

Scenario of on Street Parking Demand: A Case Study of India

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Abstract

Parking is an essential requirement of the transportation system. The availability of parking is related to the price, location and the type of parking spaces followed by infrastructure of these spaces and enforcement of regulations. Parking spaces are required by residents, employees, customers and visitors and the movement of traffic. Therefore Kolkata is one of the fast urbanising countries in the world and standard of living of the residents of Kolkata has increased dramatically and it has resulted in an unprecedented increase in personalised mode of vehicles. These huge numbers of personalised vehicles require a storage system at the end of travelling hours, which is called parking. However there are two categories of car parking which have been observed in the city and it includes on street and off street parking. On street parking is most commonly observed in the city of Kolkata and further it has been said that illegal on street parking leads to traffic congestion and it emits huge amount of vehicular pollution. Transport Department, Government of West Bengal and Kolkata Traffic Police have been taken various initiatives and provisions to mechanise on street car parking legally and make a balance between the demand and supply of parking in the various on street parking spaces in the city. B.B.D Bag, Esplanade area, Park Street, Gariahat and other adjoining commercial areas which include South City Mall, Mani Square Mall, Quest Mall, Metropolis Mall, Lake Mall are the main places for on street car parking in the city. Kolkata Municipal Corporation and Kolkata Traffic Police have been implemented several parking fees to maintain these car parking spaces systematically. Therefore in this paper an attempt has been made to point out various aspects of parking characteristics such as location, area, duration of parking, accumulation and volume in the parking spaces followed by some guidelines and provisions which will surely make better Kolkata city in future.

Keywords: On Street Parking, Traffic Congestion, Infrastructure, Commercial Area, Personalised Vehicles.

Introduction

Parking is an essential component of the transportation system. The parking strategy is associated with the demand and accessibility of parking lots. The availability of parking is related to the price, location and the type of parking space, ancillary infrastructure and the enforcement of regulations. Parking spaces are required by residents, employees, customers and visitors and the movement of traffic. Kolkata is one of the fast urbanising megacities in India, particularly during the globalisation era; the standard of living of the middle class has increased dramatically and has resulted in an unprecedented increase in registered personalised motor vehicles. Every vehicle needs a storage system at the end of travelling hours, which is called parking. More number of personalised as well as private vehicles create a tremendous pressure on the various fixed city parking lots and as a result most of the car owners park their vehicles (Two, Three and Four wheelers which include Taxi and Personalised car) on major arterial roads or adjacent to footpath illegally with a very nominal parking fee which has been observed predominantly in the city of Kolkata¹. Therefore more on street parking has reduced the wider space of the roads and it creates traffic congestions in the city which is the major problem in the city of Kolkata.

Therefore India is experiencing fastest growing economy in automobile market. Due to auto de-licencing policies, more people are easily afforded personalized vehicles compared to choose like other mode of mass transport. Kolkata city is not an exception one in this respect, most of the well-civilized people of Kolkata have been shifted to personalized vehicles, as a result these vehicles need a parking lot during peak hours which leads to occupying the road space and it positively creates more traffic congestion which is a daily phenomenon in the city of Kolkata. However most of the city part of Kolkata experiences of on-street car parking and it is obvious changing the traffic and transportation scenario and it creates a negative impact on parking activities and thus this situation is reaching an alarming stage.

Parking Pattern: A Flow Type Scenario: Parking pattern of any metropolitan city may be categorized into two type which are obviously on-street parking and off-street parking. According to Department of Civil Engineering, Rourkela has pointed out on-street parking is further categorized into two type i. Parallel parking and ii. Angle parking parallel parking means when two as more vehicles are parked parallel to each other within a specified parking lot and it results more occupying road space. Angle parking is obvious a systematic car-parking

method where two or more number of vehicles are parked at an angle of 20° to 30° parallel to each other². This on street parking is major thrust area of concern in this research paper. However (Figure-1) off-street parking can be categorized into five sub-types which are mainly surface, multi-storeyed, roof top, underground and mechanical parking and these is also quite obvious common in the city of Kolkata after implementing and constructing high-rise buildings and shopping mall in the city.

