International Journal of Research in Engineering and Science (IJRES)
ISSN (Online): 2320-9364, ISSN (Print): 2320-9356
www.ijres.org Volume 11 Issue 9 ǁ September 2023 ǁ PP. 216-218

Black Spot Analysis (Accident Black spot And Safety Analysis of Road Network for NH-166)

* (Miss Pradnya Sanjay Kamble *Department of Civil Engineering, Ashokrao Mane Group Of Institution (AMGOI) Vathar Dist - Kolhapur*

** (Prof. J. M.Shinde, *Head Of Department of Civil Engineering Ashokrao Mane Group Of Institution (AMGOI) Vathar Dist - Kolhapur,)*

***

Abstract. *With the rapid development of urban road traffic, there are a certain number of black spots in an urban road network. Therefore, it is important to create a method to effectively identify the urban road black spots in order to quickly and accurately ensure the safety of residents and maintain the sustainable development of a city. In this study, a GIS (geographic information system) and the Firefly Clustering Algorithm are combined. On the one hand, a GIS can accurately extract the distance between accident points through its spatial analysis function, overcoming the disadvantage of the accident data not usually including the specific location data. On the other hand, the Firefly Clustering Algorithm can be used to comprehensively extract the characteristics of accident points, which is particularly suitable for the identification of black spots. In order to verify the feasibility of the proposed method, this research compares the identification effect between the OD (origin–destination) cost distance calculated by GIS and the Euclidean distance. The results show that the Euclidean distance is smaller than the OD cost distance and that the accident search method based on the Euclidean distance can overestimate the number of black spots, especially for intersections. Therefore, the proposed method based on the Firefly Clustering Algorithm and GIS can not only contribute to identifying urban road black spots but also plays an auxiliary role in reducing urban road crashes and maintaining sustainable urban development.*

Keywords:
urban road; black spot identification; Firefly Clustering Algorithm; GIS (geographic information system)

Date of Submission: 14-09-2023 Date of acceptance: 29-09-2023

I. INTRODUCTION

II. Traffic accidents are regarded as one of the most serious social problems. Over and above the resulting personal emotional impact and trauma of injury or loss of life, they seriously affect people's travel safety and lead to huge socio-economic losses. As a result, traffic accidents hinder the sustainable development of society. According to the National Highway Traffic Safety Administration (NHTSA), traffic accidents have annual economic costs of $277 billion and social costs of $594 billion, including those due to the suffering and loss of life resulting from car crashes [**1**]. The Global Status Report on Road Safety 2018, launched by the World Health Organization (WHO) in December 2018, highlighted that the number of annual road traffic deaths has reached 1.35 million worldwide [**2**]. Meanwhile, urban road traffic accidents account for a high proportion of road traffic accidents. They not only cause incalculable economic losses to society but also have a serious negative impact on sustainable urban development.

III. Urban roads commonly have many similar intersections and road sections, as well as varying traffic conditions. As such, there are some traffic accidents that occur on similar road sections or intersections during a specific period of time; these areas are called black spots. Though the percentage of black spots in an urban road network is small, their harm to people's lives and property is substantial. Therefore, attention should be focused on identifying these black spots, which would help reduce the frequency of traffic accidents, improve road safety, and promote greater socio-economic benefits. Therefore, the focus of this study is on how to better identify black spots by utilizing existing traffic accident information.

IV. In general, the identification of the location of black spots is the first and most important step in the accident mitigation process. Previous studies and practices have shown that the black spot identification method is an effective and reactive means of dealing with the occurrence of accidents [**3**]. The method is especially useful when it is introduced for an urban road to help the government to manage road safety. To implement this method, the most important priority is to identify the location of black spots for safety management.

V. The available black spot identification methods include many statistical methods such as the accident number method, the accident rate method, the quality control method, the regression analysis method, and the

BP (Back Propagation) neural network method. These methods can generally be classified into three categories: the linear theory method, the nonlinear theory method, and the experiential learning method,

VI. Though no universally accepted definition of a black spot or black zone has been given, these locations are generally described as high-risk accident locations. Determining whether a place is a black spot depends on different definitions. In Australia, the definition of a black spot is given as: for individual sites such as an intersection, a mid-block, or a short road section, there has to be a history of at least three casualty crashes in any one year, three casualty crashes over a three-year period, four casualty crashes over a four-year period, five casualty crashes over a five-year period, etc. For lengths of road, there must be an average of 0.2 casualty crashes per kilometer of the length in question over five years, or the road length to be treated must be amongst the top 10% of sites with a demonstrated higher crash rate than that of other roads in a region [**16**].

