



IDENTIFICATIONS AND IMPROVEMENTS OF ACCIDENT BLACK SPOTS OF NATIONAL HIGHWAYS: A REVIEW

Engineering

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ABSTRACT

India is a large country, and highways play a significant role in the country's development. As the world's population grows, so does the number of automobiles on the road. As the number of vehicles on the road grows, so does the number of accidents. As a result, there must be reduction in accidents proving the safety of roads. The research of accidental black spots revolves around the study of road safety, and if road safety is addressed, the number of accidents is likely to decrease. So, the identification of Blackspots and improvements to the specific locations in terms of geometrics of road. Indian National Highways are thus to be engineered considering all these inputs related to safety and design standards. All of these aspects were considered in a critical review, which depicted the scenario of accidents occurring on various Indian roadways, as well as their causes and solutions.

KEYWORDS

Weighted Severity Index (WSI), black spot, horizontal curves, road accidents, operating speed, geometric Design, alignment, curvature, national highways.

INTRODUCTION

National Highways serving as the main vines of the Transport network of the country. The national highways in India cover a total distance of 70,548 kilometers, accounting for 2% of the country's total road network and carrying 40% of all traffic. According to estimates, India is responsible for roughly 10% of all fatal road accidents worldwide. As a result, a decision has been made to make concerted measures to improve road safety. One of the most effective techniques to road accident prevention is the identification of accident locations, analysis, and treatment of road accident black spots.

Accidental black spots are described as areas of the road where the risk of an accident is high or where accidents happen frequently on national highways. Researchers have also verified that the geometric design of roadways, particularly the horizontal alignment, has a significant impact on their quality and safety. The notion of Geometric Design Consistency (GDC) has proven to be the most promising technique for investigating national highway traffic safety requirements. According to research, curved parts of roadways account for more than half of all fatal crashes.

CRITICAL REVIEW:-

Arun H R et al (2018) focuses on underpass proposal for Kotapady beside National Highway-66. Due to improper connection of state highway traffic jam was commonly observed in peak hours and many accidents was already recorded in this place. The surveying of the area near the junction was done using the total station and soil samples for 5 different places near katapady was recorded. It was proposed that highway will go down around 8m and an over-bridge is designed across highway to connect the two halves of city in order to keep connection between city. Considering future development of highway, the highway was designed with width of each road up to 12m over the existing road width is 9m and bridge was proposed with 25m width and 45 m length in order to provide 6 lanes two-way road upon the bridge. It is observed that constructing underpass will be easier, economical and suitable for topographical conditions compared to other methods.

Vani A K et al (2019) This research looks into the causes of accidents on NH 75 and how to prevent them. This Indian national highway runs across the states of Karnataka (418.7 km, 260.2 mile), Andhra Pradesh (23.40 km, 14.54 mile), and Tamil Nadu (length in 60.7km, 37.7 mile). There are seven major accident zones where major efforts were taken to ensure road users' safety. A complete road survey is conducted on the entire stretch of road to determine the road way geometric restrictions, such as road width, walkway width, and road marking. Accident information is gathered from the local traffic police station. Accidents with a WSI of more than 40 are labelled as black spots. The accident data from the traffic police station was analysed using a weighted severity index for chosen 7 zones on NH-75, with 6 areas classified as black spots based on the index value. Overtaking, over speeding, and careless driving are common causes of accidents, with improved enforcement of traffic regulations and sufficient lighting at

intersections being recommended as remedial measures. LIU Yichao et al (2013) The impact of objective elements such as road conditions, traffic safety facilities, along-the-line environment, and traffic flow on the establishment of highway traffic accident prone areas is examined in this paper. If the lane is excessively broad, some vehicles will try to overtake using the extra lane width, which will increase the number of accidents. Vehicle damage and traffic accidents can occur if the radius and length of a convex vertical curve are too small and short. Long steep slopes induce acceleration, which causes the vehicle's speed to be too high or too low, resulting in accidents. When the sight distance is less than 100 m, the accident rate rises sharply as the sight distance decreases. The researcher confirms the influencing variables of highway accident black spots, conclude the cause analysis, and implements prevention and management strategies for the highway section's accident black spot.

