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Industrial Freight Movement Analysis of Waghodia GIDC Area Vadodara

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ABSTRACT: Development of any region is mainly depending on safe, timely & economic conveyance of goods & passengers, whenever and wherever required. Industrial development contributes significant freight vehicle movements on the transportation network. Freight vehicles imposing considerable impacts on traffic flow parameters and pavement deterioration. Therefore, it is interesting to estimate the number of freight vehicle trips generated from the industrial area. Very few researchers have developed the trip generation equations for the industrial freight vehicles. In this regard, this study aims to analyze the industrial freight vehicle movement from the Waghodia GIDC area of Vadodara.
The Waghodia GIDC area is having different types of industries with remarkable production and freight vehicle movements. The details regarding industrial total plot area, number of employees, raw material consumption, finished products, origin & destination of raw material & finished material respectively; number of freight vehicle per day etc. will be collected by personal interview with management of the industry. From this data freight vehicle trip generation model and OD matrix of freight vehicles will be developed. The impact of freight vehicles in GIDC area will also be studied. This study will be useful to estimate average daily freight vehicle movements using significant parameters values for a given industrial area.

Keywords- Transportation Planning, Trip generation, urban level

I. INTRODUCTION

1.1 General

Transportation plays vital roles in development and growth of any nation. Transportation comprising different mode of transportation like road, railway, waterway and shipping. These modes of transport provide movement of goods and people one place to another place road. Road transport is primary mode of transport which plays important role in conveyance of good and passengers and linking the center of production, consumption and distribution.
Urban goods movement is a vital for the prosperity of any cities, especially the shopping area that fulfil in important role for the city and region. Goods transport also causes noise, air pollution and traffic problems. Goods movement, transportation things rather than people is addressed as a separate element. Trucks move most of the freight in many countries. Light freight delivery uses many modes of transport including truck, air freight and automobile. Goods movement covers all transportation method by which freight, commodities, and information are transported into and out of place of country. The most common methods to transport freight and commodities are rail, truck, airway, waterway, while information can be transported using optic fiber cable, cellular towers, telephone wire, radio waves, electrical wires, and other technologies. There is a wide spectrum of goods movement problem. These range from a broad concern about spatial pattern of goods movement demand created by different land use arrangements to the design of trucks loading facilities in the center of the city. Little attention has been directed towards the problem of goods movement in past transportation planning studies. Urban goods movement as an important part of traffic and transportation planning. Therefore, major factors playing considerable role in urban goods movement be identified and studies.
In India, Freight Transport through National Highway play vital role had given the current inefficient Freight Facilities of Indian Railway. As per the National Highways Authority of India, about 65% of freight traffic is carried by the roads. The National Highways carry about 40% of total road traffic. Average growth of the number of vehicles has been around 10.16% per annum over recent year. It provides end delivery services for every other long-haul mode. It provides end delivery services for every other long-haul mode.

Figure 1: Waghodia GIDC Location

II. Review of Literature

Ruiz Juri et al. (2006) have shown in this research paper The Trans-Texas Corridor projects a vision of 6,400 centerline km of new roadways and railways, intended to provide a faster, safer and more reliable means of transport for people and freight. This work enhances and then applies a random utility-based multiregional input–output model to assess project impacts on trade, production, and worker locations. The model predicts a slight redistribution of economic activities, increasing the supremacy of counties located closer to export zones, and an 8% reduction in the traffic volumes on existing highways. It also suggests a greater diversification of economic activity/ production and moderate changes in the distribution of wages, floor space rents and population, following the production trends.

Russo et al.(2011) have shown in this research paper urban and metropolitan goods movements is increasing because they account for a substantial share of traffic in urban and metropolitan areas. In this context, many city administrators have implemented measures to mitigate the negative effects of freight transportation. Starting from an analysis of existing studies relative to freight policies implemented at the urban scale in Europe, this paper proposes a general classification of measures adopted at the urban scale and an analysis of expected goals and tested results. Each described measure is analyzed by considering the temporal reference scale (strategic, tactical, and operative) of the actors and decision makers involved. Each measure pursues and is linked to one or more expected goal, and the empirical results obtained in the European cities and demonstrated by specific indicators representing the goal are presented.

