Prediction of Parking Space Near By Chinchwad Railway Station By Using Queueing Mathematical Model

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Abstract- *Now a days with the increase in rate of population rate of vehicle is also increase. Which may cause lack of parking spaces in public as well as commercial Areas. people may face lot of parking problems due to less no of parking lots which even creates traffic congestion and even causes number of accidents. For this study we have used parking of commercial Area in which we have to predict the parking space required in next 5 years by queuing mathematical modeling as well as by best feting curve. For that purpose record of no of increase of vehicles in PCMC area is collected by RTO ,so as to recommend to PCMC to take attributes towards it. For that a trench is selected for study near Chinchwad railway Station of commercial area for parking study. This study is helpful for prediction of parking lot. With the help of this study we can calculate traffic intensity,% utilization of provided parking lot on every day basis, waiting time, service time, system time,interarrival time of vehicles in selected commercial area near chinchwad railway station. Then by using the data collected from RTO and by application of best feting curve on that data ,we can predict requirement of parking lot to be provided by PCMC in next 5 years.*

Keywords- parking study, queuing model , best fitting curve

I. INTRODUCTION

Parking is an essential component of the transportation in city. Vehicles must park at every destination. Seeing the situation of narrow roads in our city people may face lot of parking problems due to less no of parking lots which even creates traffic congestion and even causes number of accidents. The Pune city of Maharashtra is one of the known populated city along with a number of industries present in given area due to which the need of transportation and travelling is required in abundant. As transportation requires large number of vehicles and wider roads which are not adequately provided due to the urbanization and residential problems. Hence an efficient and well planned program which will require less space for parking management should be made. Parking lot planner will often look for the cheapest land to provide cheaper surface parking. In the last 10+ years, development has tended to be low density, single-use projects that, in large part, result from the way in which the automobile dictates development patterns. Parking is an essential element in the commercial Area; insufficient parking spaces may cause much hindrance to the people visiting the commercial buildings.

Here in this paper we have made a queuing mathematical model with the help of that model we can calculate the average service time ,average waiting time, average interarrival time of each vehicle using the parking facility provided to them. With the help of that model we can also calculate the traffic intensity , % utilization of facility ,as well as % idealness of facility. After that increased rate of population of vehicles in PCMC area in last 7 years is collected from RTO. Which is helpful for further calculation of prediction of space require for parking , for that purpose best feting curve is used. Next section discuss the methodology of study ,after which findings of the survey are presented and discussed . The conclusion of the study is presented in the last section.

II. OBJECTIVES OF REASEARCH

- The objective of study is to do the 7 days survey of provided parking lot by PCMC.
- Develop Queuing mathematical model on that survey .
- And do the predictions of % increase of vehicles in next 5 years , by best fitting curve.

