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RESEARCH ARTICLE

Analysis of Street Accessibility along Selected Areas of Enugu Urban

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ABSTRACT

With the increasing influx of people into cities, conveying both people and goods from one place to another poses a daunting challenge to city authorities. In order to move people and goods, these activities generate and attract traffic, which of course has implications on mobility. Therefore, this study aimed analyzing street accessibility along selected areas of Enugu Urban. Research questions analysed included what are the level of street accessibility of selected streets in Enugu Urban and What are the causes of reduced accessibility on selected roads in Enugu Urban. The study adopted the survey design which aimed acquiring information from the respondents as regards the topic under consideration. Purposive and simple random sampling techniques were adopted while a total number of 399 respondents were selected for the study. Well-structured questionnaires, interview, and manual traffic count facilitated data collection. Collected data were presented and analyzed using tables, percentages, means, pie and bar charts. The result showed that travel time was high (30-60 minutes) on Figure 1 due to reduced accessibility situations. Study findings from Table 1 further revealed that accessibility to major areas in the study area (Okpara Avenue, Holy Ghost and Abakpa) was poor with exception of GRA, Ogui Enugu and new Haven. On the causes of reduced accessibility on selected roads in Enugu Urban, results from Figure 2 of the study ascertained that the major causes of reduced accessibility included bad roads/pot holes, breakdown of vehicles; among others. The major recommendation of this study highlights that the government through its agency (Ministry of Transport (MOT) in collaboration with Federal Road Safety Corps (FRSC) should ensure effective and efficient intermodal coordination. This will help to remove bottlenecks and improve accessibility at major nodal points in Enugu Urban. This will also ensure easy accessibility to major areas within Enugu Urban.

Keywords: *Street Accessibility; Traffic; Enugu Urban*

Introduction

Most cities experience severe traffic and accessibility problems, especially in developing countries, which slows travel significantly. It explains reduced travel times, slower velocities, and more car lines while traveling (May, 2021). Prolonged traffic bottlenecks could result from poor traffic management near these hotspots, which are places of high traffic. Treiber (2020) claims that badly designed road networks are a prevalent cause of small critical regions, which are frequently hotspots for inaccessibility and congestion, in many developing countries.

According to Weisbrod (2022), a traffic curve where the traffic exit rate is a measure of the traffic density in the road segment can be connected to a road segment with free flow traffic. It is well known that a free-flowing road segment has a critical density point, and that any traffic input that raises the density over this point might set off a "spiraling effect" that causes the road segment to operate at an equilibrium point with low capacity. Even worse, brief spikes in traffic volume have the ability to start a huge effect that eventually leads to a collapse of traffic. Many critical congestion areas in developing regions have poor traffic management systems that if any of these critical congestion areas hits a congestion collapse, the road network can result in a massive traffic jam for elongated time periods (Treiber, 2020).

A recent survey by Holmes (2022) revealed that average commuting time is more than one hour each week day per worker in 41 out of 52 countries. This assertion as envisaged by the end of year 2020 and 2050 is an indication of what the future congestion portends for people living in urban environment (Ogunbodede, 2020). In the United States of America, road congestion causes commuters to spend an average of a full work week each year sitting in traffic (Texas Transportation Institute, 2020). In Mexico City (Mexico), 20% of workers spend more than 3 hours travelling to and from work per day and 10% spend more than 5 hours due to reduced traffic flow (Flora, 2021). In Nigeria with the case of Kaduna. The problem of reduced accessibility in Kaduna metropolis has persisted despite administrative efforts to tackle it. For example, the Kawo flyover was constructed in 2006 in order to decongest traffic along Kawo-Zaria route, while the construction of the fourth bridge along Yakowa road was also to alleviate the problem of motorists in spending hours to commute from the southern part of the metropolis to the northern part where many of the government offices are located.

