MICROSCOPIC ANALYSIS OF UNSIGNALIZED INTERSECTIONS IN HETEROGENOUS TRAFFIC CONDITIONS

Saad Ayoob Haji [(1)], Rohith Saju Mathai [(1)], Manish Kumar [(1)], Rishab Anand [(1)]

Nitin Kumar [(2)]

*[(1)] *Final year UG students, Department of Civil Engineering, Dayananda Sagar College of Engineering, Bengaluru.*

[(2)] *Assistant Professor, Department of Civil Engineering, Dayananda Sagar College of Engineering, Bengaluru.*

ABSTRACT

Unsignalized intersections in India are uncontrolled, and are characterized by disoriented traffic situation and have become hot spots for untoward incidents. In this study, traffic data has been collected at two uncontrolled intersections and analyzed traffic activity parameters such as traffic composition, speed variations, lane distribution, vehicle trajectories, conflict points and pedestrian movements. These intersections have more than 50% vehicles as two-wheelers. All the vehicle classes incline toward inner path of the road except three-wheelers and two-wheelers. The speed of inner path/lane vehicles is higher than outer path/lane vehicles as outer lane vehicles suffer from roadside obstructions. It is additionally found that the minor approach vehicles ought to speed down or halt numerous times.

Vehicle-pedestrian clashes are exceptionally common and worrisome as numerous pedestrians attempt to walk the briefest path without giving much consideration to their security. This study has incredible potential in surveying and assessing the performance and security of unsignalized intersections in India.

***Keywords**: Conflict points, Microscopic analysis, Uncontrolled intersections, Vehicle trajectories, Travel behaviour. Uncontrolled intersections, Vehicle trajectories.*

INTRODUCTION

Road intersections are the principal bottlenecks in a given network, basically because the intersection space has to be shared by the vehicles moving in distinct directions. An intersection has numerous crossing and overlapping conflict points for vehicles. Furthermore, pedestrians add to the number of conflict points by crossing the roads at the intersections. Huge number of vehicle-vehicle and vehicle-pedestrian clashes are potential causes of accidents. In order to reduce the number of clashes, signals are introduced at various intersections. The signals have been fruitful in improving the security at intersections in developing nations like India. Be that as it may, the signal installation is expensive and there are huge number of intersections in a city as well. Hence, most of the intersections in any city are unsignalized and there are attempts made to reduce the number of accidents with the assistance of stop/yield signs. In India, mainly the intersections on arterial roads are signalized and the rest of intersections are left unsignalized. Drivers in India are aggressive and headstrong and traffic rules are not actualized in entirety. Thus, the circumstances at unsignalized intersections are chaotic, making manoeuvring exceptionally risky. In spite of the fact that the situations, to some extent, are way better at signalized intersections, the red-light violations, particularly at night, are uncontrolled resulting in dangerous mishaps. Out of the total 56,151 accidents recorded from 2016 to 2019 in Karnataka, 15,736 (28%) resulted in

the loss of life. The most vulnerable entity at an intersection in India is a pedestrian. Evident from the above facts, large part of the people that kicked the bucket in an accident were the pedestrians. In order to understand the causes of accidents, it is imperative to study the traffic characteristics such as traffic volume, composition, speed, conflict points, vehicles trajectories, pedestrian movements, etc.

OBJECTIVES

a) To study the trajectories of all classes of vehicles and determining different points of conflicts.
b) To evaluate the critical gap distribution by observing accepted and rejected gaps.
c) To assess the streamwise clearance time of all classes of vehicles.
d) To evaluate follow-up time, vehicle impedance and vehicle trajectory

LITERATURE REVIEW

The assessment of unsignalized intersection for level of service, safety and security are important assignments for traffic engineers. Performing these tasks requires different parameters such as approach speeds, gap acceptance behaviour, traffic composition, intersection geometry, types of control strategy (priorities for different movements), pedestrian crossing etc. Highway Capacity Manual is widely used for performance evaluation of unsignalized intersection. The methods followed in HCM 2010 are based on the gap acceptance theory. A few other studies that centered on gap acceptance-based models are by Pant and Balakrishnan, Hamed et al., Pollatschek et al. In any case, these studies are based on the assumption that intersections are controlled with signs and the priorities are respected. Comparable studies in the Indian context are very few. Rao and Rengaraju, analyzed conflicts at urban uncontrolled intersection. Analytical and simulation models are developed for traffic conflicts. As of late, Sangole et al. and Patil et al. have studied uncontrolled intersections with limited priority. Both these studies focus on the gap acceptance behaviour of vehicles at T-intersections.

