

## GENERATION AND ANALYSIS OF TRIP GENERATION MODEL FOR THODUPUZHA MUNICIPALITY

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**Abstract** - Efficient travel systems are the brand of a developed city. Systematic approaches to traffic problems could easily lead to efficient transport systems. As in the case of the municipality of Thodupuzha, one of the largest cities in the Idukki district, the demand for travel gradually increases each year due to its importance as a gateway to holiday destinations. In the coming years, current traffic systems may not be able to fully cover this growing mandate. Therefore, this study is an attempt to understand incoming traffic to the city on its own. The study was carried out in the municipal region of Thodupuzha. About 15 departments have been studied. Data collection was based on face-to-face interviews. Questionnaires were prepared for each household and data collected. The linear regression model was created with the help of the Statistical Package for the Social Sciences (SPSS) package (v.23). Templates have been created and validated. About 600 families were able to provide details of the trip.

**Key Words:** Trip generation, statistical Package for the Social Sciences (SPSS), Regression models

### 1. INTRODUCTION

Transport is the movement of people, animals and goods from one place to another. Passenger transport may be public if operators provide operational or private services. Bulk transportation is used for large volumes of durable items. An important aspect of transport is economic activity. Transportation availability helps determine the location and success of economic activity. Most industries require raw materials and access to transportation to maintain a steady profit. Employees and residents require a method of traveling back and forth to work.

Well-developed transportation methods, such as rail systems and interstate highways, promote economic activity. Improving access to developed transport increases activity in both rural and urban environments. Transportation is a significant aspect of life that allows products or passengers to go to places and conduct business. Most companies require some kind of transportation for day-to-day operations, and companies that have minimal transportation options often experience a decline in business. Commercial companies wishing to access a high volume of customers must offer an accessible location from multiple forms of transportation. Transport plays an important role in economic growth and globalization, but most types cause air pollution and use large amounts of land. While heavily subsidized by governments, good transport planning is essential for traffic to flow and slow uncontrolled urban expansion. A mode of transport is a solution that uses a particular type of vehicle, infrastructure and operation. The transport of a person or cargo may involve one or more modes

of transport, the latter is called intermodal or multimodal transport. Each mode has its advantages and disadvantages and will be chosen for a trip based on cost, capacity and route. In trip generation, we process and estimate the total number of trips generated and attracted by each area unit (zone) in conjunction with the land use and the socio-economic characteristics of each zone. Travel generation modeling helps you achieve maximum space usage and efficient traffic. In addition, it helps to reach the full growth potential of a city.

### 2. METHODOLOGY

The methodology of the study began with the selection of the site. A questionnaire has been prepared for the collection of secondary data. Primary data were collected by the municipal office of Thodupuzha. Data analysis was performed with the help of Microsoft Excel and the software package named SPSS. Several models have been generated, including dependent and independent variables. The data correlated and factors were found depending on total travel and other forms of travel. After the models were created, they were validated using the t-test. Achievable results were taken for the final evaluation.

#### 2.1 Study Area

The Thodupuzha is a city in the Indian state of Kerala. The selection of the study area plays an important role in finding out the travel behaviour of the commuters. Thodupuzha Municipality is divided into 32 wards for which elections are held every 5 years. It has a population of 52045 which 25563 are males while 26482 are females as per report released by Census India 2011. Out of the 32 wards, 15 wards were selected randomly for data collection. Study area concentrated on core business and residential area of Thodupuzha Municipality.

#### 2.2 Questionnaire Design

A good design of questionnaire will ensure better response from the respondent and will significantly improve the quality of data. Design of questionnaire is more of an art than a science. The questionnaire should be simple and direct. Traditional household survey has three major sections; household characteristics, personal characteristics, and trip details. A questionnaire for household survey was designed by including four sections; household characteristics, personal characteristics, trip details and willingness to shift details.

