INTELLIGENT TRAFFIC CONTROL SYSTEM AT INTERSECTION: A CASE STUDY

Submitted in partial fulfillment of the requirements

For the degree of

Bachelor of Engineering

By

Shaikh Mohamed Ishaque Rafiq (18DCE15)

Qureshi Mohammed Usama (17CE45)

Shaikh Salah Raisuddin (18DCE16)

Chougule SaifAli Shabbir (18DCE03)

Under the guidance of

PROF.TEHSIN KAZI

Department of Civil Engineering

School of Engineering and Technology

Anjuman-I-Islam's Kalsekar Technical Campus

New Panvel, Navi Mumbai-410206

2020-2021

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CERTIFICATE

This is to certify that the project report entitled as "**Intelligent traffic control system at intersection: A case study**" is a authentic work of **Shaikh Mohamed Ishaque Rafiq (18DCE15), Qureshi Mohammed Usama (17CE45), Shaikh Salah Raisuddin (18DCE16), Chougule SaifAli Shabbir (18DCE03)** carried out work under the proper guidance.

The report was submitted to the University of Mumbai in partial fulfillment of the requirement for the award of the degree of "Bachelor of Engineering in Civil Engineering".

Prof. Tehsin Kazi

(Proect Guide)

Dr. R. B. Magar

(Head of Department)

Dr. Abdul Razak Honnutagi

(Director, AIKTC)

Approval Sheet

This dissertation report entitled **"Intelligent traffic control system at intersection: A case study" by Shaikh Mohamed Ishaque Rafiq (18DCE15), Qureshi Mohammed Usama (17CE45), Shaikh Salah Raisuddin (18DCE16), Chougule SaifAli Shabbir (18DCE03)** is approved for "**Bachelor of Engineering**" in "**Department of Civil Engineering**".

Examiners

1. .....

2. .....

Supervisors:

1. .....

2. .....

Date:

Place: Panvel

Declaration

We declare that this written submission represents my ideas in our own words and where others ideas or words have been included, we have adequately cited and referenced the original sources. We also declare that, we have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in our submission. I understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

Shaikh Mohamed Ishaque Rafiq (18DCE15) ……..

Qureshi Mohammed Usama (17CE45) ……..

Shaikh Salah Raisuddin (18DCE16) ……..

Chougule SaifAli Shabbir (18DCE03) ……..

Date:

Acknowledgement

Before we indulge into the things we would like to add a few unfeigned words for the people who are a part of our team as they have given everlasting contribution & support right from the genesis of the report till the end.

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ABSTRACT

Traffic jam and accidents are one of the major problems in a densely populated cities, whereas population and number of running vehicles are much more than the road capacity. Due to traffic jam a substantial portion of working hours have to be left on streets which indirectly put adverse impact on economy and unavoidable road accident which results loss of lives. As the number of road users constantly increases, and resources provided by current infrastructures are limited. Traffic control system has become a very important issue. The main objective of this study is to reduce the accidents at the cross junction point. For doing this a microcontrolleror barricade is used with the help of sensor based technology which will make the drivers bound to follow the traffic rules by controlling traffic system that brings the result of decreasing the rate of accident, controlling crowd, lowering the tendency of road blocking etc. This approach can be applied in cross road junction.

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Chapter 1

Introduction

1.1 General

21st century India needs planned, technologically sound and sustainable development. A crucial aspect of this development is road transportation. Traffic jam and accidents are one of the major problems in a densely populated city like Mumbai whereas its population and number of running vehicles are much more than its road capacity. Due to traffic jam a substantial portion of working hours have to be left on streets which indirectly put adverse impact on economy and unavoidable road accident which results loss of lives.

As the number of road users constantly increases, and resources provided by current infrastructures are limited. Traffic control system has become a very important issue. The main objective of this study is to reduce the accidents of the vehicle at the cross junction point. For doing this a barricade is used with the help of sensor based technology which will make the drivers bound to follow the traffic rules by controlling traffic system that brings the result of decreasing the rate of accident, controlling crowd, lowering the tendency of road blocking etc.This approach can be applied in cross road junction which are so busy and the sectors those experience a great traffic load.

The growth of traffic jam in the road network of large cities in developing countries like Bangladesh is a serious concern in case of urban areas. The traffic jam at the road intersection is most crucial because the performance of intersection affect the overall productivity of the whole road network most significantly. To reduce conflicts and ensure orderly movement of traffic at the intersection generally different types of traffic control devices are used among which traffic control barricade is one of the most popular and effective controlling tool. Traffic control barricade is a sign and signal device which is used to guide and control traffic includes pedestrians, motor drivers by placing adjacent or over or along the cross road junction, highways and other public areas. It is mainly used to warn drivers and pedestrians for guiding in a work zone and to redirect traffic on high speed roads. In case of four way road it is really very much important to control traffic in a manageable way. Important cross

road junction of our city **Khanda colony Junction** etc. Traditional traffic light system is used at these cross junction which is not suitable at this present moment.

Beside sometimes pedestrians and drivers would not like to follow traffic rule that causes unwanted incident. So authors feel interest to work on this problem area and authors think that there is a scope to develop a modern approach which is very conductive to reduce the present problem in traffic system. The major distinguishable aspect of proposed traffic control system is that after a predefined time the road will be automatically blocked and pedestrians and driver are bound to follow the traffic rule. Thus this real-time technique can be able to solve the problem. The system proposed here involves localized traffic routing for each intersection junction.

1.2 Objective

The Main objective of intelligent transportation system is to reduce rate of accident at cross road junction and warn pedestrians for guiding them in a work zone and to redirect traffic on high speed roads. In case of four way road it is very much important to control traffic in a manageable way at Important cross road junctions of our country.

The objectives of the study are:-

- To reduce rate of accidents at Cross road junctions.
- To reduce traffic jams in indirect manner.
- To Control traffic includes pedestrians.
- To make the drivers bound to follow the traffic rules by controlling traffic system
- Lowering the tendency of road blocking.
- Efficient road network enhances the progress of that region.
- Free and speedy movement for all categories of traffic.

1.3 Motivation

In our day to day life, all faces a simple problem in road i.e. traffic jam. This traffic problem occurs due to increase in vehicle density. Because of these many criminal activities occur like violation of the traffic rules, causing trouble to people crossing the road etc. Due to massive growth in urbanization and traffic violation, advance traffic control system is developed. But at times, existing system gets failed creating problem to existing traffic control system. Examining these current situation, a system is designed which reduce the violation of traffic rules by implementing new ideas to the existing one.

Chapter 2

Literature Review

2.1 History

University of Leeds (1992),says that Urban vehicular traffic, as an expression of human behavior, is variable in time and in space. The control of such traffic requires a high degree of adaptiveness to enable a suitable response to this variability. Ever since the inception of modern traffic signal controls, traffic engineers and signal system designers have attempted to make them as responsive as possible to prevailing traffic conditions. The premise always was that increased responsiveness must lead to improved traffic performance. This premise was applied to single intersection signals as well as to arterial and network signal systems. However, the extent to which traffic responsiveness is achieved depends on a variety of factors, which include: strategy sophistication, hardware capabilities, surveillance and communication equipment, as well as the operator capabilities.

A.Chattaraj (2009), says that Vehicular traffic control at road crossings has always been a matter of concern for administrations in many modern cities around the world. Several attempts have been made to design efficient automated systems to solve this problem. Most of the present day systems use pre-determined timing circuits to operate traffic signals which are not very efficient because they do not operate according to the current volume of traffic at the crossing. It is often seen in today's automated traffic control systems that vehicles have to wait at a road crossing even though there is little or no traffic in the other direction. There are other problems as well, like ambulances getting caught up by a red traffic signal and wasting valuable time. Congestion is often translated into lost time, missed opportunities, lost worker productivity, delivery delay and, in general, increased cost. Actually the traffic congestion is not only recurring (caused by recurring demand that exists virtually every day) but also non-recurring (caused by traffic incidents like damaged vehicles, crashes, work zones, weather and special events) in nature. To manage non-recurring congestion some sensor based systems were suggested for improvement over fixed timing controlled ones. However the performance was not satisfactory due to the 2 necessity of a direct line-of-sight (LOS) path between sensor and vehicles. Further, simultaneous multiple detections were difficult to handle with a sensor-based system.

D.R.Rotake and Prof.S.Karmore (2012) studied that a development of an intelligent traffic signal control (ITSC) system needed because present traffic light controllers are based on old microcontroller such as AT89C51 which has very less internal memory and no in-built ADC. These systems have limitation because they will use the predefined program that does not have the flexibility of modification on real time application. The present traffic system have fixed time interval for green and red signal which does not provide the flexibility to the system. The ITSC system consist of high-performance, low power AVR_32 microcontroller with 32kbytes of in-system programmable flash memory and in-built 8-channel, 10-bit ADC which is required to process the IR input from sensor network. The ITSC system will able to deal two basic problem of traditional traffic light system: i) Detection of traffic volume by using genetic algorithm. ii) Emergence vehicle detection such as ambulance, police etc by using wireless sensor network (IR) embedded at the signal intersection.

K.Chao and P.Y.Chen(2014), their study primarily focuses on the use of radio frequency identification (RFID) as a form of traffic flow detection, which transmits collected information related to traffic flow directly to a control system through an RS232 interface. At the same time, the sensor analyzes and judges the information using an extension algorithm designed to achieve the objective of controlling the flow of traffic. In addition, the traffic flow situation is also transmitted to a remote monitoring control system through ZigBee wireless network communication technology. The traffic flow control system developed in this study can perform remote transmission and reduce traffic accidents. And it can also effectively control traffic flow while reducing traffic delay time and maintaining the smooth flow of traffic.

L.N.Nipa and M.M.Islam(2015),studied about the traffic jam is one of the major problems in a densely populated city like Mumbai whereas its population and number of running vehicles are much more than its road capacity. Traffic signaling systems, inadequate manpower, narrow road spaces and overtaking tendency of drivers create pro-longed traffic jams. Due to traffic jam a substantial portion of working hours have to be left on streets which indirectly put adverse impact on economy and unavoidable road accident which results loss of lives. As the number of

road users constantly increases, and resources provided by current infrastructures are limited. Intelligent traffic control system has become a very important issue.

Roxanne. H (2015) . studied inadequate space and funds for the construction of new roads and the steady increase in number of vehicles has prompted scholars to investigate other solutions to traffic congestion. One area gaining interest is the use of smart traffic control systems (STCS) to make traffic routing decisions. These systems use real time data and try to mimic human reasoning thus prove promising in vehicle traffic control and management. Their paper is a review on the motivations behind the emergence of STCS and the different types of these systems in use today for road traffic management. They include – fuzzy expert systems (FES), artificial neural networks (ANN) and wireless sensor networks (WSN). They give an in depth study on the design, benefits and limitations of each technique. The paper cites and analyses a number of successfully tested and implemented STCS. From these reviews we are able to derive comparisons of the STCS discussed in this paper. For instance, for a learning or adaptive system, ANN is the best approach; for a system that just routes traffic based on real time data and does not need to derive any data patterns afterwards, then FES is the best approach; for a cheaper alternative to the FES, then WSN is the least costly approach. All prove effective in traffic control and management with respect to the context in which each of them is used.

M.patil (2016), says that in today's world there is no efficient traffic system, one way of providing efficient traffic system is by manipulating traffic lights dynamically based on traffic size. Also there are no priority services for any priority vehicles like ambulance hence some services other than normal services must be provided to priority vehicles. User faces traffic jam due to lack of notification hence must be regularly notified about current traffic conditions if he wishes to. Some strict action is required against the rule breakers such as fine deduction or in worst case license invalidation. There is a drastic need to solve these problems for efficient management of traffic.

