

A Study on Road Safety Audit and Black Spot Identification on National Highway NH-30 (Old NH-7)

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Abstract: Road traffic accidents on the National Highway 30 have emerged as a significant concern due to increasing traffic volume, rapid urbanization, and deficiencies in road infrastructure and traffic management. This study, titled "A Study on Road Safety Audit and Black Spot Identification on National Highway NH-30 (Old NH-7)", aims to evaluate the existing road safety conditions and identify accident-prone locations (black spots) to enhance the overall safety of the highway corridor. The analysis reveals that inadequate traffic control devices, poor road markings, insufficient illumination, unsafe intersections, roadside encroachments, lack of pedestrian infrastructure, and over-speeding are the major contributing factors to road crashes. Several locations exhibit a high concentration of fatal and grievous accidents, indicating the urgent need for engineering and traffic management interventions. Based on the identified deficiencies, suitable remedial measures, including improved signage, enhanced pavement markings, geometric improvements, better street lighting, speed management strategies, pedestrian safety facilities, and strengthened enforcement, are recommended. The study highlights the significance of periodic Road Safety Audits as a proactive tool for identifying potential hazards and preventing accidents before they occur. The findings of this research provide practical recommendations for highway authorities and transportation agencies to improve road safety, reduce accident rates, and support sustainable highway management on NH-30.

Keywords: Road Safety Audit (RSA), Black Spot Identification, Accident Analysis, Highway Safety, Traffic Engineering, Road Infrastructure, Safety Improvement Measures.

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I. INTRODUCTION

Road accidents is one of the main sources of death, handicap and hospitalization of individuals overall and Indian specific. Something like one out of 10 individuals killed on streets across the world is from India, as per the World Health Organization. Fatalities and injuries brought about by street mishaps are turning into the issues of extraordinary concern especially with the increasing motorization, because of expanding populace and expanded vehicular entrance across the length and broadness of the country. Road traffic injuries are the main source of death all around the world and the chief reason for death in the age

gathering of 15 to 49 years. Road crashes cause severe social and economic consequences; without action the global yearly number of road deaths is expected to rise to almost 2.4 million by 2030. The bulk of these will occur in poor and middle-income nations, which currently account for nine out of ten of the world's population. The number of people killed on the roads across the world. Motorcyclists, bicyclists, and pedestrians will account for nearly half of those fatalities.

A Road Safety Audit (RSA) is defined as "the formal safety performance examination of an existing or future road or intersection by an independent, multidisciplinary team". It qualitatively estimates and reports on potential road safety issues and identifies

opportunities for improvements in safety for all road users. Typically, the stages of road safety audit can be divided into five stages such as feasibility, preliminary, detailed design, construction, and pre-opening. Feasibility stage studies about how well the proposed highway fits with the existing highway/road network. Preliminary design completion stage audit includes assessment of horizontal and vertical alignments, sight lines, cross sections and layout of junctions including slip roads, this is the last opportunity to change core design concepts if any.

Detailed design completion stage audit look into things like junction layout, sign placement, carriageway markings, and lighting etc. Construction stage audit includes inspection of safety measures adopted for work zone, workmen, road users, and traffic control devices adopted at construction site. Finally, in the pre-opening stage, the audit team will inspect the project site both during daytime hours and during the hours of darkness to identify hazards specific to vehicle operations. Further, in the first one or two months of operation, the audit team collect incident or crash data if any in order to take corrective action as needed.

This review paper presents a comprehensive synthesis of the available literature on accident studies and Road Safety Audit practices for urban road networks. It examines various accident causation factors, analytical methodologies, safety audit procedures, emerging technologies, and implementation challenges. The review also identifies existing research gaps and outlines future research directions for developing safer, smarter, and more sustainable urban transportation systems.

II. OBJECTIVES OF THE STUDY

The main objective of the study is to evaluate the safety performance of NH-30 (Old NH-7) through Road Safety Audit and Black Spot Identification. The specific objectives are:

- To study the existing traffic and roadway characteristics of NH-30 (Old NH-7).
- To collect and analyze accident data for identifying black spots along the selected highway stretch.
- To conduct a detailed Road Safety Audit of the study corridor.

- To identify geometric, operational, and environmental factors contributing to accidents.
- To assess the adequacy of road signs, markings, lighting, intersections, and other safety features.
- To rank accident-prone locations based on accident frequency and severity.
- To recommend appropriate engineering, enforcement, and traffic management measures for improving road safety.
- To suggest cost-effective remedial measures for reducing accident occurrence and enhancing overall highway safety.

