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DATA ANALYSIS OF ACCIDENT RATE AT BLACK SPOTS IN AMRAVATI (MAHARASHTRA)

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Abstract - *Road safety in India remains in a developing phase, with traffic accidents arising from multiple contributing factors such as inadequate road conditions, human error, vehicle-related issues, lack of proper infrastructure for pedestrians and cyclists, and environmental influences like poor weather and low visibility. These incidents result in fatalities, injuries, property damage, social hardship, and environmental degradation. Areas on roadways with a high frequency of accidents are known as black spots. A case study conducted on NH-6 in the Amravati district of Maharashtra identified key problems, including poor road and shoulder conditions and the presence of trees and utility poles along the roadside. The study highlights these safety deficiencies and proposes measures to enhance road safety and reduce accidents for all users.*

Key Words: Black Spot Analysis on NH-6, Accident Rate & Frequency, FIR index

1.INTRODUCTION

Road transport plays a vital role in India's transportation system and significantly contributes to the nation's economy. Over the years, there has been substantial growth in motorization, urban development, the number of vehicles, and the expansion of road networks to meet increasing transportation demands. However, this rapid growth has also led to a rise in road accidents and fatalities. Such accidents can be viewed as an unintended consequence of increased urbanization, motorization, and infrastructure expansion. They place a heavy burden on individuals, society, and property. The sharp increase in traffic volume on Indian roads in recent years has further escalated the frequency of accidents. Since effective and sustainable safety measures have not yet been fully developed especially for remote and low-traffic rural areas it is important to adopt a structured hierarchy of control, similar to approaches used in occupational safety and health, to improve road safety outcomes.

Fig 1 : Study area source : Google Map

1.1 OBJECTIVE & SCOPE OF THE WORK

The selected road stretch was divided into four sections, and accident data from the past eleven years was gathered for analysis. The main objectives of the study are as follows:

- To Identify Accident-Prone Locations (Black Spots) Along The Selected Road,
- To Conduct A Detailed Analysis Of The Most Critical Or High-Ranking Spots, And
- To Recommend Suitable Corrective Measures To Reduce The Occurrence Of Accidents.

1.2 ROAD SELECTED FOR BLACK SPOT ANALYSIS

For this study, a two-lane stretch of approximately 20 km on NH-6, running from Hotel Gauri Inn to Hotel Landmark in Badnera, was selected. The route was further divided into four equal segments of 5 km each to facilitate systematic data collection and analysis. The identified sections are:

Stretch 1 – Hotel Gauri Inn to Biyani Square,
Stretch 2 – Biyani Square to Dastur Nagar
Stretch 3 – Dastur Nagar to Purepur kolhapur Restaurant
Stretch 4 – Annex Restaurant to Hotel Landmark

2. DATA ANALYSIS

Overall Accident Rate = Length of Stretch (km) ×11 Sum of Total Accidents over 11 years
Length of each stretch = 5 km Period = 11 years
Calculate accident rate per km per year using the formula:
Accident Rate = Total Accidents (11 years)

$$\frac{\text{Total Accidents (11 years)}}{\text{Length} \times \text{Years}}$$

Table -1: Accident Rate

Name of stretch	Length	No Of in a year	
		Sum of 11 year	Accident Rate
Hotel Gauri inn to Biyani Square	5km	528	9.6
Biyani Square to Dastur nagar	5km	562	10.22
Dastur nagar to Purepur Kolhapur	5km	315	5.73
Purepur Kolhapur to Hotel landmark	5km	278	5.05

Fig 2 : Black Spot Points on Stretch 1 source : Google Map

Table 2 Frequency of accident

Distance of origin	No of accidents (2015- 2025)	Frequency y	Total frequency
0 – 5	528	31.38	31.38
5 – 10	562	33.40	64.78
10 – 15	315	18.71	83.49
15 – 20	278	16.51	100
Total	1683	100	

3.BLACK SPOT ANALYSIS

A road section where a high concentration of accidents occurs is referred to as a black spot. Analyzing such locations is essential for enhancing the overall traffic environment and safety. A detailed assessment of the four selected stretches is presented in Figures 2, 3, 4, and 5, along with Tables 3, 4, 5, and 6.