III. METHODOLOGY OF STUDY

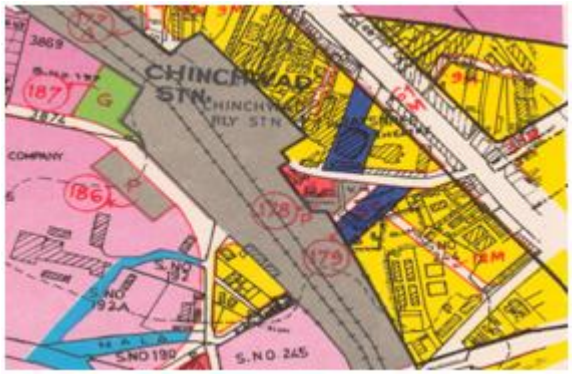


Fig1.Development plan near chinchwad railway station

1) For parking study the area which is mostly circulated due to peoples are taken into consideration.
2) Hence for the parking study we have considered area nearby chinchwad station on Mumbai puna highway.
3) This area is circulated by peoples due to large no of commercial complexes situated near by chinchwad railway station.
4) By observations of parking of those commercial complexes, it is states that parking area provided to those commercial complexes are very less.
5) Due to that over all parking load is carried out by the parking lots which is provided by PCMC . in front of those commercial complexes on the street of Mumbai puna highway.
6) In this parking study we have observed the 3 parking lots as 70 no of bays provided for two wheelers , 20 parking bays provided for four wheelers , and again 30 no of bays provided for two wheelers .Respectively
7) And then overall on street parking survey is carried out on that on street parking lot provided by PCMC.
8) 8) For that matter 1 week survey is carried out in which vehicle no, arrival time and departure time is noted down of every single vehical.
9) With the help of that collated data queuing mathematical model is prepared.
10) The sample analysis of that model is given in analysis portion of this paper.
11) With the help of the queuing mathematical model we are able to calculate the overall of vehicles visited at parking lot in total survey time of 10 hours and 30 mints.
12) With the help of the queuing mathematical model we are able to calculate the overall l no of vehicles visited at parking lot in total survey time of 10 hours and 30 mints.
13) We have used excel sheet for further calculation of service time , waiting time , system time ,inter-arrival time. which is clearly explained in analysis part of this paper .
14) Hear I have given an sample of that excel calculations as representation of overall work is clumsy .
15) With the help of queuing mathematical modeling and the data obtained form RTO , which is of increased no of vehicles in last 7 years . we are able to predict the requirement of parking lots in next 5 years . which is explained in analysis part of this paper

IV. ANALYSIS

1) Here we have used Queuing mathematical model on the survey which is carried out of one week.
2) By using excel sheet , with the help of the queuing mathematical model we can calculate average service time, average waiting time, average inter arrival time, as well as average system time .
3) Along with that traffic intensity, and facility utilization can be calculated.
4) Here we have given sample analysis of parking lot provide by PCMC with availability of 30 bays, for 2 wheeler vehicles.
5) (See table) In the given table column 1 represents vehicle no ,column no 2 represents service start time , column no 3 represents service finish time , column no 4 is service time which is obtain by subtracting service start form service finish time; column no 5 is waiting time which is obtain by subtracting arrival time from service start time; column no 6 is for system time which is obtain by subtracting arrival from service finish time; column no 7 represents inter arrival time which will get from 2nd arrival time minus 1st arrival time respectively.
6) Then by using these traffic intensity and facility utilization is calculated by details given below the table.

Vehicle number	Arrival time	Service start	Service finish	service time	waiting time	system time	Interarrival time
MH 02 X 6450	9:00	9:00	9:10	0:10	0:00	0:10	0:00
MH-12 AD 4597	9:00	9:00	18:00	9:00	0:00	9:00	0:05
MH-02 OQ 5151	9:05	9:05	9:20	0:15	0:00	0:15	0:03
GJ -22 P 9009	9:08	9:08	9:21	0:13	0:00	0:13	0:05
MH -14 B 2969	9:13	9:13	10:15	1:02	0:00	1:02	0:05
PB-24 N 8952	9:18	9:18	11:00	1:42	0:00	1:42	0:01
MH 12 Y 7893	9:19	9:19	9:30	0:11	0:00	0:11	0:03
MH 34 X 7130	9:22	9:22	9:40	0:18	0:00	0:18	0:02
MH 25 VH 1478	9:24	9:24	9:48	0:24	0:00	0:24	0:00
MH 24 H 5697	9:24	9:24	19:30	10:06	0:00	10:06	0:04
MH 16 H 4897	9:28	9:28	10:00	0:32	0:00	0:32	0:04
MH02 G 4555	9:32	9:32	10:45	1:13	0:00	1:13	0:03
GJ 12 F 1269	9:35	9:35	9:55	0:20	0:00	0:20	0:03
MH 07 R 5974	9:38	9:38	9:42	0:04	0:00	0:04	0:02
MH 06 S 5900	9:40	9:40	11:00	1:20	0:00	1:20	0:05
DL 21 C 4792	9:45	9:45	10:05	0:20	0:00	0:20	0:04
MH 12 X1267	9:49	9:49	9:59	0:10	0:00	0:10	0:01
MH 14 V 1369	9:50	9:50	19:00	9:10	0:00	9:10	0:02
AP 2 F 4179	9:52	9:52	10:45	0:53	0:00	0:53	0:00
MH 14 A 1269	9:52	9:52	10:27	0:35	0:00	0:35	0:01
MH02 G 4575	9:53	9:53	10:15	0:22	0:00	0:22	0:03
MH 12 K 7923	9:56	9:56	10:10	0:14	0:00	0:14	0:00
MH 02 HY 8886	9:56	9:56	12:00	2:04	0:00	2:04	0:01
MH 12 B2229	9:57	9:57	13:00	3:03	0:00	3:03	0:01
MH 14 M 4079	9:58	9:58	13:10	3:12	0:00	3:12	0:02
MH 14 S 1197	10:00	10:00	14:00	4:00	0:00	4:00	0:02
MH 12 E 1169	10:02	10:02	19:30	9:28	0:00	9:28	0:01
MH 14 Q 4469	10:03	10:03	10:30	0:27	0:00	0:27	0:02
GJ 39 Q 4490	10:05	10:05	10:35	0:30	0:00	0:30	0:03
MH 03 F 1100	10:08	10:08	11:00	0:52	0:00	0:52	0:00
MH 06 HU 4493	10:08	10:08	10:30	0:22	0:00	0:22	0:01
MH 02 MK 2297	10:09	10:09	10:38	0:29	0:00	0:29	0:03
MH 47 R 4920	10:12	10:12	10:55	0:43	0:00	0:43	0:01
MH 01 K 0006	10:13	10:13	13:10	2:57	0:00	2:57	0:04
MH 02 E 4500	10:17	10:17	10:51	0:34	0:00	0:34	0:01
MH 12 G 4447	10:18	10:18	10:38	0:20	0:00	0:20	0:02
MH 06 B 1236	10:20	10:20	10:34	0:14	0:00	0:14	0:01
MH 12 A 4479	10:21	10:21	10:48	0:27	0:00	0:27	0:02
MH 38 K 5698	10:23	10:23	11:15	0:52	0:00	0:52	0:02
MH 14 NH 1299	10:25	10:27	11:03	0:36	0:02	0:38	0:00
PB 44 W 1003	10:25	10:30	10:45	0:15	0:05	0:20	0:01
HR 56 O 5678	10:26	10:30	10:45	0:15	0:04	0:19	0:01
MH 12 V 7532	10:27	10:35	10:55	0:20	0:08	0:28	0:03
MH 22 K 9513	10:30	10:34	11:00	0:26	0:04	0:30	0:05
MH 09 K 4375	10:35	10:38	11:02	0:24	0:03	0:27	0:03
MH 02 FT 8990	10:38	10:38	11:15	0:37	0:00	0:37	0:02

