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Assessment of accidental Red Zone spots - A case study of Sangli- Pune highway

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ABSTRACT

The places where maximum number of accident occurs are known as red zone spots. Various studies on road accidents indicate the prevention of road accidents mainly involves in conscious planning, design and operation of roads. One of the most important factors in this method is the systematic identification and treatment of hazardous locations or the accident black spots. In general, the various factors that cause accidents can be broadly categorized into road related, vehicle related and driver related. The various causes of accidents may be due to three factors: - Driver, Vehicle and Road Environment. So for this work we have analyses Sangli-Pune Highway (230km) which is located in Maharashtra State if India. From the accidental data analysis Red zone spots are analyzed

Keywords : - Red zone spots, mitigation, black spot, assessment.

I. INTRODUCTION

India has a well-knit and coordinated system of transport which plays an important role in development of economic activities by promoting fair distribution of produced goods and services and movement of people. The share of transport sector in Gross Domestic Product (GDP) of India is steadily growing. It is one of the key indicators in assessment of socio-economic development of the country. Since traffic accidents are indicator of bottlenecks and other hindrances in smooth flow of traffic, hence NCRB collects detailed data on traffic accidents including road accidents for inferring the trend and patterns of traffic accidents for the

planners to devise appropriate preventive strategies. The Bureau collects data on 'Traffic Accidents' comprising of (i) Road Accidents (ii) Railway Accidents and (iii) Railway Crossing Accidents, as these are the major contributors of accidental deaths.

First of all, road accident data required is to be collected which will include locations of the accident from severity, damages and injury. By studying damages data will sorted e.g. Major, minor or frequency traffic, heavy & light traffic or two wheeler traffic. Then Black spot analysis will be carried out on observed patches. This analysis will give patches which will be considered as accidents hot spots having high risk.

After identifying hot spots, conclusion of reasons, mitigation and alternatives for these needs to be figured out. Purpose of this paper is to analyze / identify hot spot areas on selected road section and find out factors/ causes behind accidents. Once causes are figured out, possible solutions to reduce these road accident occurrences will be proposed.

2. Methodology

The primary data is collected from concerned 5 Police stations. The data from these records of 5 years (2013 - 2017) were extracted from the FIR record:

- Sangli Urban Police Station.
- Sangli Rural Police Station.
- Islampur Police Station.
- Karad Police Station.
- Satara MIDC Police Station.

Sangli – Pune Highway divided in 5 zones and the accident data for each zone was tabulated:

- Zone I: Sangli Bus Stand to Islampur.
- Zone II: Islampur to Karad.
- Zone III: karad to umbraj.
- Zone IV: umbraj to satara.
- Zone V: satara to Pune

Identification of accidental Red zone spot is the procedure to find spots that are particularly dangerous where accidents had occurred historically in this study the identification of such hazardous locations are done based on accidental record available about location of accident, nature of accident, causes of accidents and classification of accidents and others by using various method .

Following are steps in methodology-

1. Primary data collection.
2. Data analysis to identify zones.
3. Zone selection.
4. Identification and factors responsible for accidents.
5. Identify and rank analyzed black spots.
6. Communicate with authority for Improvement.

- Primary & Secondary data :

Any data that an investor collects himself are termed as primary data. Data taken from figures collected by others are termed as secondary data.

- Mean :

The sum of all observations divided by the total number of observations is called as mean.

- Poisson distribution:

A discrete random variable X taking values 0,1,2,3,…is said to follow Poisson distribution with parameter m if its probability mass function (p.m.f) is given by

$$P[X=x] = e^{-m}m^x/x!; \quad x=0,1,2$$

$$m > 0$$

$$= 0 ; \text{ otherwise}$$

X follows Poisson distribution with parameter m is symbolically written as

$p(x) \longrightarrow (m)$. Its p.m.f is denoted by p(x).

$P(x) \geq 0$, for all X. Since $e^{-m} > 0$. Mean = E(x) = m

STUDY AREA

The Study area was carried out at Sangli – Pune Highway is around 230 KM. The study stretch was selected from Sangli to Kolhapur (AH-27) (Pune - Bangalore).

3. Data Analysis-

Mean =[∑ (no. of accidents in years 2013 - 17)]÷ (Total years).