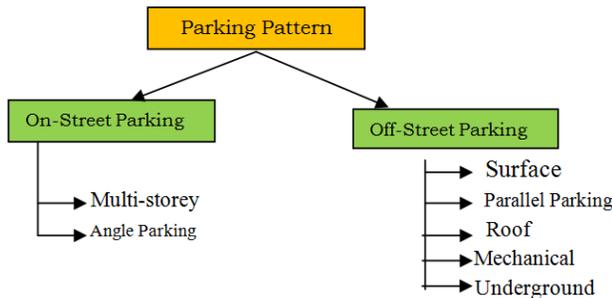


Figure- 1
Type of Parking Pattern

Objectives: The study has been conducted with a view to fulfil the following objectives: i. To identify the growth of different modes of urban transport and its importance in the city of Kolkata. ii. To make a relation between time slot variations and passenger car unit in different on street parking spaces within the KMC boundary of Kolkata. iii. To identify various purpose of on street parking at some selected parking spaces followed by daily income from various parking places in Kolkata. iv. To calculate temporal variation of on street parking and passenger car unit variation with time at various parking spaces in the city of Kolkata. v. To measure demand and supply of parking spaces in the city of Kolkata. vi. To point out various parking policy and legislative provisions in the city of Kolkata.

Methodology

The First Phase: The first phase of the study was a preliminary attempt to gather various information and secondary data in registered vehicular population from various sources. The data covered vehicular population, location and parking space information, parking rate (day and night), passenger car unit (PCU) , Time wise variation of PCU, purpose of parking at different parking space in the city of Kolkata. The information have been collected from the Transport Department, Government of West Bengal, Kolkata Traffic Police, Kolkata Municipal Corporation, Kolkata Metropolitan Development Authority, West Bengal Pollution Control Board and other offices of the 15 borough in the city.

The intermediate phase: Collection of primary data has been made with the help of structured questionnaire. The primary survey has been conducted on the basis of various perceptions from the traffic policemen, pedestrians, and personalized car owners, drivers of two and three wheelers and the people of

Kolkata at different parking spaces with the help of questionnaire survey. Relevant photographs have been taken during the field survey to illustrate the scenario more specifically.

The final phase: After the collection of primary and secondary data, computation, tabulation and analysis of the same have been done. In this phase, data have been processed to prepare relevant maps and cartographic diagrams.

Study area

This study is confined to the city of Kolkata. In order to understand the parking behaviour and mode of choice of motorists with respect to shopping as well as work trips in the city of Kolkata, survey have been conducted at nine major locations including six busy traffic intersection points and three very popular shopping mall and arcade in Kolkata. In north Kolkata, it has been selected one busy market point which is namely as Burrabazar followed by in central Kolkata six locations have been selected and these are mainly B.B.D. Bag area, Dalhousie area, New Market area, Park Street, Mani Square and Camac street are as well two points such as Gariahat area and Metropolis mall, Highland Park have been selected the nodal station from South Kolkata.

However, while it has been calculated the vehicular population according to 2015 data bases provided by Kolkata Traffic Police and it is nearly 12.04 lakhs, out of this 6-5 lakhs are considered as personalized vehicles. It is very much remarkable that, the road space of Kolkata is only 7% and almost 12 lakhs vehicles are regularly plying on the major arterial roads and then it creates huge proportion of traffic Jam. According to transport Department, Government West Bengal, it has been estimated that 48% can are parked regularly based as on-street parking followed by 32 per cent car are parked off bit area and 20 per cent car are being parked in the underground area.

Transport Profile of Kolkata City

As per the ADB report, it has emerged that more than 40 per cent share dominated by cars and two wheelers people opting this mode for comfort ability and as symbol of high urban status that has to be maintained in the city³. While the share of the other mode of vehicles is low like, percentage of taxi, which is approximately 7 per cent though considered being high in relation to West Bengal and other megacities of India. However 'Katatel' and 'LPG' driven three wheelers are also being observed in the city of Kolkata which is approximately more than 5 per cent out of total sharing of modal shift.

