Research Paper **Engineering**

Effect of Traffic Composition and Road Width on Urban Traffic Stream

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ABSTRACT

Day by day the traffic of an urban streets increases rapidly .Due to the increase in traffic the problems related to this also become more and more complex . Most of the Indian cities are having heterogeneous traffic(i.e., mix traffic of Non-motorized and motorized vehicles) which make the use of same road. The area selected for this study was two lane/three lane urban road of Ahmedabad city. For this study the Mid-block section of each Road has been selected. The video graphic as well manual method was used for collection of traffic data such as measurement of flow and Spot speeds. Due to change in carriageway width and vehicle composition, the traffic stream speed and flow also encounter more congestion level along the length of link.

Keywords : Heterogeneous Traffic; Urban streets; Speed; Flow; Traffic Stream; Vehicle Composition

1 INTRODUCTION

Day by day the traffic of an urban streets increases rapidly .Due to the increase in traffic the problems related to this also become more and more complex .The urban roads of India generally carry the heterogeneous traffic which is the combination of various vehicles like Cars, Buses, Trucks, Motor cycles, Light goods vehicles, Auto Rickshaws, Pedal Cycles, Hand drawn carts, Animal drawn carts etc. These all vehicles have different speeds, size, Load carrying capacities or passenger capacities etc. which affect the urban heterogeneous traffic flow. Most of the Indian cities are having heterogeneous traffic(i.e., mix traffic of Non-motorized and motorized vehicles) which make the use of same road. Table1 indicates total numbers of registered motor vehicles in Ahmedabad. In developing countries like India the urban as well as rural road networks serve the heterogeneous traffic having a wide range of type of vehicles, characteristics (static as well as dynamic) of vehicles, variation in behavior of drivers. Also there is wide variation in the income of urban people which directly affect ownership of different types of vehicles (i.e., Cars, two wheelers, cycles etc.).This results into heterogeneous traffic on urban arterial streets. Traffic in Ahmedabad is characterized by significant presence of inter city traffic and its composition. The city is presently suffering from several transport problems like traffic congestion, parking difficulties, insufficient road width, and higher use of personalized mode of transportation, high delay at signalized intersection, proliferating intermediate passenger transport vehicles, road accidents and inadequate mass transit facilities.

2.0 DATA COLLECTION AND ANALYSIS

The area selected for this study was two lane/three lane urban road of Ahmedabad city. For this study the Mid-block section of each road has been selected. The first traffic survey work was carried out on 132' ring road near pallav cross roads. This road has three lanes on each direction of traffic flow. To measure the spot speed, time taken by different vehicles to cross 40.00/50.00 m distance was measured in seconds. For example, a car takes 4.00 seconds to cross 50.00 m distance then the speed of this car will be 45.00 km/h. The disadvantage of this method is that it is too tedious and time consuming. However the results are accurate and reliable by

this method. Another important traffic flow characteristics is the flow which is measured in vehicles per hour. This is accurately possible by videography method. If we play the video again and again we can count the total numbers of different vehicles. Data related to Roadway and Traffic survey included the following:

- No. of lanes
- Width of lane
- Surface of the pavement
- Speed of vehicle (km/h)
- Flow (PCU/H)

The width of each lane varies from 3.25m to 3.50 m. The lateral clearance includes width of paved shoulder, lateral distance of any object or sign board from the edge of carriageway.

2.1 Overall Transportation Scenario:

Traffic in Ahmedabad is characterized by significant presence of inter city traffic and its composition. The city is presently suffering from several transport problems like traffic congestion, parking difficulties, insufficient road width, and higher use of personalized mode of transportation, high delay at signalized intersection, proliferating intermediate passenger transport vehicles, road accidents and inadequate mass transit facilities.

2.3 Vehicular Growth and Composition:

There are different category of vehicle registered in Ahmedabad city. It is obseeved that the predominant mode of transport within the city is two wheelers. It consists 71.64 of total registered vehicles. However four wheelers (cars) and three-wheelers are of 15.22 and 4.94% respectively. On the other hand primary survey of this study also indicates percentage of bicycles in vehicle composition is also significant. The overall growth rate of two wheelers is more than cars and 3 – wheelers. Total vehicles registered in Ahmedabad are covered more than 20% share of total vehicles registered in Gujarat. Overall growth rate is 8.46%, which indicates high use of personalized vehicles. Average growth rate of vehicles also shows increasing trend.

