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ENHANCING ROAD SAFETY: IDENTIFYING AND MITIGATING FACTORS CONTRIBUTING TO ACCIDENTS ON PUNE NAGAR HIGHWAY

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ABSTRACT

Road accidents are a significant public health concern, with various factors contributing to their occurrence. This study focuses on identifying and analysing the factors contributing to accidents on the Pune Nagar Highway in India. Through a comprehensive review of literature and data analysis, key factors such as narrow or no shoulder, roadside or median concrete structures, poor road signage, roadside steep slopes or drop-offs, sharp road curvatures, and curb stones were identified as major contributors to accidents. By understanding these factors and proposing effective safety measures, this study aims to reduce the rate and severity of accidents on the Pune Nagar Highway, ultimately improving road safety for all road users.

Keywords: Road safety, Pune Nagar Highway, accidents, infrastructure factors, safety measures.

1 INTRODUCTION

1.1. Overview of Pune Nagar Highway:

Pune Nagar Highway, officially known as National Highway 60, is a vital transportation corridor connecting the city of Pune in Maharashtra to the town of Nagar. Spanning approximately 96 kilometres, this highway serves as a critical route for commuters and freight transportation, facilitating economic activities in the region. Known for its scenic landscapes and proximity to several industrial and residential areas, Pune Nagar Highway plays a crucial role in the transportation network of Maharashtra.

1.2. Importance of Studying Safety Measures and Accident Causes:

Understanding and addressing the safety challenges on Pune Nagar Highway are of paramount importance due to the highway's significant role in regional transportation. According to the World Health Organization (WHO), road traffic injuries are a leading cause of death globally, with a disproportionate impact on low- and middle-income countries. Studying safety measures and accident causes on Pune Nagar Highway can provide insights into improving road safety practices, reducing the number of accidents, and ultimately saving lives.

1.3. Purpose of the Study:

The primary purpose of this study is to conduct a comprehensive analysis of safety measures on Pune Nagar Highway and to identify the causes of accidents occurring on the highway. By examining existing safety measures, analysing accident data, and identifying key factors contributing to accidents, this study aims to provide valuable recommendations for enhancing road safety on Pune Nagar Highway.

1.4 Objectives are as follows:

- To analyse the existing safety measures on Pune Nagar Highway for accidents.
- To identify the causes of accidents on the Pune Nagar Highway.
- To propose recommendations for improving safety measures and reducing accidents on Pune-Nagar Highway

2. BACKGROUND

2.1. History and Development of Pune Nagar Highway:

The Pune Nagar Highway, also known as National Highway 60, has undergone significant development since its inception. Originally constructed to connect the city of Pune with the town of Nagar, the highway has evolved

into a key transportation artery in Maharashtra. The highway's development can be traced back to the early days of India's independence when infrastructure projects aimed to improve connectivity and facilitate economic growth in the region.

Over the years, the Pune Nagar Highway has undergone various upgrades and expansions to accommodate the increasing traffic volume and improve safety. These developments have included the widening of the highway, the construction of bypasses and flyovers, and the implementation of modern traffic management systems. These efforts reflect the government's commitment to enhancing the highway's capacity and ensuring the safety of commuters and freight transporters.

2.2. Traffic Volume and Characteristics:

The Pune Nagar Highway experiences a significant volume of traffic, comprising a mix of passenger vehicles, commercial vehicles, and two-wheelers. The highway serves as a crucial link between Pune and Nagar, as well as other cities and towns along its route. The traffic on the highway exhibits diverse characteristics, including varying speeds, vehicle sizes, and driving behaviours.

3 LITERATURE REVIEW:

Aniket Bora et.al. (2023): The paper discussed the use of a Convolutional Neural Network (CNN)-based approach to classify distracted and non-distracted drivers based on their body movements. The proposed CNN model achieved a high accuracy rate in detecting driver distraction activities, with potential applications in enhancing driver safety on the road.

Takshak Pothare et.al. (2023): The study emphasized the importance of technology, such as Automated Driving Systems (ADS), in improving road safety and reducing fatalities. The proposed system aimed to detect accidents using smartphone sensors, alert the nearest ambulance, and inform relatives of victims promptly, highlighting the potential to reduce response time and save lives.

