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Black Spot Analysis on Amravati Nagpur Highway

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ABSTRACT: Traffic safety plays a major role in sustainable transportation development. Where highest number of accidents occur is called a Black Spot. Identification of black spot, methodologies developed based on the total number of accidents occurred in that particular location. Accident severity is increasing in order due to increasing in vehicle population. The main cause of accidents are the driver, vehicle and general degradation of environment. Generally accidents occur at intersection where low volume traffic mixes with high volume traffic. Traffic crashes in India are increasing on a steady rate. It results in property damages as well as death of road users. Maharashtra is one of the India's more advanced state and having relatively higher density of road network as well as motor vehicle as compared to other state. Amravati Nagpur National highway is a four lane highway connecting many of its major manufacturing center, commercial and cultural centers. Amravati Nagpur Highway having four lanes constructed and maintained by National Highway Authority of India(NHAD). Hence basic case of accident can be identified according to that the remedial measures may be adopted to improve the performance of highways.

KEYWORDS: Black spot analysis, Number of accident.

I. INTRODUCTION

General:

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 in the economic and social development. To avoid this 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. 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.

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.

1.1 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. 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.

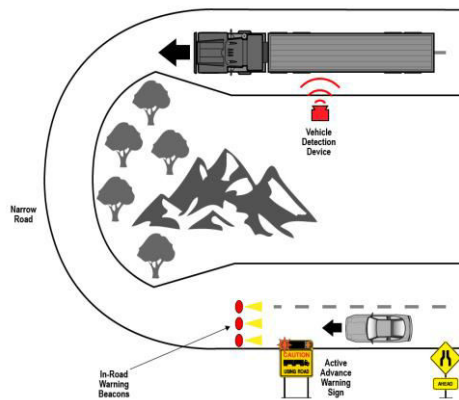


Fig 1: Black Spot of the Road
Source:<http://en.wikipedia.org>

1.2 OBJECTIVES:

The objectives of this study are specifically given as following.

- Identification of black spot on Amravati-Nagpur highway.
- To find out traffic problem on Amravati-Nagpur highway.
- To identify various traffic and road related factors causing accidents and suggestion of possible improvements.

II. LITERATURE REVIEW

ILiyamollsen “Evaluation and treatment of accident black spots using Geographic Information System” ISSN: 2319-8753 Vol. 2, Issue 8, August 2013

The location in a road where highest number of traffic accidents occurs is called a Black Spot. The recent study conducted by the Kerala Road Safety Authority (KRSA) found that, the maximum numbers of accident-prone stretches or the black spots are in Alappuzha district. In traditional identification of black spots, methodologies developed based on the total number of accidents occurred in that particular location. These criteria do not provide consideration to the road improvements and result in misidentification of locations that are not truly hazardous from the road safety perspective. The study includes collection of secondary accident data and prioritizing the accident prone locations by using Weighted Severity Index (WSI) method. WSI method follows a system of assigning scores based on the number and severity of accidents in that particular location in the last three years.

III. METHODOLOGY

The process of eliminating or improving accident black spots in a road network is composed of several activities, as illustrated.

- To collect accident data on Amravati Nagpur National Highway.
- Detailed analysis of the identified black spots.
- To find out different methods to prioritize hazardous locations.
- To identify various traffic and road related factors causing accidents.
- The reading taken on Amravati Nagpur Highway then analyze by method of ranking according to the importance of parameter.
- The most important parameter because of which more number of accidents occurred had given top rank and maximum weightage.
- Analysis of the top ranked accidental spots.
- The percentage after giving rank and weightage were calculated and on the basis of value of percentage the accidental black spots were identified.