O.Gadage (2017), says that 21st century India needs planned, technologically sound and sustainable development. A crucial aspect of this development is road transportation. The infrastructure facilities play major role in developing any zone of a country in the modern era and globalization. A smart and efficient road network enhances the progress of that region. A fresh outlook is needed if these road networks

and new developing ones are to be truly a part of the modern world. His project highlights on optimizing the construction and execution aspect of a road network. He also focuses on analyzing the current and future demand for designing a very efficient and smart road junction with aim to have a free and speedy movement for all categories of traffic.

S.Tabish and E.M.Kumar(2017), says that Walking is not usually considered a transportation mode. This is because it does not employ vehicles or because it is a fundamental means of movement. But walking is the most efficient and efective mode of transportation for the short trips. People walk for many purpose i.e. work, shopping and recreation etc. Moreover every journey necessarily starts and ends as a walk trip. All trips in urban areas, be it by bus, car or train begin and ends as a pedestrian movement. In India, the proportion of pedestrian movement is very large. Pedestrians are the most vulnerable among road users and the most affected in urban traffic accident. Complete segregation from vehicle through space may solve the problem of pedestrian's causalities in road traffic accidents especially at cross walks. These can be achieved by using stairways or pedestrian bridges and subways i.e. foot over bridges and foot under bridges which is defined as pedestrian movement in vertical direction or at gradients.

2.2 Traffic Survey

According to the report on **TRAFFIC STUDIES AT BOISE STATE UNIVERSITY.** Traffic engineers and planners need information about traffic. They need information to design and manage road and traffic system. They use the information for planning and designing traffic facilities, selecting geometric standards, economic analysis and determination of priorities. They use this to justify warrant of traffic control devices such as signs, traffic signals, pavement markings, school and pedestrian crossings. The also use this information to study the effectiveness of introduced schemes, diagnosing given situations and finding appropriate solutions, forecasting the effects of projected strategies, calibrating and validating traffic models. Transportation system is a dynamic system. Information about traffic must be regularly updated to keep pace with ever-changing transportation system. Data must be collected and analyzed systematically to get representative information. Traffic

surveys are the means of obtaining information about traffic. This is a systematic way of collecting data to be used for various traffic engineering purposes.

2.2.1 Main purpose of traffic survey:

The main purpose of traffic survey are: traffic monitoring, traffic control and management, traffic enforcement, traffic forecasting, model calibration and validating etc.

2.2.2 Parts of traffic studies:

Traffic studies include

- Inventory of road traffic physical features
- Traffic stream characteristics-volume, speed, density, occupancy studies etc.
- Capacity studies of streets and intersections
- System usage studies-Travel time and delay, O-D survey
- Travel demand-home interview survey
- Road users cost-Value of travel time, vehicle operating cost
- Parking supply & demand studies
- Axle load survey
- Mass transit performance and usage studies
- Traffic accidents studies
- Environmental impact studies of transport

Chapter 3

Methodology

3.1. Working principle of barrier or gate at cross road junctions.

- Identification of problems : Accident at cross road junction
- Study of literatures, study of various traffic studies and accident data analysis
- Solution of problem: Traffic control barrier.

Barriers are basically the gates which allows the vehicle to make in their required direction

G-1= Gate 1 or Barrier 1

G-2= Gate 2 or Barrier 2

G-3= Gate 3 or Barrier 3

G-4= Gate 4 or Barrier 4

Step 1 : When the barrier G-1 is open & the rest barriers such as barrierG-2, G-3, G-4 are closed, only the vehicles from the road belong to barrier G-1 will be allowed to move in their required direction as shown in Fig.4.1 by the arrows &the vehicles of other roadsbelong to barrier G-2, G-3, G-4 are restricted to move.

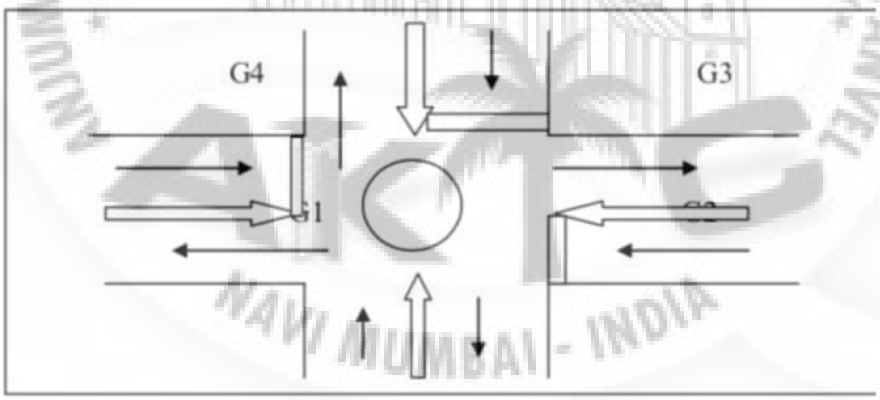


Fig.3.1.1: Barricade of G1 is opened and G2, G3 and G4 are closed.

Step 2: After a predetermined time period, controlled by signals, barrier G-2 will open & barrier G-1, G-3, G-4 will be closed. So only the vehicles from the road belong to barrier G-2 will be moved in their required direction as shown in Fig. 4.2 by the arrows.

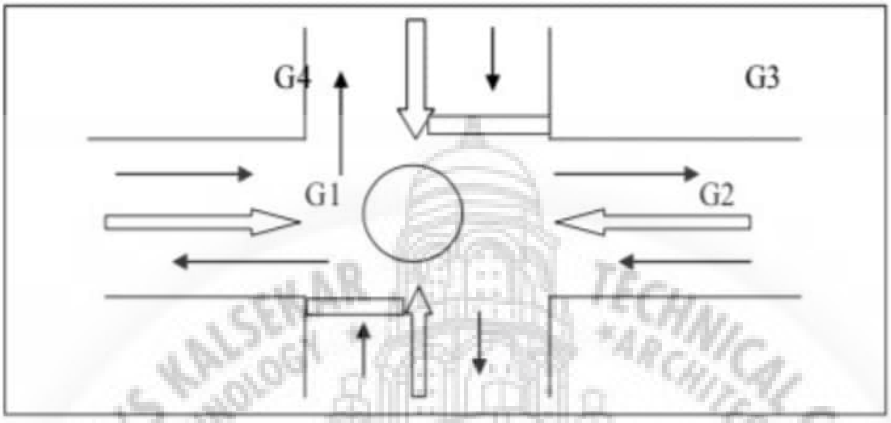


Fig. 3.1.2: Barricade of G2 is opened and G1, G3 and G4 are closed.

Step 3: Again after a predetermined fixed period barrier G-3 will be opened but barrier G-1, G-2 and G-4 will be closed. So only the vehicles from the road belong to barrier G-3 will be allowed to move in their required direction as shown in Fig.4.3 by the arrow.

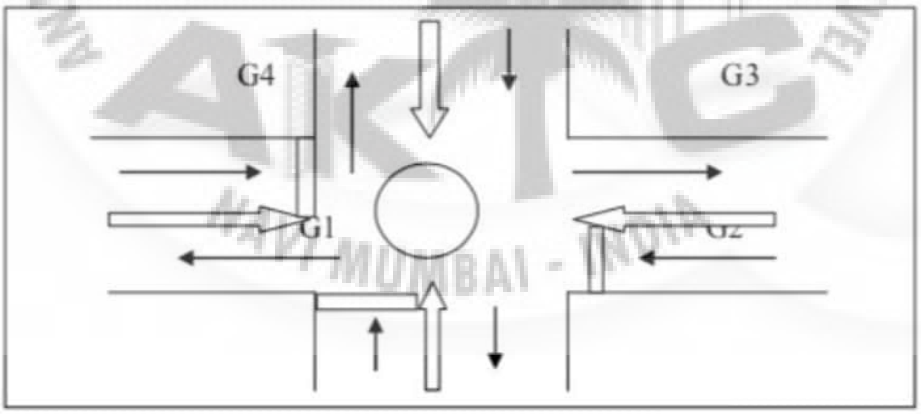


Fig.3.1.3: Barricade of G3 is opened and G1, G2 and G4 are closed.

Step 4: At the end on the cycle, barrier G-4 will be opened but barrier G-1, G-2, G-3 will be closed. So only the vehicles from the road belong to barrier G-4 will be allowed to move in their required directions shown in Fig. 4.4 by the arrows.

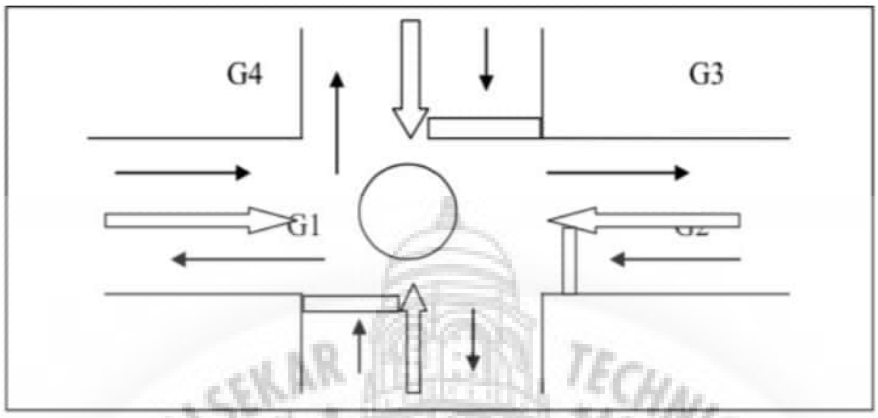


Fig. 3.1.4: Barricade of G4 is opened and G1, G2 and G3 are closed.

In such a way the total process will be repeated continuously until different kinds of requirements will be occurred.

3.2 Actual representation.

Fig3.2.1: when barrier or gate is close (signal is red):-

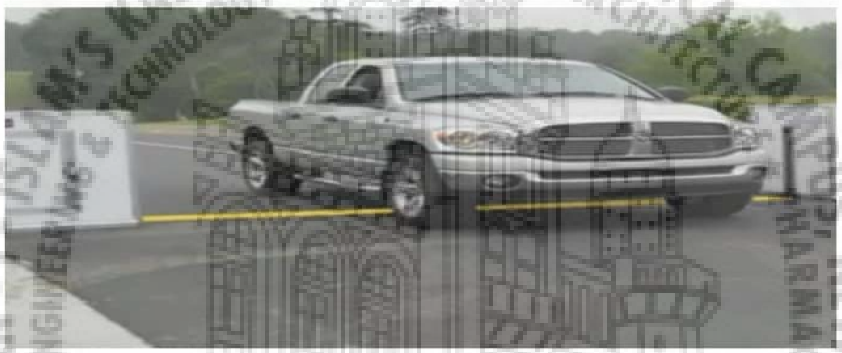


Fig3.2.2: when barrier or gate is get open (signal is green):-

Fig 3.2.3: Barrier or gate again closed after passing of vehicle (again signal is red)

3.3 Traffic Volume Study

Traffic data are needed in research, planning, designing and regulation phases of traffic engineering and are also used in establishing priorities and schedules of traffic improvements. The traffic engineer must acquire general knowledge of traffic volume characteristics in order to measure and understand the magnitude, composition, and time and route distributionvolume for each area under his jurisdiction.

3.3.1.Definitions:

1. Volume/flow:

The total number of vehicles that pass over a given point or section of a lane or roadway during given time interval is called volume.It is the actual numbers of vehicles observe or predicted to passing a point during a given time interval.

2. Rate of flow:

The equivalent hourly rate at which vehicles pass over a given point or section of a lane or roadway during a time interval less than one hour,usually 15min.

