



Locational Difference in road surface quality in Calabar Urban: The legal and planning Implication

Victor Ani Offiong¹, Francis E Ogban²

¹⁻² Planning and Building Law, Common Wealth University, London Graduate School, England, United Kingdom

² Department of Urban and Regional Planning, Cross River State University, England, United Kingdom

Abstract

The study was aimed at assessing the locational difference of roads surface quality in Calabar Urban, and its legal and planning implication thereof. The study adopted a mixed method research design, which comprised survey research design and geospatial research design. Discrete type of data from both primary and secondary sources were obtained. Data collection was from direct field measurement. Out of a total of 1677 roads, 109 roads were major roads and 8 were highways. These were identified and 25 roads were purposively selected in the study. Analysis of Variance (ANOVA) was adopted in testing the hypothesis of the study. The result of the study revealed the measurement of road width, road length and sidewalk width of 8 highways with Murtala Muhammed Highway indicating the highest. Map of the study area showing minor roads, major roads and highways was designed. The map visualizes three major road types, which include: tiny yellow lines representing minor roads, the thick gold colour lines represent major roads and the dotted black and white lines represent the highways. The highways are Eta Agbor, IBB way, Marian, Murtala Mohammed Highway, Airport Bypass, Parliamentary, Calabar Road and Mary Slessor. Lastly, the result of the tested hypothesis revealed that road surfaces (potholes and patches) do not differ significantly within the three distinct network zones in the Calabar Urban. It was thus recommended that efficient laws and policy should be put in place for proper management of road whilst old roads should be renovated and expanded to increase their carrying capacity.

Keywords: road, road surface quality, locational difference, planning and legal implication, law, Calabar Urban

1. Introduction

Cities are complex spatial structures supported by transport systems. The impact of urban transportation on flow of urban elements is one of the most contested concerns in metropolitan transportation planning today. Transportation brings many benefits to individuals, communities, and the local economy (National Express Transit, 2017) ^[5]. Not only does transportation system provide mobility for people and goods, it influences the pattern of growth and economic activities by providing access to places. More important is the fact that urban transport efficiency has high influence on the socio-economic survival and strength of a city. Nigeria today has an extensive road infrastructure and government has continually placed priority to road transport infrastructure development in appreciation of its development facilitating roles in the movement of people and goods (Yakubu, 2016) ^[7]. Road transport is by far the most important element in the country transportation network carrying about 95% of all the nations' goods and passenger (Olagunju, 2011). In Nigeria, there are different types of transport networks, majorly classified according to their quality. The quality is determined by the width, type of surface, number of lanes, facilities available, and so on. There are the high quality Trunk 'A' roads, some dual carriage, owned and maintained by the Federal Government, and linking the States and the Federal capital. According to Federal Ministry of Works (FMW, 2013), Nigerian road network is classified into four categories namely: A, B, C and F. According to Federal Ministry of Works (FMW, 2013), Nigerian road network is classified into four categories namely: A, B, C and F. Road networks in Nigeria

is characterized by structural deficiency, pot holes, lack of architectural designs plan and poor policies. These appalling conditions of road surface quality in Nigeria, permeates all states and cities in the Country. For instance, road surface quality in Calabar urban, Cross River State, lacks complementary road facilities such as boulevard and sidewalks. The poor layouts and alignments of many roads in the city create friction points at intersections. Many of the roads have pavements of less than seven meters wide and their narrow widths are responsible for lack of pedestrian sidewalks along them. Furthermore, many streets also experience reduction in their carriage capacity during rainy season as a result of poor drainage system. Cases of flooding often lead to traffic diversion thus, increasing travel time from 30minutes to 1hour (Sule, 2005) ^[6]. In addition, the road surfaces quality in Calabar is plagued with potholes, which are a notorious problem and frequent cause of several accidents and damages to all kinds of vehicles. These damages pose serious threat to the sustainability of transport infrastructures in Calabar urban in particular and to Nigeria in general. Based on this backdrop, the study assesses the quality of road surfaces in Calabar urban and the legal as well as planning implication of poor road network.

1.1. Objectives of study

1. To examine the spatial variation of road surface quality in Calabar urban as well as to examine the legal and planning implication thereof.

1.2. Research Hypothesis

There is no significant variation in road surface quality across the Calabar urban.

