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Trip Generation and Distribution Model for Madurai City

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Abstract:
The aim of transportation planning is to perform a conditional predication of travel demand in order to ameliorate the inefficiencies of the existing transport systems such as congestion, delays and accidents and to provide new transportation facility or improving existing facility which will enhance the operating conditions of the future traffic flows, where they are expected to overload the network. To reduce inefficiencies of the existing transport systems travel demand forecasting method is essential. Ring and radial road pattern is followed in most of major and medium sized cities. These roads carry heavy traffic as they are the major links used by vehicle users to travel from and to the CBD. The task of managing the traffic in major corridors has become a very challenging task in recent years. Though it gives comfort to road user, have generate certain problems like congestion, lack of safety, degeneration of environment.

The situation already becomes unmanageable in many cities. In order to understand the nature of this problems and formulate proposals for the safe and efficient movement of people and goods, transportation planning is important. But, to develop such plan, to study the characteristics of study area in detail will be need to know the travel pattern of the traffic. This travel demand forecasting can be adequately applied to medium sized cities like Madurai to avoid the future chaos in terms of traffic movements. It consists of four stages namely trip generation, trip distribution, modal split and trip assignment. In the trip generation phase, relationships are established to estimate the number of trips produced by or attracted to a given zone.

These trips are distributed as trip interchanges to various zones in the trip distribution stage.The main aim of this study is to develop travel demand modeling for the existing and forecasted situations. The review of literature is presented under the titles of trip generation method, trip distribution method. Data collection can be broadly classified as primary data and secondary data. The primary data consists of household data, Origin-Destination data and traffic volume data. The secondary data includes capacity of road network, details of road inventory and road maps. After the data collection, it is analysed using various software such as trip generation models are developed using Multiple Regression Method in SPSS software. Trip Distributions O-D Matrix are also generated using SPSS. Once the models are developed it is calibrated, validated and various scenarios are to be formulated for analysis. The best scenario will be recommend to enhance the quality of operation of traffic for improving the existing situation.

Index Terms:
About four key words or phrases in alphabetical order, separated by commas.

INTRODUCTION:

1 GENERAL:

The concern about the report is to discuss as detailed as possible on trip generation and distribution rates in Madurai. Increase population, transportation volume have impact and affect the people. The primary objective for improving traffic flow is to enhance the efficiency of the existing roadway system and therefore to alleviate traffic congestion and related problems such as air pollution.

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Other factors motivating their implementation include financial difficulties in supporting new major transportation projects, and the environmental and physical constraints associated with new infrastructure construction. Moreover, there has been a growing recognition that implementing programs consisting of several interrelated traffic flow enhancement strategies can lead to substantial reductions in travel time and delay. The transportation-related problems of many of today's cities stem from a number of interrelated factors. Growing urban populations and increasing household in- comes have led to a rise in motor vehicle ownership, which in turn has created a greater propensity for travel and a demand for more roads.In addition, the forecasts of such growth are also important for decision-making in trip frequency, trip dis- tribution, modal choice and route choice, as in general people who own a car tend to travel more frequently, make longer journeys and are reluctant to switch to other modes. These issues are in turn important for making forecasts of traffic and travel demand at the national level. Transport system has been satisfying the demands of the techno centered society which has ever growing population. India, one of the fast developing nations, has well equipped self-sufficient transport system which caters to the needs of people by way of air, water and earth. Transportation system in India has been the unavoidable contributory factor for the development of the nation. The interstate and intrastate transport facilities bridge the gap between languages, cultures and societies.

1.1.1TRIP GENERATION:

Trip generation is defined as the number of individual trips generated in a given period of time. The purpose of this stage is to predict the total number of trips which are generated from and attracted to each zone in the study area.Trip generation is the first phase of the classical 'four-stage' transport model.

1.1.2 TRIP DISTRIBUTION:

Trip distribution is defined "The number of trips generated in every zone under the study area has to be distributed to the various zones in which there trips are attracted.

1.1.3TRIP GENERATION AND DISTRIBUTION MODEL:

The purpose of this stage is to predict the total number of trips which are generated from and attracted to each zone in the study area. Trip generation and distribution analysis provides the means for relating the number of trips in any zone to its land-use and socio-economic characteristics such as land use intensity, characteristics of activities and location within the urban environment. Trip generation and distribution model attempt to identify and quantify the trip ends related to various urban activities without taking into account other trip characteristics such as direction, length or duration. The main reason for this is that logistic regression predicts probabilities rather than the total number of trips. In order to be able to model trip generation using logistic regression, the number of trips (trip frequency) can be treated as a set of mutually exclusive categorical variables; therefore the built-in upper and lower limits are incorporated.

