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Identification of Accidental Black Spots on Local Pune City Roads

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ABSTRACT

To supply blood, arteries and veins play the important role in the body similarly, road networks play a vital role in transportation system. Transportation system has geared up its performance level by constructing expressways, national highways, state highways etc. in consideration of increasing traffic. "Black spot is the place where accidents are historically occurred" This paper emphasizes the study of some local city roads (Khadi Machine Chowk-Kondhwa, KMC-Undri and KMC-Katraj) of Pune. From the present traffic accident statistics the identification of accidental black spots is done in present study by using ranking method with the help of severity index.

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Introduction

Transportation is the movement of people, animals and goods from one place to another. India has a road network of over 4689842 kilometers in 2013, the second largest road network in the world. The traffic moving on Indian road networks are of mixed type of vehicular traffic which is one of the causes of accidents in India. According to WHO road traffic injuries are the 6th leading cause of death in India and according to road accident statistics 2013, no. of people killed in India are 1, 42,485 per year. One fatal accident every 3.7 minutes 16 people die in every hour in India which is equal to 390 deaths happening every day.

Expressways and Highways are playing the important roles in carrying the road traffic volume. For speedy transportation of men and goods between Mumbai and Pune, the Yashwantrao Chavan Mumbai- Pune Expressway is constructed. Which is India's first six-lane concrete, high speed, access controlled tolled expressway, maintained by MSRDC [Maharashtra State Road Development Corporation]. Expressway has an evidence of large no. of accidents. In 10 years there were 1758 accidents with more than 400 fatalities.

Katraj- Kondhwa road, Kondhwa- Saswad road and Hadapsar Bypass road these are the some local city roads of Pune city meeting at Khadi machine chowk which serve as center. In two years 2013-14, Katraj Kondhwa road stretch of 2.9kms, Kondhwa(Bk) road stretch of 1.9kms and Undri road of stretch 2.4kms has witnessed of total 29 accidents in which 13 are fatal, 10 semi fatal and 6 nonfatal.

Accident is an unexpected and undesirable event, especially one resulting in damage or harm. Main cause of road accidents and crashes are due to human errors such as over speeding, drunken driving, distraction to driver, red light jumping, avoiding safety gears like seat belts and helmets. To identify accidental black spot we have adopted ranking method in which severity index is calculated at each change.

Literature Survey

Study of accidental black spot is not an easy task as a considerable volume of literature on road accidents & road safety is produced continually in many different languages by many different organizations. There are many good studies

concerning the geography of road accidents. A brief review of the various studies on black spot identification is given as follows:

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.

Aruna D. Thube (2010), APC (Accidental prevention committee) inspected 18027 km of length of NH/SH categories of rural highways in the Maharashtra state and identified number of accidental black spots with help of PWD. APC identified accidental prone areas by using the accidental data which is maintained at local police stations. After inspection of these locations APC suggested the possible improvement measures at such locations.

Snehal U. Bobade (2015), Adopted ranking method to identify accidental black spots on national highway and expressway. D. S. Sujit Kumar, Road traffic injury were collected from Govt. general hospital, Kurpool. They use Trauma score -injury severity score methodology to evaluate probability of survival for each patient then hazardous index is calculated. S.M. Sohel Mahmud, Anindydev Sarkar, Md. Mazharul Hoque, (2011), An in-depth study has been conducted to identify the major hazardous locations of the Dhaka-Aricha highway and to evaluate the causative factors of accidents on these locations through data analysis, using GIS technology, on the site field observation and focus group discussion.

Aim & Objectives

The basic aim & objectives of this study are to identify accidents black spots on local city roads of Pune city.

Methodology

- 1) The study for finding out the accidental black spots and severity index is carried out in two main steps 1st is collection of data and analysis of data and 2nd is the onsite investigation.
- 2) The road length of field investigation site is divided in a suitable chainage to carry out field investigations.

- 3) The data regarding road accidents is collected from the concerned police stations and police officers.
- 4) The analysis of data is done and the accident prone locations are marked.
- 5) In the previous research, some of the researchers had already gave typical locations or situations where accident Occurred repeatedly and criteria's responsible for road accidents.
- 6) On the basis of this criteria's some work have been already done and this parameters are well defined so we referred these parameters for our research method.
- 7) These criteria's are ranked and weighted according to their importance using ranking method and the percentage severity index at each location is calculated.
- 8) By comparing analysed data obtained from concern police station and investigated data from field, the spot where the data is matched considered as accidental black spot.

Study area

Pune district is the 7th most populous city in India and the second largest city in the state of Maharashtra. Study area contains the places of worship, water sources separated from their users. Due to which the people from the surrounding area try to cross the roads as a shortcut way. The locations of the study area are shown in satellite images.

. The following are the some stretches of roads of Pune city also has been selected for the study.

