



TRAFFIC FLOW INTO LAFIA METROPOLIS, NASAWARA STATE, NIGERIA.

Mailafiya Benjamin Yusuf^{1*}, Adamu A. Y.², Sule E.³, and Musa D. Bala.⁴

¹⁻⁴Road Research Department, Nigerian Building and Road Research Institute (NBBRI).

*Corresponding Author's Email: benjaminmailafiya@gmail.com

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ABSTRACT: *This study quantified the vehicular flow into Lafia metropolis, a key commercial corridor linking northern and eastern Nigeria. Traffic-counting devices were deployed on the Makurdi-Lafia, Shendam-Lafia, and Akwanga-Lafia highways for one week. The collected data were analyzed to obtain vehicle volumes, class distributions, and speed statistics at these entry points. Results indicate that Akwanga-Lafia recorded the highest total vehicles (110,161), followed by Makurdi-Lafia (83,731) and Shendam-Lafia (55,995). Makurdi-Lafia also exhibited the highest recorded speed (156.8 km/h). Notably, a significant percentage of medium and heavy vehicles exceeded their posted speed limits, likely due to their lower PSL values. These findings highlight specific high-volume and high-speed corridors where traffic management and enforcement should be intensified. The study fulfills its aim by providing evidence-based insights for improving road safety in Lafia.*

KEYWORDS: Vehicular speed; traffic volume; speed distribution; Lafia metropolis.



INTRODUCTION

Metropolitan areas are rapidly increasing in population and traffic volume since the last few decades. And also, there has been rapid increase in vehicles on the urban roads (Badveeti et al, 2020). The increase in the volume of vehicles also comes with its down side which is increase in road traffic clashes. Road Traffic Crash (RTC) is a global concern which is considered to be the 12th cause of death for all age ranges (WHO, 2023). The global burden of deaths and injuries from road traffic crashes was recognized, and the United Nations General Assembly adopted resolution A/RES/64/255 in 2010, proclaiming 2011-2020 as the Decade of Action for Road Safety, with the goal to stabilize and then reduce road traffic fatalities (United Nations, 2010). And by 2015, it was decided to include road safety in the 2030 Agenda for Sustainable Development, with Sustainable Development Goals (SDG) target 3.6, which aims to halve deaths and injuries from Road Traffic Crashes (The Global Goals, 2015). In the African region, road traffic crash injuries have been high, and at 2021, an estimate of about 225,482 deaths has occurred. The African region accounts for 19% of global deaths, despite accounting for only 15% of global population and having merely 3% of the global vehicle fleet (WHO, 2023). Road Traffic Crash (RTC) has become one of the leading causes of deaths in Nigeria and the world. Several publications such as Ajijah (2017) and PRS RTC Report (2017) have clearly attributed the incessant road crashes in Nigeria to the influence of driving speed among other factors such as: bad roads, mechanical failure of vehicles etc. Hence this study seeks to isolate the contribution of over speeding and vehicle volume to these statistics and proffer tangible solutions to the challenge.

The study was carried out within Lafia metropolis of Nasarawa State. Lafia town has significant vehicular activities being the linking route from Abuja and most Northern States to the Eastern States via Makurdi. This cannot be unrelated to commercial activities within the states. The volume of heavy vehicular activities within the metropolis also poses a huge challenge in designing and constructing safe roads for driving at unregulated speed limits.

Therefore, this study assessed the distribution of driving speeds at different locations of the metropolis at day-time and night-time. Then attempt to identify all the possible speed trends with respect to the set study variables and make suitable recommendations.

Over speeding has been listed as one of the major causes of accidents by the World Health Organization. A common saying has it that; speed thrills but kills. And also, a call to be careful while driving: over speeding leads to loss of control, and when crashes occur, lives are lost (vanguardngr.com visited on 12/03/2022). Speeds of vehicles have been widely acknowledged as one of the key factors that determine safety of roads globally (Oluwasegun et al, 2023). Vehicle classification plays a critical part in decision making in traffic control and administration (Myreen et al, 2015). According to the Nigerian Bureau of Statistics, for every twenty-four (24) hours, no fewer than two lives are lost on Nigerian roads due to road crashes; and every year more than 20,000 vehicles are involved in accidents. In addition to the statistics on death and injuries; highway-related crashes result in immeasurable pain and suffering, billions of dollars in medical expenses and loss of productivity (Siyan, Oyeyemi and Agunbiade, 2019).



In the regulation of road vehicle speed, most countries impose speed limits which are very important in checking the speeds of different vehicles on different roads at different times; thereby increasing and enhancing safety on the roads. Notwithstanding these speed limits are constantly being violated by road users either intentionally or out of sheer ignorance.

It is a globally acceptable practice that the establishment of suitable speed limits should be based on the correct technical assessments of the unique situations on each road such as congestion, traffic mix etc. Then the established speed limits should clearly inform road users of maximum driving speeds under favourable conditions which safety institutions consider reasonable and safe for a highway section (FHWA, 1998). Research on roads are motivated strongly by Significant increase in number of vehicles, increase in population density and as well as urbanization (Muhammad and Shakeel, 2024)

Aim and Objectives

The aim of this study is to determine the traffic flow into the metropolis through the highways leading into Lafia metropolis with the view to mitigate the factors that influence road crashes through the following objectives:

1. To determine the vehicular volume into Lafia metropolis
2. To determine the speed distribution of vehicles into the metropolis.