3. Average Daily Traffic (ADT):

The average 24-hr volume at a given location over a defined time period less than one year. The common application is to measure an ADT for each month of the year. Others are:

- Planning of highway activities
- Measurement of current demand
- Evaluation of existing traffic flow

4. Average Annual Daily Traffic (AADT):

Average Annual Daily Traffic (AADT): The average 24-hr volume at a given location over a full 365 days year, estimated as the number of vehicles passing a site in a year divided by 365 days (366 in leap year).

- Estimation of highway user revenues
- Accident rates per 1000 vehicle-km
- Traffic volume trends
- Economic feasibility
- Development of hierarchical system of facilities
- Improvement and maintenance programmers.

3.4 TRAFFIC ENGINEERING STUDIES AND ANALYSIS

3.4.1 INTRODUCTION

The traffic engineering studies are carried out for collecting traffic data are also called traffic surveys. Traffic Engineering studies are carried out to analysis the traffic characteristics and their movements along the identified roads. The results of this studies are used for the design of geometric features and traffic control measures for safe and efficient traffic movement. The analysis of results of these studies are also useful for accessing the need of proposed road projects with justifications.

The different traffic engineering studies generally we carried out are:

(a) Traffic Volume Study

(b) Pedestrians Study

(c) Accident Study

3.5 Traffic Volume Study

According to Department of Civil Engineering of **AHSANULLAH UNIVERSITY OF SCIENCE AND TECHNOLOGY (A U S T).** Traffic volume study are conducted to determine the volume of traffic moving on a roads and classification of road way vehicles at particular section at particular time. Volume of day or an hour can vary greatly, depending on the different day of week or different time period of a day. Traffic volume study is the determination of the number movement, and classification of roadway vehicles at a given location.

3.5.1 Methods of calculation of traffic volume

1) Manual method

2) Combination of manual and mechanical method

3) Automatic devices

4) Moving observer method

5) Photographic method

3.5.2 This traffic volume study help to understand:-

- Volume and direction of traffic.
- Variation of vehicles, flow on different parts of a road junction.
- Proportion of cars, heavy vehicles, slow vehicles on different parts of road junction.

3.5.3 Collection of traffic volume data:-

- Traffic volume count data we done by- **Manual counting.**

3.5.4.Accident study at cross road junction.

It is a survey which is used to determine the number of road accidents or signal crossing vehicles per hour.

3.6 PEDESTRIAN

3.6.1 DEFINITION OF PEDESTRIAN:

It is element of road which is provide a path on both side of the road for pedestrian. Pedestrian is used to include people who walk, sit crutches or wheelchair be they children teenagers, adults, elderly person, person with disabilities, workers, resident, shoppers. Every traveler is pedestrian at some stage of his travel period. Hence pedestrian facilities are very significant in urban transport. But unfortunately in India while designing and planning the roads, pedestrian are not considered as designed element, that's why pedestrian traffic and vehicular traffic are interact with each other which results to increasing traffic and conflict between pedestrian and vehicles. Therefore it is very important to study the pedestrian. To study about the pedestrian we must need to study IRC guidelines which gives standard dimensions and conditions. After study the IRC guidelines we compare the guidelines and the actual site. After the comparison we found many corrections on actual site.

3.6.2 IRC GUIDELINE FOR PEDESTRIAN

General principle:-

- Pedestrian facilities should be planned in an integrated manner so as to ensure a continuous pedestrian flow. It should be useful therefore to look at pedestrian needs for an area as a whole and prepare an overall strategic plan.
- The basic aim should be to reduce pedestrian conflicts with vehicular traffic to the minimum. Efforts should be made to create such condition that pedestrian are not forced to walk in unsafe circumstances and that the motorist respect the position of pedestrian.
- While planning, the convenience of pedestrian should be a paramount consideration to ensure full utilization of the facilities .
- While designing and planning the pedestrian facilities, the overall objectives would be continuity, comfort and safety.

3.6.3 Physical characteristics:

The pedestrian facilities shall comply with following physical characteristics:

1. Footpath surface:

An even surface without cracks or bumps for comfortable walking. All surface should be stable, firm, and slip resistant.

2. Footpath width :

The footpath should be wide enough to accommodate pedestrian flow at any given point of time.

3. Obstructions:

The obstruction can be an electric pole , tree, garbage bin, and hoardings. The location of garbage bin, electric pole etc. should be on one side of the footpath so as to give a clear walkway to the pedestrian.

4. Continuity:

The continuity of the pedestrian facility is very important For the pedestrian with disability and of old age .Frequent kerbs cuts along a street both impede traffic flow and create more conflict point between vehicles and pedestrian.

3.6.4 PEDESTRIAN FACILITIES DESIGN STANDARDS

1.FOOTPATH:

Height of the kerb at the edge should, however, not exceed the height of a standard public step riser 150mm

2. CLEAR WALKING ZONE:

The minimum size of clear walking zone should 1.8m (wide)x 2.2m (height).

3. CLEAR HEIGHT :

A clear height of 2.2 m is required for the entire width of the footpath walking zone.

4. WIDTH :

The minimum width of a clear unobstructed pathway should be 1800mm .

5.DEAD WIDTH :

For footpath in shopping areas an extra 1 meter should be added to the stipulated 4 meter width this extra width is called Dead width .

3.6.5 PEDESTRIAN CROSSING

Pedestrian must be given the shortest possible direct route to cross the street. Mid-block crossing must be provide for people to cross the street safely between building entries or bus stop location or active land uses on opposite sides of the street. Crossing must be Provide at all T-junctions.

3.6.5.1 KEY GUIDELINES FOR PEDESTRIAN CROSSING

- Minimum 3meter wide pedestrian crossing and 2.5 meter wide cycle crossing.
- All crossing should have universal accessibility features.
- Mid-block crossing must be provided at regular intervals.
- Make sure the crossing point is always well drained.

3.6.5.2 Increased Pedestrian design consideration in streets would provide:

- Increase in comfort for current walking population.
- Comfortable last mile connectivity from MRTS Station - therefore increased ridership of buses and metro.
- Reduce dependency on the car, if shorter trips can be made comfortably by foot.
- More exercise, so better health for people working.
- Prioritization of public transport and non-motorized private mode street design.
- Reduced car use leading to reduced congestion and pollution.
- More equity in the provision of comfortably public spaces and amenities to all sections of society.

3.6.6 CAUSES WHICH LEADS TO PEDESTRIAN TRAFFIC:

- No extra space allowed for pedestrians interested in stopping at attractions. Therefore stopping pedestrian disrupts moving pedestrian flow on sidewalk.
- Insufficient pedestrian data available while designing pedestrian.
- Illegal hawkers occupy pedestrian land.
- Un-uniform pedestrian width.
- Maintenance of pedestrian.

3.7 ACCIDENT STUDIES

3.7.1 Importance of accident studies

According to the department of Civil Engineering MILAN BATISTA ON MUTUAL COEFFICIENT OF RESTITUTION IN TWO CAR COLLINEAR COLLISIONS,2006. The problem of accident is very acute in road transportation due to: (i) complex flow patens of vehicular traffic (ii) presence of mixed type of vehicles and (iii) the Pedestrians on the roads. Traffic accidents may involve property damages, personal Injuries and also deaths. One of the main objective s of traffic engineering is to Provide safe traffic movements. Road accident cannot be totally prevented, the accident rate can be decreased Substantially by suitable traffic engineering and management measures. It is essential to analysis every individual accident and to maintain zone wise accident records

3.7.2 OBJECTIVE:-

1. To study the causes of accident and to suggest corrective treatment at potential location

2. To evaluate existing design, regulations and control measures

3. To support purposed changes in design, regulations and control measures in the selected zone

4. To carry out 'before and after studies' after implementing changes and to demonstrate

the improvement in the accident problem

5. To support the proposed design and provide economic justification to the improvement suggested by the traffic engineer

6. To carry out before and after studies and to demonstrate the improvement in the

problem.

3.7.3 Causes of road accidents

The various causes of road accidents are:

Road Users- Excessive speed and rash driving, violation of traffic rules, failure to perceive traffic situation or sign or signal in adequate time, carelessness, fatigue, alcohol, sleep etc.

1. **Vehicle-** Defects such as failure of brakes, steering system, tyreburst, lighting system.

2. **Road Condition-** Skidding road surface, pot holes, ruts.

3. **Road design-** Defective geometric design like inadequate sight distance, inadequate width of shoulders, improper curve design, improper traffic control devices and improper lighting,.

4. **Environmental factors** - Unfavourable weather conditions like mist, snow, smoke and heavy rainfall which restrict normal visibility and makes driving unsafe.

5. **Other causes-** Improper location of advertisement boards, gate of level crossing not closed when required etc.

3.7.4 Accident statistics

The statistical analysis of accident is carried out periodically at critical locations or road stretches which will help to arrive at suitable measures to effectively decrease accident rates. It is the measure (or estimates) of the number and severity of accident. These statistics reports are to be maintained zone-wise. Accident prone stretches of different roads may be assessed by finding the accident density per length of the road. The places of accidents are marked on the map and the points of their clustering (BLACK SPOT) are determined. By statistical study of accident occurrence at a particular road or location or zone of study for a long period of time it is possible to predict with reasonable accuracy the probability of accident occurrence per day or relative safety of different classes of road user in that location. The interpretation of the statistical data is very important to provide insight to the problem. The position of India in the year 2009 in country-wise number of person killed per 100000 populations.

3.7.5 Accident Analysis

Accident data collection

The accident data collection is the first step in the accident study. The data collection of the accidents is primarily done by the police. Motorist accident reports are secondary data which are filed by motorists themselves. The data to be collected should comprise all of these parameters:

1. **General**- Date, time, person involved in accident, classification of accident like fatal, serious, minor
2. **Location**- Description and detail of location of accident
3. **Details of vehicle involved**- Registration number, description of vehicle, loading
4. **Nature of accident-** Details of collision, damages, injury and casualty
5. **Road and traffic condition-** Details of road geometry, surface characteristics, type of traffic, traffic density etc..
6. **Primary causes of accident-** Details of various possible cases (already mentioned) which are the main causes of accident
7. **Accident cost-** Financial losses incurred due to property damage, personal injury and Casualty

