Full Length Research Paper

Urban spatial structure and work trip patterns in South-western Nigeria: The example of Ilesa

Adetunji, M. A.[1] and Aloba, O.[2]

[1]Department of Geography and Resource Management, Osun State University, Osogbo, Osun State, Nigeria.
[2]Department of Geography, Obafemi Awolowo University, Ile-Ife, Osun State, Nigeria

Many studies on urban work trips in Nigeria have focused on major urban centres like Lagos, Kano and Ibadan which are the main commercial and industrial centres. Studies of urban spatial structure and work trips patterns in medium sized cities and towns like Akure, Ilesa, Ondo and Osogbo in South-Western Nigeria have received little or no attention. The fewness of these studies has made it difficult to have access to adequate and appropriate information and data base for any effective and meaningful planning for urban mobility patterns in this category of cities in Nigeria. This study examines the structure of urban work trips in a traditional but economically, socially and politically dynamic Yoruba town of Ilesa which is the most important town in Ijesa Region in Osun State. A systematic random sampling procedure was employed to administer 1,365 questionnaires (2.5% of the total heads of households in the city) heads of selected households spread across eleven traffic analysis zones. Using descriptive and cartographic techniques with Arc view 3.2, geographical information system (GIS) software, the spatial structure of work trips pattern, origins and destinations of urban residents in Ilesa were clearly discerned. The study concludes that a greater spread of socio-economic facilities would not only enhance accessibility but also reduce the pressure on main transport arteries in the metropolis. It is suggested that a renewal of physical planning of Ilesa and cities of similar sizes in Nigeria would facilitate increase in the mobility of the city dwellers

Key words: Urban spatial structure, work trip pattern, geographical information system (GIS), medium-sized cities, traffic analysis zones, physical planning.

INTRODUCTION

Urban work-trips in many parts of the world have received a considerable theoretical and empirical treatment in the literature (Aloba, 1989; Sangkug, 2006: Stead and Marshall, 2001; Okoko, 2008). Studies have revealed that the shape, form and structure of many cities and towns have a direct relationship with the spatial distribution of their work-trips and other trip types. However, detailed research works on urban work-trips in medium sized cities in Nigeria have received little or no attention by scholars. Such neglect is unhealthy for an effective urban planning and city management in the 21st century because work-trips are not only undertaken routinely by urban work force but also now constitute the most visible part of urban traffic and movements within the city space of emerging urban centres in Nigeria. Other identified forms of urban trips like those of social and recreational trips which largely occur on weekends or during national festivals, do not have the same rhythm, flow, dynamism and impact like those of work-trips (Papacoastal, 1987).

The general view is that the pattern of urban work-trips is strongly influenced by residential as well as the spatial locations of work places (Okoko, 2008; Naess, 2004). For instance, urban zones with a considerable number of employment opportunities would in all probability attract to themselves large percentages of urban work-trips originating from other zones with little or no employment

*Corresponding author. E-mail: maadetunji@yahoo.com. Tel: +234- 08066245425.

facilities. Thus, purely residential areas in cities are potentially zones of origin while the industrial, commercial, administrative, and recreational zones are areas of destinations for most urban commuters (Aloba, 1989; Okoko, 2008; Naess, 2004; Tanimowo, 2006). Therefore, the aim of this paper is to examine in detail the movement patterns of urban workers living in a medium sized city of Ilesa in order to enhance our future understanding of city structure, form and direction of such movements as the town expands and developed socially, economically and politically. The work of this nature will not only show the present urban spatial characteristics of this class of towns but also enable planners, policy formulators, local politicians and other stakeholders to fashion out appropriate and sustainable solutions to urban transportation problems and the possible direction of future development in Nigeria's rapidly changing medium towns and cities. Conceptual framework and literature review of this paper discussed some relevant theories of urban spatial structure and literatures because of the light they shed on the subject matter.

CONCEPTUAL FRAMEWORK AND LITERATURE REVIEW

Theoretically, areal differentiation is a fundamental principle in spatial interaction and the urban sub-space is not an exception to this rule which has long been recognized in geographic research (Hartshorne, 1939). The complex structure of cities and the interdependent relationships among their various systems are depicted by the daily massive movements of people, goods and services from and to identifiable central places within the urban landscape. While the higher urban central places like universities and some other tertiary institutions, specialist medical centers and big industrial establishments may have the whole city as their catchment area, lower other centres such as primary schools, small clinics and shops would depend on a much smaller surrounding threshold populations. Thus, the length, form and the entire structure of urban trips would differ areally from one part of the city to the other. Parts of the city with either high concentrations of socio-economic facilities or heterogeneous land-use patterns such as residential, commercial, recreational, and administrative amenities would generally attract more trips to themselves than zones that are homogeneous in nature (Adetunji, 2010; Aloba, 1989; Okoko, 2008).