Therefore, it is not possible to predict a negative number of trips and the estimates of the model will show the underlying probabilities for the actual number of trips. This will also provide a behavioral framework that directly links the number of trips to utility-based consumer and decision-making theory. Logistic regression can be used to model trip generation as binary, multinomial or nested logit frameworks. An added advantage of using this approach is the ability to predict the frequency and number of trips made by each individual. In transport modeling, 'trip' or 'journey' (both terms are used Interchangeably here) is a one-way movement from a point of origin to a point of destination A Home-Based (HB) Trip is one where the home of the trip maker is either the origin or the destination of the trip and a Non-Home-Based (NHB) Trip is, conversely, one where neither end of the trip is the home of the traveller.

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Trip Generation is often defined as the total number of trips generated by households or individuals, be they HB or NHB. A Trip Production is defined as the home end of an HB trip or as the origin of an NHB trip and a Trip Attraction is normally defined as the non-home end of an HB trip or the destination of an NHB trip.

1.1.4 FACTORS INFLUENCING TRIP GENERATION

1.1.4.1Land-Use Factors / Area Type / Location Variable

Location reflects the surrounding environment and should ideally measure the spatial separation of households from each of the amenities which they desire, e.g. schools, shops and workplaces. Different uses of land produce different trip generation characteristics. For the purposes of trip generation, the significant land uses include:

• Residential land use, which can be represented in terms of acres of

residential land, number of dwelling units, number of dwelling units'per

acre, number of persons per acre, or total population.

• Commercial and industrial land use, which can be expressed as the

numbers employed per unit area of land and the amount of floor space

occupied.

1.1.4.2The Social-Economic Characteristics OfThe Population

The social-economic characteristics of the population could be expected to produce different movement demands. For example, factory or manual workers could be expected to produce quite different movement characteristics to executive clerical workers. Schuldiner indicated that a trip generation

model based on socio-economic characteristics held some promise. However Taylor showed that for all modes of travel and a range of journey purposes there appears to be little relationship between the zonal socio-economic characteristics examined by him and trip generation.

1.1.4.3 The Degree Of Urbanization:

The degree of urbanization exhibited by an area can be used to represent the level of integration of the household in the local community. Schuldiner found in his analysis of data relating to Chicago that the index of urbanization, which he derived based on fertility rate, female labour participation rate and the incidence of single family dwellings, appeared to exert a significant effect on trip generation rates. The measure of the degree of urbanization often used is distance from the central area. The argument for the use of this factor is that characteristics of the population and development, and hence the movement demand, change with distance from the central area. For example, within the central area residential development may consist largely of 'temporary' hotel, 16 flat and boarding-house accommodation occupied by young, single or transient persons, while the outer suburbs may consist large of single family dwelling units occupied by married couple with families.

1.3 PROJECT STUDY AREA:

The area selected for this project work is Madurai city. Madurai is located in the south west part of Tamil Nadu. The district is bounded by the Dindigul, Pudukottai, Sivagangai, Virudunagar and Theni districts. Madurai city is about 100 meters above mean sea level. Geographically the city is located on 9°55’ north latitude and 78°7’east longitude. Madurai city is well connected by road, rail and air. Figure 1 shows the location of the project town. Madurai.Municipal Corporation, covering 51.96 sq.kms, comprises of a total population of 928,869 persons, whereas the Madurai Urban Agglomeration comprising the city and surrounding settlements accommodates a population of 11,94,665 persons.

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Table 1.1 Project Study Area Zone Details

