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# TRAFFIC PARAMETERS FOR HETEROGENEOUS CONDITIONS AT GIRL'S HIGHSCHOOL SQUARE, AMRAVATI

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**Abstract -** *The knowledge of different macroscopic parameters of traffic volume is an important basic input required for planning, analysis and operation of roadway systems. Expressing traffic volume as number of vehicles passing a given section of road or traffic lane per unit time will be inappropriate when several types of vehicles with widely varying static and dynamic characteristics are comprised in the traffic. The problem of measuring volume of such heterogeneous traffic has been addressed by converting the different types of vehicles into equivalent passenger cars and expressing the volume in terms of PCU (Passenger Car Unit) per hour, spot speed study and saturation flow. The vehicles of highly heterogeneous traffic with widely varying physical and operational characteristics such as the one prevailing on Indian roads, occupy based on the availability of space, any convenient lateral position on the road without any lane discipline. The interaction between moving vehicles under such heterogeneous traffic condition is highly complex. In this paper, the approach is practically applied to evaluate and improve the safety performance of some congested intersections in Amravati city in Maharashtra.*

***Key Words***: Keywords: Passenger Car Unit (PCU).

## 1. INTRODUCTION

Most of the injuries and crashes has chance to occur at intersection. With the rapid growth of the number of various vehicles, the ratio of the traffic accidents to vehicle number is increasing greatly. Safety on roads is a major concern in the developing world because of its impact on the global economy and people's welfare. Due to the rising population, the traffic risk has increased especially in developing nations like India, as the infrastructure is unable to cope up with the increasing traffic.

Traffic volume is defined as the no. of vehicles crossing a particular cross section per unit time. It is measured in vehicle per minute, vehicle per hour and vehicle per day. In order to express the traffic flow on a road per unit time, it is necessary to convert the flow of the different vehicle classes into a standard vehicle class known as passenger car unit.

The problem of measuring volume of such heterogeneous traffic has been addressed by converting the different types of vehicles into equivalent passenger cars and expressing the volume in terms of Passenger Car Unit (PCU) per hour.

Hourly pattern: The way traffic flow characteristic varies in Morning and Evening. Maximum hourly volume of traffic is said to be peak hourly volume. Daily Pattern: The day-to-day variation throughout the week 24 hours count at specified location is said to be average daily traffic and the 24 hours traffic volume at given location averaged of full 365 days is said to be average annual daily traffic (AADT).

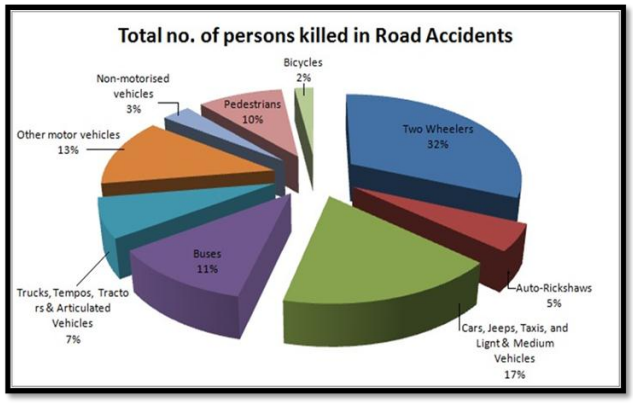


**Fig -1**: Total number of persons killed in road accidents in India

## 2. LITERATURE REVIEW

Significant efforts have been implemented in the last few decades, for reducing the rate of accidents particularly at intersections. This literature assessment has tested many of those proposed counter measures designed to either prevent accidents or reduce fatal as well as minor injuries in the event of crash at unsignalized intersection. Further, the need of enhancements to the effectiveness or methods of implementation of modern-day countermeasures has been assessed. This chapter affords an evaluation of applicable literature to bring out the historical past of the observe undertaken on this dissertation. The research contribution which has a direct relevance are treated in a greater detail and major findings summarized briefly. Some of the historical work which have contributed greatly to the understanding of the safety concerns of the unsignalized intersections. The

amount of the literature on the subject has increased hastily in recent years, in particular to improve safety of intersection, numerous of that is to be had in the court cases of the conferences that are very useful to understand the current developments in site visitors engineering.