Transport through well defined routes or networks-roads, railroads and water ways in cities with water fronts, provides the link between the urban populations and areas of activities in the metropolis (Olatubara, 1995). However, the emerging spatial patterns of inter-action in an urban space is a function of complex factors such as commuters' personal characteristics like sex, income, professional status, family size, access to car ownership as well as societal cultural values and norms (Adetunji, 2010; Naess, 2004)

For many urban centres in the more developed economies with long history of urban planning, residential areas serve as origins, while the different locations of various socio-economic service centres serve as destinations for a high percentage of urban trips including work trips (Fadare, 1989, 1997). Studies have thus shown that the range and trip generation vary from one type of service centre to another (Aloba, 1998). Not until only recently, the patterns of urban trip generation have been very difficult to discern in many traditional cities in Africa in general and in Nigeria in particular partly as a result of undifferentiated urban land-use, though many of them had large populations, they remained basically agro-based urban centres (Ayeni, 1975; Ojo, 1970). However, the New Urbanism model seems to lend some credibility to the undifferentiated land-use patterns in African cities where many activities are clustered together within walking distance, interconnected by a system of street networks specifically designed to encourage walking and reduce the number and length of automobile trips (Congress for the New Urbanism, 2000a, b). The basic philosophy of the Smart Growth model is that when facilities and services are located close to homes or residential areas, they will be chosen as destinations for activity participation and consequently reduce long distance travel which calls for high dependency on automobile trips (Newman and Kenworthy, 1989). The Smart Growth model even though offers some useful explanations on the relationship between land-use and urban transportation, it has been criticized on the ground that it does not take into consideration some variables like consumer preferences, traffic congestion, environ-mental problems, housing affordability, socially desirable level of population density and cost of public services. However, unreliable information and appropriate data base on urban land-use and transportation patterns constitutes the greatest obstacle to theoretical and empirical studies of mobility pattern of urban residents to work in Third World Countries and Nigeria in particular (Fadare and Hay, 1990). This paper therefore focuses on the patterns, structure and the direction of movement of urban residents to work in a medium sized city in Nigeria which is fast experiencing traffic congestion along major routes where banks and small poly-shops are located.

THE STUDY AREA

Ilesa, which is one of the most rapidly growing urban centres in South-western Nigeria, is the study area (Peel, 1983). The town is located on latitude 7° 48′ N and longitude 5°E Ilesa metropolitan area comprises Ilesa West and East Local Government Areas. Both council areas are bounded in the North, West and South by Obokun, Atakunmosa and Oriade Local Government areas, respectively. The town covers a total area of about 73.6 km^2 and is located about 32 km North – East of the

Table 1. Percentage distribution of workers across different traffic analysis zones in Ilesa.

Home / origin	Work location											Total
	Owa's Palace	Ilaje	Imo	Okesa	Irojo	Bolorunduro	Ayeso	General hospital	George Burton	Oke-oye	Isokun	
Owa's palace	60.0	0	0	6.2	0	00	22.2	6.7	00	**00**	**4.4**	**100**
Ilaje	32.0	40.0	2.0	4.0	-	-	-	10.0	-	2.0	10.0	100.0
Imo	9.6	19.2	25.5	5.8	11.5	11.5	9.6	1.9	3.8	00	00	100
Okesa	18.2	3.6	1.6	58.2	-	1.8	10.9	00	00	00	3.6	100
Irojo	14.0	00	4.0	16.0	22.0	27.0	9.0	4.0	00	4.0	00	100
Bolorunduro	8.5	00	8.5	4.2	8.5	51.1	22.3	00	00	00	00	100
Ayeso	28.4	00	1.2	3.9	10.8	15.7	35.3	00	00	00	3.9	100
General hospital	25.0	7.5	2.5	00	2.5	00	1.0	50.0	00	00	2.5	100
George Burton	17.4	4.3	32.6	4.3	00	4.3	10.9	10.9	8.9	2.2	4.3	100
Oke-Ooye	8.3	2.1	6.3	2.1	18.8	00	6.3	-	4.2	43.8	8.3	100
Isokun	15.1	1.9	26.4	3.8	3.8	3.8	3.8	7.5	-	-	34.0	100
Zonal average total	21.2	7.3	10.3	10.7	7.2	10.6	12.6	7.5	1.5	4.7	6.4	100

Source: Author's Field Survey, 2009.

ancient and university town of Ile-Ife with which it shares the same senatorial seat in the upper national legislative chamber. Osogbo, the capital of Osun state is about 30 km from Ilesa.

