

Park and Ride System at Orion Mall Intersection

Vineet Oni¹ Mr. Gnanamurthy P B²

¹PG Student ²Assistant Professor

^{1,2}Department of Civil Engineering

^{1,2}G.S.K.S.J.T.I, Bengaluru - 01

Abstract— Transportation system management is one of the most important and current need for solving urban travel problems. The possibility of reducing congestion by managing within the existing system is the need of the hour. One of such management technique is the provision of Park and Ride facility. The present study identifies the different Park and Ride facilities implemented around the world in general and looks at provision of Suburban Park and Ride facility in particular. The proposed site is located along the boundary the Bangalore metropolitan area. Traffic surveys were carried out to know about the traffic and travel characteristics. Detailed analysis was carried out to arrive at the possible travel demand and capacity of the Park and Ride facility. Opinion survey was carried out to evaluate the willingness of commuters to use the facility and amount of fare to be collected. The resulting mode shift was estimated. The cost of construction and revenue generated with the facility is also calculated. The results indicate that there will be 34% reduction in private vehicles travelling to the CBD area from the proposed site.

Key words: Orion Mall Intersection, Park and Ride System

I. INTRODUCTION

A. General

Park and Ride system is a parking facility given all along the border of the CBD zone. These go about as an uncongested collection focuses accepting cars going into the CBD zone. Such an activity reduces the quantity of vehicles voyaging towards constrained territories and can be categorized as a practical Transportation System Management process.

B. The objectives of the study are

- To look at the current parking demand at the study area given the distinctive parking sorts and supply.
- To assess the existing traffic data by various traffic surveys.
- To attain at the possible demand for P + R Lot.
- To design new parking and Ride system.
- To estimate the feasibility of the P + R lot.

C. Selection of Study Area

- According to American Association of State Highway and Transport Officials (AASHTO), urban park and ride lots are defined as lots that are characteristically between 6.4 and 8 kilometres from the CBD and that provide an intermodal or change of mode service. The obligation is that these lots should be positioned along the inner edges of the urban area. They should be capable enough to accumulate the traffic as much as possible to the origin and act as a transfer cum intermodal change location or points. The expected modal change is in between private and public transportation. Hence the following guidelines were formulated in the selection of Park and Ride lot.

- It should serve as ideal collection point for urban catchment area.
- Existing informal lot and transit system.
- High residential population density.
- It should have sufficient space to allow for offsite parking with minimal capital cost.
- A majority of traffic should pass through the P+R site.

II. STUDY METHODOLOGY

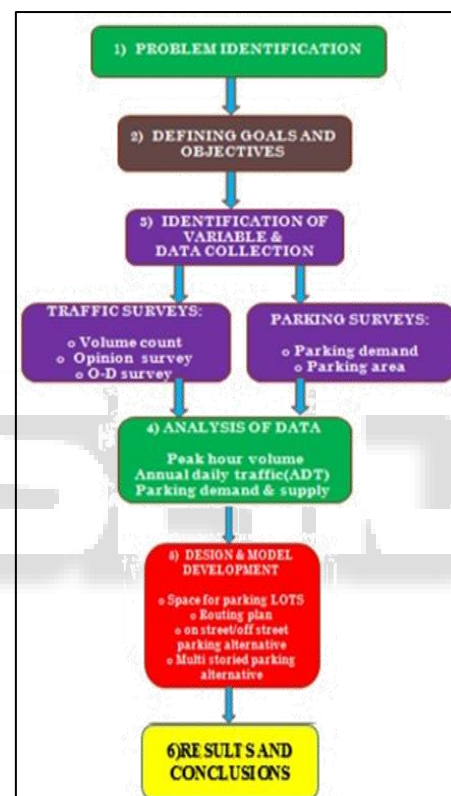


Fig. 1: Methodology

III. STUDY AREA PROFILE

The study area is located at Orion Mall intersection in Bengaluru as shown in the figure 2. It is located at 8km from the central business district (CBD). It is located along the Bengaluru – Tumkur road (NH-4). The Orion mall intersection 3 approaching roads i.e., Yeswanthpur, Vijayanagar and Rajajinagar. A metro line runs over the road and Soap Factory metro station is located near to the study area.