Hameed Aswad Mohammed et al (2013) Focused to improve roadway design and reduce hazardous spots, and studies focused on safety and geometric design objects. Highway geometric design features and attributes are considered in this study, and explanations are offered as to how they effect highway safety to what extent. Carriageway, horizontal curvature, median, shoulder, and vertical curve are some of the key geometric design components that might affect highway safety. Horizontal curves have higher crash rates than tangent parts, according to previous study. Accidents will occur if the superelevation value is incorrect or if there is no superelevation. Horizontal alignment has regularly shown that accidents grow with ever sharper curves, according to researchers based on traffic safety to roadway relates. In comparison to up-gradients, accidents increase with down-gradients. It examines the findings of investigations in different nations and presents current international understanding of the relationship between safety and the key non-intersection geometric design criteria. Anuj U. Manerikar et al. (2016) This study objects to identify road accidents black spots of NH - 4 from study area of chainage (82.00 to 83.00) by studying accident data acquired by NHAI of year 2014-2015. Aim of this paper was to find out accidental prone areas on NH-4 by seeing different parameters such as; nature, classification and causes of accident by Ranking Method. The constraint which is reason for road accident was given highest rank. Here, Severity index is calculated for severity of a particular location of highway accidents. Overall 34 locations were identified with nature of parameter on severity index i.e classification and causes of road accidents, which indicate accidental black spot. It was sure that overspeed, skidding and grievous injuries where responsible for greater number of accidents.

Pritam Kashi del at (2019) This paper objects to identify the accidental black spots on the NH-48 extending from Bhujbal Chowk (Wakad Brige) to Chandani Chowk having a length 12 km. The analysis of accidental black spots was done from primary and secondary data. Primary data was collected by conducting physical survey on NH-48 and secondary data (Existing data) was collected from NHAI for two

years (2017-2018). The primary and secondary data was analysed by ranking method, weight severity method and accidental density method then accidental black spots were detected on NH-48. All together 9 black spots were detected in the stretch of 12km on NH-48. Studies carried out on the stretch spanning from Bhujbal Chowk to Chandani Chowk has found out that one of the major reason of accidents is the rear end collisions which occurs due to improper transition, over speeding, loss of control over vehicle and visibility at junction.

K Geetha Rani et al (2018) In this paper highway geometric design and safety is studied in order to improve highway design and avoid hazardous spots. Safety has been investigated in relation to design factors such as shoulder width, super elevation, median width, curve radius, horizontal and vertical curves, lane width, sight distance, and so on. After reviewing several studies on cross-sectional and alignment parameters it has been found that, the presence of a median, certain types of accidents, such as head-on collisions, are reduced. Horizontal curves with gradients and surfaces having low coefficients of friction, they become more dangerous. In this approach, highway geometric design components and attributes are taken into account, and explanations on how they affect highway safety are provided.

Jeena Johny et al (2019) This paper is focused on influence of alignment parameters in the accidents rate. A methodology is suggested for evaluating two-lane highway uniformity and safety through alignment parameter. The geometric data collected for this study included information about the horizontal curves. Previous five years (2013-2017) highway accident data were gathered from respective police stations of nearby area. Alignment indices of the 33 sections were found out. With significant variables different trials of modelling were done. The dependent variables are Minor accidents, Major accidents, Fatal accidents, Total accidents and EPDO. The Ratio of curve length to tangent length, Ratio of curve length to road length, Average curve length, Average Tangent Length, was found to be the most influencing variables on the accidents on horizontal curves have strong relations on accidents.

Athira Mohan et al (2017) This paper objects to identify the accident locations along Amravati-Nagpur highway length from Asian highway no. 46. The top accident-black spot were selected as accident prone section based on Weighted Severity Index Method and recommendations are made for improvement the highway safety. The study area from Futaila chouk to Outer ring road stretch (13km) was chosen for black spot studies and some of major busy places such as Wadi and Wadhamma. On identified black spots, a comprehensive road inventory study was carried out for particular highway stretch to measure highway geometric parameters like road width, type of shoulders, median, surface condition, edge obstruction, road markings, road signs etc. Accident data was taken from local police stations for three consecutive years (2014-2016). The five major black spots along the national highway were identified based on a study of crash data using the severity index technique and the density method.

Snehal Bobade et al (2015) Studied on identification of highway accidental locations on NH-9 i.e Pune-Solapur Highway and Mumbai-Pune Expressway by method of ranking. Study area was selected from 76 km to 78 km for experimental investigation on Mumbai-Pune Expressway as pilot study. According to data collected by MSRDC, more number of accidents is witnessed from km 76 to km 78 in recent past. The top three vital parameters were small secondary road meeting the main highway in a steep slope, right turns of road on down slope, footpath or cattle crossing. Based on the ranks calculated after giving percentages of black spot the location or area is identified as black spot. Arun Kumar et al (2016) This article investigates the length of NH-21A between BADDI and NALAGARIH, which is prone to accidents, and provides information to the beneficiaries. The data collected from PWD was analysed, and the sites where the most accidents occurred were found. To determine accident black spot locations, data from respective police stations was collected over the past five years (2009-2014). After compiling the data, five black spots were identified, three of which were T-junctions and two of which were intersections with the highest number of accidents. Crash spots on the highway length were identified by reviewing the FIRs obtained from the police station, and then crash diagrams were created using the data from the FIRs. The most deaths, horrific injuries, and minor accidents happened near union Sandholi, whereas large accidents occurred in Kishanpura. High and mixed traffic volumes, overtaking, and vehicle speeding are all

