

Demand and Supply Analysis of parking in commercial Area: A Case Study Probortak More Area, Chittagong

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ABSTRACT: Transportation engineers and urban planners often report uncertain estimates as precise numbers, and unwarranted trust in the accuracy of these precise numbers can lead to bad transportation and land use policies. This paper presents data on parking and trip generation rates to illustrate the misuse of precise numbers to report statistically insignificant estimates. Beyond the problem of statistical insignificance, parking and trip generation rates typically report the parking demand and vehicle trips observed at suburban sites with ample free parking and no public transit. When decision makers use these parking and trip generation rates for city planning, they create a city where everyone drives to their destinations and parks free when they get there.

KEYWORDS: Demand and Supply, Parking, Commercial area.

1 INTRODUCTION

1.1 BACKGROUND OF THE STUDY

Every day a significant percentage of drivers in single-occupancy vehicles search for a parking space. Additionally, less experienced drivers or out-of-towners further contribute to the increase of traffic congestion. The type of the planned activity, time of a day, day of the week, current congestion of particular routes, knowledge of city streets, and potentially available parking places have significant influence on a chosen parking search strategy[1]. Chittagong is one of the most important cities in Bangladesh. Because of the commercial activities the city has become a commercial hub of the country. Day by day the trade and business has increased. For this reason the number of private cars, trucks and other vehicles has been increasing day by day [2]. So it is essential to improve the transportation system in this city. We have to consider every components of transportation system so that the city becomes more walk-able as well as attractive.

Parking is an essential component of the transportation system. Parking is the act of stopping a vehicle and leaving it unoccupied for more than a brief time. Parking on one or both sides of a road is commonly permitted, though often with restrictions [3]. Parking facilities are constructed in combination with most buildings, to facilitate the coming and going of the buildings' users.

1.2 GOALS AND OBJECTIVES OF THE STUDY

The objectives of this study are:

- To analyze the parking demand and supply in Probortak Area, Chittagong.
- To know the parking trend in this region.
- To Estimate the existing private and public parking supply. Identify whether or not there is an observed shortfall of parking.

1.3 SCOPE AND LIMITATION OF THE STUDY

This report offers an overview of Probortak area’s current parking requirements and compares them with industry standards as well as actual (observed) parking demand rates in several peer cities. In practice, many cities’ minimum (and maximum) parking requirements – that is, how many parking spaces developers are required to construct as part of any development project –are not empirically linked to actual demand for parking at a particular development site. Parking requirements that do not reflect the contextual variability of parking demand incur unnecessary costs on both developers and cities, and create excesses of parking supply that may reduce an area’s walkability and attractiveness.

Though the study is comprised of some objectives that are effective for the further development of parking of the study area it has few limitations. There is no available data of the parked cars in the concern authority. Lack of man power to survey the study area. The driver does not maintain the traffic rules. They parked their cars here and there. There are no proper rules for parking.

1.4 STUDY AREA PROFILE

This study is confined to the city of Chittagong. In order to understand the parking behavior and mode choice of motorists with respect to shopping as well as work trips in the city of Chittagong, surveys will be conducted at a commercial place named Probortak More Area. This area has some important markets. For example- Mimi super market, Afmi plaza, CSCR.

2 CONCEPTUAL BACKGROUND

2.1 PARKING

Parking is the act of stopping a vehicle and leaving it unoccupied for more than a brief time. Parking on one or both sides of a road is commonly permitted, though often with restrictions. Parking facilities are constructed in combination with most buildings, to facilitate the coming and going of the buildings' users.

2.2 PARKING TYPE

- a. Parallel parking
- b. Perpendicular parking
- c. Angle parking/echelon parking
- d. On street parking
- e. off street parking
- f. Valet parking



Figure 1: Mimi super market parking



Figure 2: Afmi plaza underground parking

2.2.1 PARALLEL PARKING

With parallel parking of cars, these are arranged in a line, with the front bumper of one car facing the back bumper of an adjacent one. This is done parallel to a curb, when one is provided. Parallel parking is the most common mode of street side parking for cars. It may also be used in parking lots and parking structures, but usually only to supplement parking spaces that use the other modes. [3]

