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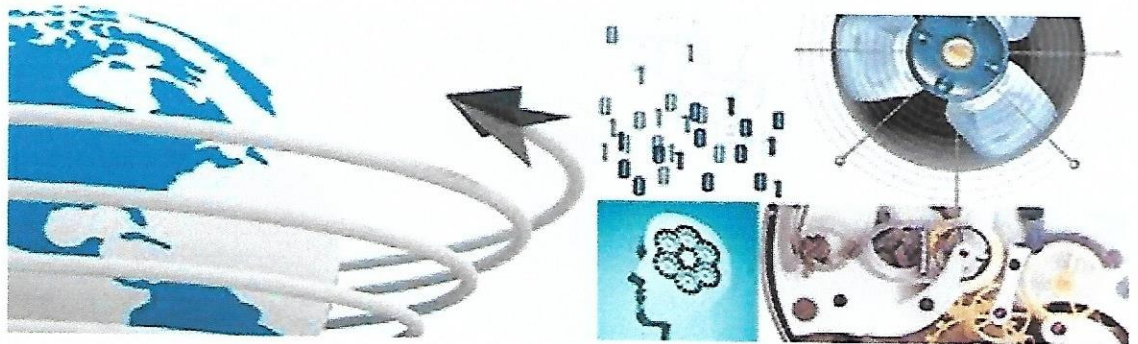
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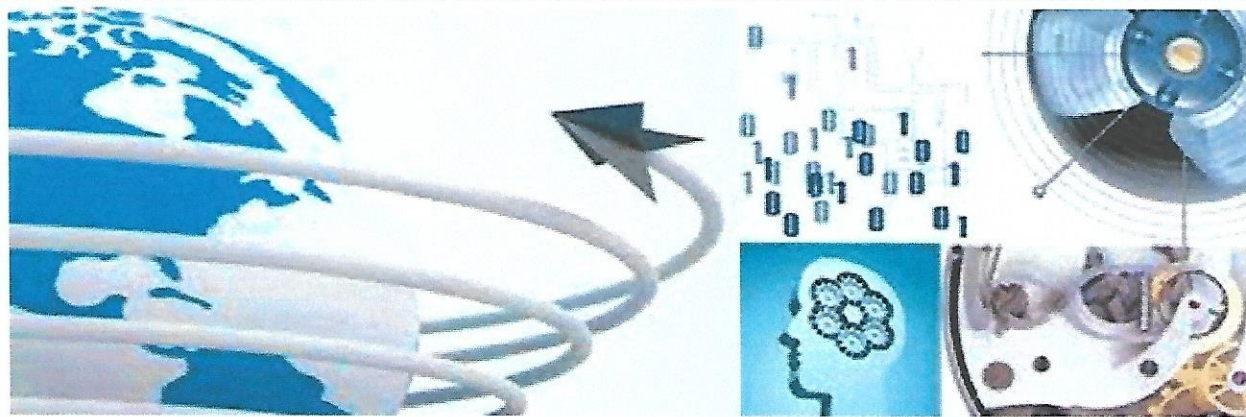
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# Assessing intra-city road traffic in an indigenous African city, Ibadan, Nigeria

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## Abstract

*The study examines the intra-city road traffic situation in Ibadan city, Nigeria. The study was carried out in the five metropolitan local government areas of the city. Survey approach through the use of questionnaire was used for data collection. 50 respondents were sampled in each of the neighbourhoods across the three residential areas of the city (low, medium, high), making a total of 150. Descriptive statistics of means, simple percentages and charts were employed in analyzing the data collected. Results show that 41.3 % of the respondents spent daily between 21 to 30 minutes on traffic congestion, 30% between 5 to 20 minutes, 27.4 % above 30 minutes and 1.3% less than 5 minutes. On the spatio-temporal pattern of traffic congestion in the three residential areas of the city, results reveal that traffic congestion occurred throughout the day along some major routes in the high density residential area. The ranking of some major routes in the city by respondents equally showed that routes along the high density residential areas of the city ranked highest followed by those in the medium density. Some of the causes of traffic congestion identified in the study include: high number of vehicles plying the roads, narrow road networks, erection of structures near some major routes in the city and impatience on the part of vehicle drivers. The study suggested resuscitation of the railway to enhance inter-modal link, expansion of existing roads in the city and introduction of efficient intra-city mass transit system to reduce the number of vehicles on the road.*