factors that contribute to accidents on NH 21 A. Heavy trucks and two-wheelers were responsible for the majority of highway accidents. For the enrichment and benefit of society, the analysis of these black spots and other pertinent data will be shared with the police department.

S.U.Bobade et al (2015) This paper identifies black spot on Pune – Solapur highway. Accidental black spots analysis is done the help of several methods like ranking and severity index by using secondary data. Remedial measures are suggested to betterment of the performance of highway safety. For this study 40 km to 50 km has been taken as study area, and total 35 accidents occurred on this particular stretch from 2013 to 2014. From analysis it was clear that total 9 accident spots are above the baseline of severity index i.e 22.42 with the parameter such as nature of accident, 11 accidental spots are above the baseline of severity index i.e 31 with classification of accidents and 18 accident spots are above the baseline of severity index i.e 21 with causes of accidents which evidently show the presence of accidental prone locations. Using the approach of ranking and severity index, accidental black spots were discovered by taking into account all of these factors.

Sanjith Anchan et al (2015) Studied identification of accident black spots by using remote sensing & GIS techniques for particular portion of National highway-75, i.e from Nelyadi to Sakaleshpura. 58 km road stretch was selected from Nelyadi to Sakaleshpura connecting Mangalore-Bangalore highway as study area. The methodology utilized for the accident investigation in current study is done in two sections i.e spatial data and its related analysis, and non-spatial data and its analysis. In this study toposheet from survey of India has been taken to prepare a base map. Road accident data obtained from respective police stations for consecutive 4 years and black spots were plotted by obtaining the GPS co-ordinates of particular locations. According to the findings of this study (both spatial and non-spatial analysis). This strategy for reducing accidents will be extremely beneficial to the National Highway System, Highway Authorities, and Police Departments.

Sudipa Chatterjee et al (2019) The purpose of this research was to uncover the critical safety hazards that were discovered during RSA on two major two-lane undivided highways in West Bengal, India. RSAs can be carried out in five stages: (i) planning, (ii) preliminary design, (iii) detailed design, (v) building, and (vi) operation and maintenance of an pre-existing road. Here 137-kilometer long NH 117, which stretches from north to south across three main West Bengal districts, was chosen as the study region. During the audit, the team observed the type of geometry and traffic behaviour at the site that might result in an accident of varying severity. Hazardous aspects were divided into three categories by the RSA team: road geometry, road infrastructure, and road users. The most accident-prone areas on both routes were discovered to have horizontal curves. At horizontal curves on two of the study highways, insufficient visual distance was regularly recorded. Finally, it was discovered that road users lack a fundamental understanding of road safety.

Kundan Meshram et al (2013) Studied on analysis of accidents on NH-3 i.e. from Indore to Dhamnod. The accident data for analysis is collected from respective police station from 2009 to 2011. The traffic data was collected from year 2009 to 2011 and converted into Average Daily Traffic. The year wise severity Index, was calculated from 2009 to 2011 i.e. 19.97, 18.42 & 20.8 in 2011. The traffic flow is seen increasing from year to year in present study. Accidents occurring in urban part of Indore is more than 35 % of total accidents in each year. This is due to over speeding of vehicles. The maximum number of deaths is been registered in rural highway portion and this is due to heavy load vehicles coming from villages. In taken study area, the occurrence of fatal accidents is 2 in a week and 6 for minor accidents in a week. The accidents caused by inadequate road geometry are very less in city than accidents caused by road geometry in highway.

Shailendra Singh, Shivam Singh Patel (2020) Studied on accidental black spots by considering parameters such as location and considering the various factors reasons for occurring of accidents by using method of Accident Density. For the investigation, Kanpur-Lucknow-Ayodhya Section of NH-25 & NH-28 was selected for study. According to the data collected for the period June-2014 to August-2018 year, 6042 accidents was recorded. Depending upon the site condition/requirement the corrective measures needed Short Term Measures only, and in some cases Long Term Measures including

Cautionary Measures. Based on Black Spot locations Long Term Measures includes construction of Flyover, Underpass, and Junction Improvement including Crash Barrier also has been taken in Long Term Measures i.e Cautionary accident black spot signs at both ends, solar red blinking signals at both the ends and rumble strips together with rumble strip sign.

