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Trip Generation Models for a Developing City in Nigeria

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ABSTRACT - This study was conducted in Uyo, the capital city of Akwa Ibom State, Nigeria. The objective is to formulate models for estimating future trip generation patterns in the city. To achieve this, relationships among the types of trips generated and the socio-economic parameters of households were established. Household sample survey was conducted and data were obtained from 480 households in 25 communities randomly selected in five demarcated zones within the city. Eight dependent variables and six independent variables were selected for the study. The dependent variables were; work trip, market trip, health trip, school trip, funeral trip, wedding trip, recreational trip and religious trip. Independent variables (socio-economic parameters) were: distance, household size, income, education, occupation and car ownership. Regression models have been formulated for estimation of future worktrips, markets trips, health trips, funeral trips and wedding trip. These models provide the basis for a new urban development policy that will ultimately bring about long term/permanent solution to the chaotic traffic problem usually experienced on the major roads of the city.

Keyword: Models, Trip, Uyo, Nigeria.

INTRODUCTION

Movement is an aspect of regional organisation that has been lightly stressed in human geography. It is important to study the movement patterns of a city because movements of every sort create spatial structures, and once established such spatial arrangements influence subsequent movement. Thus,

spatial arrangements are reciprocally tied to movement processes, Abler (1972).

Basic to any planning is an understanding of materials, Creighton (1972). Materials are viewed here in a broad sense. The engineer for example, must understand not only the strength of the materials used in bridge but also the loads that will be imposed on that bridge. The materials of urban transportation planner include not only the physical ways and vehicles within which people and goods move about but also the trips themselves and the activities which generate the trips.

Trip is an event. Basically it is a journey of a person in an automobile or a transit vehicle to a destination outside the block of trip origin. When we talk about trips the emphasis is on linking origins and destinations. The question why things move from an origin to a destination is explained by the ideas of transferability, complementarity, the relative attractiveness of alternative destinations, the technology needed to overcome distance friction and intervening obstacles to interactions.

Transportation is traditionally a derived demand. This means that, transportation is demanded not as an end in itself but as a means of reaching other socio-economic activities at diverse location in space. Transportation therefore plays a most basic role in spatial organisation and functioning.

Transportation and communication systems are created or improved only after there is a demand which the new systems will satisfy. Transportation improvements foster increased interactions, but are not solely responsible for them. According to Ullman (1956) there are three basic conditions affecting transportation development:

Complementarity

For two places to interact there must be a demand in one place and a supply at another, and the demand and the supply must be specifically complementary. Complementarity is so important as a basis for spatial interaction that even a very low value bulk commodities can move many thousands of kilometers if complementarity conditions are properly met.

Intervening Opportunity

Considering the potential for a movement of persons from place A to place B we have to consider any place C between them which might act as an intervening origin or a alternative destination. In a sense, intervening opportunities are spatial sponges soaking a potential interactions between complementary places. Intervening opportunities do not always curtail long distance interactions; it is entirely possible that a sequence of such

opportunities can help to create interaction between **widely separated areas** by making intermediate transport links profitable and **thereby paying part of** the cost of the link between distance places.

Transferability

Transferability is the friction of distance and is measured in real time and costs. If the time and money costs of traversing the distance are too large; the movement will not take place despite perfect complementarity and the absence of intervening opportunities. Transferability differs between places, between classes of movements and between modes of movements.

Explanation of region's interaction pattern permits social controls and suitable controls can advance the general welfare (Abler et al, 1972). Inside the city interaction potential increases with city size. Usually specialized units occupy different places within a city, and their specific complementarities provide the potential for spatial interaction within the city. When the specialized units are geographically separated, interaction occurs only after distance barriers have been overcome.