**Keywords-** Traffic congestion, Ibadan city, urbanization

## I. INTRODUCTION

The rate of urbanization has been increasing over the years in both the developed and developing countries. However, urbanization rate in developing countries are higher because most developed nations have almost reached their threshold of urbanization. The world's population is put at about 6.572 billion people out of whom the United Nations data indicated that about 3 billion people (50 percent) live in urban areas [6]. Whereas about 66 percent of the entire world's population lived in the countryside in the early 1950s [7], current estimates show that by 2030, about 61 percent of the total population in the world will be living in cities; and that all the world's increase in population in the next three

decades will occur in low and middle income countries [8] [9]. This high urbanization rate being experienced in developing countries poses great challenges to infrastructural development in most cities. While continents like Europe and the Americas have stabilized their population growth and economy to a large extent, most countries in Africa, Asia and Latin America have in the last few decades not been able to deliver on their promises of alleviating the precarious state of living environment of their citizens [10]. Within the global context, Africa is generally assessed as a rural and the least urbanized continent with the antecedent of high rate of slum development, crime, underdevelopment as well as overpopulation. However, in most recent times, current trends suggested that Africa's rate of urbanization is two times faster than Latin America and Asia [11] [6]. Conservative estimates indicated that within the next two decades, 87 percent of the population growth in Africa will take place in urban areas [12]. Cities over the years have witnessed an exploding rate of growth in most developing countries [1] [2]. In view of the implications of the increasing urban population in low and middle-income countries, the 2002 Johannesburg's World Summit on Sustainable Development (WSSD) called on all governments to address the overwhelming challenge of provision of urban basic services especially decent houses, transportation, water and sanitation for the teeming people in slums where the quality of life is appalling. The trend of urbanization and city growth in developing countries are characterized by rapidity of urban increase, urbanization outpacing industrialization, and a high rate of urban population growth by natural increase and migration [13]. The continued alarming growth of the urban population is one of the major factors partly contributing to the high rate of physical development mishap in Nigeria [3] [4] [5]. Urban dwellers in Nigeria are faced with a myriad of problems ranging from security of lives and property, traffic congestion, health, housing, poverty and many others. [14], notes that whether we think of welfare services or employment opportunities, the urban system in Nigeria today is already proving inadequate as a means of achieving the type of social order that the country desires. With an urbanization rate of about 5.5 percent per annum [15], it is anticipated that

the urban population in Nigeria would have reached 65 percent of the total population. The focal point of this study, Ibadan city is not left out of the various challenges enumerated so far facing urban centers in Nigeria. Ibadan is the third largest city in Nigeria with a population estimate of 3,800,000 [16]. In terms of areal extent, the city is the biggest in the country with 11 Local government Areas and a land mass of 214 km<sup>2</sup> in 1988[17]. Ibadan is a large sprawling city with no discernible pattern of growth or development and this has earned the city such epithets as “the world’s largest indigenous city,” “the black metropolis” or “the largest urban village in Africa”. Ibadan is on altitude of 237.7 meters above the mean sea level [17]. Over the years, the city has been grappling with traffic congestion along the major roads within the metropolis. One of the major functions of the spatial structure of any human settlement is to facilitate the movement of people and goods within the settlement [18]. Efficient transport system coupled with good road networks enhances the movement of people within any urban centre.

## 2.0 OBJECTIVES OF THE STUDY

- To identify spatial- temporal pattern of traffic congestion in the city
- To examine the average time spent on traffic by road users in the city
- To examine the cause(s) of traffic congestion in the city
- To identify those things that needed to be done to reduce traffic congestion in the city.

