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Estimating Capacity and Level of Service of PGIMER Roads, Chandigarh

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Abstract- In this paper a significant effort has been made to study the traffic flow characteristics of PGIMER Chandigarh. It is considered as one of the best medical and research institution situated on the outer periphery of the Chandigarh. It is facing lots of traffic problems nowadays. The city is now not able to control and satisfy the vehicular needs owing to the increase in population which has grown manifolds. An effort has been made in order to study the various problems occurring on the roads of PGIMER. The present study is about the evaluation of traffic flow characteristics on the two main gates of PGIMER and the main roads adjoining to them. Due to mixed nature of traffic it gets difficult to accommodate all the kinds of traffic on these roads. Excessive delays occur with low running speeds and traffic congestion at various junctions and midblock sections. The study includes the analysis of the traffic characteristics like volume, capacity, level of service. The data was analyzed for peak hour of the traffic.

Index terms: Capacity, Level of Service

1. INTRODUCTION

Traffic on Indian roads consists of variety of vehicles. These vehicles have widely different static and dynamic characteristics. The traffic is also very different from homogeneous traffic which primarily consists of motorized traffic [6]. Chandigarh today faces the problems that the carefully designed original Plan was meant to avoid. Chandigarh's road network is under intense pressure today due to increase in population, explosive growth in the number of private vehicles which has increased the number of personalised vehicles, partly due to the absence of an efficient and reliable public transport system. There is now a lot of intercity vehicular traffic from the neighboring states which have strong daily interaction with the city. With the increasing traffic growth, there is congestion on the roads and increase in the number of accidents [11].

1.1 Study area

This study aims at collecting and analyzing the volume, speed on PGIMER roads. PGIMER is a top ranking medical and research institution situated on the outer periphery of Chandigarh in North-West direction in Sector-11. It has educational, medical research and training facilities for its students. It attracts thousands of patients across the northern region. These visitors use different types of vehicles such as scooters, motor cycles, cars, jeeps, bicycles, rickshaws, auto-rickshaws and pedestrians. The institute has two main entries i.e. from Gate 1 and Gate 2. It has V5 and V6 type of roads. One of its main entries is connected to Madhya Marg opposite to Punjab University Chandigarh. Its second entry connects New OPD to Vidya Path. The main roads carrying the maximum traffic are opposite to the Nehru hospital and new OPD road [13].

Major challenges faced by the commuters are:

- Traffic on the main road of the institute is one of the major challenges.
- PGIMER is handling more than four to five times its capacity.
- Considering high ownership of four wheelers and two wheelers by the city dwellers, volume on the roads is increasing manifold.
- There is high pedestrian traffic in some sections of PGIMER.
- The Level of Service of roads is deteriorating and leading to delays and congestions adding to misery of road users.

