Scientific Journal of Impact Factor (SJIF): 4.72

e-ISSN (O): 2348-4470
p-ISSN (P): 2348-6406

International Journal of Advance Engineering and Research Development

Volume 4, Issue 2, February -2017

A Review On Capacity And Level Of Service For Urban Road

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Abstract— *Estimation of capacity is fundamental to planning, design and operation of the roads. Now days in India the traffic is increasing rapidly and traffic volume on roads exceeds the normal limit. Traffic congestion has become a very serious problem in metropolitan cities because cities have expanded without any planning and control. Capacity is mainly depends on the speed, flow and density. Level of service is a qualitative measure describing operational conditions within a traffic stream. In city most of the roads are congested and operate in level of service E or F. The objective of the study is to increase the urban road capacity and to improve the level of service of urban road.*

Keywords-*Capacity,Speed,Volume,V/C,Delay,Congestion,Level Of Service(LOS)*

I. INTRODUCTION

In India, the urbanization has impacted various sectors of the country amongst which transport sector is most affected due to urban vehicular growth. Effect of urban vehicular growth is delays, congestion, road safety and pollution and transport efficiency. Due to rapid growth of the population and increment in vehicle ownership, the traffic is increased rapidly in the urban area. Therefore estimation of capacity is required. The Indian traffic scenario comprises of heterogeneous conditions which can be characterized as sharing of road space among many traffic vehicles having different physical dimensions, poor lane discipline and vehicle following concept is not the norm. These characteristics promote a greater impact on capacity and performance of traffic on roads. A homogeneous traffic stream makes many calculations much simpler because vehicle size, speed, and following distances can be held constant. Heterogeneous traffic situations cannot be engineered by using the concepts based on the homogeneous traffic situations, doing so may lead to erroneous results which ultimately goes down to the wrong estimation of the capacity values on which the performance of the road depends. Homogeneous traffic situation's concepts fail the heterogeneous situation as the traffic flow characteristics are unique. Thus the need arises for analyzing the heterogeneous traffic flow parameters to estimate the capacity of roadway and level of service.

II. LITERATURE SURVEY

(Chetan R. Patel, Dr.G.J.Joshi) [1] They have developed multi-regime speed – flow relation for 5 min. data extracted from the field survey. Greenshield model is used for the determination of design capacities, level of service and characterize different operating condition on a road network. ANN (Artificial Neural Network) model is developed for generating missing stream speed data for unobserved values of flow rates. By using clustering method volume to capacity ratio range is find out for level of service. The capacity of six lane divided road is increase by using the Greenshield model and ANN. **(Dr .B .V. Khode, Pratik U. Mankar)** [2] used microscopic simulation model for analysis of capacity of roads to improve the roadway and traffic condition. Capacity of two lane road is given by

$$c_a = c_b \cdot f_g \cdot f_w \cdot f_{ds} \cdot f_{smv} \cdot f_s \cdot f_{ui}$$

Where, c_a= actual capacity, c_b= basic capacity and

$f_g \cdot f_w \cdot f_{ds} \cdot f_{smv} \cdot f_s \cdot f_{ui}$ Are modification factor for gradient, lane width, directional split, slow moving vehicle, shoulder conditions and unevenness index?

PCU values have considerable effect on traffic volume and composition which affect the capacity. Lane width has substantial effect on capacity and capacity of road section increase with increase in carriageway width. For modeling of heterogeneous traffic condition HETEROSIM software is helpful. For estimation of capacity of roads VISSIM software is useful and it is capable of simulating heterogeneous traffic flow condition. **(Satish Chandra, Upendra Kumar)** [3] found that the effect of lane width on the capacity of a two-lane road under mixed traffic condition. They have developed the second degree equation between capacity and the total carriageway width. This equation is used to derive the adjustment factors for the capacity on substandard lane width. The value of adjustment factors are lower than those given in HCM (1994). If the width of lane is increase the capacity is increase linearly and PCU value of the vehicle is also