In Enugu State particularly Enugu Urban, accessibility to key areas have manifested in increased travel time from point of origin to destination, gridlocks, frustrations, noise and air pollution (Nnaemeka-Okeke, 2020). The unprecedented sprawl of Enugu Urban arising from population surge and the relocation of the urban poor to the urban fringe is complicating the speed of road traffic flow and accessibility to key areas in Enugu Urban. For instance, the influx of people from areas like Awkunanaw, Achara Layout, Idaw River, Emene, Abakpa, Trans Ekulu and GRA at peak periods often chokes up traffic towards the city centre (Ogui, Ogbete, Okpara Avenue, New Haven) where commercial and other social activities are largely located in the metropolis. Hence, intra urban travelers in Enugu, particularly, commuters spend relatively long time travelling from one part of the city to the other. For example, a journey of fifteen minutes under a normal traffic situation may end up taking forty-five minutes or more. This problem inhibits commuters' access to urban resources which are spatially located across the metropolis. Against this backdrop of existing serious and growing accessibility issues, it is believed that proper identification of traffic characteristics, control techniques and information systems are the first step in tackling traffic challenges being faced by most urban areas. This is necessary as it provides an essential guidance for selecting appropriate measures and that is what this study was set to address.

Aim and Research Questions

The aim of this research is geared towards analyzing street accessibility along selected areas of Enugu Urban. This is with a view to discovering how policy recommendations can help alleviate the daunting challenge of accessing key facility and services in the city centre. Research questions answered by the study included: What is the level of street accessibility of selected streets in Enugu urban? and What are the causes of reduced accessibility on selected roads in Enugu Urban?

Literature Review

Theoretical Review: Traffic Theory

Alber (2015) introduced the theory of traffic flow for the purpose of understanding the flow of traffic in urban centres. Transportation engineers can now comprehend and communicate the characteristics of traffic flow thanks to this theory. According to Alber (2015), there are quite a number of cars on major roads at any given time. These cars communicate with one another and affect how traffic moves in general. According to Alber (2015), there are two main categories of traffic flow that are:

(i) Uninterrupted flow

(ii) Interrupted flow

Uninterrupted Flow

According to Alber (2015), interactions between cars and the road as well as between cars themselves control the uninterrupted flow of traffic. On an interstate highway, vehicles move in a continuous flow. On the other hand, there are instances of disruptions in the flow of traffic on interstate highways. As an illustration, consider the Enugu Portharcourt Expressway and the Enugu Abakiliki Road. These instances of traffic flow interruptions are typically brought about by obstructions such as potholes and broken-down vehicles, or by the actions of Federal Road Safety Corps officials or the police. Nonetheless, the interrupted flow—discussed later—is pertinent to this investigation.

Interrupted Flow

According to Alber (2015), among other things, road crossing areas and traffic signals are examples of externally controlled flows that break flow patterns. Vehicle-to-vehicle contacts have a supplementary function in determining traffic flow during interrupted flow situations. On intraurban roadways, vehicles engage in interrupted flow. In the study area, notable examples of this flow are the movement of vehicles to and from Ogbete, New Haven, Okpara Avenue, Kenyatta, Awkunanaw in Enugu Urban. Traffic lights, traffic wardens, speed breakers and other traffic control devices depending on the local government interrupt movements of vehicles. It is the interruption in the movement of these vehicles that leads to traffic gridlocks. Taking Awkunanaw and Abakpa for example, movement of vehicles from Achara layout, Abakpa Nike to Okpara Avenue via Agbani road and Fire service road is usually interrupted by traffic lights at major intersections. Movement however continued after an interval and this process continue. However, during the peak hours and owing to the density of vehicles playing this road at this time, there is usually traffic congestion, which sometimes results into jam density and an all-day of traffic jam as the case may be. The extent of the congestion is however dependent or measured by some parameters.

The traffic flow theory helps to explain the characteristics of traffic stream and hence, predict the consequences of alternative designs (Alber, 2015). The parameters (questionnaire) in the other hand helps to explain the characteristics of traffic congestion as experience in the three local governments under study.

Mobility Pattern in Nigerian Cities

According to Oladipo (2020), an urban area is a town or settlement with a high population density, and intra-urban mobility is the movement of people and products within a city. He went on to say that intra-urban transportation is a crucial component of any city that is fast urbanizing and is required for development.

According to Haider and Badami (2020), mobility is the foundation of the human race's activity system. They also noted that for the well-being of the urban poor to be improved, there must be more movement or accessibility to jobs, healthcare, education, and other urban services. This was further supported by Kumar (2022), who proposed that motorized and non-motorized modes of transportation—such as walking and bicycling—are the main means of transportation in cities. He disclosed that the motorized transport comprises of privately owned and operated cars as well as publically available vehicles under either private or public control.

