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Management of Parking Spaces in the Walled City of Jaipur

Sample study of Jauhari Bazaar and Bapu Bazaar

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Abstract

Parking problem in Jaipur can be studied by dividing it into two parts, the area within the older city popularly known as the walled city and the area outside it. Parking is an important issue inside the walled city and an emerging one outside it. This paper aims at studying the existing parking problems and their causes, and management in the walled city. Being the major hub of commercial activities in the city, a tourist centre and a densely populated region, the land utilisation inside the walled city has reached its zenith and no further scope of space creation (increasing the supply) is left to deal with the rising demand for parking in this area. The paper therefore explores the question–Can an efficient price mechanism and better management practices improve the conditions of current parking needs in the city.

Keeping in mind the limited period of my internship and the huge area of the Walled City I sampled down my study to Jauhari and Bapu Bazaars. These are two very vibrant areas of the Walled city and are frequently visited by both locals and tourists alike. Besides, the construction of the multi-level underground parking at Ramnivas Bagh close to these areas gave me the opportunity to study the parking management in perspective of future response as well. My research methodology comprised collection of secondary as well as primary data. Secondary data involved literature review of past studies in this field while primary data collection was done in three different ways. First, was direct observation during field trips, second, involved interviews with government authorities and local actors and third, was the survey stage which was divided into online and personal questionnaire for customers and shopkeepers respectively. In order to find alternatives for parking problem in this area I also studied different international best practices in light of their application under the current circumstances in the Walled City. Keeping in mind the development plans that are under process, like the mass public transport system spearheaded by the upcoming Jaipur Metro, I explored both short-term and long-term possible solutions for this problem. Learning from other countries pointed that the conventional approach of supply creation to meet the growing parking need is not a pragmatic solution in the long run. In order to address the parking problem we should focus on discouraging the parking demand. This can work in tandem with a good public transport plus demand-responsive parking prices.

Introduction

Jaipur is one of the first planned cities of India. According to the City Development Plan, Jaipur is a fast growing city, ranking 11th in the list of Indian mega cities with a population of 2.3 million and annual growth rate of 4.5%. Jaipur was founded by Maharaja Sawai Mansingh II in 1727 A.D. The city was developed according to the traditional pattern of a city being circled by a wall with nine entry gates. Jaipur walled city evolved as a gridiron plan with the main road running almost east-west along the ridge in the centre and the palace complex at the core. By 1734, the main markets of the town including Jauhari Bazaar, Sireh Deorhi Bazaar, Kishanpole Bazaar and Gangauri Bazaar had been built. One of the unique features of the walled city is its compactness and walk ability from one market to the other.

Population distribution is uneven in Jaipur. The Walled City, despite the lowest area has the highest population density of 58,207 persons per square kilometre. It is now seeing a decline in the population density as more people are moving outside the walls; for better living environment. As far as the commercialisation pattern, it has been unplanned and has taken place along the main roads. Initially the plots along these roads were residential, but with increasing land value and road traffic they have been commercialised. This led to an increase in parking demand and thereby reduced the effective carriage way. Around 54% of the total commercial area of the city, 60% wholesale units, 32% percent of the total workforces reside within the walled city. Besides, there is a large presence of informal activities in the Walled City of which 80% operate along the roads. The Walled City is also a major tourist attraction for both international and domestic tourists and is frequented by tourists for sightseeing as well as shopping of Rajasthani handicrafts and jewellery whose retail and wholesale markets are primarily located within the walled city area. The Walled city has been used beyond its capacity and is now facing the problems of congestion, traffic and parking.

Parking is an important issue in the Walled City and an emerging one outside it. It not only causes on-road congestion by reducing the carriage way, but the time spent in cruising to find a free on-street parking also slows down the traffic and adds to traffic congestion. This cruising further adds to the accumulated pollution in this area. Jaipur has seen a continuous vehicle growth and has 15,37,576 registered vehicles up to March 2010 with 293 vehicles per thousand persons. The increasing number of vehicles in the city will require proportional parking spaces and “the average car spends about 95% of its life parked.” (Shoup, Donald, 2005). The question is could we afford this much parking spaces in the future? If not, what better alternatives do we have?

Objective

The objective of the study was to explore answers to the following questions:

- Is the conventional approach of increasing supply to meet the growing parking demand appropriate?
- Will it survive in the long-run?
- Can a market-oriented approach of demand, supply and price, provide a better long-term alternative?Research Setting

Research Setting

Keeping in mind the time period of my internship and the wide area of the Walled City, I narrowed down my study to two sample areas within it namely Jauhari Bazaar and Bapu Bazaar.

Jauhari Bazaar is famous for its gems and jewellery shops. It's located close to the famous Hawa Mahal of Jaipur. Owing to its location and its market for gold and silver ware, it is frequented by not just the locals, but is also on the top list of every tourist. The market is spread on either sides of the main road. The road has a width of 18.29 meters[1] with 3.66 meters[2] curb space meant for parking on either side. Jauhari Bazaar has around 400 shops. Besides, jewellery it has shops selling garments, spices and Rajasthani handicrafts.

Bapu Bazaar is adjacent to Jauhari Bazaar and lies between Sanagneri Gate and New Gate. This bazaar is famous for its *Mojri* footwear locally known as *Juti*. It has around 190 dealing in fabrics and sari along with a variety of original leather goods like bags and purses, and local perfumes and trinkets.

Currently most of the parking is done on-street which is free. Other than the on-street parking, there are both commercial as well as Jaipur Nagar Nigam (JNN) paid off-street parking spaces run on contract basis by private bidders. There are four off-street parking places developed by the government to address the parking needs in this area namely, Sanjay Market, Ramleela Ground, Sanganeri Gate and Ramnivas Bagh. Ramnivas Bagh is currently under construction and is developed as a multi-level parking structure. Besides these off-street parking areas, the parking needs are also met by some of the off-street parking lots of commercial buildings. This includes the Navjeevan complex, Gem Parking, which was earlier used as a theatre and Sarougi Mansion Parking space.

The two bazaars are closed to each other which enabled me to study and evaluate the parking problem as a whole. I surveyed these bazaars to find what, when, where and to whom the parking problem occurred and affected and to scope out improvement in the current practice, if any, and their practical applicability.

