DEMAND ASSESSMENT OF MULTI LEVEL CAR PARKING IN GARUDA MALL

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Abstract

There are more than 45 Lakh vehicles registered in Bengaluru as for 2014 and may likely go up to 50 lakh by 2015.Increasing parking demand together with limited parking space availability and the absence of a parking regulation is an impediment to the smooth flow of traffic, especially in and around the major commercial areas. The main objective of parking is to make an assessment of already existing shopping complex. The present study is also intended to evaluate the parking patterns, identifying authorized and unauthorized parking around the study area. There are several Multilevel Car Parking (MLCP) in the city but they are not fully utilized even population of vehicle is very high. here is a need to study the popularity of these parking spaces even though they are located in important places. Garuda Mall MLCP location was considered for the study.

Keywords: *MLCP, Parking Issues, Annual Growth*

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1. INTRODUCTION

The number of motorized vehicles has been on an increase in Bengaluru. The annual growth rate of vehicles at 10% per annum is more than the growth rate of population which is 3%. Many city roads are already suffering from congestion. The problem of congestion is compounded by the fact that parking is free in Bengaluru and on-street parking is unregulated. As a result, parked vehicles take up precious road space leaving less road space for moving vehicles. Parking, both on-street and off-street occupies valuable urban land.

2. LITERATURE REVIEW

2.1 Parking issues-Bengaluru: An Overview

The Parking issues of Bangalore are intricately related to the city structure, Infrastructure, traffic and management. The various parking issues on Bangalore have been defined as follows:

i. The One way system proposed for speedy movement within the city and streamlining the traffic had facilitated clear carriageways with removal of parking from the roads. These have resulted in moving the "on street parking" to the other roads and spaces available surrounding to these roads.
ii. The practice of "Pay and Park "has been tried for a few years for about 71 locations, this has been discarded since 2005. Though the Pay and Park has been discarded, this has resulted in the haphazard and unregulated parking, often some illegal collection of fee for parking.

2.2 Site Reconnaissance Survey

In order to understand the site, a site reconnaissance survey is essential. This survey was done for the study area to capture the road characteristics like available ROW and carriageway width. Land use in the site vicinity was surveyed.

2.3 On-street and Off Parking Survey

On-street parking surveys are intended to collect the extent of usage of parking facilities along the roadside. The survey has been conducted by counting the vehicles parked on the road at regular time intervals for a particular duration of the day.

3. CASE STUDY: GARUDA MALL

3.1 Study Area and Site Plan

The site is located on the corner of Magrath Road and Commissariat Road junction under Ashok Nagar limits in the north south direction making it a North - East corner. The site area is estimated to be 14814 sqmt and the site in a broad sense is located in a predominantly profitable locality where the commercial activity is intense. Towards the Southern side of the site is Wesley Church opposite of which is the foot ball stadium. North of Garuda Mall is the Police officers ground and to the west is the 2nd cross road with mixed land use.

Zone 1: Part of Magrath road, Brigade road, Residency road.

Zone 2: Commissariat road, Primrose road, some part of Magrath road, Brunton road and Brunton cross road

Zone 3: Part of Magrath road, part of Richmond road, Victoria road.

Zone 4: Museum road, Mother Teresa road, part of Richmond road, Bowee Ln street, wood street, Castle street, part of Brigade road.

4. DATA COLLECTION AND ANALYSIS

4.1 Parking Supply

Two types of on-street parking, parallel, and angular are prevailing in the study area. In on-street parking, vehicles are parked on the street. They may be authorized parking stretches as well as stretches where parking is prohibited but still parking is observed.

