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ANALYSIS OF ROAD TRANSPORT INFRASTRUCTURE AND TRAFFIC CONGESTION IN OGBOMOSO, NIGERIA

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ABSTRACT

The urban centres are usually plagued by range of transport problems. One of the most significant urban transport problems is traffic congestion. It is experienced when the supply of the urban transport networks can no longer meet the demand for them. This study evaluates road transport infrastructure and traffic congestion in the city of Ogbomoso, Nigeria. The study used primary data which were obtained in the major traffic corridors through random and accidental sampling techniques from 60 respondents (commuters and vehicle operators) in Ogbomoso. Data were analyzed using descriptive statistics. Analysis of Variance was also used to examine differences in the traffic congestion across the traffic corridors. The results indicated that there exist road infrastructure in the study area like bridges, bus tops and motor parks among others of which most are in fair conditions. It is observed that 66.7% of respondent are of the opinion that the level of traffic congestion along the route is high. Findings from Analysis of Variance (ANOVA) reveals that with F-value of 8.422 and P-value of 0.000, it is observed that there is significant differences in the incidence of traffic congestion along the traffic corridor in Ogbomoso at $p<0.05$ confidence level. Pedestrian Safety Measures and Prohibition of On-Street Parking among others are some of the recommendations suggested to enhance smooth road traffic in the study area.

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INTRODUCTION

Road transport in Nigeria cities has been grown tremendously, with increasing population, economic activities with majority of urban dwellers heavily depend on road as the mode of transportation for the satisfaction of their basic social and economic needs. In spite of the inevitable role of transportation system for urban development, road transportation in Nigeria is in chaotic state. The high dependency ratio on urban development, road transportation and growth in motor vehicle ownership is an evident problem of road transportation in Nigeria cities. Congestion occurs in two basic forms – reoccurring and non-reoccurring. Reoccurring congestion is caused by travel demand exceeding travel system capacity. It occurs every day where roads are too narrow, signal timing is inappropriate, or transit systems do not provide enough service. Non-reoccurring congestion is caused by incidents affecting the system.

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The incidents may affect either the demand or capacity of the system. Accidents, vehicle breakdowns, short-term construction and weather are all incidents that affect the capacity of the system and cause congestion. Auclair (2000) stated that 'if the present trend for automobile ownership persists, there will be problem of space for automobile'. However, this has led to traffic congestion in most urban centres. According to Philippe Cole (2002) 'one thing all global cities will have in common over the next several decades is rising traffic congestion'. Traffic congestion is a condition on road networks that occurs as use increases, and is characterized by slower speeds, longer trip times, and increased vehicular queuing. The most common example is the physical use of road by vehicles. When traffic demand is great enough that the interaction between vehicles slows the speed of the traffic stream, this results in some congestion. As demand approaches the capacity of a road (or of the intersection along the road), extreme traffic congestion sets in. when vehicles are fully stopped for periods of time, this is colloquially known as a traffic jam or traffic snarl-up. Also

traffic congestion occurs when a volume of traffic or modal split generates the demand for space greater than the available road capacity; this point is commonly termed saturation. There are a number of specific circumstances which cause or aggravate congestion; most of them reduce the capacity of a road at a giving point or over a certain length, or increase the number of vehicles required for a given volume of people or goods. About half of U.S. traffic congestion is recurring, and is attributed to sheer weight of traffic; most of the rest is attributed to traffic incident, road work and weather events. Traffic research still cannot fully predict under which conditions a "traffic jam" (as opposed to heavy, but smoothly flowing traffic) may suddenly occur. It has been found that individual incidents (such as accidents or even a single car braking heavily in a previously smooth flow) may cause ripple effect (a cascading failure) which then spread out and create a sustained traffic jam when, otherwise, normal flow might have continued for some time longer. This paper therefore argues in absolute sense that there is need for effective management, proper maintenance and sustenance of our roads. It is on this note that the study seeks to analyses road transport facilities, traffic congestion and management techniques in Ogbomoso Oyo state, Nigeria.