IV. CASE STUDY AND DATA COLLECTION

Accident Severity has been increasing rapidly year by year. Road transport is an important mode of transportation in India. Road transport system has its contribution in national economy of India. There is expansion in motorization, urbanization, number of vehicles and length of the road networks over the years, so as to meet the demands of road transport. The adverse effect of this expansion on country is that, it leads to increase in number of road accidents and road crash fatalities. A Road accident is negative externality associated with expansion in road network, urbanization and motorization in the country. Road accidents impose a great burden on individuals, society and property. The steep growth of traffic on the Indian roads in recent years has caused a sharp increase in the incidence of traffic accidents. As sustainable solutions for all classes of road safety have not been identified, particularly remote roads and low-traffic rural, a hierarchy of control should be applied, similar to classifications used to improve occupational safety and health.

4.1 DATA COLLECTION AND STUDY STRETCH

The information available for accident studies is the FIR (First Information Report) lodged in the police stations. The data from these records of last four years (2016-2020) were extracted from the FIR record filed under IPCno.279/337/338/304 (A). Vehicles those involved in accidents and reported in the F.I.R with the details of accident. The categories of vehicles include tempo, auto, and different types of two-wheelers, cars, mini-truck, minibus, motor cycle, tanker, truck and bus. The following data was collected:

1. Date and Time of occurrence of accidents
2. Location of accident.
3. Details of accident i.e. injuries, fatalities and property damage.
4. Type of Hitting Vehicle
5. Type of Hitten Vehicle

4.2 ROAD SELECTED FOR STUDY

Two-lane road of about 20 Km from hotel Gauri Inn to hotel Landmark Badnera on NH-6 was chosen for this study. The road was divided into four stretches of 5 Km each. The following stretches were selected for data collection.

- (i) Stretch 1 - Hotel Gauri Inn to Biyani Square
- (ii) Stretch 2 – Biyani Square to Dastur nagar
- (iii) Stretch3- Dastur nagar to Annex Restaurant
- (iv) Stretch4- Annex Restaurant to Hotel Landmark Badnera

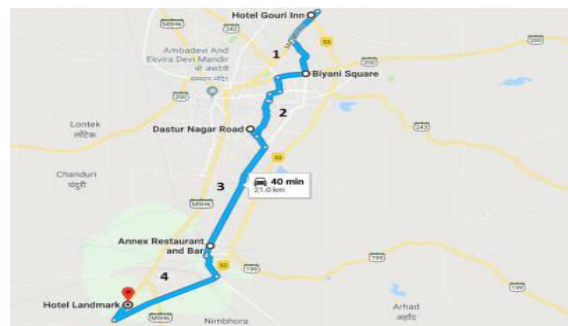


Fig 2: Study Area , Source – Google Map



4.3 ANNUAL VARIATION IN ACCIDENTS

Fig. shows the annual variation in accidents of total stretches during year 2016-2020. It is observed that percentage accidents are increasing in most of the year. In the year 2020 accident rate was high and low in the year 2016. It may be due to increase in no of vehicles, increase in population, bad traffic environment. Fig.3 shows annual variation in accidents of the four stretches. It is observed that no. of accidents are more for stretch-2 and 4 are more higher than stretch -1 and 3. This is because of high traffic volume on stretch 4. Traffic volume decreases on stretch-1 as it is connected to NH-6. Stretch-2 has high population density. Accident rate is more due to more number of non commercial and commercial vehicles on the road, bad traffic environment.

4.4 HOURLY VARIATION IN ACCIDENTS

Fig. shows hourly variation in accidents. One can observe more accidents occurs in between 7PM to 9PM. During this hour line truck (Truck Series) start their long journey. Most of the driver do not use speedometer as they drive by approximate speed, then speed crosses limiting speed as a result accident occur. Also drivers drink and drive in the evening hour. Accident also occurs due to overloading of vehicles. In India load capacity is 10 ton or 16.2 ton for goods carriage but they carry more loads that results uncontrol and lead to accidents.