[1] *As per the interview with Ashok Swami, Revenue Officer, Jaipur Nagar Nigam, Government of Rajasthan*
[2] *As per the interview with Ashok Swami, Revenue Officer, Jaipur Nagar Nigam, Government of Rajasthan*

Research Methodology

Data collection and analysis was mainly divided in two stages. First stage comprised the secondary data collection. This involved reviewing past studies and surveys done on the same topic. The literatures that were covered in this stage were:

- Jaipur Development Plan 2001-2011 by Jaipur Development Authority, (1996).
- Integrated Parking Infrastructure Project for the Walled City of Jaipur, Draft Final Report, October, 2000.

This stage provided the necessary information about the government plans for addressing the issue and parking demand data. Besides the above mentioned literatures, secondary data was also collected from government websites.

The second stage included the primary data collection which took place in three stages:

1. Field Trips: Direct on-field observations to assess the parking problems in these areas.
2. Interviews: Personal interviews with government officials and locals. The locals included the shopkeepers, shoppers and the off-street parking contractors.
3. Survey: Two kinds of surveys were conducted to assess different issues related to parking problems. The first survey was an online questionnaire for the shoppers visiting Jauhari and Bapu Bazaars. Fifty people were covered in the survey. The second survey was a personal questionnaire for the local shopkeepers in Jauhari Bazaar. A total of t31 shopkeepers were covered in this survey.

Main questions that guided the research were:

- What, where, when and to whom the parking problem occurred and affected: To learn the reasons, location, the peak hour of the parking problem and the people affected directly and indirectly.
- What is the response of the existing parking management and government to address the parking problems.
- Are the parking prices related to parking demand in these areas?
- What are the indirect effects of parking?
- What are the international best practices? Can we learn a lesson?

Literature Review of Some Past Studies

Master Development Plan-2011, Jaipur Region

- The plan has projected the population size of Jaipur city by 2011 to be 4.216 million and by 2016 to be 5.540 million. The plan has envisaged a four-tier development system. The first tier includes Jaipur city urban complex including settlements that form continuous development area. The plan has assigned a population size of 3.5 million to first tier and the spill over to the two rings of satellite towns, which form the second and third tiers of development.
- An extent of 270.0 sq km of land has been estimated to be brought under urban development in Jaipur City Urban complex (first tier of development).
- The plan has recommended that the Walled City area, which is of historical importance, to be conserved and treated as a Special Area. It has recommended decongestion of the Walled City area and has proposed relocation of the wholesale traders.

Integrated Parking Infrastructure Project for the Walled City of Jaipur, Consulting Engineering Services, 2000

Under the study to appreciate traffic and parking characteristics a number of field surveys were carried out. They included:

- Road Network Inventory Survey
- Classified Traffic Volume Count Surveys
- Speed and Delays Surveys
- Parking Surveys
- Opinion surveys
- Willingness to pay Surveys
- Shop inventory Surveys
- The salient findings of the study were:
- The variation in traffic between the working day and holiday is only 0.5%.

Traffic composition results show that two wheelers have maximum share varying from 39-47% followed by cycles which is from 17-35%t. Cars have share of 5-11% while the transport mode share vary from 0-2% only.

Parking duration results indicate that on-street parking duration for 70-90% of vehicles is only for 30 minutes, 5-15% vehicles are parked for one hour duration and the rest of the vehicles for more than one hour. At off-street parking sites parking duration vary from 30 minutes to 12 hours.

The study had also projected parking demands for both off-street and on-street areas using the traffic flow, floor area in abutting shops of the parking stretches and number of workers in abutting shops as

independent variables singly and in combination of all three to develop linear regression equations (simple and multiple).

Table 1: The demand projected for different time period by location

Serial No	Location	Mode	Year			
			2005	2010	2015	2020
1	Tripoliya Bazaar	Car	86	94	103	114
		Two wheeler	389	425	466	513
		Cycle	1073	1174	1289	1419
2	Jauhari Bazaar	Car	79	86	94	103
		Two wheeler	257	280	307	337
		Cycle	981	1071	1172	1287
3	Chaura Rasta	Car	80	88	97	107
		Two wheeler	193	212	234	258
		Cycle	1000	1098	1209	1335
4	Kishanpole Bazaar	Car	122	135	149	165
		Two wheeler	216	238	263	292
		Cycle	1531	1687	1864	2064
5	Nehru Bazaar	Car	91	98	106	116
		Two wheeler	356	385	418	455
		Cycle	1132	1224	1329	1447

Table 2: Projected Parking Demand at Off-street Parking Sites

Location	Mode	Time Period	Year			
		2000	2005	2010	2015	2020
Sanjay Market	Two wheeler	61	67	73	79	86
	Car	95	104	113	123	134
Sanganeri Gate	Two wheeler	40	44	48	52	57
	Car	20	22	24	26	28
Bapu Bazaar (E)	Two wheeler	27	31	35	40	46
	Car	0	0	0	0	0
Bapu Bazaar (W)	Two wheeler	114	130	149	170	195
	Car	0	0	0	0	0
Ramleela Ground	Two wheeler	65	74	83	94	106
	Car	28	32	36	41	46
Ramnivas Garden	Two wheeler	3	3	4	4	4
	Car	49	53	58	63	68

The study recognised following components as a part of integrated Parking Policy for the Walled City of Jaipur:

- Access Policy
- Supply of Parking Spaces
- Parking Pricing
- Public Transport Service
- Institutional Arrangement

This study recommended the following sites to be developed on the commercial format for the integrated parking infrastructure project.

