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Analysis of Road Transport Dynamics in Gombe City, Gombe State, Nigeria

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ABSTRACT: *Road transportation, particularly in developing world continuous to be among the crucial factors of global change in the 21st century affecting the physical dimension of cities. As such, the paper examines the road transport development in Gombe city. In order to achieve the objectives of this research, road maps of Gombe metropolis of 1996, 2005 and 2014 were acquired to determine the changes in road network development using alpha, beta and gamma indices and 282 copies of questionnaire were distributed to assess the effects of road transport development on commercial activities in the study area. The results of the computation of gamma: 56.9%, 57.9% and 60.0%, beta: 1.61, 1.70 and 1.80 and alpha 31.3%, 35.3% and 38.9% indices indicated that there is a significant increase in road connectivity in Gombe metropolis from 1996 through the 2005 to 2014. Further results revealed 95% of the respondents indicated that improvement in road network affects movement and economic activities in many ways which include: provision of access to commercial outfits which bring about profit by locating along major roads, junctions and roundabouts which in turn result to increase in income, improvement in standard of living and reduction in poverty. It is therefore, concluded that road transport development dictate the pattern of urban commercial outfits and also affects commercial activities positively. The study discovered the importance of road transport infrastructure to the improvement of commercial activities in the study area. It is consequently, recommended that more roads should be constructed, renovated and dualyzed in order to improve and diversify the commercial nature of Gombe metropolis. The study further exposed that urban roads are given more priority in Gombe State. Thus, recommended that rural roads should be improved to harness the economic potentials in the state at large.*

Keywords: *City, Connectivity, Dynamics, Road, Transportation.*

I. INTRODUCTION

Transportation encompasses the movement of people, goods and services from one point of origin to destination (Filani, 1993). Transportation is indispensable to modern economic development especially in a developing country like Nigeria. It plays a vital role in shaping the economy of any nation (or region) because modern industries and commercial activities rely on proper, well developed and efficient transport system (Anyanwu, Oaikhena, Oyefusi and Dimowo, 1997). In support of this, Wane (2001), pointed out that transportation is a crucial vector for urban insertion since it gives access to economic activity, facilitate family life, and helps in spinning social networks. Transport is a central dimension of the national and global production systems that are reshaping the world, making it a topic of universal interest and importance. People move from one place to the other, regularly or occasionally. Goods collected, extracted and manufactured, must be distributed from place to place prior to consumption. People who need services, which are generally provided at a limited number of places, must travel in order to access such services. Transport therefore fulfils a very important function in a society and is one of the most pervasive factors in any economy (Munby in Hoyle and Knowles, 2001). Transport developments may lead to changes in the pattern of land use in an urban centre around the transport corridors, with more transport intensive uses; including consumer activities locating closer to transport interchanges. Commercial, retail and residential development may be affected.

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These impacts can be important at a local level but basically affect the geographical pattern of activity rather than the overall level of activity. The effects are therefore, local rather than national or even regional (Planning, Economic and Development Consultants, 2004).

There are different conventional transport modes: roads, rail, air, water and pipelines. These modes of transport are all important in one way or the other. However, roads transport serves other modes of transport as it provides door-to-door services. Schneider (1994) described roads as an integrated system that is made up of nodes and routes. The nodes are towns which associated themselves to the roads, while the routes are the different types of roads. Howel (1984) defined road as an economic penetrating route which is required to open ways for investment in new activities such as agriculture and commerce. Musa (2003) defined roads as those which are clearly necessary ingredients of nearly every aspect of economic and social development. It links the most remote locations and has been found to be more useful in gathering goods to collection points for distribution and marketing in rural and urban centres.

Road networks are observed in terms of its components of accessibility, connectivity, traffic density, level of service, compactness and density of particular roads. Access to major roads provides relative advantages consequent upon which commercial users locate to enjoy the advantages. Good road projects clearly contribute to poverty reduction by improving the living conditions of people and by augmenting the opportunities available for trade and employment (Onakomaiya, 2012).The economic development of Nigeria has reflected the development of her transport systems. This is particularly true of the road transport system, which is by far the most widely used mode of transport in the country. Filani (2003), noted that the vast majority of transportation in Nigeria is by road. Today, road transport accounts for more than 90% of the country's goods and passengers movements. This was further reaffirmed by Onakomaiya (2012), that of all commodity movements to and from the sea-ports, at least two-thirds are now handled by road transport, while up to 90% of all other internal movements of goods and persons take place by roads. The potential significance of road development for investment, trade, growth and poverty alleviation has long been recognized. Not only does road transport infrastructure facilitate the direct provision of services to consumers, it also provides intermediate inputs that enter into the production of other sectors and raise factor productivity (Anyanwu, *et al*., 1997). As such, its role toward enhancing economic growth and diversification cannot be underestimated. Thus, the role played by roads in economic development has motivated government to spend a lot on transport development with huge amount of money budgeted to roads in the transport sector (National Development plan, 1975-1980).

It is also evident that Gombe state government has spent a significant amount of her financial resources constructing, expanding and modernizing roads in the state, mostly in the state capital (Gombe), where many other such projects are still ongoing. The state government has since the creation of the state in 1996 embarked upon the development of more roads to enhance connectivity and accessibility, within and around the state. Gombe state government recognized road development as a catalyst for development, particularly in the state capital, the question that always arises is, has the major financial investment in road development over the years influenced connectivity in city? This is the focus of this study. Thus, the objective of the study is to determine the changes in road network development over three periods in Gombe (1996, 2005 and 2014).