Conceptual Issues and Literature

Concept of traffic system management: The concept of traffic system management endeavours to apply traffic management philosophies to the various elements of the transport system and it is geared towards enhancing the use of the combination of modes that best represent an area desired balanced between the goals of efficient mobility attractiveness in the operation of its urban transportation system (Adewale, 2002). Traffic system management is a technique for solving urban transportation problem that makes more efficient use of the existing ways, vehicles and terminals available at a point in time. It is a scientific approach that ensures the overall best use of the existing urban transport facilities, subject to the constraint of environmental preservation and public acceptability. The main objectives of urban traffic system management are: highway and transit facilities, to co-ordinate individual traffic system management elements, and to achieve the maximum efficiency of the existing. The transportation systems management approach to congestion mitigation seeks to identify improvements to enhance the capacity of existing system of an operational nature. Through better management and operation of existing transportation facilities, these techniques are designed to improve traffic flow, air quality, and movement of vehicles and goods, as well as enhance system accessibility and safety.

Concept of accessibility: Accessibility can be measured in relation to distance socially, economically and physically (Okafor, 1979). According to (Mrakpor, 1986) social distance is determined by social-economic status or class; this is in turn affected by education, income or the combination of the two. The economic distance is measured in terms of cost such as time and cost of transport. The physical distance is measured in terms of linear distance from generating zone to attracting zone. It is therefore possible to use the concept of accessibility to determine the relationship between capacity of roads to accommodate vehicles and the number of vehicles striving to use it.

Concept of Travel Time Variability: Travel Time Variability has several distinct components, including differences in travel time from day-to-day, over the course of the day, and even from vehicle-to-vehicle (Noland and Polak, 2002). It isimportant to recognize that this definition is independent of congestion effects. A congested system according to (Noland et. al. 2002) may exhibit very stable day-to-day travel times that travelers anticipate in advance. Variability introduces uncertainty for travelers such that they do not know exactly when they will arrive at a destination. Therefore, it is generally recognized that for road travel, incident (or non-recurrent delay) is the major source of travel time variability which occurs as a result of a reduction in effective road capacity while it is unknown how the probability of an incident (including the likely severity and duration of the incident) is effected by recurrent congestion, reduced capacity during peak travel times will result in greater travel delay and potentially can result in greater variability at peak times. Travel Time Variability (or the uncertainty in trip journey times) is clearly an added cost to atraveler making a given journey. In simplistic terms, this can be interpreted as simply the added travel time from extra delay. In reality, the behavioural reactions to uncertain travel times are significantly more complex. The earliest theoretical contribution travel time variability was that of Gaver (1968). His contribution was to embody the concept of travel time variability within a model of utility maximization with the result that travelers select a slack time by departing earlier than they would with no travel time variability. Knight (1974) specifies a similar hypothesis of a "safety margin" being selected by travellers.

Literature review

Transportation planning is a crucial part of city planning that is inculcated into any land use plan as every land use has a considerable requirement to support it. However, (Obateru, 2003) recognizes a positive correlation between the sizes of cities and the sizes of their land taken up by roads; the larger cities have the greater part of their land used for roads. This is explained by the fact that high order roads are more characteristics of large cities. He also assert further that in well planned cities, roads and streets account of the average for 25-35 percent of urban land (in Nigeria cities), about 40 percent in American cities of Washington D.C, while Los Angeles has a more higher percent of about 41-45.

Traffic Congestion: Traffic congestion occurs when urban road network is no longer able to accommodate the volume of traffic that uses them. This situation is caused by rapid growth in motorization with less than corresponding improvement in the road network and related facilities. Congestion increases travel cost and causes physical and psychological discomfort. There are three types of congestion are outlined by Brownfield et al (2003) as recurrent congestion, non-recurrent congestion and the pre-congestion state. These types are basedupon the frequency and predictability of the congestion – factors which will impact on driver behaviour. The costs associated with each type of congestion are likely to be different. Non-recurrent congestion costs may be more difficult to quantify due to the inherent sparseness of adequate amounts of data needed – it may be argued that the costs could be higher as drivers have not been able to take the possibility of congestion into account in planning their journey or alternatively the costs may beless dramatic as drivers pre-developed strategies for coping with congestion will not have come into play. Some routes are increasingly subject to non-recurrent congestion however, for example with accident black spots. In these cases drivers may 'learn' an expected cost in terms of likely delay

and successful contingency routes. The Pre-congestion state will carry some costs similar to those of congestion, including loss of control over drivers' environment, deterioration in the environment and other impacts.

