Impact Factor (SJIF): 4.542

International Journal of Advance Research in Engineering, Science & Technology

e-ISSN: 2393-9877, p-ISSN: 2394-2444

Volume 4, Issue 4, April-2017

Industrial Trip Generation Model For The Ceramic Industries Of The Himatnagar City

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Abstract:- Due to urbanization process developing cities are surrounded by different types of industrial and recreational activities. These activities giving impact on existing road network by increased vehicular trips. It can create traffic congestion, delay, air and noise pollution etc. Hence, it is necessary to estimate these types of vehicular trips generated by industrial or recreational activities. In India few researches have been carried out to develop the industrial trip generation model. Keeping this in view the study is aimed to develop industrial trip generation model for the developing city like Himatnagar. Himatnagar city is facing urbanization problems due to increased outer growth of the area. Due to ceramic industries, packaging industries, laminates industries, agriculture industries, GIDC, and Sabar Dairy, trips by industrial employees, goods vehicle trips for raw material (in coming trips) and finished material (outgoing trips) creating traffic congestion on existing road network..

Keywords: Trip generation model, Trip production model, Trip attraction model.

I. INTRODUCTION

Urban transportation covers the movement of both people and goods within an urban area. At the individual level, urban transportation can be characterized by a trip. However, at the millions of these individual trips define urban transportation (Barber, 1995). A trip is as a journey made by an individual between two different points. Each trip is performed using one or multiple transportation modes for a defined purpose at a given time. Although a trip may involve more than one purpose, it is usually identified by its principal purpose (Hobbs, 1979).

Trip generation analysis, as Meyer (1974) puts it, seeks to estimate the volume of trips that will be made by individuals to work, shopping, school, and so forth, but not the flows between points within the whole system. The functioning of urban city is highly dependent on the movement of people, goods and information (Muller, 1995) and trip generation studies are vital part of transportation planning, due to the recursive nature of urban transportation modeling procedure (Bruton, 1986; Badoe and Steuart, 1997).

Personal trips are commonly classified based on their main purpose (Barber, 1995); work trips, shopping trips, social trips, recreational trips, school trips, home trips and business trips. This study focuses on industrial trips, and the factors that determine the aggregate number of industrial trips generated in urban areas.

A. Trip purpose:-

It has been found in practice that better trip generation models can be obtained if trips by different purpose are identified and modeled separately. In the case of home-based trips, five categories have been usually employed.

- Trips to work;
- Trips to school or college(education trips);
- Shopping trips;
- Social and recreational trips;
- Other trips.

The first two are usually called compulsory (or mandatory) trips and all the others are called discretionary (or optional) trips. The latter category encompasses all trips made for less routine purposes, such as health, bureaucracy (need to obtain a passport or certificate) and trips made as an accompanying person. Non-home based trips are normally not separated because they only amount to 15-20% of all trips.

B. Aim of the study:-

The aim of this study is to develop the industrial trip generation model for the ceramic industries for the Himatnagar city.

C. Objective of the study:-

- To get the information of the existing locations of the industries near by the Himatnagar. Their types, numbers of workers, floor area, details of raw materials and finished material.
- To understand the trip making characteristics of various industrial workers and generating trip attraction model (employee trips).
- To determine the independent variables for the trips generated by goods/freight transport vehicles for the different types of industries and developing their trip generation models.

D. Scope of the study:-

- The study is limited to selected area of Himatnagar city.
- The study is mainly focused on industrial trip generation behavior of the employees and goods/freight transport vehicles for the different types industries near by the Himmatanar city.
- This study enables to understand the significant parameters for the industrial trip generation.
- This study also facilitates to understand the tendency of trip makers for choosing particular time, route, location, cost etc.
- This study also enables to estimate the workers trips and goods/freight vehicle trips for any new industry established in future.

II. Literature Review

Mirjam et al. (2002) have carried out the study in European Traffic congestion problems are a constant cause of concern in today's centers of economic activity. While measures that deal with these problems generally focus on the use of private cars, increasing freight traffic as a cause of road congestion should not be ignored. Forecasts off right traffic at a local and regional scale are necessary to predict traffic flows on specific routes, and might be helpful in planning adequate infrastructure for future industrial estates. Such forecasts, however, require knowledge of the generation of freight trips by firms, a field in which little research has been done so far. This describes an attempt to uncover the relationship between firm characteristics and freight traffic. The main purpose of the research described to build a freight trip generation model which takes differences between sectors of industry into account. The study shows that trip intensity can vary over sectors by an order of magnitude, thus making this material of interest for city and infrastructure planning purposes. Regression analysis provides a basis for estimating the amount of trips generated by individual firms, and where this is not possible, the average number of trips generated by firms in specific sectors of industry, might serve the same purpose.
When it comes to choosing an indicator of firm size, the choice between the firm area And the number of employees is hard to make. Their relative importance depends on the type of activity and the direction of the flows (incoming or outgoing).