## 3.0 THEORETICAL CONCEPT

Generally, it is not easy to exhaustively define the level-of-service (LOS) concept otherwise known as concept of quality of service indicators because different people and different urban regions may put different emphasis on various components of the concept [19]. For instance, on the part of transport consumers, the dimension of level-of-service (LOS) considered are travel time, bus frequency, comfort, terminal standards, bus stop facilities, interchanges between routes and services among others [20] [21]. Travel time usually contains several different elements. For a transit trip, it includes walking into the station or bus stop, waiting time for bus services, travelling time in the transit vehicle and walking time to the destination [22] [23]. Convenience could be measured at the bus stop in terms of terminal location, shelter provided, and traffic safety. In transportation engineering profession, level-of-service concept is widely used to denote the quality of service derived from the operational characteristics of transportation facilities [21]. The concept of level-of-service (LOS) is widely recognized worldwide and popular in traffic and transportation engineering operations as a performance measurement tool [24] [25]. It is used in the Highway Capacity Manual (HCM) to represent the quality of service (QOS) and or corresponding satisfaction indices provided by a

transportation facility as perceived by the users or customers [26]. Quality of service is defined as “the overall measured or perceived performance of transit from the passenger’s point of view” [27]. Quality of service measures reflect two important aspect of transit service (1) the degree to which transit service is available to given locations and (2) the comfort and convenience of the service provided to passengers [28]. For the purpose of this study, the level-of-service (quality of service indicators) of the road networks in Ibadan city as perceived by the road users will be considered by these variables (a) travel distance from home to work and (b) average time spent on traffic. These variables were chosen because they will help in explaining the quality of service or level-of-service (LOS) road users in the city enjoy on the transport infrastructure (roads) that enhances their intra-urban mobility and accessibility.

## 4.0 AN OVERVIEW OF TRAFFIC CONGESTION

Traffic Congestion occurs when there is an imbalance between transport demand and transport supply at a specific point in time and in a specific section of the transport system. Under such circumstances, each vehicle impairs the mobility of others. What this means in essence is that the available transport infrastructure at that given time is being overstretched. Congestion can be perceived as an unavoidable consequence of the usage of scarce transport resources, particularly if they are not priced [29]. [29] observed that the most notable urban transport problems are:

- *Traffic congestion and parking difficulties.* Congestion is one of the most prevalent transport problems in large urban agglomerations, usually above 1 million inhabitants. It is particularly linked with motorization and the diffusion of the automobile, which has increased the demand for transport infrastructures. Since vehicles spend the majority of the time parked, motorization has exceeded the parking lot available which has created space consumption problems particularly in the central business district (CBD) where the spatial imprint of parked vehicles is significant.
- *Longer commuting.* On par with congestion, people are spending an increasing amount of time commuting between their residence and workplace. An important factor behind this trend is related to residential affordability as housing located further away from central areas (where most of the employment remains) is more affordable.
- *Public transport inadequacy.* Many public transit systems, or parts of them, are either over or under used. During peak hours, crowdedness creates discomfort for users as the system copes with a temporary surge in demand.

- *Difficulties for non-motorized transport.* These difficulties are either the outcome of intense traffic, where the mobility of pedestrians, bicycles and vehicles is impaired, but also because of a blatant lack of consideration for pedestrians and bicycles in the physical design of infrastructures and facilities. This is a common sight in most urban centre in Nigeria where vehicle owners are at loggerheads with bike riders popularly called “Okada”. In fact, pedestrians in most urban centres find it difficult most times moving during congestion.
- *Environmental impacts and energy consumption.* Pollution, including noise, generated by circulation has become a serious impediment to the quality of life and even the health of urban populations. Most of the vehicles especially the heavy duty trucks using gas (diesel) generate a lot of CO<sub>2</sub> in fact ,most of them generate fumes that impairs the vision of the driver of an oncoming vehicle resulting to accident most times.
- *Accidents and safety.* Growing traffic in urban areas is linked with a growing number of accidents and fatalities, especially in developing countries. Accidents account for a significant share of recurring delays.