Peak and Lean Hours wise Passenger Car Unit in Selected as Street Parking Lots

While it has been counted the passenger car unit (PCU) in the B.B.D Bag – Esplanade area, mostly in peak hours (which

include 11-00 am to 12.00 hour and 3.00 p.m. to 5.00 p.m.) Proportion to passenger car unit has identified almost more than 60 while it has almost reduced less than 30 during the lean hours (9.00 a.m. to 11.00a.m. and 7.00 p.m. to 9.00 p.m.).

Same scenario has been observed in the context of Park-street traffic intersection point, where number of two wheeler, four wheeler personalized as well as taxi and mega cab per passenger are observed almost more than 60 during peak hours and it has almost reduced in lean hours because of more peoples are engaged in their business commercial or official work. Therefore Gariahat and adjoining commercial area and Burrabazar experience more number of passenger car unit (which is neatly more than 150) during peak hour because of more plying of personalized vehicles as well as mass vehicles on the major road in the city.

However Gariahat and Burrabazar is known as busy commercial hub in the city of Kolkata, so definitely more rush of passenger car unit is quite common in this area. Therefore almost 70 to 80 per cent of two wheels are plying on the city road compared to four wheelers taxis and personalized vehicles.

In the context of Dalhousie area because of its well connectivity, some scenario has been observed that, passenger car unit is more in number (which is almost more than 180) during peak hour but during mean hours these number of passenger car unit is also observed more in number and it is approximately more than 80 and it is because of Dalhousie area is connected with all the part of Kolkata via metro, circular railway network as well as major arterial road.

While it has been accounted the passenger car-unit in Mani square area, because of this area is considered to be one of the busy commercial hub in central Kolkata PCU of two wheelers, four wheelers personalized as well as taxi are more than 70, during busy schedule but it has reduced during lean hours (9.00 a.m. to 11.00 a.m. and 7.00 p.m. to 9.00 p.m.).

Therefore, in the variation of passenger car unit in the Camac street and Elgin Road area, PCU number is more than 90 during peak hours and same situation has been observed also in metropolis mall, highland parkas well as in New Market area where passenger car unit is almost more than 100 during peak hour schedule but number of two wheeler, four wheeler (personalized vehicles) and (taxi/mega cabs) is almost nearly 60 (PCU) during lean hour in Camac Street, Metroplis mall and new market area because of more diversion of traffic.

However one remarkable situation is observed that metropolis mall, highland park experience more number of PCU during peak and lean hours (more than 60) because of more people are interested for window shopping and people are need to spent their leisure time in this shopping mall at the end of the day or in the evening⁴.

Duration of Car Parking in Different on Street Parking

Places: B.B.D Bag – Esplanade are park street, Metropolis mall, Mani square, Burrabazar, Dalhousie area, New Market, Camac Street and Gariahat area experience more duration of two wheelers parking and almost 50 to 60 percent of two wheelers are being parked more than 5 to 6 hours per day and it leads to occupy more space which reasonably effect on traffic congestion while it has been considered the four wheelers personalized car, at least 60 to 70 percent of personalized vehicles are parked in the parking lot of Mani Square, Metropolis Mall, Park Street, Camac Street Crossing, B.B.D Bag – Dalhousie area as well as Burrabazar area more than 8 to 10 hours because of its locational and economic as well as transactional importance. People of Kolkata quite visit these places in a frequent basis and they are usually visiting these places using their own car and it quite obvious occupies the on street parking area. In the concern of four wheeler taxis, sometime these taxis are also occupied the space of the major road through car parking and which is obvious more than 30 minutes during lunch or other purposes and it has positively occupied the space though they have separate parking space in Kolkata city.

On Street Parking and traffic Congestion Scenario in Kolkata City

While it has been compared between different parking places in Kolkata city, B.B.D. Bag – Esplanade area, Park Street, Dalhousie, New Market area, Camac Street – Elgin road Crossing, Metropolis Mall and Mani square, percentage share of two wheeler, four wheelers personalized vehicles are parked more than 5 hours per day becausee of these areas are considered to be busiest commercial hub as well as more private and Government offices are located here, for these reason people are parked their vehicles during their working hours (approximately 7 to 8 hours/day) and these parking are quite happened in the on street parking area and sometime these parking places have some categorization of parking having red, yellow and blue sticker parking.

