



## A CASE STUDY OF BLACK SPOTS AT MANGALORE CITY AND PROPOSAL OF MITIGATION MEASURES

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### ABSTRACT

*Transportation is responsible for the development of civilizations from very old times by meeting travel requirement of people and transport requirement of goods. An accident black spot is a term used in road safety management to denote a place where road traffic accidents have historically been concentrated. The present work deals with the study of BLACK SPOTS (accident prone location) in Mangalore city by collecting past Five-year First Investigation Reports from Mangalore City Police station and analysed to find the major causes for accidents.*

*The various parameter which causes for accidents are studied and the engineering mitigating measures are proposed to resolve accident prone location or Block Spot*

**KEYWORDS: BLACK SPOT, MITIGATION MEASURE, PAVEMENT DISTRESS**

### I. INTRODUCTION

Road safety is an issue of national concern, considering its magnitude and gravity and the consequent negative impacts on the economy, public health and the general welfare of the people. Today, Road Traffic Injuries are one of the leading causes of deaths, disabilities and hospitalizations, with severe socioeconomic costs, across the world. An unfortunate incident that happen unexpectedly and unintentionally typically resulting in damage or injury is termed as Accident. Accidents, tragically, are not often due to ignorance, but are due to carelessness, thoughtlessness and over confidence.

### ACCIDENT SCENARIO IN MANGLORE

Mangalore has grown exponentially in the past two decades. The Booming Software, Biotech and manufacturing industries have magnified the requirements of basic and service employments, which generated and magnified urban sprawl into problematic proportions. Improvement in the quality of life along with substandard public transportation has resulted in spiralling growth of private automobiles. The resultant offshoot among the worst in the world. Road accidents have registered a sharp increase recently following rapid growth in vehicle ownership. The comparative data with regard to the Place of Occurrence of road **accidents** which is reported from three Traffic Police Stations of **Mangalore** city reveals that more than 41 percent of the road **accidents** were reported in eleven places in and around **Mangalore** city.

### BLACKSPOT

There is no universal definition of accident locations on roads, commonly termed Black spots, which means that the definition of Black spot is open to much speculation. The traditional definition considered that the Black spot as a place where a high number of accidents are found or the locations where the accidents are occurring more frequently had to be identified and were marked as the Black spots.

### FACTORS INFLUENCING ROAD ACCIDENTS

These can be grouped into following.

1. Vehicle related factors: this may be due to inherent design limitations or defects to lack of maintenance, failure of components like brakes, tires and lighting. Visibility, speed and vehicle lighting are also important.
2. Road related factors: this includes pavement design and conditions, horizontal curves, insufficient lane and shoulder width, vertical curves.
3. Road user related factors: psychological factors of the users, alertness and intelligence, patience of driver, drivers experience and age
4. Environmental related factors: rain, reduced visibility, bad weather etc. heavy fog and mist and heavy rain also plays important role.

**MITIGATION OF ACCIDENTS BY THREE E'S**

1. Engineering
2. Enforcement
3. Education or educating the people

Accidents not only depend upon vehicular or environmental conditions but also depend on engineering infrastructural facilities provided. From the accident data, it has been witnessed that 48% of the accidents were occurring at day time and 52% of accidents are occurring at night time.

**ENGINEERING FACILITIES INCLUDE:**

1. **Road design:** the geometric design features of the road such as sight distance, width of the pavement, horizontal and vertical alignment design details and intersection design elements are checked and corrected if necessary. The pavement surface characteristics including the skid resistance values are checked and suitable maintenance steps are taken to bring them up to the design standards.
2. **Preventive maintenance of vehicles:** the braking system, steering and lighting arrangements of vehicles plying on the roads may be checked at suitable intervals and heavy penalties levied on defective vehicles.
3. **Before and after studies:** the record of accidents and their patterns for different locations are maintained by means of collision and condition diagrams. After making the necessary improvements in design and enforcing regulation, it is again necessary to collect and maintain the record of accidents "before and after" the introduction of preventive measures to study their efficiency.
4. **Road lighting:** proper road lighting can decrease the rate of accidents during night, due to poor visibility. Lighting is particularly desirable at intersections, bridge sites and at places where there are restrictions to traffic movements.

**Education**

Road safety knowledge and awareness will be created amongst the population through Education, training and publicity campaigns. Road safety education will also focus on school Children and college going students, while road safety publicity campaigns will be used to propagate good road safety practices among the community. The Government should encourage all professionals associated with road design, road construction, road network management, traffic management and law enforcement to attain adequate knowledge of road safety issues.

