Assessment of Automobiles and Pedestrians Control Techniques Within Markets in Kaduna State, Nigeria

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Abstract

The Assessment of automobile and pedestrian control techniques within the market environment cannot be overemphasized as it is one of the most important ways in curtailing poor market environment in terms of traffic congestion. Automobile and pedestrian congestion is a situation that arises when the road networks are incapable of accommodating the traffic generated. Automobile and pedestrians control techniques in market refers to regulation, adoption, or maintenance of automobile and pedestrian functions or feature either by design or new construction within the market. The sustainable design encompasses standard layout, adequate parking, standard road network system, provision of signs and markings, proper zoning etc. This research aimed at assessing pedestrian and automobile control technique adopted within markets in Kaduna with the view of designing a more improved circulation pattern and sustainable markets in terms of automobile and pedestrian control within the study area. With this regard, an observation method of research was adopted. The daily markets were randomly selected out of the numerous markets within Kaduna metropolis and its environs. The result shows that the proper automobiles and pedestrians control techniques was not properly observed or adopted in over 90% of the market. The study further revealed that the selected markets within Kaduna share similar features and characteristics. Therefore to curtail these, recommendations were made on various practical methods for integration/adoption in market design so as to archive an effective automobile control within the markets in Kaduna metropolis.

Keywords: Automobiles, Control Techniques, Market Congestion, Pedestrian

INTRODUCTION

A Market is "a location at which there is a public gathering of buyers and sellers at a known time" (John, 2003). Michael (2009) defined market as "any established operating means of exchange for business dealings between buyers and sellers; a place where goods are bought and sold". Oxford dictionary (2014) defines market as "A gathering in a public place for buying and selling merchandise or farm products, especially one held regularly". Cournot (2009) believes that market is a building or open space where buying and selling are regularly held. In other word market is a number of a small independently operated shop or stall, in the same building and sometimes all selling the same type of goods.

 (Donaldoni, 2009), defined market as "the whole of any region in which buyers and sellers are in such free intercourse with one another that the price of the same goods tend to equality easily and quickly". Market is such a place which provides lower cost of retailing which is basically in small and medium operational levels. The need for a market place is being propelled by the need to buy and sell products, goods and services.

The importance of a sustainable automobile and pedestrian traffic control techniques design and implementation within any given market environment, cannot be overemphasized. One of the greatest threats to a sustainable market environment is the poor automobile and pedestrian traffic control techniques design, and implementation within any market environment which on the long run lead to an excessive traffic of people and automobiles which tends to bring about a state of overcrowding and making movement slow or difficult within the market otherwise known as congestion. Therefore the assessment of automobile and pedestrian control techniques within the markets environment to investigate its cause and effect and to further proffer solutions of the existing situation within Kaduna metropolis and its environs is very vital.

Traffic congestion within markets in Kaduna metropolis and its environs in most cases is as a result of poor pedestrian and automobile control techniques measures being put in place or not duly considered when setting up markets. The congestion also occur as a result of rapid growth in the number of cars and people within the market with no corresponding way of improvement in the road network and other control measures within the markets. The existing market design in Kaduna state lacks adequate walkways/ circulations for both pedestrians and vehicles, no adequate parking spaces, lacks standard aisle / signage, no defined shop numbering / zoning or proper location of entrance /exit gates and also lacks organized open spaces for street hawking. The above strategies prohibit smooth flow and business transaction among the market users. The research aimed at assessing the physical planning and arrangement of control technique measures implored within markets in Kaduna metropolis and its environs for a sustainable automobiles and pedestrians circulations in markets. In addition, the research seeks to provide an operational guideline that shall be used as a templates for planning,

designing and implementation of market's automobile and pedestrian control techniques within Kaduna state.

