

# Travel Time and Delay Study of Selected Links of Kalupur Area – Ahmedabad

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**Abstract** - Road transportation have more significant than other (Rail, Air, Water) tradition transpiration facility in India. India has second largest road network across the world at 4.7 million km. This road network transports more than 60 per cent of all goods in the country and 85 per cent of India's total passenger traffic. Road transportation has gradually increased over the years with the improvement in connectivity between cities, towns and villages in the country. Along with the increasing in vehicle population is also encountered.

India is now suffering from complex problem of highly increasing vehicle population and that resulting in other transpiration problems like congestion, travel time delay, accidents etc. The increase in population and motor vehicles requires more efficient transportation systems to provide safe and economic transport of goods and passengers. To study the traffic characteristics on road network there is a need to study the existing traffic conditions. For that the traffic surveys are carried out on selected stretches of Kalupur area of Ahmedabad city. The specific purposes of this research is to identify Level of service and locations of delays to determine the significant factors causing these delays by using Floating car method, license plate method and GPS method to make recommendations for improving the flow of traffic. Travel time data was collected by license plate method and by GPS during morning and evening peak hours on each stretches simultaneously. From the interpretation of the data collected Flow-Delay Model was generated. The Level of Service (LOS) concept proposed in Highway Capacity Manual 2000 was used to determine the level of congestion. From the theoretical studies, it can be inferred that the travel time delays are largely depends on traffic flow, on street parking, haphazard movement of vehicle (No lane discipline).

**Keyword-** Travel time and Delay, License plate method, GPS, Level of Service

## 1. INTRODUCTION

The backbone of any developing nation is depends on its transportation and road transport is primary among all ways of transportation. As the more use of road transport it increase the vehicle population. India has experiencing tremendous growth of vehicle population (fig.1) an average growth rate of 9% per year in country.

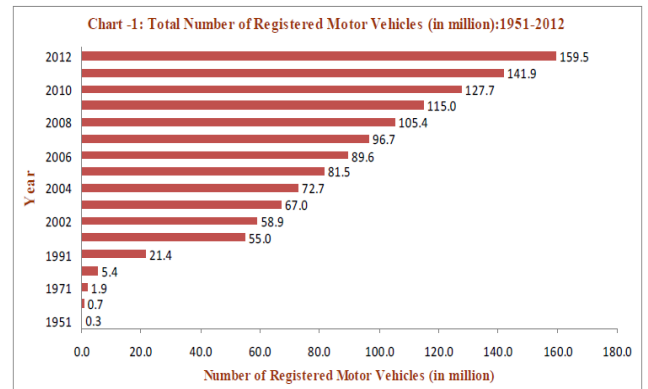


Fig. 1.1: Total Number of Registered Motor Vehicle (in million): 1951-2012  
(Source: Road Transportation Year Book 2011-12)

Due to the increase in vehicles, cities of India is become congested and the Ahmedabad has one of them. Result of traffic congestion is pollution (e.g. Delhi). Pollution in India due to traffic is 94% of total population. Ahmedabad has emerged as an important economic and industrial hub in India

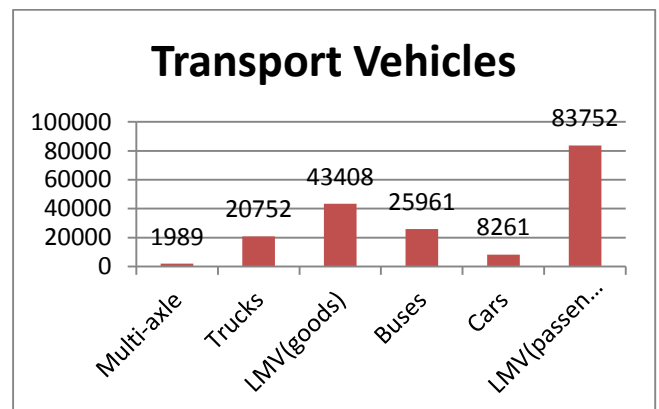


Fig. 1.2: Total number of Transport vehicle in Ahmedabad City

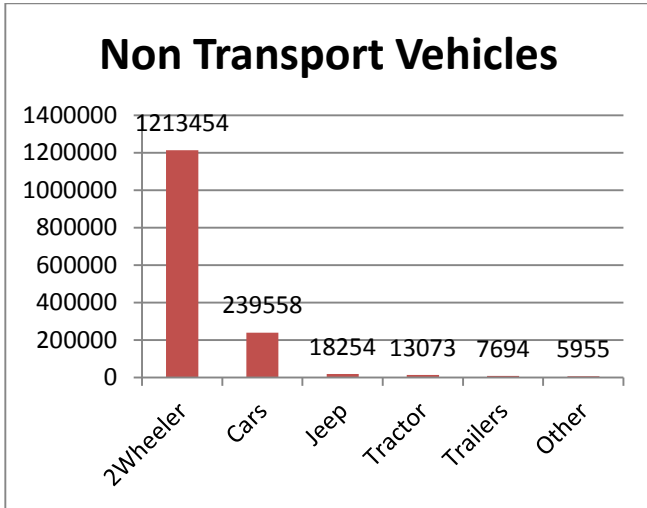


Fig. 1.3: Total number of Non-Transport vehicle in Ahmedabad City

## 2. OBJECTIVES

- To find the types of delays experienced.
- To determine the travel time and delay of selected stretch.
- To determine the level of service of selected stretch.
- To determine relation between travel time delay and volume of vehicle
- To determine the effect of vehicular composition on travel time delay.

## 3. STUDY AREA

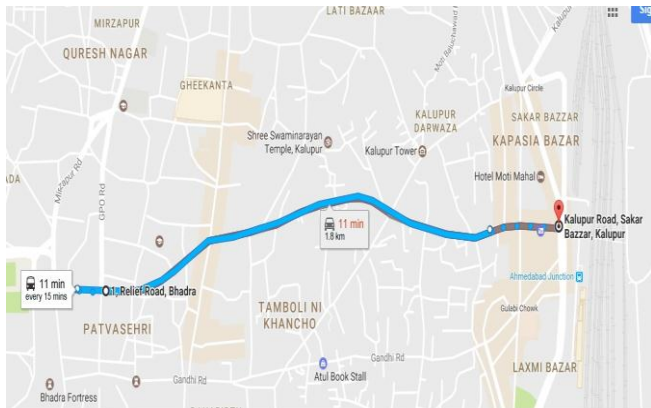


Fig.3.1: Relief Road having length 1.9 km.



Fig.3.2: Kalapur station to kalapur circle Road having length 0.4 km.