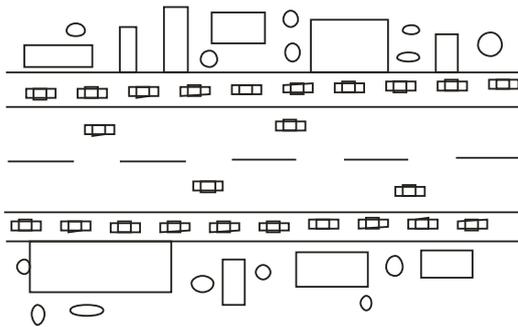


Figure 3: Plan of Parallel parking

2.2.2 PERPENDICULAR PARKING

With perpendicular parking of cars, these are parked side to side, perpendicular to an aisle, curb, or wall. This type of car parking is more scalable than parallel parking and is therefore commonly used in car parking lots and car parking structures. [3]

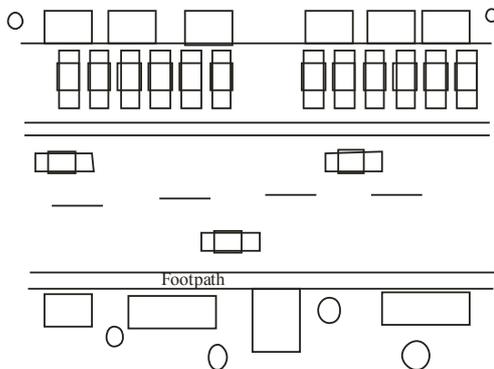


Figure 4: Plan of Perpendicular parking

2.2.3 ANGULAR PARKING

Angle parking, known as echelon parking in Britain, of cars is similar to perpendicular parking for these vehicles, except that cars are arranged at an angle to the aisle (an acute angle with the direction of approach). The gentler turn allows easier and quicker parking, narrower aisles, and thus higher density than perpendicular parking. While in theory the aisles are one-way, in practice they are typically wide enough to allow two cars to pass slowly when drivers go down the aisles the wrong way. [3]

2.3 PARKING SPACE

The width of angled and perpendicular parking spaces usually ranges from 2.3 to 2.75 metres (7.5–9.0 ft). For example, normal parking spaces in a city are 8.5 feet wide, while compact spaces are 7.5 feet wide. Because the boundary between parking space and driving area is not always well-defined, the length of a parking space is more difficult to establish. However, most angled and perpendicular spaces are considered to be between 3.2 and 5.5 metres (10 and 18 ft) in length. Parallel parking spaces are typically cited as being approximately 2.76 metres (9.1 ft) wide by 6.1 meters (20 ft.) long. [4]

2.4 TYPES OF PARKING SURVEYS

- Parking Space inventory
- Patrol Method by using surveys
- Questionnaires' type parking usage surveys
- Cordon Count
- Photographic Methods

2.4.1 PARKING SPACE INVENTORY

The first steps in parking surveys are to collect data on the amount, types and location of space actually or potentially available for parking in an area. The area to be surveyed should first be delineated. The central business district is usually the area where parking surveyed is needed. The data on parking facilities should be recorded on the plans using suitable symbols. [5]

- length of kerb
- Number of parking spaces
- Street width.
- Location of bus stops, bus bays etc.
- Traffic management measures in force
- Numbers and types of parking signs for regulation of parking.
- Vacant or unused land suitable for temporary parking space.

2.4.2 PATROL METHOD BY USING SURVEYS

The purpose of using parking usage survey is to obtain data on extend of usage of parking spaces. The survey will include count of parked vehicles at regular intervals through a period, covering both the morning and evening peak period, and the parking accumulation and turn over. [5]

2.4.3 QUESTIONNAIRES' TYPE PARKING USAGE SURVEYS

The questionnaire types parking usage survey involves interviews with the drivers who use the parking facilities. As a result, it is possible to collect information on the extent, to which the existing facilities are being used, the parking requirements at the prices existing at the time of survey, the parking demand at different prices, the distribution of demand over area and time and the journey purpose of car parkers.

