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Study and Analysis of Vehicular Trip Generation: A Case Study

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Abstract - *With fast-growing economy and spatial distribution of major activities, travel needs of people increase at a rapid pace. Increased transport activity can however lead to an increase in pollution, congestion and accidents. In this way it's important to give consideration towards transportation and study, expressing traffic volume, as numbers of vehicles crossing a section of road per unit time. Traffic volume studies are conducted to collect data on the number of vehicles that pass a point during a specified time period. This present study executes the estimation of traffic volume using exponential growth and service flow rate by converting the traffic stream of different types of vehicles into traffic stream consisting of only Passenger Cars using Passenger Car Unit (PCU) factors.*

Key Words: **Traffic Volume, Service flow rate, PCU and Exponential growth.**

1.INTRODUCTION

Traffic volume is defined as the number of vehicles crossing a particular cross section per unit time. Traffic volume studies are conducted to determine the number, movements, and classifications of roadway vehicles at a given location. It is measured in vehicle per minute, vehicle per hour and vehicle per day. The collected data are useful for identifying the volume characteristics like flow rate, average daily traffic and peak hour volume. In order to express the traffic flow on a road per unit time, it is necessary to convert the flow of the different vehicle classes into a standard vehicle class known as passenger car unit. In developing countries like India, there exists wide variety of vehicles in terms of their physical dimensions, performance, throughput etc. and exhibits dynamic nature. It is very complex to evaluate the capacity, which is the fundamental basis for the design, planning, layout and operation of roads and highways. Hence, the precise evaluation of vehicle interaction in the traffic is the prerequisite fundamental for the determination of roadway capacity, which can be obtained from the collection of traffic volume data.

Traffic volume survey can be executed in many ways based on the extent of data to be collected, manpower available, instruments/technology available, and budget. There are two main classifications of traffic volume count. They are manual count and automatic counts. Enumerators can execute manual counts if the traffic is found to be low. But the data obtained may not be precise. On the other hand, in automatic methods, sensors are used in order to collect the traffic data, which will be precise. There are three cyclic variations of the traffic volume namely: Hourly pattern, day-to-day pattern and monthly/seasonal pattern. The traffic volume characteristics vary during the mornings and evenings, which can be found highest which can be termed as peak hours.

Traffic forecasting is defined as the process of predicting the future traffic volume based on the growth rate trends in the previous years. Forecasting of data is essential for planning, management, design and layout of the roads and highways. In the present study, traffic volume survey is conducted at Gajuwaka-Scindia GNT road and the traffic forecasting for the future years is evaluated using the exponential growth equation.

2. PURPOSE OF STUDY

- To record base year traffic volume.
- To determine the vehicle composition on the study stretch and service flow rate in PCU.
- To estimate the future traffic volume using exponential growth analysis.

3. STUDY AREA

Gajuwaka is an area lying 17km to the south of Visakhapatnam city in the state of Andhra Pradesh with a population of 57479. With fast-growing economy and spatial distribution of major activities, travel needs of people increase at a rapid pace. Its growth has mirrored to that of Visakhapatnam city. The geographical position of the area Centre is on longitude 17.7N and 83.2167E.

4. METHODOLOGY

The collection of traffic volume data was done at peak hours of weekdays at Gajuwaka-Scindia GNT Road in the city of Visakhapatnam. Videography technique is adopted because of low manpower. The vehicles were classified into cycles, cycle rickshaw, two-wheeler, three-wheeler, car, LCV, bus and truck. Video was recorded for three hours from 7 a.m. to 10 a.m. A camcorder was mounted on

a stand and was placed at a certain height so as to cover the entire road width clearly. Later, the recorded data was played in a computer and manually counted the number of different type of vehicles crossing the point. The data was collected in 15-minute time interval.

4.1 Classification of Vehicles

The traffic was found to be heterogeneous in nature. Hence for the purpose of study, the vehicles were classified as follows:

- Cycles
- Cycle Rickshaw
- Motorized Two-Wheelers, which include scooters, mopeds and bikes.
- Motorized Three-wheelers, which include auto rickshaws.
- Cars, which include small passenger cars, sedans, hatchbacks, Sports Utility Vehicles (SUVs) and jeeps.
- Light Commercial Vehicles (LCVs), which include goods carrying jeeps, Tata Ace etc.
- Bus, which include multi axle and single axil buses.
- Trucks, which include single axle and multi axle lorries.

