© May 2016 | IJIRT | Volume 2 Issue 12 | ISSN: 2349-6002

Freight Truck Trip Generation Model for Mehsana GIDC

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***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 Mehsana 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 SPSS software, which establishes relationship between the daily number of truck trips per day generated by the total floor area of industries, total number of HCV on owner and weight of goods in HCV. A general model for truck trip generation has been developed. The model result gave an effective value of R^2 equal to 0.812, indicating that the explanatory variables included in the model explain 81.20% of the dependent variable. The model also validated by road side interview survey. Accurate forecasting of future truck trips using this model can be done.**

***Index Terms*- Freight transport, truck trip, truck trip generation**

I. INTRODUCTION

Transportation Engineering has contributed a lot in advancement of civilization, technological progress and development of a nation. The Road transport is vital to the economic development and social integration of the country. Transport sector accounts for a share of 6.4 per cent in India's GDP, in which road transport has contributed with a share of 4.7 per cent in India's GDP.
Goods movements by trucks play a critical role in the national and regional economy. Out of total 38, 44,583 number of trucks registered in India, 2, 59,213(6.7%) number of trucks are registered in Gujarat (2010). The increased importance of truck activity in both transportation engineering and planning has created a need for truck-oriented analytical tools. A particular planning need is for trip generation data that can be used to estimate truck traffic patterns, beginning with the ability to estimate truck trips generated by a variety of common land uses.

Information on the movement of trucks is important for an effective management of transportation infrastructure. In truck demand forecasting model, trip generation is most fundamental but often neglected process in today's business. Truck trip generation is the first step in modeling and understanding the impacts of truck traffic on congestion and the environment. Aggregate truck trip-generation data by traffic analysis zone is necessary for travel demand modeling.

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 Mehsana. Mehsana GIDC region is dominated by truck transport since many years. Around more than 1000 trucks of Mehsana GIDC region are moving on the important national freight corridor NH-134.

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 Mehsana GIDC

Table 1Number of Vehicles registered in Mehsana

	Year	2010-2011	2011-12	2012-2013
Goods Vehicles	Truck/Lorries	16126	16491	16986
	Tanker	1190	1362	1473
	Three wheeler LGVs	6746	7106	7679
	Other LGVs	3323	4205	5071

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- Based upon existing scenario of the developed relationship of freight movement forecasting for future freight movement carried out which could be helpful in identifying whether the existing network is sufficient or not for the future trips. No model is developed for the prediction of freight trip movement for the GIDC area. It is necessary to develop a model considering important parameters for trip generation for freight trip movement. 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 Mehsana GIDC by conducting surveys. To estimate number of truck trips per unit production area.

II STUDY AREA

The area of study taken for the thesis work is Mehsana GIDC. Mehsana GIDC is one of the Industrial Estates from among 107 GIDC of Gujarat state. It is located in district Mehsana of Gujarat state. There are in all 360 industries within the GIDC, out of which major industries are plastic, wires, pipes and box industries. Around 18 lakhs people living in Mehsana.

Table 2 Mehsana Detail

Study area	: Mehsana GIDC
District Headquarter: Mehsana	
Population	: Around 18 lakhs
Total Industry	: 360
Industries	: Most industries are of plastic, wires, box and steel materials

Figure 1Study Area

III. DATA COLLECTION AND ANALYSIS

The mostly used data collection techniques for understanding of present behavior of freight transportation are: (1) Roadside Interview Survey, (2) Travel Diary Survey, (3) Mail survey, (4) Telephone Survey, (5) Cordon Count Survey and (6) GPS Receiver attached to sample of truck, In this study data collected by company travel diary and road side interview survey and collected Industry information, Total floor area of industry, manufacturing items, total number of LCV and HCV, capacity of LCV and HCV, Weight of LCV and HCV, total number of truck trip per day will be collected.

(A) Company travel diary survey

In this survey I have collected data from Companies in Mehsana GIDC.I requested company owner to fill the survey form and out of 360, 210 company owners agreed to give the data and had filled the survey form. The data collected shown in table 2.

Table 3Data Collection Sheet

Sr no.	Data Collected	Total	Average
1	Total Floor Area (Sqm.)	455720	4319.62
2	Total number of goods vehicles	997	9.45
3	Number of LCV(Owner)	553	5.24
4	Number of HCV(Owner)	437	4.14
5	Capacity of LCV(tonns)	758.5	7.2
6	Capacity of HCV(tonns)	1417.5	13.43
7	Trip per day(LCV)	536.46	5.09
8	trip per day(HCV)	448.97	4.27
9	Weight of goods in LCV (Tonns)	578.8	5.49
10	Weight of goods in HCV (Tonns)	815.5	3.83
11	Incoming trip per day(LCV)	215.16	2.04
12	Incoming trip per day(HCV)	217.93	2.08
13	Outgoing trip per day(LCV)	321.3	3.05
14	Outgoing trip per day(HCV)	231.04	2.19