Congestion Type Definition

Recurrent congestion: Occurs at regular times at a site. It can be anticipated by road users that normally use the route during those times. Examples of recurrent congestion are morning or evening peak hour congestion, or congestion due to regular events such as a street market on a particular day each week.

Non-recurrent congestion: Occurs at non-regular times at a site. It is unexpected and unpredictable by the driver and is normally due to incidents such as accidents, vehicle breakdowns or other unforeseen loss of carriageway capacity. Congestion occur due tonon-recurring highway incidents, such as a crash or roadworks, which may reduce the road's capacity below normal levels.

Pre-congestion (Borderline congestion): Occurs where free-flow conditions breakdown but full congestion has not yet occurred. This mayoccur either side of the time period when congestion occurs or upstream or downstream of congestion that is already occurring. The increase in traffic congestion is more than a time-wasting nuisance to freight movers. High levels of traffic congestion have been found to reduce the number of trip a truck driver can make in a day and therefore increase shipment costs, which impacts the competitiveness of metropolitan manufacturers and other businesses. However, traffic congestion is one of the most predominant encountered in most cities of the world; Nigeria cities are no exception (Ogazi, 1992) in Joseph O. Basorun (2003). As it observed from some countries in the world, Nigeria is not left out in her own share of traffic congestion which is as a result of many factors. Most major cities in Nigeria such as lagos, Ibadan are not left without the problem of traffic congestion. The causes could be attributed to many factors such as: the distance existing between place of residence and place of employment which necessitated a need for trip making, the schedule of working hours in the country which allows for simultaneous movement around specific hours which results into traffic peak periods between 7:30am and 9:00am in the morning and 4:00pm and 6:00pm in the evening during which long queues of vehicles are found in major corridor of the city.

MATERIALS AND METHODS

The research assesses road transport facility and the general traffic congestion situation in the study area. The study uses some major traffic corridor for sampling purposes, namely; Takie Junction, Orita naira, Sabo, and city area (Federal Government College Road). The vehicle operators, owners and the passengers were surveyed and questionnaires were administered to vehicle operators and commuters through random sampling and accidental sampling techniques. In all a total of sixty (60) questionnaire were administered. Data were analyzed using descriptive statistics. Analysis of Variance was also used to examine differences in the traffic congestion across the traffic corridors.

Study Area: The city of Ogbomoso is located approximately on 4^{o} 15' east longitude and 8^{o} 7' latitude. The town is situated on an important transport route linking the north and south of Nigeria, and towns in the southwest region. Ogbomoso is 53 kilometres from Oyo on the northeast, 57 kilometres southwest Ilorin in Kwara state, 104 kilometres northwest of Ibadan the Oyo state capital and 58 kilometres northwest of Osogbo the Osun state capital. Ogbomoso is an administrative, political and traditional centre for all the rural communities within its jurisdiction. The region is characterized by a fairly uniform temperature, moderate to heavy seasonal rainfall and relative humidity. Only daily rainfall records are kep in the town, but measurements from close climatologic stations in Ilorin and Osogbo are considered to be representative of the region. The mean annual temperature is 26.20degree C. the lowest temperature are experienced in august with 24.3degree as mean and the highest in march with a mean of 28.7degreeC the regions around Ogbomoso have two season like other areas in the southwest of Nigeria. These include:

- The wet season between April and October.
- The dry season between November and March.

The mean is high annual in the early is 1247mm. the relative humidity is high in the early mornings throughout the year with marked decrease in the afternoon. Ogbomoso is affected during the season by the tropical constitutional air mass (harmattan winds), while it is also affected during the wet season by the tropical air masses. Ogbomoso lies within the western uplands. The large part of this plateau lies between 300 and 650 metres above sea level. The relief of Ogbomoso is moderate with low-forested hills, but occasionally very steep sided ridges rise abruptly from the surrounding country. Ogbomoso is situated in the transitional zone between the rainforest of Ibadan geographical region and the northern savannah zone. They are therefore regarded as the derived savannah. Under the prevailing climatic conditions, the rain forest, but under the influence of high agricultural activity associated with bush burning, little high forest remains outside the forest reserves. The existing land use in Ogbomoso is characterized by compact development of residential zones. The land use is typical of any urban settlement where a large proportion of the developed land is devoted to residential use and only a small proportion is used for commercial, industrial and other uses. At present Ogbomoso occupies a land area of 3527 hectares.