ZONE – 1	ZONE – 2	ZONE – 3	ZONE – 4
Santhi Nagar	Thiruppaalai	Swami Sannidhi	Pazhangaanatham
Koodal Nagar	Kannanendhal	Ismailpuram	Sundarajapuram
Anaiyur	Parasuraamanpatti	Sourashtra Hr. Sec. School	Madurai Baskaradass Nagar
Sambandhar Alankulam	Karpaga Nagar	Pangajam Colony	Perumal Theppakulam
B.B.Kulam	Uthangudi	Mariamman Theppakulam	Krishnarayar Theppakulam
Meenambalpura M	Masthaanpatti	Iraavadhanallur	Tamilsangam
Kailaasapuram	Melamadai	SinnaAnuppanadi	SokkanadharKovil
Vilangudi	Tahsildhar Nagar	Anuppanadi	North Krishnan Kovil
Thathaneri	Vandiyur	Chinthamani	MeenakshiKovil
Aarappalayam	Saathamangala M	Meenakshi Nagar	JadamuniKovil
Ponnaharam	Arignar Anna Nagar	Avaniyaapuram	Kaajimar Street
Krishnaapalaya M	Madhichiyam	VillapuramPudhu Nagar	Subramaniapuram
Azhagaradi	Aazhwarpuram	Kathirvel Nagar	SolaiAzhagupuram
Viswasapuri	Sellur	Villaapuram	Jaihindpuram
Melapponnahara M	Pandhalkudi	Keeraithurai	Veerakali Amman Kovil
Railway Colony	Goripalayam	SappaniKovil	Thennaharam
Ellis Nagar	Ahimsapuram	South Krishnan Kovil	Kovalan Nagar
S.S.Colony	Narimedu	Manjanakara Street	T.V.S.Nagar
Ponmeni	Chokkikulam	Dhrowpathi Amman Kovil	Paamban Swami Nagar
Arasaradi Othakkadai	Tallakulam	St.Marys	Mannar College
Bethaniyapuram	K.K.Nagar	Kaamarajapuram	Thirupparamkundra M
Kochadai	Pudur	Balaranganathapura M	Haarvipatti
Visalakshi Nagar	Lourdhu Nagar	Navarathinapuram	Thirunahar
	Reserve Line	Lakshmipuram	Balaji Nagar
	Aathikulam	ThirumalaiNaicker Mahal	Muthuramalingapura M

Fig 1.1 Project Study Area Map

Table 1.3Zone Wise Distribution Of MMC

ZONE-WISE DISTRIBUTION OF MMC

DETAILS	ZONE 1	ZONE 2	ZONE 3	ZONE 4	TOTAL
WARDS (NOS.)	23	26	25	26	100
WARD LIST	1 TO 23	24 TO 49	50 TO 74	75 TO 100	1 TO 100
AREA (SQ. KM)	37.35	46.94	27.01	36.7	148

1.3.1 IDENTIFIED PROBLEMS

Like any other metropolitan cities in India, Madurai also faces many transport problems. Low travel speed, high accident rate involving fatalities and increased vehicular pollution are mainly due to:

- Congestion and pollution has caused increasing governmental and public concerns about urban development
- Problems related to land use planning (urban sprawl) to some degree.
- Considerable waste of time and the related costs, since in congested places both noise and atmospheric emission of hazardous substances increase.
- Urban congestion may be reduced by changing the modal split in favor of public transport and eco-friendly forms of travel (such as biking and walking).
- Frequent traffic jams at numerous road intersections;
- Very high number of auto rickshaws', share autos
- Increases in vehicle volume.
- Delays in signal.
- Parking problems.
- Increasing the density of residential areas.

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- Social-economic characteristics of the population.
- The degree of urbanization.

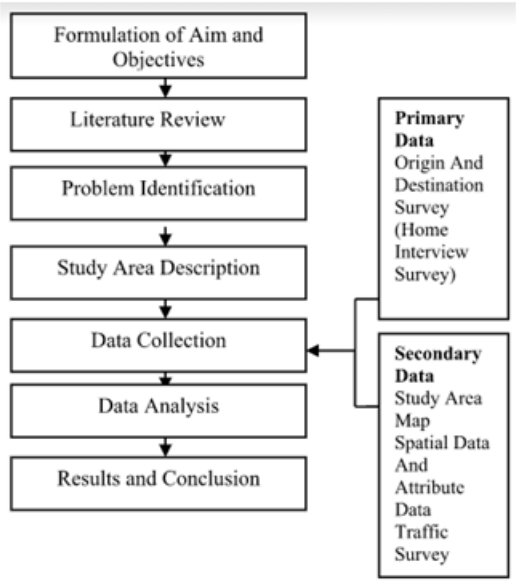
1.4AIM:

To determine the trip generation and distribution rates in the study area and creating the transport model for considering future scenario.

