



APPLICATION OF QGIS FOR PARKING STUDY IN TIRUPATI

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Abstract- Tirupati-Tirumala is a most prominent pilgrimage all over the world. Many temples, educational institutions, hospitals, hotels and government established are situated in this temple town apart from the large component of floating population. It is observed that the two wheelers, auto rikshaws and four wheelers are increasing year by year compelling more and more space for parking. The original road patterns in the town are unable to cater the ever increasing parking demand. Also increased and irregular parking of vehicles are resulting in reduction of road capacity and there by traffic jams and delays. The local administration however taking measures such as implementing single side parking on alternate week day basic at crowded areas, implementing one way traffic restrictions etc. to mitigate with parking induced delays and problems. However these measures are not adequate to address the ever increasing parking problem. The municipality should grant permissions only to those multi-storey structures such as apartments and shopping complexes which show adequate cellar or valet parking. In order to avoid non serious road users the municipality may collect parking charges. But before taking any such initiative the municipality should have a credible data on parking. The current work concentrates on parking studies for a small crowd portion in Central Tirupati. QGIS, open source GIS software is used for this purpose.

Key words: Parking, Parking Studies, QGIS, Parking Adequacy.

I. INTRODUCTION

Tirupati & Tirumala is world renowned Hindu pilgrimage having number of temples, educational institutions, hospitals and other establishments belonging to State Government, Central Government and Tirumala Tirupati Devasthanams (TTD). According to 2011 census Tirupati Municipal Corporation is the ninth most populous city in Andhra Pradesh with a population of 3, 74,260. For the year 2012 – 2013, Ministry of Tourism, Government of India named Tirupati as the Best Heritage City and Tirupati has selected as one of the Smart City under Smart Cities Mission by the National Government.

Based on the records of Tirupati Regional Transport Office, the total number of registered vehicles is 2, 43,680 as on January 2014. As the number of registered vehicles is increasing year by year there is a shortage of available parking space. Also as the parked vehicles encroach on the roads the traffic capacities are going the decrease which leads traffic congestions, accidents and delays.

The current study concentrates on some part of central Tirupati and uses QGIS tool for parking studies.

II. LITERATURE REVIEW

T. Subramani has conducted parking studies for Salem town in Tamil Nadu. He adopted In-out Survey, Fixed Period Sampling and License Plate Method of Survey for his studies. Based on the studies he recommended paid parking as well as off street parking for Salem town.

Priyanka Kolhar conducted parking studies for Dharwad city, Karnataka. She has divided total city parking area into 20 lots. She has mainly conducted Parking Space studies in her work.

McKenna Associates have conducted parking studies for City of Berea, Ohio. The defined study area included 13 blocks within downtown Berea. They conducted turnover and occupancy license plate field surveys because they provided factual evidence of parking supply and demand.

Fei Li and Zhan Guo studied the effects of parking reforms in London. It was found that there is a reduction of approximately 0.76 parking spaces per unit in residential development applications, or 49% of the pre-reform level. Orth-Rodgers & Associates, Inc. in the year 2002 have conducted parking studies for Wilmington city. The strategies adopted are Typical Weekday Analysis, Friday Evening Analysis and Saturday Mid-day Analysis.

Nelson\Nygaard Consulting Associates Inc. has conducted parking supply and demand studies and analysis for City of Portsmouth.

Todd Litman have discussed more than two-dowzen strategies for more efficient use of parking resources.

Er. Sandeep Singh, Dr. Umesh Sharma made a comprehensive study of parking problem in Sector – 17 also known as heart of Chandigarh in which various parameters have been worked out to identify the problem. These parameters have been correlated to work out a long lasting solution based on the advanced parking management system techniques.

Roanoke Valley – Alleghany Regional Commission have conducted comprehensive On-Street Inventory and Off-Street Inventory in Downtown Roanoke and have come up with many suggestion such provision of separate bicycle parking, restriction times and parking prices etc.

Garala Thejesh Kumar in his paper discussed the strategies to be adopted for meeting the parking demands for Tirupati city, have emphasised on multilevel parking systems and gave other useful suggestions in the light of Government's decision declare Tirupati as smart city.

