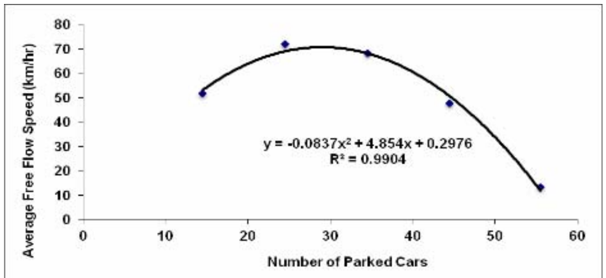

Figure 5: Graph showing Relationship Between Average Free Flow Speed and Number of Parked Cars

2. Free Flow Speed – Environmental Factor Relationship

The mean free flow speed was calculated respectively for dry and wet pavement conditions for the four different sections. Table 8 presents the summary of statistic data (mean and standard deviation) for section A while Table 9 is the corresponding summarized true speed at 95% upper confidence level (mean + 1.96 x standard error). There was a reduction of 0.5km/hr to 14.0km/hr on the road due to the wet condition which approximates to percentage reduction of 0.9% to 21.0%. The corresponding values based on time means at 95% confidence levels were 1.7km/hr to 9.98km/hr.

3 Free Flow Speed and Road Geometry/Condition

Table 10 shows the summary of average free flow speed and geometric condition at each section of the road. The graph of average free flow speed against each of the road geometry i.e. road width, number of lanes, shoulder width, number of intersections, travel way width and number of traffic control units are shown in Figures 6-11. These outcomes can form the basis of adjustment factors for the free flow speed of traffic stream on an urban arterial. For instance, a road width of 8metres or more will not attract any reduction in operating value but lower widths will attract at a unit rate of 17km/hr or less. The corresponding values for the different factors are summarized in Table 11.

Table 8: Mean Free Flow Speed Statistics (mean + standard deviation) (km/hr)

Section	A	B	C	D
Wet condition	73.8±11.10	66.8±14.99	71.1±10.72	57.5 ±6.10
Dry condition	72.0±12.00	80.8±7.18	74.2±5.00	58.0 ±7.76
Reduction (km/hr)	1.8	14.0	3.1	0.5
% Reduction	2.2	21.0	4.2	0.87

Table 9: True Free Flow Speed/pavement Condition Relationship

Section / Pavement Condition	Section A	Section B	Section C	Section D	Average Free Flow Speed (km/h)
Wet	78.44	73.32	74.75	60.05	71.64
Dry	76.37	83.30	76.44	60.85	74.24

Percentage reduction in free flow speed on wet pavement
=100(74.24 – 71.64)/74.24 = 3.5%

Table10: Summary of Free Flow Speed – Road Geometry Relationship

	Road width (m)	Shoulder with (m)	Number of lanes	Travel road width	Number of intersection	Number of traffic control unit	Mean free flow speed (km/h)
Section A	8.10	2.3	2	20.8	11	1	75.31
Section B	10.7	3.0	3	29.2	9	-	75.5
Section C	10.7	2.7	3	28.6	5	1	73.7
Section D	7.1	2.2	1	19.5	15	1	59.0

Table 11: Quantitative Measure of Geometric Effect on Free Flow Speed

S/No.	Factor	Unit	Critical value	Rate of reduction (km/hr/unit)
1	Road width	m	8	17.0
2	No. of Lanes	No.	2	15.0
3	Shoulder width	m	1.2	0.5
4	No. of intersections	No.	4	0.5
5	Overall roadway	M	20	17.0
6	No. of control Units	No.	1	-

