Parking Pattern and Its Impact on Sustainable Urban Development in Akure Metropolis

By

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Abstract

The provision of access and mobility is fundamental to economic and social activities such as agriculture, manufacturing, commerce, recreation and tourism and the likes. However, parking facilities as an important component of transportation infrastructure seems to be overlooked in the face of increasing car ownership and increasing commuting activities which generate enormous parking demand. The paper examined the parking patterns, problems and their causes in Akure urban with a view to reducing the challenges. The data used were collected through direct field survey of selected road intersections covering traffic volume and composition, traffic delay and causes and land use activities. On-street parking surveys were also carried out along selected roads in the city while off-street parking surveys were carried out at some selected locations. The analysis of data collected revealed that variations exist in traffic flows and delays at the studied intersections while parking problems were found to be the greatest causes of delays at the road intersections followed by traffic control problems in the city. Chi-square method was employed to measure the relationship between parking demand and parking space capacity per activity area. The result shows that while parking space demand is very high, the activity areas with less parking facilities, receives less patronage. The study recommends off-street parking facilities and discourages on-street parking to reduce traffic congestions and delays at road intersections.

Keywords: transportation, parking pattern, intersection, congestion, sustainability.

1.0 Introduction

The challenges facing urban centres have continued to grow particularly within the past three decades. In fact, cities will increasingly face a seemingly paradoxical situation. The city serves as a magnet for employment opportunities, shops, services and leisure activities. Over the years, it has become the epicentre of economic and social life and has been called upon to accommodate increasingly varied activities and house a growing proportion of the population. The efficient functioning of a national economy therefore depends largely on the adequacy and efficiency of its transport system. The number of mega cities is on the increase all over the world and it has been confirmed that more than half of the world population lives in cities (World Resource Institute, 2006). This situation is experienced because the global urban population growth rate average 2 per cent annually whereas it is 0.3 in the rural areas. Since economic reformation, the number of vehicles has increased rapidly in big- and mid-sized cities of Mainland China (Obot *et al* 2009). The development of the road transport system and related facilities has been inadequate for this type of rapid growth.

The Nigerian urban centres have undergone rapid changes in terms of social, economic, administrative and political status, especially after the attainment of independence in 1960. During the colonial period, Nigerian cities were very few but after independence, there has been phenomenal rise in urban population, resulting in increasing demand for transport (Ogunbodede, 2003). This has led to traffic congestion, parking problems, accidents, noise, and air pollution on many urban roads, and according to Ogundare (2013) all these constitute barriers to mobility that hinders sustainable transport system in the Nigerian urban environment.

Nigeria is one of the countries in the developing world with rapid urbanization and fast growing cities. A study of the changing morphology of many Nigerian cities gives an insight into the evolution of urban transport problems in Nigeria. Most of the scholars who have worked on urban transport problems in Nigeria have identified congestion as the most serious. Congestion occurs when transport demand exceeds transport supply at a specific point in time and in a specific section of the transport systems. Under such circumstances each vehicle impairs the mobility of others. It is now a common feature of most urban centres of Nigeria and most especially Lagos, Ibadan, Port Harcourt, Enugu and others which are commercial and industrial nerve centres of the country, having the most problems (Aderamo, 2012).

However, associated with the traffic congestions are problems of parking. Parking demands far outweigh the available supply in most Nigerian cities (Ogunbodede and Ogundare, 2014). This therefore results on road-side illegal parking which, are common features in urban centres of Nigeria. The ineffective regulation on parking has further worsened the situation. Also, since vehicles spend the majority of the time parked the situation has created land consumption problems particularly in the Central Business Districts (CBDs). Unfortunately, the more parking facilities provided, the greater the demand for parking (Ogunbodede, 2004; Ogundare, 2013) since there is continuous increase in motorization.

The poor parking situation arises as a result of the various roles of Akure as an industrial, commercial, educational, administrative, and transportation centre. Also, the sudden rise in car ownership consequent upon improved standards of living has all combined to compound the problem. Traffic cannot flow efficiently; hence it results to clogging of the urban roads.

