Feasibity Studies of the Behaviour of Tricycle Operators at A Given Signalised Intersections in Kano Metropolis: Case Study of Tal'udu and Gwammaja.

BAITI AKILU BOYI[1], NURUDEEN YUSUF[2], KABIRU SAMAILA[3]
[1] *Civil Engineering Department, Waziri Umaru Federal Polytechnic, Birnin Kebbi, Kebbi State*
[2, 3] *Civil Engineering Department, Usmanu Danfodiyo University, Sokoto, Sokoto State*

Abstract- ***Traffic control signals offer advantages for regulating traffic at signalized intersections, but may cause problems if they are not heeded to by the road users. Non-compliance of traffic signals may increase intersection delay, road crash frequency, red light violation, fuel consumption and vehicle operating cost; and might encourage the use of alternative routes. Traffic analysis and forecasting becomes irrelevant if road users do not comply with the traffic regulations. This study investigates tricycle operators behavioral pattern or compliance rate at signalized intersections. Field observations were conducted at two signalized intersections located in Kano Metropolis, Nigeria. The results showed that, out of a total of sampled 2926 tricycle operators who had a chance for violation, 1017 (34.76%) drivers ran red lights, 56 (2.0%) drivers were using mobile phone/earpiece while operating, 578 (19.75%) drivers practicing overloading, 329(11.24%) drivers picking/ dropping passengers at intersection, 36 (1.23%) drivers smoking while operating, 32 (1.10%) Trafficator failure/miss-information and only 878 (30%) drivers come to complete stop at red and comply with all the traffic regulations. It was observed that tricycle drivers have high tendency for running red lights. Bar charts were drawn to show the relationship between the variables observed. The study also reveals that most of the signalized intersections are not well coordinated. This study advocates for strategies, policies and measures that would control, enforce and regulate the behaviors of tricycle operators at signalized intersections by relevant government agencies such as the Federal Road Safety Commission, Nigeria Police and the Department of Road Traffic Services.***

Indexed Terms- ***Driver, Red Light Violation, Traffic Signal, Traffic Volume***

I. INTRODUCTION

The transport system in any nation is determined by the socio-economic and political needs of the society [1]. Whereas the rate of growth in the nation's social and economic sectors far exceeds the provision of transport infrastructure and services. As such, the available resources in the transport sector cannot cope with the increasing movement needs of the people. Since there is a ban, on the use of the motorcycle in some cities at a time there is a rapid increase in urban population, the need for the tricycle as a means of transportation becomes obvious. In most cities in Nigeria, it is such that the city centre is congested with business premises while the fringes are occupied by low- and medium-income earners. Faced with this, commuters are forced to make longer trips on vehicles and trek longer distance of a consecutive estimate of two trips per person. With the above, it is clear that there is impending mobility crisis arising from demand/supply gap [2]. The emergence of various modes of transportation gave rise to tricycles especially in view of its flexibility and the need to cope with socio-economic trends. Most tricycle brands in Nigeria are motorcycles with side cars, which have the legal capacity of 5 passengers including the driver. Tricycles are a popular mode of public transportation among commuters due to their high accessibility, availability, affordability, and convenience. Being much less expensive in fares than other vehicles, they play an important role in Nigeria's overall transportation system. Tricycles are the most convenient transportation in rural areas especially from the central town to the villages. Within big cities, they are usually located in smaller roads, lanes and alleys where other public transportation do not or cannot operate [3].

"However, information on the use of tricycles for public transport in the urban fringe (the location between the city and the rural areas) of Nigerian cities is very scanty. This is due to the fact that tricycles are relatively new and thus little is written about the nature, use and operation of tricycles as a mode of public transport particularly in the peri-urban area [3]. It is as a result of this that the study seeks to assess the operational behavior of tricycle in the peri-urban (urban fringe) of Kano with a view to adding to the few available literature on the operations of tricycles in the country particularly in the peri-urban area [3].