II. STUDY AREA

Gombe is located between Latitudes 10°15'02"N to 10o20'00"N and between longitudes 11°05'00"E to 11o15'05"E. Gombe town shares common boundary with Akko Local Government Area in south and west, Yamaltu-Deba L.G.A. to the east and Kwami L.G.A. to the north (see fig. 1.0) and occupies a total land area of 52Km2. It is the capital of Gombe state with a population of 266,844 (NPC, 2006). The population is projected to be 399,531 persons using 3.2% growth rate Gombe State Office (NPC, 2009). Gombe is well linked to other regional centres by trunk "A" roads. A single gauge railway line on the Bauchi to Maiduguri route also links the town, in addition to an international airport. Further more. The study area is divided into different residential quarters which include: GRA, Federal Low Cost, Arawa, State Low Cost, Kumbiya-kumbiya, Pantami, Jekadafari, Tudun Wada, Madaki, Dawaki, Bolari, Yalanguruza and Shamaki among others.

III. MATERIALS AND METHODS

Two sources of data were used in the course of carrying out this research work. These include: Primary sources; information acquired through reconnaissance survey, questionnaire, personal interviews, and the researcher's observations. Secondary sources; information acquired through the use of textbooks, theses, project materials, publications, journals and internet. There are 24 major road corridors that form the road network in Gombe city. The roads were alphabetically arranged and ranked in ascending order. The identified roads formed the sample points where the copies of questionnaire were administered to the respondents. A total of 282 copies of questionnaires were distributed and 280 were recovered for the analysis. Direct method of questionnaire administration was adopted and carried out personally by the author. Information collected on the effects of road transport development in the study area were summarized, presented and discussed. Various responses were analyzed using non-inferential statistics. The methods employed include the use of percentages, frequency distribution, tables and graphs. Three graphic theoretic measures were used in analyzing the road network connectivity: Alpha, Beta and Gamma indices. The roads network in Gombe city during each period were converted into topological graphs. These graphs were then analyzed to determine the alpha, beta and gamma indices. These indices help to determine the connectivity level in the area under study.

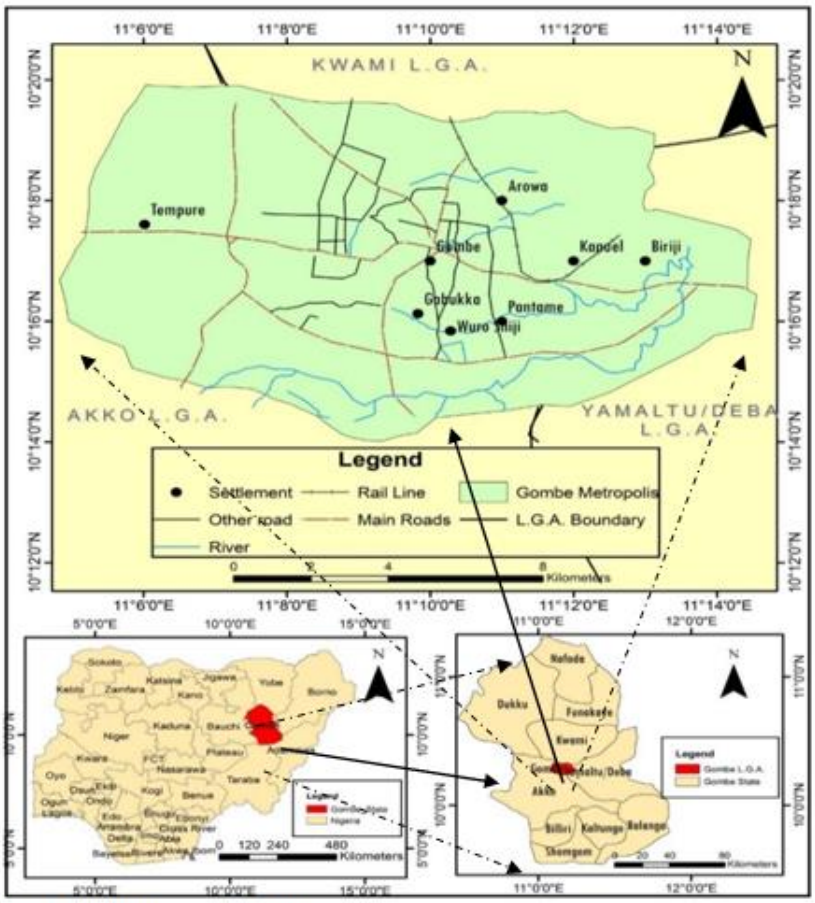

Fig. 1: Map of Gombe City.
Source: Ministry of Land and Survey, Gombe State.

