

# Identification of Accidental Black spots on National Highways and Expressways.

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**Abstract-** National highways and expressways are considered as main veins for the development of states in the country. On the other hand it has been observed that more than 13 peoples are dying in the road accidents per hour all over the world. Government of India formulated Accidental Prevention Committee (APC) in the year 1997 for identifying accidental prone spots on the rural highways of the state and suggested the suitable remedial measures for reducing the accidents.

The Yeshwantrao Chavan Expressway (Mumbai - Pune Expressway) has witnessed large number of accidents since it became fully operational in April 2002. According to daily DNA, dated April 3, 2012, there were 11,057 accidents in 10 years of its existence. The PWD (Public Works Department) Government of Maharashtra state had undertaken the improvement of such accidental prone spots which generally designated as the black spots on highways. But little research has been done till day on prevention of accidents. The paper deals with study and identification of accidental black spots on Pune-Solapur National Highway (NH9) and Mumbai-Pune Expressway by method of ranking.

**Keywords-** Accidental Black Spots, Expressways, National Highways.

## I. INTRODUCTION

An unfortunate incident that happen unexpectedly and unintentionally typically resulting in damage or injury is termed as Accident. It has been observed that 13 people are dying per hour all over the world. The world health organization (WHO), in its global status reports on road safety 2013, observers that road traffic injuries "the leading cause of death for young people aged 15-29". Worldwide and that while many countries have taken steps to reduce fatal accidents from road traffic accidents the total "remains unacceptably high at 1.24 million per year" More than 80,000 people are killed on Indian roads every year and almost 1.2 billion are injured. India is having road fatality ratio 14 per 10,000 vehicles which is almost highest in the world. Maharashtra is one of the India's more advanced state and having relatively higher density of road network as well as motor vehicles compared to other states. National highways and expressways are considered as main vein for development of the country. The Mumbai- Pune Expressway (officially known as Yeshwantrao Chavan Expressway) is India's first six lane concrete, high speed access controlled tolled expressway which has been designed and constructed as per International Standards and it is one of the busiest roads in the country. The expressway handles about 43,000 PCU's daily and it is designed to handle up to 1,00,000 PCU's. It spans distance of 93 km from Mumbai (financial capital of India and administrative capital of Maharashtra) with pune, an industrial and educational hub. While designing and planning of Mumbai-Pune Expressway

the vision may be to construct accident free expressway and normal causes of accidents were properly taken into consideration. Since, it was made fully operational from April 2002, has been observed that large number of accidents are occurring which exhibits serious fatal accidents. Recently according to Maharashtra State Road Development Corporation (MSRDC) statistics from 15<sup>th</sup> April 2005 to 13<sup>th</sup> November 2010 total 8225 accidents had occurred on Mumbai- Pune Expressway so it was nominated as 'Death Trap' by leading news paper in India.

Therefore, it is essential to identify such accidental prone areas on Mumbai – Pune Expressway and Pune – Solapur highway. The attempt has been made in this research to identify accidental black spots by method of ranking.

## II. RATIONALE AND SIGNIFICANCE OF THE STUDY

The place where road traffic accidents have historically been concentrated is termed as an accidental black spot in road safety management. Hauer (1996) titled that accidental black spot can be identified by accident rate (the annual no of road fatalities per capita per year and per vehicle km) & accidental frequency (a traffic accident involving vehicles, pedestrians or cyclists). The road parameters such as road width, width of one shoulder, deficiency in super elevation, deficiency in sight distance, radius of horizontal curve are responsible for occurrence of accidents. Whereas human errors such as speed control of vehicles, violation of traffic rules by drinking alcohol and driving vehicle, lack of sleep etc.

are causing fatal accidents on roads. According to the report submitted by J P Research India Pvt. Ltd. on analysis of 372 accidents between oct. 2012 to oct. 2014 on Mumbai- Pune Expressway shows that, human error had the highest influence on occurrence of accidents with 58% followed by combined human & infrastructural factors which are 22% & vehicle factor alone as 13%. Hence it is necessary to study the cases of accidents & rank the parameters responsible for occurrence of accidents according to their severity. This paper deals with study of such accidental prone areas by considering various parameters such as village and its water source separated by a highway, narrow bridge, right turn of road on a down slope, small subsidiary road meeting the main highway in a steep slope, a summit in the road, summits followed by a horizontal curve, absence of guard stones or curve indicator on curve, trees by road side, erosion of shoulders due to cart tracks & footpath or cattle crossing, places of worship/ prayers, passenger pick up sheds at the junction, wayside bus stop without bus bays, amenities separated from their users ranking them on their severity and finally identify the accidental black spot with highest value of percentage of occurrence of accident on Mumbai- Pune Expressway and Pune- Solapur National Highway(NH-9).