Table 3: Black Spot Analysis of Stretch 1

Accident Point	Nos.	Problems	Safety Enhancement
Hotel Gauri inn	4	Un-signalised T junction	Junction Improvement
Arjun Nagar	2	Trees on Shoulder	Trees on Shoulder should be removed
Welcome point	4	On Street Parking	Off Street Parking Facility
Divisional commissioner office	3	Trees and poles on shoulder, Sight distance obstruction	Clearance of obstruction on shoulder, Sight distance visibility
Biyani Square	10	Cross junction, Unpainted median, Auto stand	Junction improvement

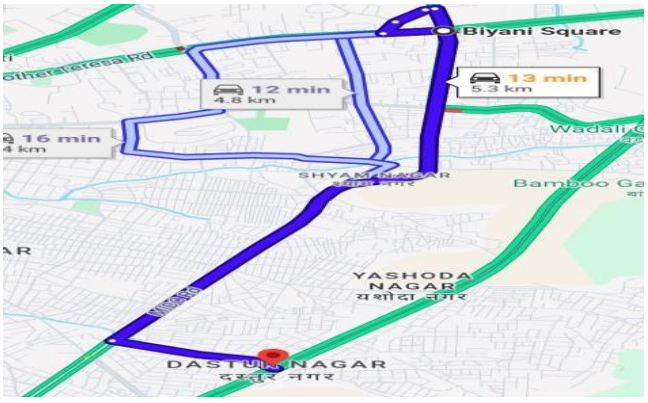

FIG 3 : Black Spot Points on Stretch 2

Table 4: Black Spot Analysis of Stretch 2

Accident Point	Nos	Problems	Safety Enhancement
Yashoda Nagar	20	Bad condition of median,Shops on shoulder On street parking	Junction Improvement Clearance of obstruction on the shoulder, off street parking facility
Police Club	07	Trees on Blind Corner	Need to removed Trees from shoulder
Petrol pump	04	Bad condition of speed breaker and shoulder	Speed breaker and shoulder maintenances
Wadali T-Point	06	T-Junction,Trees on blind corner, Bus Stop	Trees on shoulder should be removed Road marking
Kumbhar Wa	05	Taxi stand Trees and poles on shoulder,Median without sign on the road	Junction Improvement Maintenance of shoulder
Hanuman Temple	02	Bad shoulder T point	Road Marking Shoulder Maintenances
SBI Bank	04	Bus stop Bad condition of speed breaker	Road Maintenances
Sakha Mangal karyalay	03	T point Unsignalized On street parking	Signalization Off street parking facility

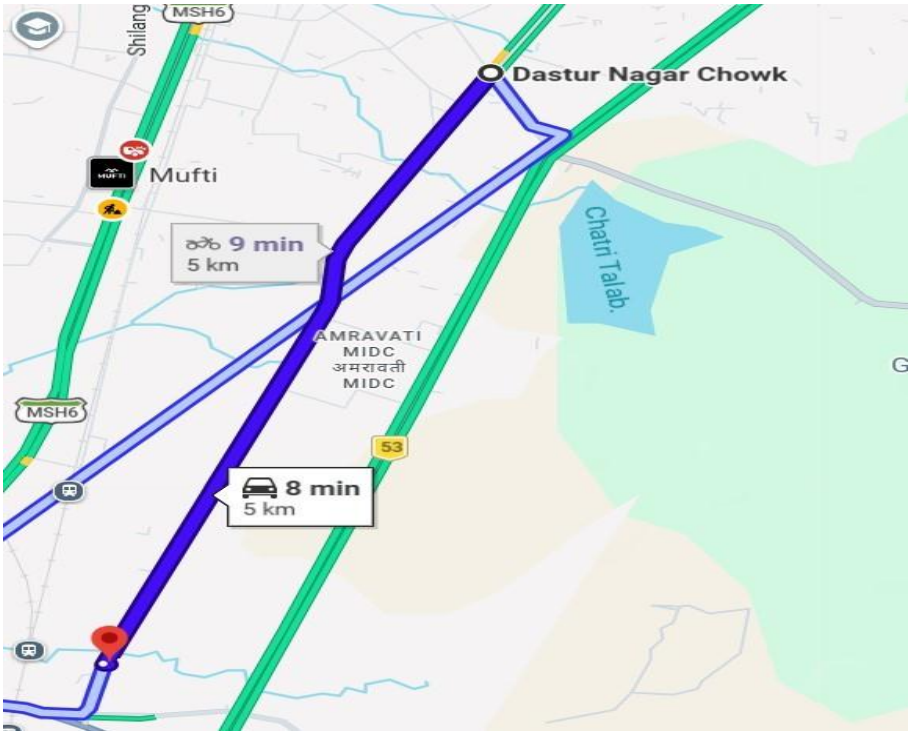

FIG 4: Black Spot Points on Stretch 3

Table 5: Black Spot Analysis of Stretch 3

Accident Point	Nos.	Problem	Safety Enhancement
Dastur nagar	15	Unsignalised, Auto stand Vehicle parking on shoulder , Vendors on Shoulders	Junction improvement, Separate auto stand Clearance of obstruction from shoulder
Gondbaba Temple	19	Cross section , Auto stand , Blind curve, Unpainted Median	Speed limit restriction Junction improvement Medians to be painted
Gunwant lawn	6	Cross junction, Blind Curve, Trees and poles on shoulder	Clearance of obstruction from shoulder Curve sight distance
Lords Hotel	4	T junction	Clearance obstruction from shoulder
Anand Marble	3	T junction , Bad condition of road	Junction improvement Separate auto stand
			Shoulder maintenances, Road marking
Anand Marble	3	T junction , Bad condition of road	Junction improvement Separate auto stand
			Shoulder maintenances, Road marking