There has been a series of conscious efforts by the State government to construct parking spaces in some activity centres some of which are inadequate and in some areas not available. Efforts are also made to decentralize offices, construction of new roads and widening of the existing ones. Each of these solutions was introduced and tried at different times, but the parking problems worsened and appeared to defy all attempted solutions. The objective of this paper is to give a brief evaluation of the effectiveness or otherwise of parking spaces in Akure metropolis.

2.0 Review of Related Literature

Automobile use is obviously related to a variety of advantages such as on demand mobility, comfort, status, speed, and convenience. These advantages jointly illustrate why automobile ownership continues to grow worldwide, especially in urban areas. When given the choice and opportunity, most individuals will prefer using an automobile. Several factors influence the growth of the total vehicle fleet, such as sustained economic growth (increase in income and quality of life), complex individual urban movement patterns (many households have more than one automobile), more leisure time and suburbanization. Therefore, rising automobile mobility can be perceived as a positive consequence of economic development. The acute growth in the total number of vehicles gives rise to congestion at peak traffic hours on major thoroughfares, as well as increased parking demand in business districts and often throughout the metropolitan area.

Cities are important generators and attractors of movement, which have created a set of geographical paradoxes that are self-reinforcing. For instance, specialization leads to additional transport demands while agglomeration leads to congestion. Over time, a state of automobile dependency has emerged which results in a diminution in the role of other modes, thereby limiting still further alternatives to urban mobility. In addition to the factors contributing to the growth of driving, Rodrigue

(2011) identified two major factors contributing to automobile dependency: under-pricing and consumer choices; planning and investment practices. Planning and the ensuing allocation of public funds aim towards improving road and parking facilities is an on-going attempt to avoid congestion. Other transportation alternatives tend to be disregarded. In many cases, zoning regulations impose minimum standards of road and parking services and *defacto* impose a regulated automobile dependency.

However, urbanization has been one factor contributing significantly to urban transportation problems, especially in the developing countries. Although urbanization is a global phenomenon, 90% of the growth in urban population occurs in developing countries which place intense pressures on urban infrastructures, particularly transportation to cope (Rodrigue, 2009). Since 1950, the world's urban population has more than doubled. The global urban population is projected to increase from 2.9 billion in 2001, reaching 3.5 billion in 2010 to about 4.9 billion in 2030 and in percentage terms (i.e. urbanization level), the world's urban population will increase from 48% of the total world population in 2001 to about 60% of the total world's population in 2030 and all the world's increase in population in the next decades will occur in low and middle income countries (UN-HABITAT, 2008; UNFPA, 2007). This is the outcome of natural increase, rural-urban migration and international migration.

Demographic and mobility growth have been shaped by the capacity and requirements of urban transport infrastructures such as roads, transit systems or walkways, consequently there is a wide variety of urban forms and associated urban transportation systems. Historically, movements within cities tended to be restricted to walking, which made medium and long distance urban linkages rather inefficient and time consuming. Thus, activity modes tended to be agglomerated and urban forms compact. Cities built recently because of their dispersed urban forms encourage automobile dependency and are linked with high levels of mobility. The evolution of

transportation has generally led to changes in urban form. The more radical the change in transport technology, have been, the more alteration on the urban form. Among the fundamental change in urban form is the emergence of new clusters, expressing new urban activities and new relationship between elements of the urban system. In many cities, the Central Business District (CBD), once the primary destination of commuters and serviced by public transportation, has been changed by new manufacturing, retailing and management practices.

However, Litman (2011) conceptualized parking problem in terms of a paradigm shift which describes a fundamental change in how a problem is perceived and solutions evaluated. Parking problem and solutions can be viewed in terms of a shift from the old paradigm to the new one. The old paradigm assumes that parking should be abundant and free at most destinations. It strives to maximize supply and minimize price (Wilson and Shoup, 1999). The paradigm also assumes that parking lots should almost never be filled and that parking facility costs should be incorporated into the costs of buildings or subsidized by governments and that every destination should satisfy its own parking needs. The old, parking paradigm asserts that parking requirements should be applied rigidly without exception or variation and that parking management should be seen as a last resort to be applied only if increasing supply is infeasible.

