ANALYSIS OF TRAVEL DEMAND IN AKURE, NIGERIA

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Abstract

The study investigates travel demand in Akure using an activity-based analysis. Data was sourced by administering questionnaires to 1107 respondents living and working in Akure metropolis targeting the residents in Ajipowo, Alagbaka, Aule, Ijapo, Oba-Ile, Orita-Obele, and Shagari residential estates. The modelling methods in Activity-Travel Analysis incorporating the non-identical, non-independent random components uses one of two general structures: the first is an error-components structure and the second is the general multinomial Probit (MNP) structure. In this study, the first was used to determine the levels of utils accruable to households. A multiple regression analysis was subsequently done for the various estates. The findings show that Alagbaka and Ijapo have the largest fleet sizes because there are more rich people in that the estate. The following recommendations were made: an improved public transportation system should be provided in the city, of a quality to persuade private car owners to use public transportation systems; mega schools should be decentralized more "mini-model schools" built with more geographic spread; the road network in Akure should be improved and existing link roads and street should be paved in order to take traffic off the main arteries and reduce trip time and costs.

Keywords*: activity-based travel analysis; trip times; households; utils*

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1. Introduction

The activity based approach (ABA) is based on the motivation that travel decisions are activity based, and that any understanding of travel behaviour is secondary to the fundamental understanding of activity behaviour. Prior to the emergence of the ABA, there has been the "Four Stage" model, developed to evaluate capital intensive infrastructure projects during a period when rapid increases in transportation supply were arguably possible. The fundamental changes in urban, environmental and energy policies forced a re-consideration of travel forecasting and it was during this period that the first ABA was studied. The ABA includes a number of behavioural and conceptual frameworks. The activity approach explicitly recognizes and addresses the inability of four stage models to reflect underlying behaviour and, therefore, their inability to be responsive to evolving policies orientated to the management versus expansion of transportation infrastructures and services (Chandra, 2003)

There are several limitations of the four-stage model. The most significant ones are: ignorance of travel as a demand derived from activity participation decisions: a focus on individual trips, ignoring the spatial and temporalinter-relationships between all trips and activities comprising the individual activity pattern; misrepresentation of overall behaviour as an outcome of a true choice process, rather than as defined by a range of complex constraints that delimit choice; inadequate specification of the interrelationships between travel and activity participation and scheduling, including activity linkages and interpersonal constraints; misspecification of individual choice sets, resulting from the inability to establish distinct choice alternatives available to the decision-maker in a constrained environment; and the construction of models based strictly on the concept of utility maximization, neglecting substantial evidence relative to alternative decision strategies involving household dynamics, information levels, choice complexity, discontinuous specifications, and habit formation.

These theoretical deficiencies appear most prominently in the inability of conventional models to adequately perform in complex policy applications, despite their acceptable performance in certain well defined situations. The four-stage model does not reflect the linkages between trips and activities and underlying activity behavior that generates the trips.

However, the ABA is characterized by several interrelated themes, but the methods and models generally reflected one or more of these themes:
travel is derived from demand for activity participation; sequences or patterns of behavior, and not individual trips, are the relevant unit of analysis; household and other social structures influence travel and activity behavior; spatial, temporal, transportation, and interpersonal interdependencies constrain both activity and travel behaviour; ABAs reflect the scheduling of activities in time and space(Bhat,1998)

The ABA is conceptually designed to take as the basic unit of analysis the travel-activity pattern, defined as the revealed pattern of behavior represented by travel activities (both in-home and non-home) over a specified time period (often a single day). These travel activity patterns are referred to as household activity patterns and arise via the scheduling and execution of household activity programmes (Zhang, 2005). Individual activity programmes results from some decision process that is assumed to allocate responsibilities in a manner consistent with a range of environmental, transportation, and household constraints (Koppelman, 2000).

Akure is the capital city of Ondo State, with agriculture and government being the major employers of labour. The movements of households are therefore mainly connected with commuting to work/school and farm settlements. Most roads and streets are narrow but few main arteries in the city centre are newly dualised for more throughputs via the central business district (CBD). Coming to the CBD from inner streets in city and adjourning settlements and estates takes a lot of time due to heavy traffic congestion before linking to the dual-carriage roads. Household trips are therefore influenced by the travel time and cost – most of the city dwellers are low income earners. Demand for transport in this city will therefore be peculiar. The household must make sure that trips are important as resources must be adequately utilized.