#### 2.3 Sample Size Calculation

It is impractical and unnecessary to interview all the residents

of the study area. Since travel patterns tend to be uniform in a particular zone, it is sufficient if a sampling procedure is employed. The size of the sample is usually determined on the basis of the population of the study area, and the standards of the Bureau of Public Roads (B.P.R) are often used. The sample is selected in an unbiased way from the register of elector's or valuation list. A number of techniques are available for the home-interview survey. The full interview technique involves interviewing as many members of the households as possible and directly recording all the information. In the home questionnaire technique the interviewer collect only details of the household characteristics, leaving forms for household residents to complete in regard to travel information. The above technique is more speedy and it may be possible to cover about 20 household per day. Since the population of Thodupuzha municipality is 52045 which is under 1,50,000 and thus the sample size is selected as 1 in 20 households.

## 2.4 Data Collection

The details of the population and the map of the area were collected by the municipal office of the selected area. Using the designed questionnaire, the data collection method was implemented through the home interview survey. 600 home samples were collected from the study area consisting of a total of 2027 individuals. A random sampling method was used for the sampling technique. This data can identify the current behavior of the trip and also reveal factors that influence the mode selection.

## 2.4 Data Entry and Coding

The data collected from the respondents through the questionnaire survey was fed into the computer and appropriate statistical analysis will be carried out. The analysis includes coding and sorting of the input data. This sorted data will be processed in the form of tables and charts. The sorting and processing of the coded data will be done using Microsoft Excel. The important socio-economic characteristics such as age, gender, monthly income, vehicle ownership, purpose of trip, occupation were analyzed. This data may identify current travel behaviour of employees in Thodupuzha and also reveals factors affecting the generation of trips. Descriptive statistics on the demographic profile of employees will be tabulated.

Vehicle selection based on gender is another result which is of great importance. More than 20% of female use two wheelers. Above 70% of the male select two wheelers for its convenience and cost efficiency. College students & students of age 18-30 choose two wheelers. It was discovered in the study that two wheelers were the most popular in the population under study. About 60% of females used Auto rickshaws. Below 40% of population of males used auto rickshaw. More than 50% of males were using cars as a medium. More than 50% of population of males used buses as a cost-effective way.

Choice of vehicle among the various age groups is an interesting area of study. The choice of mode selection within age groups shown some surprising results. below 18 seemed more inclined towards bus transport while 26-55 hugely favoured two wheelers. Bus transport was also favoured by older citizens. Age group above 55 heavily relied on auto

rickshaws. Along with cars for security and minimal risk transport.

For the sample size put under study 63% was married while 37% were unmarried. Marriage status although may seem unrelated to traffic it does affect the traffic. Families always travel in bulk and may choose a car rather than any other vehicle.

## 2.5 Development of models

The linear regression model was formulated using the data from 600 households. From that 400 households were considered for model building and the rest 200 samples were kept for validation. Here each household is treated as an observation. Using the primary data collected, the socio-economic details such as household monthly income, vehicle ownership, number of employees in house, household size and the details such as people under different age categories were sorted and coded for each house.

The total trip in that area is categories as different trips. For that trips were categorised into purpose wise. Here trips are classified into six according to their purpose. They are

- i. Work trip
- ii. Educational trip
- iii. Recreational trip
- iv. Shopping trip
- v. Other trips

The religion trips, social trips and other personal trips were included in 'other trips'.

## 3. MODEL RESULTS

### 3.1 Trip Generation Model for All Trips

The total trips generated per household per day as dependent variable and other parameters such as household monthly income, number of vehicle ownership, number of employees in household, number of licenced person in house and also different age group is conceded as the independent factors. And a linear regression models were formulated.

$$T = -3.476 - 0.547A + 2.996B + 5.103C + 2.848D + 4.573E + 0.045G + 2.719H$$

T = Number of trips generated per household per day A= House hold size.

B= No. of vehicles per house

C= No. of persons in house in age(4-18).

