# GIS Based Road Safety Audit Of State Highways In Piparia SH19

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***Abstract-*** *Many traffic issues arise in cities as a result of the fast growth in the number of automobiles. This includes traffic accidents as a significant factor. In cities, accidents are caused by a combination of traffic conditions and user profiles. The deaths are also caused by a number of other factors, such as drunk driving, speeding, poor road design, etc.*

*This study investigates road safety, specifically the 10.5-kilometer RSA from Sandiya to Piparia on SH19, which is the main problem for emerging nations like India with extensive networks. Road Safety Audits (RSAs) are a proactive and cost-effective way to improve road safety by determining whether the roads are meeting the highest safety standards for all kinds of road users, even though there are other recognised methods for identifying road safety deficiencies or risk factors involved.*

***Keywords***- Road safety audit, Road safety improvement, Human factors, Freeway road inspection

## I. INTRODUCTION

In the modern world, roads and transport have become essential components of all human existence. Everyone uses the roads in some capacity. Despite reducing travel times, the current transport system has raised the danger of fatalities. Each year, thousands of people are killed and thousands more are seriously injured in traffic accidents. Approximately 80,000 people are killed in traffic accidents in India alone each year, accounting for 13% of all fatalities worldwide. There are three categories of accidents based on their severity: fatal accidents, injuries, and property damage simply. A major factor in the majority of collisions is the driver.Inthe majority ofincidents, the cause is either negligence or the road user's ignorance of road safety. Therefore, teaching road safety is just as important as teaching any other survival skill.

## SAFETY PROBLEM IN INDIA

Increased traffic congestion and accidents on road networks, which were never built for the volumes and types of traffic they are now expected to transport, are the results of growing urbanisation and automobile populations in many developing nations. Pedestrian-vehicle conflicts are also common as a result of unplanned urban expansion, which has created conflicting land uses. Due to the migration of people from rural to urban regions, many new urban inhabitants are frequently unaccustomed to the high traffic levels. Consequently, driving conditions have frequently deteriorated significantly, and the competition between various road user classes and risks has increased significantly. Furthermore, inadequate pedestrian provisions, poorly built junctions, and poor road maintenance have frequently exacerbated the inherent risks. In developing nations like India, these factors have all played a part in the severe issues with road safety. Road accidents worldwide are thought to claim the lives of about 3 lakh people each year and injure 10 to 15 million more. An increasing number of developing countries are concerned about road accidents, which cost them about 1% of their annual Gross National Product (GNP), which they cannot afford to lose.


**Fig 1 Road Safety Action**

### Accident Scenario in India

According to studies on traffic accidents, developing nations have a higher accident rate than developed nations.

One important factor in the country's economic prosperity has been the road transport sector's phenomenal rise. Over 80,000 to 90,000 people in the nation lose their lives in traffic accidents each year, and almost 4.5 lakh are injured. Despite having only 1.5% of the world's motor vehicle population, India accounts for 6% of all traffic incidents worldwide. The accident rate is still extremely high when compared to wealthy countries, despite the fact that it has been gradually rising over the previous 25 years. According to UNESCO, there are 1,37,423 accidents on Indian roads every day, resulting in the deaths of 16 children, and one death every minute. Two-wheelers are responsible for 25% of all traffic crash fatalities, with a total of 1214 crashes occurring daily. It is estimated that 377 individuals perish every day, which is the same as a jumbo plane crashing every day.

**Road Condition and Traffic Safety**

Road conditions continue to have an underappreciated impact on road safety. The impact of road conditions on accidents is likely to be established by the highway engineer based on extensive scientific research that includes the analysis of traffic accidents and the study of how cars are operated under various road conditions. The following are the primary road conditions that lead to accidents:

- Road Width
- Width and state of shoulders
- Width of the median
- Grades
- Deficiency in sight distance.

**Road Safety Audit in India**

An excellent tool for enhancing roadway safety in India is this audit. Since it appears that basic and precise data on accidents cannot currently be obtained, RSA solutions can be used to reduce the number of accidents caused by flawed roadway geometry and structure. Many resources can be used to reduce accidents by enhancing street operations and computations. A professional in street wellness can do this by acting out an autonomous mind security component. This authority can make comments about the street's well-being following an effective assessment. All types of street projects, including new roadway construction and current street restoration, can be covered by the RSA.

**1.6 OBJETIVES OF THE RESEARCH**

- The identification of blackspots and the analysis of accidents using QGIS involves examining accident data in order to identify areas with a high concentration of accidents.
- Investigate highway geometrics and silent features of road for accident reduction.
- Identifying the Blind Spots on SH19 considering a 10 kms strentch and provide necessary recommendations.