Koppelman and Pas (1984) have derived that there are at least two approaches in terms of data aggregation in trip generation models: aggregate trip generation models and disaggregate trip generation models. In aggregate models, data at a given geographic level, such as neighborhood or city, are used. In disaggregate models, data at the household or individual levels are used. Linear regression and categorical analysis techniques are widely used in estimating the aggregate models (FHWA, 1975; Hobbs, 1979; Koppelman and Pas, 1984; Bruton, 1986; Sheppard, 1995). Discrete choice models are used for disaggregate models (Vickerman and Barmby, 1985).
The socio-economic characteristics of the trip makers are assumed to be significant determinants of travel behavior and include income, age, gender, employment status, auto ownership, and household size. The physical and demographic characteristics of the area include employment, population, and density.

Qiuping et al. (2013) have studied Xi'an city in China the volume of slow traffic generation is mainly influenced by urban land use, such as the land-use type, the land development intensity, the population, the labor resources, each kind of the employment opportunities and the education opportunities. First, the quantitative relationship between the slow traffic generation and the relative indexes is established in the case of usual residential districts, shopping centers, and office buildings in some area of Xi'an. On this basis the paper forecasts the slow traffic generation of each land use type through investigating the economic indexes of the land combination of Li Jiacun cross in Xi'an. And then the paper builds up the relational model between land use and slow traffic. Finally, it puts forward some questions to be considered in using the slow traffic generation forecast method related to land use. This study is expected to provide reference for forecasting land use-slow traffic in the future year according to the related data of proposed development in Xi'an city.

The study of quantitative relationship between land use and slow traffic volume fully reflects that urban land use patterns decide the spatial and temporal characteristics, trip generation intensity and flow of the slow traffic demand, providing a direct method to analyze the relationship between land use and slow traffic planning.

Munuzuri et al. (2009) have focused on urban freight transport barely incited any modeling efforts when compared to passenger cars public transport, which is mainly due to the lack of available data and the complexity of the delivery route patterns and the involved decision making. We present here a modeling approach consisting of a demand model followed by an entropy maximization procedure to estimate an origin-destination matrix for urban freight transport vehicles, both for business to business and home deliveries, during the morning peak hour. This approach requires relatively few data inputs in comparison with other existing models and represents an initial step toward the inclusion of freight delivery models in overall urban transport planning. The application of the model is illustrated with a case study in the city of Seville, with its efficiency tested by the validation of the results using actual traffic counts.

Vinodkumar et al. (2016) the aim of this research work have to determined the factors affecting trip generation for the selected groups of industries within the region and to develop trip generation model. To develop trip generation model considering all the affecting parameters for the future trips estimation, the industries are classified based on the plot area and numbers of employee. The model has been developed using several regression analyses by means of Statistical Package for the Social Sciences (SPSS), which establishes relationship between numbers of trips each activity produce or attract by the employees and their socioeconomic attributes. A general model for trip generation has been developed. The model result gave an effective value of R2 equal to 0.99, indicating that the explanatory variables such as area of industries, income of employee, travel distance, travel time and travel cost included in the model explain 99% of the dependent variable. Travel cost and travel time are the main factors affecting trip generation.

III. Some basic definitions

Before any discussion detailing the trip generation modeling process, it is important at this point to emphasize a few clue definitions.

- **Trip:** One-way journey from a point of origin to a point of destination.
- **Home-based trip:** When home of the trip-maker is either the origin or destination of the trip.
- **Non- home- based trip:** Neither end of the trip is the home of the trip maker.
- **Trip-production:** Home end (origin or destination) of a home-based trip, or origin of a non-home-based trip.
- **Trip-attraction:** Non-home end (origin or destination) of a home-based trip, or destination of a non-home-based trip.
- **Trip generation:** it is the first step in the conventional four-step transportation forecasting process (followed by **trip** distribution, mode choice, and route assignment), widely used for forecasting travel demands. It predicts the number of trips originating in or destined for a particular traffic analysis zone.
- **Industry:** The production side of business activity is referred as industry. It is business activity, which is related to the raising, producing, processing or manufacturing of products.

