JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue

JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)

An International Scholarly Open Access, Peer-reviewed, Refereed Journal

STUDY OF TRIP GENERATION PATTERN OF MALLS

CASE STUDY- NASHIK & PUNE

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Abstract: Trip generation analysis involves the development of relationship between vehicle trips and land use characteristics, which can be used to forecast the number of trips generated by specific land uses.

ln general, an estimate of trip attraction is less accurate than trip production as it is difficult to generalize and model the factors that influence one's decision to travel to a particular place. The main contributing factor for trip attraction is works trips. Trips for shopping are the next main category of trip attraction. This study deals with the trip generation rate of the shopping malls, the number of people coming to the shopping mall and also with the parking demand of the malls.

The purpose of this study is to collect data about the number of people coming to malls in Nashik and Pune city, and develop models for estimating the trip generation rate of the malls and the parking demand of malls. The model will be used for planning and design of malls for the proposed area and traffic control schemes on the roadways near the malls and also for providing parking facility. A series of surveys was conducted to obtain data about the trip generation at 30 malls. Using this data Regression model is developed.

Index Terms **- Trip generation, Regression, Histograms, correlation, Iterations.**

I. INTRODUCTION

Trip generation analysis involves the development of relationship between vehicle trips and land use characteristics, which can be used to forecast the number of trips generated by specific land uses.

Travel request anticipating is fundamental for the plan of transportation offices and administrations, and furthermore for arranging, venture, and strategy improvement. Trip age is the initial step of the conventional four-venture travel request estimating process. It is critical that this step produce s an accurate value as these values form the basis for the subsequent steps and the error in this step can propagate in the entire estimation process. The outing age step comprises: of the cycles to gauge trip creation and excursion fascination (TA) of a traffic investigation zone (TAZ). TA identifies the number of trips attracted by the various activity centers in the TAZ and trip production identifies the number of tips produced by the households in the T J\Z. Ingcnr:.11, an estimate of TA is less accurate than trip production as it i difficult to generalize and model the factors that influence one' s decision to t ravel to a particular place. The mam contributing factor for TA is work trips. Trips for shopping are the following primary class of TA. This study deals with the trip generation rate of the shopping mall, the number of people coming to the shopping mall and also with the parking demand of the malls.

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1.1. Purposes of Regression /Correlation Analyses

- Gives evaluations of upsides of ward variable from upsides of autonomous variable.
- Provides estimates of mean value of Y for each value of X
- Get proportions of blunder engaged with utilizing the relapse line as a premise of assessment
- Measure degree of association between two variables I strength of relationship.

1.2. Aim of Study

To assess the trip generation characteristics of malls.

1.3. Objective of Study

• To comprehend the explanations for trip making conduct.
• To produce mathematical relationships to synthesize the! tip-making pattern on the basis of observed trips.
• To study the parking need for the malls.
• To access the influence area of malls.
• Investigate the locational attributes of malls.

II. METHODOLOGY

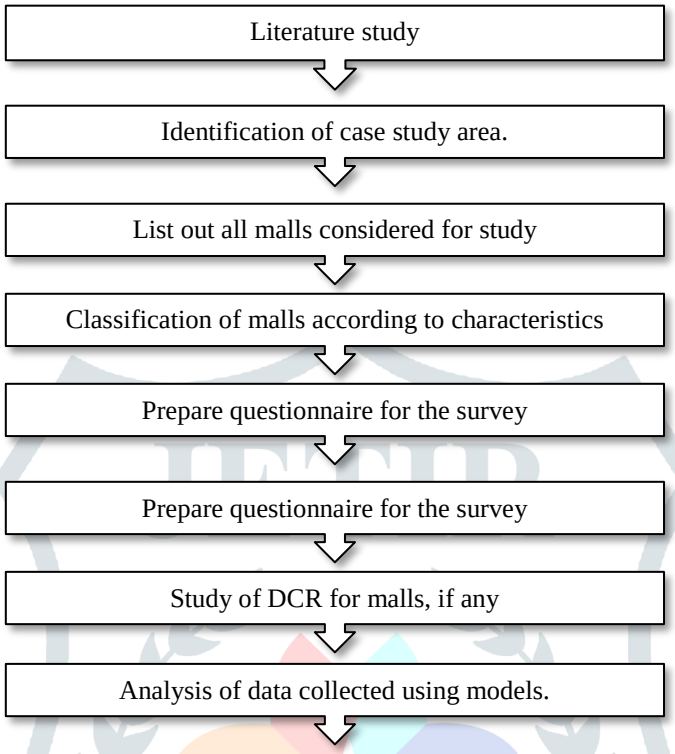


Fig: Flow chart of methodology

2.1. Literature study.

Literature of various authors, theories and terminologies related to Trip generation and models used in thesis topic are studied.