The Government has been undertaking various Publicity measures in the form of telecast/broadcast of T.V. spots/Radio jingles, organizing Road Safety Week, seminars, exhibitions, all India essay competition on road safety, printing of calendars, Children activity books, book on signage and sign, posters, etc., containing road safety messages for various segments of road users viz. Pedestrians, cyclists, school children, heavy vehicle drivers, etc.

All the people in our country are not educated enough to understand the requirement of road safety. Hence the measures taken should reach every common man. It can be fulfilled by organising various awareness programs such as street plays regarding the road safety or traffic rules.

**Enforcement**

Enforcement of the traffic rules and regulations on the road users and maintaining the facilities provided plays an important role in the mitigation of accidents. The measure includes:

1. Speed control: to enable drivers of buses to develop correct speed habits tachometers may be fitted so as to give the record of speeds.

Traffic control devices: signals may be re-designed or signal system be introduced if necessary. Similarly, proper traffic control devices like signs, markings or channelizing islands may be installed wherever found necessary

**OBJECTIVES**

- (1) To study the causes of accidents and to suggest corrective treatment at potential location.
- (2) To evaluate existing designs.
- (3) To carry out before and after studies and to demonstrate the improvement in the problem.
- (4) To make computations of financial loss.
- (5) To give economic justification for the improvements suggested.

## II. RESEARCH METHODOLOGY

### THE METHODOLOGY ADOPTED FOR THE STUDY IS AS FOLLOWS:

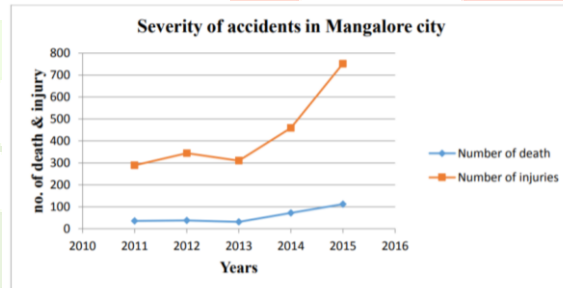
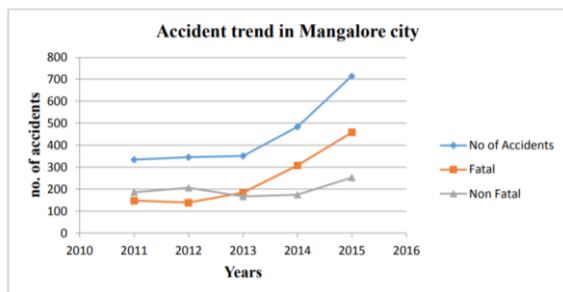
1. To collect accident data of past 5 years in Mangalore city from police department to identify severity of black spot.
2. The data which are collected are called as secondary data.
3. Incorporation of data to MS Excel.
4. Visual survey is determined at the black spot to identify the causes for the accident.
5. To find out different methods to prioritize hazardous locations.
6. Pavement condition survey is performed to determine actual road condition.
7. Traffic volume survey is done at the identified black spot in order to know the number of vehicles crossing a section of road per unit time at any selected period.
8. The analysis of black spot is done to check the severity in future.
9. After analysing the black spot suitable remedial measures may be proposed.
10. The proposed measures may prove to be effective if they are implemented

## III. ANALYSIS OF COLLECTED DATA

### IDENTIFICATION OF BLACK SPOTS

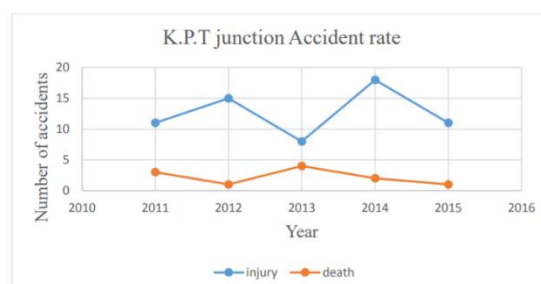
Accident data for Mangalore city is obtained from Mangalore city Police Station and obtained data are tabulated. Black spot locations are identified based on the accident data collected from police department and general interviewing with local people. Mangalore city is an accident-prone area as it contains four black spots of the Mangalore city namely, K.P.T circle, Mukka junction, Kulai junction. The data was incorporated into MS excel and the trends of accident growth are obtained from the same which revealed the importance of accident study in the identified black spots. Also forecasting of the collected data was done in order to know the future predictions. The following tables show the accident scenario of Mangalore city. Day by day the accidents in the Mangalore city is increasing. Comparatively year wise the accident rate in the city is been increasing, as we can observe in the below table, total no. of accidents in the year 2011 is 334 while in 2015 it has been increased to 715 which is double the no, of accidents in 2011. The death rate caused in the accidents itself shows the severity of accidents in the city. From the below it can be observed that the death rate has been increased nearly four times from the year 2011 to 2015. The trends in accidents can be well understood by referring to the charts shown below.