1.5 OBJECTIVES:

- To identify the trip attraction and trip production zones
- To analyze the household structure and residential characteristics of the study area
- To measures the mobility such as travel time, travel distance and trip frequency.
- To improve the safety of travel
- To analyze the trip generation and distribution rates

CHAPTER 2
METHODOLOGY



2.1 IDENTIFICATION OF FACTORS GOVERNING TRIP GENERATION AND ATTRACTION RATES

- Income
- Car ownership
- Family size and composition
- Land use characteristics
- Distance of zone from the down centre
- Accessibility
- Employment opportunities

2.2DATA COLLECTION

2.2.1 HOUSEHOLD SURVEY

2.2.1.1 CHALLENGES

Designing a questionnaire that includes detailed information on intermodal trips has two main challenges. First, the survey should collect duration, distance, mode and sequence of each stage without losing the information on the overall trip. Hence, one main task is to maintain the concept of the "main transport mode" and add information on access and egress stages. This ensures comparability to other existing surveys. Our goal is to get reliable results from a representative sample in the project region. Beyond the use of socio-demographic statistics like age and income distribution for assessing the sample, it is also important to evaluate the reported trip data and compare it to existing surveys. As our survey is the first intermodal trip survey in the project region, the trip data has to be comparable to conventional surveys in Germany which use the concept of "main transport mode". Second, the complexity of the survey should be minimised in order not to confuse survey participants. The need for further comprehensive information leads to an increasing number of questions that participants have to answer. However, the questionnaire should not be overloaded with too many questions.

2.2.1.2. SURVEY METHOD

Traditional household surveys which aim to collect information about people's travel behaviour use trip diaries. The participants are asked to fill out the trip diaries. Usually such trip diaries are paper based (PAPI) and sent out by mail. Intermodal trip collection needs more comprehensive information – each stage of an intermodal trip has to be reported like a conventional trip.

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Due to this increasing need for information and the increasing time expenditure for participants reporting intermodal trips, it is hard to incorporate an intermodal household survey with PAPI methods without confusing the participant with too many questions or possibilities to fill in. Hence, our intermodal survey is web-based. It is designed in a sequential way with a smart filter management. The respondents only answer questions which fit with their intermodal travel behaviour. The drawback of using web-based survey methods is the risk of getting an overrepresentation of younger persons. Since our goal is to get reliable data for a representative sample in the project region of the Madurai area, we wanted to avoid such a biased age distribution in the sample.

2.3 DATA COLLECTED LOCATIONS

Fig.2.2 Zone 1 Ward Map

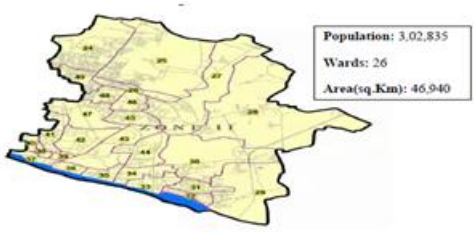

Fig.2.3 Zone 2 Ward Map

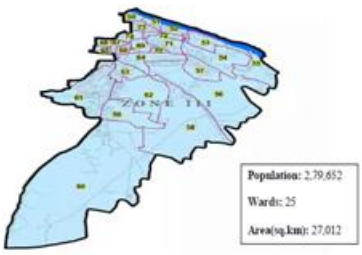

Fig 2.4 Zone 3 Ward Map

Fig.2.5 Zone 4 Ward Map

Table2.1 Selected Ward For Survey Samples

ZONE – 1	ZONE – 2	ZONE - 3	ZONE – 4
Santhi Nagar	Thiruppaalai	Swami Sannidhi	**Pazhangaanatham**
Koodal Nagar	Kannanendhal	Ismailpuram	Sundarajapuram
Anaiyur	Parasuraamanpa Tti	Sourashtra Hr. Sec. School	Madurai Baskaradass Nagar
Sambandhar Alankulam	Karpaga Nagar	**Pangajam Colony**	Perumal Theppakulam
B.B.Kulam	Uthangudi	**Mariamman Theppakulam**	Krishnarayar Theppakulam
Meenambalpura M	Masthaanpatti	Iraavadhanallur	Tamilsangam
Kailaasapuram	Melamadai	**SinnaAnuppanadi**	SokkanadharKovil
Vilangudi	Tahsildhar Nagar	Anuppanadi	North Krishnan Kovil
Thathaneri	Vandiyur	Chinthamani	MeenakshiKovil
Aarappalayam	Saathamangala M	Meenakshi Nagar	JadamuniKovil
Ponnaharam	Arignar Anna Nagar	Avaniyaapuram	Kaajimar Street
Krishnaapalaya M	Madhichiyam	VillapuramPudhu Nagar	Subramaniapuram
Azhagaradi	Aazhwarpuram	Kathirvel Nagar	SolaiAzhagupuram
Viswasapuri	Sellur	Villaapuram	**Jaihindpuram**
Melaponnahara M	Pandhalkudi	Keeraithurai	Veerakali Amman Kovil
Railway Colony	Goripalayam	SappaniKovil	Thennaharam
Ellis Nagar	Ahimsapuram	South Krishnan Kovil	Kovalan Nagar
S.S.Colony	Narimedu	Manjanakara Street	T.V.S.Nagar
Ponmeni	**Chokkikulam**	Dhrowpathi Amman Kovil	Paamban Swami Nagar
Arasaradi Othakkadai	**Tallakulam**	St.Marys	**Mannar College**
Bethaniyapuram	**K.K.Nagar**	Kaamarajapuram	**Thiruparamkundra M**
Kochadai	Pudur	Balaranganathapura M	Haarvipatti
Visalakshi Nagar	Lourdhu Nagar	Navarathinapuram	**Thirunahar**
	Reserve Line	Lakshmipuram	Balaji Nagar
	Aathikulam	ThirumalaiNaicker Mahal	Muthuramalingapura M