Nadezda and Arkady (2013) have focused on transportation trip generation model based on mixed-use and transport infrastructure near th0e site. Transport trip generation models are considered with an aim to improve the accuracy of generated trips. Information systems are reviewed, and smart growth criteria that could affect the accuracy of trip generation models are also identified. Experimental results of transport generated trips based on linear regression equations. Transportation trip generation models were evaluated taking into account the mixed land use and transport infrastructure availability in the research area. The number of transport generated trips was calculated based on linear regression equations. Accuracy of generated trips per hour was maximized by the evaluation of smart growth criteria.

Vinodkumar et al. (2016) the aim of this research work have to determine 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.

Patel & Shukla et al. (2016) 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 R2 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.

III. Methodology

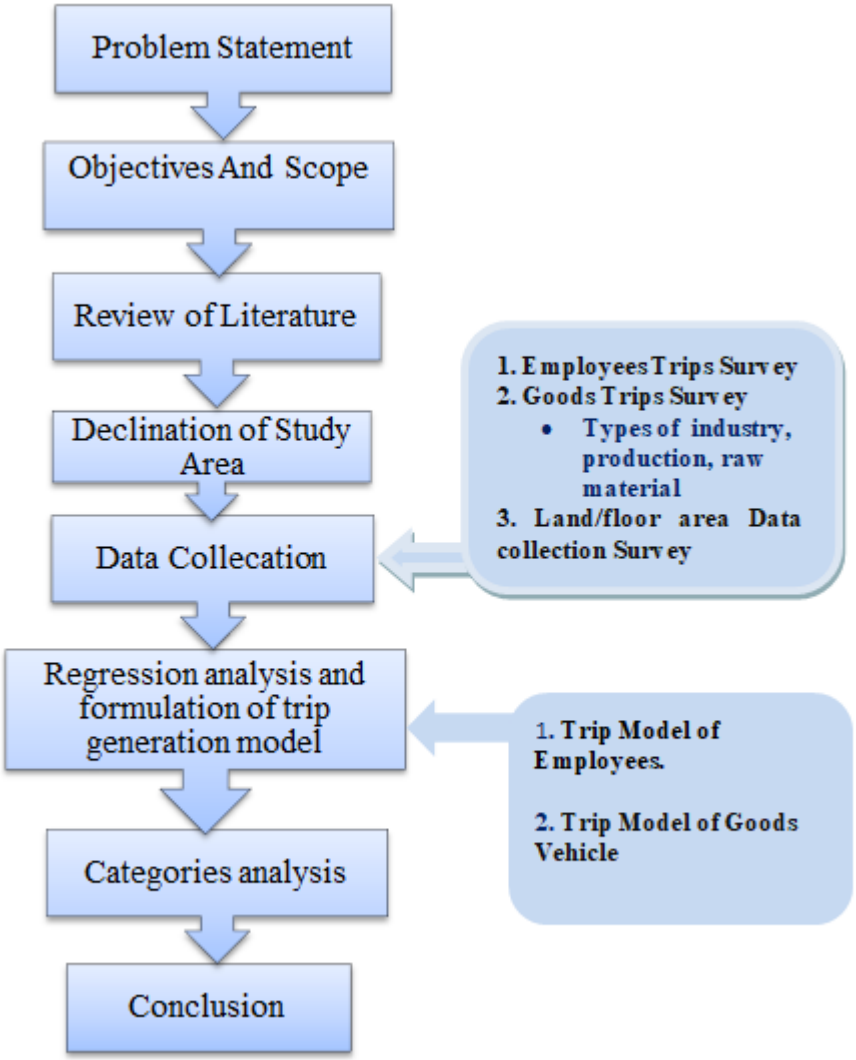


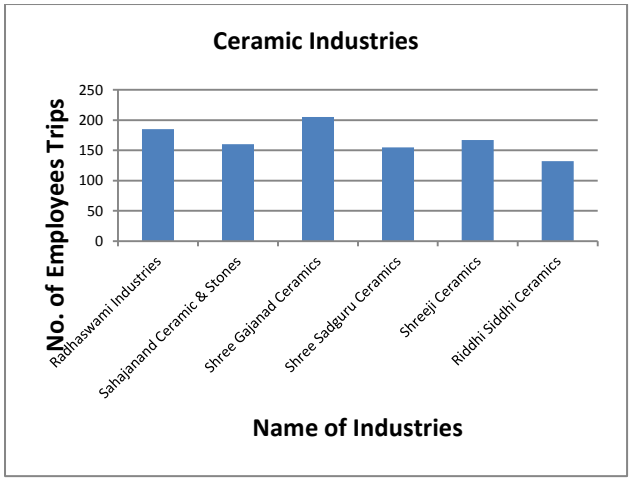
Figure 2 Methodology Chart

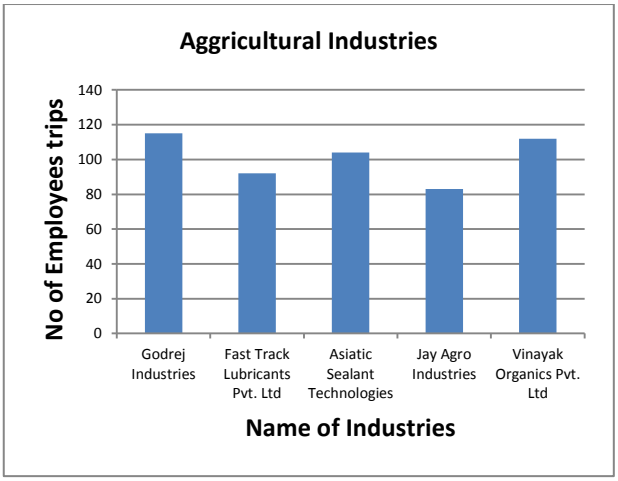
Employees Trips Data collection

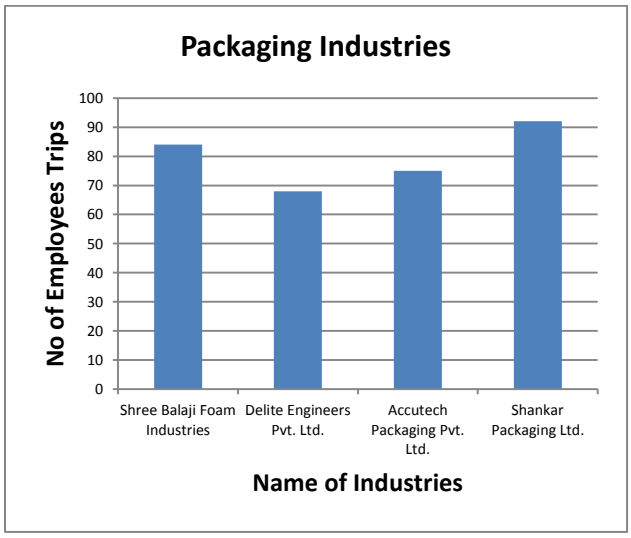
Industrial survey had taken at five categories of industries divided into study area. The process consist collection of origin and destination data. The information on the travel pattern includes number of trips made, their origin and destination, purpose of trip, travel mode, travel time and so on. 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.

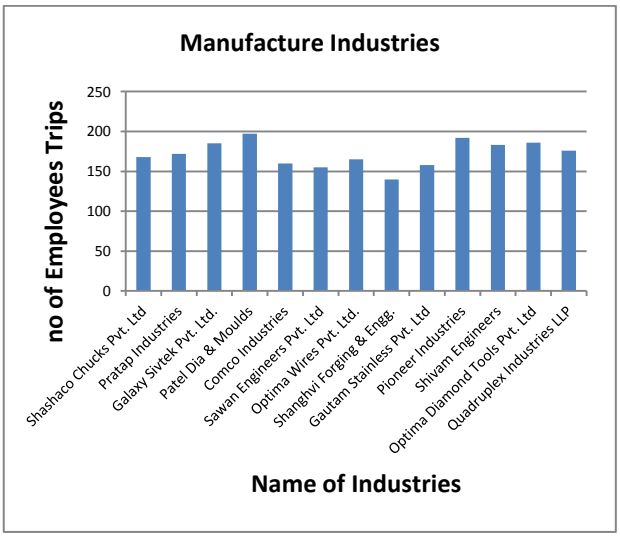
The sections are described below:

