

Accident analysis and black spot detection on NH544- Karukutty to Athani Road Stretch

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Abstract - Accidents are those incidents which are not natural, but are a result of various actions. Various factors that are responsible for the causation of an accident must be identified and remedial measures should be taken to avoid such occurrences in the future. Various traffic studies like road inventory, signal inventory, traffic volume count, pedestrian volume count, spot speed study, speed and delay study, accident study etc. helps in choking out various improvement measures and thereby avoiding chances of accidents in future. Accident data collection involves identifying the cause and type of vehicles involved in the accident which in turn helps in implementing accident preventive measures in the field of road design and other features. The objective of this study is to locate the accident prone area on a selected road stretch, determine the probable reasons for accidents, identify the black spot and suggest remedial measures. In this work accident analysis and black spot detection is conducted on a selected stretch of NH-544 (Karukutty - Athani).

Key Words: Accident, Road Safety, Black spot, Accident Severity Index, Weighted Severity Index

1. INTRODUCTION

Road safety is one of the most important areas of concern throughout the world as the number of accidents and fatalities are showing an upward trend over the past few years. Not only ignorance but also carelessness, thoughtlessness and over confidence can be attributed to be the main reasons for these accidents. Number of motor vehicles on the roads is reaching an all time high value, so is the number of accidents and fatalities. Complex flow pattern, mixed traffic conditions, large pedestrian volume and failure in enforcing traffic laws alleviate the problem. The major outcomes of road accidents are loss of life, injuries and damage to property. Traffic engineers are the ones responsible for providing safe traffic movements, frame traffic management measures and create awareness among the public on the importance of traffic laws. It is not possible to totally prevent road accidents, but adopting suitable traffic management measures can reduce the severity of accidents to a greater extent. Once an accident occurs, proper study must be conducted to find out the probable reason for that accident. If a number of accidents are due to a same reason, some remedial measures must be taken to avoid accidents in the future. Accident black spot detection is the process of determining a point on the road stretch where

the maximum number of accidents has occurred. Certain indices may be used to rank the major junctions on the selected road stretch. Based on those indices, the black spot on that stretch is identified. Detailed traffic study is conducted at that black spot and the probable reason for accidents is determined. Suitable remedial measures that would prevent accidents in future on that same spot are also suggested. Some of the major factors that have an influence on accidents are:

Vehicle – Failure of vehicle brake, steering system, tyre burst or puncture, absence of windscreen wipers, issues to vehicle lighting system can lead to accidents.

Road – Available sight distance, alignment of road, gradient, width and condition of carriageway, width and condition of shoulders, drainage factors, and pavement surface characteristics are causative factors of accidents.

Road users – Carelessness from road users like vehicle drivers, pedestrians, fatigue, influence of alcohols and drugs, jumping of traffic signals may lead to accidents.

Environmental factors – It includes weather conditions like rain and snow which affect the visibility on roads and change pavement surface conditions like skid resistance.

Other causes – Some miscellaneous causes of accidents include lack of visibility of roads due to advertisement boards, failure to close gates at level crossings, moving animal groups on roads without having sufficient number of men to attend them.

Accident black spot is a particular section on a road stretch which is considered as a high risk location involved in many vehicle crashes. Different indices may be used to rank the major junctions on a road stretch and finally the black spots may be determined based upon the ranking obtained.

In this study, the selected road stretch is from Karukutty to Athani on NH544 (old NH 47) which is an accident prone area. The number of accidents on the selected road stretch is very high compared to other stretches. Probable reasons for this variation may be increased pedestrian traffic due to the presence of a number of educational institutions on this stretch. Accident data of the road stretches are kept zone wise in police stations which control the traffic movements under their jurisdiction. First investigation report related to

an accident gives an idea about the probable cause of that accident and the outcome. Black spot identification is essential to sort out the traffic problems in the stretch and avoid accidents of similar nature in the future.

