Proceedings of 4th RIT Post Graduates Conference (RIT PG Con-18)
NOVATEUR PUBLICATIONS
JournalNX- A Multidisciplinary Peer Reviewed Journal (ISSN No:2581-4230)
April, 13th, 2018

IDENTIFICATION OF BLACK SPOTS ON STATE HIGHWAY-75

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***Abstract*: The issue of road accidents is an increasing problem in developing countries. There are many steps required to achieve road safety measures. Road safety is necessary to reduce accident involving both human and vehicle damage. The safety deficiencies were detected to minimize accidents and to save road users. By studying the various accident parameters and by using accident rate method, accident black spots analysis is done. The data is analysed by developing regression model. Using such analysis blackspots locations were identified for further improvement in road safety and also the causes of accident are studied. For the study Sangli – Kolhapur road (SH-75) is taken having longitude and latitude for sangli (N 16.8530, E 74.5630) and for Kolhapur (N16.7290, E 74.2824).**

Keywords: Accidents, Black spots, road safety.

I. INTRODUCTION

Road accidents are globally recognized as a serious public health problem. Road accidents is mainly caused due to the rapid increase in number of **vehicles running on roads**. The improper road geometry, such as pavement characteristics, road types, surface condition, visibility obstruction and environmental conditions are road factor responsible for accidents. Vehicle design (dimension & weight) is vehicle factor caused for accidents. Driver's characteristics, pedestrian behaviour, road user's behaviour, Traffic density, traffic characteristics these are human factors responsible on accident. These road accidents leads to the fatalities and injuries worldwide. [4]

The places, it may be a few meter of stretch instead of particular point, where the intensity of accidents are more termed as **'black spots'**. Various studies on road accidents indicate the preventation of road accidents mainly involves in conscious planning, design and operation of roads. [3] The systematic identification and treatment to the accident black spots is the general process. [5]

Major causes of accidents may be divided into three factors,
Human, Vehicle, Road Environment.

II. METHODOLOGY

Identification of accidental black spot is the procedure to find spots that are particularly dangerous where accidents had occurred frequently. 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 accident rate and regression method.

a) Details of Study Stretch

Sangli – Kolhapur Road
Shastri Chawk (Sangli Road) to Ankali fata is SH
Ankali fata to Shiroli fata is NH.
NH connects to the Pune – Benglore highway which is AH 47

TABLE NO 1: The Stretch details are shown.

Length	42 KM
Average Travel Time	50 Min
Origin	Sangli Stand
Destination	Shiroli fata
Bypassed Towns	Ankali, Udgav, Jaysingpur, Nimshirgav, Tamdalge, Hatkanangle, Atigre, Chokak, Herle, Halondi.

FIGURE NO 1: Map Showing Study Stretch Area.

b) Primary and Secondary Data Collection

Traffic Data:

The road inventory data such as Traffic volume count survey was collected from Public Work Department.

TABLE NO 2: Traffic Data

	May 2017	December 2016
PCU	28,087	26,891
Avg. Traffic (in 72 Hrs.)	55,910/ ton	53,449/ ton

Road Accident Data:

The accident data for the study stretches was collected from the record kept by the regional police stations. The road accident data for last 5 years from 2013 to 2017 was collected including accident location, timing, no. of persons involved, type of severity, no. of vehicles involved etc.

TABLE NO. 3: Total Fatal, Major and Minor Accidents on Sangli – Kolhapur Road.

Sangli - Kolhapur Road				
Year	**Total Accidents**	**Fatal Accident**	**Major Accidents**	**Minor Accidents**
2013	99	35	43	21
2014	73	19	38	16
2015	56	13	27	16
2016	86	24	51	11
2017	59	9	30	20

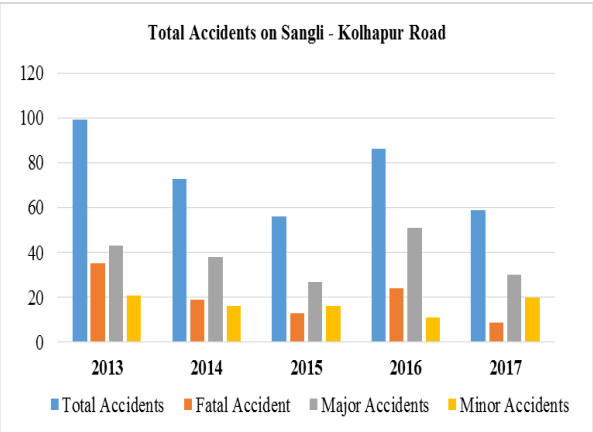

FIGURE NO. 2: Graphical Representation of Fatal, Major and Minor Accidents on Sangli – Kolhapur Road.