The followings are some of the problems that necessitate the investigation:

The Lack of adequate or effective means of transport, Secondly is the increase in the demand for the transport services to the remote area from alongside the main roads or centers due to poor transport infrastructures and city planning in Nigeria, then tricycle transport plays an important role and has attracted many young and youth aged person into the business [4].

Plate 1: Overloading Practice

Thus, the primary aim of this research is to study tricycle operators' compliance rate at signalized intersections. The study will also provide information needed to examine the effectiveness of traffic control and regulations; as well as the safety at traffic signal lights in Kano metropolis. The study was mainly a fieldwork which includes determination and assessment of some variables such as traffic volume, loading practice, compliance with traffic regulations, traffic lane used, operator's age, vehicle characteristics, conflict involving tricycle, accident involving tricycle. Other traffic variables such as speed, density and headway are out of the scope of this study.

II. MATERIALS AND METHODS

2.1 Materials

The following materials were used for the conduct of the exercise;

Traffic counter, Accessories, Road Sign, Personnel and Data collection forms.

2.2 Methods

Two signalized intersections located in Gwammaja area and Tal'udu area within Kano metropolis were selected for the study. The intersections were chosen such that they were far from regular police enforcement points. Intersections that have police presence were excluded from the analysis because driver behaviour in urban areas would be affected by heavy police presence. Furthermore, the intersections chosen, as much as possible, had level terrain with sufficient sight distance.

Manual Traffic volume survey was initially carried out starting from 7:00am to 7:00pm of the day which approximately makes twelve (12) hours, this was done for the two intersections selected with the aim of determining the peak and off-peak periods, because road users' behavior are governed in respect to the traffic volume condition. There were no zebra crossings or similar markings at the signalized intersections. All intersections studied are located on highways that are essentially dual carriageways. Also, all the signalized facilities are solar powered. This ensures continuous operations even in the face of power outage from the national grid.

Data collected includes the intersections type (cruciform and T), traffic volume, and driver compliance. Intersection type was selected such that one intersection was cruciform-shaped and the other was T-shaped. These criteria were applied in the collection of data for red lights cases where tricycle operators had the choice of respecting or violating the

red light. Tricycles that came afterward during the same cycle were not considered, because they had to stop behind the stopped vehicles and did not have the opportunity of violating the red light. The study areas are shown in Figure 1 and 2.

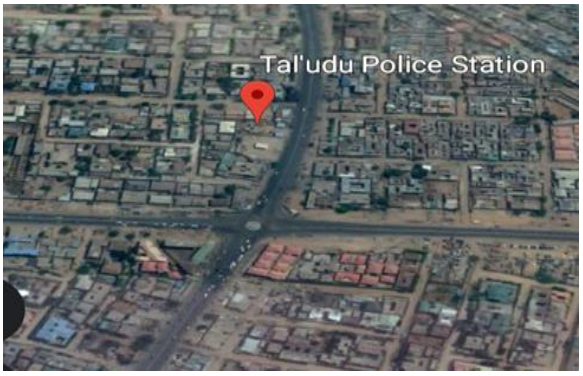

Figure 1: Tal'udu intersection

Figure 2: Gwammaja (Gidan Malam)

III. RESULTS AND DISCUSSION

3.1 Results Presentation

TABLE 1: Traffic volume data for Tal'udu intersection

AVERAGE DATA FOR WHOLE APPROACHES			
TIME(HOURS)	TRICYCLE	MINI BUS/PASSENGER CAR	TRUCK/LONG BUS
07:00-8:00	810.25	498.5	9
08:00-9:00	1095.25	622	13.75
09:00-10:00	1000.75	559.25	23.25
10:00-11:00	1040.75	608	28
11;00-12:00	1038.25	619.25	25.5
12:00-01:00	1015	597.75	20.25
01:00-02:00	1077.25	544.25	23.75
02:00-03:00	874.75	519.75	24.25
03:00-04:00	840.25	485	22.5
04:00-05:00	900.75	488	18
05:00-06:00	982.5	416.6666667	29.5
06:00-07:00	1181.5	598.75	36.75
TOTAL	11857.25	6557.166667	274.5