Table-1 RTO, Ahmedabad- Vehicle population

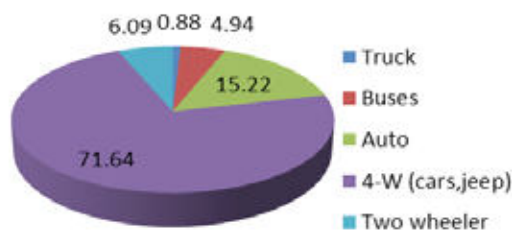| Sr No	Type of vehicle	Year			Percentage Of Vehicles composition in Last year
		2009-10	2010-11	2011-12	
1	Truck	31437	32612	34586	1.23
2	Buses	23739	24142	24831	0.88
3	Auto	115699	128240	139587	4.94
4	4-W	339055	383588	429688	15.2
5	Two wheeler	339055	383588	429688	71.6
6	Other	143001	724914	171906	6.09
	Total	2238452	2444240	2651116	100

Fig. -1 Chart showing Vehicles composition
(Source RTO- Ahmedabad)

2.4 Data Collection:
The required data for and analysis and results are traffic volume (V), realised stream speed at operating traffic volume (Vs) , free flow speed (Sfs), capacity of road section, composition of traffic and width of the road section. In the present study, the video graphic method has been used for collection of traffic data such as measurement of flow. At the 132'Ring road site, the video camera placed on the top of compound wall, on the AEC to SOLA road, the video camera placed on the High angle at left side, While at C.G. road camera was put on the top of high compound wall. A continuous video graphic survey was carried out for 2 hours in the morning and in the evening. After collecting the data, the analysis has been done in the Transport laboratory for classified volume counts and speed measurements.

2.5 Data Collection Application:
The roads were selected in such a way that using different sets of traffic data, Traffic flow can be modeled for a wide range of roadway traffic and control conditions. Three road stretches were considered under this study. Number of traffic lanes, carriage way width, surface type and various data collection techniques are considered in this study. Depending on the prevailing roadway conditions and abutting land use, two different methods were adopted for collection of traffic data for this study. Where the abutting land use patterns were favourable for placing the video camera at the suitable location to cover the traffic movement on selected stretch of road, the video graphic method was used for collection traffic data. Otherwise the manual method was adopted for the same. In video graphic method, a pre-selected suitable stretch of the road was marked by painting and road marker were placed in the beginning and end of the marked section of road in such a way that they are not directly visible by the oncoming traffic, but can be identified by the video camera.

The video camera was placed at a suitable location (e.g on the roof of high rise building or on the top of compound wall by the side of the road) and the traffic movements on the marked road were recorded continuously for the selected period to cover the peak as well as off peak traffic movements. The recording was then replayed a number of times in laboratory and the traffic volume, composition of traffic and travel time of different modes were extracted by manual method. The number of vehicles and there types were noted for every 5 minute interval. The travel time of different vehicle during each 5 min-

ute interval was obtained manually by using digital stopwatch. Since the recording can be played a number of times in the laboratory, the data collected by videography are more accurate than the direct data collection in the field by manual method. However, where it was difficult to get a suitable place for placing the video camera at a point to cover the required road stretch within the view limit of camera, manual method was used for collecting data directly in the field. For this method a large number of students (i.e., students of M.E.second , M.E. fourth Sem,) were employed in the field for the selected period. The number of trained students were broadly divided into two groups – one for classified volume count of traffic, while the other for obtaining spot speed for different vehicles.

Depending on the availability of the data and the composition of different vehicle types in the stream, the vehicle type observed in the field have been logically categorized into groups. For example, in some cases, all bigger vehicles like bus, truck etc. were put into one group. Similarly, car, jeep ,van etc. were put in one group.

The classified traffic counts were available for every five-minute interval. Traffic counts were aggregated for 5- minute interval and then appropriately converted into hourly traffic volume in PCU per hour (PCU/H) .

Total Three stretches were considered for the case study. The data collection on these roads has been done by Videography. The collected data was then analyzed in the transportation laboratory and the speed and volume per five-minute time interval was found out. The speed-flow relationship has been developed for all the three roads for 5 min. time interval data.

