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Research Article

Transport Corridor Planning for Zaria Road using Bus Rapid Transit Approach

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Abstract:

Background of study: Kano Metropolis is experiencing rapid urban growth, creating an urgent need for a modern and efficient urban transport system. Among its key corridors, Zaria Road has emerged as a promising candidate for development using a Bus Rapid Transit (BRT) model to address the challenges posed by current informal and inefficient transportation modes.

Aims and scope of paper: This study assesses the feasibility of BRT implementation on Zaria Road by examining traffic patterns, passenger flow, and key traffic nodes, leading to infrastructure and design recommendations.

Methods: A mixed-method approach combined field surveys, traffic and passenger counts, questionnaires, and stakeholder interviews with secondary data from recent literature. The analysis used both descriptive and inferential statistics.

Result: Public transport on Zaria Road is largely informal, with 65% of operators unlicensed. Tricycles dominate at 67%, averaging 37,198 daily—far surpassing buses and taxis. Peak hours (5–6 a.m. and 9–10 a.m.) see up to 18,960 passengers, mainly commuting from residential areas to key hubs like motor parks, markets, and hospitals.

Conclusion: Zaria Road's 90-meter right of way and high passenger demand make it well-suited for BRT development. A 15.9 km corridor with 54 proposed stops is recommended, supported by public-private partnerships and tricycle restrictions to ensure success.

Keywords: Bus Rapid Transit; Transport; Transport Corridor Planning; Zaria Road;

1. INTRODUCTION

The present rapid urban growth of cities from developing countries coupled with poor governance causes negative externalities such as lagging infrastructure development. In combination with rapidly rising motorized vehicle use this leads to severe traffic congestion affecting the mobility of the urban residents (Vermeiren et al., 2015). The twentieth century brought significant advancements in transportation sector with the development of rail modes, the introduction of individual car (fuel-powered car) and buses, with cars becoming the dominant transport mode at the turn of the 21st century.

Motorization has been increasing at unprecedented rate, with numbers of motor vehicles worldwide projected to reach2.6 billion by 2050,the majority of which will be found in developing countries (Cervero, 2013) which Nigeria is not exempted. These are challenges faced by Transport planners in the form of demand for more parking spaces, effective traffic management techniques, crowding in public transport and more car traffic, and may affect safety and comfort in infrastructure (Pyddoke et al., 2017).

In 2019, the world population is estimated to be 7.7 billion people, and is projected to be 8.5 billion in 2030 and 9.7 billion in 2050 and countries of West Africa could account for more than half of the growth (Jagiełło, 2017). Transportation planning would play a vital role in addressing traffic congestions that would characterize most cities in developing nation, as such there is need to improve sustainable mode of transportation that is affordable, accessible as it carries more people and has less effect on the environment (it consumed efficient energy and emit less waste) and usually it encourage walking and cycling.

There is needs for governments as well as urban planners particularly in developing countries to bring effective policies that would improve mobility and

transport systems. particular emphasis need to be given to public and mass transit systems of which Bus rapid Transit is most ideal due to its cost effectiveness and ease of implementation over short period of time. The New York-based Institute of Transportation & Development Policy (ITDP), defines BRT as "a high-quality bus-based transit system that delivers fast, comfortable and cost-effective urban mobility through the provision of segregated right-of-way infrastructure, rapid and frequent operations, and excellence in marketing and customer service" (Wright Hook, 2007).

BRT is popular as a solution for reducing transportation traffic problems and emissions (Omar et al., 2017). Bus Rapid Transit (BRT) is growing in popularity throughout the world; the reasons for this phenomenon include its passenger and developer attractiveness, its high performance and quality, and its ability to be built quickly, incrementally, and economically. BRT also provides sufficient transport capacity to meet demands in many corridors, even in the largest metropolitan regions (Levinson et al., 2002)

However, Bus Rapid Transit involves the integration of facilities, services, amenities, operations and intelligent transportation system improvement that are designed to improve performance and attractiveness to passengers. Transit planning can take place at regional planning, metropolitan planning or corridor planning levels. This study would concentrate on corridor planning level.