The objectives of the study are to:

- determine the types of trips made by households in Akure;
- estimate the aggregate utility for trips made by households in Akure;
- estimate the average trip time for a household in Akure;
- determine the average distance covered by households in Akure.

2. Literature Review

Since the beginning of civilization, the viability and economic success of communities have been, to a major extent, determined by the efficiency of the transportation infrastructure (Chandra, 2003). Planning for transportation needs of communities therefore depends to a large extent on being able to understand the travel demand pattern of the people involved. Forecasting will therefore be done by transportation planners and engineers who must rely on the responses of consumers or people making transport trips to ever-changing attributes of transportation systems and environment.

Transport demand can be modelled in several ways of which activity-based modelling, trip-base (origin-destination) modelling and purpose-based modelling are just a few. The importance of realistic representations of behaviour in travel demand modelling cannot be over-emphasized, as attention has shifted from evaluating long-term investment-based capital improvement strategies for understanding travel behaviour responses to shorter-term congestion management policies such as alternate work schedules, telecommuting, and congestion-pricing. The result has been an increasing realization in the field that the traditional *statistically-oriented* trip-based modelling approach to travel demand analysis needs to be replaced by a more *behaviourally-oriented* activity-based modelling approach. (Chandra, 2003).

The trip based approach uses individual trips as the unit of analysis and usually includes four sequential steps. The first step, trip generation, involves the estimation of the number of home-based and non-home based person-trips produced from, and attracted to, each zone in the study area. The second, trip distribution, determines the trip-interchanges (*i.e.*, the number of trips from each zone to another zone). The third step, mode choice, splits the person-trips between each pair of zones by travel mode obtaining both the number of vehicle trips and number of transit trips between zones. The fourth and final, assignment, step as signs the vehicle trips to the road way network to obtain link volumes and travel times and the person trips to the transit network. Time-of-day of trips is either not modelled or is modelled in only a limited way, in the trip-based approach. Most commonly, time is introduced by applying time-of-day factors to 24-hour travel volumes at the end of the traffic assignment step or at the end of the trip generation step. (Lee, 2003)

A fundamental conceptual problem with the trip-based approach is the use of trips as the unit of analysis. Separate models are developed for home-based trips and non- home-based trips, without a consideration of dependence among such trips. Further, the organization (scheduling) of trips is not considered; that is, there is no distinction between home-based trips made as part of a single-stop sojourn from home and those made as part of a multiple-stop sojourn from home. Similarly, there is no distinction between non-home-based trips made during the morning commute, evening commute, from work, and as part of pursuing multiple stops in a single sojourn from home. Thus, the organization of trips and the resulting inter-relationships in the attributes of multiple trips are ignored in all the steps of the trip-based method. This is difficult to justify from a behavioural standpoint. It is unlikely that households will determine the number of home-based trips and the number of non-home-based trips separately. Rather, the needs of the households are likely to be translated into a certain number of total activity stops by purpose followed by (or jointly with) decisions regarding how the stops are best organized. Similarly, the location of a stop in a multistep sojourn (or tour) is likely to be affected by the location of other stops on the tour. Such multi-stop tours are becoming increasingly prevalent (see Gordonetal., 1988;

Lockwood and Demetsky, 1994) and ignoring them in travel analysis means "discarding an element that is doubtless important in the individual's organization of time and space"(Hanson, 1986). Also, in a multi-step tour from home consisting of, say, a grocery shopping stop and a social visit, the trip-based approach fails to recognize that the travel mode for all three trips (home to shop, shop to visit, and visit to home) will be the same. The travel mode chosen will depend on various characteristics of all three trips (and not any one single trip) and, consequently, these trips cannot be studied independently.

The behavioural inadequacy of the trip-based approach and the consequent limitations of the approach in evaluating demand management policies, has led to the emergence of the activity-based approach to demand analysis.