1.2 Study Area

Kaduna State occupies a central position in the map of the Federal Republic of Nigeria as shown in Figure (1 and 2), and a landmass of about 45, 567 square kilometers. The state lies between latitude 09^0 02'N and 11^0 32'S and between longitude 96^0 15'E and 08^0 60'E. The life of the people of the state has been greatly influenced by the geographical setting. The two climatic conditions in the state greatly influence activities of the people, who are predominantly occupied in agriculture during the rainy season. The rainy season lasts for about six (6) months from May to October. The people engage in cultural festivals & commercial activities during the dry season which last form November to April. (Canback Global Income Distribution Database, 2008).
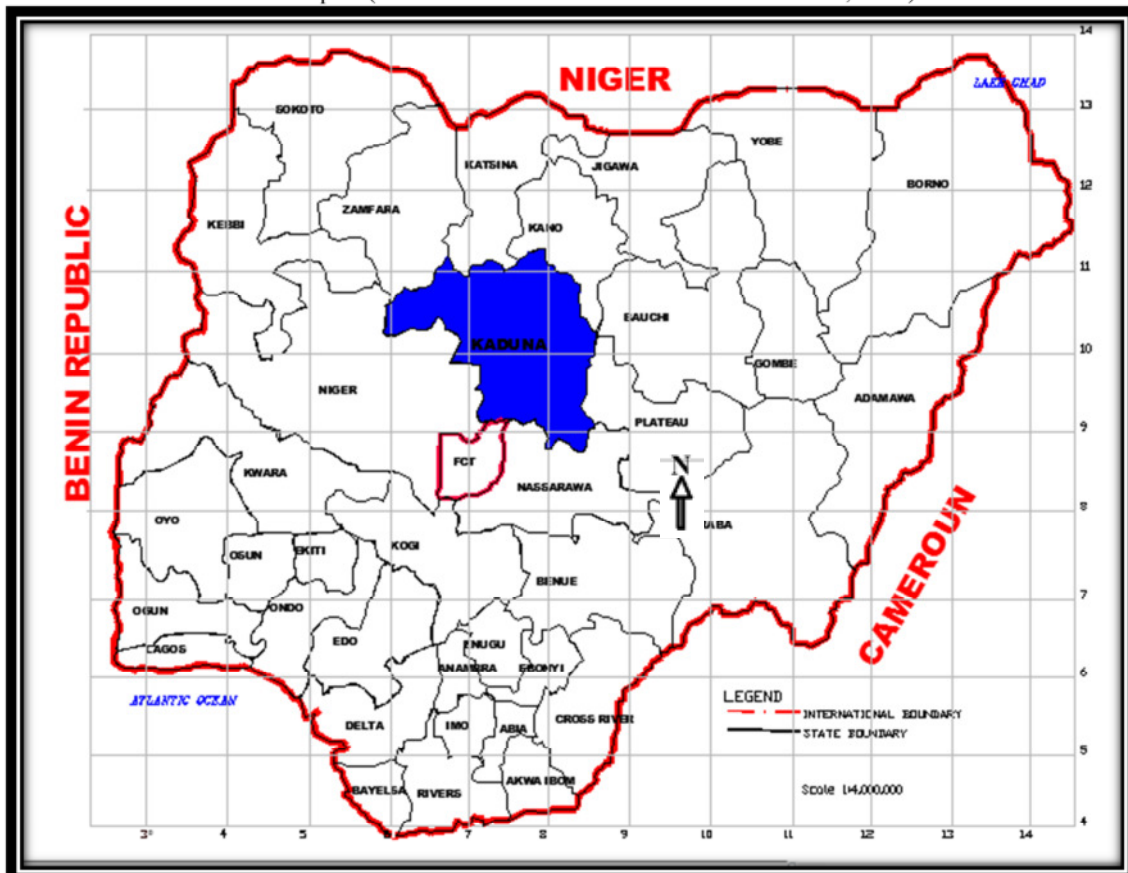

Figure 1: Nigeria showing the study area (Kaduna state) *in blue*.
Source; Kaduna state ministry of lands, survey and country planning, 2018