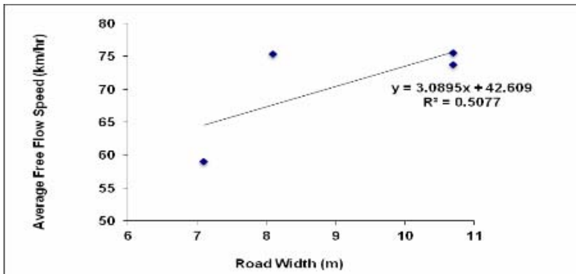

Figure 6: Graph of Average Free Flow Speed against Road Width

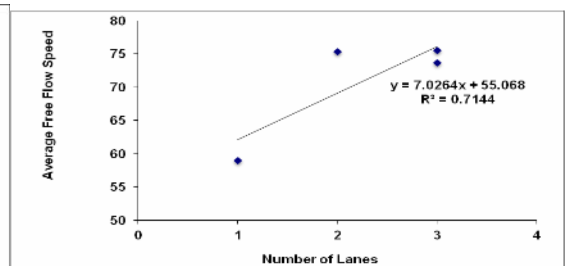

Figure 7: Graph of Average Free Flow Speed against Number of Lanes

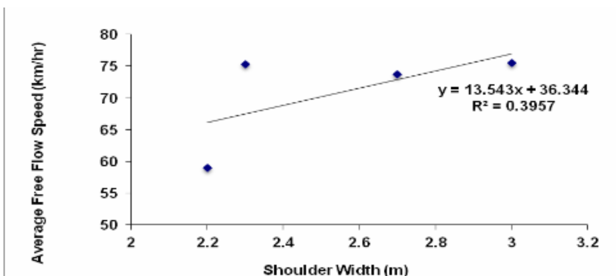

Figure 8: Graph of Average Free Flow Speed against Shoulder Width

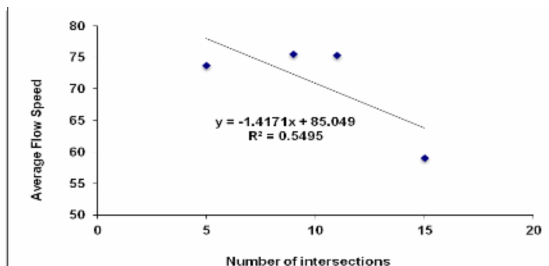

Figure 9: Graph of Average Free Flow Speed against Number of Intersections

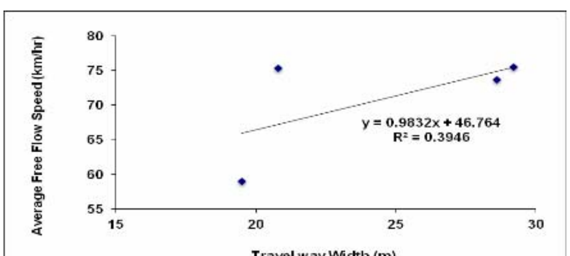

Figure 10: Graph of Average Free Flow Speed against Travel Way Width

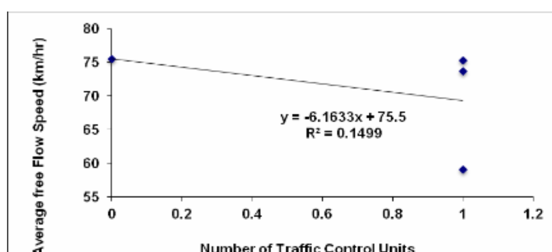

Figure 11: Graph of Average Free Flow Speed against Number of Traffic Control Units

DISCUSSIONS

As can be observed from Tables 4-11 and the corresponding Figures 2-11, the results of this study established that the drivers' desired speed on an urban arterial are influenced quantitatively by the various factors. For instance, the pavement condition when wet could impact as much as 10-14km/hr or 12-21% reduction in free flow speed; which are relatively higher than the reported 10km/hr for rains and 8% for wet pavement for other countries. This observation could be explained by many reasons, among which include the general state of pavement condition (various degrees of failures - potholes, edge breaks etc.), driver's age and state of mind, roadside land-use and density, businesses and parking. The variation in free flow speed values (66.8, 71.1 and 57.5km/hr (wet) and 80.8, 74.2 and 58.0km/hr (dry)) for the different sections, especially B (with exception of section A) even attested to this deduction. Their corresponding coefficient of variation (CV = 100xSD/mean) of 22.4%, 15.1% and 10.6% for wet and 8.9%, 6.7% and 13.9% for dry show a reasonable consistency of the vehicles movement and by implication the behaviour of the drivers on the arterial. The better performances of the drivers during dry weather clearly show the influence. However, the results for section A showed otherwise which is absolutely a negation of the common logic.

