International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 06 | June 2020 www.irjet.net p-ISSN: 2395-0072

"STUDY ON CAPACITY AND LEVEL OF SERVICE FOR URBAN AREAS UNDER MIXED TRAFFIC CONDITIONS": A CASE STUDY OF SRINAGAR CITY"

MIR FAISAL MANZOOR[1], MUDASIR NABI DAR[2]

[1]M.Tech Student Transportation Engineering Desh Baghat University Punjab India
[2]M.Tech Student Transportation Engineering Desh Baghat University Punjab India

---

Abstract - *The Road network of any city are its life saver and the assessment of their execution and evaluation is exceptionally fundamental for future activity arranging, plan, operation and support etc. Activity of traffic stream in most cities of India could be a blended activity characteristics additionally the activity blockage is the common issue in most major cities in India. The objective of the display considers is to progress the performance operation of the urban street arrange by proposing the correct choices to improve the activity capacity by finding out the level of services of the different roads. The city we are here discussing is the summer capital of Jammu and Kashmir i.e. Srinagar city The city road network is cramped because of missing links, incomplete roads, inefficient radials, bottlenecks, etc. Some of the radials like Rangreth Road, Airport Road, Nowgham-Chanpora-Rambagh, Parimpora-Qamarwari, Bemina Chowk, and Athwajan-Pantha Chowk are the few roads of Srinagar City which shows major traffic jams due to congestion, two lane road network and heavy density of mixed traffic in peak hours. Around 80000 vehicles enter the Srinagar city on daily basis as per report. Srinagar has historically developed with a radial road network spanning in north, south and west directions. All the radials are witnessing extreme traffic flows much beyond their capacities, hence poor level of service.*

KeyWords:levelofservice, radials, bottlenecks, trafficjam, congestioncapacaties

1. INTRODUCTION

Relentless increase in population is major problem in India. Because of increase in population the various modes of transportation are increasd in cities which resulted in jammed traffic condition on the road. The vehicle proportion is way more diverse with many inadequately performing vehicles, slow moving vehicles and non-motorized vehicles. For efficient and increased vehicle traffic it requires better roadway infrastructure with higher capacity. Thus for effectual planning and operation there's a desire to seek out the traffic volume and estimate roadway capacity. Capacity of a road is greatly influenced by roadway, traffic condition and driver condition. The recital of the urban roadway depends on the capacity and actual traffic volume and also the purpose of the identical are constructive for monetary and efficient design of road-network. Traffic carrying capacity are often a benchmark for rather than the quantity of exploitation of the prevailing roads which successively are often used for determining present requirements likewise as predict future requirements of the road improvements supported the traffic. Urban cities in India are witnessing for very high rate of increment, consequently the increase in traffic in their transport corridors. The anxiety about the deterioration within the LOS is because of the uninhibited growth of vehicle traffic volume, shortfall of supply side of transportation capacity, leading to the supplementary delay, additional fuel consumption, user cost etc. Therefore it's obligatory to assess the amount of service of highways passing through the urban cities over a period of your time so as to adopt the various transport improvement programmes on short likewise as future basis for improving the amount of service.

Scope of facility has developed very largely. This led to the rise in vehicle traffic especially privately transport network. Thus road space available was becoming insufficient to fulfill the growing demand of traffic and congestion started. The population of srinagar is growing day by day. The intensity of the traffic and pedestrians crossing has increased significantly and there's no scope for increasing the road length and widening because of land acquisition problem especially at junctions in multiple directions. For a range of reasons like population, economic and auto ownership growth, increasing traffic demand can exceed

the carrying capacity of the road during peak periods. As a consequence, traffic condition deteriorates and safety risk worsens. Capacity of a road is represented by the most rate at which vehicles can taste a given point in an hour under prevailing operational conditions. Intersection capacity or volume-to-capacity ratio is one in every of the operational measures of effectiveness employed in measuring LOS.

Since independence, India has witnessed tremendous economic process that resulted rapid urbanization and growing needs of transportation as a subsequence (Lal and Clement, 2005; Singh, 2014). the present infrastructures thus became quite inadequate to cater the requirements and also don't warrant to supply the required service level. At the identical time, the mixed traffic composed of a large range of auto categories made it difficult to pick appropriate lane configuration as capacity analysis and assessment of level-ofservice (LOS) for such mixed traffic is kind of complicated. Also, recommended LOS criteria in Highway Capacity Manuals of developed nations might not be adoptable in context of India or other developing countries thanks to difference in traffic characteristics and driving culture. Besides, the complex, encroachment and plenty of others affect the service level provided to the users yet the current study thus, geared toward identifying suitable alternative performance measure and developing a technique which might exhibit compatibility with prevalent heterogeneous traffic for the determination of LOS.

