

Parking Management Blueprints for Rajkot - Solution to Urban Transport Problems

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Abstract — Rajkot is a developing city of Gujarat since last few years. The image of the Rajkot city is constantly changing day by day. Especially in areas such as Metoda, Soni bazaar, Gujri beggar and Yagnik road are highly developed areas for different business markets and Commercial Centers. Major transformations in these areas occur day by day because of Resettlement of shopping centers, commercial centers etc. In the center zone nearby Soni Bazar, Gujri Bazar, and Yagnik Road While Industrial areas are shifting towards Metoda. Thus the major displacement pattern affecting an internal area of the city, resulting in surplus traffic volume and issues of parking space due to unorganized growth of concentric development. The growth of the city also results in a crowded automobile culture, therefore up-gradation of transport facilities over the peripheral area of the city become essential. In India, developing cities has a reinforced and a well organized image to compare to the last few years. Rajkot city has well organized image in case of transport facilities, socioeconomic and cultural infrastructure while lacks of parking facilities and unorganized parked vehicles provide a distorted impression on this well organized developed city. Lack of enforcement of bylaws also results in undermining of development. The growth of population in Rajkot is frightening. Inaccurate predictions of vehicle in parking space, lack of road space and poor infrastructure for transport facilities make the condition more and more worse. The public transport system is very weak and these forces the commuter to personalized modes of transport. Economic activity is congregating and intensifying in Rajkot, as a result of which a large number of passenger and goods transport trips originated and end within the city. To sustain the urban activity of Rajkot, there should be adequate parking facilities and appropriate management.

Index Terms- central business district; management; modes of transport; parking; road space.

1. INTRODUCTION

In India, Rajkot is one of the city populated more than 10 lacs. It is observed to be growing at a rate of 20% per decade. The city has potential tourist spot. The major portion of economic activity of the city is located in the oldest area of the town, namely: Metoda, Soni Bazar, Gujari Bajar, Yagnik Road. Economic activity in the form of wholesale trade, commerce, household industries, administration and tourist spots generate heavy traffic to and from these areas. The limited road space of the town is congested with vehicular and pedestrian traffic. The shopkeeper and vendors also occupy the sidewalks and carriageway. Consequently traffic in these areas faces acute congestion, bottlenecks and road hazards.

Parking demand in Rajkot city, especially the old commercial area meets by roadside parking along all the major roads and there are no off-street parking facilities ever increasing parking demands. The vehicles are parked in multi rows, parallel, on the carriageway while there is a heavy demand of traffic. Further, the limited enforcement, regulatory measures and absent of civic sense habit of commuters fail to control and manage the parking

problem. We restrict the scope of study to major CBD's like: Metoda, Sonibajar, Gujari Bajar, Yagnik Road.

This research paper explores some of the objectives such as follows:

- Evaluation of parking demand and attribution
- Parking demand projection
- Augmentation of existing parking space
- Enhancement of parking management scheme and approach.

2. STUDY AREA

Rajkot is the fourth largest city in the state of Gujarat, India, after Ahmedabad, Surat, and Vadodara. Rajkot is the 35th-largest urban agglomeration in India, with a population more than 1.28 million as of 2012. Rajkot is the Ninth cleanest city of India. Rajkot is also the 22nd-fastest-growing city in the world. The city contains the administrative headquarters of the Rajkot District, 245 km from the state capital Gandhinagar, and is located on the banks of the Aji and Nyari Rivers. Rajkot was the capital of

