

Estimation of Capacity and Existing Level of Service (Los) on Kadodara-Bardoli Road.

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ABSTRACT:The present study is an investigation in behaviour heterogeneous traffic stream speed and flow rate on an access in Surat district (Kadodara-Bardoli). Pilot survey was carried out for the determination of location of videography. Surveys including classified volume and speed data are carried out by manual as well as video graphic technique. Inventory surveys were also carried out for gathering primary information regarding road geometry, which includes number of lanes, lane markings, median and service lane. Attempts have been made to develop relationship between macroscopic parameters such as speed, flow, density and determine the capacity and LOS of the stretch. Thus the results can prove to be useful for evaluation of traffic quality roads in heterogeneous traffic condition and for the future transportation development and planning.

KEYWORDS:capacity, LOS, heterogeneous traffic, video graphic technique, pilot survey, spot speed, density, flow rate, PCU.

I. INTRODUCTION

After independence, India has witnessed inflammation in economic growth that has resulted in rapid urbanization which led to need of transportation. This road network caters different types of vehicles like bullock cart, bicycle, 2-wheeler, 3-wheeler, 4-wheeler, truck, bus etc. Traffic in developing countries like India is significantly different from those of developed countries because of mixed traffic condition Metropolitan cities in India are witnessing high rate of population increase and hence raise in traffic on their traffic corridors. Due to increase in population there is increase in number of vehicles and ultimately increase in the number of road users. Increase in flow results in platoon formation which ultimately results in delay in traffic. Transport sector is a great concern for transport planners and evaluation of the quality of service provided and designed by them. The quality of transport supply can be expressed in terms of LOS (level of service) which can be useful for determining the long-term as well as short-term transportation planning programs. The traffic stream speed and flow rate helps the capacity of road under the traffic conditions. The road network provides the arterial network to facilitate trade, social integration and economic development. The US highway capacity manual has obtained estimation of capacity having homogeneous traffic. But Indian roads having heterogeneous traffic condition it is quite difficult to estimate the capacity and other various parameters.

Objective are

1. To conduct classified traffic volume counts to determine number of vehicles using road.
2. To conduct spot speed study for determining the average speed of vehicles.
3. To develop relationship between speed, flow and density.
4. To estimate the capacity of road (Kadodara-Bardoli road).
5. To determine existing LOS.

II. RELATED WORK

Ramanayya (1988) in his study concluded that the capacity standards developed in western countries are applicable for homogeneous traffic and doesn't consider mixed traffic conditions prevailed in India. Maitra et. al. (1999) conducted his study on development of LOS based on congestion, 10 LOS have been proposed with 9 in a stable flow zone as A-E, and one 'F' representing unstable zone. DR G.J.Joshi and Chetan R Patel (2012) in their study presented the capacity estimation and level of service for roads in Indian mixed traffic condition. The study was carried out on corridor of Surat city known as "Gaurav Path" (6-lane divided with service road). They carried out videography technique for traffic surveys. From this it was concluded that traffic flow in mixed traffic was quite complex with loose discipline and diverse static and dynamic vehicular characteristics. The capacity was found per lane which was quite realistic

compared to other studies. Based on this capacity and volume LOS was identified. Thus our study work can be useful for future transportation infrastructure planning.

III. METHODOLOGY

The systematic flow chart of methodology of this research work is depicted in figure -1.