Table 3: Statement of proposed Equivalent Car Space (ECS)

Serial No	Location	ECS
A	Sanjay Market	
	Lower Basement	73
	Upper Basement	52
	Surface Parking	75
	Total	200
B	Ramleela Ground	
	Lower Basement	170
	Upper Basement	144
	Total	314
C	Ramnivas Garden-Phase I	
	Lower Basement	158
	Upper Basement	151
	Total	309
	Ramnivas Garden-Phase II	
	Lower Basement	158
	Upper Basement	148
	Total	306
D	RSIC and Old Pension Office Building	
	Surface Parking(under stilt)	95
	First Fee	100
	Lower Basement	88
	Upper Basement	101
	Total	306
E	Rajasthan Chamber of Commerce and Industry Office and Directorate of Public	

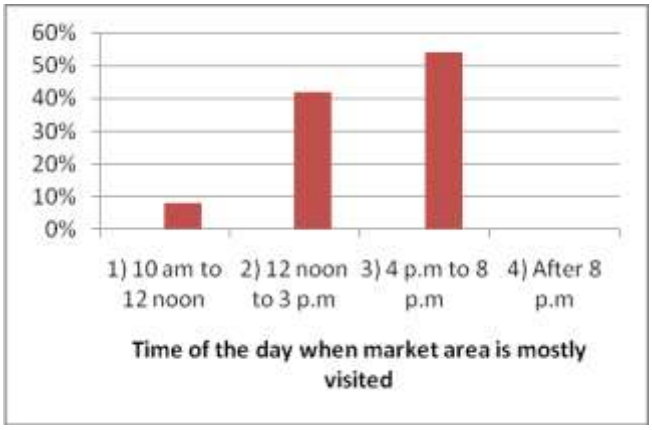
	Relation Building (DPR) premises	
	Surface Parking	145
	Lower Basement	131
	Upper Basement	114
	Total	384
	DPR	
	Surface Parking	25
	Grand Total	1928

Existing Parking Scenario

On-Street Parking: Under the provision of Rajasthan Motor Vehicle Rules, Rule 8.1(iii) Jaipur Nagar Nigam has assigned on-street parking spaces parallel to the shops in Jauhari Bazaar and Bapu Bazaar. Different parking spaces are allocated for two-wheelers, four-wheelers, rickshaws and auto-rickshaws on-street as per the rule. All these parking spaces are free parking spaces. In Jauhari Bazaar though, four wheelers are subject to a time limit of two hours. For the regulation of the two hours limit a traffic police inspector inspects the area every two hours and notes the vehicle numbers. On finding a four-wheeler been parked for more than two hours, the vehicle is towed.

Most of the on-street parking is haphazard and inefficiently utilised. Both the customers and the shopkeepers complained about a wrongly parked vehicle behind their vehicle in the questionnaire survey. In Jauhari Bazaar the two wheelers are parked in two lanes. Vehicles are so parked that little space is left for parking another vehicle in the second lane (away from the shop/close to the road). Roads in both the markets lack proper lining demarcating road lines and parking lines. Further the parking traffic is biased towards the two wheelers in both the markets. Peak parking demand was found to be in the evening between 4-8pm as revealed in the online questionnaire survey for the customers. 54% of the respondents visit these areas between these times. The survey revealed that 58% of the customers parked their vehicles for one-two hours.

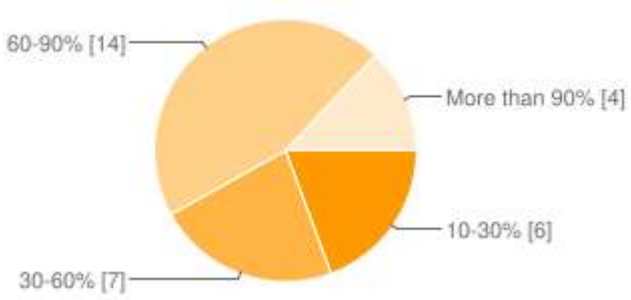
Figure 1: Time when the market is mostly visited by customers



Source: Online survey done under the study

On-street parking spaces is dominantly utilised by the shopkeepers. Around 45% of the shopkeepers in the survey answered that approximately 60-90% of the parked on-street vehicles belonged to the shopkeepers themselves pointing towards the long term use of these parking areas.

Figure 2: Percentage of shopkeepers' vehicles on-street



Source: Personal Questionnaire Survey done under the study

At present, the total on-street demand in Jauhari and Bapu Bazaars is 295 ECS and 47 ECS respectively. Comparatively the parking supply in Jauhari and Bapu Bazaars is 555 ECS and 70 ECS respectively indicating that there is a supply surplus instead of shortage.

Table 4: Current On-street Demand and Supply in Jauhari and Bapu Bazaar

S. No	Location	Supply (ECS)	Demand (ECS)
1	Jauhari Bazaar	555	295
2	Bapu Bazaar	70	47

Note: Demand is interpolated from the estimated demand data by the study done by CES(2000)

In 2000, Bapu Bazaar was pedestrian, its current on-street demand is interpolated from the estimated off-street demand by the study done by CES (2000), assuming that the on-street parking demand was shifted to off-street parking areas.

Calculation for total on-street supply:

1 ECS= 2.5X10 m^2

Jauhari Bazaar

Total Stretch of Jauhari Bazaar (adding parking stretch both sides) = 1387.13 metre

Assuming, parking is done perpendicularly on either side of road stretch.

Total supply= 1387.13/2.5 = 555 ECS

Bapu Bazaar

Total stretch of Bapu Bazaar (adding parking stretch both sides) = 695.4 metre

Parking width= 2.5 metre

Assumption: Parking is done parallel to road, for road is narrow.

Total parking area = 695.4X2.5 = 1738.5 m^2

Parking supply= 70 ECS

The current demand and supply analysis is contradicted by the findings of online survey. It showed that 98% of the online respondents complained about parking problem in these areas. This point to the fact that these parking spaces are not efficiently utilised and therefore there is an acute need to look into this matter.

On-street parking in Jauhari Bazaar. Picture showing the inefficient utilisation of parking spaces.

On-street parking in Bapu Bazaar. Inefficient utilisation of parking spaces.

