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Study of Traffic Volume and Level of Service of Srinagar City

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Abstract: ***India is a developing country and our traffic in urban streets seeing a boost which affects the minimum quality or level of service to be provided by the road. Level of service (LOS) is a quality measure which describes the operational conditions within a traffic stream, generally in terms of service provided by the road to the user. Traffic flow in most cities of India is a mixed traffic characteristics and also traffic congestion is the most common problem in major cities in India. Level of service defined by the highway capacity manual is mainly for the homogeneous traffic conditions but in India there is a heterogeneous traffic condition which keeps on increasing with every passing day. In general performance of a road is expressed in terms of LOS. The present study is an attempt to study different parameters such as capacity, level of service, vehicle to capacity ratio, peak hour traffic, peak hour volume and peak 15-min volume. Traffic volume count was conducted to determine the number, movements and classification of roadway vehicles at a given location. For the conducting of traffic volume count, Manual methods were used, in which vehicles were counted manually. Data collected was then analyzed to determine V/C ratio, then corresponding LOS was predicted.***

Keywords: LOS, Peak hour, capacity, traffic volume

I. INTRODUCTION

The term level of service (LOS) has been introduced by the highway capacity manual (HCM) which represents the level of facility and user can derive from a road under various operating characteristics and traffic volumes. When a road is carrying traffic in equal volume to its capacity or say volume to capacity ratio near to one, under ideal traffic and roadway conditions, the operating conditions become poor. Dropping of speed and frequency of delays or stops mount up. The service which is offered by a roadway to the users can differ under different traffic volumes. The term level of service (LOS) is defined as a qualitative measure which describes the operational conditions within traffic stream and their observation by motorists and travelers. HCM (2000) defined LOS as a quality measure describing operational conditions within a traffic stream, generally in terms of such service measures as speed and travel time, freedom to maneuver, traffic interruptions, comfort and convenience. LOS in urban area or controlled sections is totally different as that in rural areas or uncontrolled areas. The LOS for urban and suburban arterials can be related to the flow conditions, average overall travel speed, and peak hour factor and service volume to capacity ratio. The term peak hour factor is shown as the ratio of peak hour volume to the rate flow which is maximum during a given time period within the peak hour (say 5min, 10 min or 15 min). Highway capacity manual (HCM) describes six level of service (LOS) based on different operating conditions. Six LOS described in the HCM are from LOS A TO LOS F. Road with LOS A signifies the best operating conditions among all LOS and road having LOS F is the worst of all defined LOS.

Level	Traffic Condition
A	Free flow traffic
B	Reasonably free flow
C	Stable flow
D	Approaching unstable flow
E	Restricted flow
F	Almost non-existent

Table 1.1 Level of service

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Indian traffic characteristics are fundamentally very different from those in the developed countries. India with heterogeneous type of traffic needs speed flow curve to be defined according to road and traffic conditions prevalent in Indian condition. Vehicle speed is reduced in heterogeneous traffic flow, where as speed ranges defined in highway capacity manual (HCM) 2010 are quite higher as it is modeled for homogeneous traffic flow. Thus the speed ranges for urban streets in Indian context need to be redefined properly. Level of service is used to measure the quality of traffic flow by volume to capacity (v/c) ratio.