The study area demarcates urban area in the north side of Bengaluru. The commuters travelling from urban and suburban area use either the Metro (BMRCL) or Public Transport (BMTc Bus) facilities. Due to insufficient road networks in the area, the commuters use their own private vehicles in order to reach their destinations in the CBD areas. Henceforth, a suitable Park and Ride system or facility (lot) at this intersection will render a nearby access

for these commuters to park their vehicles at this system or facility (lot) and use the Public Transport to reach their destinations. Thus, it will fetch about shift in the mode of transport and increases the public transport usage.

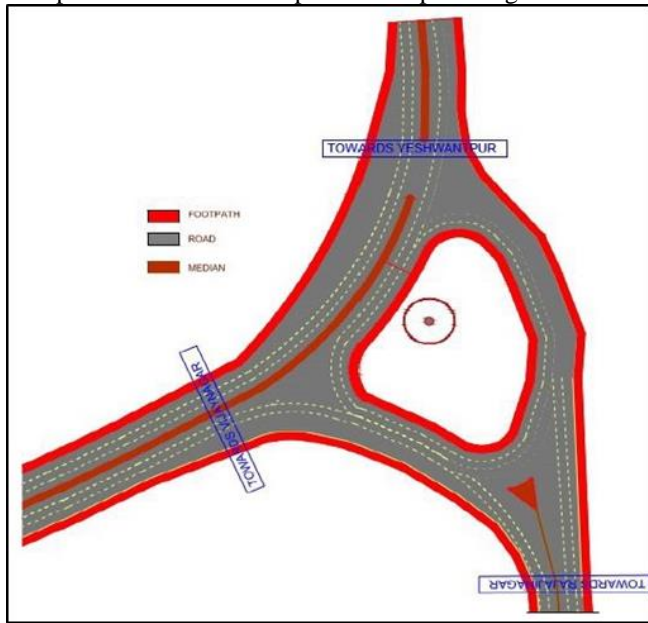


Fig. 2: Study Area

IV. SURVEYS

To access the characteristics of the project site, the following traffic surveys are conducted;

- Classified volume count survey
- O-D survey
- Opinion survey

These surveys were done or carried out on two week days and a weekend i.e. on Monday, Tuesday and Saturday. Origin - Destination surveys were carried out to measure the catchment area for P + R lot and travel distances from the site. Further Opinion survey was conducted to determine the passenger demand for P and R lot.

V. DATA ANALYSIS

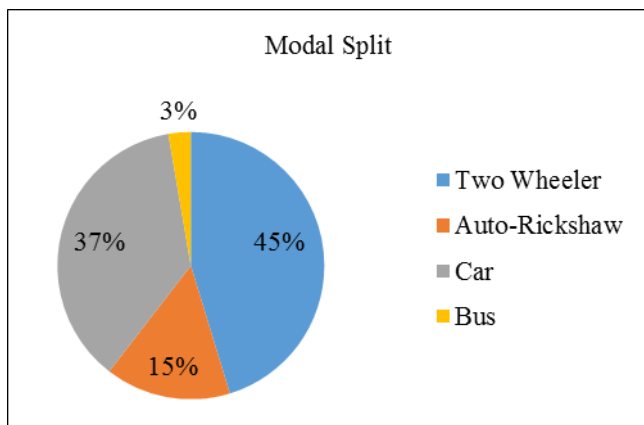


Fig. 3: Modal Split

Figure 3 represents the modal share for the selected traffic of the present year. It is found that 37% of the modal share is owned by the Cars, 45% by the Bikes, 15% by the Auto rickshaws (3W) and 3% by the Bus.