2.1**The Activity-based Approach**

The activity-based approach to travel demand analysis views travel as a derived demand; derived from the need to pursue activities distributed in space (Jones, 1988); (Garling, 1994). The approach adopts a holistic framework that recognizes the complex interactions inactivity and travel behaviour. The conceptual appeal of this approach originates from the realization that the need and desire to participate in activities is more basic than the travel that some of these participations may entail. By placing primary emphasis on activity participation and focusing on sequences or patterns of activity behaviour (using the whole day or longer periods of time as the unit of analysis), such an approach can address congestion - management issues through an examination of how people modify their activity participations (for example, will individuals substitute more out-of-home activities for in-home activities in the evening if they arrived early from work due to a work-schedule change?)

The shift to an activity-based paradigm has also received an impetus because of the increased information demands placed on travel models by the 1990 Clean Air Act Amendments (C.A.A.As).

3. Methodology

Questionnaires were administered to 1107 respondents living and working in Akure metropolis targeting the residents in Ajipowo, Alagbaka, Aule, Ijapo, Oba-Ile, Orita-Obele, and Shagari residential estates. The distributions are as follows:

Table 1: Questionnaire Distribution

S/N	Estate	Respondents	Questionnaire distribution	Percentage returned
1	Ajipowo	308	400	77
2	Alagbaka	56	60	93
3	Aule	105	110	95
4	Ijapo	87	90	97
5	Oba-Ile	78	90	87
6	Orita-Obele	176	180	98
7	Shagari	297	300	99
	Total	1107	1230	90

Source: Author's field work.

The population of Ondo State is 3,441,024 and that of Akure is 588,000 (NPC, 2011). The population of Akure is about17.09 percent of the State's population. Our sample size is

therefore taken as 1% of the population [about 1230 households or 5880 persons, as an average household in Akure is made up of five individuals (Nigerian Bureau of Statistics, 2010)].
The questionnaire was designed to elicit the following information:

a) Household size;
b) Household daily trips;
c) Number of vehicles available to household;
d) Household destination from home (distances);
e) Trip times
f) Trip utilities

The following trip types are possible: work, school, leisure, market, hospital and religious. Work and school are commuting trip types and are expected to be the most common trips.

The modelling methods in Activity-Travel Analysis incorporating the non-identical, non-independent random components uses one of two general structures: the first is an error-components structure and the second is the general multinomial probit (MNP) structure. The first is used for this study. The error-components structure partitions the overall error into two components: one component which allows the random components to be non-identical and non-independent, and the other component which is specified to be independent and identically distributed across alternatives. In particular, consider the following utility function for alternative i:

$$U_i = V_i + \zeta_i$$
$$= V_i + \mu' z_i + \epsilon_i \quad \text{---}(1)$$

where V_i and ζ_i are the systematic and random components of utility, and ζ_i is further partitioned into two components, μ z_i and ϵ_i.z_i is a vector of observed data associated with alternative I, μ is a random vector with zero mean and density $g(\mu \mid \Sigma)$, Σ is the variance-covariance matrix of the vector μ, and ϵ_i is the independently and identically standard distributed across alternatives with density function f(.).The component induces heteroscedasticity and correlation across unobserved utility components of the alternatives (see Train, 1995). While different distributional assumptions might be made regarding f(.) and g(.), it is typical to assume a standard type I extreme value for f(.), and a normal distribution for g(.). This results in an error-components model with a logit kernel. On the other hand, if a standard normal distribution is used for f(.), the result is an error-components probit model. Both these structures will involve integrals in the choice probability expressions which do not have a closed-form solution. The estimation of these models is achieved using logit simulators (in the first case) or probit simulators (in the second case). Different and very general patterns of heteroscedasticity and correlation in unobserved components among alternatives can be generated by appropriate specification of the vectors [see (Bhat, 1998c), (Bolduc, 1996) and (Brownstone, 1999)].

The income of the residents of Akure was grouped into six classes for easier data analysis. The class one has an income range of 18000-79999 naira per month and was designated as one. The income class of the remaining group is shown in table 2. On the spreadsheet for the computation of multiple regression, the designation against each income group is enter/registered for then in the computation, so that income class one is gets 1 and income class two gets 2 and so on till income class six gets 6.