MH 14 KQ 7811	10:40	10:45	11:00	0:15	0:05	0:20	0:00
RJ 11 HJ 1240	10:40	10:45	11:03	0:18	0:05	0:23	0:02
MH 14 F 1039	10:42	10:45	11:20	0:35	0:03	0:38	0:03
MH 14 TY 2233	10:45	10:45	11:07	0:22	0:00	0:22	0:00
MH 04 A Z 8870	10:45	10:48	11:00	0:12	0:03	0:15	0:04
MH 09 HG 1893	10:49	10:51	11:05	0:14	0:02	0:16	0:02
MH 12 GQ 5597	10:51	10:55	11:10	0:15	0:04	0:19	0:01
MH 14 DS 7815	10:52	10:55	11:20	0:25	0:03	0:28	0:03
MH 02 CD 4597	10:55	11:00	11:20	0:20	0:05	0:25	0:04
TOTAL				219:03	29:54	248:57	6:58

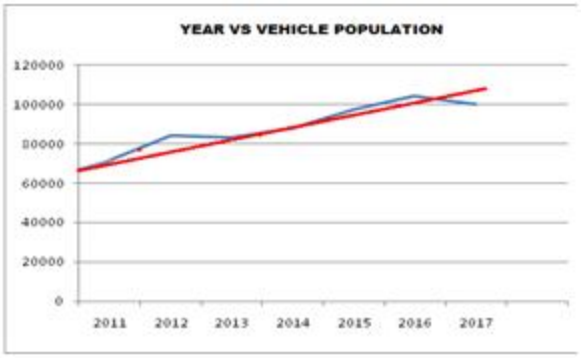
Here, as the no of arrival of vehicles is very large up to 7.30pm, in the given table we have given up to 10:55 am only, but the total given above is related with actual calculations having an arrival time up to 7.30 pm restively.