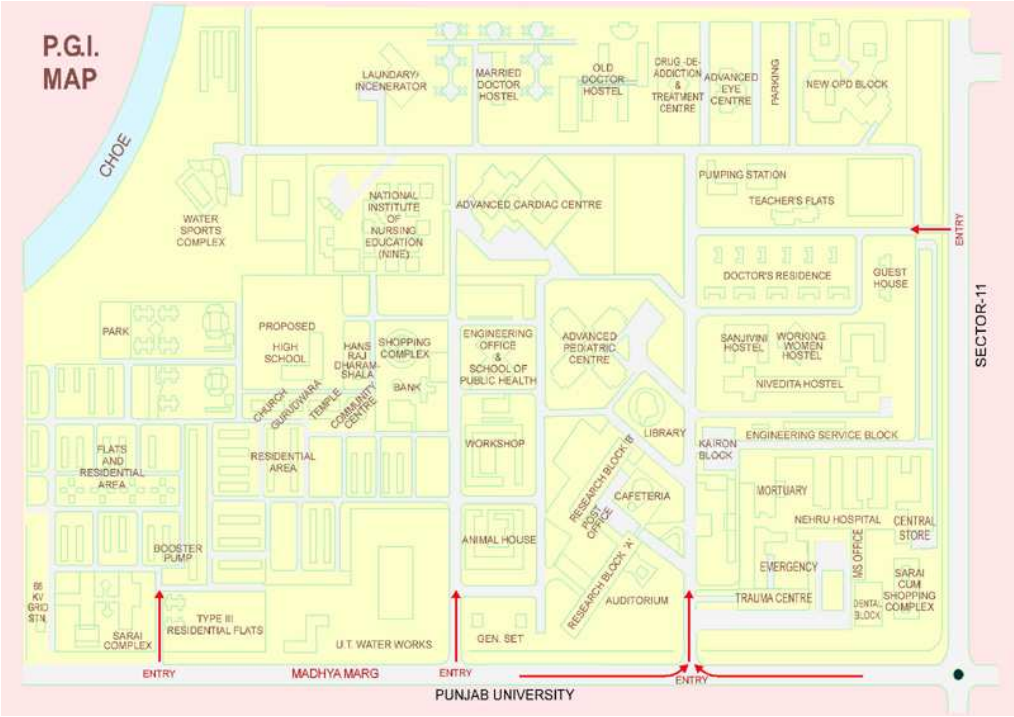

Fig. 1 Roadmap of PGIMER

1.2 Objective and methodology of the study

Objective and scope of study is:

- To study the traffic flow variations on the selected roads of PGIMER to determine hourly and daily variation of traffic.
- To study the traffic flow pattern on the weekdays and weekends and determine traffic composition.
- To evaluate the capacity, level of service and traffic performance of the road.
- To give suggestions for improvement in the traffic characteristics of PGIMER.

Study methodology has the following steps:

- Pilot Survey: Pilot survey was conducted in order to understand the road network and the existing problems in that area.
- Selection of critical points: This was done based on the Pilot survey. The critical points were decided based on the stretches carrying the maximum traffic.
- Data Collection: The Data was collected for the volume studies, for the purpose of designing or improving planning and management.
- Traffic Volume Study: The traffic volume counts were done manually and by videography technique at the selected points.
- Data Analysis: Data collected was then analysed to determine the traffic composition, daily and hourly traffic variations on weekdays and weekends, to determine capacity and Level of Service.
- Conclusions and Recommendations: After the analysis was done conclusions were drawn and recommendations were made for the same.

2. DATA COLLECTION AND ANALYSIS

The data collection was done after carefully studying the Study Area. After doing the pilot survey particular roads were taken. It was made sure that the roads under study were free from all the obstructions like signals, stop signs and excessive kerb parking etc. The study was conducted on a clear weather when the pavement was dry and no repair work was under operation at that time [7] [8]. In the Study Area, the roads in front of Nehru Hospital and OPD were taken for the traffic surveys which include traffic Volume Study, Capacity Study, Estimation of Level of Service.

Traffic volume study was conducted on the working days i.e. from Monday to Saturday on both the gates (Gate 1 and Gate 2). Both Gate 1 and Gate 2 have separate entrance and an exit. The counting of vehicles going inside P.G.I. and coming out of P.G.I. was done for both the gates continuously for 10 hours from 07:30 am to 05:30 pm as from pilot survey it was observed that these were the busiest hours during which the traffic was high as compared to the other part of the day.

The physical characteristics of the two gates at which volume study was done were measured with the help of measuring tape. The width of entrance and exit is 7 m at Gate 1 and width of entrance and exit is 7 m.

2.1 Method used for volume count

Videography technique was used for calculating volume count on both the gates. For this a Sony Digital Handycam was mounted over a tripod stand [9]. It was placed at a point where it could capture the view without any obstruction. The video was made continuously for the required number of hours. Later the counts of vehicles going inside and coming out of P.G.I. were made watching the video. Thedata collected from video was compiled in time interval of an hour, based on which the data sheets were made for hourly and daily variation of traffic volume and for weekly variation in the traffic volume. Normally traffic increases, reaches to the maximum value during peak hours and start decreasing in off peak hours. Therefore, we can say that traffic movements are depended on hourly and daily variations.

