

Parking Study And Analysis Using T-Test Significance

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ABSTRACT

India has the world's second biggest population and a burgeoning economy. Due to economic expansion, there is a considerable flow of vehicles these days, and every family owns one or more vehicles. The biggest concern currently is parking vehicles, either on or off the roadway. Parking spaces are few in the central business district locations. Many regions have congested parking due to a lack of parking space. The current parking analysis study is being carried out in major regions of Shivamogga city. The four locations in Shivamogga city are chosen as research areas, and the survey is carried out using parking space inventory, parking usage by patrolling survey, and In-out survey to determine parking occupancy, accumulation, parking load, and total parked vehicles at the designated regions. On the four study areas, the t-test was used with a 5% significant threshold. And it is discovered that all of the selected study areas have t-test values that are less than the crucial value, indicating good significance of fit.

Keywords— parking surveys, parking occupancy, T-test

1. Introduction

The current study the parking area at Shivamogga city is selected. In this study the four study areas are selected for the study purpose. The selected study areas are the central area of business and the variation of traffic flow can be seen. The selected study areas at Shivamogga city are JNNCE college which has off-street parking system and in JNNCE the three parking areas are considered which are parking at MBA block, parking at administrative block and parking at step building. Nehru Road is one of the selected areas which has on-street parking likewise the Railway station which has surface parking system and KSRTC bus stand which has underground parking system. These parking areas have both 2-wheeler and 4-wheeler parking facility except KSRTC bus stand which has only 2-wheeler parking system. The considered surveys are carried out at the study area and analysed the collected data from the study areas for 3-days which is one day at weekday and other two days at weekend except at JNNCE college in college one day at each place is collected. The data were analysed based on In-out and parking using y patrolling survey format. And occupancy at parking area, parking of vehicles throughout the survey period, and parking load are calculated and based on the analysed data the suitable data for t-test is considered and applied to find out whether the parking data is within the t-critical value.

2. Various types of parking surveys:

The following surveys are considered for the current study

- parking space inventory
- parking usage survey by patrol
- In-Out studies

3. Objectives:

The following objectives for present study are derived from the detailed literature review to know

- To analyse the significance of T-test on selected study area.

4. Study areas:

For the present study Shivamogga city is selected as it has prime location where it has maximum vehicular movement are seen at the parking location throughout the day. The selected study areas are as follows

1. JNNCE
 - a. Parking at the MBA block,
 - b. Parking at the step building,
 - c. Parking at the administrative block.
2. NEHRU ROAD
3. RAILWAY STATION
4. KSRTC BUS STAND

5. Geometric collection

The geometric details are gathered by doing a parking space inventory in order to learn more about the parking area.

RAILWAY STATION

The parking space at the train station and separate parking has been provided, with a capacity of 753 for surface car parking, 704 for two-wheelers, and 49 for cars or four-wheelers. The parking spot measures 39.6m in length and 54m in width. The vehicle length and breadth for a 2-wheeler are 2*0.6m and 4.3*2.5m for a 4-wheeler.

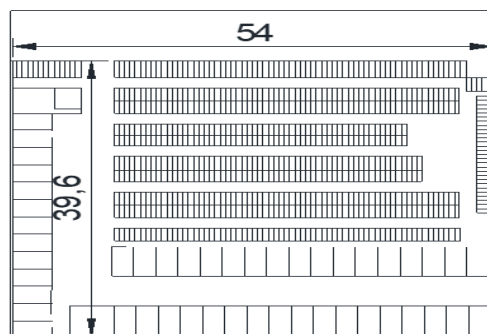


Fig 1: The image of existing parking area of railway station shown by using Auto-CADD from the collected data.

6. Data collection: The data are collected from the parking using by patrolling survey and the In-out survey at the selected study areas. The selected study areas are most crowded place at Shivamogga which has more flow of vehicles. The selected study areas have both On-street and Off-street parking system. The data of 3 days are collected at the following study areas.