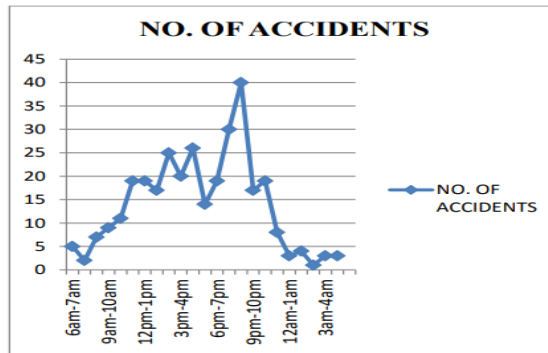


Fig 3: Hourly Variation in Accidents (2016-2020)

4.5 MONTHLY VARIATION IN ACCIDENTS

Fig.9 shows the monthly variation in accidents. Maximum number of accident occurs in summer season i.e. in the month of March, April and May. This is due to distraction related to environment. Problem in these months are fatigue, glare, inconvenient heat.

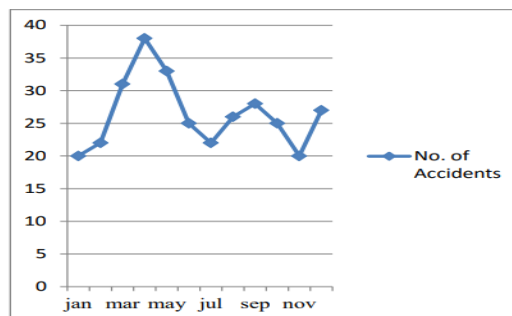


Fig 4: Accident month wise (2016-2020)



V. RESULT AND DISCUSSION

5.1 SAMPLE CALCULATION

The sample calculations for km 43.700 for nature of accidents.

- a. Consider chainage 43.700 from Table .1
- b. Parameter 3 i.e “Rear end Collision” was found and hence marked as Y (YES).
- c. Parameter 1 i.e “overturning” was absent and hence marked as N (NO).
- d. Accordingly all the parameters for all the chainages were marked as Y or N.

Table 1 Accident Study of the road

Sr No.	Accident Location (Km)	Nature of Accident							severity	SI (%)
		1	2	3	4	5	6	7		
	A	B								
1	40.000	N	N	Y	N	N	N	N	6	21.42
2	41.000	N	N	N	N	N	Y	N	5	17.85
3	41.500	N	N	Y	N	N	N	N	6	21.42
4	43.700	N	N	Y	N	N	N	N	6	21.42
5	44.300	N	N	Y	N	N	N	N	6	21.42
6	44.350	N	N	N	Y	N	N	N	3	10.71
7	44.450	Y	N	N	N	N	N	N	7	25
8	44.750	Y	N	N	N	N	N	N	7	25
9	45.500	N	N	N	N	N	Y	N	5	17.85
10	46.100	N	N	Y	N	N	N	N	6	21.42
11	46.200	N	N	N	N	N	Y	N	5	17.85
12	46.600	Y	N	N	N	N	N	N	7	25
13	46.600	N	N	N	Y	N	N	N	3	10.71
14	47.300	Y	N	N	N	N	N	N	7	25
15	47.300	N	N	N	N	N	Y	N	5	17.85
16	47.600	Y	N	N	N	N	N	N	7	25
17	47.700	Y	N	N	N	N	N	N	7	25



18	47.700	N	N	Y	N	N	N	N	6	21.42
19	48.150	N	Y	N	N	N	N	N	4	14.28
20	48.150	N	N	Y	N	N	N	N	6	21.42
21	48.400	N	Y	N	N	N	N	N	4	14.28
22	48.400	Y	N	N	N	N	N	N	7	25
23	48.400	Y	N	N	N	N	N	N	7	25
24	48.630	N	Y	N	N	N	N	N	4	14.28
25	49.350	N	N	N	N	N	N	Y	2	7.14
	Yes	8	3	7	2	0	4	1		
	Ranking	1	4	2	5	7	3	6		
	Weigh	7	4	6	3	1	5	2	28	
severity index benchmark									21.4	

5.2 ANALYSIS OF DATA

Method adopted for analysis is called as Ranking Method. This method determines the vulnerability of a particular spot to accidents. It finds the most predominant parameter out of the available. It is based on logical analysis wherein the parameter occurring most frequently is given the top rank and the parameters that have occurred rarely are given lower ranks. Ranks given to different parameters are applicable to that particular study area only.

