OPEN ACCESS

International
Journal
Of Modern Engineering Research (IJMER)

Traffic Management Problems and Solutions in Ibom Plaza Roundabout

Udechukwu John Abaraogu[1], Udeme Hanson Iron[2],and Ini Christopher Umoh[3]
[1]*PhD, Lecturer of Water and Environmental Engrg.Uniuyo, Uyo, Nigeria.*
2PhD, Lecturer of Structural Engineering in Uniuyo, Uyo, Nigeria.
[3]*Lecturer of Geotechnical Engineering Uniuyo, Uyo, Nigeria.*
Corresponding Author: Udechukwu John Abaraogu

ABSTRACT: *This study examines the challenges and solutions associated with traffic management in road transportation, using Ibom Plaza Roundabout as a case study. To achieve this aim, the study set out specific objectives: to evaluate the traffic flow characteristics of the five roads converging at the roundabout; to identify the major causes of traffic congestion, particularly during peak periods; to determine the specific times of the day and days of the week when traffic volume is highest; and to assess the measures implemented by government authorities to regulate traffic at the roundabout, including their effectiveness.Data for the study were obtained through the administration of questionnaires, interviews, and direct field observations. A total of 156 questionnaires were distributed, out of which 150 were successfully retrieved. Responses were gathered from key stakeholders in the transport sector, including commuters, transport operators, and private vehicle owners, focusing on prevailing traffic conditions and management challenges within the study area.The collected data were presented using Tables and charts, while analysis was conducted using simple percentages and simple linear regression with the aid of the Statistical Package for the Social Sciences (SPSS).The findings revealed several major causes of congestion, including excessive reliance on low-occupancy vehicles, narrow road widths, indiscriminate parking, roadside loading and off-loading of passengers and goods, on-street trading activities, delayed removal of broken-down vehicles, and ineffective traffic control measures.Based on these findings, the study recommends widening the existing narrow roads to dual carriageways or constructing a flyover, providing adequate parking facilities, increasing the number of bus terminals along the corridor, developing park-and-ride facilities, enforcing restrictions on on-street parking and illegal trading, adopting more effective traffic management strategies, implementing pedestrian-priority schemes, introducing mass transit buses, installing additional traffic control devices such as traffic lights and lane markings, and ensuring regular road assessment and maintenance within the study area.*

KEY WARDS: *Traffic congestion, Traffic diversion, Traffic management, On-street parking, Urban transportation, Traffic flow, Ibom Plaza*

Date of Submission: 08-05-2026 Date of acceptance: 19-05-2026

I. INTRODUCTION

1.1 Background of the Study

The movement of people and goods in a city, referred to as traffic flow, is the joint consequence of land activity. [1] opine that there is a direct interaction between the type and intensity of land use and transportation facilities provided. Land use is one of the prime determinants of movement and activity. For example, trip generation which needs streets and transport systems for movement, and if this movement is not effectively managed it could lead to traffic congestion.

According to [2] traffic congestion may be defined as the situation that arises when road networks are no longer capable of accommodating the volume of traffic on them. However, the situation is usually caused by rapid growth in motorization with less than corresponding improvement in the road network and related facilities, the poor structural pattern of roads especially in the core urban area of cities and the unplanned growth and haphazard land-use distribution [2]. Urban areas of less developed countries are experiencing growth; car

ownership rate has been on the increase. Uyo metropolis is urbanizing, ownership of cars is on the rise and is significant.

In their study in Illorin, Nigeria [3] observed that traffic problems as a result of congested mobile vehicles cannot be overemphasized as it affects mobility. They pointed out that encroachment of market into the road e.g. on-street trading/parking reduces the width/carriage capacity of the road, which consequently impedes traffic flow; inadequate road infrastructure such as lay-bys, bus terminal, parking lots have led to on-street loading and discharging of cargo and passengers makes flow of traffic difficult. However, Vehicles especially long trucks make u-turn at illegal places, broken down vehicles are left unattended to, the operation of tricyclists is chaotic and makes it difficult for even pedestrian to move freely and safely. [4] state that, traffic management can be described as the general process of adjusting the use of existing road system to improve traffic operations without resorting to major new construction; the term "traffic management" comprises a variety of techniques for dealing with highway and traffic related issues. As a concept, it is a process for planning and operating a system of urban highway and street-network [4].

Ibom connection (Plaza) which is one of the major diversions round about in Uyo local government area in Akwa Ibom State has been a major attractor of traffic due to the commercial activities that take place there [5]. The massive movement of people has put considerable pressure on the transportation infrastructure in the study area. The result is evident in the massive daily traffic congestion in the peak periods, great loss of precious man hours and stranded commuters seen endlessly waiting for buses that are inadequate. Traffic in the area had not been adequately managed. It is against this backdrop that this study was conceived, to identify the problem associated with road transportation traffic management in the study area and proffer solutions for alleviating them.

1.2 Statement of the Problem

Urban areas in Nigeria especially the central business districts (CBDs) attract large number of traffic due to commercial, administrative and recreational activities. Uyo is a classic example of such cities that have developed rapidly since 1987 when it became seat of government and State Capital. Many activities such as commercial banks, e-library, shopping mall, wholesale and retail stores, markets and others are noticed within the city center, and the activities has taken the advantage and opportunities offered by the CBD areas. the concentration of this activities in the area have attracted more people to live within its confines, the implication is that it has increased car owners, number of on-street trading and road side hawking activities [5]. Roadside parking and hawking and their effects on vehicular traffic in Uyo metropolis has been the nagging issue. It has been observed to have substantial negative effects on the safety of people, and smooth flow of traffic. In terms of security, the area has become dens of criminals, stealing hide out, snatching of phones, rape etc. On-street trading and packing impede smooth flow of vehicle movement and cause road accident that could result in injury or death; traffic congestion resulting in delay of movement and waste of time; parking difficulties; encroachment on the right of ways and reduction in road widths. These problems if not effectively managed could lead to serious mobility crises in the future. There arises the need to proffer pragmatic solution to address the problems.