Day 1
Date:-17/05/17
Name of Street: - Mumbai puna highway near Chinchwad railway station. in-front of mahalaxmi complex
Parking type;- 2 wheeler (30 available)

Sum of service time =219:03
Sum of waiting time = 29:54
Sum of system time = 248:57
Sum of inter arrival time = 6:58
Average service time = 219:03/245 = 1:29
Average waiting time = 29:54/245 = 0:12
Average system time = 248:57/245 = 1:39
Average inter arrival time =6:58/245 =0:02
Traffic Intensity=(1:29/0:02) *100= 64.5 %
Facility Utilization= (219:03/210)*100= 104.28%

Likewise reaming 70 bays 2 wheelers, 20 bays 4 wheelers and 30 bays 2 wheelers for 7 days can be calculated.

After this calculations due to increase in vehicle population the rate of traffic intensity may also goes on increasing on every day basis ,hence last 7 years data related to % increase of vehicles is obtain from RTO. And prediction of increase of % of vehicles in next 5 years can be calculated by best fitting curve. which is shown as below .



y=mx+c
Slope = m = $\frac{y_2-y_1}{x_2-x_1} = \frac{88-82}{14-13} = 6$ m = 6 ; c = 66
x = for 2018 we have to calculate hence,
x_1= 2048-2011 = 7
y_1 = 6×7+66k = 108k

y_1 = 1,08,000
likewise we can calculate for 2019, 2020, 2021, 2022
x_2 = 8
$y_2 = 6 \times 8 + 66 = 114k$
y_2= 1,14,000
x_3 = 9
y_3= 6×9+66 = 120k
y_3 = 1,20,000
x_3 = 10
y_3 = 6×10+66 = 126k
y_3= 1,26,000
x_4= 11
y_4= 6×11+66 = 132k
y_4= 1,32,000
Everyday number of vehicles visited in the parking lot (2 wheeler)(70 available)
= 406+408+411+268+344+410+400
$=\frac{2647}{7}$
=379

Everyday number of vehicles visited in parking lot (2 wheeler)(30 available)

$=\frac{1882}{7}$

=269

Total =379+269=648

648 vehicles on an average visited at parking lot

(1) % increase of vehicles in the year 2018 = 108000-100405 = 7,595

$= \frac{7595}{100405} \times 100 = 7.56\%$

(2) % increase of vehicles in the year 2019 = 114000-108000 = 6000

$= \frac{6000}{108000} \times 100 = 5.5\%$

(3) % increase of vehicles in the year 2020 = 120000-114000 = 6000

$= \frac{6000}{114000} \times 100 = 5.26\%$

(4) % increase of vehicles in the year 2021 = 126000-120000 = 6000

$=\frac{6000}{120000} \times 100 = 5\%$

(5) % increase of vehicles in the year 2022 = 132000-126000 = 6000

$= \frac{6000}{126000} \times 100 = 4.76\%$

Vehicles which do not get parking spaces on everyday basis are

110+135+135+104+66+140

$= \frac{821}{7} = 118$ (30 available)

Also,

170+166+176+110+132+173+172

$= \frac{1099}{7} = 157$ (70 available)

118+157=275

$= \frac{275}{648} \times 100 = 42.43\%$

V RESULT AND DISCUSSION

In 2017 there are 42.43% vehicles are there which do not get the parking spaces.

2017=42.43%=275
2018=49.99%=324
2019= 55.49% =360
2020=60.75%=427
2021=65.75% = 427
2022= 70.51%=456

For parking of 1 two wheeler vehicle 2*0.7 m area is required . Hence for parking of these above two wheeler vehicle below area will be required at the end of 2022.

324*2*0.7=453.6sq m
360*2*0.7=504 sq m
394*2*0.7 = 551.60 sq m
427*2*0.7 = 597.80 sq m
456*2*0.7 = 638.40 sq m

VI. CONCLUSION

From the above analysis it is clear that the rate of increase of vehicles in PCMC area is increased by 6%,which will indirectly affect the commercial Areas near chinchwad railway station.

Which may causes deficiency of parking lots in next 5 years in abundant amount.

For that matter PCMC is suggested to take an attributes towards it.

And provide an alternative arrangement for vehicles which are getting attracted towards the commercial area near chinchwad railway station.

PCMC is suggested to make an audit of all commercial areas in PCMC. In every 6 months whether the plans which are get sanction by PCMC are provided with required amount of parking lots.??

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