the Saurashtra State from 15 April 1948 to 31 October 1956, before its merger with Bombay State on 1 November 1956. Rajkot was incorporated into Gujarat State from 1 May 1960. Rajkot is located at 22.3°N 70.78°E. It has an average elevation of 128 meters (420 ft). The city is spread in the area of 170.00 km². Rajkot is situated in the region called Saurashtra in the Gujarat state of India. The significance of Rajkot location is owing to the fact that it is one of the prime industrial centers of Gujarat. As of the 2011 India census, Rajkot recorded population of 1,286,134. Rajkot has many historical landmarks and places to visit. The Jubilee Garden is a large, open park in the center of the city featuring many monuments from colonial times. Located prominently in the center of the garden is the Connaught Hall. Other notable points of interest near the garden include the historic Mohandas Gandhi High School, Kaba Gandhi No Delo (Mohandas Gandhi's childhood residence), Rashtriya Shala, Watson Museum, Rotary Dolls Museum, Lang Library, Rotary Midtown Library and Saurashtra Cricket Association Stadium. These all places are nearby soni bazar, gujaribazar, yagnik road. Thus these locations are prime for the traffic and parking spaces. Further the main market of the city lies on these location. So these four location are studies for parking evaluation

3. METHODOLOGY

For the evaluation of parking demand, parking supply and parking space of the related study area data were collected by conducting parking duration and accumulation survey, inventory of regulatory measures, inventory of parking spaces and user opinion survey.

A) Parking survey

As in this survey are executed assessing parking demands, parking characteristics, parking accumulation and duration within the study area.

volume

In the road section, there is other traffic flow also carried out

B) User survey.

The two wheelers and four wheeler were interviewed and inspected to gather data of social, economic activity, duration of parking, trip origination, time needed to reach the final destination and problems faced during the trip also surveyed.

C) Inventory of Regulation and Control

With the help of field inspection the enforcement measures were studied. These measures were studied, modified as per field condition

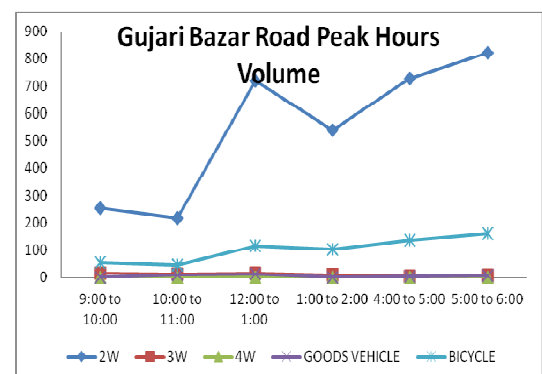
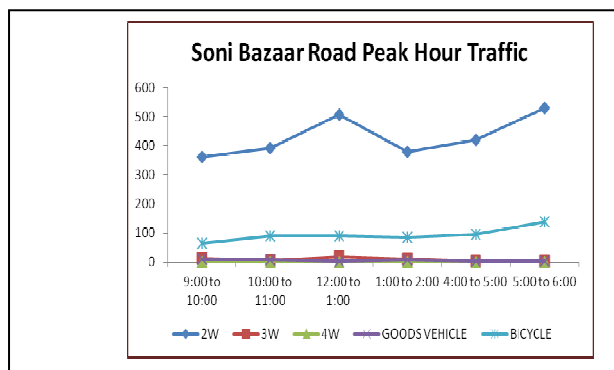
D) Inventory of off-street parking.

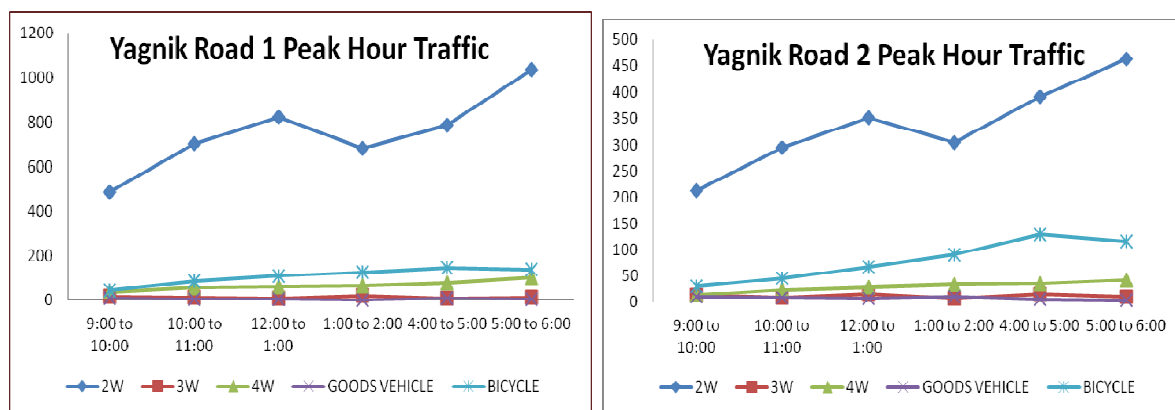
Off-street parking facilities of the study area were carried out along with evaluation of available spaces and their effectiveness as parking.