1.3 Calabar Urban Description

Calabar is a city located on the Cross River estuary with good a harbour. It lies between longitude 8°17'30''E and 8°22'30 E and latitude 04° 66'0N and 05° 4'0N. It covers a total land mass of 274. 349 square kilometer. Calabar is bound in the north by Odukpani Local Government, to the west by the Cross River channel to the east by the Great Qua River and to the south by Akpabuyo Local Government Area. The city has a population of 370,022 (National Population Commission, 2006). The road network of Calabar depicted on the orthophoto map of the Calabar Urban reveals that Calabar has about 1677 roads, 1566 minor roads, 101 major roads and 8 highways. Three major highways bisect the city, the Murtala Mohammed Highway, Parliamentary and Marian Road. All traffic in the inner city is emptied into the highways which are easily overloaded beyond their carrying capacity. Recently, there has been an improvement in land transportation, even though some of the roads are in a very bad shape. The Calabar- Iking highway and Calabar – Ikom- Ogoja Roads are the main existing routes from Calabar, and they are in deplorable condition.

2. Literature Review

Ezirim (2003) observed in Nigeria that about 26% of the paved road network was in poor condition requiring rehabilitation and reconstruction while 42% was in fair condition that requires resurfacing to prevent further decline to poor conditions. The conditions of unpaved roads were even worsening. Umoren, Sule, and Eni (2011) noted that good quality road infrastructure attracts immense socio-economic development than the bad road condition. Data on road transport infrastructure variables were obtained from field survey, questionnaire and data from relevant agencies. Factor analysis technique was applied to the fourteen variables to achieve a parsimonious description and identify the major factors which act as a pivot of road infrastructure quality development. The study revealed that the Calabar Urban has a total length of 6288km of roads, where 1272.6km (20%) are paved or tarred roads while about 5015.4km (80%) were unpaved or untarred roads. Furthermore, it was noted that a greater percentage of the roads in the area are unpaved and it is recommended that efforts should be made to increase the length of paved roads in the area to attract socio-economic development. Akinleye and Tijani (2017) in their study, assessed the condition of asphalt concrete used for pavement construction in southwest Nigeria so as to ascertain the causes of failure of newly constructed/rehabilitated asphalt roads. Samples of asphalt concrete and bitumen were collected from three asphalt plants selected for the study. Samples from each plant were subjected to bitumen extraction and sieve analysis, hot mix Marshall Stability and flow tests, penetration and viscosity tests. Results obtained were compared to the 2007 Federal Ministry of Works and Housing Standard Specifications for Roads and Bridges. The results revealed that none of the samples met all the criteria stated in the specifications, suggesting that the nature of asphalt concrete is a possible cause of premature failure of road pavements in southwest Nigeria. It is

recommended that further research be conducted on other constituents of asphalt concrete as well as other structures of the flexible pavement. Naazie, Braimah, Vincent and Atindana (2018) The study sought to investigate the effects of bad roads on transportation system and its maintenance and service cost in the Gushegu District in the Northern Region of Ghana. Both primary and secondary data were collected for the study. The primary data involved 150 Drivers, Driver Mates and Transport Owners using mainly questionnaire. The findings showed that bad roads had effects on transportation system as this brought about frequent break down of vehicles and increased maintenance cost. It is therefore recommended that government should formulate a good road infrastructure policy that will enhance the sustainability of road infrastructure and should also encourage public participation in road infrastructure provision and maintenance to accelerate development of the District. The integration of complex networks methods by transport specialists is very recent (Kuby, Tierney and Robert 2005) and comes as a complement to other approaches such as circulation, routing and flow optimization which strongly focus on transport costs. We propose distinguishing amongst the structure and the dynamics of transportation networks. Transportation networks have been defined and analyzed with regard to their topology, geometry, morphology, and spatial structure. It presents a critical overview of main global (network level) and local (node level) measures and examines their usefulness for understanding transportation networks. Okoko (2007) investigates the travel modes of school children in a densely settled neighbourhood in Akure town, Nigeria. The comprehensive result of the survey shows that the dominant mode of travel to school in the Calabar Urban is walking. Out of total sample of 300, the number of school children that walked to school was found to be 142, representing 47.33 per cent of the sample. The high percentage underscores the importance of walking as a means of commuting to school. School buses came second as a means of transport for school children, accounting for 21.67 per cent. Private cars and public transport accounted for 15.33 per cent and 15.67 per cent respectively. The information was subjected to a chi-square (X^2) analysis principally to determine whether there was any significant difference in the mode choice pattern of school education in the selected school. The Calabar central city traffic flow problems characterized in Sule (1980) above can only be resolved by specific urban central city circulation redevelopment. It is not exaggeration according to the author to mention that a chaotic traffic problem only helps to reduce the marginal productivity of labour as the efficiency of workers become weakened by the result of the difficulties involved in intra-city movement, while the author posits that the recruitment of traffic warders (Pseudo-police recruits) to remedy the problem of traffic congestion in Calabar is piecemeal solution and haphazard, because of the narrow nature of Akim Road, Goldie Street, Target Road, and Calabar Road's one-lane traffic design at the CBD. The argument that Calabar urban roads such as Akim, Goldie Street, Target, Calabar Roads, etc, are narrow is no longer tenable since all of these roads have now been tarred with complementary road facilities such as streetlights, drainages, pedestrian flyovers and walkway while some have become dualized.