Based on reports of most vehicle manufacturers that an average of 17 kilometres can be covered with one gallon of premium motor spirit (PMS) for motoring within cities, one can concur that for this study that same average should apply to trips within Akure being a medium sized city without many private car owners, compared to Lagos and Abuja.

The relationship between trip distance made by households and their attributes can be better understood by doing a multiple regression analysis.
The multiple regressions is depicted by

$$Y = f(X_1, X_2, X_3, \ldots X_n) \quad (2)$$

Where Y is the dependent variable and $X_1, X_2, X_3, \ldots X_n$are the independent variables on which y relies.

Table 2			
S/N	Income Class	Income range Naira/month	Designation
1	One	18000-79999	1
2	Two	142000-203999	2
3	Three	204000-265999	3
4	Four	328000-389999	4
5	Five	390000-451999	5
6	Six	452000-above	6

Source: Author's field work.

For this study Y is the trip distance (Y_{dist}) and the X_1, X_2, X_3,Xx_4 are size (X_{size}), fleet size (X_{flsize}), income (X_{incm}), utility(X_{utils}), respectively so that the regression equation will now be

$$Y_{dist} = b_0 + (b_1 * X_{size}) + (b_2 * X_{incm}) + (b_3 * X_{flsize}) + (b_4 * X_{utils}) + e \quad (3)$$

Where $b_0$is the intercept and $b_1, b_2, b_3,$ *and* $b_4$are coefficients of the equations and e is the value of unforeseen error. The activity-based analysis will enable us to know the trips made by households based on their respective activities (leisure, school, work and religion) and the respective utility enjoyed from these trips.

4. Findings and Discussion

4.1Distribution of Residents

Table 3 shows the respondents from various estates, with Ajipowo Estate having the highest number of respondent 308, and Alagbaka the least at 56. Ajipowo is an average residential estate with lots of low income earners while Alagbaka and Ijapo had the richest set of respondents so it not out of place for these sets of respondents (Alagbaka and Ijapo) have a larger fleet size of four per household. The same fleet size is seen in Oba-Ile Estate; however, cars in Alagbaka are more expensive than those in Ijapo and Oba-Ile. Average household trip times per household per week are 267, 241, 240, 216, 214, 198, and 192 for Shagari, Ajipowo, Oba-Ile, Orita-Obele, Ijapo, Alagbaka and Aule respectively.

Shagari and Ajipowo Estates are relatively far from the city centre so the average trip time per household is expected to be fairly high as many of their residents are farmers and low income earning civil servants. Oba-Ile is the farthest of the estates and it is not unexpected for this estate to have a fairly high average trip time. Aule and Alagbaka residents were noted to have most of them working in the Federal University of Technology, Akure (FUTA) and in the State Secretariat respectively.

Table 3: Estates in Akure metropolis

S/N	Estate	Respondents	Average household size	Average no vehicles per household	Average trip time by household (minutes/week)
1	Ajipowo	308	6	2	241
2	Alagbaka	56	5	4	198
3	Aule	105	4	3	192
4	Ijapo	87	5	4	214
5	Oba-Ile	78	5	4	240
6	Orita-Obele	176	6	2	216
7	Shagari	297	7	2	267
		1107			224

Source: Author's field work.

However, the average trip time of Orita-Obele households is relatively high even though many of the residents work in FUTA and in the immediate environs which should results to shorter trip times. But the gridlock at Road-block Junction is a major factor in time accumulation for this estate. Aule GRA has the smallest average household size of 4. The average household size for Shagari Estate is 7 the highest.

4.2**Trip Distance and Utility**

In economics, it is expected that the higher the income of a household the more disposable income and savings they will have. The propensity to save and/or spend will then be high, giving families a choice in their priorities. The same goes for trip making, as it is a way of disposing income. Humans are rational entities and so they will only make trips from which they will get the most satisfactions (utility). Utility is measured in utils. Table 4 shows the average utility enjoyed for trips by residents in Akure displayed according to the respective estates.