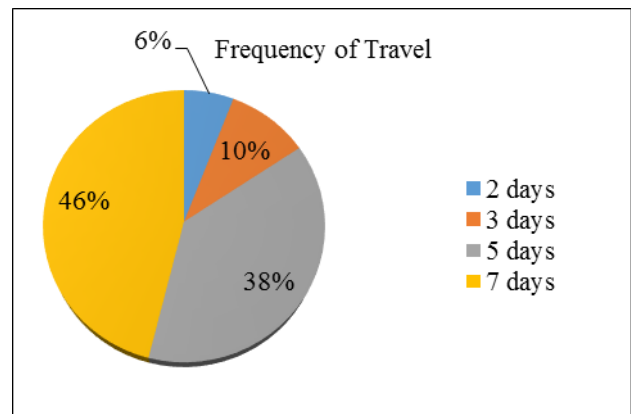


Fig. 4: Frequency of Travel

Figure 4 shows the Travel Frequency by the travellers. It is found that nearly 84% of travellers travel along the route regularly. Most of the trips are work and commercial purpose.

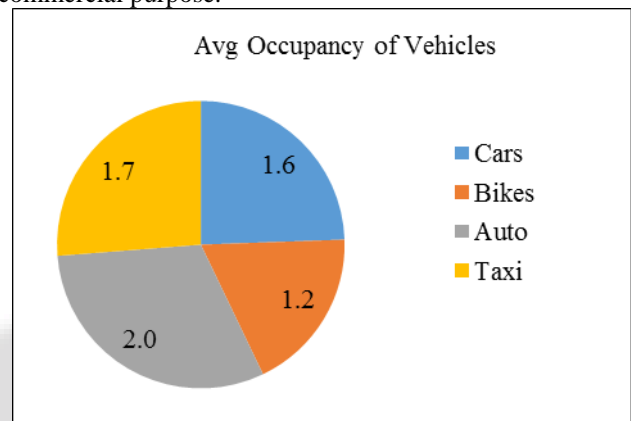


Fig. 5: Average occupancy of vehicles

Figure 5 represents the Average occupancy of the vehicles. It tells that Cars, Bikes, Autos and taxis carry passengers less than half of their occupancy levels. It is found that the commuters are not interested or willing to go for car-pooling or ride sharing programs.

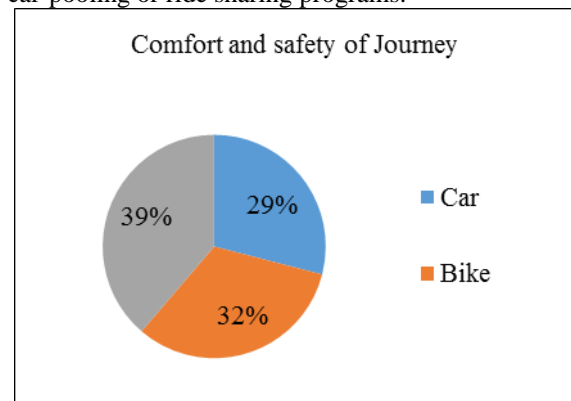


Fig. 6: Comfort and safety of journey

Figure 6 shows the Comfort and safety of journey. It is found that 29% of commuters traveling by Car, 32% travelling by Bikes and 39% pedestrians feel a good (comfortable and safe) type of journey.

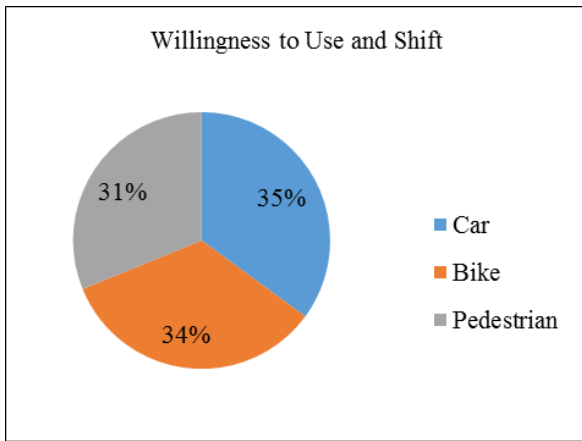


Fig. 7: Willingness to Use and Shift

Figure 7 represents the percentage of commuters willing to use and shift the Park and Ride lot. Based on these data the demand (approximate) for P+R lot was estimated as shown in the table 2. Car-Bike i.e. 35% and 34% are the commuters who are willing to use their private vehicles in order to travel from their origins to the Park and Ride system or facility (lot). Further these travellers or commuters are willing to use Public Transportation to reach their destinations.

