

Effective Road Network System in Satara City

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Abstract— Travel has become an integral part of all of us and hence traffic congestion has been one of the major problems in India especially in metropolitan cities. This study investigates the causes, effects and remedies of traffic congestion which become common in the most roadways in the Satara City. This paper includes analysis of the traffic congestion in Satara city, when studying traffic congestion in Satara city, the main causes of traffic congestion have been measured indicating the inadequate road capacity, poor road pavement, poor road network, poor parking facilities along the road and presence of heavy traffic. By reducing traffic congestion and road maintenance, Satara city can play the significant role by ensuring healthy environment free from traffic congestion.

Key words: Traffic Congestion, Road Maintenance, Road Network System, Traffic Volume Survey

I. INTRODUCTION

Transportation is a means of carrying goods and people from one location to another. Transport refers to the activity that simplifies physical movement of goods as well as Individuals from one location to another. There are several modes of transport that comprises road transport, rail transport, water transport and air transport. Road transport is one of the most ideal and cost effective mode of transportation in India. India consumes a road network of terminated 5,472,144 kilometers as on 31 March 2015, the second largest road network in the world. The country's road network consists of various road categories like Expressways, National Highways, State Highways, Major District Roads, Other District Roads and Village Roads etc. Roads are the dominant mode of transportation in India. Road transport of our country is facing a number of problems such as traffic congestion, road maintenance, parking problems, vehicular pollution and road safety.

A. Description of Satara City:-

Satara city is administrated by Municipal Corporation which comes under Satara Municipal Region. The Satara city is situated in Maharashtra state of India.

As per provisional reports of Register India, population of Satara city in 2011 is 120,195; of which male and female are 61,129 and 59,066 respectively. Though

Satara city has population of 120,195; its metropolitan population is 149,335 of which 76,101 are males and 73,234 are females.

B. Transport in Satara City:-

Satara city is connected with Maharashtra by road and rail. National Highway 4 running between Mumbai and Chennai permits through Satara. A bypass was built in the 1990's to avoid traffic congestion in the city. NH4 part of the Golden Quadrilateral, has been fully converted to a 4-lane separated highway while the stretch between Pune and Satara has been

promoted to 6-lane. State Highway 58 joins Satara with Mahabaleshwar and Solapur.

Satara railway station lies on the Pune-Miraj route of the Central Railways and is controlled by the Pune Railway Division. The railway station is located an east of the city and is served by several express trains.

There are various important roads within a Satara city which connecting schools, colleges, ST stand, banks, theatres, markets and it also connects Taluka headquarters, Zilla parishad, Munciality, PWD office and other rural areas to city for employment, regular day life and education purpose. It also connects city with the State Highway and National Highway.

This paper focused on the traffic congestion and road maintenance in Satara city

C. Traffic Congestion:

Traffic congestion involves queuing, slower speeds and increased travel times, which impose costs on the economy and generate multiple impacts on urban regions and their inhabitants [1]. The first part of this paper includes the analysis of traffic congestion in Satara city; the first step in reducing traffic congestion is to estimate the amount of traffic on the road at congested point in the Satara city. A common method is adopted to estimate the traffic congestion such as using traffic volume survey and count the number of vehicles during the heavy traffic (peak hour) passing through congested points. The main reason behind the traffic congestion is their improper control system and inadequate number of traffic signals in the city. There are various congested points in Satara city of which only 1 have traffic signal. The growing traffic congestion in Satara city requires proper traffic management for healthy mobility in City

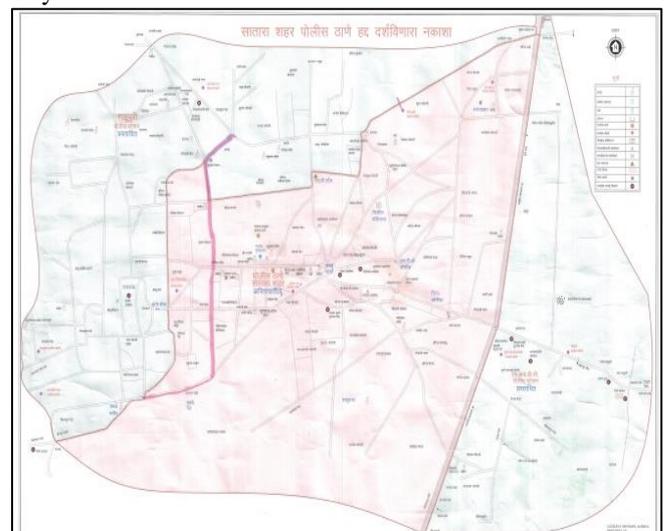


Fig. 1: Satara City Road Map

1) Objectives:-

- 1) Conduct traffic volume survey in order to identify high density point areas among city
- 2) To determine volume of traffic at congested points

II. METHODOLOGY

The work started with collection of data regarding road map, traffic congestion, road maintenance, existing condition of the road for detailed study of Satara city with the help of the administrative offices. There are two surveys carried out namely field survey for traffic congestion and field survey for drainage system to collect data and other relevant information regarding existing condition of roads within the city which is required in the process of work.

