Onitsha Urban Road Transport System: Implications for Urban Transport Planning

Ikegbunam, Florence Ifeoma
M.SC, CMEMAN, MEBAN
Department of Environmental Management,
Anambra State University, P.M.B. 02, Uli,
Anambra State, Nigeria.

Abstract

This paper investigated the Onitsha urban road vehicular transport system. The parameters of study are the route ways or travel ways, the terminal facilities, the rolling stocks and their associated variables. The methodology of study was direct field observation and measurement. The city was segregated into five traffic zones. Roads in the traffic zones were aggregated. Using stratified random sampling technique; eight arterial roads and two freeways were selected for study. Eleven hours of traffic count were undertaken by manual devices, from 7a.m through 6p.m from Monday through Saturday on each of them. The null hypothesis that there is no significant relationship between traffic congestion and hourly flow of traffic was validated using Pearson's Product Moment correlation. The result obtained was tested for significance using student t-test. The results show positive correlation between traffic congestion and hourly flow of traffic for seven roads; and a negative correlation for three roads. Environmental problems arising from urban road transportation in Onitsha were evaluated with policy implications and recommendations made.

Introduction

The technological revolutions that brought about automobiles were hailed as major engineering masterpieces. The enthusiasm was borne out of the obvious advantages automobiles have over erstwhile modes of transportation namely: increased accessibility, mobility and flexibility. Many cities have grown consequent on their location on the principal transport arteries or at ferry points or as a result of economic, commercial, industrial, educational, and religious functions, which they perform. The attraction and vitality of cities depend on efficient transportation services.

Roads in Onitsha serve a multiplicity of needs. They not only connect and link homes with places of employment, but also integrate the city's social, cultural, political and economic areas. Accessibility, mobility and flexibility conferred by road transportation services have instigated the streaming of pedestrians, and vehicles of all sorts into the city of Onitsha; to participate in businesses as varied as the trip makers and at different locations. The growth of the city of Onitsha from a small fishing and farming settlement, to a flourishing commercial center; can be traced to its site and situation at the break of bulk point, entre pot point and trans-shipment centre (Udo, 1978); extensive direct commercial contacts, and contacts with European missionary activities (Okoye, 1975).

Early development of motorized ferry and overland transportation services gave rise to rapid population movement into Onitsha and growth of vehicles of sorts such as cars, buses, trucks, lorries and bikes. There was heightened demand for transportation services, as well.

By 1967, Onitsha had an internal traffic flow of 3,000 vehicles per day; and the road traffic census of 1972 shows that the greatest volume of heavy traffic in the then East Central State was observed along two major directions centred around Onitsha (Monanu and Ofomata, 1975, p.131). The first runs from Onitsha through Enugu, Nkalagu and Abakaliki. The other runs from Onitsha through Ihiala to Owerri and Aba. Today, Onitsha has an internal traffic flow of 88,668 vehicles per day (Ikegbunam, 2008). Similarly, in the Federal Government Industrial Survey of 1967, Onitsha had 75 industries 2 of which employed over 200 persons each (Okoye, 1975, p.89).

Data available from the Onitsha Chamber of Commerce, Mines, Industry and Agriculture (ONCCMIA), show that there are over 300 registered medium scale enterprises, cottage and micro industrial and commercial concerns (ONCCMIA, 2008). Onitsha has planned markets in addition to clusters of business thoroughfares. Every nook and corner of the city seethes with one business activity or the other.

Road development grew from 4 arterials in 1925, to 7 arterials in 1966 (Okoye, 1996). By 2008, Onitsha has 239 accesses, 14 arterials, 34 collectors and 2 main freeways (Ikegbunam, 2008). Arising from the above is that rising urban transport needs and increased motorization in the city has spawn a number of environmental problems such as ubiquitous incidence of traffic congestion and associated delay on most of the arterials and the freeways. Others are dust, dirt, visual intrusion, accidents, flooding of adjacent areas and erosion of the sidewalks and road shoulders. The problem is exacerbated by intensification of land use close to the vicinity of the road space such that it is difficult to differentiate living space and commercial space from moving/parking space for vehicles. This is common on Awka Road, Old and New Market Roads, Oguta and Sokoto Roads, Venn Roads North and South as well as Iweka and Port Harcourt Roads. These roads have become notorious for traffic congestion and associated delays, noise, dust, dirt and blocked drains. The problem is worsened by the fact that the same road space provided for in 1966 and used by a fewer number of persons and vehicles, is today still being used by close to one million people and near corresponding number of vehicles. It should be noted that unplanned and uncoordinated patterns of development characterized by massive urban sprawl in all directions have met these roads unprepared. Encroachments on them by various land uses have further aggravated their accessibility challenges.

