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TRAFFIC FLOW ANALYSIS OF CBD AREA OF ANAND CITY

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Abstract: -*For scientific planning of the road system, it is needed to have a proper data base for existing traffic parameters of the roads. In CBD areas all the commercial activities takes place and it attracts traffic due to growing population, rapid urbanization, and increasing commercial and economic activities. High population generates heavy vehicular traffic which leads to conflict and congestion. The area selected for study has a railway station, bus station, municipal market police station, post office, major hospitals and major administration buildings. So traffic tends to be high in the area and that may lead to congestion, delay, increase in travel time and increasing fuel consumption. The speed-flow relationship has been obtained. Capacity and level of service has been worked out.*

Keywords: - Traffic flow, Capacity, Level of Service, Speed.

I. INTRODUCTION

Over the last few decades the traffic congestion is major issue in urban areas. The increase in congestion is mainly due to increase in private vehicle ownership. Also the development of road infrastructure and traffic management is not able to cope up the increase in congestion. Study of basic traffic flow characteristics like traffic volume is pre requisites for effective planning, design, operation and management of roadway systems.The traffic flow behaviour of heterogeneous traffic is quite complex with loose lane discipline and diverse static and dynamic characteristics.

II. OBJECTIVES OF STUDY

The objectives of study are:

- To derive traffic flow parameters from collected data on selected roads of the area.
- To derive speed – flow relationship.
- To estimate capacity and Level of Service.

III. SCOPE OF STUDY

In this study, area near Anand Railway station has been selected for traffic flow analysis. The scope of study is to collect traffic stream data, classified volume count, spot speeds and derive analytical relationship between speed and flow and use it for LOS evaluation.

IV. METHODOLOGY

The study will follows following steps.

1. The first step was to study and identification of study area location.
2. Several literature research papers, books, thesis reports, related to study are referred.
3. Data required for the study is collected.
4. Collected data was analysed.
5. Capacity evaluation is done.
6. Conclusion and recommendation were given.

V.STUDY AREA LOCATION

Anand is located 22.57°N 72.93°E. Itis known as the Milk Capital of India. It became famous for Amul dairy and its milk revolution. This city hosts the Head Office of Gujarat Cooperative Milk Marketing Federation Ltd (AMUL), National Dairy Development Board of India, well known Business school-IRMA and Anand Agricultural University. Also other famous educational hubs of the city are Vallabh Vidhyanagar and Karamsad, an educational suburb of Anand which is home to close to 10,000 students from all over India.