2.2. Identification of case study area.

Pune and Nashik cities are the fastest growing cities in Maharashtra after Mumbai. Transportation facility, Topography and other such parameters are favorable in these ci ties for the new developments like Malls. Number of malls required for the survey is fulfilled by the two cities. Boom of mal ls in big cities is creating problems related to parking in the areas having malls. This parameter is also considered during selection of study a rea. So, Nashik and Pune cities are selected as the study areas.

2.3. Classification of malls according to characteristics considered.

• Classification of malls is based on city i.e. malls in Nashik, malls in Pune.
• Malls having different products for sale are considered for study.

2.4. Preparation of questionnaire for the primary survey.

Three types of questionnaire formats are prepared for survey.
•Establishment survey
•Parking survey
•Individual's (Customer's) survey
Based on the pattern of questionnaire format pilot survey has done. During pilot survey various problems have occulted such as, less cooperation from visitor, mall managers etc.,

2.5. Study of DCR for malls, if any.

OCR for malls is not available for stud y. For malls OCR are not prepared.

2.6. Analysis of data collected using models.

From primary and secondary surveys data is collected. Data analysis is done using Regression Model.

2.7. Problem: Trip Generation of Malls

The trip generation rate of shopping malls is influenced by a number of factors, including time of the day, day of the week, seasonality, weather, Special offers in malls, location. The most typical time for shopping during the weekday is after work; in particular, 6 to 9 PM on Fridays attracts the greatest number of customers on a weekday.

In addition, Saturdays and Sundays are very busy periods for malls. As a general rule, there is a huge variety in the quantity of individuals showing up at the shopping centers in any event, during similar time span over various fifteen-minute stretches.

As a result, the sample size becomes very important particularly when significant fluctuations exist in the number of trips to the malls. The need for a large sample

space and the highly inconsistent nature of the trip generation makes the estimation of trip generation rate of the mall a very complex process.

It is hard to consider every one of the elements impacting the outing age pace of shopping center particularly factors like land use qualities of the encompassing region. However other factors like the physical features of the mall that are easy to measure and analyze are incorporated in the estimation of the trip generation. Parking demand calculation is necessary for the malls as it attracts large number of vehicles. The previously mentioned focuses structure the reason for undertaking this review.

2.8. Problems faced during survey and the analysis part:

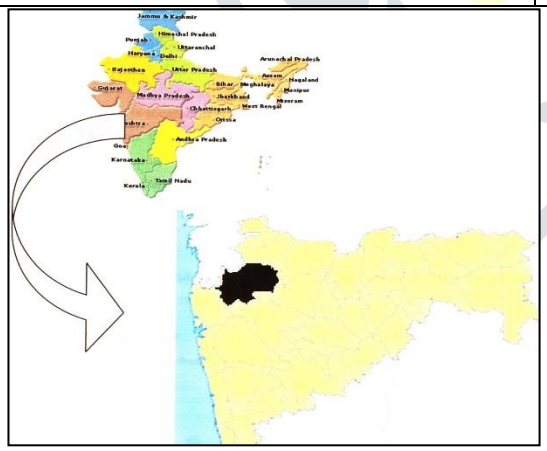
• Accurate trip distance is not available.

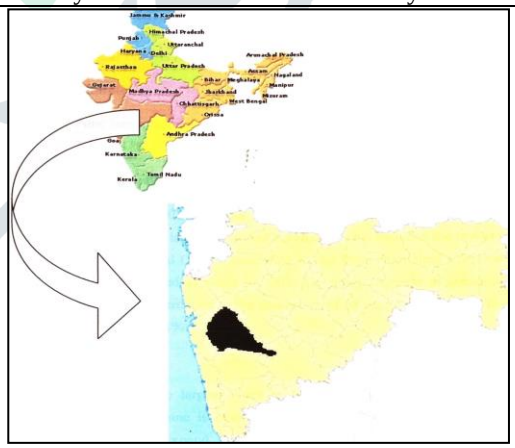
• Survey is carried out at peak hours. Total daily count is estimated from calculations. Peak hours for different types of malls are different. e.g., for malls like Big Bazaar the peak hours are considered as the period of discount offers. And for other malls Saturday, Sunday evening time is observed to be peak hour. Only peak hour survey is not giving the exact count of visitors visiting the mall in a day.