Name of Road	No. of Lanes	Divided/ Undivided	Flow type	Length (km)	Width (m)
Relief Road	Two Lane	Undivided	Two way	1.95	12
Kalapur station to Sakarbajar	Three Lane	Undivided	One Way	0.4	12
Kalapur station to kalapur circle	Three Lane	Undivided	One way	0.45	12
Sarangpur Tank to Kalapur	Four Lane	Divided	Two way	0.5	11.7

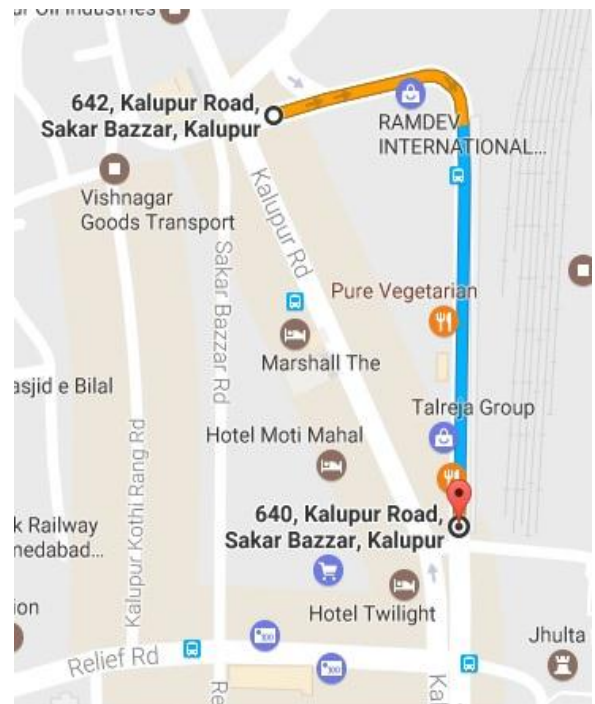


Fig.3.3: Kalapur station to kalapur circle having length 0.45 km.

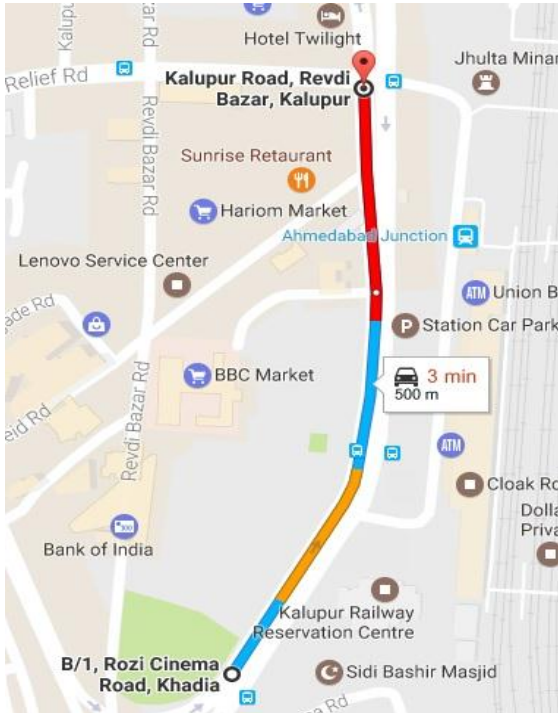


Fig.3.4: Sarangpur Tank to Kalupur station having length 0.5 km

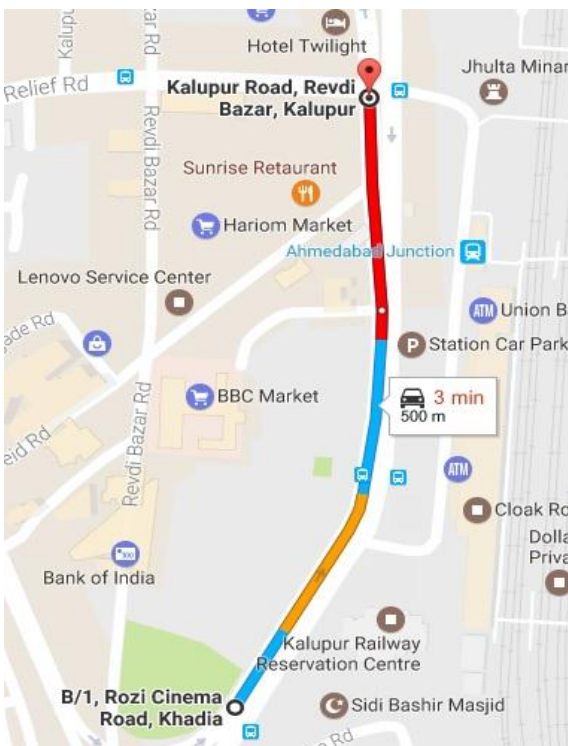
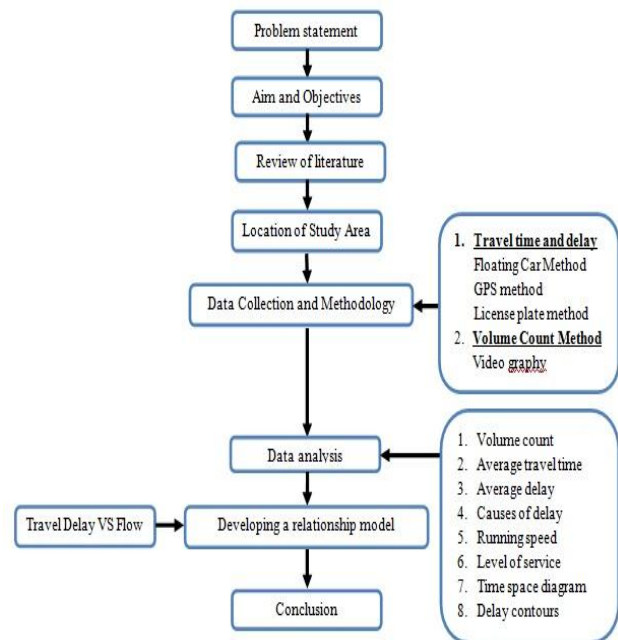


Fig.3.5: Kalupur station to Sarangpur Tank having length 0.5 km.

#### 4. METHODOLOGY AND DATA COLLECTION



##### 1. Traffic Volume Count Survey

Traffic volume count carried out by videography on selected stretches of Kalupur area Ahmedabad during morning peak (8am to 12pm) and evening peak (1pm to 8pm).

##### 2. Travel Time and Delay Survey

Travel time delay study carried out by License plate method (Videography) during morning peak hours (10am to 12pm) and evening peak hours (4pm to 6pm) and also by GPS probe vehicle during above peak hours for the determination of congestion spot.