IV. RESULTS AND DISCUSSION

4.1 Road Network Development Dynamics of Gombe City

In order to determine the changes in connectivity over time in the study area, three graphic theoretic measures were used in analyzing the network connectivity, which are all based upon the relationship between the number of edges and vertices in a network. They include: Beta, Gamma and Alpha indexes. It is clear that the number of both edges (links) and vertices (nodes) continue to increase from 1996 through the 2005 to 2014 (see figure1).The

alpha, beta and gamma indices were calculated from the topological maps that were generated from the road network maps of different period (figure 3a, 4a and 5a) to show the degree of connectivity in Gombe city (see figure 3b, 4b and 5b). On the other hand, figure 2 contains the summary of the trend of roads network dynamics in Gombe.

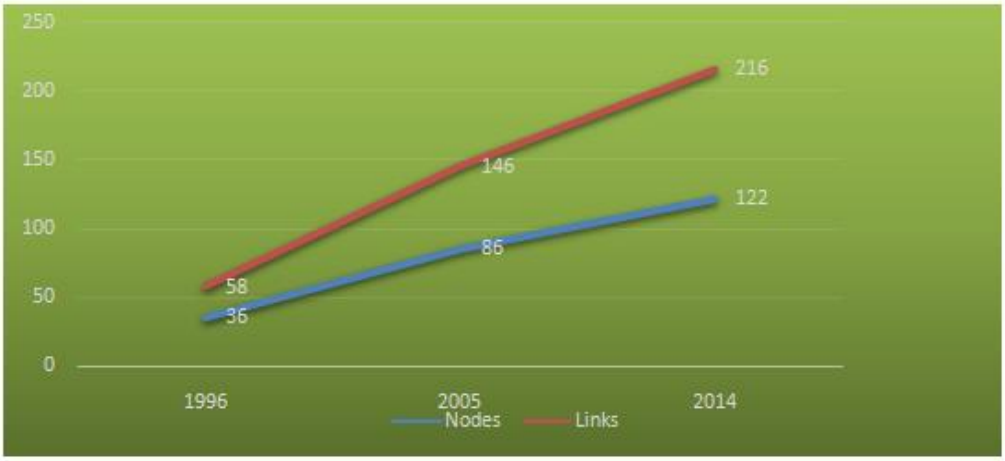

Fig.1: Road Edges and Vertices of Gombe City
Source: Author's Work, 2015.

The results of the measure of connectivity on table 1, shows the degree of changes in connectivity of road network in Gombe city. The results of the computation of gamma, beta, and alpha indices indicated that there is a substantial increase in road connectivity in Gombe city from 1996 through the 2005 to 2014. The beta index revealed that there is increase in connectivity in the area from 1.61 in 1996 to 1.70 in 2005 and 1.80 in 2014. In the case of alpha index, connectivity was 31.3% in 1996 but increased to 35.3% in 2005 and 38.9% in 2014.Thegamma index further revealed an increase in road connectivity over the last two decades. The result shows that road connectivity witnessed an increase from 56.9% in 1996 to 57.9% and 60.0% in 2005 and 2014. In a nutshell, all the three indices calculated have indicated improvement in connectivity in Gombe city. Without doubt therefore, it can be concluded that a lot has been done in the area in terms of road construction for the period under study.

Table 1: Road Connectivity Indices of Gombe City Over Three Time Period

S/N	Year	Beta	Gamma	Alpha
1	1996	1.61	56.9%	31.3%
2	2005	1.70	57.9%	35.3%
3	2014	1.80	60.0%	38.9%

Source: Author's Work, 2015.