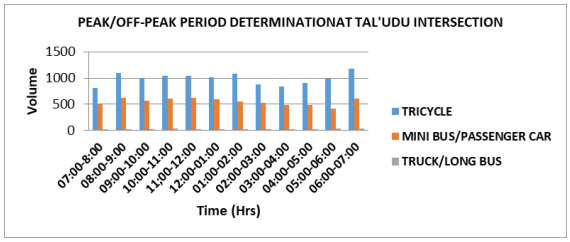

FIGURE 3: Traffic volume showing peak and off-peak periods from (7AM-7PM) for Tal'udu intersection

TABLE 2: Average traffic survey data for Tal'udu intersection taken from 7:00AM-6:30PM

PERIOD	APPROACH	VOLUME	MOBILE PHONE/ EARPIECE	TRAFICATOR FAILURE/ MISS INFORMATION	PICK-UP/DROP-OFF AT INTERSECTION		RED LIGHT VIOLATION	OPERATORS' AGE			VEHICLES CONDITION			OVERLOADING
					PICK-UP	DROP-OFF		YOUNG	MIDDLE	OLD	GOOD	FAIR	POOR	
7:00AM - 8:00AM	EAST	740	16	6	7	49	243	370	111	370	296	74	21	190
	NORTH	625	7	8	12	53	251	360	107	360	286	71	33	145
	SOUTH	812	13	7	8	94	257	406	146	361	338	81	34	53
	WEST	749	20	11	15	91	266	375	112	323	287	75	41	190
TOTAL		2926	56	32	42	287	1017	1511	476	1414	1207	301	129	578
1:00PM - 2:00PM	EAST	1170	6	81	3	2	97	410	586	175	586	468	117	63
	NORTH	1041	6	13	11	13	34	364	521	159	521	416	104	22
	SOUTH	1079	2	11	9	10	53	331	555	184	514	410	109	36
	WEST	1112	9	35	12	7	47	415	594	178	556	513	121	20
TOTAL		4402	23	140	35	32	231	1520	2256	696	2177	1807	451	141
4:30PM - 5:30PM	EAST	1162	3	50	11	15	37	461	456	300	546	358	86	50
	NORTH	1246	3	11	9	9	31	437	620	187	620	499	124	32
	SOUTH	1375	4	7	8	10	39	452	688	235	630	519	137	51
	WEST	1139	8	29	3	5	24	443	683	189	644	545	127	32
TOTAL		4922	18	97	31	39	131	1793	2447	911	2440	1921	474	165
5:30PM - 5:30PM	EAST	2026	3	40	5	11	27	740	756	561	940	589	135	49
	NORTH	1831	1	8	4	5	26	641	906	275	906	732	183	33
	SOUTH	1924	3	11	8	6	40	674	962	375	962	699	192	34
	WEST	2422	14	47	11	13	47	938	1439	400	1382	1125	268	47
TOTAL		8203	21	106	28	35	140	2993	4063	1611	4190	3145	778	163