[29] observed that traffic congestion in an urban centre could be viewed in these patterns daily trips that is mandatory (workplace-home) or voluntary (visit to friends, relations, market/shopping). Mandatory as the name implies is often performed within fixed schedules while voluntary is based on the person’s decision to embark on such trip at any given point in time. Urban congestion comes in two categories:

- *Recurrent congestion.* The consequence of factors that cause regular demand surges on the transportation system, such as commuting, shopping or weekend trips. However, even recurrent congestion can have unforeseen impacts in terms of its duration and severity. Mandatory trips are mainly responsible for the peaks in circulation flows, what this means in essence is that most of the congestion in urban areas are recurring at specific times of the day and on specific segments of transport system. This is true for most urban centres in Nigeria. In fact some major roads in Ibadan city exhibit these characteristics.
- *Non-recurrent congestion.* The other half of congestion is caused by random events such as accidents and unusual weather conditions (rain, snowstorms, sandstorms), which are unexpected and unplanned. Non-recurrent congestion is linked to the presence and effectiveness of

incident response strategies. As far as accidents are concerned, their randomness is influenced by the level of traffic as the higher the traffic on specific road segments the higher the probability of accidents.

## 5.0 STUDY AREA AND METHODS

The study was carried out in Ibadan metropolitan area comprising of the five local government areas. Covering the five local government areas is capital intensive. Considering the heterogeneous nature of the city, the 50 respondents each were selected from neighbourhoods across the three residential areas (low, medium and high) in these five local government areas. In all, a total of 150 respondents were sampled. A well designed/structured questionnaire was used to collect data on the demographic characteristics of the respondents; travel distance to office or place of work, time of the day traffic is encountered along the way, causes of traffic congestion and so on. The data was collated and analyzed using statistical package for social sciences (SPSS).Results are presented using simple percentages and charts.

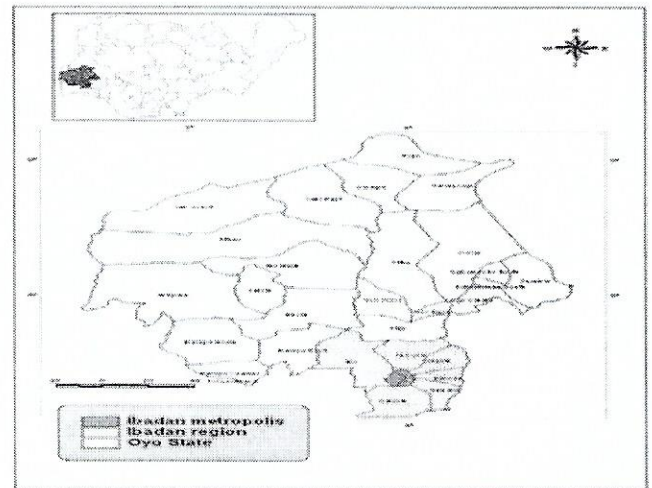


Fig 1 map of Ibadan

## 6.0 RESULTS AND FINDINGS

### 6.1 Demographic Characteristics of Respondents

In the study, 62 female and 88 male were sampled with a mean age of 37.4 years for both sex. The results in fig 2 show that 44 % of the respondents engage in business, 22 % are artisans, 18.7 % civil servants, 4.7 % respectively are professionals and those who engage in other occupations, 3.3 % are students while 2.7 % are retirees. Going by this breakdown, it is obvious that most of the respondents engage in private business, craft and civil service.

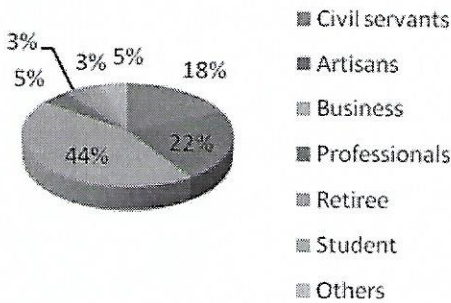


Fig 2 occupational distribution

Results in fig 3 show that 27 % of the respondents sampled earn between 21-40,000 Naira per month, 21% between 41- 60,000, 20 % between 61-80,000, 13 % between 81-100,000, 10 % above 100,000, 5 % between 10-20,000 and 4 % less than 10,000. Looking at the breakdown, it could be said that more than half (68 %) of the respondents in the study area monthly income ranges between 21- 80,000 Naira. The reason for this is not farfetched as could be seen in fig 2 most of the respondents are business people who may even surpass the average amount they claimed to be making in some months, equally with recent increment in worker’s salary, one would expect this pattern of income distribution in the above figure.