##### 3. Time space diagram

Time-space diagrams are commonly used to solve a wide variety of transportation problems. By studying how the position of a vehicle changes over time, we can better understand the performance characteristics of the transportation system under analysis.

##### 4. Level of Service

It divides the quality of traffic into six levels ranging from level A to level F. A represents the best quality of traffic where the driver has the freedom to drive with free flow speed and level F represents the worst quality of traffic.

Range of free flow speed	i	ii	iii	iv
	90 to 70 kmph	70 to 55 kmph	55 to 50 kmph	50 to 40 kmph
Typical free flow speed	80 kmph	65 kmph	55 kmph	45 kmph
Level of Service	Average Travel Speed kmph			
A	>72	>59	>50	>41
B	>56 – 72	>46 – 59	>39 – 50	>32 – 41
C	>40 – 56	>33 – 46	>28 – 39	>23 – 32
D	>32 – 40	>26 – 33	>22 – 17	>18 – 23
E	>26 – 32	>21 – 26	>17 – 22	>14 – 18
F	<=26	<=21	<=17	<=14

Source: EXHIBIT 15-2. Urban street LOS by Class (HCM2000)



5. ANALYSIS AND RESULT

1. From Kalupur Railway station to Vijadighar (Relief Road)

Table 5.1: Volume count data

Vehicle Type	2W	3W	CAR	BUS/truck	LCV	N.M.
No. of Vehicle	21520	8804	553	2	19	1089

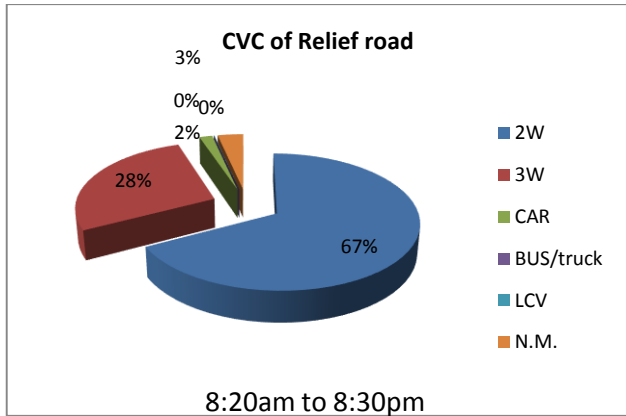


Fig. 5.1: Total Vehicle count at Relief road from Kalupur Railway station to Vijadighar

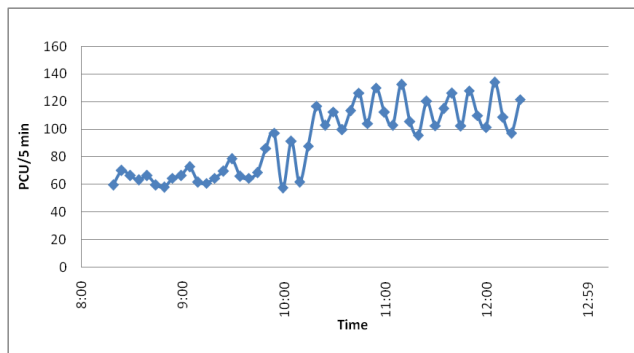


Fig.5.2: Hourly Fluctuation of Traffic flow of 5min data interval Kalupur Railway station to Vijadighar

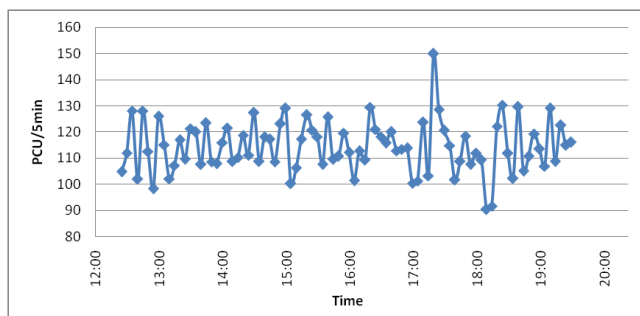


Fig.5.3: Hourly Fluctuation of Traffic flow 5min data interval Kalupur Railway station to Vijadighar

• Speed profile and Time space diagram by GPS

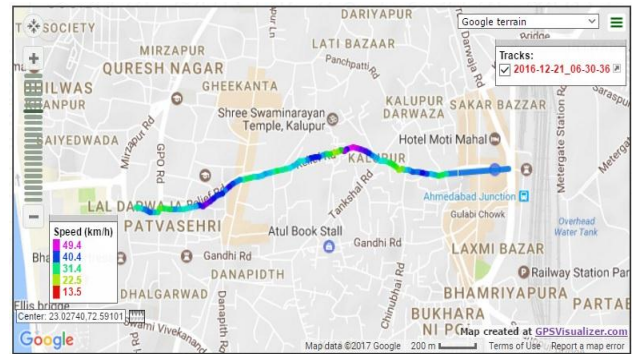


Fig.5.4: Free flow speed profile from Kalupur Railway station to Vijadighar

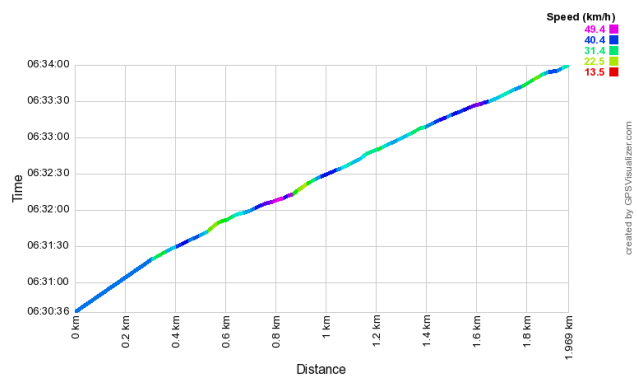


Fig.5.5: Time Space diagram at free flow speed from Kalupur Railway station to Vijadighar

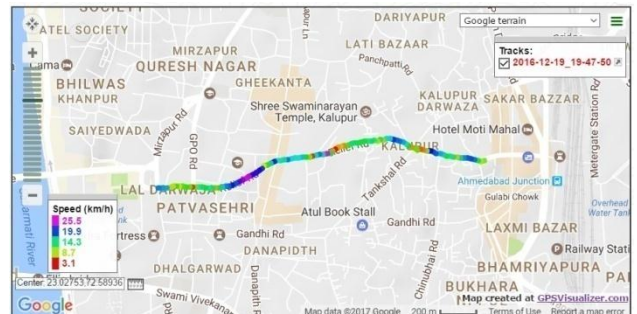


Fig.5.6: Speed profile at Peak hour from Kalupur Railway station to Vijadighar

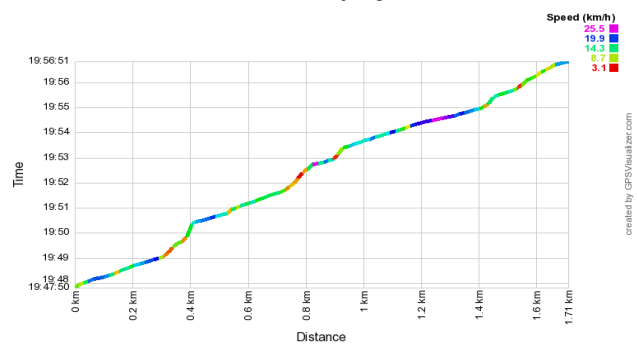


Fig.5.7: Time space at at Peak hour from Kalupur Railway station to Vijadighar

Flow Delay Relationship from license plate method

Table-5.2: Flow & Delay Analysis Data of Two hour from Kalupur Railway station to Vijadighar.