The survey can either be made by making enquiries amount of car owners living in the vicinity of the survey area, or by the making enquiries amount the drivers of car seen to park in the area at the time of the survey. [5]

2.4.4 CORDON COUNT

In this method, to be surveyed is demarcated by a cordon line which is crossed by the roads emanating from the area. Counting stations are established at these crossing points and a count is made of all the vehicles entering and living the area. The difference between two traffic gives the numbers of vehicles parked or in motion in the area. The counting can be manual or automatic. [5]

2.4.5 PHOTOGRAPHIC METHODS

The photographic method is finding useful application in parking surveys. The photographic method is used in aerial photography in producing maps. Survey to study the behavior of different aspects of road traffic such as speed, volume, concentration, accidents and geometric design. [5]

2.5 PARKING DEMAND

Parking Demand refers to the amount of parking that would be used at a particular time, place and price. It is a critical factor in evaluating parking problems and solutions. Parking demand is affected by vehicle ownership, trip rates, mode split,

duration (how long motorists park), geographic location (i.e., downtown, regional town centre or suburban), the quality of travel alternatives, type of trip (work, shopping, recreational), and factors such as fuel and road pricing.

2.6 PARKING SUPPLY

Parking supply refers to the amount of legal space provide for parking. It may be off street parking space or on street parking space.

Parking volume: The number of vehicles parking in a particular area over a given period of time is called parking volume. It is usually measured in vehicles per day. [5]

Parking load: The area under the parking accumulation curve during a specific period is called parking load. (Kadlyali, 2010)

Parking duration: The length of time spent in a parking space is called the parking duration.

Parking Index: Parking Index is the percentage of parking bays actually occupied by the parked vehicles as compared to the theoretical number available. [5]

$$\text{Parking Index} = \frac{\text{Number of bays occupied}}{\text{Theoretical number of bays available}} * 100$$

Parking turn-over: The rate of the usage of the available parking space is called parking turnover. Thus if there were 10 parking spaces used by 100 vehicles in a period of, say time 12 hours, then the parking turn over would be = $\frac{100}{10}$ vehicles per space in a period of 12 hours. [5]

3 METHODOLOGY

3.1 INTRODUCTION

A system of broad principles or rules from which specific methods or procedures may be derived to interpret or solve different problems within the scope of a particular discipline. Unlike an algorithm, a methodology is not a formula but a set of practices.

3.2 SELECTION OF PROJECT

The selected project topic is analysis of parking at Pobortok More in Chittagong, in case of Demand and Supply.

3.3 SETTLING OF GOAL AND OBJECTIVE

- To analyze parking demand and supply.
- To know the parking trend in this region.
- To estimate the existing public and private parking facilities.

3.4 LITERATURE REVIEW

Literature review for learning about different parking analysis method, how conduct this survey, what will be the benefits in this survey.

3.5 DATA COLLECTION

Data are collected from two sources

1. Primary data source
2. Secondary data source.

3.5.1 PRIMARY DATA COLLECTION

Primary data collected from field survey in different method such as parking space inventory, cordon survey etc.

Primary data includes:

1. Demand.
2. Supply.
3. Accumulation curve.

3.5.2 SECONDARY DATA COLLECTION

Secondary data collected from different types of report, internet etc.

Secondary data includes:

1. Method of survey.
2. Theoretical concept.

3.6 DATA ANALYSIS AND FINDINGS

By SPSS software and Microsoft Excel we analysis the data which collected from field survey. After input data we calculate demand and supply and draw an accumulation curve.

3.7 REPORT WRITING & PRESENTATION

After the final analysis, the study has prepared as a report and then the presentation of the Report was prepared.

4 DATA PROCESSING

The data which is obtained by Probortak more area is analyzed through the SPSS software. The sample is taken by randomly. 60 drivers of different vehicles are taken as sample in different parking lot. Samples are also taken from the vehicle users who parked their vehicles on the street.

Table 1: Trip purposes in the Probortak more Area

Activity	Trip purpose			
	Frequency	Percent	Valid Percent	Cumulative Percent
To work	9	15.0	15.0	15.0
Shopping	18	30.0	30.0	45.0
Business	6	10.0	10.0	55.0
Personal affair	7	11.7	11.7	66.7
To eat restaurant	4	6.7	6.7	73.3
School/college/university	4	6.7	6.7	80.0
Service passenger	12	20.0	20.0	100.0
Total	60	100.0	100.0	

In Probortak more area, there are Mimi super market, Afmi plaza etc. As Probortak more area is one of the important marketing places so we see in the above table 30% of trip is done for marketing/ shopping purpose. Again we see that 20% of vehicles come here to serve the passengers. Different type of CNG, taxi and public bus come and parked the vehicles. Here people also come for their business (10%), to eat (6.7%), to do their personal work (15%) and also come Chittagong Medical College and Premier University (6.7%).

