



International Journal of Advance Engineering and Research Development

Volume 4, Issue 4, April -2017

“ON –STREET PARKING: A BIGGEST PROBLEM OF URBAN STREETS”

Rakesh j prajapatil¹, Jayesh Juremalani², N.B Parmar³

¹Post Graduate Student, Civil Engineering Department Parul Institute of Engineering & Technology

²Assistant Professor, Civil Engineering Department Parul Institute of Engineering & Technology

³Professor, Civil Engineering Department Parul Institute of Engineering & Technology

Abstract: Parking is considered to be one of the major issues for all the urban streets of developing cities of the world. Specially in India on-street parking has been the burning problem of the metropolitan cities like Mumbai, Kolkata, Chennai, Ahmedabad, etc. Problems like reduction in carriage width, congestion, and increase in number of accident are the results of improper on street parking management. The global exposure says that Paid parking can be one of the effective tools for managing the on-street parking problem. The benefits of such a paid policy are shown to depend on the improvement in search externalities in the on-street parking market itself, plus effects on other distorted urban transport markets, including congested freeway and backroad use, mass-transit and off-street parking. But, the policy variables that play a part in mode choice decisions for commuters are the parking cost and the travel time by transit, and the results suggest that raising the cost of parking at work sites and decreasing the transit travel time (by improving service and decreasing headways) will reduce the drive alone mode share. Thus the present paper is an attempt to know the review of the parking research going on into the world. The attempt is made to summarize the effective steps that can be taken in order to reduce the extent of parking problem.

Keywords- On-street parking, parking demand, parking cost. Paid parking policy

I. INTRODUCTION

The economics of parking has traditionally been something of an ‘ugly sister’ in the field of transport economics research. Only a handful of articles appear in the mainstream literature¹. And this is despite the fact that nearly all cities intervene on a regular basis in the urban parking market. The majority of the literature is devoted instead to sophisticated pricing solutions to the problems of congestion and air pollution, such as road tolls, which almost no cities have adopted. When commuters can park their cars free at work, they are more likely to drive alone. American employers provide 85 million free parking spaces for commuters. Approximately 91 percent of commuters in the U.S. drive to work, and 92 percent of the cars driven to work have only one occupant [1]. Using data from the 1990, Nationwide Personal Transportation Survey (NPTS), Shoup (1995) estimated that parking is free to the driver for 95 percent of automobile work trips. Employers encourage solo driving to work when they pay part of the cost of the commute trip — the parking cost — while requiring the employee to pay only the driving cost. This leads to a significant reduction in the cost of driving to work, thus encouraging more driving. By offering their employees free parking at work, employers stymie public goals of reducing solo driving and increasing the use of carpooling, transit, walking, and bicycling for the commute to work. The downtown areas of major cities are typically congested. According to the Experience of papa costa in China and other countries indicates that parking demand control can be an efficient tool for restricting traffic flow in and out of a downtown district. Outside China, research on the effect of parking fees in reducing automobile usage began in the 1960s. Many economists hypothesized that zone-based parking pricing by geographic district was practical, but little information is currently available to systematically apply this theory to Chinese cities. Two categories of factors affect people’s choice of travel mode: Individual traveler attributes such as gender, age, income, and car ownership and so on; and external factors such travel time, traffic policies, fare structure, quality of transit service, etc. Hence the present paper is an attempt to understand the various parameters and the research taken place in the field of on street parking and to have a brief review of the global scenario of parking policies.

II. OBJECTIVES

The aim of the paper is to understand extent of the on street parking problem and to brief the various methodology and the techniques adopted to solve the problem. The main objective of the research was as follows:

- a. To understand the parking problems and their effect on the users.
- b. To summarize the tools and techniques adopted by different cities all over the world for managing parking problem.
- c. To identify the variables affecting the response of the people towards the paid parking policy.

III. LITERATURE REVIEW

3.1 General

Parking is free in most parts of all Indian cities. Even the priced parking is very low. Indian cities are known to have the lowest parking fees in the world. But this needs to change if parking strategy is expected to reduce travel demand and car usage. But some regressive trends have also set in as evident in the recent case of Khan Market, a posh Commercial area in Central Delhi where the traders have fought to assure free parking to the rich clientele.