Therefore more hours of car parking leads to more occupying road space and it results more congestion and it also emits more vehicular emission in the city of Kolkata while it has been considered the lean hours, sometime two wheelers and four wheelers personalized vehicles are parked approximately 2 to 3 hours per day. However, in considering the percentage share 50 to 60 per cent vehicles are sharing the parking space more than 4 to 5 hours.

Relationship between space reduction and congestion scenario in Kolkata

Gariahat and adjoining commercial area, Dalhousie area, Burrabazar, Camac Street Elgin Road crossing has occupied more road space which is approximately more than 25 to 40 per cent. Therefore during peak hours B.B.D Bag – Esplanade area, Gariahat area, Dalhousie area, (Table-1) New Market area as

well as Camac street area have experienced more waiting time in the traffic signal system and it is almost more than 5 to 6 minutes whereas during lean hours, the waiting time is approximately 3 to 4 minutes. However more waiting time is explored because of more number of personalized vehicles are plying on the city road as well as occupying the road space which is obviously the problem of encroachment and it results more waiting time in the all busy traffic signals and it results more automobile emission. According congestion scenario, B.B.D Bag area is considered under alarming situation followed by Gariahat and adjoining area as well as Dalhousie area are under critical condition where as Burrabazar, Camac Street are under very high congestion zone followed by Metropolis Mall, Highland Park, and Mani square are under highly congested situation.

Comparison of percentage share and parking interference Index between Different cities in India

According to Ministry of Urban Development, Government of India, it has been pointed out that Hyderabad, Chennai as well as Kolkata city are experienced more percentage share of on-street parking (which is approximately 30 per cent) compared to Bengaluru, Delhi as well as Mumbai. Therefore people of Kolkata city have been shifted towards personalized vehicles, that mean they are mostly parked their car at the end of the journey, as a results it requires more parking space while the other megacities, people mostly depend an mass transport so the

percentage sharing of an street parking scenario have been reduced⁵.

However in the phases of on-street parking inference index among selected Indian cities like Delhi, Kolkata as well as in Mumbai car parking index value is more and it is obviously more than 3 followed by Hyderabad, Chennai, Bengaluru as well as Pune where car parking index value approximately 1.5 and it is because of people of Hyderabad, Chennai, Bengaluru as well as Pune depend on mass transport, so it is quite obvious on-street car parking index value might be lower than the other cities.

Therefore (Table-2) Kolkata is experienced nominal parking fees which positively creates more occupying road space and thus it creates traffic congestion. During 7 am to 10 p.m. fees charged per hour basis is very nominal in the case of two wheelers which is approximately 5 rupees/hours followed by 10 rupees for car, van and mini buses and 20 rupees for bus as well as lorry. During night time (10 p.m. to 7 a.m.) rate chart is little bit hike but it is again very nominal compared to other Indian cities (10 rupees for two wheeler followed by 30 rupees for car/van/mini buses as well as 60 rupees for bus/lorry) and it results were hours of on-street car parking. However in the category of commercial as well as instituted vehicles category 15,000 rupees to be given to the authority or Kolkata traffic polices per year basis for getting on street parking facilities.

**Table-1
Relationship between space reduction and congestion scenario in kolkata**

Major on street parking lots	Space reduced on roads (%)	Waiting periods (peak hours)	Waiting periods (lean hours)	Congestion scenario
b.b.d bag-esplanade area	34.5	360 Seconds	240 Seconds	Alarming
Parkstreet	27.5	300 Seconds	240seconds	Critical
Gariahat and adjoining commercial area	57.6	300 Seconds	180 Seconds	Very high
Burrabazar	36.8	240 Seconds	240 seconds	Very high
Dalhousie area	38.4	300 Seconds	240 Seconds	Critical
New maket area	28.9	300 Seconds	180 Seconds	Very high
Camac street and elgin road area	38.43	360 Seconds	180 Seconds	Very high
Metropolis highland park	26.5	240 Seconds	180 Seconds	High
Mani Square	21.32	240 Seconds	180seconds	High

Data Source: Primary Data, 2015

Table-2
Chart of rates for day and night parking in Kolkata (2014-2015)