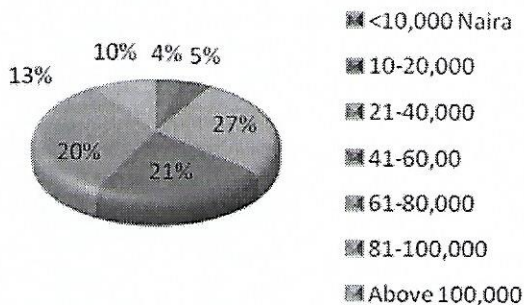


Fig 3 monthly income

### 7.0 VEHICLE AND MOTOR BIKE OWNERSHIP

Regarding vehicle ownership, results in table 1 indicate that 57.3 % of the respondents owned their own vehicle while 42.7 % do not. In terms of number of vehicles owned, 30 % owned one vehicle, 18.7% owned 2, 6.7% owned 3 and 2 % owned 4 or more vehicles. The purposes for which the respondents use their vehicle for was equally examined. Results indicate that 40 % use their vehicle for private use while 13.3 % is for commercial

purposes (Transporter) and 4 % use theirs for both. Equally , the results in table 1 show that 20.7 % of the respondents owned motor bike while majority (79.3%) do not. 10 % use their motor bike for commercial purposes (Okada rider) while 8 % is for private use and 2.7 % use theirs for both . A closer look at this result shows high vehicle ownership among respondents. The reason for this is in two fold, first, in the last few years there has been an upward review of workers salary in the country compared to fifteen years ago, and therefore many civil servants can now afford fairly used vehicles popularly called ‘tokunbo’. Equally, the federal government’s decision to increase the age limit of fairly used vehicles being imported has made it possible for many people in the city to own cars.

Table 1 Vehicle and motor bike ownership

Vehicle ownership		Yes 86 (57.3%)	No 64 (42.7)
Number of cars owned			
1	45	30%	
2	28	18.7 %	
3	10	6.7 %	
4 & above	3	2 %	
Purpose for which is used			
Private	60	40 %	
Commercial	20	13.3%	
Both	6	4 %	
Motorbike ownership		Yes 31 (20.7%)	No 119 (79.3%)
Purpose for which is used			
Commercial	15	10%	
Private	13	8 %	
Both	2	2.7%	

### 8.0 TRIP DISTANCE TO WORK/BUSINESS

In a bid to examining the distance residents in the city travel before getting to their places of work, the results in table 2 show the distance covered in minutes .However distance as used here implies the number of minutes it will take residents to get to their place of work assuming there was no congestion on the way (real distance). Results from this table indicate that most (44 %) will spend between 21- 30 minutes before getting to their place of work, 24. 7 % between 31-40 minutes, 16.7 % between 10-20 minutes, 8.7 % above 40 minutes and 5.3 % will spend less than 10 minutes

Table 2 Trip distance from home to work

Distance minutes	in	%



< 10	5.3
10-20	16.7
21-30	44.7
31-40	24.7
Above 40	8.7
Total	100

#### 9.0 SPATIO - TEMPORAL PATTERN OF TRAFFIC CONGESTION IN THE CITY

The spatial pattern of traffic congestion in the three residential areas (High, medium, low) of the city and time of occurrence was examined in table 3. The result shows that traffic congestion was very high in the three residential areas in the evening and morning. However, there are variations; the breakdown shows that 73.5% of respondents from the low density residential areas encountered traffic during the morning and evening as compared to 63.5% and 56.2% from the medium and low density residential areas. Another salient point from the result is the high percentage (48) of respondents from the high density that encountered traffic throughout the day along the various routes in their neighbourhoods as compared to 19.2% and 14.5% from the low and medium density residential areas. One major reason that could be adduced to higher traffic congestion in the high density residential areas is due to the city's fabric. The high density area is situated in the core of the city (CBD) where most commercial activities take place. Therefore, there is very high vehicular and human traffic most times of the day in this part of the city. Again, most roads here are single lane built over forty years ago by the colonial masters. The high rate of urbanization taking place in the city means that these roads cannot handle the volume traffic being witnessed now.