The aim of the protection techniques is to reduce annual highway fatalities. This aim can be done via the good-sized utility of low-value, tested countermeasures that lessen the variety of crashes on the kingdom's highways. Many of the hints and research for implementation of safety Plan gives techniques that can be hired to reduce the variety of unsignalized intersection collisions. The document may be of precise interest to protection practitioners with duty for enforcing applications to reduce injuries and fatalities on the highway system. Though research done on the various macroscopic parameters on the road is not highly documented, the contributions from researchers across the nation and the world have proven to be significantly essential. This paper indicates a very comprehensive review of literature for studies analyzing safety of congested intersection.

## 3. METHODOLOGY

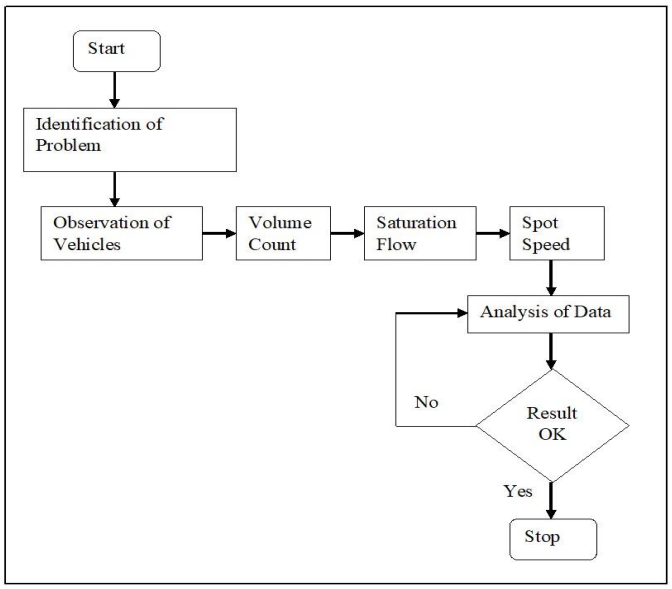


**Fig -2**: Flow Chart for Traffic Analysis

These types of intersections are particularly divided into types: one is direct assessment that's based on the statistics of traffic accidents; the opposite is indirect assessment which is based on site visitors warfare method. Direct evaluation approach in particular includes crash frequency, crash valuation, crash severity, and crash statistic models. However, whilst those techniques carried out, the assessment end result's accuracy is affected because of long length and inaccuracy of statistical data. To accumulate intersection crash records might be a trouble to many researchers, mainly because of the difficulty to attain these data and the reliability of past crash records.

The indirect assessment technique based totally on-site visitors battle technique is a noticeably new traffic safety assessment technique, that is broadly speaking implemented to evaluate intersection site visitors' safety through the ratio of struggle quantity and visitors' flow. Traffic war method strategies typically cover conflicting points, number of conflicts, conflict price, conflict distribution, and battle forecasting models. But this technique also has shortcomings, along with the inaccuracy of the located visitor's conflicts numbers, and the shortage of right division of traffic conflicts in keeping with unique traffic conflicts diverse outcomes on site visitors' safety. The judgment and determination of traffic conflicts are greater subjective nature. One-of-a-kind observers might also give special site visitors struggle judgments. Similarly, traffic war approach is a time-eating challenge. Although site visitors conflict approach has such issues, this technique has been utilized by many researchers to examine intersection site visitors' safety overall performance. As mentioned above, both crash-based totally and war-based protection evaluation methods have a few limitations in actual packages.

