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BLACK SPOT ON HIGHWAY AND REMEDIAL MEASURES: A REVIEW

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Abstract: In this paper, a literature review is given of the methods and techniques that are used to analyze black spots and black zones. Although, no universally accepted definition of a black spot or black zone is given, these locations will in general be described as high risk accident locations. In this context, several statistical models are described in literature to model the accident frequency and accident severity. This study gives an overview of these models. Additionally, several alternative methods that are used to identify and rank black spots are described. Furthermore, some techniques that are used to profile these accident locations and the use of before- and after studies to estimate the effect of treatment on these sites are discussed in this text. Finally, an overview of the methods and techniques that are used in India, Belgium, Denmark and Australia, etc, to analyze black spots is presented.

Keywords **- Black zones, Black spots, Accident frequency, Accident severity**

I. INTRODUCTION

The problem of accident is a very acute in highway transportation due to complex flow pattern of vehicular traffic, presence of mixed traffic along with pedestrians. Traffic accident leads to loss of life and property. Thus the traffic engineers have to undertake a big responsibility of providing safe traffic movements to the road users and ensure their safety. Road accidents cannot be totally prevented but by suitable traffic engineering and management the accident rate can be reduced to a certain extent. For this reason systematic study of traffic accidents are required to be carried out. Proper investigation of the cause of accident will help to propose preventive measures in terms of design and control.

According to Ministry of Road Transport & Highways (MoRTH), Government of India, road accident black spot on National Highways is a road stretch of about 500m in length in which either 5 road accidents (involving fatalities/grievous injuries) took place during last three calendar years or 10 fatalities took place during last three calendar years.

Growth in urbanization and in the number of vehicles in many developing countries has led to increased traffic congestion in urban centers and increase in traffic accidents on road networks, which were never designed for the volumes and types of traffic, which they are now required to carry. In addition, unplanned urban growth has led to incompatible land uses, with high levels of pedestrian-vehicle conflicts. The drift from rural areas to urban centers often results in large number of new urban residents unused to such high traffic levels. As a result, there has often been a severe deterioration in driving conditions and a significant increase in the hazards and competition between different classes of road users.

II. LITERATURE REVIEW

Many researchers have worked and published their work on Black spot on Highway and remedial measures. Some important papers relating to this are referred in this work. The methodology, observations, conclusions and further scope of work of these publications are used to finalize the objectives of present work. Summary of such reports is presented in further sections. The available literature of review is classified as follow:

Apparao G, *et. al(*2013), The Critical Crash Rate Factor Method is an easy-to-use statistical test method, which is very effective in identifying Accident-prone stretches for Four Lane Highways. From analysis, it is clear that maximum number of crashes occurs during the weekends; this may be due to the large number of tourists coming to Haridwar and Rishikesh. From analysis it is evident that maximum number of crashes occurs in the months of August and December. This may be due to the onset of rainy season in august and due to the fog in the month of December. The peak period for Crashes comes out to be between 14.00 - 16.00 hrs. The Crash ratio developed for the sections can be used for prioritizing Safety Development program.

Liyamol Isen, *et. al* (2013),The study was an attempt to find out the most vulnerable accident locations or the black spots in Alappuzha and Ernakulam districts making use of GIS. The WSI method was used to rank the accident locations, and top ranked six spots in Alappuzha and ten spots in Ernakulam were selected as per the WSI value for the data collection and analysis in GIS platform. Based on the analysis, Kalavoor in Alappuzha and two spots Kalamassery and Mulamthuruthy in Ernakulam were identified as most vulnerable accident locations and suggested some possible alternative or corrective measures to improve the transportation system in these locations, from which the decision maker can select suitable measure for the location. The method is found to be effective in identifying the black spots, provided sufficient secondary data is available.