The new parking paradigm on the other hand strives to provide optimal parking supply and price. The new paradigm strives to use parking facilities efficiently. It considers full lots to be acceptable, provided that additional parking is available nearby and any spill over problems are addressed. It emphasizes sharing of parking facilities between different destinations and favours charging parking facility costs directly to users and providing financial rewards to people who reduce their parking demand. While the old paradigm tends to resist change and places a heavy burden of proof on innovation, the new paradigm recognizes that transport

and land use conditions evolve so parking planning practices need frequent adjustment (Cuddy, 2007).

Moreover, to provide optimal and efficient parking supply, it is the practice in conventional planning to determine how much parking should be provided at a particular centre by planners based on recommended minimum parking standards made available by various professional organizations. This will in addition provides an index or parking ratio used to calculate the number of spaces to supply at a particular location. According to Litman (2009), these are unconstrained and unadjusted values, which generally reflect the minimum supply that could be needed. These standards are often excessive and can usually be adjusted significantly downward.

It is obvious that better and improved ways are now available to determine how much parking to supply at a particular place or centre. These are the efficiency-based standards which take into account, geographic, demographic and economic factors that affect parking demand (Cuddy, 2007; VTPI, 2008). They also reflect the relative costs and benefits of different options, so less parking is supplied where parking supply is relatively costly to provide and where management programmes are easy to implement. Litman (2007) suggested an integrated parking plan which should be adjusted to reflect the needs of a particular situation. The steps include defining the geographic scope of analysis such as the site, street, district/neighbourhood and regional scale; carefully defining the parking problems; parking planning should be coordinated with a community's overall strategic vision and development of a comprehensive evaluation framework.

3.0 Study Area

Akure the setting for the study is rapidly emerging as a metropolitan city, its change from provincial headquarter to a state capital in 1976 gave the

city an accelerated physical and economic growth (Aribigbola and Osunsanmi, 2010). Located within Ondo State in the South-western part of Nigeria, Akure lies approximately 7^0 15^1 and 7^0 17^1 north of the Equator and between longitude 5^0 14^1 and 5^0 15^1 east of the Greenwich Meridian (Fig.1.1). Akure is about 700km Southwest of Abuja and 311km north of Lagos State, (Wikipedia, 2017). The subsequent increase in oil revenue accruable to the state since 2003 has consequently raised the general standard of living of the citizenry (Ogunbodede, 2006; Adeoye, 2016).

The most noticeable of the physical expansion of the city is its population growth and urban landmass. The estimated amount of the built-up area from available land use maps have shown immense increase from 16km^2 in 1980 to about 30km^2 in 2000. Presently, the total area extent of Akure is 991km^2 (383 sq.ml) and about 370m above the sea level (Wikipedia, 2017). The population rose from 123,000 in 1985 to 239,124 in 1991. The national population projection for the year 1996 and 2000 put the city population at 269,207 and 298,712 respectively. A sharp increase was recorded in the 2006 census, which put Akure south at 353,211 and Akure north population at 131,587 respectively (NPC, 2007). However, the last known estimated population in year 2015 was 556,300. This was 0.305% of total Nigeria population. Thus, if population growth rate would be same as in period 2006 – 2015 (+4.64%/year), Akure population in 2017 would be 609,165 (NPC, 2017).

The increase in landmass and population is evident in economic activities including daily trade in commodities carried out in a network of traditional and modern markets, service industries, government establishments, hotels and guest houses, which dotted the landscape of both inner and outskirts of the city. These activities have equally increased the number of traffic and travel volume in the city as people travel between their homes and offices, get services, shop and conduct businesses.

In addition, the city being strategically located in the heart of the State is linked by fairly good roads to all other local government areas which generate considerably daily road traffic into the city. These intra-city and inter-state journeys are largely responsible for the peak traffic flow and congestion in the city. Space demand to park vehicles at places of destination is therefore high with almost all the commercial and business centres located within the city without designated parking areas. Consequently, vehicles are usually parked indiscriminately along the roads creating traffic obstruction and travel delay.