## 4. IMPLEMENTATION

### 4.1 Intersection: Girl's high school square, Amravati:

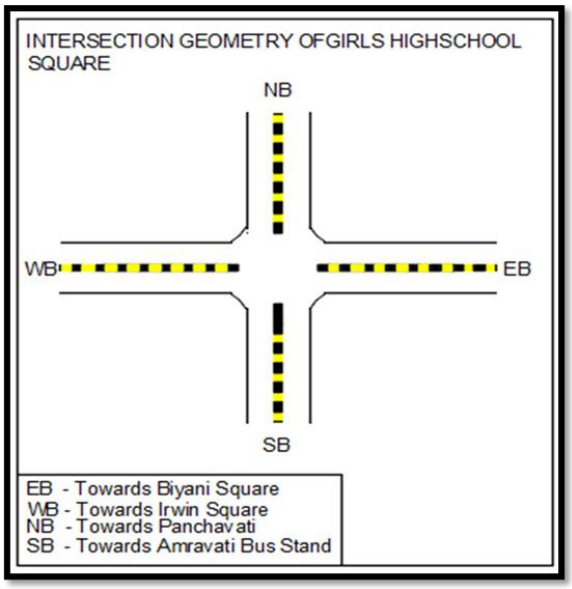


**Fig -3**: Intersection Geometry of Girls High School Square

### 4.2 Volume Count Survey on Girls High School Square

PCU at Girl's High School Square (Evening Peak Hour 5:30 pm To 6:30 pm)

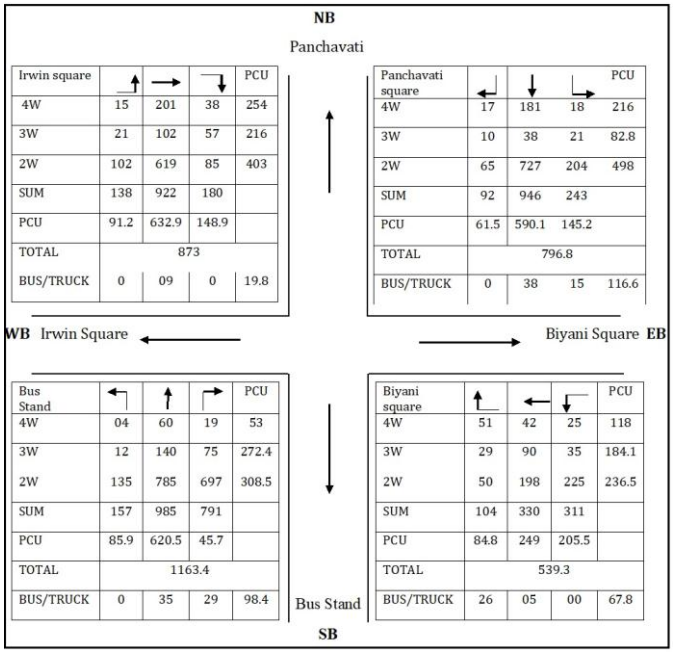


**Fig -4:** Volume Count Survey on Girls High School Square

NB – North Bound

EB – East Bound

WB – West Bound

SB – South Bound

### 4.3 Spot Speed of Girl's High School Square

**Table -1**: Spot speed study between Girl's High School square & Irwin Road

| Lowest Limit Kmph | Upper Limit Kmph | Middle Speed (S) (Kmph) | Observed Freq. In Group | % Freq. In Group | Cum. % Freq. In Group |
|---|---|---|---|---|---|
| 0 | 2 | 1 | 0 | 0.00 | 0.00 |
| 2 | 4 | 3 | 1 | 0.49 | 0.49 |
| 4 | 6 | 5 | 3 | 1.46 | 1.95 |
| 6 | 8 | 7 | 5 | 2.44 | 4.39 |
| 8 | 10 | 9 | 10 | 4.88 | 9.27 |
| 10 | 12 | 11 | 12 | 5.85 | 15.12 |
| 12 | 14 | 13 | 13 | 6.34 | 21.46 |
| 14 | 16 | 15 | 15 | 7.32 | 28.78 |
| 16 | 18 | 17 | 15 | 7.32 | 36.10 |
| 18 | 20 | 19 | 16 | 7.80 | 43.90 |
| 20 | 22 | 21 | 18 | 8.78 | 52.68 |
| 22 | 24 | 23 | 21 | 10.24 | 62.93 |
| 24 | 26 | 25 | 22 | 10.73 | 73.66 |
| 26 | 28 | 27 | 18 | 8.78 | 82.44 |
| 28 | 30 | 29 | 15 | 7.32 | 89.76 |
| 30 | 32 | 31 | 9 | 4.39 | 94.15 |
| 32 | 34 | 33 | 6 | 2.93 | 97.07 |
| 34 | 36 | 35 | 3 | 1.46 | 98.54 |
| 36 | 38 | 37 | 2 | 0.98 | 99.51 |
| 38 | 40 | 39 | 1 | 0.49 | 100.00 |
| 40 | 42 | 41 | 0 | 0.00 | 100.00 |