A number of works had been done on urban road transport in Onitsha (Monanu, 1975; Monanu and Ofomata, 1975; Muoghalu, 1988; Okoye, 1996, Ikegbunam, 2008). Except for Ikegbunam, (2008); none of these works had taken a critical study of the Onitsha urban road vehicular transport system with a view to suggesting pro - active measures to deal with the associated problems, hence this present effort.

This paper is divided into five sections. The next section looks at the theoretical basis of the study. The study area follows next to that. Methodology of investigation follows. Data presentation and discussion of findings follows next. Policy implications and recommendations wrap up the work.

Theoretical Framework

The theoretical basis of this study is the systems theory developed in the biological sciences by Louis Von Bertallanffy (1950). A system is a set of objects with attributes and the relationship between the objects and the attributes (Harvey, 1969). Immergert and Pilecki (1973) looks at the system as an entity composed of parts, the relationship between the parts and the entity. Therefore, all things as objects, ideas, information, etc have connections with many other things whose interconnection should form the pivot of any meaningful study. On this premise, McLaughlin (1969), noted that most planning tasks are hinged on the type of activities connected by flows of people, goods, materials, energy, etc.

In this study, the system is termed the Onitsha Traffic System. Traffic system or potential interaction center can be a city, parts of a city or a section of the city. Transportation system involves the flows of people, idea, materials, goods and services from one location to another resulting in spatial distribution of resources. Systems have properties peculiar to them such as system openness, variables, subsystems and supra systems. Transport system as an open system maintains dynamic relationship between the functionally differentiated parts, such that any distortion and/or dysfunction in any of the sub systems will trigger off reactions through the entire system.

The Onitsha Traffic System has two main subsystems and their attributes. These are the physical subsystem, whose attributes are the stock of facilities, the rolling stock and the terminal facilities; and their associated variables. The second is the socio-economic subsystem such as the various differentiated functions, which instigate variable flows within the city, and the trip making population of the city, which influence transport service demand, modal choice, mobility index etc; which varies from one part of the city to another. Figure 1 is the schema illustrating the Onitsha Traffic System.

