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Mode Choice Analysis for Working and Non-Working Days of Aluva Town

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Abstract: **Travel behavior of the people plays an important role in transportation planning in an urban environment. The behavioral 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. This study is conducted in Aluva Corporation areas and method used to collect data was household surveys. The details of activities in one working day and one non working day of households are taken. The data obtained from survey has analyzed. NLOGIT 4.0 software has been used for building the mode choice model.**

Keywords: **Activity Based Approach, Mode Choice, Multinomial Logit Model, NLOGIT.**

I. INTRODUCTION

Transportation in urban areas is highly complex because of the various modes involved, and the amount and variety of traffic. In this particular scenario mode choice plays a key factor in transportation planning. Mode choice analysis, the third step in the Conventional transportation planning process, is an important component in a traveler‟s decision making process. It is the process of arriving at a decision about which mode to use under a set of circumstances. Future travel demand can only be estimated knowing the shares of different modes. This study is an effort to understand the various factors influencing the mode choice in the study area and then to develop mode choice models for the study area.

II. LITERATURE REVIEW

Mode choice analysis is the third step of the classical four- step transport planning process, coming after trip generation, which explains the level of trip making, trip distribution and relative frequency of trip lengths. Future transportation pattern can only be accurately forecast, if the motivations that guide the traveller in his choice of transport modes can be analyzed. The activity-based approach requires time-use survey data for analysis and destination. A time-use survey entails the collection of data regarding all activities (in home and out-of-home) pursued by individuals over the course of a day (or multiple days). Mode choice can be influenced by different factors. Mode choice analysis is the process of arriving at a decision about the mode availed of by the public in a particular set of circumstances. The examination of both in-home and out-of-home activities facilitates an understanding of how individuals substitute out-of-home activities for in-home activities (or vice-versa) in response to changing travel conditions. This, in turn, translates to an understanding of when trips are generated or suppressed. It is important to note that administrating time-use surveys is similar to administrating household travel surveys, except for collection of in-home as well as out of-home activities. The information elicited from respondents is a little more extensive in time-use surveys compared totravel surveys, but experience suggests that the respondent burden or response rates are not significantly different between time-use and travel surveys.

The activity-based approach does require more careful and extensive preparation of data to construct entire "sequences" of activities and travel. On the other hand, such intensive scrutiny of data helps identify data inconsistencies which might go unchecked in the trip-based approach .For example, there might be "gaps" in an individual's travel diary because of non-reporting of several trips, these will be identified during data preparation for activity analysis, but may not be identified in the trip-based approach since it highlights individual trips and not the sequence between trips and activities.

III. STUDY AREA

We have choosen our study area as Aluva. Aluva, is a suburb of Kochi in the Ernakulamdistrict of Kerala, India.Located on the River Periyar, Aluva is the industrial epicenter of the state. A major transportation hub, with easy access to all major forms of transportation, Aluva acts as a corridor which links the highland districts to the rest of the state. It is the starting point of Kochi metro rail under construction.

IV. DATA COLLECTION

Household survey was used to collect data. The study required data regarding household characteristics, economic status, and trip characteristics. Household characteristics include gender and family size. Economic status includes their annual income, floor area, educational qualification, type and number of owned vehicle. Trip characteristics include purpose of trip, origin, destination, mode they used. Mode is categorized walk, two wheeler, auto rickshaw, bus, car and cycle. These variables can be used in the model formulation to develop suitable mode choice models. We have collected 150 samples from Aluva.

V. MULTINOMIAL LOGIT MODELS

The MultiNomial Logistic (MNL) model structure has been widely used for both urban and intercity mode choice models primarily due to its simple mathematical form, ease of estimation and interpretation, and the ability to add or remove choice alternatives. The general expression for the probability of choosing an alternative „*i*" (*i = 1,2,.., J*) from a set of *J* alternatives is:

$$Pr(i)=exp(vi)/(\Sigma\ )$$

Where Pr (*i*) is the probability of the decision-maker choosing alternative *i* and Vj is the systematic component of the utility of alternative j. A term relating to the subject mode i appear as the numerator and the summation of the similar terms corresponding to all competing modes is placed in the denominator. This specification ensures that all trips that have been assigned to the available modes. NLOGIT software was used for modeling. The multinomial logit model, has served as the basic platform for discrete choice modeling for decades. Among its restrictive features is its inability to capture individual choice specific variation due to unobserved factors. The error components logit model, has emerged as a form that allows this. In a repeated choice (panel data) situation, this will play the role of a type of random effects model.

VI. NLOGIT SOFTWARE

NLOGIT is a major suite of programs for the estimation of discrete choice models. It is originally an extension of the multinomial logit model. The program, itself, consists of a special set of estimation and analysis routines, specifically for this class of models and style of analysis. *LIMDEP* provides the foundation for *NLOGIT*, including the full set of tools used for setting up the data, such as importing data files, transforming variables (e.g., **CREATE**), and so on. *NLOGIT* is created by adding a set of capabilities to *LIMDEP*. The estimation results produced by *NLOGIT* look essentially the same as by *LIMDEP*, but at various points, there are differences that are characteristic of this type of modeling.

VII. PRELIMINARY ANALYSIS

From Table I it is clear that car is the major mode used for work trips by all people above age 21. Cycle is not used for work trip.

Table I. Mode Distribution of Work Trips Based on Age

Age	<21	21-30	31-40	41-50	51-60	>60
Walk	0%	6.9%	9%	11%	14.8%	26.3%
Two wheeler	100%	38%	17.8%	21.8%	14.8%	5.2%
Auto	0%	0%	0%	7.8%	11.11%	0%
Bus	0%	17.1%	23.2%	18.75%	26%	21%
Cycle	0%	0%	0%	0%	0%	0%
Car	0%	38%	50%	40.6%	33.33%	47.36%

Table II shows that,car is the major mode choice for distances above 5 km. For smaller distances walk and two wheeler are the major modes.