### **III. BRIEF OVERVIEW OF LITERATURE**

Nagarajan and Cefil (2012) used remote sensing (RS) & GIS for identification of black spots and accident analysis for a particular stretch of NH - 45 starting from Tambaram to Chengalpet. Eleven accident locations were identified in the study using high resolution satellite map (IKONS) based on the non-spatial data collected from police department and the field survey conducted in terms of traffic volume and vehicle spot speed, and plotting of the study stretch using Arc GIS software.

Reshma and Sheikh (2012) in their study prioritized some of the major accident spots generally referred to as black spots in South Bangalore by using Arc GIS software by assigning possible weights for various accident components.

Srinivasan et al. (1987) developed a scientific method for the identification and improvement of accident prone locations on national highways (NHs) in Kerala. Three methods were used in their study to identify the black spots, i.e. i)Quantum of accident method; ii) Accident prone index (API) method and iii) WSI method. The study concluded that the method based on WSI was found to be most suitable in identifying black spots.

Iljoon Chang and Seong W. Kim (2011), in their study use Bayesian Approach with a Poisson Mixture Model for Identifying Accident-Prone Spots. During their study they consider a mixture of the zero-inflated Poisson and the Poisson regression models to analyse zero-inflated data sets drawn from traffic accident studies. They also perform simulation study and real data analyses are performed to demonstrate model fitting performances of the proposed model.

Srinivas Rao. B et al (2005), conducted an accident study on NH - 5 Between Anapakalli to Visakhapatnam during the year 2003 and it runs through urban, semi urban and rural areas.

This study attempt at identifying accidental black spots by arranging the parameters causing accidents on the basis of their severity, ranks are given to each and every parameter and by calculating the percentage the accidental black spots are identified.

### **IV. AIM AND OBJECTIVES**

The basic aim of the study is to identify accidental black spots on Mumbai-Pune Expressway and Pune-Solapur National Highway NH-9 by considering the parameters responsible for occurrence of accidents using method of ranking. Till day there is no authentic process of identification of accidental black spots on Mumbai-Pune Expressway and Pune-Solapur Highway, hence it is necessary to study in detail accidental black spot on Mumbai - Pune Expressway and Pune - Solapur Highway. The objectives of the study were;

- Identify accidental black spots on Mumbai-Pune Expressway and Pune-Solapur Highway.
- To improve accident data collection system especially location identification.

### **V. METHODOLOGY OF THE STUDY**

The methodology adopted for the study was as follows:

- To collect accident data on Mumbai-Pune Expressway from police department.
- Comparison of real time data with records available in the police station.
- To find out different methods to prioritize hazardous locations.
- To identify various traffic and road related factors causing accidents.
- To carry out analysis of black spots by using statistical models.
- Detailed analysis of the top ranked spots.

### **VI. EXPERIMENTAL INVESTIGATION**

For experimental investigation on Mumbai-Pune Expressway km 76 – km 78 was selected as pilot study. According to the statistics provided by MSRDC, km 76- km 78 has witnessed maximum accidents in recent past. The observations are taken by considering various parameters responsible for occurrence of accidents such as

1. Village and its water source separated by highway.
2. Narrow Bridges.
3. A right turns of road on down slope.
4. Small subsidiary road meeting the main highway in a steep slope.
5. Absences of guard stones or curve indicator on the curve.
6. Trees by the roadside.
7. Erosion of shoulder due to cart tracks, footpath or cattle crossing.
8. Place of worship/prayers.
9. Passenger pickup sheds at the junction.
10. Amenities separated from their users.

The observations are as follows;

Table 1: km 78 to 77.77, 77.595 and 77.01 there was presence of accidental black spot on Mumbai –Pune.

Table 2 km 78 to 77.86, 77.64, 77.59,77.23 and 77.15 there was presence of accidental black spots black spot on Mumbai –Pune

Table 3 km 63.5, km 62.0, km 60.5, km 58.5 there was presence of accidental black spots on National Highway.

**Table 1 : Observation table for Identification of black spots on Mumbai to Pune (Expressway)**

Chainage	Points									
	1	2	3	4	5	6	7	8	9	10
78	Y	N	N	N	N	N	Y	N	N	Y
77.955	Y	N	N	N	N	N	Y	N	N	Y
77.925	Y	N	N	N	N	N	N	N	N	Y
77.91	Y	N	N	N	N	N	Y	N	N	Y
77.865	Y	N	N	N	N	N	Y	N	N	Y
77.838	Y	N	N	N	N	N	Y	N	N	Y
77.82	Y	N	N	N	N	N	Y	N	N	Y
77.775	N	N	N	N	N	N	N	N	N	Y
77.73	N	N	N	N	N	N	N	N	N	N
77.685	N	N	N	N	N	N	N	N	N	N
77.64	N	N	N	N	N	N	N	N	N	N
77.595	N	N	N	Y	N	N	N	N	N	N
77.55	N	N	N	N	N	N	N	N	N	N
77.505	N	N	N	N	N	N	N	N	N	N
77.46	N	N	N	N	N	N	N	N	N	N
77.415	N	N	N	N	N	N	N	N	N	N
77.37	N	N	N	N	N	N	N	N	N	N
77.325	N	N	N	N	N	N	N	N	N	N
77.298	N	N	N	N	N	N	N	N	N	N
77.28	N	N	N	N	N	N	N	N	N	N
77.235	N	N	N	N	N	N	N	N	N	N
77.15	N	N	N	N	N	N	N	N	N	N
77.145	N	N	N	N	N	N	N	N	N	N
77.1	N	N	N	N	N	N	N	N	N	N
77.055	N	N	N	N	N	N	N	N	N	N
77.01	N	N	N	Y	N	N	Y	N	N	N
76.984	N	N	N	N	N	N	N	N	N	N
76.965	N	N	N	N	N	N	N	N	N	N