Off-Street Parking: JNN has allocated four off-street parking areas close to Jauhari and Bapu Bazaars namely Sanjay Market, Ramleela Ground, Ramnivas Bagh and Sanagneri Gate (Bapu Bazaar Vyapari Mandal parking). Out of these four parking areas, Ramnivas Bagh parking is now developed as a multi-level underground parking. Sanganeri Gate parking is exclusively reserved for the shopkeepers of Bapu Bazaar and is operated by the Bapu Bazaar Vyapari Mandal. JNN runs the public off-street parking spaces on contract basis for one year. These contracts are given to the highest bidder in the auction. Currently, Sanjay Market parking area is the only one among the four which is running on contract basis and although at present nobody is operating the Ramleela Ground parking area, it is still open for parking. Parking charges for the off-street public parking spaces are regulated by JNN which are as follows:

Table 5: Jaipur Nagar Nigam Off-Street Public Parking Charges

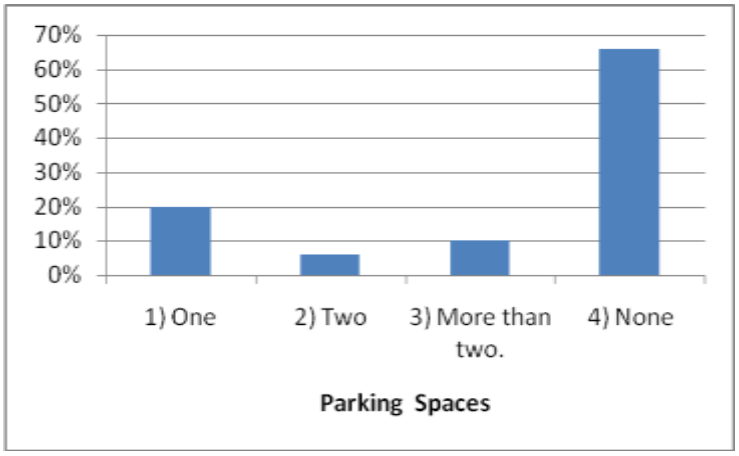
S. No	Duration	Two-Wheelers	Cycle	Cars	Bus
1	First 3 Hours	Rs 3	Rs 2	Rs 10	Rs 30
2	3 hours-12 hours	Rs 5	Rs 3	Rs 15	Rs 50
3	12 hours-24 hours	Rs 10	Rs 5	Rs 20	Rs 100
4	Monthly	Rs 150	Rs 75	Rs 400	Rs 1500

Source: Jaipur Nagar Nigam Terms and Conditions for Off-Street Parking contracts

Interview with the Sanjay market parking contractor Mohammad Shafi Kureshi revealed that about 40% users were Jauhari and Bapu Bazaars shopkeepers, 30% users were local residents and the remaining parking was used by short-term users. Since, Ramleela Ground is not operated by anybody information about its parking capacity was not available. The cost and revenue analysis of Sanjay Market off-street parking space reveals great loss to the contractor pointing that the current parking prices are inadequate to recover the costs. Further cost and revenue analysis based on the parking fees charged by the contractor revealed that even these prices were insufficient to recover the costs, which also opens the prospects of illegal off-street parking in the area which is not designated to the contractor legally. Other Finding of the conducted surveys

More than 60% of online respondents were unaware about the off-street parking lots near Bapu and Jauhari Bazaars. This lack of information about the vacant parking spaces directly influences the cruising time of finding parking spaces.

Figure 3: Percentage of customers knowing about off-street parking spaces.

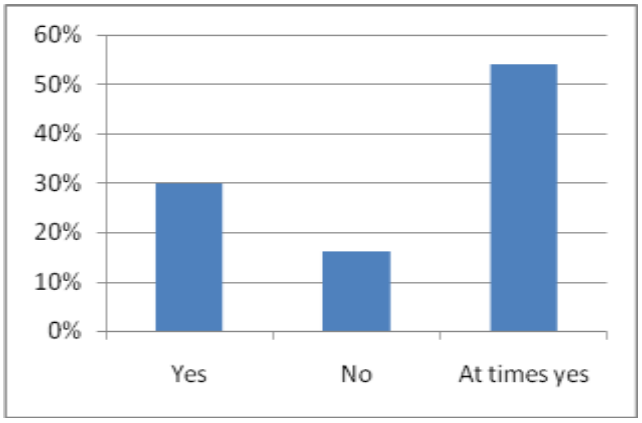


Source: Online survey conducted under the study

One question in the online survey was the choice that customers usually make while visiting an area based on the parking scenario. Respondents were asked if the parking problems influence their travel choices to these areas. Around 30% strictly avoided and more than 50% 'at times' avoided visiting these places. This question is very important and need not just be seen as a reply to absence of vacant parking

spaces. Parking problem comes with various negative externalities (loss of precious time in cruising and also on finding a wrongly parked vehicle, etc.) and therefore a presence of these combined effects should be seen as a cause of this reply.

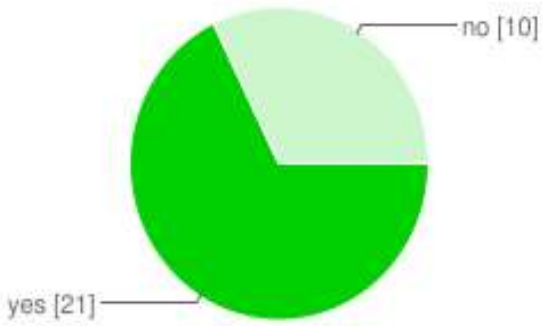
Figure 4: Percentage of Customers whose travel choices are influenced by parking conditions.



Source: Online survey conducted under the study

One other interesting finding was the understanding of the shopkeepers of customers' priority of visit that is influenced by parking. About 29 out of 31 contacted shopkeepers accepted the influence of parking on their business. This was also pointed by their willingness of keeping the on-street parking spaces for the short term users (customers).

Figure 5: Should the on-street parking spaces be only meant for customers? Shopkeepers' response:



Source: Personal Questionnaire survey conducted under the study

Case Study: Cost and Revenue Analysis, Sanjay Market Off-Street Parking Area

- Total number of cars per day: 200
- Contract price: 17.5 Lakh
- Number of employees: 6-8
- Salary per worker per day: Rs 150-200
- Expenses on stationary per day: Rs 8-9
- Other expenses (like snacks, etc.): Rs 100 per day
- Nature of the areas: Open parking space
- Characteristics of parkers: 40% Jauhari plus Bapu Bazaar shopkeepers, 30% residential parking and rest short-term users.

Cost and revenue analysis of Sanjay Market based on the above information.