Table 1 Hourly and daily traffic volume variation at Gate 1

COUNT HOUR	MONDAY		TUESDAY		WEDNESDAY		THURSDAY		FRIDAY		
DIRECTION	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT	
07:30 am- 08:30 am	1255	439	1435	575	1331	583	840	414	1081	417	5
08:30 am- 09:30 am	1270	516	1751	638	1335	609	1231	488	1267	484	1
09:30 am- 10:30 am	1292	598	1237	603	1421	720	1442	540	1641	567	1
10:30 am- 11:30 am	808	543	899	644	948	647	1154	729	1295	838	9
11:30 am- 12:30 pm	918	967	880	971	770	898	783	696	848	770	7
12:30 pm- 01:30 pm	783	770	740	845	616	728	637	733	663	761	6
01:30 pm- 02:30 pm	659	561	624	571	489	627	575	634	560	634	5
02:30 pm- 03:30 pm	516	644	506	756	537	664	465	783	485	856	4
03:30 pm- 04:30 pm	354	510	381	761	343	479	359	581	352	611	3
04:30 pm- 05:30 pm	250	420	311	695	259	424	287	493	286	477	2
TOTAL VOLUME	8105	5968	8764	7059	8049	6379	7773	6091	8478	6415	7
TOTAL PCU	7237	5380	7836	6354	7234	5766	6984	5503	7603	5832	6

Table 2Hourly and daily traffic volume variation at Gate 2

COUNT HOUR	MONDAY		TUESDAY		WEDNESDAY		THURSDAY		FRIDAY		SATURDAY	
DIRECTION	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
07:30 am- 08:30 am	949	454	831	401	901	440	642	372	732	387	602	376
08:30 am- 09:30 am	773	402	769	385	782	396	775	411	711	394	885	448
09:30 am- 10:30 am	572	533	594	524	594	532	776	480	652	531	961	437
10:30 am- 11:30 am	639	713	670	657	665	700	586	632	589	675	624	591
11:30 am- 12:30 pm	559	804	614	789	597	802	440	656	442	747	466	568
12:30 pm- 01:30 pm	486	803	591	824	549	828	471	747	469	881	500	621
01:30 pm- 02:30 pm	485	750	492	741	499	756	487	716	466	793	542	675
02:30 pm- 03:30 pm	434	712	473	703	464	717	395	698	389	702	425	734
03:30 pm- 04:30 pm	309	581	358	547	343	574	354	636	361	621	368	688
04:30 pm- 05:30 pm	204	521	266	459	246	509	246	489	244	477	263	522
TOTAL VOLUME	5410	6273	5658	6030	5640	6254	5172	5837	5055	6208	5636	5660
TOTAL PCU	4898	5611	5041	5424	5062	5594	4668	5235	4562	5587	5119	5080

From the hourly variation plot for Gate 1 for 6 days a week, it is observed that the maximum number of vehicles going inside PGI was 1751 vehicles i.e. 1562 PCUs 0830 am-0930 am on Tuesday and the maximum number of vehicles coming out of PGI was 971 vehicles i.e. 585 PCUs 1130 am-1230 pm on Tuesday. From the hourly variation plot for Gate 2 for 6 days a week, it was observed that the maximum traffic in number going inside PGI was 961 vehicles i.e. 893 PCUs 09:30 am-1030 am on Saturday and the maximum traffic in number coming out of PGI was 881 vehicles i.e. 803 PCUs 1230 pm-0130 pm on Friday.

