Black Spot Analysis on National Highway - 4

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Abstract— The national highways network of **India** is responsible for development of civilizations and economic development of the country by meeting travel requirements of people and goods. Road accidents are one of the major elements which block the development of civilizations and economic growth due to the high economic loss as well as loss of life it causes. Hence it is important to identify such places of high accident chances and rectify them as soon as possible. Several methods can be adopted to identify such accident prone zones or accidental black spots. Accidental black spots are the spots where accidents have occurred historically many times. Government of India formulated Accidental Prevention Committee (APC) in year 1997 by identifying accidental prone spots on the rural highways of the state and suggested the suitable remedial measures for reducing the accidents [1].
The present study aims to identify accidental black spots on a section (820 km-830 km) of National Highway - 4 by studying the accidental data provided by the National Highway Authority of India (NHAI) during year 2014-2015. In present study for identification of black spots Ranking Method is used. During that study basic causes of accidents were found out and suitable remedial measures were also provided for a particular spot.

Keywords—Accidental black spots ,National Highway, Severity Index.

I. INTRODUCTION

Road network of a country is one of the most important factors responsible for the economic and social development of that country. India has a high population and requires a large amount of transportation services like air, land and water transportation. Road network is the only means of transportation which has deep penetration in all areas and responsible for door to door service. Hence it is very important to increase and maintain the road network of our country.

Maharashtra is one of the fastest growing states in India. The main reason for its development is its wide road network which facilitates a better and faster transportation which helps in its overall development. With increase in population the number of vehicles is also increasing which are responsible for occurrence of more number of accidents. This causes an obstruction is the economic and social development. To avoid this the accident prone zones on the highways must be studied, identified and rectified to reduce the accidents. An accidental black spot is a term used in road safety management to denote a place where road traffic accidents have historically been concentrated [2].It has been observed that almost 13 people die in road accidents all around the world every hour. According to World Health Organization (WHO) road accidents are the leading cause of death amongst people aged between 15-29 [3].

At the time of designing of national highway, vision is to construct accident free highway for that purpose normal causes of accidents are taken into consideration. For present study accidental data collected from National Highway Authority of India NHAI is analyzed by Ranking Method and black spot on national highway was found out.

II. OBJECTIVE OF STUDY

The basic aim of study is to find out accidental prone spots on Pune Bangalore National Highway between 820 km-830 km by considering different parameters such as; nature of accident, classification of accident and causes of accident.

III. WHAT IS BLACK SPOT

An accident black spot is a term used in road safety management to denote a place where road traffic accidents have historically been concentrated [2]. Black spot methods are designed to identify the prone spots in particular stretch and reduce the crash risk in that area by providing remedial measures. Identification of locations for safety improvement is the starting point of all the processes. The process is sometimes known as black spot identification or hazardous identification location. Generally black spot are termed to define the location where many accidents have occurred and risk (severe, major, and minor) is involved in that accident

IV. STUDY AREA

Pune-Bangalore highway is a controlled access highway with speed limit of 100 km/hr for present study 820 km-830 km has been selected

V. EXPERIMENTAL INVESTIGATION

For experimental investigation on Pune – Bangalore National Highway from 820 km– 830 km we had found out 81 numbers of accidents. The methodology consists of analysis of contributing factors for accidents that occurred on the Pune – Bangalore highway during 1 year resulted in fatal or grievous injury. The accidental observations for Pune-Bangalore National Highway are given in **Table 1, Table 2, and Table 3** for Nature of accidents, classification of accidents and causes of accidents respectively.

LEGENDS

A:Accident Location: 1.Chainage

B: Nature of Accident: 1-Overturning, 2-Head on collision, 3-Rear end collision,4-Collision brush, 5-Right turn collision, 6-Skidding,7-Absence of guard stone or curve indicator on the curve.

C: Classification of Accident: 1-fatal,2-Grievious Injury,3-minor Injured,4-Non Injured.

D:Causes of accident: 1-Drunken,2-overspeeding,3-vehicle out of control,4-fault of driver of motor vehicle/driver of other vehicle,5-Defect in mechanical condition of motor