Table 6: Total Revenue of Sanjay Market

Type	Number of cars per day	Revenue 1 (JNN Prices) per month	Revenue 2 (Prices charged by the contractor) per month
Long-term users (Shopkeepers from Jauhari and Bapu Bazaars)	80	80X400 = Rs 32,000	80X400 = Rs 32,000
Local residents	60	60X400 = Rs 24,000	60X400 = Rs 24,000
Short-term users	60 (0-3 hours)	60X10X30 = Rs 18,000	60X15X30= Rs 27,000
Total	200	Rs 9,84,000	Rs 10,92,000

Table 7: Total Expenditure of Sanjay Market

S.No	Source of Expenses	Expenses
1	Contract Cost	Rs 17,50,000
2	Employee Salary	Rs 4,47,000
3	Stationary	Rs 2,920
4	Others	Rs 36,500
5	Total	Rs 22,36,420

Source: Interview with the Sanjay Market parking contractor, Mohammad Shafi Kureshi

Figure 5: Prices charged by the contractor.

Current Policy Response

In order to meet the growing parking demand Jaipur Development Authority is now building an underground multi-level parking at Ramnivas Bagh. Recently, to address the issue of on-street parking in Jauhari Bazaar and to make it a modal road, the government has allocated parking spaces of 50 cars each in Sanjay Market and Ramleela ground to the shopkeepers of Jauhari Bazaar and have continued with the two hours parking limit for four-wheelers. Further, the work of demarcation of parking lines, road lines, parking areas for city buses, auto-rickshaws, cycle rickshaw stands and disabled is proposed. Other recommended proposals involved construction of ramp to the pedestrian area, removal of stray animals and encroachments.

Market–Oriented Approach

Market-oriented parking ideas have a long history (for example, Roth 1965) but have only recently received attention through the work of Donald Shoup (2005).(Asian Development Bank report). As described in the report, this approach seeks to 'let prices do the parking'. Market-oriented approach opens up the market for parking where parking demand and supply respond to market-based parking prices and in which there prices are responsive to supply and demand conditions.

The problem of spill over is defused as a problem via pricing (both on-street and off-street) that can adjust easily in the face of demand changes. Parking supply is expected to respond to these price signals. This may then promote parking as a business and invite private sector to play a major role.

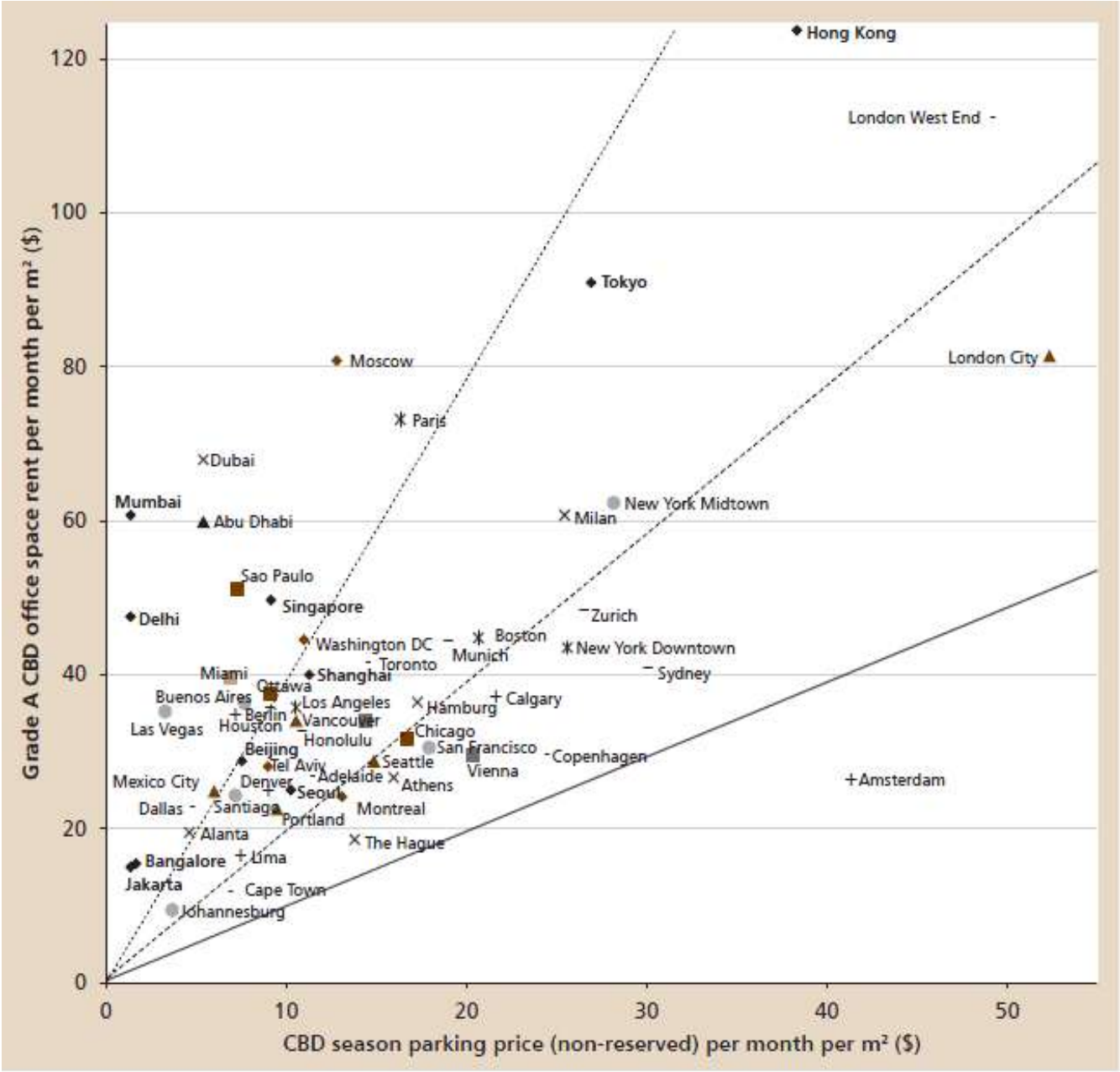
Why Market-Oriented Approach?

