Assessment of Travel Characteristics in Akure Metropolis

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ABSTRACT: The travel characteristics of commuters in Akure Metropolis were obtained in terms of trip destinations, travel modes, capacity of vehicles used, number of vehicles and the frequency of trips. The travel distance, travel time and cost of travel were also measured. It was found that an average 9,391 intercity trips were generated daily from Akure Metropolis to various destinations out of which Lagos has the highest number of person trips. 77.54% and 22.46% of the total trips were made by bus and car respectively. The socio-economic status of the people was analyzed quantitatively and qualitatively. The analysis results show that people with an average income ranging from N20,001 to ₦30,000 travel most with public vehicles while people between the ages of 31 and 50 make the highest number of trips. Regression analysis of the trips generated in terms of the travel characteristics produced a model which explained the data to an accuracy of 98.7%.

Keywords: Metropolis, Intercity, Socio-Economic, Travel Modes, Regression Analysis

ORIGINAL ARTICLE

INTRODUCTION

Transportation is essential for movement of goods and services between communities as well as exchange of ideas and innovations among people. It can have an enormous capacity for promoting socio economic growth, raising standards of living and creating a good society at large. The engineering aspect of transportation considers the movement of people and goods from one location to the other in a fast, convenient and safe manner and at minimum cost. It includes transportation planning, transportation economy and finance, transportation policy, transportation administration or management and transportation law or legal requirements.

The dominant form of transportation in Akure is by road. However, the downward trend in the economy of the nation has implications for various spheres of life including the conventional intercity public transport system. Majority of residents in Akure experience varying degree of problems regarding the satisfaction of their basic travel requirements. Some of these problems include the deplorable state of roads and motor parks (garages), uncomfortable seating arrangements imposed by drivers, inadequate motor vehicles, illiteracy of drivers and many others.

Hence, this paper examines the travel characteristics of residents of Akure based on the travel modes, determines the number of trips generated from Akure to other cities as well as the socio-economic status of the commuters and develops a relationship between the travel characteristics and the number of trips generated.

Akure Metropolis: Background of the Study Area

The date of founding of Akure cannot be asserted, however, history has it that the town had been firmly established by AD 1440. Akure was made Ondo state capital on February 3, 1976 by the Military Government. This eventually led to the establishment of many ministries and statutory corporations. When the state finally took off on April 1976, an increase of immigrants to the town led to an unprecedented rise in the city's population. This correspondingly led to a higher demand for residential accommodation and increased or improved transportation facilities.

Akure is geographically located on latitude $70^{\circ}20'$N and longitude 50°E and is easily accessible to other major urban centers in the state, such as Owo in the East, Ado-Ekiti in the North and Ondo in the South, all within 50km radius. Within 100 km radius are the towns of Ikare, Ikole Ekiti, ljero Ekiti to the North and Okitipupa in the South. The topography of the town is relatively flat. Akure is connected to other parts of the country by road network system. Being an administrative center of the state, the rate of population growth in Akure has been greater than that of any town in the state. The provincial census figure for Akure in 1991 was given as 239, 124 people.

Land Use Pattern

The natural pattern of development is linear along its main roads namely Oyemekun, Oba Adesida, Hospital, Arakale and Oda roads. The existing land use is characterized by a medium density of structure within the inner core areas. Akure is mostly residential with residential areas forming over 90% of the developed area with little or no industrial areas. The additional activities such as warehousing, manufacturing, workshops and other commercial purposes are commonly located within the residential neighborhoods. Generally, there is lack of recreational open spaces or amusement parks except for school playing fields.

BACKGROUND LITERATURE

A transportation system may be defined as consisting of the fixed facilities, the flow entities and the control system that permit people and goods to overcome the friction of geographical space efficiently in order to participate in a timely manner in some desired activity [1]. Transportation systems operate and change in response to demand and the introduction of modem transport facilities can sometimes stimulate demand [2]. Consequently, a road transportation system would include not only the roads but also vehicles, passengers and related freight which are all interdependent. Changes in anyone of these factors will affect all the others [3].

Transportation depends greatly on land use which can be defined as the diverse ways in which the land is being put to use [4]. These include residential, commercial, industrial, recreational, institutional land uses. Land use and transport planning are closely connected because the demand for travel facilities is a function of human land activity and conversely the provision of transport facilities has often stimulated land use activity [5].

Trip studies include study of purpose for making trips, origin and destination of the trips within the city, frequency of making trips, the economy of making trips and finally the available transport modes in the city. The study area is divided into traffic zones for which trip attractions and productions are estimated. Land use activity is considered as the generator of trip for individuals while commercial land use, floor space and employment are frequently considered to be of considerable importance. Socio- economic details of the residents are obtained since many surveys have indicated a connection between trip making and income as well as between trip making and social status [6].

