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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 lead 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 lead 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

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. 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".Over the last decade, a noticeable change has been found in the growth of urbanization in India. As the population growth is increased day to day, the use of transportation system is also increasing. But the urban transport problems degrading due to lack of organized urban road network, inefficient transit system. The economic and commercial growths are mainly observed in the core of the urban area i.e., CBD. A good transportation system must be implied to obtain the mobility in traffic movement. The on-street parking is one of the main reasons for cruising of parking in CBDs which creates congestion and resists the traffic flow. Due to the convenience of the people (in terms of availability of all needs), they prefer to visit CBDs to fulfill their requirements. The parking issue is prominent mainly in metropolitan cities.India's fastest economic development and more comfortable and faster vehicles have led to dramatic increase in the number of personalised vehicles particularly motorised two wheelers and passenger cars. Statistics revealed by the Centre for science and environment (2009) states that country reached first millions of personalized vehicle in 1971, after that another 20 years passed to add 2 more million. But in last decade just only in 4 years (2001 to 2004) 16 Million vehicles were added. This growth of vehicles directly results in increase of parking demand spaces. Addition of a single vehicle leads to likely demand for parking space at 3 places, at the residence, work place and shopping areas. The problem of parking demand becomes more acute in high commercial city centres where limited public parking plots fails to meet ever increasing parking demand. The second order metropolitan cities of India are facing daily problems of parking particularly in CBD area. Free on-street parking policy and insufficient management measures on major urban street of CBD areas of this cities leads to chaotic parking behaviour, double lane parking, congestion during peak hours and high level of air pollution. Global practices followed in developed countries for efficient management of on-street parking space have

proved effective tool in handling the parking demand. The present project showcases response of vehicle parkers to paid policy measure for on-street and off street parking by adopting differential graded parking fees as per parking duration.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 lead 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. The paper tries to observe the root cause of the parking problems and come up with appropriate solutions.Vadodara is the cultural capital of Gujarat where all traditional festivals are celebrated in a unique way. Vadodara is the 20th largest populous city in India. Vadodara is the third largest city of Gujarat tailing behind Ahmadabad and Surat, with an area of 159.95 sq. km and population of 18.22 lakh (2014).

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 avaibility 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

3.1 METHODOLOGY

As observed from the various literature, it seems that their 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.While selection of the site, the whole study area was analyzed. The goal of the study was to observe understand the problems occurring in the region and their root causes. It has to be understood that CBD areas have a high demand almost at all times. This means that parking facilities are in use most of the time. The major parking behavior of the sites was on street parking with few or no facilities for off street parking. The structures in both the areas are relatively low thus there are very few off street parking spaces available in the structures. The areas experience congestions, delays, accidents, and also causes environmental pollution due to noise and smoke, as on street parking reduces the effective travelling width of the street and decreases the LOS of the street.

The major causes of parking problems are enlisted as follows:

- High demand and lack of supply of parking spaces.
- No specific parking marking on the street.
- Lack of Engineering, Education and Enforcement for On street parking.
- Heterogeneous parking type.
- Human error.
- Double parking.
- Short duration parking causes ripple effect or shockwave.
- Accidents due to vehicle maneuverability.
- Encroachment by hawkers.

In order to properly access 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 steps 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 on 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.

3.2 COMPUTATION

The data was collected and computed for a few parking terms required for analysis.

1. Parking Inventory Survey:

The inventory survey was done by measurement of the road width and the trip length for the study area. The dimensions of various on street parking spaces we calculated and then the space was converted into ECS or Equivalent Car Space by considering the ECS of On street parking as 20sq.m as per SP-12:2015.

On street ECS = Total Parking space in sq.m /20 sq.m

2. Parking Demand Survey:

The parking demand survey was obtained using "Fixed Period Sampling" where the initially all the number of parked vehicles were calculated and then after regular intervals the parked vehicles were again counted over the length of the study period. The vehicles were then converted in terms of ECS for ease of calculations.

Eg. ECS for one 2-wheeler = 1 × $\mathbf{0.25}$ = 0.25 ECS

3. Parking Volume:

The total number of vehicles parked during the study period. It is calculated for each interval and summed up for the total day.