IV. Study Area

Himatnagar or **Himatnagar** is a municipality in Sabarkatha district in the Indian state of Gujarat. It is the administrative headquarters of the district. The town is on the bank of the river Hathmati. Himatnagar was founded in 1426 by Ahmed Shah I of Gujarat Sultanate and named it Ahmednagar after himself. He founded the town to keep Raos of Idar State in check. It is said that he was so fond of the place that he thought of making it, instead of Ahmedabad, the capital of Gujarat Sultanate. After independence of India in 1947, Idar State was merged with Union of India. From 1947 to 1956, it was a part of Bombay State as Idar district. Himatnagar was the largest city and the administrative headquarters of the Dungarpur district, Rajasthan from 1956 to 1960. As of 2011 India census,[1] Himatnagar had a population of 81,137. Himatnagar has an average literacy rate of 87.15%, higher than the state average of 78.03%: male literacy is 91.89%, and female literacy is 82.09%. In Himatnagar, 11.60% of the population is under 6 years of age. Since 1961, Himatnagar is the administrative headquarter and part of Sabarkantha district of Gujarat. Himatnagar has a railway Station (Meter gauge line) and a GSRTC Bus Depot. Himatnagar is connected with National Highway No.8.

Himatnagar is a central site for the ceramic industry of the state, and is home to several manufacturing units such as Asian Granito Limited, City Tiles Limited, Regent Tiles and Century Tiles. The town has also been home to major companies in the weighing scale industries since 1960.

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Table:1 Himatnagar Geographic Data

City Name: Himatnagar	Population: 81,137	**Geographic coordinates:**
Region: Gujarat	Country: India	Latitude: 23.6• N
	Capital: New Delhi	Longitude: 72.95˙ E
		Elevation: 127 m

