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STUDY OF PARKING SPACE IN SURAT RAILWAY STATION ROAD AND RESOLVING THE DEMANDED GAP

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Abstract: - The huge numbers of personalized vehicles require a storage system at the end of traveling hours, which is called parking. Parking space are required by residential, employees, customers and visitors and the movement of traffic. The Surat railway station is main line of Ahmedabad – Vadodara – Mumbai rail route and Surat railway station road is also main line of the Surat city. In Surat railway station two parking are allotted by railway and two parking allotted by SMC In the Project, the domain as a Surat Railway Station Road is selected which is stretching to the Varachha Region. Initially, the project studies the availability of the parking space provided by the SMC, later the study stretches to determine the gap of parking area needed for efficient parking and traffic movements. The probable outcomes may bring recommendation for better parking management in studied area. We have calculated the data forecasting for 2W and 4W up to 2040 and this forecasting bases Surat railways station parking capacity and parking demand for next 22 years will be calculated. In the Surat city total 9 multi-level parking facilities are available. Pay and parked facilities are 27. The Surat city's 4W population is 4 lakhs and 2W population is 23.5 lakhs up to 2018. We will give possible solution for recommendations parking area for next few years.

Key words: - Vehicle growth; Parking demand;

1. INTRODUCTION

1.1 General:

The parking is very important requirement of vehicles and public facilities also. Each medium of transportation involves three necessary elements, without which it cannot operate effectively: the vehicle, the right-of-way, and the terminal.

We discuss about the Surat railway station road parking problem because the Surat city is one of the India's most growing city. The city had a population of approximately 6.288 million at the 2017 data records, making it the second biggest city in the Gujarat state. The Surat city popular for Diamond polishing and textile business. The Surat city's railway station is center line of the city. We used the Surat railway station road go to Ring road, chowk bazaar, Varachha road and other places easily.

1.2 Objective of Study:

- To calculate the available parking area on Surat railway station and that parking demand for next few years.
- To estimate the parking facilities and charges of pay and park parking and facilities.
- The proper data collection of vehicles parking on railway station and requirement of parking space.

1.3 Scope of Study:

- We have only analyzed Surat railway station parking area.
- We have collected population data of 2W and 4W Surat city.
- We have collected data up to 2018 data and calculated data up to 2040.

1.4 Literature Review:

Mahak Dawra, Sahil Kulshreshtha (1) In the case of India, we focus on distributing the parking space and providing good parking facilities. We concern to the how-to increasing parking space and parking facilities. If the proper distribution and proper implementation on parking space and parking facilities so, we solved this parking problems.

Nikhil G. Yerojwar, Dinesh V. Rojatkar (2) The automatic vehicles parking system in India: New Delhi municipal council using the automated vehicle parking system. This project has been implemented by DLF. The 8 storey building his 6 story are using for parking and 2 storey the parking capacity around 1400 vehicles. This project also implements MCD (Municipal Corporation of Delhi), Navi Mumbai Corporation and HUDA (Hyderabad Urban Development Authority).

Wang Yan-ling, Wang Xin, Zhang Ming-chun (3) The layout of parking modes and parking lots based on direct and indirect economic benefits, sustainability, environmental effect and social benefits. According to this research several effective solutions on the basis of analyzing current parking situation in Beijing, increase the parking space and include control the parking demand. In this way, traffic situation of Beijing city, the urban image and living quality of public is improved effectually.

Pinky Rome, Sayantani Mukherjee (4) The manage parking well its first step is managing the on-street and off-street parking system so reduce traffic problem. How much parking lots required: Kolkata city have adopted parking for different land uses? Effective price for parking and parking revenue for public good. They use valet parking and automated parking machine for reduced parking problems. Kolkata city is a mega city so, car parking problems increasing day by day. In this city proper car parking system is urgently required. According to this literature paper parking facility are improving for all category's vehicles.

Graham Cookson & Bob Pishue (5) The impact of parking provision upon the urban environment and streetscape has barely been considered in the papers and report reviewed. While some studies investigate the impact of parking controls on traffic, this is usually only indirectly concerned with congestion and carbon emissions; traffic levels can be viewed as a surrogate for these variables.