2. METHODOLOGY

Accident data for the years 2015, 2016 and 2017 were collected from Angamaly and Nedumbassery police stations. Study stretch was finalized based on the number of accidents and considering the priority of the roads. The accident details for the years 2015, 2016, 2017 of the selected road stretch were collected from Angamaly and Nedumbassery police stations. Accident data obtained involves the type of collision, result of collision and the time of occurrence of accident. Following flow chart gives an idea about the steps followed in this work.

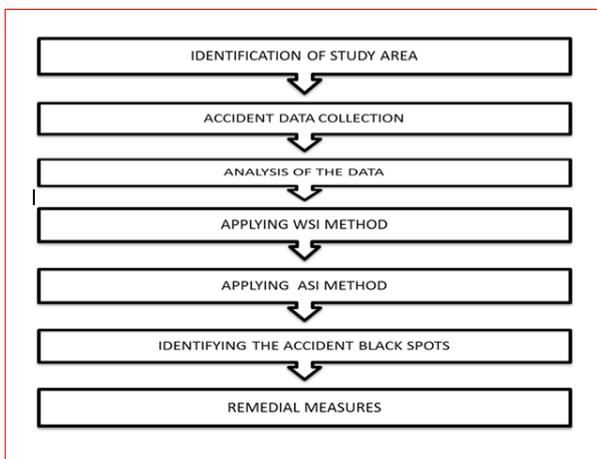


Fig-1: Flow chart of methodology

2.1 Identification of study area

The road stretch for the analysis is NH 544(old NH 47) from Karukutty(10.2270° N, 76.3749° E) to Athani(16.7269° N, 75.0641° E) which is about 10 km long. The selected road is under National Highway Authority of India (NHAI). This particular stretch was selected after conducting preliminary survey. Severity of accidents occurred in the particular road stretch, presence of schools and colleges nearby, geometry of the road were the main factors considered. This stretch has a higher length of straight roads which become very busy especially during the peak hours. Traffic density has gone up over the years. The number of accidents and fatalities has also increased in the recent years. Increase in speed of vehicles may be considered as a major reason for accidents. The map of the study stretch is given below:

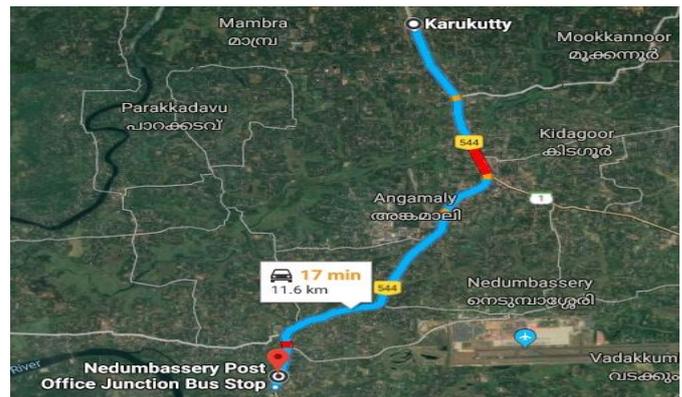


Fig-2: Location map of study area

2.2 Accident Data Collection

In order to determine the accident prone locations, the accident reports for the past three years (2015–2017) were collected from the concerned police stations. From the data obtained, we can group the accidents into different categories such as minor injuries, major injuries, number of persons killed etc. The spots on the road where most of the accidents usually occur can be identified. These spots could be listed and some indices could be worked out to identify the spot where there is a serious concern which is known as the black spot. Probable reason for the accidents on that spot could be identified by having a site visit and collecting the basic details regarding that spot.

2.3 Analysis of the Data

The data collected from police stations was sorted for the entire study stretch based on type of vehicle involved in the accident, time of occurrence of accident, gender of affected people and age group of affected people. Graphs were plotted for each category and some conclusions were drawn from the analysis.