The travel forecasting process follows trips as they begin at a trip generation zone and end at a trip attracting zone. The simulation process is in four steps in which four basic models are used namely trip generation, trip distribution, modal split and traffic assignment models. The first step in travel forecasting is trip generation which attempts to determine the connection between trip making and land use and predicts the number of trips per time period made to and from a given zone. Trip Distribution is concerned with finding the zones to or from which the generated trips are directed. Modal split is concerned with determination of the particular mode of transportation used by trip makers. Traffic assignment as the name implies involves assigning the distributed volumes of trips by mode to individual network links [7].

In trip generation analysis, three approaches are commonly used for developing models namely regression analysis, trip rate analysis and cross-classification analysis. Trip generation models are a set of mathematical equations that collectively relate travel patterns to land use, residential density, socio-economic characteristics, demographic characteristics and other parameters of the transport system [8]. In the case of trip distribution, many mathematical models have been tried such as linear programming formulations, regression models, growth factor models, opportunity models and gravity type models (which is the most popular) [7]. In the case of modal split, also three types of models are used namely trip-end models, trip interchange models and individual mode choice models. Lastly, trip assignment techniques used include all-or-nothing, iterative, incremental, user-equilibrium and system optimal traffic assignments.

DATA COLLECTION AND ANALYSIS

A transportation survey was carried out in order to obtain an inventory of the trip making pattern along with details of the travel modes available. The inventory was obtained through roadside surveys of motor parks in four zones (shown in table 1) within the study area. The average number of trips made by each mode to various destinations daily was recorded. An inventory of the land use activities and socio economic factors that influence travel patterns were obtained with the aid of questionnaires which were distributed at the various terminals or motor parks within the study areas. The study area was divided into four zones and thirty questionnaires were distributed at each terminal.

Table 1. Zones of Travel

Zone	Name	Motor Parks
1 (or A)	OJA OBA	Oja Oba park (Total filling station), Ijomu park (Oke-Ijebu junction), Cathedral motor park, Oja Oshodi market park, Old garage park, Sunshine park (Cathedral) Taiwo Express motor park, AP filling station park (Oba Adesida road), First Baptist loading park (Oba Adesida road).
2 (or B)	OYEMEKUN	Ilesha motor park, Road Block motor park (Orita- Obele Junction) NDDC loading park (Oyemekun), Akad petrol station garage, FUTA North gate motor park.
3 (or C)	OKE ARO	Ondo garage park (Ondo road), Idanre garage.
4 (or D)	IJAPO	Benin motor park, Ado garage, Ilesha/Owo expressway park (Ijapo/Fiwasaye road).

An average population of residents that travel daily was recorded during the course of this study. The roadside survey covered a total of 19 motor parks (terminals). It was discovered that residents of Akure travel (primarily) to a total of 38 destinations daily (both within and outside the city) as shown in Table 2. The table also shows a breakdown of the total number of trips generated daily. There are two main modes of travel in Akure namely cars and buses. The cars have a capacity of between 5 and 9 passengers while the buses have varying capacities of 10 to 14 passengers.

The Travel Inventories

Table 2 also shows the travel time, travel distance and cost of travel inventories. In terms of travel time, the destination with the longest travel time is Kano while the destination with the shortest travel time is Ijare. Therefore, the time range is calculated as 14. 45hrs. In terms of travel distance, the minimum travel distance is 5km while the maximum travel distance is 1023km.

Hence, the distance range is 1018km. In terms of travel cost, the maximum and minimum travel costs by car are ₦5,000 and ₦120 respectively and by bus are ₦4,500 and ₦80 respectively.