The road networks of any city are its lifeline and therefore the evaluation of their performance is extremely necessary for future traffic planning, design, operation and maintenance etc. Traffic flow in most cities of India may be a mixed traffic characteristics and also the traffic jam is that the common problem in most major cities in India. the target of the current study is to boost the performance operation of the urban road network by proposing the correct alternatives to reinforce the traffic capacity. to realize this objective, a whole methodology for analyzing the mixed traffic flow in chosen roads and analyzed. Intersections are considered because the critical points of network and estimation of their performance is extremely necessary. The road networks are considered as a lifeline for a city.. Population of Srinagar city was 11.8 lakhs in 2011. it's flyovers slowly arising and enhancing the sweetness of town. The target of study is to boost the performance operation of road. Traffic surveys are conducted to gather data on vehicular volume and speed selected road section. Traffic volume study is administrated and existing level of service is calculated he info is analyzed for peak hour traffic. Traffic surveys are conducted on working days during morning and evening peak hours and during mid hours.

1.1 Need of the Study:

Every citizen of Srinagar must have experienced the worst traffic jams seen in the recent times. Sometimes one gets caught for hours together. Due to the rise of urbanization and number of private vehicles in most parts of city badly affected the capacity and level of service of roads in their present condition. At peak hours the student community suffers the most as they are not able to reach their destinations on time. There is a need of study to find the actual causes of huge traffic jams in the city and in this study the same will be done to find the suitable solution to enhance the traffic conditions ,traffic management, capacity and level of service of the above mentioned roads by performing the various traffic studies on the given road stretches. In this study we will look forward to find the possible causes and their solutions to smoothen the traffic condition of the city

1.2 Objectives:

- To determine the capacity of above mentioned specific roads based on speed flow behavior under mixed traffic conditions
- To establish the Level of Service thresholds for the prevailing traffic conditions of above mentioned roads of Srinagar city
- To propose the traffic improvement measures for the selected road stretch
- Apart from managing traffic on the road, this study also aims to maintain the road infrastructure in good condition
- Introduction of Rotary intersection and signals at feasible stretches of above roads
- To determine observed speed ranges for existing traffic.
- To determine various parameters influencing the level of service

2. Literature Review

Level-of-Service(LOS) of a traffic facility could be a concept introduced to relate the standard of traffic service to a given rate of flow. Level-of-Service is introduced by HCM to denote the extent of quality one can derive from an area under different operation characteristics and traffic volume. HCM proposes LOS as a letter that designate a variety of operating conditions on a specific variety of facility. Six LOS letters are defined by HCM, namely A, B, C, D, E, and F, where A denote the best quality of service and denote the worst. These definitions are supported Measures of Effectiveness (MoE) of that facility. Typical measure of effectiveness include speed, travel-time, density, delay etc. there'll be an associated service volume for every of the LOS levels. A service volume or service rate of flow is that the maximum number of vehicles, passengers, or sort, which can be accommodated by a given facility or system under given conditions at a given LOS.[1]

Field Traffic surveys were carried out to capture the classified volume and speed data through manual as well as video graphic technique. Multi regime speed-flow relation was developed based on the 5-min. data extracted from the field survey. Unobserved data was simulated by artificial neural network model. The traffic flow behavior in heterogeneous traffic in Indian urban context is observed to be quite complex with loose lane discipline and diverse static and dynamic characteristics of the vehicles. The capacity of the six lane divided road comes to be 7450 vehicle and 2480 vehicles per lane which was quite realistic as compared to similar studies in India. [2]

They had studied different parameters such as capacity, level of service, vehicle to capacity ratio average journey time, and average delay in each midblock, peak hour traffic and to provide necessary improvement measures in the midblock. Speed and delay studies were conducted three times during peak and non-peak hour and the average journey time was determined. Average delay of all these mid-blocks were also determined using speed and delay studies. The vehicle to capacity ratio during peak hour was found to be exceeding 1. The level of service of the entire stretch was found to F during the entire survey. The average time required to travel the entire 3.8 km stretch during peak hour was found to be 17 minute and the average travel speed was below 13 kmph. Vehicle composition of the traffic shows that more than 50% of the vehicle composition consists of two wheelers and three wheelers [3]

In this study Satish Chandra et.al, (2004) provides the process for capacity estimation of two-lane roads under mixed traffic conditions and calculated the influencing factors which affect the capacity of road and adjustment factors for each of this condition were proposed. Capacity of a two-lane road based on these adjustment factors under heterogeneous traffic conditions was determined. HETEROSIM and VISSIM software was used for estimation of road capacity. PCU values had considerable effect on traffic volume and composition which affects the capacity. Lane width had substantial effect on capacity and capacity of road section increases with increase in carriageway width. [4]

The importance of widening a lane in congested areas. The first 0.3 m of lane widening corresponds to an increase in capacity of about 14% while 0.6 m of lane widening results in a 24% increase in capacity. [5]

The empirical origin of this distance is difficult to confirm, but many researchers also advocate a so-called “shy distance”, “buffer zone”, or “cushion” and have attempted to measure what those distances should be.