The population of Ilesa has grown from 72,029 in 1952 when the first national population census was conducted in Nigeria outside Lagos to 165,822 in 1963, 138,953 in 1991 (NPC, 2000), and 210,141 in 2006 (NPC, 2006). Since the first secondary school was established in early 1930s, the town has witnessed many transformations, socially, economically and politically by the establishments of many secondary and tertiary degree awarding institutions, medical centres of various categories including a university teaching hospital and a school of health technology. Ilesa now has a growing economic base with the presence of a nail manufacturing industry and a brewery whose regional impact has been well documented in the literature (Ajala and Olajuyin, 1996). The presence of these establishments has given a boost to the development of hotel industries some of which rank among the best in Nigeria. For instance, the Royal Park Hotel at Iloko is a five star hotel and it is located a few kilometers from the city centre. All these socio-economic activities coupled with the rising and changing political status of Ilesa generate considerable spatial inter-actions in the study area.

Three types of road networks are identifiable in Ilesa. The first category may be referred to as inter urban roads which connect Ilesa with other neighboring urban centres in South-western Nigeria. Such centres include Akure, Ile-Ife, Osogbo and Ijebu–Jesa. With the exception of the Ilesa-Akure-Ibadan road which is a dual carriage road, the other inter urban roads are single lane roads. They are all generally good surfaced tarred roads and carry substantial volume of traffic either through or into Ilesa.

The intra-urban roads are the main township roads, which radiate from the (Owa's) palace in the centre of the town where most commercial activi-ties are located. These roads include Bolorunduro, Muroko, and Egbe-Idi roads. These roads empty their traffic into the inter-urban roads at various points in the town. Some of these roads including many local roads are not tarred. During the rainy season, a large percentage of them are flooded and un-motorable. Many motorists and motorcyclists avoid these local roads particularly during the peak of rainy season (Adeyemi, 1974). The third type of roads is the local or urban minor roads which are generally narrower than the major urban roads. Many of them are not tarred but good surfaced since they are mostly pedestrian routes.

The two major types of transport modes plying these various identified roads in Ilesa are cars/taxis and motor bikes. The cars/taxis ply the

major tarred roads while the motor bikes are seen on both major and local roads. The other modes of transport which at the moment ply the route linking the centre of the town with the college of education are the commercial buses. Although the use of vehicular transport in Ilesa has increased over time, the commonest mode of urban transport is by foot especially when trips are short and do not involve carrying heavy loads.

RESEARCH METHODOLOGY

Data for this study were obtained from both primary and secondary sources. The primary data were collected through the administration of questionnaires and field observations. The questionnaires were used to gather information on the socio-economic characteristics of urban commuters and their patterns of movement to work, mode of transport, distance to work as well as frequency of journey.

A Multi-stage sampling procedure was adopted in the application of the questionnaires. Firstly, the study area was divided into 11 Traffic Analysis Zones (TAZ) based on the 1,464 census enumerated tracks identified by the national population census of 2006. The eleven identified TAZs are those of Owa's palace, Ilaje, Imo, Okesa, Irojo, Bolorunduro, Ayeso, General Hospital, George Burton, Oke Ooye and Isokun zones Table 1. In each zone, 2.5% of households were randomly selected for interview which has been found to be adequate for towns of similar size (Okoko, 2008; Tanimowo, 2006). A systematic random sampling procedure was employed to administer the 1,365 questionnaires to the heads of selected households in all the zones.

Secondary data were obtained from the road network map of the study area, scanned, geo-referenced and digitized. Data on historical and socio-economic development of the city were obtained from published documents on Osun State, Ilesa East and Ilesa West Local Government Areas. The empirical data on work trips collected from the eleven zones in Ilesa are presented in form of 11 by 11 matrixes in which the rows and columns represent the origin and destinations of urban work trips respectively. Each cell represents the relative percentage of sampled workers in the eleven urban zones who either work in their zones of residence or move out to other zones to work. Similarly, descriptive statistics such as tables of percentages and cartographic techniques as well as Arc View 3.2- GIS software, were employed to depict the patterns of movement of urban residents to work in the city and principal component analysis was employed to examine the dominant factor affecting work trip patterns in the study area

INTERPRETATION OF THE RESULTS

The findings reveal that Owa's palace zone received the highest volume of work trip in the city. This constituted about 21.2% of the total work trips in the study area. This zone is the most central zone in Ilesa. Owa's palace zone is a mixture of commercial, residential and administrative land uses. Similarly, Ayeso, Okesa, Bolorunduro and Imo zones received high proportions of workers from other zones. This constituted 12.6, 10.7, 10.6 and 10.3%, respectively. These four zones are thus the most significant destinations of trips to work in the study area. Industries, such as Yinka Oba Foam, Supreme Oil, International Breweries and the Wesley Guild Hospital

(which is part of the Obafemi Awolowo University Teaching Hospital Complex, Ile-Ife) are located in these zones. The zones of Ilaje, Irojo, George Burton, General, Oke-Ooye and Isokun are relatively unimportant as far as work trips are concerned because each of them receives small number of workers from other zones. For instance, George Burton is located in a peripheral zone and sends 91.3% of its entire work force to other nine zones in Ilesa. Only 8.7% of the sampled population in this zone stays back to work there. Similar pattern was observed for Irojo zone where 22% of their sampled populations work within the zone despite the fact that the zone maintains linkages with other seven zones. There is need for caution in interpreting these data because there is a distinction between urban zones with job oriented establishments, and those with services which attracts very few persons from other zones.