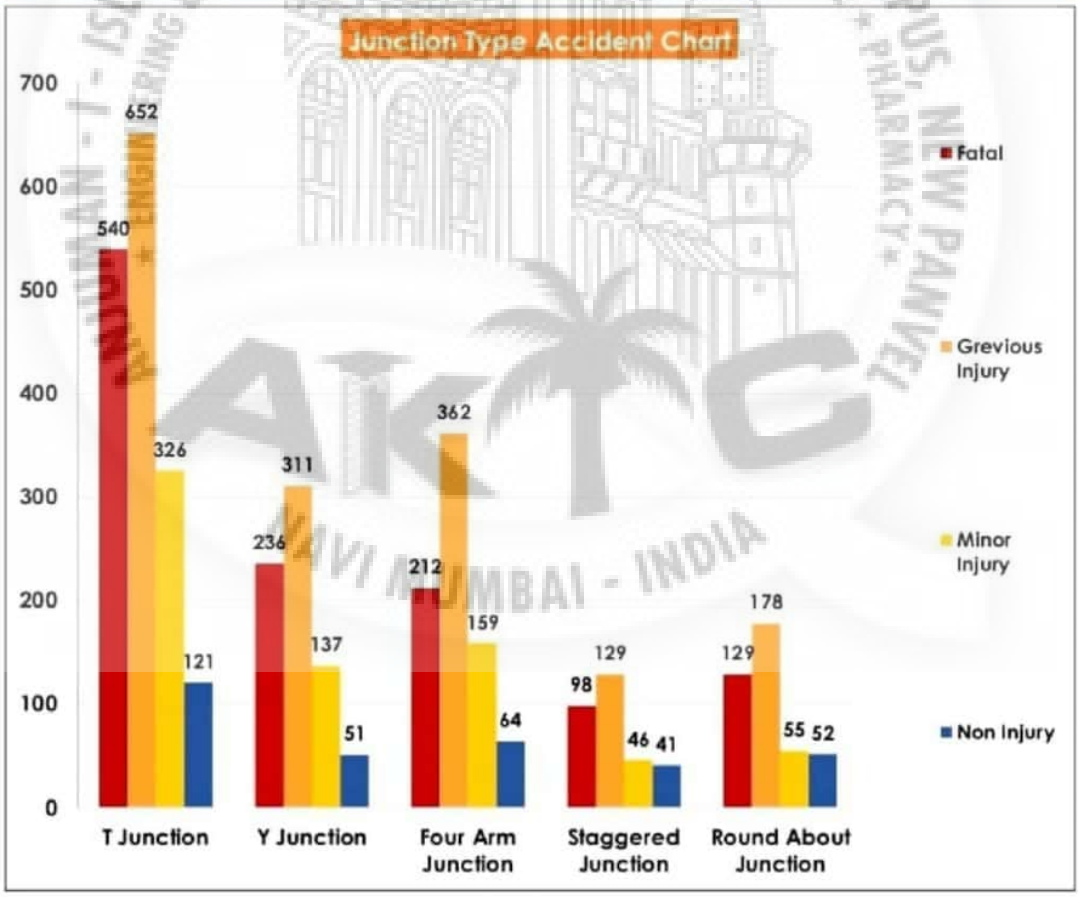
These data collected need proper storing and retrieving for the following purpose. The purposes are as follows:-

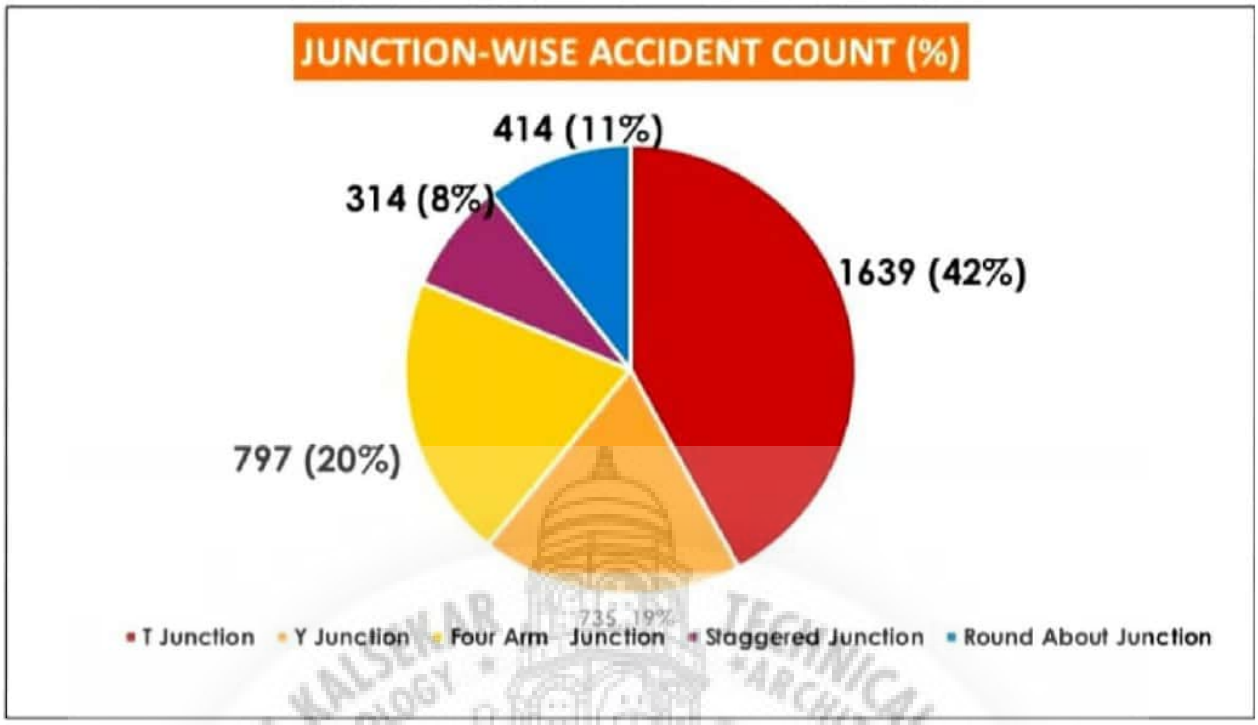
1. Identification of location of points at which unusually high number of accident occur.
2. Detailed functional evaluation of critical accident location to identify the causes of accidents.
3. Development of procedure that allows identification of hazards before large number of accidents occurs.
4. Development of different statistical measures of various accident related factors in give insight into general trends, common casual factors, driver profiles, etc.

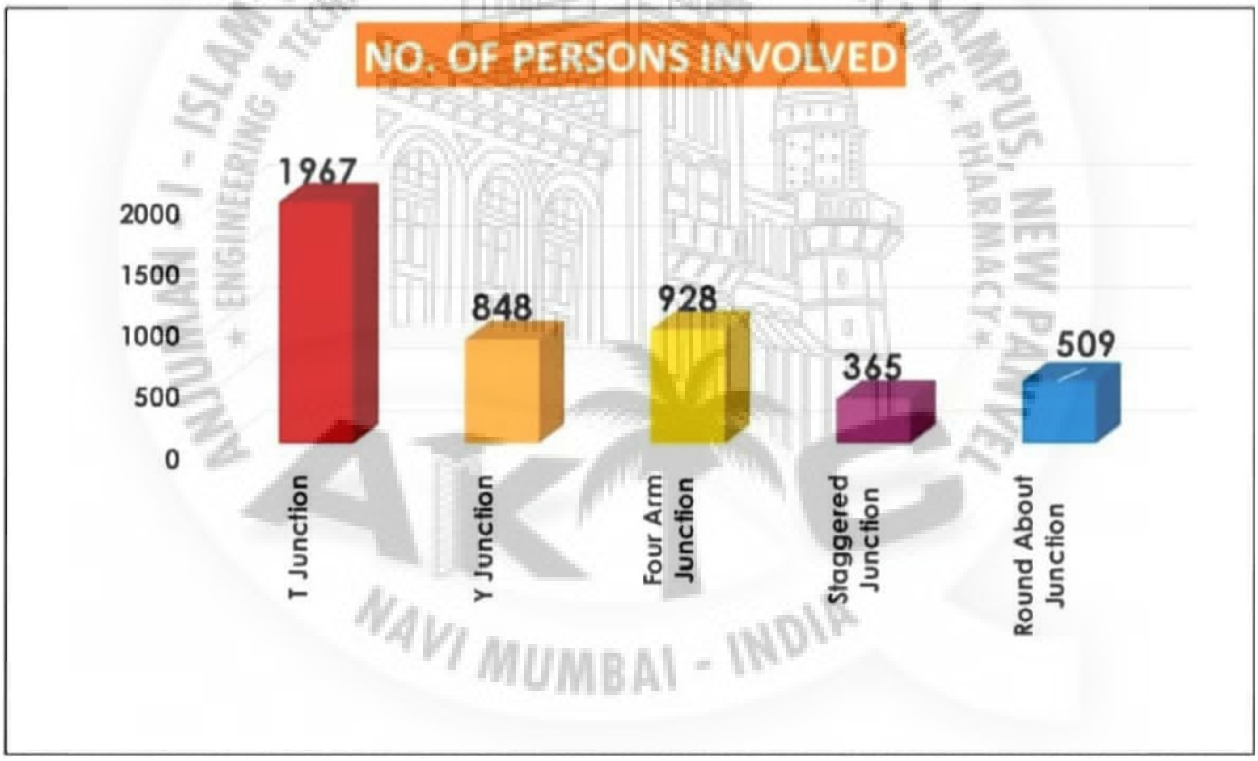
Accident data analysis

ACCIDENTS CLASSIFIED ACCORDING TO ROAD JUNCTION TYPE

Sr. No.	Junction Type	Number of Accidents					Number of persons involved			
		Fatal	Grievous Injured	Minor Injury	Non Injury	Total	Killed	Grievous Injured	Minor Injured	Total
1	T Junction	540	652	326	121	**1639**	579	926	462	**1967**
2	Y Junction	236	311	137	51	**735**	249	414	185	**848**
3	Four Arm Junction	212	362	159	64	**797**	222	463	243	**928**
4	Staggered Junction	98	129	46	41	**314**	99	197	69	**365**
5	Round About Junction	129	178	55	52	414	132	279	98	**509**
	Total	**1215**	**1632**	**723**	**329**	**3899**	**1281**	**2279**	**1057**	**4617**