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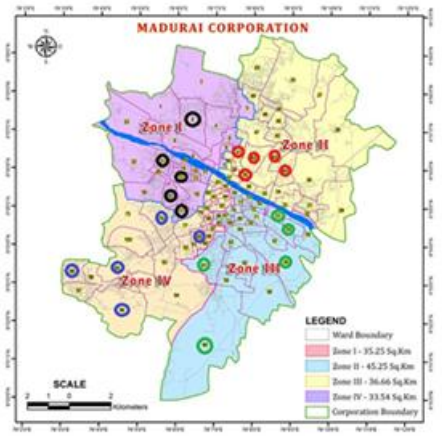

Fig.2.6 Locations Of Data Collection

CHAPTER 3
RESULTS AND DISCUSSION
3.1 DATA ANALYSIS

. The samples of about 200 for 4zones(20 wards) have been taken for the concern. The areas chosen are the major attraction area through which the inlet and outlet of the trip was made the Madurai city. With the help of the analysis, the relationship have been done for the trip behaviours and travel pattern to be made from the questionnaire collected from the people in Madurai city for all the 4 zones(20 wards).

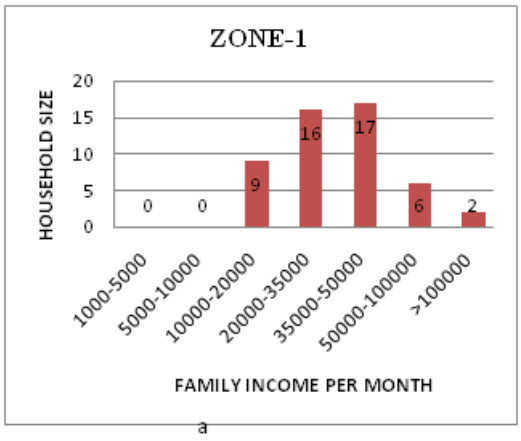

Fig 3.1 Income Factor For Zone 1

From the above table indicate In zone 1 the majority people income range between the 35000-50000.in the selection of 50 sample there are 17 sample earning income 35000-500000.

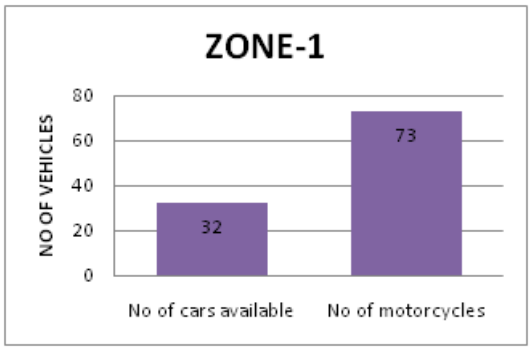

Fig 3.2 Vehicle Ownership Factor For Zone 1

From the above table in zone 1 households have the number of motorcycle ownership Is high comparing the car ownership.

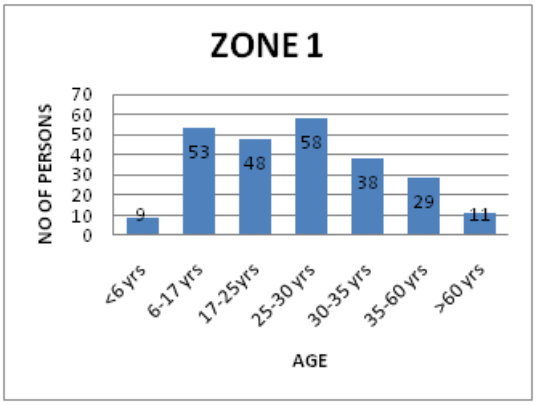

Fig 3.3 Age Factor For Zone 1

From the above table indicate in zone 1 the 25-30years age people IsHigh. In the collected 50 sample there 58 persons include in this 25-30 age category.