1.3 Aim and Objectives

The aim of this study is to identify the problems and solution associated with road transportation traffic diversion management using Ibom Plaza roundabout as a case study.

The specific objectives in the study are:

1. To assess traffic flow characteristic in the five roads that converge at the roundabout in the study area
2. To identify the cause of traffic congestion at the roundabout especially at some given period of the day in the study area,
3. To examine the time of the day and day of the week in which this area experiences heavy traffic flow
4. To appraise the measures adopted by government to manage traffic flow in the study area and the effectiveness of such measures
5. To make recommendations based on the findings.

1.4 Significance of the Study

At the end of this study, a lot of people especially those in the environmental transportation sectors will find solutions to major challenges associated with traffic management. Those to benefit in the study include, the government ministries of transport, water and natural resources, future researchers and students. More so, the study will provide solution to the challenges associated with traffic management. This would help policy makers in defining strategies to manage transportation problem. Government at various levels, researchers and even the host communities will find this study very useful. Finally, future researchers and students who intend to undertake related study on transportation planning will find it useful for reference purposes.

1.5 Scope of the Study

The focus of this study would be on identifying the problems and solutions associated with road transportation traffic management in Uyo metropolis, Akwa Ibom State. The study area is limited to Ibom Plaza Roundabout. The study would identify and map five roads that converging traffic together with the adjoining land uses that experience a heavy flow of traffic in the study area. The study would further seek to examine the causes of traffic congestion , the time of the day and day of the week in which the area experiences heavy traffic flow. However, the study would be limited to appraising the measures adopted by government to manage traffic flow and the effectiveness of such measures within the area.

1.6 The Study Area

Uyo Local Government Area was developed as an administrative centre between 1900 and 1906, with Mr. R. B. Brooks as the first Assistant District Commissioner/Officer (ADC or ADO). Its core area includesAkpayak, Ikot Afia, Nung Uyo, Aka and Oku. Uyo was not given the status of an urban centre until 1919 when it was upgraded to a third class township with a prescribed coverage of 16 square kilometers and included the township areas of Ikot Oku, Ikot Ntuen Oku, Ewet, Anua, IbiakuOffot, AdahaEyop, Iboko and the present Four Towns. When the Local Government Ordinance of 1950 which created counties, districts and local councils in the country became operational, Uyo became the Headquarters of Uyo County Council. Uyo became a state capital of Akwa Ibom State in 1987 when the state was created. The study area is gradually acquiring the attributes of a cosmopolitan city and has witnessed a rapidly increasing influx of strangers, especially since the advent of the present civilian dispensation. In essence, although the study area was originally homogeneous in socio- cultural attributes and inhabited by the indigenous Ibibio ethnic stock, the area has gradually transformed into an ethno-multilingual population with a growing influx of other ethnic groups, Igbos, Hausas, Yorubas, etc. Nevertheless, the Ibibio indigenous stock constitutes more than 80% of the population [6]. Uyo urban is located on the Longitude and Latitude basis. it lies between latitudes 50 05' 15" N and 400 56' 03" S, and between longitudes 80000' 09" E and 70050' 03"W [7]. The area is located on an elevation of about 60.96 meters (2090ft), above sea level[8]. Annual rainfall is 620.57mm. It is bounded on the north by Ikono, Itu and Ibiono Ibom LGAs. On the East, it shares a boundary with Uruan LGA, while on the southern axis are IbesikpoAsutan and Nsit Ibom LGAs while at the west it is bounded by Abak L.G.A, as shown in Figure 2. It covers an area of 214.31square kilometers [7]. Figure 2.2 shows the map of Akwa Ibom State Indicating Uyo urban in Regional context.

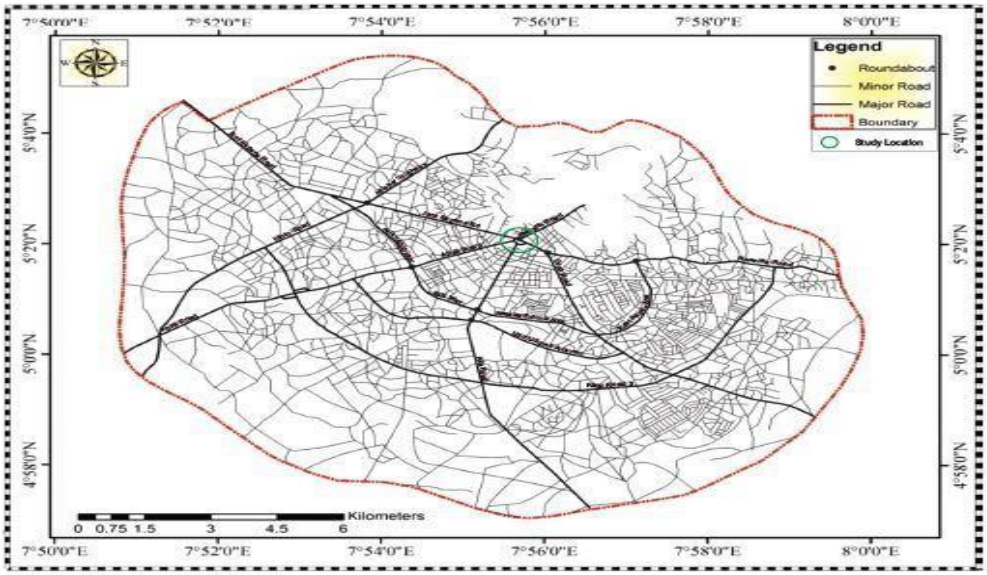

Figure 1.1: Street Map of Uyo Urban Source: Akwa Ibom State office of Survey General (2021)