E) Traffic attributes

The nature of traffic, problems of traffic and parking characteristics was investigated through collected data and various aspects of these are discussed here.

F) Traffic in study area. The peak hours traffic flow and composition is presented as shown in figures.





It is observed that traffic volume of different vehicles varies from 3000 to 4000 per hour. Maximum traffic flow observed on yagnik road 1 at Jagnath Street. The motorized vehicles mostly observed in at Yagnik road 1 and 2 while Non Motorized Vehicles observed at Soni Bazaar and Gujri Bazaar.

The peak parking demand of vehicles on selected road sections is presented in Table 1 vehicles parked in the study area comprised of 2W, 3W, 4W and Goods Vehicle. From all of these two wheelers are dominant in soni bazaar and gujri bazaar Road hilt 4W i.e. Car, Truck and Buses are dominant in Yagnik Road 1 & Yagnik Road 2.

G) Parking Accumulation.

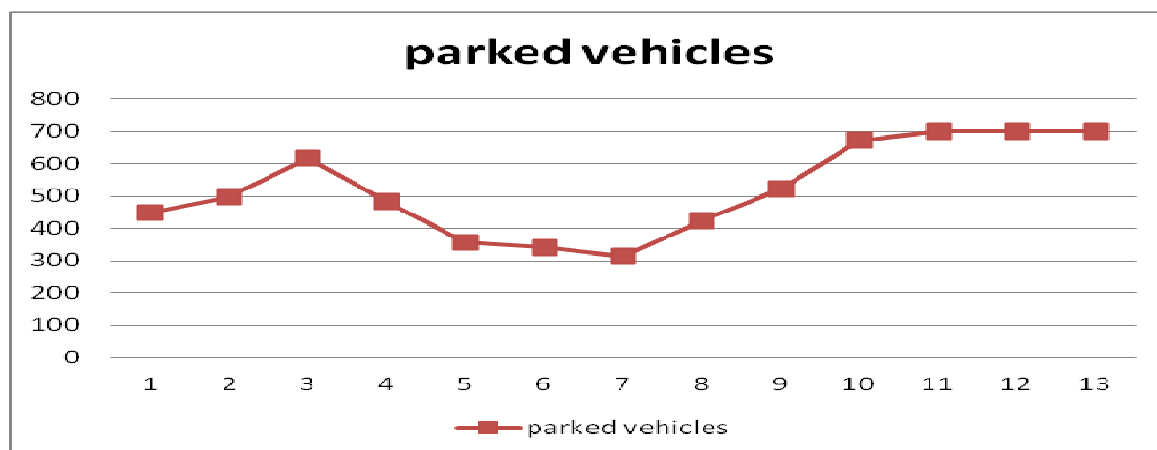


Figure 1 Parking Demand on Roads

Table 1: Types of Vehicles, Number of Vehicles and ECS						
ROAD	2W	3W	CAR	GOODS VEHICLE	BICYCLE	TOTAL
SONI BAZAR	2587 (647)	53 (43)	0 (0)	37 (74)	563 (141)	3240 (905)
GUJRI BAZAR	3280 (820)	66 (53)	4 (4)	38 (76)	612 (153)	4000 (1106)
YAGNIK ROAD 1	4521 (1131)	78 (63)	401 (401)	31 (62)	643 (161)	5674 (1818)
YAGNIK ROAD 2	2016 (504)	71 (57)	175 (175)	47 (94)	479 (120)	2788 (950)
					Total	4779

The equivalent car space index of vehicles as per car space conversion standards are listed out as shown in Table 3.