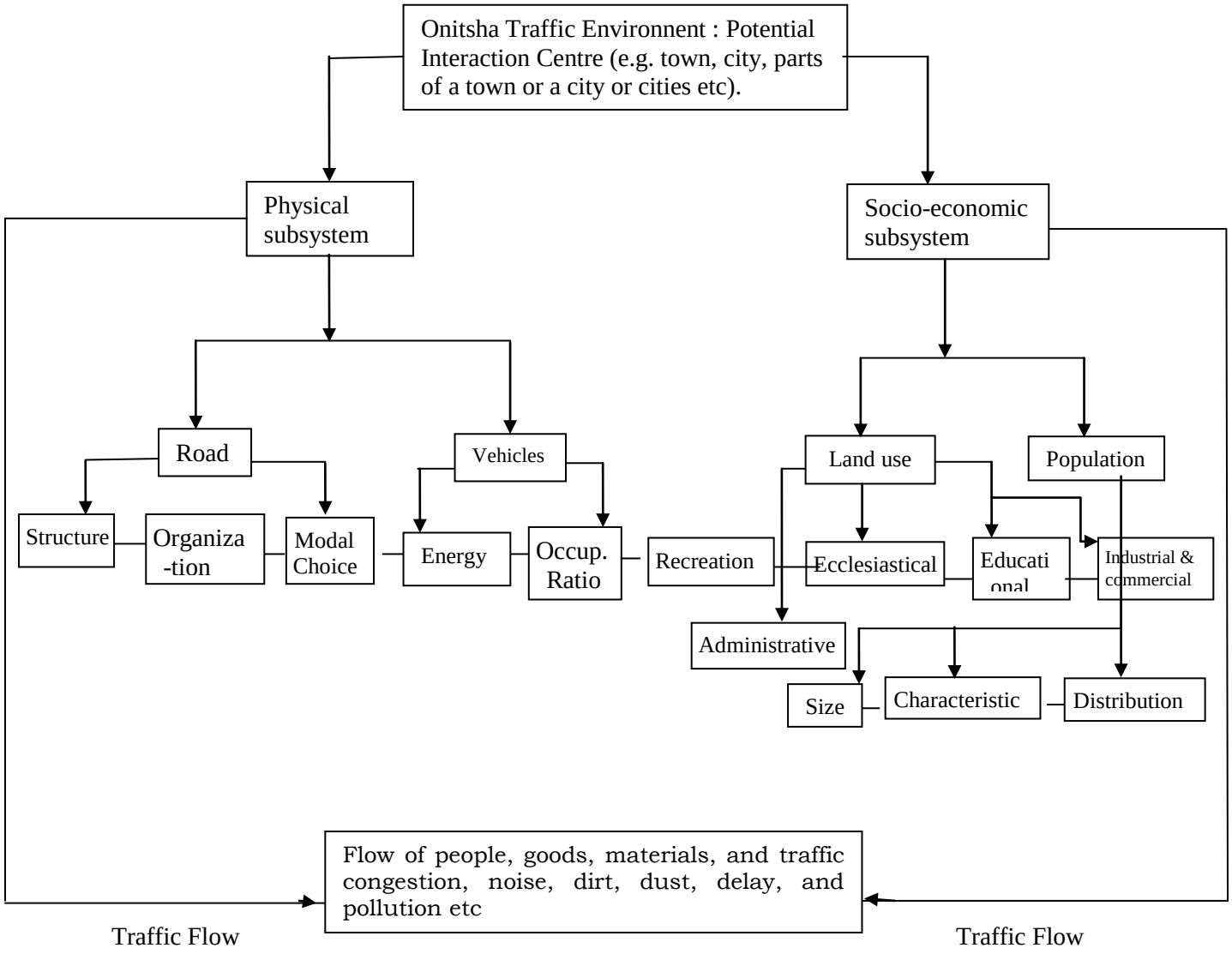

Fig.1: Onitsha Traffic System

The basic assumptions of the Onitsha Traffic System are that:

Transportation demand is relative as it varies spatially and temporary, and among socio-economic classes in the city;

The component of the various dimensions of transportation interaction system are interconnected and can be considered together to determine the magnitude of their externalities;

Accessibility within the city can be improved by manipulating those aspects of transportation subsystem that confer low relative user satisfaction.

The interaction of the subsystems (i.e. physical and socio-economic) generate flows of all sorts whose impacts on the environment are seen as traffic congestion, accident, dirt, dust, delay, noise, pollution, surface of shear failure, etc.

Systems theory as applied in this study explains traffic situation in Onitsha in a holistic and comprehensive manner and offers useful basis for explaining trip origin-destination in Onitsha. It brings into focus the idea of unity in diversity and connectivity between all things, such that a dysfunction, for example, of flow in a traffic stream, will result in congestion, accident, delay, bad temper, increase in ambient pollution, among others.

This work adopted the variables of the rolling and stock of facilities (i.e. vehicles and route ways), and the terminal facilities; and one variable in the socio-economic subsystem (i.e. the trip makers).

The Study Area

The study area is the Onitsha legal city. The legal city of Onitsha is made up of Onitsha North and South Local Govt. Areas. Onitsha lies within the coordinates of latitudes $6^{o}78'$N and $6^{o}86'$N and longitudes $6^{o}47'$E and $6^{o}49'$E. Onitsha has an area of 50 square kilometers with its neighbouring satellite towns (Anambra State Government, 2008). Onitsha lies on the dip slope section of the east facing scarp slopes of the Awka-Orlu cuesta landscape. It is underlain by flood plain deposits, and coarse to fine grained Nanka sands of the Bende-Ameki formation of the Eocene era (Orajaka, 1975,p.7) The sand stone member of this formation outcrops in some sections and have been exploited for civil engineering works (Udo, 1978). Onitsha stands at 50 meters above sea level (Ofomata, 1975,p.9). The Onitsha legal city is bounded by four Local Government Areas namely; Idemili North to the east and Oyi Local Government to the North East, Anambra West to the North, and Ogbaru in the South and South West. The Western neighbour of Onitsha is the River Niger, which separates Anambra and Delta states.