= ∑ (99+73+56+86+59) ÷ (5)

= 373 ÷ 5

= 74.6

Table 1: Total Accidents on Sangli - Pune Road with day/night and Dead/injured

Year	Total Accidents	Dead	Injured	Day	Night
2013	99	35	95	54	45
2014	73	19	73	40	33
2015	56	14	59	31	20
2016	86	35	73	55	36
2017	59	25	77	35	24

Figure 2 : Chart Showing Total Accidents on Sangli Pune Road with details day/night and dead/injured -→

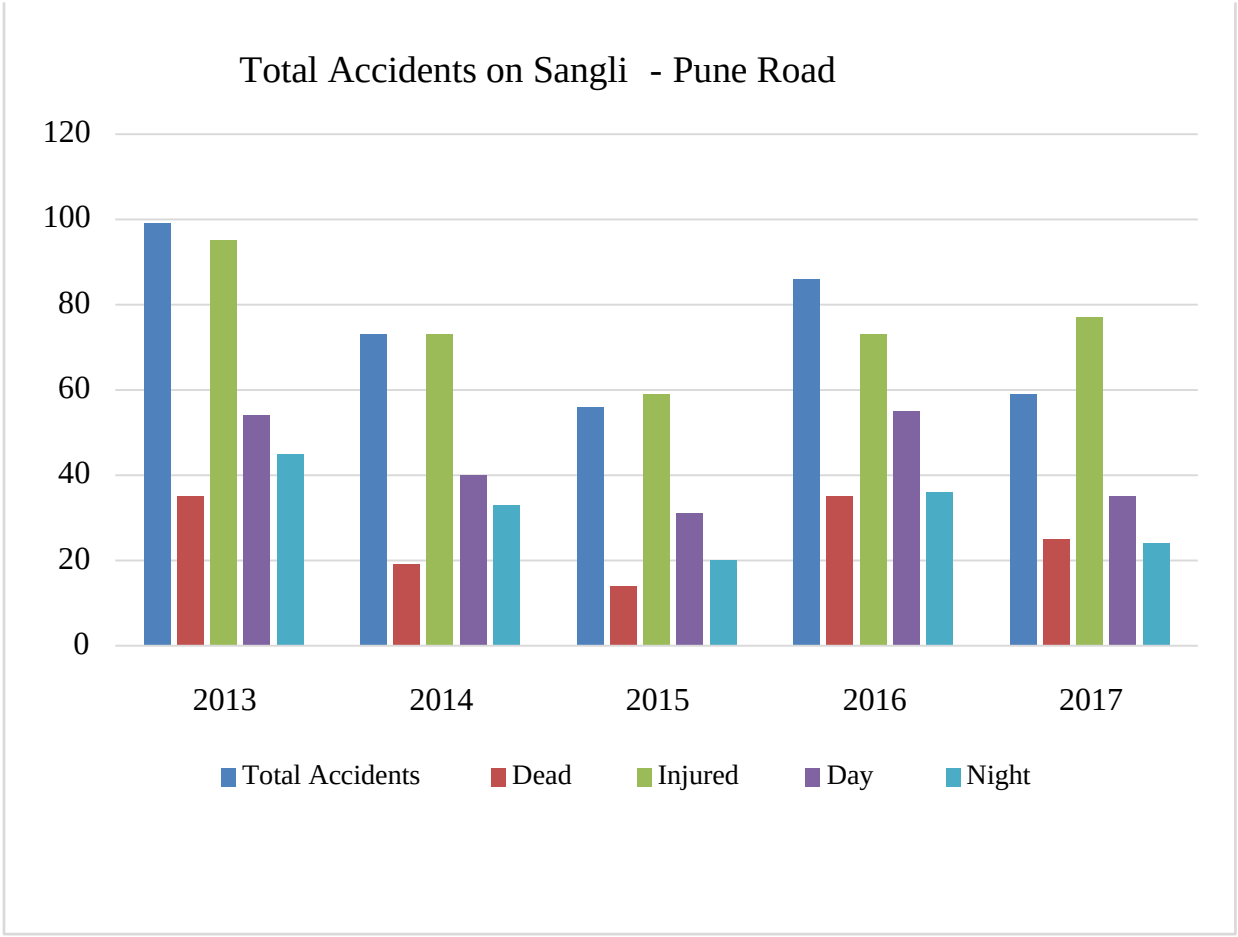

Table 2: Vehicles involved in Accidents on Sangli Pune Road

Sangli - Pune Road			
	Types of Vehicles		
Year	**2 -Wheeler**	**4 -Wheeler**	**Heavy Vehicles**
2013	56	46	51

