

Spatial Structure of Road Infrastructure in Ekiti State, Nigeria: Options for Transformation

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Abstract

The extent to which a nation's landmass is covered by road network is an index of the degree of mobility of people, goods and services within the country, and the quality of the network measures the ease and cost of that mobility. Roads dominates the transport sector in most developing countries carrying eighty to ninety percent of passenger and freight. It plays a critical role in the entire transportation chain in that it connects other modes of transportation and permeates all aspects of modern economic activities in the economy. Hence the objectives of this study which examines spatial structure of road infrastructure in Ekiti State Nigeria; options for transformation are to determine the level of connectivity of road networks in the study area and also to determine the most accessible node from other significant nodes in the study area. To get a topological characteristics of the transportation network in the study area, a graph of the road network of Ekiti State was abstracted from the map sourced from the federal Road Maintenance Agency FERMA (Ado Ekiti Office). The most commonly used graph theoretic measurement of Karsky (1963) namely; the Beta (β) index, the Gamma (γ) index and the Alpha (α) index were used to determine the connectivity of road networks in the State. Shimmel index and associated number methods were also used to determine the most accessible node from other notable nodes in the study area. The results showed that the connectivity level is low with Beta index 1.39, Gamma index 0.49 and Alpha index 0.24. Result from the accessibility analyses showed that Ado-Ekiti is the most accessible node from other notable nodes on the study area. The study recommends options

for the transformation of the road transport sub-sector in the study area.

Key words: Spatial; Structure; Road; Infrastructure; Transportation

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INTRODUCTION

Transport has been recognized the World-over as very key and important in the transformation of the economy of countries of the world whether developed or underdeveloped. Arosanyin (1998) and Filani (2005) have this in mind when they documented that the sector provides the means of interaction and intergration of the various regions and sectors of any country. Leinbach (1983) in his justification of the inevitability of the transport sector observed that a non-efficient transport system perpetuates subsistence life style and limits the space of transformation and integration of the society. Among the various modes of transport, the road transport seems to be the most important especially in the developing countries because to a large extent, a substantial percentage of people and goods are moved by road from one geographical area to another. Road networks are so key and important because they provide access to work, markets, education and health care centres, they facilitate our social interaction and support our economy and even our competitiveness (Arosanyin 1998, Peter et al 2005, Ogunleye 2010).

According to Sunday (2011), Road infrastructure plays a critical role in the entire transportation chain. It connects other modes of transportation and permeates all

aspects of modern economic activities in the economy. Road transport infrastructure has enormous influence on economic growth and development, and social cohesion. It is estimated that road transportation accounts for about 90 percent of the national passenger and freight services and provides access to rural areas where majority of the economically active segment of the population lives. CBN (2003) also documented that the extent to which a nation's landmass is covered by road network is an index of the degree of mobility of people, goods and services within the country, and the quality of the network measures the ease and cost of that mobility. It further asserted that transport in general plays a crucial role in shaping the destiny of many nations because modern industry and commercial activities rest on proper, well-developed and efficient transport system. Governments of developed countries of the world have shown considerable concern for the provision of road infrastructure for example, the United Kingdom government's Ten-year plan for transport constituted and ambitious programme of investment. £180 billion was sought to improve the condition for all users of Britain's road (Peter et al 2005). Likewise in India, in order to meet the supply of raw materials for improved industrialization the governments in her 5th Development plan spent 20 percent of the development fund on transport. This was done through the improvement of the railways, and the ports and by increasing the number of access roads and the number of trucks on the roads (Arosanjin, 1998). The Federal government of Nigeria in the federal Executive council meeting of Wednesday November 30, 2005, approved an amount of N7 Billion for road projects in Abia, Taraba, Enugu, Zamfara, Osun and Kwara States (The Punch, December 1, 2005). In the same vein, the federal government's commitment to road and bridge construction from May 1999 to December, 2005 according to the federal ministry of works stands at N401, 101,281,461.64 for a project span of 14,632.24 kilometers (The Punch, May 29, 2006). On Ekiti roads alone the federal government of Nigeria in 2006 claimed to have spent N20.1 billion to complete five federal roads. The completed roads are Ado-Igede road, Igede-Itawure road, Ifaki-Ikole-Omuo Kogi State border and limited rehabilitation of Ado-Otun-Kwara border (The Punch, May 22, 2006). The Ekiti State government had allocated several billions of naira to the road transport subsector since her creation in 1996.

