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A Comprehensive Enhancement in Analysing the Speed Flow and Modelling of Headway in Urban Traffic at Warangal City

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ABSTRACT: The problems associated with mixed traffic conditions on urban streets of developing countries are unique. Pedestrians, bicycles, buses, cars, motorcycles/scooters, auto rickshaws, cycle rickshaws and various other kinds of travel modes share the same street space creating inefficient mobility conditions that are robbing the economic potential of the Warangal city in developing different areas. (Near Radhika theatre Near Arts and Science College, Near University cross road, Near NIT second gate) Due to various reasons these problems are yet to be resolved. The inability to resolve these problems is making them more and more complex. Increasing motor vehicle ownership in the developing countries is further aggravating the situation. Hence knowledge of fundamental traffic flow characteristics and associated analytical techniques is an essential requirement in the planning, design and operation of transportation systems. Understanding the behavior of heterogeneous traffic on urban road network is difficult when compared to homogeneous traffic conditions in Warangal city. The main objective of this study includes: Developing mathematical models of speed, flow and headway for mixed traffic conditions, finding suitable headway distribution for the collected headway data and fixing the flow levels and developing suitable relationship between speed, flow and thus to estimate capacity of the road serving mixed traffic.

I. INTRODUCTION

The problems associated with mixed traffic conditions on urban avenues of creating nations are novel. People on foot, bikes, transports, autos, bikes/bikes, auto rickshaws, cycle rickshaws and different sorts of movement modes share a similar road space making wasteful versatility conditions that are looting the financial capability of the urban communities in creating nations. Because of different reasons these issues are yet to be settled. The failure to determine these issues is making them more perplexing. The inability to resolve these problems is making them more and more complex. Increasing motor vehicle ownership in the developing countries is further aggravating the situation. Hence knowledge of fundamental traffic flow characteristics and associated analytical techniques is an essential requirement in the planning, design and operation of transportation systems.

Urban Transport Scenario In India

Urban Transport is one of the most important components of urban infrastructure. A good network of roads and an efficient Mass Urban Transport System make a substantial contribution to the “working efficiency” of a large city. A poor urban transport framework may back off financial development of the city and furthermore prompt its rot. It has

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been assessed that the poor Traffic and Transportation situation in the urban territories of the nation as of now result in a yearly loss of the request of Rs. 20,000 crores in vehicles working and travel time costs alone.

Need For the Study

Understanding the behavior of heterogeneous traffic on urban road network is difficult when compared to homogeneous traffic conditions. Knowledge of fundamental traffic flow characteristics and associated analytical techniques is an essential requirement in the planning, design and operation of transportation systems. Speed-flow relationships are applied in many areas of transportation and traffic engineering. It has been used as a tool to determine design capacities for roads to determine level of service for traffic flow and to calculate travel costs on a specific road section.

Objectives of the study

The broad Objectives of the study are:

1. Developing mathematical models of speed, flow and headway for mixed traffic conditions at Warangal city
2. Finding suitable headway distribution for the collected headway data and fixing the flow levels.
3. Developing suitable relationship between speed, flow and thus to estimate capacity of the road serving mixed traffic.

II. LITERATURE REVIEW

Speed is a basic proportion of movement execution of a parkway framework. Most expository and reproduction models of movement anticipate speed as the proportion of the execution, given the outline, request and control on the interstate framework. Vehicular speed is additionally one of the critical information parameters for the reproduction models as the associations between the vehicles are very touchy to it. The velocities of individual vehicles must be determined as a reasonable scientific model for producing them inside in a PC.

M G Raichur (1996) studied speed – stream qualities on NH – 8 between Baroda – Surat segment. In this investigation the genuine voyage velocities of various kinds of vehicles at which they travel at specific state of activity volume were seen by receiving the Moving auto spectator strategy. By breaking down the information the stream speed and stream were ascertained.

Dowling (2004) suggested refreshed Bureau of Public Road speed-stream bends for turnpikes and signalized arterials to enhance the exactness of speed gauges utilized in transportation request models. These refreshed bends by and large included the utilization of higher power works that show generally little affectability to volume changes until the point when request surpasses limit when the anticipated speed drops unexpectedly to a low esteem.