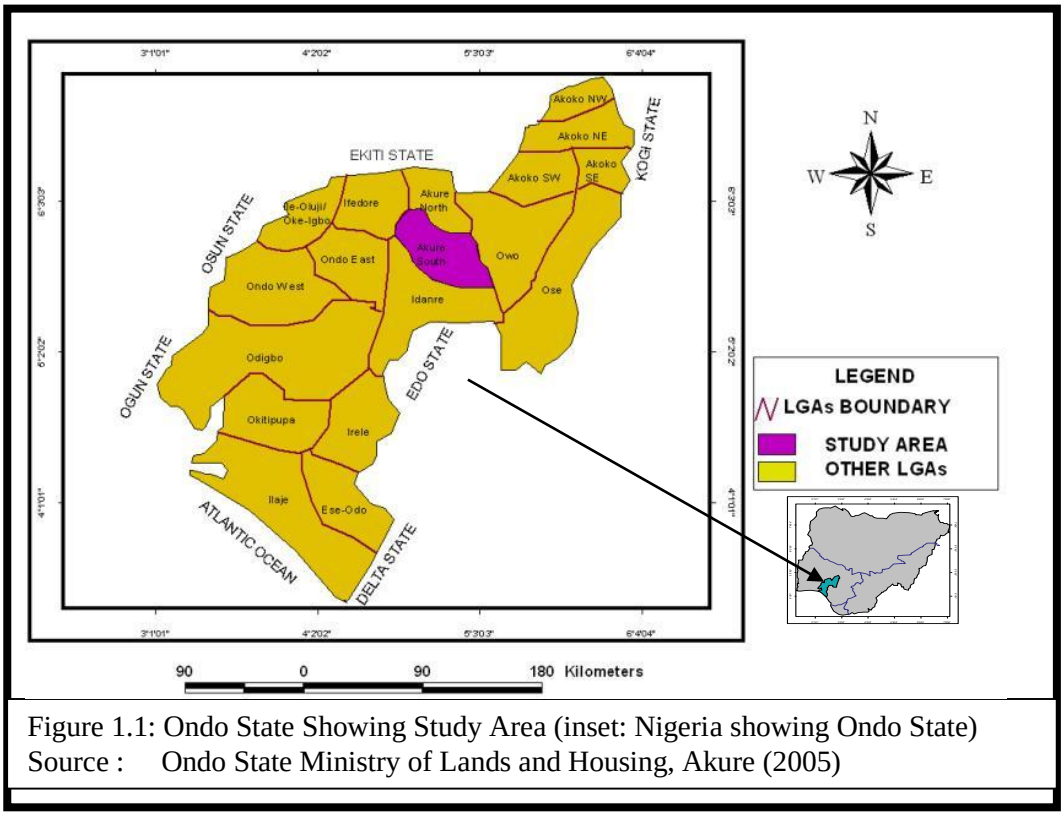


Figure 1.1: Ondo State Showing Study Area (inset: Nigeria showing Ondo State)
Source : Ondo State Ministry of Lands and Housing, Akure (2005)

4.0 Research Methods

To achieve the objectives of this study, reconnaissance survey was carried out to identify various roads and intersections as well as activity centres in the study area. Akure was chosen as the study locality because it has high car ownership and the use of public transport. Data collection involves the use of questionnaire which was in three parts. The first part contained nine questions on general information which include personal characteristics and socio-demographic influence such as age, income, convenience, trip perception and purpose, education, household size, car ownership and occupation. The second part contained ten questions which include trip characteristics and preference for driving versus public transport, weather, comfort, satisfaction, flexibility and prestige. The last part which contain twelve questions which dealt with existing parking facilities along sampled streets; locations where parking facilities were required; types of parking system available in the study area; existing parking regulations and control. Data were also collected on attitude of commuters especially the commercial vehicles operators towards parking in the study area.

However, ten major roads/streets were randomly selected and from where data on on-street parking were collected. These roads/streets include First Bank, High Court, Hospital, Oda, Ijoka, Oke-aro, Arakale, Ondo, Adesida, and Oyemekun roads (Fig. 1.2). Data were also collected from five designated activity centres in the study area where organized parking are prevalent. The designated activity centres selected for off-street parking are First Bank Plc. parking lot; NEPA Market; State Specialist Hospital; Akure South Local Government Area Secretariat; and the State Secretariat parking lots.