Despite the huge amount of money allocated to the road infrastructural development by three tiers of government, the condition of roads all over the country remain worrisome. Oyesiku (1996) corroborated this when he asserted that despite noticeable progress recorded in investment in transport and communication, many parts of Nigeria still remain inaccessible due to the absence or inadequate transport infrastructure. According to Stephen (1998), the absence of decent roads over vast areas in tropical Africa has allowed them to perform

below expectation in the conveyance of people, goods and services from one geographical area to the other despite the huge amount of money always committed to the development of the transport sector.

The study of transportation network (road network) in terms of their topological properties dates back to Euler's classical problem of the seven bridges of Konigsberg in 1736. It was until 1936 that the first text on network topology entitled "Theories der Endlichen und Uendlichen Graphen" appeared. Precisely in 1960, William Garrison, a pioneer in theoretical Geography introduced graph theory to the study of transportation network in the literature of topography and regional science. He modeled a portion of the United States interstate highway as an ordinary graph and obtained several measures regarding relative location and accessibility of the nodes and the connectivity of the entire network (Garrison, 1960).

In Ekiti State, the condition of most of the roads is so bad that a distance of less than 15km is always traversed in a period of about an hour. As the available roads are always riddled with potholes and dangerous bends. The situation is even worsened during the raining season when most of the roads are not easily passible, most earth roads are abandoned since they must have been taken over by flood as most of them lack standard culverts and bridges. It is against this background that this study tries to examine the spatial structure of road infrastructure in an emergent State of Ekiti, Nigeria with the objectives of determining the level of road network connectivity and also to determine the most accessible node from all other significant nodes in the study area and finally to recommend options for the transformation of the road transport sub-sector of Ekiti State, Nigeria.

THE STUDY AREA

The study area is Ekiti State Nigeria which lies between longitude 4°45' and 5°45' East of the Greenwich Meridian and Latitudes 7°15' North of the Equator. It lies south of Kwara and Kogi State as well as East of Osun State. It is bounded in the south by Ondo State. Ekiti State was created on the 1st of October, 1998. The State carved out of old Ondo State covers the former twelve Local government areas that made up the Ekiti zone of the old Ondo State. However, Ekiti State on creation took off with sixteen (16) Local government areas having the additional four carved out of the old ones. Ekiti State has a land area of 6,353km. Ekiti State is in the Southwestern Region of Nigeria. The State has sixteen (16) Local government areas. (Ekiti State Government, 2006)

Ekiti State has a fairly undulating plain. It lies within a beautiful area underlined by pre-Cambrian rock group. Its landscape consists of ancient plains broken by steep sided outcrop rocks which occur singularly or in group of ridges. The most notable of these rocks are found in Efon Alaaye, Ikere-Ekiti and Okemesi Ekiti. Climatically,

the State falls entirely within Koppen’s A climatic belt. It enjoys tropical climate with two distinct seasons, these are the rainy season (April-October) and the dry season (November-March). Temperature is almost uniform throughout the year. It ranges between 21oC 28oC with relatively high humidity. The State enjoys an average of 1400mm annual rainfall. The tropical rain forest exists in the south, while the guinea savanna occupies the northern peripheries. (Ekiti State Government, 2006). The high amount of rainfall received in the State to some extent affects the durability of the roads when constructed. Since most of the roads are not provided with drainage system, culverts and standard bridges, most roads are liable to flooding when rain falls thereby compounding road transport system in the State.

The State has a total of 2,384212 people according to the provisional population census figure released after the 2006 population and housing census exercise. (Ekiti State Government, 2006). The people of Ekiti form one of the largest ethnic groups in the Yoruba nation. Ekiti are culturally homogenous and they speak a dialect of Yoruba language known as Ekiti. The homogenous nature of Ekiti confers on the State some uniqueness among the States of the federation.