ParthaPratimDey (2006) considered the issue of bimodality in the speed conveyance bend under blended movement circumstances. The parameters of speed dispersion bends are assessed and these are related with movement conditions on two path streets to recommend the cutoff points for a unimodal and a bimodal bend. The idea of the speed appropriation bend is portrayed by different parameters implying the focal inclination, spread, skewness, peakedness and the consistency.

Richard J. Porter (2007) studied the speed conduct in development work zones. Speed conduct is examined through the testing of two exact model structures that relate the needy factors 85th percentile free-stream speed and standard deviation of free-stream speed to indicator factors (work zone geometry and activity control). Models for 85th percentile speed and standard deviation of speed for traveler autos were evaluated by common slightest squares and relapse.

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Zhao Yi Huang (2008) researches the area impacts of a bottleneck on the speed-stream relationship. A separated bottleneck on the road by and large impacts a constrained section length which implies lessening impacts of the bottleneck on movement stream by a separation inside the impact region. The bottleneck consequences for the speed-stream relationship can be abridged by three focuses. Right off the bat the upper appendage of the bend is by and large watched and connected in the limit investigation which has nothing to do with the bottleneck. Second is the limit some portion of the speed-stream bend is just seen on a bottleneck. At last the lower appendage of the speed-stream bend must be seen on destinations upstream of a bottleneck.

III. METHODOLOGY

The first step is the identification of study stretches. The study Warangal districts locations should be in such a way that it should represent the real conditions of the traffic flow. In order to acquire data from those sort of locations certain criteria has to be followed for selection.

The selection of the study locations to carry the traffic volume, traffic composition, vehicular speeds and the arrival times is based on the following criteria.

- The road sections are sufficiently straight.
- The influence of the intersection on the study stretch should be minimum.
- The road should not have any gradient.
- The influence of bus stops on either side of the site is minimum.

By considering the above criteria, the following stretches were selected for conducting the survey.

1. Near Radhikatheatre
2. Near Arts and Science College
3. Near University cross road
4. Near NIT second gate

All the locations are of Four lane divided (Two way traffic) and having lane discipline.

IV. DATA COLLECTION

The second step is data collection on identified sections. Data regarding Volume counts, space mean speeds, free flow speeds, time headways were collected at selected stretches. Traffic Volume counts were collected by using Manual method. In this study the data was collected regarding volume of different types of vehicles for 6 hrs of duration with 15 minutes time intervals at a the reference point of stretch. Spot speeds were measured by using Pro Laser Infrared Radar gun. This works on the principle of sending out invisible laser beam pulses (*per second*) and recording the time taken to receive the pulses back from the object in motion. Registration method is adapted to measure space mean speeds.

Data analysis

The required field studies, their locations and method of data collection are briefed in earlier chapter. The data acquired at the respective locations has to be analyzed for better description of models. This involves extraction and grouping of traffic data with respect to the variables under study and developing the relationship between speed and flow for different type of vehicles, fitting distributions for free speed and headways. All the locations that were selected are on the urban roads having good design standard. All the locations are leveled and mid - block sections.

Traffic volume

Traffic volume is the most basic of all traffic parameters and the one most used in planning, design, control, operation and management analysis. As the flow increases the speed of the vehicles reduces because of more interaction between vehicles. At all the four locations the volume is collected for six hours (9AM TO 12 AM and 2PM TO 5PM) and every hour is divided into 15 minutes interval.

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Influence of proportion of various types of vehicles on vehicular speeds

The speed of a specific sort of vehicle relies upon the stream present on the roadway. On the off chance that the stream is more than the velocities of vehicles will be less a direct result of more connection between the vehicles and bad habit – versa. In homogeneous rush hour gridlock condition the speed of the vehicle relies upon the stream present on the roadway which is comprising of single sort of vehicle where as in heterogeneous rush hour gridlock condition the paces of various kinds of vehicles changes because of the nearness of different vehicle composes in the rush hour gridlock stream and for the most part because of the wide variety in the working and execution attributes of vehicles. The vehicles likewise differ in measure, mobility, control, static and dynamic qualities.