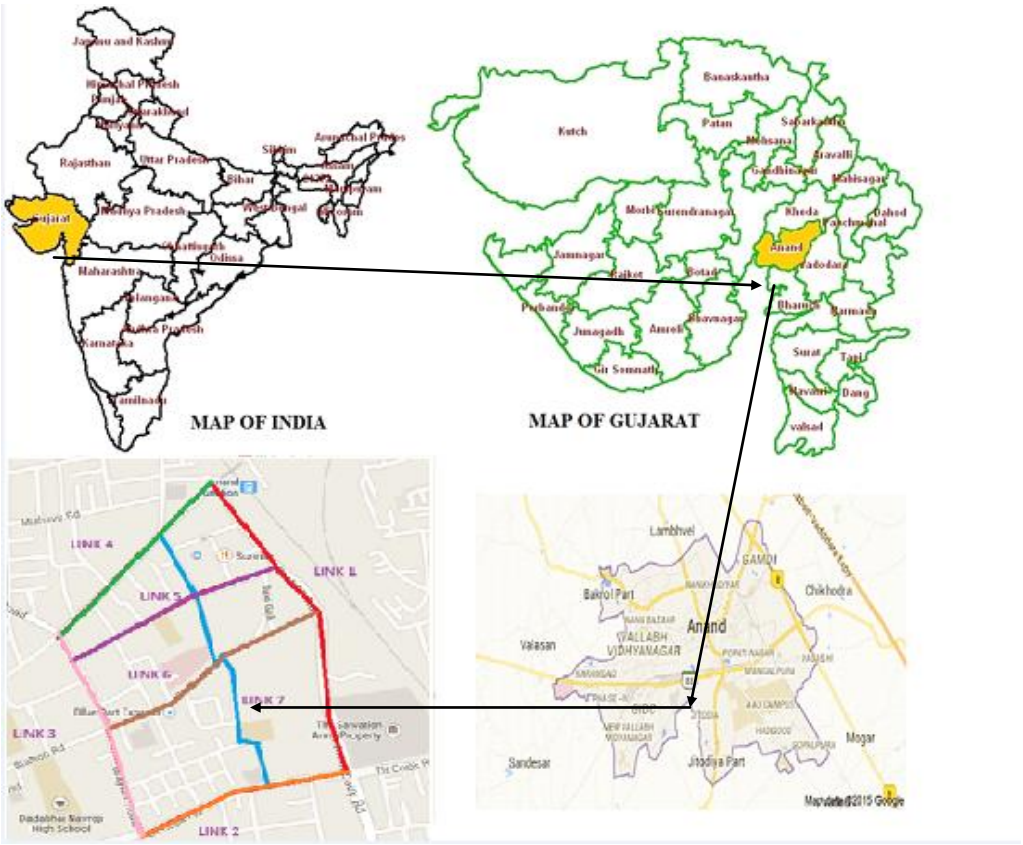


Figure 1 Study area profile

VI. DATA COLLECTION

1) Road Inventory Survey

The road inventory survey gives the details of geometrics of roads and also the land use in the area. The details of selected stretch are as shown in figure 2. The roadway inventory was carried out for all the links.

2) Classified Volume Counts

The classified volume count on the identified links was carried out from 8:00 am to 8:00 pm. On link 1 from Railway Station pedestrian overpass (Ch: 0.0km) to Gurudwara circle (CH: 0.822 km) was done by video recording technique. On other links the classified volume count was done manually.

3) Spot Speed Study

Spot speed on each link was carried out using video recording technique. A 20m stretch was selected on the link for the study. The time for vehicle to pass the stretch was noted down by replaying DVDs.

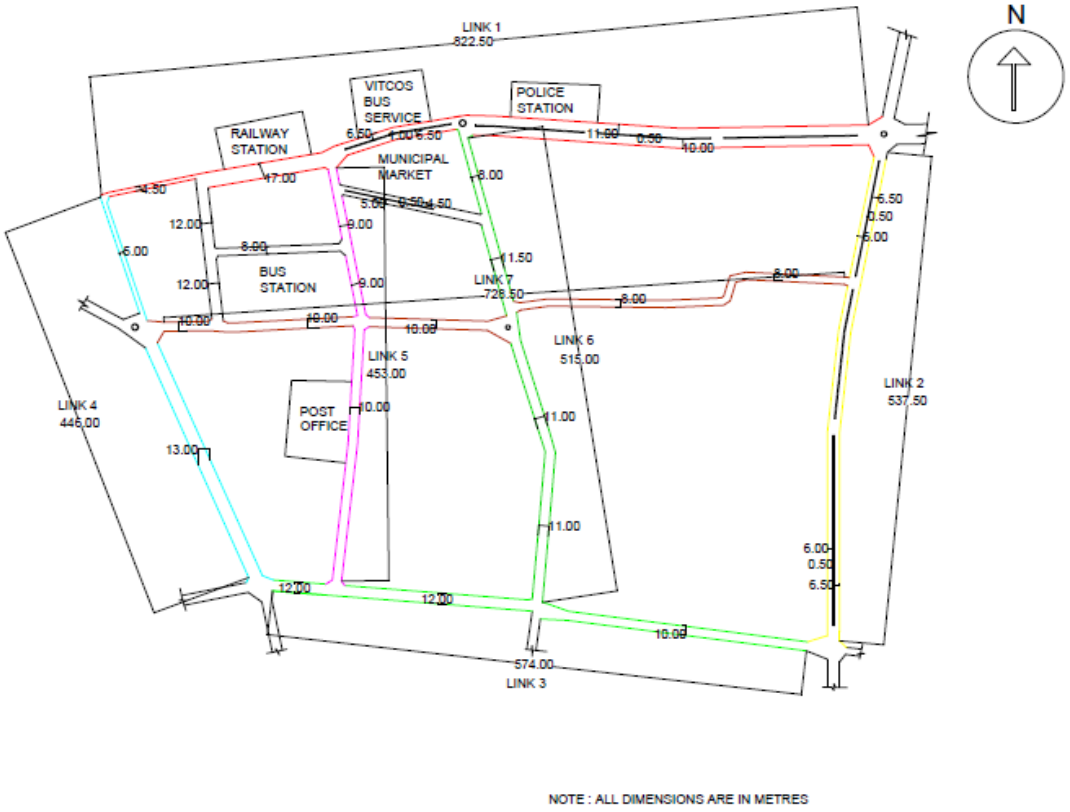


Figure 2 Road inventory details.