### SCENERIO OF MANGALORE



### K.P.T junction

K.P.T circle is a main junction point in Mangalore city where Edapalli- Panvel national Highway meets with the road going towards Bajpe International Airport. As a result the junction experiences a lot of traffic in the entire day. Accidents are taking places in this junction because of meeting of one national highway (NH-66) and major district road, Because of this condition maximum number of vehicles moment takes place and there is no traffic signal at the junction. Even with the provision of channelizing islands also the traffic accidents have not decreased significantly. Also due to very high traffic during the entire day the Police men are finding it difficult to control the traffic manually. The radius of roundabout is very less which causes traffic problems and led to the accidents. Set back distance at the junction is insufficient. Even the road condition is also not as good as it contains pot holes, rutting etc.as shown in fig below fig

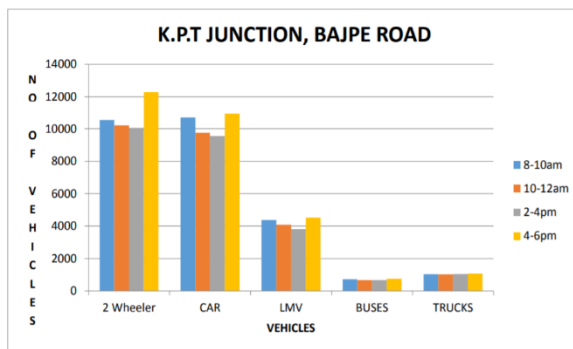
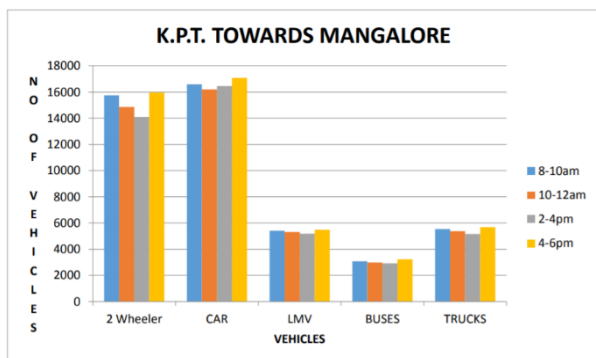
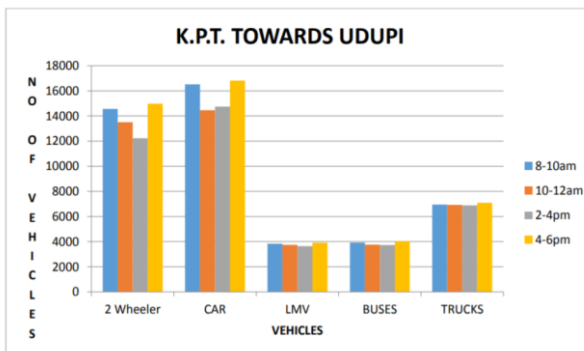


**PHYSICAL DATA ANALYSIS:** The study of traffic survey, origin and destination, visual survey and distress will help us to know the traffic flow pattern, number of vehicle passing per each hour at the junction, the direction of which the vehicles move towards, the origin and destination of the vehicle, and general character of accident prone area for deciding the most predominant parameter causing accidents

**TRAFFIC VOLUME SURVEY:** Traffic volume is the number of vehicles crossing a section of road per unit time at any selected period. Traffic volume is a true measure of the relative importance of roads to decide the priority for improvement and expansion. It is used in control of existing facilities and also for planning and designing the new facility. The traffic volume study at K.P.T junction is carried out and graphs for weekdays and weekends were plotted, due to traffic volume study it can be concluded that that the road carries a heavy wheel load and the road is damaged and it experiences the rutting and pot holes.