2. MATERIAL AND METHOD

Descriptive research design was adopted in the study. This research design is used in preliminary and exploratory studies to allow the researcher to gather information, present and interpret for the purposes of clarification. Primary data this is the first hand information that shall be obtained directly from the field. The primary data required in this research will be collected using questionnaires, interviews and inventory surveys. Population is the total number of the target group in the area of the study, that is the total number of element either the element are going to be selected or not. While sample is the part of the population selected as the target population.

This study was conducted on Zaria corridor, the target population are commuters and commercial transport operators The sample frame enables the researcher to determine the population of study for the purpose of conducting a research. There is no population to draw the sample of this study using scientific method, so the research used Conventional method whereby a total of 500 questionnaire was administered to Commuters to capture their trip origin and destination. In the same way, another 500 Questionnaire was administered to Commercial transport operators flying Zaria road. Descriptive statistics methods would be use for objective one and two analysis, while AutoCAD software, ArcGIS was used to achieve objective three.

Respondents reasons for the choice of mode of transport were rank based on the Weighted Average Index (WAI) which is given as:

$$WAI = F_1 \times W_1 \times F_2 \times W_2 \times F_3 \times W_3 \times F_4 \times W_4 \times F_5 \times W_5 \quad (1)$$

$$WAI = F_1 + F_2 + F_3 + F_4 + F_5 \quad (2)$$

$$WAI = \sum_{\text{fi}} \times W_i \quad (3)$$

Where,

F = frequency of the respondents
W = weight of each scale
i = weight.

Note (5 = strongly agree, 4 = agree, 3 = Neutral, 2 = Disagree and 1 = strongly disagree)

3. RESULT AND DISCUSSION

Result : This section discusses the socioeconomic characteristics of the residents in the study area which cover residence, gender, age, marital status, educational level, occupation, average monthly income, and vehicle ownership. Frequency and parentage of response on the socio-economic characteristics of the respondents in the study area are presented.

The gender distribution of respondents as presented in table 1 revealed dominance of male respondents (282) 62.3% against the female respondents (171) 37.7%. Male respondents dominated the female because they were more visible in the study area and are more disposed to responding to enquiries than the females.

Moreover, table 1 also revealed the age distribution of the respondent. Majority (190) 41.9% of the respondents fall between the age bracket of 19 to 29years, followed by (95) 21% within the age brackets of 30 to 39years. However, (73) 16.1% of the residents were below 18 years age, followed by (38) 8.4% within the age of 40 to 49years, while (30) 6.6% were between 50 to 59years and lastly (27) 6% between 60 and above account the least respectively. This is an indication that majority of the respondents are still in their active and productive age. Age is important attribute that helps in making trip.

Table 1 also shows the educational status of the respondents. Knowledge influences reasoning, attitudes and understanding of individuals from a given social phenomena. Knowing the educational background of respondents during a survey is important because it does not only impart confidence to the researcher but also explain the quality of the data collected. The findings presented in table 1 also revealed dominant respondents (140) 30.9% with informal education, followed by (139) 30.7% with only Secondary education, However (80) 17.7% were having only primary education, whereas (77) 17% were having tertiary education, and lastly (17) 3.8% with no education. This is an indication that majority of the respondents 65.4 were literate, and thus

capable of providing adequate and relevant information with regards to their origin and destination survey in the study area.

Trip making and pattern of an individual due to marital status may differ, findings presented in table 1 revealed the dominant respondents in the study area were single (204) 45%, married people accounted for (185) 40.8% of the respondents, followed by (39) 8.6% were divorced, while (25) 5.5% were widow. In addition, marital status is relevant to the study because married people will be more willing to make trip and more likely to use public transportation.

Furthermore, table 1 depicts the household size of the respondents, household size is an important determinants in any transport planning research, specifically those that have to do with socio-economic status. Its relevance to this research work is simply because larger household size is a major determinant of trip making decision. The study revealed that households with 1-4 persons accounted for (175) 38.6% of the respondents, 5-9 persons accounted (105) 23.2%, 10-14 accounted (149) 32.9%, while 15 and above accounted (15) 5.3% of the total respondents. This posited that majority of the respondents were having 1-4 person per household in the study area.

