Travel Demand Modeling Techniques

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Abstract— Transportation plays important role in the economy of any country. The GDP rate of any country is increases due to efficient road network. The urban transportation planning process depends on four stage travel demand forecasting models. The four steps are Trip Generation, Trip distribution, Modal split analysis and route assignment. This four step travel models are considered as four stage modeling method. Arising with the day, a person starts its first trip from walking. Then a number of trips are generated by a person during whole day. The aspect of this paper is to introduce basic four stage travel demand process which is very useful for urban planners. The basic literature related to each stage is discussed in very brief in this paper.

**Key words:** Travel Demand Modeling, Travel Demand Modeling Techniques

I. INTRODUCTION

Travel demand modeling technique is known as four step urban transportation planning process. The first stage is known as Trip Generation, second is Trip distribution, third stage is Modal split analysis and forth one is Traffic or Route assignment. In everyday number of trips are generated from study area. To understand the travel and trip pattern in our study area we requires knowledge of basic methods of Urban planning. So this travel demand methods helps urban planners to study the various parameters which are helpful like trip behavior of individuals, trip pattern, trip generation rates, mode choice or selection of mode (private, Para transit or public) for making trips, and choice of route or path. There are numerous factors like socio economic characteristics, economic characteristics of people which is considered as major factor for trip generation. The following figure 1 indicates four stage of Urban planning process methods.

![Fig. 1: Four stage of Urban Planning Process](image)

II. TRIP GENERATION

Trip generation is first step in travel demand modeling process. It is the analysis and model building phase starts with the first step commonly. Trip generation means how many number of trips ends in given study area. It is classified in terms of “Production” and “Attractions”. It is also define as origin and destination points. As an urban Transport planner our first step is to select study area. We can able to analyze the total number of trips ends in our study area by conducting different types of surveys. We can take the help of house hold survey methods and origin and destination survey methods. So in the trip generation, we can find the total number of trips generated as well as attracted in our study area. Here the meaning of terms “ORIGIN” means the point from which trip will starts and “DESTINATION” means point at which trip ends. The O-D surveys are very helpful to collect the basic data for trip generation rate.

Now most important part is factors affecting trip generation. The socio economic factors are the basic factors affecting trip generation rates. It includes house hold size, house hold structure, income, vehicle ownership, age of person making trip and their education. The land use factors like distance of destination place from origin distance of CBD, types and condition of road, types of study area and residential density etc. For instance the residential density is higher the number of dwelling units, residential plots, apartments, flats are higher. Then it produces very high rate of trip generation. Trip generation rate is also depends on type of travel mode, distance of trip and travel time.

III. TRIP DISTRIBUTION

The decision to travel for a given purpose is called trip generation. While the decision to choose destination from origin is directional distribution of trips forms the second stage of travel demand modeling. Trip distribution is determined by the number of trip ends originated in zone I to number of trips end attracted to zone j, which can be understood by the matrix between zones. The matrix is called origin destination matrix. The following figure indicates typical O-D matrix.

![Fig. 2: O-D Matrix](image)

A. Trip Distribution Models

The various trip distribution models are listed below which is growth factor models, synthetic models and opportunity models. Growth factor models are sub classified as Unifirm growth factor model, average growth factor model, fratar model, detroit model and doubly constrained growth factor models.

![Fig. 3: Trip Matrix](image)
Synthetic models are sub classified as Gravity models, opportunity models, intervening opportunities models and competing opportunities models.

IV. MODAL SPLIT ANALYSIS

The third stage in travel demand modeling is modal split. It is determined by number of trips of people processes by the different mode of travel. In other words, modal split sub model of travel demand modeling is used to distribute total travel demand in two or more mode categories. These categories are public transport riders and personal/private vehicle riders.

Modal split analysis means selection of mode for trip purpose. There are basically most famous mode among people are public transport vehicles like auto rickshaw, van, taxi, GSRTC buses and BRTS or Vitcos which works as public transportation modes. Similarly another is private vehicles like bicycle, two wheelers, three wheelers and car. The selection of specified mode for trip is depends on individual person. After finding trip generation rates and trip distribution pattern in study area, urban planner can able to study mode choice selection pattern for given study area. The most important factors are socio economic factors which are responsible for mode choice analysis. These factors are income, vehicle ownership, house hold size, residence location etc. The another factors are vehicle time, waiting time, travel time, travel cost, transfer time etc.

The mathematical tools to understand the mode choice behaviour in study area are Probit analysis and logit analysis techniques.

V. ROUTE ASSIGNMENT OR TRAFFIC ASSIGNMENT

It is the fourth and final phase of transportation planning modeling techniques. The trip is directly depends on distance between origin and destination points. The shortest route having less distance as compared to other route is selected as minimum path for travel. So here travellers will choose the route which takes minimum travel time, minimum travel distance dependent on the traffic volume on the road. The following are commonly used traffic assignment techniques:

1) All or nothing assignment models
2) Multiple route assignment models
3) Capacity restraint assignment models
4) Capacity retrain multipath route assignment models
5) Diversion curves restraint models

So, in the hand of Urban planner these are four stage modeling techniques which is used to find present trip generation pattern in given study area, forecasting of future trip distribution matrix from collected O-D matrix data base, selection of mode either public or private for trip and selection of shortest path and route for making trip.

REFERENCES