



A Review on “Parking Issues and Challenges in CBD Area”

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ABSTRACT

Due to the escalation in economical and population growth, the Indian Metros and major cities are undergoing a mobility crisis. It is observed that today, urban areas are facing a tremendous pressure about parking spaces. This has led to rise of transportation issues such as traffic disruption, congestion, inconsistent demand and supply, accidents and a number of environmental problems. The reason can be considered as poor parking management and policies. Due to lack of enforcement, India faces issues like encroachment over footpaths, illegal parking, double parking as well as criminal activities. In Central Business Districts, On street parking is a becoming a major issue due to high demand and lack to parking spaces thus affecting the efficiency of the road and influencing the growth of the business district. In a city's Central Business District (CBD), much of the economic activity is concentrated in a small area. This leads to the attraction of a large number of people and hence vehicles. In India, the roads are narrow and the population density is high. Also as India being a developing country the concept of parking plazas etc. are yet to be applicable everywhere. Therefore On street parking is a major parking practice on Indian roads. All major cities and their CBD zones face an issue regarding the ill effects on On street parking. These not only decrease the width of already narrow roads but leads to other problems like congestions, accidents, delays etc. These also cause a bad impact to the environment both to the air and noise index. On street parking. One major reason for On street parking in India is that it is free, even in CBD areas, hence this promotes the user to use his private vehicles rather than public transport. Drivers in CBD areas in order to reduce the walking distance to their destination, prefer On street parking as it is cheap and lack of enforcement, create and environment of congestion, time delays, high emission level and reduction in efficiency of the region. Most cases it has also been seen that there has been availability of parking space, but lack of education and enforcement has led to On street parking issues. The review paper tries to observe the root cause of the parking problems and come up with appropriate solutions.

KEYWORDS: On Street Parking, Off Street Parking, Parking Survey, Commercial Business District (CBD)

1. INTRODUCTION

Background of the study-

There has been unprecedented growth of Urban areas in the last decade. As more and more cities and towns

are nurturing and expanding, the financial status and revenue is also increasing. More and more people are spending on luxurious amenities like vehicles etc. Thus the numbers of vehicles have increased drastically.

Every vehicle irrespective of its size, needs to be parked somewhere, hence requires a parking space. Residentially these can be accommodated in garages and lots, but when in CBD areas these create issues. Parking is an important commodity in CBD areas as a land space is required for parking. In most of the CBD areas there is no or less off street parking facility and vehicles tend to be parked at the kerb, footpath, pavements etc i.e. On-street parking. The paper makes an effort to understand the parking demands in the Indian market place. With the need for parking increasing everyday higher and higher and lack of proper awareness and management, the On-street parking problems have soared. There is a need of urgency to find the most appropriate solution which can be applied in order to control the current parking scenario and make it better. Creating more Off-street parking solutions is not applicable everywhere as land is a very valuable asset and cannot be used unwisely. The focus has been tried to bring forward the fine assessment of parking policies, parking demands and redesigning the current parking scenario in the cities and especially in their CBD areas to meet with the demands. Parking has been a trending issue which has bothered urban planners and transport officers plenty in the recent years. Parking is one of the major issues in today's world that has been created due to the increase in on road traffic. The unavailability of parking spaces has significantly increased the need of parking spaces especially in Central Business district areas. Indian major cities are facing major parking problems with the increase in vehicular traffic clubbed together with poor quality of roads and mismanagement. Parking issue not only creates a problem for the mode choice but also creates an economical setback for that location. This topic is very crucial as every transportation planner knows about the issue but very few have addressed to it including the government. It is a genuine fact that all major cities in developing nations are facing this issue and are yet to find a suitable solution for the urban parking scenario. Till date, this issue related to parking is not limited to urban CBD areas but is being widespread across the cities and nearby regions. Thus, not only affecting the traffic conditions of the area and its working but also the overall picture of the transportation system and it has now become a fundamental concern regarding the modern

transportation network. The accessibility of parking not only affects the preference of type and method of journey, but also influences the practicality and competitive position of business districts. Hence the issues related to the mismanagement of the parking system should be a major concern for a transportation planner. Every vehicle owner considers and prefers a good parking which is easily accessible, cheap and near to the desired location of the journey. It becomes very important to understand and facilitate the needs of a desirable parking system. Generally there are two type of parking system, one is "Offstreet parking" and the other is "On street parking".