Table 1 Parking volume

Total Accumulation of Parked vehicles on street				Total Accumulation of Parked vehicles off street	
Zones	**Weekday**	**weekend**	**Change %**	**weekday**	**Weekend**
Zone 1	670	480	28.35	15	18
Zone 2	149	65	56.37	-	-
Zone 3	240	105	56.25	90	25
Zone 4	357	286	19.88	-	-
TOTAL	1461	936	33.89	105	43

4.2 Parking Volume – zone wise

The total number of vehicles parked in an area at a particular time was counted i.e. the accumulation surveys were done for all Zones, for weekdays and weekend the result is given in**Table 2 and Table 3.**

Table 2: Cars Turn Over at Garuda Mall during Summer Holidays

Day	Cars turnover	TW turnover(ECS)	AUTO(ECS)	Rounded off(ECS)
Monday	1006	994	29	1280
Tuesday	993	811	35	1220
Wednesday	996	1050	41	1291
Thursday	995	967	40	1267
Friday	1217	891	48	1513
Saturday	2151	1803	96	2674
Sunday	2183	1766	30	2650

Table 3 Peak hour and off-peak parking Demand and Supply Gap at Garuda Mall

	Peak Hour (ECS)		Gap	Off-peak Hour (ECS)		Gap
Day	**Demand**	**Supply**	**Volume**	**Demand**	**Supply**	**Volume**
Monday	176	972	796	56	972	916
Tuesday	167	972	804	84	972	888
Wednesday	187	972	785	90	972	882
Thursdy	123	972	849	85	972	887
Friday	125	972	847	67	972	905
Saturdy	261	972	712	123	972	849
Sunday	399	972	573	220	972	752

4.3 Parking Demand and Supply Gap

Peak parking demand and supply observed at Garuda Mall MLCP is from the primary parking surveys as given in Table 3. Supply is calculated on the basis of parking norms and available type of parking style.

It is observed that during the weekdays the average total gap between supply and demand is about 849 ECS and during the weekends the average gap is about 573 during the peak hours. Similarly the off-peak demand during the weekdays is 85 and weekend is 752. This shows that at any given time the parking slots at Garuda Mall are underutilized i.e. slots are vacant.

The total day's parking turnover was also done for 8 days from Sunday to Sunday to know the actual turn over at the Garuda Mall MLCP. The Total variation of the week can be obtained and the flow pattern of the parking can be known. The details are as shown in Table 4 below.

Table 4 ParkingVariation over at Garuda Mall

Day	Cars turnover	TW turnover(ECS)	AUTO(ECS)	Rounded off(ECS)
Monday	708	292	29	796
Tuesday	647	496	35	790
Wednesday	599	304	41	772
Thursday	474	284	40	565
Friday	670	380	48	790
Saturday	1003	672	96	1220
Sunday	1206	736	30	1410

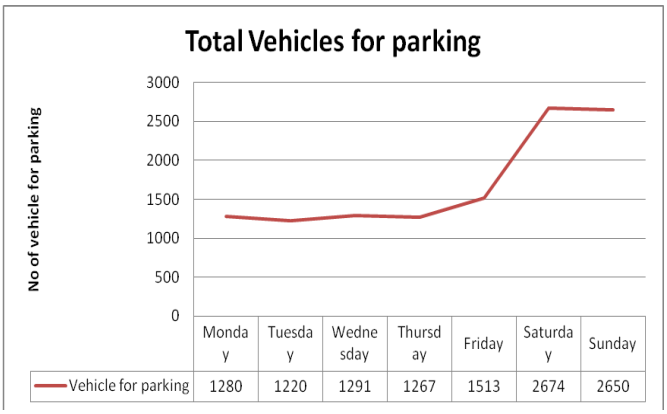

Fig 1 Parking Variations during Summer Holidays

5 TRAFFIC VOLUMES COUNTS SURVEY

Turning Movement volume counts was conducted on two Locations weekdays and one weekend near LIFESTYLE, Garuda Mall. The traffic volume counts were conducted for every 15 minutes interval starting from peak hour 9.00 AM to 12.00 PM and 4.PM to 8PM. The peak hour traffic flow was found to be between 15.30 PM to 16.30 PM. The highest traffic has been observed on commissiorait road, the traffic volume summary is shown in Tables

Table 5 Traffic Volume Summary-Weekday

Location	Total Volume (Vehicle)	Total PCU	Peak Hour (Vehicles)	Peak Hour (PCU)	% Peak Hour (PCU)
LIFESTYLE	59317	67619	8459	9816	14.5%
Garuda Mall	41905	49755	7076	7807	15.7%
Mid block	20285	24575	3308	3985	16.21 %