Table 3 Spatio- temporal pattern of traffic congestion in the city

Neighbourhood	Afternoon	Morning & evening	Throughout the day	
High density	4.1%	73.5%	48.2%	100%
Medium density	22%	63.5%	14.5%	100%
Low density	24.6%	56.2%	19.2%	100%

				%
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#### 10.0 AVERAGE TIME SPENT ON TRAFFIC DAILY

More respondents (27.4%) maintained that they spent above 30 minutes daily on traffic while going or coming back from work/business, 26 % spent between 21-25 minutes, 25.3% between 11-20minutes ,15.3 between 26-30 minutes and 4.7% 5-10minutes . Going by these results, it could be said that most of the respondents in the city spent an average of 20 minutes or more daily on traffic congestion. This is not peculiar to Ibadan city alone, in Nigeria; most cities are facing a similar problem.

Table 4 Average time spent on traffic congestion daily by respondents

Average time spent	%
< 5minutes	1.3
5-10 minutes	4.7
11-15 minutes	16
16-20 minutes	9.3
21-25 minutes	26
26-30 minutes	15.3
Above 30 minutes	27.4%

#### 11. RANKING OF SOME MAJOR ROUTES IN THE STUDY AREA BASED ON THEIR LEVEL OF CONGESTION

In order to ascertain the level of traffic congestion along some major routes in the study area, respondents were asked to rank these routes based on their own perception. Majority of these routes selected were major arterial routes. Results in table 5 show that Iwo Road- Bere route with mean value of 1.45 ranked first followed by Ojoo-Moniya (1.27), Challenge-Apata (1.04), Dugbe- Ojoo (0.98), Challenge- Dugbe (0.89), Agodi-Mokola (0.70), and U.I-Agodi (0.60). This result is revealing two things; first the route that was ranked number one in terms of traffic congestion is located in the high density neighborhood of the city. Iwo road is a commercial hub and gateway to other neighboring cities, therefore traffic congestion along this route is chaotic most of the times. Secondly, the other routes that ranked second and third respectively are located in the medium density residential areas, the traffic congestion recorded on these routes could be attributed to their location. For instance, Ojoo-Moniya is a major arterial route connecting the city to the northern part of the country; heavy duty trucks carrying petroleum products from Lagos ply this route on daily basis making it impassable most times for other road users. Similarly, Challenge –Apata route equally witnesses a high vehicular traffic especially heavy duty trucks moving petroleum products from the depot at the Nigerian National Petroleum Corporation (NNPC) depot located at Apata. The respondents ranking of these routes based on their own personal experiences to a certain level reflects the true situation of traffic along some of these

routes in the city. There is no inter-modal link in the city, road transport therefore serves as the only source of moving people and goods, and heavy duty trucks compete with smaller vehicles on the existing narrow roads.

Table 5 Ranking of some routes in the study area on congestion

Route	Mean score	Rank
Dugbe-Ojoo	0.98	4 <sup>th</sup>
Challenge- Dugbe	0.89	5 <sup>th</sup>
Ojoo-Moniya	1.27	2 <sup>nd</sup>
Iwo Road – Bere	1.45	1 <sup>st</sup>
Challenge- Apata	1.03	3 <sup>rd</sup>
Agodi Gate- UCH- Mokola	0.70	6 <sup>th</sup>
U.I-Agodi	0.60	7 <sup>th</sup>