1.7.1 Rainfall

The study area is within the rain forest belt of Nigeria. Two distinct conditions or seasons (i.e. wet and dry season) exists. The wet season begins in April and last till October, while the dry season begins in November till March. A short period of drought is usually experienced in July and August. While a period of harmattan characterized by cold dry wind and lower temperature normally occurs between December and February [9]. The rainfall pattern in the area is oscillatory, that is convectional rainfall occurs in area. This results in heavy rain, accompanied by thunder and lightning. The annual rainfall ranges from 590.02mm - 620.57mm [9]. The spatial structure of Uyo Urban is radial in nature The centre is also a converging point for traffics going to

different parts of Akwa Ibom State. Industries, worship centers and high-classes residential neighborhood are found mostly on the peripheral areas. Apart from religions activities, few low-income dwellers, informal business and transport terminal, the central business area would remain without activities after normal working hours [10]. Land use activities in Uyo metropolis includes: residential, institutional, commercial, circulation and recreational. These land use cover the variety of uses of different development such as; roads, banks, filling stations, markets, retail stores, shopping malls, offices, hostels, telecommunication masts, carpentry, mechanics, barber's shops gardens etc. Uyo has some noticeable roads like Ikot Ekpene road, Oron road, NwaniIba road, Aka road, Abak road and wellington Bassey way. They have schools, pipe borne water, electricity, recreational centres, etc.

II. MATERIAL AND METHODS

2.1 Research Design

The study adopted the survey research design which involves a representative sample of which inferences about the population of the study area was made. However, a sample was drawn from the entire population under investigation and inferences was made. 156 questionnaires were administered.

2.2 Types and Sources of Data

2.2.1 Types of Data

Data types in this study included the age, sex, occupational, monthly income and educational qualification of the respondents. Others included; road condition, road infrastructure, car ownership rate, travel characteristics (travel time, travel cost, passengers' waiting time and travel frequency), operators, traders and passengers challenges (unexpected breakdown, accidents, long journey time, long waits, frequent stops), traffic management techniques (e.g. parking restrictions, park and ride, preferential treatment for High Occupancy Vehicles, traffic signs such as pavement markings, road signs, etc.), traffic origin- destination on the five different roads meeting at the Ibom plaza roundabout and on street trading.

2.2.2 Sources of Data

Data for the study were sourced from the following;

i. Primary Sources: The primary sources involved the administration of questionnaire, interviews and observation. Structured questionnaires were administered on three categories of respondents namely; the Commuters, Commercial operators and Car owners.

ii. Secondary Sources: The secondary sources of data involved both published and unpublished documents. Data obtained from past review of related literatures and of past related studies from Physical Planning Department, Uyo State Secretariat, Local Government Traffic Unit Uyo, the internet, transport journals; traffic journals, text books etc, were used.

2.3 Population, Sample Size and Sample Technique

2.3.1 Population

According to [7], the projected population figure for Uyo Local Government Area stood at 59807 persons.

2.3.2 Sample Size

The formula used to determine the sample size according to[11]states that$n = \frac{N}{1+Ne^{(2)}}$which is designated as follows:

n = Sample size N = Population e = Level of precision in % = level of precision or sampling error at 0.08

Required sample size = 156

The 156 questionnaires were divided equally among the three groups – the commuter, the commercial operators and the private car owners at 52 questionnaires each.

2.3.3 Sampling Technique

A systematic sampling method was used to determine the actual respondents to be administered questionnaires: every 10th commuter, car owner and bus operators was used and interviewed in line with [12] who opined that a sample error of less than 10% and a confident level of more than 90% are accepTable.

2.3.4 Methods of Data Collection

Data were collected through the use of questionnaire; Origin and Destination Count, and Observations. A total of 156 designed questionnaire were distributed to the commuters of the study areas of Ibom Plaza.Origin and Destination Survey: A three days traffic volumetric count was conducted, while another three working days were used to collect data on geometric data, control measures, traffic data and delay data. The counting of the number of vehicles which transverse the assumed stop line of the intersection approach marked by the researcher over a period of thirty minutes was conducted. This was done with the use of stopwatch and pro-formal recording sheet. Also, an average thirty minutes approach and directional volume at the intersection

approach were obtained. The counting of the number of vehicles "stopped and not stopping" on approach length for every fifteen seconds interval for a period of thirty minutes was done.

2.3.5 Data/Statistical Analysis

Both descriptive and inferential techniques were used in the analysis of data. The quantitative data was subjected to descriptive statistics such as measures of central tendency; mean and median, and the results and findings were presented in frequency Tables, pie charts and bar graphs.

2.3.6 Statistical Technique

The null hypothesis that "there is no significant relationship between the level of flow and the level of on street parking and on-street trading in Uyo metropolis (Ibom Plaza)" was tested using the simple linear regression analysis based on statistical package for social science (SPSS)represented statistically as equation 2.1:

$$y = a+bx+E. \quad [2.1]$$

Where;

y = Dependent variable , a= Intercept, x= Independent variable, E= Residual (error)

From the hypothesis, the dependent variable (y) represents traffic flow characteristics while the independent variable (x) represents the level of on-street parking and trading.

III. RESULTS AND DISCUSSIONS

3.1 Sample Distribution

Table 3.1: Sample Distribution

Road Diversion Arm Randomly Selected	**% Total Sample**	**Distribution**
Ikot Ekpene Road	20.5	32
Willington Bassey way	19.9	31
Oron Road	19.9	31
Aka Road	19.9	31
Abak Road	19.9	31
Total	**100**	**156**

Source: Researcher's field survey, 2023

Table 3.1 revealed that Ikot Ekpene road had the majority number of respondents at 20.5%, while Willington Bassey way, Oron Road, Aka Road and Abak Road had the same number of respondents at 19.9%.

3.2 Sample Size Characteristics

Table 3.2: Sample Size characteristics

Intended sample size	Retrieved Sample size	Percentage
156	150	96%

Source: Researcher's field survey, 2023

Out of the 156 intended sample size, 150 respondents from the five-road traffic diversion points participated in the survey. This is equivalent to 96% of response rate (Table 3.2).

3.3 Sex Distribution of Respondents

Table 3.3: Sex Distribution of Respondents

Sex	**Frequency**	**Percentage**
Male	134	89.3
Female	16	10.7
Total	**150**	**100**

Source: Field Survey, 2023

Table 3.3 shows that 89.3 percent respondents were males while female respondents were 10.7 percent. This implied that the percentage of males dominated the survey. By implication, males were more than females reasons being that male dominated transport sector.