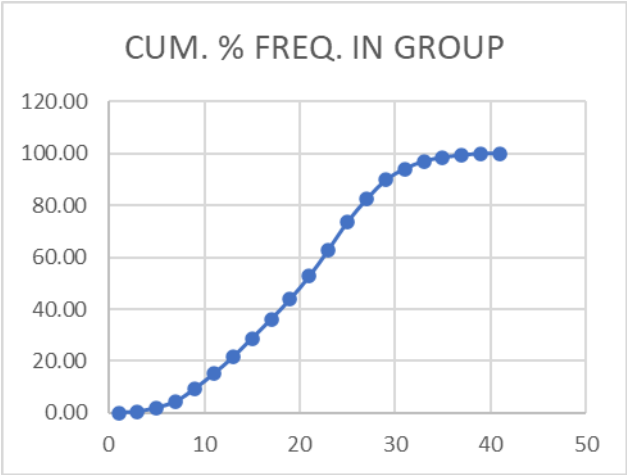


**Chart -1**: Cumulative Percentage Frequency in Group for Girl's High School square Road

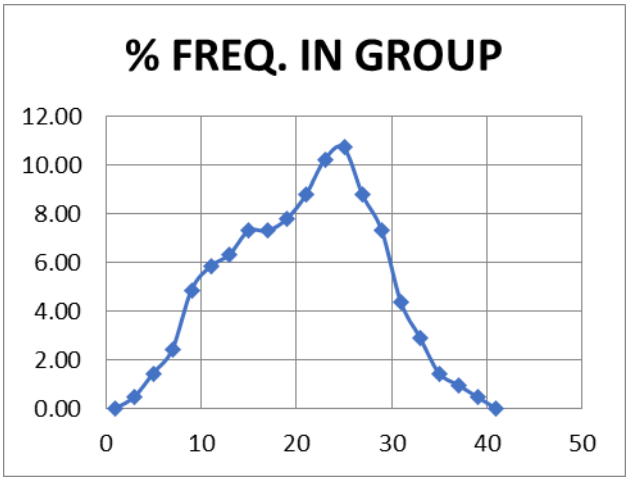


**Chart -2**: Percentage Frequency in Group Girl's High School square Road

### 4.4 Saturation Flow

Saturation Flow is calculated by Saturation Headway Method, in this method by observing queue at the intersections. A headway value is calculated and from that finally saturation flow is obtained. Saturation flow is the value which is the maximum traffic movement at the intersection by assuming fully green time is allowed for 1 hour, this is needed for the calculation for delays and level of service at intersections, it is important to adopt correct saturation flow rates for the intersection to be used, as a result of inappropriate values that would often use as default from overseas software developers. This can result in wrong results and decisions based on saturation flow.

To determine the saturation flow rate from time measurements taken in the field the following equation is used:

s = 3600/hs

Where, s = saturation flow rate;

3600 = number of seconds per hour;

hs = saturation headway.