High Cost of Parking: The current parking prices reflect the absence of evaluation of the actual cost of parking spaces. The opportunity cost of parking spaces is very high, yet it is neglected while calculating the parking prices. This also hinders the growth of parking as a business and thus stops the entry of private firms. A normal car requires a space of 25 squares per meter, the same space when used on rent costs a monthly charge of Rs 21,500 at Rs 860 per square meter[3] compared to a monthly charge of Rs 400 in the off-street Sanjay Market. The per day cost of parking would be Rs 716, which means that if we assume that the parking space is used for 12 hours a day then per hour parking cost would amount to around Rs 60 per hour for a car. The current parking price of Rs 10 is way too little as compared to the opportunity cost of parking. Same concerns were also voiced by India's National Urban Transport Policy, Government of India, 2006, which suggested "Levy of a high parking fee, that truly represents the value of the land occupied, should be used as a means to make the use of public transport more attractive."

[3] *As told by a shopkeeper of Bapu bazaar in an interview.*

Figure 6 compares the parking prices to rent ratio of per square meter per month in various cities across the world. Cities in the left corner have higher parking prices than rent prices whereas cities in the right corner have considerably very low parking prices.

Figure 6: CBD Parking Prices Compared with CBD Grade A Office Rents In Many International Cities



Source: Parking Policy in Asian Cities, Asian Development Bank, 2011.

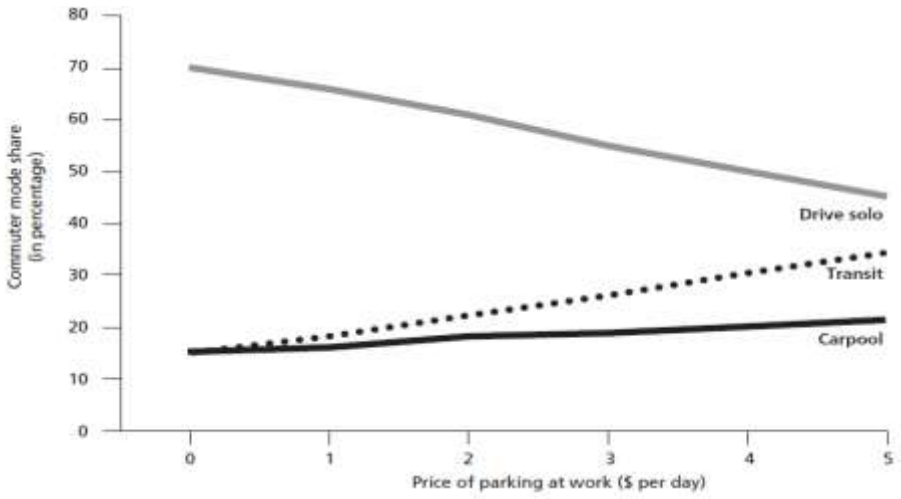
Cost Recovery of the Government owned off-street Parking lots Study done for the Integrated Parking Infrastructure Project for the Walled City of Jaipur does not call the project to be financially viable with lower charges when full parking is allowed inside the walled city as well. It only calls the project financially viable when partial or complete restriction of parking inside the walled city is done along with cost increase by 10% and revenue reduction of 10%. This reasons the difficulty faced by the government in persuading the private companies to develop these parking structures. Similar difficulties are also

faced by Ahmedabad, Dhaka and Ha Noi cities. The alternative sources of revenue generation in these models such as commercial floors indicate the large cost recovery gap.

Market pricing would help greatly in cost recovery (as pointed by the Asian Development Bank, 2011 report), but still does not guarantee cost recovery since prices can be depressed by various factors, such as parking requirements, underpriced on-street parking, and being too liberal in allowing vacant lot parking. This calls for an integrated parking management and pricing mechanism.

Pricing as a demand rationing tool: The demand and supply analysis of the area tells us that even today, if we increase the supply of parking spaces, sooner or later the demand will outrun the supply. This would then require an increased supply generation. As already calculated the opportunity cost of parking spaces is very high and not practical implying that an increased parking supply would cost us dearly. In order to address this problem there is a need to discourage demand by discouraging car usage. Market driven pricing can prove to be an important tool to curtail the demand and encourage people to use public transport more. Donald Shoup states, "Providing anything for free or at highly subsidised rates encourages overuse and means that more parking spaces have to be provided. Therefore, charging users for parking is a market based approach that passes the true cost of parking to users and encourages use of other transportation modes". The estimates available from Todd Litman of Victoria Transport Policy Institute, shows that only a 10% increase in parking charges can reduce vehicle trip by 1-3%. Shifting from free to cost recovery parking rates can reduce automobile commuting by 10-30% especially if linked with transportation choices and complementary travel demand management measures. International surveys shows that nearly 35% would consider shifting to another mode if they were required to pay for parking with fees of $1-3 per day in suburban locations and $3-8 per day in urban locations.

Figure 7: Parking prices affects mode choices



Source: CSE India, 2009. *Choc-a-Block: Parking measures to address mobility crisis*. New Delhi: Center for Science and Environment, Clean Air Campaign

The recent announcement from the Union Ministry of Urban Development in January 2009 on the funding scheme for purchase of buses and urban transport systems under the Jawaharlal Nehru Urban Renewable Mission (JNURM) gives another reason to adopt market based prices. It has created a mandate for cities to develop parking policies as a car restraint measure. To be able to access this fund the city governments will have to give commitments to initiate institutional reforms for public transport

management and implementation, create dedicated funds from revenues from variety of sources including higher taxes on personal vehicles and diesel cars, among other measures. The key conditions include parking policy wherein parking fees represent the true value of the land occupied; which is used to make the public transport more attractive; bans parking on arterial routes; and multi-level parking centres are used more as park and ride facilities etc.

Regressive Use of Taxpayers' Resources: The current off-street parking is under priced; the prices are not enough to recover the parking costs implying a subsidy from taxpayers. Jaipur has a modest vehicle ownership of 293 vehicles per thousand persons, government subsidised parking is thus a regressive use of taxpayers' money. Existing low parking prices provides a hidden subsidy to rich car owners thereby making it essential to switch to a new policy of charging the parkers directly through market based prices.

What is the right parking price?

As much of our above discussion on market-oriented approach involved market-based prices. Our next question therefore should be "What should be the right price?" A right parking price that helps us to ensure all of the above mentioned targets. The general opinion about parking prices is whatever the parkers like to pay or are accustomed to. This overlooks the opportunity cost of parking and its implicit economic cost.