1.1 *Parking*

The growing population of India has created many problems – one of the challenging ones being car parking which we confront almost every day. Besides the problem of space for cars moving on the road, greater is the problem of space for a parked vehicle considering that private vehicles remain parked for most of their time. Roads are being built for cars to ply but are we also giving the vehicles enough space to park?. Parking is one of the major problems that is created by the increasing road track. It is an impact of transport development. The availability of less space in urban areas has increased the demand for parking space especially in areas like Central business district.

1.2 *Parking studies*

Before taking any measures for the betterment of conditions, data regarding availability of parking space, extent of its usage and parking demand is essential. It is also required to estimate the parking fares also. Parking surveys are intended to provide all these information. Since the duration of parking varies with different vehicles, several statistics are used to access the parking need.

1.3 *Parking statistics*

1. *Parking accumulation* It is defined as the number of vehicles parked at a given instant of time. Normally this is expressed by accumulation curve. Accumulation curve is the graph obtained by plotting the number of bays occupied with respect to time.

2. **Parking volume** Parking volume is the total number of vehicles parked at a given duration of time. This does not account for repetition of vehicles.
3. **Parking load** Parking load gives the area under the accumulation curve. It can also be obtained by simply multiplying the number of vehicles occupying the parking area at each time interval with the time interval. It is expressed as vehicle hours.
4. **Average parking duration** It is the ratio of total vehicle hours to the number of vehicles parked.
5. **Parking turnover** It is the ratio of number of vehicles parked in duration to the number of parking bays. This can be expressed as number of vehicles per bay per time duration.
6. **Parking index** Parking index is also called occupancy or efficiency. It is defined as the ratio of number of bays occupied in time duration to the total space available. It gives an aggregate measure of how effectively the parking space is utilized. Parking index can be found out as follows

$$\text{Parking index} = \text{parking load} / \text{parking capacity} \times 100$$

1.4 Effects of parking

Parking has some effects like congestion, accidents, pollution, obstruction to fire-fighting operations etc.

1. **Congestion** Parking takes considerable street space leading to the lowering of the road capacity. Hence, speed will be reduced, journey time and delay will also subsequently increase. The operational cost of the vehicle increases leading to great economical loss to the community.
2. **Accidents** Careless maneuvering of parking and unparking leads to accidents which are referred to as parking accidents. Common type of parking accidents occur while driving out a car from the parking area, careless opening of the doors of parked cars, and while bringing in the vehicle to the parking lot for parking.
3. **Environmental pollution** They also cause pollution to the environment because stopping and starting of vehicles while parking and unparking results in noise and fumes. They also affect the aesthetic beauty of the buildings because a car parked at every available space creates a feeling that building rises from a plinth of cars.
4. **Obstruction to firefighting operations** Parked vehicles may obstruct the movement of firefighting vehicles. Sometimes they block access to hydrants and access to buildings.

1.5 Types of Parking

1. **On street parking:** On street parking means the vehicles are parked on the sides of the street itself. This will be usually controlled by government agencies itself. Common types of on-street parking are as listed below. As per IRC the standard dimensions of a car is taken as 5× 2.5 m and that for a truck is 3.75× 7.5 m.
2. **Off street parking:** Off street parking means vehicles are parked off the street itself. This will be usually controlled by commercial agencies itself.
3. **Parallel parking:** The vehicles are parked along the length of the road. Here there is no backward movement involved while parking or un parking the vehicle. Hence, it is the most safest parking from the accident perspective. However, it consumes the maximum curb length and therefore only a minimum number of vehicles can be parked for a given kerbed length. This method of parking produces least obstruction to the on-going track on the road since least road width is used.
4. **30 parking:** In thirty degree parking, the vehicles are parked at 30 with respect to the roindad alignment. In this case, more vehicles can be parked compared to parallel parking. Also there is better maneuver-ability. Delay caused to the track is also minimum in this type of parking.
5. **45 parking:** As the angle of parking increases, more number of vehicles can be parked. Hence compared to parallel parking and thirty degree parking, more number of vehicles can be accommodated in this type of parking.
6. **60 parking:** The vehicles are parked at 60 to the direction of road. More number of vehicles can be accommodated in this parking type.
7. **Right angle parking:** In right angle parking or 90parking, the vehicles are parked perpendicular to the direction of the road. Although it consumes maximum width kerbed length required is very little. In this type of parking, the vehicles need complex maneuvering and this may cause severe accidents. This arrangement causes obstruction to

the road track particularly if the road width is less. However, it can accommodate maximum number of vehicles for a given kerbed length.