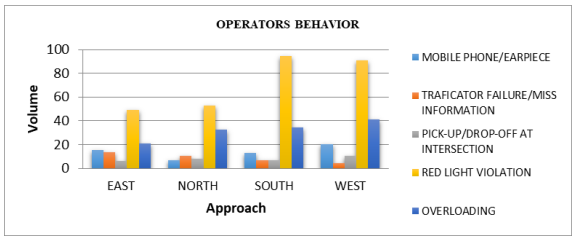

FIGURE 4: Operator's behavior by 7:00AM-8:00AM at Tal'udu

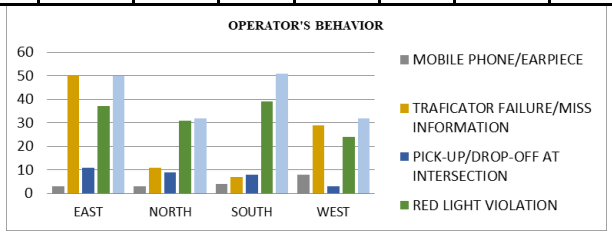

FIGURE 5: Operator's behavior by 1:00PM-2:00PM at Tal'udu

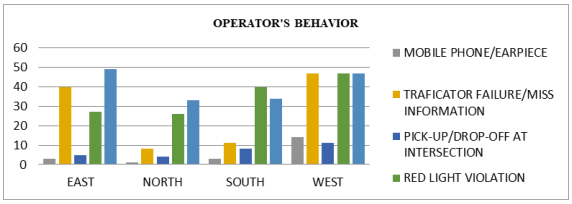

FIGURE 6: Operator's behavior by 4:30PM-5:30PM at Tal'udu

TABLE 3: Operator's age category and vehicles condition at Tal'udu intersection

APPROACH	OPERATORS' AGE			VEHICLES CONDITION		
	YOUNG	MIDDLE	OLD	GOOD	FAIR	POOR
EAST	1854.333	2168	1146.67	2441.333	1710.667	411.667
NORTH	1692.667	2407	727.667	2407	1933.333	482.667
SOUTH	1714	2611.667	940	2467.333	1966.667	520.333
WEST	2061.333	3091.667	879.667	2905	2469.667	591
TOTAL	7322.333	10278.33	3694	10220.67	8080.333	2005.667

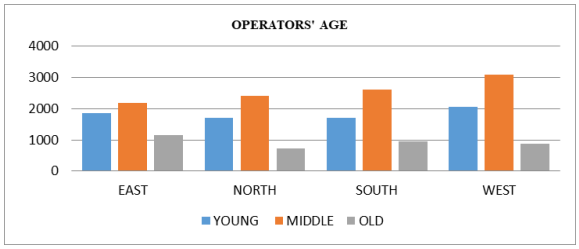

FIGURE 7: Operator's age category at Tal'udu intersection

TABLE 4: Traffic volume data for Gwammaja intersection

DETERMNATON OF PEAK AND OFF-PEAK PERIODS AT GWAMMAJA INTERSECTION			
AVERAGE DATA FOR WHOLE APPROACHES			
HOURS	TRICYCLE	MINI BUS/PASSENGER CAR	TRUCK/LONG BUS
07:00-8:00	626.666667	481.3333333	10.33333333
08:00-9:00	777	523.3333333	10
09:00-10:00	896.666667	512	11.33333333
10:00-11:00	915	512.6666667	8
11;00-12:00	919.333333	495.6666667	6
12:00-01:00	920	517.6666667	12.66666667
01:00-02:00	1042	508	11.33333333
02:00-03:00	1059.666667	529	10
03:00-04:00	912.333333	512	11.33333333
04:00-05:00	1016	519	7.333333333
05:00-06:00	1034.33333	517.3333333	10
06:00-07:00	1115.33333	509	7.333333333
TOTAL	11234.3333	6137	115.6666667

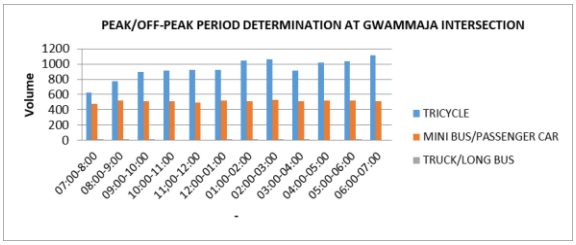

FIGURE 8: Traffic volume showing peak and off-peak periods from (7AM-7PM) for Gwammaja intersection

TABLE 5: Average traffic survey data for Gwammaja intersection taken from 7:00AM-6:30PM