Time Interval	TOTAL PCU /5min	Avg Delay/ 5min	Time Interval	TOTAL PCU /5min	Avg Delay/ 5min
10:00	41.4	7.25	11:00	36.8	6.58
10:05	46	7.45	11:05	46	7.4
10:10	32.2	6.22	11:10	27.6	6
10:15	41.4	7.23	11:15	27.6	6
10:20	59.8	8.1	11:20	23	5.5
10:25	50.6	7.51	11:25	41.4	7.22
10:30	55.2	7.54	11:30	46	7.58
10:35	59.8	8.09	11:35	59.8	8.05
10:40	50.6	7.48	11:40	41.4	7.18
10:45	32.2	6.2	11:45	36.8	6.52
10:50	46	7.44	11:50	46	7.44
10:55	46	7.47	11:55	36.8	6.51

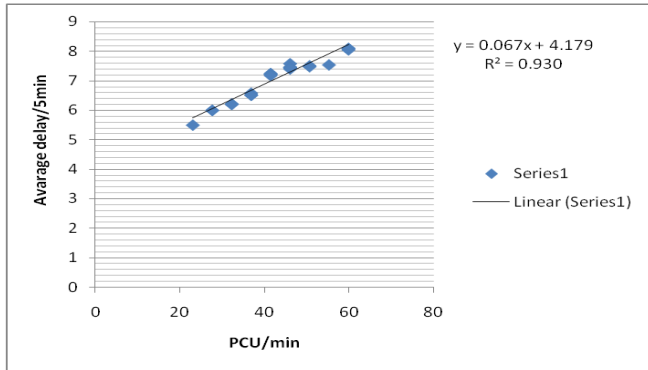


Fig.5.8: Flow Delay Relationship of two hour data from Kalupur Railway station to Vijadighar

2. From Vijadighar to Kalupur Railway station

Table 5.3: Volume count data

Vehicle Type	2W	3W	CAR	BUS	LCV	Truck	N.M.
No. of Vehicle	22203	9200	623	43	16	5	1174

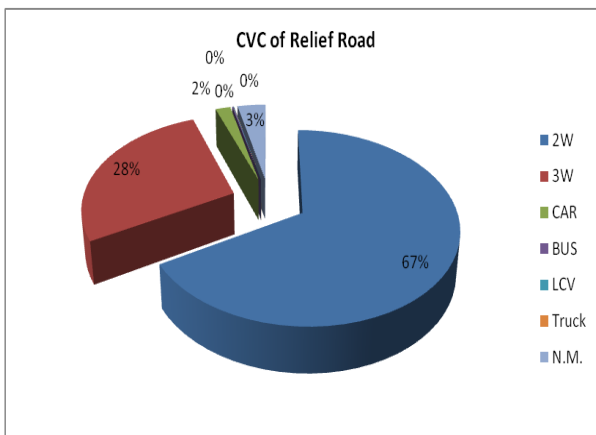


Fig.5.9: Total Vehicle count at Relief road from Vijadighar to Kalupur Railway station

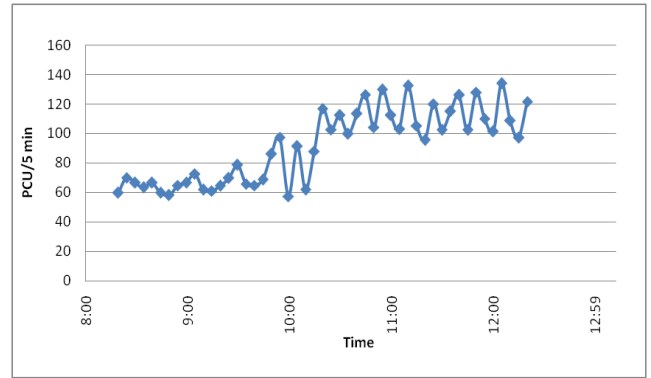


Fig.5.10: Hourly Fluctuation of Traffic flow from Vijadighar to Kalupur Railway station

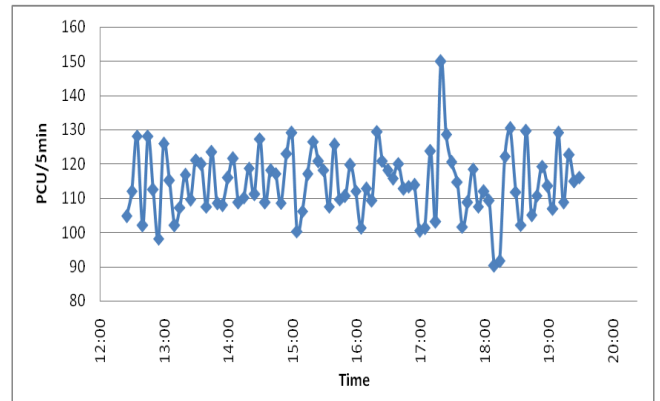


Fig.5.11: Hourly Fluctuation of Traffic flow from Vijadighar to Kalupur Railway station

• Speed profile and Time space diagram by GPS



Fig.5.12: Free flow speed profile from Vijadighar to Kalupur Railway station

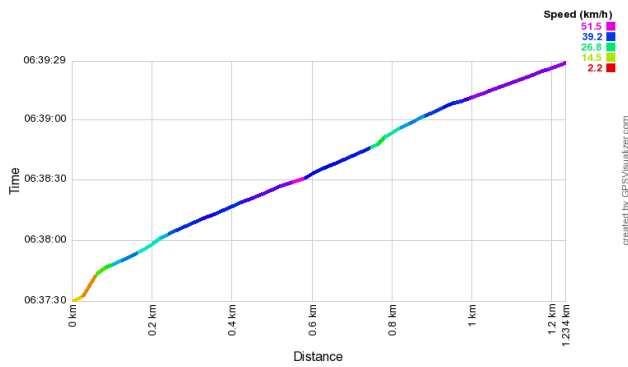


Fig.5.13: Time Space diagram at free flow speed from Vijadighar to Kalupur Railway station