Figure 2: Kaduna state showing Local Government Areas
Source; Kaduna state ministry of lands, survey and country planning, 2018

The British selected Kaduna as the capital of their colony of Northern Nigeria in 1913 and developed an expansive layout for the city. As an industrial and administrative centre, Kaduna has drawn migrants from all over Nigeria, making it one of the country's most ethnically diverse cities. The city's political and economic elite has exerted great influence in national affairs since Nigeria gained independence in 1960 (Canback Global Income Distribution Database, 2008).The town is also one of Nigeria's leading manufacturing centers, specializing in textile production, petroleum refining, vehicle assembly, brewing, food processing, and printing and publishing.

1.2.1   Markets in Kaduna state.

The state consists of seventy four (74) markets which cut across the 23 Local Government Areas. Out of the seventy four (74) markets, the selected market are; Kaduna central market, sabon tasha market, railway station market, kakuri market, sabon gari market, kasuwan danmagaji, yakowa market, and kafanchan market. The market days are shown in the Table 1

Table 1: Showing Markets in Kaduna State and Their Market Days

SN	Local Government Area	Market	Market Days
1	Chikun	Sabon Tasha,	Daily
2	Jema'a	Kafanchan,	Daily
3	Kaduna North	Central Market, Kawo	Daily Tuesdays
4	Kaduna South	Monday Market, Kakuri, Railway	Mondays Daily Tuesdays
5	Sabon Gari	Sabon Gari Market,	Daily
6	Zaria	Dan Magaji	Daily

Source; Department of Research and Statistics, Kaduna State Ministry of Economic Planning 2018

2.0 Methodology
This research was a field research and conducted using a quantitative method of research in the generation of data observed within the study areas. This research made use of personal observation, personal interviews with the stakeholders within the market, transportation and traffic management sectors. In this regard a random sampling approach was adopted as a result of a limited population samples.

2.1 Method of Data Collection
2.1.1 Sampling Technique
The sampling technique adopted in the course of this research is the Stratified Random Sampling. In most cases, the target population is not so homogenous so as to call for different sampling techniques. In stratified sampling, the population is divided into separate strata and within each stratum separate but proportional samples are drawn. Different population parameters such as mean, median, standard deviation etc. can be calculated separately for each stratum.
2.1.2 Observation
Field observation and reconnaissance survey of the existing study areas (Kaduna central market, sabon tasha market, railway station market, kakuri market, sabon gari market, kasuwan danmagaji, yakowa market, and kafanchan market) was carried out so as to determine the automobile and pedestrians control techniques put in place. The data collected on control techniques measures includes; road capacity, layout, zoning, sidewalks, pedestrians bridge, sizes of aisle, shop numbering, street naming, entrances and exits points, traffic automated system, speed bombs and speed breakers and number of stalls.
2.1.3 Opinion Survey/ Interview
Survey was conducted on both the study area to know the measures taken in terms of control techniques with regard to market designs considerations. Also interview was carried out with various stake holders in the markets over some basic control techniques measures within the market environment.
2.1.4 Data Collection Instruments
The data collection instrument used in carrying out this research is basically a well-structured observation schedule as shown in Table 2. The use of camera was also used to capture data directly on the site.

Table 2: Showing Component of Observation Schedule for Automobiles Control Technique

SN	Automobiles Control Techniques Element		Pedestrians Control Techniques Element
1.	Roads size	1	Aisle
2.	Type of road provided	2.	major lane
3.	Provision of Pedestrian bridge	3.	Pedestrian bridge
4.	Road markings	4.	organized open space
5.	Traffic automation systems	5.	pedestrian Traffic automation systems
6.	Parking spaces	6.	Shop numbering and street naming
7.	Speed bombs	7.	exit
8.	Lay bys	8.	Entrances
9.	Railings	9.	Railings
10.	side walks	10	side walks
11.	Number of stall		