3. Methodology

3.1.1. Types of data

The different types of data used for this study include: Geospatial data, data on road measurement, data on road surface quality, and data on orthophoto map of Calabar

3.2. Sources of data

Two main sources of data were explored for this study. Primary sources of data: This involved the use of Global Positioning System (GPS) to take coordinates of locations. The measuring tape was used to take direct measurement of sidewalk width, drainage width and depth. Secondary sources of data: This involved the use of data from the attribute table of orthophoto map of Calabar. Geometrical calculation was used to derive the measurement of road width and road lengths.

3.3. Sampling framework

Out of a total of 1677 roads, 109 roads Were major roads

And 8 were highways. These were identified and 25 roads were purposively selected for the study.

3.4. Sampling technique

The Calabar Urban was stratified into three traffic zones based on road network density and density of nodes per zone. Purposive sampling was employed in selecting the roads within the three traffic zones for equal representation. A total of 25 roads were considered and the high density/traffic zone had 11 roads, medium density/traffic zone had 9 roads while low density/traffic zone had 5 roads (Table 3.2).

3.5. Sample size

There are 109 major roads identified in the orthophoto map of Calabar and confirmed through ground truthing with Global Position System (GPS), of these 25 roads were selected for the survey (Table 3.1).

Table 1: Distribution of Samples

Zones	Road type	No. of nodes	No. of roads	20% sample size
High density traffic (Zone A)	Major roads	55	50	11
Medium density traffic (Zone B)	Highway/major	45	41	9
Low density traffic (Zone C)	Highway/major	27	19	5
Total		126	109	25

Source: Authors' reconnaissance survey, 2019

Table 2: Table of Sample Size

Road type	No of Roads Considered
Highways	8
Major roads	17
Total	25

Source: Authors' reconnaissance survey, 2019

3.6 Data analysis

The data collected or generated for this study was presented using tables, charts, graphs and the statistical technique such as ANOVA was employed to analyze the data.

The tested hypothesis was expressed as follows:

3.6.1 Hypothesis

H₀: There is no significant variation in road surface quality across the Calabar Urban.

H₁: There is significant variation in road surface quality across the Calabar Urban.

To test this hypothesis, Analysis of Variance (ANOVA) was employed to compare the surface roads across the Calabar Urban. The statistic showed the variation in surface roads of different zones in the Calabar Urban.

The formula for Analysis of Variance is given below as: —

$$TSS = BSS + WSS$$

$$\sum(x_{ij} - \bar{x})^2 = \sum n_i (x_i - \bar{x})^2 + \sum \sum_i (x_{ij} - \bar{x}_i)^2$$

Where: X = grand mean

TSS = Total sum of squares = $\sum \sum (x_{ij} - X)^2$

BSS = Between sum of squares = $\sum r_j (x_j - \bar{x})^2$

WSS = Within sum of squares = $\sum \sum (x_{ij} - \bar{x}_i)^2$

MSS = Mean sum of square = SST / n-1

BMS = Between mean sum of square = SSB / n-c

WMS = Within mean sum of square = SSW / n-c

4. Result and Discussion of Findings

Table 4.1 shows the characteristics of roads such as road width and road length. The road widths and road lengths of 17 major roads and 8 highways was derived through geometrical calculation. Figure 9 indicates the road width, road length and sidewalk width of highways. This reveals the measurement of road width, road length and sidewalk width of 8 highways with Murtala Muhammed Highway indicating the highest. Road width and length of major roads as shown in Figure 10 show the measurement of road width and road length of 17 major roads with New Airport, Goldie and MCC Road indicating the longest respectively.