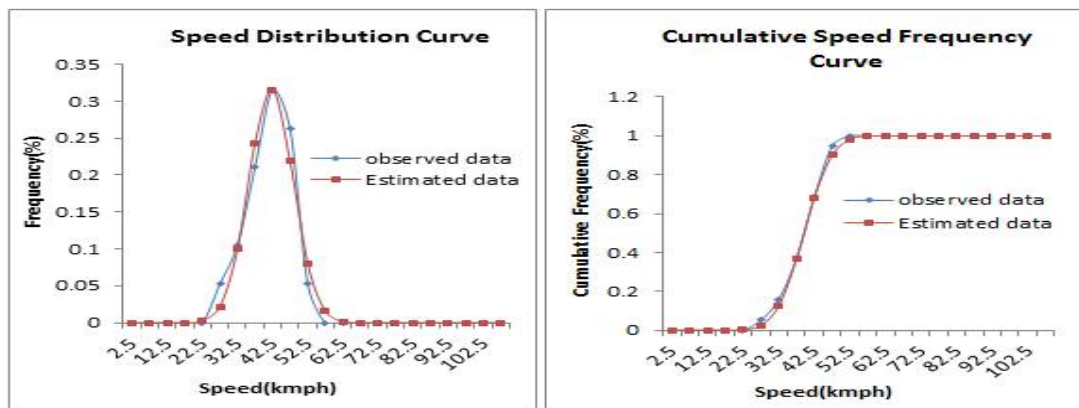


Figure: Distribution of spot speeds at radhika theatre: Auto’

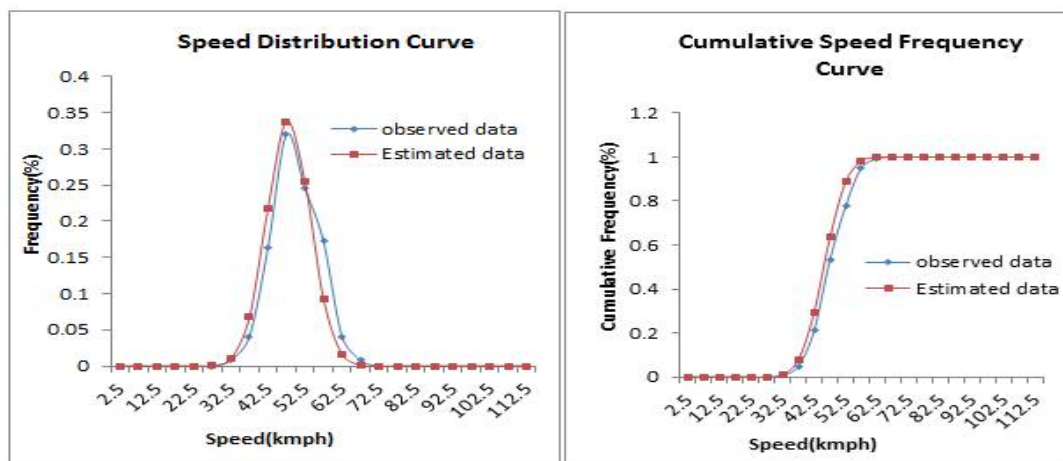


Figure: Distribution of spot speeds at University cross road: Auto’s

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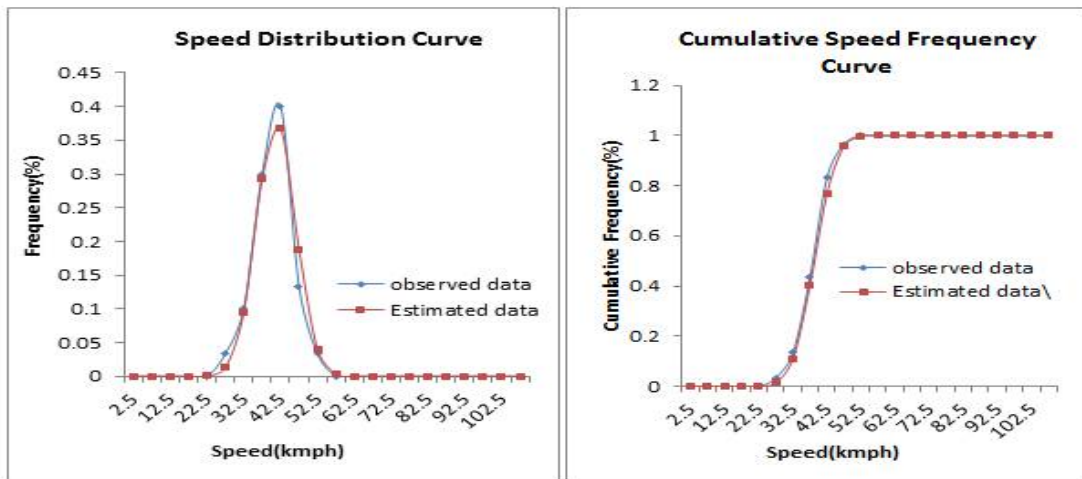