Parking Volume = ΣPt

Where Pt = Total parked vehicle at interval "t"

4. Parking Index:

It is the actual number of parking bays occupied by parking with respect to the theoretical number of parking spaces available. It provides with the percentage of the ratio to demand and supply.

Parking Index = Number of bays occupied /Theoretical number of bays available*100

5. Parking Turnover:

Number of the handling of the deployable parking places.

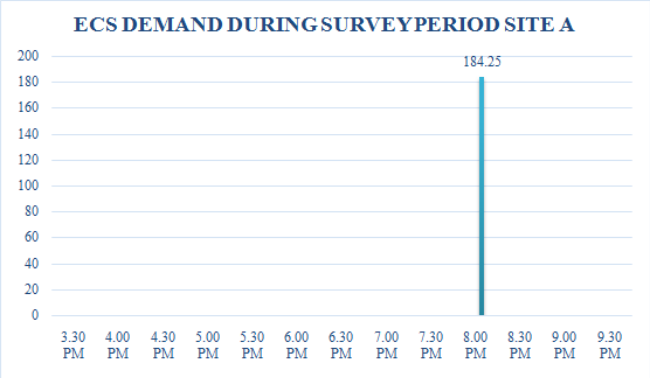
Eg. If there are 50 parking spaces used 2000 vehicles in a period of, say 12 hours, then the parking turn over would be = 2000/50 = 40 vehicles per bay in a time of 12 hours.

4. RESULTS & DISCUSSIONS

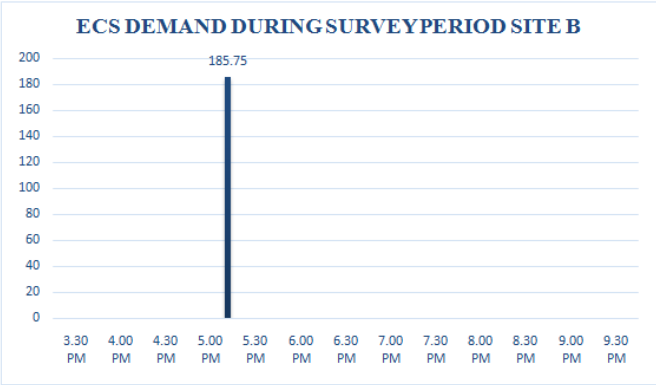
According to the objective of analyzing the On street parking problems of CBD areas, two study areas were selected in Vadodara city. These two area were selected on the basis of their high demand for parking. The study time period for both the areas was of 7 days for 6 hours. The timing was selected considering the peak hour demand timings for both the study regions. First to obtain the parking inventory data, the on street parking spaces were analyzed and the data was converted in terms of ECS and a total available ECS for parking was determined for both the sites. Similarly, in order to find the demand for parking spaces "Fixed Period Sampling" method was used at an interval of 30 min for a duration of 6 hours for 7 days. Using this data, parking parameters such as parked vehicle volume, parking index, parking turnover and average parked vehicle volume were calculated.

4.1 ECS DEMAND

The Parking inventory data provided us with the available ECS available for parking for the region. With the help of ECS demand data, we could figure out the peak demand and supply variations and the average variations for both the sites in order to provide appropriate solutions.For the study area Site A, the demand seems to be increasing during the later part of the study time. The parking demand gradually increases and is maximum at 8.00pm and the starts to decrease. Peak ECS is observed at 8.00pm of 184.25 ECS on the 6 th day. The chart shows represents the all day parking accumulation which has been merged and analyzed which shows the peak ECS demand and its variations with respect to time. Similarly, for the study area 2, the demand seems to be increasing during the earlier part of the study time. The parking demand is initially high and is maximum at 5.00pm and then starts to decrease. Peak ECS is observed at 5.00pm of 185.75 ECS on the 7th day. The chart shows represents the all day parking accumulation which has been merged and analyzed which shows the peak ECS demand and its variations with respect to time.



