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A Case Study on Demand Estimation of On-Street Parking in Urban CBD

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Abstract: ***On-street parking is taken into account together of the essential and important components of the urban transportation Despite conurbation , central downtown (CBD) areas still attract significant number of trips, especially for shopping, trade and commerce purposes. The parking issue is trending all round the world especially in central downtown (CBD). Kolkata is one among the most important and oldest metropolitan cities in India which is additionally suffering from the parking problems. Insufficient off-street parking facilities and tendency to park the vehicles almost the destination cause high parking demand. The vehicle ownership and therefore the poor quality of transit system also are the explanations for increase in demand. Factors that stop the most carriageway width reduction, reduction in flow speed and generate unnecessary congestion which creates cruising of parking. Proper parking management policy should be apply to control & regulate the demand. Parameters like age, vehicle ownership, parking duration, annual family income, distance between origin and destination are incorporated to get the demand model. Some field surveys like in-out survey and questionnaire survey were conducted to get the info for above mentioned parameter. The study provides a fundamental insight into the assessment of on-street parking demand using different data monitoring intervals and should ac- cordingly facilitate planners and policymakers to formulate on-street parking demand manage- ment measures in developing countries.***

Keywords: CBD area, Parking Demand Model, Parking duration, Parking supply, SPSS

I. INTRODUCTION

Over the past decade, we have witnessed a major shift in the growth of urbanization in India. As the increase is increased day to day, the utilization of transportation is additionally increasing. But the urban transport problems degrading thanks to lack of organized urban road network, inefficient transit system. Commercial economic and growths are mostly seen in the urban area's core (CBD). A good transportation must be implied to get the mobility in traffic movement. The on-street parking is one of the foremost 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 like to go to CBDs to satisfy their requirements. With increase in population and their income, the numbers of 4-wheelers are also increasing, cause to parking issue in most of the metropolitan cities The problem is very common in India which is a developing country, which means the problem is with developing countries. The parking issue is prominent mainly in metropolitan cities. So, a metropolitan city, Kolkata is chosen because the case study area for this study.Kolkata is one among the most important and oldest metropolitan cities in India.

Due to dense population and dense industrialization, Kolkata CBD areas also are facing an equivalent transport problems. The land use pattern of Kolkata is especially concentrated in CBDs. Due to the less scattered land use pattern in other a part of the town the utmost parking demand is generated in CBD. The growth of Kolkata will staged if we fail to manage the traffic movement of CBDs.

As the parking issue is that the most reason for resisting the traffic movement, the study is concentrated to manage the parking demand.

II. OBJECTIVE

The objectives of this study:

1) To get the parking demand model and

2) Calculate the parking demand and do comparision of demand with the present supply.

Much research has already been done. A number of research papers are studied to satisfy the objectives. The results of some work are briefly described in section 3.

III. LITERATURE SURVEY

David A. Hensher *, Jenny King, 2001, This demand model is used for the parking demand estimation and compared to the already existing parking supply .The current supply and the calculated existing parking demand are represented.It show the correlation coefficients between dependent and independent variables respectively.We can see that even the minimum demand for parking is lower than that of this supply.The situation will get worse for the "maximum" case.The demand will be maximum in the years to come if an adequate policy is not in place to control the parking demand.The process used in this study can also be used to calculate parking demand for similar types of CBD.

Huanmei Qin , Qing Xiao, Hongzhi Guan, Xiaosong Pan, 2010, The parking demand of the different areas like shopping centre and supermarkets in the commercial buildings is calculate which depends upon the parking survey data.With the increase in the accessibility of the public transport, there is decrease in parking demand. While the public transport accessibility index is under 40, with the increase of the accessibility ,parking demand decreases. When the public transport accessibility index is above 60, with the increase of the public transport accessibility parking demand decreases little. In this we also calculate the rate of parking demand under different accessibility levels and the relation model. We come to the conclusions that it will give some important references for the of demand of parking for different buildings in urban areas & calculate the different building's parking index.