1. JNNCE
 - a. Parking at the MBA block,
 - b. Parking at the step building,
 - c. Parking at the administrative block.
2. NEHRU ROAD
3. RAILWAY STATION
4. KSRTC BUS STAND

The sample of the collected data is shown in the below tables

Table 1: A. The collected data sample of 2-wheeler by parking usage by patrolling survey at MBA block in JNNCE.

07:00		07:30		08:00		08:30		09:00		09:30		10:00		10:30		11:00		11:30		12:00	
L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R
		250		250		250		250		250		250		250		250		250		250	
		349		349		349		349		349		349		349		349		349		349	
		46		46		46		46		46		46		46		46		46		46	
		602		602		602		602		602		602		602		602		602		602	
				147		147		147		147		147		147		147		147		147	
				714		714		714		714		714		714		714		714		714	
				75		75		75		75		75		75		75		75		75	
				484		484		484		484		484		484		484		484		484	

Table 2: B. The collected data sample of 2-wheeler by parking usage by patrolling survey at MBA block in JNNCE.

12:30		01:00		01:30		02:00		02:30		03:00		03:30		04:00		04:30		05:00		05:30	
L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R
250		250		250		250		250		250		250		250		250		250		250	
349		349		349		349		349		349		349		349		349		349		349	
46		46		46		46		46		46		46		46		46		46		46	
602		602		602		602		602		602		602		602		602		602		602	
147		147		147		147		147		147		147		147		147		147		147	
714		714		714		714		714		714		714		714		714		714		714	
75		75		75		75		75		75		75		75		75		75		75	
484		484		484		484		484		484		484		484		484		484		484	

Table 3: The collected data of 2-wheeler by In-out survey at MBA block in JNNCE.

TIM E	07:00	07:30	08:00	08:30	09:00	09:30	10:00	10:30	11:00	11:30	12:00	12:30	01:00	01:30	02:00	02:30	03:00	03:30	04:00	04:30	05:00	05:30
IN	0	4	5	4	1	10	8	14	12	0	0	0	1	0	2	0	0	0	0	0	0	0
OUT	0	0	0	0	0	0	0	0	0	1	2	1	0	2	0	1	1	1	1	2	3	9

Table 4: The collected data of 4-wheeler by In-out survey at MBA block in JNNCE.

TIM E	07:00	07:30	08:00	08:30	09:00	09:30	10:00	10:30	11:00	11:30	12:00	12:30	01:00	01:30	02:00	02:30	03:00	03:30	04:00	04:30	05:00	05:30
IN	0	1	0	0	0	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0
OUT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

7. CONCLUSION

Based on the collected data at the selected study areas after the thorough analysis of the parking survey the parking criteria at the study areas are

T-test

The analysed data from the parking using by patrolling survey and In-out survey used for the t-test. The occupancy data is used for the t-test to know the variation at the 5% significance level for 42 D.F. to analyse the t-test occupancy of 2-wheeler is considered as X and occupancy of the 4-wheeler is considered as Y. in selected study areas having both 2-wheeler and 4-wheeler parking except the parking at the KSRTC bus stand there the occupancy value is considered as 0. The t-test applied on each selected area for the study.

Table 5: The analysed data to find mean for MBA block parking for 2-wheeler.

X	X- $\sum X$	(X- $\sum X$) ²
0	-869	755161
4	-865	748225
9	-856	732736
13	-856	732736
14	-855	731025
24	-845	714025
32	-837	700569
46	-823	677329
58	-811	657721
57	-812	659344
55	-814	662596
55	-814	662596
55	-814	665856
53	-816	665856
53	-816	665856
53	-816	665856
53	-816	667489
52	-817	667489
51	-818	669124
49	-820	672400
46	-823	677329
37	-832	692224
$\sum X=869$		(X- $\sum X$) ² =15143542

The above table5 the2-wheeler occupancy at MBA block is considered as X and it is calculated find the mean and standard deviation of the X value for the t-test analysis.

