STUDY ON DETERMINATION OF ACCIDENT RISK INDEX BY TRACJECTORY METHOD AT SMART CITY ROAD BHOPAL

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1.Abstract The challenges in road management, particularly in regulating traffic and mitigating conflicts on smart city roads, are a pressing concern. This paper aims to determine a risk index for safety prediction, assess the performance improvement of safety measures, provide early accident warnings, and determine the fatal rate using trajectory methods to analyze driver behavior, road safety, traffic flow, and vehicle behavior in Bhopal city.

The analysis reveals that the highest risk index is concentrated between 5 PM and 7 PM, with peak values observed on Sundays. The findings are based on an examination of various days at different time intervals on smart city roads, particularly focusing on aspects such as driver behavior, vehicle interactions at junctions, and curves.

Peak traffic congestion hours are identified as occurring between 5 PM and 7 PM, with slightly elevated traffic volumes between 9 AM and 10 AM. The study underscores non-compliance with traffic rules, including issues like malfunctioning signals, U-turns in the same lane, unauthorized parking, and vehicles encroaching on pedestrian crossings as contributing factors to heightened risk during the identified peak hours.

In conclusion, this research provides insights into the challenges and risk factors associated with traffic management and safety in a smart city context, emphasizing specific time frames and days with elevated risk indices. The findings can inform strategies for enhancing road safety and traffic management in Bhopal's smart city road area.

Keywords: Drivers behavior , road safety, traffic flow, vehicle behavior

Introduction: Road safety is a critical concern worldwide, as traffic accidents result in a significant loss of lives and property each year. To address this issue effectively, researchers and experts have developed various methods and techniques to analyze and improve road safety. One such approach is the trajectory method, which focuses on understanding and predicting the movement of vehicles on the road.

The trajectory method involves the collection and analysis of data related to the paths that vehicles follow, including their speed, direction, and interactions with other vehicles. This method provides valuable insights into the dynamics of traffic, helping to identify potential hazards, design safer road infrastructure, and develop strategies to reduce accidents.

In this summary, we will explore the trajectory method's significance in enhancing road safety and its role in shaping policies and practices that aim to reduce road accidents and create safer transportation systems.

About Bhopal city : India's Madhya Pradesh state's capital, Bhopal, is a mesmerising fusion of natural beauty, history, and culture. Bhopal, which is located in the centre of the nation, has a lengthy and varied history that stretches back to the 11th century. One of India's most alluring towns, Bhopal is renowned for its tranquil lakes, gorgeous architecture, and gracious residents.The beautiful lakes in Bhopal are a distinctive feature of the city. The city is renowned for being the "City of Lakes," with the two most notable lakes being Upper Lake (Bada Talab) and Lower Lake (Chhota Talab).

Fig1.1 Google Map of Bhopal

Selection of study area: The selection of a traffic study area is a critical aspect of prediction of traffic. The study area must be representative of the traffic patterns and conditions being studied and should be large enough to provide meaningful results. For the study purpose smart city road tree view area is we are going to study and analyse.

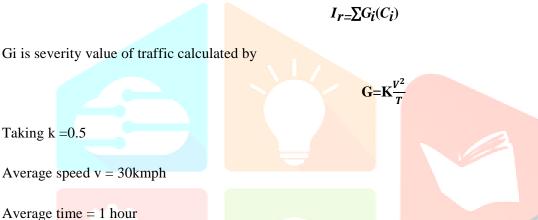It connects new market road to Manit college and surrounded by new market , sagar gaire , Nit Bhopal .

Fig 2 aerial view of smart city road

Objective: The project aims to significantly reduce accidents, injuries, and fatalities on Bhopal smart city roads by utilizing data-driven insights and proactively addressing potential risks. By calculating risk index the project aims to create a safer and more efficient transportation system for residents and visitors alike.

- ➤ To determine risk index calculation
- ➤ To determine Safety Prediction in Bhopal city
- ➤ Evaluation of performance Improvement in safety in Bhopal city
- ➤ To predict Early Warning of accident
- ➤ To determine fatal rate

Materials and methods: The trajectory method is an approach used in the field of road safety and transportation engineering to analyze and understand the movement and behavior of vehicles on roadways. This method is employed to gain insights into the interactions between vehicles and to predict and prevent potential accidents.

Risk index is calculated by the formula given below

$$I_r = \sum G_i(C_i)$$

Gi is severity value of traffic calculated by

$$G = K\frac{V^2}{T}$$

Taking k =0.5

Average speed v = 30kmph

Average time = 1 hour

Table 1 Calculation Risk Index

	Gi*Ci						
	Monday	**Tuesday**	**Wednesday**	**Thursday**	**Friday**	**Saturday**	**Sunday**
8-9am	3.375	4.25	3.5	3.5	2.625	3.75	1.25
9-10am	8.5	8.875	8.125	9	7.75	12.125	5.625
10-11am	6.875	6	6.75	8.375	8.875	6.875	6.375
11-12pm	6.125	5.125	4.625	3.875	4.625	3.875	8.375
12-1pm	7.25	6.5	5.375	5	3.5	4.625	9.125
1-2pm	3.375	2.875	3.625	2.25	3.5	2.625	4.25
2-3pm	8.5	8.375	8.25	7.5	7.875	8.625	8.875
3-4pm	7.75	6.5	7.375	6.375	6.875	5.625	8.375
4-5pm	9.875	8.875	11.375	10	11	10.125	11.5
5-6pm	10.625	11.125	12.625	11.375	12.125	11.25	12.25
6-7pm	11.75	11.375	12.25	10.375	10.125	13.75	8.375
$I_r = \sum(Gi*Ci)$	**84**	**79.875**	**83.875**	**77.625**	**78.875**	**83.25**	**84.375**

Results and discussion: After the calculation we find that maximum risk index lies between **5PM-7PM**

In Sunday maximum value of risk index are found.

This report presents findings from a risk index analysis conducted at a smart city road tree view location. It identifies peak traffic hours (5pm-7pm), with some congestion from 9am-10am. The study reveals the highest risk index during peak hours, particularly on Sundays, due to violations of traffic rules, including malfunctioning signals, improper U-turns, parking violations, and vehicles obstructing zebra crossings. Key risk factors are malfunctioning signals, improper U-turns, parking violations, and zebra crossing obstructions. Addressing these issues through maintenance, law enforcement, and public awareness campaigns can enhance road safety and efficiency.

Recommendation: 1. The risk index on the smart city road peaks between 5 pm and 6 pm, leading to an increase in the fatality rate.

2. Adequate installation and maintenance of traffic signals are essential.

3. Traffic police presence is necessary to prevent U-turns on the same lane.

4. Implementation of measures to prevent U-turns on the same lane and enforce stricter penalties for invalid parking will be crucial to reducing the risk index.

5. Zebra crossings must be clearly visible to ensure that pedestrians cross at designated points.

6. Implementing signals helps avoid uncontrolled vehicle crossings, thus reducing the risk index.

7. Vehicles turning on zebra crossings compromise pedestrian safety, necessitating better enforcement and awareness campaigns.

By considering these conclusions and implementing appropriate measures, it is possible to reduce the traffic risk index and create safer road conditions for all users.

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