However, it could still be explained by the fact that this section, being the only undivided portion allows the drivers more latitude to demonstrate their personal attribute and desire at overtaking and perform other movement manouvres. The simple principle for car following theory with which traffic stream flow operations are analyzed can easily breakdown. An organized movement is more probable on the divided arterial because the interactions with on-coming vehicles have been completely eliminated. It is at the intersections that it may manifest and will involve only for the left turning vehicles. Even, the highest values obtained for this section during the wet period is still more suspect. Another reason is that it is a sub-urban and hence the operating free flow speed should be close to that of the freeway. This is even more probable because the coefficient of variation for the two pavement conditions is 15% and 16.7% implying a good consistency of the data and person-machine control-road response system. The instantaneous speed is the most discerning indication of the overall duration for the performance of all the necessary activities for safe driving on a road.

Table 4 clearly shows the influence of drivers' age on free flow speeds. Their quantitative measures are averagely in the range of 0.36 and 0.68km/hr. As expected, the younger drivers operate on higher speeds than the older ones and it is consistent for all the sections. However, an interesting observation is noted for the drivers of age 40-49years. The drivers in the group operate on a speed same with or atimes higher than those in the 20-29 age brackets. This can be explained by their probable better understanding of the roads due to long time of driving coupled with their energy. As drivers grow older, such energy decreases in obedience to the law of nature – older bones get weaker and hence fewer propensities for higher work rate. Driving age in Nigeria commences from 18years while there is no official terminal age. It depends on how the body can cope. An equally relevant and related factor is the age of the vehicles. It is definite that age of the vehicle impact negatively on the performance of the road. The quantitative measurements are 1.30, 2.86 and 1.3625km/hr/year age of vehicle; with an average of 2.07km/hr/yr unit reduction factor. The reasons for this are obvious. The performance of vehicles decreases as they age and it is at old age they are converted to transportation operations. Both vehicles and drivers have their respective lifespans.

Another factor is the level of passenger occupancy of the vehicles. The speeds are averagely higher as the passenger capacity for each vehicle is being met. The measure of this effect was estimated for sections B, C and D to be in the range of 2.46-2.73km/hr/passenger. Table 5 and Figure 3 show that for section A (undivided), there is a reduction in speed because the occupants of a vehicle fast arriving from a non-urban journey shall be alighting at their destinations. This implies that the only activity predominating in the mind of the driver is how to reach the destination and return for more passengers. The usual stops to either drop or pick a passenger no longer exist. The various effect of the road geometry is succinctly summarized in Table 11. The critical values and the unit values reasonably agree with applicable modifications to various operational parameters for traffic stream analysis. The carriageway width of 8.0m, number of lanes of 2 and shoulder width of 1.4m are reasonable as they compare with standards. The same applies to other factors.

CONCLUSIONS

The following conclusions were reached from the study.

1. The traffic volume distribution on an urban arterial in Ilorin is trimodal with morning, noon and evening peaks and lulls in between.

2. The changes in the road geometry on each section of the arterial in terms of shoulder width, number of lanes, road/carriageway width and distance of nearest obstruction to the edge of the road do affect the instantaneous speeds. The corresponding numerical values of these factors on the Offa Garage-Emir's Road are about 0.5, 15, 27 and17km/hr for sections A, B and C respectively.

3. Different free flow speeds operate on distinct sections of the arterial. Respectively, the values are 72.0, 80.8, 74.2 and 58.0km/hr for section A, B, C and D when the pavement is dry, but correspondingly for wet conditions they are 73.9, 66.8, 71.1 and 57.5km/hr. Section B (Gaa Akanbi junction to "A" Division) has the highest average free flow speed while Section D (Post Office to Oja-Oba) has the lowest average free flow speed. The density

or level of usage reflects the deteriorating values along the routes.

