

TRANSPORTATION MODELING AND ANALYSIS OF TRIP GENERATION AND TRIP DISTRIBUTION FOR INDORE CITY

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Abstract: Transportation engineers while planning urban traffic faces uncertain and surprised events. Factors affecting forecasting traffic for future are traffic uncertainties, vehicle types, purpose type and their complications associated. Inaccurate traffic planning tends to bad transportation. This research is made to search for existing techniques of trip generation and trip distribution. Data collection techniques for future study and research scope investigation are also major inspiration to conduct literature of this research. The rapid industrial and commercial development coupled with the rise in population in the recent past has contributed to a large scale increase in traffic in the City. This increasing intensity of traffic has resulted in the manifestation of a number of problems which pose a potential threat to the economic vitality and productive efficiency of the City. Traffic congestion is already severe on many road sections and parking problems are aggravating. The mass transport share is low and as a result, the City is experiencing rise in the use of personalized modes (specially two wheelers) and consequently facing severe problems of congestion while vehicular pollution is assuming critical dimensions. Indore city urban area is continuing high traffic growth and expected to grow with higher percentage in coming decades. The need of transport system study is noted for future transportation facility and traffic planning. There is an urgent need for significant improvements in the transport system including mass transport system keeping in view the long term requirements of the City. The survey is conducted in morning and evening peak hours to count classified volume of vehicle flow and critical links around selected square are noticed for morning and evening peak hours. Results are presented as a future trip generation for year 2025 and suggestions are proposed to manage future traffic demands and load. The research concluded that most of the traffic forecasted is due to industrial factor. The second most responsible factor is Business factor. As city is having rapid growing trends and it is also analyzed analytically that the growth will be continue in future hence suggestions in terms of immediate, short term and long term need of actions are suggested at the end of the research.

Keywords: Traffic Study, Traffic planning, Trip Generation, Trip Analysis, Trip Distribution.

I. PROBLEM DEFINITION AND OBJECTIVE

- To know the types and pattern of traffic on selected streets by O-D survey.
- To forecast the traffic for Ten years.
- To Prepare the trip generation models to know the

Numbers of Trip at particular Zone.

- To Prepare Trip Distribution Models To know Distance Patterns of Trips at various Zones.
- To Obtain the Optimum routes for the passengers.
- To Improve transportation facilities at various zones of selected study area.

Region Selection

Marimata Region in Indore City is selected for research purpose

The routes selected are:

From Marmata Square to Banganga Square. (950m)

From Marimata Square to Imli Bazar (1.3 KM)

From Marimata Square to Tilak path Intersection (700m)

From Marimata to IOL Fuel Station VIP road (450m)

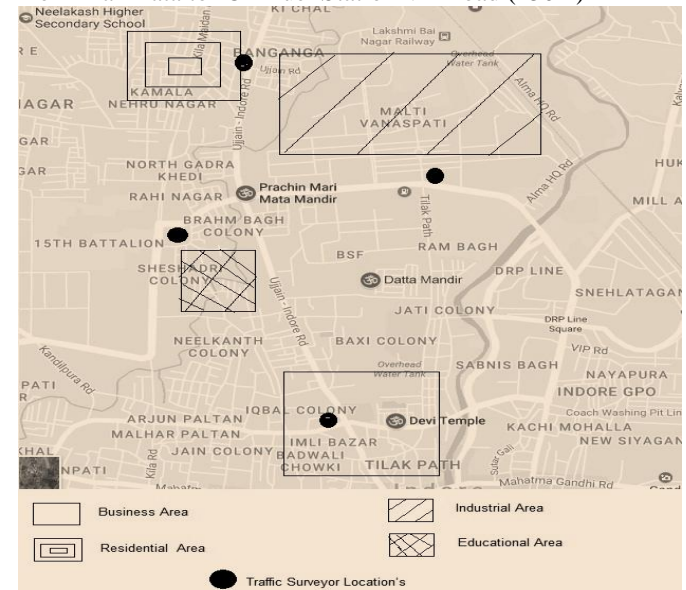


Figure: Marimata Square and Survey Locations with Selected Routes for Traffic Study

II. METHODOLOGY

The survey is conducted in morning and evening peak hours to count classified volume of vehicle flow and critical links around selected square are noticed for morning and evening peak hours. Traffic count provides information for:

- Category wise flow of vehicles types.
- Purpose wise flow of overall traffic for business, industrial, educational and other purpose.

Origin-Destination (OD) Survey

Origin - destination surveys is conducted for 7 continuous days with the help of roadside interview method and questionnaire method for 2 hours morning and evening peak hrs. The traffic data is collected for vehicle types, type of

purpose, origin and destination inward and outward flow.