The key question today is how the available legal parking spaces can be utilized to highest efficiency and financial viability. How new parking facilities may be developed as a multi-use shared amenity to increase efficiency in use of space, time and finances. International experience shows that efficient utilization of the existing legal parking lots can increase parking capacity by at least 20-40%. It will prevent illegal parking and also free up space from parking. A management strategy that hinges on charging for parking, stopping parking on walkways, and adding on-street roadway parking can also generate parking surplus. The worldwide scenario of parking problem can be understood by referring some research work on parking problem, parking management and parking measures in whole world. The literatures are as below:

3.2 Parking demand modelling

John Golias et al in the paper "Off street Parking Choice sensitivity" published in journal Transportation planning and Technology (2002), had conducted a questionnaire-based survey and the stated preference method was used to develop an explanatory model. The model assessment showed that parking cost has, as expected, the most important impact on the choice of parking alternatives. Furthermore, all other variables with a significant impact on parking choice are time related, i.e., search time for a parking space, duration of parking and walking time from the parking space to the final destination. It is also shown that parking choice decisions did not depend on driver and trip characteristics. The utility model developed by them is as follows:

$$U_p = 1.2940 + 0.2137 * D - 0.0512(TW/GTS) - 0.0056 * (C/GTS).$$

D=Duration of parking

TW/GTS=Ratio of Walking time to Searching time.

C/GTS=parking cost/searching time.

Angel Ibeas et al in the paper "Modeling demand in restricted parking zones" published in journal Transportation research part A (2011), had tried to develop the linear regression and weighted regression model for the demand of the parking in restricted zones in western cities of Greece. The equation developed represented that the parking demand is the function of parking capacity, high turnover spaces, and land use and vehicle ownership. The equation developed is as follows:

$$P = B_0 + B_1 (PLA) + B_2 (HTURN) + B_3 (SRES) + B_4 (VEH).$$

PLA=Parking Capacity

HTURN=Number of high turnover spaces where the residents permits is not valid.

SRES=residential surface area of zone in square metres.

VEH=Number of vehicle belonging to household in the zone.

Priyanka Kolhar in her paper entitled "On street parking management plan and cost benefit analysis for Dharwad City, Karnataka, India" has tried to develop the parking demand equation as the function of different types of purpose for visiting COMMERCIAL area and the Frequency of the visit. Also, an attempt was made to find the cost benefit analysis for the paid parking scheme if implemented. The paper of the author is published in journal International Journal of Engineering research and applications (2012).

The parking demand equation developed is as follows:

$$P = 0.661 + 9.012A + 8.51B + 4.7C + 6.091D + 4.563E \text{ with } R^2 = 0.967$$

A=Shop owner B=work C=Shopping D=Other E=Education

$$P = 0.337 + 7.093A + 8.59B + 9.16C + 5.19D \text{ with } R^2 = 0.959$$

A=daily B= Twice in weekly C=Weekly Visit D=Occasionally

Shoup (1999) explains that the availability of free or underpriced curb (on-street) parking creates a classic problem. Studies have found that between eight per cent and 74 per cent of cars in congested traffic were cruising in search of curb parking, and that the average time to find a curb space ranged between three and 14 minutes. Shoup explains towns and cities can eliminate the economic incentive to cruise by charging market-clearing prices for curb parking spaces. That is to reduce the 'cruising' time, on street parking locations need to charge to create turnover of the space. Shoup puts this 'vacancy' rate at around 15 per cent. Depending on the location [or time], to achieve the same 15 percent vacancy rate, it is needed to charge more than at locations [or times] with less demand.

3.3 Parking Costs and charges

Shoup (1997) in a US context highlights that the problem is neither a shortage of parking nor an excess of cars, but fundamentally it is free parking. This is supported by evidence that free parking is fundamentally unfair as it is essentially a subsidization of car driving by those who use alternative modes of transport. Shoup (1999) develops the case by explaining how the cost of free parking "stimulates the demand for vehicle travel" which in turn puts pressure on town planners to allow higher minimum parking requirements, negatively impacting accessibility.

According to T Litman (Victoria Transport Institute, 2010) parking spaces need to be priced

- To cover land cost- opportunity cost
 - To Control demand
 - To prevent market from being distorted
 - To generate revenue for maintenance.
- Ideally, the prices for the on-street parking should be based on
- Actual land cost
 - Directing and delay
 - Accessibility
 - Turnover and accumulation
 - Congestion Pricing
 - Spill over Impact

Using studies from Edinburgh, Rye et. al. (2005) highlights that if there is an increase in cost of parking, than there are five major effects on driver behavior. Drivers either:

1. Change parking location,
2. Change the start time of journey,
3. Change travel mode,
4. Change destination or;
5. Cancel the trip.

3.4 Parking prices and Travel behaviour

Willson and Shoup (1990), in their study on employer-paid parking and its effect on mode choice, found that free parking encourages single-occupant vehicle (SOV) driving. This makes sense considering the fact that the subsidy of free parking makes driving cheaper. Also telling is that when employers reduced or eliminated free parking, SOV driving decreased, and carpooling and transit use increased. Consequently, another negative outcome of free (or cheap) parking is SOV driving.