IV. ANALYSIS AND RESULTS METHODOLOGY

The study is conducted based on the following lines:

- Data collection - The required data collected are follows:
 - Road data – road lengths & widths
 - Parking data – 8:00 am to 8:00 pm parked vehicle data for a period of one month
- GIS Data Preparation – Following are layers developed using QGIS
 - Layer showing main roads and lateral roads
 - Layer showing roads or streets with their code
 - Layer showing land mark or important buildings
 - Layer showing available parking space for on road parking
- Data Analysis
 - Graphs were drawn for average parking and peak hour parking requirement were arrived
- Interpretation
 - Available parking is compared with existing parking and parking adequacies were arrived

Selection of Study Area

To conduct the traffic study a closed circuit of main roads in the central Tirupati were considered as study area and shown in the Fig.1. These roads include Gandhi Road, T.K. Street, V.V Mahal Road and Tilak Road. Fig.2 shows the streets with their codes, which was developed in QGIS software.



Fig.1. Map Showing Parking Study Area

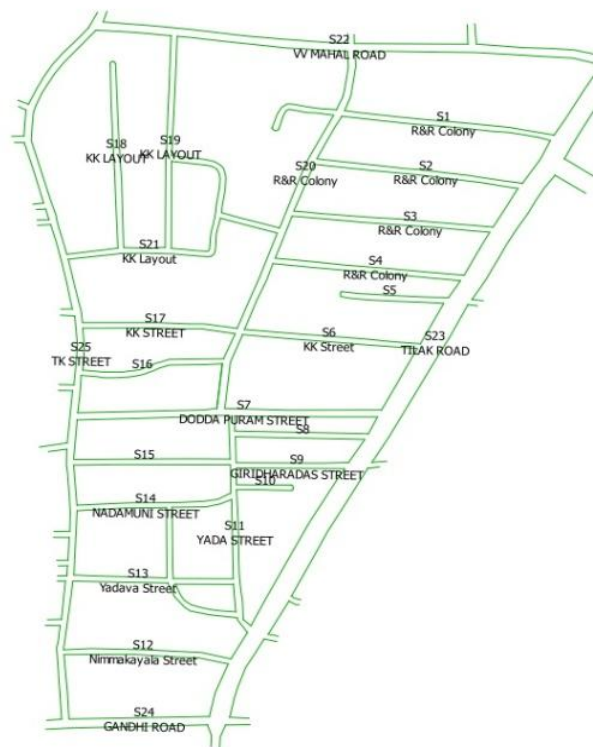


Fig.2. Map Showing Roads With Their Codes

Collection of Road Data

The length and width of main roads, each and every lateral that comes within the boundaries of mains roads were measured with chain and tape accurately and these Streets & Street Codes are shown in the Table.1. Later these details were digitized and various road maps were developed using QGIS. Various layers are developed in QGIS for better interpretation purpose.

Table 1: Streets & Street Codes

STREET IDENTITY	STREET NAME	ROADLENGTH (m)	ROADWIDTH (m)
S1	R&R COLONY	190	7.5
S2	R&R COLONY	190	6
S3	R&R COLONY	180	6
S4	R&R COLONY	170	7
S6 & S17	KK STREET	300	6
S8	DODDA PURAM STREET	260	6.5
S9	GIRIDHARADAS STREET	95	3
S11	YADA STREET	205	3.5
S12	NIMAKAYALA STREET	150	4.8
S13	YADAVA STREET	140	5.4
S14	NADAMUNI STREET	140	4.5
S18	KK LAYOUT	180	6.4
S19	KK LAYOUT	210	4.5
S20	R&R Colony	365	7.5
S21	KK Layout	130	6.5
S22	VV MAHAL ROAD	450	11
S23	TILAK ROAD	700	15
S24	GANDHI ROAD	150	10
S25	TK STREET	700	4.5

Collection of Parking Data

The parking data for each street on each side is collected from 8:00 AM to 8:00 PM for a period of one month. The collected data includes two wheelers, three wheelers and four wheelers. Table 2 shows the parking typical data sheet for street S1. The hourly variation of Parking is shown in the Fig.3. for street S1.