Sandip Chakrabarti and Taraknath Mazumder, 2010, in this parking study give the overview of the parameters that affects the parking demand of a family of car owners.It was found that every parameter had a different level of influence on the parking demand for different locations. While looking at the maximum level parking demand functions, similar location unique elasticities have been estimated.This clearly indicates that various policy tools need to be adopted to manage parking demand in various locations. The choice of mode functions derived from this study reveal that the characteristics of the parking supply can play an important role in reducing dependence on the car. However, the relative influence of parking parameters does depend on the trip purpose as well as location, order and hierarchy of the destinations.It should be noted that the equations derived in this study are based on relatively small sample sizes. Therefore, they are only useful in exploring the causal relationships and will not be rigorous enough to be used for prediction purposes.

T. Subramani, 2012, Parking takes up a considerable amount of space on the road, resulting in a decrease in road capacity.So, the speed will decrease, the travel time and also later increase in delay.The increament in the operating cost of the vehicle, resulting in significant economic losses.According to the parking study on the existing traffic conditions on the road network, it is necessary and obligated to remove on the street parking system for a transportation system which is more efficient. Some common parking accidents occur when moving a car from the parking , careless open the doors of the cars which is parked and enter the vehicle into the parking lot to park.It also cause environmental pollution because stopping and starting the vehicle while parking produces some noises and fumes.

J. Aderamo and K.A.Salau, 2013, Parking is a major problem of Nigeria in many urban centers.This is due to the lack of clearly designated parking areas in many of these cities.This caused problem of delay and congestion.With help of this study we come to know the pattern and parking problems like on-street and off-street parking problems in Ilorin and the contributing factors.The parking setting templates were built to estimate the street car park and the off-road needs of the selected routes and parking lots in Ilorin.This will go far to identify the requirements of the parking in the different parts of the city.In addition, it is adviced to develop a more efficient and effective traffic management system for city.As we know the rate of growth of traffic increases in the city Ilorin, and we not compromise with the parking problems until they attain the level of larger urban centres in Nigeria.

Ali Najmi a , Maryam Bostanara a , Ziyuan Gu a,b and Taha H. Rashidi 2021, They had presented a model structure which is an agent-based for urban parking systems to study effect of different SLM and to know the condition of a urban areas which are congested and formed parking supply policies. In addition, the new pricing formula and simple smart parking service have been implemented.Model framework was applied to know the importance of implementation of travel demand management and supply of parking policies in downtown. Policies are more used to four parking in the street, between 98 car parks, known as destination parking lots.Also scenarios of individual demand in the analysis has been included and impact of policies on the increase in demand and demand sensitivity scenarios considered to the different policies has not been modeled.Some key factor like modal choice is used in determining the application portfolio.The pricing and provisioning policies of parking are some main reasons that influence the behavior of individuals in terms of choice of modality.

IV. METHODOLOGY

Parking demand is that the number of parking lot needed during a given area at a while interval. When the demand for parking supply is sufficient, the problem becomes more critical for transportation.

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The parking demand model are obtained by analyzing the information gathered from various types of surveys. Parameters like average number of 4-wheelers owned, average duration of parking (in hours) and of car transit the preferred probability due to itransit was incorporated during this study. A general form of the regression equation is shown below.

(2) Y = Parking demand

x_1 = Average number of 4-wheelers owned

x_2 = Average duration of parking (in hours)

x_3 = Mode choice

over transit as the mode of transport = 1- (3)

where,

U is the utility function is said to be a transit preference function which depends on ionic parameters such as age (A) of the user, annual family income (AIf) and distance(D) of destination from origin.

Two sorts of surveys are administered to develop parking demand model. In-out survey is conducted to urge the height parking accumulation and therefore the peak parking period. Questionnaire survey was administered to urge the worth of desired parameters. Finally, the demand for modern models has been developed and the data has been updated..

V. SURVEY LOCATION

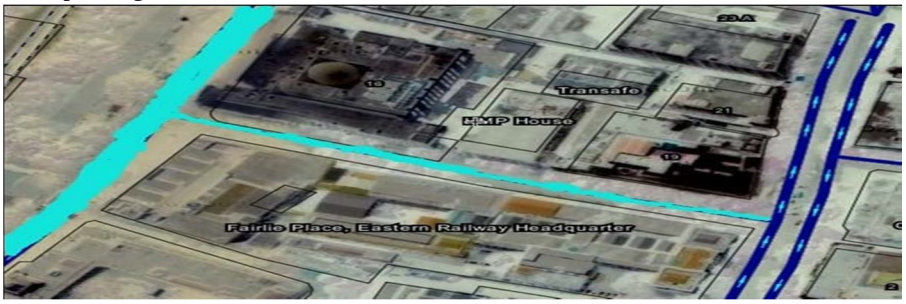
For the case study Some Areas of Kolkata Metropolitan Area (KMA) are selected. Two area selected as case study are CBDs- Gariahat and Dalhousie. The detailed description of the situation of location are shown in figures (Fig 1, Fig 2) below.