According to Oyesiku and Odufuwa (2021), the state of transport in Nigeria is depressing given that almost 90% of passenger and freight transactions occur on roads. Public transportation within cities is generally seen as the

responsibility of the government; but, because of a lack of funding and ineffective management, government-provided transportation within cities is insufficient and dysfunctional. Informal public transportation services run by private companies or individuals have taken over the transportation market, taking advantage of the underprivileged by charging higher fares.

In a similar vein, Schintler (2020) reported that in a number of Nigerian cities, there is a noteworthy positive correlation between intra-urban travel and psychological distress. He attributed accessibility difficulty in Nigerian cities to gender disparities in travel patterns, specifically in the areas of commute to work, complexity of travel planning, shortened work trips, domestic travel, trips resulting from the replacement of home production for market production, and female preference for public transportation along with a more traditional approach to choosing travel options.

According to Kumar (2022), inadequate basic infrastructure—which is typically defined by a lack of both number and quality of road networks—is to blame for the mobility stress that exists in Nigerian cities. He believed that crossroads were ill-designed for turning, poorly managed, and closely placed apart. Additionally, parked cars and business activity (like street sellers) push people from the sidewalks onto the roadway, decreasing its capacity and creating safety risks.

Empirical Review

Numerous academics and writers have shared their perspectives on accessibility issues with metropolitan road networks. In Kaduna state, Nigeria, Ibrahim & Salisu (2020) investigated how road construction affected travel costs and times. The study calculated the travel time between a few chosen significant settlements in relation to their accessibility and road connection. The administration of the questionnaires took place in the chosen settlements' large vehicle parks. The study's findings demonstrated a considerable reduction in the amount of time needed to travel between various points in Kaduna State, which is attributable to the state's large investments in road construction. Greater spatial integration in the State has resulted from the reduction in travel time. It also showed that shorter travel times and increased accessibility and connection were directly correlated with road development.

Aderamo (2022) investigated traffic congestion issues and their causes at certain road crossings in Ilorin, Nigeria, with an emphasis on the reasons of intra-urban traffic difficulties in urban transport systems. Estimates of traffic volume and delay were made, and the reasons for the delays were found. The outcome showed that there are fluctuations in traffic flow and delays at the crossings both in space and time. The main sources of delays were determined to be parking issues and traffic wardens. To lessen traffic and delays, the report suggested that car parking be rigorously forbidden and that road intersections are signaled.

The causes, effects, and solutions of traffic congestion in the Mowe/Ibafo portion of the Lagos-Ibadan highway were examined by Popoola, Abiola, and Adeniji (2021). The study's findings demonstrated the factors that contribute to traffic congestion, including heavy trucks, inadequate road capacity, subpar pavement, poor traffic management, poor drainage systems, poor driving and parking habits, poorly designed intersections and roundabouts, a lack of pedestrian amenities, a lack of road furniture, a lack of parking facilities, and other factors. The following measures were suggested in order to significantly lessen these negative effects: making room for enough parking spaces, building appropriate drainage systems, widening the road, repairing any roads in need of repair, educating the public about traffic safety, demolishing any illegally constructed buildings or shops on the right of way (ROW), establishing a separate or alternate route for trucks and heavy machinery, providing pedestrian facilities, Comprehensive training for traffic and transportation employees, a ban on all types of roadside hawking and commerce, and fewer bus stops are required.

According to a 2022 study by Bashiru & Waziri on the issues with intraurban traffic in Lagos, Nigeria, 57% of commuters and drivers spend 30 to 60 minutes stuck in traffic. Their findings also indicated that Mondays have the worst traffic congestion. They listed the following factors as contributing to traffic congestion in Lagos: potholes and poor roads; trading activities; on-street parking; passenger loading and unloading; illegal bus stops; flooding and inadequate drainage; vehicle breakdowns; narrow roads; religious activities; high traffic volume; lack of parking spaces; and absence of traffic lights at some intersections.