Table 4Commodity-wise Industries

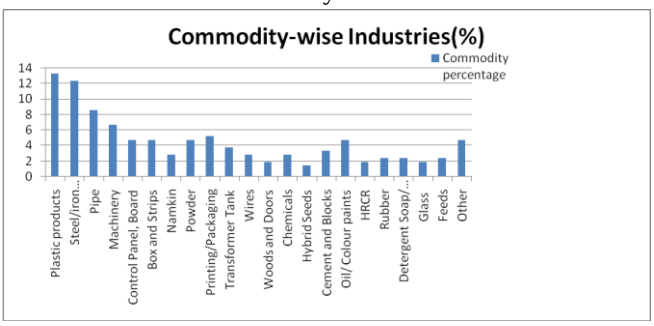


Table 5Commodity wise incoming truck trip per day

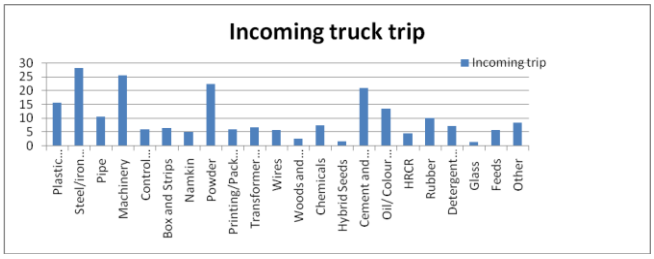


Table 6 Commodity wise outgoing truck trip per day

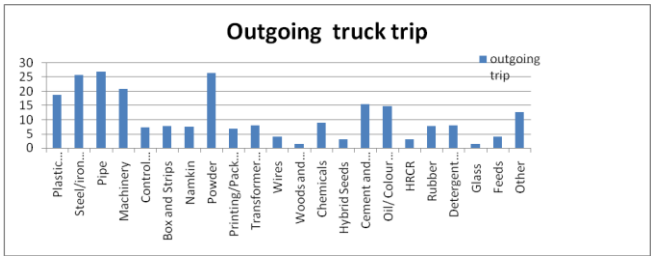
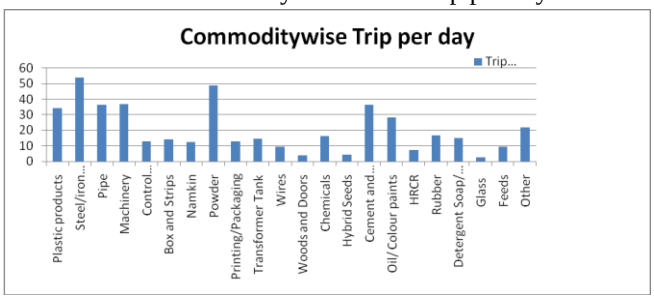


Table 7Commodity- wise truck trip per day



The commodity- wise total number of industries in percentage and its incoming and outgoing truck trip per day shown in table3,table4, table 5 and table 6.

(B) Road side interview survey

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

Table 8Entry exit truck trip per day

Industries	Incoming truck trip	Outgoing truck trip	total truck trip
360	318	324	642

In which total 210 industries in truck trip calculated by this survey.

Table 9 Entry Exit truck trip

Industries	Incoming truck trip	Outgoing truck trip	total truck trip
210	198	212	410

IV. DEVELOPMENT OF MODEL

Company travel diary survey has been carried out by interviewing 210 company's owners at Mehsana GIDC and developed truck trip generation model.

$$\mathbf{Y = -1.50021 + 0.000278}\ X_1 \mathbf{+ 0.66867}\ X_2 \mathbf{+ 0.423241}\ X_3$$

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 floor area (X_1), Total number of HCV (X_2) and Weight of goods in HCV (X_3) are considered. Other parameters asked during the personal interview are found no significant for the truck trip generation. Analysis is carried out using SPSS Software function of MS Excel.

Co-efficient of determination R^2 = 0.812983

Value of coefficient of determination R2 is 0.812983, which is nearer to 1 indicates very good linear relationship between independent variables and dependent variable. The positive multiply constant X_1, X_2 and X_3 indicates the increase of these parameters, then increase the total truck trip in daily.

V. VALIDATION OF MODEL

The Validation of model means the amount of find out the errors. The statistical and field test is carried out for model validation. The validation of model procedure is below.

(A) Statistical test

Shown tn table10 the t value more than the t critical value (t > tcr) and f value is more than the f critical (F > Fcr) so model is validate.

Table 10 Summary of model

Parameters Or Variables	Total floor are (X_1)	Total number of HCV (X_2)	Weight of HCV (X_3)
a	-1.50021		
m_i	0.000278	0.66867	0.423241
t value	7.075387	13.90424	8.669532
t critical	3.182		
R^2	0.812		
F value	298.5		
F critical	1.04686E-74		

(B) Field test

Model validation tests the ability of the model to predict future behavior. This requires comparing estimated model results to survey observations. If the estimated model results and the survey observations are in acceptable agreement, the model can be considered validated.

Table 11 Validation of model

Industry		210	Total
Company travel diary survey	Incoming	218	
	Outgoing	231	449

Road side interview survey	Incoming	198	310
	Outgoing	212	
Variance	Incoming	20	39
	Outgoing	19	

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 11

VI. CONCLUSION

It needs to be realized that truck trip generation for industrial parks requires more detailed research. Relevant conclusion can be drawn as below.

- In linear regression analysis, R^2= 0.813 indicates very good linear relationship. The significant parameters are total floor are of industry, total number of HCV (owner) and weight of goods in HCV for generation of truck trips per day.
- Total truck trips observed in GIDC Mehsana is 642 /day, out of which 318 are incoming trips/day and 324 are outgoing trips/day.
- The maximum companies in Mehsana GIDC are of Plastic products, Steel and Iron plates, Pipes and Machinery.
- The maximum daily truck trips are from industries, producing Steel and iron plates, making powder, Pipes and machinery in Mehsana GIDC.
- The developed truck trip generation model for predicting the future truck trips generated from Mehsana GIDC.

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