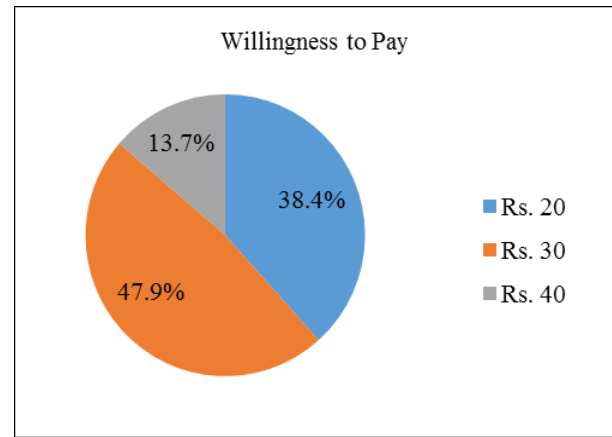


Fig. 8: Willingness to Pay

Figure 8 shows the percentage of willingness to pay for Park and Ride facility. It is found that nearly 47.9% of travellers are willing to pay Rs. 30/day for parking their vehicle, about 38.4% of travellers are willing to pay Rs. 20/day and only 13.7% of them are willing to pay an amount of Rs.40/day. The total revenue generated is shown in the Table 7.

Direction		Width of Road in m	Category of Road	Peak Hour Volume in PCU/Hour	Capacity in PCU/Hour	V/C ratio	LOS
From	To						
Yeswanthpur	Rajajinagar	9.3	Sub-Arterial (One Way, Divided)	3396	3120	1.09	F
Rajajinagar	Vijayanagar	7.3	Sub-Arterial (One Way, Divided)	2117	2400	0.88	F
Vijayanagar	Rajajinagar	7.5	Sub-Arterial (One Way, Divided)	2067	2400	0.86	F
Vijayanagar	Yeswanthpur	11.0	Sub-Arterial (One Way, Divided)	4677	3770	1.24	F

Table 1: Capacity and LOS

Table 1 shows the Capacity and LOS of the roads. It is found that all the roads are having LOS of F. All the roads are categorized into Sub arterial with one way and lanes divided.

VI. PROPOSALS

Vehicle category	Present	2020	2025	2030
Two Wheeler	1695	2377	3334	4677
Car	1149	1612	2260	3170

Mode	Present Modal Share	Present Traffic (PCU/Hr.)	% Willing to shift	Estimated Traffic (PCU/Hr.)	% Change w.r.t Total volume	Total % reduction in Private Vehicles
Car	37%	1149	35	402	14.14%	34.40%
2W	45%	1695	34	576	20.26%	
TOTAL		2844				

Table 3: Modal distribution with provision of Park and Ride facility

Table 3 shows the Modal Distribution or the Modal Split with provision of Park and Ride facility. This shows that with the provision of P + R Lot there will be 34.40% of total reduction in the private vehicles.

Category	Size
Car	2.7m x 6m
2W	0.9m x 1.8m
Driveway for Car	5.5m
Driveway for 2W	2.5m

Table 2: Estimated demand for the Park and Ride Lot (vehicles/day)

In order to determine the demand for P + R lot the traffic volume on the roads Yeswanthpur to Rajajinagar, Vijayanagar to Rajajinagar were considered. This selection was done considering these roads carry traffic towards the CBD. The primary goal of P + R lot is to reduce the traffic. The volumes of traffic on these road stretches were multiplied with percentages of willingness of travellers to shift to Park and Ride mode. The values obtained are shown in the Table 2

Table 4: Adopted standard size for P + R Lot

Table 4 represents the adopted standard size for Park and Ride lot and Table 5 shows the information regarding the proposed parking area dimensions and its perimeter.