Infrastructurally, the State is lacking. The State of electricity, portable water, refuse system is still below average. The State of the road networks in the State is still very poor. Although work has commenced on a couple of the State roads in recent times, most of the federal and local government roads are in deplorable conditions thereby making some communities to be badly linked. This is hindering socio-economic and political activities of the people.

RESEARCH METHODS

Data for this work was collected mainly from the primary and secondary sources personal observation method was used to collect data on road network characteristics in the study area. During the exercise, the roads that fall to the category of earth roads were identified so that they could be espurged form the map of the study area showing all categories of roads. In an attempt to get the topological characteristics of the road networks in the study area, the map of Ekiti State showing the road network structure was sourced from the Federal Roads Maintenance Agency (FERMA) Ado Ekiti office. The map of the State roads was ideal for the work of this magnitude because most local government roads are in most cases earth roads constructed to facilitate movement within the local government Area. Footpaths and majority of the earth roads were ignored in the process of data collection so as not to render the findings of the work useless. A graph of the road networks of Ekiti State was abstracted from the map sourced from the Federal Roads Maintenance Agency (FERMA) from which actual indices of the structure of

road networks in the State were calculated.

To get the connectivity level of the road networks in the State, three of the most commonly used graph theoretic measurements or descriptive indices (Kansky, 1963), namely, The Beta (β) index the Gamma (γ) index and the Alpha (α) index were used to determine it. Accessibility level within the State was determined using matrix in form of square table. This was carried out by the use of the shortest path between all possible parts of nodes. The node that had the lowest associated number and shimbel index was regarded as the most accessible in the State.

ANALYSIS OF DATA AND DISCUSSIONS ROAD NETWORKS CONNECTIVITY

The presentation of the topological characteristics of any network in graph form has become a widely accepted procedure in the analysis of transportation networks (Kansky 1963). In such an approach, the network is abstracted into set of nodes (points) and set of edges (links) connecting the nodes. Based on this, it becomes possible to enumerate all the pairs of relationship between the nodes. In Ekiti State, the road network which was represented graphically has fifty three (53) edges and thirty-eight (38) vertices or nodes (v). Connectivity values have been derived for the road network, using different indices of Beta (β) Gamma (γ) and Alpha (α). The values thus obtained are Stated on table 1.

Table 1
Connectivity Values of Road Networks in Ekiti State

$\text{Beta } (\beta) \ e/v = 53/58 = 1.39$ $\text{Gamma } (\gamma) \ e/3 (v-2) = 53/3 (38-2) = 0.49$ $\text{Alpha } (\alpha) \ \frac{e-v+1}{2v-5} = \frac{53-38+1}{2(38)-5} = 0.24$
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Source: Author’s Fieldwork 2010/2011

The Beta Index: The road network connectivity using the Beta index is 1.39. The beta index ranges from 0.0 from network, which consists of vertices without arcs through 1.0 and above where networks are well connected. By certain standard, this connectivity value is low and typical of underdeveloped economy.

Gamma (γ) index: The Gamma index is the ratio of the number of edges in a network to the maximum possible in the network. This is always expressed in percentages. For a completely connected network, in the gamma index, the answer always lies between 0.0 and 1.0. The connectivity level in the State is just 0.49 or 49% which is an indication of low level of road network development in the State.

Alpha (α) index: This index is a ratio based on the number of circuits on a network rather than on the number of edges. This measure is the most ideal for connectivity measure because its range of definition is a closed interval with the convenient limit of 0 and 1 (Kansky, 1963). Based on this, the index shows that the road network in Ekiti State is 0.24 or 24% maximally connected. This also is an indication of low level of economic development.

