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# MICROSCOPIC ANALYSIS OF CLEARANCE BEHAVIOUR AT AN UNSIGNALISED INTERSECTION

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ABSTRACT:

In India many of the unsignalized crossings are uncontrolled, resulting in a chaotic traffic environment and becoming accident hotspots. Traffic investigations were carried out over parameter such as traffic composition, speed variations, lane distribution, conflict points, and pedestrian movements using data collected at two uncontrolled crossings. The mobile phone camera is utilized in such a way that all the points of crossing are covered to record traffic movements. There are two types of crossings for which data is extracted: Four legged (Type I), T Intersection (Type II) . A significant number of slow-moving cars engage with closely spaced other vehicles and pedestrians in a Type I intersection. At type I intersections, more than 70% of vehicles are two-wheelers; at type II crossroads, the proportion is lower.

Except for auto-rickshaws, all vehicle types choose the inner lane. The speed of vehicles in the inner lane is higher than those in the outer lane, which are slowed by roadside friction. Minor approach vehicles are also reported to have to slow down or halt frequently. This research has a lot of possibilities for evaluating the performance and safety of a junction that isn't signalised.

## Introduction:

**INTRODUCTION**

Road intersections are the principal bottlenecks in any network, owing to the fact that the two intersection spaces must be shared by all clauses of vehicles travelling in a variety of directions. Additionally, people frequently cross roadways at junctions, resulting in a greater number of pedestrian-vehicle collisions. The high number of vehicle-to-vehicle and vehicle-to-pedestrian collisions are potential accident causes. Signals have been put at several crossroads in order to reduce conflicts. Even in developing countries like India, the signals have been helpful in increasing intersection safety. However, signal installation is expensive, and every city has too many junctions. As a result, most junctions in any city are unsignalized, and conflict points are reduced by using stop/yield signs. Only arterial crossroads are signalised in India, whereas a large number of other intersections are not. In India, drivers are aggressive, and traffic laws are not strictly enforced. As a consequence, situations at unsignalized intersections are chaotic, making manoeuvring at such a location extremely dangerous. Although the situation is slightly better at signalised intersections, red light violations are common, especially at night, resulting in numerous accidents. In Mumbai, 54 percent of the 3040 fatal accidents that occurred between 2007 and 2010 occurred at or near intersections. The pedestrian is the most hazardous element at intersections in India. This is proven by the fact that pedestrians made up 65 percent of those killed in accidents over the time period mentioned. It is required to examine traffic features such as traffic volume, composition, speed, conflict points, pedestrian movements, and so on in order to understand the causes of accidents. The main goal of this work is to investigate traffic characteristics at unsignalized crossings at a microscopic level.

The uncontrolled nature of India's unsginalized intersections makes traffic and pedestrian movement analyses extremely difficult. We gathered information at two uncontrolled intersections in Bengaluru for this study. Multiple cameras are used to collect data, and various characteristics are extracted from the video in the lab. Vehicle speed variations, traffic composition, vehicles, and lane distribution are some of the parameters extracted. Understanding these factors is important for a variety of assessments, including assessing the performance of unsignalized intersections, predicting accidents, constructing a new intersection, and proposing modifications to an existing intersection. The selected intersections are in two different locations and cater to different traffic circumstances. We have primarily focused on descriptive analysis of several parameters in this research. At uncontrolled intersections, we are now working on predicting speed, travel duration, and trffic volume.

This paper is divided into six sections, one of which being this one. The second section analyses previous research on unsignalized junctions. Section three explains the data collecting and extraction process. Section four examines traffic variables such as traffic mix, speed, and lane selection. In section five, a detailed examination of real locations of vehicle conflict points and vehicle-to-pedestrian conflict points is offered. The study's conclusions are presented in section six.

## LITERATURE REVIEW

Traffic engineers are responsible for assessing the degree of service and safety of unsignalized intersections. Approach speeds, traffic composition, gap acceptance behaviour, intersection geometry, types of control strategy (priorities for different movements), and pedestrian crossing are all required to complete these objectives. a crossing for pedestrians The Highway Capacity Manual is commonly used to assess the performance of unsignalized intersections. The gap acceptance theory explains the approach used in HCM 2010. Pant and Balakrishnan , Hamed et al. , and Pollatschek et al. are a few other studies that have focused on gap acceptance based models (4),.

