Development of Trip Generation Model for Goods Movement of Gozaria and Visnagar G.I.D.C.

Hiren R.Rudani[1], Prof. V. R. Patel [2], Prof. H. K. Dave[3]

[1]*P.G. Student, Government Engineering College, Modasa*
[2]*Associate Prof., L. D. College of Engineering, Ahmedabad*
[3]*Associate Prof., Government Engineering College, Modasa*

Abstract — *Freight transportation is very important for development of nation. Generally Freight Transportation on highway is carried out by trucks. The aim of this paper is to developed truck trip generation model for Gozaria and Visnagar GIDC. The company travel diary survey has been carried out by company by the survey. The model has been developed using multiple linear regression analysis by Regression Tool of MS Excel, which establishes relationship between the daily number of truck trips per day generated by the total floor area of industries, total weight of production in tonne and total weight of raw material in tonne. A general model for truck trip generation has been developed. The model result gave an effective value of R2 equal to 0.9421, indicating that the explanatory variables included in the model explain 94.21% of the dependent variable. The model also validated by Mehsana GIDC. Accurate forecasting of future truck trips using this model can be done.*

Keywords- Freight transport, truck trip, Regression analysis, truck trip generation

I.   INTRODUCTION

Freight Transportation is a major factor contributing to economic growth and development. It is usually considered that urban goods transport proceeds from a complex system. Freight transportation encompasses the movement of a wide variety of products, from raw materials to finished goods, from comparatively low value-to-weight commodities such as coal, grain, and gravel to high value-to-weight items such as computer parts and pharmaceuticals. It includes transport system, infrastructures and urban planning, firm's logistic strategies. The main stakes of urban goods movement (UGM) can be considered at different topics and scales: reliability of the different logistic chains, local traffic growth, local traffic congestion, urban centers economic support, environmental nuisances (noise, pollutant emissions), urban logistic centers optimal location, greenhouse gas saving, but also urban spread effects and changes in the consumer behaviour, among others.

There are two types of truck trip generation models, vehicle-based and commodity based. In vehicle-based truck trip generation models, the most common approach to estimating trip generation rates is by land use as a function of employment. Commodity-based trip generation models generally, estimate commodity flow tonnage, county-to-county or state-to-state flows and then converted to daily truck trips using payload factors.

Freight transportation is very important for development of nation. Generally freight transportation on highways is carried by truck. Freight transportation for GIDC region is very important for Gozaria and Visnagar. Gozaria and Visnagar GIDC region is dominated by truck transport since many years.

This transportation movement causes traffic congestion, delay, pollution and risk of accidents and hence affecting on the economy of the region. Thus to increase the efficiency and effectiveness of the freight movement the study of the truck trips will be carried out from Gozaria and Visnagar GIDC.

This paper in to determine the factors influencing truck trip generation for the industrial group selected for the study and validate the developed model. To understand the problems and trends concerning freight transport. To collect data on number of freight truck trips in Gozaria and Visnagar GIDC by conducting surveys. To estimate number of truck trips per unit production area.

With increased industries products in study area, increased a congestion of traffic around study area roadway network due to goods movement. To solve these problem forecast a truck trip rate by using commodity based industrial survey and analysis of data of the study area.

II.   STUDY AREA

The area of study taken for the thesis work is Gozaria and Visnagar GIDC. It is located in district Mehsana of Gujarat state. There are in all 205 industries within the GIDC, out of which major industries are plastic, stonework, machinery and chemicals. Figure shows the study area.

Figure 1 Visnagar GIDC

Figure 2. Gozaria GIDC

III.   DATA COLLECTION AND DATA ANALYSIS

The mostly used data collection techniques for understanding of present behavior of freight transportation are: Roadside Interview Survey, Travel Diary Survey, Mail survey, Telephone Survey, Cordon Count Survey and GPS Receiver attached to sample of truck. Two type of Data are surveyed and collected by Industrial Diary survey and Commercial vehicle volume count and collected Industry information, Total floor area of industry, manufacturing items, weight of manufacturing item, total number of LCV and HCV, total number of truck trip per day will be collected.

3.1 Company travel diary survey

In this survey I have collected data from Companies in Gozaria and Visnagar GIDC.I requested company owner to fill the survey form and out of 205, 112 company owners agreed to give the data and had filled the survey form. The data collected shown in table 1. The commodity- wise total number incoming and outgoing truck trip per day shown in figure 3 and figure 4.

Table 1 Data Collection Sheet

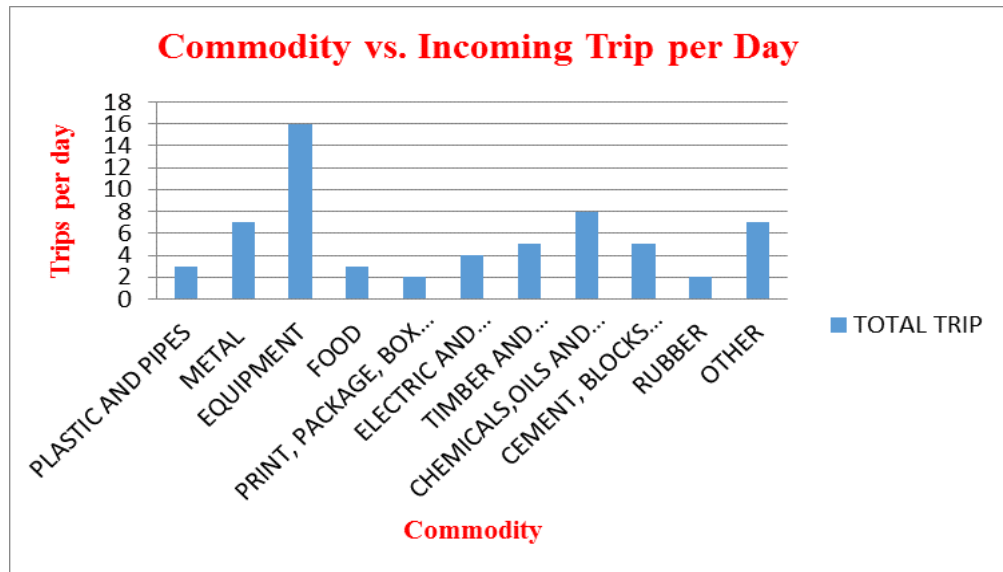|	Production Data(in tonne)	Raw Material Data(in tonne)	Floor Area (in m2)
Gozaria GIDC	146.6	155.55	71062.5
Visnagar GIDC	175	184.75	68130.53