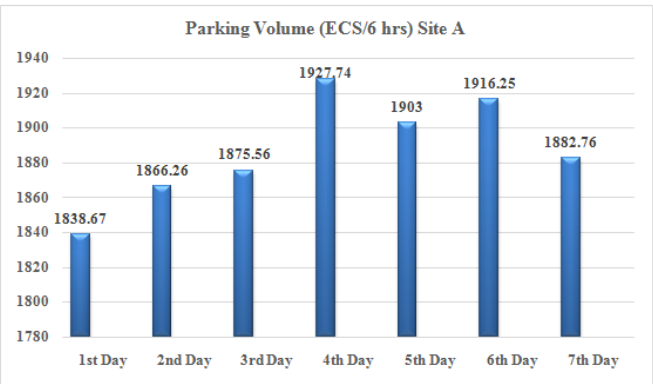
[Fig.4.1: ECS Demand For Site A)



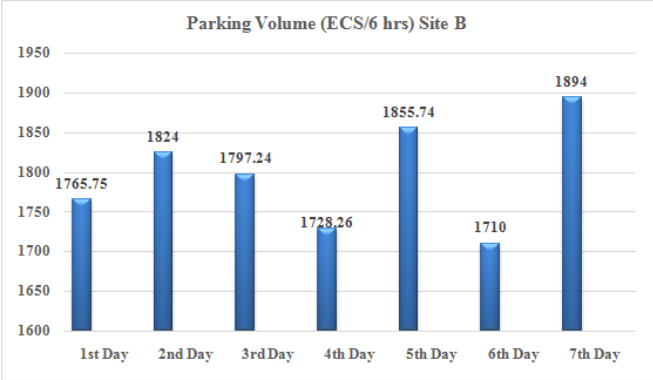
[Fig.4.2: ECS Demand For Site B)

4.2 PARKING VOLUME

The parking volume graph shows that how many vehicles are parked in the study areas selected. This gives a figure of how many vehicles operate in the region every day and the facilities required to accommodate them needs to be improved accordingly. In the study area A the average parking volume for the study period was found to be 1887 ECS per day and for study area B it was 1796.5 ECS per day. This data can be used for designing the traffic regulations in the region. The graph shows the variations in the traffic volume during the study period.



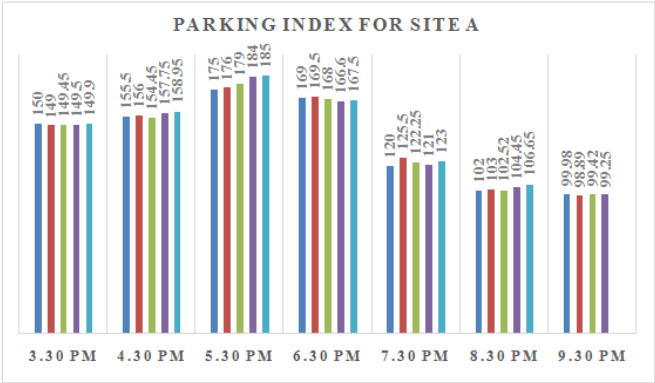
[Fig.4.3: Parking Volume at Site A)



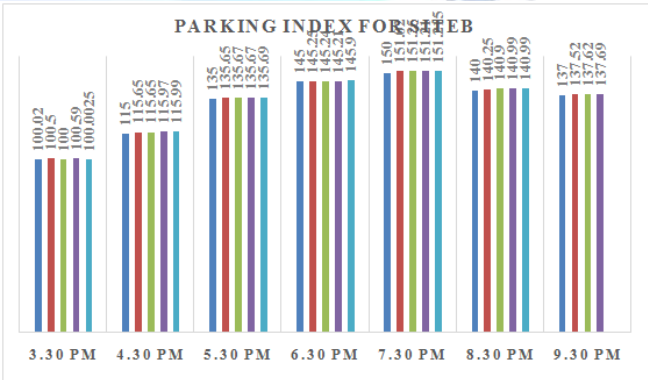
[Fig.4.4: Parking Volume at Site B)

4.3 PARKING INDEX

Parking index provides us with the data in percentage and here it is observed that the parking index during most of the study period for both the sites are greater than 100% which clearly indicates that the demand is greater than supply. This is not an appropriate scenario as it affects the overall efficiency of the transport network and also leads to accidents.