3.4 Age Distribution of Respondents

Table 3.4: Age Distribution of Respondents

Age Distribution	**Frequency**	**Percentage**
18 – 20	2	1.3
21 – 30	43	28.7

31 – 40	68	45.3
41 – 50	29	19.3
51 and above	8	5.3
Total	**150**	**100**

Source: Field Survey, 2023

In Table 3.4, it was observed that 2 (1.3 %) respondents were between 18 – 20 years of age.This was low as most of the young were not involved in rendering transportation services, while 43 (28.7 %) respondents were between 21 – 30 years. The Table further showed that 68 (45.3 %) respondents were between 31 – 40 years. This proofed that many at this age bracket were mostly commuters, while 29 (19.3 %) were between 41 – 50 years old and 8 (5.3 %) were from 51 years and above. From the Table, it was deduced that the highest number of respondents were between the ages of 21 – 41 years. This implied that most were drivers and on-street traders were between 21 – 37 years of age.

3.5 Marital Status of Respondents

Table 3.5: Marital Status of Respondents

Marital Status	**Frequency**	**Percentage**
Single	68	45.3
Married	72	48
Divorced	8	5.3
Widow /Widower	2	1.4
Total	**150**	**100**

Source: Field Survey, 2023

Table 3.5 shows that 68 (45.3 %) were single while 72 (48%) were married. The Table also revealed that 8 (5.3 %) respondents were divorced and 2 (1.4 %) were widows/widowers. The findings revealed that most of those that drive and carried out activities of on street trading/hawking around the study area are married.

3.6 Occupation of Respondents

Table 3.6: Occupation of Respondents

Occupation	**Frequency**	**Percentage**
Traders/hawkers	19	12.7
Drivers	114	76
Artisans	5	3.3
Civil servants	12	8
Applicants	-	-
Total	**150**	**100**

Source: Field Survey, 2023

In Table 3.6, it was revealed that 19 (12.7 %) were traders/hawkers while 114 (76 %) were drivers. The study further revealed that 5 (3.3 %) were artisans while 12 (8 %) were civil servants. The Table further revealed that there were no applicants interviewed. From the Table, it is clear that it is drivers/commuters were basically the highest who dominated the study location.

3.7 Educational Qualification of Respondents

Table 3.7: Educational Qualification of Respondents

Educational Qualification	**Frequency**	**Percentage**
Post-Secondary school	128	85.3

Secondary school	15	10
Primary school	7	4.7
non	-	-
Total	**150**	**100**

Source: Field Survey, 2023

Table 3.7 shows that 7 (4.7 %) respondents had primary education, 15 (10 %) had secondary education while 128 (85.3 %) respondents had above secondary education. These include people with ND/HND, university degrees, as well as post graduate degrees. This means that most of the respondents in the study area are trained above secondary school level and were mostly commercial and private drivers and as such, it can be said that literacy level is high among the respondents of the study area. As such they are able to read and understand road signs.

3.8 Monthly Income of Respondents

Table 3.8: Monthly Income of Respondents

Monthly income (N)	**Frequency**	**Percentage**
Below N18,000	2	1.3
N18,000- N20,000	5	3.3
N21,000- N30,000	7	4.7
N31,000- N40,000	89	59.4
N41,000 – N50,000	35	23.3
N51,000 and Above	12	8
Total	**150**	**100**

Source: Field Survey, 2023

Table 3.8 revealed that 2 (1.3 %) respondents earn below N18,000 monthly while 5 (3.3 %) respondents earn between N18,000 and N20,000. The Table equally noted that 7 (4.7 %) respondents earn between N21,000 and N30,000 while 89 (59 %) respondents earn between N31,000 – N40,000 monthly. Furthermore, 35 (23.3 %) respondents earn between N41,000 – N50,000 and 12 (8 %) earn above N51,000 as their monthly income. From the finding, it is obvious that those who earn between N31,000 - N40,000 monthly dominate the survey. By implication this was the average earning by most respondents.

3.9 Car Ownership

Table 3.9: Car ownership

Option	**Frequency**	**Percentage**
1-2	86	57.6
3-4	15	10
5 and Above	-	-
None	49	32.6
Total	**150**	**100**

Source: Field Survey, 2023

It was observed in Table 3.9 that 86 (57.6 %) respondents own between 1 -2 cars while 15 (10 %) respondents had between 3-4 cars and 49 (32.6 %) respondent. The findings reveal that the level of car ownership in the study area is significantly high. Those that responded that they don't own any car were mostly commercial drivers.

3.10 Types of Vehicles Used and Categories of Operators

Table 3.10: Type of Vehicle Used by Operators

Option	**Frequency**	**Percentage**
Car	40	26.7
Tricycle	59	39.3
Buses	43	28.7
Trailer	6	4
Motorbike	2	1.3
Total	**150**	**100**

Source: Field Survey, 2023

Table 3.10 shows the analysis of the type of vehicle used for transport services. It shows that 40 (26.7%) of the operators use cars, 59 (39.3%) of the operators use tricycles, 43 (28.7%) operates with mini buses, 6 (4%) uses trailer while 2 (1.3%) of the operators uses motorbikes for their operations. This means that passenger carriage is the most prominent transport service within the area.

Considering the type of operators in the study area, as observed the survey shows that 52% are National Union of Road Transport Workers while 48% are other non-classified private operators. Therefore, registered and well-known commercial operators dominate transport operation in the area.

3.11 Type of Service Rendered by the Operators

Table 3.11 Type of Service Rendered by the Operators

Option	**Frequency**	**Percentage**
Passengers service	122	81.3
Goods only	19	12.7
car hire	9	6
Total	150	100

Source: Field Survey, 2023

Table 3.11 shows type of service rendered by the operators in the study area. 122 (81.3%) of the operators render passengers service, 19 (12.7%) of the operators renders goods only service while only 9 (6%) render car hire service. This implies the high demand for transportation in the area which, of course, if not effectively managed can result to a number of bottlenecks.