For the on-street parking spaces Vickery (1954), Roth (1965), Shoup (2005) have argued that the right price at any particular time and place is that which ensures enough vacancies for zero parking searches, thus minimising external impacts on traffic. This would help in a market-based approach by providing a responsive price signal for actors in the local parking system. This would involve assessing the peak hour demand and making prices responsive to it. Thus, the parking prices should vary on an hour to hour or day to day basis, depending upon the peak demand. For example, the peak hour demand on the basis of customers' response was found to be in the evening from 4-8pm. This means during this time parking prices can be kept high in order to ensure that supply is equal to demand ensuring enough parking spaces to zero parking searches. Similarly parking prices on weekends or festival seasons like Diwali can be adjusted according to the demand. The commercial attractiveness of a region should play an important role in deciding prices.

For the off-street parking spaces cost recovery is an important factor in deciding the prices. This involves the assessment of the opportunity cost of using a piece of land for parking is an important component towards calculating the parking price for cost recovery as voiced by the Urban Transport Policy, Government of India, 2006.

Lessons from other Countries

Taipei City: The policy of the city government of Taipei City on the pricing of parking of both on-street and off-street is very close to demand-responsive ideal as discussed above. Saturation is a key criterion for pricing reviews, which take place every six months. Occupancy of 80% triggers an upward revision, while occupancy below 50% triggers a downward revision. However, in practice, this is subject to local political processes which often stall such price adjustments. Attendants with digital handheld devices issue tickets and attach them to vehicles at regular intervals. Motorists pay later at various places, including convenience stores. Parking meters also exist and accept contactless payment cards.

Tokyo: Tokyo complements its on-street pricing with time limits. Since 1 June 2006, enforcement against parking violations has drastically reduced congestion in major cities. Prior to June 2006, police used to enforce the parking regulations. They used to check how long cars had been parked in banned areas periodically, marking cars' positions with chalk and ticketing them if parked longer than 15–30 minutes. Post revision of the Road Traffic Law, private firms have been designated the responsibility of tickets for parking violations regardless of the number of minutes vehicles have been parked in banned locations.

These reforms have been assessed to be successful. The parking fines for regular cars range between 10,000-18,000 yen (US$86–155), depending upon the type of violation. Strict enforcement along with no grace period (15 minutes or more of "free" parking for drivers) led to expensive on-street parking, which costs 10,000 yen (US$86) as a penalty fee for parkers. This implementation effectively increased the on-street parking prices for drivers and also increased average parking prices in major cities in Japan at the same time. Three months after the implementation, the National Police Agency reported a decline in illegal parking on main roads in Tokyo (73.9%) and Osaka (73.3%), reduced congestion length on main roads from 27.3-23.1% at 2-4pm, and increased travel speed at 2-4pm by 9.5% and 11.8% respectively, compared to the same period of the previous year.

Hanoi: A number of streets in city core declared no-parking streets, meaning no parking of motorcycles or cars on footways or curb side (seems to be enforced effectively). The police use towing as a routine enforcement tool. One punishment is impoundment for 15 or 30 days, but this is burdening parking facilities of the Hanoi Parking Company.

Aalborg: The city has set up a parking guidance system. The real-time information is provided to motorists on main roads to city centre about the availability of parking spaces in the centre city parking facilities. As a result, the percentage of drivers unable to park in Aalborg reduced from 21% to 9%. This reduced extra driving of 930 kilo-meters per day. The pollutants reduced by 0.1%.

Helsinki: In the inner city, on-street parking in CBD area and in front of the business block is mainly reserved for short-term parking. In residential areas most on-street parking is reserved for residential parking. This is further backed by a dynamic parking guidance system in the city.

Bremen: It has an interesting pricing mechanism for parking that encourages greater use of public transport and discourages parking demand. There is no free or unregulated parking in urban centres. The parking prices are demand responsive (higher prices at attractive locations.) Parking prices are so fixed that the car use plus parking charges should not cost less than using public transport. As a result, 50% of trips to city centre are made by public transport and 22% by cycle. Public transport is used by 58% of the shoppers in the central district.

Chicago: Parking charges were raised by 30-120% to bring them up to market rates. This resulted in 35% decline in the number of parked cars. The number of all day parkers arriving before 9.30 am dropped to 72%.

Bogota: As part of the city's programme to reduce private car use was to increase public parking fee and to remove limit on the fees that private parking companies could charge. The additional revenue is dedicated to road maintenance and public transit service improvement.

Possible Solutions

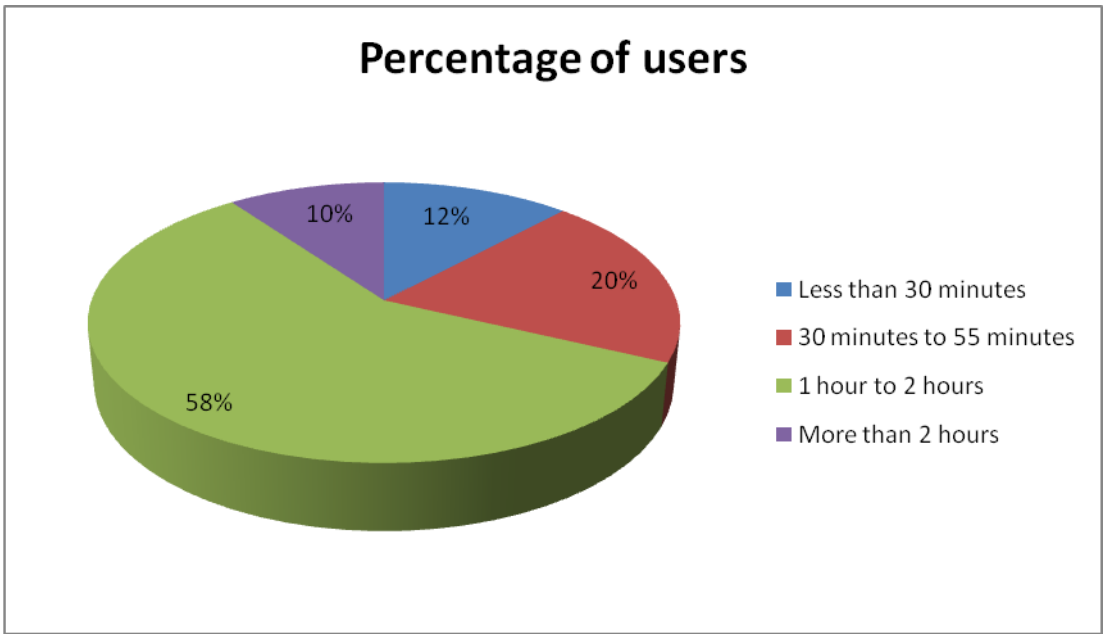
Parking solutions in Jaipur can be divided into two stages. First one addressing the parking problems keeping in mind the time required in developing the required infrastructure and facilities in the city, for example, a sound public transport system. The city is moving in the right direction of developing sound public transport in the form of BRTS (Bus Rapid Transit Service) and Jaipur Metro, which will play an important role in the future in solving parking problems. But for now, when a sound public transport system is under process, we must explore solutions that may help the current parking problems.