[Fig.4.5: Parking Index for Site A]

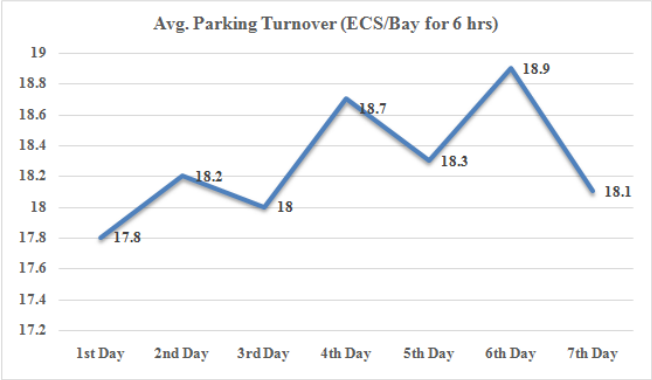


[Fig.4.6: Parking Index for Site B)

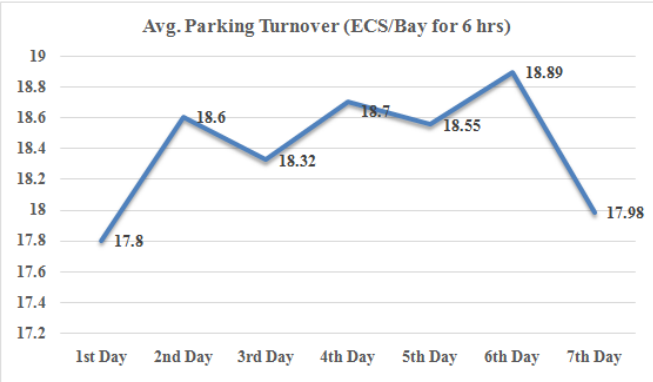
4.4 PARKING TURNOVER

This turnover data indicates how many vehicles utilize a bay during the study period. The data provides us with

the rate of use of a facility. From the results we can conclude that the average utilization for both the study area was 18 for Site A and 19 for Site B. This is useful information in order to get the efficiency of the overall parking system.



[Fig.4.7: Parking Turnover For Site A]



[Fig.4.8: Parking Turnover For Site B]

4.5 SOCIO-ECONOMICAL ASPECT

While data collection it was observed that there was no pricing for On street parking in both the study areas. As a result there was no managing authority at the site to control the parking behavior. As On street parking was freely available the ownership of responsibility towards parking and traffic operations was missing from the drivers. Parking was done on the basis of convenience without thinking about the consequences about the traffic movement. The patrolling of law enforcement authorities was also minimal and whenever they did it caused more commotion in the region. Also there was lack of parking signals, parking markings and visible guidelines which made it even difficult to educate the vehicle users. One of the major reason for decrease in road width was encroachment by hawkers. This was one of the major reasons for traffic commotion and pedestrian accidents as the visibility and the walking spaces at footpaths, both were affected.

5. CONCLUSION

The was conducted by first going through a lot of literature and a few gaps were considered. Then a couple of sites for the assessment of CBD parking problems were considered. It was observed that in Site A, the peak parking demand is 184.25 ECS and the supply of parking space was only 102.3 ECS which is not fulfilling the parking requirement of the region by 81.95 ECS. Peak Parking Index of the region is 180.1075%. Similarly, for Site B, the peak parking demand is 185.75 ECS and the supply of parking space was only 94 ECS. This indicates even worse conditions as gap in supply and demand is 91.75 ECS whereas the peak Parking Index of the region is 197.60%, which is almost twice the supply. For both the sites the parking index was greater than 100% which means that the parking here is affecting the traffic region as On street parking interferes with the traffic operations hence will lead to traffic congestion and other problems. In order to overcome the parking problems a few solutions can be suggested.

- 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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