The road armed that linked the study Point at Ibom Plaza with Oron, Ikot Ekpene, and Abak; needs to be enlarged, and constructed with Fly over. The Ibom Connection (Plaza) hardly permits the movements of vehicles. This situation is worse by the encroachment into the road by the on-street parking and on-street traders/hawkers who displayed their wares.

3.12 Traffic Jam Occurrence in the study area

Table 3.12: Traffic Jam Occurrence in the study area

Option	**Frequency**	**Percentage**
Everyday	113	75.3
2-3 days in a Week	26	17.3
Once a Week	9	6
No Response	2	1.3
Total	**150**	**100**

Source: Field Survey, 2023

Table 3.12 from the survey shows that 113 (75.3%) of the respondents often experience traffic congestion daily, 26 (17.3%) of them experience traffic congestion at interval of 2-3 days per week, 9 (6%) experience congestion

once a week while only 2 (1.3%) which was very low were indifferent. This is an indication of a high degree of traffic congestion in the area.

3.13 Time Spent in Hold up (time delay in traffic Jam)

Table 3.13: Time Spent in Hold up (time delay in traffic Jam)

Option	**Frequency**	**Percentage**
5-15mins	90	60
16- 30mins	21	14
31-46mins	24	16
47 - 1hrs 1mins	9	6
1hrs 2mins and above	-	-
No response	6	4
Total	**150**	**100**

Source: Field Survey, 2023

Table 3.13 shows the analysis of time delay in traffic hold up which revealed that 90 (60%) of the respondents usually spend 5-15mins in traffic jam, 21 (14) % usually spend 16- 30mins, 24 (16%) spend 31-46mins, 9 (6%) spend 47 - 1hrs 1mins, while 6 (4%) were indifferent about traffic hold up. This means that there is high level of traffic hold up in the area.

3.14 Travel frequency

Table 3.14: Travel frequency

Option	**Frequency**	**Percentage**
Everyday	59	39.3
5 - 6 times a week	21	14
3 - 4 times a week	30	20
1 - 2 times a week	35	23.3
No response	5	3.3
Total	**150**	**100**

Source: Field Survey, 2023

Table 3.14 shows that 59 (39.3%) of commuters' journeys to the study area every day, 35 (23.3%) 1 – 2 times a week, and 30 (20%) 3-4 times a week while 21 (14%) journeys to the area 5 – 6 times a week, only 5 (3.3%) were indifferent. The implication of this is that more people commute to the area every day, this may be one of the contributing factors to congestion, hold up in the area as demand exceeds supply.

3.15 Time of the Day in which hold up is more Prominent

Table 3.15: Time of the Day in which hold up is more Prominent

Option	**Frequency**	**Percentage**
6am - 8am	12	8.7
8am- 10am	71	48.7
10 am - 12 pm	3	2
12 pm - 2 pm	9	6
2 pm - 4 pm	3	2
4 pm - 6 pm	52	34.7
Total	**150**	**100**

Source: Field Survey, 2023

Table 3.15 shows that high traffic hold-up occurs mostly from 8am – 10am (48.7%) and 4pm – 6pm (34.6%). This indicates the morning peak period and evening peak period respectively of the area. This is as a result of commuters travelling to work in the morning, taking children to school and coming back from work in the evening.

The question that readily comes to mind is how can these congestion problems at peak period be resolved? As practiced in the advanced countries, demand management can be adopted whereby flex time work schedule with employers to reduce traffic hold up problems at peak times, work place travels plan, adopting carpooling for workers, road space allocation in which some road space are allocated to public transport vehicle like BRT, aiming to rebalance provision between private cars which often predominates due to high spatial allocation to roadside parking and for sustainable mode [13] Government and public establishment should provide transport facilities for their workers.

3.16 Frequent travel purpose

Table 3.16: Travel frequency

Option	**Frequency**	**Percentage**
Work/school	92	61
shopping	33	22
religious	13	9
leisure	12	8
No opinion	-	-
Total	**150**	**100**

Source: Field Survey, 2023

Table 3.16 shows that 92 (61%) of commuters in the area travel to work and carry their children to school daily while 33 (22%) goes for shopping. 13 (9%) commutes for religious purpose while 12 (8%) commute to catch fun. This implies that majority of the trips generated in the area are for working/schooling purposes and high traffic hold-up may be evident during the morning rush hour (people commuting to work and school) and also during the evening period when they close from work.

The implication of this for policy formulation is that there is the need to divert some of the public transport vehicles to the area during the peak period as to reduce congestion at the period. Flex time working period can be adopted whereby workers are free to choose a convenient working period, this being the case many of the traffic at the two periods (morning and evening) was redistributed thereby solving congestion problem at the two peak periods. Also BRT lane and services should be extended to the study area so that the traffic generated during the peak periods will be cleared.

3.17 Day of the week in which traffic jam is most eminent

Table 3.17: Day of the week in which traffic jam is most eminent

Option	**Frequency**	**Percentage**
Monday & Tuesday	54	36
Wed & Thursday	19	12.7
Friday & Saturday	62	41.3
Sunday	15	10
Total	**150**	**100**

Source: Field Survey, 2023

Table 3.17 reveals that traffic jam is most prominent on Monday & Tuesday 54(36%) and also on weekends 62(41.3%). This is due to the activities taking place in the area which is commercial activities, there is high demand for transportation on Mondays & Tuesday because it is the first day of the new week and also on weekends people come for shopping mostly on weekends because of availability of shopping mall, availability car parks to carry people to places like Oron, Eket, Ikot Ekpene and Abak etc.

3.18 Traffic Flow Characteristics in five roads that converge at Ibom Plaza

3.18.1 Origin and Destination Traffic Volume Count

The detailed of Traffic Flow characteristics, and traffic composition of the study site is presented in Table1 4.18.1

Table 3.18.1: Data on the geometric features, control measures and type of traffic flow.