METHODS

The study was conducted on the three major highways entering Lafia metropolis: (a) Makurdi–Lafia, (b) Shendam–Lafia, and (c) Akwanga–Lafia. An automatic pneumatic tube traffic counter (MetroCount Traffic Executive) was used to collect data. The device was installed on each highway for seven continuous days in April 2023. Installation sites were chosen to avoid distortions (far from intersections, parking areas, hills, or curves).

The equipment and setup included:

- i. **Automatic Traffic Counter (MetroCount)** – for detecting and classifying axles.
- ii. **Pneumatic tubes** – laid across the road, 2 m apart, connected to the roadside unit, using asphalt nails and flashband for fixation.
- iii. **Roadside unit** – concealed 4 m from pavement.
- iv. **Additional gear** – cones, reflective vests, measuring tape, nails, markers, notebook, and safety boots for the team.

Coordinates of the sites (near FRSC command on Makurdi-Lafia; near ITF office on Shendam-Lafia; near Govt. Sec. School Ombi on Akwanga-Lafia) were recorded as 08° 30' 95", E 8° 33' 39.6, N 80° 30' 28.74", E 80° 33' 2.12 and N 8° 32' 31.30", E 8° 31' 56.82 respectively. The posted speed

limit on all roads, as per FRSC Lafia, was 80 km/h for cars (with 45 km/h for heavy vehicles). The traffic counter recorded vehicle counts, classifications (Light, Medium, Heavy), and speeds.

Data from the week-long counts were downloaded and processed using the MetroCount software with the ARX classification scheme. We computed daily total vehicles, aggregate weekly volumes, and speed statistics (maximum, minimum, mean, 85th and 95th percentile speeds, and percent exceeding the speed limit) for each road and vehicle class. Descriptive statistics were used to summarize the results.



Figure 4: Team members with the FRSC after installation



Figure 3: Installation of Pneumatic tubes

RESULTS/FINDINGS

Vehicular Volume: Table 1 (below) summarizes the total vehicle counts by road and by day. Akwanga–Lafia was found to be the busiest route, with a total of 110,161 vehicles in the week. Makurdi–Lafia had 83,731 vehicles, and Shendam–Lafia had 55,995. The aggregate weekly total was 249,887 vehicles.

- i. **Daily Patterns:** All roads showed higher traffic on weekdays than weekends. On Akwanga–Lafia, Friday and Saturday had the highest daily counts (16,540 and 15,499), whereas Shendam–Lafia had the lowest weekday counts (around 8,000) and dropped to 5,787 on Sunday.
- ii. **Weekly Total:** The total count on Akwanga–Lafia (110,161) exceeded that on Makurdi–Lafia (83,731) and Shendam–Lafia (55,995). Akwanga–Lafia accounted for 43.9% of the total vehicles, reflecting its role as a major commercial route.

Speed Distribution: Table 2 (below) presents speed statistics for each road. Key results include:

- i. **Maximum Speeds:** The highest observed speed was 156.8 km/h on Makurdi–Lafia. Akwanga–Lafia had a max of 133.5 km/h, and Shendam–Lafia 124.6 km/h.



- ii. **85th Percentile Speeds:** The 85th percentile speed (the speed under which 85% of traffic falls) was 77.0 km/h on Makurdi–Lafia, 61.6 km/h on Shendam–Lafia, and 75.4 km/h on Akwanga–Lafia.
- iii. **Mean Speeds:** Mean speeds were 50.0 km/h, 42.1 km/h, and 48.0 km/h, respectively.
- iv. **Percent > PSL:** On Makurdi–Lafia, 3.57% of vehicles (aggregate) exceeded 80 km/h. On Shendam–Lafia and Akwanga–Lafia, these figures were 0.49% and 2.60%. Notably, when broken down by vehicle class, medium and heavy vehicles had much higher rates of exceeding their lower PSL (45 km/h). For example, 51.3% of medium vehicles on Makurdi–Lafia exceeded 45 km/h, and 51.9% of heavy vehicles exceeded 45 km/h (Table 2).

These findings highlight both road usage and compliance issues. Akwanga–Lafia’s high volume suggests congestion risks, while Makurdi–Lafia’s high speeds indicate over-speeding risks.