Table 4: Household Income and Utility of Trips

S/N	Estate	Average household size	Average household Income class	Average Utils enjoyed by Households	Total Trip distance per week	Estate type
1	Ajipowo	6	2	8	101523	Normal
2	Alagbaka	5	6	8	18274	GRA
3	Aule	4	4	7	34600	GRA
4	Ijapo	5	5	9	30104	High
5	Oba-Ile	5	4	11	28322	High
6	Orita-Obele	6	3	9	60914	Normal
7	Shagari	7	1	7	116365	Normal
					390102	

Source: Author's field work.

4.3**Energy Consumption**

It can be seen that Ajipowo Estate with average household size of 6 had a total combined trip distance per week of 101523 kilometres, while Alagbaka Estate with an average household size of 5, average income class of 6 with average utility of 8 utils made an average trip distance 18274 kilometres per week. The average household income class, average utility values, and total weekly trips for the other estates are shown on Table 4.

Table 5: Energy consumption

Estate	Gallons per week	Litres per week
Ajipowo	1725891	7,844,959.09
Alagbaka	310658	1,412081.82
Aule	588200	2,673,636.36
Ijapo	511768	2,326,218.18
Oba-Ile	481474	2,188,518.18
Orita-Obele	1035538	4,706,990.91
Shagari	1978205	8,991840.91
		30,114,245.46

Source: Authors' field work.

30,114,245.46 litres of PMS is consumed per week by the households surveyed in Akure metropolis and this is a huge financial and environmental cost on the people. It can be seen from Table 5 that Shagari and Ajipowo Estates whose residents are mostly low income earners consumed the most energy per week for transportation. This is rather ironic but it confirms the notion in urban economics that the farther away from the city centre that you reside (may be for cheaper accommodations on the outskirts of the city), the more transportation cost you pay for commuting. In addition, it was noted that the presence of Nigeria Police Traffic officers is less noticeable in these areas. On the average one can then say Akure residents consume 4302035.07 litres of PMS per day.

4.4 **Utility and Days**

Monday is the most important day for most Akure residents going by the value of utility recorded for the day (10 utils). Tuesday is the next day in ranking using the level of satisfaction of people with 9 utils (see Table 6).

Table 6: Aggregated Household utility levels for trips made on day-to-day basis

Day of the week	Utils	v= systematic component of Utility	z = the random component of utility	ΣTrip time (minutes)	ΣDistance Covered (kilometres)
Sunday	7	5	3	18262	26001
Monday	10	9	4	45563	81111
Tuesday	9	2	7	40192	66521
Wednesday	8	5	4	37622	56212
Thursday	7	4	3	41227	49021
Friday	6	5	3	43232	69123
Saturday	5	3	2	21872	42113
Average	8.428571		Total	247970	390102
Average trip time per household				3.733	;;

Source: Author's Field Work

Monday had the most distance covered because many of the residents might have travelled out of town to neighbouring towns, cities and states. Ondo State once covered the whole of the present Ondo and Ekiti States so it is not unexpected to have residents of these two States residing, working, visiting and commuting regularly across state borders: they also share a similar cultural heritage and history. Average trip time per household is 3.734 hours per week. This was gotten by changing total trip time of 247970 minutes to hours and dividing the resultant value by the number of respondents (1107).

4.5 **Trips types and days**

Most of the trip types by households were work-related as they run from Monday to Saturday for most of the residents (Table 7). It was noted that trips per day for Tuesdays, Wednesdays, Thursdays and Saturdays were three and two trips for Fridays and Sundays. Sunday trips were for religion and leisure. For Monday, the trips were for work and school. Tuesdays, Wednesdays and Thursdays had work, school and market as their trips. For Saturdays the trips recorded were work, religious, market, leisure.

Table 7: Average trips per household/per

Day of the week	Trips/day	Most Common Trip type
Sunday	2	Religious, Leisure
Monday	2	Work, School
Tuesday	3	Work, School, Market
Wednesday	3	Work, School, Market
Thursday	3	Work, School, Market
Friday	2	Work, School
Saturday	4	Work, Religious, Market, Leisure

Source: Author’s Field Work

4.6 **Significant Attributes for Trip Distance**

It can be seen that size and utility were the most significant factors that determined the making of trips by residents of Ajipowo Estate because the average household size is large in this estate and one should expect that the larger the size of a household the more the need to move about. Also, most of the people are in income class two so that any trip to be made will be returning to the household a great deal of satisfaction (utility). Income is another significant attribute because the greater the income the more the demand for trips. That is why the coefficient is negative. Fleet size has no effect on trip distance. All this can be seen from the p-value of the regression (see Table 8).