TABLE NO. 4: Total No. Of fatal and injured On Sangli – Kolhapur Road.

Sangli - Kolhapur Road			
Year	**Total Accidents**	**fatal**	**Injured**
2013	99	35	95
2014	73	19	73
2015	56	14	59
2016	86	35	73
2017	59	25	77

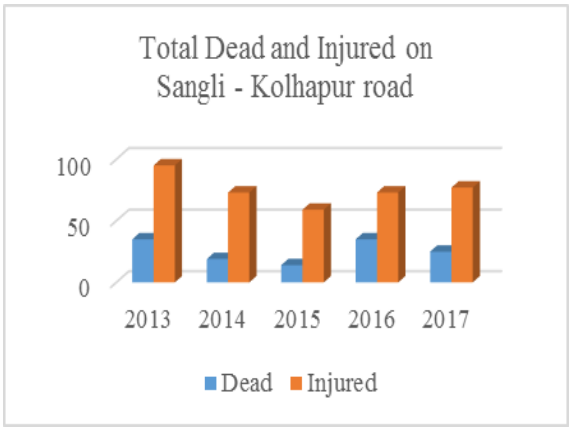

FIGURE NO. 3: Graphical Representation of Total No. Of fatal and injured On Sangli – Kolhapur Road.

TABLE NO. 5: Total Accidents at Day and Night on Sangli – Kolhapur Road.

Sangli - Kolhapur Road			
Year	**Total Accidents**	**Day**	**Night**
2013	99	54	45
2014	73	40	33
2015	56	31	20
2016	86	55	36
2017	59	35	24

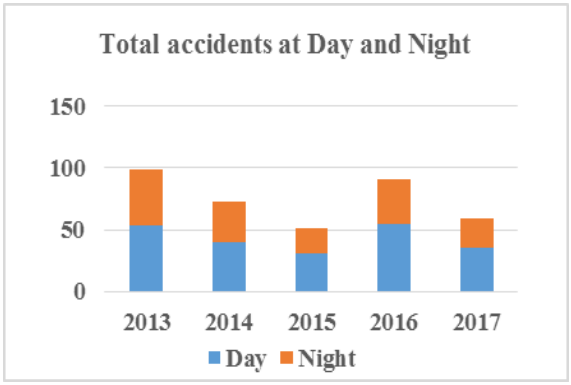

FIGURE NO. 4: Graphical Representation Total Accidents at Day and Night on Sangli – Kolhapur Road.

TABLE NO. 6: Total No. Of Vehicles Involved In Accidents on Sangli – Kolhapur Road.

Sangli - Kolhapur Road			
Year	**2 Wheeler**	**4 Wheeler**	**Heavy Vehicle**
2013	56	46	51
2014	48	36	46
2015	34	18	25
2016	49	30	38
2017	31	23	23

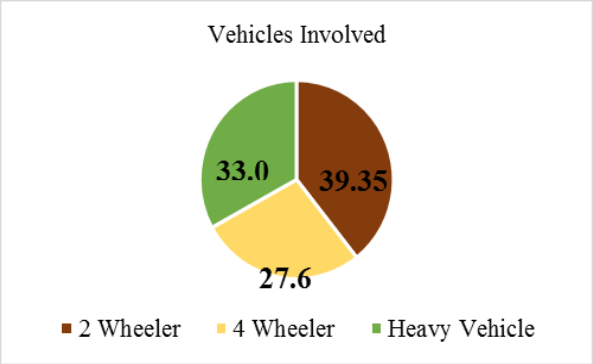

FIGURE NO. 4: Graphical Representation of No. Of Vehicles Involved In Accidents On Sangli -Kolhapur Road.

c) Data Analysis to identify accident prone zones

Accident data collected from 5 Police Stations.

TABLE NO. 7: Police Stations and Area Under Covered.

NAME OF POLICE STATION	AREA COVERED	DISTANCE
Sangli Urban	Sangli stand to Gajanan Maharaj Mandir	3 KM
Sangli Rural	Gajanan Maharaj Mandir to Ankali fata	1.5 KM
Jaysingpur	: Ankali fata to Basvan Khind	22 KM
Hatkanangle	Basvan Khind to Halondi	13.3 KM
Shiroli MIDC	: Halondi to Shiroli fata	2.2 KM

There are 28 Accident Spots on Sangli – Kolhapur Road. In last five years on Sangli – kolhapur road 78 fatal, 145 are major injured and 119 are minor injured.