Sr. No.	Type of Vehicle (per vehicle)	ECS
1	1 Car	1
2	1 Two-Wheeler	0.25
3	1 Auto	0.8
4	1 Bicycle	0.25
5	1 Animal Driven/Carts	1.2
6	1 Truck	2

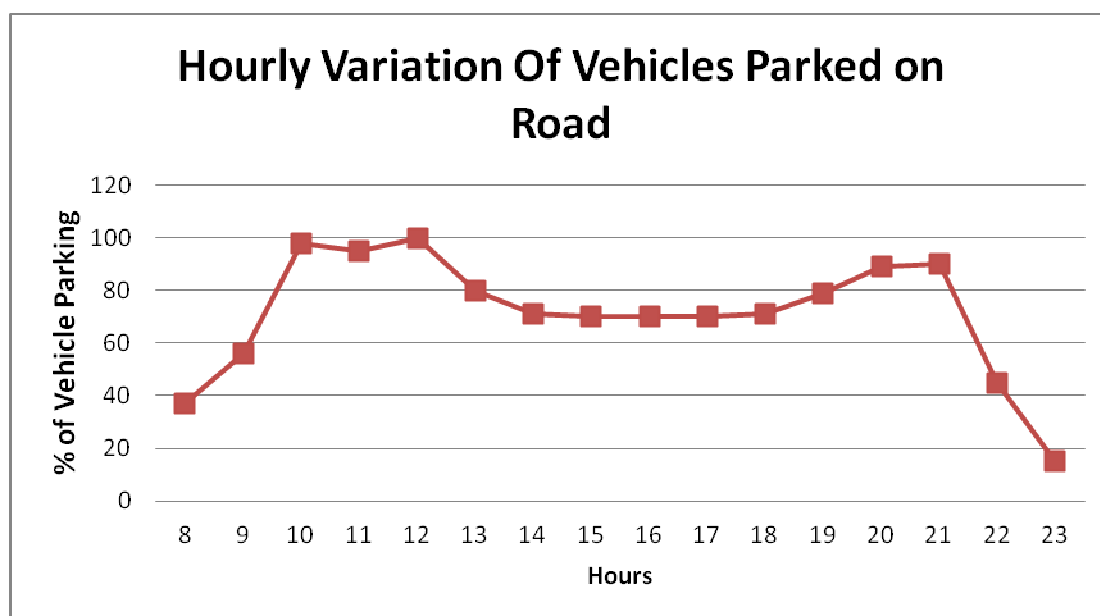


Figure 2 the hourly variations in terms of the vehicle parked on different road.

From the fig it has been seen that maximum vehicle parking at 12.00 h and than flow of parking flow reduced to approximate 50 % during 12 P.M. to 7 P.M. and again rise during 7 to 9 P.M.

The other survey is carried out for % of vehicle parked shows that 70% of vehicles are parked for 0.5 hour duration while 90

Observation of parking of the cars and two wheelers in the study area has been analyzed and cumulative percentages of cars and two wheeler parked for different time duration are presented in fig 2.

It can be seen that 90% of vehicles are parked for five hours and during peak flow hours, 75% other two wheeler were parked for less than half an hour. The parking duration of two wheelers and four wheelers are same because the share of two-wheeler commuters are mostly customers and four wheelers are mostly shop keepers.

H) Trip origin

From interviewing number of riders and travelers it has been seen that the area origin of trips

from all parts of the city. Trips are also attracted from far of place like Metoda, Raiya Circle, and Kothariya also. Thus the places are continues to be the main center for wholesale and retail trade of the Rajkot city.