Occupation, another important factor of consideration that determines people trip making behavior and pattern. Table 1 presents the occupational status of the respondents of the study area. Based on the study outcome, students accounted for (175) 38.6%, traders were (115) 25.4%, civil servant (69) 15.2%, farmers accounted for (49) 10.8%, while others (housewives, artisans) accounted for (45) 9.9%. From these, it can be deduced that majority of the respondents were students.

In addition, income is one among important determinant which is congruent to occupation. High income may result more trip making. Table 1 below illustrates the income range of the respondents with majority of the respondents (26.3% (119)) earning ₦41,000 to ₦50,000 per month. The research findings revealed (84) 18.5% earns below fifteen thousand Naira per month, (75) 16.6% earns fifteen to twenty thousand Naira per month, while (71) 15.7% of the respondents said they earns twenty one to thirty thousand Naira per month, (54) 11.9% earns thirty one to forty thousand Naira per month, and lastly which is the least (50) 11% earn about fifty one thousand Naira and above on monthly basis. Income has direct impact among the factors that motivate people to make trip and also kind of transport mode available they could afford.

Table 1. Socioeconomic Characteristics of Commuters

Gender	Frequency	Percentage
Male	282	62.3
Female	171	37.7
Total	453	100
Age distribution	**Frequency**	**Percentage**
Below 18	73	16.1
19-29	190	41.9
30-39	95	21
40-49	38	8.4
50-59	30	6.6
60 and above	27	6
Total	453	100
Educational Level	**Frequency**	**Percentage**
None	17	3.8
Informal	140	30.9
Primary	80	17.7
Secondary	139	30.7
Tertiary	77	17
Total	453	100
Marital Status	**Frequency**	**Percentage**
Single	204	45
Married	185	40.8
Divorced	39	8.6
Widow	25	5.5
Total	453	100
Household size	**Frequency**	**Percentage**
1-4	175	38.6
5-9	105	23.2
10-14	149	32.9
15 and above	24	5.3
Total	453	100
Employment type	**Frequency**	**Percentage**
Civil servant	69	15.2
Business Man	115	25.4
Farmer	49	10.8
Student	175	38.6
Others	45	9.9
Total	453	100
Income level	**Frequency**	**Percentage**
Below 15,000	84	18.5
15,000-20,000	75	16.6
21,000-30,000	71	15.7
31,000-40,000	54	11.9

41,000-50,000	119	26.3
51,000 and above	50	11
Total	453	100

The gender distribution of respondents among transport operators as presented in table 2 revealed that male respondents (455) accounted about 100%. This is because public transport operation is dominated by Male genders in Kano city, as such all respondents were male.

Moreover, table 2 also revealed the age distribution of the respondent. Majority (204) 45% of the respondents fall between the age bracket of 19 to 29 years, followed by (103) 23% within the age brackets of 30 to 39 years. However, (64) 14% of the residents were below 18 years age, followed by (38) 8% within the age of 40 to 49years, while (25) 5.4% were between 50 to 59years and lastly (21) 4.6% between 60 and above. This is an indication that majority of the respondents are still in their active and productive age.

Table 2 also shows the educational status of the respondents. Knowledge influences reasoning, attitudes and understanding of individuals from a given social phenomena. Knowing the educational background of respondents during a survey is important because it does not only impart confidence to the researcher but also explain the quality of the data collected. The findings presented in table 2 also revealed dominant respondents (183) 40.1% with informal education, followed by (129) 28.3% with only Secondary education, However (76) 17% were having only primary education, whereas (35) 7.6% were having Tertiary education, and lastly (32) 7% with none education were the least.

Origin of the Transport operators, findings presented in table 2 revealed the majority of the respondents about 46% originate from other Local government areas of Kano state, followed by 36% of the total respondents from Kano city, and lastly 18% represented respondents who hailed from other state of Nigeria. Furthermore, table 2 depicts the ownership of driving license of the respondents, ownership of driving license is important in preventing under-age and unprofessional drivers from plying roads. The study revealed that majority of respondents about 65% of the operators on Zaria road do not have operating license, whereas only 35% of them have driving license.