VII. ANALYSIS OF PARKING SURVEY DATA

1) Traffic Volume Analysis

The hourly fluctuation of traffic volume is shown in Figure 3 for all links. The morning peak period was found out to be from 11:30 am to 1:30 pm and evening peak was found out to be 5:00 pm to 6:30 pm.

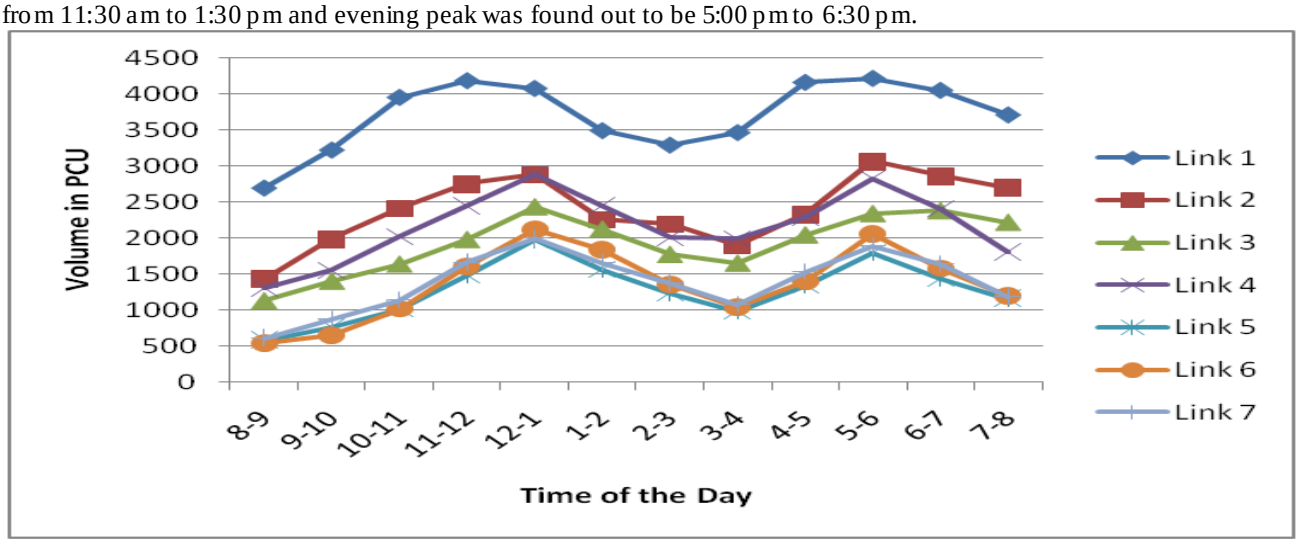
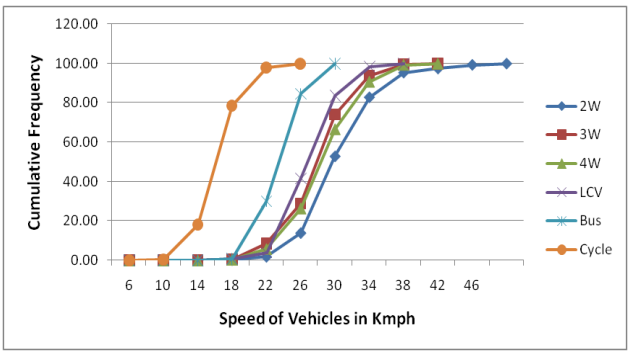