2 These studies, on the other hand, are based on the assumption that junctions are regulated by signs and that priorities are followed. There are very few similar studies in the Indian context. Conflicts at uncontrolled urban intersections were studied by Rao and Rengaraju (5) and (6). For traffic disputes, analytical and simulation models are built.Sangole et al. (7) and Patil et al. (8) recently conducted research on uncontrolled intersections with low priority. Both of these studies are concerned with vehicle gap acceptance at T-intersections. The goal of these studies is to figure out how to rate the performance of uncontrolled intersections. The intersections in this study are four-legged, and significantly more comprehensive traffic characteristics are studied.

There are several studies in the literature that connect different traffic parameters to accidents. Berge et al. (9) focused their research on how drivers choose their speed on a road section and interact with other road users. On a simulated corridor on the HA NOI, Trinh et al. (10) used a conflict strategy to improve traffic safety. Botma et al. (11) investigate the utility model, which represents drivers' free speed choices, i.e., the speed at which vehicles are driven without regard for other vehicles.

Haglund et al. (12) found a strong correlation between measured speeds and driver reports of their speed. The study also discovered that a driver's behaviour is closely linked to that of other drivers. Even if drivers are aware of their own speed at a given moment and location, they appear to have a skewed view of overall speed.

Conventional lane changing models examine driver's decisions in two steps: target lane choice and gap acceptance, and several algorithms have been created to model lane changing behaviour on highways and city streets. Since most lane shifting models were generated and validated using data such as vehicle trajectories with no consideration of driver characteristics, Sun and Lily (13) have included driver's characteristics, i.e., driver related information, into lane change models. The majority of models have concentrated on lane-changing behaviour on freeways (14) and at freeway–ramp merging regions (15); however, there has been little research on lane-changing behaviour at approaches at uncontrolled intersections.

As previously stated, there are few studies that have extensive data gathering and analysis for uncontrolled crossings. Understanding the tiny traffic characteristics at such intersections are critical to understanding the causes of accidents and developing techniques to evaluate uncontrolled intersections.

## DATA COLLECTION AND EXTRACTION:

Data is collected via video cameras, and it is manually extracted by watching the videos on a screen. Traffic data collection and extraction in India is a time-consuming and difficult task due to non-lane-based movements and a vast variety of vehicle types.

## STUDY INTERSECTIONS:

The characteristics of traffic at an unsignalized intersection vary widely depending on the intersection's location. Intersections in Jayanagar are projected to have slow speeds, several conflicts, a large number of pedestrian movements, and roadside encroachment, but intersections on the outskirts of the city are expected to have higher speeds, fewer conflicts, and less pedestrian movement. Figure 1 presents snapshots of two intersections, one in Jayanagar and the other on the outside of the city. These intersections are referred to as type I and type II, respectively.

We selected two intersections that have a wide range of traffic and geometrical characteristics. Table 1 shows the details of the selected intersections. Many other intersections were visited to determine their suitability before settling on the ones listed. The intersections are chosen with the following criteria in mind:

(a) no obstructions due to parked vehicles or other obstructions,

(b) availability of suitable locations for mounting cameras to provide a clear view of the intersection,

(c) plain terrain to avoid the impact of road gradients, and

(d) good pavement condition.