The pie chart shows tthat no of fatal, number of major injured and number of minor injured at each accident spot .

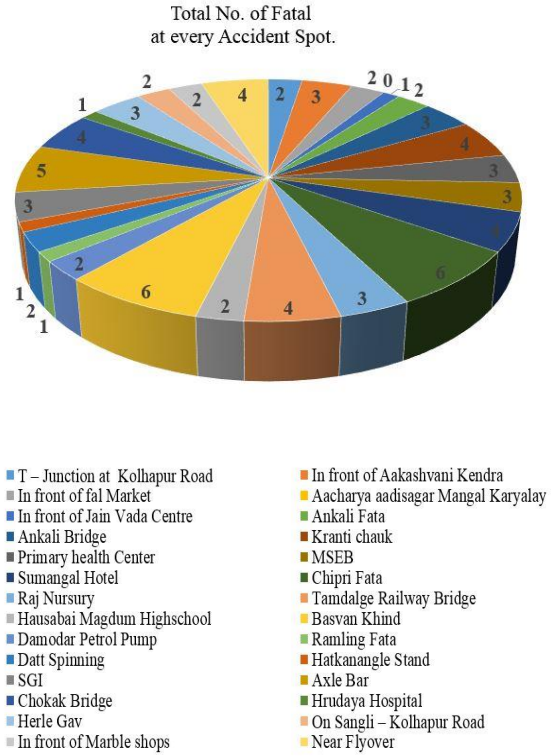

FIGURE NO. 5 Pie Chart Representation Of Fatal Accident Rate.

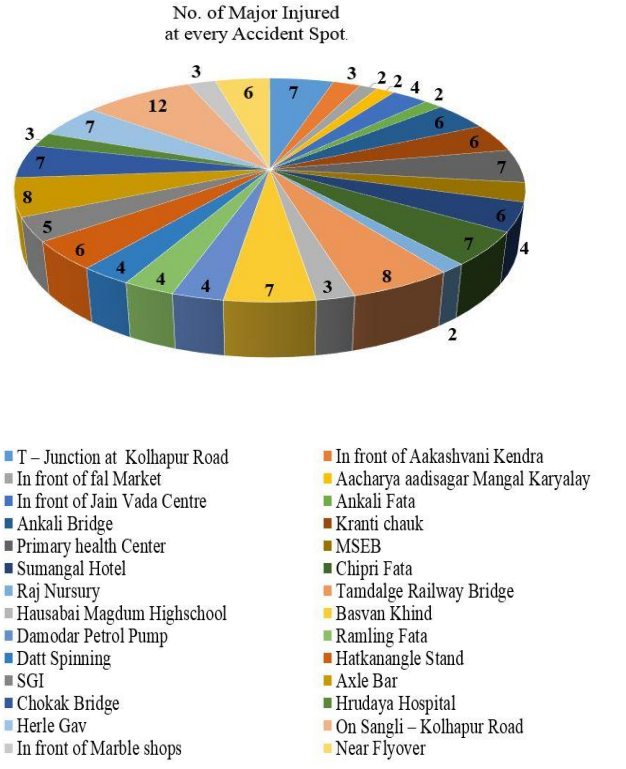

FIGURE NO. 6 Pie Chart Representation Of Major Accident Rate.

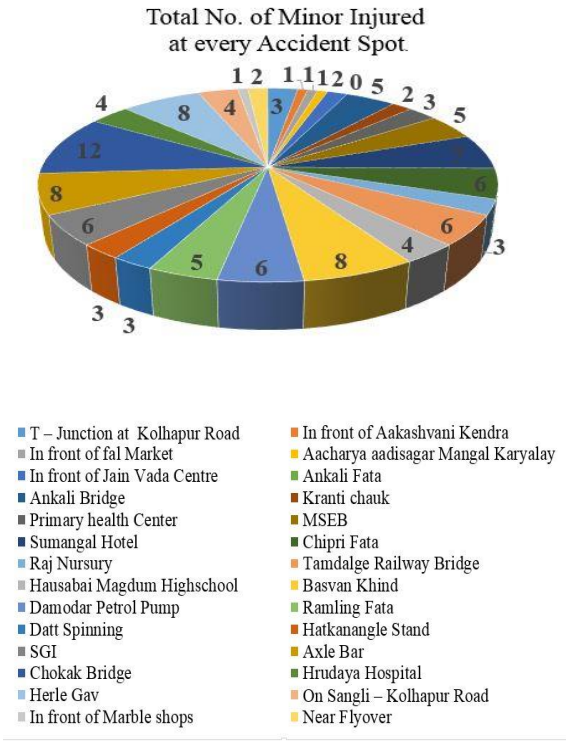

FIGURE NO. 7: Pie Chart Representation Of Minor Accident Rate.