Table 9 shows the regression analysis for Alagbaka. This estate is in the GRA, away from the city centre. Residents in this estate make more trips based on the utility they derive from such trips. Average household size is six, and income class is two, which means that there are many rich people in this estate

Table 9 shows the regression analysis for Alagbaka. This estate is in the GRA, away from the city centre. Any trip made will return to the household a great satisfaction (utility).

Household size, income and fleet size have no effect on the trip distance. See the p-value of the regression in Table 9.

Table 8: Regression Analysis for Ajipowo

	R^2	0.921	(Note: No intercept in the model. Interpret R^2 and R with caution.)				
	Adjusted R^2	0.920	n	308			
	R	0.960	k	4			
	Std. Error	96.248	Dep. Var.	Trip Distance/week (Km)			
ANOVA table							
Source	SS	df	MS	F	p-value		
Regression	32,685,217.0645	4	8,171,304.2661	882.07	7.24E-166		
Residual	2,816,173.9841	304	9,263.7302				
Total	35,501,391.0486	308					
Regression output					confidence interval		
variables	Coefficients	std. error	t (df=304)	p-value	95% lower	95% upper	
(No Intercept)	0.0000						
Size	25.8279	3.2568	7.931	4.20E-14	19.4193	32.2366	
Income	-26.2868	12.0257	2.186	.0296	2.6226	49.9510	
Fleet Size	9.7343	12.1069	0.804	.4220	-14.0896	33.5582	
Utils	12.3112	2.1670	5.681	3.13E-08	8.0470	16.5755	

Source: Author's Field Work result generated by MegaStat

Table 9: Regression Analysis for Alagbaka

	R^2	0.912	(Note: No intercept in the model. Interpret R^2 and R with caution.)			
	Adjusted R^2	0.905	n	56		
	R	0.955	k	4		
	Std. Error	106.163	Dep. Var.	**Trip time (minutes)**		
ANOVA table						
Source	*SS*	*df*	*MS*	*F*	*p-value*	
Regression	6,054,937.2297	4	1,513,734.3074	134.31	9.58E-27	
Residual	586,075.7154	52	11,270.6868			
Total	6,641,012.9451	56				
Regression output					*confidence interval*	
Variables	*coefficients*	*std. error*	*t (df=52)*	*p-value*	*95% lower*	*95% upper*
(No Intercept)						
Size	20.5069	22.9568	0.893	.3758	-25.5593	66.5731
Income	15.8243	21.0214	0.753	.4550	-26.3581	58.0068
Fleet Size	-5.9865	9.6227	-0.622	.5366	-25.2959	13.3229
Utils	27.3750	9.7356	2.812	.0069	7.8391	46.9110

Source: Author's Field Work result generated by MegaStat

Table 10: Regression Analysis for Aule						
	R^2	0.950	(Note: No intercept in the model. Interpret R^2 and R with caution.)			
	Adjusted R^2	0.948	n	106		
	R	0.975	k	4		
	Std. Error	78.502	Dep. Var.	**Trip time (minutes)**		
ANOVA table						
Source	*SS*	*df*	*MS*	*F*	*p-value*	
Regression	11,900,077.1644	4	2,975,019.2911	482.75	2.62E-65	
Residual	628,584.7012	102	6,162.5951			
Total	12,528,661.8656	106				
Regression output					*confidence interval*	
variables	*coefficients*	*std. error*	*t (df=102)*	*p-value*	*95% lower*	*95% upper*
(No Intercept)						
Size	85.0613	8.9774	9.475	1.18E-15	67.2546	102.8680
Income	-8.0774	4.5169	-1.788	.0767	-17.0367	0.8818
Fleet Size	8.3673	5.1206	1.634	.1053	-1.7893	18.5239
Utils	0.3631	4.1072	0.088	.9297	-7.7834	8.5096