Objectives of the project-

- The objective of the study is to assess the On-street parking issues in Central Business Districts of Vadodara city.
- To collect the data of the existing parking system.
- To design a new parking system for the Vadodara city.

2. LITERATURE REVIEW

[1] ASSESSMENT OF ON-STREET PARKING ISSUES IN CBD AREAS ,Ashish Pandey, Prof.AkshayGulghane, (2020), There has been unprecedented growth of Urban areas in the last decade. As more and more cities and towns are nurturing and expanding, the financial status and revenue is also increasing. More and more people are spending on luxurious amenities like vehicles etc. Thus the numbers of vehicles have increased drastically. Every vehicle irrespective of its size, needs to be parked somewhere, hence requires a parking space. Residentially these can be accommodated in garages and lots, but when in CBD areas these create issues. Parking is a important commodity in CBD areas as a land space is required for parking. In most of the CBD areas there is no or less off street parking facility and vehicles tend to be parked at the kerb, footpath, pavements etc i.e. On-street parking. The paper makes an effort to understand the parking demands in the Indian market place. With the need for parking increasing everyday higher and higher and lack of proper awareness and management, the On-street parking problems have soared. There is a need of urgency to find the most appropriate solution which can be applied in order to control the current parking scenario and make it better. Creating more Off-street parking solutions is not applicable everywhere as land is a very valuable asset and cannot be used unwisely. The focus has been tried to bring forward the fine assessment of parking policies, parking demands and redesigning the current parking scenario in the cities and especially in their CBD areas to meet with the demands.

[2] On-Street Parking Demand Assessment in CBD Area Using Different Data Frequency, Rahul and Dixit, (2020), In many Indian cities, CBD areas are characterized by high demand for on-street parking, which has often led parking space problems, especially during peak hours and special events. Lack of data for on-street parking demand and absence of unambiguous on-street parking policy result in business as usual condition for parking on major streets of CBD area. To analyze on-street parking demand and optimize the survey interval for which parking survey should be carried in CBD area, two busy urban streets of Rajkot city, Gujarat, India were considered. Selected streets have two different land-use types, namely medical and commercial. On-street parking inventory survey was carried out by license plate method 1 h interval during business hours for a normal working day to determine peak parking hours. Microscopic parking investigation was further carried out during peak parking hours by collecting demand data at 10 min data monitoring interval for four normal working days and weekends. Uniform patterns of parking were observed throw out the survey period of frequency at 10 min, however, variation in demand observed among the day. Data monitoring interval had a significant effect on observed demand. To probe further, the percentage of unique parked vehicles was extracted from the observed demand for different data monitoring interval. Analysis of PUPV revealed that PUPV followed a progressively increasing trend as monitoring interval increases. Further, a consistent trend was observed for all survey day for both subject land use. Consistency of PUPV in the form (C.V) was observed for 30 min data monitoring interval for both subject land-use types. Microscopic behavioral analysis carried by obtaining percentage repetition of parked vehicles (PRPV) between two successive sets of observations for different data monitoring intervals revealed that PRV followed a decaying trend with data monitoring interval. Statistical analysis on PRV values between different data monitoring intervals revealed similar behavior post-20 min data monitoring interval. Turnover analysis revealed a decaying trend with data monitoring interval. Turnover was observed to be consistent at 30 min data monitoring interval. In the context to consistent PUPV and consistent turnover, the study proposes to evaluate parking utilization and parking

efficiency at 30 min data monitoring interval in CBD areas of developing countries. In addition, based on the statistical result on PRV, the study proposes to provide 20 min as free parking duration.