increase linearly.**(Dr.M.S.Nagakumar, Ebin Nirmal Joseph)** [4] Studied different parameters like capacity, level of service, volume to capacity ratio, average journey time, average delay peak hour traffic for the improvement measures at the midblock section. Volume to capacity ratio was found to be exceeds 1 during peak periods. They have observed level of service E and F during peak hours. They have found that average delay time is increase and speed is decrease during peak hours. **(Pratik U. Mankar, Dr. B. V. Khode)** [5] Found the capacity of the urban road by using the dynamic PCU value and traditional model. The capacity of urban roads is find out by the Greenshield model by speed-flow relationship. The Greenshield model considered as the traditional model. The results of the traditional model are compared with microscopic simulation model and PCU value is found by Dr. Satish Chandra method. The variance between observed field capacity and simulated capacity was found to be +5% or -5%. If the road width is increase the PCU value for traffic composition is increase and capacity of road is also increase. **(Dr. L. B. Zala, Prof. A. A. Amin)** [6] They studied traffic flow parameters like capacity, level of service, speed and density. They have developed speed-flow relationship. To define the shape of speed-flow curve some extraordinary efforts are used like HCM speed-flow curve, BPR curve, MTC speed-flow curve, Akcelik speed-flow curve. R^2 value is obtained by the speed flow data. The capacity of two lane two way urban road is calculated and maximum flow is also calculated for the calculation of volume to capacity ratio. **(Ganesh Pawar, Dr. Bhalachandra Khode, Prof. Sujesh Ghodmare)** [7] Studied three different highways for analyzing the level of service. They have observed the level of service at mid block section of the roads. HCS-2000(Highway Capacity Software) is used for the estimation of the capacity and level of service. Regression analysis is used for analyzing the level of service. **(Chetan R. Patel, Dr. G. J. Joshi)** [8]studied the variation in the capacity due to the side friction, non motorized traffic and lane width. They have considered equivalent factor and dynamic car unit and also develop the stream flow models. Homogenization coefficient method, Walker's method, Headway method, multiple regression method and simulation techniques are used for the determination of equivalent factor. Dynamic Car Unit is calculated at every 1 minute interval from the observed data. Speed, flow and density model is developed separately for the Patna and Pune city. The speed and carrying capacity of the road are reduced due to the presence of the NMV and road side parking. The effect of lane width, presence of NMV and effect of side friction is mainly affect on the capacity of the urban arterial road**. (Jun Yao, Hesham Rakha, Valerian Kwigizile, Mohamed Kaseko)** [9] Found the highway capacity by using simulation model. For the estimation of capacity they have used two-regime models. The model is developed for the congested and uncongested traffic flow condition. In congested regime for flow versus density relationship is assumed to be linear and in uncongested regime speed versus flow relationship is assumed to be linear. For estimates of roadway capacity can be derived by fitting a relation between the three traffic stream variables: flow, speed and density. **(Ashutosh Arun, Madhu Errampalli)** [10] They studied different method for the estimation of capacity for Indian multi-lane highways. US-HCM (2000) and Indo-HCM are used for the estimation of capacity. Estimation of free flow speed is find out by using the HCM (2000) and Indonesian HCM (1993).They have also used simulation technique like microscopic simulation and HETEROSIM simulation model for the estimation of capacity. **(S. Velmurugan, K. Ravinder, K. Sitaramanjaneyulu)** [11] studied speed-flow equation and roadway capacity for multi-lane highways like four-lane, six-lane and eight-lane divide carriageway. Speed profiles and speed- flow equation is developed for the varying width of multi-lane highway based on the traditional and microscopic simulation model. Design service volume is identified based on the maximum hourly volume. For the critical evaluation of the speed flow equations and roadway capacities through traditional and microscopic simulation model has been undertaken. The result obtained from microscopic simulation model is more accurate compare to the traditional model. **(Parth M. Pande, Saurabh Patel, Jaimin Solanki)** [12] Observed the operation and performance of the signalized intersection. Delay is affect on the level of service. Delay is one of the principal measures of performance used to determine level of service at signalized intersection. By using different method level of service is estimated. **(Binod Singhi, Dr. Mokaddes Ali)** [13] They considered capacity, PCU, traffic volume, speed. By using the PCU volume and speed data speed flow equation is developed. Level of service is finding out by the volume to capacity ratio. For the development of model they consider the different form of speed-flow equation like linear, logarithmic, exponential, power, polynomial, bureau of public roads, Akcelik. Analyzing two parts congested and uncongested for the development of speed-flow equation for heterogeneous traffic condition. Linear regression method is used for the speed and volume to capacity ratio. The speed range is very low due to the heterogeneous traffic condition. The observed capacity was found lower than the IRC guideline. **(V Thsmizh, Shriniwas S. Arkatkar)** [14] Carried out traffic volume, traffic speed, traffic capacity. Capacity was found by the simulation model. HETEROSIM is used for the capacity estimation. The observed capacity is find out by the linear regression method from the traffic volume and speed. The PCU value is increase with increase in the width of road and increase in the magnitude of grade and its length**. (Justin Geistefeld)** [15] Considered variable speed limits. Variable speed limits are applied on a number of heavily traffic freeway sections. Level of service is compared with the german highway capacity manual. The main effect of speed limit is significantly reduced variance of the capacity distribution function. Empirical relationship is developed between the quality of service and breakdown probability. **(Johannes Asamer, Martin Reinthaler)** [16] Carried out traffic characteristics of urban roads. They observed the change in the traffic characteristics due to the weather condition is changed. Weighted harmonic mean is used for the estimating the free flow speed and the product limit method are used for the estimation of distribution of capacity. They represent the fuzzy definition in the free flow traffic. (**Ahmed Mohamed Semeida)** [17] Observed the capacity and level of service for multi-lane highway. Artificial neural network is used for the evaluation of capacity and level of service. ANN is the most effective tool for the simulation technique. ANN model gives the better and confidence result compare

to the regression method. ANN model is performed higher statistical analysis. **(Hashim Ibrahim Hassan, Abdel-Wahed Talaat Ali)** [18] Carried out effect of highway geometric characteristics on capacity. They considered lane width, shoulder width, and tangent length and also consider horizontal curve. Speed-flow density equation is also used for the analysis of capacity. Capacity is mainly depends on the roadway, traffic and driver behavior condition. The observed capacity value did not reach the HCM 2000 value.

III. CONCLUSION

From the above literature review conclude the following points.

- Capacity is affect by the volume, speed, delay lane width, shoulder condition, carriageway width, and no. of lane and side friction.
- Capacity is measured by the different formula and also simulated by the different software like HETEROSIM, VISSIM and HCS-2000.
- Capacity is also estimated by the green shield model and traditional model.
- Capacity is decrease due to the congestion and delay during morning and evening peak hour
- Multi-regime speed flow relation is developed for the estimation of capacity.
- Volume to capacity ratio is exceeds 1 during peak hour traffic
- Simulated capacity is more accurate compare to the observed capacity.
- Capacity is also affected by the weather condition like snow and rain.
- For the estimation of capacity artificial neural network and fuzzy logic is better simulation technique compare to the other method.

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