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By studying the literature related to highway safety, it becomes possible to understand the factors that lead to road accidents and the engineering measures that can be adopted to reduce these accidents.

2.1 Study by R.G. Marale and A.K. Kanase (2020)

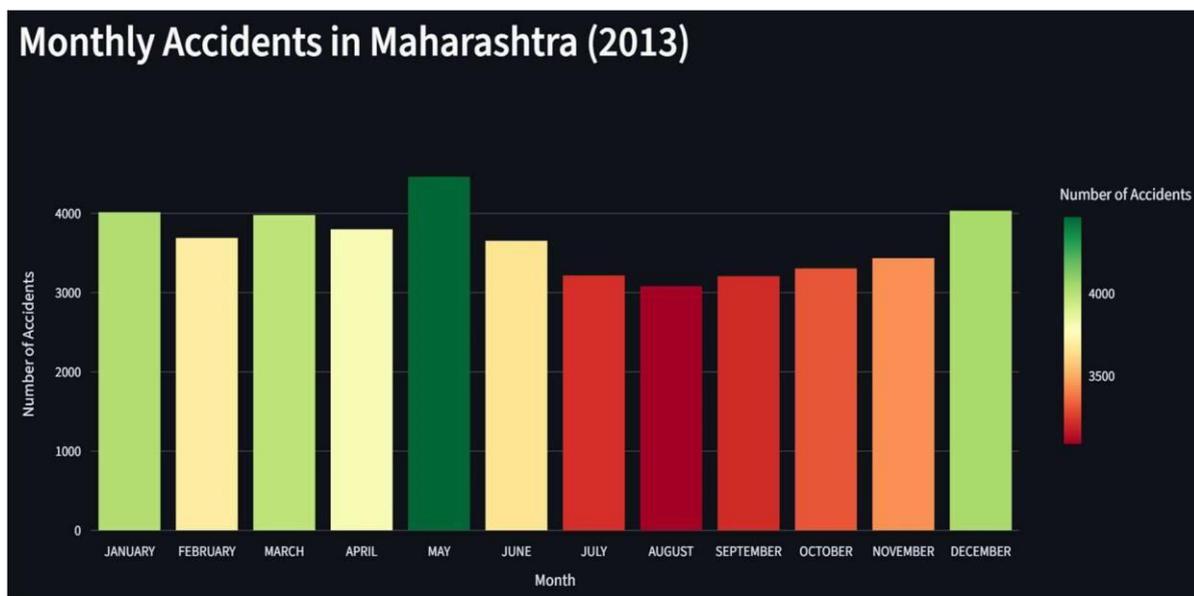
“Identification and Analysis of Accident Black Spots on NH-4 Pune–Kolhapur Section” – IJERT, Vol. 9, Issue 7

This study focused on identifying black spots along NH-4 (now NH-48) between Pune and Kolhapur. The authors collected accident data from traffic police stations for three years and used parameters such as accident frequency, severity index, and road geometry. The study revealed that poor road alignment, insufficient shoulder width, inadequate signage, and lack of lighting were major causes of accidents. Based on their analysis, the authors suggested engineering interventions such as curve realignment, shoulder improvement, installation of crash barriers, and provision of reflective road markings. The research demonstrated how civil engineering solutions could effectively minimize accident risks when combined with regular safety audits.

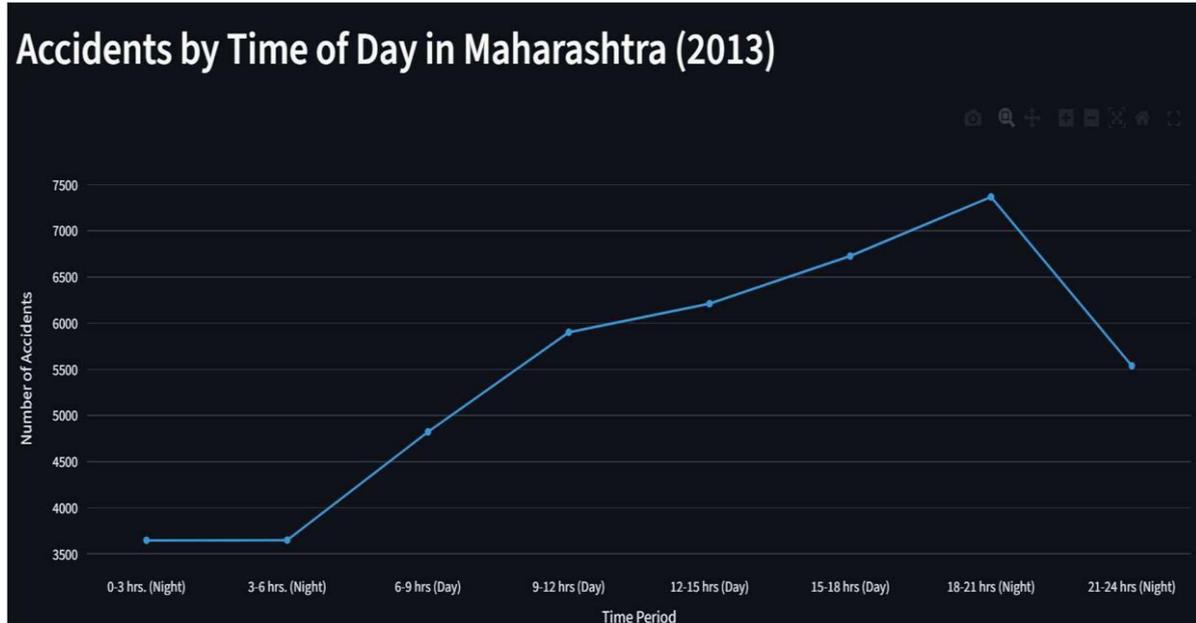
2.2 Study by N.P. Mane and S.A. Salunkhe (2022)