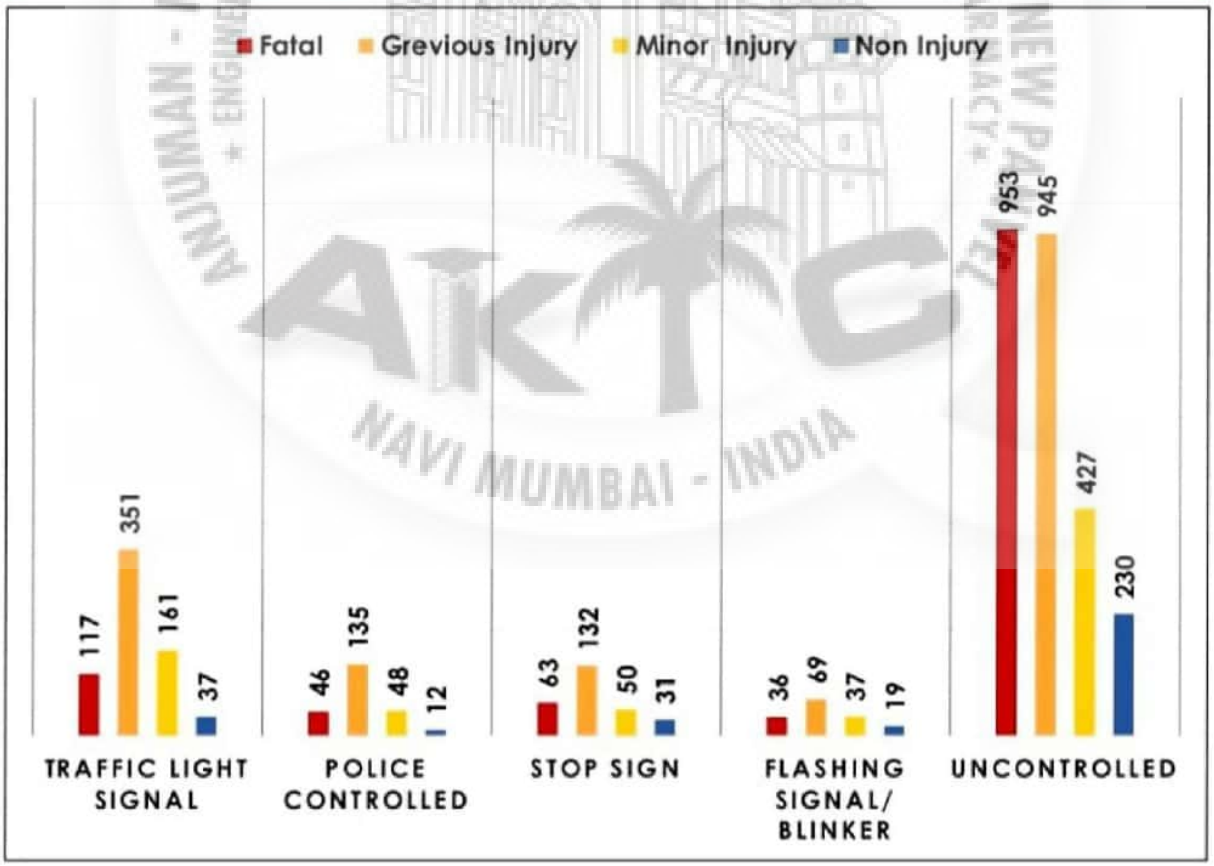


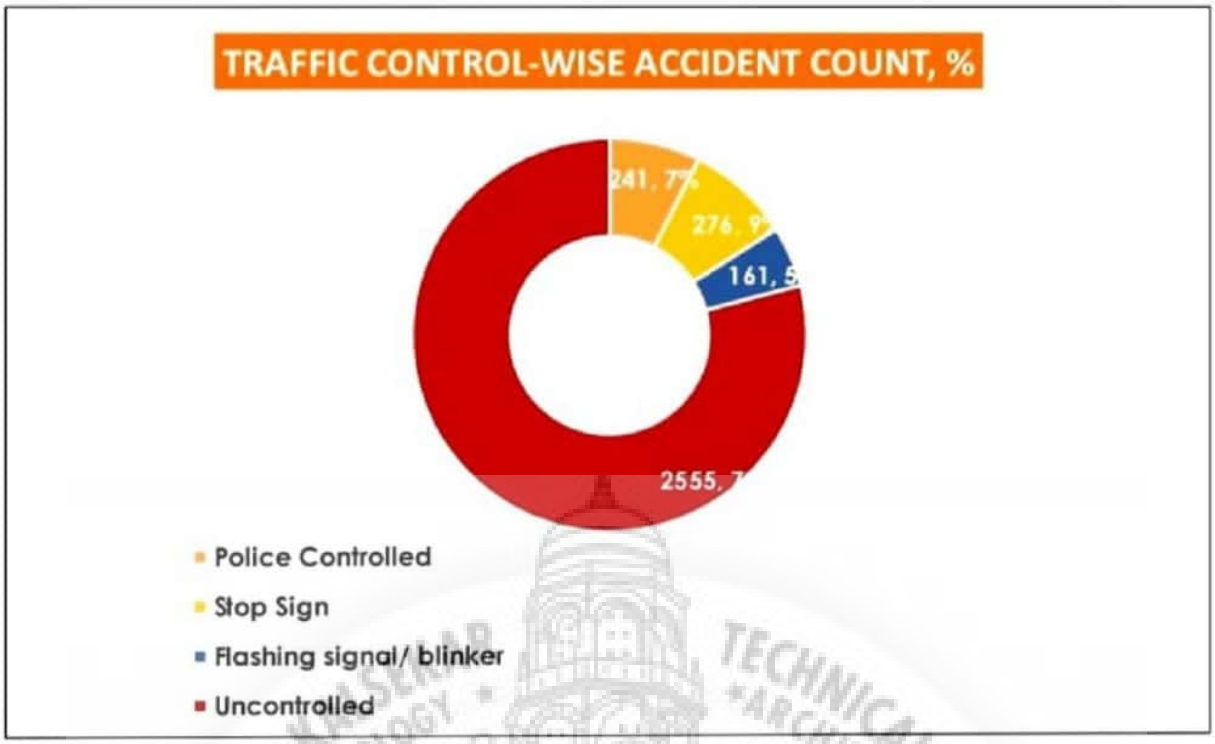


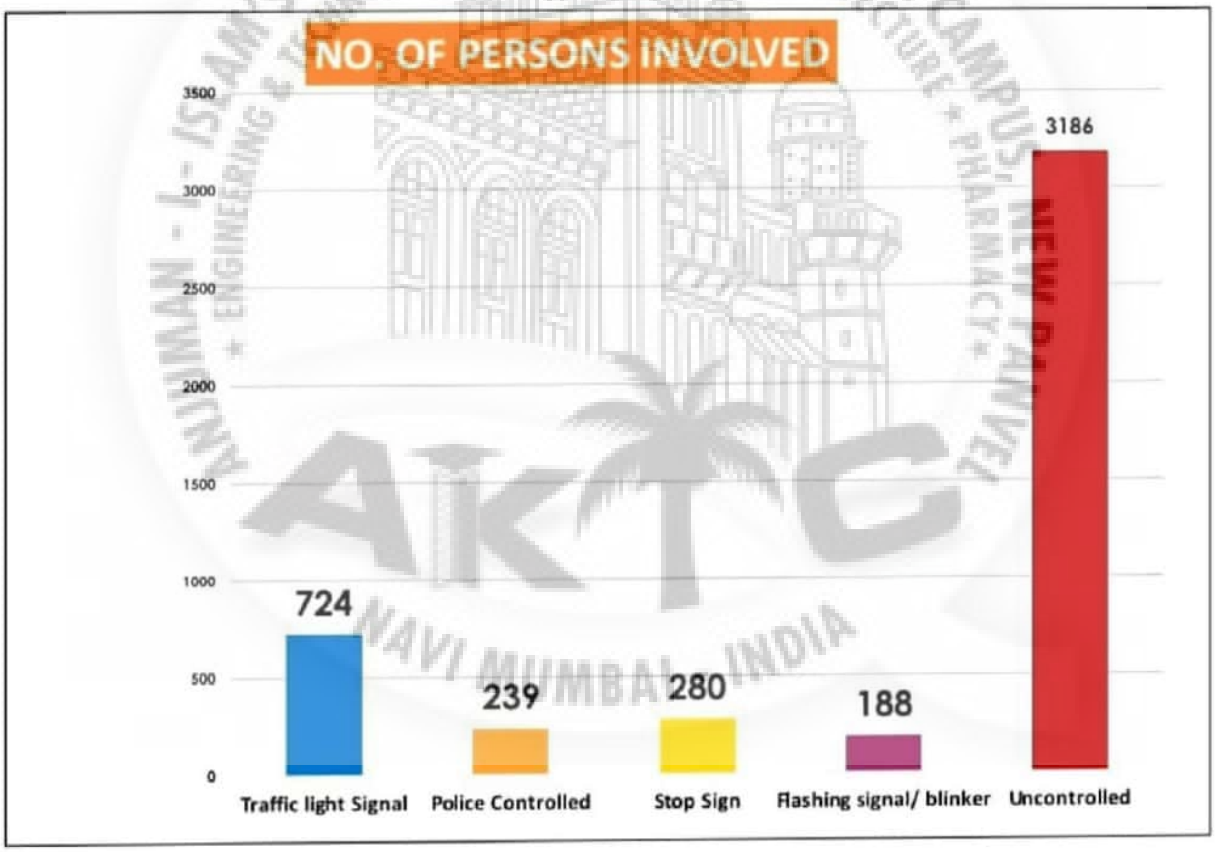
- T Junction, Y Junction and Four Arm Junction are the hotspots for road accidents in 2019.
- T Junction alone contributes to 42% road accidents in 2019 in Maharashtra.
- 29% people killed in accidents happen on T Junctions.

ACCIDENTS CLASSIFIED ACCORDING TO TRAFFIC CONTROL AT JUNCTION

Sr. No.	Traffic Control	Number of Accidents					Number of persons involved			
		Fatal	Grievous Injured	Minor Injury	Non Injury	Total	Killed	Grievous Injured	Minor Injured	Total
1	Traffic light Signal	117	351	161	37	**666**	118	405	201	**724**
2	Police Controlled	46	135	48	12	**241**	47	138	54	**239**
3	Stop Sign	63	132	50	31	**276**	63	146	71	**280**
4	Flashing signal/ blinker	36	69	37	19	**161**	36	99	53	**188**
5	Uncontrolled	953	945	427	230	**2555**	1017	1491	678	**3186**
	Total	**1215**	**1632**	**723**	**329**	**3899**	**1281**	**2279**	**1057**	**4617**



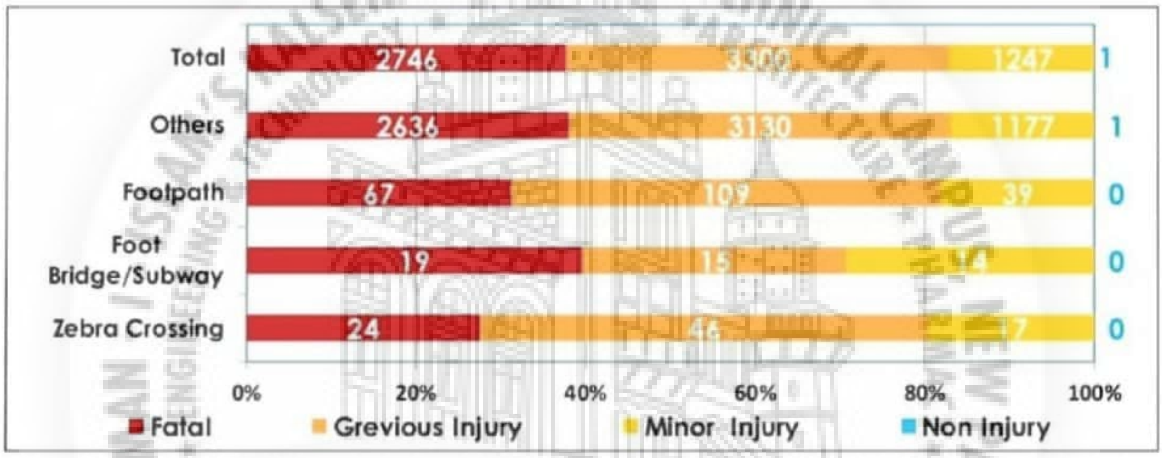


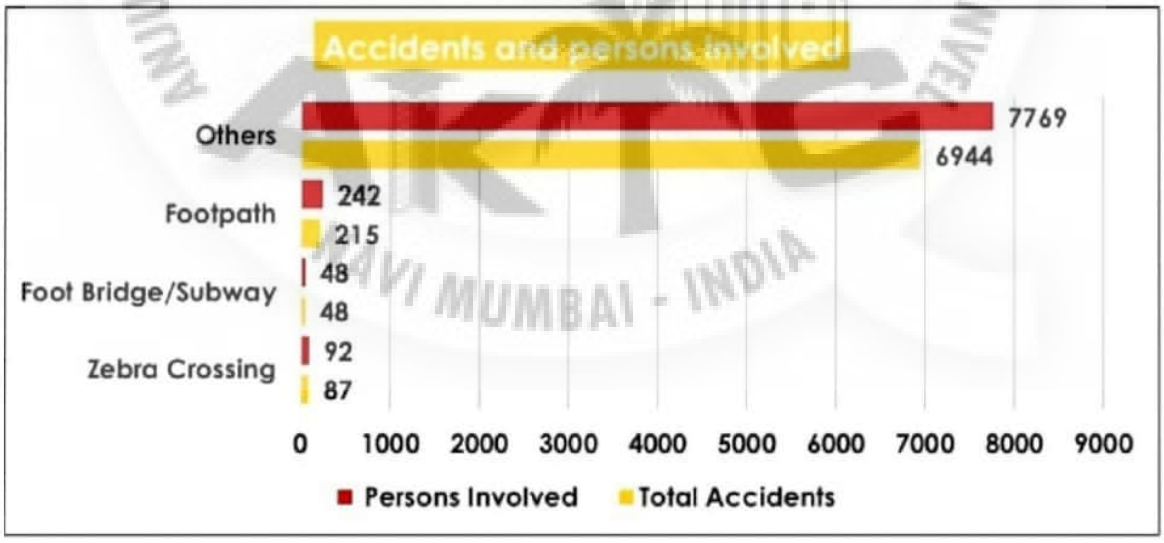


- 66% road accidents happen on places where there are no traffic signals or no control by traffic police.
- This clearly indicates the importance of traffic rules and regulations.
- There are only 600 odd road accidents on traffic light signal in 2019.

