

Level of Service on different segment Road : A Review

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ABSTRACT

Traffic congestion is a problem of the daily life of people. In the wake of the development of smart cities in India, the traffic congestion is a major bottleneck as it causes delays and immense loss of man-hours. The congestion leads to air pollution and decreasing level of service. There are a lot of measures taken all over the world but due to an exponential increase in the traffic, the Indian roads are experiencing poor level of service. Due to rapid industrialization, urbanization and commercialization there is a huge need to improve the level of service. This review paper is intended to highlight various studies reported with regards to measurement of the level of service and congestion and gives a suitable measure.

Keywords : Congestion, Capacity, Level of service.

I. INTRODUCTION

Extreme automobile dependence is one of the major aspects of urban travel of modern cities, and the most visible manifestation of this automobile dependence is the road traffic congestion problem.

Traffic congestion is not limited but especially spreading in most of the metropolitan cities and one of the most worsening problems linked with traffic engineering and urban planning, with clear implication on spheres of urban economy, environmental, and lifestyle.

Traffic congestion and decreasing level of service (LOS) is a universal problem in many metropolitan cities, predominantly in developing countries, which are delineated by heavy economic and population growth and assimilation in business and residential district. Although, many measures have been developed to represent the magnitude of traffic congestion on roadways in urban areas. But the failure of sufficiently rapid infrastructural development required to cater to this burgeoning traffic frequently leads to failures of the urban transportation system, resulting in traffic jams. According to Indian road congress (106-1990), for urban roads, the LOS is strongly affected by a factor such as heterogeneity of traffic, speed regulation, the

frequency of intersections, the presence of bus stop, on-street parking, roadside commercial activities and pedestrian volume etc.

The level of service concept differs from country to country. Highway capacity manual (HCM) developed by the transportation research board of USA provides some procedure to determine Level of service. It divides the quality of traffic into six levels ranging from level A to F. Level A represents the best quality of traffic, on the contrary, Level F represents the worst quality of traffic.

Highway capacity manual used travel speed and volume by capacity ratio to distinguish between the various level of service. The value of v/c ratio can vary between 0 and 1. Depending upon the travel speed and v/c ratio, HCM has defined six level of service, level A to F based on a graph between operating speed and v/c ratio as shown in figure:

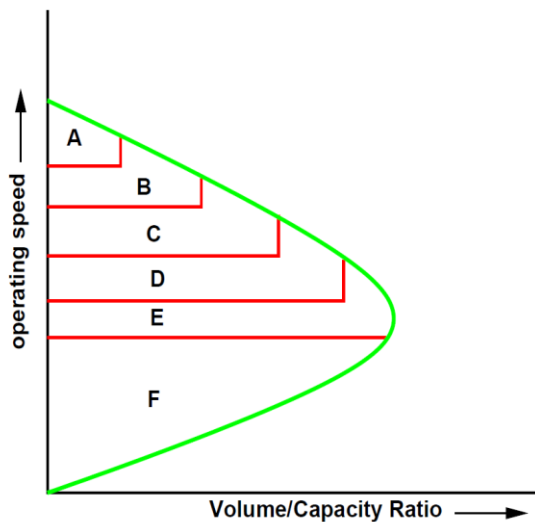


Figure 1. (Level of service A to F)

Study Related Definition

A. Level of service

Level of service (LOS) is a qualitative measure used to relate the quality of traffic service and used to analyse highways by categorizing traffic flow and assigning quality levels of traffic based on performance. Such system would include wait time, frequency of service, time it takes to pay fares, quality of ride, accessibility of depots and other criteria. And also Measure speed, density etc.

B. Capacity

Capacity is defined as the maximum number of vehicles, passengers per unit time which can be accommodated with a reasonable expectation of occurrence.

- ✓ Capacity is independent of the demand.
- ✓ Capacity depends on traffic conditions, geometric design of the road etc.
- ✓ Capacity depends on environmental conditions.
- ✓ Capacity is a probabilistic measure and it varies with respect to time and position.