### DATA COLLECTION:

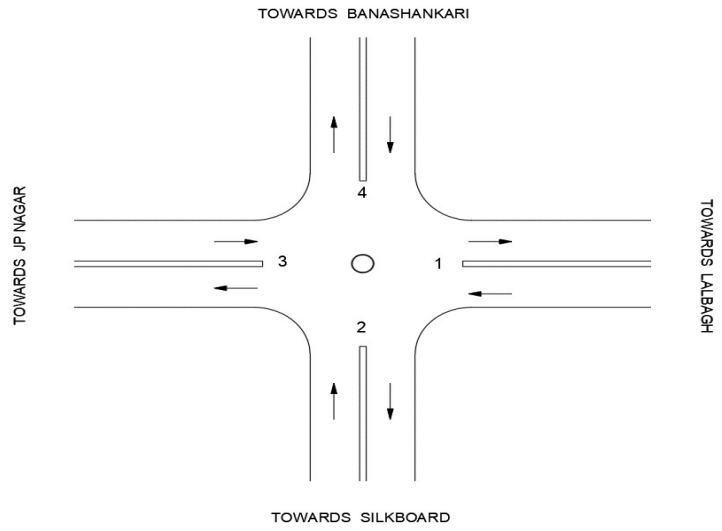
In the month of November 2021, the data collection process was carefully planned and executed. The data was collected on clear sunny days

to ensure that the pavement remained dry. At each intersection, detailed geometric data is recorded. Because different vehicle types and speeds are required at different locations, the pavement surface was marked with paint. Starting from the centre of the intersection,

At each intersection, a one-hour video recording is made. The video is recorded in such a way that observations can be made for around 70–150 metres on major approaches and about 20–50 metres on minor approaches.

## INTERSECTION


36$^{th}$Cross Road, 4$^{th}$ Block, Jayanagar, Bengaluru, Karnataka 560011




***Classified Traffic Volume data***

| **Average speed of all classes of vehicles** | | | | | |
|---|---|---|---|---|---|
| **Direction** | **2w** | **3w** | **4w** | **bus** | **Truck** |
| 1,2 LT | 11.62 | 7.91 | 6.06 | 0 | 0 |
| 1,3 Thru | 9.76 | 9.34 | 8.05 | 7.33 | 7.54 |
| 1,4 RT | 8.57 | 7.99 | 7.87 | 0 | 0 |
| 2,1 RT | 8.52 | 8.1 | 9.02 | 0 | 0 |
| 2,3 LT | 5.38 | 4.7 | 4.46 | 0 | 3.44 |
| 3,1 Thru | 9.05 | 7.96 | 7.55 | 5.76 | 6.62 |
| 3,2 RT | 8.74 | 7.74 | 7.63 | 0 | 0 |

| | | | | | |
|---|---|---|---|---|---|
| 3,4 LT | 7.62 | 6.17 | 6.1 | 0 | 0 |
| 4,1 LT | 8.96 | 8.04 | 9.03 | 0 | 6.25 |
| 4,2 Thru | 12.8 | 12.4 | 11.6 | 13.0 | 9.3 |
| 4,3 RT | 12.99 | 13.24 | 9.41 | 18.19 | 6.19 |

The magnitude of speed, or the difference in speed between cars, is the most important aspect at junctions that affects safety. The severity of collisions is mostly determined by the speeds of the cars involved. A higher speed difference between vehicles leads to a higher number of collisions.

