Goods Movement Trip Generation Using Regression Analysis for Vatva GIDC

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Abstract— The aim of this paper is to develop goods truck trip generation model for largest GIDC of Gujarat (vatva GIDC) using Regression analysis .Company interview survey is organized for data collection. Model has been developed using multiple linear regression analysis by SPSS software .Center limit theorem is used to determine best sample based on production area. Model established fundamental relationship between total no trips per day with weight of lcv,hcv total no lcv,hcv of company, total floor area, total production area. A general model is developed with effective value of R2equil to0.641. The model is validate by expanding sample to whole data and compare with cordon line survey.

Key words: Trip Generation, Regression Model, Trip, Goods Movement

I. INTRODUCTION
Social and economical development of any nation proper transportation is necessary. Transportation is mainly divided in three parts air, water and land. Total share of transportation in indian GDP is 6.7% .Out of 6.7% of total 4.7% share of road in indian GDP. Goods movements plays very important role for Regional and national economy. Total truck registered in india is 38,57,777 out of total Gujarat registered truck 2,57,777 (6.7%). The increased truck activity in GIDC area created the requirement of truck oriented tools. Trip generation equation provides basic tools for analysis of total trip generated on area. In truck demand Forecasting model trip generation is most essential process but often neglected in today scenario. In the actual scenario two types of trip generation model exists vehicle based model and commodity based model. Commodity based model generally estimate commodity flow in tonnage but not useful approach. Vehicle based model give idea of trip generation rates is by landuse as a function of employment.

Goods transportation is most important for development of nation. Goods transportation is generally done by trucks. Vatva GIDC area is dominated by truck transportation from many year. Around more than 10000 trucks of vatva GIDC region are moving on important Freight corridor NH 47.

This type of transportation in a region generates high congestion, operational delay ,pollution ,accident risk ,hence affect overall economy of country .The model will be responsible for generating effective and efficient transportation model.

The model which is developed is responsible to give idea about the existing scenario of goods movement and responsible to give idea about future scenario based on future forecasting. There is no existing model available for goods truck trip generation in vatva gide.Various researcher go incide the the concept fright truck trip generation.

II. STUDY AREA
The research work is carried for one of the largest GIDC of Gujarat (vatva GIDC). Vatva GIDC established in the year of 1968 with handful industry and now vatva GIDC becomes largest GIDC of Gujarat with 2500 industry. Total area cover in vatva gide are 527 hector. Vatva has facilities of un-interrupted power supplies and a special hi-tech Telephone Exchange to serve its various industrial units. That is reason behind high production generated from this GIDC. Vatva has big industrial unit such as GODREJ, PARLE, INTAS, TORRENT, NIRMA, National Leather Research Institute, CIPET, National Standards Laboratory, Indo German Tool etc

There is rapid growth observed in this area. More than 10000 trucks observed in this region. It is necessary to make trip generation model to determine the trips in that region and also use for forecast purpose.

<table>
<thead>
<tr>
<th>Area of Industrial Estate</th>
<th>527 Hectors</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Members</td>
<td>1500</td>
</tr>
<tr>
<td>No. of Industries in Vatva</td>
<td>2500</td>
</tr>
<tr>
<td>Type of Industries</td>
<td>Chemicals • Dyes &amp; Dye-intermediates • Engineering • Food &amp; Pharmaceuticals • Foundries • Plastic &amp; Rubber • Textiles • ICE</td>
</tr>
<tr>
<td>Revenue Generation</td>
<td>More than Rs. 10000 Crore Per Annum</td>
</tr>
</tbody>
</table>

Table 1: Vatva gide basic details

Tomaz kalpa (2014) developed goods truck trip generation model using various approach in regional level. And data collection done at company level using company interview survey. According to observation this approach is most acute and consider the trip generated by industry alone developed the Fright truck trip generation model such as ANN, Regression, exponential and find max value of R2 in regeration. That regreassion approach give best Result For FTG.

Minchoul pack and et.al (IJR 2012) The paper shows goods truck trips generation survey done in korea, in korea 700 industrial units are in opration, the developing contry such as korea ,india ,chaina etc developed many industrial parks for development of FTG. The result shows that the trip generated from indivisual industry only responsible due to production area.
III. DATA COLLECTION AND ANALYSIS

There are various methods available in the market for data collection purposes. Most common methods used are:

1. Company interview survey
2. Mail survey
3. Telephone survey
4. Video survey

Out of these methods, company interview survey is the most satisfactory among all. Because in other methods, we cannot get reliable data and accuracy is also less. That is the basic reason why we adopt the company interview survey.