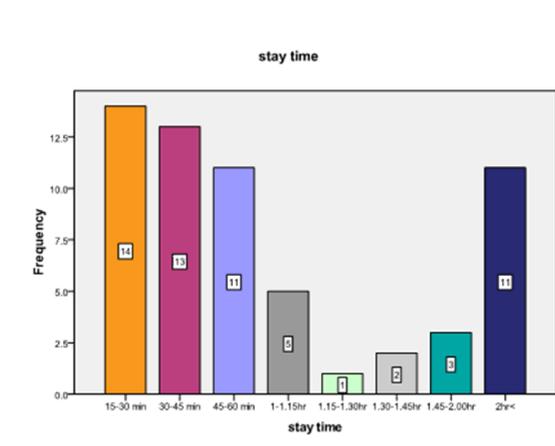


Figure 5: Time duration along which the vehicles are parked in the parking lot.

From the above bar chart we see that most of the vehicles (23.3%) stay 15 to 30 minutes in the parking lot. 21.7% vehicles stay 30 to 45 minutes and 18.3% vehicles stay 45 minutes to one hour.

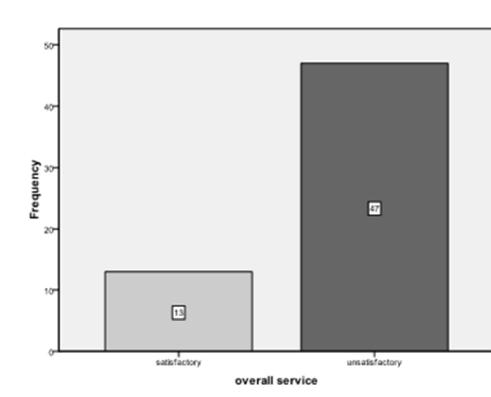


Figure 6: Overall parking facilities services

From this table and bar chart we see that almost 80% of parking facilities services is unsatisfactory. The vehicles users are not satisfied to the available parking facilities.

4.1 DEMAND AND SUPPLY ANALYSIS FOR WEEKEND-DAY

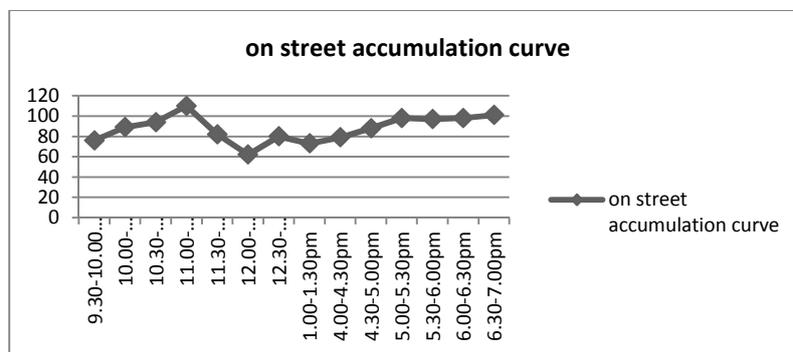


Figure 7: weekend day-on street parking accumulation curve

In pobortok more area illegal on street parking is very high because there is no facility for on street parking. In medical road most of vehicle parking on the street. Loading and unloading vehicle parking on street. Medical representative park their vehicle on road after a long.

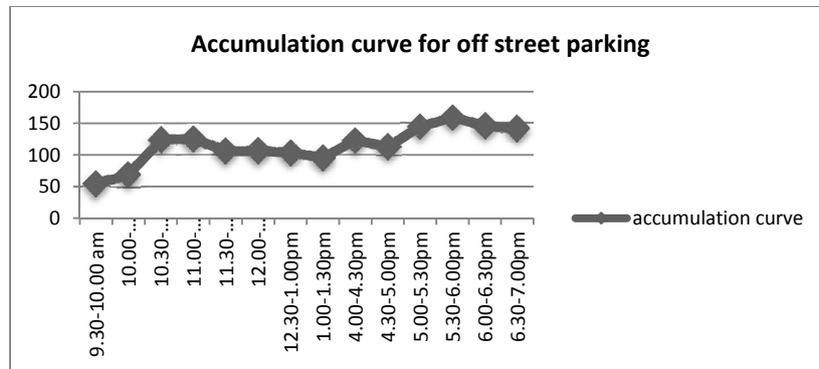


Figure 8: weekend day-off street parking accumulation curve

For off street parking we find highest parking vehicle in 10.30-11.30am and 5.00-7.00pm because in this time people come diagnostic center, and come market for buying.