Onitsha grew out of spate of migrations of people from heterogeneous cultural backgrounds, which predated 1500A.D (Okoye, 1996). Early development of extensive ferry services and overland transport infrastructure hooked Onitsha to the main axis of two international trade routes. One is the Trans-Saharan International trade route with the upper Niger-Benue Valley, from which spices, dried fish, and agricultural produce flowed. The other is the Trans-Atlantic trade route with the forest south beyond Aboh, Nembe and Kalabari (Okoye, 1996). And by 1857, following trade expeditions led by Beikie and McGregor Laid, a number of European companies participated in the flourishing Inland Niger trade with trading posts at Idah and Onitsha. Four of these later amalgamated to form the United African Company, (UAC); (Okoye, 1996). The Onitsha Main market is adjudged the biggest in the West African sub region.

Study Methodology

Direct field observation and measurement was used in data collection.

Sampling Design and Procedure

The city was segregated into four traffic zones following enumeration area demarcation by the Independent National Electoral Commission (INEC), which corresponds with residential area delimitation by Okoye, (1996). The traffic zones are Inland Town, Odoakpu/American Quarters, Otu/ Onitsha Central, and Fegge. Four classes of roads were identified in the study area. These are accesses, local collector roads, arterials and the freeways. All the arterials in all the traffic zones were aggregated. Using stratified random sampling technique two arterials were selected from each of the traffic zones, plus two freeways. Ten roads were all together selected for study. The roads are Awka Road, Old and New Market Roads, Iweka, Oguta, Owerri, Port Harcourt, and Bridge Roads and Zik's Avenue. The choice of the arterials and the freeways is informed by the weight of traffic they carry. Most of the urban road induced transport problems in the city occur on them (seen during field reconnaissance).

In addition, they traverse the major land use areas of the city. The universe of study is the vehicular traffic on selected arterials and the freeways, and terminal facilities.

Data Collection and Instrumentation

Eleven hours of traffic counts were undertaken by manual devices from 7a.m to 6p.m and from Monday via Saturday on each of the 10 roads; to obtain the weight of traffic, trip origin-destination, traffic pattern/direction, peak hour and off peak hour traffic, as well as points of heavy traffic at different times of the day. Route interviews were conducted on trip makers and automobile owners on a check lists of questions such as trip origin - destination, modal choice, parking habits, length of time spent on the traffic stream between origin and termini, length of time usually spent in a congested traffic; likely causes of traffic hiccups, etc.

Recording instruments, stopwatches, notebooks and pens were used for data collection.

Data Presentation and Discussion of Findings

The results of the eleven hours of traffic counts on selected arterials are presented on Table1.

Table1: Traffic Flow on the Ten Arterial Roads

Arterial Roads	Working Day Flow	Mean Hourly Flow	Peak Hourly Flow	Peak Hour (a.m)	Peak Hour (p.m)
Awka Road	14,571	1,325	3,418	10a.m-11a.m	4pm-5pm
Bridge Road (Bridge End)	20, 863	1,897	4,842	8a.m-9a.m	5pm-6pm
Bridge Road (Boromeo unction)	14,565	1,323	3,143	8am-9am	3pm-4pm
New Market Rd.	5,148	468	1,418	9am-10am	4pm-5pm
Old Market Road	4,326	393	1,274	9am-10am	5pm-6pm
Oguta Road	4,977	452	1,392	8am-9am	4pm-5pm
Iweka Road	8,888	808	2,215	8am-9am	4pm-5pm
Port-Harcourt Rd.	4,857	442	988	9am-10am	4pm-5pm
Owerri Road	10,109	919	2,447	10am-11am	5pm-6pm
Zik's Avenue	1,452	132	318	8am-9am	5pm-6pm

Source: Authors Field Work, 2008

Table.1 show the generalised traffic counts on 10 arterial roads under study. The table shows relative importance of each road in the over all daily transport demand in Onitsha, from 7a.m to 6p.m.

There is spatial and temporal variability not only in workingday flow, mean hour flow, morning and evening peak hour and off peak hour flow, but also on the time of the day when peak traffic occlure, in the 10 arterial under Survey.

