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Trend Analysis of Road Transport Infrastructure Development in Awka, Anambra State, Nigeria

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Abstract:

Road transport which is the most accessed means of transport system has remained vital to the growth of any society. Therefore, the development of adequate and robust road transport system is a necessity for economic growth and live ability. In this paper attempt was made to analysis the trend in road transport infrastructure development in Awka the capital city of Anambra State from 2006 to 2017. A handheld Global Positioning System (GPS) device was used to acquire the requisite coordinates. Geographic Information System (ArcGIS version 10.5) was used to acquire and plot the imageries of the routes. The result shows continues increase in the development of road transport infrastructure in the State. In 2011 roads increased from 600 (2006) to 2500 (Tarred 1900; Untarred 600) while 2017 has a count of 4,769 roads (Tarred 3,360; Untarred 1,409). The result also showed a growth rate of 12.2% from 2006 to 2011 and a growth rate of 5.20% from 2011 to 2017. It was observed that despite the increase in road construction and rehabilitation traffic congestion was still an issue in some routes. This observation is attributable to the fact that most of the carriageways are not wide enough. To enhance migration, flow of goods and services, carriage expansion and alternative routes to various locations be made.

Keywords: Road transport, transportation; infrastructure, development, Awka, Anambra State

1. Introduction

Cities are centres of economic growth. They account for a small amount of landmass but are magnets for entrepreneurs, job seekers and several other local economic boosting factors, such as capital and resources. This, however, forms the basis of the concept of competitive cities advocated by Flausch (2014). Competitive Cities theory emphasized the importance of economic and physical interventions such as better transportation system, improved waste management system, improved water supply management; thus, creating a more improved and enhanced environment, increased investment prospects, which enables it to compete more effectively. There is no competitive city in either Europe, Asia, America or in Africa without good public transportation system. Good transportation system is a key ingredient in making a city environmentally sustainable, socially viable and economically competitive. It is therefore easy to deduce that the role of good and well-planned urban infrastructure in building a city is paramount as no city can be competitive without good transportation infrastructure. Such projects act as catalyst for wider urban development and renewal. Flausch (2014) used the opening of a new metro line in the French city of Lyon to explain how intervention in transportation system helped quadruple the rate of economic development.

Road transportation is growing rapidly in cities of the developing world (Agbigbe, 2016). Road transportation has become, or is becoming, the dominant mode for personal travel and freight in most parts of the world. A combination of innovations in vehicle technologies, public investment in road infrastructure, and increasing incomes has led to its rise. It has a critical advantage over other forms of transportation due to its ability to make point-to-point connections for a very large number of origins and destinations (Anderson, 2017). Road transportation infrastructure has been recognized by many scholars in recent years not only as an important economic growth facilitator, but also as the backbone of economic development activities for many industrialized countries (Lakshmanan, 2011; Pradhan and Bagchi, 2013; and Agbigbe, 2016). The transport system is often described as the lifeblood system of modern society. Roads constitute a fundamental part of this system for both passenger and freight transports (Engström, 2016). Road transportation infrastructure

underlies the more visible forms of capital, facilitating the delivery of inputs to places of production and the delivery of finished goods to marketplaces. Road transportation infrastructure also supports various social services, providing access to schools, hospitals, and places of employment (Prud'homme, 2005; Pradhan & Bagchi, 2013; and Agbigbe, 2016).

Transportation as an important part of human activity forms the basis of all socioeconomic interactions as lack of transport facilities often hinders economic development. Bad roads, amongst others are common features of developing world transportation system (Nwafor and Onya, 2019). Ogwude, (2016) stated that the demand for urban transport is growing with the urban population surging throughout Nigeria. By the year 2030 about half of the Nigerian population will be living in the cities, increasing the pressure on transport infrastructure in urban areas. At present, urban transport infrastructure is inadequate to meet transport needs resulting in chocking traffic congestions in most cities. Transforming this infrastructure is therefore imperative. It vital to state that the ways city transport systems are planned and managed affect their competitiveness and liveability. Therefore, the aim of this study is to examine the trend of road transportation infrastructure development in Awka, Anambra State from 2006 to 2017.