**Table -2**: Saturation Flow of Girls High School Square

| Sr. No | Duration of 4th Vehicle | Duration of 8th Vehicle | No. of last Vehicle | Saturation Headway |
|---|---|---|---|---|
| 1 | 11.03 | 19.52 | 8 | 2.123 |
| 2 | 18.23 | 27.1 | 9 | 1.774 |
| 3 | 16.35 | 23.05 | 10 | 1.117 |
| 4 | 20.31 | 22.1 | 10 | 0.298 |
| 5 | 17.69 | 24.95 | 8 | 1.815 |
| 6 | 12.58 | 19.78 | 9 | 1.440 |
| 7 | 8.46 | 19.68 | 9 | 2.244 |
| 8 | 16.78 | 23.89 | 9 | 1.422 |
| 9 | 11.9 | 19.84 | 8 | 1.985 |
| 10 | 16.54 | 25.32 | 10 | 1.463 |
| 11 | 13.1 | 20.24 | 8 | 1.785 |
| 12 | 11.03 | 19.52 | 8 | 2.123 |
| 13 | 16.35 | 23.05 | 9 | 1.340 |
| 14 | 20.31 | 23.08 | 10 | 0.462 |
| 15 | 12.58 | 19.78 | 9 | 1.440 |
| 16 | 16.78 | 23.89 | 8 | 1.778 |
| 17 | 16.54 | 25.32 | 8 | 2.195 |
| 18 | 13.1 | 20.24 | 8 | 1.785 |
| 19 | 16.35 | 23.05 | 8 | 1.675 |
| 20 | 12.58 | 20.18 | 8 | 1.900 |
| 21 | 18.23 | 27.1 | 10 | 1.478 |
| 22 | 20.31 | 22.1 | 9 | 0.358 |
| 23 | 12.58 | 19.78 | 9 | 1.440 |
| 24 | 16.78 | 23.89 | 10 | 1.185 |
| 25 | 16.54 | 25.32 | 10 | 1.463 |
| 26 | 11.03 | 19.52 | 8 | 2.123 |
| 27 | 20.31 | 23.08 | 8 | 0.693 |
| 28 | 16.78 | 27.19 | 8 | 2.603 |
| 29 | 13.58 | 19.78 | 10 | 1.033 |
| 30 | 16.54 | 25.32 | 8 | 2.195 |
| 31 | 12.58 | 24.19 | 8 | 2.903 |
| 32 | 13.1 | 20.24 | 9 | 1.428 |
| 33 | 16.35 | 23.05 | 9 | 1.340 |
| 34 | 9.46 | 20.18 | 9 | 2.144 |
| 35 | 17.69 | 24.95 | 10 | 1.210 |
| 36 | 11.9 | 19.84 | 10 | 1.323 |
| 37 | 16.78 | 24.19 | 9 | 1.482 |
| 38 | 12.58 | 19.18 | 10 | 1.100 |
| 39 | 12.08 | 20.18 | 8 | 2.025 |
| 40 | 15.9 | 22.19 | 8 | 1.573 |
| | | | SUM= | 63.260 |
| | | | hs=Sum/40 | 1.582 |
| | | | s=3600/hs | 2276.308 |

## 5. ANALYSIS

### 5.1 Application of advance methodologies for improvement of intersections in Amravati city, Maharashtra, India.

Amravati city is situated in central region of India, it lies on the geographical coordinates of Latitude 20° 56' 0" N and Longitude 77° 45' 0" E.

There are many numbers of signalized and unsignalized intersections in Amravati city. All the unsignalized intersections are in flat area and many of these intersections

are controlled by police men or by signs and some of intersections are uncontrolled. Several of intersections are located in major arterials or in local roads and their main function is mobility. According to past crash data, the sum of unsignalized intersections have a high annual crash rate. Site visits was conducted at most intersections to determine the various parameters of traffic i.e. spot speed, traffic volume, density. These characteristics reviewed included traffic control, sight distances, pedestrian facilities, road surface condition, crosswalk facilities, geometric design, lighting, vehicle speeds, and on-street parking. This research has planned to evaluate and improve the safety performance of unsignalized intersections in Amravati city. Therefore, there is a need to rank the safety problems at these intersections caused by existing conditions and rank the possible safety counter measures.

### 5.2 Detailed Description of Selected Intersection Form Amravati City

In this phase of the research, the field survey of fourteen intersection are carried out to analyse traffic parameters which contributes in reducing safety and related countermeasures. All major intersections have been selected situated throughout the city for study, each of the selected intersection has major crash rate due to high volume of traffic and congestion. Data were collected at all intersections. In addition, an attempt was made to select locations of varying characteristics (e.g., flow, speed flow, density, headway). The data collected at these intersections were used as the basis of analysis for this study. An attempt was made to select locations with varying parameters.