Table 2. Socioeconomic Characteristics of Commercial Traffic Operators.

Gender	Frequency	Percentage (%)
Male	455	100
Female	0	0
Total	455	100
Age Distribution	**Frequency**	**Percentage (%)**
Below 18	64	14
19-29	204	45
30-39	103	23
40-49	38	8
50-59	25	5.4
60 and above	21	4.6
Total	455	100
Educational Level	**Frequency**	**Percentage**
None	32	7
Informal	129	28.3
Primary	76	17
Secondary	183	40.1
Tertiary	35	7.6
Total	455	100
Origin	**Frequency**	**Percentage**
Kano city	164	36
Other L.G.A of Kano	211	46
Other state	80	18
Total	455	100
Operating License	**Frequency**	**Percentage**
Yes	159	35
No	296	65
Total	455	100
Nature of Job	**Frequency**	**Percentage**
Full time	250	55
Per time	159	35
Others	46	10
Total	455	100

Figure 1 below depicts commercial vehicle traffic volumes counted at Naibawa Flyover, Zaria road on Saturday 17th July, 2021. The research findings revealed that inbound traffic volumes between 5:00pm to 6:00pm was the peak hour with total of 2,435 vehicles, followed by 9:00am to 10:00am with 2,190 vehicles, followed by 8:00am to 9:00am with total of 2,153 vehicle, and 6:00am to 7:00am with 760 vehicles which is the least commercial traffic volume.

On the out bound traffic, 5:00pm to 6:00pm accounted for the most traffic, 2,257 vehicles. This is followed by 4:00pm to 5:00pm with 2,105 vehicles while 6:00am to 7:00am recorded the least traffic volume of the day, 665 vehicles. From the analysis above, 39,896 commercial

vehicles flying Zaria road, out of these numbers, tricycles constitute the highest number of vehicular mode plying Zaria road with about 37,197 a day, followed by 1,248 buses, 642 taxis, and lastly 330 mini trucks.

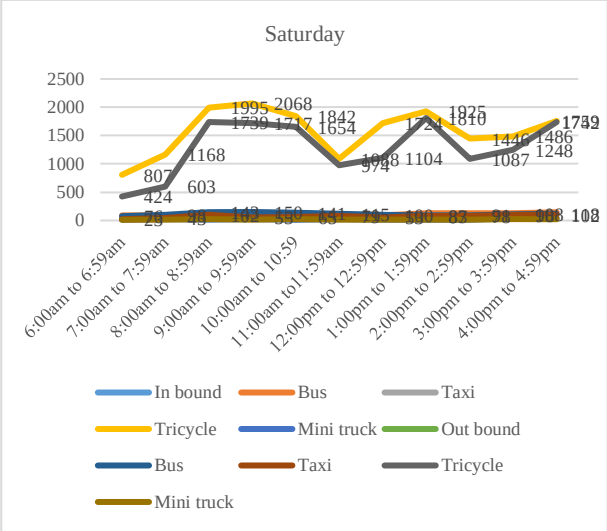

Figure 1. Commercial Vehicle Traffic Count on Saturday

Background and Policy Development: Before 2016, Kano had no formal public transport policy. Following a stakeholder dialogue that year, a draft policy was developed, inspired by Lagos's model, to create an enabling environment for sustainable urban transport like BRT and light rail through private sector participation.

Proposed BRT Project: The BRT and light rail projects were integrated into the new transport policy. The state received 100 buses and signed an MoU with a Chinese firm for buses and terminals. Technical support was provided by the World Bank and DFID's NIIF to develop regulatory frameworks, establish KAMATA, and assess existing transport infrastructure and operations.

Current Situation: Initially, BRT corridors were planned for four routes (Zaria, Gwarzo, Hadejia, and Katsina Roads), but due to economic challenges and the pandemic, only two corridors remain (Katsina and Gwarzo to 'Yan Kura Market). Despite studies and initial investment, implementation has stalled due to inadequate infrastructure, lack of competitive operator selection, and insufficient technical preparedness. Travel demand surveys (KTDS) identified needed bus volumes, but only around 30 buses are currently in use for routes requiring over 500.