In the case of Uyo city, certain important specialized functions, function of leadership, education, religion, recreation, communication, banking and hey trading activities are concentrated only within the city centre. Residential land uses are more prominent in the outer parts of the city but specialized activities are absent. Hence, every household seems to be making trips to the city center for their daily needs. The attraction of trips from all demarcated zones of the city to the city center, thus explains the heavy traffic usually experienced on Ikot Ekpene Road, Abak Road, Aka Road, Oron Road and Nwaniba Road, especially during the hours of 7:30 a.m. – 9:00 a.m.; 12:00 noon – 2:00 p.m; 3:30 p.m – 6:00 p.m. The result has always been reduced traffic flow and chaos where traffic wardens are not present.

This study seeks to establish the pattern of trips as one of its cardinal objectives. The findings will provide the government and the city planning agencies important inputs to solving, in a long term, the urban transportation problem in Uyo.

THE PROBLEM STATEMENT

The movements of people within the city, whether in a motorized mode or non-motorised mode do not occur at random as they appear to be. For example, imagine someone standing at Ibom connection (the city center point of Uyo) where it may be possible to observe the vehicle movements on the arterial roads. One will no doubt observe seemingly random movements of cars, buses, motor cycles, etc. Questions arise as to where, what and why are they going?

Attempt to search for answers reveals that there are patterns of movements. Every household is involved in these movements. Eight basic trips have been identified that people make each day within the city. These are: work trip, market trip, health trip, school trip, funeral trip, wedding trip, recreation trip, and religious trip. The frequency of each of these trips per household per week is likely to be influenced by certain socio-economic parameters such as; distance, household size, income, education, occupation and car ownership. The knowledge of the interrelationship existing between the frequency of trips and the socio-economic parameters of households is needed to estimate future patterns of trip generation in the city.

Solution to the chaotic traffic problem on major roads of the city, requires not haphazard planning actions, but a new urban development policy based on sound knowledge of trip generation patterns.

OBJECTIVES OF THE STUDY

The primary objectives of this study are:

1. To establish the pattern of trips generated in the city of Uyo.
2. To provide models for estimating future trip generation patterns in the city.
3. To identify certain socio-economic parameters of households and their relationship with the trip patterns.

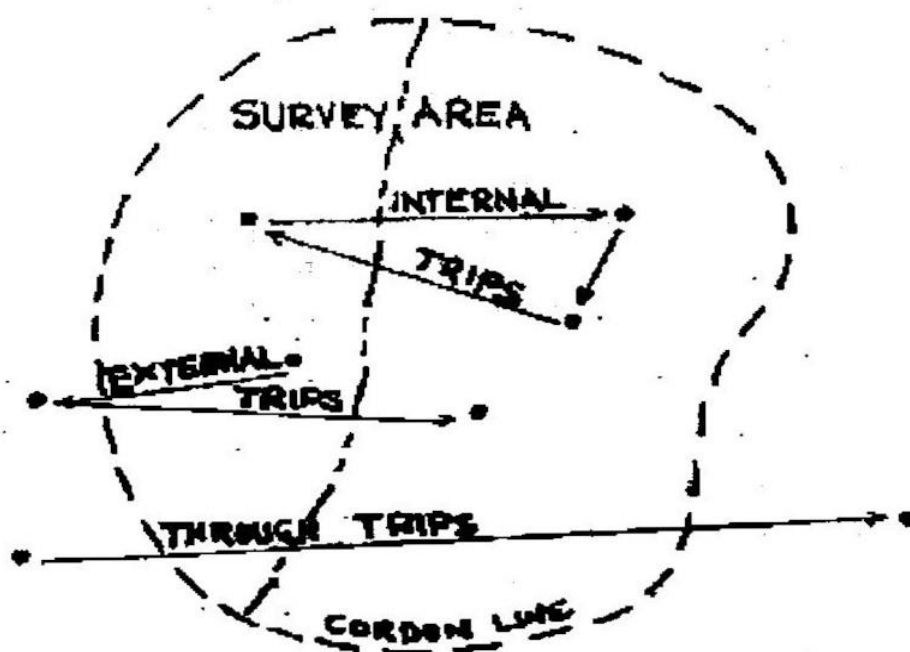


Fig. 1. Category of Trips Made Within a Metropolitan Area
Source: Creighton, R. L. (1972) pg. 154.

