Research Paper
Impact Factor: 3.567
Peer Reviewed Journal

IJMDRR
E- ISSN –2395-1885
ISSN -2395-1877

AN ANALYSIS OF VEHICLE PARKING IN URBAN AREA AT KANAYAKUMARI DISTRICT.

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Abstract
Parking plays an important role in mobility, access and the economic development of cities, at the same time, it is a profitable business for both the private and public sectors. In this paper we discuss the analysis of the vehicle parking in urban area at kanayakumari district.This paper we analyze the average number of customers (vehicles), average waiting time, traffic intensity etc. are calculated by single server queuing model with exponential service time ,non exponential service time , constant service time and simulation in the closed parking system, since the parking area can be defined as a queuing system. The model represents the parking process six days from 6 a.m. to 4p.m.

Key words: *Queuing theory, stochastic process, Poisson distribution, exponential distribution, normal distribution.*

Introduction

Parking can be defined as the act of a vehicle stopping standing or loading along a street. When this occurs on the road it is termed on-street parking and elsewhere, it is termed off-street parking. Vehicles cannot be in the state of motion, it needs tostop at places as per the motorist's requirements. Since vehicles are used for transporting people or goods from one point to another. Since every vehicles needs parking at all destinations, the demand for parking space has to put immense pressure on the urban landscape.The demand for parking services is not constant, but it varies from lowest to highest. The span between the lowest and highest demand and the dynamism of changes are fundamentalfactors which influence the required size of parking area capacities and the financial effect of parking. Since the arrivals of vehicles and length of parking time can be taken as a random variable (stochastic) and the empirical distribution of these variables then approximated with adequate theoretical distributions, for parking areas it is possible to apply the analytical approach.

Parking area as a queuing system

The queuing theory is one of the methods of operational researches studying the problems of waiting lines whose task is to serve randomly arrived units or request for service. The queuing theory uses mathematical models to determine inter-dependence among the arrival of units, their waiting to be served, their serving and finally the exit of units from the system. Since the arrival of the vehicles in the parking is irregular, Statistical analysis has confirmed that the arrivals of vehicles and the length of service time can be observed as random variables. This paper takesin to consideration 'closed parking systems' which represent parking location in to which all entering and exiting points are equipped with certain types of rambs,where when entering from the incoming terminal ,the driver takes the parking ticket and enters in to parking and the payment is made in toll booths.

If the number of vehicles arrived in the parking area is greater than the number of vehicles the existing parking capacities can serve in a unit of time, then vehicles are lined up in waiting lines and in reverse case vehicles do not wait, but parking capacities are not fully exploited. For the selected system of incoming terminals in to the parking area the arrivals intensity flow λ represent the average number of vehicles arriving in to the parking area in a unit of time under observations. For the selected system of income terminals in the parking area the intensity of servicing μ represents also the average number of vehicles which can be served in a unit of time. Service time is expressed in the number of units of time necessary for the servicing of one vehicle that is the entry of vehicles in to the parking area. The relation between the intensity of the flow of arrivals and the intensity of the flow of servicing is $\rho = \frac{\lambda}{\mu}$. If the entry servers are occupied, the vehicle wait in the line until served. Here the arrivals of vehicles in to parking area as well as the length of parking time are random variables.

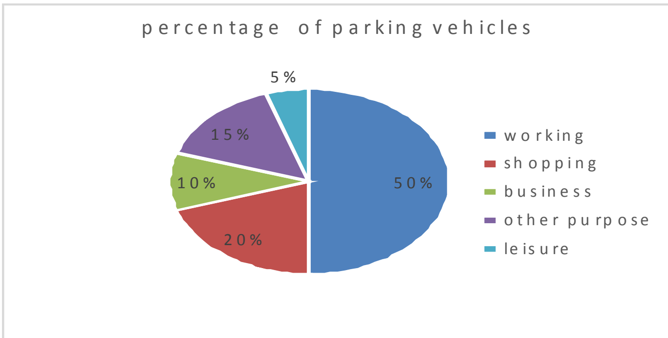
Advantages parking system.

- It is cost effective, it can generate a financial perfect in case of paid parking polices as can parking schemes based upon permits and time regulation.
- It delivers good out comes as the traffic volume will be reduced. It also helps to manage road space efficiently.
- In the long term approval of citizens and businesses can be high.
- It is well security with tech-savvy security provisions. The vehicle users are well assured on grounds of security and privacy. Their vehicles lie in safe environment and are equally well protected. The system hinders unauthorized

entry or exit and is suitable for single and multiple entry points, places like shopping malls, hospitals and hotels can manage their entire parking system.