2.3.1 Number of accidents v/s Type of vehicle involved

Traffic along the selected road stretch is mixed in nature. So the accidents on the stretch involve different types of vehicle. It is clear from the following graph that the major types of vehicles involved in accident are car and motorcycle. The reason for this trend may be that the number of this category of vehicles on the road is higher compared to other vehicle classes. Higher speed of this vehicle class may be another contributing factor.

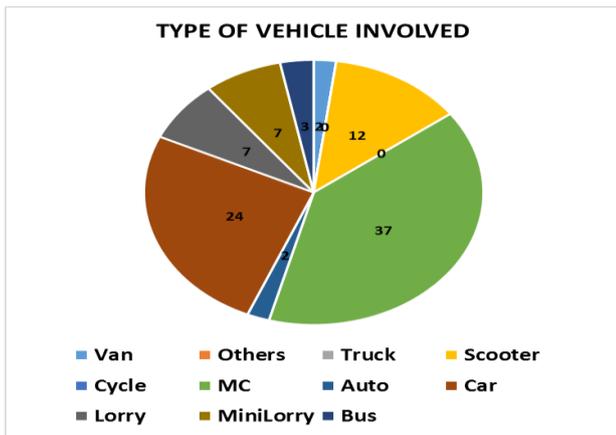


Fig-3: Graph showing type of vehicles involved in accident

2.3.2. Accident occurring time in day or night

From the obtained data, it is clear that majority of accidents occurred during day time. Traffic flow is very high during the peak hours due to increased number of work trips and educational trips. Chances of accidents during night time are high due to the over speeding of vehicles and lack of visibility. Since the selected road stretch is a part of National Highway, street lighting is proper and road stretch is comparatively straight which helps drivers to see the road and furniture clearly.

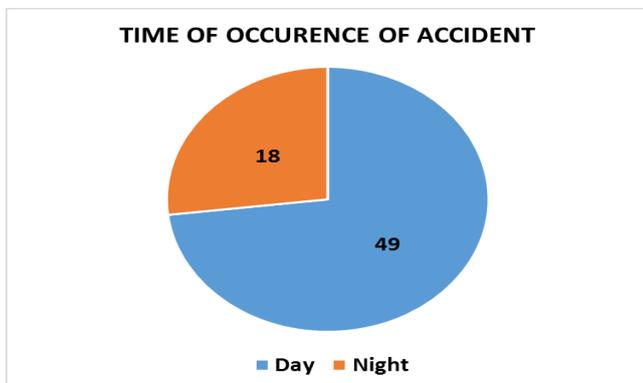


Fig-4: Graph showing the time of occurrence of accidents

2.3.3. Gender of persons involved in accident

It is a common trend that women will be more careful on roads compared to men. Women drivers and pedestrians are reluctant in taking risks on roads. Collected data also reveals the same trend that is men are more involved in accidents on the selected stretch compared to women.

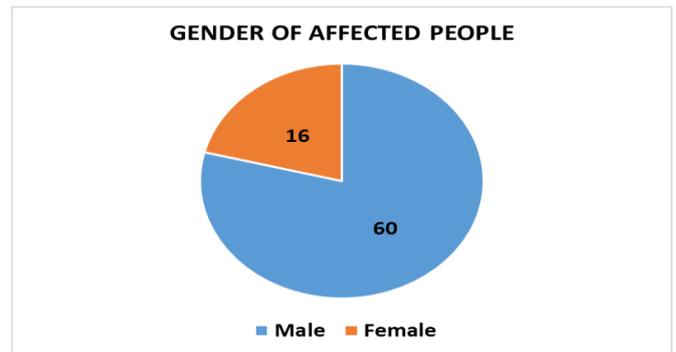


Fig-5: Graph showing the gender of affected people

2.3.4. Number of accused v/s age

Old age people are more careful on roads. Children will be always accompanied by elders. So the age group which is more prone to accidents on roads is the working class and youngsters. Youngsters are involved in rash driving and they are careless while crossing roads. Working class has to stick to the time constraint which forces them to violate traffic rules.