Table 6 Traffic Volume Summary-Weekend

Location	Total Volume (Vehicle)	Total PCU	Peak Hour (Vehicles)	Peak Hour (PCU)	% Peak Hour (PCU)
LIFESTYLE	41604	50376	6863	7945	15.9%
Garuda Mall	25734	34016	4687	5478	16.1%
Midblock	15488	19879	2432	3079	15.5%

5.1. Opinion Surveys

This section of the report elucidates the opinion of the user regarding parking problems faced by them, parking rates prevailing in the area, future parking charge system and parking fee to be charged. Opinion about willingness to pay for parking facilities, trip purpose, trip frequency, comfort level etc was collected from both car users and non-car users. Car owners are those coming in cars, while non-car users are those who are coming in other modes which include two-wheelers, bus, by walk, etc. Opinion survey results are useful in deciding the parking charge system, parking fee etc. Total of 100 samples were done in and around the Garuda Mall.

6. FUTURE CONDITIONS

6.1 Estimation of Parking Demand

This section estimates the future parking demand for the area and assesses whether the site can handle the unattended parking demand. The data regarding number of employees, built-up area etc and other base information for the study area, could not be collected adequately by the survey teams due to security restrictions during the course of the surveys at study Sites. It was the sheer reluctance of the local people to part with information during the survey period that led a situation where desired data was unobtainable. In absence of sufficient data, future parking demand has been estimated as explained below.

6.2 Parking Turnover rate / yield

It is the number of vehicles utilizing the available ECS in a unit time (usually considered for the entire day)

The mathematical equation for future parking demand is as below.

Yield = Total observed Daily Turn Over / Peak hour parking demand.....1

Assumed yield here is the rounded value of the yield obtained from …..…..1

Available Capacity = Assumed Yield x Total parking supply available …… 2

Future Parking demand = Total Observed daily turnover (1+Vehicle Growth rate) ^{n}.....3

Represents the existing situation
n- Number of years.

Percentage of Parking Space availability =

$$\frac{1-(\text{ExistingobservedTurnover})}{\text{MaximumCapacityofMLCPw.r.texistingyield}}$$

The following table summarizes the future parking demand.

Table 7: Future Parking Demand Estimation of Garuda Mall and the adjoining roads during weekdays

Sl No	Details	Garuda Mall	Adjoining Roads
1	Day	Weekday	Weekday
2	Peak hour Parking Demand	187 ECS	250 ECS
3	Total Parking supply available	972 ECS	100 ECS
4	Total observed daily ECS Turnover	708 ECS	375 ECS
5	Forecasted ECS for next 5 years	1254 ECS	600 ECS
6	Yield	3.8	1.5
7	Assumed Yield	4	1.5
8	Maximum Capacity of MLCP w.r.t existing yield	3900 ECS	150 ECS
9	Existing Parking Demand .i.e. 2014	708 ECS	375 ECS
10	Percentage unoccupied ECS availability in the year 2014	82%	-------
11	Number of ECS available for the year 2014 w.r.t assumed yield	796 ECS	-------

12	Percentage availability of ECS w.r.t to assumed yield at MLCP in the year 2014, when the on street parking in the adjoining road is shifted to Garuda Mall MLCP	72% .i.e. 702 ECS	
13	Impact w.r.t Weekdays in the year 2014	MLCP will have Sufficient availability of Parking space	
14	Future Parking Demand in the year 2020 at 10% vehicle growth	1254 ECS	600 ECS
15	Percentage unoccupied ECS availability in the year 2020	68%	-------
16	Number of ECS available for the year 2020 w.r.t assumed yield and estimated future Parking Demand	659 ECS	--------
17	Percentage availability of ECS w.r.t to assumed yield at MLCP in the year 2020 when the on street parking in the adjoining road is shifted to Garuda Mall MLCP	52% i.e. 509 ECS	
18	Impact w.r.t Weekdays by the year 2020	MLCP will still have Sufficient availability of Parking space	
19	Future Parking demand in the Year 2025 with 10% vehicle growth	2020	970
20	Percentage unoccupied ECS availability in the year 2025 value for 10% vehicle growth	48%	----------
21	Number of ECS available for the year 2025 wrt assumed yield and estimated future parking demand with 10%vehicle growth	469 ECS	
22	Percentage availability of ECS wrt assumed yield at MLCP in the year 2025 when the on street parking in the adjoining road is shifted to Garuda Mall MLCP	29% i,e 280 ECS	
23	Impact wrt Weekdays by the year 2025 with 10% vehicle growth		MLCP will still have sufficient capacity

Thus it clearly shows that there is still enormous space available at the MLCP in the coming years during the weekdays.

