

# Study of Traffic Flow Characteristics Under Heterogeneous Traffic Condition

<sup>1</sup>Salman Hafeez, <sup>2</sup>Uttam Kumar Gautam <sup>3</sup>Shubham kumar, <sup>4</sup>Shubham Kumar Azad, <sup>5</sup>Prithu Raj Mishra

<sup>1</sup>(Assistant Professor, Department of Civil Engineering, NIET, Greater Noida, INDIA)

<sup>2,3,4,5</sup>(B.Tech student Civil Engineering, Noida Institute of Engg. & Technology, Greater Noida, INDIA)

## ABSTRACT

India is a developing country and the number of vehicles is increasing rapidly over the decades at very higher rate thus causing lot of congestion and accidents. The speed of the vehicles is also affected as the traffic volume increases. Fundamental characteristics of traffic flow are speed, volume and density. Their relationship has a great impact on the proper traffic regulation for the safe, economical and efficient movement of the vehicles on the road. Due to the lack of proper traffic management the roads cannot accommodate the traffic capacity which will lead to the traffic congestion and delay in reaching the destination. Most of the researchers have done various surveys and tried to measure impact of fundamental characteristics of traffic flow on various roads and cities. Still more study is needed in this fields as different region has different traffic flow conditions. The main objective is to analyse various studies done by the researches and critically review their studies. Various method over the years has been reviewed here.

**Keyword:** Traffic volume, traffic characteristics, congestion,

## 1. INTRODUCTION

Traffic flow characteristics comprises of traffic volume, speed and composition of vehicles on road. The traffic condition in India is highly heterogeneous in nature generally drivers don't follow the rules and regulation of traffic this make traffic flow very heterogeneous in nature. One of the major problems in developing countries like India is congestion which results in delay and accidents. Traffic volume means the no of vehicle passed in unit time, which is generally calculated manually or by mechanical means. In recent times there has been a massive increase in population and economic behaviour thus resulting in huge travel demand of the traffic. The data gathered from the traffic volume and speed studies is used to determine the capacities and the LOS (Level of service) for the given road. The traffic volume data is very helpful in planning designing of road system, while as speed data is an essential measure in determining safety of road network. The data gathered in spot speed studies are used to determine vehicle speed percentile which is useful in making speed related decision. Generally, two type of speed are there "The time mean speed" & "The space mean speed".

## 2. RELATIONSHIP BETWEEN SPEED-FLOW-DENSITY

The relationship between the speed, density and traffic volume is known as the fundamental relations of traffic flow and their relationship can be expressed with the help of some curve known as fundamental diagram of traffic flow.

### A. Speed-Volume relation

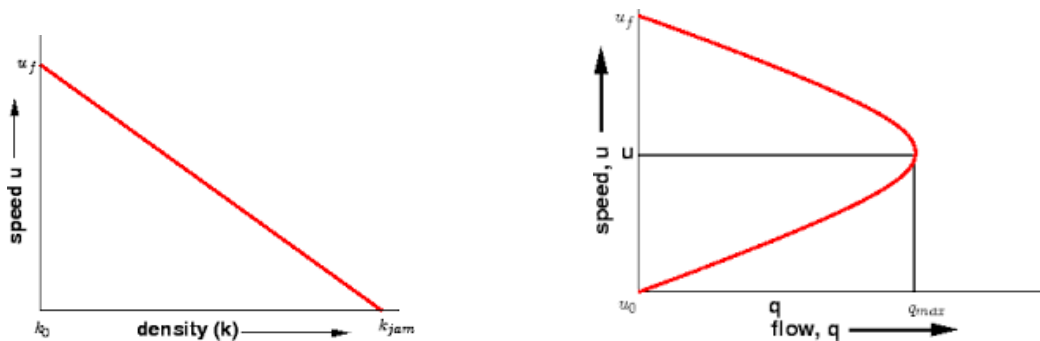
At zero speed the traffic volume will also be zero as the vehicles is not moving. As the speed increases the traffic volume also increases up to a certain limit. If the speed further increases, the spacing between the vehicles increases due to which the time headway between the vehicles also increases which results in the reduction of traffic volume. There is an optimum speed at which traffic volume is maximum.

### B. Density-Volume relation

When the density is zero flow will also be zero as there are no vehicles on the road. As the number of vehicles increases density as well as flow will also increases. When the number of vehicles reaches to the situation so that they cannot move then the traffic volume will be zero and the density corresponding to that point is maximum density which is referred as jam density.

### C. Density-Speed relation

When the speed of the vehicles increases, density decreases. It is due to the spacing between the vehicles increases as the speed increases. At zero density speed will be maximum which is called free flow speed. Further, if the speed becomes zero the density will be maximum which is called jam density.