VII. Identifying a black spot mainly depends on the definitions used. In circumstances of the urban road, a black spot may be an intersection, a section of road, or any other location that meets the definition. Therefore, this research mainly focuses on urban road black spot identification. The accident time, number, and location are essential because they provide an advantage in practice. Combined with previous definition research, this research mainly refers to the rules of black spot identification that were promulgated by China in 2001. Ultimately, the urban road black spot is regarded as being the following: For a road section within 500 meters or an intersection within 150 meters, there has to be a history of at least three casualty crashes in any one year, which means that a normal number of accidents is three in 500-meter road section or 150 meters of an intersection a year.

VIII. OBJECTIVE OF STUDY

The basic aim of study is to find out accidental prone spots on Pune Bangalore National Highway between 820 km-830 km by considering different parameters such as; nature of accident, classification of accident and causes of accident.

IX. 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 [(2)]. 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

X. STUDY AREA

Ratnagiri Kolhapur (NH-166) is a controlled access highway with speed limit of 80 km/hr for present study 820 km-830 kmhas been selected.

II. LITERATURE REVIEW

In February this year, while taking serious note of frequent road accidents, including the national highways and remote areas, Lt Governor of Jammu and Kashmir had approved a road safety action plan.

The salient features of the policy include: Centre of Excellence to be established across the state to create capacity in road safety research, raising awareness among key decision makers, stakeholders and NGOs to facilitate them in planning and promoting road safety, implementation of road safety initiatives. The action plan also envisioned creating trauma healthcare facilities on the highways, funding for road safety initiatives, establishment of safe transport infrastructure and stringent enforcement oftraffic laws.

Dr. S. S. Jain ET. al. (2011) found that trucks are parked on highway which reduces the effective width of carriageway and creating traffic hazards to high speed moving traffics. Unauthorized median openings were found which should be immediately closed. Missing roads and median markings is to be done and necessarily speed should match with speed signs. Access and service lanes are also deficient which requires immediate improvement. The most Vulnerable Road User (VRU) i.e. pedestrians and cyclists facilities near habitation are lacking and needs to befacilitated on priority.

Dr. Wen Long YUE et al. (2001) provides all the information which is related to various functions and tools of accident studies in GIS. GIS is suitable for analysis of spatial data, graphic display and visual interface etc. Such features have important applications for identification of traffic safety problems. The paper presents the process

which includes the formation of black spot and how these black spots are then analyzed in GIS using information query tool for peak hour accidents,accidents at night times, accidents involving pedestrian, etc.
LEGENDS
A:Accident Location: 1.Chainage
B: Nature of Accident: 1-Overturning, 2-Head on collision, 3-Rear end collision,4-Collision brush, 5-Right turn collision, 6-Skidding,7-Absence of guard stone or curve indicator on the curve.
C: Classification of Accident: 1-fatal,2-Grievious Injury,3- minor Injured,4-Non Injured.
D:Causes of accident: 1-Drunken,2-overspeeding,3-vehicle out of control,4-fault of driver of motor vehicle/driver of other vehicle,5-Defect in mechanical condition of motor

Sample Calculations
1. Method of ranking
Ranking method is used to find out vulnerability of a particular spot out of 6 parameters most predominant parameter was found out based on logical analysis. The parameter which is responsible for occurrence of accident has been given top rank and accordingly ranks of all parameters were given.
i. For all the 6 parameters, consider the chainage
829.1 from table no1
ii. Parameter 1-i.e "Overturning" Parameter 4 - i.e found present and hence marked **Y**(YES)
iii. Parameter 2 i.e. “Head on collision” Parameter 3
i.e "Rear end collision" and Parameter 5 i.e - "Right turn collision" - was found absent and hence marked **N** (NO)
iv. Accordingly all the parameters for all chainageswere marked as **Y** or **N**.

2. Severity Index
Severity index denotes vulnerability of a particularspot of accidents.

Severity Index =(ß/ Σ W) × 100Where,
Σ W =w1 +w2 +w3+…….w10.Consider chainage 829.1

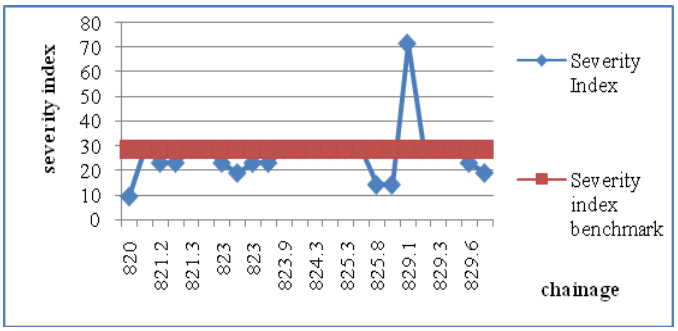
- From graph 2 it has been cleared total **10 accidental spots** are above the datum of severity index 30 with classification of accidents which clearly indicate that the presence of accidental black spots.
- From graph 3 it has been cleared total **23 accidental spots** are above the datum of severity index 20 with causes ofaccidents which clearly indicate that the presence of accidental black spot**s.**