A further careful examination of the data on inter-zonal urban work-trips reveals that more than 50% of the workers who live in Owa's Palace, Okesa, Bolorunduro and General Hospital zones work in their zones. This implies that the location of several socio-economic services like the Secondary Schools and Community Health Centres in the zones generate substantial work trips among the residents of these zones. This observation confirms Ogundana's (1970) earlier observation that most urban trips including work-trips are short in Nigeria.

In addition to the aforementioned observed pattern, Owa's palace zone also attracts more than 21% of the entire work force in Ilesa to itself. This is closely followed by Okesa (10.7%), Bolorunduro (10.6%) and Ayeso (12.6%) zones. The other zones are mostly origins of urban workers in Ilesa. The aforesaid observations are presented in Table 1

Distance traveled to work

The commuting distance to work in Ilesa constitutes the highest fraction of household trips in terms of distance traveled (Table 2). The study reveals that the distances with the highest frequency is between 1 to 2 km and the majority of the workers who belong to this category live in Ilaje, Okesa, General Hospital and Oke-Ooye zones. And in terms of population density, these are highest in Ilesa metropolis. Further analysis shows that more than 50% of sampled workers commute less than 2 km to work. However, quiet a significant proportion (16.3%) of urban workers commutes more than 4 km to work in the city. Majority of those who make such distance are from Imo, Bolorunduro, General Hospital and George Burton zones which are located at the peripheries of the study area. The mean commuting distance is 2.3 km for all categories of workers across different traffic analysis zones in Ilesa (Adeyemi, 2000). This varies from 1.7 km in Okesa zone – a high density area, to 2.7 km in Imo zone located at the outskirt of the city. The average

Table 2. Percentage distribution of distances traveled by workers to work across different traffic analysis zones in Ilesa.

District/ TAZ	Distance (km)					Total	Average
	Below 1	1-2	2-3	3-4	Above 4		
Owa palace	10.9	25.5	27.7	18.2	18.12	100	2.6
Ilaje	12.5	21.4	19.6	25.0	21.4	100	2.5
Imo	12.5	21.4	19.6	25.0	21.4	100	2.7
Okesa	31.0	44.8	3.4	13.8	6.9	100	1.7
Irojo	18.8	25.9	8.9	28.6	17.9	100	2.5
Bolorunduro	24.1	25.9	16.7	13.0	20.4	100	2.3
Ayeso	39.7	15.5	1.7	36.2	6.9	100	2.1
General hospital	13.7	43.1	7.8	7.8	27.5	100	2.4
George Burton	26.0	24.0	12.0	16.0	22.0	100	2.3
Oke-Ooye	26.4	39.1	7.3	12.7	14.5	100	2.0
Isokun	17.5	36.6	7.0	26.3	10.5	100	1.8
Average all Zone	21.0	31.4	10.9	20.4	16.3	100	24.9

Source: Author's Field Survey, 2009.

distances travel by workers in Okesa, Ayeso, Oke-Ooye and Isokun zones – all found within the high density zones, less than 2.3 km. All these are in Table 2.

There are also significant differences in commuting patterns by income earned across different traffic analysis zones in the study area. The differences in commuting patterns between the high and low income earners is however greater in Imo, Irojo, Bolorunduro and George Burton than those living in Owa's Palace, Ilaje, Oke-Ooye, Ayeso and Okesa zones. While the first categories of zones are located at the city suburbs, the latter are found in the high density areas of the town. A critical examination of Table 3 reveals that more than 40% of the low income earners who live in Owa's palace, Oke-Ooye, Okesa and Isokun zones work in their zones while the remaining 60% commute to neighboring zones to work.

In contrast, on the average, high income workers travel longer distances to work in Ilesa. For instance, more than 50% of the high income workers who live in Irojo, George Burton and Isokun zones move to other zones to work. About 100% of the high income workers who live in Bolorunduro and General Hospital zones commute to work at Irojo and Ayeso zones, respectively. These zones have a considerable large number of industries and socio-economic employment generating organizations (Table 6).

However, 24% of low income workers in all traffic analysis zones move to Owa's Palace zone to work. 11.3% move to each of Okesa and Bolorunduro zones to work. These are not only highly populated areas, but house considerable number of local craft industries and small shops owned by artisans. Less than 6% of the low income earners across different traffic analysis zones move to Irojo, General Hospital and George Burton zones to work because their location disadvantage as already

pointed out earlier on.