2. METHODOLOGY

- **Need of study: -** The parking problem is worldwide. Day by day population is increase and day by day vehicle is increase. Parking problems is not small problem. Surat city is one of the Gujarat's most growing city. Surat railway station road is main line of the Surat city and Surat city's traffic problem is huge we known that. So that, they are parked their vehicles in station parking area. Therefore, provision of adequate parking facility is essential.
- **Scope of study: -** We study the railway station parking area; railway station's different parking lots charges and which type of parking facility provide in Surat railway station.
- **Literature review: -** We study different types of literature papers related to parking. After the study literature papers, we decide methodology for using in our project.
- **Data collection: -** After the literature papers study data collection in three phases: first Regular day data collection, second - Weekend day data collection and third - Public holiday data collection.
- **Parking Surveys: -** In the parking surveys we collecting the Surat railway station parking lots 2 hours' data collection. We collect different parking lots areas, parking lots charges and parking management system.
- **Analysis of Survey & Recommended solution: -** Different parking lots data analysis and finding the problems. Find the parking demand, parking load, parking revenue generation and management system.

2.1 Data Collection:

We have measured data on Surat railway station parking area and parking charges also measured parking capacity of 2W and 4W. we have survey on regular day, public holiday and weekend day survey. The peak 2 hour in day the time is 9:00 am to 11:00 am.

- **Surat railway station parking lots details:**

Table: - 1 for Surat railway station parking location and area details

No.	Parking type	Location of parking	Area of parking [sq.mt.]
Parking 1	Common	Left of entry gate by Railway (upside)	1125.48
Parking 2	Common	Left of entry gate by Railway (on ground)	1501.8
Parking 3	VIP	Right side of entry gate	325.33
Parking 4	Staff	Near ticket window	200
Parking 5	Common	L.H. Road side (Railway)	866.1
Parking 6	Common	L.H. Road side (S M C)	2542.5
Parking 7	Pass (Bike)	L H. Road side	200
Parking 8	Rickshaw	Front side on Road	334.62
Parking 9	Rickshaw	L.H. Road side on Road	418.27
Parking 10	Taxi	Front side of station	274.39
Parking 11	Bus	Front side of station	124.8

Table: - 2 for Surat railway station 2W and 4W capacity

No.	**Location**	**Vehicle type**	**Capacity**
Parking 1 (Railway)	Front side up (P – 1, P – 3, P - 4)	2W	520
		4W	32
Parking 2 (SMC)	Front side on ground	2W	500
		4W	33
Parking 3 (Railway)	L.H road side	2W	340
		4W	17
Parking 4 (SMC)	L.H road side (P - 6, P - 7)	2W	970
		4W	40

2.2 Regular day data collection (9TH August, 2018 Thursday)

Table: - 3 for Regular day survey data collection sheet

No.	**Vehicle type**	**9:00-9:15**	**9:15-9:30**	**9:30-9:45**	**9:45-10:00**	**10:00-10:15**	**10:15-10:30**	**10:30-10:45**	**10:45-11:00**
Parking 1	2W	477	481	488	493	496	501	506	511
	4W	14	14	16	13	15	14	14	15
Parking 2	2W	424	435	442	450	458	463	469	474
	4W	35	37	39	41	44	46	45	45
Parking 3	2W	296	304	311	318	322	327	334	336
	4W	16	18	18	19	18	18	19	19
Parking 4	2W	863	883	890	906	901	915	922	936
	4W	14	15	15	15	14	14	15	15