3.0 DATA ANALYSIS AND DISCUSSION OF RESULTS
This research focuses on the daily markets out of which eight (8) where randomly selected. The selected markets are; Sabon Gari, Kasuwan Danmagaji, Central market, Kakuri market, Railway market, Sabo market, kafanchan market and the new Yakowa market as shown in Table 1

3.1 Assessing Pedestrian Control Techniques Implored in the Study Area

3.1.1 Basic Elements of Control Techniques

A workable pedestrians control techniques measures within market environment is one of the most important mechanisms that should be put in place within a market so as to enhance a sustainable and effective market environment. Table 3shows elements of control technique within markets in the study area. The results show that traffic light, speed bumps, guard rails, and pedestrian bridge are not made available within all the markets in the study areas which on the long run affects pedestrians' movement within the market. However, in the case of sidewalk, two of the markets (central market and kakuri market) are seen to have sidewalk while the rest six (6) markets do not have sidewalks. Traffic lights help in given proper direction, guidance and to give a balance between automobiles movement and pedestrians movements. However, speed bumps is also important in the market setup .When all these are not properly employed it creates conflict in movement between the automobiles and the pedestrians. Pedestrian bridge is also an important element of pedestrian movement, it create an uninterrupted movement between automobiles and pedestrians. Sidewalk creates a pedestrian path without necessary obstructing automobiles movement. Table 3shows that proper consideration was not made with regards to pedestrians control techniques. Road shoulders are made available in all the markets except for yakowa and sabon gari market. For this reason, measures should be put in place in positioning or placing this control techniques element (traffic lights, speed bumps, Pedestrians Bridge, sidewalk) and improving on the existing once so as to have to a greater extent of an effective and sustainable market environment with regards to pedestrians control techniques in markets within Kaduna state.

Table 3: Showing Basic Elements of Control Techniques within Market

SN	Market Location	Control Techniques Element						
		Traffic lights	Speed bumps	Pedestrian bridge	Side walks	rails	Drive bays	shoulders
1	Central Market	O	O	O	A	O	O	A
2	Sabo Market	O	O	O	O	O	O	A
3	Railway Market	O	O	O	O	O	O	A
4	Kakuri Market	O	O	O	A	O	O	A
5	Sabon Gari Market	O	O	O	O	O	O	O
6	Kasuwan Danmagaji	O	O	O	O	O	O	A
7	Yakowa Market	O	O	O	O	O	O	O
8	Kafanchan Market	O	O	O	O	O	O	A

Where; O=NOT AVAILABLE AND A= AVAILABLE

3.1.2   Aisle Size

The size of aisle in any market is a very vital to obtaining a sustainable pedestranization. When an aisle is not in proportion to the amount of pedestrians and other things such as carts push trucks, wheel barrow passing through it becomes a challenge for pedestrians movement within the market environment (see Figure 3 and 4). Table 4shows that virtually all the markets in the study area have variation in the sizes of aisle within the market. All the other markets except for Sabon Tasha market and sabon gari market has aisle size of maximum or equal to 3m in size. On this note all the market needs an increase in sizes of aisle to a minimum of 3m except for some part of Yakowa and Central market, as to have an effective and sustainable pedestranization within the market environment.

Table 4: Showing Sizes of Aisle

SN	Market Location	Size Of Aisles (M)			
		0-1	1-2	2-3	3 and above
1	Central Market			▪	▪
2	Sabo Market	▪	▪		
3	Railway Market			▪	
4	Kakuri Market		▪	▪	
5	Sabon Gari Market	▪	▪		
6	Kasuwan Danmagaji			▪	
7	Yakowa Market			▪	▪
8	Kafanchan Market		▪	▪	
	Total	2	4	6	2

Figure 3: Showing The size of Aislein (a)kasuwan Danmagaji market (b) railway market, (c) kafanchan market (d) yakowa market.