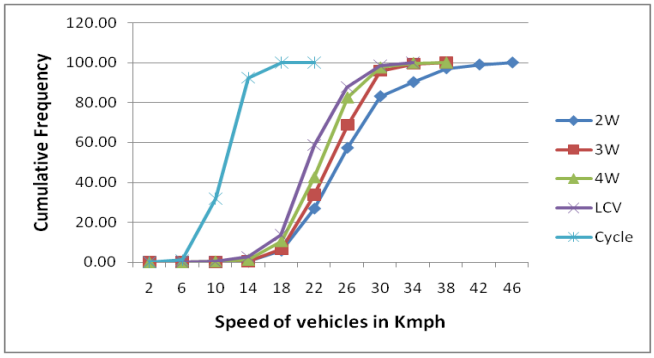
Figure 3 Hourly traffic pattern

2) Spot Speed Analysis

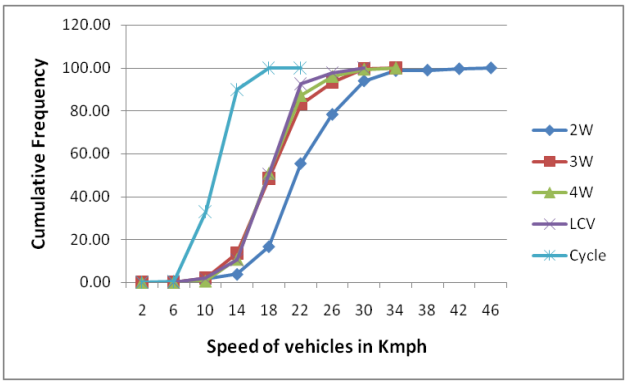
The spot – speed of different vehicles were measured and analyzed separately. The cumulative frequency diagrams for the spot speed of all the seven links are shown below:



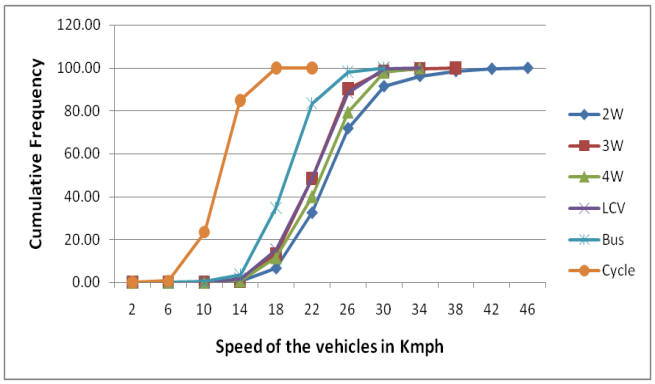
Link1



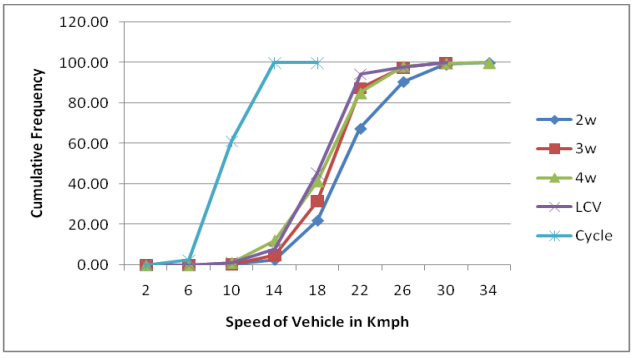
Link 2



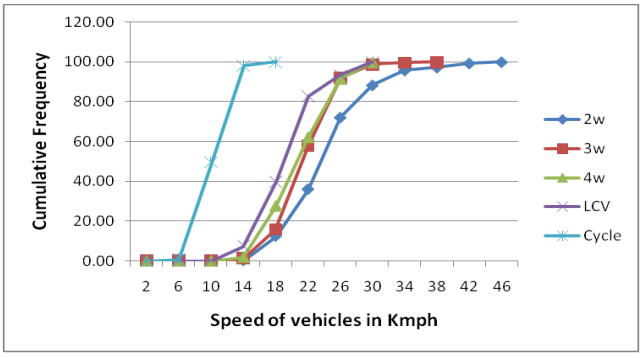
Link 3



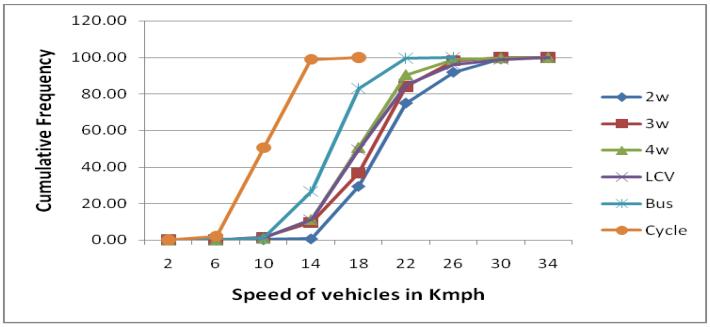
Link 4



Link 5



Link 6



Link 7

Figure 4 Cumulative Frequency Diagrams

Table 1to Table 7 shows the 98th, 85th, 50th and 15th percentile speeds of all vehicles for all links. From analysis the mean speed, mode and standard deviation of different vehicles were also obtained. Two wheelers are travelling at higher speed compared to the other vehicles.

Table 1 Spot Speed Analysis for Link 1

Percentile Speed (Kmph)	2W	3W	4W	LCV	Bus	Cycle
98th	38.7	32.8	34.0	32.0	25.8	19.0
85th	30.6	28.2	29.2	27.1	22.9	15.8
50th	25.3	24.7	24.7	23.1	20.4	13.0
15th	21.1	19.9	20.1	20.1	17.9	10.8
Mean Speed (Kmph)	28.16	25.80	26.45	24.85	21.52	14.22
Mode (Kmph)	27.0	27.5	27.5	23.5	21.0	14.0
Variance	20.43	14.54	15.92	9.74	5.56	6.22
Standard Deviation	4.52	3.81	3.99	3.12	2.36	2.49

Table 2 Spot Speed Analysis for Link2

Percentile Speed (Kmph)	2W	3W	4W	LCV	Cycle
98th	40.3	32.3	30.2	29.6	16.0
85th	31.4	28.2	26.4	26.1	14.2
50th	25.7	24.1	22.7	21.4	12.4
15th	20.3	20.1	18.9	18.1	10.1
Mean Speed (Kmph)	27.65	25.79	24.59	23.52	13.09
Mode (Kmph)	24.0	23.5	23.5	21.5	14.0
Variance	30.48	15.56	13.78	11.43	3.98
Standard Deviation	5.52	3.95	3.71	3.38	1.99

Table 3 Spot Speed Analysis for Link 3

Percentile Speed (Kmph)	2W	3W	4W	LCV	Cycle
98th	32.1	30.2	27.8	25.6	17.0
85th	27.7	23.1	22.3	21.7	14.3
50th	21.9	18.4	18.6	18.2	11.8
15th	16.5	14.7	14.7	14.6	9.4
Mean Speed (Kmph)	24.19	20.50	20.29	19.76	13.13
Mode	24.0	19.5	20.5	19.5	12.0
Variance	25.32	18.43	13.61	9.70	4.59
Standard Deviation	5.03	4.29	3.69	3.11	2.14

Table 4 Spot Speed Analysis for Link 4

Percentile Speed (Kmph)	2W	3W	4W	LCV	Bus	Cycle
98th	37.0	30.4	30.7	29.3	26.5	17.3
85th	29.0	26.2	27.2	26.4	22.7	15.0
50th	23.6	22.7	23.2	22.4	20.1	12.7
15th	19.2	18.1	18.6	17.6	17.0	10.4
Mean Speed (Kmph)	26.17	24.02	24.81	23.95	21.24	13.61
Mode (Kmph)	23.0	24.5	24.5	23.5	22.0	14.0
Variance	21.06	11.41	13.23	11.96	8.28	4.48
Standard Deviation	4.59	3.38	3.64	3.46	2.88	2.12

Table 5 Spot Speed Analysis for Link 5

Percentile Speed (Kmph)	2W	3W	4W	LCV	Cycle
98th	29.3	27.6	26.6	26.9	14.2
85th	25.1	22.8	22.7	21.3	12.4
50th	20.7	19.7	19.3	18.5	11.1
15th	17.2	16.2	14.6	15.0	9.6
Mean Speed (Kmph)	22.63	21.15	20.46	19.97	11.52
Mode (Kmph)	20.5	20.5	23.5	19.5	12.5
Variance	13.02	9.26	12.94	6.29	2.14
Standard Deviation	3.61	3.04	3.60	2.51	1.46