RESULTS AND DISCUSSION

Nature of existing road transport facility: Table1 the available parking facility in the study area. Accordingly, 20(33.3%) of respondents agreed that parking facility is available in the area, while 40(66.7%) respondents indicated that there are no parking facility in the area.

Table 1. Availability of parking facility in the area

Availability of parking facility	Frequency	Percentage (%)
Available	20	33.3
Not available	40	66.7
Total	60	100.0

Source: Author's field survey (2018)

Table 2. Types of parking facility available

Type of parking facility	Frequency	Percentage (%)
On street	45	75
Off street	15	25
No response	-	-
Total	60	100.0

Source: Author's field survey (2018)

Table 2 shows that 45(75%) of respondents are of the view that the highest parking facilities available is on-street parking, while 15(25%) respondent maintained that off-street parking facilities is quite commonin the area. Table 3 shows the mode of transport used in the study area. Accordingly, 41.67% of respondents used motorcycle, 8.3% opted for taxi cab, while 13.3% and 36.7% of respondents maintained that they used trucks/trailers and trekking/walking as their transport mode respectively. It can be infer that majority of respondents used motorcycle in the study area.

Analysis of traffic congestion

Table 4 shows traffic delay along the corridor. According to the table, 83.3% of respondents are of the opinion that they experienced traffic delay along the route, while 16.7% respondents indicated that they did not experience traffic delay. However, this may, perhaps depend on the time at which people work on or pass the road.

high and high, 13.3% of respondent observed it is low, while 20.0% of respondent noted that it is moderate in the study area. In the table 6 20(33.3%) of respondent indicated that the delay is often, 25(41.7%) respondent claimed that it is occasional, 12(20%) respondent said it is very often, while 3(5%) did not experience the delay.

Causes and effect of traffic congestion

Table 7 shows broken down of vehicles as one of the causes of traffic congestion experienced by respondents. As a matter of fact, 20(33.3%) of respondents are of the opinion that broken down of vehicles is very significant in causing traffic congestion, 35(58.3%) say it is not significant, while 5(8.3%) says it is not at all. Also in table 7,presents residents opinion on potholes as one of the causes of traffic congestion as experienced by respondents. Accordingly, 35(58.3%) of respondent are of the opinion that potholes are very significant in causing traffic congestion, 20(33.3%) respondent say it is

Table 3. Mode of transport used

Other mode of transport	Frequency	Percentage (%)
Motorcycle	25	41.67
Taxi cab	5	8.3
Truck/trailers	8	13.33
Trekking	22	36.7
Total	60	100.0

Source: Author's field survey (2018)

Table 4. Traffic delay along the road

Traffic delay experience	Frequency	Percentage (%)
Yes	50	83.3
No	10	16.7
Total	60	100.0

Source: Author's field survey (2018)

Table 5. Level of Traffic Congestion in the area

Level of traffic congestion	Frequency	Percentage (%)
Very high	15	25.0
High	25	41.7
Low	8	13.3
Moderate	12	20.0
No response	-	-
Total	60	100.0

Source: Author's field survey (2018)

Table 6. Nature of Traffic Delay

Traffic delay	Frequency	Percentage (%)
Often	20	33.3
Occasionally	25	41.7
Very often	12	20
Not at all	3	5
Total	60	100.0

Source: Author's field survey (2018)

Table 7. Causes of Traffic congestion

	Very significant		Not significant		Not at all significant	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Broken down of vehicle	20	33.3	35	58.3	5	8.3
Potholes	35	58.3	20	33.3	5	8.3
Accident on the road	40	66.7	18	30.0	2	3.3

Source: Author's field survey (2018)

Table 5 shows the level of traffic congestion along the corridor. It is observed that 25.0% and 41.7% of respondent confirmed that the level of congestion along the route is very

not significant, while 5(8.3%) says it is not at all. Concerning accident as one of the cause of traffic congestion as experienced by respondents, it is observed that 40(66.7%) of

respondent are of the opinion that accident on road is very significant in causing traffic congestion, 18(30%) respondent says it is not significant, while 2(3.3%) says it is not at all significant. This shows that accident is not a major causative agent of traffic congestion along the corridor. Table 8 shows that 25(41.7%) of respondents make trip for the purpose of work, 33(33.3%) respondents make trip to school, and 15 (16.7%) make trips for business while 5 (8.3%) while 8.3% are for social trip which carry the lowest percentage.