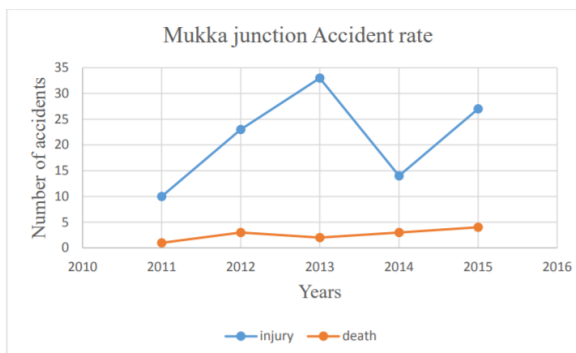
**VISUAL SURVEY AND TRAFFIC SURVEY RESULTS**

| PARAMETER         | YES  | NO   | COMMENTS                         |
|-------------------|------|------|----------------------------------|
| 1. SIGNALLED      | ---- | NO   |                                  |
| 2. SIGN POSTS     | YES  | ---- | Only Informatory                 |
| 3. ROAD HUMPS     | ---- | NO   |                                  |
| 4. SPEED BREAKER  | ---- | NO   |                                  |
| 5. BARRICADES     | ---- | NO   |                                  |
| 6. FREE LEFT      | YES  | ---- | Complete                         |
| 7. ROUNDABOUT     | YES  | ---- |                                  |
| 8. STREET LIGHTS  | YES  | ---- | Along the divider, not in circle |
| 9. ZEBRA CROSSING | YES  | ---- |                                  |
| 10. FOOT PATHS    | ---- | NO   |                                  |



**MUKKA JUNCTION**

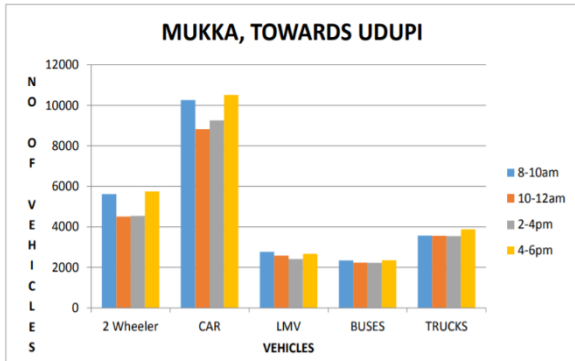
Mukka junction is a location on NH-66 near to which Srinivas School of Engineering is located. The presence of srinivas hospital as well as a petrol pump within a road stretch of 500m from the junction has resulted in the wrong movement of vehicles. As a temporary measure barricades are provide in this junction. One median opening is provided for the convenience of changing the direction at an interval of 10 m from the college as shown in Figure. Hence, the road user moves in wrong direction to change the track direction and has resulted in increased accident rate as shown in fig



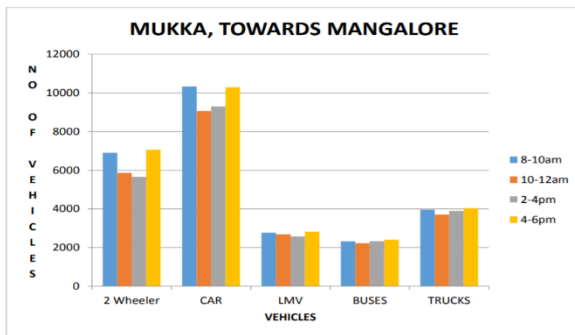
**PHYSICAL DATA ANALYSIS:** The study of traffic survey, origin and destination, visual survey and distress helps to know the traffic flow pattern, number of vehicle passing per each hour at the junction, the direction of which the vehicles move towards, the origin and destination of the vehicle, and general character of accident prone area for deciding the most predominant parameter causing accidents.

**TRAFFIC SURVEY:** Classified traffic volume counts was carried out on normal working day and as well on weekends to assess the total daily traffic, hourly variation, composition, peak hour volumes. From the surveys it was observed that the road stretch under consideration carries highly mixed traffic of both fast moving vehicles (such as cars, jeeps, vans, scooters, motor cycles, tempos, trucks, LMVs and buses) and slow moving vehicles (cycles, tractors, animal drawn carts etc.)The average daily traffic (ADT) varied from 11130 vehicles to 27676 vehicles.