Source: Wikimapia

Fig. 1: Map of Gariahat showing the survey street

A crucial junction is Gariahat is shown in (Fig1) that have good connectivity with all other parts of Kolkata, especially south of Kolkata. It is the largest commercial centers of the city which meet all the needs of the people. A good accessibility of transit is available, even people like to visit this place by their own car. In spite of getting two off-street parking zone people like better to choose onstreet parking to scale back ease time. The on-street parking creates an out sized parking demand, which creates cruise of parking.



Source: Wikimapia

Fig. 2: Map of Fairlie Place showing the survey street

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The most important and oldest office areas in Kolkata is Dalhousie square which attracts business trips from the city and even adjacent neighborhoods. The main features of this location are that it creates a huge demand for onstreet parking.
Due to the not availablity of street parking, people are bound to park vehicles on a street.. Fairlie place is that the street which has the utmost parking demand was selected by visual survey and is shown in Fig 2.

VI. SURVEY AND DATA COLLECTION

Parking statistics like parking occupancy, parking volume, average parking duration, parking turnover, etc. can obtain from various types of parking survey. Inout survey, license plate isurvey and questionnaire survey are used in this study. Details of these surveys are presented below.

A. In-Out Survey

This survey is done to calculate the occupancy and parking turnover (μi) of the parking zone .Starting occupancy of the parking space has been taken i.e count the total number of vehicles enter and exit during the fixed time and time intervals. In the last lot, the final occupancy is taken. This survey needs very less numbers of labor. One person is sufficient to perform this survey. This survey was completed from 9 hours to 18 hours in office area on weekdays and from 10 hours to 21 hours in the shopping area on weekends. In starting choose a parking lot. survey is divided into 3 parts to make it easier in conducting the survey. Mark parking bays as 1, 2, 3,...., n, for each part. Subsequently, the survey are checked manually and the videographically. This survey is conducted at an interval of 30 minutes of each hour.The data observed is filled to the Excel sheet. The accumulation and occupancy of the parking were calculated from the excel sheet.

B. License Plate Survey

This survey is supposed to provide positive and realistic data.. In this survey, every parking bay is monitored at a continuous interval of 15 minutes or so and the license plate number is noted. The parking duration for a individual vehicle in a bay is calculated from the data. Parking charge is calculated based on the duration of the parking. If the time difference is not less, then there is little chance of losing parking in the short term..We can say this method required extremely labor.

C. Questionnaire Survey

Two types of questionnaire surveys are conducted like
1) WTP questionnaire survey and
2) Online questionnaire survey.

WTP Questionnaire Survey
The survey questionnaire was carried out at all survey sites. Around 495 numbers of commuters are interviewed during the survey. A qualitative and quantitative analysis needed to be carried out to understand the situation of the existing parking and mode choice. Willingness to pay survey also must be conducted to know the users' requirement for mode shift from private vehicle to transportation system .The questionnaire consists of 4 major groups such as a)personal details,b)trip characteristics, c)parking characteristics and d)parking location choice. The data regarding age, sex, family size, family income and number of 4-wheeler owned are collected from 'personal details' group. Similarly, the data regarding use of alternative mode than private vehicle, purpose of visit, distance between origin and destination, travel time, travel cost,factor affecting PT; preferable parking type, frequency of visit, parking fee, parking fee willing to pay, waiting time, search time, walking time; important factors for choosing parking location, preferable weather for selecting a particular parking lot are collected from 'trip characteristics', 'parking characteristics' and 'parking location choice' groups respectively. Organized this data in the excel sheet.

VII. CONCLUSION

SPSS is used to generate parking demand model in this study for the two locations, viz. Gariahat and Dalhousie. Using this same model, the parking demand is estimated and compared to the existing parking supply.The current is the existing parking supply and demand is estimated. The Pearson correlation coefficients among the dependent and independent variables are plotted respectively for Gariahat and Dalhousie. We see that even the minimum parking requirement is the least present. In maximum case, situation will become worse .