MODE CHOICE

In Ilesa, the principal mode of transport to work is by foot especially when movements over short distances are involved. Table 4 indicates that more than 39% of sampled workers commute on foot to work in the study area. 14.3% rely on motorcycles, while 21.7 and 8.6% rely on taxis and buses, respectively. 15.2% of urban commuters travel to work by their personal cars. Only 1% of urban commuters use bicycles to get to work in the metropolis. The latter is contrary to the growing interest in the use of bicycles to work in cities found in the advanced economies. In all traffic analysis zones in Ilesa, variation occurs in the modal choice of urban commuters. For instance, more than 40% of workers trek to work in Okesa, General Hospital and Oke-Ooye zones. The use of public transport such as motorcycles and taxis are more popular in Irojo, Bolorunduro, Ayeso, George Burton and Isokun zones. Personal cars are mostly used by the high income earners who live at the outskirts of the city particularly at Imo (35.7%), Irojo (16.1%), George Burton (18.0%) and General Hospital zones (13.7%).

The income of commuters also plays a significant role on the modal choice to work in Ilesa. For instance, Table 5 indicates that 41.4% of the people from the low income group commute on foot to work, while 13.8, 23 and 9.5% moved mostly by motorcycles, taxis and buses to work, respectively. The majority of the sampled respondents who travel by buses to work were mostly market women who patronize the Sabo Market on Mondays for their business trans-actions. Further analysis reveals that 1% of the respondents who were farmers travel by bicycle to their farms. Only 11.2% of the people from the low

Table 3. Workers distribution by residential location and income in Ilesa.

Home / origin		Owa's palace	Ilaje	Imo	Okesa	Irojo	Bolorunduro	Ayeso	General hospital	George Burton	Okes-Ooye	Isokun	Total
		Destination / work place											
Low income earner less than #20,0000	Owa's palace	**60.0**	-	-	**7.5**	-	-	**20.0**	**7.5**	-	-	**5.0**	**100**
	Ilaje	35.0	35.0	2.5	5.0	-	-	-	10.0	-	2.5	10.0	100
	Imo	10.7	25.0	25.0	10.7	-	14.3	7.1	-	7.1	-	-	100
	Okesa	20.0	4.0	2.0	58.0	-	2.0	10.0	-	-	-	4.0	100
	Irojo	20.0	-	5.8	11.6	23.2	23.3	10.2	5.8	-	-	-	100
	Bolorunduro	8.9	-	6.7	4.4.	6.7	53.3	20.0	-	-	-	-	100
	Ayeso	29.6	-	2.0	4.1	11.2	16.3	36.7	-	-	-	-	100
	General hospital	35.7	7.1	3.6	-	3.6	-	7.1	39.3	-	-	3.6	100
	George Burton	21.6	5.1	29.7	5.4	-	5.4	5.4	7.9	10.8	2.7	5.4	100
	Oke-Ooye	8.8	2.7	6.7	2.2	15.5	-	4.4	-	4.4	46.7	10.0	100
	Isokun	15.4	2.6	15.4	2.6	2.6	5.1	5.1	7.7	-	-	43.6	100
	Total	24.0	6.7	8.3	11.3	5.9	11.3	12.3	5.8	1.8	5.3	7.3	100
Medium income #21,000 to #40,000	Owa's palace	60.0	-	-	-	-	-	40.0	-	-	-	-	100
	Ilaje	20.0	60.0	-	-	-	-	-	10.0	-	-	10.0	100
	Imo	5.0	15.0	35.0	-	25.0	10.0	10.0	-	-	-	-	100
	Okesa	-	-	20.0	60.0	-	-	20.0	-	-	-	-	100
	Irojo	-	-	-	29.6	14.8	33.3	7.4	-	-	14.8	-	100
	Bolorunduro	-	-	-	-	-	-	100.0	-	-	-	-	100
	Ayeso	-	-	-	-	-	-	-	-	-	-	-	100
	General Hospital	-	9.2	-	-	-	-	9.1	81.8	-	-	-	100
	George Burton	-	-	75.0	-	-	-	-	25.0	-	-	-	100
	Oke-Ooye	-	-	-	-	66.7	-	33.3	-	-	-	-	100
	Isokun	18.12	-	54.5	9.1	-	7.8	-	-	-	2.4	9.1	100
	Total	9.6	12.0	20.41	9.6	10.8	-	10.8	14.4	-	-	2.4	100

Table 3. Contd.

