

Estimation of Travel demand from the city commuter region of Muvattupuzha municipal area

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Abstract: Transportation is a vital infrastructure facility for the economic development of a country. The estimation of accurate trip generation is imperative for a realistic planning programme. The idea in this paper is to prepare a trip generation model to explain the travel demand from settlements falling under commuting distance of an urban area.

Keywords: Category, Muvattupuzha, Tools, Travel, Urban

I.INTRODUCTION

Transportation is a vital infrastructure facility for the economic development of a country. The movement of men or materials i.e., transport, as a service, is a derived demand. Between the two basic components of transport demand, freight and passenger traffic, there exists a serious dilemma for the planner to develop an optimal transportation system for the nation. Efficient land and location planning can help in optimization of transport effort to the effect that it promotes. Dispersal of economic activities and residential opportunities to reduce the movements. For any transportation planning process, the first stage is a survey and analysis, which establishes the present demand for travel and a relationship to explain that in terms of causal variables. The estimation of accurate trip generation is imperative for a realistic planning programme.

The idea in this study is to prepare a trip generation model to explain the travel demand from settlements falling under commuting distance of an urban area. The commuter region of Muvattupuzha has been chosen as the study area. This paper is organised as follows: Section I includes the introduction. Section II describes the study area and the procedure for conduct of physical surveys. Travel Characteristic study and model development for the study region are the subject matters of section III. Section IV explains the development of category curves. Trip attraction model is explained in Section V. Section VI gives the deficiency estimate of bus operation. Last section VII concludes the paper followed by references

A. *Need for Development of a Systematic Procedure for Estimating Travel demand from a city commuter region*

Regions consist of heterogeneous units like cities, towns and villages which are fundamentally interrelated. The functional relationships are usually revealed in the form of flows like economic flows (passenger and cargo movements), social flows (flow of students for education number of patients visiting a hospital etc.), political flows and information flows (news paper, telephone calls, telegrams). In transportation planning it is assumed that flows take place from lower order centres to higher order centres. Researchers in the study of daily and weekly activity patterns of various households have shown that there are certain movement hierarchies. The movements can be in the order: neighbourhood, community centre district centre and regional centre. This indicates the need for a systematic procedure to estimate travel from a city commuter region to city centre.

B. *Tools and techniques*

Trip generation includes both production and attraction. Following are the usual methods of trip generation models.

1. Zonal regression method
2. Household regression method
3. Category analysis
4. Person trip models

In the present study category analysis for predicting trip production from the city commuter region and household level regression model for predicting trips attracted to city centre are recommended.

C. Objectives Of study

The following are the objectives

- i) To conduct survey of local bus passengers and delineate the city commuter region
- ii) To design the survey Performa and to conduct the home interview survey.
- iii) To study some of the travel characteristics of households.
- iv) To develop category curves to explain intra regional and total trips from the study area.
- v) To build a household level model to explain the trips attracted to the city centre from it's commuter region.
- vi) To prepare a deficiency estimate of the present day bus operation from Muvattupuzha centre.

II. DESIGN OF A SURVEY QUESTIONNAIRE AND DESCRIPTION OF STUDY AREA

In Urban area, the trip rate is more than that in a city commuter region. There may be trips every day from a household in an urban area. But, in a city commuter region, sometimes a trip may be made once in two or three days or even months. Public transportation is the mode of travel used for travel to the city centre. Average trip distances are longer.

A Design of Questionnaire for Conduct of survey

The first step towards the formulation of transportation plan is to collect data to assist in the crystallization of facts and figures, the interpretation of which will lead to a more realistic forecasting of travel patterns. Transportation planning requires specific information of the current travel patterns of the area being studied. They should include the characteristics of trips by purpose, length, time of day, land activity at trip ends etc. The principal surveys of travel characteristics can be classified according to how data are obtained:

- I) At the home base
- ii) In the course of the trip
- iii) At non home base

Data are invariably obtained by the use of some form of interviewing technique although there are methods, providing only limited data which do not involve interviews. The study should indicate all possible trips in a study area. In the present study it was decided to conduct home interview survey to obtain travel and socio-economic characteristics of the dwellers. A questionnaire for conducting the household survey had to be designed to get the particulars. Whatever be the technique used the design of forms and the framing of questions is of great importance to the success of the survey. Questions should always be objective in style, clear and unambiguous and designed to enable answers to be classified into predetermined groups. The objectives of the survey are to be kept in mind in deciding the questionnaire. In the case of transportation planning, the objectives are to identify travel characteristics and relating these travel characteristics to land use and socio economic characteristics of a trip maker, at trip ends, and preparation of model split ratios and assignment of trips to various roads in the area accordingly the questionnaire should bring out the Information. The questionnaire designed consisted of two parts. While, in Part I household information was collected.