[3] ON-STREET PARKING PROBLEMS IN CBD AREA &, REMEDIEL MEASURES-A CASE STUDY OF GODHRA CITY, Naitik Gandhi and JayeshJuremalani, (2019), The unprecedented growth of vehicles has increased parking space demand into cities. It has a considerable effect on transportation development in the city. The availability of less space in urban areas has rising demand for parking space principally in central business district. Ill-effects of insufficient parking space in cities are many. Godhra is a well-known city of Panchmahal district in Gujarat which has a population of 1.62 lakh (2011). As the traffic on the existing road system in the Godhra city increases, congestion becomes serious problem. Thus, parking surveys have been carried out for collecting data about parking availability and requirement and its effect on present scenario. Fixed period sampling survey method is used for parking demand and Parking space inventory survey is carried out for parking supply at the study area. Analysis shows that peak demand and parking index are almost 1.5 times more of demand than supply and it is alarming stage for parking problem. Requirement of parking has been fulfilled by designing off-street parking facility for on street parking user so that they can park their vehicle safely and it is more helpful to transportation system by increasing utilization of carriage way width. Design of Multi level parking space has been done according to demand and supply available by using ParkCAD(5.0) and as per the SP-12(2015)Guidelines for parking facilities in urban area. Results help in reducing the congestion of on-street parking and diverge the demand to off-street parking.

[4] A Case Study on On-Street Parking Demand Estimation for 4-Wheelers in Urban CBD SaptarshiSen ,Mokaddes Ali Ahmed and Debasish Das, (2016), Lack of parking policy has become one of the most important aspects of transportation. The parking issue is trending all around the world especially in central business district (CBD). Metropolitan cities are affected mainly by this problem. Kolkata is one of the largest and oldest metropolitan cities in India which is

also affected by the parking problems. Insufficient off-street parking facilities and tendency to park the vehicles near to the destination lead to high parking demand. The vehicle ownership and the poor quality of transit system are also the reasons for increase in demand. These factors result in reduction of the main carriageway width, decrease in flow speed and creates unnecessary congestion to traffic flow which creates cruising of parking. Proper parking management policy should be implemented to control the demand. In this study, two CBDs- Gariahat (one of the largest shopping area) and Dalhousie (one of the largest office area) have been selected as the case study area. In this study a parking demand model is developed to estimate the parking demand. Parameters like age, vehicle ownership, parking duration, annual family income, distance between origin and destination are incorporated to generate the demand model. Some field surveys like in-out survey and questionnaire survey were conducted to obtain the data for above mentioned parameter. The parking demand model is generated by linear regression analysis in SPSS. Further the estimated demand is compared with the existing supply.

[5] Challenges of Vehicle Parking in Central Business District of SabzevarCity, Iran EhsanAmini, Shankar B, (2017), Central Business Districts (CBDs) are undisputable areas of traffic attraction occasioned by increasing commercial and economic activities. It attracted people from different parts of the city and its region for shopping and recreational facilities and accelerated mobility of vehicles in CBD. The greater mobility has created traffic congestion and parking problems. Due to tremendous increase in vehicular movements in the central areas in recent time, the parking efficiency is affecting people's lifestyle especially during peak hours. The availability of lesser space has been creating great challenges on transport planners for vehicular parking planning and management. Though the Sabzevar's city government has made efforts to solve parking problem in the Central Business District, the parking demand has stroked-up to the unexpected levels. This paper attempts to discuss the parking problems of central business district and proposes measures and strategies for meeting the key challenges of parking demand in the City of Sabzevar.

3. PROPOSEED METHODOLOGY

As observed from the various literature, it seems that there has been some work done on the analysis of parking problems. Parking problem in CBD areas is getting more and more common in all the major cities around the world. With the development of lifestyle, parking has been a side effect of this growth which is now catching the attention of Traffic engineers, designers and planners. Many studies were done regarding the various aspects and types of parking mainly in CBD zones, but there have been certain limitations regarding the availability of data and variations due to changing demand conditions. Most of these roads are undivided thus it has random movement of vehicles and management of such areas becomes difficult. The on street parking characteristic of the region affects the overall road capacity drastically with unexpected delays experienced by the users which are the failure of the system design. Hence, a proper study is to be done in order to understand the heterogeneity and complex behaviour of On street parking systems.