LIMITATION OF THE STUDY

In categorizing trips made in a metropolitan area **Crieghton (1972)** identified three basic types of trips:

- (i) External Trips
- (ii) Internal Trips and
- (iii) Through Trips

Internal trips are those whose origin and destinations are both within the survey areas. External trips have at least one end of each trip outside the survey area. While through trips has both origin and destination outside the survey are (Fig. 1)

Due to time and financial constraints, this study is limited only to internal trips whose origins and destinations are within the study area.

THE STUDY AREA

This study is conducted in Uyo, the capital city of Akwa Ibom State. Uyo extends between latitude $7^{\circ}47'$ to $8^{\circ}03'$ East and between Longitude $4^{\circ}52'$ to $5^{\circ}07'$ North. It covers an area of about 985.96 square kilometers and comprises a total of 112 villages (AKS Edict No. 12, 1988). The mean annual temperature in Uyo urban is $80^{\circ}\text{F}/27^{\circ}\text{C}$ with a relative humidity range of 70 to 80 percent and mean rainfall of 2484 millimeters.

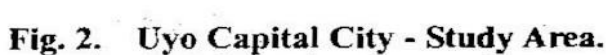
The population of the city was estimated at 279,007 in 1996 (National Population Commission, NPC, 1996 report).

Uyo traffic is a mixture of vehicles at the same time trading thrives on many roadsides. The mixed traffic and the multiple use of right of way creates a continuous hazard to mobility.

LITERATURE REVIEW

Crieghton (1972) defines a trip basically as one-way journey of a person five years of age or older in an automobile or a transit vehicle to a destination outside the block of trip origin. He identified private automobile, buses, taxis, motorcycles and bicycles as the major means of intra-urban travel. According to him, the principal data on trip have been generally gathered by massive origin-destination surveys including home interviews, road side interviews and interviews of the drivers of commercial vehicles.

Ogunjumo (1982) based his study of "The Pattern of Trip Generation in Ilorin" on household survey and disaggregate trip generation technique. He gathered ten socio-economics variables namely; number of worktrips per day by household, annual income of respondents, level of education of respondents, number of people in the household, distance from home to



workplace of respondents and vehicle ownership by household. He correlated all the above mentioned socio-economic parameters with worktrips.

In another related study of Trip Generation in Jos, Nigeria, Ayem (1979) found that the level of education did not contribute much to trips generated at the household level. He also recommended further studies to determine the role of education in trip generation in Nigeria.

Leinbach (1981) in his study of "Travel Characteristics and Mobility Behaviour in Indonesia" analysed the impact of twenty four rural road rehabilitation projects utilizing an "ex-post" household survey technique. He also focused upon spatial mobility as defined by short circulation type movements. These included market trips, relative-kin visits, trips to purchase household goods and visit to health clinics.

As part of the investigation of road impact upon travel behaviour, a correlation analysis of variables was undertaken to test hypotheses concerning the interrelationships among trip length, trip frequency, and minivan usage. Utilizing a standard SPSS routine simple Product Moment Correlations were derived for each pair of variables for each of the samples. The result suggested that the longer the distance the less the trips.

In another study of "Urban Traffic Flow Management As a Strategy for Environmental Safety in Nigerian Cities", Mala (1999) identified four major problems resulting in mobility difficulties in urban centers of Nigeria as follows:

- (i) Intermingling of the landuse.
- (ii) Poor level of planning and the human misuse of the roads combine together to inhibit the smooth flow of traffic.
- (iii) Declining value of Naira and
- (iv) Declining stock of private and public transport vehicles.

Onakomaiya (1981) attributed the traffic congestion along some roads in Nigeria to lack of proper planning. According to him the design of low income class residential areas with narrow and winding street designs, who were not thought of shift in class status to car owning group, have since rendered the planning foresight of professionals untenable.