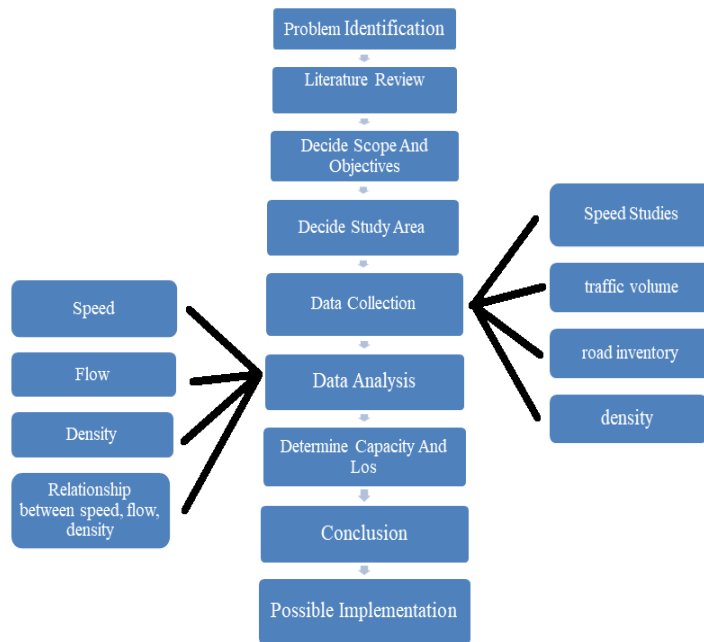


Figure1 Methodology for Proposed Work.

IV. STUDY STRETCH AND LOCATION

The study was carried out on one of the busiest traffic corridor of Surat district i.e. kadodara-bardoli road. It’s a four-lane divided road passing through recreational and shopping areas, residential localities, educational areas as well as industrial areas. Millions of people live in rural in outskirts of city and populations in increasing at rapid rate. This corridor has proved to be busiest route connecting Surat and bardoli before and after the construction of NH-53.

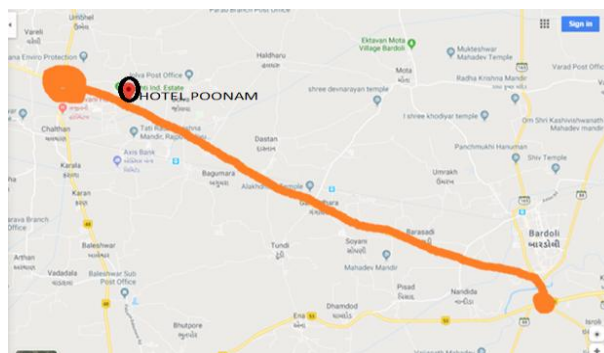


Figure 2Kadodara-Bardoli Road

V. TRAFFIC FIELD STUDY AND SURVEY

Pilot survey was conducted to determine the exact location appropriate for conducting the traffic surveys. From the pilot survey location highlighted in figure2 was selected (i.e. hotel poonam). Traffic surveys were conducted to gather data on classified vehicular volume, speed and density on the kadodara-bardoli road section and vice versa. Inventory surveys were conducted for gathering primary information regarding road geometry including number of lanes, lane markings, median, service lane etc. on the basis of inventory surveys detailed traffic surveys are planned. The surveys were conducted during the peak hours (morning and evening peak hours).

DATA COLLECTION

✓ ROAD INVENTORY SURVEY

In this survey road inventories were collected which include measurements of road geometry such as dimensions (i.e. width, height, length) of shoulder, Dividers, lanes, facilities on road includes petrol pumps, hotels, hospitals, police stations and other miscellaneous points.

✓ CLASSIFIED VOLUME COUNT SURVEY (FLOW)

The flow on the given road was determined using classified volume count study. In such collection data a survey form was made. This survey form helped in calculating the flow on the stretch. This was made in such a way so that its data it can be easily manipulated, accessed and analysed.

The Video recorded at the location was viewed and interpreted. The various category of the vehicles were been identified and their counts were noted on the survey forms. This data were collected on hourly basis which gave the volume count/ hour. Such data were collected for peak hours (morning and evening) for normal working and non-working day. This survey form was filled by the observers (i.e. group members) and end results were collected at end of this collection process and were used for analysis.

✓ SPOT SPEED SURVEY

Firstly, the spot speed data form was made in MS tool in which the times taken to cover the known distance were to be noted down. This distance was measured on field for these speed calculations (i.e. starting and ends points were determined). From the video recordings the time taken by random vehicles of different category to travel the known distance were taken and all such data were collected and processed in excel to determine the average speed of vehicles on the given road. This speed data so obtained were quite useful for further process.