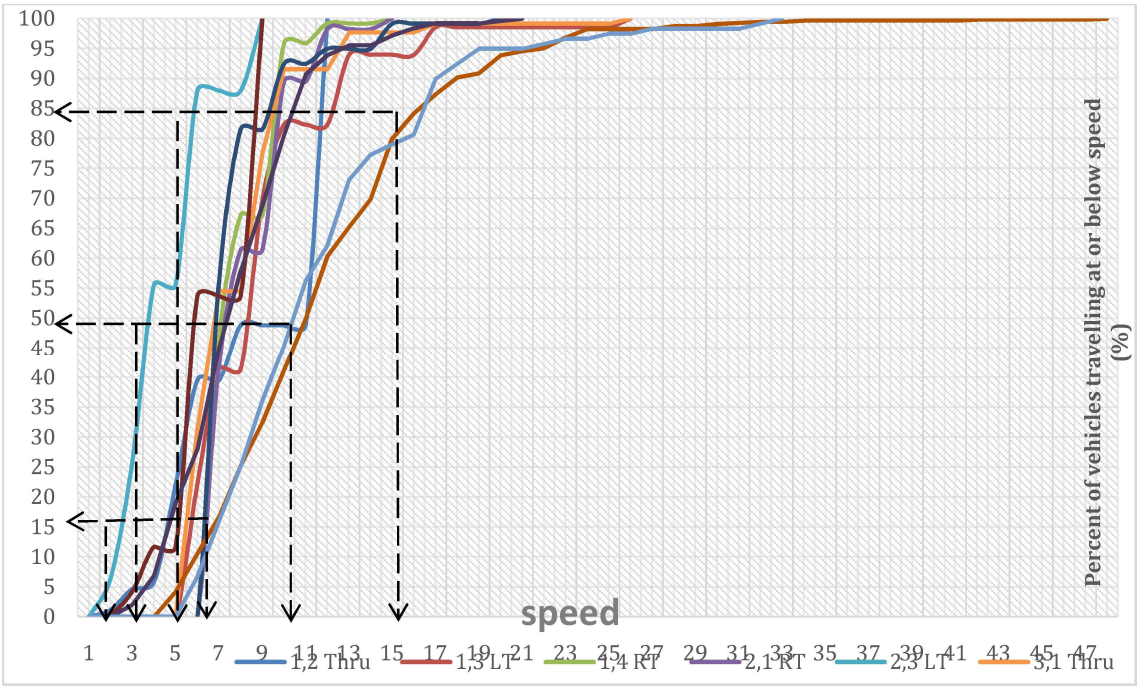
The vehicle crossing time at cross-grid lines along a vehicle path is used to compute vehicle speeds at various distances. The average speed of 2w, 3w, 4w, bus and truck in all the direction are 9.4, 8.5, 7.8, 8.07, 6.55 km/hr respectively. From the above data it is observed that the 2-wheeler vehicles move faster than other classes of vehicles

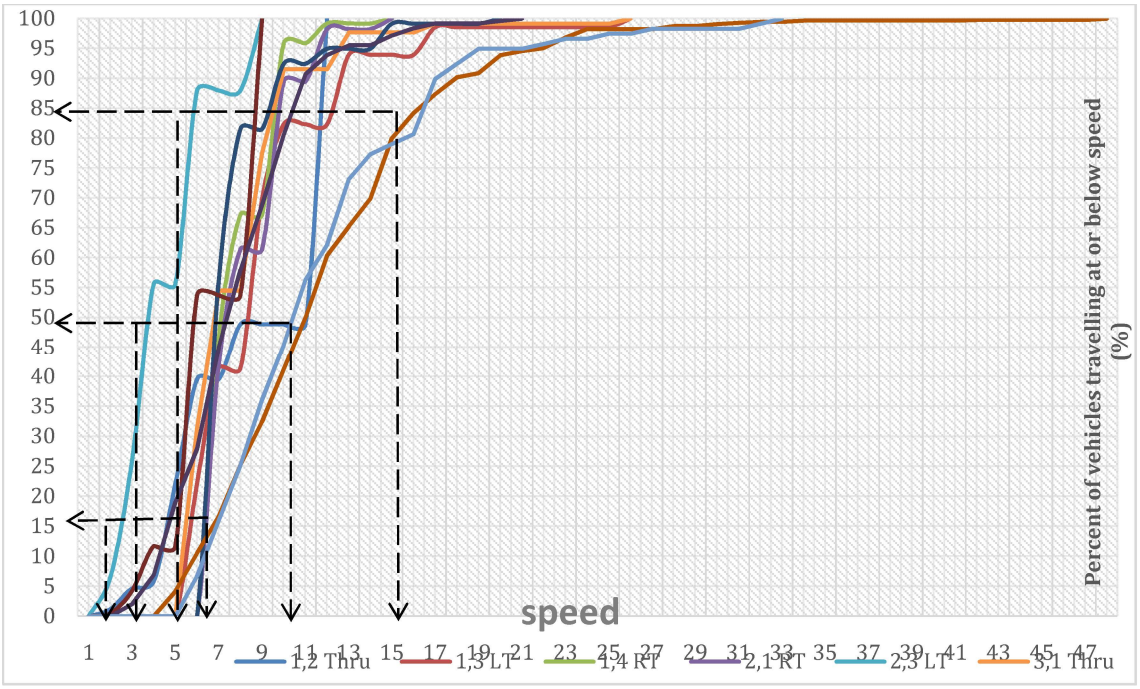
| **Traffic volume data** | | | | | | |
|---|---|---|---|---|---|---|
| **Direction** | **2w** | **3w** | **4w** | **bus** | **Truck** | **Total** |
| **1,3 Thru** | 565 | 139 | 256 | 4 | 10 | 974 |
| **1,2 LT** | 44 | 16 | 26 | 0 | 0 | 86 |
| **2,1 RT** | 35 | 7 | 15 | 0 | 0 | **57** |
| **1,4 RT** | 66 | 17 | 39 | 0 | 0 | 122 |
| **2,3 LT** | 56 | 19 | 31 | 2 | 0 | 108 |
| **3,1 Thru** | 546 | 132 | 344 | 1 | 9 | **1032** |
| **3,2 RT** | 60 | 12 | 47 | 0 | 0 | 119 |
| **3,4 LT** | 93 | 29 | 62 | 1 | 3 | 188 |
| **4,1 LT** | 136 | 43 | 64 | 0 | 4 | 247 |
| **4,3 RT** | 67 | 20 | 32 | 1 | 2 | 122 |
| **4,2 Thru** | 316 | 97 | 116 | 34 | 7 | 570 |