Table 3: Characteristics of roads: road width and road length

Road name	Road type	Road width	Road length(m)	Road length(km)
New Airport	Major	6.9	2660	2.7
Jebs	Major	6.7	1791	1.8
Edibe Edibe	Major	7.1	1622	1.6
Mbukpa	Major	7.3	1050	1
Ekpo Abasi	Major	7.5	1367	1.4
Mt. Zion	Major	6.5	1081	1.1
Uwanse	Major	6.2	1709	1.7
Mayne Avenue	Major	7.2	2118	2.1

Target	Major	6.5	1594	1.6
Goldie	Major	7.5	2919	2.9
Atamunu	Major	6.6	1984	1.9
IBB Way	Highway	14.6	3694	3.7
Atimbo	Major	11.6	2059	2.1
Etta Agbor	Highway	15.4	1632	1.6
Marian	Highway	14.6	3523	3.5
Mary Slessor	Highway	15.8	2013	2
Old Odukpani 1	Major	6.8	1007	1
Murtala Mohammed Highway	Highway	16.5	8774	8.8
Calabar Road	Highway	13	2555	2.6
MCC	Major	7.8	3211	3.2
Parliamentary	Highway	14.5	6920	6.9
Habour	Highway	14	1656	1.6
Old Odukpani 2	Major	6.7	3729	3.7
Ikot Effa	Major	6.6	820	0.82
SPC Road	Major	7.3	707	0.707

Source: Authors' fieldwork, 2019

Figure 4.2 depicts the measurement of drainage width and depth of 8 highways in the Calabar Urban with the Murtala Muhammed Highway having the widest drainage among the category of highways. The widest drainage is found along the Federal Secretariat which is often flooded. The figure represents the drainage width and depth of major roads showing the measurement of drainage width and depth of 17 major roads in the Calabar Urban with Atimbo Road showing the widest drainage among the category of major roads.

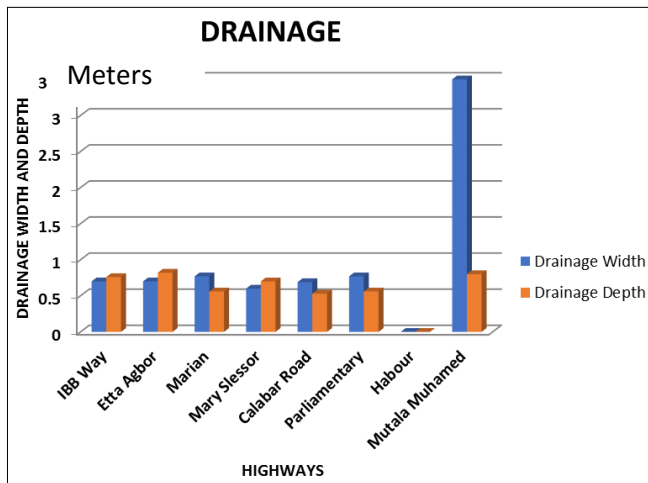


Fig 3: Drainage width and depth of highways
Source: Authors' Fieldwork, 2019

The map of Calabar showing minor roads, major roads and highways is depicted in figure 13. The 2001 orthophoto map of Calabar depicting three types of roads are represented with different colours. The tiny yellow lines represent minor

roads, the thick gold colour lines represent major roads and the dotted black and white lines represent the highways. Figure 14 is the map of Calabar showing highways in the Calabar Urban represented with dotted black and white lines. The highways are Eta Agbor, IBB way, Marian, Murtala Mohammed Highway, Airport Bypass, Parliamentary, Calabar Road and Mary Slessor.