Table 6 Spot Speed Analysis for Link 6

Percentile Speed (Kmph)	2W	3W	4W	LCV	Cycle
98th	40.3	29.8	29.8	28.8	15.4
85th	27.8	25.2	25.7	23.3	13.3
50th	23.6	22.0	21.3	19.0	11.0
15th	18.1	17.6	16.8	15.1	8.6
Mean Speed (Kmph)	26.01	23.30	22.40	20.97	12.02
Mode (Kmph)	26.0	23.5	24.0	20.5	12.0
Variance	27.00	11.40	14.11	12.66	3.20
Standard Deviation	5.20	3.38	3.76	3.56	1.79

Table 7 Spot Speed Analysis for Link 7

Percentile Speed (Kmph)	2W	3W	4W	LCV	Bus	Cycle
98^{th}	28.8	28.4	28.5	19.6	21.4	13.8
85^{th}	24.2	22.6	21.9	22.2	19.4	12.4
50^{th}	20.6	19.8	18.4	18.1	16.2	10.7
15^{th}	17.0	15.1	14.8	14.0	14.2	8.6
Mean Speed (Kmph)	22.22	20.82	20.04	18.91	17.62	11.78
Mode (Kmph)	22.5	22.5	19.5	20.0	16.0	12.0
Variance	12.05	12.78	10.70	11.22	5.51	2.50
Standard Deviation	3.47	3.57	3.27	3.35	2.35	1.58

2) Speed Flow Relationship, Capacity and Level of Service

From the observed speed and traffic volume data for 15 min interval, the space mean speeds of different categories of vehicles was found out. The 15 minute volume was expanded in hourly traffic volume. The space mean speed is obtained by:

$$v_S(\text{Space mean speed}) = \frac{n\ (\text{number of observations})}{\sum_{i=1}^{n} v_i\ (\text{Spot speed})}$$

Once the speed has been calculated a mathematical relationship has to be formed between speed and flow. The following form of equation was attempted on basis of multiple regression technique.

$$Y = A_0 + A_1X$$

Where,

Y = space mean speed (kmph),
X = traffic flow (PCU/hr),
A_0 = constant term,
A_1 = regression coefficient.

Figure 5 to figure 11 shows the speed flow relationship obtained for various links. The equations developed are shown in the figure. Now from the speed – flow curves, the capacity of the road and design service volumes was found out. The Level of Service for the various roads is shown in figure. Table 8 shows the capacity, design service volume and Level of service of all the links.