Table 6: The analysed data to find mean for MBA block parking for 4- wheeler.

Y	y- $\sum y$	(Y- $\sum y$) ²
0	-100	10000
1	-99	9801
1	-99	9801
1	-99	9801
1	-99	9801
2	-98	9604
3	-97	9409

4	-96	9216
5	-95	9025
5	-95	9025
6	-94	8836
6	-94	8836
6	-94	8836
6	-94	8836
6	-94	8836
6	-94	8836
6	-94	8836
6	-94	8836
6	-94	8836
6	-94	8836
6	-94	8836
6	-94	8836
6	-94	8836
11	-89	7921
$\sum y=100$		($\sum y$) ² =200600

In the table .6 the 4-wheeler occupancy at MBA block is considered as Y. and the mean and standard deviation for y is calculated as shown in above fig for the t-test analysis. The sample calculation of the t-test for MBA block is explained here.

Mean = $\sum x /n$,

Mean=869/22

Mean=39.5

Mean= $\sum y/n$

Mean =100/22

Mean =4.54

$S^2=1/n1-n2-2*\{\sum(x - \sum x)^2 - \sum(y - \sum y)^2\}$

$S^2= 1/22+22-2*\{15143542-200600\} =667136608.7$

S=25828.98

$T=39.5-4.54/25828(\sqrt{1/22+1/22})$.

$T=0.00448 < T 0.5=1.960$ for 42 degree of freedom.

The t-value is 0.00448 which is less than the t- critical value =1.960 for 42 degree of freedom at 5% significance level. As shown in above the other place are tested considering 2-wheeler occupancy data as x and 4- wheeler occupancy data as y. the consolidated form of the other parking places are shown in below.

Table 7: The consolidated data the t-test analysis for the study area.

sl.no	place	mean		SD		n		t-value	t-critical
		x	y	x	y	x	y		
1	JNNCE								
a	MBA	39.5	4.54	721121.04	9552	22	22	0.00448	1.96
b	Step block	170.6 8	13.1 8	282932143	1686188	22	22	0.204	1.96
c	Admin block	22.36	10.3 1	4848785	1033211	22	22	0.108	1.96
2	Nehru road	211.2 7	59	432826500	3378692 6	22	22	0.154	1.96
3	railway station	354	40.9 5	1215891013	1627292 1	22	22	0.195	1.96

4	KSRTC bus stand	1399.5	0	19079728412	0	22	22	0.221	1.96
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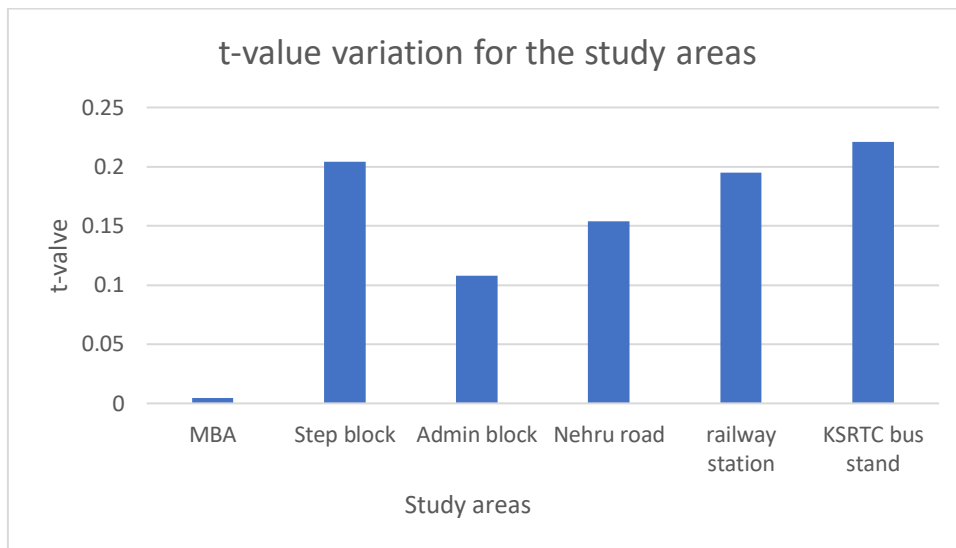


Fig 2: The variation of the t-value for the study areas.