Challenges and Recommendations: Experts criticize the project's "copy-and-paste" approach, warning that skipping critical technical steps and lacking infrastructure like terminals, bus stops, and pedestrian safety facilities could erode public trust. Effective implementation will require competent operators, proper planning, and full government commitment to meet the needs of Kano's growing population.

Discussion : This study underscores the urgent need for a structured, efficient, and sustainable urban public transport system in Kano metropolis, particularly along the Zaria Road corridor. The dominance of informal transport modes—especially tricycles, which account for over 70% of daily vehicular traffic—highlights a system that is heavily fragmented and lacking regulatory oversight. Compounding this is the finding that approximately 65% of commercial operators do not possess valid driving licenses, raising significant concerns about road safety and enforcement.

Despite these challenges, the corridor exhibits several characteristics that make it well-suited for Bus Rapid Transit (BRT) development. The road boasts a generous 90-meter right-of-way and a 22-meter carriageway, with ample space for dedicated BRT lanes and infrastructure. Furthermore, traffic counts and passenger flow data demonstrate high demand during morning and evening peak hours, particularly between 5:00–6:00 PM, when over 3,500 passengers travel the route per hour.

The study's technical design proposes a 15.9 km BRT corridor connecting Kano Line Motor Park to Kwanar Dawaki, with 54 bus stops spaced 300–400 meters apart, and 3.5-meter-wide BRT lanes carved from the existing carriageway. Importantly, the proposed system is tailored to the corridor's current demand, recommending 56 buses with 1.5-minute intervals during peak hours to meet operational efficiency.

However, findings from stakeholder interviews reveal systemic institutional and financial hurdles. Although the state government has previously committed to public transport reform and received technical support and infrastructure pledges, the BRT project has been slow to launch due to policy inconsistencies, economic constraints, and a lack of professional capacity. Experts caution that without transparent procurement processes, robust regulatory frameworks, and sufficient operator capacity, the system risks failure even before rollout.
Therefore, the study advocates for a phased and well-governed implementation model, ideally through a Public-Private Partnership (PPP). It also calls for policy enforcement—such as the regulation or restriction of tricycles on the BRT corridor—to preserve its integrity. Drawing inspiration from successful systems in Curitiba, Jakarta, and Lagos, the paper posits that Kano's BRT project could significantly enhance mobility, reduce traffic congestion, and support sustainable urban development—provided that it is executed with institutional rigor and sustained political will.

Suggestion : The state government should establish clear mechanisms to implement the proposed BRT system, involving expert input to refine the plan. To ensure smooth operation, three-wheelers should be banned from Zaria Road. Given budget constraints, implementation via public-private partnership is recommended, with government enabling private investment. Standard 12-meter buses with 90-passenger capacity should be adopted. Finally, Kano's transport

policy must be promptly updated to reflect evolving urban dynamics.

4. CONCLUSION

Kano metropolis is a rapidly growing center that is in constant need for an innovative urban management system, there is need for Government to provide an efficient and sustainable urban transport system of Which BRT would play significant role. The study has found out that there were massive passengers flow on the route, the road is gateway to many Institutional buildings and commercial hub of the city. Majority of the commuters on Zaria road surveyed complained of poor services offered by existing commercial transport operators, this is an indication for need to provide qualitative mass transit services on the corridor of which BRT system would no doubt play vital role in providing qualitative, efficient and reliable services to the need of commuters. Furthermore the study found that majority of commercial transport operators surveyed on Zaria road they do not chose fixed route to flow and justified the need to provide reliable

5. ACKNOWLEDGEMENT

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6. AUTHOR CONTRIBUTION STATEMENT

All the authors involved in this study Abubakar Isyaku Ismail, Isah Musa, and lawan kamiludeen Abba contributed significantly to the development of the concept, system design, data analysis, and article writing and editing. The authors worked together to ensure that this study provides an innovative solution for hybrid microgrid systems that combine solar and wind power with battery storage. In addition, the author is also active in simulation and testing of systems to improve the efficiency and reliability of renewable energy for people who need sustainable access to electricity.

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