Name of Road Intersection	Name of roads road corridors converging traffic at Ibom plaza	Physical Characteristics	Traffic Composition
Ibom Plaza	a) Ikot Ekpene Road b) Willington bassey way c) Oron Road d) Aka Road e) Abak road	Lanes on each approaches	Cars, Buses of different sizes, Trucks, Keke

3.18.2 Observation of intersections Average Weekly peak hour

Table 3.18.2 is the field data observation of the morning, afternoon and evening peak average hourly volume in the roundabout. "Outbound" traffic refers to the vehicles moving away from the round-a-bout, while the "inbound" means those vehicles coming in to the roundabout at a point in time.

Table 3.18.2 Observation of Intersections Average Monthly Peak Hour

Traffic Converging Point	Road	Flow	Morning Peak (7am10am)	Afternoon Peak (12pm - 3pm)	Evening Peak (4pm-7pm)	Sub-Total	Total
Ibom Plaza	Ikot Ekpene Road	In	54091	5841	52076	109980	198,320
		Out	52063	2380	31869	88340	
	Willington Bassey Way	In	75200	5200	22804	103204	184,928
		Out	66960	5138	9626	81724	
	Oron Road	In	34181	24179	44179	102539	205,077
		Out	51371	16404	34763	102538	
	Aka Road	In	44678	15779	43578	104035	191,030
		Out	35656	22345	28994	86995	
	Abak Road	In	43301	19273	31341	93915	189,889
		Out	41892	15161	38921	95974	

Source: Field Survey, 2023

The inbound traffic from Ikot Ekpene road is quite larger than the outbound (i.e. traffic going to Ikot Ekpene). More people move in and out of Ibom Plaza in the morning and evening of a total (198,320) as observed. after the day's business than, while Willington Bassey way outbound traffic is higher in the morning and also evening of total (184,928) since more vehicles travel in and outside the government house. While in Oron outbound as most people travel to air to catch a flight, the inbound most vehicle move to different housing estates as the area witness development of Housing Estate from both Government and Private Individual as observed during the traffic count survey of (205,077), Aka Road total (191,030), while Abak Road experienced high inbound and outbound of total (189,889) volume. The implication is that most people ply through these roads to their different destinations and this has resulted in heavy traffic congestion. The delays experience during the Peak and Off-Peak period on the roads, cause stress and other related issues from Traffic emission from the crowded vehicle on the road corridor.

Table 3.18.3: Mean Monthly Vehicular Traffic Volume in Ibom Plaza

Road Traffic flow converge in (Ibom Plaza)	Volume
Ikot Ekpene Road	198,320
Willington Bassey Way	184928
Oron Road	205,077

Aka Road	191,030
Abak Road	189,889
Total	**969,224**

Source: Field Survey, 2023

3.18.3 Mean Monthly Vehicular Traffic Volume in Ibom Plaza

The researcher embarked on traffic count on the sampled areas. The traffic count started from December 2023 to January, 2023. Information on the monthly traffic count as presented in Table 3.18.3 was carried out between the hours of 7:00am and 7:00pm all through the period of the study excluding Sundays. The data was arrived at by simple taking the average based on records. According to the Table 3.18.1 total of 198,320 vehicles pass through Ikot Ekpene road on monthly basis while 184,928 vehicles pass through wellington

Bassey way and 205,077 vehicles pass through Oron Road. The Table further revealed that 191,030 vehicles use Aka Road while 189,889 vehicles pass through Abak Road. In all, the study showed that the traffic flow is significantly increasing. By Implication, It may be that the level of on-street parking will equally be high and delay on the road within the study area will equally be high.

Table 3.19: Causes of traffic congestion and the roundabout in the study area

Option	Frequency	Percentage
Loading and off-loading of goods and Passengers	52	34.7
Lack of Bus Terminal	18	12
Indiscriminate Parking	12	8
On-Street Trading	15	10
Too Narrow Road	39	26
Vehicle Breakdown	12	8
No Response	2	1.3
Total	**150**	**100**

Source: Field Survey, 2023

3.19 Causes of traffic congestion and the roundabout in the study area

Table 3.19 shows that, 52 (34.7%) respondents says traffic hold up and congestion in the area is due to loading and off-loading of passengers and goods on the road, whereas 12.8% opined that lack of bus terminal are factor that contributes to the traffic jam in the area. 18 (12%) of the respondents were of the view that indiscriminate parking along the carriage way contributes to the traffic problem situation in the area, 12 (8%) of the respondents believes that on-street trading is the cause of traffic jam. About 39 (26%) of the respondents believe that too narrow road is responsible for traffic congestion on the road, 12 (8%) believes that congestion on the road is due to vehicle breakdown. Only 2 (1.3%) of the respondents were indifferent.

Table 3.20: Level of Parking Space Adequacy

Level	Frequency	Percentage
Adequate	49	32.7
Inadequate	101	67.3
Total	150	100

Source: Field Survey, 2023

3.20 Level of Parking Space Adequacy

The Table 3.20 shows that level the of parking space adequacy differ across the opinion of respondents. 49 (32.7 percent) said it is adequate while 101 (67.3 percent) said it is inadequate. Obviously, this implies that the difference in the opinion of respondents is as a result of the differences that exist in parking spaces across the study area.

Table 3.20.1: Level of Parking According to Road Arm Diversion Traffic Points in the Study Location

	On street Parking adequacy	
Road Arm Traffic Diversion	Adequate	Inadequate
Ikot Ekpene Road	11	28
Willington Bassey Way	7	18
Oron Road	10	18
Aka Road	9	18
Abak Road	10	19
Total	**49**	**101**

Source: Field Survey, 2023

3.20.1: Level of Parking According to Road Arm Diversion Traffic Points in the Study Location

In order to understand the level of parking across different road arm in the study location is deduced from Table 3.21. Table 3.21.1 revealed that level of parking according to the survey information in the Table 3.21.1, 11 of the respondents believe that road side parking in Ikot Ekpene Road Ibom Plaza diversion is adequate while 28 respondents believe it is inadequate. 7 respondents equally believed that the road side parking at Willington way Ibom Plaza arm diversion is adequate while 18 were of the opinion that it is inadequate. In the same vein, 10 of the respondents were of the view that road side parking Oron Road Ibom Plaza diversion is adequate while 18 respondents debunked that parking by the road side is inadequate. Also 9 respondents believed that parking at road arm of Aka Road is adequate while 18 respondents were of the view that it is inadequate. Similarly, 10 and 19 respondents were of the opinion that parking in Abak road arm by Ibom Plaza is adequate and inadequate respectively. This implies indiscriminate parking is high in the study area, law enforcement agency and road safety should work round the clock, either through shift, so they can properly manage illegal parking. Also, road signs and marking should be shown at strategic bay. Central car par should be provided.

