

A Study on Parking Needs at Intersections – Case of Surat T. P. Schemes

Bhasker Vijaykumar Bhatt¹, Fenil Rajeshkumar Gandhi²

¹Department of Civil Engineering, Sarvajani College of Engineering & Technology, Surat, Gujarat, India

²Department of Water Resources Engineering, M. S. University of Baroda, Vadodara, Gujarat, India

Corresponding Email: bhasker.bhatt@scet.ac.in

Abstract – Paper discusses parking needs at intersections of developed T. P. Schemes of Surat under the GTPUD Act, 1976. Land use and width of road along with existing parking facilities have an impact where the act has no specific provisions. Study identifies Parking consumes 0.1% - 2.46% road land at intersections.

Keywords – Land use, Parking, Road arm width, Surat, Urban intersection

I. Introduction

Urbanization has its advantages as well as drawbacks and the effect of the later can result in diverse losses if not attempted in time. Traffic vehicle population and resulting congestion is a most commonly faced problem in any of major urban centres in India nowadays. Present work is an outcome of a study that was performed addressing one such drawback with a view to understand the extent of parked vehicles on intersection arms having different sizes and land use with specific focus on Town planning schemes (*a widely appreciated land pooling tool for urbanization in Gujarat*) intersections that are already existing as a result of past planning efforts. The GTPUD Act, 1976 in practice provide no guideline to planners/ engineers to reserve public parking space on intersections which have been experienced to have traffic jamming causing manifold waste of time, energy and money. The objective was to identify land parcel/ space requirement apart from regular parking space provided by individual plot development governed by regulations of urban local bodies.

Present work comprises the study of existing parking facilities provided in various Town Planning Schemes (TPS) of Surat Municipal Corporation (SMC); recommendation of Indian Road Congress (IRC) on parking component; Survey for irregular and unauthorised parking of vehicles with composition thereof. In past SMC has carried out several studies for improvement of transport infrastructure in Surat and these studies resulted with several recommendations to ease the traffic congestion, improve the accessibility & mobility and overall environment. Most of the recommendations of earlier studies have been successfully implemented by the authority so far however, parking on roads is still not under much of resolved issues though attempted to some extent at major few locations.

Number of vehicles in Surat has crossed a mark of 2 million against a population of 4.5 million by the year 2013 with motorized two wheelers (average share 79%) and motorcars (average share 11%) increasing at 126.72% and 217.17% respectively in the last decade. Surat city has good

road network (more than 2541 km by year 2013). The share of mass transportation in Surat is very poor. Efforts for smoothening traffic flow on roads, the SMC has developed 149 traffic islands and signals at 61 spots using diverse funding mechanisms (including PPP), road medians with a total length of 158km; and in addition to that the Traffic police of Surat has also taken initiatives as installation of CCTV camera (more than 1000 in number covering most of important locations and intersections) with a centralized surveillance control room. Further important notation is that the authorities are still lacking with an update of a comprehensive mobility plan and efforts by various organizations are ongoing are resulting in a piecemeal treatment only.

Mechanism of Town Planning Schemes

The TPS (average area around 100 Ha) are planned by the authorities under the procedures imposed by the GTPUD Act, 1976 in entire of Gujarat state at places to promote anticipated urbanization. The act empowers authorities to take possession of land towards road construction at initial and draft stage with a total time for a scheme to get developed has a fixed horizon of 10 years. The proceedings (resulting from land price appreciation gained by the plot owners as well as leasing/selling of certain plots reserved for specific and public purpose) from the TPS is used for laying service and social infrastructure in the scheme itself by which the mechanism becomes self-sustaining. This mechanism is practised since more than 8 decades in Gujarat and roads (having 15% to 20% of scheme area) are planned at micro level while planning a TPS. However, corridors and major roads are planned in advance at the stage of preparation and sanctioning of Development plan covering larger connectivity aspects. In this situation, it becomes important to look into to intricate aspect traffic congestion resulted from TPS road planning without consideration of travelling movements. Further sections discuss on different locations under study for on road vehicle parking observed in absence of proper parking facility on TPS intersections.