2. Materials and Method

2.1. Study Area

Awka pronounced in Igbo language as *Oka* is the capital of Anambra State, Nigeria with an estimated population of 301,657 following the 2006 national population census in Nigeria. Awka is located 199.1 kilometres (123.7 mi) by road directly north of Port Harcourt. Awka is also linked to towns and major commercial hubs like Nnewi and Onitsha by road. Awka is geographically located on latitude 6° 06' and 6° 15' N and longitude 7° 05' and 7° 15' E.

Awka is growing very fast, consequently, urban infrastructure which represents the skeleton of the city has to meet rapidly increasing users' needs. For example in 1986, the geographical extent of the study area was only 9.55km² but as at 2015, it is about 21.45km² signifying an area expansion of 45 percent (Nzoiwu, Ezenwaji and Igu, 2017). This spatial spread makes a good demand on urban infrastructure including roads because the spread is usually positively correlated with the provision of infrastructure.

Figure 1: Map of Awka

2.2. Methods

Global Positioning System (GPS) and Geographic Information System (ArcGIS version 10.5) were deployed for the collection of coordinates and imageries of road networks respectively. The data collection also focused on the total number of road network (Km) constructed or rehabilitated from 2006-2017. All these data were sourced from Government establishments, such as: Ministry of Lands and Survey, Ministry of Public Utilities, Anambra State Physical Planning Board, Awka Capital Territory Development Authority, Ministry of Road Infrastructure. Secondary data sources included; library materials such as journals, conference papers, and textbooks.

3. Result and Discussion

3.1. Analysis of Road Count

Attempt was made to examine the trend in road infrastructural development in the study area through road count on ArcGIS 10.5. The road count and road type values are presented in subsequent tables. The result of the spatial count and analysis of trend in road infrastructural development in Awka are also clearly depicted in subsequent figures.

Road Type	Number of Roads	Percentage (%)
Tarred Roads	375	62.5
Untarred Roads	225	37.5
Total	600	100

Table 1: Road Type Distribution in 2006
Source: Authors ArcGIS computation, 2018

For the purpose of this research, the road type distribution in AwkaUrban for the year 2006 were categorized into tarred and untarred. As depicted in table 1, it showed that in 2006, the number of tarred roads was 375 and 225 of untarred roads. This is clearly shown in figure 1.

Figure 2: Histogram Distribution of Road Type in 2006

Figure 3: Road Map of Awka in 2006

Source: GIS Lab. Department of Surveying and Geoinformatics, Nnamdi Azikiwe University 2018

As at the year 2011, the number of roads, both tarred and untarred was shown to have increased in number. As shown in table 2, tarred roads increased from 375 to 1900 roads while the untarred category also increased from 225 to 600 in a space of 5 years.

Road Type	Number of Roads	Percentage (%)
Tarred	1900	76
Untarred	600	24
Total	2500	100

Table 2: Road Type Distribution in 2011

Source: Authors Arc GIS Computation, 2018

Figure 4: Histogram Distribution of Road Type in 2011

Figure 5: Road Map of Awka 2011

Source: GIS Lab. Department of Surveying and Geoinformatics, Nnamdi Azikiwe University 2018

The increase in the number of roads could be attributed to the opening up of new development areas leading to the creation of new access roads and the tarring of previously untarred roads. The nature of roads in Awka by 2011 has been depicted in figure 4. In 2017, as shown in figures 5, 6 and table 3, the number of tarred and untarred roads clearly surpassed that of 2006 and 2011. The number of tarred roads were counted to be 3360 while untarred is 1409.

Road Type	Number of Roads	Percentage (%)
Tarred	3360	70
Untarred	1409	30
Total	4769	100

Table 3: Road Type Distribution in 2017

Source: Authors Computation, 2018

Figure 6: Histogram Distribution of Road Type in 2017

Figure 7: Road Map of Awka 2017

Source: GIS Lab. Department of Surveying and Geoinformatics, Nnamdiazikiwe University 2018

Thus, the total number of roads, both tarred and untarred greatly increased in the study area over time. Figure 5 and Figure 6 depicted a progressive increase in the characteristic number of roads in Awka within 11 year period.

