

“Capacity Estimation of Urban roads under Mixed Traffic Condition”

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Abstract: *In India, condition of traffic due to various kind of vehicles maneuvering with different lane behavior and driver behavior resulting in supremely heterogeneous nature due to their static and dynamic features. Currently the traffic on the road rises rapidly and traffic volume overdoes normal limit. Study of several features of highway traffic is essentially required for preparation, design and maneuver of roadway facilities. For the improved vehicular road traffic it needs better roadway structure with greater capacity. An intension of this work is to analyze capacity for urban roads in heterogeneous condition. For the capacity estimation it is relatively tough to estimate traffic volume on the road. The problem of measuring flow may addressed by using Dynamic PCU values. The Capacity of urban roads is find out by green shield model and the results are compared with Microscopic simulation model. The sudden increase in width of lane on the road is checked and result shows that with the increase in road width Capacity of road also increases.*

Keywords: Traffic Volume, PCU, Traditional model, Simulation model, Traffic Capacity

1.INTRODUCTION

In India, the length of total road network presently available is 4.2 million km still peoples in India, facing massive difficulties in providing superior Vehicular traffic flow and traffic operations. The traffic on Indian roads varies significantly as of Western condition. The proportion of vehicular movement is far diverse with poorer acting vehicle and deliberate mobile vehicles. Rapid as well as constant growth in population is foremost problem for highway engineers. As growth in population altered modes of transportation are rises and resulted in congested traffic flow situation on road, for the transport of goods and passengers for short to medium distance's roads plays a significant role and road transportation package is much flexible than further modes of transport

available, Road transport play significant part in percentage shares in India GDP. Now a day's condition of traffic due to various kind of vehicles maneuvering with different lane behavior and driver behavior resulting in supremely heterogeneous nature due to their static and dynamic features. For the effective and quick vehicular traffic service it needs better highway infrastructure with greater capacity. Highway circumstances comprise of geometric parameters such as lane width of road, shoulder condition and width, pavement condition, horizontal and vertical geometric condition. For the capacity estimation it is relatively tough to estimate traffic volume on the road. The use of Dynamic PCU values which is used to convert heterogeneous flow into uniform flow. PCU values are complex parameters which depends on traffic parameters and geometric condition at the period of field survey. The main object of this research is to analyze the capacity of urban roads by means of traditional model (green shield) and result compares with microscopic model, and significant of width of lane is explored

2.LITERATURE REVIEW

There are number of extensive research work and studies has been carried out for the capacity estimation of roads for the developed and developing nations, in this paper the studies which are deal with capacity analysis are reviewed.

Satish Chandra et.al, (2004) offers procedure for two lane roads to determine capacity under diverse traffic situation and analyze the affecting factors which influence and affect the roadway capacity and provide the modification factors for each of the field condition and depends on this modification factors capacity of road was determined in heterogeneous traffic situation. Arpan Mehar et.al, (2013) determine the capacity of Indian highway in diverse traffic flow operating situations by the use of microscopic

simulation software (VISSIM) and compared the simulated traffic data with field traffic data and modify certain parameters(driver behavior) which disturb the simulation result. Chandra et.al, (2003) studied effect on the capacity by means of lane width of roads in varied traffic conditions, work on diverse roads is carried and study analysis express that PCU values for a different vehicle classes suddenly upsurge with width of lane . V.Thamizh Arasan et.al, (2005) provide a method used for showing extremely mixed traffic flow condition, author deceive diversified flow with vehicles with different steady and moving parameters without considering lane discipline and study result properly replicate heterogeneous traffic flow condition on roads wherever vehicles moving with consideration of absence of lane control. Thamizh Arasan et.al, (2010) provides a computer simulation model (HETEROSIM) to evaluate PCU values in heterogeneous traffic flow situation and state that with variation of traffic volume on road with roadway width PCU values significantly changes.ChetanR.Patel et.al (2014) a case study is carried by author on six lane roads of Pune and Patna and sudden influence of roadside friction on given traffic flow condition is checked, presence of road side friction is examined by comparing service volume and stream speed at different volume to capacity ratios and study analysis shows that the capacity of urban arterials is greatly influenced by road side friction.