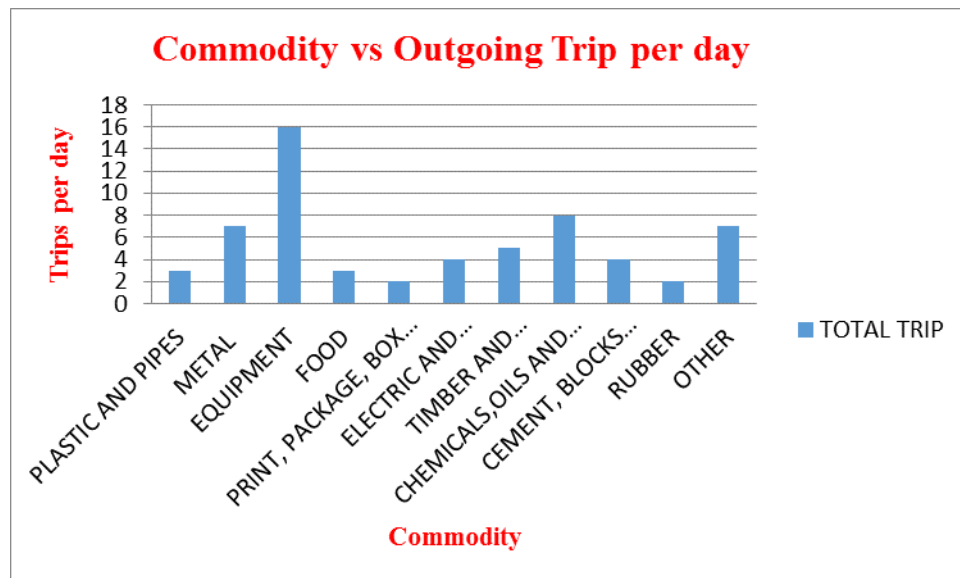*Figure 3 Commodity wise Incoming Truck Trip*

Figure 4 Commodity wise Outgoing Truck Trip

3.2 Road side interview survey

In this survey data collected to entry and exit point at Gozaria and Visnagar GIDC and how many trucks going to company at Gozaria and Visnagar GIDC. This survey in data collected at entry and exit point.

Table 2 Entry exit truck trip per day

Industries	Incoming truck trips	Outgoing truck trips	Total truck trip
205	278	256	534

IV. DEVELOPMENT OF MODEL

Company travel diary survey has been carried out by interviewing 112 company's owners at Gozaria and Visnagar GIDC and developed truck trip generation model.

$$Y=0.730865+0.23295*X1+0.110395*X2+0.000029*X3$$

In this study, Truck Trip Generation Model is developed using linear regression from the collected by company travel diary survey. In the linear regression analysis, as a dependent variable (Y) - Truck trips per day is considered and as the independent variables- Total weight of production data(X1), Total weight of raw material data(X2) and Total floor area(X3) are considered. Other parameters asked during the personal interview are found no significant for the truck trip generation. Analysis is carried out using Regression function of MS Excel.

Value of coefficient of determination $R2$ is 0.9421, which is nearer to 1 indicates very good linear relationship between independent variables and dependent variable. The positive multiply constant X1, X2 and X3 indicates the increase of these parameters, then increase the total truck trip in daily.

V. MODEL VALIDATION

Model validation tests the ability of the model to predict future behavior. This requires to apply model to other GIDC which have similar types of industries. If the estimated model results and the survey observations are in acceptable agreement, the model can be considered validated. I have collected data from Companies in Mehsana GIDC. The data collected and variance in data shown in table 3. Specifically, in order to verify the estimated general truck trip generation model, a comparison of the estimated total daily truck trips per industry (as calculated from the estimated regression model) with the actual total daily truck trips per industry (from the surveys) is included shown in table 3.

Table 3 Data collection of Mehsana GIDC

Industries	Production Data(in tonne)	Raw Material Data(in tonne)	Floor Area (in m2)	Predicted truck trip using model	Actual truck trip	Variance
177	727.85	761.45	294116.6	263	302	39

VI. CONCLUSION

➤ In linear regression analysis, $R^2= 0.9421$ indicates very good linear relationship. The significant parameters are, total weight of production, total weight of raw material and total floor are of industry for generation of truck trips per day.

- ➢ Total truck trips observed in Gozaria and Visnagar GIDC is 534 /day, out of which 278 are incoming trips/day and 256 are outgoing trips/day.
- ➢ The maximum companies in GIDC are of plastic, stonework, machinery and chemicals.

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