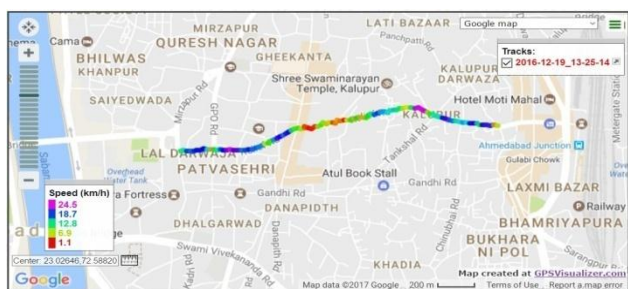


Fig.5.14: Speed profile at Peak hour from Vijadighar to Kalupur Railway station

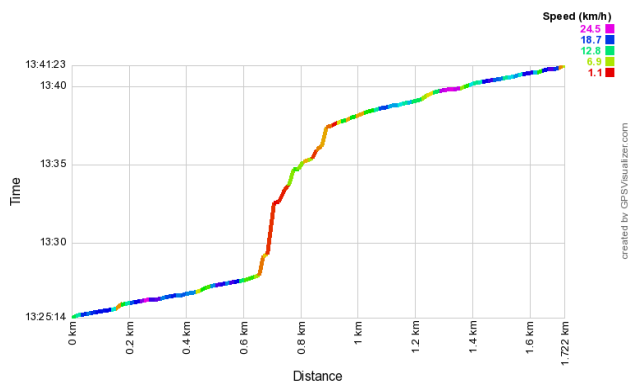


Fig.5.15: Time space at at Peak hour from Vijadighar to Kalupur Railway station

Flow Delay Relationship from License plate method

Table 5.4: Flow & Delay Analysis Data of Two hour from Vijadighar to Kalupur Railway station

Time Interval		TOTAL PCU /5min	Avg Delay/ 5min	Time Interval		TOTAL PCU /5min	Avg Delay/ 5min
10:00	10:05	55.2	7.58	11:00	11:05	41.4	7.24
10:05	10:10	55.2	7.54	11:05	11:10	41.4	7.25
10:10	10:15	50.6	7.5	11:10	11:15	36.8	6.3
10:15	10:20	41.4	7.2	11:15	11:20	50.6	7.51
10:20	10:25	50.6	7.52	11:20	11:25	32.2	6.21
10:25	10:30	36.8	6.28	11:25	11:30	46.0	7.35
10:30	10:35	36.8	6.23	11:30	11:35	46.0	7.42
10:35	10:40	55.2	7.56	11:35	11:40	46.0	7.46
10:40	10:45	59.8	8.1	11:40	11:45	46.0	7.48
10:45	10:50	55.2	7.54	11:45	11:50	55.2	7.51
10:50	10:55	55.2	7.48	11:50	11:55	55.2	7.39
10:55	11:00	50.6	7.3	11:55	12:00	36.8	6.23

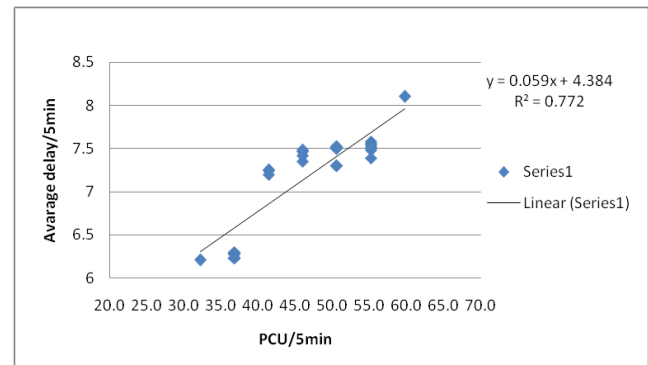


Fig.5.16: Flow Delay Relationship of two hour data from Vijadighar to Kalupur Railway station

### 3. Kalupur station to Sakar Bazar

Table 5.5 Volume count data

Vehicle type	2w	3w	Cars	Bus/ Truck	L.C.M.	N.M.
No. of Vehicle	21517	14381	4378	1385	669	1566

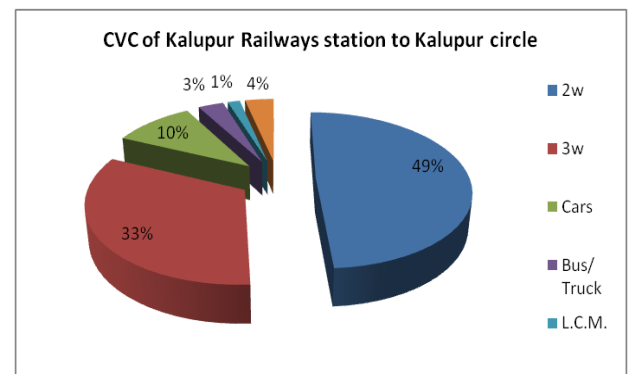


Fig.5.17: Total Vehicle count at Relief road from Kalupur station to Sakar Bazar

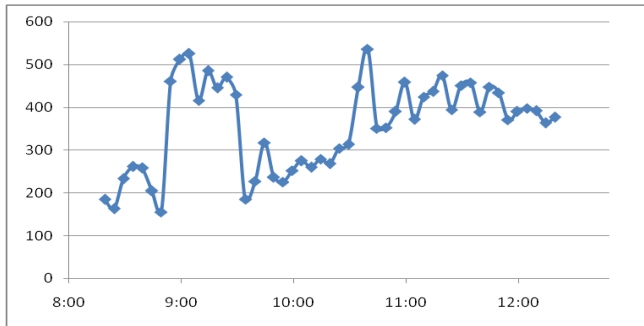


Fig.5.18: Hourly Fluctuation of Traffic flow of 5min data interval from Kalupur station to Sakar Bazar

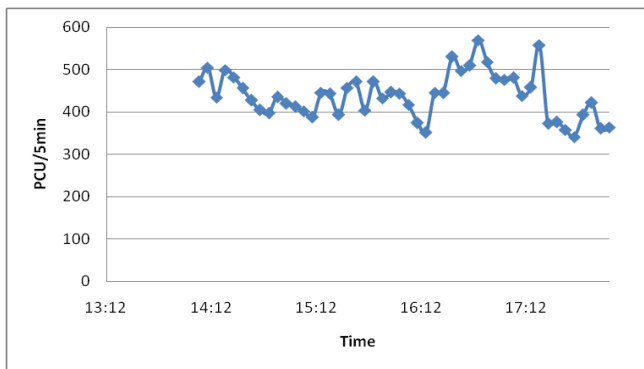


Fig.5.19: Hourly Fluctuation of Traffic flow of 5min data interval from Kalupur station to Sakar Bazar