PERIOD	APPROACH	VOLUME	MOBILE PHONE/EARPIECE	TRAFICATOR FAILURE/MISSINFORMATION	PICK-UP/DROP-OFF AT INTERSECTION		RED LIGHT VIOLATION	OPERATORS' AGE			VEHICLES CONDITION			OVERLOADING
					PICK-UP	DROP-OFF		YOUNG	MIDDLE	OLD	GOOD	FAIR	POOR	
7:00AM-8:00AM	EAST	870	2	4	4	4	67	197	435	130	435	348	87	34
	SOUTH	949	3	3	5	4	57	332	475	142	475	380	95	32
	WEST	963	3	3	6	4	63	337	482	144	482	385	97	27
TOTAL		2782	8	10	15	12	187	866	1392	416	1392	1113	279	93
1:00PM-2:00PM	EAST	1000	1	2	3	5	22	216	501	150	501	400	101	22
	SOUTH	986	2	2	3	4	20	345	494	148	494	394	99	19
	WEST	920	3	1	4	2	30	322	461	138	461	363	92	25
TOTAL		2906	6	5	10	11	72	883	1456	436	1456	1157	292	66
4:30PM-5:30PM	EAST	1195	1	1	4	3	11	262	599	178	599	478	120	12
	SOUTH	1175	1	2	3	2	14	410	589	175	589	470	118	13
	WEST	1236	2	2	2	4	13	432	620	185	620	494	124	15
TOTAL		3606	4	5	9	9	38	1104	1808	538	1808	1442	362	40
5:30PM-6:30PM	EAST	1872	2	3	3	5	15	396	937	281	937	749	183	15
	SOUTH	1676	4	2	2	4	21	587	839	252	839	671	163	14
	WEST	1705	1	4	3	4	20	596	720	255	720	682	170	24
TOTAL		8203	21	106	28	35	140	2993	4063	1611	4190	3145	778	163

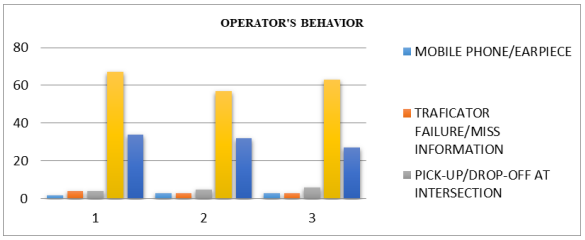

FIGURE 9: Operator's behavior by 7:00AM-8:00AM at Gwammaja

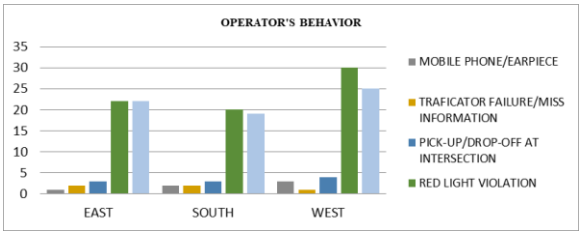

FIGURE 10: Operator's behavior by 1:00PM-2:00AM at Gwammaja

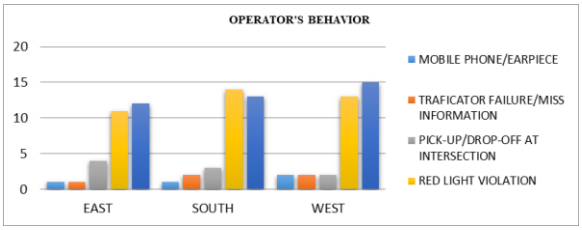

FIGURE 11: Operator's behavior by 4:30PM-5:30AM at Gwammaja

TABLE 6: Operator's age category and vehicles condition at Gwammaja intersection

APPROACH	OPERATORS' AGE			VEHICLES CONDITION		
	YOUNG	MIDDLE	OLD	GOOD	FAIR	POOR
EAST	1072	2472	739	2472	1975	491
SOUTH	1674	2396	717	2396	1915	475
WEST	1688	2282	722	2282	1924	483
TOTAL	4434	7150	2178	7150	5814	1449