ACCIDENTS CLASSIFIED ACCORDING TO PEDESTRIAN INFRASTRUCTURE - 2019

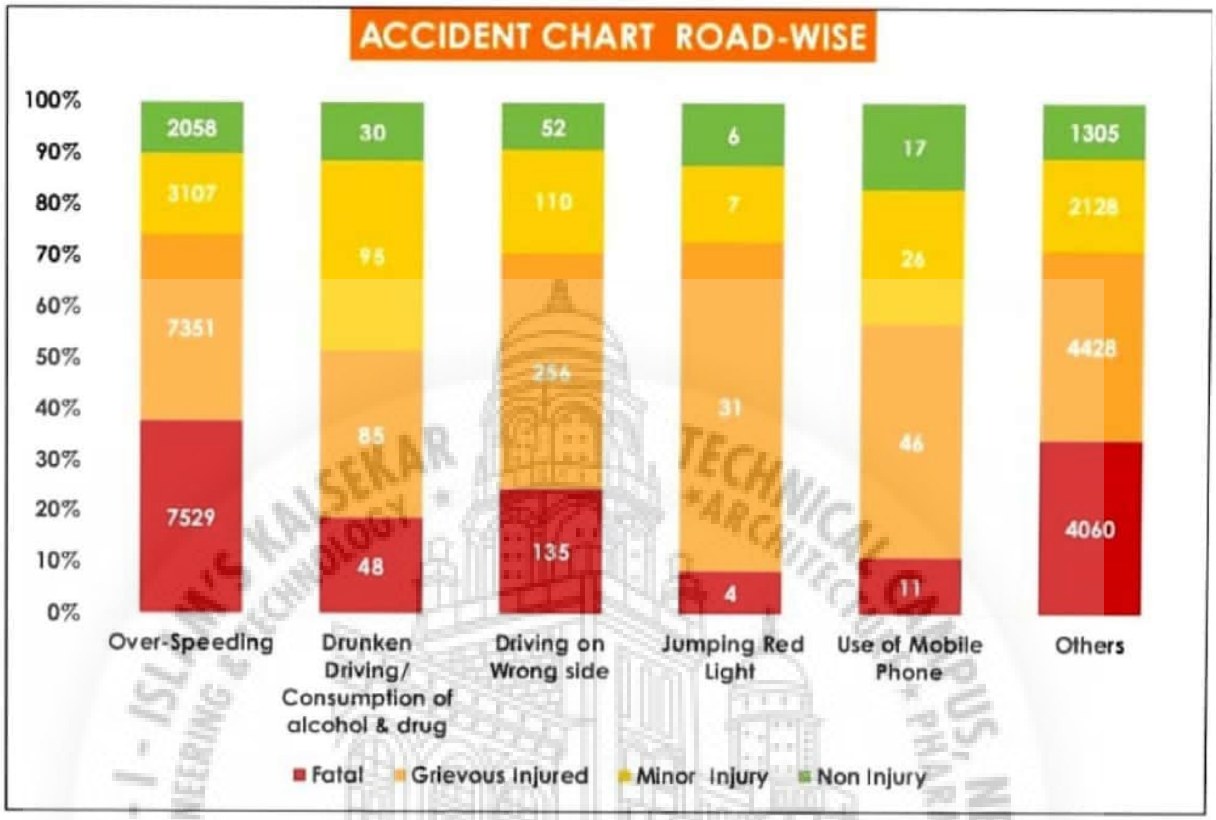
Sr. No.	Pedestrian Infrastructure	Number of Accidents					Number of persons involved			
		Fatal	Grievous Injured	Minor Injury	Non Injury	Total	Fatal	Grievous Injured	Minor Injured	Total
1	Zebra Crossing	24	46	17	0	**87**	24	51	17	**92**
2	Foot Bridge/ Subway	19	15	14	0	**48**	19	15	14	**48**
3	Footpath	67	109	39	0	**215**	67	131	44	**242**
4	Others	2636	3130	1177	1	**6944**	2739	3577	1453	**7769**
Total		**2746**	**3300**	**1247**	**1**	**7294**	**2849**	**3774**	**1528**	**8151**

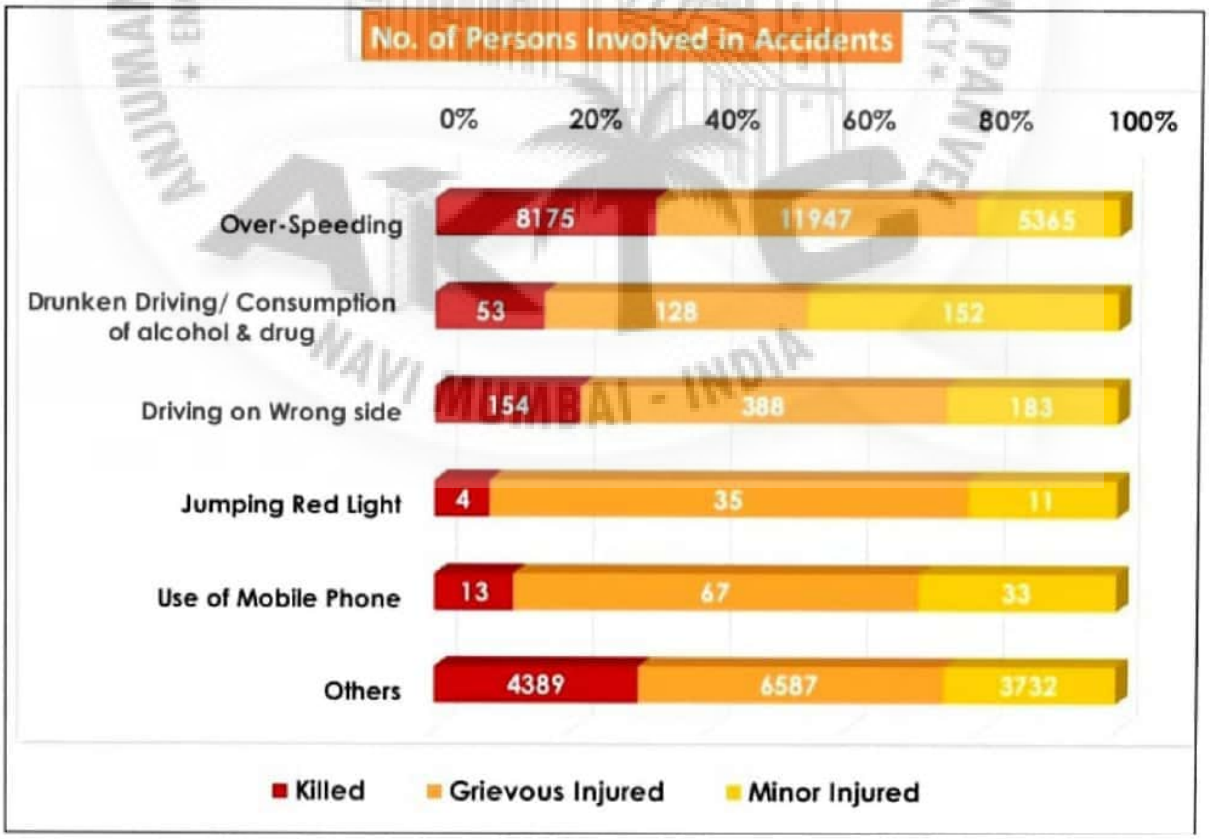




- 95% road accidents occur where there is a lack of pedestrian infrastructure and 3% accidents happen on footpaths.
- 35% people get killed in these accidents and 46% left with grievous injuries.

ROAD ACCIDENTS CLASSIFIED ACCORDING TO TYPE OF TRAFFIC VIOLATIONS





Sr. No.	Type of Traffic Violations	Number of Accidents					Number of persons involved			
		Fatal	Grievous Injured	Minor Injury	Non Injury	Total	Killed	Grievous Injured	Minor Injured	Total
1	Over-Speeding	7529	7351	3107	2058	**20045**	8175	11947	5365	**25487**
2	Drunken Driving/ Consumption of alcohol & drug	48	85	95	30	**258**	53	128	152	**333**
3	Driving on Wrong side	135	256	110	52	**553**	154	388	183	**725**
4	Jumping Red Light	4	31	7	6	**48**	4	35	11	**50**
5	Use of Mobile Phone	11	46	26	17	**100**	13	67	33	**113**
6	Others	4060	4428	2128	1305	**11921**	4389	6587	3732	**14708**
	Total	**11787**	**12197**	**5473**	**3468**	**32925**	**12788**	**19152**	**9476**	**41416**

- Over speeding has killed 8175 people in 20045 road accidents and making 11947 people Grievously injured.
- Over speeding alone was responsible for 61% of road accidents in 2019.

The purpose is to find the possible causes of accident related to driver, vehicle, and roadway. Accident analyses are made to develop information such as:

1. Driver and Pedestrian-Accident occurrence by age groups and relationships 0f accidents to physical capacities and to psychological test results.

2. Vehicle-Accident occurrence related to characteristic of vehicle, severity, location and extent of damage related to vehicles.

3. Roadway conditions-Relationships of accident occurrence and severity to characteristics of the roadway and roadway condition and relative values of changes related to roadways.

It is important to compute accident rate which reflect accident involvement by type of highway. These rates provide a means of comparing the relative safety of different highway and street system and traffic controls. Another is accident involvement by the type of drivers and vehicles associated with accidents.

Road reconstruction

The number of vehicles on the road increases from year to year, Which introduces complications into organization of traffic, sharply reduces the operation and transportation characteristics of road and lead to the growth of accident rate. This leads to the need of re into organization of traffic, characteristic of roads and lead to the gr constructing road. The places of accidents need to be properly marked so that the reconstruction can be planned accordingly.

Channelization

The Channelization of traffic at intersection separates the traffic stream travelling in different direction, providing them a separate lane that corresponds to their convenient path and spreading as far as possible the points of conflict between crossing traffic streams. The traffic lanes are separated by marking relevant lines or by constructing slightly elevated islands. Proper Channelization reduces confusion. The number of decision required to be made by the driver at any time is reduced allowing the driver time to make next decision. The principles of proper channelized intersection are:

l. The layout of intersection should be visibly clear, simple and understandable by driver.

2. Should ensure superiority to the vehicles using road of higher class.

3. Layout of intersection makes it necessary for a driver running through it to choose at each moment of time one of not more than two possible direction of travel. This is achieved by visual guidance, islands and markings.

Road signs:-

Road signs are integral part of safety as they ensure safety of the driver himself (warning signs) and safety of the other vehicles and pedestrians on road (regulatory signs). Driver should be able to read the sign from a distance so that he has enough time to understand and respond. It is essential that they are installed and have correct shape, colour, size and location. It is required to maintain them as well, without maintenance in sound condition just their instalment would not be beneficial. According to British investigation height of text in road sign should be

3.7.6 Other methods

Various other methods of traffic accident mitigation are described below:

1. **Street lighting** Street lightning of appropriate standard contributes to safety in urban area during night time due to poor visibility. Installation of good lighting results in 21% reduction in all accidents, 29% reduction in "all casualty" accidents, 21% reduction in "non pedestrian casualty" accidents, and 57% reduction in "pedestrian casualty" accidents.

2. **Improvement in skid resistance** If road is very smooth then skidding of the vehicles may occur or if the pavement is wet then wet weather crashes occur which account about 20-30%. Thus it is important to improve the skid resistance of the road. Various ways of increasing the skid resistance of road are by constructing high-friction overlay or cutting of grooves into the pavement.