Table 2. Number of Trips Generated per day

S/N	DESTINATIONS FROM AKURE	NUMBER OF TRIPS PER DAY		TOTAL NUMBER OF TRIPS PER DAY	TRAVEL DISTANCE (KM)	TRAVEL TIME (HR)	COST OF TRAVEL (in Naira)	
		CAR	BUS				CAR	BUS
1	Aba	9	14	23	381	6.00	3000	2500
2	Ado-Ekiti	150	588	738	48	0.45	400	300
3	Abuja	36	436	472	400	5.00	2500	1900
4	Akungba/Ikare Akoko	115	252	367	90	1.25	600	500
5	Auchi	18	56	74	266	3.30	1100	900
6	Benin	72	168	240	171	2.00	1200	1000
7	Ibillo	72	84	156	209	2.40	800	700
8	Ibadan	25	644	669	200	2.30	800	700
9	Idanre	120	420	540	22	0.30	250	200
10	Ido-Ani	30	112	142	81	1.30	500	400
11	Ifira-Akoko	30	84	114	97	1.50	700	600
12	Ifon	30	84	114	87	1.15	800	600
13	Ikere-Ekiti	80	224	304	36	0.45	250	200
14	Ilesha	80	476	556	72	1.00	500	400
15	Ile-Ife	95	350	445	122	1.35	600	500
16	Ilorin	36	84	120	191	2.20	1500	1200
17	Ijare	50	126	176	5	0.15	120	80
18	Ijero-Ekiti	20	84	104	86	1.30	800	600
19	Iju/Itaogbolu	90	210	300	18	0.20	150	100
20	Jos	45	70	115	703	8.00	3500	2800
21	Kaduna	18	42	60	761	9.00	3500	3000
22	Kano	-	14	14	1023	15.00	5000	4500
23	Lagos	-	924	924	312	3.45	-	1250
24	Lokoja	27	42	69	232	3.10	1300	1100
25	Makurdi	18	-	18	551	6.00	2800	2500
26	Oba Akoko	30	84	114	86	1.30	500	400
27	Okene	77	28	105	160	2.30	1000	850
28	Ondo	90	420	510	45	0.45	250	200
29	Onitsha	54	112	166	320	4.00	2200	1900
30	Oshogbo	80	252	332	118	1.75	1000	800
31	Okitipupa	30	126	156	113	1.45	900	700
32	Otun-Ekiti	-	42	42	109	2.00	900	750
33	Ore	70	224	294	85	1.00	600	500
34	Owo	130	504	634	42	0.40	300	250
35	Oyo-Ile	18	28	46	230	2.50	1000	850
36	Port-Harcourt	27	56	83	535	7.00	2500	2200
37	Warri	18	-	18	362	5.00	1900	1600
38	Zaria	9	28	37	911	12.00	4000	3500

Factors determining Trip Attractions and Impedance

The factors that influence the trip attraction and impedance are educational institutions, job opportunities, administrative centers, industries and commerce, agricultural and minerals resources potentials, population, travel distance, time and costs.

Travel Estimation

Travel was estimated through a four stage process namely trip generation, trip distribution, modal split and traffic assignment.

Trip Generation

The study showed that 9391 intercity trips were generated daily from Akure Metropolis. Table 3 shows the number of trips generated from each zone in Akure as well as their equivalent percentage values. The largest number of the inter city trips were generated from zone 4 while the least number of trips were obtained from zone 3.

Table 3. Trips generated from each zone

Zone	Zones of Travel	No of Trips Generated from Zones	% of Trips Generated from Zones
1	OJA OBA	2431	26
2	OYEMEKUN	2308	25
3	OKE ARO	1127	12
4	IJAPO	3525	37
	TOTAL	9391	100

Trip Distributions

Table 4 shows the distribution of the total number of trips and the equivalent percentage distribution of the trips generated among the origin-destination routes. The highest number of trips is directed towards Owo (33%).

Table 4. Trip Distributions

S/N	ROUTES	No of Trips Towards the Route	% distribution of trips
1	AKURE - ADO EKITI	1488	16
2	AKURE - OWO	3135	33
3	AKURE - ONDO	1884	20
4	AKURE - ILESHA	2344	25
5	AKURE - IDANRE	540	6
	Total	9391	100

Modal Split

This study revealed that the commuters have a choice of two modes for their intercity trips namely by car and bus. Data from table 2 show that 7492 trips were traveled by bus which is about 77.54% while 1899 trips traveled by car (22.46%).

Traffic Assignment

The largest number of trips is directed towards Owo route 33.38% while 15.84% is directed towards Ado Ekiti routes while Akure-llesha/Ibadan routes recorded 24.96% of the total trips generated. Others are trips directed towards Ondo and Idanre which are 20.06% and 5.75%

respectively. Therefore, it shows that there are five major routes that link Akure with other destinations.

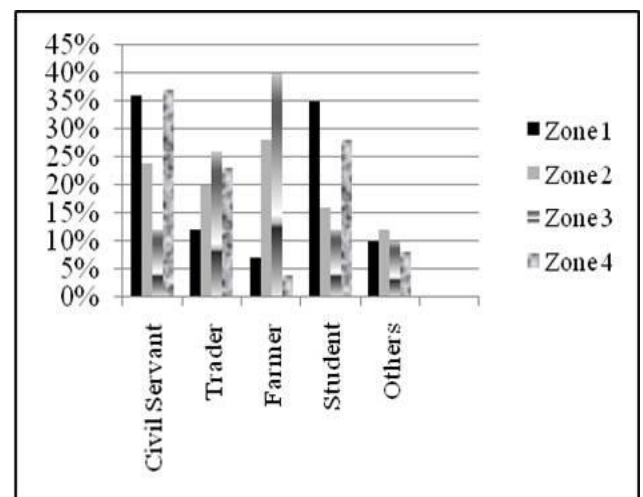**Socio-economic characteristics of the commuters**