The pattern of urban trip making in Nigeria showed that the dominant types of trip undertaken in the cities includes work, shopping and recreational trips which together account for seventy five percent of total urban trips (Ogunsanya, 1993). Out of these trips, ninety five percent are done by road using public transport hence congestion and other difficulties of movement are experienced. Oduola (1981) reported that out of the estimated 3.5 million people living in Lagos in 1977, 84 percent of this constitute commuters to work and school.

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In his analysis of the pattern of trips in Ile-Ife, Nigeria again in 1986, Ogunjumo stated that the frequency of urban journey are influenced by the size of household, number of workers in a household and vehicles ownership. He observed that people who own one or more cars have higher rates of travel than non-car owning group. He concluded that the transport problem in Ile-Ife is that of peak hour problem which require some planning.

In Maiduguri, Nigeria, the Dar Al-Handasah Consultant (1981), has analysed the pattern of traffic flow in the city. The consultants recommended the need for regular monitoring of the traffic situation because of the dynamic nature of the city.

CONCEPTUAL CONSIDERATION

The models used in disaggregated (household trip generation in the literature are generally, the growth factor, cross-classification or category analysis and multiple linear regression.

Growth factor model attempts to estimate future number of trip by households for specific purposes by any of specified categories of household attributes based on current trip rates formally.

$$T_i = F_i t_i \dots\dots\dots(1)$$

Where T_i is the future trips in zone i , t_i is the current trips in the same zone, and F_i is the growth factor defined as:

$$F_i = f(p_j^d I_i^d C_i^d) / f(p_j^c I_i^c C_i^c) \dots\dots\dots(2)$$

Where f is direct multiplicative function, P , I , and C are variables such as population, income and car ownership respectively in the function. Superscripts d and c are the future and current situation respectively.

The growth factor assumes the average trip rates will remain constant. Based on this estimate, future number of trip is made. Because of this, the method has been described as crude tending to over estimate total number of trips (Bruton, 1975, p. 91) and therefore better suited for estimating trips ends of external – internal and through movements.

The cross classification or category Analysis Model is similar to the growth factor in that it also attempts to estimate the number of trip productions on household basis for a given trip purpose as a function of household attributes. Furthermore, the model assume that trip generation rates are relatively stable over time for certain household categories. The model in its standard form is:

$$t^p(h) = T^p(h) / H(h) \dots\dots\dots(3)$$

Where $t^p(h)$ is the total average number of trips with purpose p by households of type h at a time period t ; $T^p(h)$ is the observed trips by members of household of type h for a purpose P ; $H(h)$ is the number of households in type h (Ayeeni, 1979).

The cross classification model in its rudimentary form has some drawbacks. The most important are that it has no statistical goodness-of-fit measures and requires extremely large samples of households (Douglas and Lewis, 1971).

The multiple linear regression model in trip generation measures the separate and combined influence of the factors (or household socio-economic variables) on trip production. The model attempts to expose the relative and combined importance of determining factors of trip production on the volume of trips generated. The observed relationship between the latter and the former is then translated into regression models. In mathematical form it is simply as follows:

$$Y_i = a_0 + b_1 x_{t_i} + b_2 x_{2i} + b_3 x_{3i} \dots \dots b_n x_{ni} + e_i$$

Where Y_i = dependent variable – volume at trips generation by household.

$x_{t_i} \dots x_{ni}$ = independent variables – household variables of trip demand.

a_0 = linear regression constant

$b_1 \dots, b_n$ = partial regression coefficients

e_i = error term or residuals

the statistical techniques of 'least square' fitting proves is then applied to estimate the values of the regression coefficient b_1 to b_n and the constant a_0 which best fit the given data.

Generally, the use of regression model is based on some assumptions before it can be productively applied. The basic assumption include normality, linearity, independent variables to be measure error free, no auto-correlation and that samples are randomly selected from the sample frame (Enoh, 1997). Violation of some of these assumptions may result in the equation containing coefficient with theoretically incorrect signs thus limiting the use of such equations in explaining the structure of the pattern under study.