Hess (2000) had done research on effect of free parking on commuter's choice and observed that policy variables like parking cost and improved transit travel time play a part in mode choice decisions for Commuters. The results suggest that raising the cost of parking at work sites and decreasing the transit travel time will improve the carpool mode share. This concludes that land use is a significant factor in mode choice decisions.

Shoup & Manville (2005) recommended that if curb parking is properly priced, the market could easily regulate the number of parking spaces. Eliminating minimum parking requirements would reduce the cost of urban development, improve urban design, unburden enterprise, reduce automobile dependency, and restrain urban sprawl.

Kelly and Clinch (2006) study the price sensitivity of on street parking for business and non-business trips. Their study in Dublin (Ireland) shows that the gap in price sensitivity between business and non-business trips increases as the price of parking rises. At first the impact of a change in the price of parking affects all trip purposes in the same way, but as price further increases, a progressively widening gap between business and non-business trips arises.

3.5 Parking in Commercial Areas

Searching for a parking space in COMMERCIAL area can cause stress when travelling by car or a private mode. This may be accounted to limited off-street parking space and high on street parking demand. The study carried out by Tsopelas, Ling and McCarthy (2002) reflected this conclusion. They undertook before and after interviews: the first survey was of 873 drivers; the second of 101 (who had agreed to participate in the first survey); and the third of 889. The second survey was seven months after the initial operation and the third was one year after implementation. Parking guidance and information systems, such as the web-based system described in their paper, have been developed to reduce the time spent in the search of parking space and to increase the overall efficiency of the traffic network.

David A. Hensher et al. (1999) investigated the role of parking pricing and supply by time of day in whether to drive and park in the central business district (commercial). A stated preference survey of car drivers and public transport users was undertaken at a number of parking locations, public transit interchanges, and shopping centers in Sydney commercial during 1998. The three parking locations were defined by hours of operation, a tariff schedule, and access time to the final destination from the parking station. Data from the survey were then used to estimate a nested logit model of mode and parking choices, which was then used to simulate the impacts of supply pricing scenarios on commercial parking share. The change in commercial parking share attributable to supply by time of day is less than 3%, compared to 97% attributable to parking prices.

Nandan Dawda et al (2015) concluded that for Indian cities demarcation of parking lanes, absence of parking spaces, etc. has resulted into chaotic parking behavior, double lane parking and high congestion level on the urban streets. The lack of enforcement has encouraged people to park more illegally in urban area.

3.6 Park and Ride

To encourage the use of public transport, additional parking spaces might be provided outside urban areas to for drivers to Park-and-Ride (P&R). P&R is seen as one means of securing access to congested town and city centers while maintaining the flexibility of car use and ensuring that visitors from as wide a catchment area can reach shops and employment etc.

Parkhurst (1996) claimed that while some users had reduced their car use, some were attracted by the P&R opportunity and increased their number of journeys. Looking at two major cities in the UK; Oxford and York, Parkhurst also found congestion in these cities remained the same. He therefore concluded that a package of policies, including further improvements to public transport should be used in order to achieve the desired reduction in total travel. If city center parking charges had been increased at around the same time this response would have been anticipated.

IV. CONCLUSIONS

1. In India, the available legal parking spaces is under-utilized to highest efficiency and financial viability. How new parking facilities may be developed as a multi-use shared amenity to increase efficiency in use of space, time and finances.
2. The equation of parking demand modelling clearly reveals that on street parking is mainly the function of purpose of trip and frequency of visit to CBD area. The variables like searching time, walking time, etc. also direct effects the parking demand.
3. On street parking is neither a shortage of parking nor an excess of cars, but fundamentally it is free parking. Thus paid parking polices should be introduce in this CBD area of the cities also parking charges should be decided based on the demand of privet vehicle.
4. The variables like parking cost and improved transit travel time play a part in mode choice decisions for Commuters.This concludes that land use is a significant factor in mode choice decisions.
5. Proper on street parking management need to be encourage and digital parking management should be introduce.
6. One of the effective tool to reduce the on street parking demand is park and ride facilities. So that congestion level on narrow urban street will be reduced.