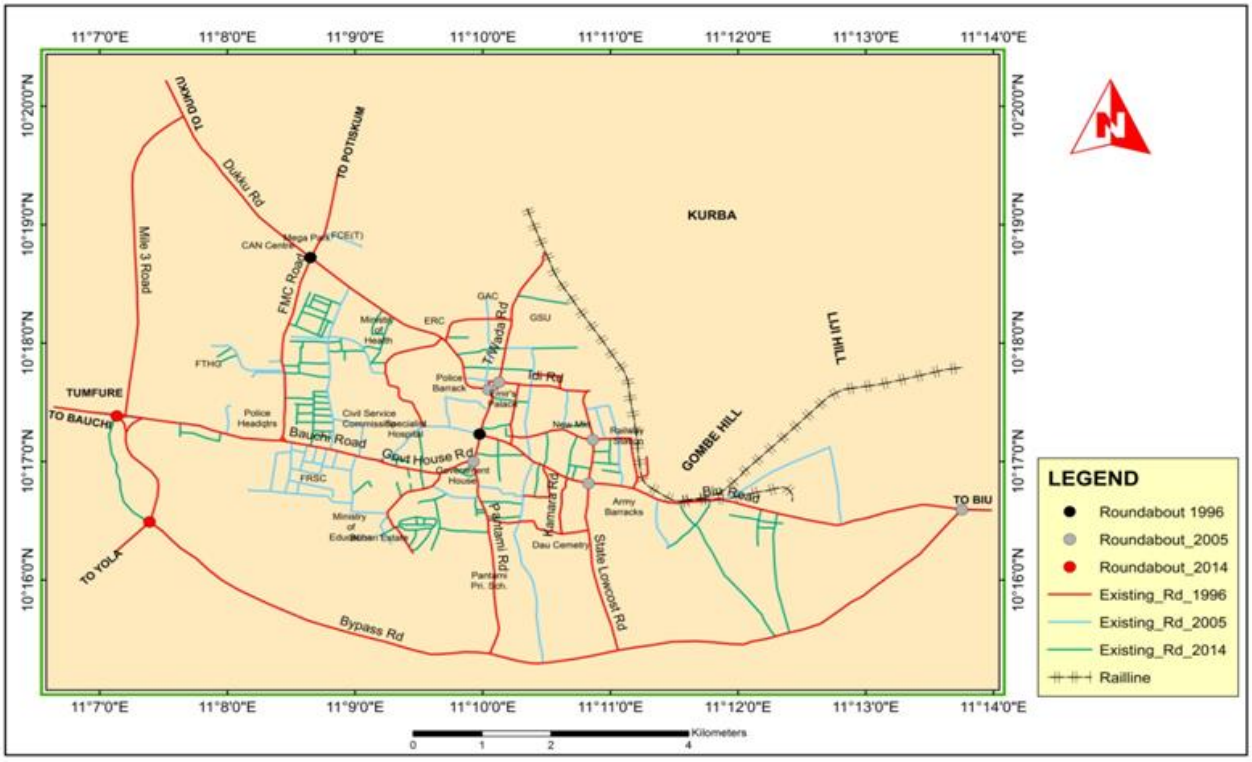

Fig. 2: Gombe Metropolis Road Network Dynamics in 1996 to 2015.
Source: Author's Work, 2015.

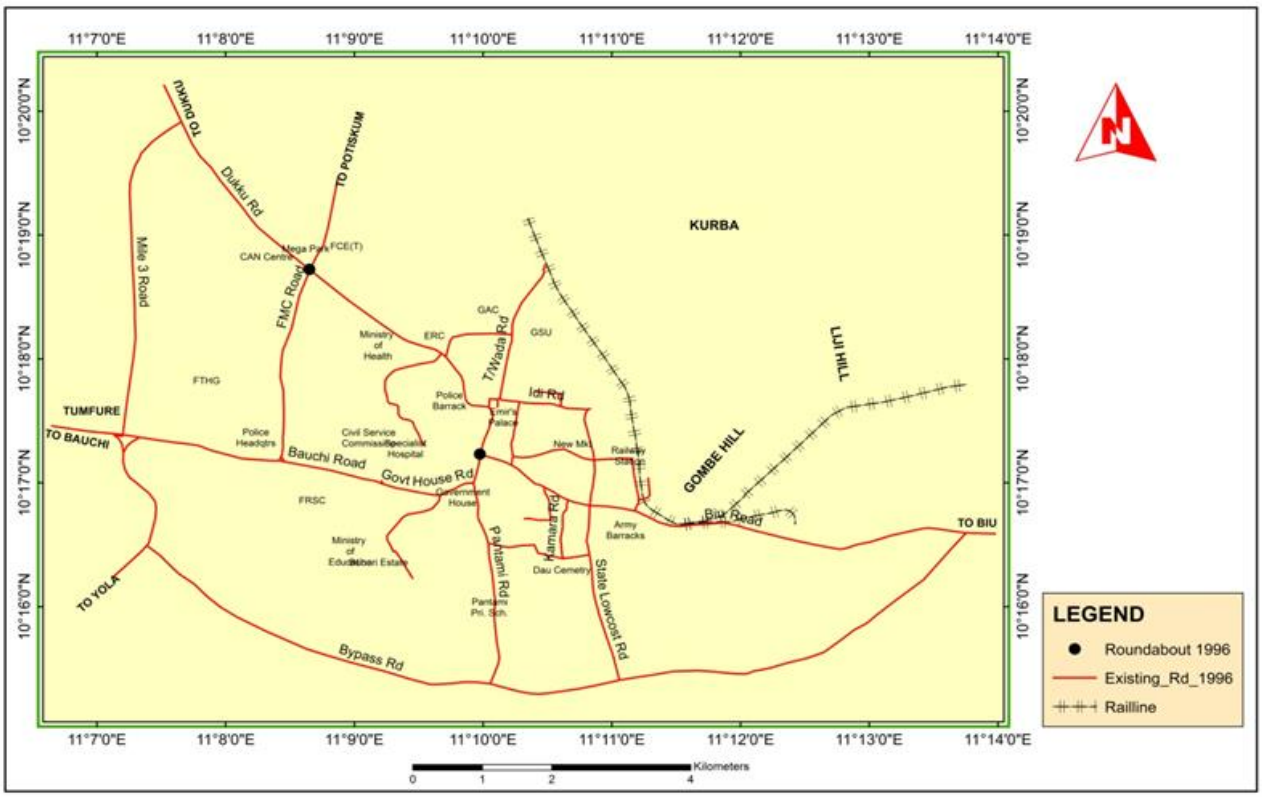

Fig. 3a: Gombe Metropolis Road Network (1996)
Source: Author's Work, 2015.