I. Rate Chart for Day Parking (7 A.M. - 10 P.M.)			
Category of Parking space	Rate per hour or part thereof (in Rs.)		
	Type of vehicle		
	Two Wheeler (Motorized)	Car / Van / Mini bus	Bus / Lorry
A	5	10	20
B	5	10	15
All category	Monthly rate in Rupees		
	600	1,200	1,500
II. Rate Chart for Night parking (10 P.M. - 7 A.M.)			
Category of Parking space	Type of vehicle		
	Two Wheeler (Motorized)	Car / Van / Mini bus	Bus / Lorry
All category	Rate per night in Rs.		
	10	30	60
All category	Monthly Rate in Rs.		
	150	400	800
III. Rate Chart for Exclusive car parking			
Sl. No.	Category	Per car per annum	
1	Commercial	15,000	
2	Institutional	15,000	

Note: In case of exclusive parking of the car possessed and used solely for private purpose, no parking fee is to be levied. It is expected that private car owners will arrange the parking of the car within his premises or any hired place for the sake of non-congestion of traffic.

Source: Kolkata Municipal Corporation, 2015

Demand and supply relationship of parking spaces in the city of Kolkata: As it definitely prescribes that, 100 per cent demand of parking spaces have been observed in the city of Kolkata but during temporal changes (2008-2013) supply of parking spaces may be enhanced (which is approximately 60 to 80 per cent) but it is not obviously proportionate to demand, so it creates illegal car parking because of that more personalized car, they don't get enough parking space for parking, as a result they are parked their car illegally in a scattered manner and thus it encroaches the road space⁶.

If it has been accounted the demand of parking spaces by the respondents, consumers are required more parking spaces (which is approximately 35%) compared to other respondents such as visitors, residents as well as employees (approximately 30%, 13% and 22%). Therefore this huge requirement of

parking spaces leads to occur illegal on street car-parking which is observed quite common in the city.

Purposes of on-street parking and parking speciality in Kolkata

A primary survey has been conducted among the respondents and from this survey, it has been identified that, more than 80 per cent respondents requires on-street parking because of shopping, official work as well as visit to major commercial hubs. while 20 to 40 per cent respondents said that they need on-street parking because of visit to temple, hotels, hospitals, banking official, as well as visit to friends and relatives houses. So overall on-street parking places is more in demand for parking the personalized vehicles in the city of Kolkata.

Parking speciality in Kolkata

To measure the parking speciality in the city of Kolkata, four parameters have been selected, these are mainly i. parking accumulation (%), ii. parking volume (%), iii. parking load (%), iv. Turnover (%).

Parking Accumulation (%): It means total number of vehicles parked at a given time. In this respect B.B.D. Bag, Gariahat – adjoining commercial area, Burrabazar, Dalhousie area almost experienced 80 per cent of parking accumulation compared to other traffic intersection points.

Parking Volume (%): It has been calculated total number of vehicles per day. Therefore in all the selected parking loss in Kolkata city, 80 to 90 per cent share of parking volume, have been observed in this area, and this volume leads to encroachment of road space. While it has been calculated parking volume, almost 70 to 80 per cent two wheelers are being calculated in this volume compared to other type of vehicles.

Parking Load (%): Parking load has been calculated, total number of space has used during a given period of time (time has been calculated in peak and lean hours). In this context percentage of parking load is hike in the area of Dalhousie, park street, Gariahat, Camac Street as well as Metropolis mall and Main square area due to its importance in the connectivity as well as transaction and commercial activities.

Turnover (%): Turnover has been calculated that when same spaces are being used by different vehicles over the time. In this respect metropolis mall, highland park and Mani square area, percentage of turn-over is almost more than 80% compared to other selected points because, these are the major thrust areas of shopping mall and more percentage of two wheelers as well as from wheelers are shared same space for a prolong time and there is no separate parking space for different categories of vehicles in these areas.