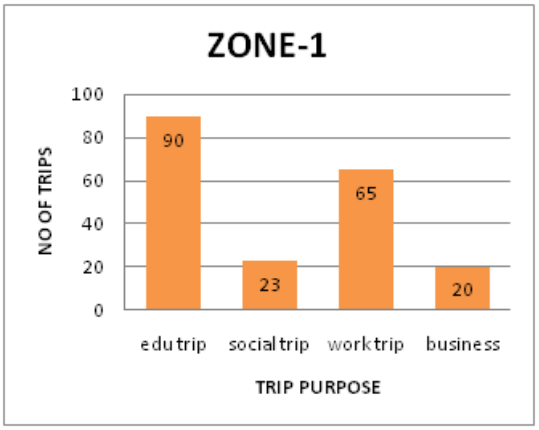

Fig 3.4 purpose of trip for zone 1

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From the above table indicate in zone 1 the trips used for the purpose of education. in the collected 50 samples there are 90 trips are generated for the education purpose.

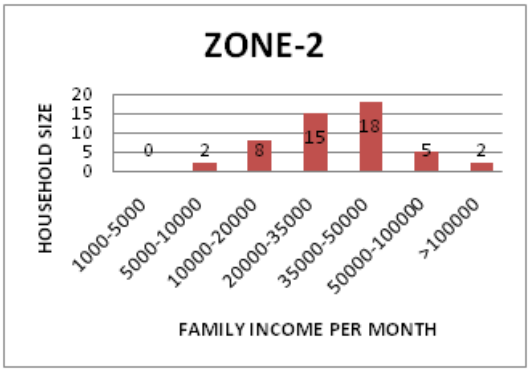

Fig 3.5 Income Factor For Zone 2

From the above table clear that in zone 2 the majority of households earning the income range between 35000-50000.in the collected 50 samples there are 18 households are earning 35000-50000Rs.

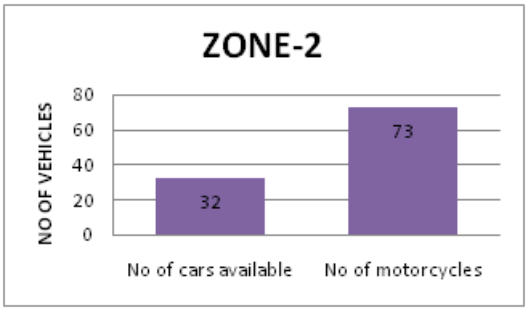

Fig 3.6 Vehicle Ownership Factor For Zone 2

From the above table in zone 2 households have the number of motorcycle ownership Is high comparing the car ownership.in the collected 50 samples there are 73 motorcycles are used for the zone 2 household persons.

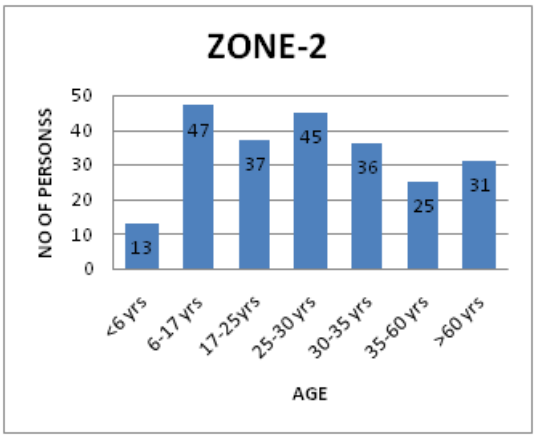

Fig 3.7 Age Factor For Zone 2

From the above table indicate in zone 2 the 6-17 years age people IsHigh. In the collected 50 sample there 47 persons include in this 6-17 age category.

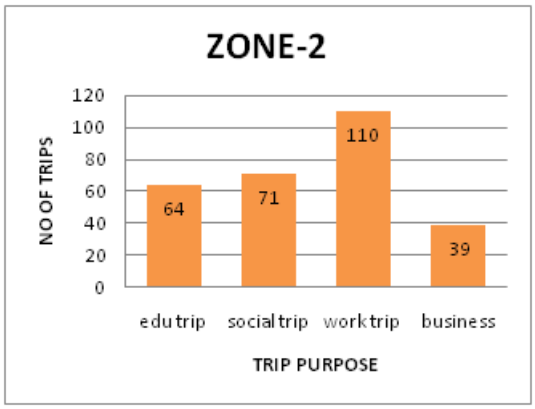

Fig 3.8Purpose Of Trip For Zone 2

From the above table indicate in zone 2 the trips used for the purpose of work. in the collected 50 samples there are 110 trips are generated for the work purpose.