1. Company interview survey

In this survey, data is collected by interview in the industry. There are 2500 industries in the Vatva GIDC area. Different methods are available in the market for sampling purposes. One of the most common and accurate formulas used for determining sample size is:

\[ N_r = \frac{4PQ}{d^2} \]

Where,
- \( N_r \) = required sample size
- \( P \) = probability of getting a correct response from an industry (0 \(<\ P \leq 1)\)
- \( Q = 1 - P \)
- \( D \) = degree of precision

In this sampling process, we consider the probability of getting a positive or correct response as 0.5. That means we consider that out of total survey, we get only 50% right response. In actual survey, we get more than 50% positive response. But for FOS, we consider that. And this hypothetical approach gives us a sample considering worst condition. We use value of \( d \) equal to 0.05. That means we use sample size equal to about 95% confidence interval. We put value in above condition. We get the value of sample size equal to 400.

Finite population correction factor gives the exact value of sample.

\[ N_e = N_r \left(1 + \left(\frac{(N_r - 1)}{N}\right)\right) \]

We put \( N \), value equal to 400 which is come from above equation. And final sample size calculated as per the above equation equals to 347.

<table>
<thead>
<tr>
<th>Type of industry</th>
<th>Total industry</th>
<th>Sample taken</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemical</td>
<td>843</td>
<td>117</td>
</tr>
<tr>
<td>Engineering</td>
<td>855</td>
<td>117</td>
</tr>
<tr>
<td>Fabrication</td>
<td>84</td>
<td>11</td>
</tr>
<tr>
<td>Furnace and Foundry</td>
<td>103</td>
<td>15</td>
</tr>
<tr>
<td>Utility</td>
<td>103</td>
<td>15</td>
</tr>
</tbody>
</table>

Table 2: Sample size as per formula

The data collected from industry has followed center limit theorem rule. According to which data collected from industry as per total area should not be extremely large or extremely small. Center limit theorem allows to take data which come at mean range neither too large nor too small.

<table>
<thead>
<tr>
<th>Ice</th>
<th>103</th>
<th>15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Packing</td>
<td>97</td>
<td>12</td>
</tr>
<tr>
<td>Plastic</td>
<td>103</td>
<td>15</td>
</tr>
<tr>
<td>Pharma and medicine</td>
<td>103</td>
<td>15</td>
</tr>
<tr>
<td>textile</td>
<td>103</td>
<td>15</td>
</tr>
</tbody>
</table>

Table 3: Comparison of data between the industry and cordon line survey

IV. DEVELOPMENT OF MODEL

Company interview survey is carried for data collection in the GIDC area on 347 industries in Vatva and trip generation model developed.

\[ Y = 0.538 + 0.001X_1 + 0.172X_2 + 0.227X_3 + 0.055X_4 + 0.263X_5 + 0.09X_6 \]

In this study, multiple linear regression equation is developed using data collected from industry. In which \( y \) is considered as a dependent variable which is trip and \( x \) are independent variables – total floor area, weight of LCV, weight of HCV, no of employees, no of LCV, no of HCV. There are many parameters considered during the interview process, but some parameters do not produce proper co-relation. Which is not considered during design. The model is developed using SPSS software.

V. VALIDATION OF MODEL

A. Field validation

In the field validation process, we use the equation generated by the SPSS software and determine the total number of trips generated by each industry. We put the equation in the data collected of all 347 industries. We have value of production area, total no LCV, total no HCV, no of employees, weight of LCV, weight of HCV. Total of trip generated by 347 industries is determined and this data extend to 2500 industries. There is a cordon line survey also carried out to determine the accuracy of model. The survey is carried out round the clock 24 hrs. And data collected for seven days round the clock. Average data of 7 days round the clock is used for validation purpose.

<table>
<thead>
<tr>
<th>Data of 347 industry</th>
<th>Data of 2500 industry expanded on center limit theorem</th>
<th>No truck as per cordon line survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>1955</td>
<td>14087</td>
<td>15177</td>
</tr>
</tbody>
</table>

Table 3: Comparison of data between the industry and cordon line survey
The difference between the main data which is collected from cordon line survey and the data which is generated from industry is come nearly same. variation of data is less than 10%. which is strong reaction that model is correct.

VI. CONCLUSION

From the above study it is realized that more specific and central approach is given for the development of trip generation model which guide the government for the future explanation of the industrial zone.

- In this research the model is developed using linear regression analysis with R² value equals to .64 and which indicates good relationship between dependent and independent variable.
- The model is developed on the largest gidc of Gujarat. So this model gives more accurate value for large industries.
- This model gives present no of trips generated in industrial zone and also give idea about future explanation of trips if the new development is take place.

REFERENCES