III. REVIEW OF LITERATURE

Ahmed et al. (2025) studied the effectiveness of Road Safety Audits (RSA) on National Highways and found that regular safety audits, improved signage, road markings, shoulder improvements, and speed management significantly reduced accident frequency and severity. The study concluded that RSA is a proactive and cost-effective approach for improving highway safety.

Sharma and Verma (2024) applied GIS-based techniques to identify accident black spots using accident records and traffic data. The study demonstrated that GIS effectively locates accident-prone areas and supports better planning and prioritization of road safety improvements.

Kumar et al. (2024) evaluated the impact of safety measures on high-speed corridors. Their findings showed that interventions such as crash barriers, proper road markings, reflective delineators, and speed control devices significantly improved road safety and reduced crashes.

Chaudhari and Khode (2024) reviewed the current scenario of black spot identification on Indian National Highways. The study emphasized that road geometry, traffic conditions, and engineering deficiencies are major contributors to accidents and highlighted the importance of identifying and rectifying black spots to enhance highway safety.

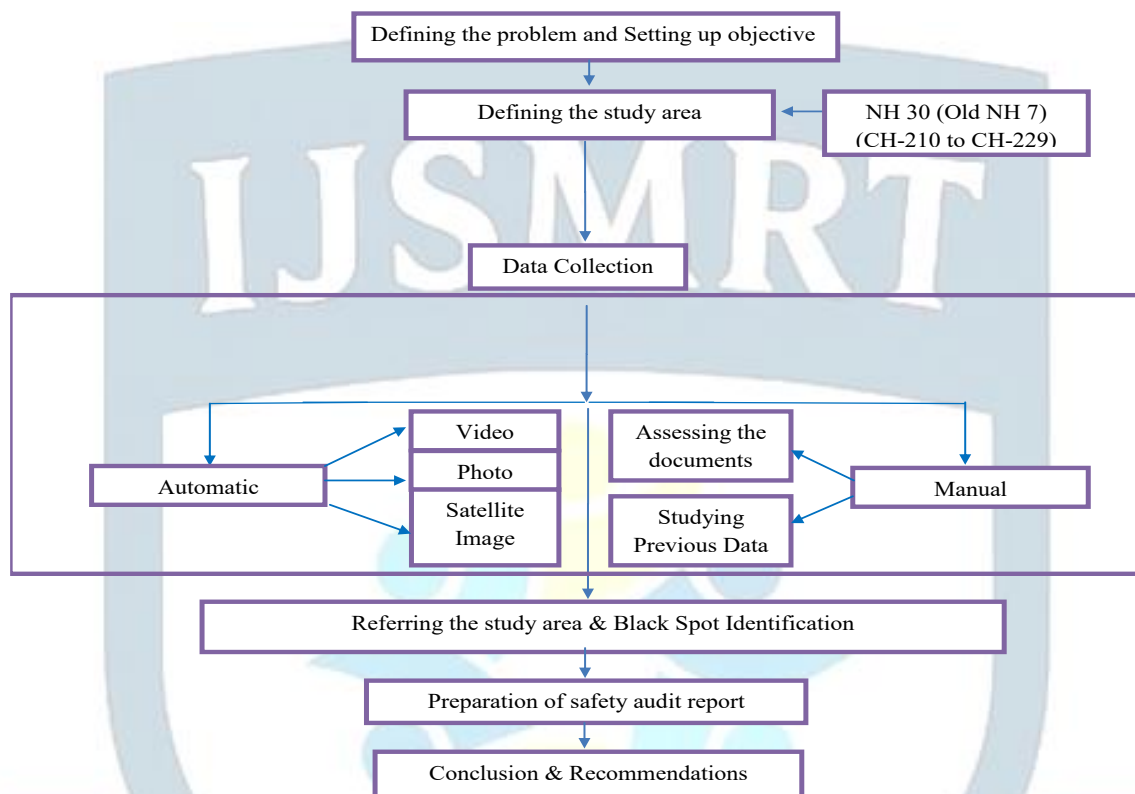
Singh and Patel (2023) analyzed accident black spots using Accident Severity Index (ASI) and Weighted Severity Index (WSI). The study identified intersections, median openings, and poor visibility sections as high-risk locations and recommended

geometric improvements, better traffic control, and speed regulation.