Table 2: Typical Parking Data Sheet for street S1
SURVEY DATA OF STREET S1

PARKING SURVEY ON STREET: DURATION DATE 28-Mar-14							PATROL STREET CODE STREET NAME		1 S1 R&R COLONY		
	LEFT SIDE			RIGHT SIDE			TOTAL VEHICLES			TOTAL PCU	
TIME	TWO WHEELER	THREE WHEELER	FOUR WHEELER	TWO WHEELER	THREE WHEELER	FOUR WHEELER	TWO WHEELER	THREE WHEELER	FOUR WHEELER	LEFT	RIGHT
8:00 AM	28	2	3	48	1	2	76	3	5	20	28
9:00 AM	29	2	3	54	1	2	83	3	5	21	31
10:00 AM	38	3	7	43	1	2	81	4	9	31	25
11:00 AM	27	3	9	50	1	1	77	4	10	27	28
12:00 PM	30	2	5	38	2	3	68	4	8	23	25
1:00 PM	29	4	8	45	3	6	74	7	14	29	33
2:00 PM	44	3	1	38	4	5	82	7	6	28	30
3:00 PM	24	1	2	26	2	1	50	3	3	16	17
4:00 PM	25	2	3	29	2	1	54	4	4	19	19
5:00 PM	46	4	6	47	4	8	93	8	14	35	38
6:00 PM	51	6	5	49	3	5	100	9	10	40	34
7:00 PM	48	3	5	44	3	2	92	6	7	34	29
8:00 PM	39	5	2	33	0	4	72	5	6	29	21
TOTAL	458	40	59	544	27	42	1002	67	101	352	358
MAX	51	6	9	54	4	8	100	9	14	40	38
AVG	35	3	5	42	2	3	77	5	8	27	28