In this paper they considered the multi-lane highways. Capacity and level of service were most important factors for the road geometry and percentage of heavy vehicles. They had developed capacity model and level of service model using Artificial Neural Network (ANN). In this paper they considered many factors like lane width, pavement width, and lateral clearance, no of lanes, median width and percentage of heavy vehicles. Free flow speed and average travel speed were calculated for passenger car. Traffic volume data was calculated from Average Annual Daily Traffic (AADT). For Capacity models and LOS models input variables were taken as SA, LW, PW, LC, MW, HV and output variable was taken as 1 desired variable density. For desert model density was decreased with the increase in PW. For agriculture model density was decreased with the increase in LW. ANN models gave so better and most confidence results compare to regression models in terms of predicting density and capacity. [6]

3. Methodology

3.1 The Methodology Adopted for the study will be as follows:

- A detailed site observations and investigations will be done which involves the reconnaissance, topographical studies and

video graphic surveys. Preliminary surveys are carried to collect the primary information about road condition, no. of lanes, shoulder condition, width of road etc.

- Field Traffic surveys are to be conducted to collect the data on selected vehicular volume and vehicular speed on chosen road sections of the city.
- After performing various traffic volume studies and collection of data, the data will be analyzed by suitable methods to estimate the capacity, level of service of the selected road stretch.
- Various surveys will be conducted during the study to check the need of signaling system and rotary intersection provisions for given road stretchs.Causes of massive traffic jams in the city and their solutions will be given second prior importance

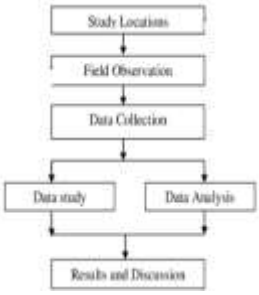

Figure 1. Flow Chart of study Methodology

3.1 Data Collection

Field studies were carried out by adopting videography technique to observe the traffic flow and speed on selected roads. A straight road segment of 60 m length was selected. Segment was free from street parking, bus stop and pedestrian activities and also it was far from any intersection. To capture the movement of vehicles at a wide range camera was kept on a tripod stand at first point and last point. Volume count for mixed traffic, the data was collected by manual method. The spot speed data was collected simultaneously using videography method manually.

All the relevant data were collected by manual method at the selected stretch in three different areas during the working days.

3.2 Study Location

The study is carried out on the important traffic corridor of Srinagar city .The main study area was Rangreth Road, Airport Road, Nowgham-Chanpora-Rambagh, Parimpora-Qamarwari, Bemina Chowk, and Athwajan-Pantha Chowk are the few roads of Srinagar City which shows major traffic jams due to congestion, two lane road network and heavy density of mixed traffic in peak hours

Figure 2 chanpora road

Figure 4 bemina road

Figure 3 Rangreth road

Figure5.qamawari road

4. DATA INTERPRATION

Determination of Theoretical Maximum Capacity

Using the relation: **C = 1000.V/S** one can easily determine the theoretical Maximum Capacity; Here, C = Capacity of a single lane, vehicle per hour V = Speed, kmph
S = Average center to center spacing of vehicles, when they follow one behind the other as a queue or space headway, m. Thus capacity depends upon the Speed and Spacing. Spacing is governed by the safe stopping distance required be the rear vehicle in case the vehicle ahead stops suddenly.

Numerically spacing is given by, S = Sg + L

Where Sg is the space gap(Head to rear)between the vehicles and L is the average length of the vehicle, both combined makes the center to center spacing of the vehicles.

Here, Sg = 0.278 V.t, where V is in Kmph and Sg in m. t is the total reaction time of the driver, generally assumed to be equal to 0.70 to 0.75 sec.

Assume t = 0.70; S = (0.7v + L) = (0.2V + L), m

Thus knowing the design speed, the spacing S can be found and thus the theoretical capacity of the lane can be found.

Or capacity of road can be calculated as---------- C= 1000V/S….. where V = constant vehicular speed in miles per hour

S =spacing.