Thus the UN authorised parking in the vicinity of Garuda Mall has to be shifted to the MLCP. This also increases the Revenue.

Table 8 Future Parking Demand Estimation of Garuda Mall and the adjoining roads during weekends

Sl No	Details	Garuda Mall	Adjoining Roads
1	Day	Weekend	Weekend
2	Peak hour Parking Demand	399 ECS	100 ECS
3	Parking supply available	972 ECS	200 ECS
4	ECS Turnover	1206 ECS	300 ECS
5	Forecasted ECS for next 5 years	2137 ECS	480 ECS
6	Yield	3	3
7	Assumed Yield	3	3
8	Maximum Capacity w.r.t existing yield	1950 ECS	600 ECS
9	Existing Parking Demand .i.e. 2014	1206 ECS	100 ECS
10	Percentage unoccupied ECS availability in the year 2014	38%	50%
11	Number of ECS available for the year 2014 w.r.t assumed yield	371 ECS	100 ECS
12	Percentage availability of ECS w.r.t to assumed yield at MLCP in the year 2014, when the on street parking in the adjoining road is shifted to Garuda Mall MLCP	23% .i.e. 221 ECS	
13	Impact w.r.t weekends in the year 2014	MLCP will have Sufficient availability of Parking space	

14	Future Parking Demand in the year 2020 at 10% vehicle growth	2137 ECS	480 ECS
15	Percentage unoccupied ECS availability in the year 2020	(minus)-10%	19%
16	Number of ECS available for the year 2020 w.r.t assumed yield and estimated future Parking Demand	(minus)-93 ECS	40 ECS
17	Percentage availability of ECS w.r.t to assumed yield at MLCP in the year 2020 when the on street parking in the adjoining road is shifted to Garuda Mall MLCP	(minus) – 3% .i.e. 27 ECS will be required	
18	Impact w.r.t Weekdays by the year 2020	MLCP will still have slight spillover of parking which can be handled by enforcement plans.	
19	Future Parking Demand in the year 2025 with *10% vehicle growth*	3441	620
20	Percentage ECS availability in the year 2025 value with 10% vehicle growth	-76%	-3%
21	Number of ECS available for the year 2025 w.r.t assumed yield and estimated future Parking Demand with 10% vehicle growth	743 ECS will be required	(minus) - 6 ECS will be required
22	Impact w.r.t Weekdays by the year 2025 with 10% vehicle growth	MLCP will have sufficient space	

For future estimation and projection of parking demand for weekend, at the site and the adjoining roads, it is observed that the yield at site is about 3.3 per ECS and 3 per ECS in the adjoining roads. The vehicle growth rate is assumed to be 10% till 2020. The forecasted parking demand for the year 2020 at the site is 2137 ECS and 480 ECS at the adjoining roads.

Considering the current year's peak parking demand at the site with 2137 ECS and the supply of 972 ECS on a particular weekend, the availability of parking space is about 38% (.i.e. 280 ECS) and the forecasted space availability in the year 2020 and 2025 at the site will be(minus) - 10%(.i.e. 100 ECS will be required).Hence the on- street parking shift is needed immediately from the adjoining roads into the MLCP.

7. DISCUSSIONS AND CONCLUSIONS

- **Current Year**: As per the surveys and analysis, the capacity of the MLCP calculated based on current peak hour parking demand and the Average turnover of a week is 954 ECS. The analysis in the preceding chapter shows that the MLCP has got sufficient car parking space to cater the present parking demand.
- **Horizon Year 2020:** At this parking demand and the shift of on-street parking into the MLCP, the MLCP will have sufficient parking spaces available during the weekdays
- **Horizon Year 2025:** Considering the vehicle growth rate of 10% annually, the parking demand at MLCP in the year 2025 is most likely to be around 2020 ECS during the weekdays and 3441 ECS in the weekends.

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