| | |
|---|---|
| **Max capacity** | **1032 (3,1 Thru)** |
| **Min capacity** | **57 (2,1 RT)** |

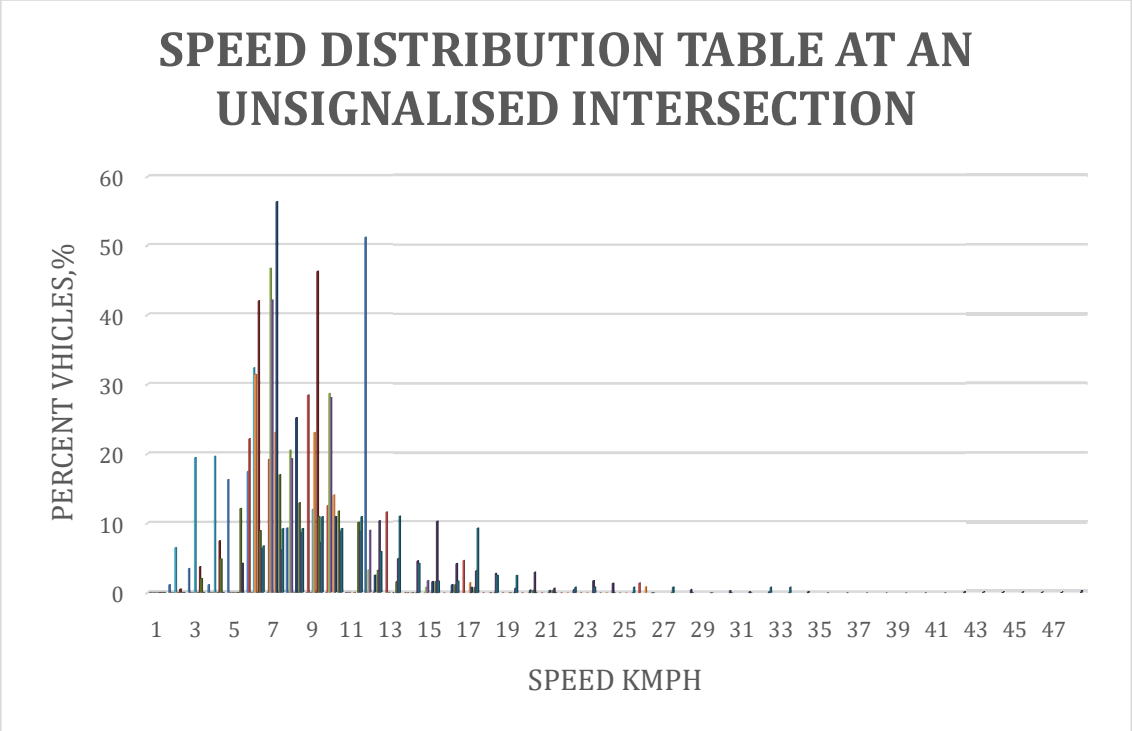
Data on traffic volume is necessary for determining the relationship between traffic volume, the number of accidents, and the causes of such incidents.By watching the recorded video, the number of vehicles going through the crossing in each direction is recorded. The max capacity of vehicles were observed at 3 to 1 straight direction and min capacity at 2 to 1 right direction. It is observed that 54.73 % of two-wheeler, 14.64 % of three-wheeler and 28.46 % of four-wheeler, 1.18% of bus and 0.96 % of Truck were passing through the intersection in a given time.