**VISUAL SURVEY AND TRAFFIC SURVEY RESULTS**

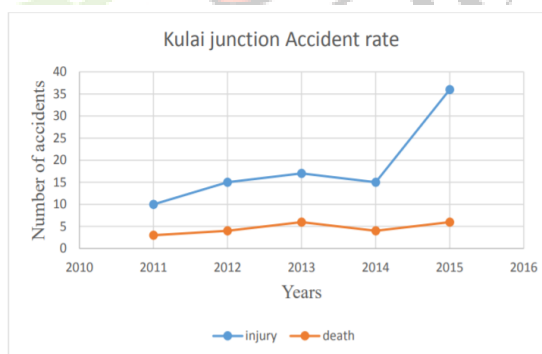


| PARAMETER         | YES  | NO | COMMENTS            |
|-------------------|------|----|---------------------|
| 1. SIGNALLED      | ---- | NO |                     |
| 2. SIGN POSTS     | ---- | NO | Only Informative.   |
| 3. ROAD HUMPS     | ---- | NO |                     |
| 4. SPEED BREAKER  | ---- | NO |                     |
| 5. BARRICADES     | YES  |    | On Both Sides.      |
| 6. FREE LEFT      | ---- | NO |                     |
| 7. ROUNDABOUT     | ---- | NO |                     |
| 8. STREET LIGHTS  | YES  |    | Along the Dividers. |
| 9. ZEBRA CROSSING | ---- | NO |                     |
| 10. FOOT PATHS    | ---- | NO |                     |



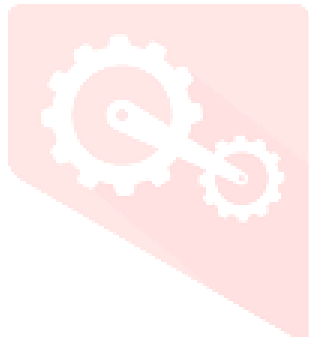
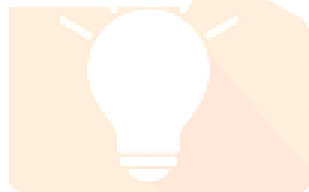
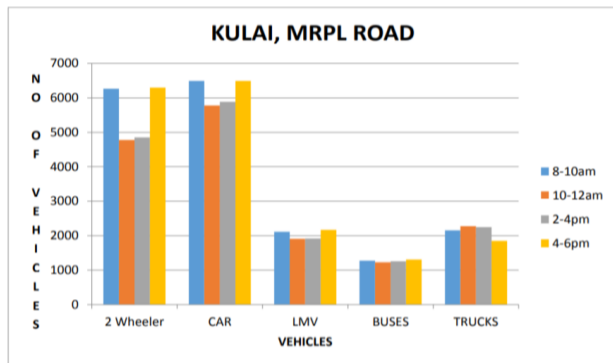
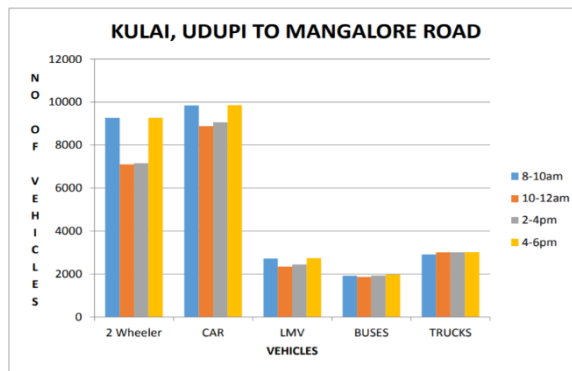
**KULAI JUNCTION**