Speed profile and Time space diagram by GPS

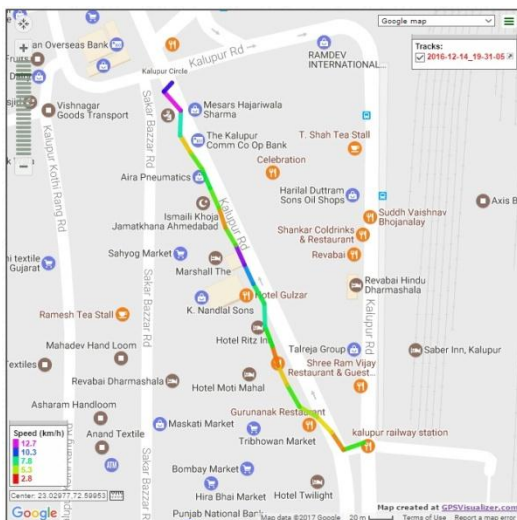


Fig. 5.20: Free flow speed profile flow from Kalupur station to Sakar Bazar

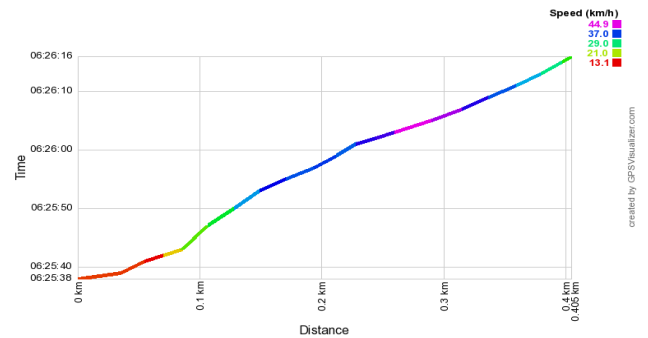


Fig.5.21: Time Space diagram at free flow speed from Kalupur station to Sakar Bazar

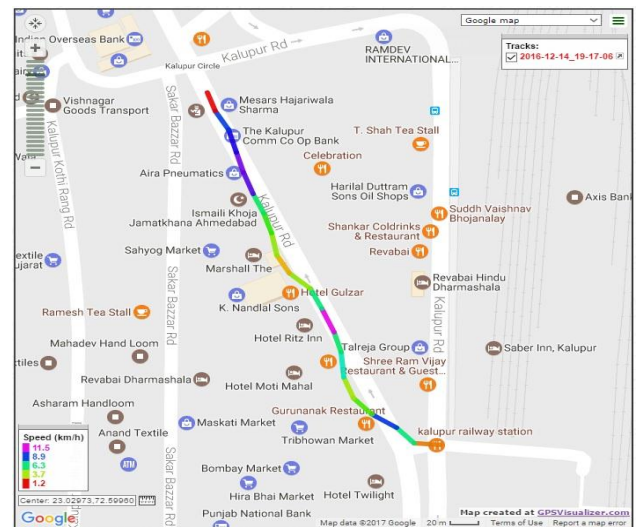


Fig.5.22: Speed profile at Peak hour from Kalupur station to Sakar Bazar

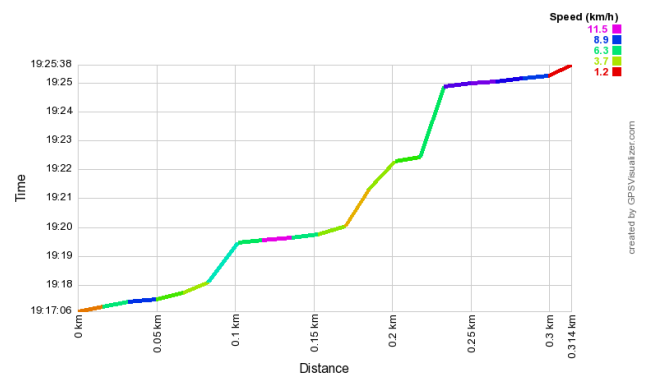


Fig.5.23: Time space at at Peak hour from Kalupur station to Sakar Bazar

Flow Delay Relationship from License plate method

Table 5.6: Flow & Delay Analysis Data of Two hour from Kalupur station to Sakar Bazar (Morning)

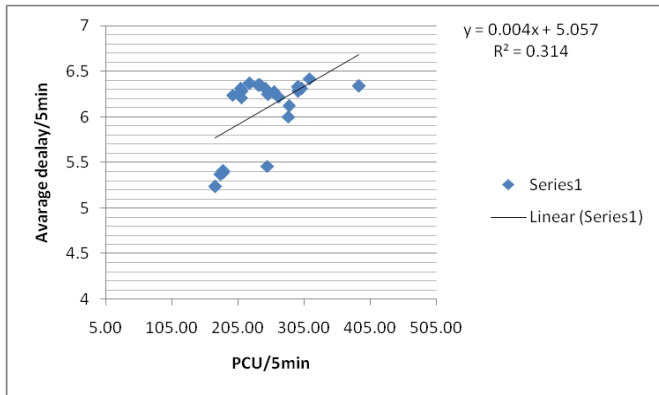


Fig.5.24: Flow Delay Relationship of two hour data from Kalupur station to Sakar Bazar

Table 5.7: Flow & Delay Analysis Data of Two hour from Kalupur station to Sakar Bazar (Evening)

Time Interval	TOTAL PCU /5min	Avg Delay/ 5min	Time Interval	TOTAL PCU /5min	Avg Delay/ 5min
4:00	444	6.02	5:00	476.3	6.0
4:05	417	5.86	5:05	481.3	6.1
4:10	375	5.70	5:10	437.9	5.8
4:15	420	5.40	5:15	458.3	6.0
4:20	445	6.03	5:20	558.3	6.1
4:25	444	6.00	5:25	372.7	5.7
4:30	435	6.20	5:30	375.7	5.8
4:35	497	6.10	5:35	357.7	5.7
4:40	509	6.21	5:40	340.7	5.5
4:45	570	6.30	5:45	392.7	5.8
4:50	518	6.23	5:50	421.7	5.4
4:55	479	6.00	5:55	412.0	5.1