Avalable from the table are that 41% of the total traffic in Onitsha are accounted for by the Bridge Roads. Awka Road accounts for 17%, Owerri Road is responsable for 12%, white Iweka Road and New Maret Road accons for 10% and 6% respective. Oguta Road, Old Market Road and Port-Harcourt Road carry 5% of the total traffic each. Field investigation show that the Bridge Road carry the greatest traffic at 20,863 véhicules per day, followed by Awka and Owerri Roads with 14,571 and 10,109 véhicules respectively. Others are: Iweka, New Maret, Oguta, Port Harcourt and Olid Maret Roads, in that order with their figures as presented on table 1.

The Owerri Road and the Bridge Road usher in traffic into and out of Onitsha. About 5% of the total traffic from the Niger Bridge is through traffic. The rest are intra-city and inter-city traffic.

Interms of internal traffic flow within the city, Awka Road is the most heavily trafficked at 14, 571 véhicules per day on avérage, followed by Iweka Road with 8,888 véhicules. The New Market and Oguta Roads has 5,148 and 4,976 véhicules per day respectively. Port-Harcourt Road and Old Market Road have 4,404 and 4,326 véhicules respectively. Onitsha has total internal traffic flow of 88,668 véhicules per day. The Bridge Road and Owerri Road are 4-lane dual carriageways, while the rest are single carriageways.

Pattern of Road Transportation

The pattern of road transportation in Onitsha can be gleaned from the fleet composition of Onitsha vehicular traffic. It also explains modal choices among trip makers in all the traffic zones. Field observation shows that 36.18% or 32, 084 of the total daily vehicular traffic in Onitsha are private cars, while 39.60% or 35,115 are mini buses. About 1.54% or 1,371 vehicles are taxicabs, while; 8.75% or 7,756 are mass carriers or kombi buses. A total of 1,172 or 1.32% are high occupancy vehicles (HOV) otherwise called luxury buses; 7.37% or 6,503 are tippers/lorries/trucks and trailers. Tanker and pick-ups/vans make up 0.46% or 407, and 4.80% or 4,258 respectively. However, more than 60% of these vehicles were registered outside Onitsha in such places as Abagana, Asaba, Abuja, Awka, Ogidi, Lagos, Nnewi; Nteje; Enugu; Benin etc (seen from their plate numbers during traffic counts and compared with data got from Motor Licensing Authorities at Onitsha). Fleet composition of Onitsha vehicular traffic is indicative of trip maker's modal choices. The average occupancy ratios of the vehicles show that the private car has occupancy ratio of 2.5 passengers. For the taxicabs, it is 6 persons per unit, while mini buses carry 15passengers. Mass carriers or kombi buses has capacity for between 27 and 32 passengers. Non- passenger vehicles like lorries, tippers, trucks, trailers, and pick-up vans carry an average of 2 persons – a conductor and a loader (sometimes goods owner or ad hoc labourers that will discharge the items being transported).

Parking Habits of Automobile Owners

Route interviews and observation made during traffic counts show the parking habits of automobile owners and operators in the four traffic zones of the city. Results of the route interview show that 9.84% of all the respondents have access to terminal facilities, while 46.31% park by the roadside. About 2.95% park along the streets, while for 20.9%, anywhere could be a park. A total of 244 respondents were interviewed at an average of 48.5 respondents per traffic zone, who were randomly selected. There are no public parks in the whole of Onitsha! What exist are private parks owned by private commercial transport companies; and local council approved roadside bus stops!

Patterns of Traffic Generation and Convergence

Patterns of traffic generation and convergence show that three major land use types instigate and dominate trip generation and convergences in Onitsha. These are the commercial/industrial, educational and administrative land uses. Buchanan (1998) had related the volume and density of traffic demand to socio-economic and other factors, which generate traffic to an area. Most intra-city and inter-city movements are induced by commerce, which generates the greatest traffic by attraction due to highest intensity of use as noted by Fortham (1977).

Onokala (1981) had stated that the pattern of work, shop and school trips contribute to problems of urban road transportation. The various educational and administrative land uses located along Awka and Oguta Roads are responsible for traffic hiccups on them during the morning and afternoon rush hours. These were identified in the Inland Town traffic zone through Odoakpu/American Quarters to G.R.A., and was seen on such roads as Awka, Old and New Market Roads, Bridge Road, Iweka and Oguta Roads, and Zik's Avenue.