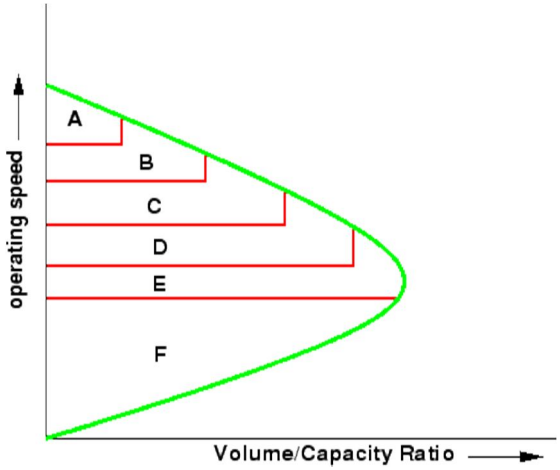

Fig. 1.2 Speed volume curve showing level of service

It measures traffic service quality that compares the no. of vehicles using a given road segment during a single peak hour with the no. of vehicles that the facility is designed to handle safely. The use of v/c ratio for analysis allows the evaluation of potential demand compared to the capacity of facility. The speed flow relationship is based on manuals and codes of practices are valid for homogeneous traffic conditions. Scope of transportation system has developed very largely. This led to the increase in vehicular traffic especially in private transport network. Thus road space available was becoming insufficient to meet the growing demands of traffic and congestion started. The population of Srinagar is increasing day by day. The intensity of traffic and pedestrians crossing has increased significantly and there is no scope for increasing the road length and widening due to land acquisition problem especially at junctions in multiple directions. The level of service analysis of urban roads in India is not decently delimited for majorly heterogeneous traffic flow. Subsequently India is a populated, therefore heterogeneous traffic flow occurs in urban roads. Homogeneous traffic flow is outlined as a region of high density and low average velocity of cars and the flow of heterogeneous traffic on urban roads are extremely composite.

A. Objective & Methodology of the Study

The main objectives of the study are:

1) To carry out traffic volume study on selected section of Srinagar city roads.
2) To study the traffic flow pattern on weekdays & weekends for hourly & daily variations.
3) To evaluate the capacity & level of service of the road.

B. Study Methodology Has the Following Steps

1) Pilot Survey: Pilot survey was conducted in order to understand the road network & the existing problems in that area.
2) 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.
3) Data collection: The Data was collected for the volume studies, for the purpose of designing or improving planning & management.
4) Traffic volume study: Traffic volume study was done by using manual counting method at selected points.
5) Data Analysis: Data collected was then analyzed to determine peak hour volume, peak 15-min volume, peak hour factor, capacity & level of service.
6) Conclusions & Recommendations: After the analysis was done, conclusions were drawn & recommendations were made for the same.

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II. DATA COLLECTION & 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 sign & excessive kerb parking. The study was conducted on a clear weather when the pavement was dry & no repair work was under operation at that time. Traffic volume survey was conducted on all the seven days of a week. Traffic volume counting was done by using manual methods. Traffic volume survey was conducted on a M.A road in Srinagar city. The particular stretch of a road was selected to conduct traffic volume survey. The road selected was a 2-lane road and the width of a road was 5m. The vehicles were counted continuously from 8:00 am to 6:00 pm for 10 hours. It was observed that 8:00 am to 9:00 am were morning peak hours and 4:00 pm to 5:00 pm were evening peak hours.

III. METHOD USED FOR TRAFFIC VOLUME STUDY

Traffic volume is a measure to quantify the traffic flow. Traffic volume or traffic flow is expressed as the number of vehicles that pass across a given transverse line of the road during time. As the carriageway width of the roads may vary, the traffic volume is generally expressed as number of vehicles per hour or per day, per traffic lane. In the present study, the traffic volume counting was done by using manual counting method. In manual counting method, vehicles were counted manually by using a hand tally system. The observer carried out the vehicle counting and recoded them on a sheet using hand tally system. The vehicle counting was carried out for an interval of 15min. Traffic volume was carried out for a heterogeneous traffic. Different classes of vehicles make use of the same roadway, thus the traffic stream consists of 'mixed traffic flow'. The vehicles of the traffic stream are classified into different vehicle classes. They are: fast moving vehicles such as (a) passenger cars, (b) buses, (c) trucks or heavy commercial vehicles (HCV), (d) Light commercial vehicles (LCV) (e) Auto-rickshaws, (f) two-wheeler automobiles (motor cycles and scooters) and (ii) slow moving vehicles such as animal drawn vehicles like bullock carts, cycle rickshaws. Heterogeneous traffic is a mixed traffic stream which consists of different type of vehicles with different dimensions. While as homogeneous traffic stream consists of vehicles of same type (same dimensions). Traffic volume data collected is converted into passenger car unit (PCU) which is a British practice system to convert different type of vehicles which offer different degree of interferences to other traffic and it is necessary to convert all types to a common unit which is known as passenger car unit (PCU). Different types of vehicles have different PCU factors.