✓ DENSITY

From the video recordings we were able to determine the density of the given road as density is total number of vehicles present at a given stretch or length of road at given instant of time (say per km). This density data were collected and analysed and no such forms were needed to calculate. From the hourly video recordings at random of one screenshot per minute was considered and taken and between the marked points total vehicles were counted. The average density is calculated in terms of vehicles/km at any instant of time.

Firstly, from a photographs total vehicles between the marked points at instant of time is counted and same is done for the remaining screenshots or photograph. The average of them is calculated in terms of vehicles per given distance at instant of time and is then converted to vehicles per km at instant of time thus giving average density for given road.

VI. DATA ANALYSIS AND RESULTS

From the data collected such as road geometry, flow (volume count), speed and density, we were able to determine q-k-v relationship (flow density and speed) in graphical form as shown in given tables and figures. The calculations were made and data presented are for both peak hours and for both roadways i.e. kadodara-bardoli and bardoli-kadodara. it was assumed that the average speed and density data were same for both ways (maximum of two). This data were further analysed for determining the capacity and level of services from volume to capacity ratio and speed data as referred (L.R.KADIYALI, 2008) and (CHETAN R. PATEL, 2012). This data thus analysed are presented in tabular as well as graphical form below.

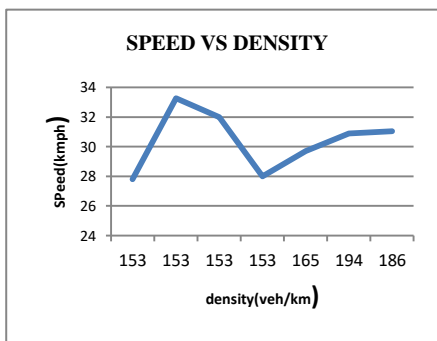
Capacity (Mathew, 2019) of the road was determined taking the average speed of vehicles. This speed of vehicles were compared with the v/c (volume to capacity) ratios and interpolated so as to obtain the actual capacity of road and this also helped to determine the level of service of road.



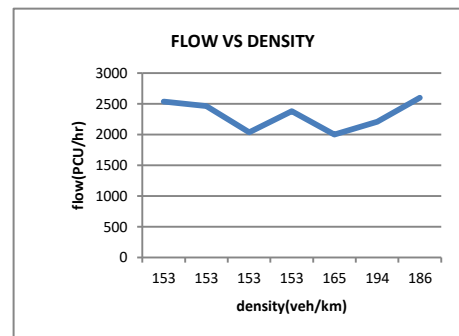
The capacities so obtained are given in the tables for different roads which match the real life condition of the road. These references helped us to represent out data within time limit and prove to be approximate and were accurate too. The level of service (LOS) indicates qualitative as well as quantitative condition of the given roads. The LOS of the given road stretch can be calculated comparing the analytical data of speed, flow, density and capacity obtained to graph of los in terms of operating speed and v/c ratios. Thus the analysis of the data are shown in below tables and graphs which include analysis of classified volume count, spot speed data, density , capacity and finally level of service (LOS) of kadodara-bardoli road.

Table 11Kadodara-Bardoli Road (Non-Working Day)

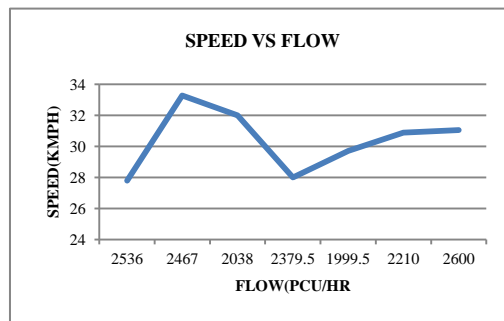
TIME	FLOW(PCU/HR)	SPEED(KMPH)	DENSITY(VEH/KM)	CAPACITYVEH/KM)
9—10 AM	2536	27.8	153	2675
10—11 AM	2467	33.28	153	2644.15
11—12 AM	2038	31.99	153	2186.7
12—1 PM	2379.5	28	153	2570.02
3—4 PM	1999.5	29.7	165	2124.86
4—5 PM	2210	30.89	194	2361.1
5—6 PM	2600	31.04	186	2780.7
Average	2318.57	30.38	165.28	2477.50



(a)



(b)



(c)

Figure 3Q-K-V Relationship for kadodara-bardoli road(non-working day) (a)speed vs density(b)flow vs density and(c) speed vs flow.