Two sets of structured proforma were used for the collection of data, one for off-street parking and the other for on-street parking. Information on the number of vehicles parked in a chosen parking lot at a particular period of time was collected. The survey was carried out between 8:00a.m –

4:00p.m on Monday to Friday of the week. A total of 700 questionnaires were administered on the general public.

The data collected were analysed using both descriptive and inferential statistics. The results were shown using tables, graphs and charts. The Chi-square statistical method was used to examine the relationship between parking capacity and parking demand in the study area.

5.0 Results and Discussion

5.1 Characteristics of the Studied Intersections

The ten studied intersections as highlighted in the research methodology were presented in Table 1. The intersections are of different types of prominent land uses and they comprise either 3-legged or 4-legged junctions.

The traffic flows at all the studied intersections are controlled by either traffic lights, traffic wardens or the presence of big round about. Common to all the intersections is the presence of traders and the location of retailing shops. These however result in road-side obstructions and parking problems from customers who patronize the sold products and thereby impeding the free flow of vehicles. Also associated with these problems are the narrowness and poor nature of the intersecting roads to separate the traffic streams

Table 1: Characteristics of the Studied Intersections

S/No.	Intersection Name	Intersection Types	Land-use Characteristics
1.	First Bank	4-legged	Commercial, Retail shops, Government offices, Government residential area.
2.	High Court	4-legged	Commercial centres, Government offices, Retail shops.
3.	Oda Road	4-legged	Commercial, Medical, Institutional, Industrial, Religious, Residential Estate.
4.	Oke Aro	3-legged	Commercial, Retail shops, Motor parks, Medical, Institutional, Residential Estate, Industrial, Market.
5.	Oba Adesida	3-legged	Commercial centres, Market, Motor parks, Tourism.
6.	Oyemekun	3-legged	Commercial, Retail shops, Government offices, Residential, Motor parks, Institutional.
7.	Ondo Road	3-legged	Commercial, Retail shops, Industrial, Institutional, Residential, Motor parks, Government offices, Market.
8.	Ijoka road	3-legged	Commercial, Retail shops, Institutional, Industrial, Residential, Market
9.	Hospital Road	4-legged	Commercial, Retail shops, Institutional, Residential, Medical.
10.	Arakale	4-legged	Commercial, Retail shops, Residential, Market.

Source: Author's Field Survey

The Table also shows that five of the intersections are either 3-legged or 4-legged, constituting 50% each. In terms of land use characteristics, majority of them are located where commercial, institutional, markets, and retail shops predominate. The intersecting arms also connect residential estates, public and private institutions and other major activity centres in the city.