Area sq.m	1642
Perimeter	167

Table 5: Proposed Parking area

Present capacity	Total demand 2016	Total demand 2020	Total demand 2025	Total demand 2030
162-C + 250-2W	1149-C + 1695-2W	1612-C + 2377-2W	2260-C + 3334-2W	3170-C + 4677-2W

Table 6: Present Capacity v/s Total Demand for the P + R Lot

The present capacity of the proposed site (P + R lot) was determined by measuring the dimensions of the available area for parking at this site as represented in the Table 5.

In order to facilitate the easy parking and travel for every direction under considerations, the site was located such that they are fully utilized.

The area designated are proposed to be parking lots for Cars with 3 level (1+2) parking facility with help of parking lifts i.e. using the hydraulic jacks or shafts. It is clear that the present proposed parking facility will endure for another 10 years. However by 2025 it is obligatory to upgrade this system to a multilevel parking facility to supply the calculated demand. On Street parking facility was proposed for the Bikes (2W) on the road parallel to the proposed site by making it a one way directional street.

Thus, Table 6 shows the Present Capacity v/s Total Demand of the P + R Lot. The adopted standard size for Park & Ride lot is shown in the Table 4.

Mode/Year	2016 Rs/Annum	2020 Rs/Annum	2025 Rs/Annum	2030 Rs/Annum
Car	₹ 14,191,200	₹ 21,286,800	₹ 28,382,400	₹ 35,478,000

Table 7: Estimated revenue from park and ride lots

No.	Item	Unit	Quantity	Rate	Amount
1	Concrete Pavers	Brass	34.87	4400 per brass	₹ 1,53,428
2	Lighting Assembly	No.	8	7000 per no.	₹ 56,000
3	Electronic Gates	No.	3	50000 per no.	₹ 1,50,000
4	Fare collection machines	No.	1	15000 per no.	₹ 15,000
5	Computers	No.	1	25000 per no.	₹ 25,000
6	Sign boards - MS	No.	3	3000 per no.	₹ 9,000
7	Sign boards Infr	No.	6	4145 per no.	₹ 24,870
8	Paint	Sq.m	32.65	110 per sq.m	₹ 3,592
9	CCTV Camera	No.	6	2000 per no.	₹ 12,000
10	Manpower	No.	3	10000 per no.	₹ 30,000
1	Maintenan	Lump	Per	100000	₹

1	ce	sum	facilit	per annum	1,00,000
1	Hydraulic Jacks	No.	54	200000 per no.	₹ 1,08,00,000
				Total cost of Construction	₹ 1,13,78,890

Table 8: Detailed estimate for construction of park and ride facility

It was found that nearly 47.9% of travellers are willing to pay Rs. 30/day for parking their vehicle, about 38.4% of travellers are willing to pay Rs. 20/day and only 13.7% of them are willing to pay an amount of Rs.40/day. The total revenue that might be generated is estimated assuming a fare or fee of Rs.20/day for the present year 2016, Rs. 30/day for the year 2020, Rs. 40/day for the year 2025 and Rs. 50/day for the year 2030. Thus Table 7 shows the estimated revenue from the Park and Ride lots.

Civil, Electronic works and manpower is required for the construction of Park and Ride facility. A detailed estimation was done to determine the total cost of construction of the P + R facility. The current SR of Karnataka state was considered for adopting the rates. The detailed estimate is shown in the above Table 8. This estimate does not include the provision of Multi storied parking system for the future.