• Kakade and Nucleus are malls with 5 to 6 floors. But total area in these malls is not in use. Managers from these malls gives the reason for this problem as, the shops in these malls are self-owned and not on rent. But this causes the problem during analysis of the survey for model making, as it gives wrong information about the mall and leads to wrong conclusion. To overcome this problem only the used area is taken into consideration.

III. CASE SUDY

Overview of Nashik City	**Overview of Pune City**
Population: - 2,066,000 **Density:** - 7,818.84/km2 (15,540 /sq mi) **Area:** - 264.23 square kilometers (102.02 sq mi) **Elevation:** - 560 meters (1,840 ft)	**Population:** - 38,28,764 **Density:** - 12,776 /km2 **Area:** - 519.2 km2 **Elevation:** - 560 meters (1,840 ft)
Nashik in 150 BC was accepted to be the country's biggest commercial center. Some of the major events in history of Nashik in the 1860s are- 1862: Nashik Road railway station was built. 1864: Nashik municipality formed. 1869: Nashik district formed.	Pune is a one of the largest cities in India, and as a result of its many colleges and universities, Pune is emerging as a prominent location for IT and manufacturing companies to expand. Pune has the eight biggest metropolitan economy and the 6th most noteworthy per capita pay in the country. It is also known as Motor City.





3.1. QUESTIONNAIRE FOR THE PRIMARY SURVEY.

Three types of questionnaire formats are prepared for survey.

1) Establishment survey: -

It includes following questions

• *Name of mall: -* • *Built-up area of mall: -* • *Number of floors: -* • *Area of each floor: -*

2) Parking survey

• *Parking area in Sq. Ft.: -* *a) 2-wheeler* *b) 4-wheeler*

• *Parking capacity in Nos.: -* *a) 2-wheeler* *b) 4-wheeler*

3) Individual's (Customer's) survey

Survey is carried out on Pick Period (like evening). After every 25th visitor sample survey is carried out. So as *n* Numbers of samples are collected. From Total count of visitors.

3.2. QUESTIONNAIRE FOR INDIVIDUAL'S (CUSTOMER'S) SURVEY.

- **Where did you come from?** *(For non-home-based trip) (distance of trip)*
- **Where do you stay?** *(Distance of trip)*
- **Occupation:** *a) Service b) Business c) Student d) Housewife*
- **Number of family members:**
- **Vehicle ownership:** *a) Car b) Motorcycle c) Bicycle*
- **How do you come here?** *a) car b) Motorcycle c) Bicycle d) Public transport*
- **Purpose to come to mall:** *a) shopping b) Leisure*
- **Products purchased:** *a) Clothing b) Food court c) Vegetables d) Toys e) Perfumes f) Sunglasses g) Bags h) Foot wear i) Grocery j) Jewelry k) Interior decorative items l) Watches m) Books n) Electric gadgets o) Cosmetics*
- **How frequently you visit the mall?** a) Weekly b) Monthly
- **Money spent:** *a) less than Rs.500/- b) more than Rs.500/- c) less than Rs.1000/- d) more than Rs.1000/-*
- **Payment by:** *a) Cash b) Card i) Credit ii) Debit*
- **Weekly money spent on petrol:**

3.3. SECONDARY SURVEY.

Built up areas of malls are collected from NMC, PMC and PCMC.

- *Name of mall: -* • *Built-up area of mall: -* • *Number of floors: -* • *Area of each floor: -* • *Area of Parking: -*

Malls in Nashik

Fig: Location of malls in Nashik city:

Fig: Location of malls in Nashik city:

Table: -Data collected by Survey of Pune & Nashik Malls

Sr. No.	Malls	Plot area	Built up Area in Sq. ft.	Built up Area under use Sq. ft.	Parking Area	Nos of Floors
1.	Pune Central Mall (Bund gardcn)	96000	120000	350000	70186	4
2.	Pune Central Mall (University Road)	960000	1200000	70000	59423	5
3.	lnorbit Mall	173600	217000	105000	145754	4
4.	Nucleus Mall	160000	200000	22000	113229	6
5.	Kakade Mall	80000	100000	120000	59423	5
6.	S.G.S Mall	84000	105000	37808.99	113229	2
7.	lshanya Mall	240000	300000	32500	199570	3
8.	Pulse Mall	26000	32500	30000	53503	3
9.	Reliance Fresh (Kharadi)	56000	70000	36000	67182	3
10.	Big Bazaar (Kothrud)	60499.2	75624	217000	33053	3
11.	Big Bazaar (Fatima nagar)	24000	30000	30000	14463	3
12.	Big Bazaar (Sinhagad road)	24000	30000	300000	12060	2
13.	Big Bazaar (Satara road)	28000	35000	250000	23479	3
14.	Big Bazaar (Kalyani nagar)	28800	36000	20000	36708	3
15.	Easy day (Dhayari)	16000	20000	50000	23254	1
16.	Phoenix Mall	280000	350000	30000	199345	5
17.	Shopper's stop	36000	45000	263230	14755	2
18.	Mega Mart (Pimpri)	30247.2	37809	45000	29145	5
19.	D-Marl (Hinjewadi)	44000	55000	30000	12065	3
20.	D-Mart (Satara road)	24000	30000	20000	11414	2
21.	D-Marl (Saner)	24000	30000	35000	14643	2
22.	Koregaon Park Plaza	210584	263230	55000	199345	4
23.	Jewel Square Mall (K.P.)	40000	50000	120000	199570	4
24.	Ozone Mall (Aundh)	28000	35000	20000	4095	3
25.	Amanora Park Centre	200000	250000	75623.85	199570	3
26.	Vlshal Mega Mart (Satara road)	16000	20000	35000	14643	1
27.	City Centre Mall	197261.6	246577	246577	199570	5

28.	Pinnacle Mall	100000	125000	125000	113464	4
29.	Big Bazaar (College road)	25600	32000	32000	11639	2
30.	Big Bazaar (Nashik road)	36000	45000	45000	14980	3

IV. RESULTS AND DISCUSSION

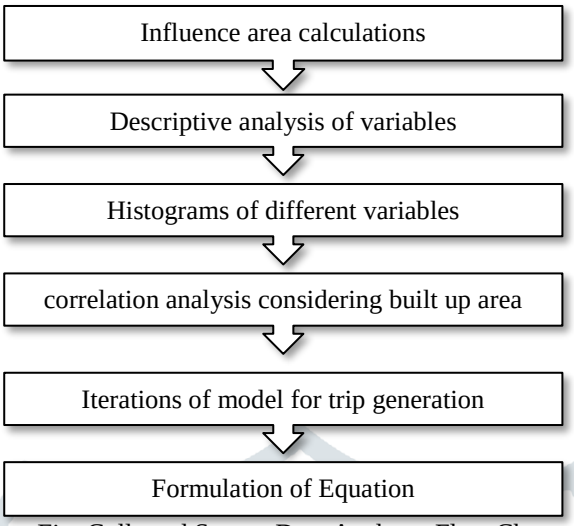


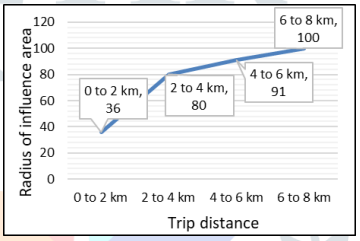
Fig: Collected Survey Data Analyses Flow Chart

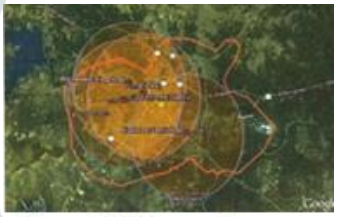
4.1. Influence area calculations

4.1.1. *Radius of Influence area of malls in Nashik:*

Calculations for the radius of influence

Trip distance	No. of trips	Percentage frequency	Cumulative frequency
0 to 2 km	20	36	36
2 to 4 km	25	44	80
4 to 6 km	6	11	91
6 to 8 km	5	9	100



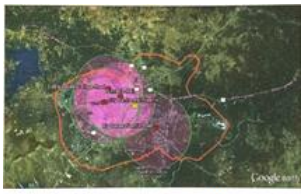


Percentile Influence Area

The radius of influence area of malls in Nashik (from survey)

Sr. No.	Median (50 %)	3rd Quartile (75%)	85th percentile (85%)
1	1.6	2.8	4.2

3rd Quartile (75%)



85th Percentile (85%)

4.1.2. Influence area calculations considering 3 categories:

A) Population of city
B) Area of city
C) Density of city *(Population Density = Number of People / Land Area.)*