KMC to Katraj chowk(2.9km)

KMC to Undri(2.4km)

KMC to Kondhwa(2.6km)

Satellite images

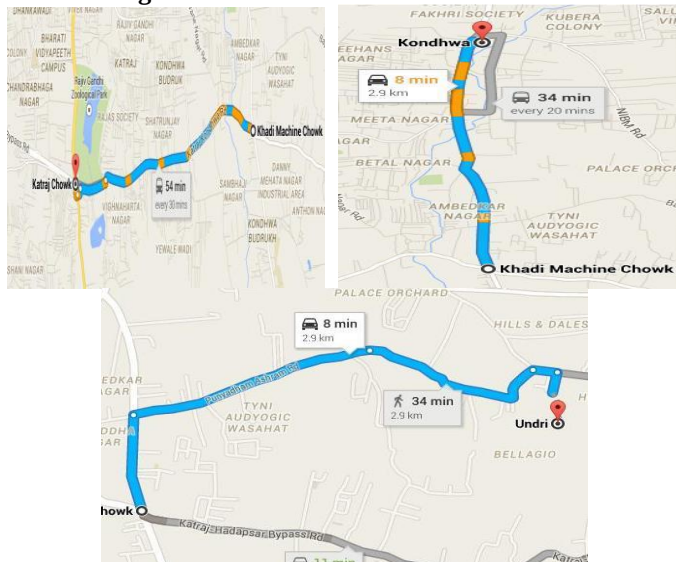


Image: Satellite images of study area

Layout of related roads

The figures given below represent the plan of KMC-Kondhwa road and KMC-Undri road respectively. Where the black colour dots indicate the accidental black spot as per the severity index and red colour dots indicate the accidental spots as per the data collected from concern police station.

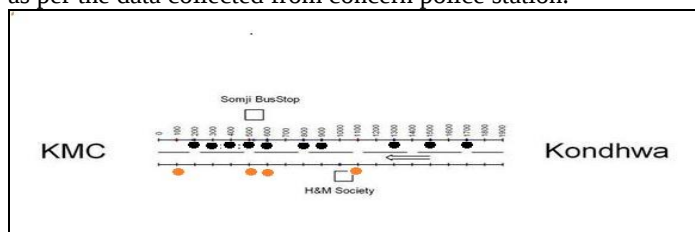


Figure 1. Plan of Khadi machine-Kondhwa Road

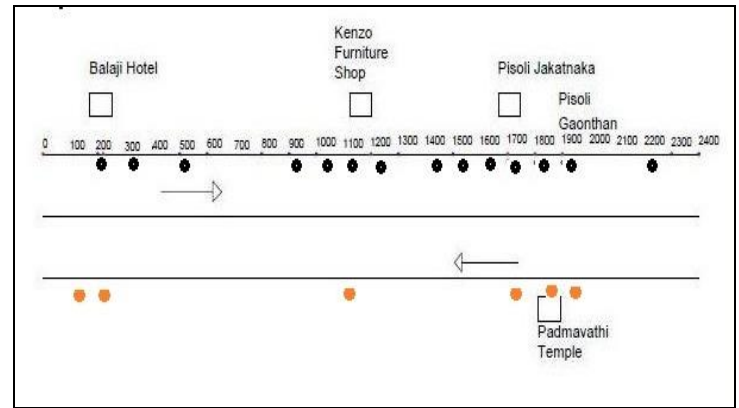


Figure 2. Plan of Khadi machine-Undri Road

Criteria's given by Aruna D. Thube in 'Accident Blackspots on Rural Highways In India' for identification of accidental blackspots :

1. Highways separating villages from its water source.

Highways separate the villagers and its water source, under such situation they have to cross the highway in search of water. Results in accident of pedestrian

2. Narrow bridges.

Bridges which are narrow in width face difficulties of overtaking for vehicles moving on it also chances of head to head collision are more in this case. Hence, results in accidents.

3. A right turns of road on down slope.

In such cases the shoulder slopes from super elevated edge to the edge of formation of shoulder. In many cases the shoulder is much lower than blacktopped surface. Due to the slopes the vehicles travels at speed. If other vehicle approaches the spot at the same time then the vehicles are forced to move to the edge of pavement. Vehicles at such locations have in effect of negative super elevation. Such locations on busier roads are always accident locations.

4. Small subsidiary road meeting the main road.

Small subsidiary road meets the main highway or main road at some locations where the driver do not have proper control over the vehicle due to the slope of subsidiary road meeting the main road.

5. Absence of guard stones on the curve.

Due to absence of guard stone the driver misjudge the location and runoff the road. There must be curve indicator hording before the starting of curve so that driver will become careful and accidents are reduced.

6. Trees by the roadside.

Trees are the major factors for the accidents in most of the places. Because if in some condition driver lose control on vehicle or break then he directly hit on the roadside tree resulting in the serious injury or sometimes death.

7. Erosion of road shoulder.

At most of the places of city roads shoulders are get badly eroded & poorly maintained. There is a 15 to 30cm level difference between road and shoulder at some chainages. This can be one of the reasons of accidents.