## II. LITERATURE REVIEW

In each research project, a review of the literature is crucial. In the field of road accidents and safety, numerous researchers have conducted studies. Different approaches have been taken by some of them to analyse accident data. Some of them have identified areas with black spots. Several of them have contributed to road safety audits and suggested safety measures. A review of the literature covering the many road safety issues is conducted in this chapter.

**Review of Literature Report**

**G. Pathan et.al (2024)** The purpose of an audit is to find any risks, evaluate the safety measures in place, and suggest changes to improve overall safety for bicycles, pedestrians, and drivers. As a vital link for both local commuters and interstate travellers, National Highway No. 44 connects Buttibori to Nagpur Airport Intersection, enabling the flow of people and products throughout central India.

A road safety audit for National Highway 44 would normally conclude with suggestions for enhancing safety features such speed limits, traffic composition, warning signs, sign boards, signage, and possible infrastructure modifications to lower accident rates and improve road safety. Point out areas that need attention and stress how crucial it is to put the recommended precautions into practice in order to reduce risks and improve road user safety overall.

**Pranesh Chawhan et.al (2024)** examined the main issue of road safety, which is a major concern for growing nations with vast networks like India. Road Safety Audit (RSA) is a proactive and cost-effective way to improve road safety by determining whether the roads are meeting the highest safety standards for all kinds of road users, even though there are other recognised methods for identifying road safety deficiencies or risk factors involved. An additional goal was to do a route Safety Audit (RSA) as part of the Nigdi-Dapodi BRT route protocol and to conduct an RSA on the current BRTS road network in Pune city.

Presentations were made of the gathered empirical data and other significant statistics about the severity of traffic

accidents and the strategies to lower RTAs that have been covered in different research. A thorough examination of numerous studies has demonstrated that accidents are the result of a complex interaction between a number of human, vehicle, and environmental factors that precede the event. Accidents on the road are caused by more than just driving carelessness or human mistake. Road traffic accidents must be seen as an important problem that requires attention in order to reduce the negative effects on social, economic, and health considerations.

**Rajat Kumar Gahlaut et.al (2024)** highlights significant defects and their effects on operational safety in order to evaluate the Gurugram-Faridabad Highway's road safety audit (RSA) and design compliance. According to the report, vulnerable road users (VRUs) are often overlooked in the design and construction of highways, and RSA must take steps to meet their unique infrastructure requirements. Uncontrolled livestock movement, unapproved gaps, and undeveloped intersections are indicated as operational safety hazards. The number of traffic accidents and fatalities has not substantially declined despite upgrades to the roads.

In addition to highlighting the significance of correcting design non-compliance and carrying out future risk assessments based on the research findings, the results concluded by proposing the mandatory application of RSA in road development projects. Ensuring safer driving conditions and lessening the impact of accidents on the Gurugram-Faridabad Highway and other comparable road corridors require addressing these problems.