In Ibadan, Nigeria, Thwala et al. (2021) investigated the causes and impacts of traffic congestion. Three communities in the Ibadan North Local Government Area—Agbowo, Bodija, and Agodi Gate—were the subject of the study. Data was gathered using a questionnaire-based survey technique. In total, 150 respondents were sampled, with fifty (50) coming from each of the three communities. When examining the data, descriptive statistics like means, straightforward percentages, and graphs were used. The findings indicate that each day, 51.3% of the respondents spend 21 minutes or more in traffic, 20.7% spend between 5 and 15 minutes, and 1.3% spend less than 5 minutes. It was also noted that because of traffic congestion, city dwellers spend nearly twice as much time traveling from their homes to their places of employment. According to the findings about the temporal and spatial patterns of traffic congestion in the three regions, Agbowo (65.3%) had the most during the evening and morning hours, followed by Bodija (48%) and Agodi Gate (31.4%). Agodi – Iwo Road route scored highest with a mean value of 1.45, followed by University of Ibadan (U.I) – Bodija – Agodi Gate route with a mean value of 1.27 and Sango – Iwo Road with a mean value of 1.03. The respondents ranked many main roads in the study area on traffic congestion. The authors suggested that street trading be outlawed and that there be enough operating mass transportation buses.

From the review, one can ascertain that accessibility issues are a global phenomenon. Also, the review revealed that certain causes were responsible for the reduced accessibility currently being experienced on major routes of cities globally. However, this study was intended to analysis street accessibility along selected areas of Enugu Urban. This is due to the fact that previous studies were silent on this subject. The study will fill this gap in literature whilst also calling for policy and implementation strategies to curb reduced accessibility as well as a act as a guide the current government's efforts at making Enugu Urban a viable commercial, and administrative centre.

Materials and Methods

The Study Area

Enugu Urban in Enugu state of Nigeria is the study area (see Figure 3.1). It is located between longitudes 07^0 20^0 E and 07^0 35^0 E and between latitudes 06^0 30^0 N and 06^0 40^0 N of the Greenwich Meridian (see Figure 1). It has an elevation of roughly 664 feet (202 meters) and a surface area of about 80 square meters (200 km square). Nkanu East Local Government Area borders it on the east, Udi Local Government Area borders it on the west, Enugu East Local Government Area borders it on the north, and Nkanu West Local Government Area borders it on the south (Ugwuoke, 2020). Enugu North Local Government Area, Enugu East Local Government Area, and Enugu South Local Government Area are the three local government areas that make up Enugu Urban.

It is connected by road, air, and train to other important cities in Nigeria. The railway line was constructed to carry coal from the interior city to the port of Port Harcourt, which was constructed specifically for this purpose and is located 151 miles (243 kilometers) south of the area formerly known as Enugu Coal Camp. The city has continued to be significant as an administrative, educational, and cultural center for Igboland (Amalu and Ajake, 2019).

Figure 1: Map of Enugu Urban
Source: Google Map (2025)

In general, the lowlands of Enugu are underlain by shale, whereas the adjacent hills are composed of sandstone. Most of the escarpment that extends from Enugu to Orlu has been ruined by gullies and soil erosion. In addition, Enugu has the Nike Lake, which is home to the Nike Late Resort Hotel. Because of the impermeable shale beneath the surface, Enugu's soil is hydromorphic, a type of mineral soil whose form is influenced by periodic wet logging. The city's soil is also reddish-brown and composed of gravel. The soil profile appears to be appropriate for both agricultural and load-bearing uses, according to Ugwuoke (2020).

Enugu is situated in an area with an equatorial climate. The range of annual precipitation is 1250 mm to 2030 mm. The annual mean temperature varies from 22^0C to 30^0C, and the relative humidity fluctuates between 40% and 80%. The most common winds are the two types of local monsoons, the north-east trade wind and the south-west trade wind. The northeast trade wind, which originates over the Sahara and dries the country, is what causes the dusty harmattan weather, also referred to as the dry season. The dry season typically lasts from November through March. The south-west trade wind, which blows when air saturated with water vapor from across the Atlantic, heralds the arrival of the rainy season. The rainy season normally runs from April to October, with a little break in August.

Emene is the location of Akanu Ibiam International Airport. Buses and taxis may both get you to the airport. The Enugu-Port Harcourt motorway, built in the 1970s, links Enugu and Port Harcourt with the southern cities of Okigwe and Aba. Furthermore, Enugu has connections to Makurdi, Onitsha, and Benin to the north, west, and east, respectively, with the cities of Abakaliki, Asaba, and Jos. Enugu is therefore located at a significant crossroads.

The city's principal thoroughfares include Okpara Avenue, Ogui Road, Market Road, Abakiliki Road, Zik Avenue, Agbani Road, Akwata Road, Onitsha Road, Chime Avenue, Nike Lake Road, and Nike Road. Bus stops, kerbside parks,

pedestrian walkways, traffic lights, traffic medians, and other traffic infrastructure are all accessible on these routes. Bus stations, as well as other transportation-related businesses, appear to be expanding quickly along these significant thoroughfares (Peace, Ifesinachi, Ekenedilichuku, The Young, and Onitsha South Parks). Local streets and other city distribution routes connect individual dwellings.