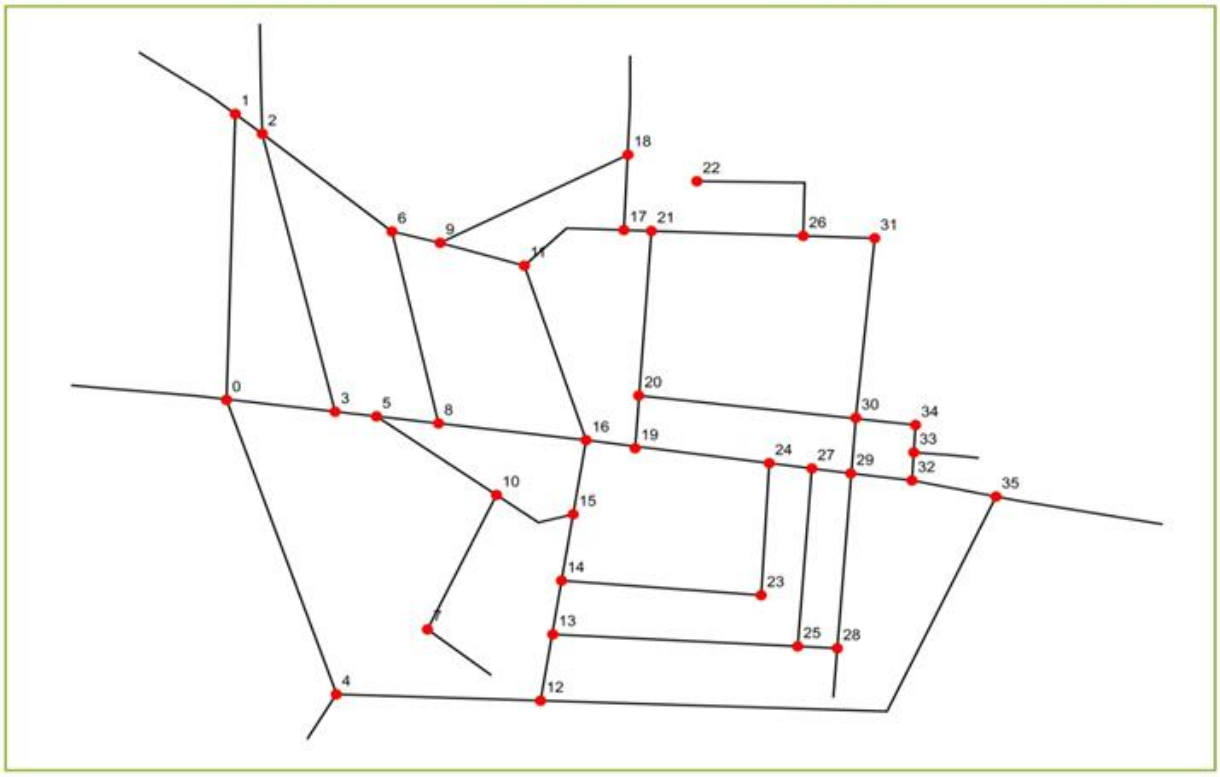

Fig. 3b: Topological Graph of the Road Network of Gombe Metropolis (1996)
Source: Author's Work, 2015.