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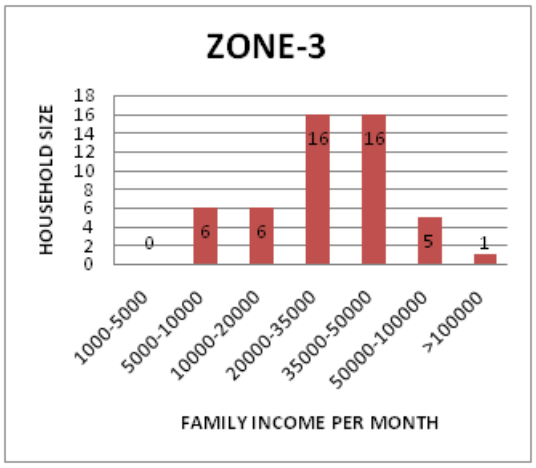

Fig 3.9 Income Factor For Zone 3

In the above table clear that in zone 3 the majority of households earning the income range between 35000-50000 and also 20000-35000 in the collected 50 samples there are 16 households are earning equal income of 35000-50000 and 20000-35000Rs.

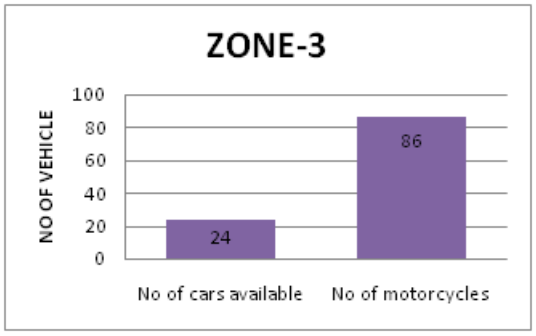

Fig 3.10 Vehicle Ownership Factor For Zone 3

From the above table in zone 3 households have the number of motorcycle ownership Is high comparing the car ownership.in the collected 50 samples there are 86 motorcycles are used for the zone 3 household persons.

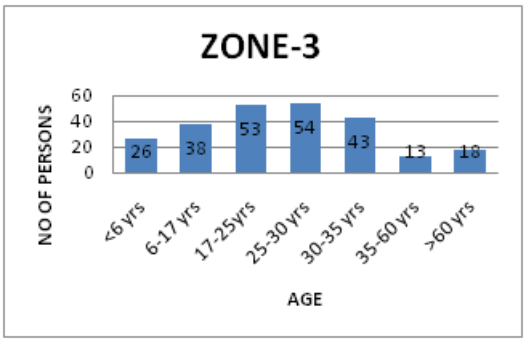

Fig 3.11 Age Factor For Zone 3

From the above table indicate in zone 3 the 25-30 years age people IsHigh. In the collected 50 sample there 54 persons include in this 25-30 age category.

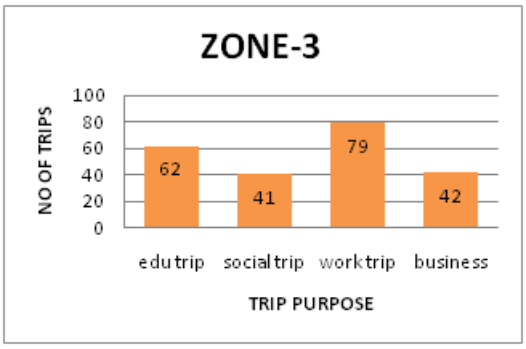

Fig 3.12Purpose Of Trip For Zone 3

From the above table indicate in zone 3 the trips used for the purpose of work. in the collected 50 samples there are 79 trips are generated for the work purpose.

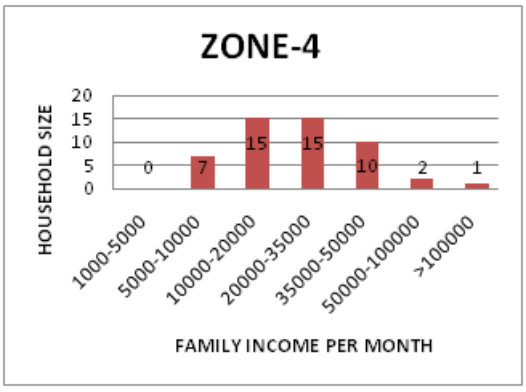

Fig 3.13 Income Factor For Zone 4

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In the above table clear that in zone 4 the majority of households earning the income range between 35000-50000 and also 10000-20000 in the collected 50 samples there are 16 households are earning equal income of 35000-50000 and 10000-20000Rs.