One important advantage of the multiple regression model over others in trip generation modeling is its capacity to allow for dummy variables to be included in the model. A number of household variables are trip generation determinants could not be measured or calibrated at interval, ratio or continuous scale, but in binary or dichotomous forms. The inclusion of the dummy or binary variables in the regression model is a process that increases the

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application of the model and does not cause its estimates to lose any of their properties (Douglas, 1971).

The main drawback of the multiple linear regression model in trip generation has also been discussed by Ayeni (1979).

In this study, the multiple regression model is used in estimating the intra-city trip for two reasons:

1. The ease of inclusion of dummy variables as determinants of households trip demand, and dis-aggregated nature of the data in trip generation as utilized by Ayeni (1979).
2. There is its explanatory function in identifying the socio-economic variables that have statistically significant contributions to the explanation of the independent variables (trips).

RESEARCH METHODOLOGY

The data used in this study were obtained from household survey. The survey followed a pilot survey to determine receptiveness of the respondents to interviews and to ensure that the period of the survey (proper) was devoid of any local or national festivals so that attention could be focused on city residents on household basis. The 500 questionnaires sought information on socio-economic characteristics of household heads such as; gender, age, marital status, household size, income level, education level, employment status and automobile ownership. All possible trips were carefully divided into eight purposes namely; work, school, market, health, funeral, wedding, recreation and religious trips.

The city was divided into five circular zones. In each zone, five communities were selected. A total of twenty-five communities were selected. The selection of the communities was based on the Akwa Ibom State Edict No. 13 of 1988. The Edict contains the names of the 112 communities that comprise Uyo capital city and these communities were regarded as sampling frame for the study. They were coded 001 to 112, then entering to table of random numbers column 20-24 was unbiasedly picked with two eyes closed. It was from this column that the 25 communities were selected., five in each zone using their code numbers. Twenty households were sampled in each community.

TECHNIQUES OF ANALYSIS

Stepwise multiple linear regression analysis was used to measure relationships among the dependent and independent variables. The independent variables are:

- | | | |
|----------------|---------------------|--------------------|
| (i) Distance | (ii) Household size | (iii) Income |
| (iv) Education | (v) Occupation | (vi) Car ownership |