### 5.3 Based on field observations, there are some notices at selected intersections in Amravati city:

#### 5.3.1 Flow:

Number of vehicles coming on road can be counted as follows.

Flow or volume: Number of vehicles that pass a point on a highway during a specific time interval. For measurement number of vehicles are counted, nt, which are passing a particular point on road in a defined period t. The flow q expressed in vehicles/hour is given by

$$q = nt/n$$

Flow is expressed in planning and design field taking a day as the measurement of time.

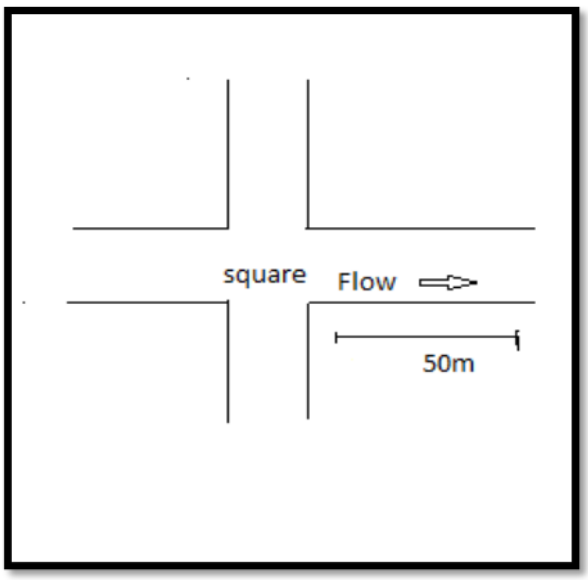


**Fig -5**: Diagrammatic representation of Saturation flow

#### 5.3.2 Speed

Passengers are more concerned with the speed of the journey. Speed of journey determines the quality of travel. It can be defined as distance travelled in per unit time. Mathematically speed or velocity v is given by,

$$S=d/t$$

Where, 'S' is the speed of the vehicle in m/s, 'd' is distance travelled in m in time t seconds.

Speed of different vehicles will vary with respect to time and space. There are different types of speed. Important among them are spot speed, running speed, journey speed, time mean speed and space mean speed.

#### 5.3.3 Spot Speed

Spot speed can be defined as 'the instantaneous speed of a vehicle at a specified location'. For designing of geometry of road, super elevation etc. Location and size of signs, design of signals, safe speed, and speed zone determination, spot speed data is required. In the analysis of Accidents, road maintenance, and congestion spot speed data is used as the basic input. Endoscope, pressure contact tubes, radar speedometer, time-lapse photographic methods can be used to calculate spot speed. It can be determined by speeds extracted from video images by recording the distance traveling by all vehicles between a particular pair of frames.

#### 5.3.4 Density

Density can be defined as the number of vehicles occupying a given length of road or lane. It can be expressed as vehicles per KM. Photograph of a length of road x can be

taken, Number of vehicles on the road can also be counted, nx at that point of time and the density can be calculated as

$$\rho=nx/x$$

The density is the number of vehicles between the point A and B divided by the distance between A and B. Density is also equally important as flow but from a different angle as it is the measure most directly related to traffic demand. Density measures the proximity of vehicles on the road which in turn affects the freedom for comfortable driving.

## 6. CONCLUSIONS

This study analysed the Traffic Parameters for Heterogeneous Conditions. It can be concluded that Light vehicles (car, jeep, etc.) occupied 35% of total vehicle. Percentage of two wheelers is relatively high. Percentage of public transport is very less need to be strengthened. Road widening is necessary where there is more congestion. PCU value of a vehicle significantly changes with change in traffic volume. If the traffic volume is maximum then spot speed is minimum at same point. In India traffic is mixed in nature having level of safety is "F" out of "A, B, C, D, E, F" Thus we need improve loss up to "C". Thus, we need to form new equation for heterogeneous traffic of India. Roadside parking should be modified or properly organized as per rules and regulations.

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