3. **Road markings** Road markings ensure proper guidance and control to the traffic on a highway. They serve as supplementary function of road sign. They serve as psychological barrier and delineation of traffic path and its lateral clearance from traffic hazards for the safe movement of traffic. Thus their purpose is to provide smooth and safe traffic flow.

4. **Guide posts with or without reflector** They are provided at the edge of the roadway to prevent the vehicles from being off tracked from the roadway. Their provision is very essential in hilly road to prevent the vehicle from sliding from top. Guide posts with reflector guide the movement of vehicle during night.

5. **Guard rail** Guard rail have similar function as of guide post. On high embankments, hilly roads, road running parallel to the bank of river, shores of lake, near rock protrusion, trees, bridge, abutments a collision with which is a great hazard for a Vehicle. It is required to retain the vehicle on the roadway which has accidentally left the road because of fault or improper operation on the part of the driver. Driver who has lost control create a major problem which can be curbed by this measure.

6. **Driver reviver stop** Driver reviver stop are generally in use in countries like U.S.A where driver can stop and refresh himself with food, recreation and rest. They play a very important part in traffic safety as they relieve the driver from the mental tension of constant driving. These stops are required to be provided after every 2 hour travel time.

7. **Constructing flyover and bypass** In areas where local traffic is high bypasses are required to separate through traffic from local traffic to decrease the accident rate. To minimize conflicts at major intersections flyovers are required for better safety and less accident rate

8 **Regular accident studies** Based on the previous records of accidents the preventive measures are taken and after that the data related to accidents are again collected to check the efficiency of the measures and for future implementation of further preventive measures.

9. **Safety measures related to enforcement** The various measures of enforcement that may be useful to prevent accidents at spots prone to accidents are enumerated below. These rules are revised from time to time to make them more comprehensive.

speed control

Checks on spot speed of all vehicles should be done at different locations and timings and legal actions on those who violate the speed limit should be taken

Training and supervision

The transport authorities should be strict while issuing licence to drivers of public service vehicles and taxis. Driving licence of the driver may be renewed after specified period, only after conducting some tests to check whether the driver is fit .

medical check

The drivers should be tested for vision and reaction time at prescribed intervals of time

Safety measures related to education

The various measures of education that may be useful to prevent accidents are enumerated below.

Education of road users

The passengers and pedestrians should be taught the rules of the road, correct manner of crossing etc. by introducing necessary instruction in the schools for the children and by the help of posters exhibiting the serious results due to carelessness of road users.

Safety drive

Imposing traffic safety week when the road users are properly directed by the help of traffic police as a means of training the public. Training courses and workshops should be organized for drivers in different parts of the country.

Safety audit

It is the procedure of assessment of the safety measures employed for the road. It has the advantages like proper planning and decision from beforehand ensures minimization of future accidents, the long term cost associated with planning is also reduced and enables all kinds of users to perceive clearly how to use it safely. Safety audit takes place in five stages as suggested by Wrisberg and Nilsson, 1996. Five Stages of Safety Audit are:

1. **Feasibility Stage**- The starting point for the design is determined such as number and type of intersection, relationship of the new scheme to the existing road, the relevant design standards.

2. **Draft Stage**- In this stage horizontal and vertical alignment, junction layout are determined. After the completion of this stage decision about land acquisition is taken.

3. **Detailed design stage**- Signing, marking, lighting, other roadside equipment and landscaping are determined.

4. **Pre-opening stage**- Before opening a new or modified road should be driven, walked or cycled. It should be done at different condition like bad weather, darkness.

5. **Monitoring of the road in use**- Assessment is done at the final stage after the road has been in operation for few months to determine whether the utilization is obtained as intended and whether any adjustment to the design are required in the light of the actual behaviour of road users.

CHAPTER 4

DATA ANALYSIS

4.1 traffic volume study

Manual count method

- Origin: khanda colony junction
- Time:5:30 - 6:00p.m (30 minutes)

Table no 4.1.1:- Location A	
Vehicles	No of vehicles
Two wheelers	242
Three wheelers	234
Four wheelers	514
Heavy vehicles	156

Table No 4.1.2:- Location B	
vehicles	No of vehicles
Two wheelers	380
Three wheelers	292
Four wheelers	462
Heavy vehicles	232

Table No 4.1.3:- Location C	
vehicles	No of vehicles
Two wheelers	430
Three wheelers	454
Four wheelers	442
Heavy vehicles	144

Table No 4.1.4:- Location D	
vehicles	No of vehicles
Two wheelers	90
Three wheelers	156
Four wheelers	74
Heavy vehicles	34

4.2 Pedestrian Study

- Origin: khanda colony junction
- Time:5:30 - 6:00p.m (30 minutes)

Table No 4.2.1:- Pedestrians crossing at location A	
1st 15 minutes	115
2nd 15 minutes	142

Table No 4.2.2:- Pedestrians crossing at location B	
1st 15 minutes	122
2nd 15 minutes	114

Table No 4.2.3:- Pedestrians crossing at location C	
1st 15 minutes	104
2nd 15 minutes	129

Table No 4.2.4:- Pedestrians crossing at location D	
1st 15 minutes	68
2nd 15 minutes	43

4.3 Vehicles Jumped Signal

- Origin: khanda colony junction
- Time:5:30 - 6:00 p.m (30 minutes)

Table No 4.3.1:- Location A	
Vehicles	No of vehicles jumped signal
Two wheelers	24
Three wheelers	13
Four wheelers	6
Heavy vehicles	11

Table No 4.3.2:- Location B	
Vehicles	No of vehicles jumped signal
Two wheelers	29
Three wheelers	17
Four wheelers	4
Heavy vehicles	9

Table No 4.3.3:- Location C	
Vehicles	No of vehicles jumped signal
Two wheelers	22
Three wheelers	14
Four wheelers	9
Heavy vehicles	12

Table No 4.3.4:- Location D	
Vehicles	No of vehicles jumped signal
Two wheelers	10
Three wheelers	17
Four wheelers	12
Heavy vehicles	6