3. METHODOLOGY

A.Selection of road

MSH-255 (Near IC Chowk, Nagpur)

MSH-260 (Wardha Road, Nagpur)

B. Field data and analysis

Field Traffic surveys are conducted to collect the data on selected vehicular volume and vehicular speed on chosen road sections of different roads passes through the metropolitan city. Preliminary surveys are carried to collect the primary information about road condition, no. of lanes, shoulder condition, width of road etc. Field data require for study is obsessed on the study patch of inner city roads, the traffic data for the field study was taken on typical weekdays for this a 30m study patch is elected with consideration of no interaction several entry of intersection. Vehicular traffic volume and speed data are composed for 3hours for morning peak hour for 8.00 a.m. to 11.00 a.m., 2 hours during off peak hour for 2 hours

from 1 to 3 p.m., and evening data for 2 h from 4.30 to 6.30 using video filming technique covering varied range of traffic conditions and flow behavior which intended to require for study intent, Entire motorcycles are categorized in eight class as Bus, Truck, LCV, Car, 2-Wheeler, 3-Wheeler, Bicycle and MAV. Physical vehicle dimensions of all vehicles on urban highway are specified in table.1. Speed parameters got from field situation for both the road are specified in table.2 and table.3 respectively based on the physical dimensions of all vehicles and speed parameters PCU values determined for both road are specified in table

Table.1.Physical vehicle dimension of all vehicles in traffic

Vehicle Categories	Length in m	Breadth in m	Total Area in m ²
Bus	11.4	2.5	28.5
Truck	13.6	2.42	32.91
LCV	6	1.9	11.4
Car	3.5	1.5	5.5
2- Wheeler	1.8	0.6	1.2
3- Wheeler	3.2	1.4	4.4
Bicycle	1.9	0.45	0.85
MAV	13.7	2.5	34.25

Table.2.Speed parameters got from field situation for Hingna road

Vehicle Categories	Speed Parameter(Km/hr)		
	Highest. Speed	Lowest. Speed	Median. Speed
BUS	77.14	27	52.07
TRUCK	72	21.6	47.12
LCV	67.5	38.57	53.1
CAR	102.85	36	69.1
2- WHEELER	83.07	26.34	55.2
3- WHEELER	49.09	21.6	35.34
BICYCLE	30.85	13.5	22.3
MAV	63.52	18	40.76

Table.3.Speed parameters got from field situation for Wardha road

Vehicle Categories	Speed Parameter(Km/hr)		
	Highest. Speed	Lowest. Speed	Median. Speed
BUS	72	25.71	49.1
TRUCK	67.5	27	47.25
LCV	60	30.85	45.6
CAR	98.18	34.83	68.17
2-WHEELER	93.91	37.24	65.57
3-WHEELER	54.1	21.17	37.58
BICYCLE	28.42	15.42	21.9
MAV	56.84	21.6	40.1

4. CAPACITY ESTIMATION USING TRADITIONAL METHOD

The capacity of road is determined by imperial method, depending by traffic volume and traffic attribute. Traffic data is extracted to obtain 5-5 minute speed data and flow data for each vehicles category, speed data for the vehicles obtained for 5-5 minute count interval are converted to average speed for each vehicles in traffic stream to obtain avg.spot speed for each vehicle category. In order to develop speed-volume relationship and to estimate roadway capacity the observed traffic volume is altered in an identical numeral of vehicles by use of passenger car unit. Dynamic PCU value is avail to novice heterogeneous traffic stream in homogeneous flow stream which given in table no.4. Which is obtained by following equation;

$$PCU_i = \frac{V_c/V_i}{A_c/A_i}$$

Capacity estimation was done for two roads and capacity of road is find by speed-flow relationship and shown in following figures.

Table.4. Dynamic PCU values of different vehicles

	Hingna Road	Wardha Road
BUS	7.25	7.55
TRUCK	9.0	9.51
LCV	3.0	3.08
CAR	1.0	1.0
2-WHEELER	0.254	0.294
3-WHEELER	1.4	1.47
BICYCLE	0.54	0.569
MAV	11.0	11.1

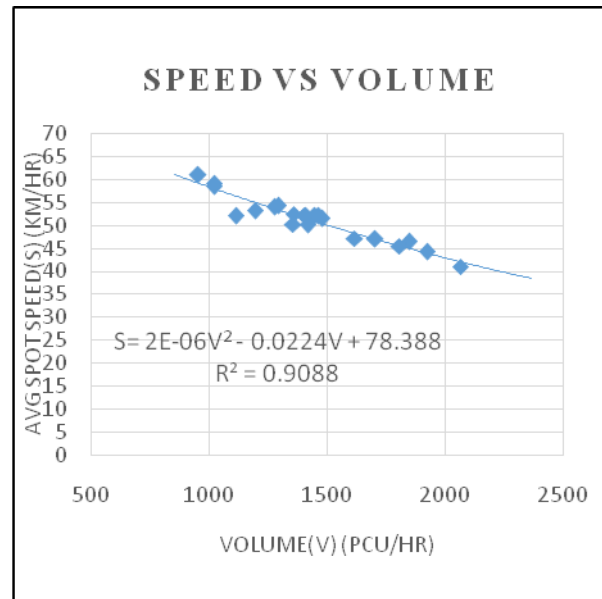


Fig. 1.