Table.1 PCU Values of Vehicles

Sno.	Vehicle Type	PCU values
1.	Truck	2.2
2.	Bus	2.2
3.	Articulated	3.2
4.	LCV Goods	1.4
5.	LCV Passengers	1.4
6.	Cars	1
7.	Two Wheelers	0.35
8.	Three Wheelers	0.7
9.	Bicycle	0.35
10.	Tricycle	0.7

Table 4.1 PCU values of different type of vehicles

IV. RESULTS & CALCULATIONS

Traffic volume data collected was analyzed to get the Peak hour volume, Peak hour factor, Peak 15-min volume and Design service volume. Traffic volume data collected was converted into PCU factors by multiplying a PCU factor with its related vehicle type. Total number of vehicles counted for 15-minute interval is multiplied by their respective PCU equivalents to get the volume. Peak hour volume was obtained by adding the four highest 15-min volumes. After finally obtaining the volume or flow rate then the capacity of the road was also determined. The value of capacity was taken from the IRC 106:1994. The IRC 106:1994 recommends the Design service volume for different categories of urban roads. The stretch were traffic volume survey was carried out was Two-

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Lane (Two-way) road. So, according to IRC 106:1994, the Design service volume (capacity) was taken as 1500. So, after determining the volume as well as capacity, then finally LOS of a stretch was determined by using V/C ratio.

Time interval (Morning hours)	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
8:00-8:15	321	475	350	322	300	301	231
8:15-8:30	319	383	307	289	309	290	284
8:30-8:45	314	346	298	279	315	278	245
8:45-9:00	366	347	300	290	321	289	225
9:00-9:15	305	392	405	310	351	299	256
9:15-9:30	310	382	370	343	369	303	202
9:30-9:45	374	449	412	379	389	275	265
9:45-10:00	380	378	400	363	403	296	294

Table 5.1 Peak Hour PCUs

Time interval (Evening hours)	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
4:00-4:15	325	367	291	299	392	265	255
4:15-4:30	310	310	311	311	380	239	272
4:30-4:45	326	282	320	320	378	250	263
4:45-5:00	306	262	330	329	393	231	257
5:00-5:15	400	384	340	352	409	241	309
5:15-5:30	371	398	370	399	420	279	314
5:30-5:45	373	425	337	405	429	295	320
5:45-6:00	335	450	392	390	417	269	293

Table 5.2 Peak Hour PCUs

After calculation of traffic volume and determining capacity from IRC 106:1990, then finally Level of service was determined using service volume to capacity (V/C) ratio. The calculation of V/C ratio is given below in the table.

DAY	TIME	PEAK HOUR TRAFFIC IN PCU/hr (VOLUME)	Total width of Road (m)	No. of lanes	Design Service Volume (C)	V/C Ratio	Level Of Service (LOS)
Monday	Peak Hour Traffic (9:00 am - 10:00 am)	1521	9.5	2	1500	1	E
	Peak Hour Traffic (5:00 pm - 6:00 am)	1607	9.5	2	1500	1.07	F

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Tuesday	Peak Hour Traffic (9:00 am - 10:00 am)	1799	9.5	2	1500	1.19	F
	Peak Hour Traffic (5:00 pm - 6:00 am)	1801	9.5	2	1500	1.20	F
WEDNESDAY	Peak Hour Traffic (9:00 am - 10:00 am)	1653	9.5	2	1500	1.10	F
	Peak Hour Traffic (5:00 pm - 6:00 am)	1581	9.5	2	1500	1.05	F
THURSDAY	Peak Hour Traffic (9:00 am - 10:00 am)	1516	9.5	2	1500	1	E
	Peak Hour Traffic (5:00 pm - 6:00 am)	1627	9.5	2	1500	1.08	F
FRIDAY	Peak Hour Traffic (9:00 am - 10:00 am)	1626	9.5	2	1500	1.08	F
	Peak Hour Traffic (5:00 pm - 6:00 am)	1727	9.5	2	1500	1.15	F
SATURDAY	Peak Hour Traffic (9:00 am - 10:00 am)	1222	9.5	2	1500	0.81	D
	Peak Hour Traffic (5:00 pm - 6:00 am)	1191	9.5	2	1500	0.79	C