Travel Time

Analysis of length of time spent on the traffic stream show variability in travel time among trip makers between trip origin and termini in the traffic zones. The reason for the variability obviously is traffic congestion, which arose from a number of factors. These include: bad road network and presence of disabled vehicles on the right of way, wrong parking, reckless driving and picking of passengers on the right of way; increase in car ownership and/or too many cars on the transport stream respectively. Others are presence of law enforcement agents (police, task force men, and revenue agents) on the roads; intensification of land uses near the road space; large pedestrian traffic in conflict with vehicle traffic.

The question then is whether a direct relationship exists between traffic congestion and hourly flow of traffic. This hypothesis was validated using Pearson's Product Moment Correlation. The results obtained were tested for significance by students''t' test of statistics. There are positive correlations between traffic congestion and hourly flow of traffic for Awka Road, Bridge Road (Bridge end), Oguta Road, Old Market Road, Iweka Road, Zik's Avenue and Port Harcourt Road; and negative correlations for the New Market Road, Owerri Road and Boromeo end of the Bridge Road. Therefore, the hourly flow of traffic does not contribute significantly to traffic congestion instead, other factors and circumstances do.

The results of co-efficient of determination show variability in the magnitude of traffic congestion explained by hourly flow of traffic. For example, in Awka Road, 44.65% of traffic congestion is attributed to hourly flow of traffic while, 55.35% is explained by some other factors. But for Port-Harcourt and Oguta Roads, the hourly flow of traffic is a causative factor of traffic congestion.

Conclusions and Policy Implications

Attempts had been made to analyze the Onitsha urban road transport system from the point of view of geography and environmental management. The discoveries made were quite revealing. Variability exists in travel mode, trip pattern, modal composition and peak and off peak hour traffic, among others.

A number of approaches/options used for containing the environmental impacts of urban road transportation include road engineering, economic and planning instruments, and sound environmental management options.
As existing roads get busier, as is the case with Onitsha traffic environment, provision of various control mechanisms such as different light pigmentation should be installed at various intersections such as Boromeo junction, Savoy junction, D.M.G.S roundabout, Ogbommanu, and Modebe junctions.

Except at Tasia Road intersection with Awka Road which has traffic control light, many of these are no longer seen in Onitsha except at Boromeo Junction, where the traffic police stay and perform the ritual of "₦20.00" collection from motorists and cyclists. Route segregation by function, space and time, and construction of by-passes and ring roads helps segregate external and internal traffic into the city. Motorways can be constructed through the suburbs. There is need for pedestrian precincts and traffic free areas to be created in the inner city, especially in Ose, Main Market, Iweka and Venn Roads and the Bridge Road (from flyover down to Uga junction). Awka Road and Oguta Road have many educational land uses on them. There is need to assign alternative routes for school runs as most of the difficulties on Awka Road occur during the morning and afternoon school runs. From DMGS down to the Main Market should be segregated as a restricted area for cars, trucks, lorries, trailers and bikes in the daytime. Alternative routes can also be segregated for inter-city buses especially mini buses that ply the Bridge Road especially, from the Lagos Park (fly over) to the Niger Street junction. Road pricing involving taxing motorists contributing to traffic congestion in a transport stream during rush hours is another approach. This is also called congestion tax. Road pricing is the most equitable method of sharing the road space. Some of the weaknesses of road pricing include subjectivity in fixing the prices. For the city of Onitsha, it is suggested that road pricing involving varied license fees be applied across time and zones depending on the severity of congestion in such areas.

Parking charges may be imposed. These include on-street parking, public off-street parking, private off-street parking and residential parking. Using parking as a restrictive mechanism could deter people from putting many cars in the transport stream. This is more applied with on-street parking. The private sector could be encouraged to provide off-street parking as is already going on around Odoakpu/ American Quarters and Otu/Onitsha Central Traffic zones. This will help rid the streets of vehicles whose drivers are not leaving the environment within a couple of hours. Private cars and slow moving vehicles should be banned from busy roads in the daytime. This approach has been used with measured success in the city of Rome (Roth, 1999). Also roadside trading and sidewalk parking should be banned. A corollary to parking charges, is the introduction of Park and Ride facilities for Old and New Market Roads, Awka and Iweka Roads, for intra city transport; and Bridge Road and Owerri Road, for inter city transports. Park and Ride have been used with success in the cities of Bogota, Belo Horizonte and Baton Rouge (Nwokolo, 2000).

Another approach is staggering of working hours. There is also advocacy for redistribution of land use within the city. In this way, heavy pedestrian traffic in conflict with vehicle flows on the roads in the study area could be curbed.

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