Source: Author's Field Work result generated by MegaStat

Table 11: Regression Analysis for Ijapo						
	R^2	0.939	(Note: No intercept in the model. Interpret R^2 and R with caution.)			
	Adjusted R^2	0.936	n	87		
	R	0.969	k	4		
	Std. Error	91.599	Dep. Var.	**Trip time (minutes)**		
ANOVA table						
Source	*SS*	*df*	*MS*	*F*	*p-value*	
Regression	10,681,343.4432	4	2,670,335.8608	318.26	1.79E-49	
Residual	696,404.9484	83	8,390.4211			
Total	11,377,748.3917	87				
Regression output					*confidence interval*	
variables	*coefficients*	*std. error*	*t (df=83)*	*p-value*	*95% lower*	*95% upper*
(No Intercept)						
Size	6.5941	4.8942	1.347	.1815	-3.1403	16.3285
Income	5.9566	6.7506	0.882	.3801	-7.4701	19.3832
Fleet Size	69.2584	20.5242	3.374	.0011	28.4366	110.0802
Utils	1.0869	8.4173	0.129	.8976	-15.6548	17.8286

Source: Author's Field Work result generated by MegaStat

Table 10 presents the regression analysis for Aule Estate. Residents are mainly civil servants and university students residing off-campus. The average household size is four and the income class is four. From the table, household size is significant, which means that the residents will make fewer trips, allowing families to save. This is why the coefficient is negative. Income, fleet size and utils have no effect on the trip distance. See the p-value of the regression in the table below.

Table 11 the regression analysis for Ijapo. The estate is located at the city centre. Fleet size is a significant factor that determined the making of trips by residents of Ijapo Estate because the average household size is large and one should expect that the larger the size of household the more the need to move about. Most of the people are in the income class three so that any trip to be made will be returning to the household a great deal of satisfaction (utility). Income and household size have no effect on trip distance. All this can be seen from the p-value of the regression (see Table 11).

Table 12 presents the regression analysis for Oba-Ile. As can be seen, income and utility were the most significant factors that determined the making of trips by residents of Oba-Ile Estate because the average household size is large in this estate and one should expect that the larger the household, the more the need to move about.

Table 12: Regression Analysis for Oba-Ile

	R^2	0.883	(Note: No intercept in the model. Interpret R^2 and R with caution.)			
	Adjusted R^2	0.876	n	79		
	R	0.940	k	4		
	Std. Error	136.891	Dep. Var.	**Trip time (minutes)**		
ANOVA table						
Source	*SS*	*df*	*MS*	*F*	*p-value*	
Regression	10,575,174.3947	4	2,643,793.5987	141.08	4.29E-34	
Residual	1,405,433.7906	75	18,739.1172			
Total	11,980,608.1853	79				
Regression output					*confidence interval*	
Variables	*coefficients*	*std. error*	*t (df=75)*	*p-value*	*95% lower*	*95% upper*
(No Intercept)						
Size	-4.9382	10.3544	-0.477	.6348	-25.5653	15.6888
Income	30.0659	10.1614	2.959	.0041	9.8233	50.3085
Fleet Size	-9.3348	8.0776	-1.156	.2515	-25.4261	6.7565
Utils	29.0720	4.9257	5.902	9.73E-08	19.2595	38.8846

Source: Author's Field Work result generated by MegaStat

Most of the people are in the income class four; that means the trip to be made will be fewer due to the income level of households in this estate.

Fleet size and household size have no effect on trip distance. All this can be seen from the p-value of the regression (see Table 12).

Table 13 shows that size of the household is the most significant factor that determined the making of trips by residents of Orita-Obele Estate because the average household size is large in this estate and one should expect that the larger the household the more the need to move about.