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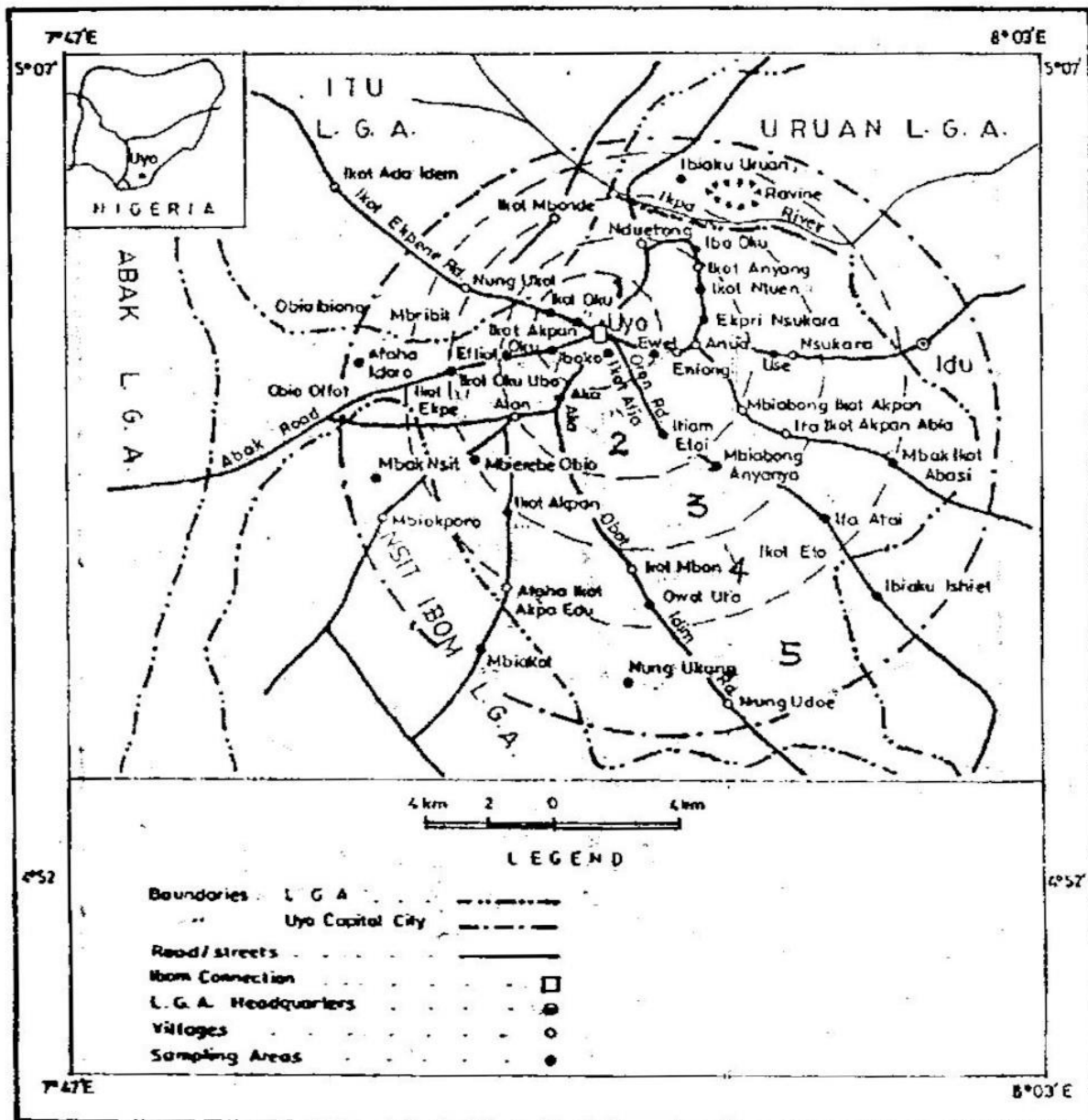


Fig. 4. Uyo Capital City showing Sampling Areas

The dependent variables are:

- | | | |
|----------------------|------------------|--------------------------|
| (i) Work trip | (ii) Market trip | (iii) Health trip |
| (iv) School trip | (v) Wedding trip | (vi) Recreation trip and |
| (vii) Religious trip | | |

During the process of the analysis some independent variables were dropped. In the case of school trip and recreation trip, all the independent variables were dropped because they lack statistical significance to trips. Hence no regression model could be formulated for school trip (Y_4) and recreation trip (Y_7).

PRESENTATION OF DATA, ANALYSIS AND DISCUSSION

Table 1 shows the array of the processed data obtained from the field survey of the five demarcated zones of the city. The data is divided into two sections; the dependent variables and the independent variables.

TRIP GENERATION MODELS

Work Trip

A total of 858 work trips were recorded weekly and they account for 37.5 percent of all trips generated. A substantial level of correlation (0.651) exists between worktrip and car ownership. The regression coefficient of -.362 indicates a small but moderate negative relationship between work trip and occupation. This means that the higher the level of occupation the less the work trip made. There is no meaningful relationship between work trip and distance (-0.070). This may be true because 61 percent of sample were self-employed. Many therefore have their work places either in their homes or near the home. Hence they record no work trip.

Using stepwise multiple regression computer analysis the following model has been derived for work trip (Y_1):

$$\text{Work trip} = 53.338 + 5.253 (\text{car ownership}) - 15.74 (\text{occupation})$$

As seen in the above equation, two of the six independent variables are selected because of their significance in explaining changes in the work trip, 65 percent and 36 percent respectively.

Market Trip

Market trip accounts for 40.3 percent of trips generated weekly with a total of 920. A substantial negative relationship (-.517) exists between market trip and distance, indicating a decrease in market trip to the city center with increased distance. The existence of local community markets in each zone limits vehicular trip to the city center for shopping.