Before they were outlawed in April 2009, commercial motorcycles were used for citywide public transit. In the city, buses, tricycles, and taxi cabs are the primary modes of transit. The Ogbete Motor Parks in Enugu are where the majority of commuters enter and exit the city. Transport pick-up locations are currently Motor Parks at Abakpa and Garki Motor Park. The yellow paint used on registered vehicles helps to distinguish registered taxis from unregistered ones.

In an effort to reduce poverty in the city, the Enugu State Government launched the "Coal City Cabs" taxi employment program in 2009. The Umuchinemere Pro-Credit Micro Finance Bank donated 200 registered Suzuki cabs, and the state government gave 200 registered Nissan Sunny taxis. These were lent to unemployed city dwellers, who will use them as taxis and eventually become the owners of the vehicles when payments are made. Additionally, twenty buses known as the "Coal City Shuttle buses," which can accommodate 82 people both sitting and standing, were introduced to offer transportation services to the city's residents (Wikipedia, 2021).

Methods

The study employed the survey design where respondents were utilized to evaluate the road networks and congestion problems in Enugu Urban, Enugu State, Nigeria. Primary and secondary data sources were employed in this study. Primary data sources comprised of all data collected firsthand by the researcher. They included the questionnaire instrument, oral interview, traffic count and personal observation. Secondary data sources included web pages, newspapers, journals, periodicals, official records from Enugu state Ministry of Transport and government gazettes. Taro Yameni (1976) was employed for the sample size determination where 399 samples constituted the respondents for the study. Purposive and simple random sampling techniques were employed for the study. Purposive sampling entailed that only areas with high population concentration coupled with high vehicular and pedestrian movement within Enugu Urban were selected. These included Abakpa, Ogbete and Achara layout. Simple random sampling technique required that respondents are chosen randomly for questionnaire administration thereby given no room for bias. Data analysis for the study adopted descriptive statistics including frequencies, percentages, means, pie and bar charts as well as manual traffic counts.

Findings and Discussions

Research Question One: What is the level of Street Accessibility of Selected Streets in Enugu Urban?

Figure 1 showed that majority (66%) of respondents spent an average of 31-60 minutes from origin to destination within Enugu Urban while 30% spent 61 minutes and above while only 4% spent between 10-30 minutes. The result further gives credence to the daunting accessibility problems in Enugu Urban. From reliable sources during the study, it was confirmed that before the current traffic situation, trips from Abakpa to Okpara Avenue lasted between 15-30 minutes while from Gariki to Holy Ghost took between 20-30 minutes.