severity (ß) =3+2+6
= 11

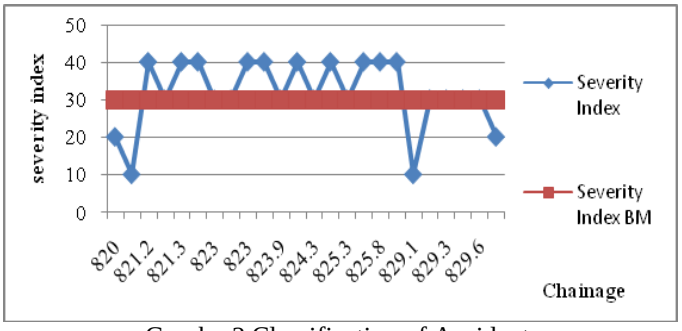
Σ W =6+5+4..+1
=21

Severity Index =(ß/ Σ W) × 100
=(11/21) x100
=52.38%
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.:
Σ W of top 3 weights =6+5+4 =15
Σ W =21
S.I Benchmark =[100-(15/21) x 100]
=28.57%
Based on analysis of data profile indicating severity Vs actualchain age is present in graph 1, graph 2 and graph 3 for Nature of accidents, classification of accidents and causes of accidents respectively.

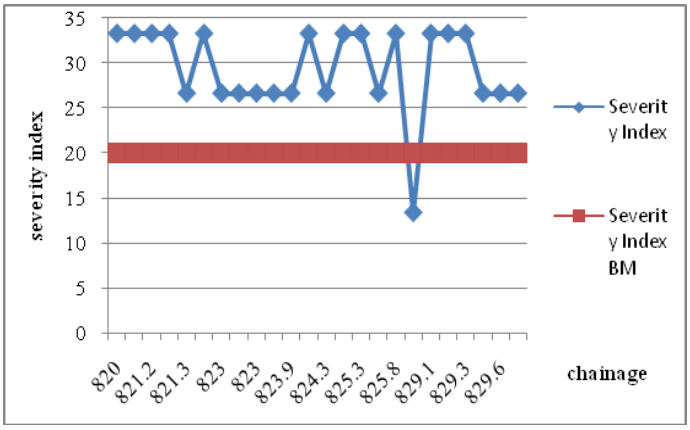
- From graph 1 it has been cleared total 1 accidental spots are above the datum of severity index of 28.57 with theparameter nature of accident which clearly indicate that the presence of accidental black spot.



Graph : 1 Nature of Accident.



Graph : 2 Classification of Accident.



Graph : 3 Causes of Accidents

III. RESULT AND DISCUSSION

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 l 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.

From graph 1,2,3 it has been cleared that total 34 spots are above the datum of severity index with nature of accidents, classification of accidents and causes of accidents respectively which clearly indicate the presence of accidentalblack spot.

IV. CONCLUSION

By considering all these parameters by using Ranking Method accidental black spots can be identified. From table 1,2 and 3 it is clear that skidding, grievous injuries and over speeding are responsible for occurrence of more number of accident.

REFERENCES

[1] Accident Black Spots in Rural Highways By Aruna.D.Thube and Dattatraya.T.Thube.
[2] Bureau of Transport and Regional Economics ofAustralia(2001).
[3] Black Spot Identification Methods in Thailand by Dr. Wichuda Kowtanapanich.
[4] S.U.Bobade, J.R.Patil, R.R.Sorate (2015), InternationalJournal of Research in Advent Technology (IJRAT), Vol.3 Issue 2

[5] Dr. L. R. Kadyali, "Principles and practices ofHighway Engineering", Khanna
[6] www.en.wikipedia.org/wiki/Accident
[7] www.en.wikipedia.org/wiki/Traffic_collision
[8] www.en.wikipedia.org/wiki/Accident_blackspot
[9] www.civil.iitb.ac.in/tvm/1111_nptel/582_Accident/plain/plain.html
[10] www.en.wikipedia.org/wiki/National_Highway_1_(India)(old_numbering)
[11] www.timesofindia.indiatimes.com/india/India-loses- Rs-55k-crore-in-roadaccidents-each-year-says-Union-minister-of-road-transport- andhighways/articleshow/45917017.cms
[12] Police stations (Pattan, Parimpora, Nowgam, Panthachowk).
[13] www.jaktrans.nic.in
[14] www.jktransport.nic.in
[15] www.dailyexcelsior.com

.