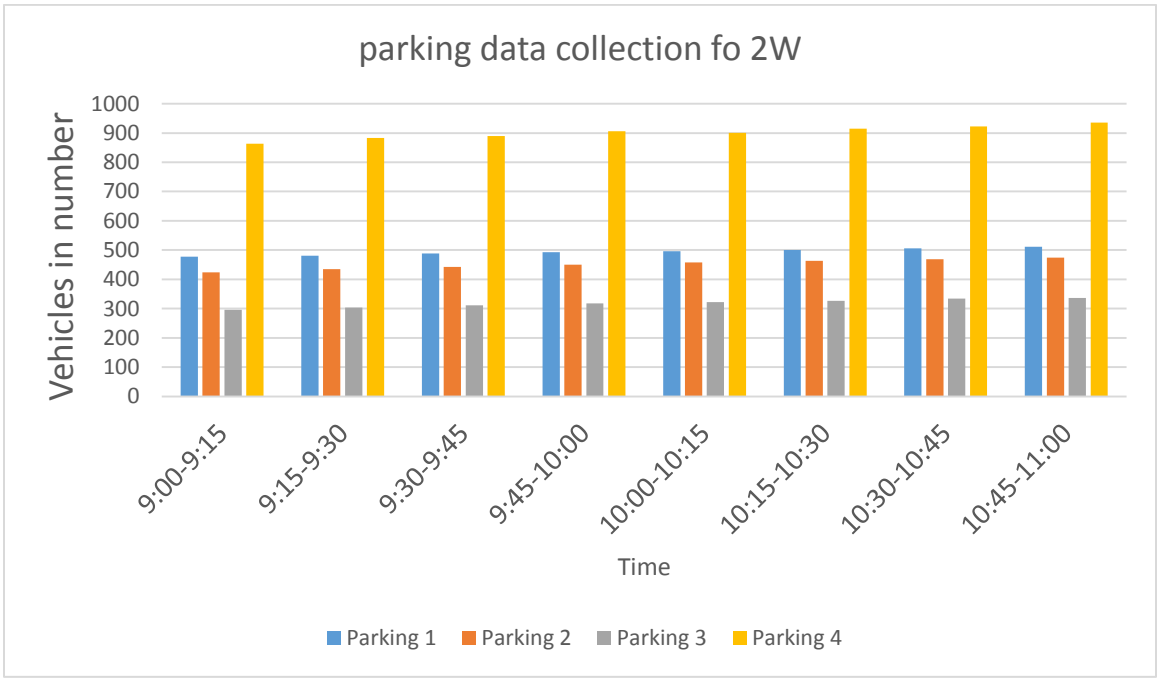

Figure: - 1 for parking data collection on regular day for 2W

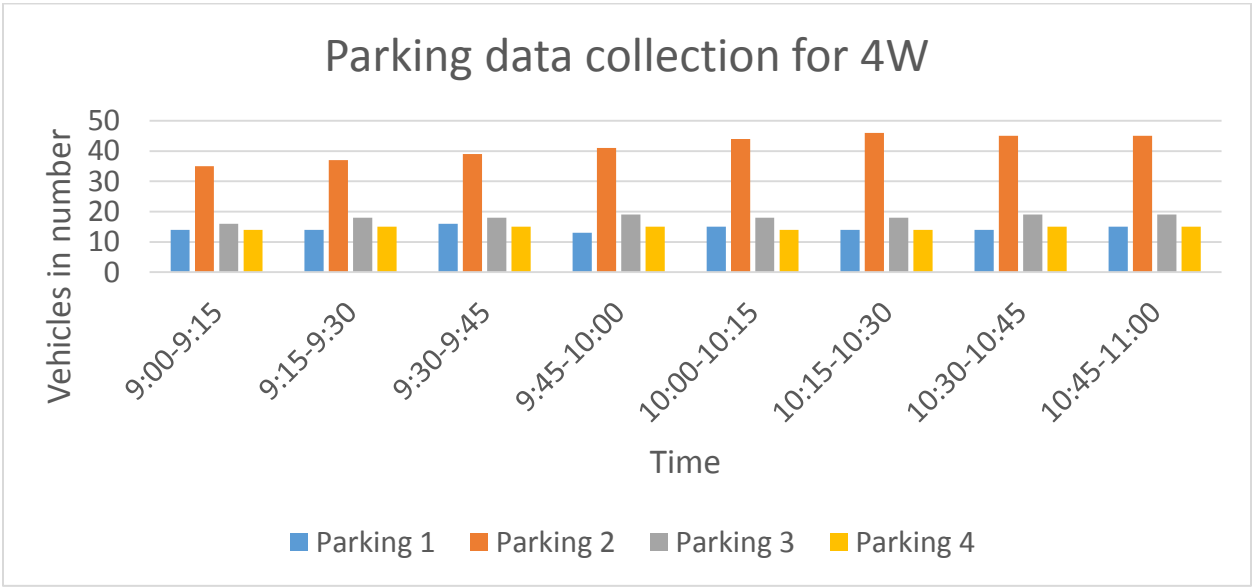

Figure: - 2 for parking data collection on regular day for 4W

The maximum number of two wheelers parked in peak hour on railway station parking 2252 and the maximum number of four wheelers parked in peak hour 96 on regular day.