## III. METHODOLOGY

**Fig 2 Flow Chart of process of Audit**

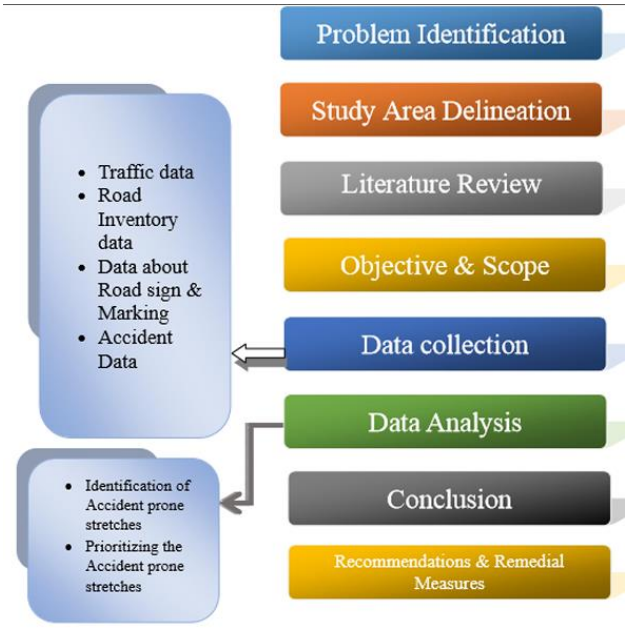



**Fig 2: Flow Chart of the Study**

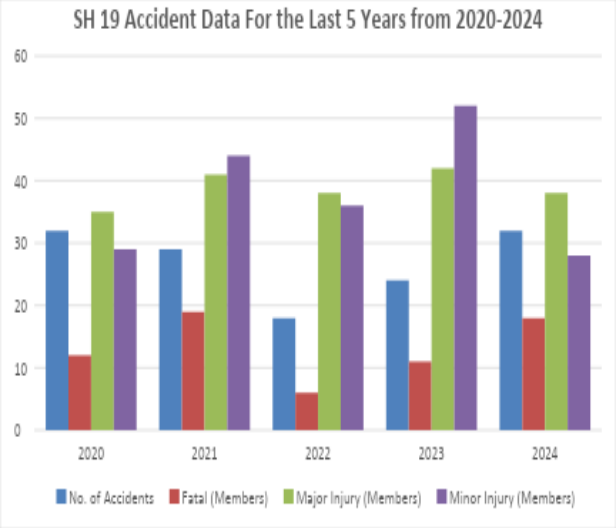
## IV. RESULTS AND DISCUSSION

The records of reported accidents are identified and tabulated using records from local police stations and ITR reports. The records were considered from 2020 till 2024. Further considering the case study, the accidents are then filtered a per considered chainage mapped using GIS application. The type of vehicle involved and the affected age group is further recorded for the accidents involved in the year 2024. Lastly, recommendations are provided in this section for enhancing the safety of the state highway.

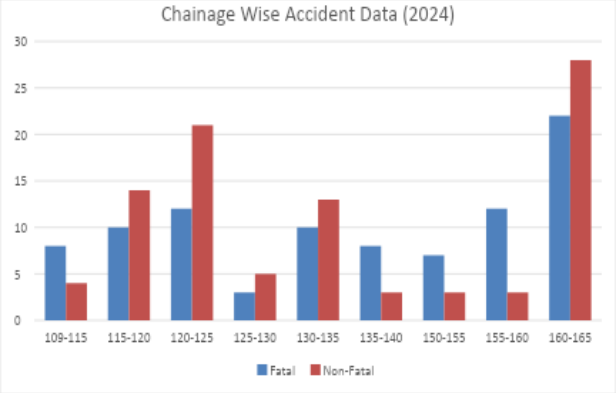
**Accident data from the Police station**

**Table 1: SH 19 Accident Data for the Last 5 Years from 2020-2024**

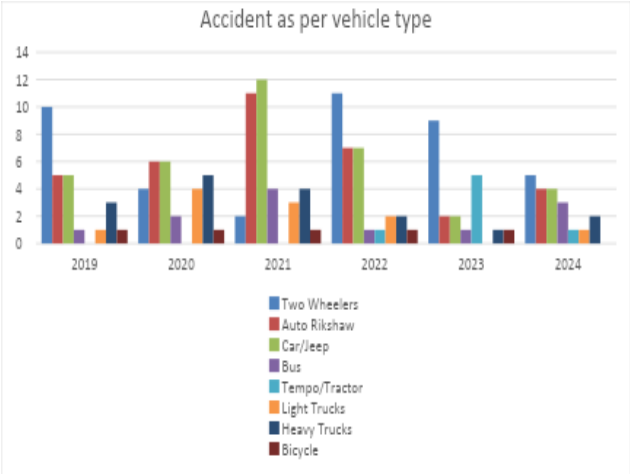
| Year | No. of Accidents | Fatal (Members) | Major Injury (Members) | Minor Injury (Members) |
|---|---|---|---|---|
| 2020 | 32 | 12 | 35 | 29 |
| 2021 | 29 | 19 | 41 | 44 |
| 2022 | 18 | 6 | 38 | 36 |
| 2023 | 24 | 11 | 42 | 52 |
| 2024 | 32 | 18 | 38 | 28 |