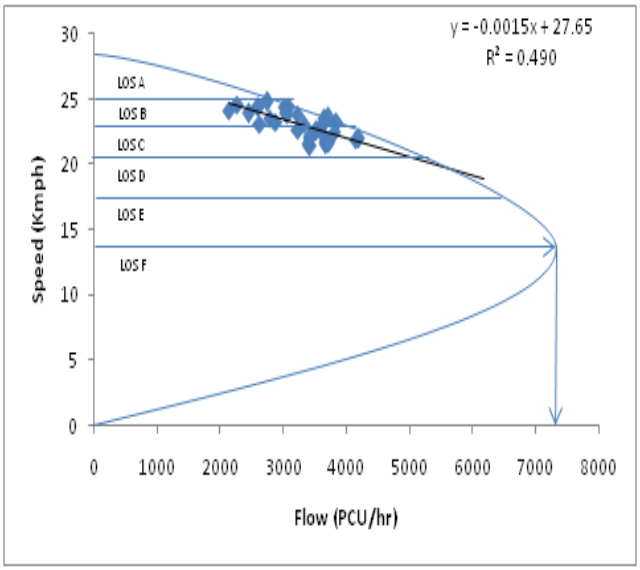


Figure 5 Speed-Flow curve for Link 1

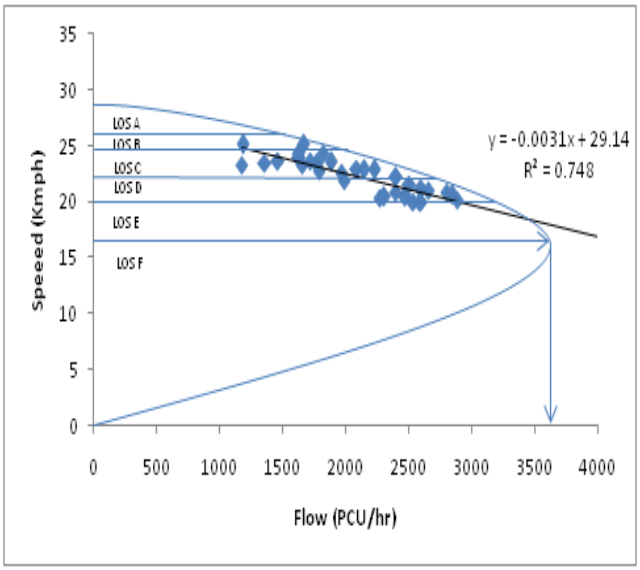


Figure 6 Speed-Flow curve for Link 2

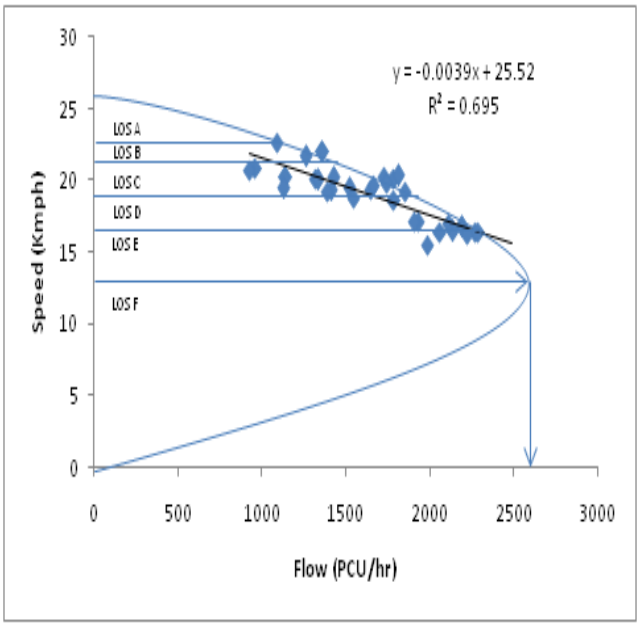


Figure 7 Speed-Flow curve for Link 3

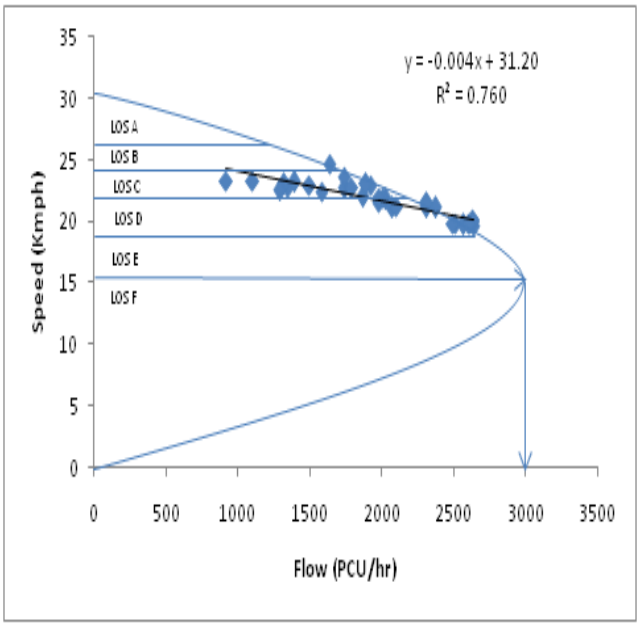


Figure 8 Speed-Flow curve for Link 4

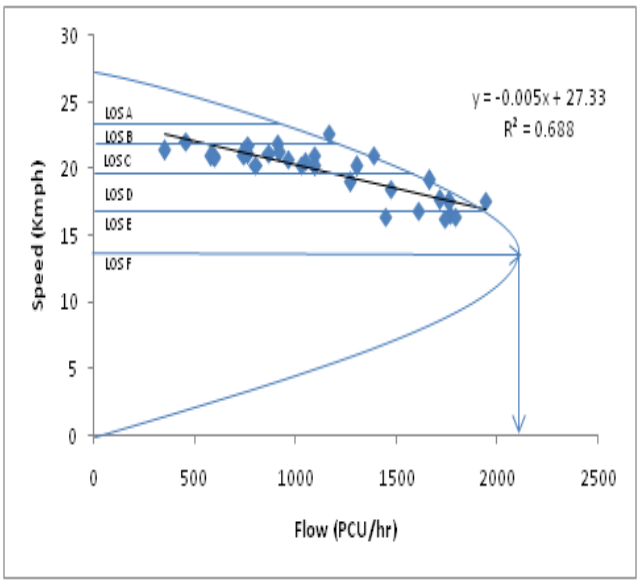


Figure 9 Speed-Flow curve for Link 5

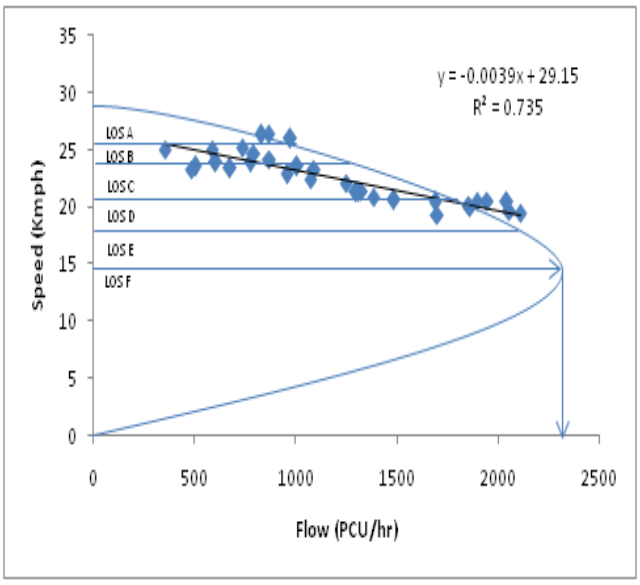


Figure 10 Speed-Flow curve for Link 6

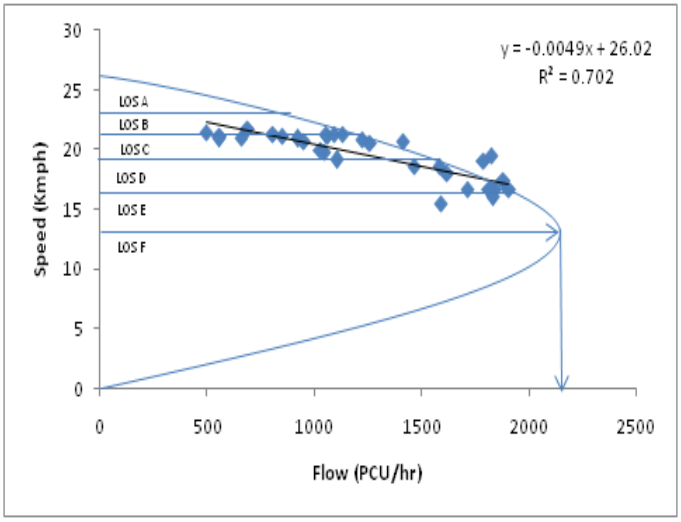


Figure 11 Speed-Flow curve for Link 7

Table 8 Capacity, Design Service Volumes and Level of Service

Links	Capacity (PCU/hr)	Design Service Volume (PCU/hr)	Level of Service
Link 1	5770	5040	It mostly operates under LOS C.
Link 2	3430	2520	It mostly operates under LOS C and extends up to LOS D.
Link 3	2310	1800	It mostly operated under LOS C and extends up to LOS D and LOS E.
Link 4	2425	2100	It mostly operated under LOS C and extends up to LOS D.
Link 5	1970	1500	It mostly operates under LOS C and extends up to LOS D and LOS E.
Link 6	1960	1652	It mostly operates under LOS C and extends up to LOS D.
Link 7	1840	1500	It mostly operates under LOS C and extends up to LOS D and LOS E.

VIII. CONCLUSIONS

Video recording technique is the best technique for collection various data related to analysis. It was convenient and efficient method for the collection of the data in the study area.The mean speed on various links was found to be less than that of the design speed. The speed – flow relations were obtained for all links and R^2 value ranges from 0.053 to 0.783. Most of the values were less than 0.7 which indicates that the various other factors also contribute to the speed of vehicles in the flow like vehicle condition, traffic composition, behaviour of drivers etc. On the selected links it was observed that the speed of fast moving vehicles was generally reduced by slow moving vehicles cycle and tractor-trailers. The other reason for reduction of speed on the links which were undivided was the loose lane discipline of the drivers.

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