3. FORECASTING OF VEHICLES POPULATION & PARKING DEMAND

3.1 Geometric Increase Method: -

The total number of two wheeler vehicle capacity is 2310 and four wheeler capacity is 122. This capacity is not satisfied for next years.

$$P_n = P\left(1 + {}^{P_r}/_{100}\right)^n$$

P_n = the population after n decade

P_r = the growth rate %

P = the present year population

n = number of decade

3.1.1 Surat city's vehicles population data

Table: - 4 Surat city's vehicular population

Year	2W population	4W population
2009	1169901	141646
2010	1270400	165508
2011	1370899	189370
2012	1495610	220932
2013	1620321	252494
2014	1745032	284056
2015	1881668	315618
2016	2049700	347180
2017	2210558	378742
2018	2380592	410304

(Source: - Surat RTO)

The Surat city's vehicles average population growth rate for two wheelers 7.69% and four wheelers average growth rate is 3.58% up to 2018. According to bases on this growth rate we calculate the future population growth of two wheelers and four wheelers.

3.2 The future forecasting of two wheelers and four wheelers.

Table: - 5 2W and 4W future growth of Surat city

Year	**2W Population in No.**	**4W Population in No.**
2018	2380592	410304
2019	2563659	424992
2020	2760805	440207
2021	2973110	455967
2022	3201743	472290
2023	3447957	489198

2024	3713105	506712
2025	3998642	524852
2026	4306138	543642
2027	4637280	563104
2028	4993287	583263
2029	5377917	604144
2030	5791479	625772
2031	6236843	648175
2032	6716457	671380
2033	7232952	695415
2034	7789166	720311
2035	8388153	746098
2036	9033202	772808
2037	9727855	800475
2038	10475928	829132
2039	11281526	858815
2040	12149076	889566