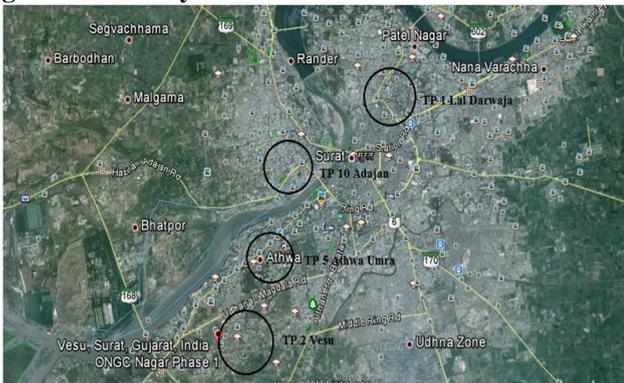
II. Study area profile and survey

Surat has emerged as one of the most dynamic cities of India recording the fastest population growth rate as a result of immigration from various parts of Gujarat and other states of India, majorly for economic reasons. According to the population distribution in Gujarat, Surat stands next to Ahmedabad. It is the biggest city in the region of south Gujarat and is the second-most advanced district in Gujarat as of 2011. Area of Surat district is 4418.05 Sq. Km. with area of

city as 326 Sq. km. Population of Surat district is 6.07 million and 2nd most populous district out of total 26 districts in Gujarat and it is 12th most populous district in India. The population density of Surat city is 1376 persons per Sq. Km.

Map below in **Figure 1** show the spread of Surat city and locations of TPS that were studied in present work. TPS namely Lal darwaja and Adajan are already developed, finalized and catering needs of citizens to its desired capacities whereas TPS of Vesu and Umra is under implementation. The idea of studying these schemes was to have realization on needs of dedicated public parking spaces at intersections apart from all routinely provided on-street as well as off-street facilities that may causes traffic congestion and contribute in road crashes to some extents.

Figure 1 Surat city and TPS locations



(Courtesy: Google earth images, Google Inc. 2012)

The Indian Roads Congress (IRC) formulated guidelines for parking vide Special Publication IRC SP: 12 of 1972: “Tentative Recommendations on the Provision of Parking Spaces for Urban Areas” gives broad idea about parking requirement for Metropolitan cities of India. A review of the same show that there is no analytical method for assessing the parking demand and formulating any need based standards. Also, such standards need frequent revisions with alteration in demands at places.

The parking space allocation in Surat is published and being practiced by Surat Urban Development Authority (SUDA) vide its General Development Control and Regulations (GDCR) document. The increasing automobile dependency and associated parking woes cannot be solved without a detailed understanding of the motorists’ behaviour, psychology, parking characteristics and other factors governing a particular mode choice. SUDA and SMC prepare TPS. Following **Table 1** show the details of TPS in Surat.

Table 1 Details of TPS

Town planning details	No. of schemes	Total scheme area (in Ha.)
Sanctioned final schemes	28	3089.54
Sanctioned preliminary schemes	27	2949.28
Sanctioned draft schemes	66	9404.80
Draft scheme submitted to govt. for sanction	7	1570.94
Proposed town planning schemes	3	734.00
Total	128	17748.56

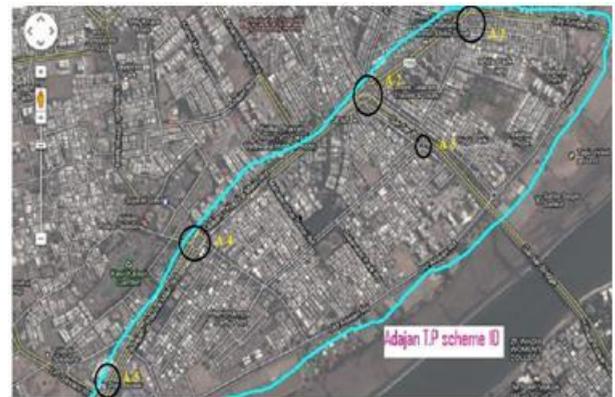
(Source: website of Surat Municipal Corporation, 2013)

Present study focussed on survey of different intersections in four TPS of Surat for parking of vehicles, traffic movement, carriage way width, land use pattern & fundamental need for parking requirement in the respective zone. Following is the details of intersections studied located in different TPS.