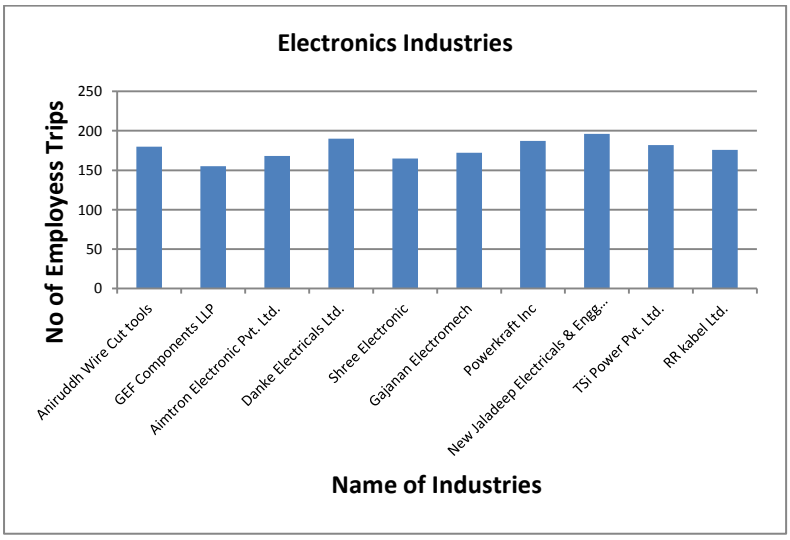
Type 1: Ceramic Industries
Type 2: Agriculture Industries
Type 3: Packaging Industries
Type 4: Manufacturing industries
Type 5: Electronic industries





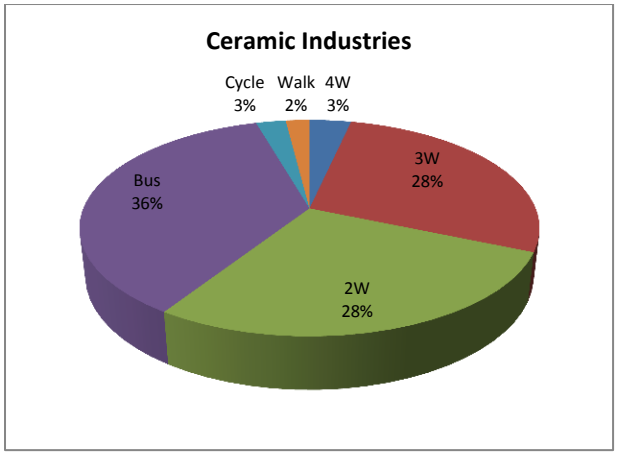


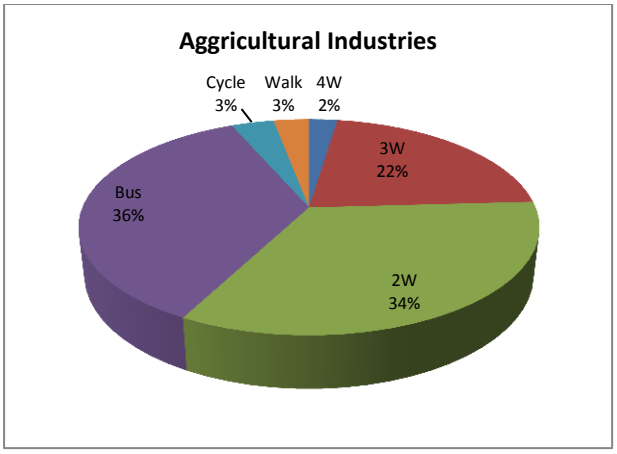


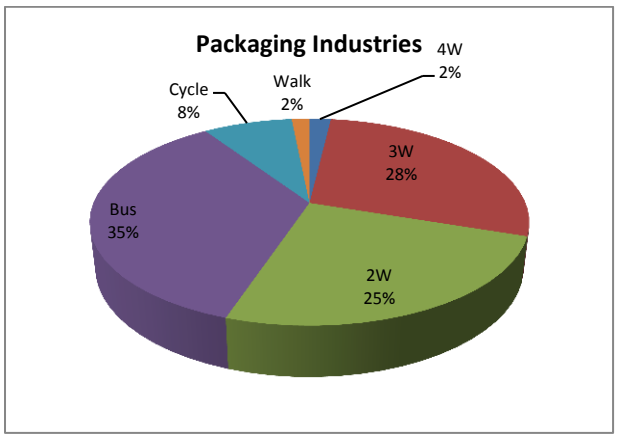


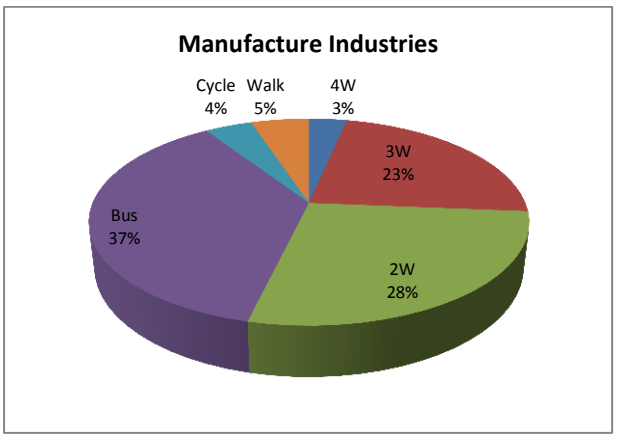
Category Analysis of Employees Trips/Day