Percentage of parking users travel purposes in Nagercoil area

In terms of respondents main reasons for travelling in Nagercoil area 20% for shopping 50% for working 10% business, 5% for travel for leisure and 15% travel for other reasons.



Single server queuing models. (Exponential service –UN **limited queues)**

This model is based on certain assumptions about the queuing system.

1. Arrivals are described by Poisson probability distribution and come from an infinite calling population.
2. Single – waiting line and each and arrival waits to be served regardless of the length of the queue
3. Queue discipline is first come, first served
4. Single server or channel and service time follow exponential distribution. Customers arrival is (vehicles) independent but the arrival rate does not change over time
5. The average service rate is more than average rate.

The following events may occur during a small interval of time, Δt just before time t.

1. The system is state n number of customers at time t and no arrival and no departure.
2. The System is in state n+1 (number of Customers) and no arrival and one departure.
3. The system is in state n-1 (number of customers) and one arrival and no departure

The process of determining p_n- probability of n customers in the system at time t

In this case, Expected number of customers in the queue $L_q = \frac{\lambda}{\mu-\lambda}$.

Expected number of customers waiting in the system $L_s = \frac{\lambda^2}{\mu(\mu-\lambda)}$

Expected waiting time for a customers in the system $W_s = \frac{1}{\mu-\lambda}$.

Expected waiting time for a customers in the queue $W_q = \frac{\lambda}{\mu(\mu-\lambda)}$.

Single server queuing models (constant service time –unlimited queues)

If the service time is constant instead of exponential distribution time for servicing each customer then the values of L_s, L_q, W_s $and W_s$ will be less than the previous case.

Expected number of customers in the queue $L_q = \frac{\lambda^2}{2\mu(\mu-\lambda)}$.

Expected number of customers waiting in the system $L_s = L_q + \frac{\lambda}{\mu}$.

Expected waiting time for a customers in the system $W_s = W_q + \frac{1}{\mu}$.

Expected waiting time for a customers in the queue $W_q = \frac{L_q}{\lambda}$.

Single server-Non exponential service time.

When the service time can-not be described by an exponential distribution, the normal could also be used to represent the service pattern of a single queuing system. A queuing model where arrivals form a possion process, while the service time follow normal distribution depends on the S.D for service time and assumes no particular form for the distribution itself. In this case

$$p_0 = 1 - \frac{\lambda}{\mu}, \rho = \frac{\lambda}{\mu}.$$

Expected number of customers in the queue $L_q = \dfrac{\lambda^2\sigma^2 + \left(\frac{\lambda}{\mu}\right)^2}{2\left(1 - \frac{\lambda}{\mu}\right)}$

Expected number ofcustomers waiting in the system $L_s = L_q + \frac{\lambda}{\mu}$

Expected waiting time for a customers in the system $W_s = w_q + \frac{1}{\mu}$

Expected waiting time for a customers in the queue $W_q = \frac{L_q}{\lambda}$

Six days vehicle parking for Nagercoil area.

Time	Day1	Day2	Day3	Day4	Day5	Day6	Total
6.00-7.00	80	67	74	79	63	55	418
7.00-8.00	108	125	117	130	119	80	679
8.00-9.00	114	134	120	158	113	94	733
9.00-10.00	75	62	71	82	69	50	409
10.00-11.00	50	48	34	42	31	39	244
11.00-12.00	35	41	34	31	39	42	222
12.00-1.00	28	25	18	24	24	30	149
1.00-2.00	14	20	24	28	19	32	137
2.00-3.00	26	31	35	32	29	44	197
3.00-4.00	32	40	24	37	34	49	216
total	562	593	551	643	540	515	3404

Analysis of service time

Time (x)	No.of vehicles served (F)	XF
2	326	652
3	284	852
4	417	1668
5	521	2605
6	382	2292
7	203	1421
8	350	2800
9	355	3195

10	204	2040
11	116	1276
12	94	1128
13	92	1196
14	60	840
total	3404	21965

Average arrival rate λ =5.67
Average service rate μ =6.45

Comparison of M/M/1 queuing models and simulation result

m/m/1 model	L_s	L_q	w_s	w_q	ρ
Exponential service time	7.30	6.39	1.28	1.127	0.87
Non exponential service time	26.0	25.0	5.0	4.0	0.88
Constant service time	2.542	1.7322	o.448	0.3053	0.81
Simulation result	7.44	6.544	1.30	1.488	0.896

Conclusion

It may be noted that the in the case of non-exponential service timethe values of L_s, L_q, w_s, w_q are more than in exponential service time.In the case of constant service time the values of L_s, L_q, w_s, w_q are less than in exponential service time. This model is also a contribution of the queuing theory a specific future which is stochastic creation of service channels. In future we develop a parking system which will not only be economic, but also an environmentally sustainable.

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