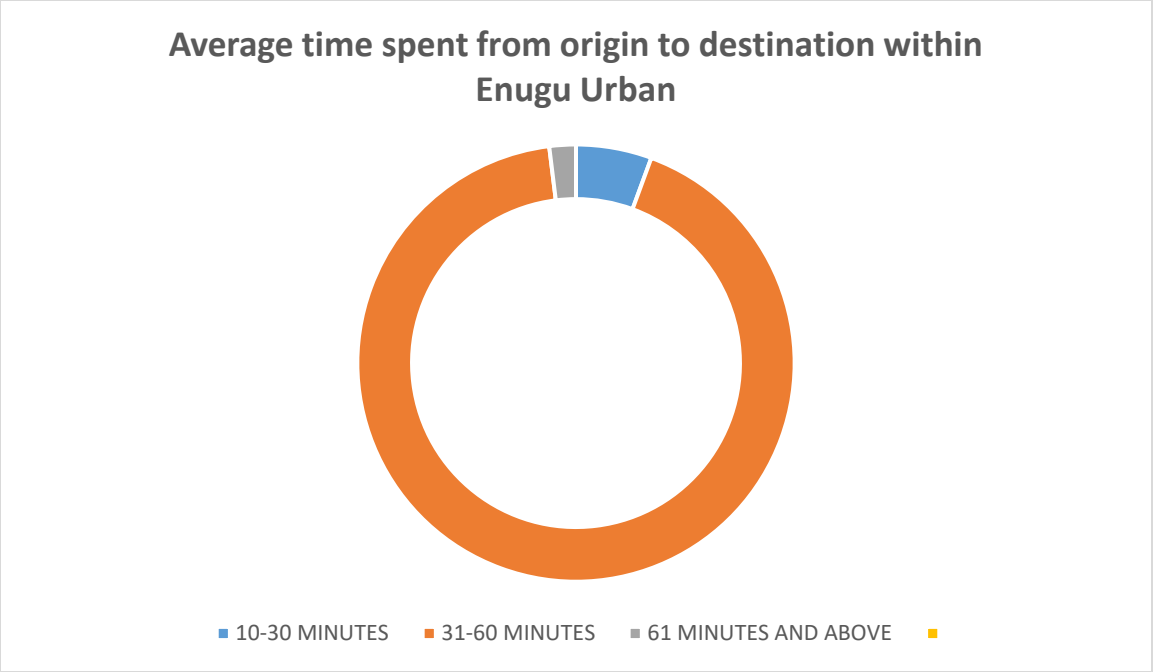

Figure 1: **Average time spent from origin to destination within Enugu Urban**
Source: Researcher's Survey, 2025

Table 1 showed the level of accessibility of respondents' street to major spots within Enugu Urban. From the result, accessibility to Okpara Avenue, Holy Ghost and Abakpa was poor while accessibility to GRA, Ogui Enugu and New Haven was fair. The disparity in findings could be attributed to the fact that most offices and government agencies were located in the areas with poor accessibility thereby necessitating heavy vehicular and pedestrian movement. This result also gives credence to the daunting accessibility problems being experienced by residents of Enugu Urban taking into account the importance of movement. The result is in consonance with that of Ibrahim and Salisu (2020) who found that shorter travel times and increased accessibility were directly correlated with road development in cities of Nigeria. Furthermore, empirical evidences corroborate with findings as commuters have to spend more time for journeys as compared to periods of increased accessibility (Aderamo, 2022; Ibrahim and Salisu, 2022).

Table 1: Response on street accessibility to major areas within Enugu CBD

Areas	*Good*	*Fair*	*Poor*	*Mean*	*Rmk*
Okpara Avenue	25	47	302	1.3	Poor
Holy Ghost	38	27	309	1.3	Poor
GRA	69	88	190	1.5	Fair
Ogui Enugu	58	94	222	1.6	Fair
New Haven	95	46	233	1.6	Fair
Abakpa	56	36	282	1.4	Poor

Source: Researcher's Survey, 2025

Research Question Two: What are the Causes of Reduced Accessibility on Selected Roads in Enugu Urban?

Figure 2 showed the causes of reduced accessibility to selected streets in Enugu Urban. From table 2, it was revealed that all identified causes were responsible for reduced accessibility in the study area. The result showed that 79% of respondents indicated bad road/pot holes; 73% indicated breakdown of vehicles; 72% indicated traffic checks/wardens; 88% indicated roadside trading/hawking; 93% indicated on-street parking; 65% indicated increased car ownership; 70% indicated irregular bus stops; 53% indicated cultural/religious activities; 73% indicated accidents; 60% indicated flooding; 80% indicated absence of traffic lights; 77% indicated construction activities; 63% indicated improper land use; 50% indicated VIP movements; 52% indicated poor travel information and 66% indicated traffic

law violation. The result therefore implies that causes of reduced accessibility in Enugu Urban are multi-faceted and therefore requires holistic approach in its remedy. The result is in conformity with the findings of Ukpata and Etika (2022), Bashiru and Waziri (2022) and Osoba (2021) who stated that bad roads/pot holes, on-street trading/hawking, religious activities, absence of street lights, flooding were among the major causes of reduced flow of traffic and inaccessibility in major cities of Nigeria.