Figure: Distribution of spot speeds at Arts and Science collage: Auto

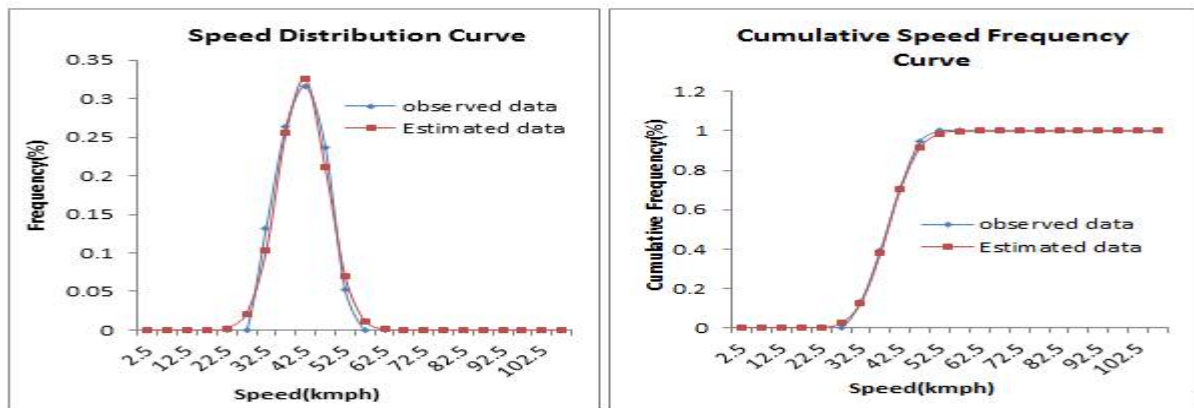


Figure: Distribution of spot speeds at Nit second gate: Auto

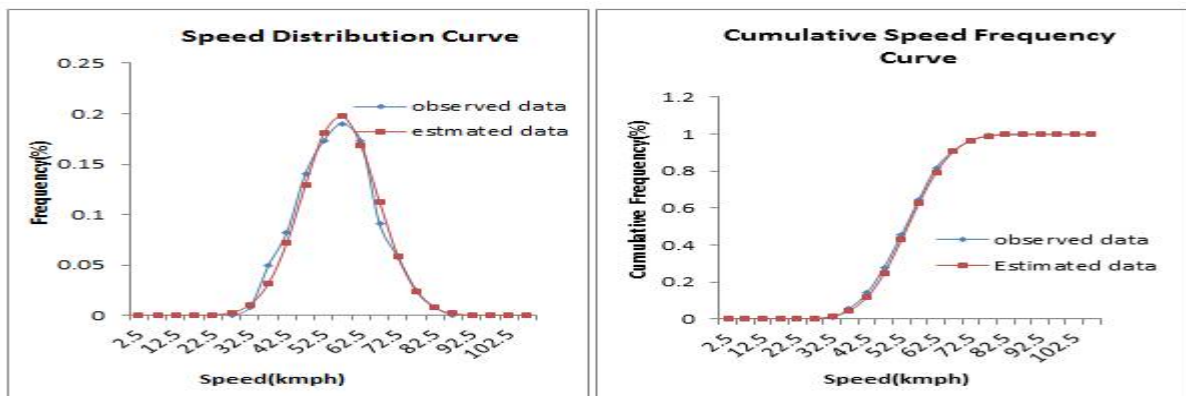


Figure: Distribution of spot speeds at Nit second gate: Truck

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The additionally gives the different percentile paces of various sorts of vehicles in each area A near appraisal of the mean and standard deviation of the free speeds for different vehicle classes were additionally given. The outcomes demonstrated that the typical dispersion bend depicted the speed disseminations palatably in the vast majority of the vehicle classes.