**PERCENTILE SPEED OF VEHICLES**




Under free-flowing conditions, the 85th percentile speed is defined as the speed at which 85 percent of drivers will drive. the speed at or below which 85 percent of the vehicles are seen travelling past a monitored spot in free-flowing conditions." The 85th percentile speed is used by traffic and transportation engineers to set the speed limit at a safe level; similarly, the 50th and 15th percentile speeds are observed.




Spot speed studies are used to determine the distribution of vehicle speeds in the traffic stream at a specific location on the roadway. This is accomplished by logging the vehicle's speed at the given location. Speed distribution studies reveal information about the overall flow of cars. The graph shows the relationship between percentile automobiles and speed in kilometres per hour.

## CONCLUSION:

In this study we looked at various microscopic traffic parameters for different kinds of vehicles at unsignalized intersections in India. This research is significant since traffic patterns in India differ significantly from those in developed countries. The data collected for this research was taken from two intersections, one of each type. To obtain the necessary information, a video was recorded. Two-wheelers are well-known in India, where they make up a significant portion of the traffic.According to the statistics, the probability of two-wheelers at the intersection is 54.73 percent, 14.64 percent for three-wheelers, 28.46 percent for four-wheelers, and 1% for buses and trucks. Except for autorickshaws, most vehicle classes favour the inner lane to prevent obstruction. Because they stop frequently to pick up and drop off passengers, auto-rickshaws prefer the outside lane. It's also worth noting that the inner lane's traffic speed is higher than the outer lane's.The 85th percentile speed of all classes of vehicles has been estimated using the above data, and a speed distribution graph has been shown. This research will be extremely beneficial in the development of performance evaluation and safety models for uncontrolled crossings.

## REFERENCES:

1. Digvijay S. Pawar - August 2015 - Microscopic behaviour of traffic behaviour at unsignalized intersection in developing world
2. Estelle Chevalier - 26 April 2007 - A macroscopic theory for unsignalized intersections
3. Yoram Shiftan - January 2005 - Evaluation of the Waiting-Time effect on Critical Gaps at Roundabouts by a Logit Model
4. Rohith Saju, Manish Kumar M, Rishabh Raj, and Nitin Kumar - Microscopic Analysis of Uncontrolled Intersections in Traffic Conditions
5. Satish Chandra - June 2009 - Microscopic Analysis of Service Delay at Uncontrolled Intersections in Mixed Traffic Conditions
6. Guangquanlu – Human factors 57 (7),1101 – 1114, 2015 - Logit-Based Analysis of Drivers' Crossing Behaviour at Un-signalized Intersections
7. HJ Ruskin – 2002 Modeling Traffic Flow at an Urban Un-signalized Intersection in Heterogenous traffic conditions
8. V. R. Rengaraju• and V. Trinadha Rao2 - 1995 - Vehicle-arrival characteristics at urban uncontrolled intersections
9. Andrea Guerrini a,⇑, Luca Crociani – 20 march 2017 - Observation results on pedestrian-vehicle interactions at non-signalized intersections towards simulation
10. Suprabeet Datta, Siddhartha Rokade, Sarvesh P.S. Rajput - 13 October 2020 - Delay and driver turning time evaluation for uncontrolled intersections under diverse traffic operational situations