Table 2 Bardoli-Kadodara Road (Non-Working Day)



TIME	FLOW(PCU/HR)	SPEED(KMPH)	DENSITY(VEH/KM)	CAPACITYVEH/KM)
9—10 AM	2000.5	27.8	153	2675
10—11 AM	2469	33.28	153	2644.15
11—12 AM	1964	31.99	153	2186.7
12—1 PM	1669	28	153	2570.02
3—4 PM	1912.5	29.7	165	2124.86
4—5 PM	2051	30.89	194	2361.1
5—6 PM	2499.5	31.04	186	2780.7
average	2080.7	30.38	165.28	2477.50

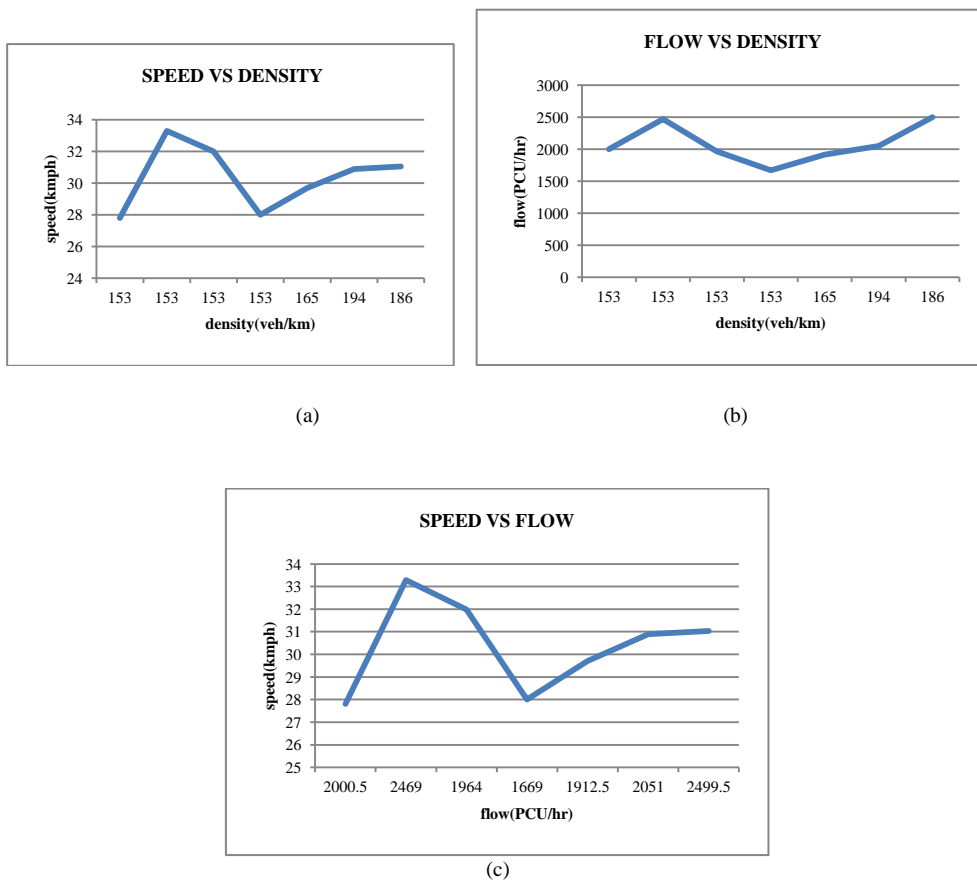


Figure 4 Q-K-V Relationship for Bardoli-Kadodara (Non-Working Day) (a)speed vs density(b)flow vs density and(c) speed vs flow.