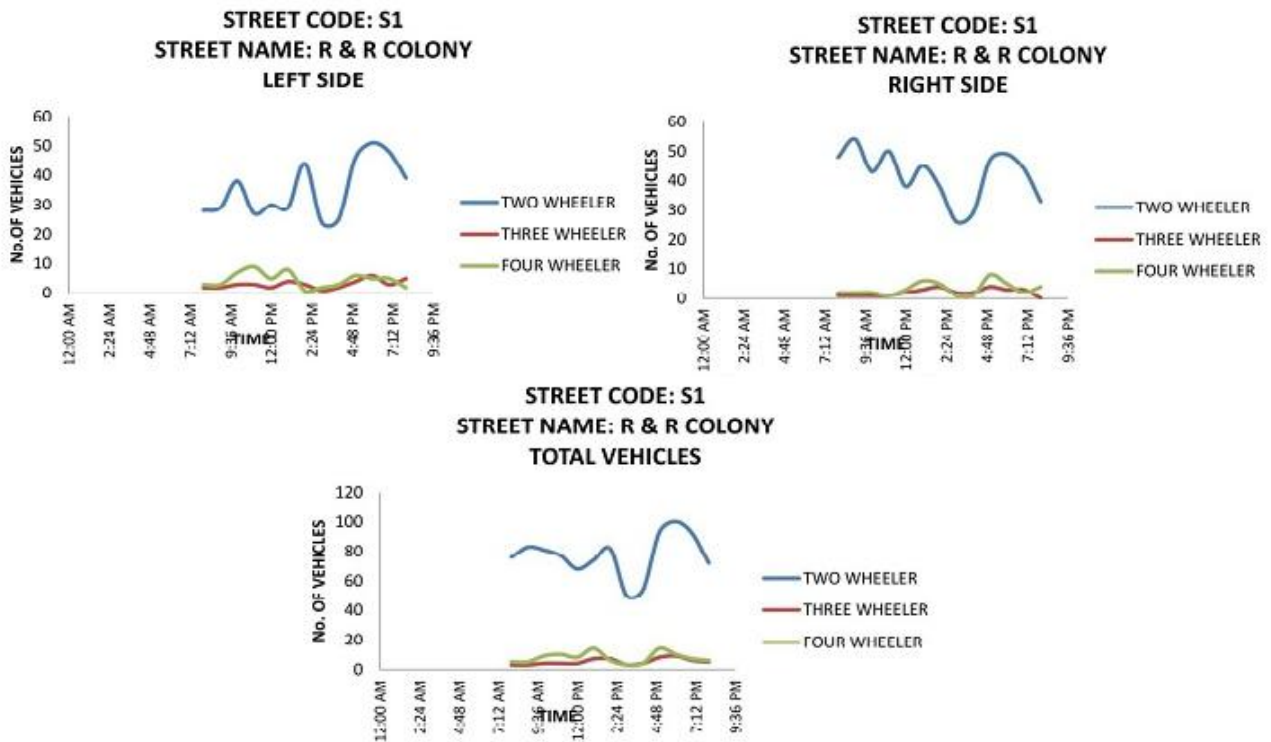


Fig.3. Graphs Showing Hourly Parking

Presentation of Parking Data

Another layer showing important building was prepared as shown in the Fig.4. The existing parking places are earmarked as a separate layer in the GIS map as shown in Fig.5.

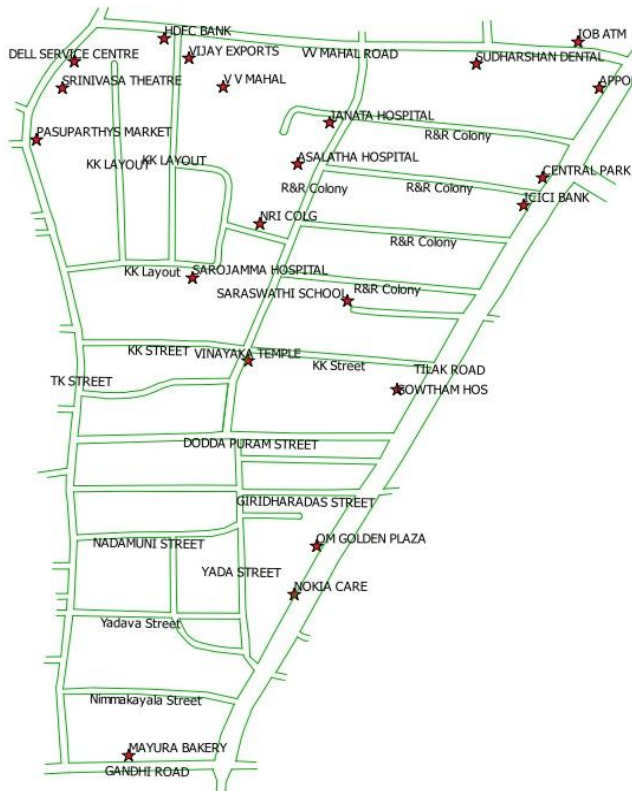


Fig.4. Showing Roads & Land Mark Building

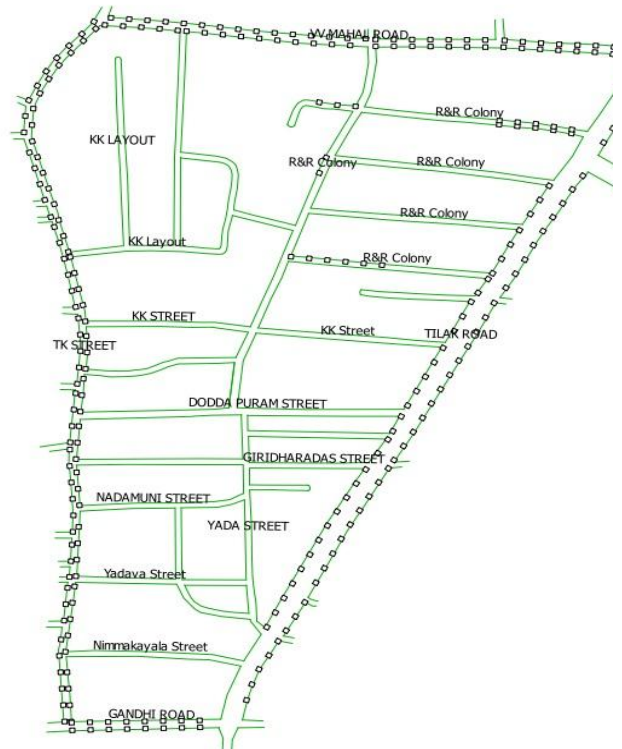


Fig.5. Showing Existing Parking Capacity

Parking Data Analysis

Having conducted hourly parking studies for all the 25 streets over a period of one month, the parking adequacy is arrived for peak hours. These results were summarized and are shown in the Table 3.