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SUNDAY	Peak Hour Traffic (9:00 am - 10:00 am)	1182	9.5	2	1500	0.78	C
	Peak Hour Traffic (5:00 pm - 6:00 am)	1287	9.5	2	1500	0.85	D

After calculating the v/c ratio and determining LOS, then finally a graph is plotted between the v/c ratio and different days of the week. The results obtained shows that the road stretch mostly remain in the range of LOS E to LOS F and v/c ratio mostly exceeds 1 , which indicated that traffic congestion occurs most of the time and road operate below its capacity. V/C graph indicates the fluctuation in traffic flow on different days of the week, with the highest v/c ratio getting maximum on Tuesday. Traffic flow is maximum on first four days of the week and remains flat on weekends. First few days of the week are working so we expect heavy traffic rush indicating traffic jams, indicating low LOS.

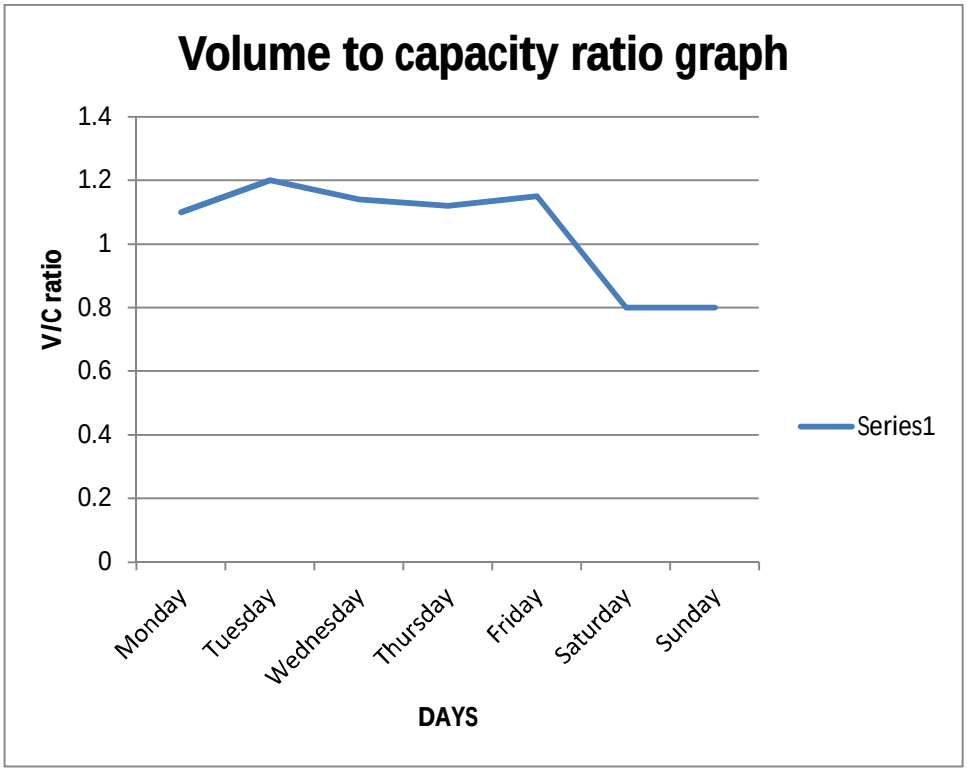

Fig. 5.1 V/C ratio graph

V. CONCLUSION

Vehicle composition of the traffic shows that more than 50% of vehicle composition consists of the two-wheelers and three-wheelers. As per the data collected from the traffic volume count, the peak hour of the traffic was identified as 9:00 am- 10:00 am & 5:00 pm- 6:00 pm. Evening peak was seen to be more congested than the morning peak. The level of service was seen ranging from C to F as calculated by V/C method. The level of service for the stretch during peak hour traffic was mostly found to be F as per V/C method which suggested jammed conditions with average overall travel speed below 15 kph. Volume to capacity ratio mostly exceeded 1 against different peak hour traffic which represented the forced flow operations. PCU value of a vehicle significantly changed with a change in traffic volume. V/C ratio graph obtained showed that the v/c curve remained maximum on working days of the week and then remained flat on non- working days. V/C graph indicated the traffic fluctuation on different days of the week. V/C ratio graph showed that how congested the present road is.