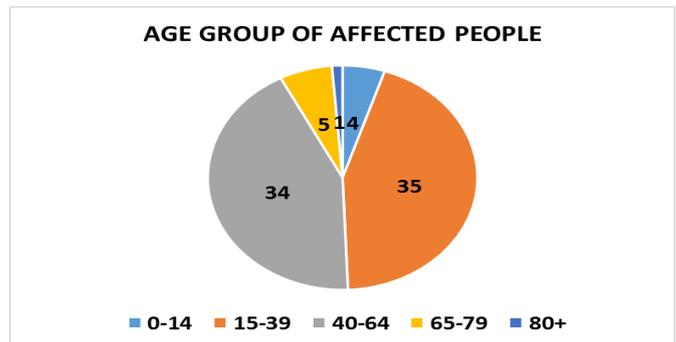


Fig-6: Graph showing age group of affected people

2.3.5. Analysis by Weighted Severity Index (WSI)

Accident data for three years (2015-2017) were collected from the police stations and four major spots were identified as crucial based on the obtained data. Weighted severity index is a dimensionless value used to rank black spots based on the number of people involved and severity of accidents in that location. It depicts the hazardousness of the spots on a road stretch. WSI value is calculated using the following equation.

$$WSI = (41 \times K) + (4 \times GI) + (1 \times MI)$$

Where,

K- Number of persons killed

GI- Number of grievous injuries

MI- Number of minor injuries

2.3.6. Analysis by Accident Severity Index (ASI)

Accident severity index is a dimensionless value which takes into account the number of accidents based on their severity. A weightage is also provided with number of fatal accidents having maximum weightage and number of minor accidents having minimum weightage. The following equation is used to calculate accident severity index.

$$ASI = (N_f \times W_f) + (N_s \times W_s) + (N_m \times W_m)$$

Where,

N_f - Number of fatal accidents at the spot in last 3 years

W_f - Weightage assigned to fatal accidents = 6

N_s - Number of serious accidents at the spot in last 3 years

W_s - Weightage assigned to serious accidents = 3

N_m - Number of minor accidents at the spot in last 3 years

W_m - Weightage assigned to minor accidents = 1

Table-1: Places with WSI and ASI values

PLACE	WSI	ASI
Karukutty	744	188
Angamaly signal	676	63
Kariyad	678	98
Athani	530	140

2.3.7. Ranking of Black spots

The ranking of black spots on the selected road stretch was done based on the WSI and ASI values. WSI values consider the number of people involved in accidents and ASI values take into account the severity of accidents. From the obtained results, Karukutty is the spot having largest WSI and ASI value which confirms that Karukutty is the accident black spot on the selected road stretch.

Table-2: Ranking of black spots based on WSI values

RANK	SPOT
1	Karukutty
2	Kariyad
3	Athani
4	Angamaly Signal

2.3.8. Remedial measures

A spot speed study and a pedestrian survey were conducted at Karukutty junction which was identified as the black spot on the selected stretch. From the study, it was found that over speeding of vehicles and high pedestrian crossing during peak hours may be the probable causes of accidents in that junction. Some of the remedial measures that may reduce accidents at the spot are:

- Appointing a traffic police officer to assist pedestrian crossing during peak hours
- Provision of speed breakers at proper intervals
- Proper sign boards and boards showing accident history on the spot
- Providing pedestrian flyover
- Provision of signals and a separate phase for vehicles intending to take U turn
- Relocating bus stops to the service road

3. CONCLUSION

The study was conducted to identify the accident black spot on the selected road stretch from Karukutty to Athani on NH544. Determination of black spots and detailed traffic study of those spots is an important step in prevention of accidents. Accident data obtained from police stations were analyzed and Karukutty was found to be the black spot based on WSI and ASI ranking. Spot speed study and pedestrian survey were conducted at Karukutty and the probable causes of accidents were listed out. Remedial measures to reduce the number of accidents were also suggested which include appointing a traffic police officer and installation of traffic signal and speed breakers at the junction.

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