Nikhil.T.R, *et. al* (2013),It is observed during the study that the Gorgunte Palya and Jalahalli Junctions were already declared Black Spot / accident zone. From the accident data we also observed that the accidents are increasing Inadequate sight distance, road condition, poor visibility at night, drivers negligence etc. It is also observed during study that there is lot of pedestrian deaths in spite of having Zebra crossing and pedestrian signals mainly due to high speed of vehicles, so it is suggested to construct speed brake or road humps before pedestrian signals. During the study in Goguntepalya it is observed that there is poor vision of Piers of metro and loss of human life and damages to vehicle at night hours, the remedial measures suggested for Improvements of junctions are, Provision of Road humps before the pedestrian signals. Provision of road humps in the stretches before intersection or junction point. Installation of proper sign posts aside the roads. Provision of pedestrian underpass/ sky walk at certain places where pedestrian movement is more. Improving the sight distance at the intersection by increasing the set back distances in the junctions. Increasing the signal timings by twice to avoid the accumulation of vehicles to reduce the jam lengths. Increasing the signal rest timings by twice to avoid accidents. Increasing the skid resistance of the pavement . Repairs of cracked surface and filling up of pot holes to reduce the accidents. Installation of cat eyes and road reflectors in the junctions and also near the road humps. Installation of reflectors to piers of Metro so that the accident caused due to collision against pier will be avoided.

Huy Huu Nguyen, *et. al* (2015), In order to avoid unexpected shortcomings in the implementation of the method, it is important to pay special attention to the following two aspects. First, safety potential is the difference between the actual accident cost and the expected accident cost conforming to the best-practice design standard. The expected accident cost depends on the basic accident cost rate. In ideal circumstances this expected accident cost contains no influence of the infrastructure on the accidents any more but represents the accident cost caused only by the other two components of the transport system – vehicle and road users. The best way to estimate the target values would be to calculate the accident cost rate for a sample of spots with best practice design. Another possibility would be to use a specific percentile of the overall distribution of the accident cost rates. Second, statistical tests must be done to make sure that the random variation is not the decisive factor in the process of identifying the high accident frequency locations. Random variation in accident count at the identified locations can be estimated by Poisson probability distribution.

Snehal Bobade, et. al (2016) 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 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. By considering all these parameters by using Ranking Method accidental black spots can be identified. it is clear that skidding, grievous injuries and over speeding are responsible for occurrence of more number of accident.

K. Chandrasekhar Reddy (2017),Ten accident hot spots /accident-prone locations were identified. Most of the road accidents of vehicles that are getting into a junction wherever a lot of aspect roads. Vehicles liable for most of the accidents are Trucks/Lorries and followed by Auto Rickshaw and Car/Jeep/Van. Most of the road accidents occurred during 9-10am and 4-5pm; it may be due to peak hour traffic. Vehicles approaching intersections are directed to definite paths with appropriate islands and channels, marking etc. Shoulder width, pavement width, sight distance, signal and pedestrian crossing facilities ought to be improved.

Maen Ghadi, *et. al* (2017), Based on the results obtained from the case studies and overall comparison, it can be summarized and concluded that; dangerous locations on two types of roads had been compared to discover the affection of the speed factor on the efficiency of each selected BS analysis method. Two types of BS identification methods had been selected; the first is the SPA method which is based on a spatial identification of accidents clustering locations, and the second is the SLW screening method. It was noted that in low speed urban road accidents tend to be more aggregated around real dangerous points or conflict areas like, intersections or pedestrian crossing locations. These areas can be identified using local and global Maron's indexes as in the applied SPA method. Therefore, SPA can overcome SLW in this type of roads of being more applicable and flexible in identifying BS lengths of clustering accident locations more efficiently. Whereas, in the case of a high speed road

types, like a motorway M3 road example; crashes distribution pattern are seem to be more scattered from the exact dangerous point which make it difficult for spatial method to identify any real black spot using clustering technique, and allow sectioning SLW method to be able of identifying BS more efficiently, regardless its fixed length, by using a suitable threshold value equal to the average observed number of accidents for all similar locations.