Speed Volume relationship of Hingna Road (MSH-255)

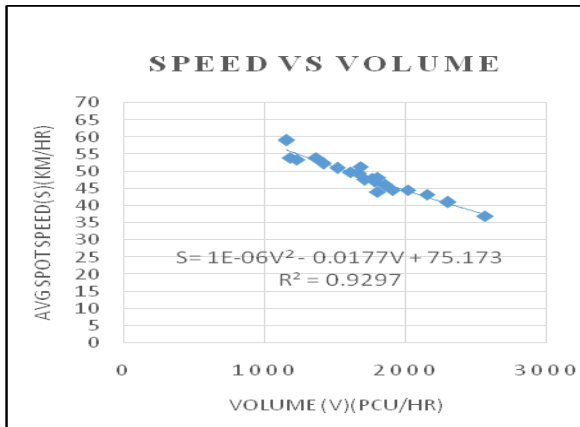


Fig. 2. Speed Volume relationship of Wardha Road (MSH-260)

5. CAPACITY ESTIMATION USING MICRO SIMULATION METHOD USING COMPUTER SIMULATION (VISSIM)

Capacity of road is also determined by using microscopic simulation model (VISSIM), Speed volume graphs are plotted from simulation. Obtained results from Simulation software are similarly matched with traditional method.

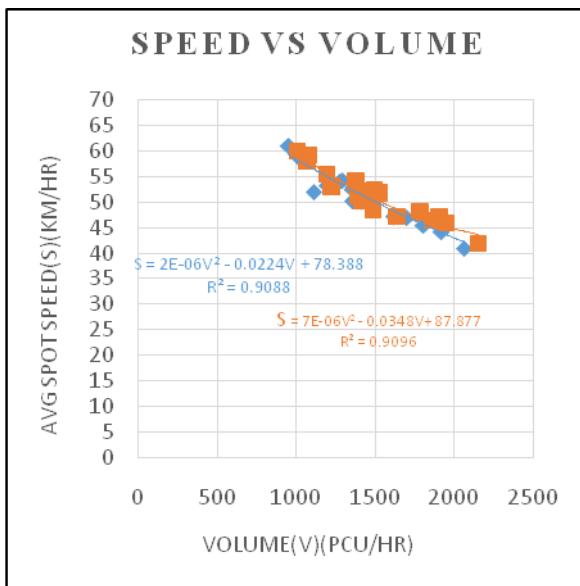


Fig. 3. Comparison of Field data with simulated data for Hingna Road (MSH-255)

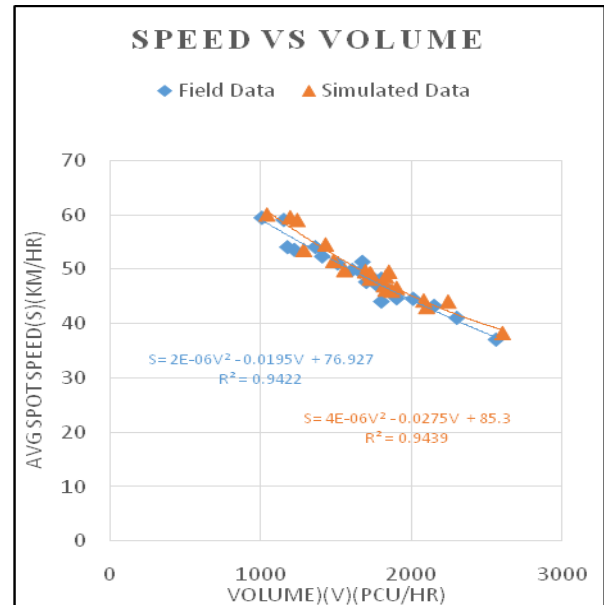


Fig. 4. Comparison of Field data with simulated data for Wardha Road (MSH260)

Variation of theoretical volume with obtained simulated volume with plus minus 5% are shown in fig.5 and fig.6.

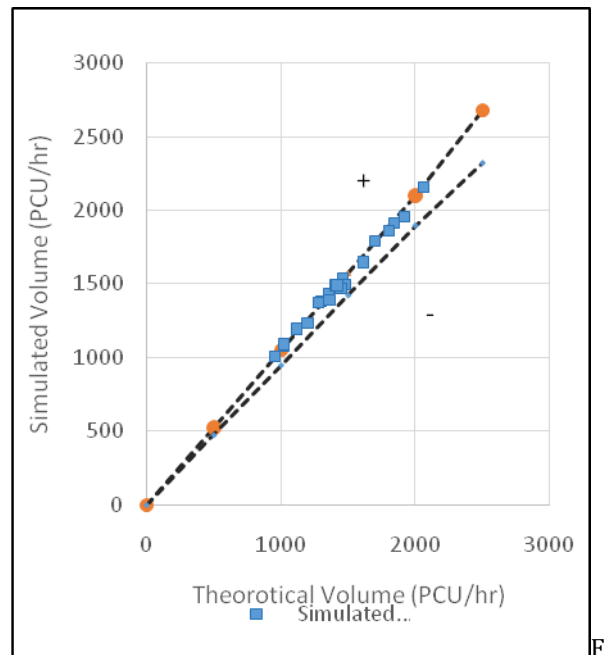


Fig. 5. Variation of Theoretical Volume with Simulated Volume on Hingna Road (MSH-255)