As the current demand and supply analysis showed that it is not the shortage of on-street parking which is the problem rather the inefficient utilisation of it, this calls for alternatives to ensure better utilisation of on-street parking places. One of the easiest ways could be operating on-street parking spaces by private bidders similar to the off-street parking and charging fees for parking.

Next, step towards proper on-street parking management should be recognition of long-term and short-term users. Survey under study said that around 69% of on-street vehicles belonged to the shopkeepers themselves pointing towards a long-term use of a considerable amount of on-street parking. This means that significant parking spaces remain blocked for a very long time or in other words remain reserved. Shared parking or multiple usage of the same parking space is a better and efficient parking technique. The current policy response of shifting the shopkeepers' four wheelers to off-street parking space is a step towards the same. Yet, what needs to be understood further is, on-street parking traffic is hugely biased towards four-wheelers and therefore shifting of long-term four wheelers to off-street parking lots would be a half targeted approach. There is a need to recognise long-term two wheelers as well and shift them to off-street parking spaces. This policy mainly calls for encouraging short-term users to use more of on-street parking and long-term parkers to off-street parking. Prices of parking are an important tool to influence parking choices. Till we keep our on-street parking under-priced or free compared to off-street, the former would always be a more attractive choice for it not only would be cheaper, but also more convenient. Therefore pricing of on-street parking should be higher than that of the off-street parking spaces. What is important here is that instead of making off-street parking cheaper than the on-street parking, the latter should be kept demand responsive and regularly revised as done in Taipei City.

Priced parking can also be combined with time limits for better effect. This would mean that for a certain time limit on-street parking can be kept at nominal prices, but any parking above the said time limit would be charged dearly. This would increase the frequency of per square usage of on-street parking. The current online survey revealed that around 58% of the customers visiting Jauhari Bazaar and Bapu Bazaar spent between one-two hours, 20% between 30-55 minutes, 12% less than 30 minutes and 10% more than two hours. Since the major users use a parking space between one totwo hours, if we reduce the parking limits to one hour then we can provide three times more parking spaces to customers using parking spaces for 30-55 minutes, six times more space to users using parking space less than 30 minutes.

Figure 8: Duration of parking by customers in Jauhari Bazaar and Bapu Bazaar



As previously discussed the online survey showed the paucity of information regarding the off-street parking spaces among the customers. The lack of information directly affects one's cruising time on road for finding vacant parking spaces. This not only eats away the time of the parker, but also adds to the traffic, and in the case of the already congested traffic in the Walled City is highly unacceptable. As seen above, parking conditions also influence one's choice of travel therefore one needs to be very particular about ensuring that the parking experience of a customer is hassle free. This would mean that the customer gets a parking place quickly and his travel time to the destination place does not include extra cruising time to find a place for his vehicle to park. Further, if we see the examples of other cities like Aalborg (mentioned above), a sound guiding system has reduced the percentage of drivers unable to park from 21-9%. This reduced extra driving of 930 kilo-meters per day. The pollutants reduced by 0.1%. We can learn from this and can ensure a sound information system about vacant parking places both on-street and off-street for the parkers. The exact model of implementation of this was beyond the scope of this study, but a rudimentary plan can be the collection and processing of information on vacant parking spaces from various on-street and off-street parking spaces through CCTV cameras. This information can then be displayed at every entry gate along with the side walls of the veranda facing the roads.

The second stage of policy should be designed keeping in mind the future demand and supply of parking spaces. In the long run even after the efficient utilisation of parking spaces, demand will outrun supply. This makes the construction of proposed multi-level parking structures insignificant, even if in the long run we are backed by good public transport like the Metro and BRTS. For a good public transport system in itself does not ensure its greater usage. One can easily see this reasoning in the words of Donald Shoup (2005):

Off-street parking requirements encourage everyone to drive wherever they go because they know they can usually park free when they get there: 87% of all trips in the US are now made by personal motor vehicles and only 1.5% by public transit.

Despite the fact that the US has one of the most developed public transport system it could not encourage a greater use of public transport. In order to ensure that the parking supply does not fall short of parking demand in the future, the correct approach is not increasing the supply but discouraging the demand. For example, the total number of registered vehicles in 2009-2010 in Jaipur district was 15,49,737 on the basis of this if we extrapolate the total number of registered vehicles in Jaipur district in 2020 it would be around 51,51,19,587. This means we need to develop parking structures equivalent to accommodate these many vehicles. If we calculate the total parking area for these many vehicles, on the basis one 1 ECS = 25 sq. meter, total area needed to park these many vehicles would be around 12,87,79,89,675 sq. meter. The question is can we afford this much parking at the cost of other alternative uses to which this much space can be put to? The answer is an open no. Therefore the correct policy should be focused on discouraging demand and not increasing supply to meet this demand. It is here that the market-oriented parking policy plays an important role. As already discussed and seen pricing is an important tool to ration parking demands. High work place parking prices encourages more people to use public transports and carpool alternatives. As already mentioned, this policy should be backed by a sound public transport and therefore should be the long run plan of Jaipur City when Metro and BRTS would provide better public transport alternatives to people. The parking prices should be kept demand responsive and regularly revised on hourly and daily basis.

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