5.3 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.: Summation of the weightages assigned to top 5 parameters $7+6+5+4= 22$

Weightage of all parameters= 28 Severity Index Benchmark = $100 - [(22/28) \times 100] = 21.42$

Based on analysis of data profile indicating severity Vs actual chainage is present in figure 7, figure 8, and figure 9 for Nature of accidents, classification of accidents and causes of accidents respectively.

- From figure 6 it has been cleared total 8 accidental spots are above the datum of severity index of 21.42 with the parameter nature of accident which clearly indicate that the presence of accidental black spot.
- From figure 7 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 figure 8 it has been cleared total 17 accidental spots are above the datum of severity index 20 with causes of accidents which clearly indicate that the presence of accidental black spots.

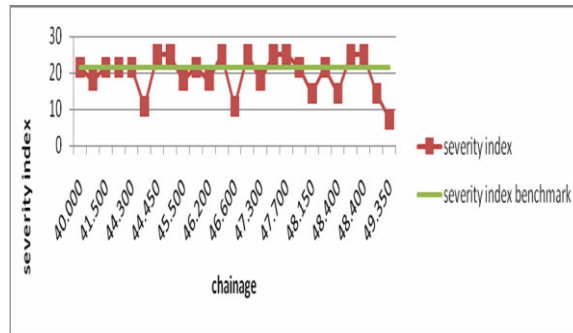


Fig 6: Profile Showing Severity Vs Actual Chainage for Nature of Accident

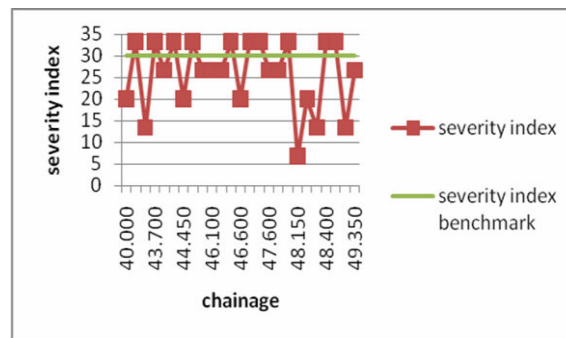


Fig 7: Profile Showing Severity Vs Actual Chainage for Classification of Accidents

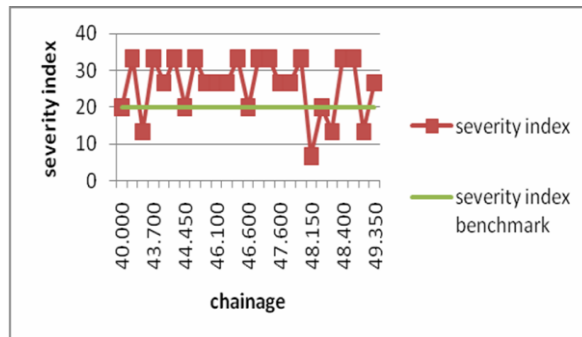


Fig 8: Profile Showing Severity Vs Actual Chainage for Causes of Accidents

VI. CONCLUSION

- By considering all these parameters by using method of ranking and severity index the accidental black spots can be identified.
- **More** number of accidents were occurred due to **causes of accidents** and **least** number of accidents are occurred due to **nature of accidents**, the main inducing causes for traffic accidents are identified, which provides a basis for improving the conditions of traffic facilities and enhancing traffic safety
- Lack of proper warning signs, road markings, signals, inadequate illumination on footpaths and cycle tracks, poor emergency response capability and injustice in the implementation of traffic laws are the main causes of road accidents.
- Systematic accident reporting and recording centers must be established with the help of different highways agencies, so that regular monitoring and identification of black spot can be possible. Deficiency in Geometric design play a significant rule towards accident, which should be checked and counter measured with engineering concepts.
- Most of the accidents are not merely due to some serious causes, but ignorance of some minor causes may results major accidents. It also emphasizes the need to understand the importance of minor weakness and flaws in the road traffic system and their low cost remedial measures.



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