Arkesh Prabhakar Khetade et.al. (2023): The study conducted a survey on the Mumbai-Pune expressway to collect information from vehicle operators regarding factors contributing to road accidents. The research focused on understanding driver behaviour and factors influencing compliance with traffic rules, highlighting the need for effective road safety measures.

Arkesh Prabhakar Khetade et.al. (2023): This study conducted a methodological investigation of published sources to understand the causes and types of accidents, compiling a structured review of the literature on accident causes. The study aimed to identify relevant resources related to accident causes, arranging them alphabetically. The review provided insights into the scope and breadth of literature on accident causes on highways, offering a comprehensive overview of the topic.

Mayura Yeole et.al. (2021): The study presented an accident prediction model for the Mumbai-Pune expressway in India using artificial neural networks (ANN). The research highlighted the increasing trend of road crash losses in India and the world over the past decade. The study emphasized the importance of traffic safety research and the development of prediction models to reduce accidents and improve road safety.

Sachin Kumar et.al. (2020): The study focused on designing a system for accident detection and alerting emergency services using smartphone sensors and GPS technology. The proposed system aimed to improve emergency response and reduce the severity of road accidents, highlighting the potential for technology to enhance road safety.

Prof. A.V. Patil et.al. (2019): The study by Prof. A.V. Patil and colleagues focused on the increasing hazards and road accidents due to the growing population and vehicle usage. The purpose of their project was to develop a system that could locate a vehicle in case of an accident and send an alert message, including the location, to the police station or rescue team. The system utilized a vibration sensor to detect accidents, and once triggered, it sent

an alert message through a GSM modem. The police could then trace the location using a GPS modem. This system aimed to improve emergency response and reduce the loss of life due to road accidents.

Prof. K.H. Ghorpade et.al. (2019): The study reviewed various studies on black spot identification in India, focusing on reducing accident rates. The research highlighted methods such as the Accident Density Method and Weighted Severity Index to identify black spots and emphasized the need for improved road infrastructure and compliance with traffic rules to reduce accidents.

S. Ashok Kumar et.al. (2018): The study analysed road traffic accidents on the Mumbai-Pune Expressway, identifying human factors as the primary contributor to accidents. Factors such as over speeding, alcohol consumption, fatigue/sleep, and obstacles were identified as common causes of road traffic accidents, emphasizing the need for improved driver behaviour and adherence to traffic rules.

Geeta Makhija et.al. (2017): Geeta Makhija and colleagues emphasized the critical role of transportation in economic, industrial, social, and cultural development. They highlighted the importance of road transport in facilitating trade and civilization's development. The study underscored the significance of well-designed, constructed, and maintained roads for India's economic and cultural progress, noting that roads also play a vital role in national defence. The study referenced the 18th annual report "Crime in Maharashtra, 2015," which reported 37 deaths per day due to road accidents in Maharashtra, with five accidents registered per hour. While there was a decrease in accidents from 2014 to 2015, fatalities increased by 1.15% in Maharashtra. The study highlighted the concept of accident black spots, areas where road traffic accidents have historically been concentrated, and emphasized the need to address these spots to reduce casualties.

Rutuja Gawade et.al. (2017): The paper analysed accident data and identified black spots on the route from Chandani Chowk to KJEI Campus in Pune. It emphasized the importance of road safety management and recommended the application of advanced algorithms and machine learning to identify probable black spots. The study also suggested intensive social awareness campaigns to reduce accidents and fatalities.

Snehal Bobade Sorate et.al. (2016): The study focused on identifying accidental black spots on the Pune-Solapur highway using various methods, including ranking and severity index analysis. The research aimed to identify areas prone to accidents and investigate the causes of accidents, with a specific focus on a segment of the highway with a high accident rate. The study's findings were based on analysing accident locations, nature, classification, and causes, using parameters such as accidental density and weighted severity index.