Table 13: Regression Analysis for Orita-Obele						
	R^2	0.931	(Note: No intercept in the model. Interpret R^2 and R with caution.)			
	Adjusted R^2	0.929	n	177		
	R	0.965	k	4		
	Std. Error	94.254	Dep. Var.	**Trip time (minutes)**		
ANOVA table						
Source	*SS*	*df*	*MS*	*F*	*p-value*	
Regression	20,764,089.3652	4	5,191,022.3413	584.32	2.67E-99	
Residual	1,536,903.3415	173	8,883.8343			
Total	22,300,992.7067	177				
Regression output					*confidence interval*	
variables	*coefficients*	*std. error*	*t (df=173)*	*p-value*	*95% lower*	*95% upper*
(No Intercept)						
Size	48.6073	5.1677	9.406	3.14E-17	38.4075	58.8070
Income	17.3487	6.9822	2.485	.0139	3.5675	31.1299
Fleet Size	-6.6747	4.8296	-1.382	.1687	-16.2073	2.8579
Utils	2.6251	2.4001	1.094	.2756	-2.1122	7.3623

Source: Author's Field Work result generated by MegaStat

Table 14: Regression Analysis for Shagari						
	R^2	0.874	(Note: No intercept in the model. Interpret R^2 and R with caution.)			
	Adjusted R^2	0.872	n	296		
	R	0.935	k	4		
	Std. Error	147.635	Dep. Var.	Trip time (minutes)		
ANOVA table						
Source	SS	df	MS	F	p-value	
Regression	44,219,860.6836	4	11,054,965.1709	507.20	4.70E-130	
Residual	6,364,473.6236	292	21,796.1425			
Total	50,584,334.3072	296				
Regression output					confidence interval	
variables	coefficients	std. error	t (df=292)	p-value	95% lower	95% upper
(No Intercept)	0.0000					
Size	27.5348	4.1145	6.692	1.12E-10	19.4370	35.6327
Income	48.4428	9.3497	5.181	4.12E-07	30.0414	66.8442
Fleet Size	5.9555	5.3595	1.111	.2674	-4.5927	16.5037
Utils	15.4294	2.8365	5.440	1.13E-07	9.8468	21.0121

Source: Author's Field Work result generated by MegaStat

Also most of the people are in income class three so that any trip to be made will be returning to the household a great deal of satisfaction (utility).

Income is another significant factor that affects the making of trips because the greater the income the more the demand for trip. That is why the coefficient is negative. Fleet size and utility have no effect on trip distance. All this can be seen from the p-value of the regression (see Table 13).

5. Conclusion and Recommendations

Ajipowo Estate had the highest number of respondent 308, while Alagbaka the least at 56. Low income estates are more densely populated due to poor family planning. Wealthier estates have larger fleet sizes. However, Shagari Estate with relatively poorer households had the highest number average trip times per household. This can be attributed to the fact that they have more people making aggregated trips (though more individualized per household than any other estate). Aule and Alagbaka had the least average trip time per household because households travel more jointly and commuting distances are the shortest.

Due to their relative distance from centre of town, Oba-Ile residents make sure their every trip made is highly justified and rewarding so that they had the highest average utils per trip. However, Alagbaka made the least total trip distance per week of 18274 km, making them the least fuel consuming residents in Akure at 1412081.82 litres of PMS per week.

Monday is the most important day for most Akure residents going by the value of utility recorded for the day (10 utils) and most of the trip types by households were work-related as they run from Monday to Saturday for most of the residents.

It can be seen that size and utility were the most significant factors that determined trip making by residents of Ajipowo Estate. For Alagbaka, the value of accruable utils was the most significant factor in trip making decisions. For Aule and Orita-Obele Estates, trip making decisions were determined by the size of the family while for Ijapo Estate, it was the size of the fleet. For Oba-Ile residents, it was income and utils. However, for Shagari Estate residents it was household size, income and utils that were the significant factors in their trip decision making.

The following recommendations are hereby made to improve urban travel and accessibility in Akure:

a. There should be an improved public transportation system in the city, with higher capacity vehicles with comfortable seats and cheaper fare and reliable running times, so as to persuade car owners to drop their private vehicles at home and use public transportation systems.
b. The introduction of Mega Schools increases the average trips made by lower income households as they strive to have “better” education for their wards no matter the distance, increasing their expenses on trips. There is, therefore, a need to decentralize the Mega Schools and have more “Mini-Model Schools” built with more geographic spread.
c. The road network in Akure should be improved and existing link roads and streets paved in order to take traffic of the main arteries and reduce trip time and costs.

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