Intersections in T. P. 10: Adajan

- A1: Makkai bridge intersection
- A2: Gujarat gas circle intersection
- A3: Swami temple intersection
- A4: BAPS hospital intersection
- A5: Star bazaar intersection

Figure 2 Location of selected intersections in TPS-10



(Courtesy: Google earth images, Google Inc. 2012)

Intersections of T. P. 5: Athwa-Umra

- AU1: Chancellor building intersection
- AU2: SCET college admin intersection
- AU3: Jalaram dairy intersection
- AU4: Ritz square intersection
- AU5: Rangila park intersection
- AU6: Pizza hut intersection

Figure 3 Location of selected intersections in TPS-5

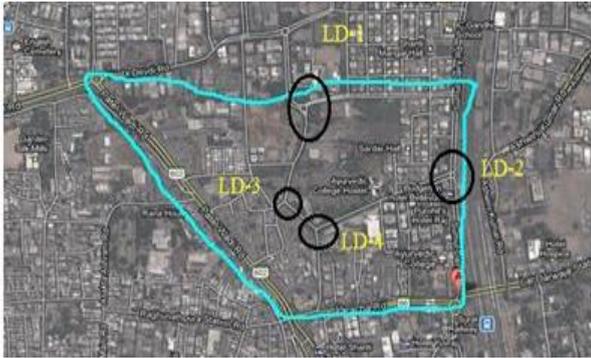


(Courtesy: Google earth images, Google Inc. 2012)

Intersections of T. P. 1: Lal darwaja

- LD 1: Venus jewel intersection
- LD 2: Parisar complex intersection
- LD 3: Patel wadi intersection
- LD 4: KARP intersection

Figure 4 Location of selected intersections in TPS-1

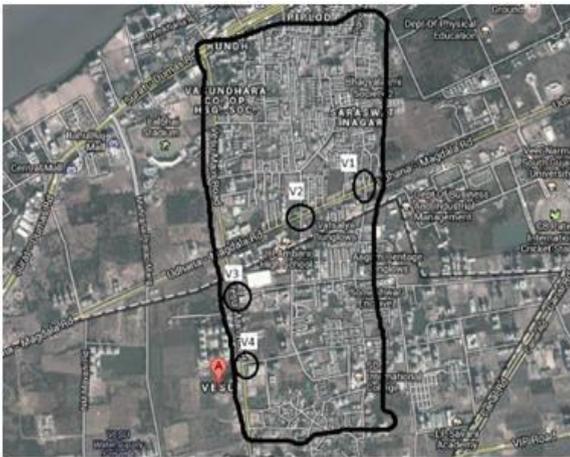


(Courtesy: Google earth images, Google Inc. 2012)

Intersections of T.P.2: Vesu

- V1: Piplod patiya intersection
- V2: J. H. ambani intersection
- V3: SBI bank intersection
- V4: Aagam arcade intersection

Figure 5 Location of selected intersections in TPS-2



(Courtesy: Google earth images, Google Inc. 2012)

Average occupancy of vehicles at different intersections was observed and recorded at intersections as listed earlier. Duration of survey was 9am to 10am in and 5pm to 6pm for nine days in constant. The survey included the counting of number of vehicles parked on-street at places where it was not designated parking space. The survey recorded different types of vehicles and categorised as 2wheelers, 3 wheelers, 4wheelers and others (i.e. hawkers, trucks and such). Based on recorded data, average for land occupancy was obtained for all these locations.

Table 2 Survey data for TPS-1

Intersection	Time	Vehicle Type			
		2W	3W	4W	Other
LD 1	9 -10 AM	3	1	2	1
	5-6 PM	5	2	6	1
LD 2	9 -10 AM	7	2	3	1
	5-6 PM	9	2	3	1
LD 3	9 -10 AM	3	1	2	3
	5-6 PM	4	2	2	3
LD 4	9 -10 AM	2	1	2	3
	5-6 PM	5	2	1	1

Above is a sample table of data recorded at different intersections of TPS-1 only for entire duration of observation

with category of vehicles. Values shown in the table is an average of entire of survey duration.