Athira Mohan, *et. al* (2017), The Weighted Severity Index (WSI) method was used to rank the accident locations. The top five spots were selected as black spots as per the WSI value from the collected data and suggested some possible alternative measures improve the transportation system. The overall methodology was found to be effective for the identification, evaluation, and treatment of accident black spots if sufficient data is available. The deficiencies like non-availability of parking lane, no zebra crossing, no guard rails and sign boards and also the no proper road markings and unauthorized parking etc. It is also observed that most of the 2-wheelers are not using the helmets and also over speeding their vehicles. Implementation of the suggested improvements will help to increase the overall road safety.

Sandeep Verma, *et. al* (2018),This study carried out two critical data one was road accident data and other was a road geometric data. Road accident data was collected from Police department, this data are used to briefly describe general characteristics of the road accidents like accident location, number of accidents per year, number of person die and number of person injured. Road geometric data collected from field survey this data describe wide range of road geometric design elements and its harmful effects on the traffic. Based on the analysis of accident data the frequency and occurrence of road traffic accidents revealed dramatic variations because of the impact of various factors such as temporal variation (i.e. monthly, yearly) Alignment effect (i.e. Tangent, mountainous and escarpment areas) Driver characteristic, Traffic rules awareness etc. On the other hand causes of road traffic accidents based on the vital information from the pedestrian, local people, drivers and officers of nearest police station through questionnaire, survey and interviews; road design problems over speeding, failure to give way to vehicles and pedestrians, overtaking in winding horizontal curves, no awareness of traffic rules.

Abdullah Maltaş, *et. al* (2018), In this study, ABS has been identified by simple ranking, sliding window and, peak searching using by K-means clustering method in Istanbul, Sogutlucesme-15 Temmuz Sehitler Bridge corridor. In the analysis, three different performance measures such as ACF, EPDO-ACF, and RSI were used. According to three performance measures and network screening methods that used, Temmuz Sehitler Bridge tollbooths segment was identified and marked with red color as the first ABS section of the corridor in the study corridor. As seen in the analysis, the tollbooths segment, where has a high traffic volume, has been the riskiest site regarding all of the performance measures. Therefore, the factors that cause accidents in this region should be identified and effective countermeasures should be taken. In consequence of replacing tollbooths with open toll system, a reduction in the number of accidents is expected. When considering the total length of the segments classified as primary, secondary and tertiary crash zones by simple ranking, sliding window and peak searching methods; it is seen that these lengths are shorter in sliding window method. Therefore, the segments identified hazardous by the sliding window method would be the most efficient method to identify the countermeasures and the priority of the segments.

Nivea John, *et. al* (2019), The project was aimed to identify, evaluate and improve the accident blackspots in the Westfort-Kunnmkulam road. Analysis was done by Weighted Severity Index method and identification of blackspot was done by Quantum Geographic Information System (QGIS). The characteristic analysis of accident data results the causes for accidents .Major black spots are Amala junction, in front of Amala hospital, Peramangalam, Mundur, Kaiparmbu junction and in front of the beverage outlet in Kaiparambu. Appropriate remedial measures were suggested in order to reduce the intensity of accidents. The overall methodology was found to be effective by locating the high severe black spots using QGIS.

III. CONCLUSION

From studying of many papers it found that the accidents are increasing Inadequate sight distance, road condition, poor visibility at night, drivers negligence etc. It is also observed during study that there is lot of pedestrian deaths in spite of having Zebra crossing and pedestrian signals mainly due to high speed of vehicles, so it is suggested to construct speed brake or road humps before pedestrian signals. Pedestrian road marking should be provided in the location. Hazard marker and median marker should be erected on location. Advance Cautionary and Informatory Sign board should be installed on the location. Median marker along with the kerb painting should be provided. Solar blinker should be provided.

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