4.2 ON STREET PARKING DEMAND (PEAK HOUR)

1 Car = 1 car, 2 Rickshaw = 1 car, 2 CNG = 1 car, 4 motor cycle = 1 car

On street parking demand-10.30-11.30 A.M (peak hour) =204 car per hour

On street parking demand-11.30-12.30 A.M (peak hour) =144 car per hour

On street parking demand-5.00-6.00 P.M (peak hour) =195 car per hour

On street parking demand-6.00-7.00 P.M (peak hour) =199 car per hour

Overall on parking demand (peak hour) = $\frac{200+144+195+199}{4}$ car per hour=184 car per hour

4.3 OFF STREET PARKING DEMAND (PEAK HOUR)

Off street parking demand-10.30-11.30 A.M (peak hour) =250 car per hour

Off street parking demand-11.30-12.30 A.M (peak hour) =212 car per hour

Off street parking demand-5.00-6.00 P.M (peak hour) =304 car per hour

Off street parking demand-6.00-7.00 P.M (peak hour) =288 car per hour

Overall off parking demand (peak hour) = $\frac{250+212+304+288}{4}$ car per hour= 264car per hour

Capacity or supply=280 car per hour

4.4 COMPARE BETWEEN OF STREET AND ON STREET PARKING ACCUMULATION CURVE IN WEEK DAY

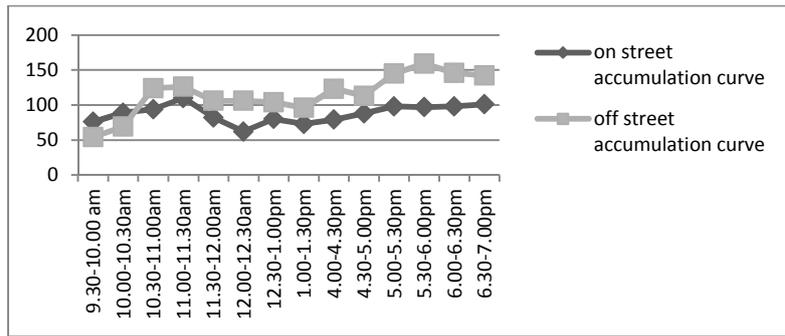


Figure 9: Compare between of street and on street parking accumulation curve in week day

Compare between two accumulation curve in weekend day we show that off street paring is high than on street parking. In weekend day most of the people come for marketing in afmi plaza and Mimi super market on car and parking on parking bay. Highest off street parking found 5.00-6.00 pm.

4.5 DEMAND AND SUPPLY ANALYSIS FOR WEEK-DAY

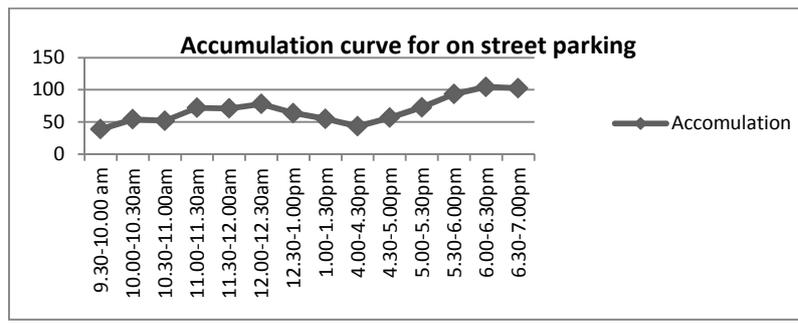


Figure 10: week day-on street parking accumulation curve

In week day accumulation curve show that highest on street parking found in 11.00-12.00am and 5.00-7.00pm.in weekend day morning time on street parking relatively low than weekend day because afmi plaza and Mimi super market close in Sunday and Monday up to 2.00 pm.