Gupta et al. (2023) conducted Road Safety Audits focusing on vulnerable road users. The study

identified deficiencies such as inadequate pedestrian facilities, poor lighting, and lack of cyclist infrastructure, recommending pedestrian crossings, dedicated bicycle lanes, and improved street lighting to enhance overall road safety.

IV. METHODOLOGY



V. SELECTION OF STUDY AREA

Rewa is a city in the north-eastern part of Madhya Pradesh state in India with latitude of 24.5362° N and longitude of 81.3037° E. The maximum length of Rewa district is 125 km from east to west and the length of Rewa from north to south is 96 km. This area is surrounded by Kaimur hills to the south Vindhychal ranges pass through the middle of the district. The area selected for the study is NH 30 (Old NH 7)

National Highway 30: Major 1984.3 km-way is a National Highway in India connecting Sitarganj (Uttarakhand) to Ibrahimpatnam Vijayawada (Andhra Pradesh). National Highway 30 runs from North to South, covering a total of six states from Uttarakhand to Andhra Pradesh. It starts at the junction of NH-9 at Sitarganj and ends at the junction of NH-65 at Ibrahimpatnam, Vijayawada. NH-30 runs through the states of Uttarakhand, Uttar Pradesh, Madhya Pradesh, Chhattisgarh, Telangana, and Andhra Pradesh in India. It passes through key cities like Lucknow, Prayagraj, Rewa, Jabalpur, and Raipur.

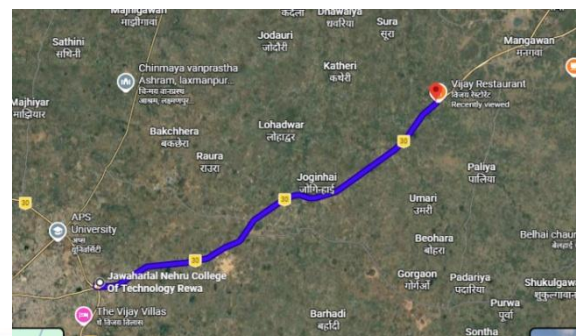
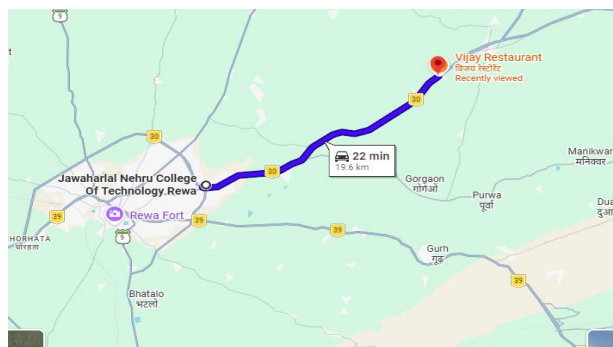


Figure 1: Google & Satellite Image of selected area



Figure 2: Survey Images

VI. RECOMMENDATIONS OF ROAD SAFETY AUDIT (RSA)

Table 1: Road safety Audit Report

Problem Identified	Suggested Measure	Priority
Over-speeding	Install speed limit signs, speed display boards, enforcement cameras, and rumble strips at critical locations.	Immediate
Inadequate highway lighting	Provide LED Street lighting at intersections, bus stops, and accident-prone locations.	Immediate
Unsafe median openings	Close unauthorized openings and redesign median openings as per IRC guidelines.	Immediate
Poor visibility at intersections	Remove sight obstructions, improve junction geometry, and install advance warning signs.	Immediate
Absence of pedestrian crossing facilities	Construct zebra crossings, pedestrian refuges, and foot overbridges where warranted.	Short
Lack of footpaths	Construct continuous and obstruction-free footpaths on both sides in built-up areas.	Short
Roadside encroachments	Remove illegal encroachments and maintain the required right-of-way.	Immediate