5. ANALYSIS & RESULTS

The traffic volume data observed at Gajuwaka-Scindia GNT Roads is presented in the table below. (Table 1)

Table 1 here

The traffic volume observed at the study area is converted into traffic stream consisting of only passenger cars by multiplying each category of vehicle with its respective Passenger Car Unit factor suggested by IRC 106:1998 (Guidelines for the capacity of urban roads) and is presented in the below table. (Table 2)

Table 2 here

The traffic composition found at the study area is represented in the below figure. (Figure 1)

Figure 1 here

5.1 Forecasting of Traffic Volume

The future year forecasting of traffic volume is done by exponential growth formula. The exponential growth predicts the future volume for given year based on percentage of growth from the previous year. This is typically limited to five years or less. This method is not recommend unless it can be supported by the data.

$$\mathbf{Volume_{FY} = Volume_{BY} * (1+Gr)^{(FY-GY)}}$$

Where:

FY = Future Year.

BY = Base Year.

Gr = Growth Rate.

(Source: Low Comprehensive Mobility Plan for Visakhapatnam City)

Therefore forecasting the traffic volume for the future year 2025 is obtained by above formula with a growth rate of 2.77% for the base year 2016 as 2027 veh/hour.

6. CONCLUSIONS

The following are the important conclusions drawn from this study:

- The traffic volume for the base year 2016 is 1818 vehicles/hour.
- Two-wheelers occupied 55% of the total vehicles.
- Public transport should be increased and improved.
- The Service flow rate is 1624 PCU/hour.
- The forecasted traffic volume for the future year 2025 is 2027 vehicles/hour.

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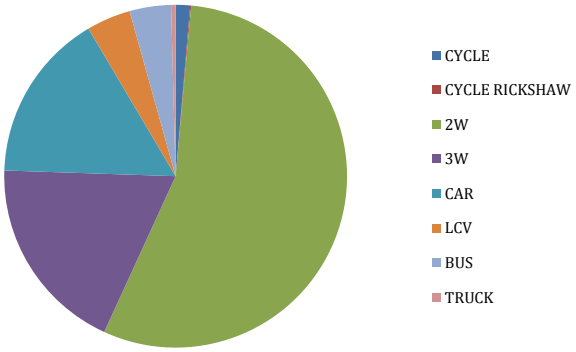

Figure 1. Vehicle Composition.

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Table 1: Traffic Volume Study of Study Area

TIME	CYCLE	CYCLE RICKSHAW	2W	3W	CAR	LCV	BUS	TRUCK
7.00-7.15	6	1	231	74	70	18	11	2
7.15-7.30	8	0	220	75	66	27	18	1
7.30-7.45	6	0	264	83	64	15	15	2
7.45-8.00	6	0	233	60	62	19	19	2
8.00-8.15	5	0	256	95	73	21	20	2
8.15-8.30	7	0	269	98	81	18	24	1
8.30-8.45	6	1	272	93	79	18	16	3
8.45-9.00	6	0	261	97	85	17	18	2
9.00-9.15	8	1	248	91	74	19	21	2
9.15-9.30	7	0	264	79	64	16	17	2
9.30-9.45	5	2	249	86	80	20	19	1
9.45-10.00	4	0	253	88	73	19	15	3
Total Veh.	**74.00**	**5.00**	**3020.00**	**1019.00**	**871.00**	**227.00**	**213.00**	**23.00**
Veh/Hr.	**24.67**	**1.67**	**1006.67**	**339.67**	**290.33**	**75.67**	**71.00**	**7.67**
Veh/15Min.	**6.17**	**0.42**	**251.67**	**84.92**	**72.58**	**18.92**	**17.75**	**1.92**

Table 2: Converted Number of Vehicles (PCU)

Type of Vehicle	Number of Vehicle/hour	Equivalency Factor	PCU/hour	% of PCU
CYCLE	24.67	0.5	12.33	0.76%
CYCLE RICKSHAW	1.67	2	3.33	0.21%
2W	1006.67	0.5	503.33	31.00%
3W	339.67	1	339.67	20.92%
CAR	290.33	1	290.33	17.88%
LCV	75.67	3	227.00	13.98%
BUS	71.00	3	213.00	13.12%
TRUCK	7.67	4.5	34.50	2.13%
Service Flow Rate = 1624 PCU/hour				