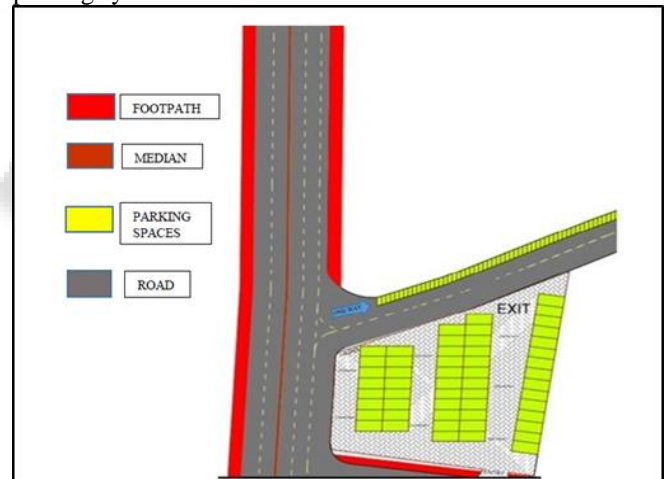


Fig. 9: Proposed Park and Ride lot

VII. RESULTS AND CONCLUSIONS

- From figure 7 it's clear that about 34% of 2W users, 35% of car users and 31% of auto or bus users are willing to shift and use P + R facility.
- From Figure 8 it is found that the majority of the passengers are willing to pay a parking fare in the range of Rs 20-30 /day for using this facility.
- The parking demand at this facility was higher on the weekday than weekend in view that the users who parked at this facility and gone for work and commercial/business purposes.
- It is estimated that with the provision of P + R facility nearly 34.40% of traffic travelling towards CBD area will shift to public transport (bur or metro) in the current year.

- It is found that there will be a considerable sum of revenue generation with the provision of P + R facility and will be adequate for construction and maintenance of the facility.
- Table 8 shows the detailed estimate for construction of park & ride facility which is less than the revenue generated in the present year. Hence the project is economically feasible.
- Provision of P + R lot will minimize the quantity of vehicles going into the urban communities (CBD) in this manner accomplishing the widespread objective and advantages of sustainable transportation.
- The Benefit - Cost ratio analysis for the project can be completed for different situations & alternatives.
- The study can be reached out by directing SP & RP surveys and discrete decision modelling to land at travel demand.

REFERENCES

- [1] Manjunath S Sharanappanavar Professor, KLECET, Chikodi, "Feasibility Study on Provision of Park and Ride Facility at Hebbal Intersection – Bengaluru" International Journal of Science and Research (IJSR), November 2015
- [2] L. G. Nungesser and N. P. Ledbetter, Federal, "Procedures for Estimating Park-and-Ride Demand in Large Texas Cities" Interim Report, Highway Administration (Texas Transportation Institute Texas A&M University), College Station, TX, February 1987.
- [3] U. R. Abdus-Samad and W.L. Grecco, "Predicting Park 'N Ride Parking Demand, - Purdue University," Joint Highway Research Project Purdue University, West Lafayette, IN, December 1972.
- [4] D. Bolger, D. Colquhoun, and J. Morrall, "Planning and Design of Park-and-Ride Facilities for the Calgary Light Rail Transit System," Transportation Research Record No. 1361, Washington, DC, 1992.
- [5] Draft Preliminary Report – "Park-n-Ride Evaluation - A Technical Appendix to the RTD Strategic Plan," Regional Transit District, Denver, CO, 1994.
- [6] Kathy Kerchowskas and Ashish K., "Park and Ride Planning Manual," Volume III, Sen - University of Illinois at Chicago Circle, U.S.Department of Transportation Research & Special Programs Administration (DOT-RSPA-DPB-78-11), Springfield, VA, November 1977.
- [7] McLean, VA, "Park-and-Ride Facilities - Guidelines for Planning Design and Operation," Daniel Consultants, Inc., Federal Highway Administration, January 1986.
- [8] John D.Edwards, Parking, "the Parking Handbook for Small Communities, Institute of Transportation Engineers and National Trust for Historic Preservation," 1994.
- [9] Bus-Based Park & Ride, "A Good Practice Guide, the English Historic Towns Forum, Huntingdon Centre, the Vineyards," The Paragon, Bath BA1 5NA, England, June 1993.