REFERENCES

1. *Arnott, R., Rowse, J. (1999). Modeling Parking, Journal of Urban Economics, 45, pp. 97-124.*
2. *Axhausen, K.W., Polak, J.W., Boltze, M., Puzicha, J. (1994). Effectiveness of the parking guidance information system in Frankfurt am Main, Traffic Engineering and Control, 35, pp.304-309.*
3. *Belles, B. B., Carrese, S., Negrenti, E. (2007). Parking search model,In Pro-ceedings of the sixth triennial symposium on transportation analysis TRISTAN VI, 6 p.*
4. *Benenson, I., Martens, K., Birfir, S. (2008). PARKAGENT: an agent-based model of parking in the city, Computers, Environment and Urban Systems, 32, pp.431-439.*
5. *Bifulco, G. N. (1993). A stochastic user equilibrium assignment model for the evaluation of parking policies, European Journal of Operational Research, 71, pp.269-287.*
6. *Caicedo, F. (2010). Real-time parking information management to reduce search time, vehicle displacement and emissions, Transportation Research Part D, 15, pp.228-234.*
7. *Gantelet, E., Lefauconnier, A. (2006). The time looking for a parking space: strategies, associated nuisances and stakes of parking management in France, Association for European Transport and Contributors, 7 p.*
8. *Hualiang, T., Yi, Q., Ping, Y. (2002). Parking search time and information identification for off-street spaces in New York City, Transportation Research Record, 1800, pp. 44-52.*
9. *Polak, J., Axhausen, K. (1990). Parking search behaviour: a review of current research and future prospects, Transport Studies Unit, Working Paper 547, Oxford University, 26 p.*
10. *Tong, C. O., Wong, S. C., Lau, W.W.T. (2004). A demand-supply equilibrium model for parking services in Hong Kong, Transactions Hong Kong Institution of Engineers, 11, Issue 1, pp. 48-53.*
11. *ERGUN, G. (1971), Development of a Downtown Parking Model. Highway Research Record no 369, pp. 118-134, Highway Research Board, Washington, D.C.*
12. *FREENEY, B.P. (1986), A Review of Impact of Parking Policy Measures on Travel Demand. VTI rapport 308A, Statens vag-och trafik institut, Linkoping.*
13. *GILLEN, D.W. (1978), Parking Policy, Parking Location Decisions and the Distribution of Congestion. Transportation no 7, pp.69-85.*

14. HUNT, J.D. AND TEPLY, S. (1993), *A Nested Logit Model of Parking Location Choice*. *Transportation Research Part B*, Vol. 27B, no 4, pp. 253-265.
15. MATTSON, J.O. (1955), *What Parking means to Business*. Highway Research Board, Washington, D.C.
16. Adiv, A. and W. Wang (1987), "On-street Parking Meter Behaviour", *Transportation Quarterly* 41, 281-307.
17. Arnott, R., A. de Palma and R. Lindsey (1991a), "A Temporal and Spatial Equilibrium Analysis of Commuter Parking", *Journal of Public Economics* 45, 301-337.
18. Arnott, R., A. de Palma and R. Lindsey (1991b), "Does Providing Information to Drivers Reduce Traffic Congestion?", *Transportation Research* 25 A, 309-318.
19. Arnott, R. and J. Rowse (1995), "On Comparative-Static Analysis in Numerical Nonlinear Economic Models", *Computational Economics* 8, 95-105
20. Douglas, R.W. (1975), "A Parking Model - The Effect of Supply on Demand", *American Economist* 19 (1), 85-86.
21. Gillen, D.W. (1978), "Parking Policy, Parking Location Decisions and the Distribution of Congestion", *Transportation* 7, 69-85.
22. Hunt, J.D. (1988), "Parking Location Choice: Insights and Representations Based on Observed Behaviour and the Hierarchical Logit Modelling Formulation", presented at the Institute of Transportation Engineers International Conference in Vancouver, B.C., Canada, Sept. 26-29.
23. Muromachi, Y., N. Harata, O. Ohta, and A. Yoshido (1995), "A Study of Dynamic Parking Demand Allocation Models," presented at the 7th World Conference on Transport Research, Sydney, June 1995.
24. Verhoef, E., P. Nijkamp, and P. Rietveld (1995), "The Economics of Regulatory Parking Policies: The (Im)possibilities of Parking Policies in Traffic Regulation," *Transportation Research - A* 29A, 141-156.
25. Westin, R.B. and D.W. Gillen (1978), "Parking Location and Transit Demand: A Case Study of Endogenous Attributes in Disaggregate Mode Choice Models", *Journal of Econometrics* 8, 75-101.
26. Yousif and Purnawan (1999) and Valleley (1997) "Influence of On-Street Parking on infrastructure system."
27. Bhaskar vijaykumar bhatt and Fenil Rajeshkumar Gandhi (2014) "A Study on Parking needs at intersections: A Case of Surat T.P scheme"
28. Rajat Rastogi. (2006), *Preferences of vehicle parkers in Kota city- A stated preference study*, *Indian Highways*, 34(3), 45-59.
29. Nandan Dawda. (2016), *modelling response to paid parking polices using soft computing technique*, 12th international conference named TPMDC 2016.