2014	48	36	46
2015	34	18	25
2016	49	30	38
2017	31	23	23

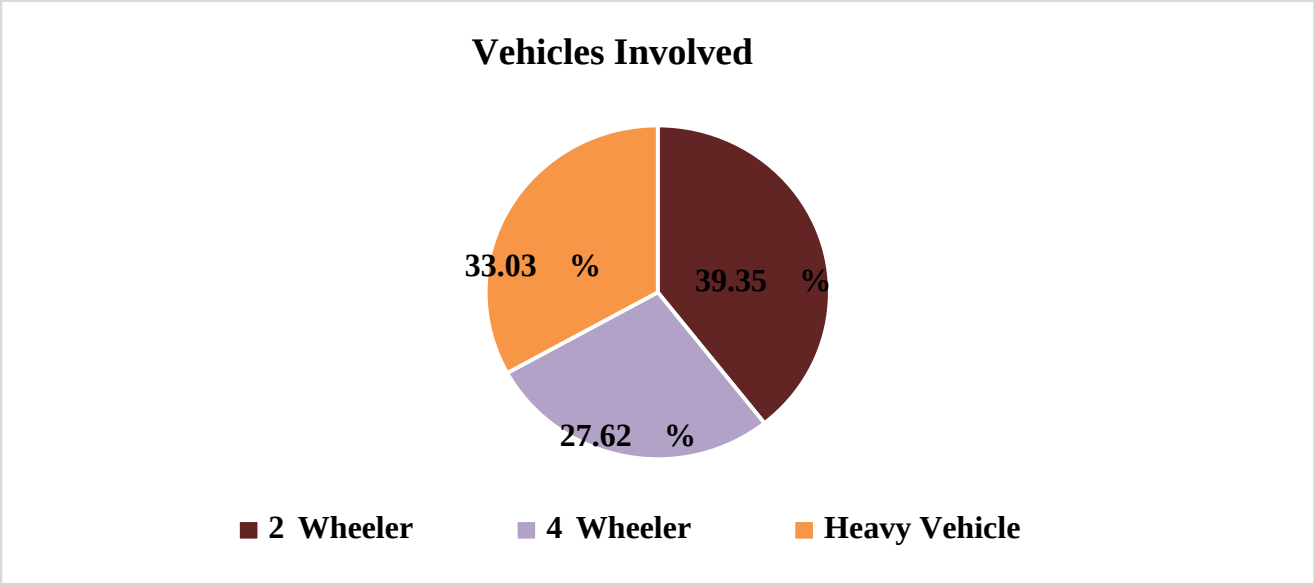

Figure 4 : Chart Showing : Vehicles involved in Accidents on Sangli Pune

Identified Red zone spots ranking according to data analysis:-From above 5 police station, total 7 black spots are analyzed at different locations on Sangli-Pune Road. Following table indicates names of red zone spots with their rankings.

Table 3 : Analyzed Black Spots with ranking

Name of identified black spot	Ranking Number
Pet Naka (Islampur)	1
Umbraj Fata	2
Karad highway	3
Satara highway	4

Karad city	5
Satara city	6
Pune city	7

Application of Poisson distribution

We can predict the probability of number of road accidents in year using Poisson distribution.

Let, no. of road accidents = x ; mean= m = 74.6

Now, X $\longrightarrow$ P (m=74.6)

To find probability that no accident occurs in year =

$P(x=0) = e^{-m} m^x / x! = e^{-74.6} (74.6)^x / x!$

$= e^{-74.6} (74.6)^0 / 0!$

$= 3.9961*10^{-33}$

4. Concluding Remarks-

The identification and analysis of accident Red Zone spots help in identifying the stretches where accidents are more and these spots reduce the road safety in general. The spot on the road where traffic accidents frequently occur is termed as Red zone spots.

From whole analysis and also from literature survey following points are observed and concluded:-

1. Accident intensity is varying for each year.
2. From the data collection it is observed that, most of the accidents are caused due to driver's error.
3. It is proposed to educate the road users with various modes to reduce the number of accidents
4. It has been observed that mostly accidents occur at night time, maximum due to overtaking of vehicles and high speed of vehicles and less due to misbalance of automobiles and most of the accused vehicle analyzed is truck.
5. The accident rate can be decreased by road side clearance, proper maintenance of shoulders, lighting, and junction improvement.
6. Speed limit should be brought down by providing humps near accident spots. Sight distance near curves should be obstruction free.
7. From the analysis it is observed that 33% of 2 wheelers are involved, 40 % of 4 wheelers are involved and 28 % of heavy vehicles are involved.
8. Education measures:-it is very essential to educate the road users for various precautionary measures to use the roadway facilities with safety.
    i. Digital bill boards shall be used to educate the road users.
    ii. Drivers shall be educated by special classes conducted.
    iii. Children shall be educated about the traffic rules and regulations at schools.
    iv. Organizing the workshops for the road users by the help of traffic police and transport staff.

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