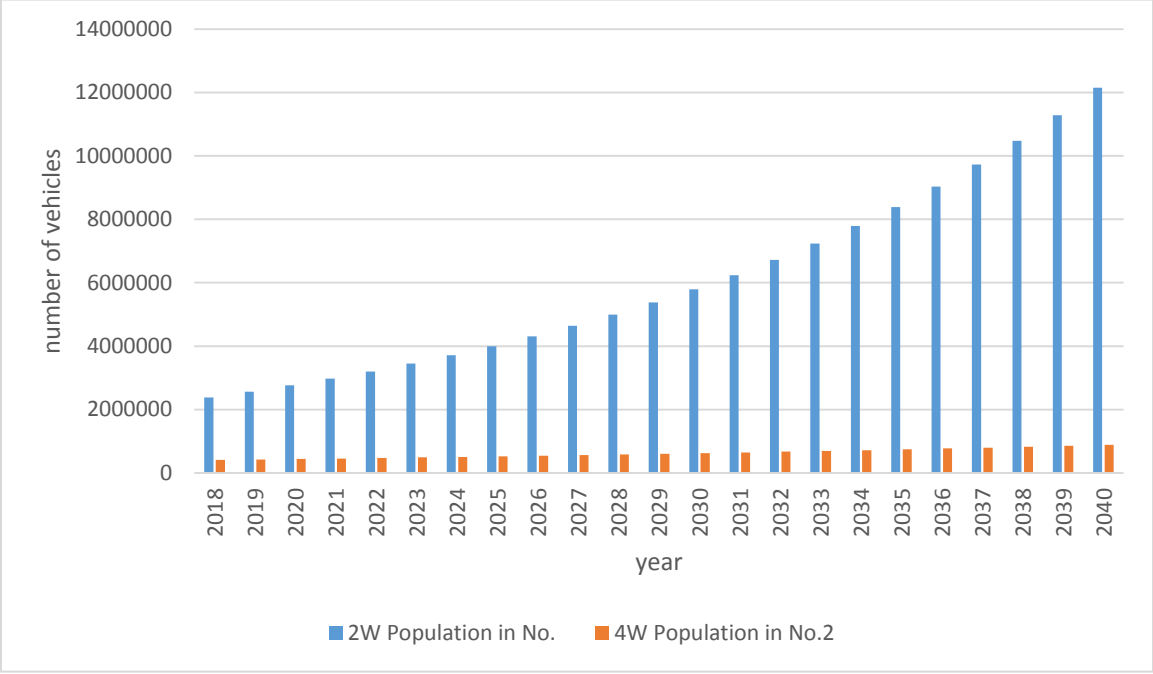

Figure: - 3 Forecasting of 2W & 4W

3.3 The 2W and 4W parking demand forecasting on Surat railway station

- **One 2W parking area required: -**
  - The current capacity of 2W : - 2310
  - The current parking area : - 3910.48 sq.mt.
  - The standard length of 2W in India : - 1.95 m.
  - The standard width of 2W in India : - 0.85 m.
  - The standard area occupied for one 2W in India : - 1.65 sq.mt.
- **One 4W parking area required: -**
  - The current capacity of 4W : - 122
  - The current parking area : - 1804.63 sq.mt.
  - The standard length of 4W in India : - 4.81 m.
  - The standard width of 4W in India : - 2.60 m.
  - The standard area occupied for one 4W in India : - 12.50 sq.mt.

Table: - 6 2W & 4W parking demand forecasting on Surat railway station

year	2W Future parking demand per day	Remark for 2W	4W Future parking demand per day	Remark for 4W
2018	2252	**Adequate**	96	**Adequate**
2019	2337	**Adequate**	99	**Adequate**
2020	2425	**Inadequate**	103	**Adequate**
2021	2517	**Inadequate**	109	**Adequate**
2022	2627	**Inadequate**	116	**Adequate**
2023	2737	**Inadequate**	125	**Inadequate**
2024	2857	**Inadequate**	136	**Adequate**
2025	2987	**Inadequate**	147	**Inadequate**
2026	3277	**Inadequate**	159	**Inadequate**
2027	3437	**Inadequate**	171	**Inadequate**
2028	3787	**Inadequate**	183	**Inadequate**
2029	4086	**Inadequate**	196	**Inadequate**
2030	4391	**Inadequate**	209	**Inadequate**
2031	4771	**Inadequate**	223	**Inadequate**
2032	5221	**Inadequate**	236	**Inadequate**
2033	5711	**Inadequate**	249	**Inadequate**
2034	6261	**Inadequate**	264	**Inadequate**
2035	6891	**Inadequate**	279	**Inadequate**
2036	7591	**Inadequate**	296	**Inadequate**
2037	8361	**Inadequate**	312	**Inadequate**

2038	9251	**Inadequate**	328	**Inadequate**
2039	10141	**Inadequate**	343	**Inadequate**
2040	11031	**Inadequate**	359	**Inadequate**