Area of city

Area influenced per Mall= (Area of city/no. of malls)

a) Pune City: Area of Pune: 516.2 km2 No. of malls considered in Pune: 26 Area influenced per mall in Pune: 516.2 / 25 = 20.6 km2 Influence radius of malls in Pune city: 1.76 km	b) Nashik City: Area of City: 264.2 km2 No. of malls considered in Nashik City: 4 Area influenced per mall in Nashik city: 264.2/4 = 66.05 km2 Influence radius of malls in Nashik city: 14.24 km

** Here number of malls considered is 25, as only one mall is surveyed at PCMC (Mega mart) is not considered. Addition of PCMC area and population for calculations for only one mall will give less accurate values.*

On similar lines calculations for other two categories are done

4.2. Descriptive analysis of variables

A descriptive analysis is an important first step for conducting statistical analyses. It gives you an idea of the distribution of your data, helps you detect outliers and typos, and enable you identify associations among variables, thus making you ready to conduct further statistical analyses.

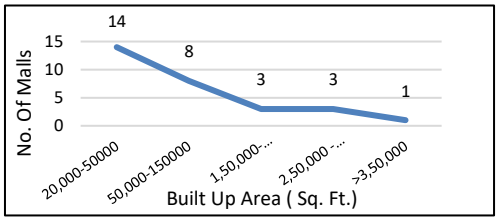
Descriptive Analysis is the type of analysis of data that helps describe, show or summarize data points in a constructive way such that patterns might emerge that fulfill every condition of the data. It is one of the most important steps for conducting statistical data analysis.

Descriptive analytics is a statistical method that is used to search and summarize historical data in order to identify patterns or meaning.

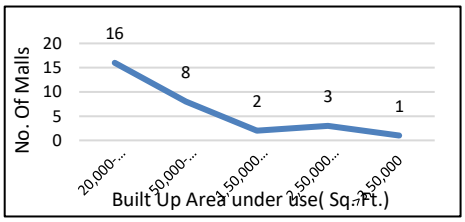
4.3. Histograms of different variables

1. No. of malls Vs Built-up area

Built up area (sq.ft)	20,000-50,000	50,000-1,50,000	1,50,000-2,50,000	2,50,000-3,50,000	>3,50,000
Nos of Malls	14	8	3	3	1



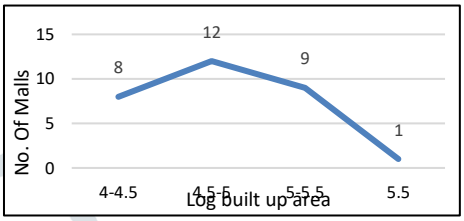
2. No. of malls Vs Built up area under use



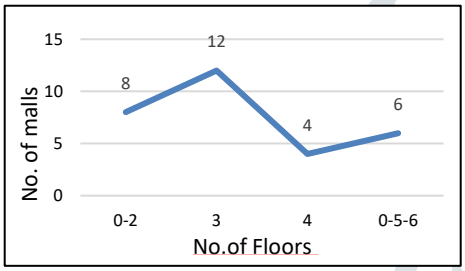
Built up area (sq.ft.)	20,000-50,000	50,000-1,50,000	1,50,000-2,50,000	2,50,000-3,50,000	>3,50,000
No. of malls	16	8	2	3	1

3. No. of malls, Vs log built up area

log built up area	4-4.5	4.5-5	5-5.5	5.5
No. of malls	8	12	9	1



4. No. of malls Vs Number of floors



No. of floors	0-2	3	4	0-5-6
No. of malls	8	12	4	6

4.4. Correlation analysis

Correlation Analysis is statistical method that is used to discover if there is a relationship between two variables/datasets, and how strong that relationship may be.

In terms of Trip generation research this means that, correlation analysis is used to analyse quantitative data gathered from research methods such as surveys, to identify whether there is any significant connections, patterns, or trends between the two.

Essentially, correlation analysis is used for spotting patterns within datasets. A positive correlation result means that both variables increase in relation to each other, while a negative correlation means that as one variable decreases, the other increases

1) correlation analysis considering built up area
2) Correlation for trip generation using under use area
3) Correlation analysis considering log built up area

4.5. Iterations of model for trip generation

Iterative refers to a systematic, repetitive, and recursive process in qualitative data analysis. An iterative approach involves a sequence of tasks carried out in exactly the same manner each time and executed multiple times

Iterative stepwise regression adds or removes one independent variable at a time to or from the multiple linear regression equation. To perform iterative stepwise regression, Predictor: Calculates the partial F statistic for each independent variable

Typically, a regression analysis is done for one of two purposes: In order to predict the value of the dependent variable for individuals for whom some information concerning the explanatory variables is available, or in order to estimate the effect of some explanatory variable on the dependent variable

