Study of Parking Patterns for Different Parking Facilities

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Abstract: **As we all know that world's population is increasing day by day. Increasing population increases the vehicle use. So, now parking has become a major issue now a day. There is a huge demand of proper parking facilities. In order to short out the parking demand, we need to study the parking pattern so that we can improve the parking facilities. I collected data from different parking space in my University. Initially we figured out what is the variation of PCU (Passenger Car Unit) with a certain time and then we compared all these data with the help of t- test to find out whether these parking pattern are same or different.**

Keywords: **Parking, PCU, t-test, Pattern.**

I.   INTRODUCTION

World's vehicle use statics are increasing day by day. It's a major issue for proper parking facilities in order to maintain the traffic conditions and adequate traffic flow. So, to overcome with the traffic and parking problems, we need to understand the parking demands so that we can improve the parking facilities. So, in order to know the parking demand, we have to analyze firstly the parking patterns. So, to study the parking pattern, I had surveyed the different parking facilities present at "Lovely Professional University" where the parking demand is at the peak. Most of the people have their own vehicles, so there is a huge demand of proper parking space.

Proper design of parking space is very important for good transporting system. If there will be lack of parking space and facility then it will be a chaotic condition for everyone. But designing of any parking space is not a easy job. It seeks a lot of parameters which we need to know, we need to find out with the help of simple data by applying some technique.

Generally, there are two types of parking patterns.

(i). On Street Parking

It includes (a). Parallel Parking, (b) Angle Parking

(ii). Off Street Parking

It includes (a). Surface car parking, (b). multistory car parking, (c). Roof parking, (d). Mechanical car parking,

(e). Underground car parking.

There are certain characteristics which have full impact on parking demands such as:

(i). Parking accumulation - It is defined as the number of parked vehicle at a specified time is called Parking accumulation.

(ii). Parking duration - Parking duration is defined as the length of time for which vehicle uses the facility.

(iii). Parking volume - Parking volume means number of vehicle involved in parking activity is called parking volume.

(iv). Occupancy - It is defined as the ratio of number of vehicles using parking facility to the number of parking facility available at a specified time.

In order to understand the parking patterns, we had converted all the observations of parking study i.e., vehicular parking data parked in the particular parking space into a single unit called PCU (Passenger Car Unit) given by Indian Road Congress and compared the data of different parking facilities to know the parking pattern.

II.   RESEARCH METHODOLOGY

A.   Data Collection Site

There are several parking places inside LPU. We collected data from different three major site inside Lovely Professional University Campus. The data collection process carried out on working days of the University.

i.   Main Parking

ii.   Eastern Gate Parking

iii.   Southern Gate Parking

B.   Data collection methodology

Discussing about the data collected in LPU campus, we collected all these data from different site in LPU at the same time from 8 am to 10 am as this time is for college start hours. I surveyed all the above given parking place, from this survey I got the number of two wheeler motorized and non-motorized vehicle, four wheeler vehicles, three wheeler vehicles being crossed the road in LPU and being parked at a specified parking place.

C.   Data analysis and methodology

LPU data: From the three site I had collected the data. After collection of data I convert all these number vehicles in terms of PCU (Passenger Car Unit) by multiplying it with its corresponding PCU factor which is described in IRC-6.

Table 1: PCU factor for different type of vehicle by Indian Road Congress – 6

Sr. No.	Vehicle Type	PCU
	Fast Vehicles	
1.	Two wheeler motor cycle or scooter etc	0.5
2.	Passenger car pick up van	1.0
3.	Auto rickshaw	1.2
4.	Light commercial vehicle	1.4
5.	Truck or Bus	2.2
6.	Agricultural tractor trailer	4.0
	Slow Vehicles	
1.	Cycle	0.4
2.	Cycle Rickshaw	1.5
3.	Tonga (horse drawn vehicle)	1.5
4.	Hand cart	2.0

D.   Final Data Analysis:

I compared all these PCU calculated data with each other to find out that either these parking pattern are different or not. Now question is which test we should apply. Here we are applying

"t-test", the reason behind this is we have less number of samples so we cannot go for any other test.

$$t = \frac{\overline{X}_1 - \overline{X}_2}{\sqrt{\dfrac{\Sigma(X_{1i} - \overline{X}_1)^2 + \Sigma(X_{2i} - \overline{X}_2)^2}{n_1 + n_2 - 2}} \times \sqrt{\dfrac{1}{n_1} + \dfrac{1}{n_2}}}$$

with d.f. $= (n_1 + n_2 - 2)$

't'-indicates the t-value, while 'X bar' denotes mean.

First we find out the value of degree of freedom (i.e. d.f.) for finding out this 'd.f.' we need number of sample ('n') so we will get the value of 'd.f.'

After that we will find the 't'-value (this will be t-critical value).

So, at 8 % significance level, t-Critical should be 2.306004.

By putting the values in the formula, we get 't-stat'.

Now if 't-stat' will be greater than 't-critical' then our parking pattern is different otherwise it will not be different.