Table 1: Data Obtained for Dependent and Independent Variables in the 25 Communities

DEPENDENT VARIABLES								INDEPENDENT VARIABLES							
S/N	Market Trip (Y ₁)	Health Trip (Y ₂)	School Trip (Y ₃)	Federal Trip (Y ₄)	Wedding Trip (Y ₅)	Social Trip (Y ₆)	Religious Trip (Y ₇)	Total	Distance (X ₁)	Household (X ₂)	Income (X ₃)	Education (X ₄)	Occupation (X ₅)	Car Ownership	
1	18	0	16	0	2	2	0	34	1.5km	8	1	1.2	3.0	0	ZONE 1 88
2	38	4	0	2	4	2	4	64		4	1	1.2	2.7	0	
3	64	4	4	2	4	0	2	108		4	1	1.2	2.4	0	
4	8	0	0	0	0	0	0	58		6	1	1.2	2.7	0	
5	24	102	0	4	0	0	1	180	2.5km	6	2	1.2	2.1	0	ZONE 2 97
6	60	16	20	2	8	0	0	128		3	2	2.0	2.6	3	
7	42	2	0	0	0	0	0	78		5	1	1.4	2.6	2	
8	90	0	0	0	2	0	0	94		2	1	1.7	2.4	0	
9	64	2	20	0	0	0	4	104	5.5km	6	1	1.7	2.6	4	ZONE 3 98
10	16	0	0	0	0	0	0	52		4	1	1.5	1.7	0	
11	60	2	10	0	2	2	0	90		6	1	1.4	3.0	4	
12	24	2	10	0	2	2	0	50		7	1	1.25	3.0	0	
13	18	2	0	0	0	0	0	90	9.5km	8	1	1.2	3.0	4	ZONE 4 98
14	34	0	6	2	0	0	0	40		6	1	1.2	3.0	0	
15	18	0	0	2	0	0	0	34		7	1	1.0	3.0	0	
16	106	8	80	2	2	0	8	290		7	1	1.5	2.7	2	
17	80	2	0	0	2	0	0	144	12.5km	4	2	2.25	1.6	2	ZONE 5 99
18	18	2	10	0	0	0	0	50		8	1	0.7	3.0	1	
19	26	2	0	0	2	0	4	114		7	1	1.2	3.0	3	
20	40	6	20	0	6	6	18	182		4	2	2.1	2.2	6	
21	20	0	0	0	0	0	0	20	TOTAL	6	1	0.8	3.0	0	37
22	36	0	20	0	0	0	0	58		5	1	6.7	3.0	0	
23	64	3	30	0	0	0	0	90		3	1	0.7	3.0	0	
24	20	0	0	0	0	0	0	104		3	2	1.87	1.6	5	
25	18	3	0	0	0	0	0	18		4	1	1.8	3.0	0	
	920	162	230	22	36	14	42	2284		133	30	35.3	65		

Source: Author's Field Work (2002)

Table 2: Regression Coefficients Matrix of Trips and Socio-economic Indices of Households

TRIPS	Socio-Economic Parameters					
	Distance	Household Size X_2	Income X_3	Education X_4	Occupation X_5	Car Ownership X_6
Work trip	-.070	-.007	.164	.164	-.362*	.651*
Market trip	-.517*	-.171	.021	.205	-.059	-.056
Health trip	.347	.267	.473*	-.269	.120	-.320
School trip	-.25	.14	-.04	.05	.12	.15
Funeral trip	-.186	.107	.505*	-.062	.206	-.015
Wedding trip	-.055	-.163	.176	.445*	.259	.077
Recreation trip	-.19	-.008	.24	.25	-.02	.38
Religious trip	-.316	-.039	.048	.095	-.017	.512

*Significant Coefficient at 0.05 level of significance

Source: Computed from Author's Field Data (2002)

It should be expected that market trip and household size would have a high positive correlation. This is because more persons in a household increases consumption level and that ordinarily would demand more market trips. To the contrary, the coefficient of -.171 shows no meaningful relationship. Again, the existence of zonal market explains this phenomenon. The following simple regression model is therefore derived for market trip:

$$\text{Market trips} = 30.284 - 1.7 (\text{Distance})$$

Health Trip

A total of 162 health trips were recorded. This accounts for 7.1 percent of all trips. There is a small but moderate level of correlation (.473) between health trip and income. This indicates that health trip increases with increased income. Low income families seldom visit clinic/hospital, instead local drug shops and traditional healing homes suffice.