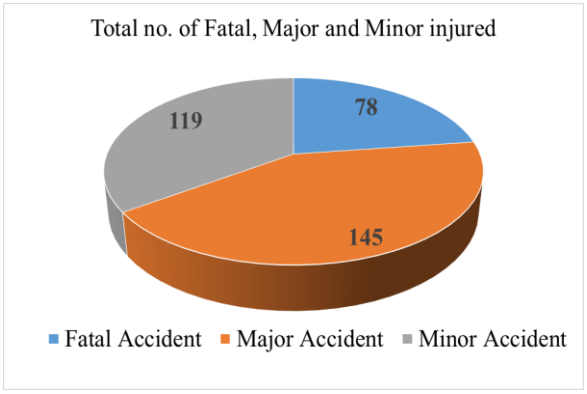

FIGURE NO. 8: Pie Chart Representation Of Total No. Of Fatal, Major And Minor Injured.

Total no. of Fatal, Major and Minor injured and Years of collected data is considered for analysis. By considering these, Regression equation is developed.

X is taken as a data collected years.
Y is taken as a Total number of accidents in that year.

X	2013	2014	2015	2016	2017
Y	130	92	73	58	102

$$\Sigma Y = n.a + b.\Sigma u + c.\Sigma u^2 \quad \dots (1)$$
$$\Sigma Yu = a.\Sigma u + b.\Sigma u^2 + c.\Sigma u^3 \quad \dots (2)$$
$$\Sigma u^2 Y = a.\Sigma u^2 + b.\Sigma u^3 + c.\Sigma u^4 \quad \dots (3)$$

Substituting all values in equation no. 1, 2 and 3.
We get,

$$5a+10c-455=0$$
$$10b+90=0$$
$$10a+34c-1078=0$$

Solving above equations,
a = 67, b = -9, c = 12
Hence, equation 1 becomes,

$$\mathbf{Y = 12\ X^2 - 48369\ X + 48740902}$$

d) Zone Selection

Blackspots along with National Highway are,

TABLE NO. 8: Result Showing Top Black Spots from locationStudy

BLACK SPOTS	FATAL	MAJOR	MINOR	TOTAL
Chokak Bridge	4	7	12	23
Basvan Khind	6	7	8	21
Axle Bar	5	8	8	21
Chipri Fata	6	7	6	19
Tamdalge Railway Bridge	4	8	6	18
Herle Gaon	3	7	8	18
On Sangli – Kolhapur Road	2	12	4	18
Sumangal Hotel	4	6	7	17
Ankali Bridge	3	6	5	14
Total	**37**	**68**	**64**	**169**

Accident Rate per KM

R = A/L
Where,
A = Total No. of accidents occur in a one year
L = Length of Stretch in KM

R = 99/42 = **2.36** .....For 2013
R = 73/42 **= 1.34** .....For 2014
R = 56/42 = **1.33** .....For 2015
R =86/42 = **2.05** ..... For 2016
R = 59/42 = **1.40** .....For 2017

After finding Blackspot, accident data were extracted for these 9 identified Blackspots and further analysed.

IV. RESULT

TABLE NO. 9: Result Showing Location and their causes of accident

Sr. No.	Location	Causes
1	Chokak Bridge	Steep gradient with sharp curve
2	Basvan Khind	Junction point on curve without safety provision like road markings, signs
3	Axle Bar	Steep gradient with intersection and improper sight visibility
4	Chipri Fata	No sign boards and speed breakers at junction point
5	Tamdalge Railway Bridge	Steep (up/down) gradient
6	Herle Gaon	Intersection of SH with village road without traffic coming measures.
7	Halondi	Commercial area causing traffic congestion
8	Sumangal Hotel	Steep (up) gradient, improper sight distance

V. CONCLUSION

From the collected data, it is concluded that accident rate has dropped from 2013 to 2015; but in 2016 accidents were more than 2015 because of expansion work of road lanes. The number of accidents are more in a day than accident at night.

It clearly shows that at these black spots, no. of accidents are more because year by year no. of vehicles are increasing. Two wheeler have caused more accidents.

The 8 Black Spot locations given in Table no. 9 on Sangli – Kolhapur Road had more than 50 % of total accidents on the whole stretch for last 5 years.

After visiting the site it seen that there are more number of accidents because of road geometry and insufficient road marking.

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