The level of service is then calculated by the ratio ;

LOS = V/C

V= VOLUME

C= CAPACITY OF LANE

Table No 1 ***LEVEL OF SERVICE THRASHHOLD***

S. No	Vehicle type	PCU-Equivalent factor
1	Motor cycle and scooter	0.50
2	Passenger car, van, auto rickshaw	1.00
3	Truck or bus	3.00
4	Truck-trailer / Tractor-trailer	4.50
5	Cycle	0.50
6	Cycle rickshaw	2.00
7	Handcart	3.00
8	Horse-drawn vehicle	4.00
9	Small bullock-cart	6.00
10	Big bullock-cart	8.00

Table No 2.PCU factor

LEVEL OF SERVICE(LOS)	V/C RATIO
A	<0.125
B	0.125-0.276
C	0.276-0.479
D	0.479-0.715
E	0.715-1.00
F	>1.00

4.1DATE COLLECTION AND DATA ANALYSIS

The data shown in the below given table no 3 was collected from the Parimpora-Qamarwari road of srinagar.(9:30-10:30)AM

Table no 3

TYPE OF VEHICLE	NO OF OBSERVATION/HOUR/PCU	SPEED.KMPH	V/C RATIO
TWO WHEELER	250	40	**.738**
CAR	900	35	
BUS	450	30	
TRUCK	150	25	

The data shown in the below given table no 4 was collected from the Parimpora-Qamarwari road of srinagar.(11:30-12:30**)**

Table no 4

TYPE OF VEHICLE	NO OF OBSERVATION/HOUR/PCU	SPEED.KMPH	V/C RATIO
TWO WHEELER	100	60	
CAR	300	55	
BUS	400	40	**0..374**
TRUCK	100	30	

The data shown in the below given table no 5 was collected from the Parimpora-Qamarwari road of Srinagar. .(4:30-5:30)PM

TYPE OF VEHICLE	NO OF OBSERVATION/HOUR/PCU	SPEED.KMPH	V/C RATIO
2W	163	60	
CAR	852	50	
BUS	236	35	**1.050**
TRUCK	1200	30	

Table no 5

The data shown in the below given table no 6 was collected from the Rangreth Road of Srinagar. (9:30-10:30)AM

Table no 6

TYPE OF VEHICLE	NO OF OBSERVATION/PCU	SPEED.KMPH	V/C RATIO
TWO WHEELER	200	55	

CAR	400	45	
BUS	300	27	
TRUCK	100	20	**0.472**

The data shown in the below given table no 7 was collected from the Rangreth Road of Srinagar. (11:30-12:30)

TYPE OF VEHICLE	NO OF OBSERVATION /PCU	SPEED.KM PH	V/C RATIO
TWO WHEELER	300	40	
CAR	850	30	
BUS	600	20	**1.014**
TRUCK	50	20	

Table no 7

The data shown in the below given table no 8 was collected from the Rangreth Road of Srinagar. (4:30-5:30)PM

Table no 8

TYPE OF VEHICLE	NO OF OBSERVATION/PCU	SPEED.KM PH	V/C RATIO
TWO WHEELER	200	44	
CAR	900	28	
BUS	500	24	**0.899**
TRUCK	50	20	

The data shown in the below given table no 9 was collected from the Athwajan-Pantha Chowk of Srinagar. (9:30-10:30)AM

Table no 9

TYPE OF VEHICLE	NO OF OBSERVATION/PCU	SPEED.KMPH	V/C RATIO
TWO WHEELER	100	50	
CAR	1000	40	
BUS	300	35	
TRUCK	200	35	**0.720**

The data shown in the below given tableno 10 was collected from the Athwajan-Pantha Chowk of Srinagar. (11:30-12:30**)**

Table no 10

TYPE OF VEHICLE	NO OF OBSERVATION/PCU	SPEED.KMPH	V/C RATIO
TWO WHEELER	75	65	
CAR	400	60	
BUS	200	45	
TRUCK	300	40	**0.380**

The data shown in the below given table no 11 was collected from Athwajan-Pantha Chowk of Srinagar(4:30-5:30)PM

TYPE OF VEHICLE	NO OF OBSERVATION/ PCU	SPEED.KMPH	V/C RATIO
TWO WHEELER	150	40	
CAR	1100	35	**.903**
BUS	230	30	
TRUCK	300	25	

Table no 11

5 RESULTS

Table no 12: level of services of roads

ROAD	LOS 9:30-10:30 AM	LOS 11:30-12:30	LOS 4:30-5:30 PM
Parimpora-Qamarwari road	E	C	F
Rangreth Road	F	C	E
Athwajan-Pantha Chowk of Srinagar	E	C	E

- **Parimpora-Qamarwari road**: The traffic volume and existing capacity ratio of Parimpora-Qamarwari road **is 0.730, 0.374, 1.050** at 9:30-10:30, 11:30-12:30, 4:30-5:30 respectively. Therefore s the LOS of the road is E and F during peak hours and C during mid hours.