Figure 4: Showing The size of Aisle in (a) Sabon Gari market (b) central market (c) kakuri market (d) sabo market

3.1.4   Entrances and Exits

Provision of entrances and exit gates is an important tool for controlling pedestrian traffic within a market setup, whether in terms of emergency or otherwise. Table 5 shows that only Central Market, Sabo Market, Kakuri Market and Kasuwan Danmagaji made provision for entrance gates, while other markets have no defined gates separately for entrance and exit. On this note provision of gates should be made on the other market to archive a proper pedestrians control within the market environment. A clear provision of entrances and exit gates saperately, is a very important tool for controlling pedestrian traffic within the market which also helps during any emergency situation for crowd control.

Table 5: Showing Provision for the number of Entrances and Exits within the Study Area

SN	Market Location	Provision of Entrance and Exits
		No; of entrances/exits gate
1	Central Market	31
2	Sabo Market	8
3	Railway Market	Not define
4	Kakuri Market	18
5	Sabon Gari Market	Not define
6	KasuwanDanmagaji	1
7	Yakowa Market	Not define
8	Kafanchan Market	Not define
	Total	

The need to provide and to also improve on the sizes of the existing gates cannot be over emphasis as it goes a long way in bringing about an effective pedestrian control technique by containing a reasonable amount of pedestrian traffic flowing through it either in terms of emergency or otherwise. Figure 5 shows the existing gate in central market and Kakuri market. Table 6 shows the size of the existing gate in all the market.

Figure 5 : Showing existing gate (a) Central   Market (b) Kakuri market

Table 6: Showing Sizes Of Entrances And Exits Within The Study Area

SN	Market Location	Entrances And Exit Sizes			
		Sizes of entrances/exits gate (m)			
		0-0.99	1-1.99	2-2.99	3 and above
1	Central Market			▪	▪
2	Sabo Market		▪	▪	
3	Railway Market	-	-	-	-
4	Kakuri Market		▪	▪	▪
5	Sabon Gari Market				
6	Kasuwan Danmagaji				▪
7	Yakowa Market				
8	Kafanchan Market				

3.2 Assess Automobiles Control Techniques Implored Within Markets in Kaduna State".
3.2.1   Numbers of Stalls

The number of stalls within a market is one of the most important tools to be considered in terms of automobile control techniques as it is in direct proportion and a serious determinant in providing facilities such as parking spaces within the market, of which according to standard should be 2-5 parking for every 100m². Table 7 shows

the stall in the different market in the study area. Base on this research it shows that the provisions of stalls within the markets were not in proportion to the parking. Proper measures should be put in place to ensure that when setting up a market the number of stalls provided should be in proportion to the number of parking facilities provided within the market.

Table 7 Showing Numbers of Stalls in the Study Area

SN	Market Location	Number Of Stalls			
		0-500	501-1000	1001-1500	1501 and above
1	Central Market				▪
2	Sabo Market			▪	
3	Railway Market	▪			
4	Kakuri Market			▪	
5	Sabon Gari Market				▪
6	Kasuwan Danmagaji	▪			
7	Yakowa Market		▪		
8	Kafanchan Market	▪			
	Total	3	3	1	1

3.2.2 Parking

Parking is an important mechanism within the market environment, its location and the numbers provided in relationship with the area or number of stalls within the market entirely matters. According to FAO design standard of 2-5 parking for every 100m² of sales area. Table 8 shows that parking conditions within the markets based on the number of stalls provided shows that parking is inadequate as it does not tally and not in correlation with the number of stall provided as shown in Table 7.Central market, has the highest number of parking (250) as against the over 6000 stalls provided, while sabo market has 49 number, railway 37 and kafanchan market 41 as against between 500-1500 stalls number. Figure 6 shows different parking space in the study area. With this regard, measures should be put in place in the provision of adequate parking that will accommodate every category of automobiles such as trucks, small or light cars, tricycles, motor bikes, bicycles as it is one of the most important mechanism that should be put in place in order to have an effective and a sustainable automobile control within the market environment.