The stretches of roads are listed as below:
1. 132'Ring road (from Jaymangal to Pallav)
2. From Naranpura AEC to Sola
3. C.G.Road (from Girish cold Drink to Jade Blue)

The data collected for the above stretches are analysed and the speed flow graphs were prepared through Fig.2 to 4.
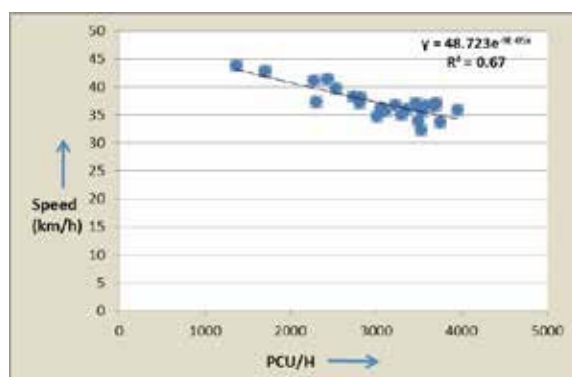

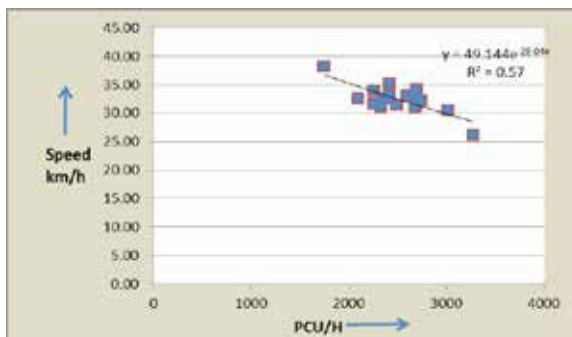**Fig. 2 Speed –Flow relationship(132' Ring road-Jaymanagal to Pallav)**

Fig. 3 Speed –Flow relationship (Naranpura AEC to Sola road)
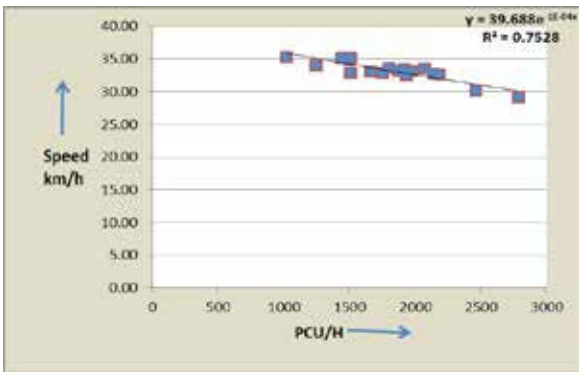
Fig. 4 Speed –Flow relationship(C.G. road Girish cold drink to Jade Blue)

The maximum flow was observed on 132'Ring road(Table-2) in which two wheelers have more contribution . Also the graphical relationship between the road width and the flow(PCU/H) is shown in the Fig.-5.

Table-2 Road Stretches with maximum Flow values having varying widths

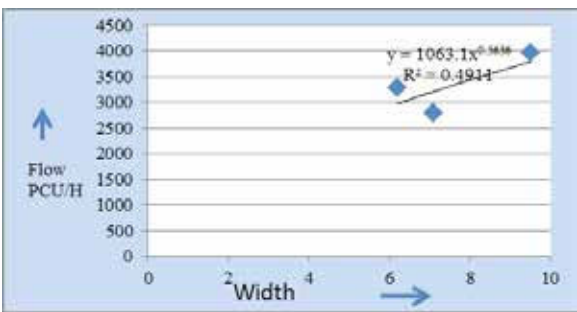| Sr. No	Name of Road Stretch	No. of Lanes	Total Width (m)	Maximum flow observed (PCU/H)
1	132'Ring Road(Jaymangal to Pallav)	3	9.5	3955
2	Naranpura AEC to Sola Road	2	6.2	3274
3	C.G.Road (Girish Cold Drink to Jade Blue)	2	7.1	2786

Fig- 5 graph showing the relationship between Road width and Flow

3 CONCLUSIONS

Based on traffic demand and desired level service, the carriageway width is provided in terms of number of lanes. Normally the width of traffic lane should be uniform along the length of a roadway with same number of traffic lanes. However in this study the carriageway widths were found to vary even along the length of the urban road, and similar links in different locations were also found to have variations in the carriageway width. The non-uniform carriageway width along the road is common especially in developing countries. Due to change in carriageway width, the traffic stream speed also encounters more congestion level along the length of link. Another factor is the composition of Traffic which is very much important. As the Volume of Large size and slow moving vehicles increases the traffic flow as well as the speed decrease.

4 ACKNOWLEDGEMENTS

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