4 METHODOLOGY

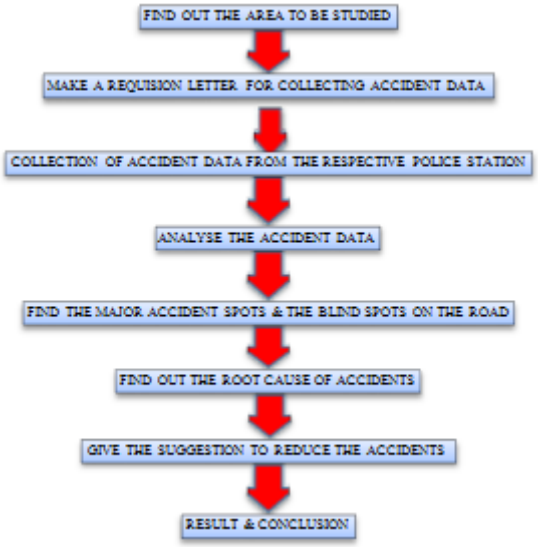
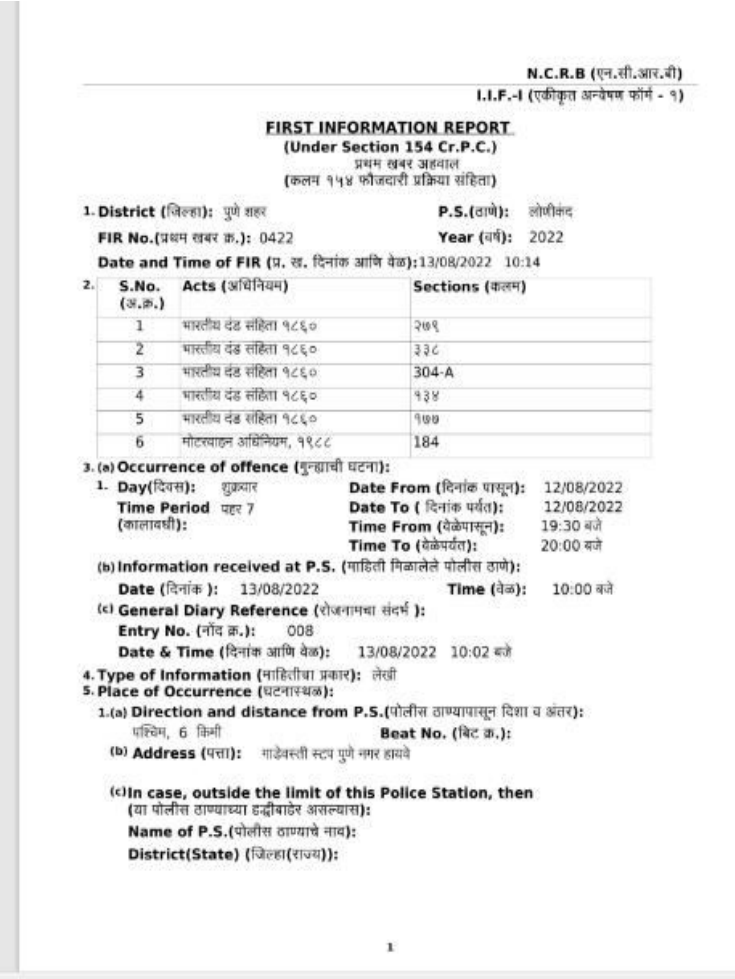


Figure 1: Methodology

4.1 Data Collection:

When conducting a research, two approaches are possible either the information required is already available and only needs to be extracted, or the information is not available and needs to be collected. By using the first approach, the information is said to be collected using the secondary sources while the second will be the primary sources. In this research, both primary and secondary sources were used to collect required information.



N.C.R.B (एन.सी.आर.बी)
I.I.F.-I (एकीकृत अन्वेषण फॉर्म - १)

FIRST INFORMATION REPORT
(Under Section 154 Cr.P.C.)
प्रथम खबर अहवाल
(कलम १५४ फौजदारी प्रक्रिया संहिता)

1. **District** (जिल्हा): पुणे शहर **P.S.**(ठाणे): लोणीकंद
FIR No.(प्रथम खबर क्र.): 0422 **Year** (वर्ष): 2022
Date and Time of FIR (प्र. ख. दिनांक आणि वेळ):13/08/2022 10:14

2.