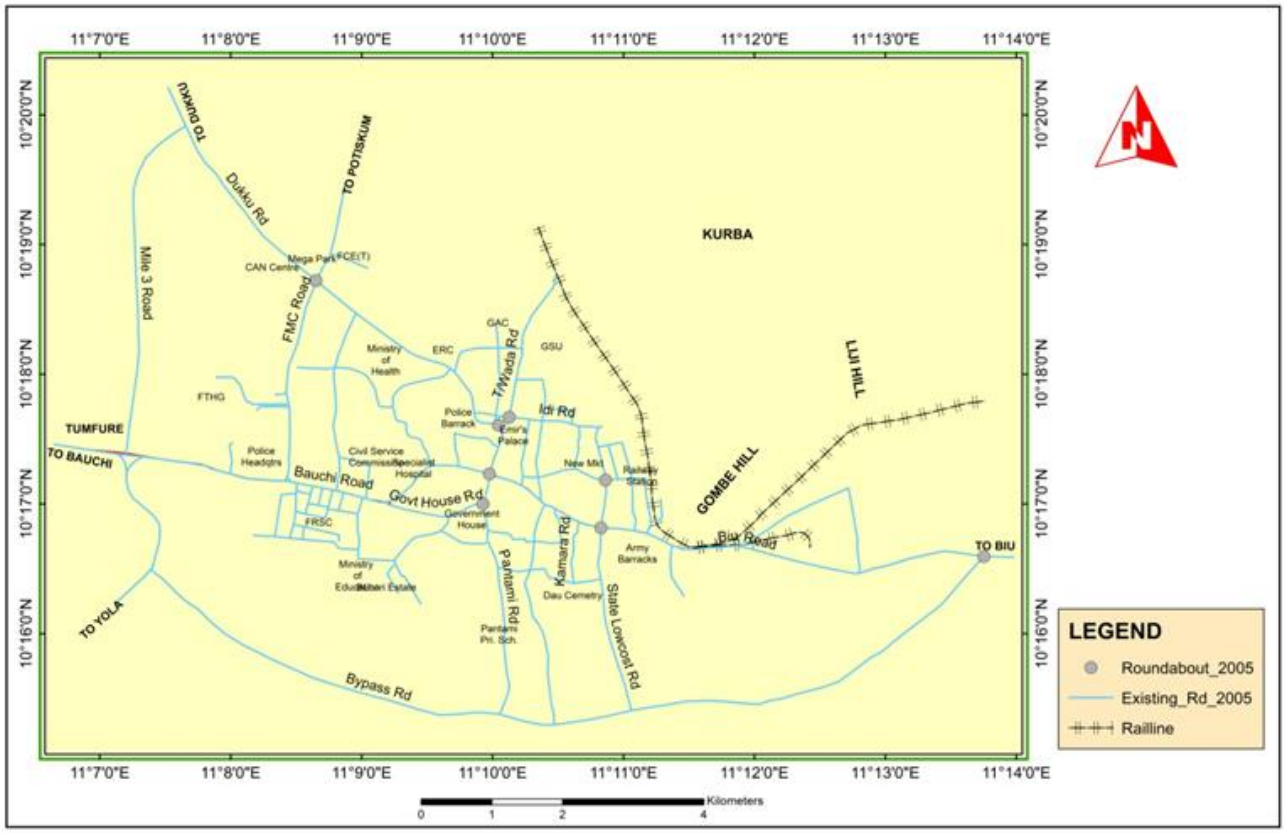

Fig. 4a: Gombe Metropolis Road Network (2005)
Source: Author's Work, 2015.

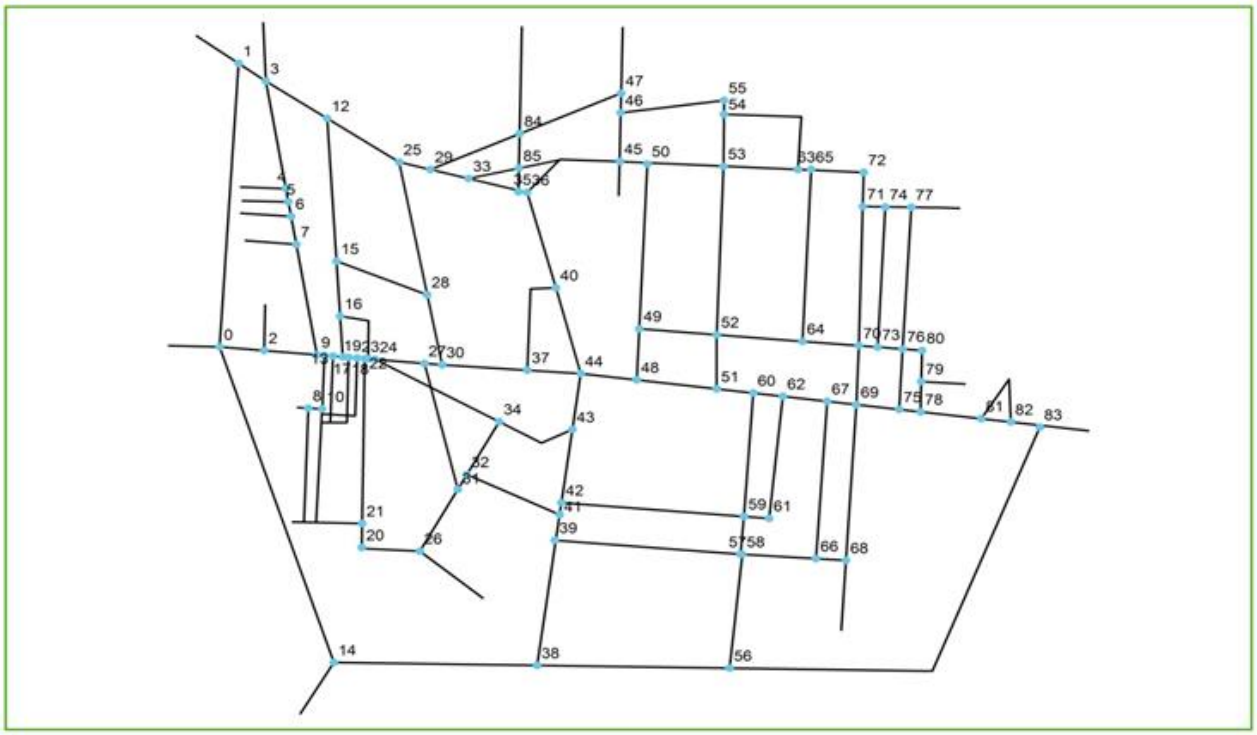

Fig. 4b: Topological Graph of the Road Network of Gombe Metropolis (2005)
Source: Author's Work, 2015.