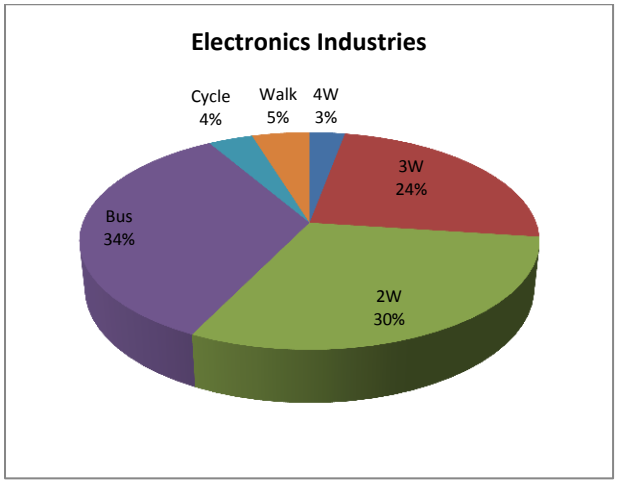
From the Employees trips survey, it is clear vision about the share of Industries size with respect to total trips per day as a various types of mode and travel time.

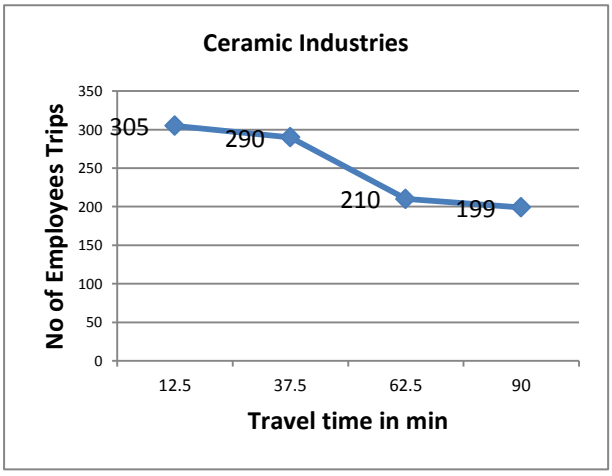


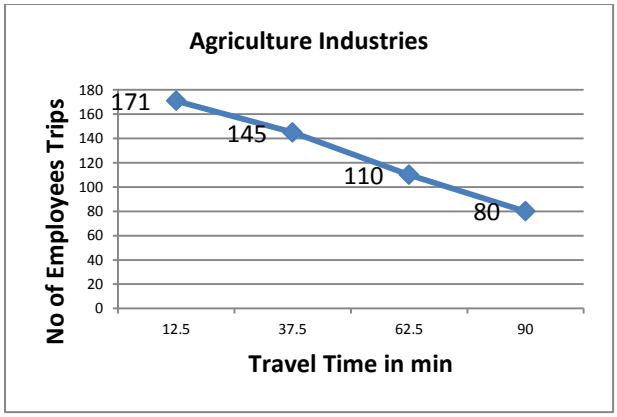


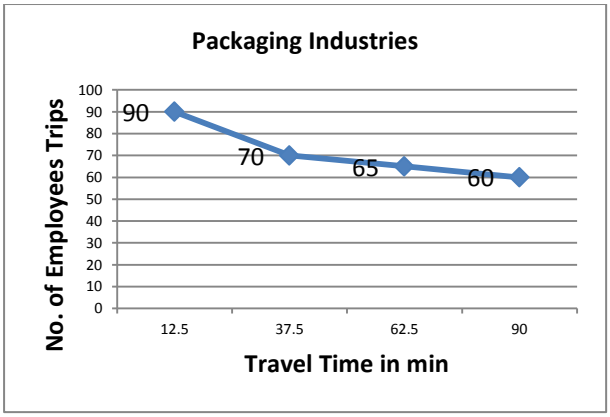


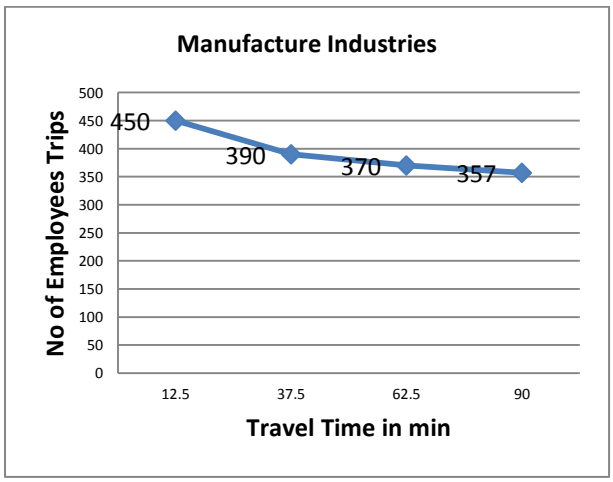


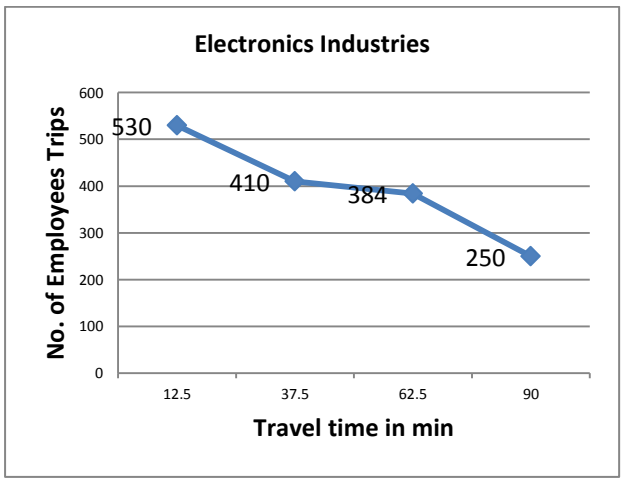












MODAL DEVELOPMENT

5.4.1 Ceramic industrial Trip generation model:

$$Y=215+0.025X3+1.12X4 \quad \ldots\ldots\ldots\ldots \text{(I)}$$

Where,
X3=Ave. monthly salary
X4=Ave. Daily Raw material (Ton)

5.4.2 Agriculture industrial Trip generation model:

$$Y=15.10+4.6X4 \quad \ldots\ldots\ldots\ldots \text{(II)}$$

Where,
Y=Num. of employees trips
X4=Ave. Daily Raw material (Ton)

5.4.3 Packaging industrial Trip generation model:

$$Y=-160.20+0.022X3+5.02X4 \quad \ldots\ldots\ldots\ldots \text{(III)}$$

Where,
Y=Num. of employees trips
X3=Ave. monthly salary
X4=Ave. Daily Raw material (Ton)

5.4.4 Ceramic industrial Goods Trip generation model:

$$Y=6.53-0.008X3+0.65X4 \quad \ldots\ldots\ldots\ldots \text{(IV)}$$

Where,
Y= Num. of Goods vehicle Trips
X3= Ave. Daily Finished material trips distance (km)
X4=Ave. Daily Raw material (Ton)

5.4.5 Manufacture industrial Goods Trip generation model:

$$Y=24.85-0.038X3+0.586X4 \quad \ldots\ldots\ldots (V)$$

Where,
Y= Num. of Goods vehicle Trips
X3= Ave. Daily Finished material trips distance (km)
X4=Ave. Daily Raw material (Ton)

VI. CONCLUSION

The industrial goods/freight vehicles survey, their trips from industries per day are identified.

- Ceramic industries employee use Bus and 3W modes maximum in daily industrial activity.
- Agricultural industries employee use 2W and Bus modes maximum in daily industrial activity.
- Packaging industries employee use Bus and 3W modes maximum in daily industrial activity.
- So, the most of the employees use 2W and Bus modes maximum in daily industrial activity.
- Trip length frequency distribution for all types of industries' employee reveal that maximum numbers of trips have 0 to 25 minutes travel time.

The multiple regression method, which is one of the popular methods used to predict the trip generation, is used in this study. The relevant conclusions are as follows:

1. The employee trip generation model for ceramic industries have reasonable explanatory power with R^2 value of 0.72, indicating that the explanatory variables entered into the model explain 72% of the variation in the daily trips per industry.

- The variables that mostly affect the number of daily trips per industry are the Average monthly salary and Average Daily consumption of Raw material (Ton).

2. The employee trip generation model for agricultural industries have reasonable explanatory power with R^2 value of 0.89, indicating that the explanatory variables entered into the model explain 89% of the variation in the daily trips per industry.

- The variables that mostly affect the number of daily trips per industry are Average Daily consumption of Raw material (Ton).

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