S.No. (अ.क्र.)	Acts (अधिनियम)	Sections (कलम)
1	भारतीय दंड संहिता १८६०	२७९
2	भारतीय दंड संहिता १८६०	३३८
3	भारतीय दंड संहिता १८६०	304-A
4	भारतीय दंड संहिता १८६०	९३४
5	भारतीय दंड संहिता १८६०	१७७
6	मोटरवाहन अधिनियम, १९८८	184

3. (a) **Occurrence of offence** (गुन्ह्याची घटना):
1. **Day**(दिवस): शुक्रवार **Date From** (दिनांक पासून): 12/08/2022
Time Period (कालावधी): पहर 7 **Date To** (दिनांक पर्यंत): 12/08/2022
Time From (वेळेपासून): 19:30 बजे
Time To (वेळेपर्यंत): 20:00 बजे
(b) **Information received at P.S.** (माहिती मिळालेले पोलीस ठाणे):
Date (दिनांक): 13/08/2022 **Time** (वेळ): 10:00 बजे
(c) **General Diary Reference** (रोजनामचा संदर्भ):
Entry No. (नोंद क्र.): 008
Date & Time (दिनांक आणि वेळ): 13/08/2022 10:02 बजे
4. **Type of Information** (माहितीचा प्रकार): लेखी
5. **Place of Occurrence** (घटनास्थळ):
1.(a) **Direction and distance from P.S.**(पोलीस ठाण्यापासून दिशा व अंतर):
पश्चिम, 6 किमी **Beat No.** (बिट क्र.):
(b) **Address** (पत्ता): गाडेवस्ती स्टॉप पुणे नगर हायवे
(c) **In case, outside the limit of this Police Station, then** (या पोलीस ठाण्याच्या हद्दीबाहेर असल्यास):
Name of P.S.(पोलीस ठाण्याचे नाव):
District(State) (जिल्हा(राज्य)):

1

Fig.2: Sample of Accident Data

4.2 Primary Sources:

It was only field observations used to get information from the field.

4.3 Field Observations:

During this research Information was collected in four days, and the method used was observation. During the work, the areas of interest were. The quality of traffic signs, with respect to their need and to whether they are correctly placed or legible in the dark. The quality of road markings, in particular whether they are visible or are consistent with traffic signs. The quality of traffic lighting. In particular the system used whether it is convenient and efficient.

4.4 Secondary Sources:

As secondary sources, documents to highlight road safety in general and measures that can be adopted to improve road safety in particular were consulted especially external sources which include publications and/or reports from earlier researches on road safety.

5 DATA ANALYSIS

5.1 Area to be studied:

We have decided to work on a particular area (Kharadi Bypass to Lonikand) this comes under Pune Nagar highway, the area in between these two points is around 13kms. Most of the accidents have been observed in this area only, so we have planned out to do a case study on this area, but for this we have to collect accident data for 5years if possible and then we can provide some suggestions to avoid the road traffic and accident issues the local peoples are facing.

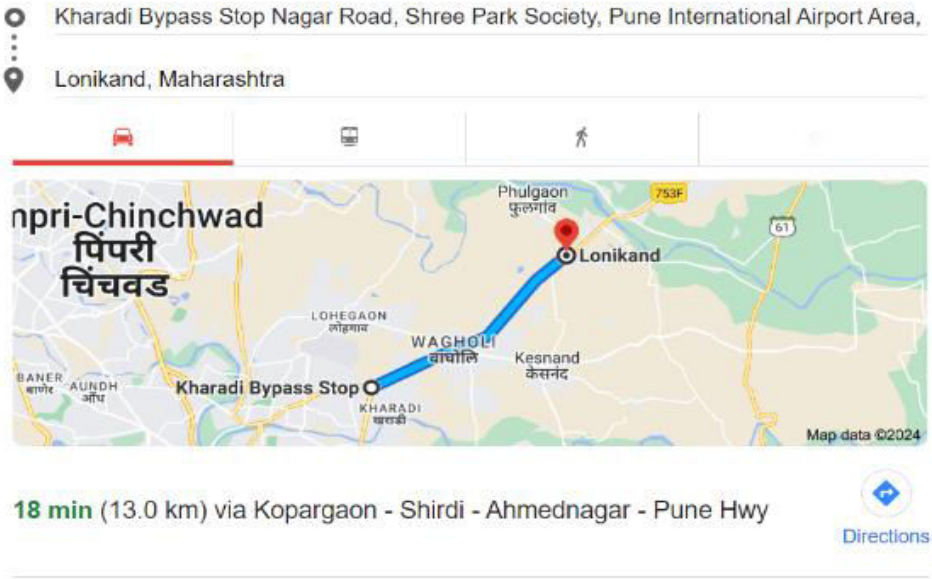


Fig.3 Project Area

5.2 Analysis of the Accident Data:

In this process we have decided to find out the root cause of accident and also to figure out the major accident spots and blind spots on the pune nagar highway.

