iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 7 **Issue:** IV **Month of publication:** April 2019

DOI: https://doi.org/10.22214/ijraset.2019.4344

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 7 Issue IV, Apr 2019- Available at www.ijraset.com

Study on different Methods to Calculate Various Traffic Parameters – A Review

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Abstract: ***Transport planning plays a major role in the context of Transportation Engineering. If the transport planning lacks or fails, the consumers suffer in various zones such as comfort, congestion, accidents, etc. For a better transport planning, it requires actual traffic conditions to better understand the present road traffic and road infrastructure build-up. These include traffic flow, speed, volume, headway, density, capacity, etc. There are various methods available for data collection and analysis of the same. In this paper, an endeavour is kept to study the various methods and discuss its advantages, disadvantages and suitability for data collection.***

Keywords: speed, volume, density, travel time, flow, etc.

I. INTRODUCTION

India is a developing country and with that, the rate of vehicle ownership levels and road infrastructure build-up has increased drastically in the last century. The continuous increase in the vehicle ownership levels gives rise to various traffic problems to the consumers such as congestion, travel time delay, accidents, etc. While considering it, on the other hand, various road traffic management systems have been introduced with focus on road safety, comfort and capacity. The basic requirements to tackle traffic problems for these management systems are a huge amount of real time traffic data.

Basically, these management systems work in 3 consecutive stages i.e. the measurement stage, decision making stage and finally the execution stage. Depending on the traffic and road infrastructure situations, effective suggestions and decisions are taken, and later executed on the road traffic network to change its state. However, these decisions are purely based on the measured data. The measured data is captured from the traffic analysis of the road network. Various parameters can be monitored with the help of the traffic analysis. They include traffic flow, speed, density PCU, travel time, delay time, running speed, journey speed, etc. There are various methods available for traffic data collection. This report discusses methods like aerial photography, floating car method, moving observer method, use of video camera, etc to collect traffic data.

II. LITERATURE REVIEW

Abhinav Sundarrajan (2016) conducted research on 'Traffic State Estimation Using Floating Method'. The traffic analysis was conducted on a 13km expressway in Central Singapore with floating car method. The paper mainly focuses on deriving the most reliable traffic flow and density that can be achieved by using as minimum probe vehicles. By providing sufficient probe penetration, the traffic parameters like average speed and more importantly density can be measured more reliably.

Peter Bickel (2007) conducted study on 'Measuring Traffic'. This study was conducted on the freeways of California. A traffic performance measurement system is responsible for traffic data collection with the help of various automatic sensors present on the freeways. In this paper he discusses various problems that have come up on while gathering traffic data such as velocity, travel time and density. In particular, the study focuses on detecting the sensor's malfunctioning, imputing incorrect or missing traffic data. Inductive loops were used as a source for data collection on freeways, but as a result it was found that similar data was also available for arterial roads also that was having a very complex geometry of road.

Bum-Jin Park (2014) conducted research on 'A method for measuring accurate traffic density by aerial photography'. The study was conducted on a 9.2km stretch between An-Hyun Junction and Jo-Nam Junction of the Seoul Ring Express Highway. The road geometry consists of an 8-lane 2-way highway having lane width of 3m. The aerial photographs were taken using a Short Take-Off and Landing (STOL) that was flying with a speed of 180 to 200km/hr on the highway. Traffic density is defined as the number of vehicles present within 1km of road. In this paper, the traffic density obtained from aerial photography was almost the same as that of the representative 1km section when counted.

Amar Ghadage (2016) conducted research on 'To study the various methods of Traffic Flow Measurement'. In this paper he compared the Moving Observer Method and Manual Count method. Along with this, he discussed the advantages and disadvantages

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of the moving observer method. The result of volume obtained from the moving observer method was comparatively less than that of the manual count method. But the observed error can be minimized by using the correction factor later.

Nipjyoti Bharadwaj (2016) conducted research on 'Traffic Data Analysis using Image Processing Technique On Delhi-Gurgaon Expressway'. The study was conducted on Delhi-Gurgaon Expressway which is heterogenous in nature and having a non-lane based behaviour. In this paper, TRaffic AnalyZer and EnumeratoR (TRAZER) was used to process the traffic data that was captured with the help video. This was done to check the accuracy of the traffic parameters such as traffic vehicle count, speed,etc. The data captured from TRAZEr was compared with the traffic data of same time that was obtained manually. The main aim of the paper was to check its efficiency for calculating traffic parameters under heterogenous traffic conditions.

Shahram Moafipoor (2005) conducted study on 'Traffic Flow Estimate Using LiDAR Data: Operational Experiences. This paper discusses the algorithms used in the current software of LiDAR with its limitations and efficiency. The working of LiDAR has mainly 5 components i.e scanning each segment, extracting the elevated points, refining the vehicle objects and removing the non vehicle objects, vehicle parametization, vehicle classification. The total traffic volume can be estimated from this data and later other traffic parameters such as speed, flow and density can be analyzed.