I) Existing parking supply

As per the matrix of the parking space, a survey has been conducted to calculate the available parking in terms of ECS in the study area the total accommodation of vehicles is 4779 ECS. The area wise details of the ECS are presented in the table.

SR.No.	Road Space	Curb Side Parking	On Road Parking	Off-Street Parking Lots	No Parking Zone
1	Soni Bazar Road	√	√	√	√
2	Guzri Market	√	√	√	√
3	Yagnik Road 1	√	√	√	×
4	Yagnik Road 2	√	√	√	×

Sr. No.	Road Space	
1	Soni Bazar Road	150
2	Guzri Market	150
3	Yagnik Road 1	642
4	Yagnik Road 2	524

J) Projection of parking demand (mathematical model generation)

The growth in parking demand is directly related to growth in activities located in the study area coupled with an increasing ‘vehicle ownership’ (V₀) in the city, besides ‘economic status’ (I_n) of the people visiting the area, and the growth levels in ‘trade and commerce’ (T_c), which is the main activity in the study area considered for parking demand projection.

$$PD \geq Gr_1V_0 + Gr_2T_c + Gr_3I_n + \dots + Gr_m(X)$$

$$PD \geq \sum_{i=1}^m Gr_i(X)$$

(1)

Where,

m = finite demand

x = contributing factor

V₀ = vehicle ownership

T_c = trade and commerce

I_n = economic status (per capita income),, etc. (other factor)

PD = parking demand

Gr = growth rate

As per equation (1) parking demand (PD) is always more than the sum of all factors, and responsible for the increase/contribution to the growth of parking because of the following reason:

- Inadequate infrastructure development
- Large time gap between the assessment of parking status/number of vehicles and supply of parking lots.
- Vibrant socio-cultural aspects (i.e. festive seasons) contribute to an increase in parking demand in any Indian city with well-designed parking.

Location	Parking Demand for the Year(Nos./ECS)			
	Mode	2014(observed)	2019	2024
Soni Bazar Road	Car	0 (0)	0 (0)	0 (0)
	Two-wheeler	2587 (647)	3622 (906)	5071 (1267)
Guzri Market	Car	4 (4)	5.6 (5.6)	8 (8)
	Two-wheeler	3280 (820)	4592 (1148)	6429 (1608)
Yagnik Road 1	Car	401 (401)	562 (562)	786 (786)
	Two-wheeler	4521 (1131)	6329.4 (1583)	8862 (2216)

Yagnik Road 2	Car	175 (175)	245 (245)	343 (343)
	Two-wheeler	2016 (504)	2822.4 (705.6)	3951.36 (987.84)

K) Capacity augmentation

There is a lack of open space nearby the study area are identified for developing on-street parking facilities. There is scope of parking at multistory level and under ground level. Surface parking and off-street parking are available at small patches of open land, but now there is no more open land to provide surface on-street parking. After taking into account the space for exit, entry and circulation surface, off-street parking can accommodate spaces for 1500 ECS .

The projected parking demand for 2024 AD, is 7215 ECS (for cars and two wheelers only) of the the present demand of 3682 ECS is available for two wheeler and cars through management strategy and pricing for parking space.

The remaining demand of 3533 ECS is double than that the additional space created through surface off-street parking space which is nearly 1500 ECS

4. CONCLUSION

It has been observed that most vehicles are parked for very short durations during the peak hours because of trading areas. The area is also linked different important destinations of trading and commercial centers so traffic flow is obstructed because of existing on street parking facilities. Results in delay and waste of time occur for long trips. To prevent these delays and to best utilize space available in the area multistory parking or Roof parking are the solutions. The parking demand of the study area is 3681 ECS at present and available parking space for 1500 ECS so a deficiency in parking 2181 ECS at present. It is evident that the smooth running flow of traffic a well organized parking facilities are necessary to establish.

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