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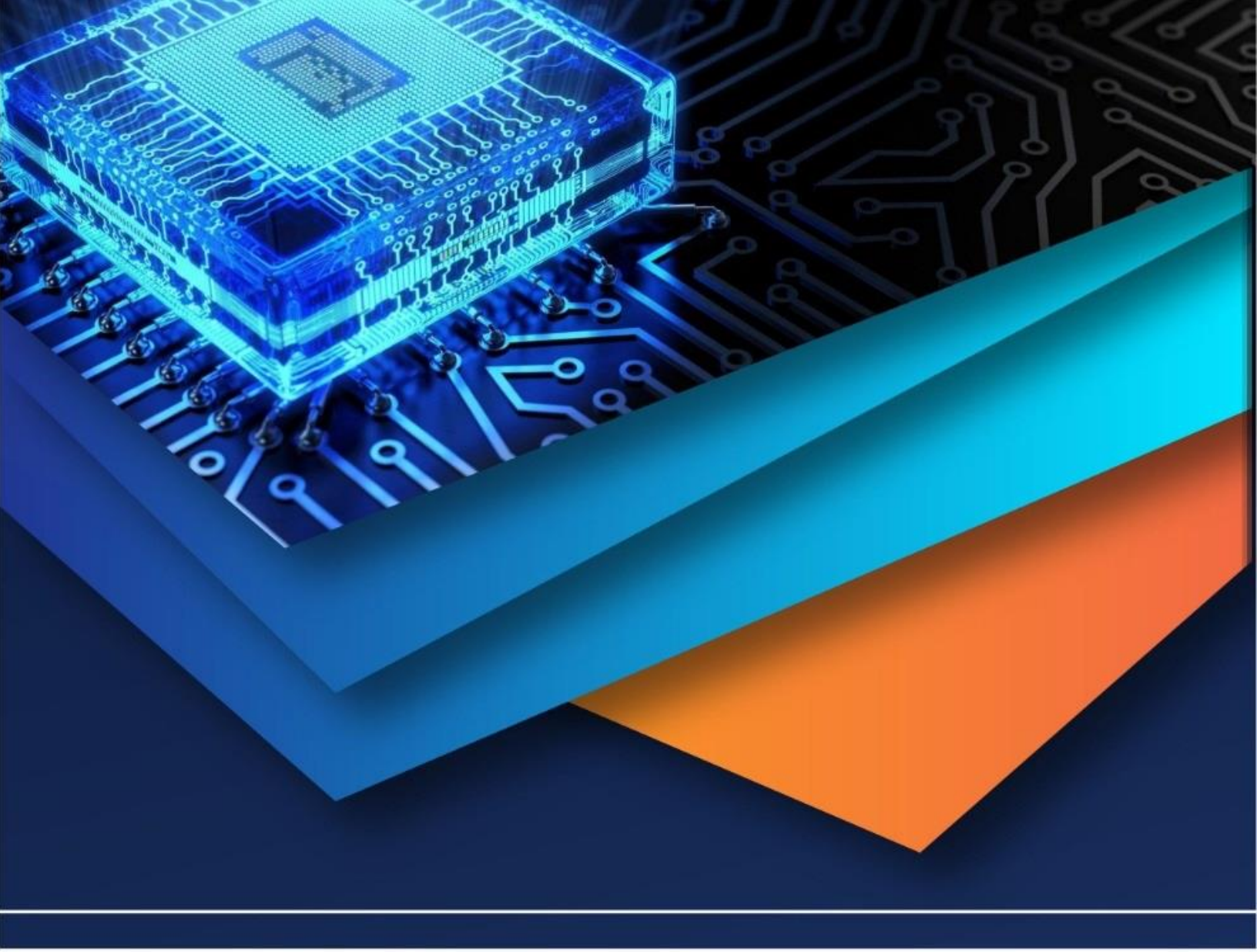

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