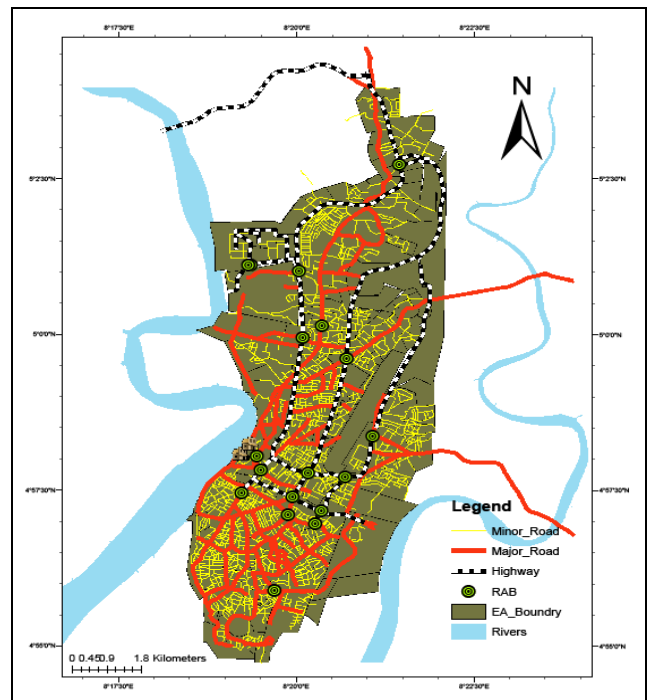
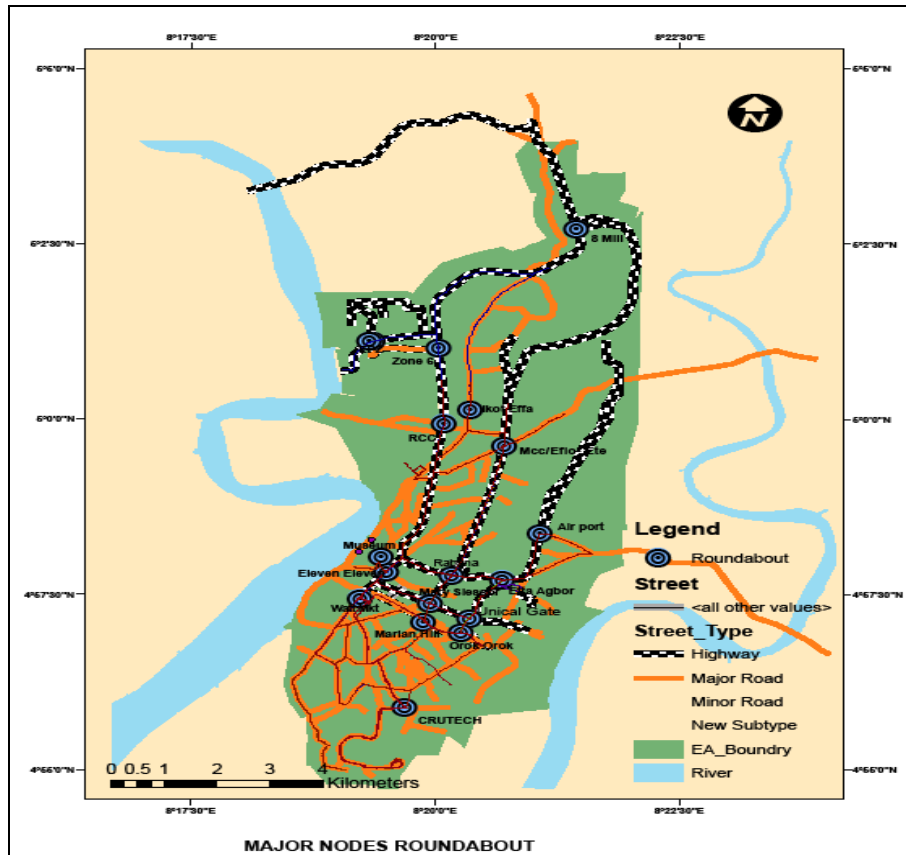


Fig 4: Map of Calabar showing minor road, major roads and highways
Source: Authors' GIS Analysis, 2019



Source: Author's GIS analysis, 2019

Fig 5: Map of Calabar showing the major nodes- roundabout

4.2. Test of Hypothesis

The result of the analysis indicates that road surface quality determined by the two indices (potholes and patches) do not differ significantly. From the statistical result and the interpretation given, the F- ratio was not significant at 0.05 evels despite differences in mean ($F = 1.385, P \geq 0.266$). By this result, the null hypothesis H_0 is therefore retained meaning that there is no significant variation in road surface quality across the Calabar Urban. This implies that road surfaces quality (potholes and patches) do not differ significantly within the three distinct network zones in the Calabar Urban.