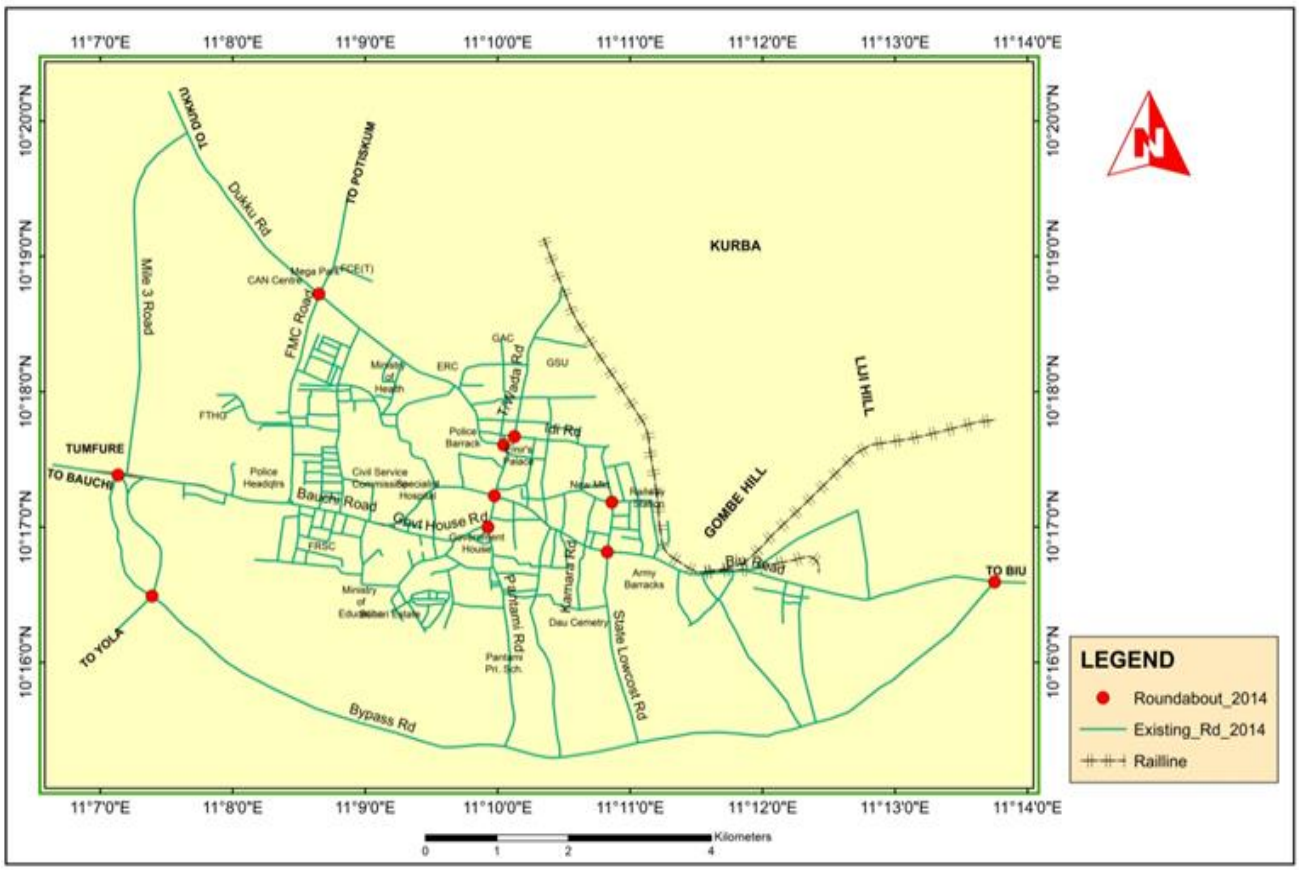

Fig. 5a: Gombe Metropolis Road Network (2014)
Source: Author's Work, 2015.