8. Place of worship or prayers.

Such places found very close to the carriageway or sometimes at the meeting of two roads formed corner in the road. Due to this head on collision happens many times due to the insufficient sight distance.

9. Passenger pickup sheds at the junction.

In most of the cases such sheds are located at the junction of two roads forming corner which may be problematic to the driver due to insufficient sight distance.

Table 3. Khadi Machine to Kondhwa(Kh)

Weightage	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1		
Rank	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
Chainage/Criteria no.	10	7	4	9	13	3	6	1	2	5	8	11	12	14	15	% Severity Index	
100				Y	Y											19.16	*
200	Y	Y				Y										32.5	*
300	Y	Y														24.16	*
400	Y	Y														24.16	*
500	Y	Y														24.16	**
600		Y				Y	Y									27.5	**
700		Y														11.66	
800		Y		Y	Y		Y									38.33	*
900	Y		Y													23.33	*
1000																0	
1100																0	*
1200	Y															12.5	
1300	Y		Y													23.33	*
1400	Y															12.5	
1500	Y		Y													23.33	*
1600	Y															12.5	
1700	Y		Y	Y	Y											42.5	*
1800																0	
1900																0	
Total	11	7	4	3	3	2	2	0	0	0	0	0	0	0	0		

1)The value of 23.33% is taken as datum reference value to decide whether the spot is accidental black spot or not which is calculated as follow

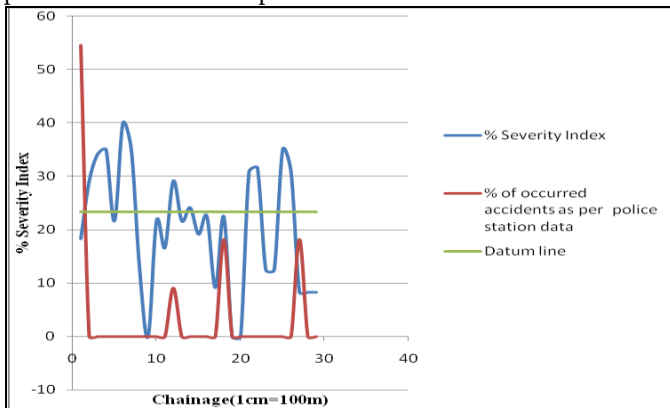
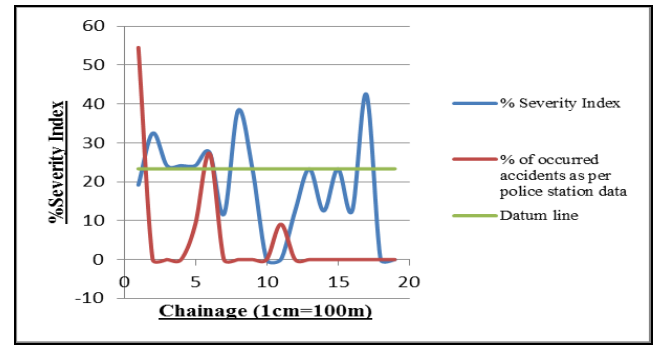
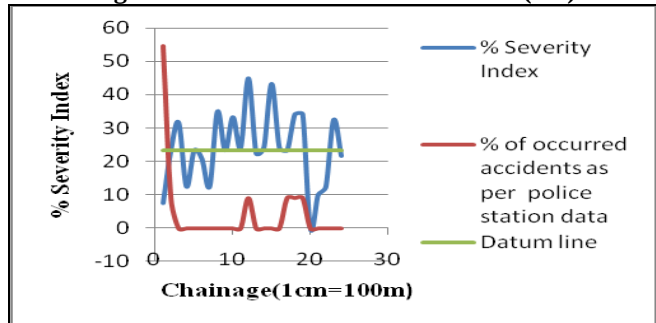
= $100 - \left[\frac{\text{sum of the half max. weighted criteria's}}{\text{total sum of the criteria's}} \times 100 \right]$

= $100 - \left\{ \left[\frac{(8+9+10+11+12+13+14+15)}{(1+2+3+\dots+15)} \right] \times 100 \right\}$

=23.33 %

2)The % severity index above 23.33 % is considered as accidental black spot and below 23.33 % is non-accidental black spot.

Following graphs are prepared as % severity index according to ranking method and police station data versus chainage in meter. In the graph red coloured line indicates the % of occurred accidents as per the police station data, blue coloured line indicates the % of severity index and green coloured line indicates the datum line which decides where the spot is accidental black spot or not.

**Figure 4. Khadi Machine chowk to Katraj chowk****Figure 5. Khadi Machine to Kondhwa(Kh)****Figure 6. Khadi Machine chowk to Undri**

Conclusion

From the analysis it is clear that by using ranking method & severity index accidental black spots can be identified. Further for rectification methods such type of analysis will help like the spot with higher severity index can be checked for various parameters and the parameter which is contributing more as per its rank should be treated first.

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