Terminal Area Survey

Data and information is collected for movement of traffic for selected four terminals inward and outward.

The terminals are:

- Banganga Square
- Imli Bazar
- Tilak path Intersection
- IOL Fuel Station VIP road

Vehicle Wise Trip

Seven days survey record provides traffic distribution vehicle type wise and location wise, data from table and questionnaire is to be utilized to generate trips in tables for morning and evening peak hours.

Correlation Regression Trip Analysis (Purpose Wise)

Correlation Regression Equations:

$$Y = a + b_1X_i + b_2X_p + b_3X_v$$

Where,

Y is Dependent variable trip.

X_i is independent variable income growth

X_p is independent variable population growth

X_v is independent variable vehicle growth

$$a = \sum Y/n$$

$$b = \sum xY / \sum x^2$$

n = Number of years

Sample Business Purpose Analysis for 10 Years

Income Growth vs Business Trip Analysis (Morning)

Year	Y Trip	X Income growth	X	x ²	xY
2007	2338	3627	-1058	1119364	-2473604
2008	2403	3867	-818	669124	-1965654
2009	2470	4123	-562	315844	-1388140
2010	2539	4395	-290	84100	-736310
2011	2609	4685	0	0	0
2012	2682	4995	310	96100	831420
2013	2756	5325	640	409600	1763840
2014	2832	5677	992	984064	2809344
2015	2911	6052	1367	1868689	3979337
2016	2992	6452	1767	3122289	5286864
	26532	49198	2348	8669174	8107097
a=	2653.2				
b=	0.935163719				

Similarly trip analysis is performed for morning and evening business, education, industrial and other purpose.

Morning trip equations:

For Business Purpose

$$Y_B = 2653.2 + 0.9351X_i + 0.9154 X_p + 0.002218 X_v$$

For Education Purpose

$$Y_E = 1663.6 + 0.5862X_i + 0.5739 X_p + 0.00139 X_v$$

For Industrial Purpose

$$Y_I = 4186.5 + 1.4750 X_i + 1.4438 X_p + 0.00349 X_v$$

For Other Purpose

$$Y_O = 1194.9 + 0.4212X_i + 0.4124 X_p + 0.000999 X_v$$

Evening trip equations:

For Business Purpose

$$Y_B = 2847.1 + 1.00399X_i + 0.98298 X_p + 0.0023819 X_v$$

For Education Purpose

$$Y_E = 640.3 + 0.22655X_i + 0.2220 X_p + 0.000537 X_v$$

For Industrial Purpose

$$Y_I = 3687.2 + 1.2991X_i + 1.2717 X_p + 0.003082 X_v$$

For Other Purpose

$$Y_O = 1702.6 + 0.60026X_i + 0.5876 X_p + 0.001424 X_v$$

This Equation is generated with the help of regression analysis and used for finding out the number of trips in N number of years in the Different Purposes like industrial, Education, Business, others.

Trip Distribution Purpose Wise

Growth Factor Method are based on the assumption that the present travel pattern can be projected to the Design year in the future by using certain expansion factors. This can be represented by Formula:

$$T_{i-j} = t_{i-j} \times E$$

Where,

T_{i-j} = Design year, Number of Trips from Zone i To Zone j.

t_{i-j} = Observed Base year, Number of Trips From Zone i To Zone j.

E = Growth Factor.

Morning Purpose Wise Trip Distribution with Future Trip for Year 2025

Business Trip Distribution (Morning)

		Tilak Path	Banganga Square	IOL Pump	ImliChauk	T
		1	2	3	4	
Tilak Path	1	5	332	232	122	691
Banganga Square	2	697	11	510	275	1493
IOL Pump	3	234	256	4	166	660
ImliChauk	4	97	162	105	3	367
						3211

E	6.022111
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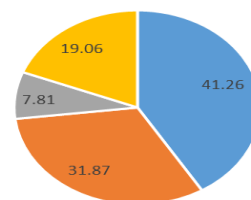
Business Trip Distribution for Year 2025 (Morning)

		Tilak Path	Banganga Square	IOL Pump	ImliChauk	T
		1	2	3	4	
Tilak Path	1	30	1999	1397	735	4161
Banganga Square	2	4197	66	3071	1656	8991
IOL Pump	3	1409	1542	24	1000	3975
ImliChauk	4	584	976	632	18	2210
						19337

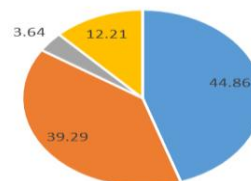
Similarly trip distribution for morning and evening is performed for business, education, industrial and other purpose for year 2025