D= No. of persons in house in age (19-30).

E= No. of persons in house in age (31-55). F= No. of persons in house in age above 55 G= No. of licenced person in house

H= monthly income of house.

By analysis the linear regression model for trip production, it is found that trip production rate is mainly depends on no. of persons in age group 4-18, age group 31-55, persons above age 55, age group in 19-30. The trip production also influenced by other factors it has only less significance than any other parameters. House hold size is independent on trip. That means if house hold size increases there is no considerable increase in trips in the studied area.

Overall model fit

The overall model fit is seemed good since  $R^2 = 0.79$  which means 79% of the variance of the dependent variables can be explained by the model. (Shown in table 1)

Table 1 Model Summary of Total Trips Produced

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.889 <sup>a</sup>	.790	.736	4.048

### 3.2 Trip Generation Model for Work Trip

While considering the work trip the age group below 19 is not taken. Here the work trip model were built by taking total number of work trip generated in each house is taken as the depended variable and other parameters such as household size, different age group (above 19) is taken as the in depended variables

$$Tw = -0.542 + 1.052 * A + .857 * B + .471 * C - .031 * D + .194 * E + .530 * F$$

Tw= Number of work trip in each house

A = No. of persons in house in age (19-30). B = No. of persons in house in age (31-55). C = No. of persons in house in age above 55 D = Household size

E = Household vehicles ownership. F = Monthly income of each house.

The total work trip in that area is highly influenced by the age group 19-30. The production of work trip in not depending the house hold size. The work is also greatly influenced by age group 31-55, age above 55, monthly income. And household vehicle ownership is found to have less significance when compare to other parameters.

Overall model fit

The model is acceptable since  $R^2 = 0.540$  which means 54% of the variance of dependent variables can be explained by the model. (Shown in table 2)

Table 2 Model summary of Work Trips Produced

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.735 <sup>a</sup>	.54	.505	1.24

## 4. CONCLUSIONS

Trip generation models formulated using SPSS v.23 were based on linear regression analysis. Numerous models were developed. One was a model for total trip production in the area and other for work trips that were made from the area. From the models that was created it was evident that the domestic transport in the area widely depended on economic situation, employment, vehicle ownership...etc.

## REFERENCES

- [1]Oyedepo, Olugbenga Joseph., Makinde, Oluyemisi Opeyemi.,(2010). "Regression Model of Household Trip Generation of Ado-Ekiti Township in Nigeria", European Journal of Scientific Research,vol.(28),pp. pp.132-140
- [2]Yang, Shuo.,et al.,(2016). "The Research on Prediction Models for Urban Family Member Trip generation", KSCE Journal of Civil Engineering
- [3]Kim, Hye-Ran.,et al.,(2012). "Commuter's Behavioral Differences in Activity Generation and Scheduling between the Activity Types", KSCE Journal of Civil Engineering,vol.(16),pp. 1040-1047
- [4]Kitamura, Ryuichi.,(2010). "A dynamic model system of household car ownership,trip generation, and modal split: model development and simulation experiment", Transportation,vol.(36),pp.711-732
- [5]Noland,Robert.,Smart, Micheal.,Guo,Ziye.,(2016). "Bikeshare trip generation in New York City", Transportation Research, vol.33,pp.164-181
- [6]Tivan,Guang.,Ewing,Reid.,Rachel,Weinberger,Shively.,Kevin.,Stinger,Preston.,Ham idi,shima.,(2106). "Trip and parking generation at transit-oriented developments: a case study of Redmond TOD, Seattle region", Springer Science+Business Media,pp.16-30
- [7] Alexander, Lauren.,Shan, Jiang.,Murga, Mikel.,González, Marta C. ,(2016). "Origin- destination trips by purpose and time of day inferred from mobile phone data", Transportation Research, pp.150-164
- [8] Handy,Susan.,(2016). "Trip generation: Introduction to the special section", The journal of transport and land use, pp.1-4

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