Table No : 1 Nature of accidents

Sr.No	Chainage	Nature of Accident							
		1	2	3	4	5	6	severity	SI(%)
1	820	N	N	N	N	Y	N	2	9.52
2	820.4	N	N	N	Y	N	Y	8	28.00
3	821.2	N	Y	N	N	N	N	5	23.08
4	821.3	N	N	Y	N	N	N	5	23.08
5	821.3	N	N	N	N	N	Y	6	28.57
6	822	N	N	N	N	N	Y	6	28.57
7	823	N	y	N	N	N	N	5	23.08
8	823	N	Y	N	N	N	N	4	19.04
9	823	N	N	Y	N	N	N	5	23.08
10	823.9	N	N	Y	N	N	N	5	23.08
11	823.9	N	N	N	N	N	Y	6	28.57
12	824.1	N	N	N	N	N	Y	6	28.57
13	824.3	N	N	N	N	N	Y	6	28.57
14	824.6	N	N	N	N	N	Y	6	28.57
15	825.3	N	N	N	N	N	Y	6	28.57
16	825.4	N	N	Y	N	N	Y	11	52.38
17	825.8	Y	N	N	N	N	N	3	14.28
18	828.4	Y	N	N	N	N	N	3	14.28
19	829.1	Y	N	N	Y	N	Y	11	52.38
20	829.2	N	N	N	N	N	Y	6	28.57
21	829.3	N	N	N	N	N	Y	6	28.57
22	829.3	N	N	N	N	N	Y	6	28.57
23	829.6	N	Y	N	N	N	N	5	23.08
24	829.8	N	N	Y	N	N	N	4	19.04
	Yes	3	4	5	2	1	13		
	Ranking	4	3	2	5	6	1		
	Weightage	3	4	5	2	1	6		
	SI Benchmark								28.57

Table No : 2 Classification of Accident

Sr.No	Chainage	Classification Of Accident					
		1	2	3	4	severity	SI(%)
1	820	N	N	N	Y	2	20
2	820.4	y	N	N	N	1	10
3	821.2	N	N	Y	N	4	40
4	821.3	N	Y	N	N	3	30
5	821.3	N	N	Y	N	4	40
6	822	N	N	Y	N	4	40
7	823	N	Y	N	Y	3	30
8	823	N	Y	N	N	3	30
9	823	N	N	Y	N	4	40
10	823.9	N	N	Y	N	4	40
11	823.9	N	Y	N	N	3	30
12	824.1	N	N	Y	N	4	40
13	824.3	N	Y	N	N	3	30
14	824.6	N	N	Y	N	4	40
15	825	N	Y	N	N	3	30
16	825	N	N	Y	N	4	40
17	826	N	N	Y	N	4	40
18	828	N	N	Y	N	4	40
19	829	Y	Y	N	Y	1	10
20	829	N	Y	N	N	3	30
21	829	N	Y	N	N	3	30
22	829	N	Y	N	N	3	30
23	830	N	Y	N	N	3	30
24	830	Y	N	N	N	2	20
	Yes	3	11	10	2		
	Ranking	3	1	2	4		
	Weightage	2	4	3	1		
	SI Benchmark						30

Table No : 3 Causes of Accident

Sr.No	Chainage	Causes of accidents					Severity	SI(%)
		1	2	3	4	5		
1	820	N	N	Y	Y	N	5	33.33
2	820.4	N	N	y	N	N	5	33.33
3	821.2	N	N	Y	N	Y	5	33.33
4	821.3	N	N	Y	N	N	5	33.33
5	821.3	N	Y	N	N	N	4	26.66
6	822	N	N	Y	N	N	5	33.33
7	823	N	y	N	N	Y	4	26.66
8	823	N	Y	N	N	N	4	26.66
9	823	N	Y	N	N	N	4	26.66
10	823.9	N	Y	N	N	N	4	26.66
11	823.9	N	Y	N	N	N	4	26.66
12	824.1	N	N	Y	N	N	5	33.33
13	824.3	N	y	N	N	N	4	26.66
14	824.6	N	N	Y	N	N	5	33.33
15	825	N	N	Y	N	N	5	33.33
16	825	N	Y	N	N	N	4	26.66
17	826	N	N	Y	N	N	5	33.33
18	828	N	N	N	Y	N	2	13.33
19	829	N	N	Y	N	N	5	33.33
20	829	N	N	Y	N	N	5	33.33
21	829	N	N	Y	N	Y	5	33.33
22	829	N	Y	N	N	N	4	26.66
23	830	N	Y	N	N	N	4	26.66
24	830	Y	Y	N	N	N	4	26.66
	Yes	1	11	10	2	3		
	Ranking	5	1	2	4	3		
	Weightage	1	5	4	2	3		
	SI Benchmark							20

Sample Calculations

1. Method of ranking

Ranking method is used to find out vulnerability of a particular spot out of 6 parameters most predominant parameter was found out based on logical analysis. The parameter which is responsible for occurrence of accident has been given top rank and accordingly ranks of all parameters were given.

i. For all the 6 parameters, consider the chainage 829.1 from table no1

ii. Parameter 1-i.e "Overturning" Parameter 4 - i.e found present and hence marked **Y**(YES)

iii. Parameter 2 i.e. "Head on collision" Parameter 3 i.e "Rear end collision" and Parameter 5 i.e - "Right turn collision" - was found absent and hence marked **N** (NO)

iv. Accordingly all the parameters for all chainages were marked as **Y** or **N**.

2. Severity Index

Severity index denotes vulnerability of a particular spot of accidents.