Table 1: Vehicular Volume into Lafia Metropolis

DAYS ROAD	Mon	Tues	Wed	Thurs	Fri	Sat	Sun	T. A.	T. V.	V.P (%)
Makurdi-Lafia	11836	12781	10974	13168	13437	11086	10334	84888	83731	98.64
Shendam-Lafia	8183	8951	8497	8724	8472	7381	5787	56741	55995	98.69
Akwanga-Lafia	16888	16825	14527	16540	15019	15499	14864	112242	110161	98.15
TOTAL	36907	38557	33998	38432	36928	33966	30985	253871	249887	98.43

Where,

T.A.=Total Activities

T.V.=Total Vehicles

V.P.=Vehicle Percentage (%)

**Table 2:** Speed Distribution OF Vehicles into The Metropolis

	Max.	Min.	Mean	85%	95%	PSL	%>PSL	Aggregate
Makurdi-Lafia	156.80	10.10	50.00	65.34	77.04	80	3.57	Light
Shendam-Lafia	124.60	10.2	42.10	52.38	61.56	80	0.49	
Akwanga-Lafia	133.50	10.10	48.00	64.44	75.42	80	2.60	
Makurdi-Lafia	65.00	13.10	45.60	55.98	61.20	45	51.29	Medium
Shendam-Lafia	65.00	10.80	43.50	54.90	60.66	45	42.53	
Akwanga-Lafia	65.00	10.80	43.60	55.62	60.84	45	43.00	
Makurdi-Lafia	60.00	21.00	45.30	52.92	56.88	45	51.90	Heavy
Shendam-Lafia	60.00	15.80	40.00	48.60	54.00	45	26.96	
Akwanga-Lafia	59.90	11.90	44.90	54.00	57.42	45	50.98	

DISCUSSION

The traffic counts reveal distinct patterns on the three highways. Akwanga–Lafia has the highest volume, likely due to it serving as a main artery for goods and commuters between central Nigeria and Lafia. Its daily traffic consistently exceeded that of the other roads. In contrast, Shendam–Lafia had the lowest counts, possibly reflecting less economic or population centers along that route. Makurdi–Lafia’s volume was intermediate.

Speed analysis indicates that Makurdi–Lafia is a corridor of concern for speeding. The maximum and 95th percentile speeds were highest here (156.8 km/h and 77.0 km/h), suggesting that a small fraction of driver are traveling very fast. In contrast, mean speeds are similar across the roads (42–50 km/h), indicating that most traffic moves at moderate speeds, but the high-end outliers are notable on Makurdi–Lafia.

Medium and heavy trucks show particularly high rates of exceeding their 45 km/h limits on Makurdi–Lafia: over half of these vehicles exceeded 45 km/h. This is likely because Makurdi–Lafia may be designed for higher speeds, and drivers naturally travel faster despite the lower heavy-vehicle limit. Heavy vehicles on Shendam had a much lower violation rate (26.96%), possibly due to less opportunity for speeding or different enforcement.



These findings are consistent with previous studies. For example, Oluwasegun et al. (2023) noted that lower posted speed limits for heavy vehicles tend to result in higher apparent violation percentages when those vehicles use highways with higher free-flow speeds. Similarly, Maude et al. (2022) reported high traffic volumes on the Makurdi corridor, supporting our observation that Makurdi–Lafia carries significant traffic. The high volume on Akwanga–Lafia suggests it should be prioritized for infrastructure improvements, while the high speeds on Makurdi–Lafia call for stronger enforcement or adjusted speed limits.

Overall, the data show that traffic flow into Lafia is substantial and that speeding is a real issue on at least one major route. The figures will allow traffic engineers and policymakers to target interventions where they are most needed.

IMPLICATIONS TO RESEARCH AND PRACTICE

This study provides a quantitative basis for traffic management in Lafia. For practitioners, the identification of Akwanga–Lafia as the busiest route suggests that road maintenance, capacity expansion, or traffic calming measures may be most beneficial there. The data indicate that Makurdi–Lafia is a hotspot for speeding; thus, authorities (e.g. FRSC) might consider installing speed cameras or increasing patrols on this corridor. The high violation rates for medium and heavy vehicles imply the need for focused enforcement of heavy-vehicle speed limits, perhaps through weigh stations or checkpoints.

For researchers, the results highlight the value of detailed traffic monitoring in informing safety strategies. The methodology demonstrated here can be applied to other Nigerian cities to build a broader understanding of highway usage patterns. Future studies could link these traffic volumes with crash data to model risk exposure. Additionally, the distinct speed profiles by vehicle class suggest further investigation into how mixed-traffic dynamics affect compliance and safety.

CONCLUSION

This study successfully measured and analyzed the flow of vehicles into Lafia metropolis. The main findings are that Akwanga–Lafia is the busiest entry point, carrying over 110,000 vehicles per week, and that Makurdi–Lafia exhibits the highest vehicle speeds, with some drivers reaching nearly 157 km/h. These results confirm that the study objectives were met, providing evidence-based insight into traffic volumes and speed patterns. The high traffic on Akwanga–Lafia and the speeding on Makurdi–Lafia have direct implications for safety and infrastructure planning. By quantifying these flows, the study contributes valuable data to support traffic planning and road safety efforts in Nasarawa State.



FUTURE RESEARCH

Further research should expand this work temporally and spatially. Longitudinal monitoring could capture seasonal or yearly changes in traffic flow. Including additional entry points or secondary roads could provide a more complete traffic profile of Lafia. Integrating crash statistics would allow direct assessment of how traffic volume and speed correlate with incidents, enabling predictive safety models. Finally, studies on driver behavior (e.g. reasons for speeding) and the effectiveness of specific countermeasures (speed limit changes, enforcement strategies) would complement this traffic flow analysis.

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