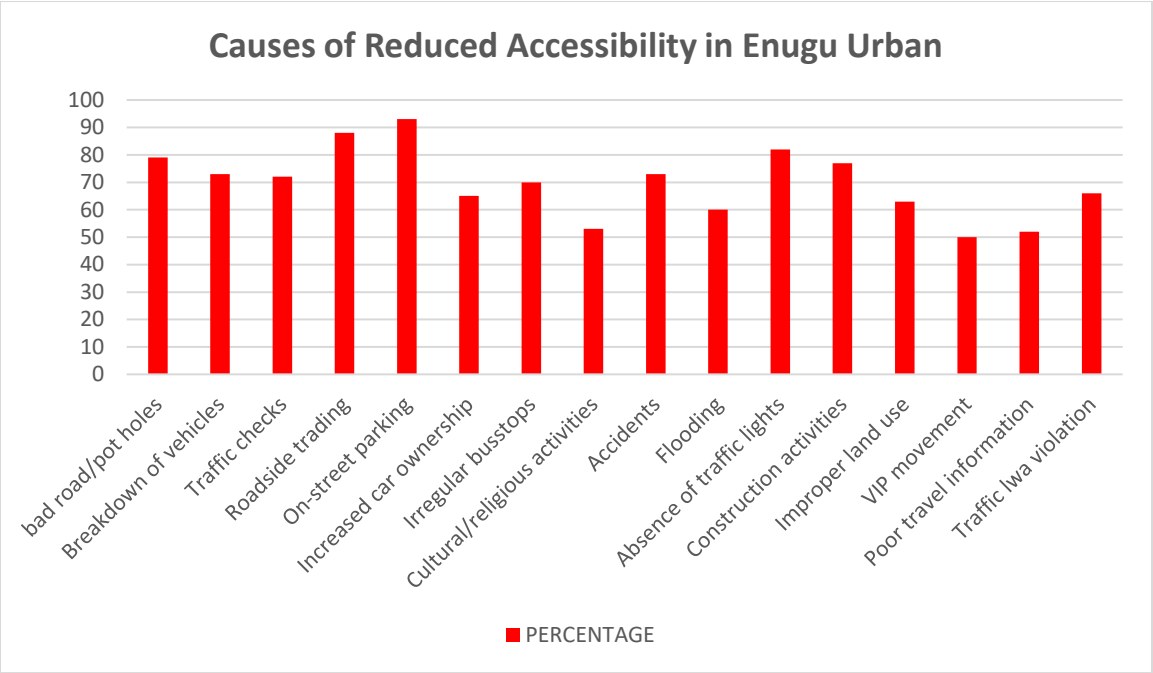

Figure 2: Causes of reduced accessibility to selected streets in Enugu Urban
Source: Researcher's Survey, 2025

Conclusion

Lasting solutions to urban transport and accessibility problems requires a combined efforts and understandings of academia, transport practitioners and policy makers at various tier of government. The recent efforts to address accessibility issues have shown that successful urban transport planning and administration requires sizeable capital investments and should be on long-term basis.

Towards improving accessibility in urban areas, there is also the need to ensure result-oriented integration of transport modes in the metropolis, state and the country at large. An integrated transport system implies the development of a seamless chain of connected and complementary transport means linking different modes of transport in such a way that every mode has the opportunity of fulfilling its distinct potentials in a partnering manner. A pragmatic transportation development plan, designed to ensure sustainable result, will only be intelligent if based on the principle of integrated and inter-modal transport connectivity. It is what the enormity of the accessibility problems facing urban centres of Nigeria demand, and to which critical examination should be directed.

Recommendations

From the above findings, the study makes the following recommendations:

1. The government through its agency (Ministry of Transport (MOT) in collaboration with Federal Road Safety Corps (FRSC) should ensure effective and efficient intermodal coordination. This will help to remove bottlenecks and improve accessibility at major nodal points in Enugu Urban. This will also ensure easy accessibility to major areas within Enugu Urban.

2. The government should formulate policies that encourage public transportation policy (reduction in transport fares, adherence to vehicle carrying capacity and provision of more coal city buses). This will go a long way in reducing the volume of vehicles plying roads in Enugu Urban.
3. The government through its agencies, FRSC, Ministry of Works with advice from town planners should embark on prompt maintenance, reconstruction and construction of old and new transport infrastructure and facilities in Enugu Urban. This will go a long way in ensuring easy flow of traffic within and around the metropolis.
4. Town planners should ensure the provision of adequate information on the human and topographical features of areas. This will help to properly align roads, regulate population and vehicles plying through streets in Enugu Urban, Enugu state and Nigeria in general.

Areas for Further Research

The study's scope can be further expanded to incorporate more cities whilst comparing the level of accessibility between selected streets of these cities. This will reveal useful insights when planning for regional and national transport policies.

Also, more sophisticated statistical techniques like the Principal Component Analysis (PCA) can be utilized to determine the weightiness of the causes of reduced accessibility on the selected streets of the study.

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