Table 3.21: Traffic control measure used in the area (Ibom Plaza) and its effectiveness

Option	Frequency	Percentage
Use of traffic warden	8	5.3
Traffic light	17	11.3
Lane marking	2	1.3
Parking restriction	4	2.7
None of the above	119	79.3
Total	**150**	**100**

Source: Field Survey, 2023

3.21 Traffic control measure used in the area and its effectiveness

The survey reveals that the traffic control measure used in the study area is the use of traffic control officers also known as traffic wardens, traffic light, lane marking and parking restriction.

Table 3.22: Effectiveness of Traffic Control Measure in the Area

Level	Frequency	Percentage
Yes	28	18.7
No	122	81.3
Total	**150**	**100**

Source: Field Survey, 2023

3.22 Effectiveness of Traffic Control Measure in the Area

However, Table 3.22 of the survey also revealed that 122 (81.3%) majority of respondents were of the opinion that the measure is not effective while only 28(18.7%) of the respondents were of the opinion that the measure was effective this was below approved percentage standard of 95% agreement. Many of the traffic wardens could not help when the traffic situation become chaotic. The traffic wardens were seen many at times roaming, some gossips during traffic gridlock. Many of the intersection and road arm diversion in the study area were not

provided with traffic light, lane marking and parking restrictions. By implication these factors were responsible for ineffectiveness of the traffic control measure in the study area.

Table 3.23: Availability of Traffic Law Enforcement Agents at Ibom Plaza

Level	Frequency	Percentage
Yes	114	76
No	34	22.7
No Opinion	2	1.3
Total	**150**	**100**

Source: Field Survey, 2023

3.23 Availability of Traffic Law Enforcement Agents at Ibom Plaza and their Effectiveness

Considering the degree of availability of the traffic law enforcement agents, Table 3.23 shows that 114 (76%) of the respondents agreed that there are traffic law enforcement agents at Ibom Plaza and along the road within the study location, 34 (22.7%) of the respondents objected to this while 2% of the respondents did not respond to the question.

3.24 Test of Hypothesis

Table 3.24: Relationship between Traffic Flow Characteristics and on-street parking in Ibom Plaza

Road Arm Traffic Diversion (Ibom Plaza)	Volume (x)	Adequate (yi)	Inadequate (yii)
Ikot Ekpene Road	198,320	11	28
Willington Bassey Way	184,928	7	18
Oron Road	205,077	10	18
Aka Road	191,030	9	18
Abak Road	189,889	10	19
Total	**969,224**	**49**	**101**

Source: Field Survey, 2023

The hypothesis formulated in the study was tested using simple linear regression analysis. The null hypothesis stated that "there is no significant relationship between traffic flow characteristics (Volume) and the level of on-street parking in Ibom Plaza. Variables for testing the hypothesis were extracted from Table 3.18 and Table 3.20. For precision reasons, data were treated spatially in line with the specific Road traffic diversions converged within the Ibom Plaza axis. To this end, the level of adequacy was subcategorized as seen in Table 3.24. However, data from Table 3.18 was used as the independent variable (x) while Table 3.20 and Table 4.20 were used as the dependent variables ($y_i$and y_{ii}). Regression analysis was the statistical technique used in the analysis based on Statistical Package for Social Sciences (SPSS). The result of the analysis is presented in Table 3.26.

Table 3.25: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.855[a]	.731	.721	.438

Source: Statistical Computations

The result in Table 3.25 revealed that the calculated significant value was .855 which is greater than 0.05. Based on this result, the null hypothesis was accepted and the alternative hypothesis was rejected. Obviously, the result of .855 shows a negative relationship between the variables that are investigated. Therefore, the result implies that there is no significant relationship between vehicular traffic flow characteristics and the level of on-street parking in Ibom Plaza.

3.27 Discussionof Findings

i. Traffic flow characteristics in the study area;The study noted that the volume of traffic within the Ibom Plaza Axis is significantly high. As seen in Table 3.18, it was revealed that the rate at which the volume of traffic is increasing is alarming. The reason for the increase in the traffic flow is due to the increase in the number of vehicle owners and drivers coupled with the availability of narrow roads and on-street parking/trading. Another inevitable reason for traffic volume increase in the location is the constant increase in activities such as growing commercial activities like shopping mall, on street/hawking and so on. All of these activities make the study location to be evidently busy. Therefore, the study noted that the traffic volume in the area is high. This finding aligns with that of [14] who earlier revealed that the CBD is characterized with massive traffic flow. He further opines that the CBD is the hub of activities therefore; it is inevitable for traffic not to be increasingly high in the CBD. The result of the hypothesis therefore showed that there is no significant relationship between vehicular traffic flow characteristics (volume) and the level of on-street parking in the study area. Also, with the findings of [14] in Lagos state Nigeria, it was observed that increase in car ownership was the contributing factor to traffic problems experienced in the CBD as many car owners finds it more convenient to travel to work by their car rather than public transport.

ii. Examinations of the causes of traffic problems

include increased car ownership, indiscriminate parking spaces, on-street trading, ineffectiveness of the traffic law enforcement agency (corruption where-by some of them do extort money from the traffic offenders hence this encourage them more to flout traffic regulations), inadequate facilities needed to effect smooth traffic control (insufficient control facilities: road markings, traffic signs, ramp metering, traffic calming, road space managements and bus stop) and inadequate skills by the available traffic agents in the study location. Inadequate enforcement of laws, rules and regulation by the law enforcement agents in the study area culminates certain causes of flouting traffic rule and encouraging on-street parking/trading. This finding agrees with that of [15] who pointed out that parking facilities insufficiency, inappropriate enforcement of relevant traffic laws can contribute to on-street parking and encourage on-street trading that block traffic carriage way.