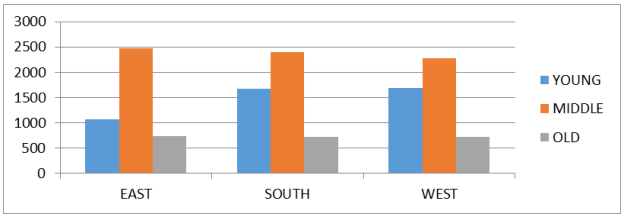

FIGURE 12: Operator's age category

3.2 Discussion

Results from Table1 shows that, the peak hour periods for the tricycle operators, for morning and evening peaks, morning peak occurs around 8am-9:00am and rose to 11:00am-12:00noon, and the highest peak occurs around 6:00pm-7:00pm. Result further shows that the passenger car and trucks/long vehicles' peak period at Tal'udu Intersection occurs from 9:00am-10:00am and rose to 12:00noon-1:00pm, and the highest peak also occurs around 6:00pm-7:00pm.

Results from Table 2 indicates that, in terms of operators' age category, most of the operators are of medium age category (adults) followed by the young and the elderly came a bit distant. In addition, overloading is the highest offense committed by the operators followed by red light violation, trafficator failure, picking/dropping of passengers as well as well as mobile phone usage respectively. The result further shows that, hardly an operator will pass across Tal'udu Intersection without committing any of the traffic violation offence. Finally, results obtained from Table3 shows that, most of the vehicles are in good condition.

In the same vein, result from Table 4 shows that, the peak hour periods for the tricycle operators, that is the morning and evening peaks, morning peak occurs around 9am-10:00am and rose to 11:00am-12:00noon, the afternoon peak occurs around 1:00pm-2:00pm to 2:00pm-3:00pm and the highest peak occurs around 6:00pm-7:00pm. Result further shows that the passenger car peak period at Gwammaja Intersection occurs from 8:00am-10:00am and rose to 12:00noon-1:00pm. Results of traffic survey data obtained from Table 5 follow a similar pattern with that obtained in Table 2, which indicates that, in terms of operators' age category, most of the operators are of medium age category (adults) followed by the young and the elderly came a bit distant. In addition, overloading is the highest offense committed by the operators followed by red light violation, trafficator failure, picking/dropping of passengers as well as well as mobile phone usage respectively. Result further shows that, hardly an operator will pass across Gwammaja Intersection without committing any of the traffic violation offence. Results obtained from Table6 shows that, most of the vehicles are within the ranges of good to fair conditions.

CONCLUSION

This study investigated tricycle operators' compliance at signalized traffic intersection in Kano metropolis during peak/off-peak periods and during the dry season. The study produced a better understanding of the tricycle operators' responses towards the existing traffic systems at the studied signalized intersections

RECOMMENDATION

The following recommendations would be appropriate in effectively reducing the tendency for drivers to run red lights:

1. Putting in place effective Signal operation countermeasures. Such countermeasures may include increasing the yellow interval duration, providing green extension, improving signal coordination, and improving signal phasing.
2. Putting in place Motorist information countermeasures that focus on attracting the attention of drivers to traffic signal. This may include improving sight distance, improving signal visibility and conspicuity, and adding advance warning signs.
3. Putting in place Physical improvement countermeasures which are more significant in scope and are often part of more substantial improvement projects. These measures may include removing unneeded signals, adding capacity with additional traffic lanes, providing and maintaining conspicuous zebra crossings, and flattening sharp curves.
4. Putting in place effective Automated/Manual Enforcement Mechanism. This may include camera installations and placement of police officers at each junction to make arrests and ensure prosecution of offenders.
5. Putting in place an effective Red Light Running Legislation and providing Educational and Public Awareness Campaigns to raise public awareness about running red light and the attendant road crashes potential.

Relevant road traffic and safety Government Agencies such as the Federal Road Safety Commission (FRSC), the Directorate of Road Traffic Services (DTRS) and the Nigeria Police will find these recommendations useful and helpful in designing better management strategies of signalized intersections, and thereby prevent road crashes and fatality.

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