	Owa's palace	-	-	-	-	-	-	-	-	-	-	-	100
	Ilaje	-	-	-	-	-	-	-	-	-	-	-	100
	Imo	25.0	-	-	-	25.0	-	25.0	25.0	--	-	-	100
	Okesa	-	-	-	-	-	-	-	-	-	-	-	100
	Irojo	-	-	-	-	50.0	50.0	-	-	-	-	-	100
High income #40,000 and above	Bolorunduro	-	-	-	-	100.0	-	-	-	-	-	-	100
	Ayeso	-	-	-	-	-	-	-	-	-	-	-	100
	General Hospital	--	--	-	-	-	-	100.0	-	-	-	-	100
	George Burton	-	-	20.0	-	-	-	60.0	20.0	-	-	-	100
	Oke-Ooye	-	-	-	-	-	-	-	-	-	-	-	100
	Isokun	-	-	66.7	-	33.3	-	-	-	-	-	-	100
	Total	6.7	-	20.0	-	26.7	6.7	26.7	13.3	-	-	-	100

Source- Author's Field Survey, 2009.

income group travel by car to different activity centres in the study area. The implication of the aforementioned analysis is that low income earners depend mostly on foot as well as public transport for their day to day commuting patterns to different activity centres in Ilesa.

These results are similar to what have been observed in parts of the world. For example, Danielle (2002) has observed in a study of on the Netherlands that the use of motorized modes increases with income while people with income below national minimum make less use of motorized modes even though they make more trips on average

Determinants of households work trips patterns in the city

In order to evaluate the most significant factors influencing the commuting pattern of urban residents to work in the study area, a principal component analysis was used Table 6. The variable considered include: The distribution patterns of land use elements (work places, market, schools etc), socio-economic characteristics of urban workers such as sex of head of household, marital status, age group, education background, occupation, income level) and transport attributes (that is, trip frequency, travel time, transport mode and transport cost).

The result revealed that three factors whose eigenvalues are greater than unity constituted 76.13% of the total variance and is responsible for the factors affecting work trips patterns in the city. Those variables ranked high on factor 1 was distribution patterns of work places (areas of city with more mixed land-uses) and this explained about 53.55% of the total variance. The second factor which explained another 12.56% of the total

variance concerned those variables that are directly related to transport attributes such as distance travel to work (0.607) and transport cost to work (0.413). The third component which described 10.02% of the total variance of the factors affecting work trips in the city are socio-economic characteristics of urban commuters (Table 7 and 8).

CONCLUSION AND PLANNING IMPLICATIONS

The paper has examined the spatial structure and patterns of work trips in Ilesa, the major city of Ijesa Region. High rate of urbanization trends over the past three decades coupled with poor planning of urban environment and political fortunes of the city have led to land-use differentiations which have directly influenced the pattern and structure of urban work trips in the study area

Table 4. Percentage distribution of modal choice to work by urban commuters in the study area.

Traffic analysis zone	Transport mode to work						
	Foot	Bicycle	Motorcycle	Taxi	Bus	Personal car	Total
Owa's palace	25.5	1.8	21.8	27.3	9.1	14.5	100
Ilaje	38.4	-	23.2	15.2	7.1	16.1	100
Imo	26.8	1.8	8.9	17.9	8.9	35.7	100
Okesa	69.0	-	10.3	10.3	1.7	8.6	100
Irojo	34.8	-	5.4	34.8	8.9	16.1	100
Bolorunduro	35.2	1.9	9.3	33.3	7.4	13.0	100
Ayeso	39.7	-	6.9	34.5	10.3	8.6	100
General hospital	45.1	-	13.7	13.7	13.7	13.7	100
George Burton	26.0	2.0	14.0	26.0	14.0	18.0	100
Oke-Ooye	51.8	-	18.2	11.8	7.3	10.9	100
Isokun	37.7	3.5	25.4	14.0	7.0	12.3	100
% Total	39.3	1.0	14.3	21.7	8.6	15.2	100

Source: Author's Field Survey, 2009.

Table 5. Percentage distribution of mode of transport used by different income group in Ilesa.

Income group	Mode of transport						
	Foot	Bicycle	Motorcycle	Taxis	Bus	Personal car	Total
Low income earners less than #20,000=	41.4	1.0	13.8	23.0	9.5	11.2	100
Meddle Income earners #20,000-#40,000	34.5	-	17.3	16.8	5.2	26.2	100
High Income More than #40,000=	11.1%	-	11.1	11.1	-	66.7	100

Source: Author's Field Survey, 2009.

Table 6. Result of principal component analysis on work trip showing communalities.

Parameter	Raw		Rescaled	
	Initial	Extraction	Initial	Extraction
Sex of head of household	.121	.005	1.000	.042
Marital status	.616	.049	1.000	.080
Age group	4.408	4.170	1.000	.946
Educational background	2.012	.368	1.000	.183
Distric code: Place of work	22.095	22.061	1.000	.998
Monthly income range	1.165	.138	1.000	.118
Travel time to work	1.409	.340	1.000	.241
Distance from residence to place of work	1.979	1.290	1.000	.652
Transport mode to work	3.521	2.875	1.000	.816
Transport cost to work	1.272	.465	1.000	.366
Occupation	1.352	.150	1.000	.111
Trip frequency to work	2.919	.725	1.000	.248

Extraction method: Principal component analysis.

