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 MarimataSquare 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 Routs 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:

\[ Y = a + b_1 X_1 + b_2 X_2 + b_3 X_3 \]

Where,
- \( Y \) is Dependent variable trip.
- \( X_1 \) is independent variable income growth
- \( X_2 \) is independent variable population growth
- \( X_3 \) is independent variable vehicle growth

\[ a = \frac{\sum Y}{n} \]

\[ b = \frac{\sum xY}{\sum x^2} \]

\( n = \) Number of years

Sample Business Purpose Analysis for 10 Years

Income Growth vs Business Trip Analysis (Morning)

<table>
<thead>
<tr>
<th>Year</th>
<th>Y Trip / Income growth</th>
<th>X</th>
<th>a</th>
<th>b</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>2238</td>
<td>3527</td>
<td>895</td>
<td>25736</td>
</tr>
<tr>
<td>2008</td>
<td>1940</td>
<td>3075</td>
<td>618</td>
<td>169214</td>
</tr>
<tr>
<td>2009</td>
<td>2670</td>
<td>4215</td>
<td>662</td>
<td>358844</td>
</tr>
<tr>
<td>2010</td>
<td>3539</td>
<td>4395</td>
<td>290</td>
<td>845300</td>
</tr>
<tr>
<td>2011</td>
<td>2609</td>
<td>4665</td>
<td>0</td>
<td>896</td>
</tr>
<tr>
<td>2012</td>
<td>3883</td>
<td>4995</td>
<td>350</td>
<td>40300</td>
</tr>
<tr>
<td>2013</td>
<td>2756</td>
<td>3355</td>
<td>640</td>
<td>90560</td>
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<tr>
<td>2014</td>
<td>2812</td>
<td>5677</td>
<td>992</td>
<td>984064</td>
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<tr>
<td>2015</td>
<td>3023</td>
<td>6052</td>
<td>1567</td>
<td>986869</td>
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<tr>
<td>2016</td>
<td>2983</td>
<td>6452</td>
<td>1587</td>
<td>1022889</td>
</tr>
<tr>
<td>2017</td>
<td>26532</td>
<td>49898</td>
<td>2348</td>
<td>8699174</td>
</tr>
</tbody>
</table>

\( Y = \sum Y / n \)

\( X = \sum x \)

\( n = \) Number of years

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:

\[ T_{i,j} = t_{i,j} X E \]

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

<table>
<thead>
<tr>
<th>Year</th>
<th>Morning Purpose Percentage</th>
<th>Business Purpose</th>
<th>Education Purpose</th>
<th>Industrial Purpose</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>2025</td>
<td>43.26%</td>
<td>31.87%</td>
<td>19.06%</td>
<td>3.64%</td>
<td>12.23%</td>
</tr>
</tbody>
</table>

Similarly trip distribution for morning and evening is performed for business, education, industrial and other purpose 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 squares 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 the traffic pattern selection with the traffic demand.

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 shows that the future traffic demand for purpose wise will increase with the rate of vehicles increases that result in the increase 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 decide the road condition and composition of area. And the 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 decide the number 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 is established and equations are established to be used for future forecasting of any of the required year.
- Trip distribution model is analyzed and forecasting is performed to present purpose wise trips for the year 2025. Further, it is followed by presenting the 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 broaden 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 required 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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