The primary aim of these studies is to reach at the performance evaluation for uncontrolled intersections. In this study, the intersections are four legged and traffic characteristics are studied and examined in detail. Numerous studies are found within the writing in which different traffic parameters are related to mishaps. The study carried out by Berge et al. centers on the drivers' speed choice on a street section and interaction with other road users. Trinh et al. applied conflict technique for traffic safety on model corridor on HA NOI. The study by Botma et al. deals with the utility model which explains the free speed choice of drivers i.e., speed at which vehicles are driven without any influence of other vehicles. The study conducted by Haglund et al. gives a strong connection between observed speeds and driver's reports of the speed they were travelling with. The study also found that a driver's behaviour is closely related to the behaviour of other drivers. Indeed, on the off chance that drivers at large are mindful of their claim on speed at a certain time and place, they show up to have a one-sided recognition of the speed level in common. Diverse algorithms are developed to model the lane changing behaviour on highways and urban streets, traditional lane changing models study driver's choices in two steps: target lane choice and gap acceptance. Sun and Lily have included driver's characteristics i.e., driver related information into lane changing models since most of models were derived and validated using data such as vehicle trajectories, with no consideration of driver characteristics. Most models have focused on lane-changing behaviour on freeways and at freeway–ramp merging areas; limited research and investigation has addressed the lane changing behaviour at approaches close to uncontrolled intersections.

METHODOLOGY:

A. Data collection and extraction:

Data is collected using video cameras, and the extraction is done manually by playing the videos on a screen. Because of the non-lane-based movements and a large number of vehicle types, traffic data collection and extraction is very time consuming and laborious task

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B. Analysis of traffic characteristics:

i. **Traffic Composition:** Traffic composition is the involved vehicle type and the proportions of each vehicle type in the mixed traffic flow.

ii. **Lane preference:** Different classes of vehicles prefer different lanes depending upon the type of lane i.e. fast moving vehicles prefer and the slow moving and heavy vehicles prefer outer lanes.

iii. **Speed:** The primary factor at intersections that affect the safety is magnitude of speed or the variance of the speed between vehicles. The severity of accidents largely depends on the speeds of vehicles involved in the accidents. Higher variance speed between vehicles causes more number of accidents. Accident rate increases exponentially as the speed differential in the traffic stream increases.

iv. **Lane changing data:** Most of the vehicles change the lanes in the intersection influence area/zone to avoid collisions with other vehicles.

C. Analysis of Traffic Conflict Points:

Vehicles at intersections move in several directions (through, left turning, right turning from different approaches). The combination of these movements in several directions creates many conflicts points and conflict areas. A traffic conflict is an observable situation in which two or more road users approach each other in space and time to such an extent that there is a risk of collision if their movements remained unchanged. The number of conflicts for an intersection can be reduced by proper geometric design and traffic control measures. Good understanding of how and where conflicts occur is required for the proper geometric design and implementing efficient traffic control measures. The measures to reduce the conflicts will help to minimize the number and severity of accidents. Reliability of conflict point measurement is one of the problems associated with the traffic conflict technique

CONCLUSION**:**

In this study, we will analyze various microscopic traffic parameters for different types of unsignalized intersections in India. This study is important as the traffic characteristics are very different in India from that in developed countries. Essentially, the unsignalized intersections in India are uncontrolled. Many observations and further evaluations will be made about the proportions of different classes of vehicles at the intersections. The lane changing analysis will help to ascertain the adoption of various lanes according to the vehicles' speed. The conflicts of the vehicles and pedestrian will also be taken into consideration as pedestrians try to move in the shortest possible direction while crossing the intersection. This study will be of great help in developing performance evaluation and safety models for uncontrolled intersections.

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