Unauthorized roadside parking	Develop designated parking bays and install No Parking signs with enforcement.	Short
Improper bus stop locations	Relocate bus stops to safer locations with properly designed bus bays.	Short
Utility poles close to roadway	Shift utility poles outside the clear zone or provide crash barriers.	Short
Trees close to carriageway	Maintain adequate clear zone or protect trees using crash barriers.	Immediate
Open roadside drains	Cover drains or provide guard rails to prevent vehicle and pedestrian accidents.	Immediate
Vendor activities on shoulder	Relocate vendors to designated vending zones away from the highway.	Short
Potholes and pavement distress	Carry out periodic maintenance, patch repairs, resurfacing, and rut correction.	Short
Water logging	Improve roadside drainage and maintain proper cross slope.	Short
Slippery pavement	Apply anti-skid surface treatment and improve pavement texture.	Immediate
Inadequate road signs	Install IRC-compliant regulatory, warning, and informatory signs.	Immediate
Missing road markings	Repaint lane markings, edge lines, stop lines, arrows, and zebra crossings using thermoplastic paint.	Short
Lack of guard rails	Install W-beam crash barriers and pedestrian guard rails at hazardous sections.	Short
Wrong-side driving	Install median barriers, directional signage, and strengthen enforcement.	Short
Unsafe overtaking	Introduce no-overtaking zones, centerline markings, and warning signs.	Short
Pedestrian jaywalking	Provide designated crossing facilities and install pedestrian fencing where necessary.	Immediate
Helmet and seatbelt non-compliance	Conduct strict enforcement through police and awareness campaigns.	Short
Garbage accumulation	Ensure regular roadside cleaning and provide waste collection bins.	Immediate

VII. INVESTIGATIONS OF NH 30 & Black Spots analysis

Table 2: Investigation between CH-210 to CH-229

S.No.	Chainage (CH)	Defects (Short)	Suggestions (Short)
1	CH-210	Unsafe crash barrier, shoulder drop-off, faded markings, no pedestrian facilities	Install crash terminals, stabilize shoulders, refresh markings, provide sidewalks & zebra crossing
2	CH-211	Missing lane markings, unsafe pedestrian crossing, no traffic calming, wide median opening	Apply road markings, construct zebra crossing, install rumble strips, improve shoulders & median
3	CH-212	No Defect	—

4	CH-213	No lane markings, loose shoulders, unsafe commercial access, inadequate curve safety	Mark lanes, pave shoulders, provide service lane, install chevrons & rumble strips
5	CH-214	No pedestrian crossing, eroded shoulders, faded markings, misplaced road studs	Construct zebra crossing, pave shoulders, refresh markings, relocate road studs
6	CH-215	Bridge approach drop-off, no edge lines, discontinuous crash barrier, poor hazard markers	Level shoulders, mark edge lines, extend barrier, install reflective hazard markers
7	CH-216	Unsafe toll islands, unpaved shoulders, poor lane guidance, misaligned barriers	Install crash cushions, pave shoulders, improve lane markings, align barriers
8	CH-217	Animal encroachment, unsafe crash barrier terminal, faded markings, uneven pavement	Install fencing, upgrade barrier terminal, remark lanes, level shoulders
9	CH-218	Unsafe barrier ends, illegal median crossing, eroded shoulders, poor junction guidance	Install crash cushions, provide median barrier, pave shoulders, improve markings & signs
10	CH-219	Unsafe intersection, no pedestrian facilities, poor side road, faded markings	Channelize junction, provide footpath, resurface side road, refresh markings
11	CH-220	No edge lines, loose shoulders, pavement edge drop-off, overgrown vegetation	Mark edge lines, pave shoulders, trim trees, install rumble strips
12	CH-221	Uncontrolled intersections, unpaved shoulders, faded markings, lack of pedestrian facilities	Improve junction layout, pave shoulders, install warning signs, provide pedestrian facilities
13	CH-222	Poor truck lay-by access, unpaved shoulders, faded markings, unsafe underpass crossing	Construct taper lanes, pave shoulders, refresh markings, install warning signs
14	CH-223	Loose shoulders, unprotected embankment, defective markings, roadside encroachment	Pave shoulders, install crash barriers, standardize markings, regulate roadside activities
15	CH-224	No Defect	—
16	CH-225	Loose shoulders, faded markings, lack of pedestrian facilities	Pave shoulders, repaint markings, provide pedestrian crossing & warning signs
17	CH-226	Substandard shoulders, no pedestrian path, vegetation, inconsistent markings	Pave shoulders, construct walkway, clear vegetation, extend markings
18	CH-227	Unpaved service lane, leaning light poles, faded markings	Pave service road, repair poles, refresh markings
19	CH-228	Pavement cracking, leaning light pole, unpaved shoulders/median	Rehabilitate pavement, secure light poles, stabilize shoulders & median
20	CH-229	Damaged pavement, roadside encroachment, unpaved approach, poor traffic channelization	Repair pavement & drainage, pave approach road, remove encroachment, channelize intersection