III.   DATA AND ITS ANALYSIS

i.   Main Parking

Table 2: PCU for Main Parking (In front of 28 blocks)

TIME	CYCLE	TWO WHEELER	FOUR WHEELER	PCU
08:00	18	24	14	38.8
08:15	06	18	06	19.8
08:30	03	21	18	36.9
08:45	22	68	56	121.2
09:00	08	22	21	43.6
09:15	06	18	20	39.4
09:30	21	32	24	58.0
09:45	36	52	52	113.2

ii.   Eastern Gate Parking

Table 3: PCU for Eastern Gate Parking (Block-1 parking)

TIME	CYCLE	TWO WHEELER	FOUR WHEELER	PCU
08:00	00	00	02	02.8
08:15	00	03	02	04.3
08:30	06	08	04	12.0
08:45	08	12	06	17.6
09:00	09	03	03	09.3
09:15	12	02	01	07.2
09:30	06	03	04	09.5
09:45	03	01	01	03.1

iii.   Southern Gate Parking

Table 4: PCU for Southern Gate parking (55-58 block parking)

TIME	CYCLE	TWO WHEELER	FOUR WHEELER	PCU
08:00	06	22	06	21.8
08:15	02	08	03	09.0
08:30	06	18	12	28.2
08:45	22	98	36	108.2
09:00	04	18	06	54.0
09:15	03	22	08	23.4
09:30	12	56	12	49.6
09:45	18	58	21	65.6
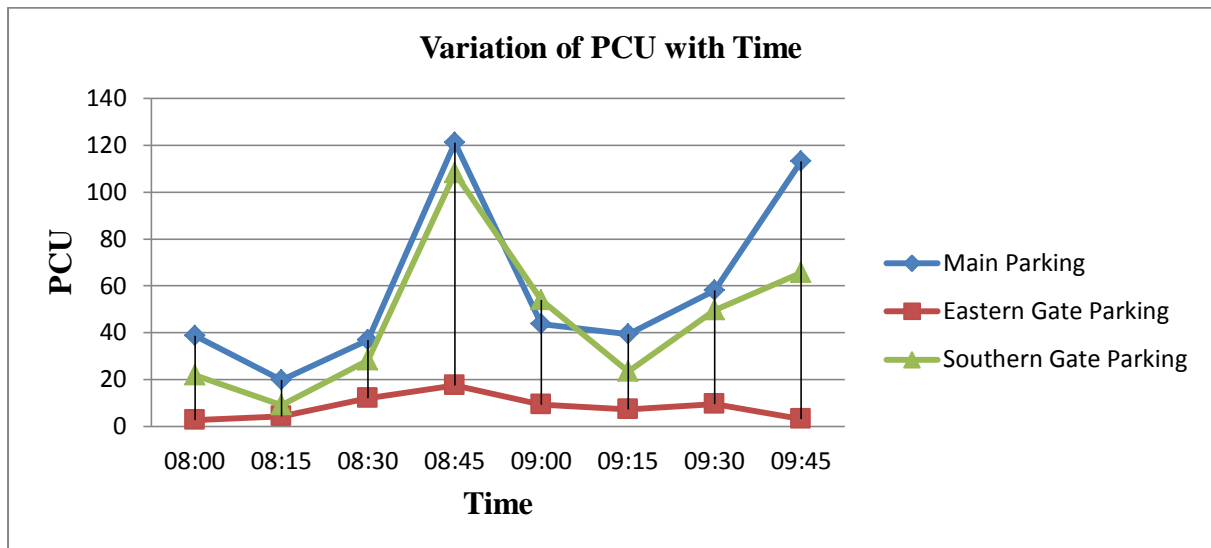
Graph 1: Variation of PCU with Time for these three parking facilities.

Comparison of analyzed data through 't-test':

Table 5: Comparison of mean of the PCU by t-test

Sr. No.	Parking Place	t-Critical	t-stat	Type of parking
1.	Southern Gate & Eastern Gate	2.306004	3.223	Different
2.	Main Parking & Southern Gate	2.306004	0.795	Not Different
3.	Eastern Gate & Main Parking	2.306004	3.782	Different

After comparing the different parking spaces in terms of PCU by 't-test', we observed the different parking patterns inside the parking spaces of LPU.

The parking pattern of Main Parking & Southern Gate have not different while Southern Gate & Eastern Gate, Eastern Gate & Main Parking have different parking pattern.

The parking spaces where there is different parking pattern, it means that there is the different demand of parking facilities while the places where the parking pattern is same, there is the same demand of parking facilities.

IV.   RESULT AND DISCUSSION

The result of this study gives us the information about the different parking patterns of the parking facilities present at LPU. The different parking pattern means the parking places between whom the comparison has been carried out have different parking facilities in the sense of area of parking to the total number of vehicle parked. They are different because at one parking place, there is more number of vehicle parked in accordance with the area of parking space in compare to the other parking place. At some parking places, there is no alignment for parking for different vehicles, somewhere the spacing between alignments are very much. These all leads to the misuse of parking places and difference of parking pattern. So, there should be proper alignment for parking of different vehicles, there should be proper drainage system, there should be shades, there must be green environment, etc. to improve the parking facilities.

V.   CONCLUSION

Study of parking facilities are very complex process as it involves numerous activities depending on execution of each activity in accordance with parking specifications and proper survey. There is a huge parking demand in LPU. Therefore, developing a short-term or a long-term parking improvement plan requires the cooperation public i.e., students, staffs, and

the university management. The factor that affect the demand for parking at LPU include the number & percentage of vehicles in the parking traffic stream, the distance between the vehicles & the main stopping line, the distance between the parked vehicle & the nearest vehicle stop or the rest area and the facilities provided at the parking places. If the parking facilities at some places not expanded, it is highly probable that more vehicles will be parked on the shoulder adjacent to the rest area.

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