Recommendations for parking are as follows:

Criteria for selection of final iteration:

p-value- It should be less than 0.01, t-stat- It should be greater than 1.96, Significance f- It should be less than 5%

4.6. Formulation of Equation:

Resulting equation:

$Y = b0 + b1\ x_1 + b2\ x_2$

$Y = 476.4033227 + 0.002971\ 545\ (x_1) + 102.4699785\ (x_2)$

(3.070955094) (1.46802783)

Here, x1-Built up area under use ..... (3.0709955094 - t stat for the coefficient)

x2- No. of floors..... (1.46802783 - t stat for the coefficient)

Above equation shows that

b_0 : 476.4033227 .....interpreted as: amount of trips would be produced if there is no population in a zone (x1=0)

b_1: 0.002971 545 .....interpreted as: additional 20,000 sq. ft area of mall would produce additional 60 t rips
b_2 : 102.4699785 .....interpreted as: one additional floor of mall would produce additional I 102.4699785 trips
Resulting equation for calculating the demand for equivalent car space for malls

$$Y = b_o+b_1x_1+b_2x_2+b_3x_3+b_4x_4$$

$$Y = 26.66924848 + 0.00076303(x_1) + 57.06383497(x_2) + 201.68641\,51(x_3) + 163.6293708(x_4)$$
$$(2.171\,152987) \quad (1.238650454) \quad (3.470782286) \quad (2.466026661)$$

Here, x_1: Built up area under use..... (2.171 152987: t stat for the coefficient)
x_2: Malls having individual stores……. (1.238650454: t stat for the coefficient)
x_3: Malls with entertainment facility ..... (3.470782286: t stat for the coefficient)
x_4: Malls having built up area above llakh sq.ft...(2.466026661: t stat for the coefficient)

Above equation shows that

b_0 : 26.66924848.....interpreted as: The value of coefficient is added to get result

b_1 : 0.000763 ……. interpreted as: additional 1000 sq.ft. area of mall would produce additional requirement of 1 equivalent car space

b_2 : 57.06383 ..... interpreted as: malls having individual stores would produce additional requirement of 57 equivalent car spaces

b_3 : 201.6864 ..... interpreted as: malls with entertainment facility would produce additional requirement of 202 equivalent car spaces

b_4 : 163.6293 .....interpreted as: malls having area above 1 lakh sq. ft. would produce additional requirement of 164 equivalent car spaces

V. ACKNOWLEDGEMENT

With deep sense of gratitude, i would like to thanks all the people who have lit my path with their kind guidance. I am very grateful to these intellectuals who did their best to help during my project planning work. It is my proud privilege to express deep sense of gratitude to Prof. Dr. A. S. Maheshwari, Associate Dean of SOET, Sandip University Nashik, for his comments and kind permission to complete this project planning work. We remain indebted to Prof. Ms. Madhuri Nikam, Civil Department for her timely suggestion and valuable guidance. The special gratitude goes to project guide, staff members and technical staff members of Civil Department for their excellent and precious guidance in completion of this work.

VI. REFERENCES

[1] Ayer, R. L.(Oct. 2003), Paper on 'Mall Mania in India: Changing Consumer Shopping Habits'. pg. 1-2
[2] L.R.Kadiyali, Book on, 'Traffic Engi neering and Transport Planning'.pg. 1-5
[3] Oyedepo, 0. J., Makinde, O.O.,Europian Journal of Scientific Research , Vol 28 #1 2009 on 'Regression Model of Household Trips of Ado-Eki ti Township in Nigeria'. pg. 1 and pg.3-4
[4] Rhee, P. J.(Oct. 2003), Paper on, 'Improvement of t rip generation forecast with category analysis in Seoul metropolitan area'. pg. 818-820
[5] Tapan K. Datta, K. L., 'Tri p Generation: Fundamentals & Appl ications'.Module I Trip Generation Handbook 2nd Edition an ITE Recommended practice July 2004. pg. 2 and pg. 7
[6] Tom V. Mathew and K. V. Krishna Rao, Book on 'Introduction to transportation Engineering', Chapter 7. Trip Generation N PTEL . pg. 7.1-7.2
[7] hnp;//www.pcmindia.gov.in
[8] http;//www.punecorporato.in.org
[9] http;/www.nashikcorporation.go.in

Books:-
[1] Higher Engineering Mathematic By:- B.V. Ranmana
[2] Practicals in Statistics By:- H. L. Sharma.