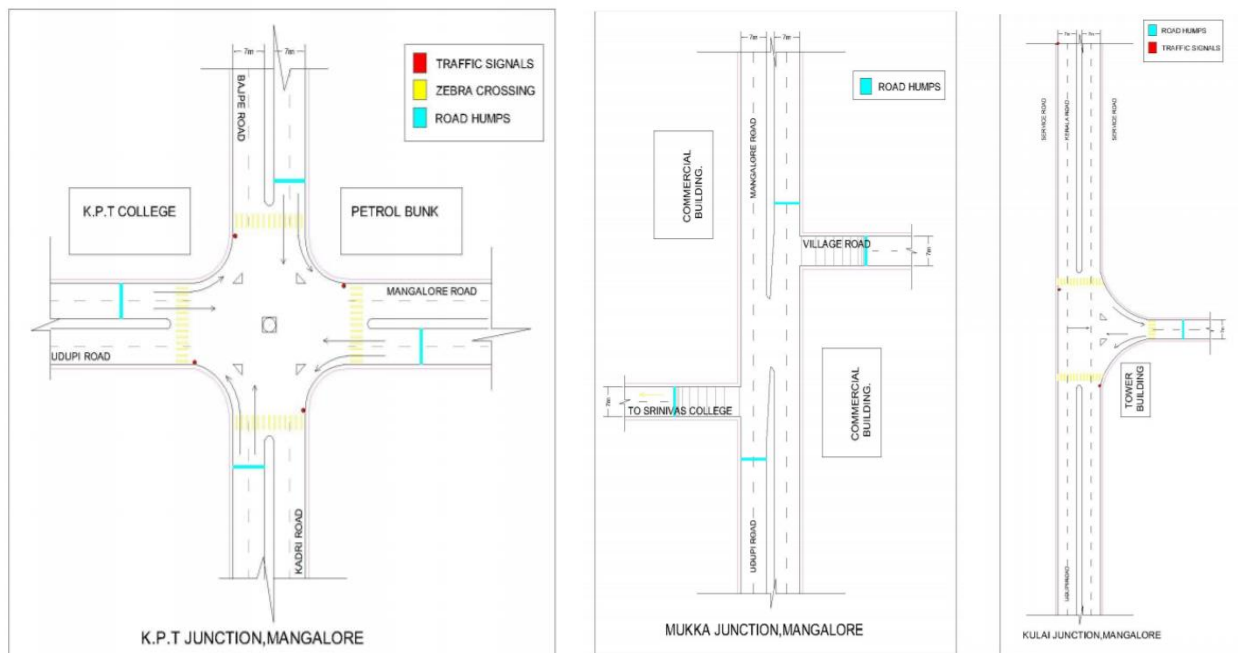
Kulai is a ward under municipal limits of Mangalore city Corporation. It is near to Surathkal town. It is a residential cum commercial area. The Kulai junction connects to Mangalore Refinery and Petrochemicals Limited (MRPL). It is to the left while travelling from Udupi to Mangalore. Lots of heavy vehicles take this route to reach MRPL. As a temporary measure barricades are already installed at this junction. The present scenario of Kulai junction is shown in below Fig



**VISUAL SURVEY AND TRAFFIC SURVEY RESULTS**

| PARAMETER         | YES  | NO   | COMMENTS                           |
|-------------------|------|------|------------------------------------|
| 1. SIGNALLED      |      | NO   | ----                               |
| 2. SIGN POSTS     | YES  | ---- | Only Informative signs             |
| 3. ROAD HUMPS     | ---- | NO   | ----                               |
| 4. SPEED BREAKER  | ---- | NO   | ----                               |
| 5. BARRICADES     | YES  | ---- | Only two                           |
| 6. FREE LEFT      | ---- | NO   | ----                               |
| 7. ROUNDABOUT     | ---- | NO   | Only light pole                    |
| 8. STREET LIGHTS  | YES  | ---- | Along the divider. not in junction |
| 9. ZEBRA CROSSING | YES  | ---- | Present only in NH                 |
| 10. FOOT PATHS    | ---- | NO   | ----                               |



**MITIGATION MEASURES****ENGINEERING SOLUTION****IMPROVISED JUNCTIONS****IV. RESULTS, DISCUSSION AND CONCLUSION****RESULTS AND DISCUSSION**

The severity of accidents studied based on the data collected from the Police Department. Traffic surveys, road inventory data collection, alignment surveys and local enquiries were carried out to identify the major causes of accidents.

A few short-term measures include providing adequate road furniture, speed breakers, lane markings, pedestrian crossings and good pavement maintenance are proposed as a mitigation measure.

The long-term measures involve widening of the pavement and shoulders, traffic signal provision of road humps and the underpass are proposed as a mitigation measure.

In addition, restrict the illegal parking at intersection.

Once the proposed measures are implemented, the future studies may be carried out to assess the improvised impact at the identified black spots by proposed mitigation measures.

**CONCLUSION**

The country's road safety campaigns are inadequate and often limited to festive seasons. At other times, such campaigns are often limited to media and roadside slogans like "drive carefully", "accident kill more passengers", "drive to stay alive", and "only living celebrates". For these campaigns to be effective, they must be year-round and not just limited to festive seasons.

Road safety requires taking into account the general problem posed by the heterogeneity of the traffic mix different categories of vehicles. "Health of the nation is more important than the wealth of the nation". Road safety is a major public health concern, so attention must be given to road safety measures. Strict implementation of road safety measures reduces the road accidents injuries and fatality.

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