Following **Figure 6** show typical detail of a TPS (here shown is TPS-1) where plot boundaries can be seen along with road markings. The shaded portion is the area having influence on the intersection. This area was analysed for the land use so as to visualise the effect of land use and vehicle parking.

Figure 6 TPS Lal darwaja with area of intersection analysis



(Courtesy: Surat Municipal Corporation, 2013)

Based on the data obtained, standard requirement of area was applied and area requirement for parked vehicle was obtained. **Table 3** show the total area analysed for its land use around intersections and its percentile distribution for TPS-1 out of all four TPS under study.

Table 3 Land use at intersections of TPS-1

Inter-section	Total Area	% of total area					
		Road	R	C	I	M	O
LD 1	11524.22	19.58	25.95	30.09	24.81	0	0
LD 2	8286.75	46.26	0	0	26.06	13.39	14.51
LD 3	9877.64	56.02	10.26	22.93	0	0	10.68
LD 4	5403.20	53.59	0	33.39	0	0	13.33

Here land use types are shown as R=Residential, C=Commercial, I=Institutional, M=Mixed and O=Open.

Under this intersections the average area of valuable road space occupied by different categories of vehicles are obtained and shown in **Table 4** below. Based on the average number of vehicles observed as parked on road, typical vehicle area required was applied and total occupied area of road was obtained. The shown values are of intersections of TPS-1 in specific.

Table 4 Road area occupied by vehicle parking in TPS-1

Intersections	Road Area (Sq. Mt.)	% of 2W	% of 3W	% of 4W	% of Other W
LD 1	15871.15	0.05	0.15	0.30	0.18
LD 2	6588.01	0.88	0.36	1.96	0.22
LD 3	18815.91	0.09	0.13	0.13	0.15
LD 4	6775.56	0.48	0.35	1.04	0.42

III. Results and Tables

As a result of the survey for all the TPS intersections, an intervention was obtained that show variation in the land use percentage and road space occupancy by parked vehicles on road itself. **Table 5** show different land use range and

percentile area occupied on road arms with minimum as 0.10% at locations with institutional establishments and highest as 2.40% of commercial area in a range of 31% -40%. The table also show in general that wherever there is commercial land use on a road arm of an intersection, the road area occupancy is higher compared to other land use. This in particular suggest to propose parking space well in advance at the TPS planning stage only, if commercial land use is proposed near intersections irrespective of road width.

Table 5 Land use and road occupancy by parked vehicles

Percentile range of land use on intersection	Road area occupied by vehicles			
	C	I	O	M
0% - 10 %	1.20%	0.10%	0	0
11% - 20 %	0.50%	0.31%	0.32%	0.32%
21% - 30 %	1.00%	0.80%	0.57%	0.57%
31% - 40 %	2.46%	1.97%	0	0

Where, C= Commercial, I= Institutional, M= Mixed, O= Open

Another interesting intervention led from the road width and parked vehicles point of view. Here in **Table 6**, is can be seen that parking space demand varies with the variation in the road width. It shows that wider the road, more of road space is occupied by parked vehicles drawing a conclusion that there shall be parking space provision at all the wider road arms around intersections so as to release congestion of traffic. The percentile values shown in the table are that of the road area for the intersection under study.

Table 6 Road width and parking area

Major arm width (Mt.)	Minor arm width (Mt.)	Road Area % under parking
60	60	4.10
60	45	3.10
60	36	2.60
60	24	1.30
45	45	5.10
45	36	4.60
45	24	3.60
45	18	3.00
24	24	3.40
24	18	3.10
24	15	3.00
24	12	2.90
18	12	4.20
12	12	3.40
12	9	2.50
12	7.5	2.10

IV. Conclusion

- In general, road space consumed by parked vehicles varies from 0.1% to 2.46% in surveyed intersections having different land use of T. P. Schemes of Surat. However, for land use having 30%-40% commercial and residential each, the observed parking on road space was 2.46% and 2.60% respectively.
- For the combination of road arm widths (6mt to 60mt), road space used for parking was ranging in 1.30% to 5.10% of total area of intersection.
- Standing and parked vehicles obstruct the flow of traffic consuming valuable road space.
- Present practice of designing of intersections using IRC as well as The GTPUD Act, 1976 provide no guideline for parking land allocation at such locations.

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