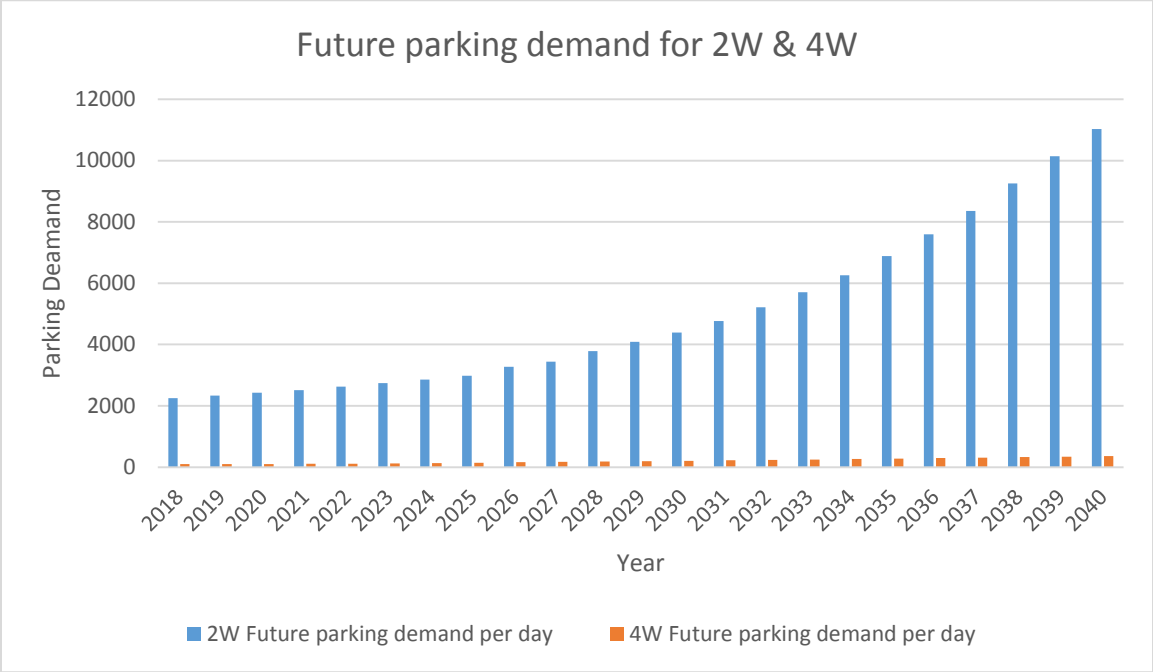

Figure: - 4 Future parking demand

- The two wheelers parking area adequate for next 2 – 3 years so, this problem's solution is very needful because the parking demand is rapidly increase per year. The two wheelers parking demand growth rate 2018 to 2040 is 17.72%.
- The four wheelers parking area adequate for next 6 – 7 years so, this problem's solution is very needful because the parking demand is more and more increase per year. The four wheelers parking demand growth rate 2018 to 2040 is 12.45%.

4. SOLUTION

4.1 The bridge parking system

The multi-level parking system is very common but very effective method for parking demand satisfaction. We can use the railway station platform area including area of rail line. On this area we construct one bridge type structure for parking.

The Surat railway station approximate area is 103572 sq.mt. so, we can use this area for construct bridge for parking. The main benefit of this bridge we have increase many parking areas.

4.1.1 The geometric layout details of this bridge

- Height : - 10m
- Length : - 70
- Width : - 500

- Total parking area : - 26021.26 sq.mt.
- Total construction area : - 35000 sq.mt.
- Number of 2W capacity : - 11520
- Area required for 2W : - 19000 sq.mt.
- Number of 4W capacity : - 370
- Area required for 4W : - 4700 sq.mt.
- Slope on parking area : - 1:25
- Ramp slope : - 1:10
- Width of ramp : - 4.75