(Handy et al., 2002). Descriptive statistics, principal component analysis and cartographic techniques with aids of Arc view 3.2 a Geographical Information System soft ware used to show the origins and destinations of work trips in the city. The findings revealed that the areas of the city with more mixed land- uses particularly Ayeso, Okesa, Bolorunduro and Imo zones attract a consi- derable volume of work trips than areas of the city with less mixed land use which are mostly use for residential purpose particularly in Ilaje, Oke-Ooye and Isokun zones. The result of principal component analysis also confirmed that the distribution patterns of work places/

Table 7. Result of total variance explained of work trip pattern.

Variable	Component	Initial Eigenvalues[a]			Extraction sums of squared loadings		
		Total	% of variance	Cumulative %	Total	% of variance	Cumulative %
Raw	1	22.956	53.548	53.548	22.956	53.548	53.548
	2	5.383	12.557	66.105	5.383	12.557	66.105
	3	4.297	10.023	76.128	4.297	10.023	76.128
	4	2.616	6.102	82.230			
	5	2.437	5.684	87.914			
	6	1.499	3.497	91.411			
	7	0.926	2.160	93.571			
	8	0.904	2.110	95.681			
	9	0.678	1.583	97.264			
	10	0.622	1.452	98.715			
	11	0.507	1.183	99.899			
	12	0.044	0.101	100.000			
Rescaled	1	22.956	53.548	53.548	1.565	13.039	13.039
	2	5.383	12.557	66.105	2.065	17.211	30.251
	3	4.297	10.023	76.128	1.172	9.764	40.015
	4	2.616	6.102	82.230			
	5	2.437	5.684	87.914			
	6	1.499	3.497	91.411			
	7	0.926	2.160	93.571			
	8	0.904	2.110	95.681			
	9	0.678	1.583	97.264			
	10	0.622	1.452	98.715			
	11	0.507	1.183	99.899			
	12	0.044	0.101	100.000			

Extraction method: Principal component analysis. [a]When analyzing a covariance matrix, the initial eigenvalues are the same across the raw and rescaled solution.

Table 8. Result of component matix[a] on work trip pattern.

Parameter	Raw			Rescaled		
	Component					
	1	2	3	1	2	3
Sex of head of household	-0.023	-0.067	0.001	-0.065	-0.194	0.004
Marital status	-0.013	-0.202	0.091	-0.017	-0.258	0.115
Age group	0.303	-1.022	1.742	0.145	-0.487	0.830
Educational background	-0.176	0.578	0.048	-0.124	0.408	0.034
Distric code: Place of work	4.682	-0.244	-0.286	0.996	-0.052	-0.061
Monthly income range	0.042	0.358	0.086	0.039	0.332	0.080
Travel time to work	0.431	0.328	0.216	0.363	.276	0.182
Distance from residence to place of work	0.523	0.854	0.536	0.372	0.607	0.381
Transport mode to work	0.400	1.423	0.830	0.213	0.758	0.443
Transport cost to work	0.418	0.466	0.271	0.371	.413	0.240
Occupation	-0.307	-0.210	-0.108	-0.264	-0.181	-0.093
Trip frequency to work	0.148	0.805	-0.235	0.087	0.471	-0.138

Extraction method: Principal component analysis. [a]3 components extracted.

more employment generating establishments explained about 53.55% from a total of 76.13% of the total variance of the factors affecting urban work trip patterns in the study area. Apart from the transport attributes such as

distance traveled and modal choice to work, the socio-economic characteristics of workers contributed significantly to the factors affecting work trip patterns in Ilesa and these accounted for 12.56 and 10.02% of the total variance, respectively. This study is highly essential particularly in the developing countries where transport infrastructure which constitutes an important component of land use types is poorly developed for any meaningfully socio-economic and political development. The study concluded that a renewal of physical planning of the city would facilitate increase in the mobility of the city dwellers. It further concluded that there is need to reducing travel growth by encouraging forms of sustainable urban development in such a case that the design and lay-out of urban centres could reduce long distance travel which rely mostly on automobile. The study further concluded that the encouragement of balancing residential areas (houses) and employment generating organizations (jobs) would encouraged walking and cycling particularly in the 21st century when the emission of carbon monoxide and many other toxic substances from automobile creates chronic health diseases to human health.

Endnotes:

(1) The distribution of urban land-use characteristics/ socio-economic employment generating organizations influence the pattern of work trips in the study area which is tangential to the research findings of Aloba.

(2) The socio-economic characteristics of workers such as income determined the pattern of work trips. For instance, high income workers commute long distance than low income earners as observed by Judy et al. 2005

REFERENCES

Adetunji MA (2010). Spatial Analysis of Urban Mobility Pattern in Ilesa, Osun State. Unpublished Ph.D Thesis.. Department of Geography, Obafemi Awolowo University, Ile- Ife.