Table 3 Hourly and daily traffic volume variation of total traffic from Gate 1 and Gate 2

COUNT HOUR	MONDAY		TUESDAY		WEDNESDAY		THURSDAY		FRIDAY		SATURDAY	
DIRECTION	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
07:30 am- 08:30 am	2204	893	2317	976	2232	1023	1482	786	1813	804	1200	773
08:30 am- 09:30 am	2043	918	2520	1023	2117	1005	2006	899	1978	878	2057	936
09:30 am- 10:30 am	1864	1131	1831	1127	2015	1252	2218	1020	2293	1098	2402	935
10:30 am- 11:30 am	1447	1256	1569	1301	1613	1347	1740	1361	1884	1513	1534	1224
11:30 am- 12:30 pm	1477	1771	1494	1760	1367	1700	1223	1352	1290	1517	1182	1195
12:30 pm- 01:30 pm	1269	1573	1331	1669	1165	1556	1108	1480	1132	1642	1109	1323
01:30 pm- 02:30 pm	1144	1311	1116	1312	988	1383	1062	1350	1026	1427	1131	1329
02:30 pm- 03:30 pm	950	1356	979	1459	1001	1381	860	1481	874	1558	860	1462
03:30 pm- 04:30 pm	663	1091	739	1308	686	1053	713	1217	713	1232	732	1245
04:30 pm- 05:30 pm	454	941	577	1154	505	933	533	982	530	954	540	1032
TOTAL VOLUME	**13515**	**12241**	**14422**	**13089**	**13689**	**12633**	**12945**	**11928**	**13533**	**12623**	**12747**	**11454**

From the hourly variation plot for Gate 1 and Gate 2 combined for 6 days a week, it is observed that the maximum number of vehicles going inside PGI was 2520 vehicles 08:30 am-09:30 am on Tuesday and the maximum number of vehicles coming out of PGI was 1771 vehicles 11:30 am-1230 pm on Monday.

The composition of traffic going inside and coming out of PGI from both the gates follows almost the same trend on all days. It mainly consists of 50 percent of 4 Wheelers or Cars, 44 percent of 2-Wheelers and 6 percent of 3- Wheelers for traffic going inside and for traffic coming out the composition of traffic as observed was 50percent of 4 Wheelers or Cars, 44 percent of 2- Wheelers and 6 percent of 3- Wheelers. It can be seen from the above analysis that the composition of traffic follows the same trend for traffic going inside and coming outside of PGI. Traffic flow pattern follows almost the same trend on all the days also [12].

LOCATION	PERIOD	TOTAL VEHICLE	TOTAL PCU'S
GATE NO. 1	PEAK HOUR FOR TRAFFIC COMING IN	1751	1562
	PEAK HOUR FOR TRAFFIC GOING OUT	971	869
GATE NO. 2	PEAK HOUR FOR TRAFFIC COMING IN	961	893
	PEAK HOUR FOR TRAFFIC GOING OUT	881	803

3. CAPACITY AND LEVEL OF SERVICE COMPUTATION

Capacity was calculated for the two roads adjoining Gate 1 (opposite to Nehru Hospital) and Gate 2 (New OPD), as these are the major roads of P.G.I. carrying maximum traffic volume. The physical features of the roads are: Road opposite to Nehru Hospital (Gate 1) has width of 10 m and New OPD road (Gate 2) has width of 9.5 m.

Using the results from volume analysis, peak hour flow can be determined for both the gates for traffic going inside and coming out [1].

Table 4 Peak Hour PCUs at Gate 1 and Gate 2

We can calculate Level of Service during peak in morning and evening hours from V/C ratio. Capacity can be calculated from the reference tables for design service volume [3].

The level of service for road opposite to Nehru hospital during the peak hours approaches E as the V/C ratio is greater than 1 which is highly unacceptable. The LOS- E for the peak hour can be determined according to the V/C ratio [4] [5]. Moreover, the low speed is mandatory in this area as it is the main road connecting all the main hospitals. There are no restrictions for loading and unloading of the passengers which lead to lower level of service. Hence, very unstable flow with intolerable delays and lower running speeds on this road [2].