Table 8: Showing Parking Conditions within the Study Area

SN	Market Location	Parking				
		No; of parking	No; of parking for trucks	No; of parking for tricycle and motor bike	Location of parking	Major parking area
1	Central Market	250	0	0	Outside market	Parking lot
2	Sabo Market	49	0	0	In the market	Parking lot
3	Railway Market	24	0	0	Outside market	Parking lot
4	Kakuri Market	0	0	0	NOT DEFINED	-
5	Sabongari Market	0	0	0	NOT DEFINED	-
6	KasuwanDanmagaji	0	0	0	NOT DEFINED	-
7	Yakowa Market	0	0	0	NOT DEFINED	-
8	Kafanchan Market	31	0	0	IN THE MARKET	Parking lot
	Total	**1310**				

Figure 6: Showing Parking space in (a) Sabon Gari market (b) central market (c) kafanchan market (d) yakowa market

3.3 Ways of improving the existing control techniques within the market".

One of the objectives of this research in particular is seeking to address ways to improve on the control techniques within markets in the study areas. With regard to control techniques elements, measures should be put in place in positioning or placing this control techniques element (traffic lights, speed bumps, pedestrians bridge, sidewalk) and improving on the existing once so as to have to a greater extent an effective and sustainable market environment with regards to both automobiles and pedestrians control techniques within markets in Kaduna state.

Provision of gates in the market is also important which should be made available in other markets so as to archive a proper pedestrians control within the market environment. Shop numbering, street naming and aisle is very vital and it helps to eliminate confusion among the market users. This also provides direction and guidance to the prospective users and visitors coming to the market.

The size of roads in every market is one of the most important tools for an effective automobile traffic control in market, when the roads cannot adequately accommodate the traffic generated within the market; it becomes a serious problem to traffic control in the markets. Proper control techniques measure should be also be put in place on the roads for an effective control techniques such as signs, markings and also parking restrictions so as to restrict parking along the road that will affect the road carry capacity and further creating traffic congestion.

Proper measures should be put in place to ensure that the number of stalls correspond with the parking facility in the market. Parking is an important mechanism within the market environment, its location and the numbers provided in relationship to the area or number of stalls within the market entirely matters. According to FAO design standard of 2-5 parking for every 100m² of sales area or two (2) parking for every five (5) stalls in a developing country or a less motorized society and one (1) parking per stall for a highly motorized society. With this regard, measures should be put in place in the provision of adequate parking that will accommodate every category of automobiles such as trucks, small or light cars, tricycles, motor bikes and bicycles among others as

an important mechanism to be considered to enhance an effective automobile control within the markets. However, the inadequacy or non-provision of these facilities is the sole causes of indiscriminate parking within the market environment.

3.4 Summary of discussion of results
The Assessment of pedestrian and automobiles control techniques for effectiveness within the market environment were buying and selling merchandise or farm produce takes place within Kaduna state cannot be duly overemphasis as it is one of the most important mechanism or ways in curtailing poor market environment in terms of congestion, were by the users find it so difficult and frustrating to perform transaction within the market environment. This research shows that important pedestrians and automobiles control techniques measures were not properly adopted in most of the existing markets. Pedestrians control techniques such as the aisle sizes in places like Sabo, Kakuri and Sabon gari were not placed properly. In view of automobiles control techniques, the research shows that the road sizes, type of road provided within the markets are below standard while the parking spaces provided are inadequate compare to the number of stall when compared to the standards. In addition, other automobiles were not considered in the provision of parking space such as the truck which constitute a greater percentage of automobiles congestion causative elements within the market, also the tricycles, motor bikes and bicycles were not duly considered and they are contributing factors affecting automobiles control techniques within the market environment, especially when the parking is not well defined or not being provided for.