Traffic study analysis

Fig 4.1.1 Traffic Study For TWO Wheeler

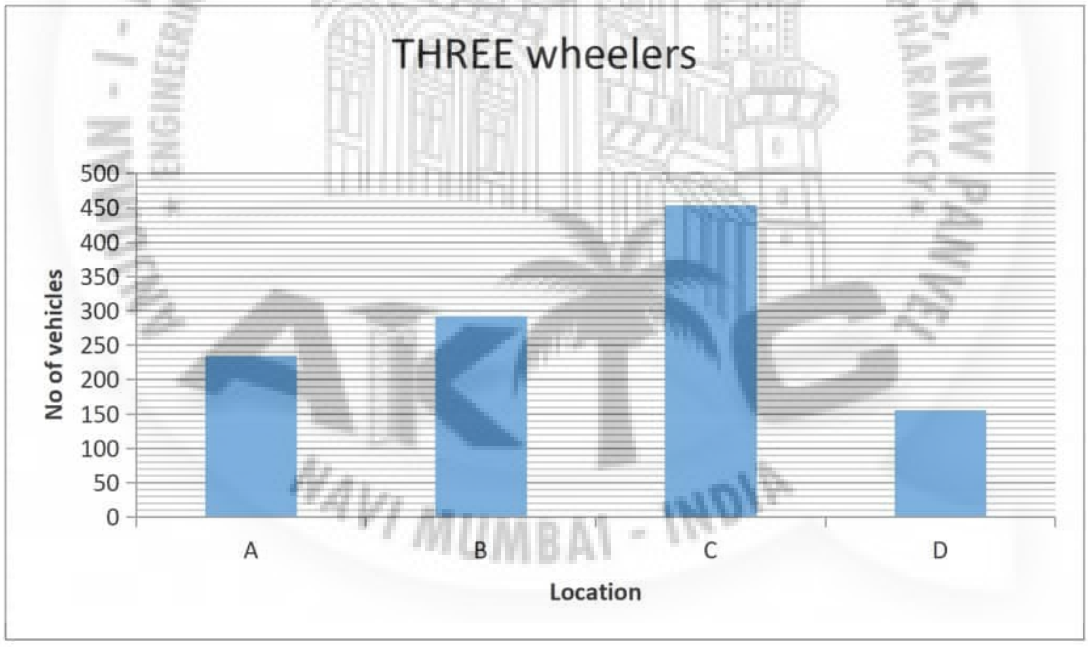


Fig 4.1.2 Traffic Study For THREE Wheeler

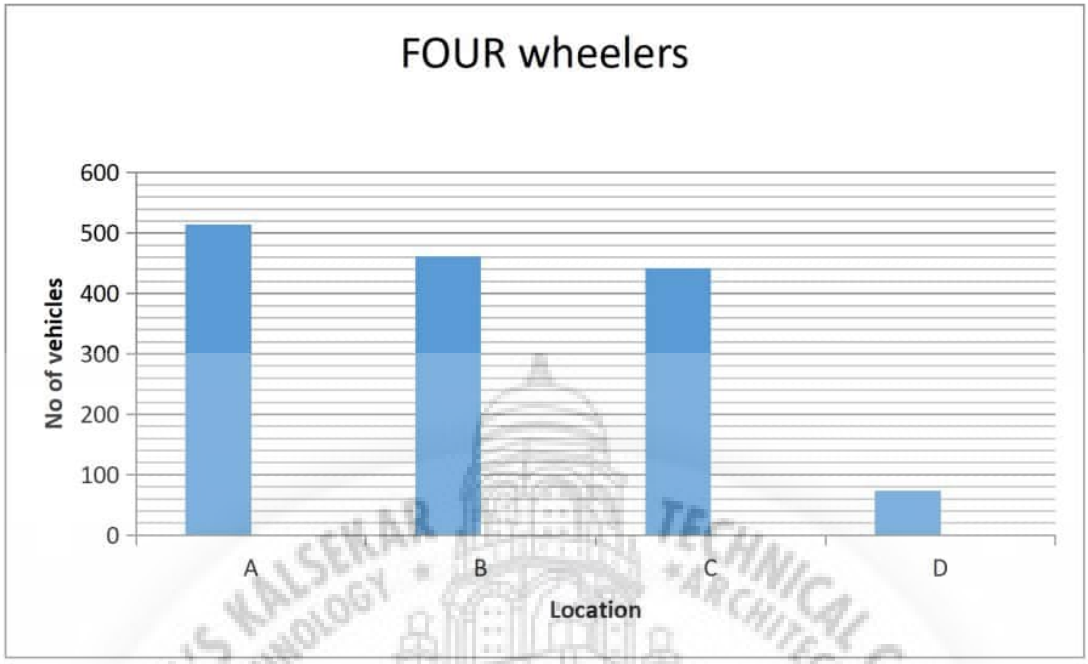


Fig 4.1.3 Traffic Study For FOUR Wheeler

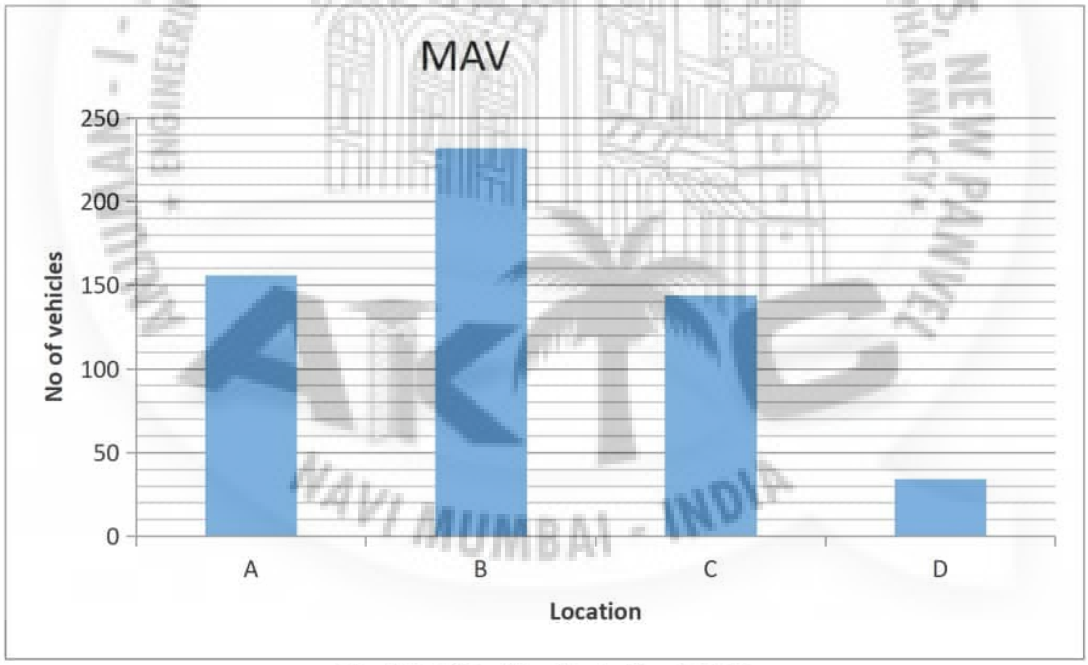


Fig 4.1.4 Traffic Study For MAV

Vehicles Jumped Signal analysis

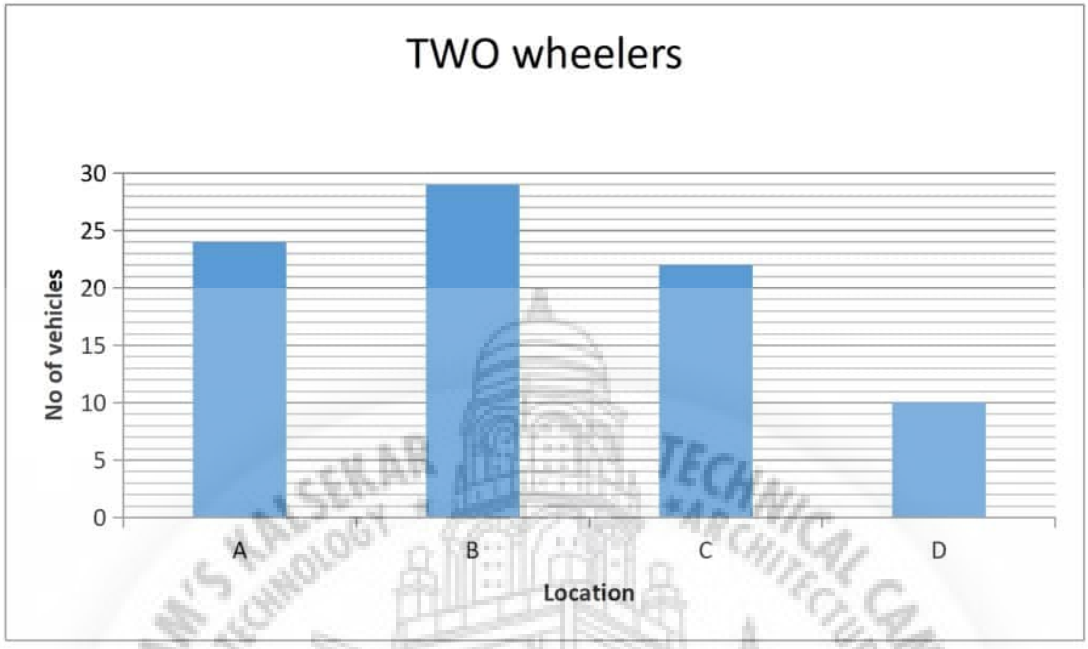


Fig 4.3.1 TWO Wheelers jumped signal

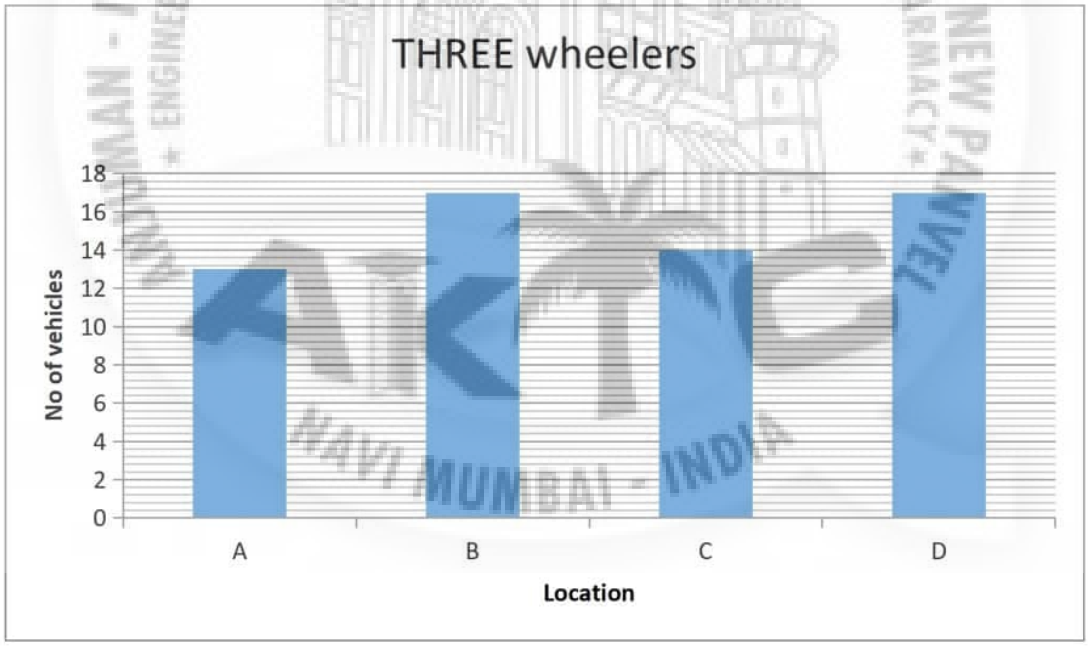


Fig 4.3.2 THREE Wheelers jumped signal

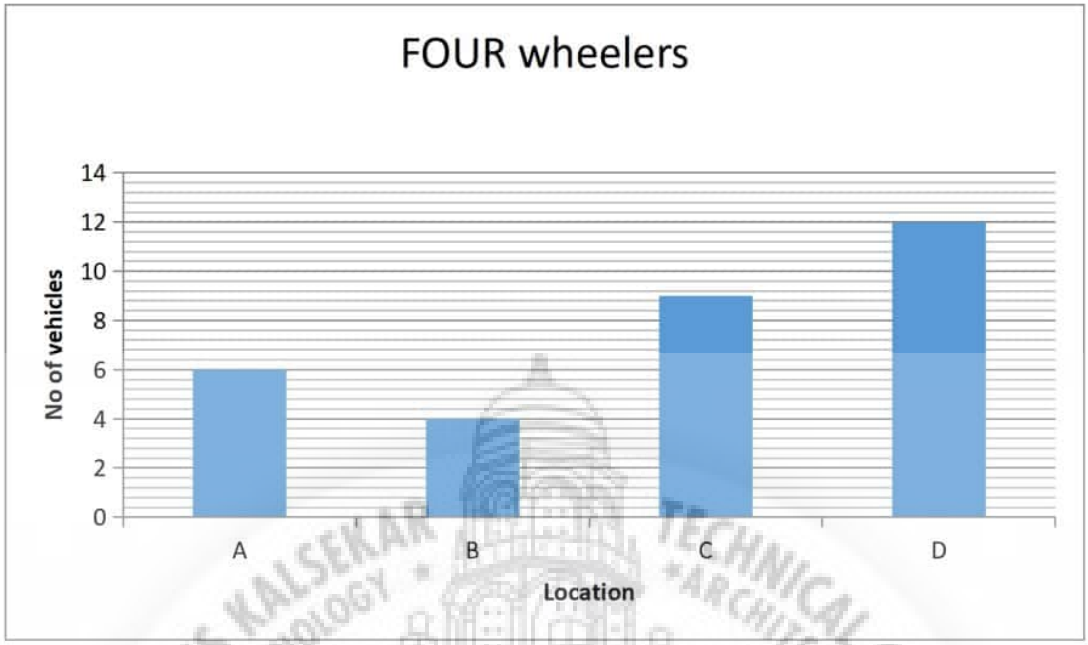


Fig 4.3.3 FOUR Wheelers jumped signal

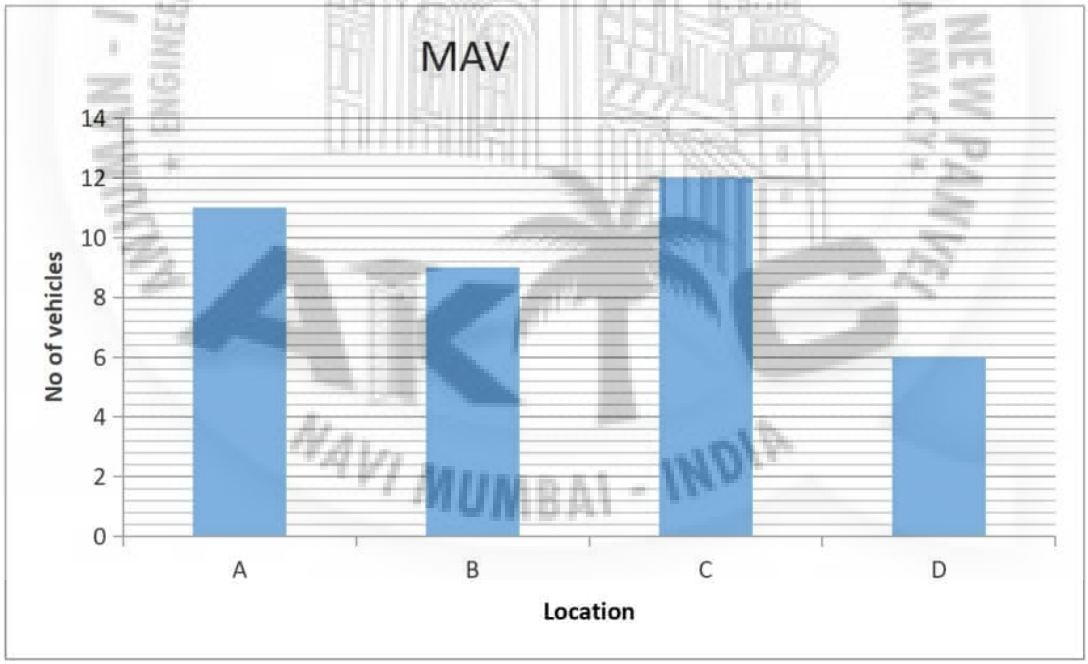


Fig 4.3.4 MAV jumped signal

Chapter 5

Remedial measures

5.1 Remedial measures provided :

The remedial measures that can be provided as per different traffic studies and surveys are as follows:

- Continuous maintenance.
- Barriers should be placed in parts.

5.2 Remedial measures at personal level :

Guide people through following ways:

- **Seminar in schools and colleges:-** Prepare Presentation on road awarness and traffic rules then visit schools and colleges to aware the students and teachers.
- **Provide Sign Boards:-** Prepare a sign boards which shows the barrier or gate at specific interval to guide pedestrians and vehicles.

Chapter 6

Result and Conclusion

Through out the analysis from the past and recent studies and the data that have been collected from the various surveys at khanda colony junction it is found that the proposed technology will be feasible and applicable at khanda colony junction.

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