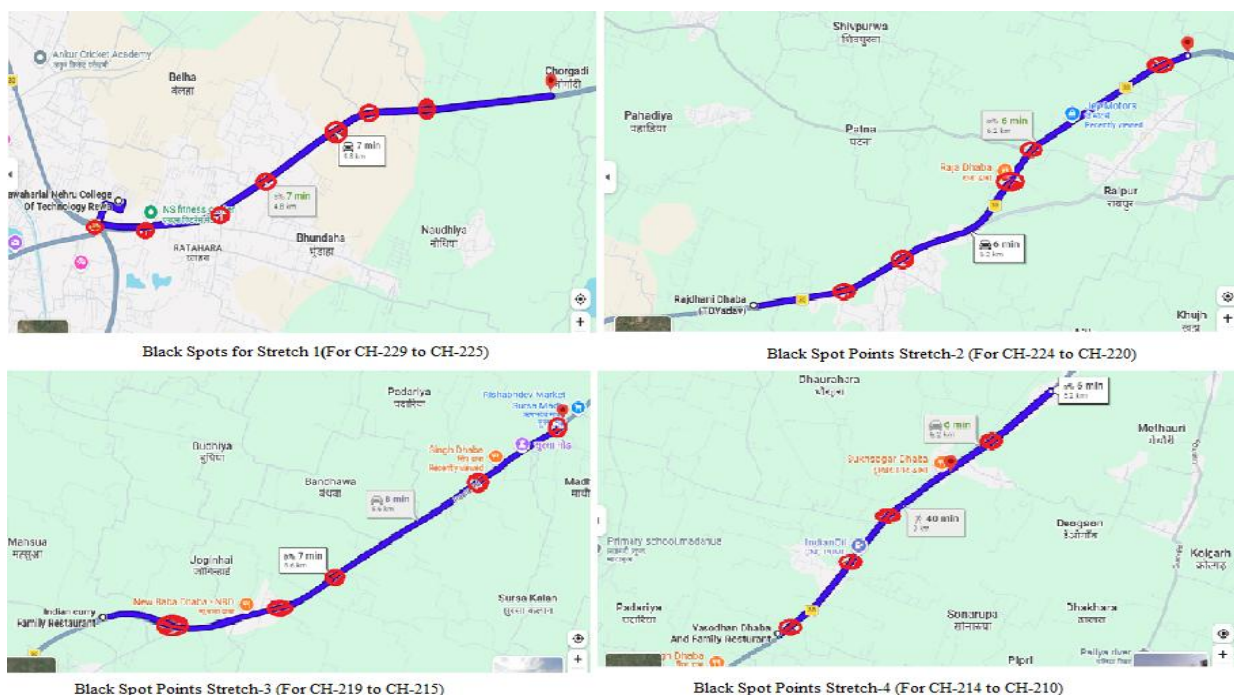


Figure 3: Black Spots for all four stretches

Table 3: Black Spot Analysis

Chainage	Nos	Problems	Safety Enhancement
CH-229 to CH-225	1	Sharp horizontal curve, inadequate warning signs, poor night visibility	Install Chevron signs, improve street lighting, provide retro-reflective road studs, improve curve delineation
CH-229 to CH-226	2	Median openings causing conflicting traffic movements	Close unauthorized median openings, redesign median, install channelizers
CH-229 to CH-227	3	Skewed intersection causing vehicle conflicts	Realign intersection, provide channelization and proper lane markings
CH-229 to CH-228	4	Conflicting movements at uncontrolled median opening	Close unnecessary median openings, install channelizers
CH-229 to CH-229	5	Skewed intersection causing vehicle conflicts	Realign intersection, provide channelization and proper lane markings
CH-229 to CH-230	6	Conflicting movements at uncontrolled median opening	Close unnecessary median openings, install channelizers
CH-229 to CH-231	7	On-street parking near petrol pump causing obstruction, vehicles entering/exiting petrol pump, reduced carriageway width, conflict between through traffic and turning vehicles	Prohibit parking within the influence area of the petrol pump, provide designated parking bays away from the carriageway, install No Parking signs, develop acceleration/deceleration lanes, provide channelized entry/exit, install road markings and warning signs
CH-224 to CH-220	1	Illegal median crossing by pedestrians and motor vehicles	Install pedestrian fencing, foot overbridge or underpass