iii. Examination of the time of the day and day of the week in which the study area experience heavy traffic flow it was revealed that traffic jam mostly occurred in the morning, afternoon and evening between the early hours of 7-10am, 12-3pm and 4-7pm respectively. Similar, demand for transportation were high on Mondays and Tuesdays being the first day and second day of the week. And on weekends, Fridays and Saturdays as most people go for shopping. This also agree with the findings of [16] in his observation at the Alaba international market Ojo local government area, that the massive movement of people into the location on the first day of the week and on weekends put considerable pressure on the available transportation infrastructure in the study area. The result of the findings was the massive daily traffic congestion in two peak periods, great loss of precious man hours and most commuters stranded. This was evident as many Commuters were seen endlessly waiting for buses plying the location.

iv. Appraisal on the measures adopted by government to manage traffic flow and the effectiveness of such measures. The study revealed that the measures used in the study area as observed were use of traffic control officers also known as traffic wardens, traffic light, lane marking and parking restriction, these were not effective. Many of the traffic wardens could not help when the traffic situation become chaotic, for instance Oron road by Udo Umana Traffic light. The traffic wardens were seen many at times playing truancy, standing to gossips during traffic gridlock. Many of other intersections in the study area were not provided with traffic light. These factors were responsible for ineffectiveness of the traffic control measure in the study area. This agrees with the findings of [16] who observed that Government use traffic control warders to manage the traffic along road. In his findings the measure has not been effective because during peak periods, traffic on the road increase beyond the control of the traffic wardens.

IV. CONCLUSIONS AND RECOMMENDATIONS

4.1 Conclusion

The poor parking facilities and total disregard for traffic regulations by road users and on-street traders altogether play a major role in the daily traffic congestion in the study area. Moreover, the method of manual traffic control system used has not fared well compared with developed world, as this has been described as ineffective. Traffic agentscompromise with operators that violate the traffic rule and also there is lack of adequate competent personnel to control the ever-increasing traffic flow in the study area. New techniques of electronic traffic control has not been adopted.

4.2 Recommendations

There is need for Federal and state Government to expand the road network capacity to at least four lanes flyover in order to accommodate the ever-increasing volume of traffic in the study area. Parking facilities should be put in place by State Government on the road; there should be restrictions and strict enforcement of

parking rules and regulations to stop operators from on street parking and trading. Bus-terminals should be located at strategic locations along the road by State Government or other relevant NGOs and Agencies. On street trading should be discouraged in the study area through strict enforcement of relevant laws. Also, more traffic control officers should be employed and retrained on modern traffic control techniques and facilities. There is need to put in place some traffic infrastructures such as: traffic light, lane marking, pedestrian walkways (like 4-lane Roundabout) etc. A park and ride space should be provided outside the roundabout region where car owners can park their cars and join a high occupancy vehicle to the city center (CBD). This would reduce the rate of congestion along the road that converged traffic in the roundabout. Adequate mass transit buses should be made available to lift large numbers of commuters at once rather than having the small occupancy vehicles (mini-Buses, Keke tricycle and private vehicles) flooding the road without making much impact on traffic demand. Frequent road assessment should be carried out by maintenance agencies (Federal Road Maintenance Agency) to free the road of pot holes and bumps in order to improve the free flow of traffic in the study area.

REFERENCES

[1]. Okoko, E. (2006) Transportation planning and modelling. Lagos: MelleniumPublishers..
[2]. Okon A. (2015), Analysis of Uyo Government Policy on Urban Transportation. Institute of management Technology (IMT) Enugu.Unpublished document
[3]. Aderamo, A. J. and Kalue (2013) A graph theoretic analysis of inrta-urban network in Ilorin, Nigeria. American International Journal of Contemporary Research, 4 (9) 122 – 130
[4]. Adebisi, O. (2004), Transport Systems Management in Nigeria; in VanduChikolo et al (eds) Perspectives on Urban Transportation in Nigeria. Nigerian Institute of Transport Technology (NITT), Zaria.
[5]. Udo, E. (2009), A Study of Inland Water Transport InIbakar, Akwa Ibom state A PhD thesis submitted to University of Calabar.
[6]. Ukpong, Akpan and Akang, (2001). Traffic in the city core. Biological and Environmental Engineering, Unpublished Document.
[7]. Uyo Local Government Buletin Uyo Capital City Development Authority CAP 136 2019).
[8]. Njungbwen E., Roy M., and Dewingong C. (2010). Land Use Changes in Uyo Urban And Implications For Urban Environmental Management.
[9]. Edidiong U. (2021) Biophysical Impacts of Modern Public Transportation Facilities and Traffic Hotspots in Uyo Urban; Unpublished document .
[10]. Ikurekong, E. E. (2003). Urban Vehicle traffic and Air pollution in Uyo In: E. n. Adinna, O. B. Ekop, V. I Attah (Ed.) Envrionmental pollution and management in the tropics. Enugu. SNAAP Press Ltd. 366 – 371.
[11]. Taro Yamane. (1970). Statistics: An introductory analysis (2nd ed.). Harper & Row.
[12]. Hussey, R.., & Hussey, J.. (1997). Business research: A practical guide for undergraduate and postgraduate students. Macmillan Press..
[13]. Abacho, O. (2014) Effects of Road side Parking and Hawking on Vehicular Traffic in Calabar Central Business District, Nigeria. Unpublished Document.
[14]. Laval, J. (2014) Traffic flow theory. International Journal of Engineering, 29 (91 -102).
[15]. Aderamo, A. J and Salau, K. A (2013): Parking Patterns and Problems in Developing Countries: A Case From Ilorin, Nigeria. African Journal of Engineering Research, Vol. 1(2), pp. 40-48.
[16]. Asenime, C.O. (2009), A Study of Inland Water Transport In Lagos Metropolis. A PhD thesis submitted to University of Lagos