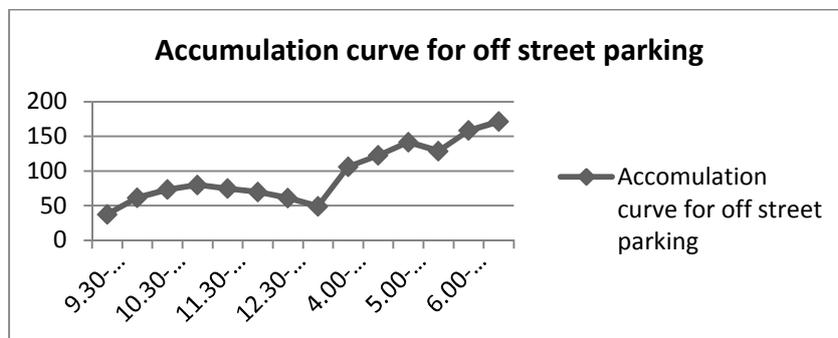


Figure 11: week day-off street parking accumulation curve

In week day off street parking also low in Sunday and Monday up to 2.0 pm.due to because afmi plaza and Mimi super market close in Sunday and Monday up to 2.00 pm.after 2.00 pm people come for marketing and number off street parking is increased.

4.6 COMPARE BETWEEN OF STREET AND ON STREET PARKING ACCUMULATION CURVE IN WEEK DAY

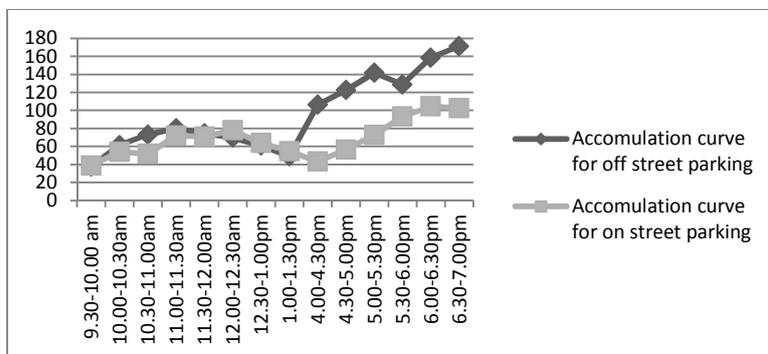


Figure 12: Compare between of street and on street parking accumulation curve in week day

Compare between off street parking and on street parking in week day show that on street parking is high than off street parking. In morning time people come for medical for treatment.

4.7 ON STREET PARKING DEMAND (PEAK HOUR)

- On street parking demand-10.30-11.30 A.M (peak hour) =124 car per hour
- On street parking demand-11.30-12.30 A.M (peak hour) =143 car per hour
- On street parking demand-5.00-6.00 P.M (peak hour) =166 car per hour
- On street parking demand-6.00-7.00 P.M (peak hour) =207 car per hour
- Overall on parking demand (peak hour) = $\frac{124+143+166+207}{4}$ car per hour=160 car per hour

4.8 OFF STREET PARKING DEMAND (PEAK HOUR)

- Off street parking demand-10.30-11.30 A.M (peak hour) =153 car per hour
- Off street parking demand-11.30-12.30 A.M (peak hour) =144 car per hour
- Off street parking demand-5.00-6.00 P.M (peak hour) =269 car per hour
- Off street parking demand-6.00-7.00 P.M (peak hour) =329 car per hour
- Overall off parking demand (peak hour) = $\frac{153+144+269+329}{4}$ car per hour= 224 car per hour
- Capacity or supply=280 car per hour

4.9 COMPARISON BETWEEN WEEK AND WEEKEND DAY ACCUMULATION CURVE

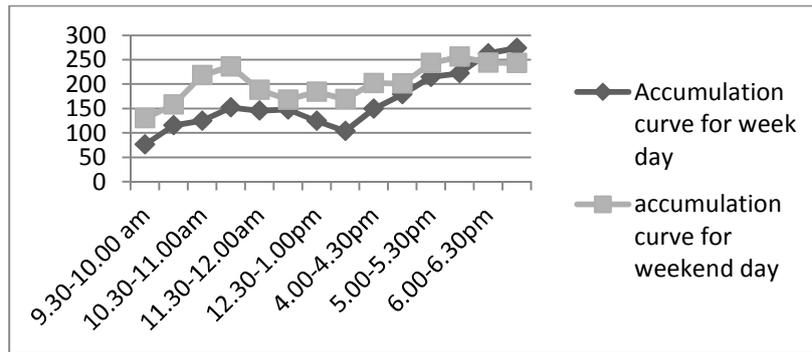


Figure 13: Comparison between week day and weekend day accumulation curve

Comparison between week day and weekend day accumulation curve we see that weekend day accumulation curve is higher than week accumulation curve. So the demand of weekend day is higher than week day. afmi plaza and Mimi super market being close up to 2.00pm in Sunday and Monday.