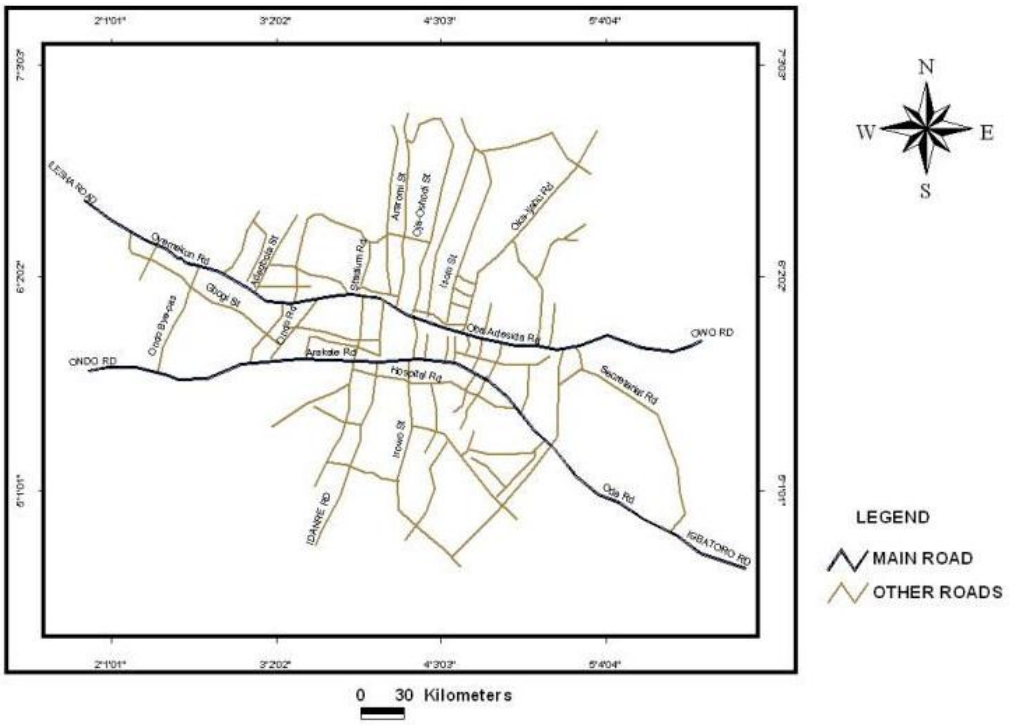


Figure 1.2: Akure Road Network Map
Source: Author's Field survey, 2013

5.2 Pattern of Traffic Composition

Table 2 below shows the average peak-hour traffic composition at the sampled intersections. The table shows that respondents at the sampled junctions claimed that taxi cabs with about 49% formed the highest occurrence of traffic composition in the study area followed by private cars with about 26%. Motor cycles (Okada) constitute 16% of the traffic

composition while buses and truck/lorries constitute 6.1 and 2.6% respectively.

Table 2: Traffic Composition at the Studied Junctions

S/N	Traffic Composition	Frequency	% of the Total
1.	Motor cycles (Okada)	112	16.0
2.	Taxi cabs	346	49.4
3.	Private cars	181	25.9
4.	Buses	43	6.1
5.	Trucks/Lorries	18	2.6
	Total	**700**	**100.0**

Source: Author's Field survey

The use of motor cycles among the types of vehicles used is significant in public transportation in the city. This mode has become popular and it has helped a lot in reducing the transportation problem in the city. Taxi cabs are regular mode of use in meeting the needs of the inhabitants in terms of public transportation while there are now more private cars on the city's roads due to improved income and better purchasing power of workers. Buses provide services for the transportation of goods and people while delivery vans or trucks are used mainly for transporting goods in the city.

5.3 Causes of Delays at Intersections

Population increase influence economic activities that dotted the landscape of any city. Both inner and outskirt of a city like Akure is linked together by roads. This not only increase the number of traffic and travel volume in the area as people travel between their homes and jobs, get services, shop and conduct businesses and so on; but has led to heavy traffic and delays on the roads. However, there are some factors which contribute to traffic

delays in the study area. The varied subjective notions of the respondents are shown in Table 3.

Table 3: Factors Causing Traffic Delay at Studied Intersections

Factors	**SA**	**A**	**D**	**SD**
Parking Problems	558	114	22	06
Traffic Controls	361	257	48	34
Breakdown of Vehicles	81	193	299	127
Accidents	117	132	228	223
Road Side Hawking	87	131	221	261
Pedestrian Crossing	53	101	331	215
Road Constructions	124	143	266	167
Weather	48	53	357	242

Source: Author's Field survey

In order to ascertain the notion of the respondents about factors causing traffic delays at the intersections, the indicated subjective notion of the 700 respondents were transformed to objective notion using 4-point rating scale of Likerts. The summary is presented in Table 4.

Table 4: Respondents notion on Factors Causing Traffic Delay

Factors	SA	A	D	SD	TWV	MWV
PRP	2232	342	44	06	**2624**	**3.75**
TRC	1444	771	96	34	**2345**	**3.35**
BKV	324	579	598	127	**1628**	**2.33**
ACC	468	396	456	223	**1543**	**2.20**
RSH	348	393	442	261	**1444**	**2.06**
PDC	212	303	662	215	**1392**	**1.99**
RDC	496	429	532	167	**1624**	**2.32**
WTH	192	159	714	242	**1307**	**1.87**