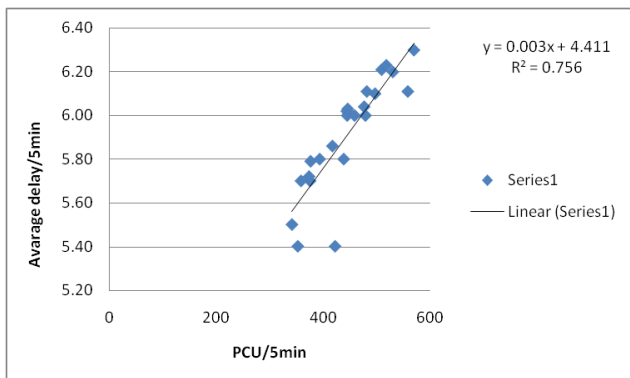


Fig.5.25: Flow Delay Relationship of two hour data from Kalupur station to Sakar Bazar

4. Kalupur Railway station to Kalupur police station

Time Interval	TOTAL PCU /5min	Avg Delay/ 5min	Time Interval	TOTAL PCU /5min	Avg Delay/ 5min
10:00	182.60	5.39	11:00	295.00	6.28
10:05	182.40	5.41	11:05	236.00	6.35
10:10	178.24	5.37	11:10	249.68	6.26
10:15	208.48	6.31	11:15	266.32	6.22
10:20	170.38	5.24	11:20	313.04	6.42
10:25	210.60	6.28	11:25	248.94	5.46
10:30	222.30	6.37	11:30	281.34	6
10:35	300.70	6.31	11:35	281.56	6.12
10:40	388.02	6.34	11:40	250.10	6.25
10:45	196.52	6.24	11:45	296.10	6.33
10:50	209.62	6.21	11:50	259.34	6.27
10:55	237.80	6.35	11:55	245.92	6.31

Table 5.8: Volume count data

Vehicle Type	Two Wheelers	Cars	Three Wheelers	Bus/ Truck	L.C.V	Cycle
No. of Vehicle	22878	4046	17885	1424	756	1638

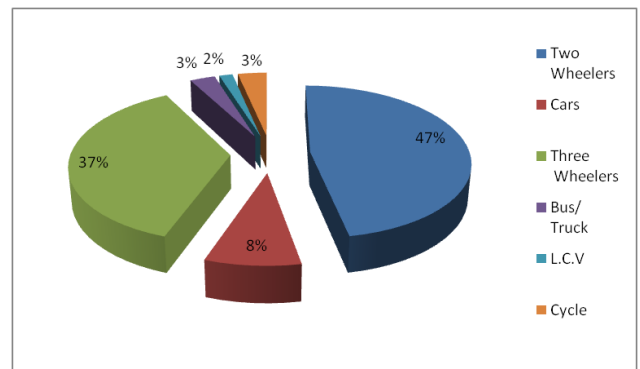


Fig.5.26: Total Vehicle count From Kalupur Railway station to Kalupur police station

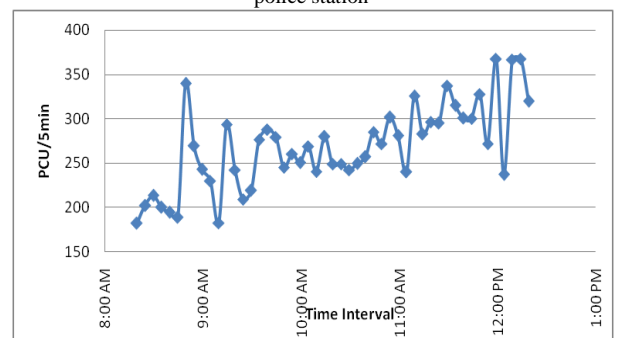


Fig.5.27: Hourly Fluctuation of Traffic flow of 5min data interval from Kalupur Railway station to Kalupur police station



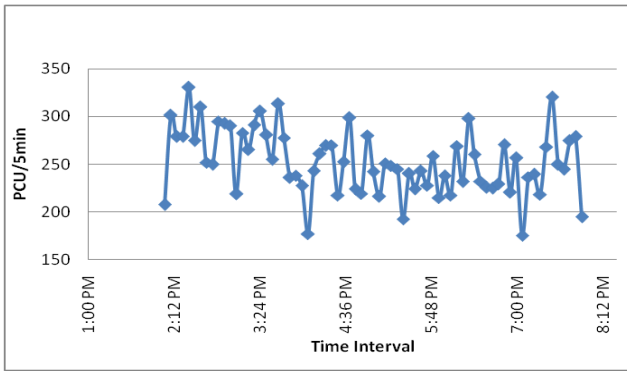


Fig.5.28: Hourly Fluctuation of Traffic flow of 5min data interval from Kalupur Railway station to Kalupur police station

- Speed profile and Time space diagram by GPS



Fig.5.31: Time space at at Peak hour Kalupur Railway station to Kalupur police station



Fig.5.29: Free flow speed profile flow from Kalupur Railway station to Kalupur police station

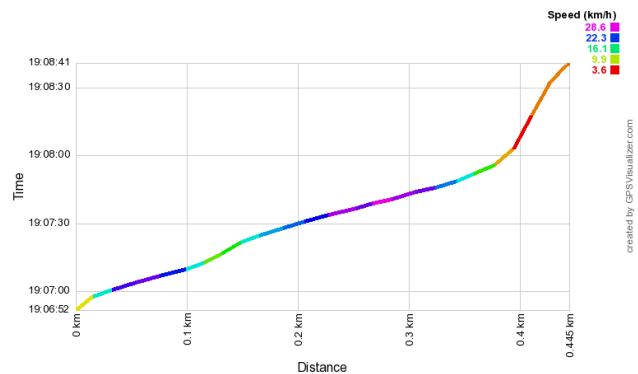


Fig.5.32: Time space at at Peak hour Kalupur Railway station to Kalupur police station

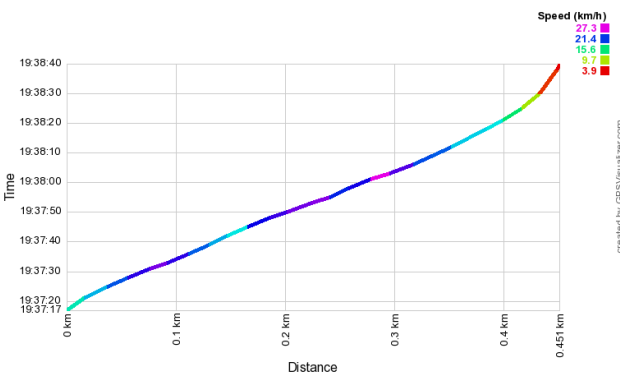


Fig.5.30: Time Space diagram at free flow speed from Kalupur Railway station to Kalupur police station