Table 3 Summary of Parking Adequacy Calculations

STREET CODE	STREET NAME	ROAD LENGTH	EFFECTIVE LENGTH(ASSUMED)	ROAD WIDTH	ACTUAL PCU's		MAXIMUM PCU's				AVERAGE PCU's		REMARKS
					LEFT	RIGHT	OCC TIME	LEFT	OCC TIME	RIGHT	LEFT	RIGHT	
S1	R&R COLONY	190	180	7.5	60	60	6:00 PM	40	9:00 AM	38	27	28	Parking is Adequate
S2	R&R COLONY	190	180	6	60	60	10:00 AM	43	7:00 PM	58	28	27	Parking is Adequate
S3	R&R COLONY	180	170	6	57	57	4:00 PM	23	10:00 AM	20	13	14	Parking is Adequate
S4	R&R COLONY	170	160	7	53	53	9:00 AM	20	10:00 AM	18	13	13	Parking is Adequate
S5		90	80	2.5									Can't provide parking
S6 & S17	KK STREET	300	290	6	97	97	7:00 PM	31	7:00 PM	32	17	18	Parking is Adequate
S7	DODDAPURAM STREET	260	250	6.5	83	83	4:00 PM	15	4:00 PM	14	9	7	Parking is Adequate
S8		110	100	3	33	33	9:00 AM	4	8:00 AM	9	3	5	Can't provide parking
S9	GIRIDHARADAS STREET	95	85	3	28	28	8:00 AM	5	10:00 AM	8	2	6	Can't provide parking
S10		45	35	2.5									Can't provide parking
S11	YADA STREET	205	195	3.5	65	65	11:00 AM	14	11:00 AM	15	6	8	One side parking is Adequate
S12	NIMMAKAYALA STREET	150	140	4.8	47	47	5:00 PM	24	3:00 PM	23	9	13	One side parking is Adequate
S13	YADAVA STREET	140	130	5.4	43	43	9:00 AM	13	4:00 PM	17	11	13	One side parking is Adequate
S14	NADAMUNI STREET	140	130	4.5	43	43	8:00 AM	7	8:00 AM	10	5	8	One side parking is Adequate
S15		150	140	1.5									Can't provide parking
S16		130	120	1.5									Can't provide parking
S18	KK LAYOUT	180	170	6.4	57	57	3:00 PM	15	6:00 PM	18	12	15	Parking is Adequate
S19	KK LAYOUT	210	200	4.5	67	67	10:00 AM	17	8:00 AM	16	12	10	One side parking is Adequate
S20	R&R COLONY	365	355	7.5	118	118	5:00 PM	46	10:00 AM	45	30	20	Parking is Adequate
S21	KK LAYOUT	130	120	6.5	40	40	3:00 PM	9	10:00 AM	17	7	13	Parking is Adequate
S22	VV MAHAL ROAD	450	440	11	147	147	10:00 AM	104	7:00 PM	34	36	24	Parking is Adequate
S23	TILAK ROAD	700	690	15	230	230	8:00 PM	182	8:00 PM	137	95	97	Parking is Adequate
S24	GANDHI ROAD	140	130	10	43	43	5:00 PM	14	11:00 AM	44	5	28	Parking is Adequate
S25	TK STREET	700	690	4.5	230	230	1:00 PM	77	10:00 AM	58	50	30	One side parking is Adequate

V. CONCLUSIONS

For the parking study conducted following conclusions can be drawn:

- On street parking can be provided for 11 streets
- For 6 streets one side parking is quite adequate
- For 5 streets it is rather impossible to provide the adequate parking even when the option of both side parking is excised

SCOPE FOR FUTURE WORK

The current study is a kind of pilot project which focuses only 25 streets. Also the parking data is limited to only one month. The same studies may be extended for all the streets that come under 50 municipal wards over a period of one year. This data will really help the decision markers to provide complete & viable solutions for parking problem in Tirupati.

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