A. Collection of data:-

Data regarding to the road map of Satara city, traffic congestion, present condition of the roads and drainage system in city is collected from Nagarpalika, PWD office and Vahtuk control office.

B. Field survey for Traffic Congestion:-

To estimate the amount of traffic on the road at congested point, a common method is adopted such as using traffic volume survey and count the number of vehicles during the heavy traffic (peak hour) passing through congested points in Satara City.

The traffic density based analysis is carried at various spot and at various timings like during peak rush hour in morning and evening. The areas finalized for traffic congestion analysis are very much nearer to local market, government offices and public school. The spot which are finalized for analysis are;

- 1) Satara ST stand
- 2) Powai Naka
- 3) Rajwada Chowk (Gol bag circle)

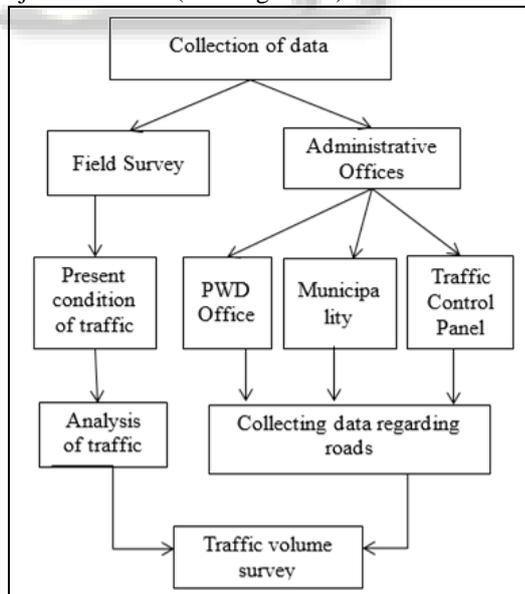


Fig. 2: Flowchart of methodology

III. RESULT & DISCUSSION

Traffic studies are carried out to analyze the traffic characteristics. It helps in geometric design and traffic control, which tends to a safe and efficient traffic

movement. In this paper I had done traffic volume study to analyze the traffic flow within the satara city to study the traffic congestion at congested points. Traffic volume is defined as the no. of vehicles crossing a particular cross section per unit time. It is measured in vehicle per minute, vehicle per hour and vehicle per day [8].

The volume of traffic was classified majorly as bikes, auto rickshaws, cars/taxis, buses/trucks. The summary of the data is provided below in tables.

A. Satara ST Stand

ST stand is situated on the main road connecting to National Highway Number 04 and Stara city. The number of heavy vehicles and path walkers is observed to very heavy.

Vehicles	Satara stand to powai naka	powai naka to Satara stand	Satara stand to civil hospital road	Total
Bikes	1789	1563	328	3680
Auto - rickshaw	286	186	79	1127
Car / Taxis	419	246	47	712
Buses / Trucks	63	39	07	109
Total (veh/hr)				5628

Table 1: Survey at peak hour 09:00am to 10:00am
To calculate density 20% additional volume is consider for future development,

To find density time is taken 1hour,

$$\text{Density} = \text{rate of flow} / \text{time}$$

$$= 5628 + (5628 \times 0.2) / 1$$

$$= 6753.6\text{veh/hr}$$

Vehicles	Satara stand to powai naka	powai naka to ST stand	Satara stand to civil hospital road	Total
Bikes	2005	1977	438	4420
Auto rickshaw	375	296	115	789
Car / Taxis	431	388	80	899
Buses / Trucks	71	50	09	130
Total (veh/hr)				6235

Table 2: Survey at peak hour 06:00pm to 07:00pm
To calculate density 20% additional volume is consider for future development,

To find density time is taken 1 hour,

$$\text{Density} = \text{rate of flow} / \text{time}$$

$$= 6235 + (6235 \times 0.2) / 1$$

$$= 7482 \text{ veh/hr}$$

B. Powai Naka

It is an area where seven road from various areas are connected, having elevation at signal point. This is considered as one of the most rushed area in Satara city. During peak hour's average traffic jam of 20 min is observed.

Indications,

- A-B= Bombay Rest. Road to Powai naka,
- C-D= Y. C. clg road to Powai naka,

E-F= Rajwada road to Powai naka,
G-H= Police Head Quater road to Powai naka,
I -J= Satara stand road to Powai naka,
K-L= Civil hospital Road to Powai naka

Vehicles	A-B	C-D	E-F	G-H	I-J	K-L	Total
Bikes	1238	1048	669	1217	1129	898	6499
Auto rickshaw	123	98	83	136	79	87	606
Car / Taxis	327	237	187	167	201	153	1272
Buses / Trucks	21	34	17	19	11	09	111
Total (veh/hr)							8788

Table 3: Survey at peak hour 09:00am to 10:00am Powai naka (Towards)

To calculate density 20% additional volume is consider for future development.