4.10 COMPARISON BETWEEN DEMAND AND SUPPLY BOTH WEEK AND WEEKEND DAY

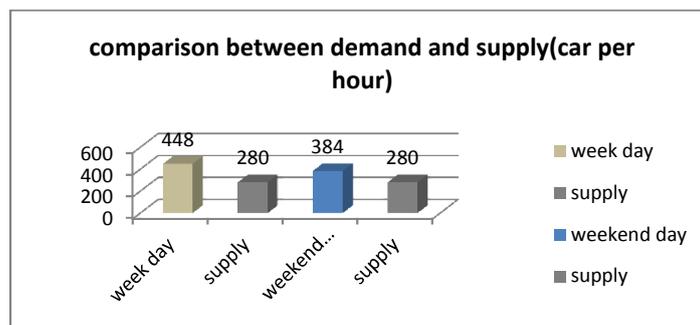


Figure 14: Comparison between demand and supply both week and weekend day

From the above figure we see that the demand for parking space is greater than the supply. Here we see that in the week day the demand is 488 cars per hour but the supply is 280 cars per hour which is almost half to meet the demand. We also see in the weekend day the demand for parking is 384 cars per hour but the supply is the same that means 280 which is very much less than the demand.

4.11 EXISTING PARKING CONDITION IN STUDY AREA

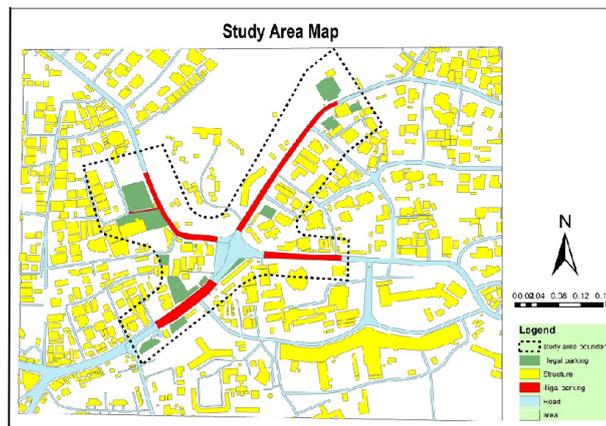


Figure 14: Existing parking condition in study Area

The study area map show that there are two types of parking mainly occur such as on street parking and off street parking. But most of the on street parking are illegal and create traffic congestion. This area is a mixed land use area so it needs proper parking management.

5 FINDINGS AND CONCLUSION

5.1 SUMMARY FINDINGS

Parking is one of the most important elements in transportation system. The parking demand and supply analysis of probortak more area will elaborate the future such type of study. From this study we find results which show us the parking trend and also the parking demand of this area.

From the analysis part we see that most of the cars are parked in three parking lots. These are Mimi super market parking lot, afmi plaza underground parking lot and CSCR diagnostic center. In the evening this lots are fulfilled by different vehicles and many time the vehicles users do not get space for vehicles.

The total capacity of this area is 280 cars per hour which is not sufficient to meet the demand of the vehicles. Even if we consider the off streets parking then there is also lack of parking spaces. On the other hand there is no on street parking lot in this area but there are a lot of vehicles which is parked besides the road. This is one of the most influential causes for jam. Again the road width is not sufficient. So if we there is lack of specific parking lot, we cannot be able to reduce the jam of this area. There are also some management problems in the parking lot. Sometimes police charge on street parking illegally.

5.2 CONCLUSION

This study highlights the parameters which influence the parking demand of an automobile owning household. It has been observed that each parameter has varied level of influence on parking demand for various locations. While looking at the aggregate level parking demand functions, similar location specific elasticity's have been observed. This clearly points to the fact that varied policy tools need to be adopted for parking demand management at various locations. The mode choice functions derived in this study reveal that parking supply characteristics can play a significant role in reducing automobile dependency. However, the relative influence of parking parameters does depend on the trip purpose as well as location, order and hierarchy of the destinations.

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