Table 3Kadodara-Bardoli Road (Working Day)

TIME	FLOW(PCU/HR)	SPEED(KMPH)	DENSITY(VEH/KM)	CAPACITYVEH/KM)
9—10 AM	2480	27.2	191	2607.78
10—11 AM	2519	29.3	153	2674.09
11—12 AM	2690	29.4	153	2855.62
12—1 PM	2312	30.25	153	2462.2
3—4 PM	2422	26.52	153	2541.44
4—5 PM	2349	26.31	268	2462.3
5—6 PM	2242.5	25.99	191	2345.7
average	2430.64	27.85	180.28	2564.16

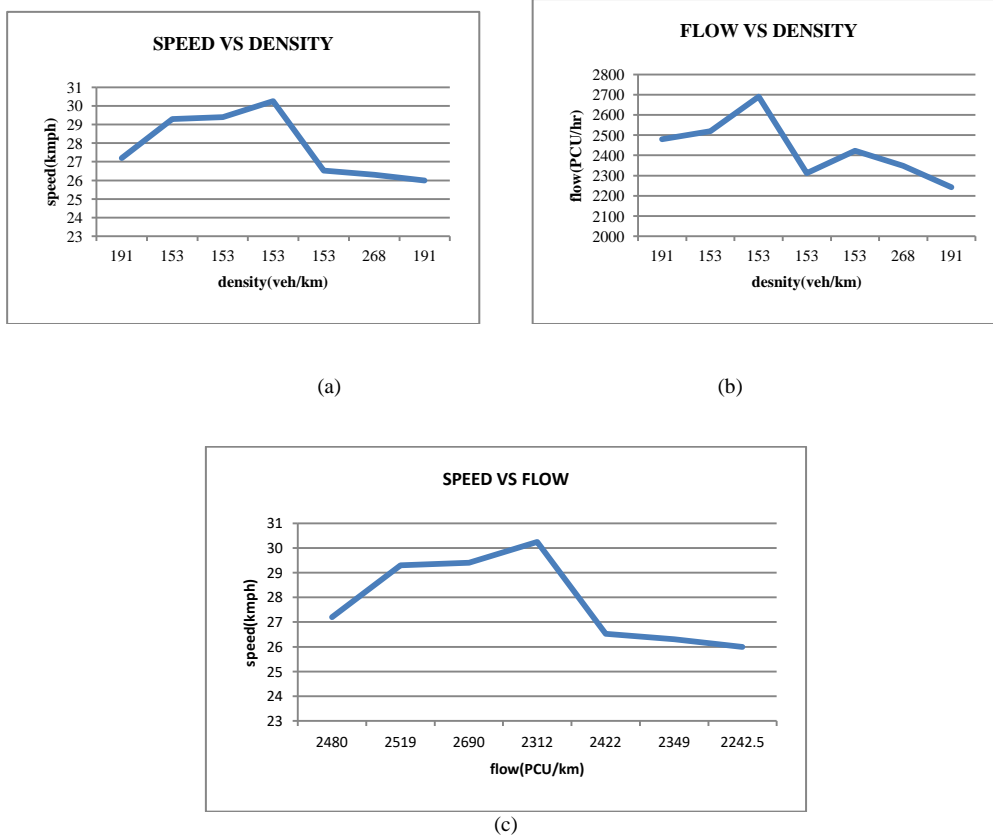
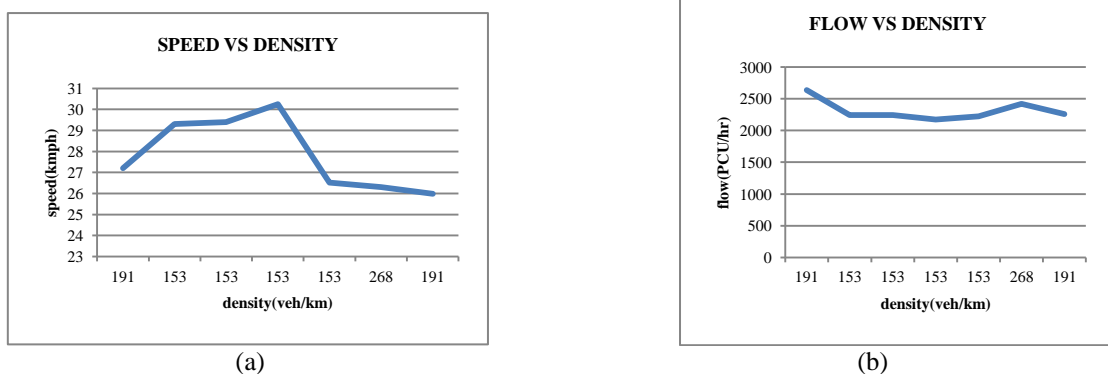
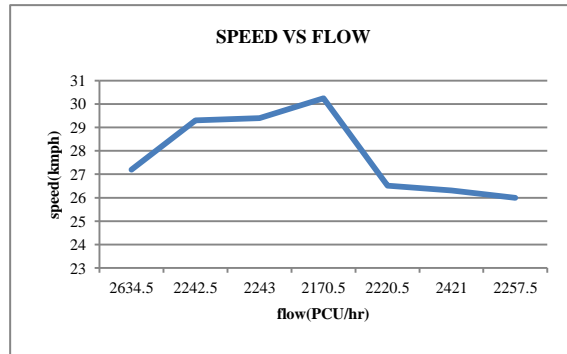