To find density time is taken 1 hour,

$$\text{Density} = \text{rate of flow} / \text{time}$$

$$= 8788 + (8788 \times 0.2) / 1$$

$$= 10545.6 \text{ veh/hr}$$

Vehicles	B-A	D-C	F-E	J-I	L-K	Total
Bikes	1124	1287	621	1047	636	4715
Auto rickshaw	107	104	69	73	67	420
Car / Taxis	319	248	193	174	147	1081
Buses / Trucks	26	43	16	18	07	110
Total (veh/hr)						6326

Table 4: Survey at peak hour 09:00pm to 10:00pm Powai naka (Away)

To calculate density 20% additional volume is consider for future development.

To find density time is taken 1 hour

$$\text{Density} = \text{rate of flow} / \text{time}$$

$$= 6326 + (6326 \times 0.2) / 1$$

$$= 7591 \text{ veh/hr}$$

Total Density= 10545.6 + 7591 = 18136.6 veh/hr

Vehicles	A-B	C-D	E-F	G-H	I-J	K-L	Total
Bikes	1347	1189	723	1364	1259	934	5816
Auto rickshaw	142	137	98	183	93	103	756
Car / Taxis	387	326	219	198	297	176	1603
Buses/Trucks	27	48	29	26	21	17	168
Total (veh/hr)							8343

Table 5: Survey at peak hour 06:00am to 07:00am Powai naka (Towards)

To calculate density 20% additional volume is consider for future development.

To find density time is taken 1 hour

$$\text{Density} = \text{rate of flow} / \text{time}$$

$$= 8343 + (8343 \times 0.2) / 1$$

$$= 10011.6 \text{ veh/hr}$$

Vehicles	B-A	D-C	F-E	J-I	L-K	Total
Bikes	1270	1421	1895	1977	721	7284
Auto	165	168	360	296	73	1062

rickshaw						
Car /taxis	322	297	623	388	174	1804
Buses/Trucks	42	74	32	50	11	209
Total (veh/hr)						10359

Table 6: Survey at peak hour 06:00am to 07:00am powai naka (Away)

To calculate density 20% additional volume is consider for future development.

To find density time is taken 1 hour

$$\text{Density} = \text{rate of flow} / \text{time}$$

$$= 10359 + (10359 \times 0.2) / 1$$

$$= 12430.8 \text{ veh/hr}$$

Total Density= 10011.6 + 12430.8 = 22442.4 veh/hr

C. Rajwada (Gol bag circle)

In this area local city bus stand is situated along with food court and child playing garden. In evening and holidays public rush along with motorcycles and car are observed.

Indication:

A-B= Powai naka road to Rajwada,

C-D= Samarth mandir to Rajwada circle,

E-F = D.C bank road to Rajwada

Vehicle	A-B	C-D	E-F	B-A	D-C	F-E	Total
	Towards	Towards	Towards	Away	Away	Away	(Towards + Away)
Bikes	657	1001	72	536	927	87	3280
Auto rickshaw	90	99	39	97	83	49	457
Car / Taxis	171	107	18	152	96	23	567
Buses/Trucks	12	6	0	9	8	0	35
Total (veh/hr)							4339

Table 7: Survey at peak hour 09:00am to 10:00am

To calculate density 20% additional volume is consider for future development.

To find density time is taken 1 hour

$$\text{Density} = \text{rate of flow} / \text{time}$$

$$= 4339 + (4339 \times 0.2) / 1$$

$$= 5206.8 \text{ veh/hr}$$

Vehicle	A-B	C-D	E-F	B-A	D-C	F-E	Total
	Towards	Towards	Towards	Away	Away	Away	(Towards + Away)
Bikes	1031	1057	90	548	836	96	3658
Auto rickshaw	198	105	46	87	89	52	577
Car / Taxis	173	126	12	164	93	27	595
Buses / Trucks	15	3	0	7	9	0	34

Total (veh/hr)	4339
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Table 8: Survey at peak hour 05:00pm to 06:00pm

To calculate density 20% additional volume is consider for future development.

To find density time is taken 1 hour

$$\begin{aligned} \text{Density} &= \text{rate of flow / time} \\ &= 4864 + (4864 \times 0.2) \\ &= 5836.8 \text{ veh/hr.} \end{aligned}$$

IV. CONCLUSIONS

Carrying this work was intended to analyse the traffic congestion areas in Satara city during peak and slack hours. In order to get data various points have been identified and visited during peak and slack hours during day time and night as well. While studying it has been observed that the road width and market concentration are one of the important reasons for traffic congestions. Various traffic models have been studied with the help of local traffic control department and the strategies by using they control city traffic during peak hours.

Some of the important conclusions drawn from this study can be summarized as follows:

- 1) The main causes of traffic congestion are inadequate road capacity, poor traffic control management, on-street parking and poor road network.
- 2) Proper drainage system helps to increase the life of the roads and to reduce the maintenance cost of the roads.

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