4.0 CONCLUSION AND RECOMMENDATIONS
4.1 Conclusion
It is worthy of note that the Assessment of automobiles and pedestrians control techniques within a market environment cannot be duly overemphasis as it is one of the most vital mechanism or ways for an effective market environment in terms of congestion. Automobile and Pedestrians control techniques in market with regard this research is the regulation, adoption, or maintenance of automobiles and pedestrians' functions or feature via the use of architectural and constructional methods within the market environment to archiving a sustainable, effective and efficient control techniques within the market environment.

The research shows that the proper automobiles and pedestrians control techniques is not properly adopted in over 90% of the market. Roads are made available but there is still the need for a standard road network system within the markets with regards its sizes and positioning. Parking spaces are inadequate in all the markets when compared to the number of stalls and size of the markets in general. Sizes of major lanes and aisle in over 67% of the research area are not to standard, and other automobiles and pedestrians control techniques elements were not considered such as Pedestrians Bridge, railings, side walk, road shoulders, motor bikes and tricycles parking, speed bombs, pelican crossing, road marking, street naming, shops numbering, and speed bombs.

The results was used to proffer a sustainable, efficient and effective control techniques measures within the markets such as standard road network system, adequate parking, introduction of pedestrian bridges, railings, sizeable or standard aisle, introduction of pedestrians sidewalks, park and rides, proper pedestranization of the market environment, and good or proper layout within the markets. In view of this also, government and developers should put into cognizance all the elements aforementioned above and to also ensure strict compliance to the recommendations made in this research so as to achieve a sustainable, workable and effective automobile and pedestrians control technique within the market environment in Kaduna state.

4.2 Recommendations
The need to put in place a sustainable, functional and workable automobile control techniques measures cannot be overemphasized. In view of these, recommendations were made towards improving automobiles and pedestrians control techniques within markets, and they are;

i.   A sustainable, efficient and effective pedestrians control techniques measures within the markets should be put in place such as sizable or standard aisles and major lane to accommodate the traffic generated within the market. Pedestranization of the market should be highly considered whereby the pedestrians activities is separated from automobiles activities so as to ease pedestrians movement within the market, this can be archive by introducing pedestrians bridges at strategic locations within the markets, introduction of traffic automated systems, well defined side walk, pedestrians crossing, provision of signage, provision of guard railings.

ii. Proper Automobiles control techniques within a market is a vital tool to archiving a conducive market environment. Therefore to archive these, standard road network system should be put in place. Also adequate parking that will meet the standard required either during peak period or otherwise should also be put in place, which are normally 2-5 cars for every 5 stall or 2-5 for every 100m² sales area.

iii. For a sustainable and effective automobile control, introduction of pedestrian bridges, introduction of railings

to separate roadways and pedestrians walkways, introduction of traffic dictator to give priority to timing of vehicles for easing congestion and minimise delays, introduction of restrains, introduction of high occupancy vehicle (HOV) lane, pitch marking, drive -way, priority control, pavement marking within the markets should be put in place.

iv.   Introduction of park and ride should be considered, whereby buyers and sellers would park distance from the market in the parking space and then using a high occupancy vehicle or bus to convey them to the market which will go a long way in reducing the number of cars flaunting the market and in turn curb congestion within the market environment.

v.   Strict management policies should be put in place to tackle traffic offenders within the market and other automobile and pedestrians related offences.

vi.   This research shall serve as a model for developing or redeveloping or remodelling any market and it also contains newer standards that should be introduce into market bye-laws so as to have a market that shall meet the day-to-day changing needs of the market environment and it prospective users in general.

In view of these, all the various market stakeholders should ensure strict compliance to all the recommendations aforementioned above in the course of developing markets both locally and internationally so as to enhance a sustainable, workable and effective automobile and pedestrians control technique within the market environment in Kaduna state and other states in Nigeria.

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