As shown in the above graph the t-value for the selected study areas varies from one place to other. The MBA has less t-value when compared to other study areas. While the KSRTC bus stand has more t-value than the other study areas. The t-test applied to the study areas is satisfactory.

The data collected are analysed for the selected study areas. The t-test is applied to the analysed data of occupancy for the 5% of significance level with the t-critical value 1.96. the data of t-test is shown in table 7.87 and it explained in the graph 7.22. the t-vlaue for the selected are consolidated and shown in below table. As shown in the above table 7 the KSRTC bus stand has more t-value when compared to other areas and the MBA block has less t-value. The t-test value for all selected parking areas is within the t-critical value. Hence, the t-test applied to the parking area is satisfactory.

Reference

[1]. Rafiat Oluwatosin Omisore & Joseph O. Oyedepo, "Evaluation of off-street parking in central business district of southwestern Nigeria -a case study of Akure". In international journal of advanced research, pp 529-536. IJAR, 2019.

[2]. Herin k.j & jisha akkara. "Study of on-street and off-street parking choice behaviour". In international journal of advanced research in computer and communication engineering, pp 79-83. IJARCCCE,2019.

[3]. Naitik Gandhi, Jayesh juremalani. "On-street parking problems in CBD area & remedied measures – a case study of Godhra city". In international journal of civil engineering and technology. pp1375-1385. IJCIET, 2019.

[4]. Pranav D. Desai, Karana. K. Bijwe, Surabh. S. Bora, Dnyaneshwar. A. Aware and prof. S.S Kolapkar. "Analysis of parking trends and design of an off-street parking system and implementation of management solutions on J.M. Road, pune". In international journal of engineering research and technology. pp1517-1522. IJERT, 2019.

[5]. L.R. Kadiyali. "Traffic engineering and transport planning". pp80-82. Khanna publication, 2018.ss

[6]. Dr.lajqi naser, Dr.lajqi shpetim & Dr.doci illir. "The methodology for vehicles parking analysis :case study -city of prishtina". In international scientific journal. pp 499-503. ISJ, 2017.

[7]. Dr.Kirti mohan sharma, Parmesh prjapti & mridul jain. "problem of parking and their possible solutions with special reference to Kota city". In CPUH-research journal. pp18-24. CPUH, 2017.



- [8]. Herrdis herdianshyah, Sugiyanto, Andrew Guntur Octavianto, Edison Guntur Aritonang, Malya Nova Imaduddin, Dedi, Mafira Milaningrum.” capacity analysis of parking lot and volume of vehicle toward sustainable parking convenience”. In IOP publication, pp 1-6. IOP, 2017.
- [9]. Er. Gurpreet Singh & Er. Harpreet Singh.” A study of parking accumulation in Chandigarh city centre”. In international journal of engineering research & technology. pp 427-432. IJERT, 2016.
- [10]. Sitesh singh.” Study of parking patterns for different parking facilities”. In international journal of civil and structural engineering research. pp 35-39. IJCSE, 2014.
- [11]. T. subramani.” parking study on main corridors in major urban centre”. In international journal of modern engineering research, pp 742-748. IJMER, 2012.
- [12] Ranjith Kumar. “Research Methodology a step-by-step for beginners”. In SAGE publications. pp 191-213. SAGE, 2011.
- [13] Douglas C. Montgomery, George C. Runger.” Applied statistics and probability for engineers”. pp 284-344. 2011.