Figures 1, 2 and 3 are bar charts showing the income distribution (in naira), age distribution and occupational status of commuters in the four zones.
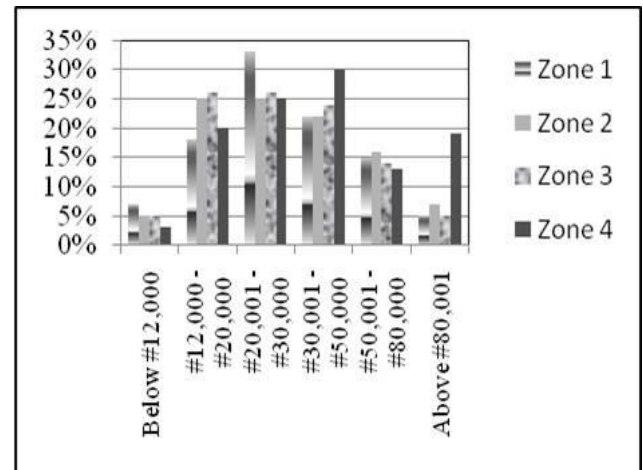
Figure 1. Income Distribution of commuters in the Analysis Zones
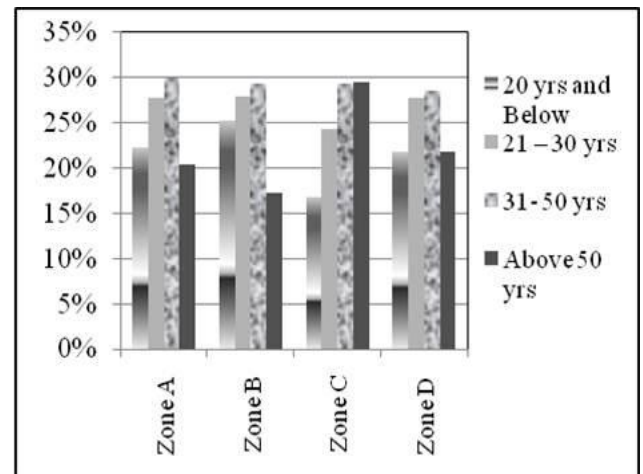
Figure 2. Age Distribution of Commuters in the Zones

Figure 3. Distribution of commuters by Occupational Status

Model Development

Using regression analysis, a model was developed for estimating the number of trips that can be generated from Akure based on the travel data. The regression equation or model which explains the data to an accuracy of 98.7% based on its R^2 value as indicated by the Analysis of Variance (ANOVA) test is given as: Total number of Trips = 381.27 + (33.44 * Travel Distance) – (2923.08 * Travel Time) – (3.58 * Cost of Travel by Car) + (4.98 * Cost of Travel by Bus).

DISCUSSION

The value of trips generated from Akure Metropolis daily is 9391. These trips were attracted to 38 destinations with the highest number of trips generated from the Ijapo (zone 4), followed by Oja Oba (zone 1) and the least was from Oke Aro (zone 3).

The highest number of trips generated from Akure is directed towards the Akure - Owo route while the least number of trips generated from Akure is directed towards the Akure - Idanre route. It was also established that the number of trips attracted to a certain route depend on the condition of the road. In all, there are five major routes that link Akure with other destinations.

The two modes used for inter city travel in Akure are the Bus and Car. It was found that 77.54% of the trips were made by bus while the remaining 22.46% were made by car.

The highest number of trips were directed towards the Akure- Owo route (33%), followed by the Akure-Ilesha (25%) while the lowest number of trips were directed towards the Akure –Idanre (6%).

In terms of income distribution, figure 1 shows that the highest number of commuters in Akure are from zone 1 with income ranging between ₦20,001 and ₦30,000 while the least number of commuters take off from zone 4 with corresponding income ranging below ₦12,000. Figure 2 shows a fairly uniform rate of commuting across the zones for the different age groups and also commuters between the ages of 31 and 50 make the highest number of trips. Figure 3 shows that the highest and lowest numbers of commuters in Akure comprise of farmers in zones 3 and 4 respectively.

CONCLUSION

This study showed that buses were more available than cars in all the terminal points visited and people traveled more by bus than by car. The number of private car owners in Akure has increased thereby reducing the number of trips made by public transport.

Commuters in Akure travel in order to satisfy their social, political and cultural needs. They travel to work, to school, for shopping, and for recreational purposes and they choose their mode of travel based on availability, reliability, speed, cost, comfort, security and convenience. Based on this study, it appears that the occupational status and income distribution have significant impact on the number of trips generated in Akure while the age distribution has little effect thereof.

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