**Table 2: Observation table for Identification of black spots on Mumbai Pune Expressway (Facing to pune)**

Chainage	points									
	1	2	3	4	5	6	7	8	9	10
63.5	Y	N	N	Y	Y	Y	Y	N	N	N
63.0	N	N	N	N	N	N	N	N	N	N
62.5	N	N	N	N	N	N	N	N	N	N
62.0	Y	N	N	Y	Y	Y	N	Y	Y	Y
61.5	N	N	N	N	N	N	N	N	N	N
61.0	N	N	N	N	N	N	N	N	N	N
60.5	Y	Y	Y	Y	Y	Y	Y	N	N	Y
60	N	N	N	N	N	N	N	N	N	N
59.5	N	N	N	N	N	N	N	N	N	N
59	N	N	N	N	N	N	N	N	N	N
58.5	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
58	N	N	N	N	N	N	N	N	N	N
57.5	N	N	N	N	N	N	N	N	N	N
57	N	N	N	N	N	N	N	N	N	N
56.5	N	N	N	N	N	N	N	N	N	N
56	N	N	N	N	N	N	N	N	N	N

**Table 3: Observation table for Identification of black spots on National Highway.**

Chainage	points									
	1	2	3	4	5	6	7	8	9	10
63.5	Y	N	N	Y	Y	Y	Y	N	N	N
63.0	N	N	N	N	N	N	N	N	N	N
62.5	N	N	N	N	N	N	N	N	N	N
62.0	Y	N	N	Y	Y	Y	N	Y	Y	Y
61.5	N	N	N	N	N	N	N	N	N	N
61.0	N	N	N	N	N	N	N	N	N	N
60.5	Y	Y	Y	Y	Y	Y	Y	N	N	Y
60	N	N	N	N	N	N	N	N	N	N
59.5	N	N	N	N	N	N	N	N	N	N
59	N	N	N	N	N	N	N	N	N	N
58.5	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
58	N	N	N	N	N	N	N	N	N	N
57.5	N	N	N	N	N	N	N	N	N	N
57	N	N	N	N	N	N	N	N	N	N
56.5	N	N	N	N	N	N	N	N	N	N
56	N	N	N	N	N	N	N	N	N	N

**Table 4: Observation table for Identification of black spots on National Highway**

R	4	3	8	10	7	2	9	1	6	5	T	%
CP	1	2	3	4	5	6	7	8	9	10	55	-
63.5	4	-	-	10	7	2	9	-	-	-	32	58.18
63	-	-	-	-	-	-	-	-	-	-	-	-
62.5	-	-	-	-	-	-	-	-	-	-	-	-
62	4	-	-	10	7	2	-	1	6	5	35	63.63
61.5	-	-	-	-	-	-	-	-	-	-	-	-
61	-	-	-	-	-	-	-	-	-	-	-	-
60.5	4	3	8	10	7	2	9	-	-	5	48	87.27
60	-	-	-	-	-	-	-	-	-	-	-	-
59.5	-	-	-	-	-	-	-	-	-	-	-	-
59	-	-	-	-	-	-	-	-	-	-	-	-
58.5	4	3	8	10	7	2	9	1	6	5	55	100
58	-	-	-	-	-	-	-	-	-	-	-	-
57.5	-	-	-	-	-	-	-	-	-	-	-	-
57	-	-	-	-	-	-	-	-	-	-	-	-
56.5	-	-	-	-	-	-	-	-	-	-	-	-
56	-	-	-	-	-	-	-	-	-	-	-	-

R: Ranking, C: Chain-age, P: Points, T: Total

## V. RESULTS AND CONCLUSIONS

The reading taken on Mumbai-Pune Expressway and Pune-Solapur National Highway then analysed by method of ranking. According to importance of the parameter. The most important parameter had given minimum rank. The percentages after giving rank were calculated and on the basis of value of percentage the accidental black spot was identified. The method of ranking is as shown in table 4. It has been concluded that by considering all these 10 parameters by using method of ranking the accidental black spots can be identified. The separate investigation is necessary to nullify the effect of these parameters so as to reduce the severity of accidental black spots.

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