Table: 1Acciidenet Data

Accident Spots	No of Accident in 2022-23
Gade Vasti Wagholi – Bakori phata	6
Bazartal, Wagholi	5
Awhalwadi Phata	4
Lonikand	12
Kesnand Gaon	4
Perne Phata	4
Kesnand-Theur Phata	6
Tulapur Phata	5
Khandvenagar, Pune Nagar Road	4

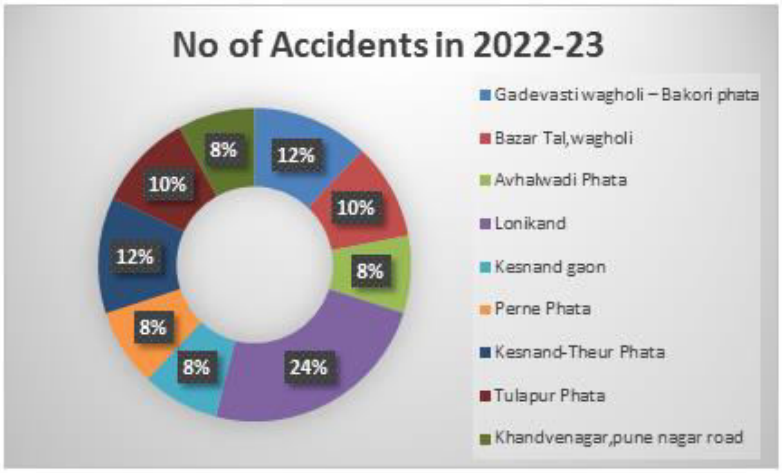


Fig.4: No of accidents in 2022-23

At the location of kesnand phata, there is a provision of a traffic signal meant to regulate the flow of vehicles; however, it is observed that adherence to the prescribed traffic rules by the motorists is lacking. This non-compliance with traffic regulations leads to a rise in the frequency of road accidents and subsequently contributes to the escalation of traffic congestion on the bustling pune nagar highway

Fig.5: Kesnandphata (Source Google Map)

At the location known as Bakori phata, a crucial intersection in terms of traffic and safety, there is a notable absence of any signalling system being provided to regulate the flow of vehicles. This deficiency in traffic management infrastructure has been identified as a significant contributing factor to the high frequency of accidents occurring at this particular spot.

Fig.6: Bakori Phata

6 RESULT AND DISCUSSION

Identified factors contributing to accidents on the Pune Nagar highway include, Narrow/No shoulder: Provide adequate shoulder width to allow vehicles to pull over safely in emergencies.

Roadside/Median Concrete Structure: Ensure Road infrastructure does not pose a hazard to vehicles in case of accidents.

Poor/Ineffective Road Signage: Improve Road signage to provide clear guidance to drivers.

Roadside Steep Slope/Drop-Off: Ensure Road edges are safe and do not pose a risk to vehicles.

Sharp Road Curvatures: Design roads with gentle curves to reduce the risk of accidents.

Curb Stones: Install effective measures to prevent vehicles from colliding with curbs.

7 CONCLUSION

The following conclusions can be drawn:

The main causes of accidents are speed, traffic, vehicle use, careless driving and illegal pedestrians. It is necessary to measure the prevention of accidents for drivers and pedestrians and to involve experts from different fields such as police, road management, traffic health, work vehicle design. Road safety is an important public health problem. Therefore, security measures should be taken seriously. Implement strict road safety measures to reduce the number of people injured in accidents.

- **Stopping Distance:** Provide sufficient stopping distance so that the driver can react to the danger in time.
- **Extra Widening:** Provide wider roads to ensure the safety of vehicles to reduce road accidents.
- **Longer Cycle Times:** Increase the length of the signal cycle to improve traffic flow and reduce the likelihood of accidents.
- **Placing Radium Stickers:** Placing radium stickers can help reduce night accidents.
- **Provide Road Signs:** Provide clear road signs for drivers.

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