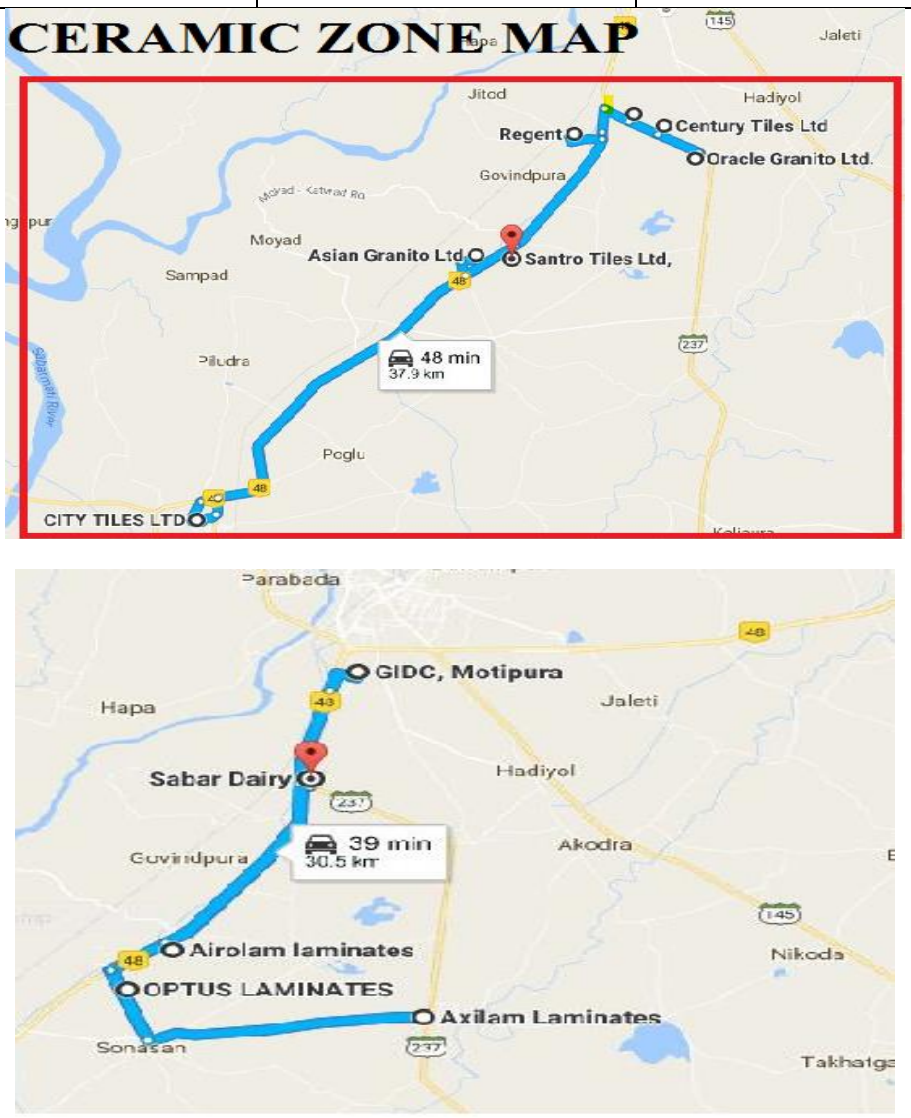

Figure: 1 Himatnagar industrial maps (Source: Google Map)

List of the units in **Himatnagar** & Nearby Area

1. Asian Granito India Ltd., 147-A, Ceramic Zone, Dalpur, Pratij
2. Oracle Granito Ltd., Block No.386, sabar Dairy, Talod Road, Himatnagar
3. Regent Granito (I) Ltd., Hasipur, Nr.Sabar dairy, N.H.8, Himatnagar
4. Century Tiles Ltd., Block No.212,Nr.Sabar Dairy, Gadhoda, Himatnagar
5. City Tiles Ltd., Block No.121, Dalpur, Prantij

V. Data collection and data analysis

The process consist collection of origin and destination data. The information on the travel pattern includes number of trips made, their origin and destination, purpose of trip, travel mode, travel time and so on. The information on industrial

employee interview survey characteristics includes type of Employee name, age, salary, vehicle ownership and so on. Based on these data it is possible to relate the amount of travel to industry and zonal characteristics and develop equations for trip generation rates.

Table 2: Data collection for Ceramic Industries

Name of industries	Area(sq.m)	Ave. Trips time(min)	Ave. Monthly salary	Ave. Daily raw materials(ton)	Ave. Daily finished materials(ton)	No. of Employees Trips
	X1	**X2**	**X3**	**X4**	**X5**	**Y**
Asian Granito India LTD	231280	23.80	37034.38	71	105	1030
Regent Granito India LTD	121406	27.30	15820	57.71	80.14	556
VRN Ceramic Ltd	74520	30.11	18390.47	99.42	107.28	650
Sonata Ceramica Pvt Ltd	33379	28.33	14746.25	55.14	73.85	560
Century Tiles Ltd	36776	26.30	13973.39	91.57	104.2	630
City Tiles Ltd	105218	30.13	18921.05	97.33	107.13	592
Sentro Tiles Ltd	24281.1	28.33	14746.15	59.71	96.85	630
Oracle Granito India Ltd	60000	26.63	16691.3	89.14	94.85	770
Gladder Ceramics Ltd	21812	26.85	14896.17	56.72	77.42	574
Prime Insulator Pvt Ltd	41733	36.25	18460	45.42	60.85	578

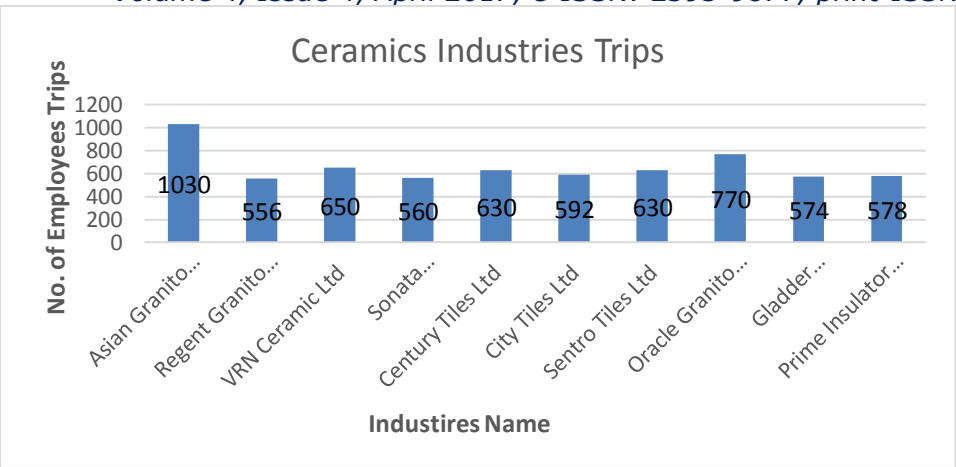

Figure 2: Distribution of daily trips to Ceramics industries.