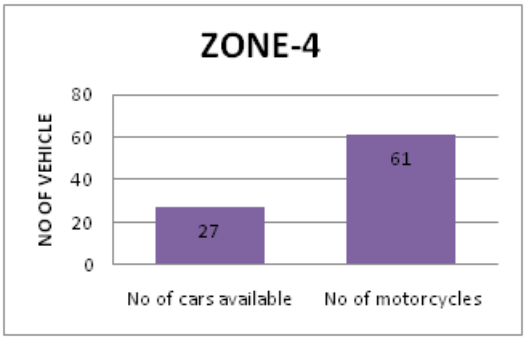

Fig 3.14 Vehicle Ownership Factor For Zone 4

From the above table in zone 4 households have the number of motorcycle ownership Is high comparing the car ownership.in the collected 50 samples there are 61 motorcycles are used for the zone 4 household persons.

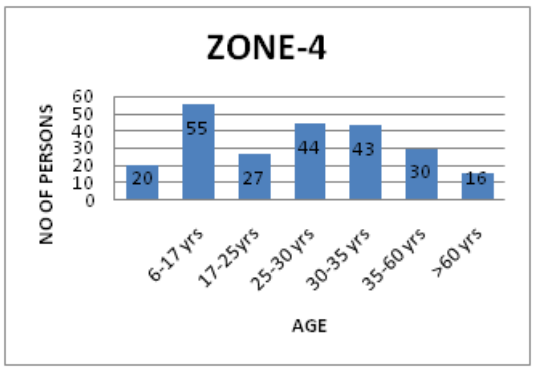

Fig 3.15Age Factor For Zone 4

From the above table indicate in zone 4 the 6-17 years age people IsHigh. In the collected 50 sample there 55 persons include in this 6-17 age category.

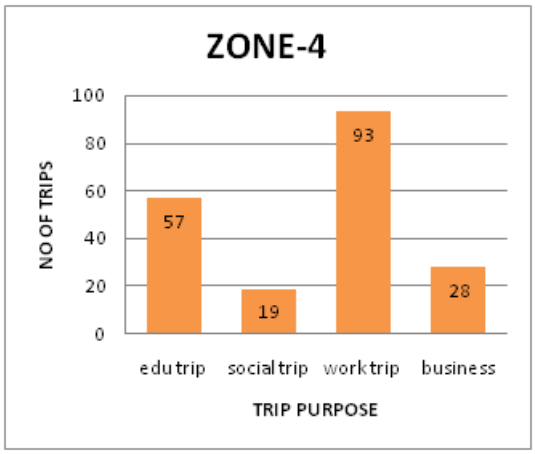

Fig 3.16Purpose Of Trip For Zone 4

From the above table indicate in zone 4 the trips used for the purpose of work. In the collected 50 samples there are 93 trips are generated for the work purpose.In the above analysis total trips generated from zone 1 is 198 and the same for zone 2 is 284 and for zone 3 is 224 and for zone 4 is 197.the maximum number of trips generated from zone 2.Trips most used by people was work related for all zones.The reason for the maximum trip generation in zone due to the maximum density in the same zone.

CHAPTER 4
SUMMARY AND CONCLUSIONS

4.1 GENERAL

Travel demand derives from the need to carry out activities in multiple locations. Thus, the level and characteristics of travel demand are influenced by the activity system and the transportation opportunities in the area. In order to analyse and design transportation systems, it is necessary to estimate the existing demand and to predict the changes in it that will result from the projects being studied and/or from changes in external factors. Mathematical demand models can be used for all these purpose.

4.2 SUMMARY AND CONCLUSION:

The study area was selected and issues involved were identified. The aim and objective of the project were properly defined to overcome the issues identified.

An extensive literature survey revealed several important aspects in identifying the methodology. In this investigation, research methodology has been framed with the help of literature review.A travel-demand model can be defined as a mathematical relationship between travel-demand flows and their characteristics on the one hand, and given activity and transportation supply systems and their characteristics. The trip generation and distribution model used to forecast the travel demand. In this study the works regarding trip production zones and trip attraction zones are identified. Household survey for 200 samples including 20 wards around the four zonehas been collected throughout Madurai city, from this trip generation and distribution rates are generated. From the analysis of household survey the results shows that zone 2 have more trip generation because it has higher density zone comparing the other zone.

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