- **Rangreth Road**: The traffic volume and existing capacity ratio of Parimpora-Qamarwari road **is 1.014, 0.472, 0.899** at 9:30-10:30, 11:30-12:30, 4:30-5:30 respectively. Therefore s the LOS of the road is Fand E during peak hours and C during mid hours.

  Athwajan-Pantha Chowk of Srinagar: The traffic volume and existing capacity ratio of Parimpora-Qamarwari road **is 0.720, 0.380, 0.903** at 9:30-10:30, 11:30-12:30, 4:30-5:30 respectively. Therefore s the LOS of the road is E and F during peak hours and C during mid hours

6. CONCLUSIONS

Parimpora-Qamarwari Road has LOS of "EAND F" during peak hours which means the vehicle approaches unstable flow and traffic congestion. And having LOS 'C' during mid hour with stable flow. The Urban streets should have minimum LOS of 'C',Worst LOS comes during peak hour .so to avoid these traffic congestion during peak hour on Parimpora-Qamarwari Road we have to increase the carriage width of the lane and also we can construct an median of suitable length.

Athwajan-Pantha Chowk has LOS "E AND E" during peak hours which means the vehicle approaches unstable flow and traffic congestion. And having LOS 'C' during mid hour with stable flow. The Urban streets should have minimum LOS of 'C',Worst LOS comes during peak hour.The traffic congestion during peak hour on Athwajan-Pantha Chowk is due the worse condition of the road (i.e. potholes)and also on the road there are many stone quarries and due to the movement of trucks the road congests at peak hours.To avoid these traffic congestion we need to make the road serviceable (by repairing the existing surface coarse) and also we can restrict the truck movement's during the peak hours.

Rangreth Road has LOS "F AND E" during peak hours which means the vehicle approaches unstable flow and traffic congestion. And having LOS 'C' during mid hour with stable flow. The Urban streets should have minimum LOS of 'C',Worst LOS comes during peak hour. so to avoid these traffic congestion during peak hour on Rangreth Road we have to increase the carriage width of the lane and also we can construct an median of suitable length to avoid congestion and take some action against illegal encroachments which are also secondary cause of traffic congestion

References

[1]https://www.greaterkashmir.com/news/srinagar/traffic-congestion-in-srinagar-reaches-atipping-point-report/

[2] Chetan R Patel, Dr. G. J. Joshi, " Capacity and LOS for Urban Arterial Road In Indian Mixed Traffic Condition" , in Proscenia - Social And Behavioral Science, pp.527-534 2012.

[3] Ebin Nirmal Joseph, Dr.M.S.Nagakumar, "Evaluation Of Capacity and Level Of Service Of Urban Road" , in International Journal of Emerging Technologies and Engineering (IJETE), pp.85-91, August 2014

[4] Pratik U. Mankar , Dr. B.V Khode , "Comparative Study of Methods used for a Capacity estimation of Road" , in IJSTE - International Journal of Science Technology & Engineering , Vol. 2 , pp. 45-49 , 2016

[5] Satish Chandra , Upendra Kumar , "Effect of lane width on capacity under mixed traffic conditions in India " ,in Journal Of Transportation Engineering , ASCE , pp. 155-160 , 2003

[6] Ahmed Mohamed Semeida, "New Models to Evaluate the Level of Service And Capacity for Rural Multi-Lane Highways in Egypt", in Alexandria Engineering Journal, pp. 455-466, 2013.

[7] Birago Dora, "Level Of Service Delivery Of Public Transport And Mode Choice In Accra, Ghana." Journal of the Ghana Institution of Engineers, 2014.

[8] Highway Capacity Manual, HCM-2000, Transportation Research Board, Washington

[9] Mehar.A; Chandra.S; and Velmurugan.S, Passenger Car Units at Different Levels of Service for Capacity Analysis of Multilane Interurban Highways in India, Journal of transportation engineering, vol. 140, January 2014

[10] Bhuyan Prasanta Kumar and Krishna Rao K. V., "Defining Level of Service Criteria of Urban Streets in Indian Context." European transport\TransportiEuropeino.49 (2011).

[11] Ebin Joseph Nirmal and Dr.M.S.Nagakumar, Evaluation of Capacity And Level of service of Urban Roads (2014)