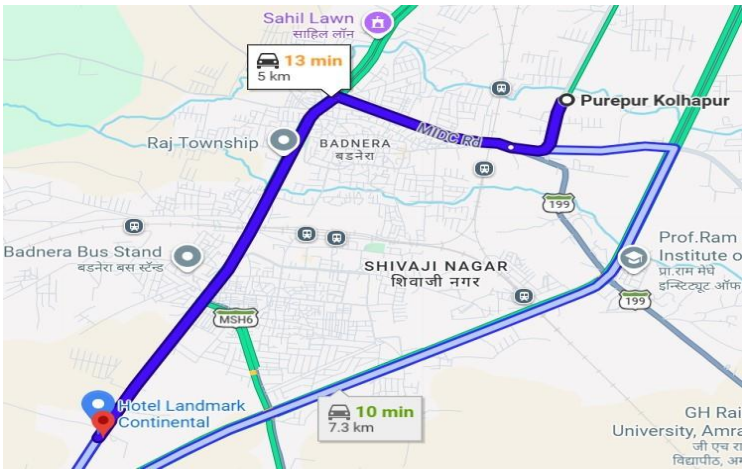

FIG 4: Black Spot Points on Stretch 3

Table 6: Black Spot Analysis of Stretch 4

Accident Point	Nos.	Problems	Safety Enhancement
Purepur kolhapur	3	Plants on shoulde,Bad Condition of Road, Road without marking	Clearance of obstruction on the Shoulder, Maintenance of road
Bagiya Restaurant	7	T junction, Steep Gradient on Blind Corner	Trees on Corner should be removed, Speed restriction
Savata maidan	9	Trees on shoulder, school, Edge drop	Clearance of obstruction on the shoulder, Road Maintenance
Badnera Police station	3`	T junction, Bad speed breakers	Junction improvement, Maintenances of speed breaker
Juniwasti Bus stop	4	Vendors on Road, Road without Marking	Restriction to Vendors, Road marking
Badnera bus stand	4	Motor garage, shops on shoulder	Clearance of obstruction on the shoulder

4. CONCLUSION

- Stretch 4 is the most accident-prone (37.9%), followed by Stretch 2 (32.5%) and Stretch 3 (23%), while Stretch 1 has the least accidents.
- Road safety can be improved through traffic calming, better intersection design, shoulder maintenance, hazard removal, traffic signals, and safe curve visibility. Two-wheelers account for most fatalities (55%), highlighting the need for focused safety measures for riders.
- Accidents peak in summer (March–May) due to heat, glare, and driver fatigue.
- Safety infrastructure like bicycle lanes, pedestrian paths, parking zones, and traffic calming is essential for urban roads.
- Continuous highway patrolling is needed for better monitoring, faster response, and enforcement of traffic rules.

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2) Dr. L. R. Kadiyali, Traffic Engineering and Transport Planning.

3) Road traffic safety depends on pavement condition, traffic volume, and roadway geometry (Kadiyali; Road Traffic Safety).

4) Poor pavement condition (low PCI, low skid resistance, surface defects) increases accident frequency and severity (Al-Masaeid & Assolie, 2025; Lebaku et al., 2025; Amani et al., 2024).

5) Deteriorated pavements also influence unsafe driver behavior and raise single-vehicle crash risk, especially with poor geometry (Amani et al., 2024).

6) Models combining pavement and traffic data provide better crash prediction accuracy (Popoola et al., 2022; Gupta & Kaur, 2021).

7) Inadequate road geometry (narrow lanes, poor shoulders, sharp curves) and low-friction surfaces significantly increase accidents (Kabir & Hossain, 2018; Baskara et al., 2017).

8) Higher traffic volume increases crash frequency due to greater vehicle interaction (Safety Cube Project, 2016).

9) Poor surface conditions and geometric deficiencies are strongly linked to higher crash rates (Elvik et al., 2012; Lamm et al., 2011; Harwood et al., 2010).

10) Accident occurrence is influenced by the combined effect of traffic exposure, pavement quality, and roadway design (Hakkert & Gitelman, 2007; Sayed & Rodriguez, 2005; Ding et al., 2003).