Table 4: Anova Analysis

	Sum of Squares	f	Mean Square	F	Sig.
Between Groups	425.879	2	212.939	1.385	.266
Within Groups	4611.636	30	153.721		
Total	5037.515	32			

Source: Authors' Field work, 2019

5. Legal and Planning Implication

The need for effective enforcement of laws governing construction, quality and maintenance of utilization of transport infrastructures in Calabar metropolis cannot be overemphasize. The implication of poor construction and maintenance of road crisscrossing the urban landscape of Calabar Metropolis, has called for a need to execute effectively, with punitive measure, building and construction laws that guide the construction of roads, particularly in urban Calabar urban. The Nigerian building and construction code, has set out, specifically, laws on the types, quantity and quality of materials needed in the construction of urban roads. However, the lack of

enforcement of the law, has given the government and her contractors the leverage of cutting corners to get the job done. That is to say the need to misappropriate funds allocated for the construction of quality road networks has outweighed the need to abide by the rule of law and ensure the safety of road user, by constructing high quality roads that will last for years. The non-compliance with the rule of law has manifested in the tons of accidents that occur in most urban roads. For instance, the Calabar – Itu road, has a notorious reputation for being one of the worst interstate road networks and it is responsible for many accidents that have claimed many lives. The poor state of the road is attributed to the poor maintenance culture of the government of both states of Cross River and Akwa Ibom, and the poor quality of materials used in constructing the road. Furthermore, the inefficiency of poor road planning poses a serious threat and challenge to the growing urban transport users and this has called for the need for a re-evaluation of the transport laws in the city because the existing laws do not seem to solve the growing transport issues plaguing the city. The lack of efficient and effective traffic law enforcement has been responsible for several accidents in the country especially among motorcycle operators (Olagunju, 2009) [4]. Olagunju, at a one-day workshop on motorcycle operations in Nigeria, organized by the Federal Road Safety Corps in March 2006, expressed dismay at the level of disobedience to traffic rules and regulations by the riders. The weak laws and planning strategies surrounding urban transport facilities, has led to majority of the road accidents and poor road network in the city. Hence, it becomes relevant that the extant traffic policy And plans of Cross River State, should give thorough and proper re-evaluation to end that the transport menace

dissipating in the Calabar Metropolis roads is curbed. And this, in consequences, gives rise to the growing need for law in the area of road planning and implementation. If the government and its agencies efficiently re-evaluate transportation laws governing the usage of transport facilities, the problems identified in this study will be a thing of the past.

6. Conclusion and Recommendation

The overall transport structures or networks are integrated patterns in which groups of centers (nodes) are linked by a set of routes. The quality of road facilities, the design, physical arrangements, development and management of road networks are faced with challenges. Since transport efficiency has high influence on the socio-economic survival and strength of a city, there is need for proper spatial arrangement for easy accessibility and economic growth. Road accidents, loss of lives, social conflicts, subsequent law suits, unnecessary overloading of courts dockets are amongst the consequences of bad road surfaces. Further appeal in event of non-satisfaction with court verdicts in the courts of first instance, and ultimately, waste of time by productive members of the society; who would be in and out of courts seeking for justice.

As a follow up to the study, the following recommendations were formulated

1. Complementary road facilities such as stop over for passengers and sidewalks should be provided and maintained in all the major roads and highways to boost road network efficiency.
2. The carrying capacity of drainage systems should be expanded to large enough to carry running water during the rainy season to reduce street flooding or over land flow.
3. All the major roads in Calabar, especially in Calabar South LGA should be built to standard to carry the weight of volume of vehicles. Major roads with high volume of traffic should be dualized to ease access. Streets, roads and lanes which have been converted to major roads should be upgraded in terms of width and with facilities such as street light.

Nodal split roads are recommended to be constructed in Calabar Urban to provide separate lanes for lorries, cars and bicycles to reduce traffic congestion on the major roads and highway

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