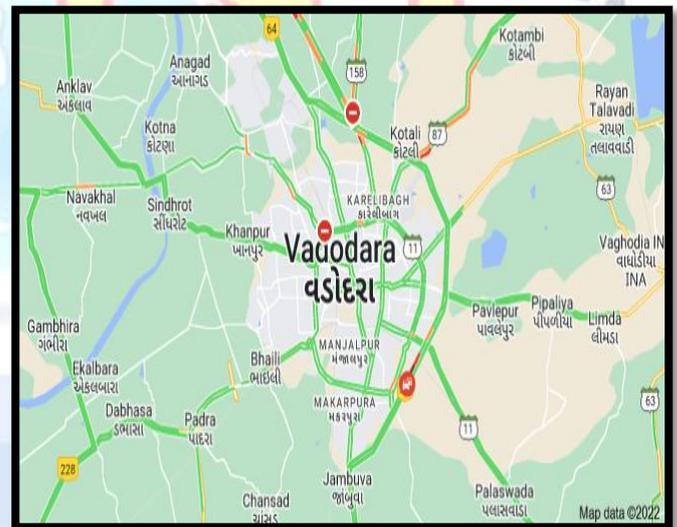
Concept Methodology-

In order to properly assess the On street parking in CBD areas, it becomes important to understand the whole literature and concept of it with its limitations. The figure illustrates the methodology used for the study and focuses on the real life observations and analytical approach that can be studied for the assessment of On street parking. By doing so we can actually compare ground level reality and decision making ability of drivers and pedestrians while parking and walking. Overall we can thus find an optimized solution which may reduce on street parking problems. The methodology used in this study has been classified into various steps. The first step is to identify the CBD zones and analyze with the characteristics of all the zones are similar in order to analyze for an universal solution. The second step is to go through the literature reviews in order to identify the literature gaps and come up with a proper study area. The literature states that CBD areas all around the globe have similar characteristic i.e. small road width, too many shops, high density, heterogeneous types of vehicles and a high parking demand. The third step is that data needs to be collected and analyzed on the basis of type, duration, size, peak hour etc. Geometrical features of the study

area are also measures such as width of road, number of intersections, length, encroachment areas. And finally the three E's of the areas i.e. Engineering, Education and Enforcement. Fourth, all the accumulated data needs to be processed in order to provide the best possible measure for the parking issues in these zones and working upon the future scopes as these zones are the economical lifeline of the region, hence the socio economic parameter of on street parking in these region can be looked and researched upon.

Study Area-

CBD areas have common characteristics all over. These are stretches of roads of 5-6 km of length where major commercial market is. Two major CBD areas stretches were considered where on street parking was prominent. All the major components were measured and analysed like road width, footpath, encroachment, crossings etc. The overall traffic was converted into different types of vehicles for ease in the analysis, namely two-wheeler (2W), three-wheeler (3W), small car (SC), big car (BC) and heavy vehicle (HV).



[Fig.1.1: Map of Vadodara City]

M. G. Road: This road is heavy traffic volume road of Vadodara city. It involves increased commercial activities like jewellery shop, readymade garment, and cosmetics shops in the vicinity of each other which has high potential for trip attraction. It allows the on-street parking on either side of carriage way with odd-even date parking scheme.

Jubelibaug to Kothi: This Street is one of the popular road of the city area in Vadodara having high

commercial activities like footwear shop, readymade garments shop, cinema theatre, Banks as well as few religious places which automatically attract the visitors and thereby generates high demand of parking.

This area is situated in the west part of the Vadodara city. It has one of the major commercial area in this region. It has been observed that during working hours this area experiences traffic problems like congestion, delays and sometimes accidents. Hence the area was considered for study.

On both streets it was observed that no demarcations of parking bays were made for the vehicles. Due to heavy flow of traffic on both the roads it was practically difficult to implement enforcement for illegal parking which resulted in double parking and occupancy of para-transit as well as car commonly featured on both the sides of road. Such chaotic parking reduced the carriage way width which created conflict and delay to through traffic, apart from congestion problems. Encroachment by the street hawkers as well as illegal parking of vehicles restricted the available stretch of carriage way for through traffic.

4. CONCLUSION

- Uses of zone based parking system across the city and discourage the use of private vehicles in CBD districts. This can be achieved by optimizing public transport in the region, differentiating parking on the basis of vehicle types and heavy penalties for parking offenders and encroachers.
- It is also observed that on some level parking can be managed in spite of less space but proper education must be imparted to public. Hence the 3 E's i.e. Engineering, Education and Enforcement needs to be worked on.
- If On street parking need to be managed, minimal charges should be levied so that proper management can be done by an independent authority of the parking spaces. This would not only help in better management but would also discourage usage of private vehicles.

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Conflict of interest statement

Authors declare that they do not have any conflict of interest.

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