Provision and Regulations for on-street parking policy

The on-street parking in Kolkata city is required some special attentions which include: i. More Maximisation of the effective width. ii. Space selection for on street parking. iii. On street parking on major arterial Roads & transit corridors. iv. Proper traffic signs & Road markings should be assigned to mark out the parking place. v. Categorisation of parking category for different type of vehicles. vi. Provision for more parking of good vehicles in commercial areas. vii. Different parking zones for different type of vehicles. viii. Parking guidance & information (PGI) system should be assigned. ix. Parking fee should be collected regularly. x. Proper control of traffic movements in different on street parking lots. xi. Monitoring& enforcement of regulation system in different parking places. xii. Off street parking places adjacent to major arterial roads and Underground Parking facilities.

Parking Policy for on-Street Parking

An initiated by Kolkata Municipal Corporation: Various norms have already been initiated by Kolkata Municipal Corporation to implement the scientific regeneration of on street parking. i. Revision of regulation of on street parking in terms of various land use category. ii. More utilisation of same parking place. iii. Multilevel car parking should be allocated for commercial areas in Kolkata. iv. Identification of major congested areas at major traffic intersection points in Kolkata. v. More shifting towards mass transport. vi. Provision of parking policy in different land property. vii. Constitutional provision followed by legalised parking authority.

Proposed Parking Places in the City of Kolkata

As it has already been decided that, Kolkata city is not being extended horizontally but new key plans should be formulated immediately to ban on –street car parking and in this regard it has been followed foreign parking cordon policies which are definitely more effective and it reduces the traffic congestion scenario in Kolkata city. Thus the shopping mall and high rise buildings are already been considered as sky scrapper so various type of Multi-level parking(parking in different tiers or floor of a parking place), Horizontal circulation car parking(it mainly includes horizontal nature of parking but all the vehicles might be parked in individual level according to height), Puzzle car parking(this type of parking mainly follows the zigzag approach of parking but in the different floor), Parkon parking system (this type of parking also include vertico-horizontal parking which mainly aligned in such a manner that one car is parked either on roof top or ground floor and it may easily come out through the lifting process.

Findings

During the primary survey and after completion of this research paper, some findings have been explored and these include mainly: i. Kolkata city provides on street parking and this consumes one fourth of the road surface, this phenomenon is responsible for slow movement of vehicles and it emits huge amount of automobile emissions. ii. Parking charges are very nominal compared to other megacities; however investment in parking is not sufficient so far in many megacities. iii. Introduction of on street meter parking system which helps to increase the revenue of the Kolkata Municipal Corporation and is also helpful to parkers. iv. In Kolkata, on street parking spaces is very narrow in nature and some of the on road parking areas which are exclusively for four wheelers, two and three wheelers illegally utilise this space. v. Proper parking management policy is required in order to face the growing parking problems and more attention must be paid to eliminate or reduce illegal parking and for regulation of the parking system. vi. Removal of encroachments on footpaths and new parking places should be created which will reduce the traffic congestion. vii. Strict prohibition is needed on two wheelers in

the four wheeler parking spaces. viii. Suitable modern parking system like multi-storeyed parking system or park and ride system have to be introduced. ix. Restriction on parking duration hours will encourage short term duration and discourage the long term parking duration. x. Additional taxes can be levied on additional vehicles purchasers followed by more parking fee which may reduce the parking demand. xi. During the peak hours in the downtown areas, parking charges should be increased which may reduce the intensity of parking demand during peak hours. xii. The Government should create off street parking because it can reduce the traffic congestion, pollution as well as traffic accidents. xiii. Urban planners should give adequate priority for the creation of more parking facilities particularly in the downtown areas. xiv. Public-Private-Partnership model can be evolved to solve some the bottlenecks of parking in the city which will promote sustainable urban development in city of Kolkata.

Conclusion

From the above discussion, it has been pointed out that more dependency on personalized vehicles enhance the number of vehicles and it needs more parking spaces but it is quite obvious that, due to encroachment process by high rise building, no separate parking spaces have not been constructed for parking, as a result, people are usually parked their car adjacent to road

and obviously it occupies the road space, therefore illegal car parking reduces the road space and it leads to more congestion in the city of Kolkata. However due to auto-delicensing policy people of Kolkata have shifted towards personalized car but stringent laws and rules should be implemented to ban the illegal car parking in the city of Kolkata which obviously makes the city more sustain in future.

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