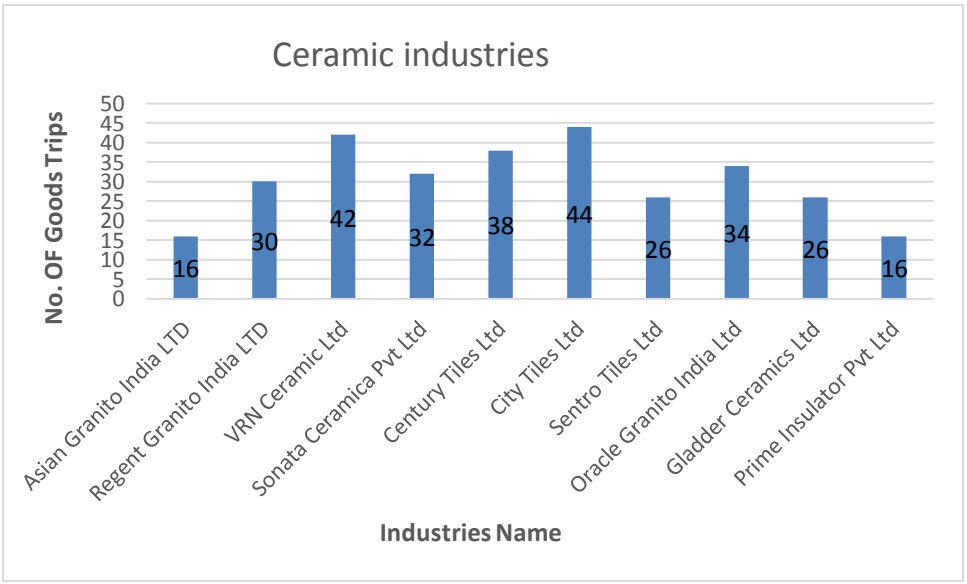

Figure 3: Distribution of daily goods vehicle trips to Ceramics industries

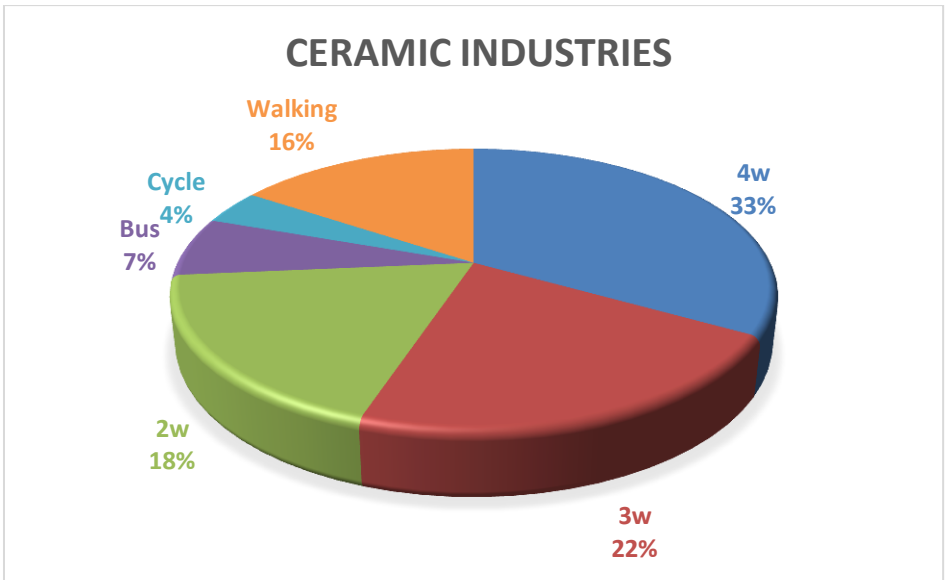

Figure 4: Ceramic industries trips/day (Mode wise)

Figure shows Desire line diagram to indicate the origin and destination of the employees trips for ceramic industries.