CONCLUSIONS

The paper provides a comprehensive review in the numerous methods used for to identify accidental black spots on National highways and to recommend preventive and long term measures for identified highway accidental black spots by prioritizing them and finding out the probable reason of accidents. Based on the review of various studies, findings are concluded as follows: -

- 1) The accident locations were ranked using the Weighted Severity Index (WSI) technique, which was found to be useful for identifying, estimating, and treating accident black spots on roadways.
- 2) For analysed stretches of roadway, the method of accident severity value was utilised to identify higher accident-prone locations. (23)
- 3) By considering all these parameters. By method of ranking and severity index all these parameters are considered to identify accident black spots. (13)
- 4) Speed barriers should be installed in both directions of highway to 40km/hr to reduce accidents. (16)
- 5) Automatic traffic signals were installed at intersections and curves. (16)
- 6) Making use of WSI method, Geographic Information System and site investigation. The methodology was found to be effective for attaining the above goals provided sufficient data is available. (25)

REFERENCES:

- [1] Arun HR, Raksha Rajani DSouza (2018), Proposal of Underpass at Katapady Junction, International Journal of Scientific & Engineering Research, ISSN 2229-5518
- [2] Vani A, Prathap Kumar N K (2019), Accident Analysis on NH-75 from Buthenahally Bypass to Devarayapattana Bypass Hassan, International Journal of Innovative Research in Science, Engineering and Technology, 8(6).
- [3] LIU Yichao (2013), Highway traffics accident black spots analysis of influencing factors, International journal of communication and technologies in education -ASCE 2295.
- [4] HameedAswad Mohammed (2013), The influence of road geometric design elements on highway safety, International journal of civil engineering and technology, 4(4):146-162.
- [5] Snehal Bobade – Sorate, Anuj U. Manerikar (2016), Black Spot Analysis on National Highway – 4, International journal of engineering research & technology, 5(3):2278-0181.
- [6] Pritam Kashid, Yugandhar Shinde (2019), Identification and Analysis of Accidental Blackspots on NH-48, International Research Journal of Engineering and Technology, 6(8):2395-0072.
- [7] K. Geetha Rani, B Srikanth (2018), Accident rate comparison of various national highways and preventive measures for accident reduction, International journal of advance research in science and engineering, 7(6): 2319-8354.
- [8] Jeena Johny A, Jisha Akkara (2019), Two lane highway consistency based on alignment indices, International Journal of Advanced Research in Computer and Communication Engineering, 8(1):2319-5940.
- [9] Athira Mohan, V.S.Landge (2017), Identification of accidental black spots on national highway, International Journal of Civil Engineering and Technology, 8(4):0976-6316.
- [10] Snehal U Bobade, Jalindar R Patil, Raviraj R Sorate (2015), Identification of Accidental Black spots on National Highways and Expressways, International Journal of Research in Advent Technology, E-ISSN:2321-9637.
- [11] Arun Kumar, Ajay Singh Chauhan, Abhishek Thakur (2016), Black Spot Analysis on NH-21A, Indian Journal of Science and Technology, 9(44):0974-5645.
- [12] S. U. Bobade, R.R.Sorate (2015) Black spots analysis on pune-solapur national highway, International Research Journal of Engineering and Technology, 2(3):2395-0072.
- [13] Sanjith.S.Anchan, Basavaraja N H, H Gangadhara Bhat (2015), Identification and Analysis of Accident Black Spots along the Selected Stretches of NH-75 Using Remote Sensing & GIS Technology, Research gate : 326477864.
- [14] Sudipa Chatterjee, Partha Sarathi Bandyopadhyaya, Sudeshna Mitra (2019), Identifying critical safety issues on two lane national highways in india – A case study from NH 117 and NH 60, Transport Research Procedia 48 (2020) 3908–3923.
- [15] Kundan Meshram, H.S. Goliya (2013), Accident Analysis on National Highway-3 Between Indore to Dhamnod, International Journal of Application or Innovation in Engineering & Management, 2(7):2319-4847.
- [16] Shailendra Singh, Shivam Singh Patel (2020), Identification and Improvement of Accident Black Spots on Kanpur-Lucknow & Lucknow-Faizabad including Shaheed Path (NH-25, NH-28 and NH-56A&B) Uttar Pradesh, International Journal of Scientific Development and Research, 5(5):2455-2631.
- [17] Transportation Research Board (2000), Highway Capacity Manual, HCM 2000, National Research Council.