- Flow Delay Relationship from License plate method
- 5.12: Flow & Delay Analysis Data of Two hour Kalupur Railway station to Kalupur police station (Morning)

Time Interval	TOTAL PCU /5min	Avg Delay/ 5min	Time Interval	TOTAL PCU /5min	Avg Delay/ 5min
10:00	183	5.39	11:00	295	6.28
10:05	182	5.41	11:05	236	6.35
10:10	178	5.37	11:10	250	6.26
10:15	208	6.31	11:15	266	6.22
10:20	170	5.24	11:20	313	6.42
10:25	211	6.28	11:25	249	5.46
10:30	222	6.37	11:30	281	6.00
10:35	301	6.31	11:35	282	6.12
10:40	388	6.34	11:40	250	6.25
10:45	197	6.24	11:45	296	6.33
10:50	210	6.21	11:50	259	6.27
10:55	238	6.35	11:55	246	6.31

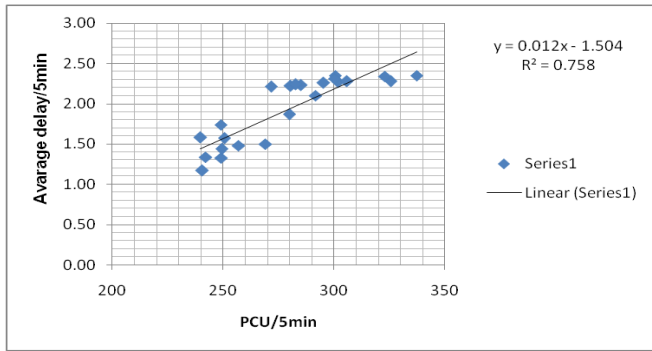


Fig.5.33: Flow Delay Relationship of two hour data Kalapur Railway station to Kalapur police station

Table 5.12: Flow & Delay Analysis Data of Two hour Kalapur Railway station to Kalapur police station (Evening)

Time Interval	TOTAL PCU /5min	Avg Delay/ 5min	Time Interval	TOTAL PCU /5min	Avg Delay/ 5min		
4:00	4:05	246	2.51	5:00	5:05	228	2.51
4:05	4:10	223	2.38	5:05	5:10	239	2.56
4:10	4:15	243	2.32	5:10	5:15	260	2.58
4:15	4:20	224	2.29	5:15	5:20	230	2.49
4:20	4:25	288	2.74	5:20	5:25	222	2.46
4:25	4:30	279	2.60	5:25	5:30	188	2.30
4:30	4:35	227	2.54	5:30	5:35	208	2.45
4:35	4:40	220	2.31	5:35	5:40	215	2.41
4:40	4:45	290	2.60	5:40	5:45	252	2.54
4:45	4:50	242	2.40	5:45	5:50	251	2.59
4:50	4:55	228	2.42	5:50	5:55	277	2.61
4:55	5:00	262	2.54	5:55	6:00	246	3

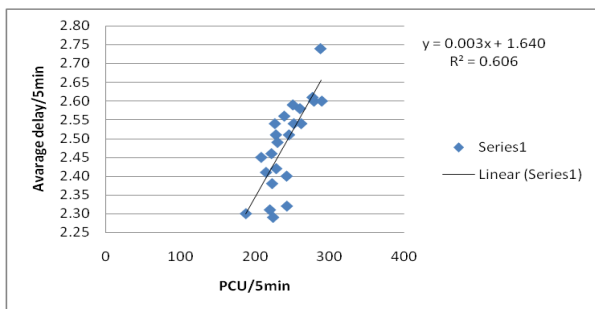


Fig.5.34: Flow Delay Relationship of two hour data Kalapur Railway station to Kalapur police station

• Summary

Stretch		Length (km)	Width (m)	FF Speed (kmph)	Avg.Speed in Peak period kmph	FF Travel time (mm:ss)	Avg. TT in Peak Hour (mm:ss)	Avg. Delay (mm:ss)	R <sup>2</sup>	L.O.S
Relief Road	Vijadighar to Kalapur stn.	1.95	12	43.78	3.25	2:46	10:00	7:15	0.772	F
	Kalapur stn. To Vijadighar	1.95	12	43.78	3	2:46	9:45	7	0.93	F
Kalapur Railway station to sakar bazaar	Morning	0.4	12	40	4	0:40	6:00	7	0.314	F
	Evening	0.4	12	40	4	1:40	6	7	0.756	F
Kalapur Railway station to Kalapur police station	Morning	0.45	11.75	26	8.18	1:00	3:30	2:30	0.606	F
	Evening	0.45	11.75	26	8	1:00	3:00	2:00	0.758	F

• Contour maps based on GPS

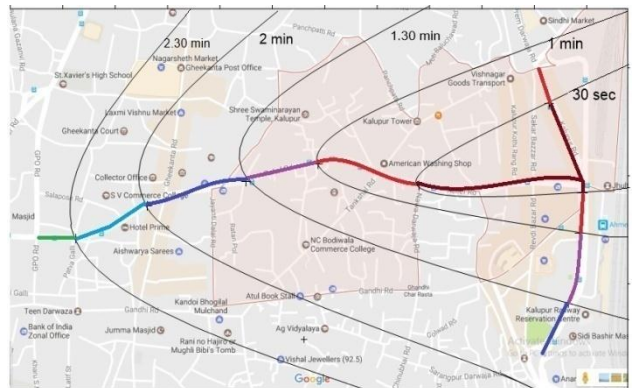


Fig.5.35 Free flow speed contour map

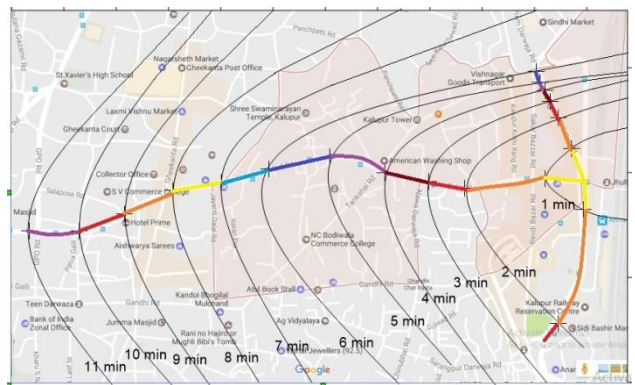


Fig.5.36 Peak period speed contour map

## CONCLUSION

From this study maximum delay is encountered avg. 6min on the sakar bazaar road of length 0.4km and the flow delay relationship result  $R^2$  says that the delay is linearly proportional flow. The level of service of all stretches has "F" so there may need some traffic regulation or other measures to improve traffic movement.

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