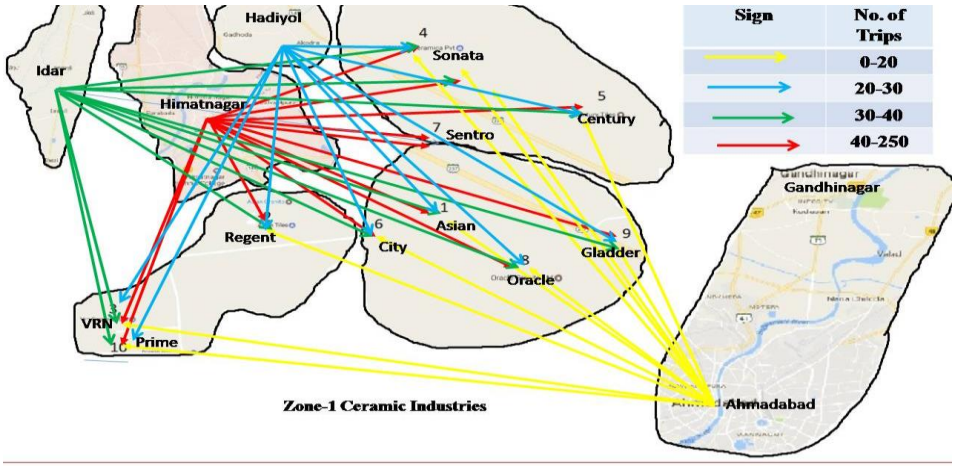

Figure 5: Desire line diagram for ceramic employee trips

VI. Model development

The Statistical Package for the Social Sciences (SPSS) is one of the largely used statistical analyses. The SPSS program provides a wide range of procedures and tests used in statistics. Moreover, it offers descriptive statistics such as frequencies, mean and correlations. Finally, it is useful for developing charts. In this research, the SPSS software will be used to estimate the industrial trip generation models using linear regression method.

Using the various data from the industries, the trip generation model is developing using the multiple regression analysis. The regression analysis conducted few times. In each stage, the regression model is evaluated according to statistical tests. The final projected ceramic industrial trip generation model is:

(1.) Y=624.28-0.01X1-14.73X2+0.026X3+1.35X4-0.395X5 R^2**=0.90**

(2.) Y=595.86-0.01X1-14.23X2+0.025X3+1.1X4 R^2**=0.90**

(3.) Y=648.48-12.2X2+0.01X3+1.12X4-0.45X5 R^2**=0.86**

(4.) Y=720.39-0.001X1-15.43X2+0.024X3 R^2**=0.88**

(5.) Y=616.08-11.65X2-0.017X3+0.83X4 R^2**=0.86**

(6.) Y=159.18+0.017X3-0.23X4+2.18X5 R^2**=0.82**

(7.) Y=887.31+0.001X1-12.03X2 R^2**=0.63**

(8.) Y=712.02-12.87X2+0.017X3 R^2**=0.85**

(9.) Y=223.6+0.019X3+1.25X4 R^2**=0.80**

(10.) Y=173.34-4.66X4+9.04X5 R^2**=0.34**

(11.) Y=525.7+0.002X1 R^2**=0.52**

(12.) Y=1326.86-23.5X2 R^2**=0.29**

(13.) Y=310.41+0.019X3 R^2**=0.77**

(14.) Y=538.46+1.640X4 R^2**=0.05**

(15.) Y=277.2+4.18X5 R^2**=0.22**

Where,
Y=Num. of employees trips

X1=Area (sq.m)

X2=Ave. trip time (min)

X3=Ave. monthly salary

X4=Ave. Daily Raw material (Ton)

X5=Ave. Daily Finished material (Ton)

$$Y=223.6+0.019X3+1.25X4$$

Where,
X3=Ave. monthly salary

X4=Ave. Daily Raw material (Ton)

This model (eq. 9) is best because of the coefficient of X3 (Ave. monthly salary) and X4 (Ave. Daily Raw material (Ton)) are 0.019 and 1.25 respectively. These coefficients have positive sign indicate that the monthly salary and Ave. Daily Raw material increases, the daily trips will increases.

VII. Conclusion

Trip production models were formulated and validated for the ceramic industrial area of Himatnagar city. It has been found that trip production is a function of age group and employment rate while trip attraction is influenced by number of commercial establishments and employment opportunities of the zone. The models developed can be of effective use for a transport planner while formulating long term transportation options strategies for the city.

REFERENCES

[1] Divya Priya C., (2014). "Freight Trip Generation Models for Chennai, India", Transportation Research Board Conference.

[2] Comi F. and Russo A., (2011). "Measures for Sustainable Freight Transportation at Urban", Journal of Urban Planning and Development.

[3] Nadezda Z. and Arkady B., (2013). "Regression analysis for transport trip generation evaluation" Transportation Management System Riga Technical University.

[4] Vinodkumar R., Varia H. R. and Rajpara G., (2016). "Development of Regional Industrial Trip Generation Model", Indian Journal of Transportation Management system.

[5] Kadiyali L.R., (2012), A textbook on "Traffic Engineering and Transport Planning" Khanna Publishers.