Source: Author's Field survey
GMWV: 19.87/8 = 2.48

However, the Mean Weight Value (MWV) and the Gross Mean Weight Value (GMWV), that is, the cut-off point of rejecting or accepting any of the responses above were done as calculated. From Table 4, factors such as breakdown of vehicles (BKV), accidents (ACC), road side hawking (RSH), pedestrian crossing (PDC), road construction (RDC), and weather (WTH) were rejected because their respective mean weight values of 2.33, 2.20, 2.06, 1.99, 2.32, and 1.87 are lesser than the GMWV of 2.48. Moreover, the notion that traffic delay in Akure is caused by parking problems (PRP) and traffic controls (TRC) with a mean weight value of 3.75 and 3.35 were accepted because their MWV are greater than the GMWV of 2.48.

5.4 Trip Generation and Parking Demand

Intra-urban journeys in Akure indicate the form of spatial interaction of various land uses, which also provide a measure of the spatial organization of the city. The travel efficiency relates to the cost of movement in time value, in distance, and in convenience. However, convenience here relates specifically to parking. Trip generation and attracting capacity of land use

in terms of the number of vehicles and parking demand is used as a gauge to assess the functional role of each zone in terms of space efficiency. Table 5 provides data on vehicular traffic count as a measure of parking demand per activity area and the actual parking capacity in existence.

Table 5: Parking Demand and Capacity in Activity Space in Akure

S/N	Activity Area	Parking Space Capacity	Parking Demand	Mean Parking Demand/Hour
1	First Bank	48	120	70
2	NEPA Market	30	85	56
3	Specialist Hosp.	52	160	105
4	Isinkan Market	60	92	75
5	State Secretariat	150	430	225

Source: Author's Field survey

Table 5 shows that parking demand in the designated activity areas of the city is indicative of the high demand when compared with the existing parking space, and reflects the volume of vehicular traffic per hour to these activity areas. This implies that excess vehicular traffic in these areas is parked along the roads and causes delay in movement within the city.

However, the nature of this relationship can be further expressed statistically as shown in Table 6. The summary of the analysis shows that there is significant difference between parking capacity and parking demand in Akure since the Chi-square calculated of 16.9 is greater than Table value of 15.5.

Table 6: Summary of Chi-square Analysis

Variable	Degree of Freedom	Level of Significance	Calculated Value	Tabulated Value	Decision
Available parking spaces and parking space demand in Akure	(5 – 1) (3 – 1) = 8	0.05 or 5%	16.9	15.5	Parking capacity is significant to parking demand

6.0 Planning Implications and Conclusion

The study has empirically established parking as a long standing problem in many urban centres in Nigeria. This has been due to inadequate or absence of clearly designated areas for parking in many of our cities. This has equally led to traffic congestion and delay problems on our roads. The study has examined the pattern of parking capacity and demand in the study area which will go a long way in assessing the parking needs of the different parts of the city.

However, it is recommended that a more effective traffic management system should be evolved for Akure. With the high rate of growth of Akure, traffic and parking problems should not be left until they attain the levels which are already experienced in larger urban centres in Nigeria and other climes.

It is recommended that there should be more use of traffic wardens at junctions and intersections than the use of traffic lights which may cause delay at times because of its inefficiency in the area. Planning should be comprehensive enough to include the provision of on-street parking to augment demand where the road carriage way is wide enough to accommodate one-way parallel parking. Where the street width is

inadequate to accommodate on-street parking, indiscriminate parking on the streets should be prohibited and enforced by the local government authority. Also, parking in adjacent and unauthorised spaces which are perpendicular to street corridors should be prohibited to ensure both effective patronage of the designated parking areas and ease intra-urban movement especially within the inner core of the city.

Likewise, directional signs to the parking and enhanced pedestrian walkways to connect the parking to businesses are essential to effective use of the parking facilities. It is recommended that effective and good signposts be erected as this could be employed in order to reduce illegal parking and traffic congestion. A unified parking management plan must be developed, implemented and enforced in order to coordinate use of parking facilities. If well managed, the parking areas can be effective business in themselves. However, it is recommended that a new institutional arrangement and procedure for the development and management of traffic in Akure should be created.

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