4.1.2 After construction of bridge work (2W & 4W)

Table: - 7 Bridge parking for 2W & 4W

Year	2W Future parking demand per day	Remark for 2W	4W Future parking demand per day	Remark for 4W
2021	2517	**Adequate**	109	**Adequate**
2022	2627	**Adequate**	116	**Adequate**
2023	2737	**Adequate**	125	**Adequate**
2024	2857	**Adequate**	136	**Adequate**
2025	2987	**Adequate**	147	**Adequate**
2026	3277	**Adequate**	159	**Adequate**
2027	3437	**Adequate**	171	**Adequate**
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2032	5221	**Adequate**	236	**Adequate**
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2038	9251	**Adequate**	328	**Adequate**
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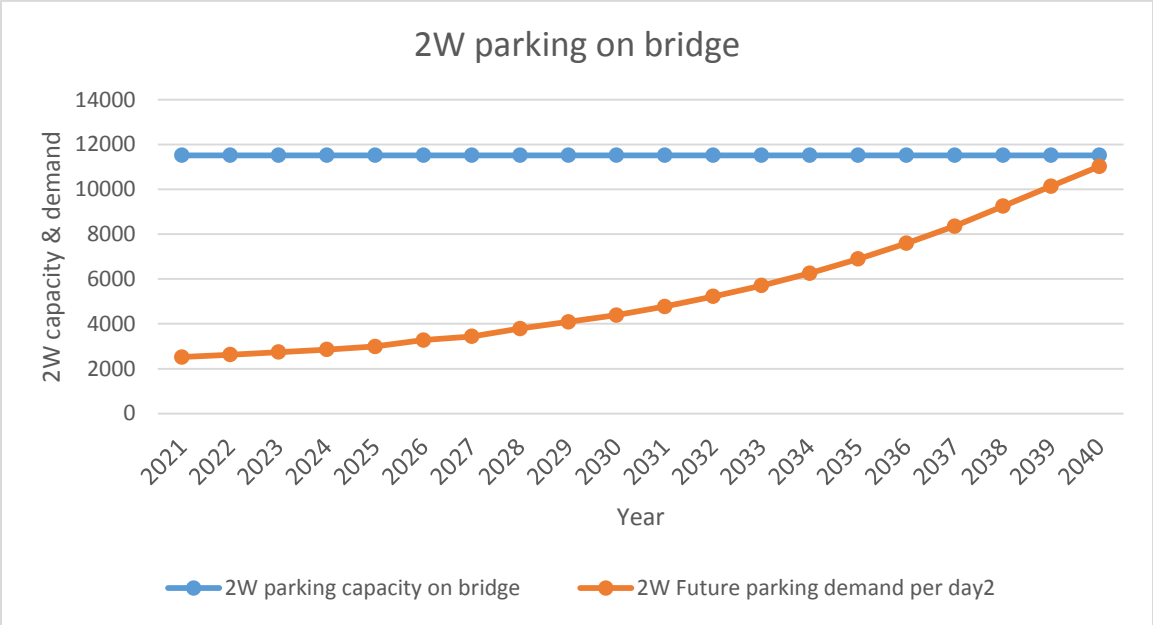

Figure: - 5 2W parking on bridge

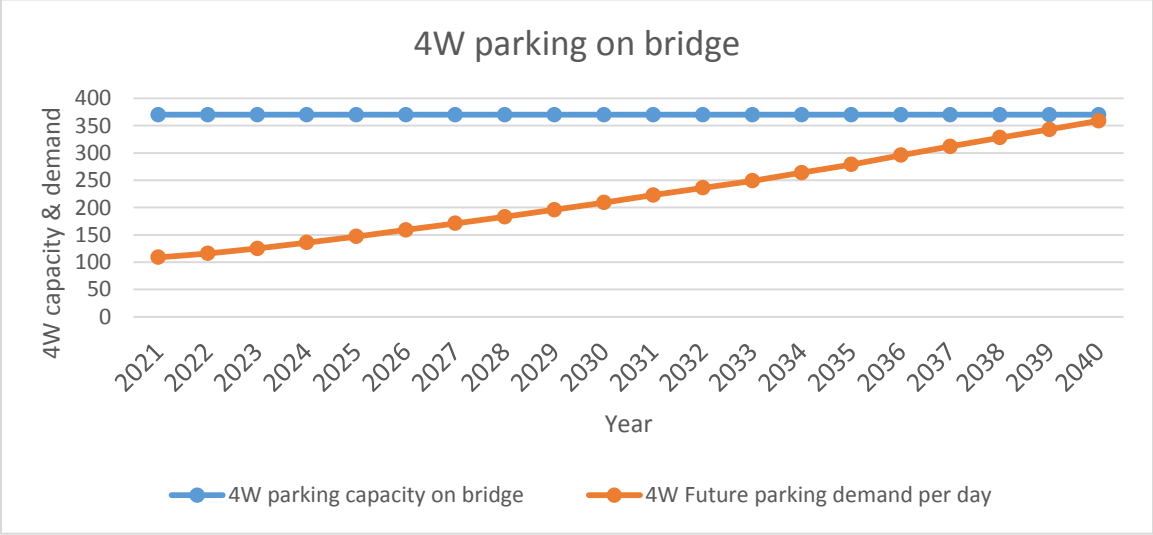

Figure: - 6 4W parking on bridge

5. CONCLUSION

The parking is not a small problem. If it is not solved tactfully now, then it will become a huge problem in the near future. The Multi-level parking recommended for provide the easy accessibility and mobility. By providing multi-level parking of G+3 and Basement 1&2, we can satisfy the demand of Two-Wheelers parking up-to year 2021 and also satisfy the demand of Four-wheelers parking up-to year 2023. The bridge parking system is very effective system because this parking is adequate for next 20-22 years.