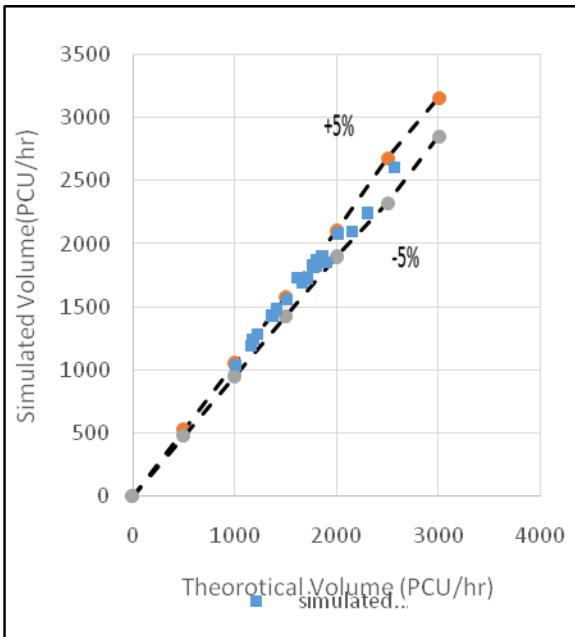


Fig. 6. Variation of Theoretical Volume with Simulated Volume on Wardha Road (MSH-260)

6. EFFECT ON CAPACITY BY IMPACT OF WIDTH OF LANE

From given speed volume correlation obtained from field data it was suggested that the width of road increases capacity of road also increases and it is more noticeable in heterogeneous flow situation where motor vehicles don't postdate lane discipline. Table 5. Shows the road width and capacity of road Obtained from field.

Table.5. Road Specification

Sr. No.	Name of Road	Carriageway width	Obtained Field Capacity
1	Hingna Road (MSH-255)	7.4	2064
2	Wardha Road (MSH-260)	10.4	2562

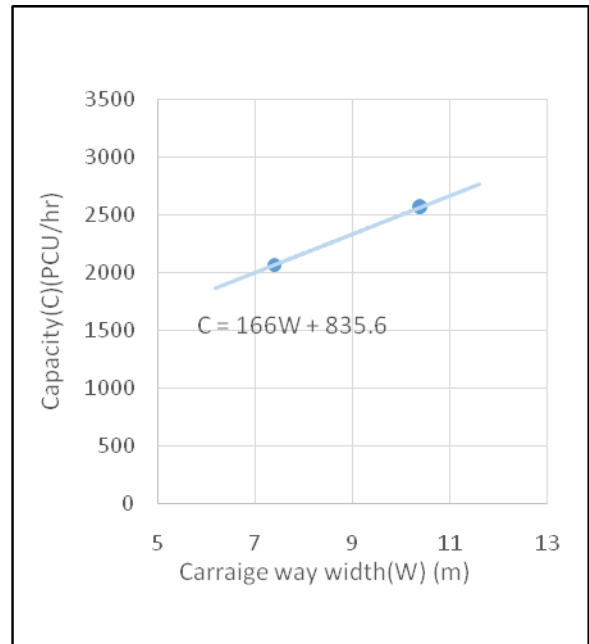


Fig. 7. Capacity compared to width of Carriageway

7. RESULT & CONCLUSION

The Traffic data for urban road, the dynamic PCU values are found by Dr.Satish Chandra method, Based on the parameters and Data obtained for capacity estimation the following conclusions have been drawn.

- The observed field capacity and simulated capacity is found to be ±5%
- The further increase in road width the PCU values for traffic composition are increases as well as capacity of road increases.

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Dr.B.V.Khode is currently a professor in Transportation Engineering Division of the Department of Civil Engineering of G.H. Rasoni College of Engineering, Nagpur, Maharashtra, India. He has professional experience of about 26 years in teaching research. He had guided several doctorate degree student and has published more than 4 research paper in international and national journals and conferences.

BIOGRAPHIES



Pratik Mankar is a M.Tech scholar in Transportation Engineering Division, Department of Civil Engineering, G.H. Rasoni College of Engineering, Nagpur, Maharashtra, India. His research work is in the area of mixed traffic flow condition. He also completed research work in the concrete mix design. Mr Pratik Manakar obtains his undergraduate degree in the areas of Civil Engineering in the year 2014 from R.T.M.N. University, Nagpur, Maharashtra.