Figure 8: Distribution of Tarred Road Type from 2006 to 2017

Source: Arcgis Analysis, 2018

Years	Total Number of Roads	Growth rate (%)
2006	600	-
2011	2500	316.67%
2017	4769	90.76%

Table 4: Road Distribution from 2006 - 2017

Source: Author's Field Survey, 2018

A modified Long, Tang, and Heilig(2007)'s method of calculating and comparing the trend of change was adopted for data analysis. The comparison of the road statistics assisted in identifying the percentage change, trend and rate of change between 2006 and 2017. In achieving this, a table was prepared showing the number of tarred/untarred roads, total number of roads and percentage change for each year measured against each other. To determine the rate of change of roads, the year period 2006-2017 was divided into two sub-periods 2006-2011 and 2011-2017 and compared against each other.

The comparative analysis in road change focuses on the two sub-periods (2006 -2011 and 2011 – 2017, a total of 11years) and the spatial distribution of the average (annual) rate of change between the two periods.

Trend of change was calculated by dividing the observed change by the sum of roads in that period multiplied by 100

$$(\text{Trend}) \% \text{ change} = \frac{\text{Observed Change}}{\text{Total Roads}} \times \frac{100}{1} \dots\dots\dots (2)$$

Where Observed change = (No. of the type of roads in the after year – No. of the type of roads in the before year).

Total Number = Total of type of roads in both years (e.g. total of tarred roads in 2006 + total of tarred roads in 2011).

The annual percentage rate = Trend divided by N (number of years).

Periods	No. of Roads	Total No. of roads	Trend of change (%)	Annual rate (%)
2006-2011	1900	3100	61.29%	12.26%
2011-2017	2269	7269	31.21%	5.20%

Table 5: Trend of Change and Annual Rate of Change of Roads (2006 – 2017)

Source: Author's Computation, 2018

A trend percentage with a value greater than zero reveals that the land use type has increased over the period of years while a value less than zero shows a decrease in the land cover/land use type over a period of time. On a general note, the trend showed that the nature of roads are increasing in the study area being greatest between 2006 and 2011 for both tarred and untarred roads.

Figure 9: Histogram of Trend of Change of Roads from 2006 to 2017

Figure 10: Histogram of Annual Rate of Change of Roads from 2006 to 2017

Years	Road Type	Number of Roads	Total No. of roads	Trend of change (%)	Annual rate (%)
2006-2011	Tarred	1525	2275	67.03%	13.41%
	Untarred	375	825	46.35%	9.27%
2011-2017	Tarred	1460	5260	22.75%	3.79%
	Untarred	809	2009	40.26%	6.71%

Table 6: Trend of Change and Annual Rate of Road Type from 2006 to 2017

Source: Author's Computation, 2018

Figure 11: Histogram of Trend of Change of Road Type from 2006 to 2017

Figure 12: Histogram of Annual Growth Rate for Road Type from 2006 to 2017

4. Conclusion

Scholars and researchers agree that transportation infrastructure, including roads for automobiles and trucks, facilitate economic development and drives economic activities in developed countries. These transportation infrastructures were part of the economic development planning that occurred during the industrial revolution in the 19th and early 20th centuries. There is no doubt that a relationship exists between transportation and economic development (Olamigoke and Emmanuel, 2013). The benefits of road infrastructure development are either direct or indirect. The benefits include travel time savings and employment opportunities that are related to the road investment, increased production and efficiency as a result of delivery of raw materials, improved access to market, and improved access to social services such as healthcare and educational facilities.

It can be deduced from the analysis of the field data, that the trend/pattern of road infrastructure has been progressive both for asphalted (tarred) and non-asphalted (untarred) road network. More importantly, the untarred road networks were more in number compared to the tarred, these may be the reason why some of the road networks in various communities have rural characters and were easily waterlogged especially during the wet season, which impacts negatively on the general aesthetics. It was also discovered that majority of the road network within the study area were characterized by potholes, poor drainage systems and poorly tarred road network. This has been attributed to deficiency in the use of durable materials for construction, and subsequently, contributed to infrastructure decay which is pulling down the economic development and growth of the people of the study area.

Inadequate maintenance in the road sector and narrow road network imposed severe challenges of traffic congestion and accidents even in the newly constructed or rehabilitated roads. To enhance migration, flow of goods and services, carriage expansion and construction of alternative routes to various locations are recommended.

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