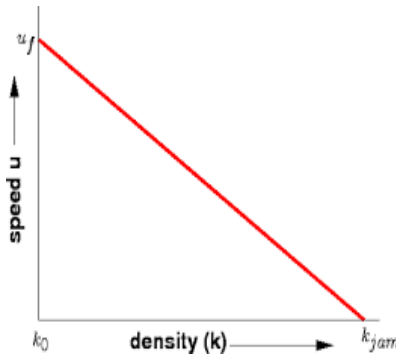


Fig 1 Fundamental diagram of traffic flow

### 3. STUDY OF FUNDAMENTAL VARIABLES OF TRAFFIC FLOW

**Hamdy Faheem (2014)** analysed the traffic characteristics on rural multi-lane Cairo-Aswan agriculture four-lane divided highway. Empirical data from study sites were used in his investigation. Correlation and regression analysis were used to investigate the relationship between average travel speed (ATS) and different traffic characteristics. The study results show that most traffic characteristics have significant correlations with ATS. The major contributing variables in the regression model are density, percentage of heavy vehicles and lane position. The result show that the ATS of median lane is higher when compare with shoulder lane having same density and the flow rate of median lane is higher when compare with shoulder lane having same density. Moreover, the ATS of median lane is higher than that of shoulder lane at the same flow rate.

**Arasan and Arkatkar (2011)** investigate the effect of variation of traffic composition, road width, magnitude of upgrade and its length on highways capacity in India. The study concluded that highway capacity significantly changes with change in traffic volume composition, width of roadway, magnitude of upgrade, and its length.

**Semeida (2013)** studied to investigate the relationship between roadway factors and operating speed at multi-lane highways. He concluded that the most influential variables on operating speed are pavement width, followed by median width and existence of side access along road section. The result also showed that the posted speed limit has a very small effect on the operating speed. In another study by Semeida (2013) investigated the impact of road geometric characteristics and heavy vehicles on level-of-service and capacity in rural multi-lane highways in Egypt. He concluded that the most influential variables were heavy vehicles, lane width, and existence of side access.

**Al Ghamdi (2001)** analysed the time headways of vehicle arrivals on urban roads in Riyadh based on lane-wise traffic data collected under different volume levels. The study revealed that negative exponential, shifted exponential and gamma distributions reasonably fitted time headways at low and medium flow rates on freeways, whereas the Erlang distribution was found to be appropriate in high traffic flows.

**Rashmi S M and Srikanth R (2017)** performed the study of traffic volume as well as pedestrian volume on Kengeri-Uttarahalli road. The findings revealed that the traffic volume is more in peak hours which is the main reason of congestion on the roads. The study concluded that maximum number of vehicles are on Monday

whereas minimum number of vehicles is on Sunday. In addition, the result showed that urban road caters heavy traffic due to which the level of service is reduced.

**Leong(1978)** examined the speed and capacity at 31 states in New South Wales using the multiple regression analysis. His study revealed that with increase in the width of the pavement, shoulder and sight distance there is an increment in free flow speed.

**Figuroa and Tarko (2005)** he studied the about the factors of free-flow speeds, especially on tangent segments of two-lane rural highways and developed free-flow speed models that identify factors of mean speed and speed dispersion on tangent segments and horizontal curves of two-lane rural highways. The advantages of the models developed in this study, over the traditional OLS models, include predicting any user-specified percentile, involving more design variables than traditional OLS models, and separating the impacts on mean speed from the impacts on speed dispersion.

#### 4. CONCLUSION

- In recent years, more emphasis is being placed on travel time-based measures such as congestion index, to quantify traffic congestion. Probe vehicles using GPS are attractive for estimating congestion measures.
- It may be concluded that most of the study of traffic characteristics is done on National Highways, very less study has been done on the expressways.
- Various statistical methodologies have been used for modelling the data and findings gathered from the various survey. Most of the researchers have used regression techniques for modelling. However, some other statistical and distribution techniques can be used.
- Most of the researchers concluded that density of the roads is high which are the leading causes of congestion.
- It is observed that lane position in rural multi-lane highways has a significant impact on traffic performance and characteristics.
- It is observed from the study that travel speed of median lane is higher than that of shoulder lane at the same density.
- With wider use of GPS in public transport buses, the availability of bus probe data in a continual and uninterrupted manner renders this approach as an attractive option.
- Due to heterogeneous traffic flow it is difficult to analyse one-hour data and make a conclusion about its level of service. Most of the researchers have taken the data for a small duration. Therefore, survey has to be done for different days, months and season of the year to get the appropriate data for the study.

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