Irina Yatskiv (2012) conducted research on 'An overview of Different Methods Available to Observe traffic flows Using New Technologies'. This paper discusses the comparative analysis of modern traffic flow measurement techniques in concern with goals of survey, the amount of data that can be calculated, available resources and the feasibility to collect data. The different output from these methods are speed, flow, density, time headway, travel time, etc. Also it discusses additional information like real time data, dependence on weather conditions, data for public/scientists are available or not for various methods.

III. CONCLUSION

A. Using floating car data method for estimation of traffic is made easier since a minimum of 5% to 10% of probe vehicles can be considered for analysis which will give reliable results of traffic characteristics, especially traffic density.

B. Total dependency on sensors such as inductive loops would not be a great thought since it has its own drawbacks like sensor malfunction and imputation of missing data.

C. Aerial photography can be used for estimating the traffic density since the results are almost similar as that of manual methods, but the application of it still lacks as it is costly and many cheap methods are available for calculating density viz camera recording method.

D. In most of the cases, moving observer method can be applied as it is economical, data for speed and flow can be collected at the same time, additional information like causes of delay can also be noted if required.

E. TRaffic AnalyZer and EnumeratoR is found to be good and gives consistent results for analysing the speed.

F. LiDAR can be used to compute large amount of traffic data in a very less processing time when traffic volume is to be calculated.

G. Among all the methods, it can be concluded that camera recording method for data collection and manual analysis is the most cheapest method to determine the various traffic parameters . Also speed, volume and density can be analysed at the same time efficiently.

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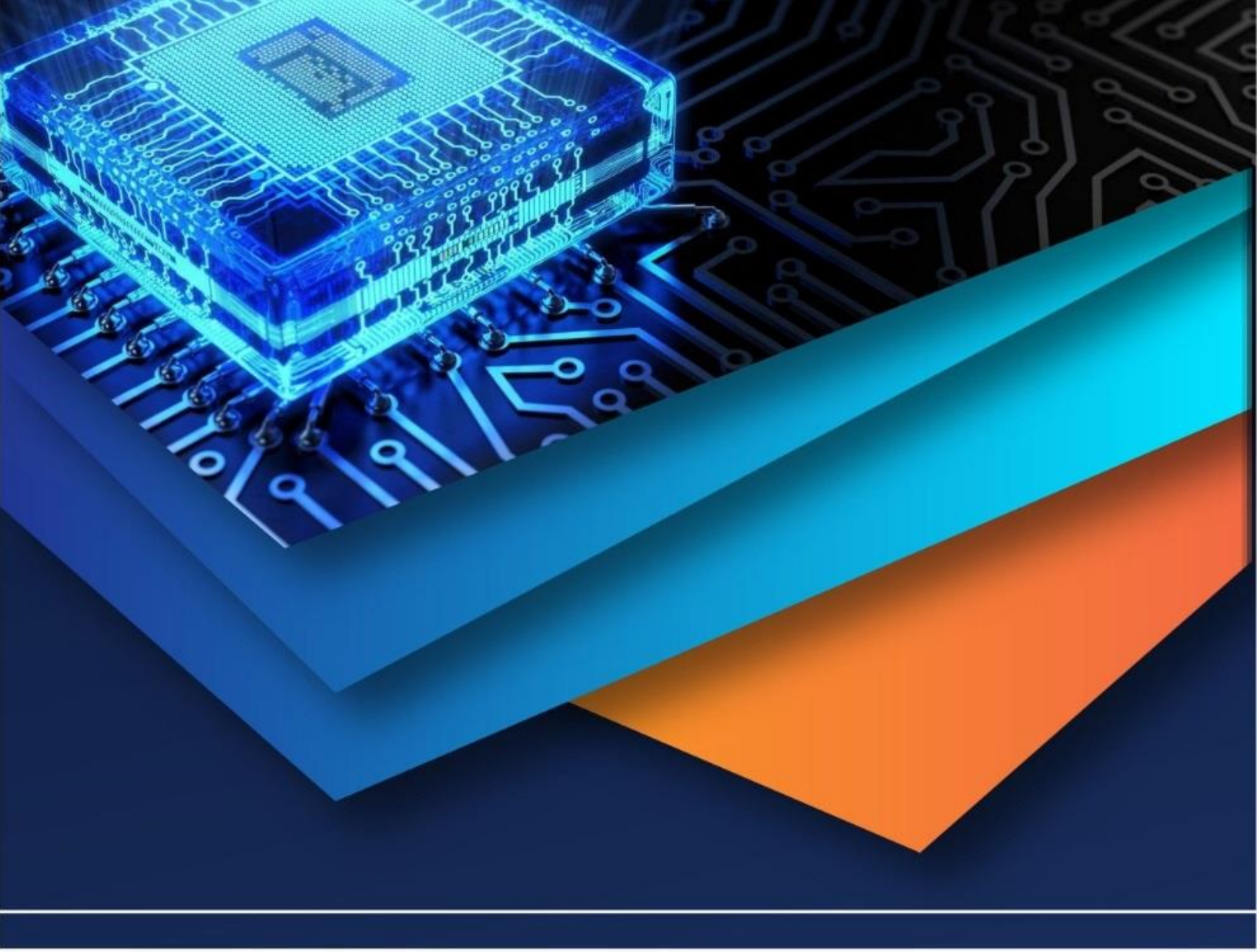

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