Figure 51 Q-K-V Relationship for Kadodara-Bardoli (Working Day)(a)speed vs density(b)flow vs density and(c) speed vs flow.

Table 4Bardoli-Kadodara Road (Working Day)

TIME	FLOW(PCU/HR)	SPEED(KMPH)	DENSITY(VEH/KM)	CAPACITYVEH/KM)
9—10 AM	2634.5	27.2	191	2607.78
10—11 AM	2242.5	29.3	153	2674.09
11—12 AM	2243	29.4	153	2855.62
12—1 PM	2170.5	30.25	153	2462.2
3—4 PM	2220.5	26.52	153	2541.44
4—5 PM	2421	26.31	268	2462.3
5—6 PM	2257.5	25.99	191	2345.7
average	2312.78	27.85	180.28	2564.16





(c)

Figure 6 Q-K-V Relationship for Bardoli-Kadodara (Working Day)(a)speed vs density(b)flow vs density and (c) speed vs flow.

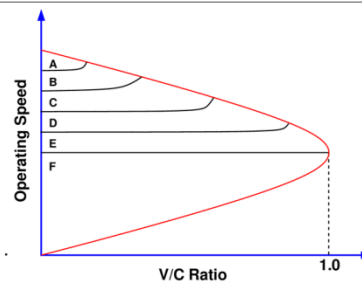


Figure 7 Los In Terms Of Operating Speed and V/C Ratios

Table 5 The LOS of A Block Section

LOS	QUALITY	SPEED(KMPH)	V/C	DESCRIPTION
A	Free flow	80	0.6	High level of physical and psychological comfort
B	Reasonable free-flow	70	0.7	Reasonable level of physical and psychological comfort
C	Near free-flow	60	0.8	Local deterioration possible with blockages
D	Medium free-flow	50	0.85	Non-recoverable local disruption
E	At capacity flow	40	0.9	Minor disturbance resulting breakdown
F	Congested flow	15	1.0	Break down of flow capacity drops

Based on the data the results can be compared and estimated for capacity and level of services.

VII. CONCLUSION

From this work we can have the following conclusions

1. The maximum flow for Kadodara-Bardoli road is 2690 PCU/HR, minimum is 1669 PCU/HR and its average maximum flow is 2430.64 PCU/HR.
2. The maximum speed on the stretch is 33.28 kmph, minimum is 25.99 kmph and its average maximum speed comes to be 30.28 kmph.
3. The maximum capacity for the road is 2855.62 VEH/KM, minimum is 2124.86 VEH/KM and average maximum capacity is 2564.16 VEH/KM at instant of time.

4. The level of service (LOS) for the given road obtained is 'E'. So there is and need to improve the level of service by changing the road geometry of the road section.
5. The Q-K-V relationship practically obtained differs from those obtained theoretically.
6. The guidelines given by the HCM manual were for homogeneous roads which do not co- relate with Indian roads having heterogeneous traffic flow.
7. The flow of given road is nearly at its capacity so to increase this capacity future extension of road is needed.

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