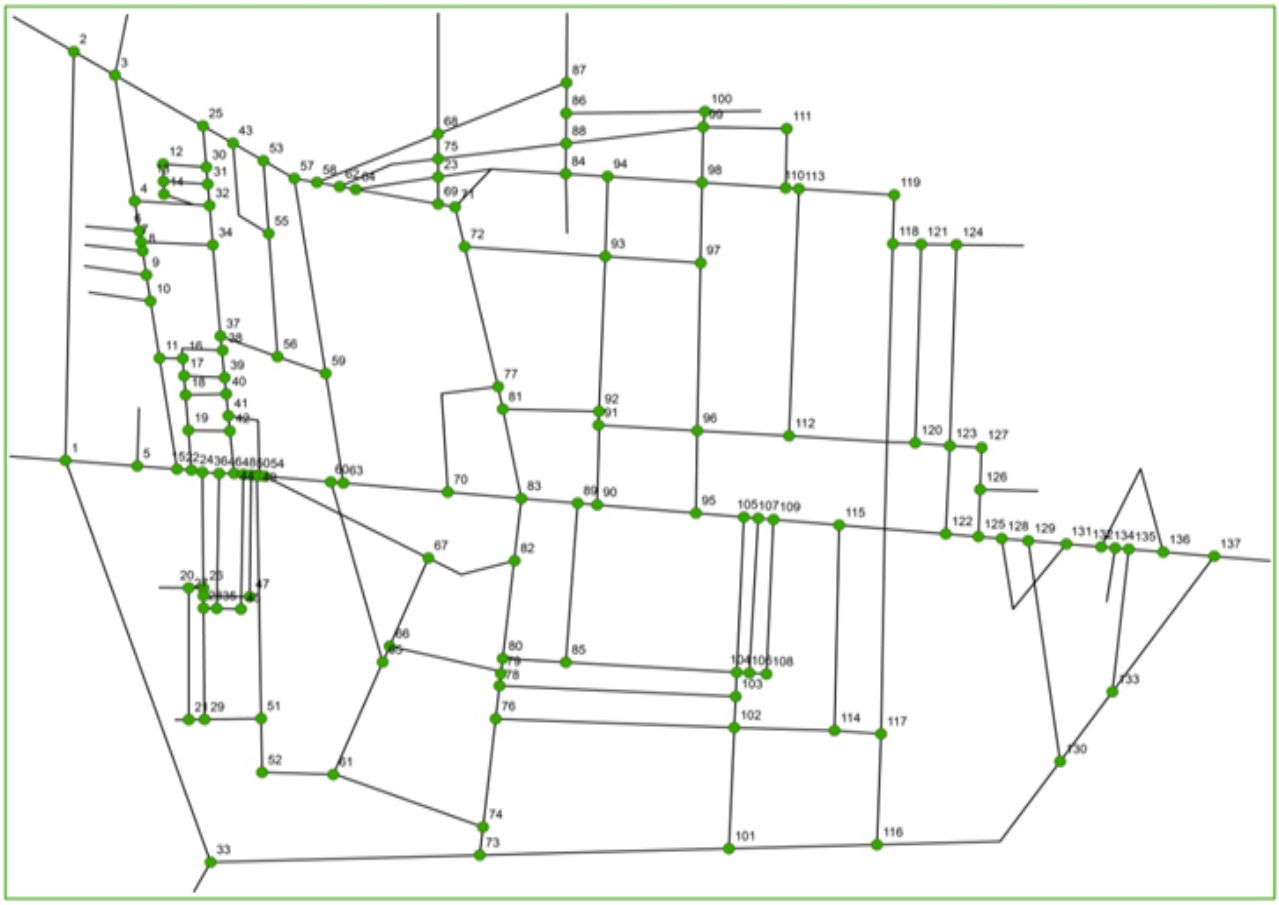

Fig. 5b: Topological Graph of the Road Network of Gombe Metropolis (2014)
Source: Author's Work, 2015.

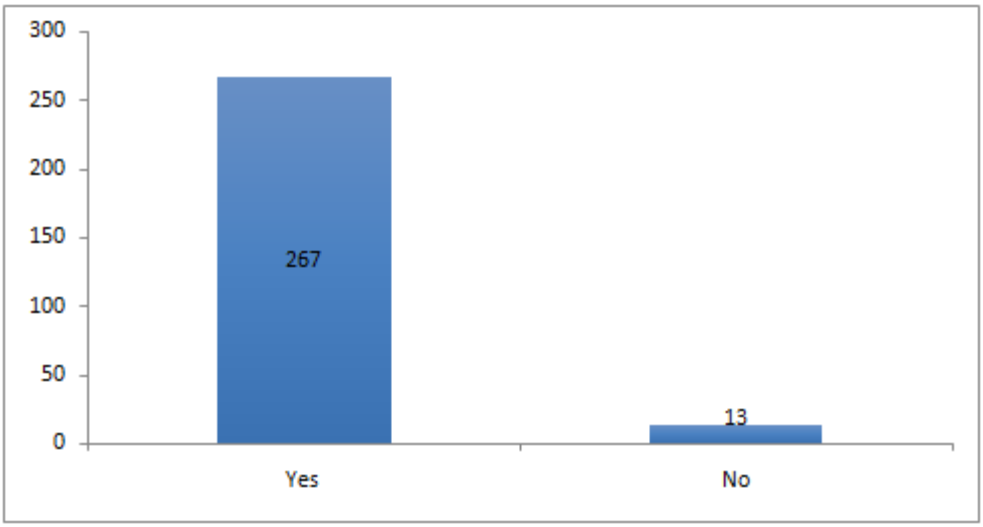

Fig. 6: Socio-Economic Impacts of Roads Network
Source: Author's Work, 2015.

Fig, 6: shows that 95% (267) of the respondents understood and accepted the fact that constructing new roads has impacted on their businesses, while only 5% (13) says road construction had no impact on their commercial endeavours. This implies that construction of roads affects business positively and contributes to the development of different commercial activities anywhere in the world, particularly in the study area.

V. CONCLUSION

The study was on the analysis of road transport dynamics in Gombe city. As such, the findings of this research were summarized. Based on the results of road network development presented in the study, beta index revealed that there is an increase in the number of roads leading to each node from 1.61 in 1996 to 1.70 in 2005 and 1.80 in 2014. Alpha was 31.3% in 1996 but increased to 35.3% in 2005 and 38.9% 2014. Gamma index further revealed an increase in road network connectivity over the period of time under study. The result shows that road connectivity witnessed an increase from 56.9% in 1996 to 57.9% and 60.0% in 2005 and 2014 respectively. The study allows the following conclusions to be drawn. The results of the computation of gamma, beta, and alpha indices indicated that there is a significant increase in road connectivity in Gombe city from 1996 through the 2005 to 2014.

The following recommendations are made based on the researcher's findings to chart a way forward on the part of road transport development, in the study area.

VI. RECOMMENDATIONS

i. The study discovered the importance of road transport infrastructure to the improvement of commercial activities in the study area. It is therefore, recommended that more roads should be constructed, renovated and dualised in order to improve and diversify the commercial nature of Gombe metropolis.

ii. It was also discovered that urban roads are given more priority in Gombe State. It is also recommended that rural roads should be improved to harness the economic potentials in the state at large.

iii. The study tried to analyze one of the indicators of road transport development in the study area, which is connectivity indicator. As such further research can explore the rest of the critical indicators such as: accessibility, road density, etc. Other areas to pay attention to in the future include: effects of road transport cost, travel distance, travel time savings on commercial activities in the study area. This would go a long way in understanding the important nexus that exist between road transport and commercial activities in most of the cities of the developing world.

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