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The demand will be increase in the future if the necessary step regarding proper policy is not taken to control parking demand. The controlling factors for parking demand need to be found out to control the demand. The methodology used in this study can also be used for assessing parking demand for other similar type of CBDs.

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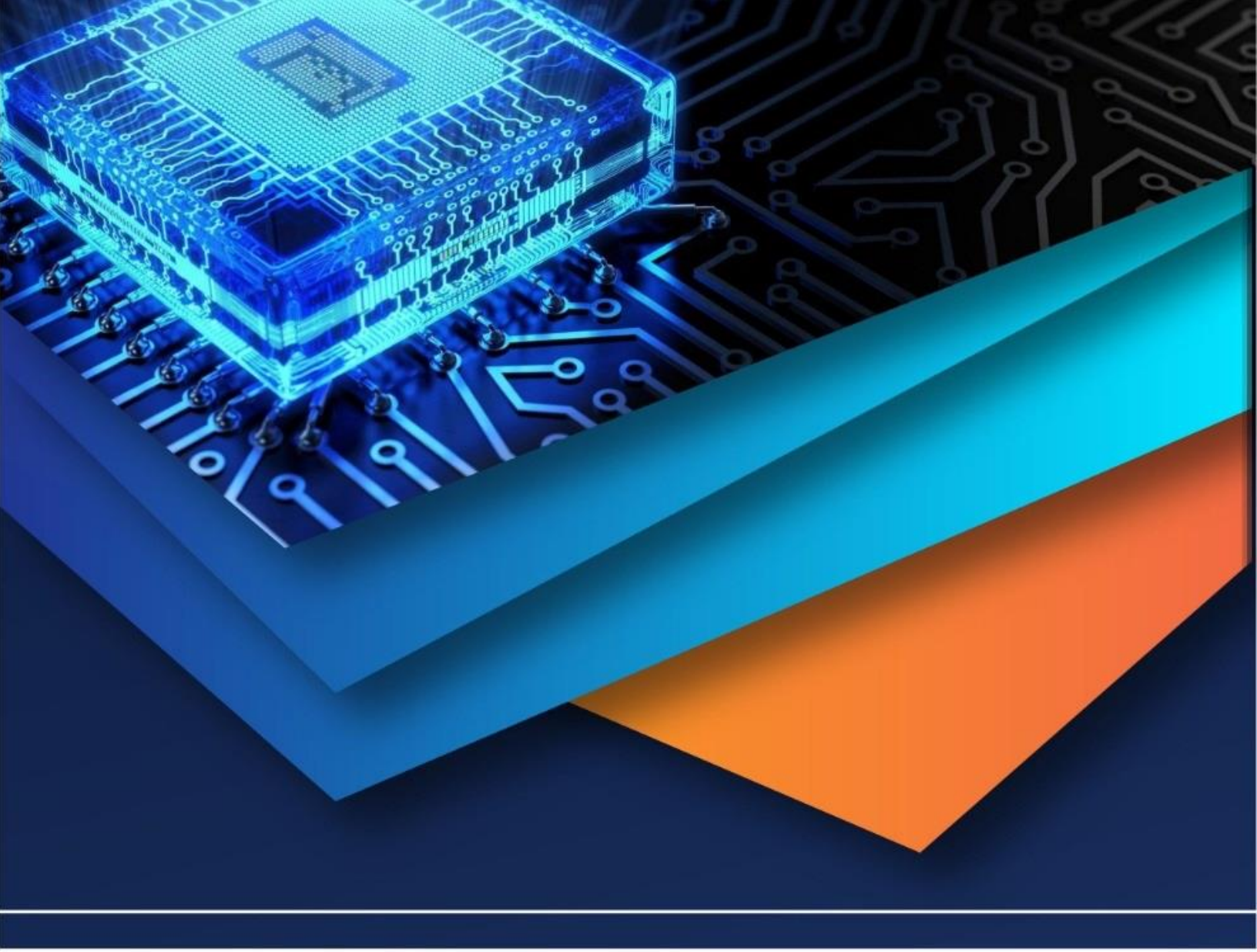
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