4. A linear relationship exists between free flow speed of commuter vehicles and drivers' age, number of passengers in the car and car age with following respective rates of (a) decrease of 0.46km/hr/yr of driver's age, (b) an increase of 0.53km/hr per passenger in the car, (c) a decrease of 1.48 km/hr/yr of age of car.

5. A linear relationship does not exist between free flow speed and road side parking situation due to other prevailing factors.

6. The average free flow speed of commercial saloon cars is lower on wet pavement than on dry pavement, the percentage reduction being about 12%.

7. There are variations in free flow speed with changes in road geometry and characteristics.

RECOMMENDATIONS

The estimates of the various factor modification parameters obtained from this study can be used in urban road highway planning and analysis on Offa Garrage-Emir's road and other Nigerian roads with similar characteristics with the Ilorin transportation system evolution. The free flow speed modifications can be applied in the analysis and design of Ilorin urban arterial. This study should be conducted on arterials in other towns in Nigeria so that a national operational data base value could be established.

AKNOWLEDGEMENTS

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APPENDIX

Free Flow Speed Data in Respect of Various Factors for Section A

S/NO	Speed 1 (Km/h)	Speed 2 (Km/h)	Speed 3 (Km/h)	Average Speed (km/h)	DA	DS	NPIC	PC	CA	NPC
1	75	80	90	81.6	29	M	4	DRY	1	15
2	65	70	55	63.3	35	M	2	DRY	3	18
3	85	65	70	73.3	43	M	4	DRY	1	10
4	80	80	85	82.6	47	M	6	DRY	2	14
5	70	85	65	73.3	35	M	3	DRY	1	22
6	75	70	80	75.0	40	M	2	DRY	2	16
7	60	60	80	66.7	32	M	2	DRY	2	19
8	70	65	80	71.6	28	M	3	DRY	1	21
9	80	70	85	78.3	30	M	2	DRY	1	17
10	70	85	65	73.3	29	M	2	DRY	3	24
11	85	70	75	76.7	24	M	4	DRY	4	12
12	90	60	90	80.0	39	M	2	DRY	2	30
13	70	60	50	60.0	43	M	6	DRY	1	18
14	65	65	70	66.7	45	M	4	DRY	4	15
15	40	50	50	46.7	58	M	6	DRY	9	26
16	55	70	85	70.0	42	M	2	DRY	1	14
17	80	75	50	68.3	48	M	5	DRY	2	16
18	65	50	40	51.7	32	M	5	DRY	5	20
19	75	80	70	75.0	28	M	4	DRY	1	29
20	90	90	95	91.7	31	M	3	DRY	1	18
21	100	80	80	86.7	26	M	3	DRY	2	15
22	80	55	40	58.3	43	M	4	DRY	4	25
23	95	100	90	95.0	47	M	2	DRY	3	32
24	75	75	80	76.7	38	M	3	DRY	6	16
25	55	45	50	50.0	54	M	4	DRY	5	37
26	70	55	60	61.7	62	M	3	DRY	9	29
27	80	80	85	81.7	41	M	3	DRY	6	16
28	90	70	65	75.0	40	M	2	DRY	4	19
29	60	70	70	66.7	60	M	5	WET	2	17
30	70	75	90	78.3	28	M	3	WET	3	20
31	65	70	75	70.0	33	M	3	WET	3	15
32	75	65	65	68.3	37	M	4	WET	4	17
33	80	85	80	81.6	29	M	6	WET	3	13
34	85	85	100	90.0	36	M	2	WET	2	12
35	90	70	60	73.3	24	M	3	WET	3	17
36	65	85	90	80.0	28	M	2	WET	4	25
37	60	50	70	60.0	34	M	3	WET	3	17
38	45	60	55	53.3	48	M	3	WET	7	19
39	55	70	60	61.7	53	M	4	WET	4	21
40	80	90	90	86.7	42	M	6	WET	2	20

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