Severity Index $=(ß/ \Sigma W) \times 100$
Where,
$\Sigma W = w1 + w2 + w3 + \ldots w10$.
Consider chainage 829.1

severity $(ß) = 3+2+6$
$= 11$
$\Sigma W = 6+5+4..+1$
$= 21$

Severity Index $=(ß/ \Sigma W) \times 100$
$=(11/21) \times 100$
$=52.38\%$

3. Severity index benchmark

Severity index benchmark is the severity index value above which corresponding spots are black spots. It is calculated as the sum of weightages assigned to the top 5 parameters divided by weightage of all the parameters. The value obtained in % is then subtracted from 100 to obtain Severity Index Benchmark
For e.g.:

ΣW of top 3 weights $=6+5+4 =15$
$\Sigma W = 21$
S.I Benchmark $=[100-(15/21) \times 100]$
$=28.57\%$

Based on analysis of data profile indicating severity Vs actual chain age is present in graph 1, graph 2 and graph 3 for
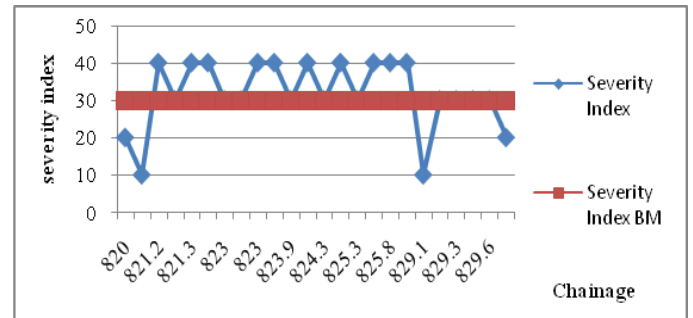Nature of accidents, classification of accidents and causes of accidents respectively.

➢ From graph 1 it has been cleared total 1 accidental spots are above the datum of severity index of 28.57 with the parameter nature of accident which clearly indicate that the presence of accidental black spot.

➢ From graph 2 it has been cleared total **10 accidental spots** are above the datum of severity index 30 with classification of accidents which clearly indicate that the presence of accidental black spots.
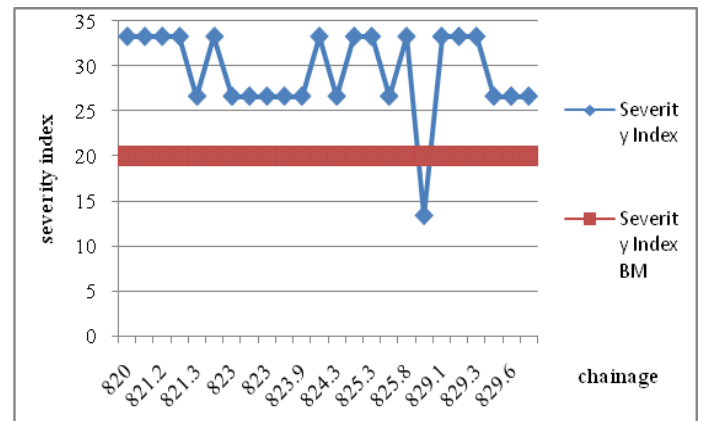
➢ From graph 3 it has been cleared total **23 accidental spots** are above the datum of severity index 20 with causes of accidents which clearly indicate that the presence of accidental black spot**s.**
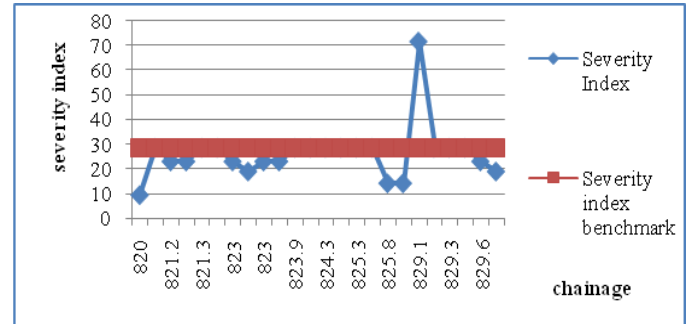
Graph : 1 Nature of Accident.

Graph : 2 Classification of Accident.

Graph : 3 Causes of Accidents

VI. RESULT AND DISCUSSION

Readings taken on Pune-Bangalore Highway from 820 km-830 km are analyzed by Ranking Method,
In method of ranking according to importance of parameter (i.e parameter which is responsible l for occurrence of more number of accidents) the rank and weightage are given. The percentages after giving rank and weightage are calculated and on the basis of value of percentage the accidental black spot is identified.

From graph 1,2,3 it has been cleared that total 34 spots are above the datum of severity index with nature of accidents, classification of accidents and causes of accidents respectively which clearly indicate the presence of accidental black spot.

VII. CONCLUSION

By considering all these parameters by using Ranking Method accidental black spots can be identified. From table 1,2 and 3 it is clear that skidding, grievous injuries and over speeding are responsible for occurrence of more number of accident.

VIII. AKNOWLEDGEMENT

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