Adeyemi EO (2000). "A Geographical Analysis of Traffic Density in Ilesa" Osun State College of Education, Ilesa p. 99.

Adeyemi EO (1974). Rainfall Pattern in Ilesa and its Environment. Unpublished B.Sc. Dissertation. Department of Geography, Obafemi Awolowo University, Ile-Ife.

Ajala OA, Olajuyin LO (1996). "Regional Impact of the International Breweries PLC, Ilesa. An Analysis in Input Acquisition Production and Labour Force" Ife Soc. Sci. Rev. 1(1&2):63-68.

Aloba O (1989). "The Structure of Work-Trips in Benin City, Nigeria". Faculty of Business and Social Sciences, University of Ilorin, Nigeria, Ilorin J. Bus. Soc. Sci. 1(1):63-81.

Aloba O (1998). "Some Observation on Urban Mobility in Osogbo, Nigeria" Ife Soc. Sci. Rev. 15(1):162-173.

Ayeni MAO (1975). A Model of the Metropolis The Development of a Lowry Model for Jos, Plateau State, Nigeria. Socio Econ. Planning Sci. pp.273-283.

Ayeni MAO (1975). Some Determinants Of The Propensity To Interact In An Urban System. A case study of Jos, Nigeria. Niger. Geographical J. 18(2):111-120.

Congress for the New Urbanism (2000a). Website New Urbanism Basics. http://www.enu.org/newurbanism.html, page dated July 5th 2000, page assessed August 23rd 2000.

Congress for the New Urbanism (2002b). Website page New urbanism Basics. http/:www.cnu.org/newurbanism.html,page date July 5th 2000, page accessed. August 23rd 2000.

Danielle ME (2002). Urban Form and Activity Travel Patterns. An Activity Based Approach to Travel in a Spatial Context. Teachnische University Its Drukkerij Technische Universities Enndhoven. Dutch, Netherlands.

Fadare SO (1989). "Analysis of Factors Affecting Household Trip Generation in the Residential Areas of Ibadan". Ife Res. Pub. Geogr. pp. 34-48.

Fadare SO (1997). " Urban Sprawl and Trip Length Characteristics in Ibadan, Nigeria". Ife Planning J. 1(1):55-69.

Fadare SO, Hay AM (1990). "Housing Densities, Life Style And Travel Behavior In A Third World City. The Example of Ibadan. Nigerian" J. Econ. Soc. Stud. 32(2):177-190.

Handy SL, Marlon B, Reid E, Richard GK (2002). "How the Built Environment Affects Physical Activity: views from Urban planning," Am. J. Preventative Med. 23:64-73.

Hartshorne R (1939). The Nature of Geography: A Critical Survey of Current Thought in the Light of the Past. Pennsylvania Association of American Geographers.

Judy B, Rakhi B, Maureen C, Somik L, Akie T (2005). "Urban Poverty And Transport. The Case of Mumbai." World Bank Policy Research Working Paper 3693, September 2005 pp.1-75.

Naess P (2004). Urban Structure And Travel Behaivour Experiences from empirical research in Norway and Denmark. Aalborg University, Aalborg Denmark Mark. E-mail: peter @ plan auc. Dk Ejtir 3(2):155-178.

Newman PWG, Kenworthy JR (1989). "Cities and Automobile Dependence" Aldershot Glower publications.

NPC (2000). 1991 Population Census of the Federal Republic of Nigeria Abuja. National Population Commission.

NPC (2006). National Population Census of the Federal Republic of Nigeria. Abuja National Population Commission.

Ogundana B (1970). "Forms and Functions of Transport in Ife Region". The Ife Region in S.A. Agboola, ed. Former Occassional Publication, Department of Geography, University of Ife, Ile-Ife (OAU) pp.85-113.

Okoko E (2008). Urban Transportation Planning and Modelling". Millennium Publishers. Akure Nigeria.

Papacoastal CS (1987). Fundamentals of Transportation Engineering New Delhi: Prentice-Hall of India.

Tanimowo NB (2006). Land Use Mixed and Intra-Urban Travel Pattern in Ogbomoso, a Nigerian Medium Sized Town. J. Human Ecol. 20(3):207-214.

Sangkug L (2006). The Correlation and Casual Investigation into Land Use –Transportation Relationship. Evidence from the Dallas-fort Worth Metropolitan Area. Unpublished Ph.D. Thesis Department of Urban and Regional Science office of Graduate Studies of A & M University, Texas.

Stead D, Marshall S (2001). The Relationship between Urban Form and Travel Patterns, An International Review and Evaluation. Bartlett School of Planning, University College London, United Kingdom, E:d.stead@ucl.ac.uk EJTIR 2:113-141.