ACCESSIBILITY OF ROAD NETWORK (NODAL ACCESSIBILITY)

As Stated in the research methods of this work, the matrix in form of square table was used to determine the degree of accessibility within the road networks in the State. Hence 1 to 38 denote the notable towns and villages in the States and are represented as follows:

1 – Okemesi, 2 – Ido Ajinare, 3 – Ijero, 4 – Odo Owa,, 5 – Ayetoro, 6 – Otun, 7-Iye, 8 – Ayede, 9 – Iyemero, 10 – Itapaji, 11 – Oke Ako, 12 – Irele, 13 – Ipao, 14 – Oke, Ayedun, 15 – Ilasa, 16 – Omuo, 17 – Ode, 18 – Ikole, 19 – Ilupeju, 20 – Oye, 21 – Ifaki, 22 – Ido, 23 – Igede, 24 – Aromoko, 25 – Ita Ido, 26 – Ado Ekiti, 27 – Iworoko, 28 – Afao, 29 – Iluomoba, 30 – Agbado, 31 – Ise, 32 – Ikere, 33 – Igbara Odo, 34 – Ilawe, 35 – Ikogosi, 36 – Ogotun, 37 – Efon Alaaye, 38 – Emure.

From the analysis, node 26 has 5 as its associated number and 107 as its shimbel index. This node has the least associated number and Shimbel index of all the major nodes in the State and thus represents the most accessible. Therefore, Ado Ekiti is the most accessible settlement to all other major settlement in the State. Furthermore, node 29, which is Iluomoba Ekiti has 114 and 56 as its Shimbel index and associated number respectively. This implies that this is next to Ado Ekiti in terms of accessibility to other notable nodes in the State. Nodes 23 and 28 which are Igede Ekiti and Afao Ekiti respectively have 117 and 06 as their Shimbel index and associated number. They are next to Iluomoba Ekiti as far as accessibility from all other notable settlements is concerned in the State. Some settlements, Ifaki and Ido-Ekiti that have been laying claim to the best central location in the State are far from being so because they have 122 and 129 as their Shimbel index respectively. Irele Ekiti in the northern part of the State and Efon Alaaye that locate at the western part of the State (the border town to Osun State) have 208 and 199 as their Shimbel index respectively. This clearly shows that they have the least central location and the least most accessible potentials from other notable settlements in the State.

RECOMMENDATIONS AND OPTIONS FOR TRANSFORMATION

For effective and sustainable road transport system and

improved structure of road infrastructure in Ekiti State, the following recommendations are inevitable.

1. The Ekiti Road Maintenance Agency (EKPOMA) should identify dilapidated roads (especially the State controlled roads) in the State and focus her attention on their rehabilitation and maintenance instead of engaging in outright construction of roads. Construction of new roads should be the concern of government. Going by the level of connectivity of the road network in the State construction of these new roads should be handled by competent construction companies that are better equipped financially and otherwise.

2. The various federal roads in Ekiti State should be visited. Fieldwork exercise showed that most of the federal roads in the State are in bad shape. All these roads should be properly fixed for improved and easy movement of people, goods and services in the State.

3. The various narrow (colonial) bridges that are on some of the major highways in the State should be demolished forth with and standard ones constructed to replace them.

4. The connectivity indices of road network in the State are still very low going by findings from Beta, Gamma and Alpha indices. It is recommended that more rural access roads should be constructed and even earth roads upgraded to pave way for easy movement of people, goods and services in the State.

5. Iluomoba, Ijan Ekiti and Igede Ekiti should be favoured in the citing of government establishment by the State government. These settlements have the second and third best central locations among other major settlements in the State after Ado Ekiti. This will assist various communities in the State to undergo minimum stress before they enjoy basic facilities that require patronage at the State capital. It will also be a good strategy to de-congest Ado Ekiti, the State/capital that is gradually becoming over-stressed as a result of rapid urbanization.

6. Globally, demand for basic infrastructural services has outstripped the supply capacity of existing assets. Most governments, especially in the developing countries are currently having the challenges of providing infrastructure. Hence the new paradigm of public-private partnership that have started in Nigeria (the concession of Lagos-Ibadan Expressway to Bi-Courtney consortium for 25 years and the Build-operate-Transfer (BOT) model of Lagos State under Lekki concession company) should be encouraged in Nigeria. This idea could be embraced by the government of Ekiti State for rapid transformation of the road infrastructure in the State.

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