C. Congestion Parameters

- ✓ Capacity
- ✓ Speed
- ✓ Delay or travel time
- ✓ Cost incurred due to congestion

D. Factor affecting level of service

- ✓ Speed and travel time
- ✓ Traffic interruptions/ restrictions
- ✓ Freedom to travel with desired speed

- ✓ Driver comfort and convenience
- ✓ Volume
- ✓ Lane width
- ✓ Grade
- ✓ Lateral clearance
- ✓ Geometric design
- ✓ Number of lanes
- ✓ Interchange density
- ✓ Traffic composition
- ✓ Operating cost
- ✓ safety

E. Factor affecting capacity

- ✓ Lane width
- ✓ Lateral clearance
- ✓ Width of shoulder
- ✓ Grades
- ✓ Presence of intersection
- ✓ Alignment
- ✓ Surface condition

F. Congestion affecting level of service

- ✓ Congestion has been variously defined as a physical condition in traffic streams involving reduced speeds, restrained movement, extended delays and paralysis of the traffic network.
- ✓ The volume by capacity (V/C) is a popular preliminary measure that compares the given traffic conditions with the limiting on- capacity conditions and is used to assess the LOS of the Road.

G. Present scenario

- ✓ The Level of Service is getting reduced day by day and it is getting difficult to manoeuvre the vehicle.
- ✓ The congestion has caused traffic jams leading to delays and also air and noise pollution.
- ✓ The poor level of service is affecting the overall economic growth of the city.

II. METHODS AND MATERIAL

Literature review

Chetan R Patel (2012) [1] in the present study held on mix traffic stream speed and flow rate on an access controlled urban arterial six-lane divided road in Surat city, for taking field traffic survey they carried out manual as well as videography technique, in addition,

they also developed multi regime speed – flow relation based on 5 min extracted data from the field survey, then unobserved data is simulated by artificial neural network model and level of service is based on volume to capacity ratio are established by cluster analysis approach. This study is base for capacity calculation of the arterial road with other traffic, control and roadway conditions, and also established speed flow relation will be the ideal for the similar kind of roadway section. In resulting, developing LOS based on capacity and volume will be appropriate in examine traffic quality and also LOS and capacity criteria will be useful for the long and short-term infrastructure planning by the local government.

Desai Vishal Jitendrabhai (2016) [2] study carried out based on measurement metrics such as speed, travel time/delay and volume and level of service. They developed a new methodology based on using the speed variation as the basis for quantifying congestion. According to the traffic volume count and spot speed study, they found the average speed of that stretch 40 to 45kmph for two-wheelers and for four-wheelers it is 25 to 30kmph, here it' less speed as compared to LOS criteria. Due to the effect of encroachment and on-street parking on congestion level has been quantified on the study area.

Ajay. k. Duggal (2016) [3] his study describe that determination of level of service (LOS) is the different for urban and rural area, According to author, there are 6 different stages for defining LOS in urban areas such as respectively Defining study area, Determining peak hour volume and peak hour factor, Defining free-flow speed, Classify urban street type and class, Determining running time, delay time, and hence to find the average travel speed during peak hours and non-peak hours using floating car method and final analysis of collected data determine the LOS. Where, On the contrary, rural L.O.S is based on density, flow, space headway.

Ebin Nirmal Joseph (2014) [4] in his study took a 3.8km long stretch in Bangalore city and divided into six mid-blocks, the study covered by different parameters such as capacity, level of service (LOS), volume to capacity ratio (V/C), average journey time, and average delay time. Conducting speed and delay analysis on each block found overall average journey time 17.26 min including 6.366 min delay time (crossing, signal), running speed 20.917 KMPH and journey speed 13.02

KMPH. Then, in spot speed analysis found average journey speed. As well as volume to capacity ratio of each midblock exceeds 1 during the peak hour traffic, overall Level of service was found out based on the average speed among each mid-block. In addition, in the whole stretch found the presence of on-street parking, poor of lane discipline driving.

Ivana Nedevska (2017) [5] according to author analysis of capacity and level of service is necessary, in order to obtain a delay of the analysed facilities, and this type of analysis can be analytical and empirical. This paper reveals that capacity of a roundabout with one lane is estimated with gap acceptance technique, using parameters of the critical gap and follow-up time. Where level of service at a roundabout is determined by calculating or measuring the control delay of each movement on the minor street. However, this method is only used for a roundabout with one lane. Multiple-lane roundabout needs different condition.