Similarly, the level of service for New OPD road during the peak hour approaches D with V/C ratio approaching 0.8. Hence, the road has a very unstable flow with tolerable delays and lower running speeds. This road connects the residential area and the New OPD, solower speed is mandatory. As there are no waiting restrictions on the roadway in both the directions, this leads to lower level ofservice. And the loading and unloading of the passengers is also allowed on these roads. Hence this road provides very unstable flow [10].

Table 5 Computation of V/C ratio

4. CONCLUSIONS

The following main conclusions have been drawn from the study:

i. From the present study the maximum of 8764 vehicles i.e. 7836 PCUs going inside P.G.I. and 7059 vehicles i.e. 6354 PCUs coming out of P.G.I. on Tuesday and a minimum of 7111 vehicles i.e. 6342 PCUs going inside P.G.I. on Saturday and a minimum of 5794 vehicles i.e. 5212 PCUs coming out of P.G.I on Saturday only.

ii. From the hourly variation plot for Gate 1 for 6 days (Monday to Saturday) a week, the maximum number of vehicles going inside PGI was 1751 vehicles 08:30 am-09:30 am on Tuesday and the maximum number of vehicles coming out of PGI was 971 vehicles 11:30 am-12:30 pm on Tuesday.

iii. The maximum PCUs going inside was 1562 PCUs 08:30 am-09:30 am on Tuesday and the maximum PCUs coming out was 869 PCUs 11:30 am-12:30 pm on Monday and Tuesday from Gate 1.

iv. From the hourly variation plot for Gate 2 for 6 days (Monday to Saturday) a week, the maximum traffic in number going inside PGI was 961 vehicles i.e. 893 PCUs 09:30 am-10:30 am on Saturday and the maximum traffic in number coming out of PGI was 881 vehicles i.e. 803 PCUs 12:30 pm-01:30 pm on Friday.

v. The maximum PCUs going inside was 893 PCUs 08:30 am-10:30 am on Saturday and the maximum PCUs coming out was757 PCUs 12:30 pm-01:30 pm on Tuesday at Gate 2.

vi. The composition of traffic going inside consists of 52percent of 4 Wheelers or Cars, 42 percent of 2- Wheelers and 6percent of 3-Wheelers and for traffic coming out the composition of traffic was 49percent of 4 Wheelers or Cars, 46percent of 2- Wheelers and 5 percent of 3- Wheelers. Traffic flow pattern follows almost the same trend on all the working days.

vii. The variation of total traffic on Gate 1 and Gate 2 indicated a maximum of 14422 vehicles going inside P.G.I. on Tuesday and 13089 vehicles coming out of P.G.I. on Tuesday and a minimum of 12747 vehicles going inside P.G.I. on Saturday and a minimum of 11454 vehicles coming out of P.G.I on Saturday.

LOCATION	PERIOD	Volume (PCU/hr) (V)	Width of road (m)	No. of lanes	DESIGN SERVICE VOLUME (C)	V/C RATIO	LEVEL OF SERVICE
GATE NO. 1	PEAK HOUR FLOW (PCU)	2431	10	3	2200	1.1	E
GATE NO. 2	PEAK HOUR FLOW (PCU)	1696	9.5	3	2100	0.8	D

viii. From the hourly variation plot for Gate 1 and Gate 2 combined for 6 days a week, it was observed that the maximum traffic in number going inside PGI was 2520 vehicles 08:30 am-09:30 am on Tuesday and the maximum traffic in number coming out of PGI was 1771 vehicles 11:30 am-12:30 pm on Monday.

ix. The level of service was computed using v/c ratio for Gate no. 1 and Gate no. 2 during the peak and it was found to be LOS- E and D respectively. This zone has very unstable flow with intolerable delays and lower running speeds on this road.

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