## 12.0 CAUSES OF TRAFFIC CONGESTION IN THE CITY

On the causes of traffic congestion in the city, results in table 6 indicate that 26.7 % of the respondents attributed it to many vehicles in the city while 22 % claimed that the roads in the city are narrow and 20 % attributed it to bad roads. Also 14 % observed that erecting of shops and displaying of wares by traders contribute to traffic congestion along some major routes in the city while 10 % claimed that impatience on the part of most drivers in obeying the traffic laws result to congestion most times while 7.3 % claimed that too many motor bikes popularly called 'Okada' in the city of Ibadan has resulted to traffic congestion. Their argument is that these bike riders most times do not obey traffic laws; they compete with vehicles on the existing narrow roads. Going by the breakdown of these results, the number one cause respondents observed is high number of vehicles in the city and this is associated with the high rate of urbanization the city of Ibadan has experienced over the years. Similarly, the second cause of traffic congestion as shown by the results above is narrow road networks in the city; it would be observed that most roads in the city were constructed some thirty to forty years ago when the population of the city was very small. These roads then were wide enough considering the population at that time, but with the rate of urbanization and the high level of commercial activities going on in the city presently; one would say that these roads have out lived their usefulness in terms of easier movement of people and goods within the city. Respondents equally blamed the traffic congestion in the city on illegal erection of shops by traders along some routes in the city. For instance, Iwo Road- Bere route that was ranked highest in terms of traffic congestion (table 5) has been taken over by traders who erected shops very close to the road with their wares displayed.

Table 6 causes of traffic congestion

Causes	%
Too many vehicles on the road	26.7
Narrow road networks in the city	22
Bad roads	20
Erecting of shops near the roads and displaying of wares by traders	14
Impatience on the part of drivers	10
Too many motorbikes in the city	7.3
Total	100

## DISCUSSIONS

In this study, an attempt has been made to examine the effect and causes of traffic congestion in an indigenous African city Ibadan, Nigeria by considering the components of level- of- service (LOS) or quality of service of the transport infrastructure (roads in the city). The two components adopted were: travel distance from home to work and average time spent on traffic daily. It was found that most respondents spent an average of 21 minutes and above daily from home to work. Findings from the study also revealed that traffic congestion lasts for an average of 20 minutes and above daily along the major routes in the study area. The implication of this is that residents in the city most times spend twice the number of time they ought to use in getting to their places of work. It is obvious from this findings that the quality of service (LOS) residents are getting from the transport infrastructure (roads) in the city is not enough. Again, there were variations across the three residential areas on temporal occurrence of traffic congestion. 48.2% of respondents from the high density residential areas maintained that traffic congestion along their routes lasted throughout the day as against 19.2% and 14.5% respectively in the low and medium density residential areas.

Results equally revealed that all the three residential areas recorded the highest traffic congestion in the morning and evening period. . On the ranking of the various routes in the study area on traffic congestion by respondents, findings from the study showed that Iwo Road- Bere route was ranked highest followed by Ojoo-Moniya, Challenge- Apata routes. Some of the causes of traffic congestion identified in the study include: high number of vehicles in the city, narrow road networks, bad roads, erection of shops near the roads, and impatience on the part of some drivers. Based on these findings, the following recommendations are made:-

- Government in the state should expand the existing roads in the city by making them dual Carriage.
- Government through town planning authorities should set guide lines for erection of buildings and shops near the main roads in the city.

- A law banning street trading should be set in motion and offenders should be tried to serve as deterrent to others.
- Provision of functional mass transit which offers good alternative to driving will help in reducing the number of vehicles on the road.
- Resuscitation of ailing railway lines in the city to enhance intermodal link with the roads.

#### 14.0 CONCLUSIONS

Traffic congestion is one of the problems of urbanization facing most cities in Nigeria. However, that of Ibadan seems to be more pronounced because of its size and primordial nature. The city from the outset was not properly laid out unlike other emerging cities (Abuja) in the country that have master plan. This study has been able to examine some of the major causes of traffic congestion in the study area. It is hoped that if these causes are properly addressed the city will in the near future witness free flow of traffic.

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