Pedestrian Safety Measures: Some of the notable pedestrian safety measures include zebra crossing and pelican crossing. The disadvantage of zebra crossing is that it can cause accidents where motorists are impatient. Pelican crossing is a traffic management contrivance with a button attached to it. By pressing the button, a red light shows on the opposite side of the road, stopping vehicular traffic. Other pedestrian traffic management measures include overhead bridges and underpasses.

Table 8. Trip purpose

Trip purpose	Frequency	Percentage (%)
journey to work	25	41.7
Journey to school	20	33.3
Business trip	15	16.7
Social trip	5	8.3
Total	60	100.0

Source: Author's field survey (2018)

Table 9. Analysis of Variance (ANOVA) of differences in traffic congestion across the traffic corridor in Ogbomoso

ANOVA

Traffic congestion

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	7272.624	5	1454.525	8.422	.000
Within Groups	211741.7	1226	172.709		
Total	219014.3	1231			

Source: Author's computation, 2018

Table 10. Traffic Management Techniques in Osogbo

	Traffic Management Techniques	Percentage (%)	
		Yes	No
1	Use of Traffic warden	84.2	15.8
2	Use of traffic light	35.5	64.5
3	Lane marking	30.2	69.8
4	Parking restriction	45.2	54.8
5	Public enlightenment campaign	52.4	47.6

Source: Author's field survey (2018)

Table 9 presents variation in the traffic congestion across the traffic corridor in Ogbomoso. According to the table, with F-value of 8.422 and P-value of 0.000, it is observed that there is significant differences in the incidence of traffic congestion along the traffic corridor in Ogbomoso at $p<0.05$ confidence level. This however, implies that the situation of traffic congestion experiences in each of the major traffic corridor does not remain the same, a situation which pose serious dangers to the mobility of people particularly and quality of life of people in general

Management Techniques Adopted for Road Traffic in Ogbomoso: Respondents were asked about the management techniques used to combat road traffic congestion in Ogbomoso. Their response is contained in Table 10. Table 10 shows some of the road traffic management techniques adopted in the study area. According to the table, 84.2% of respondents mention the use of traffic warden, 35.5% highlights the use of traffic light, while 30.2%, 45.2% and 52.4% of respondents accounted for the fact that lane marking, parking restriction and public enlightenment campaign are being used as road traffic management techniques.

Policy Issues and Conclusion

The following recommendations are advanced to guide policy directions on road traffic management in Ogbomoso, Nigeria

Overhead bridges are usually located at a point where there is a sizeable concentration of pedestrian traffic so that they do not have to trek for a long distance before they could have access to it.

Prohibition of On-Street Parking: The traffic management strategy frowns at the idea of parking vehicles along the sides of the road or street. This is so because cars that are so parked take up whole lanes on either side of the road. Thus a four-lane road could be reduced to a two-lane road due to on-street parking.

Improved Junction Control Measures: At junctions conflicts are usually generated. The ways to manage traffic at junctions and circumvent accidents include the use of semaphore, rotary, grade separation and road design.

Pedestrianization Measures: Pedestrian traffic is heaviest at the CBD everywhere in the world which causes traffic congestion when cars jam people passing around. A walk-way should be provided for disallowing people not to cross the road unnecessarily.

Other Associated Traffic Management: Traffic counters permanently installed, to provide real-time traffic counts.

- Traffic reporting, via radio, GPS or possibly mobile phones, to advise road users
- Navigation systems, possibly linked up to automatic traffic reporting
- Lane splitting/filtering, where space-efficient vehicles, usually motorcycles, scooters, and ultra-narrow cars ride or drive in the space between cars, buses, and trucks. This is however illegal in many countries as it is perceived as a safety risk
- Speed limit reductions, as practiced on the M25 motorway in London. With lower speeds allowing cars to drive closer together, this increases the capacity of a road. Note that this measure is only effective if the interval between cars is reduced, not the distance itself. Low intervals are generally only safe at low speeds.

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