Torsten Bergh (2016) [6] it is total difference study on 2+1 road concept to experience capacity and level of service, in this design has one continuous lane in each direction, a middle lane changing direction every one to three kilometres with a median barrier separating the two traffic directions and This is created by introducing a continuous median barrier and adding overtaking lanes within an overtaking strategy. The differences are the existence of 1+1-sections, less overtaking opportunities and a slightly narrower cross-section. This concept is totally different because the HCM LOS-concept has never been adopted in Swedish planning and design procedures (Trafikverket, 2014b).

In this Swedish design 400 m pre-warning sign and a lane change sign at the start of 150 m long taper. The guard-rail reflector pattern and the interval are also changed. One major difference between a 2+1-road and a two-lane road is overtaking opportunities, restricted to overtaking lanes or continuous due to on-coming traffic and sight distances. According to author one of the weak point in this design is traffic delays due to emergency stops and accidents blocking one direction on 2+1 design in terms of level-of-service and traffic management.

Finally, from the simulation author conclude that full-scale test to close overtaking lanes during heavy peak traffic flows with capacity breakdowns indicate that

capacity in a scientific interpretation has not been impacted positively. However, further research and empirical investigations are needed.

Naveen Kumar R (2014) [7] a study carried out by suggested a methodology to study and evaluate the performance and efficiency at-grade intersection and improvement using signal coordination, which involves reconnaissance survey, road inventory survey, turning moment survey of the vehicle at junctions and signal cycle study. The data collected from the five junctions has been calculated as per HCM 2000 manual, and calculation which covered capacity, delay, and level of service. To add, Analysing of collected traffic data into PTV Vistro software, 120 seconds optimum cycle length is obtained for coordinating intersections and time-space diagram is obtained to coordinate successive traffic signals by respective offset obtained. Eventually, as per the time-space diagram yellow period is included in the green period that's the fractures in the band of progression due to irregular block lengths and unequal speeds, as well as V/C ratio of all junctions is exceeded one that means the level of service is reduced to F, which shows the least performance.

III. CONCLUSION

From the above study it can be concluded that level of service varies country to country, and also has different methodology for determination, but in generally level of service of road is basically depends on some common factors such as on-street parking, encroachment, lack of lane discipline, driver perception and reaction time, street hawkers, pedestrian behaviour, different types of road and class, and peak and non-peak hours. For accurate measurement 1994 HCM provide different criteria like a footpath, parking space, traffic signals etc. for various section of basic freeway section, multilane highways, two-lane highway segments, arterial roads and intersections.

IV. REFERENCES

- [1] Chetan R Patel, Dr G.J.Joshi "Capacity and LOS for Urban arterial road in Indian mixed traffic condition" Social and behavioral science 48 (2012)527 – 534, Surat, India.
- [2] Desai Vishal, Shah Harsh, Patel Harsh, Brahhatri Sanjay "Estimation of Level of service through

congestion on urban road – A case study of Vrundavan Cross Road" Volume: 03 Issue: 05, May – 2016, e-ISSN: 2395-0056, e-ISSN: 2395-0072, Gujarat, India.

- [3] Robin Babit, Viranta Sharma, Ajay K. Duggal "Level of service concept in urban roads" Vol. III, Issue I, July 2016, e-ISSN: 2349-6185, Chandigarh, India.
- [4] Ebin Nirmal Joseph, Dr M.S.Nagakumar, "evaluation of capacity and level of service of urban roads" (IJETE) ISSN: 2348-8050, ICRTIET-2014, Bangalore, Indian.
- [5] Ivana Nedevska, Slobodan Ognjenovic, Vera Murgul, "Methodology for analysis Capacity and Level of Service for Roundabout with One Lane" Procedia engineering 187(2017) 797 – 802, Russia.
- [6] Torsten Bergh, Mats Remgard, Arne Carlsson, Johan Olstam, and Per Stromgren, "2+1 roads recent Swedish capacity and level of service experience" Transportation Research Procedia volume 15, 2016, Sweden.
- [7] Naveen Kumar R, Dr M.S.Nagakumar, "Performance Evaluation of at-grade intersection and improvement using signal coordination" ICRTIET-2014 Conference proceeding, (IJSRET) ISSN: 2278-0882, Bangalore, India.
- [8] Tom V. Mathew, K V Krishna Rao, "Capacity and level of service", NPTEL May 3, 2007.
- [9] IRC (1990), "Guidelines for Capacity of Urban Roads in Plain Areas". IRC-106(1990), Indian Road Congress, New Delhi.