Table II. Mode Distribution of Work Trips Based on Distance

Distance(km)	<5	5-10	10-20	20-40	>40
Walk	30.31%	0%	0%	0%	0%
Two wheeler	31.65%	24.32%	19.44%	0%	0%
Auto	7.6%	5.4%	0%	0%	0%
Bus	7.6%	32.43%	25%	25%	50%
Cycle	0%	0%	0%	0%	0%
Car	22.78%	37.85%	55.56%	75%	50%

As per Table III, all employees except daily waged people has an affinity towards two wheeler and car.

Table III. Mode Distribution of Work Trips Based on Occupation

Employment status	Government employee	Private employee	Self employee	Daily waged
Walk	12.5%	7.1%	13.8%	75%
Two wheeler	27.5%	17.4%	31%	0%
Auto	2.5%	3%	6.8%	0%
Bus	22.5%	21.5%	13.8%	25%
Cycle	0%	0%	0%	0%
Car	35%	51%	34.6%	0%

Table IV shows that children below 14 years prefer school bus and students above 18 prefer two wheeler and bus.

Table IV. Mode Distribution of Educational Trips Based on Age

Age	<10	10-13	14-17	18-21	>21
Walk	12.5%	10%	20.9%	3.6%	0%
Two wheeler	0%	0%	0%	42.9%	53.4%
Auto	15.6%	13.5%	0%	0%	0%
Bus	0%	3.3%	50%	50%	40%
Cycle	0%	20%	12.5%	3.5%	0%
Car	2.9%	6.6%	8.3%	0%	6.6%
School bus	50%	46.6%	8.3%	0%	0%

From Table V it is clear that distance is a major factor in selecting mode for educational trip.

Table V. Mode Distribution of Educational Trips Based on Distance

Distance(km)	<2	2-5	5-8	>6
Walk	36.4%	22.2%	0%	0%
Two wheeler	9.1%	2.22%	9.1%	39.5%
Auto	9.1%	8.9%	15.2%	0%
Bus	0%	13.3%	33.4%	23.3%
Cycle	9.1%	15.6%	12.1%	0%
Car	18.15%	6.7%	12.1%	7%
School bus	18.15%	31.7%	18.1%	30.2%

Table VI shows that car is the major mode used for shopping trips by all employed persons.

Table VI. Mode Distribution of Shopping Trips Based on Occupation

Government employee	Private employee	Self employee	Daily waged
Walk	15.1%	17.1%	24.5%	33.3%
Two wheeler	12.1%	20%	24.5%	0%
Auto	9.1%	11.4%	7.6%	0%
Bus	6.1%	7.2%	5.7%	33.3%

Cycle	0%	0%	1.9%	0%
Car	57.6%	44.3%	35.8%	33.3%

Table VII shows that walk and bus are the major modes used by daily waged people.

Table VII. Mode Distribution of Religious Trips Based on Occupation

Government employee	Private employee	Self employee	Daily waged
Walk	41.6%	37.5%	35.7%	50%
Two wheeler	8.4%	2.5%	17.9%	0%
Auto	8.4%	2.5%	0%	0%
Bus	0%	0%	3.6%	50%
Car	57.6%	57.5%	42.8%	0%

Table VII shows that two wheeler and car are the major mode choice for higher income groups.

Table VIII. Mode Distribution of Trips Based on Monthly Income

Income	Walk	Two wheeler	Auto	Bus	Car	Cycle
<10000	36.2%	0%	0%	63.8%	0%	0%
10001- 50000	4.7%	43.5%	3.8%	14.2%	31.8%	1.3%
50001-100000	0.7%	31.6%	1.9%	6.3%	59.5%	0%
>100000	0%	46%	0%	0%	54%	0%

Table IX. Trip Distribution in Working and Non-Working days

Purpose	Work	Education	Shopping	Recreation	Medical	Religious	Others
Working days	47%	29%	12%	0%	1%	6%	2%
Non working days	5%	8%	25%	13%	4%	11%	23%

VIII. MODEL DEVELOPMENT

Table IX. Working Days Parameter Estimates

Variable	Coefficient	Standard Error
BTWTT	-0.25848519	0.11641088
BTWTC	-0.25851044	0.17933250
BBUSTT	0.00413932	0.01288464
BBUSTC	-0.01360546	0.02282393
BCARTT	-0.00257539	0.03149386
BCARTC	-0.01593385	0.02204346
BWALKTT	0.00290025	0.00154905
BCYCTT	0.00719886	0.00370564
BAUTOTT	-0.01518788	0.04553902
BAUTOTC	-0.00219259	0.00692032
BSBTT	-0.01993497	0.01333015

Table X. Non Working Days Parameter Estimates

Variable	Coefficient	Standard Error
BTWTT	-0.28774521	0.08722124
BTWTC	-0.02184749	0.14542640
BBUSTT	-0.05211847	0.02863096
BBUSTC	-0.00278677	0.04739637
BCARTT	-0.07276079	0.12191798
BCARTC	-0.03301225	0.07186196

BWALKTT	-0.00032203	0.00399373
BAUTOTT	-0.01015023	0.02091401
BAUTOTC	0.00179771	0.00237050

TT represents travel time and TC represents travel cost for different modes.

IX. CONCLUSION

For work trips most of the people prefer bus. Even if the travel time increases people prefer bus because travel cost is less. Car is more preferred than two wheeler. Walk and cycle are also preferred. During non working days Auto is the more preferred mode. Walk is also preferred. Compared with two wheeler, car is more preferred for shopping, recreation and religious purposes during non working days.

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