B Description of the Study area

The commuter region of Muvattupuzha centre is selected as the study area. Muvattupuzha is about 43 km South-East of Cochin, on the main central road. It is the Taluk headquarter as well as a revenue divisional head quarter. The activities in the study area are mostly confined to agriculture. There are five main routes from Muvattupuzha. To determine the boundary of the commuter region, a survey was conducted in local buses on each route and the places to which 90% of the travellers commute were found out by drawing cumulative curves.

C Conduct of Home Interview Survey

For the present study, a representative sample of dwelling units was selected and personal interviews were conducted on each member of the household above 5 years of age. This information is collected through the questionnaire. About 300 households were interviewed so as to ensure sufficient coverage of all socioeconomic groups. Random sampling technique was adapted for selecting the households

III. TRAVEL CHARACTERISTIC STUDIES

Transportation planning requires specific information of the current travel patterns of the area being studied. They should include the characteristics of trips by purpose, length, time of day, land activity at trip ends etc. About 300 households have been interviewed in this study. It is proposed to classify the information gathered so as to get some insight into the travel behaviour of the travellers from the study area. The following are some of the characteristics of dwellers as obtained from the analysis of home interview survey data:

- 1) Average number of persons per house hold - 5.6
- 2) Number of trips / house hold/day - 2.3
- 3) Per capita trip rate / day - 0.41
- 4) 34 per cent of the families have income range between Rs. 5000 – 10,000 per month.

- 5) 60 per cent of household have 4 to 5 trip makers.
- 6) 45 per cent of households have 2 employees
- 7) 50 per cent of families have no vehicle, 30 per cent have one vehicle and 20 per cent have 2 vehicles.
- 8) It can be seen that the predominant mode of travel is bus constituting nearly 52 per cent of total trips. Walk trips constitute 21 per cent.
- 9) 45 per cent of trips are made for work purpose, while, 42 percent of trips are performed for education.
- 10) Only 13 percent of trips are for other purposes.

IV. DEVELOPMENT OF CATEGORY CURVES

Only trip generation stage is relevant in the transportation planning of a city commuter region. In trip generation analysis, relationships are established between the number of trips produced by, and attracted to, a given zone. Trips are always said to be produced by the zone at the home end of the trip regardless of whether it originated or terminated at the home end. For the purpose of trip generation and other models, trips are stratified by trip purpose categories. The reason for doing this is that the trip making behaviour of individuals differs for different trip purpose. Three most significant determinants of trip production are family size, car ownership and average income of the head of the household. US Dot procedure for category analysis is recommended in this study. For the purpose of analysis, household monthly income is classified in the following ranges.

- (i) Rs. 0 -5000
- (ii) Rs.5001 – 10,000
- (iii) Rs.10001 – 15,000
- (iv) Rs.15001 – 20,000
- (v) Rs.20,001 – 25,000
- (vi) Rs.25,001 – 30,000
- (vii) Rs.30,001 – 35,000
- (viii) Rs.35,001 – 40,000

Vehicle ownership levels assumed are as follows.

- i) No vehicles
- ii) Car owners
- iii) Scooter owners

Different trip purposes considered for study were:

- i) Home based work trips (HBW)
- ii) Home based education trips (HBE)
- iii) Home based other trips (HBO)

Using the data from home interview survey category curves was developed. Category curves have been developed both for intra regional and total trips (Fig 1.)

A. Findings From Category Analysis

Following are the inferences drawn from, the category curves developed.

- 1 For high income class, work trip rates are higher followed by Educational trips. For low income class, Educational trips are higher. This establishes the fact that most of the travel is mainly for work and Educational purposes.
- 2 Trips rates are higher for scooter owners when compared with other vehicle ownership categories.

The adequacy of the category model was tested by taking 50 households. The standard error expressed as a percentage is obtained as 8.34

V. DEVELOPMENT OF HOUSEHOLD LEVEL TRIP ATTRACTION MODEL FOR THE NODAL CENTRE.

An attempt has been made to develop a trip attraction model which will explain the number of trips which are attracted to Muvattupuzha nodal centre from different settlements falling under its own commuter region. The model developed has been used to work out the present day deficiency of bus operation from Muvattupuzha centre. The form of the model proposed in the study was

$\text{Trips/household} = b_0 + b_1 (\text{employees/household}) + b_2 (\text{cars/household}) + b_3 (\text{total member/household})$