Income was selected as the only variable having statistically significant contributions to the explanation of changes in health trip. The health trip model is as follows:

$$\text{Health trips} = 16.556 + 16.250 (\text{Income})$$

School Trip

School trip accounts for only 10.10 percent of the total trips generated with 230 weekly total. However, no variable was selected as significantly contributing to variation in school trip. This is probably due to the fact that both primary and secondary institutions are located almost in all the communities sampled. Hence, majority of pupils and students attend schools located nearer. This is a good development but more attention should be

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given to the maintenance of these schools and to update their learning and teaching facilities.

Funeral Trip

Funeral trip recorded 22 weekly total, 0.96 percent of trips generated. Again, only income was selected among other variables as significant in explaining changes in funeral trip. With the coefficient of .505, income accounts for about 50 percent variation in funeral trip. Consequently, the following simple regression model is derived:

$$\text{Funeral trips} = 1.128 + 1.289 (\text{Income})$$

Wedding Trip

Wedding trip accounts for 1.6 percent, with 36 weekly total. Education is selected as the only significant variable with standardized regression coefficient of .445, explaining about 44 percent of variation in wedding trip. Other variables are dropped as insignificant. Therefore, regression model for wedding trip is derived as follows:

$$\text{Wedding trips} = 1.433 + 1.548 (\text{Education})$$

Recreation Trip

Only 14 was recorded for recreation trip, this is 0.6 percent of total weekly trips generated in the city. No socio-economic parameter was selected as significant in explaining recreation trip hence no model could be formulated. The low generation of recreation trip may be the result of unavailability of parks and recreational open spaces of Uyo (Enoh, 1996).

Religious Trip

A total of 42 trips was recorded for religion. This represents 1.84 percent of the over all trips generated. Car ownership was selected as the only variable significant in explaining variation in religious trip with coefficient of .512. This means only households that own car(s) afford to move outside the block of residence to attend religious service of choice on the one hand or choice of residence may be determined among other things by the location of religious body of choice in the block of residence. From the analysis, future pattern of religious trip can be estimated using the following model:

$$\text{Religious trips} = 5.638 + .718 (\text{car ownership})$$

CONCLUSION AND RECOMMENDATION

This study has identified the patterns of trip generated in Uyo. The analysis shows that market trip is the highest generated trip in the city. It accounts for 40.3 percent of all intra-city trips. It is followed by work trip, accounting for 37.5 percent. These two types of trips accounted for about 80 percent of intra-city trips in the study area. Journey for recreation was as low as 0.6 percent, and it represents the least of the intra-city trips: This probably is as a result of the fact that not much concern has been shown by either the state government or the Uyo Capital City Development Authority or Uyo Local Government in the development of recreational activities in Uyo urban. Thus the recommendation made by Enoh (1996) which recommended the creation of parks and recreation board charged with the responsibilities of providing recreation facilities to the citizens of Uyo is upheld.

The analysis also shows that socio-economic characteristics of the households are important determinants of intra-city trips generation. The study thus gives insight into the effects of the household characteristics in intra-city trip generation. Changes in these determinants would definitely affect trip rates and consequently the types and level of services to be provided by the intra-city transport operators.

The models formulated in the study provide future interaction bases that must be followed by appropriate planning decisions such as:

- (i) Widening of Oron road, Aka road and Abak road to become dual carriage roads.
- (ii) Decentralising specialized functions of education, communication, and key trading activities from the city center to other zones of the capital city.
- (iii) Develop satellite towns around the city.
- (iv) Provide for the city appropriate infrastructures, amenities and recreation facilities.

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