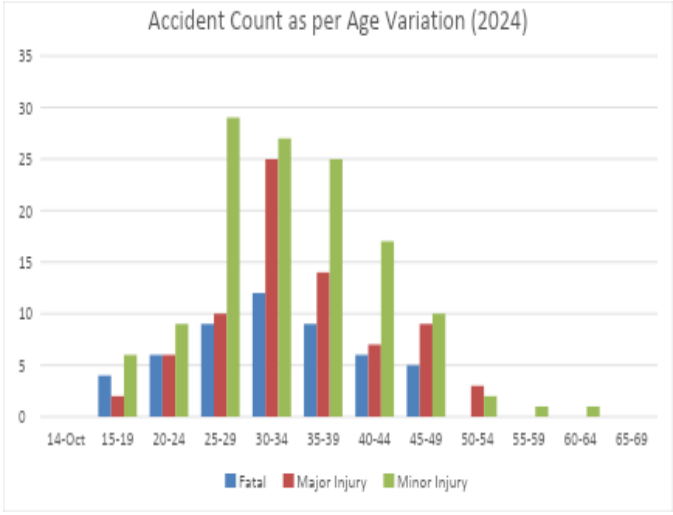

**Graph 1 SH 19 Accident Data For the Last 5 Years from 2020-2024**




**Graph 2 Chainage-wise accident data**




**Graph 3 Accidents data of study area**




**Graph 4 Accident Count as per Age Variation**

## V. CONCLUSION AND FUTURE SCOPE

The foundations of roadway design are crucial in determining its level of safety. One of the main causes of accidents is human error, which makes it almost impossible to manage a driver's emotional state and physical state. Highway engineers are powerless to prevent alcohol misuse, enforce seat belt use, or influence drivers' decisions at crossings. Nonetheless, a well-designed geometric layout will lessen accidents and assist regulate the speed of traffic on a guided path. The idea behind a well-designed road is to prevent accidents and to negate the carelessness of drivers. Comparing India to wealthy nations, it is discovered that safety issues are given far less attention. Drawing on the aforementioned recommendations and the current comprehensive Road Safety Audit on SH-19, the following findings are made:

### Reported Accidents

Over the five-year period from 2020 to 2024, State Highway 19 exhibited considerable fluctuations in road safety incidents, with no discernible trend in overall accident frequency. Annual data indicate that while accident counts varied—from a low of 18 in 2022 to highs of 32 in both 2020 and 2024—the severity and type of injuries likewise experienced significant variability. Fatalities peaked at 19 in 2021, dropped to 6 in 2022, and rose again thereafter, indicative of irregular but recurrent increases in accident severity. Despite occasional reductions in accident numbers, both major and minor injuries consistently remained at elevated levels, with particularly high figures in 2021 and 2023. For instance, 2023 recorded the highest minor injury count (52) across the period. These patterns suggest that, although the frequency of accidents may decline or increase only modestly, the potential for serious outcomes persists. The

data underscores the critical need for ongoing and enhanced road safety strategies on State Highway 19, focusing not only on reducing accident incidence but also on mitigating the severity of injuries sustained.

**Chainage wise reported accidents**

The spatial distribution of accidents along the highway chainage indicates significant variability in crash frequency and severity, with certain segments emerging as critical safety concern zones. Notably, the 160–165 km segment recorded the highest accident concentration, comprising 22 fatal and 28 non-fatal incidents, thereby warranting immediate safety interventions. Similarly, the 120–125 km segment exhibited a high accident load with 12 fatal and 21 non-fatal cases, highlighting persistent infrastructural or operational deficiencies. Moderate risk levels were observed in the 115–120 km and 130–135 km segments, each reporting 10 fatal accidents and elevated non-fatal figures. In contrast, chainage intervals such as 125–130 km, 135–140 km, 150–155 km, and 155–160 km reflected relatively lower accident frequencies, possibly due to better geometric design, reduced vehicular conflict, or lower traffic intensity. The observed spatial clustering of both fatal and non-fatal incidents underscores the need for location-specific safety strategies, including geometric corrections, improved signage, stricter enforcement, and public awareness initiatives to mitigate risks and enhance overall roadway safety.

- Road geometries were provided as per guidelines of MORTH Manual of Specifications and Design Specifications.
- Minor junctions had sight distance problem due to vegetation when approaching to main highway. Informatory sign boards showing name of the access road to the main highway was also missing. Accidents were observed to be more at those locations. Safety barriers were missing at high embankment area, along the curve.
- Safety barriers were not connected properly with the rigid concrete safety barriers at same locations.
- Due to vegetation, visibility along the curves was not proper. At curves, missing/removed curve sign boards were also found.
- It was also found that local people were damaging median kerbs of some location of the study stretch which were using as unauthorized median found with missing solar blinkers and informatory sign boards.
- Lacking of Informatory sign boards was also found on highway segment at some locations. Sign posts were installed but still cautionary/mandatory sign boards were found missing from the post.
- lack of Workplace Traffic Management was found missing. Along with it, the necessary cautionary sign boards were also found missing.
- Two High Tension Lines were found hanging without proper vertical clearance which poses high safety risk to all vehicles and trucks.

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