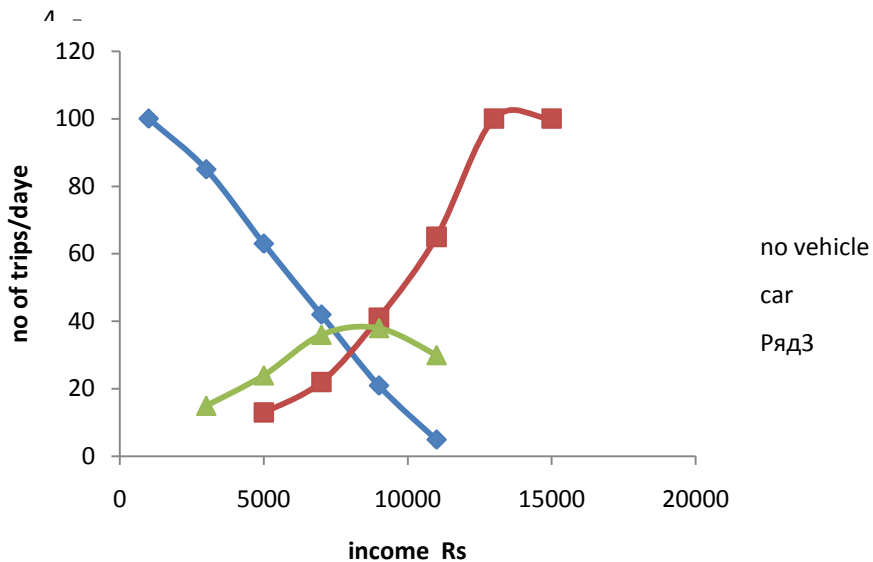
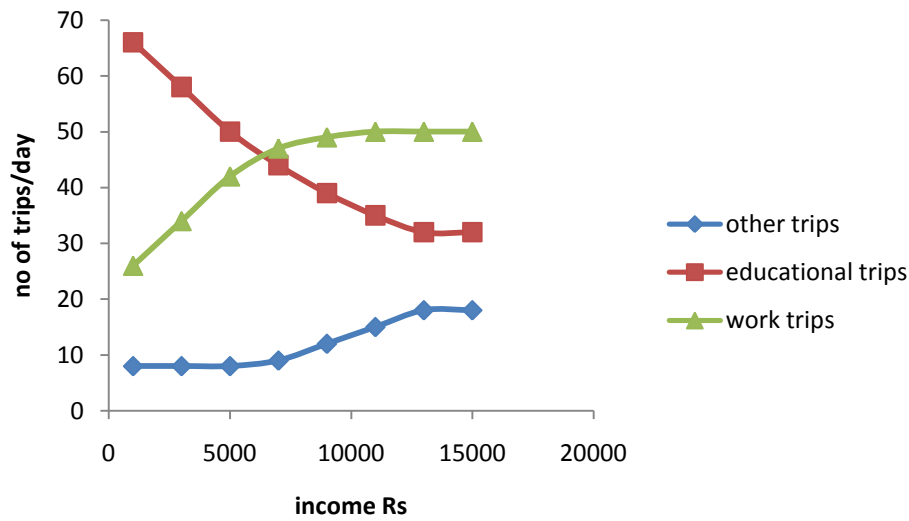


Fig.1 Category curves

VI. DEFICIENCY ESTIMATE OF THE PRESENT DAY BUS OPERATION FROM MUVATTUPUZHA CENTRE

Making use of the equations developed a deficiency estimate of the present day bus operation from Muvattupuzha centre has been worked out. For this purpose, the daily trips from each zone to Muvattupuzha centre is worked out using the equations developed. From ‘Way Bill Register’ average daily collection and 30th highest collection were found out. Peaking ratio for calculation of design daily demand was calculated by dividing the 30th highest collection by the average collection. A peaking ratio of 1.29 was obtained. A peak hour factor of 25 per cent was selected. Daily demand from each zone was then multiplied by the peaking ratio and the peak hour factor. Taking the bus occupancy as 60, the number of bus trips .required was calculated.

VII. CONCLUSION

The main objective of this thesis was to develop a procedure for estimating trip generations from settlements falling under commuting distance of an urban area. For this purpose, the commuting region of Muvattupuzha urban area was chosen as the test bed. A survey was conducted in local buses and based on the surveys conducted the commuter region of Muvattupuzha Home interview surveys were conducted in the delineated area. From category analysis curves developed it was found that for high income group, work trip rates are higher followed by education trips. For low income class, on the other hand, educational trips are higher. Scooter owners have been found to make more trips than others. Category analysis, which bases its predictions on the assumption that the trip generation rates exhibited today

by different classes of households will hold good in the future was found to give a fair degree of accuracy in short-term estimates of future trip generation. Five sets of mathematical models have been built in this study to explain the trips attracted to Muvattupuzha centre. In all the models developed, the R^2 value was found to be between 0.67 and 0.83. Based on the models developed, a deficiency estimate of the number of bus trips as at present has been prepared. From this it has been noticed that many of the settlements in the commuter region of Muvattupuzha centre are deficient in the number of bus trips. Analysis of this nature using category analysis technique leading to the development of trip production models has been carried out for the first time for Muvattupuzha and it is hoped that the findings of the study would be useful to Road Transport Corporation.

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