Percentage Contribution of Purpose Present Year

Morning Purpose Percentage

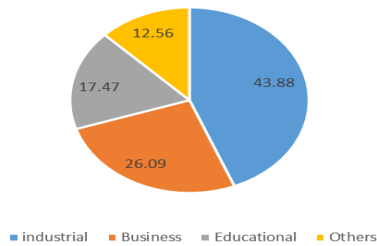


Evening Purpose Percentage

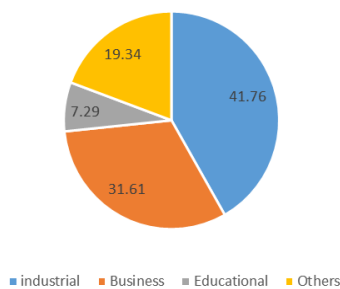


Percentage Contribution of Purpose for Year 2025

Morning Purpose Percentage for Year 2025



Evening Purpose Percentage for Year 2025



III. CONCLUSION

However Present research investigated the traffic scenario for Indore city, and for one of the most congested and busy traffic square of the city. The problem is defined and scientifically data is collected before analysis. The approach presented can be used as a standard approach to solve similar future traffic researches. Data is analyzed on the basis of scientific and well proved techniques which investigate and highlight major traffic problems in the sequence of their intensity. The results are well understandable and comparable in terms of they are presented with graphs and pie charts. The results can be explained to future researchers with easy to read formats and can be used as a reference for further research works.

The Following Points To be Noted Below:

(1) The complete details of Origin and Designation of the passengers with the help of OD survey are easily obtained. The result show that the future traffic demand for purpose wise will increases will the rate of vehicles increases that result in the increases in the number of trips. And exactly information about the traffic pattern selection with the traffic demand.

(2) For a Particular Zone the exact Number of Trips in Present and future can be obtained with the trip generation. The number of trips will decided the Road condition and composition of area. And the Trip Generation is the basic analysis for traffic forecasting in the particular region or zones.

(3) For a Particular Region it is Necessary to know the distribution of Number of trips in That particular Zones. The trips distribution will distribution of trips percentage wise the trips in different purpose will help to decide the traffic patterns and traffic condition of that region. And with the help of that analysis the traffic forecasting has been done for next N numbers of years.

The conclusion can be highlighted with following points:

- OD survey for selected routes were conducted, inward and outward flow for all types of vehicle category were traced for each route selected. It helps to know the traffic load contribution of various vehicle types for different routes considered.
- Trip generation is performed for morning and evening peak hours, it is helpful to find trips for current year.
- Correlation regression trip analysis is conducted on the basis of collected data, it is conducted on the basis of purpose of trip. It provides values of constants to be used while calculating future forecasting.
- Trip assignment model are established and equations are established to be used for future forecasting of any of the required year.
- Trip distribution model is analysed and forecasting is performed to present purpose wise trips for the year 2025. Further it is followed by presenting graphical representation of morning and evening percentage of purpose for year 2025.

IV. RECOMMENDATIONS

Main problem noticed responsible for congestion at Marimata square is the narrow width of Imli Bazar road and is required to broad the road.

- Imli bazar road from Marimata square is highly a business area.
- Overall business trips in results are increasing from 4146 to 21680 by year 2025.
- Business growth as shown in pie chart is also remarkably increasing up to year 2025.
- Imli bazar road is direct link to Jawaharmarg and carry heavy public transportation for business, educational, residential and other trips.
- Two wheeler, three wheeler and car load is maximum at Imli bazar road, which causes slow movement of traffic at Imli bazar road.

There is need of four lane road between Marimata square and Banganga square terminal.

- Banganga terminal is highly industrial traffic area and IOL fuel pump also involves moderated industrial traffic load.
- Industrial trips are increasing from 4745 to 28643 and will cause traffic problems.
- There is also over loaded and congested bus traffic movement on Banganga road.
- It is suggested that immediate link road is not required it will be require by the year 2020.

Double lane link road is suggested by the year 2020 between Banganga square terminal and IOL fuel pump terminal, it will bypass Marimata square and will help fast movement of traffic.

- It will carry increasing industrial traffic from Marimata square to Banganga square road.
- It will also help to bypass educational buses trips

bypassing Marimata to and from IOL fuel pump terminal to Banganga square terminal.

It is also suggested that there is immediate need of Marimata square widening and a circle is required to construct at Marimata square, it will help present traffic to pass Marimata square without delay and minimum traffic congestion.

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