CH-224 to CH-221	2	Conflicting movements at uncontrolled median opening	Close unnecessary median openings, install channelizers
CH-224 to CH-222	3	Unauthorized roadside parking, commercial activities,	Restrict roadside parking, develop parking bays,
CH-224 to CH-223	4	Bus stop located on carriageway causing traffic obstruction, Blind crest (summit) reducing visibility	Construct bus bay, relocate bus stop, provide bus shelter, Install advance warning signs, reduce speed limit, improve vertical alignment
CH-224 to CH-224	5	Conflicting movements at uncontrolled median opening, Animals frequently crossing roadway	Close unnecessary median openings, install channelizers, Install animal crossing signs, fencing, cattle guards where appropriate
CH-219 to CH-215	1	Narrow bridge with no approach warning	Install hazard markers, bridge narrowing signs, reflective delineators
CH-219 to CH-216	2	Divider not available, On Street Parking	Construction of divider, clearance of obstruction
CH-219 to CH-217	3	Poor lane discipline near toll plaza	Improve lane channelization, pavement markings, advance guide signs
CH-219 to CH-218	4	Conflicting movements at uncontrolled median opening	Close unnecessary median openings, install channelizers
CH-219 to CH-219	5	On Street Parking, Village Area on Both Side, Bad Shoulder, Shop of hotel on road parking	Installation of Speed Breakers, Clearance of obstruction on Shoulder
CH-214 to CH-210	1	Unsignalized T-intersection, inadequate sight distance due to vegetation	Junction improvement, install STOP/GIVE WAY signs, clear roadside vegetation, provide convex mirror if required
CH-214 to CH-211	2	Median openings causing conflicting traffic movements, Unauthorized roadside parking, commercial activities, pedestrian movement	Close unauthorized median openings, redesign median, install channelizers, Restrict roadside parking, develop parking bays, construct footpath, install pedestrian warning signs
CH-214 to CH-212	3	Minor road joining the main road, uncontrolled merging traffic, inadequate sight distance, Lack of reflective signs in fog-prone area	Install STOP/GIVE WAY signs, improve intersection geometry, clear sight obstructions, provide channelization and road markings, Install retro-reflective signs, road studs, fog guidance markers
CH-214 to CH-213	4	Missing lane markings and faded edge lines	Repaint thermoplastic lane markings, install reflective pavement markers

VIII. CONCLUSION

Accident-Prone Locations: The study identified several black spots along NH-30 with a high

occurrence of fatal and injury accidents, indicating the need for immediate safety interventions.

Road Safety Deficiencies: The Road Safety Audit (RSA) revealed major deficiencies such as inadequate

road signage, faded pavement markings, poor street lighting, unsafe median openings, roadside hazards, and insufficient pedestrian facilities.

Major Contributing Factors: Over speeding, poor visibility at intersections, roadside encroachments, unauthorized parking, and pavement distress were found to be the primary causes contributing to road accidents.

Pedestrian Safety Issues: The absence of continuous footpaths, safe pedestrian crossings, and dedicated facilities for vulnerable road users significantly increases accident risk near schools, markets, and settlements.

Effectiveness of Road Safety Audit: The study confirms that RSA is an effective proactive approach for identifying existing and potential safety hazards and recommending appropriate remedial measures before serious accidents occur.

Engineering Improvement Measures: The proposed countermeasures—including improved signage and road markings, enhanced lighting, speed management, safer median openings, roadside hazard removal, and regular pavement maintenance—can substantially improve highway safety.

Support for National Guidelines: The findings are consistent with IRC and MoRTH guidelines, demonstrating that systematic Road Safety Audits combined with black spot identification are effective tools for improving National Highway safety performance.

Overall Conclusion: An integrated approach involving engineering improvements, traffic law enforcement, regular maintenance, and public awareness is essential for reducing accident frequency and severity on NH-30. The implementation of the recommended measures will enhance road safety, improve traffic operations, and contribute towards achieving safer and more sustainable highway transportation.

VIII. FUTURE SCOPE

The review of previous studies suggests several promising directions for future research and practical implementation:

- Extend the study to the entire NH-30 and other National Highways.
- Use GIS and GPS for accurate black spot mapping.

- Apply AI and Machine Learning for accident prediction.
- Utilize drones and remote sensing for road safety surveys.
- Implement Intelligent Transportation Systems (ITS) for real-time monitoring.
- Conduct cost-benefit analysis of proposed safety measures.
- Study driver behaviour and vulnerable road user safety.
- Evaluate the effectiveness of implemented safety measures through follow-up audits.
- Analyze the impact of weather and environmental conditions on road safety.
- Develop a centralized Road Safety Information System for continuous monitoring and decision-making.

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