Table: Spot Speeds of all vehicles at Different Stretches

Location	Average Speed	Max Speed	Std Deviation	Percentile Speeds			
				15th	50th	85th	98 th
Radhika Theatre	48.44	70	8.5	40.8	48.5	57.5	65.8
University cross Road	45.19	66	7.99	36.25	45.41	53.57	60
Arts & Science collage	49.38	78	9.3	39.37	48.81	59.72	70.83
Nit second gate	56.58	84	12.06	43.5	57.5	70	79.16

Discussions

The spot speeds measured at any particular location will depend upon various factors, for example, the geometric format of a street, the volume of movement, the structure of activity, the state of the street, natural impacts, the human component related with singular drivers and the attributes of vehicles. Thus the paces estimated demonstrate a lot of dissipate. The examination is finished by gathering the speed information with a speed - class interim of 5 kmph and a recurrence dispersion table is developed. In the charts the even pivot speaks to the speed class limits and the vertical hub speaks to the rate recurrence and aggregate rate recurrence.

Time Headway Distributions

It is necessary to study the time headways phenomenon at various volume levels. Several authors reported previously that the intervehicular headway follow statistical distributions following random phenomenon But the conditions under which the distributions were developed are quite different from the one that occurs in a mixed traffic stream. Under mixed traffic conditions with varying percentage of slow and fast moving vehicles headways follow different distributions with varying traffic volume. From the data analysis it is observed that normal distribution is fitted at Radhika theatre and Exponential distribution is fitted for observed headways at the remaining three stretches the chi-square observed values are less than chi-square critical values. Hence the distributions fitted were accepted for the data collected at the study sections. The results of headway analysis are as follows:

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Table: Headway Distributions for Various Flow Levels at Different Stretches

Location	Data collected		Traffic volume (vph)	Distribution Fitted
	From	To		
Radhika Theatre	9AM	10AM	2936	Normal
	10AM	11AM	3398	Normal
university cross Road	9AM	10AM	632	Negative exponential
	10AM	11AM	748	Negative exponential
Arts and Science Collage	9AM	10AM	1085	Negative exponential
	10AM	11AM	1238	Negative exponential
Nit second gate	9AM	10AM	1079	Negative exponential
	10AM	11AM	1372	Negative exponential

DISCUSSION:

If all the vehicles using a highway have equal speeds and move in well-defined sequential fibres then determination of maximum volumes or capacity would be fairly simple. However vehicles tend to form groups or platoons even at low volumes due to variation in speeds and vehicle characteristics. The presence of two and three wheelers add an additional problem namely the bunching up of vehicles and moving abreast due to their freedom to move laterally and longitudinally. The space interval between successively moving vehicles shows generally a wide degree of variation. The headways reflect the vehicular spacing characteristics often random in nature. So it is associated with the some probabilistic nature. Once the spacing behaviour is known it is possible to predict its characteristics which can be utilised in further traffic analysis.

The headway that was collected at various locations is used to for fitting the various types of distributions under the presence of mixed traffic. The normal distribution was fitted for the data collected for two hours at Radhika theatre and was reported table 4.5 and 4.6 From the analysis at the remaining three stretches i.e University cross road, Arts and Science collage and Nit second gate the negative exponential distribution is fitted. Though the volume at Arts and Science collage and Nit second gate are more when compared the traffic volume at University cross road the vehicle arrival pattern is found to be random.

V. CONCLUSIONS

The following conclusions were drawn from the present study Capacity of a two-lane road at Radhika Theatre analysis has shown that the spot speed data for any particular vehicle follows a normal distribution with a specific mean and standard distribution From the free speeds study at various stretches the standard deviation values for different type of

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vehicles are less which means that most of the vehicles are travelling almost around mean speed of that particular group of vehicles. From the analysis at Radhika Theatre it is observed that the capacity values are exceeding the standard values specified in IRC. It shows that existing capacity may not sufficient for accommodating exiting traffic. If proper measures are not taken then it will be problem to accommodate the future traffic. The equations developed for determining the influence of percentage of various vehicles lead to mixed results. The extensive study is needed to achieve accurate results. At various stretches the influence of percentage of different types of vehicles on average speeds of various vehicles are different. Analysis of headway data gave rise to normal distribution for the data collected at Radhika Theatre which is considered as high flow condition and exponential distribution for data collected at remaining three study sections which can be considered as low flow condition.

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