“Highway Safety Improvement Strategies in Pune District” – IRJET, Vol. 9, Issue 4

This research concentrated on highway safety issues specific to Pune district, analyzing accident trends along the Mumbai–Pune Expressway and nearby national highways. Using accident records from RTO and MoRTH, the authors categorized accident causes into road-related, vehicle-related, and human-related factors. Their study revealed that 68% of accidents were caused by driver negligence and speeding, 18% by road conditions, and 14% by environmental factors like fog and rain. The authors proposed recommendations such as better enforcement of speed limits, installation of safety barriers at curves, application of reflective paints, and awareness programs for drivers.



(Fig2.Data showing montly variations and frequency of accidents)



(Fig3. Distribution of Road Accidents in Maharashtra by Time of Day (2013) – Showing peak accident hours relevant to highway safety planning.)

III. DESCRIPTION OF PROBLEM STATEMENT

Road transportation plays a major role in the development of a country. Highways connect cities, towns, and rural areas and allow the movement of people and goods from one place to another. In India, highways carry a large portion of passenger and freight traffic because road transport is convenient and flexible. However, with the rapid increase in the number of vehicles, highways are facing many challenges related to traffic congestion and road safety. A large number of road accidents occur every year on highways due to various factors such as over-speeding, lack of traffic discipline, improper road design, and inadequate safety measures.

Importance of Highway Safety Highway safety is one of the most important aspects of transportation engineering. Highways are designed to allow the smooth movement of vehicles between different cities, towns, and rural areas. They play a major role in economic development by facilitating the transportation of goods and passengers. However, the rapid growth of population and the increasing number of vehicles on roads have resulted in heavy traffic on highways. This increase in traffic has also resulted in a rise in the number of road accidents. Road accidents cause serious injuries, loss of human life, and damage to property. Ensuring highway safety is therefore very important for protecting the lives of road users and improving transportation efficiency. Various safety measures such as proper road design, traffic control devices, speed regulation, and driver awareness are necessary to reduce accident rates.

3.1 Causes of Highway Accidents

Several studies conducted by transportation engineers and government organizations have identified the major causes of highway accidents. One of the most common causes is over-speeding. When vehicles travel at high speeds, drivers have less time to react to unexpected situations such as sudden braking of another vehicle or the presence of obstacles on the road. Driver negligence and violation of traffic rules also contribute significantly to accidents. Drivers sometimes ignore speed limits, traffic signals, and warning signs, which increases the risk of collisions.

Poor road design is another factor that may lead to accidents. Sharp curves, narrow roads, inadequate sight distance, and poorly designed intersections can create dangerous conditions for drivers.

In addition to these factors, environmental conditions such as fog, rain, and poor visibility during night time may also increase the chances of accidents on highways.



(Fig3. Malfunctions in Street Light and Traffic Controlling Signals Endangering Safety.)

IV. OBJECTIVE AND PROBLEM STATEMENT

In any engineering project, it is necessary to clearly define the scope and objectives of the study. The scope explains the boundaries and limitations of the project, while the objectives describe the goals that the study aims to achieve. Defining the scope and objectives helps in planning the work systematically and completing the project efficiently. Highway safety studies are conducted to understand the factors responsible for road accidents and to identify possible improvements that can enhance road safety. Such studies focus on analyzing traffic conditions, road design features, and the safety facilities available on highways.

The present project focuses on studying highway safety conditions on selected highways in the Pune region. The study mainly involves observing traffic movement, identifying safety issues, and suggesting suitable measures for improving road safety.

4.1 Scope of the Project

The scope of this project is limited to studying the safety conditions of selected highways such as the Pune–Solapur Highway and the Pune–Saswad Road. These highways were selected because they carry a large volume of daily traffic and play an important role in connecting Pune city with surrounding towns and villages.

The study mainly focuses on analyzing the existing traffic conditions and identifying potential safety hazards present on these highways. The project includes observation of traffic flow, road conditions, and the presence of traffic control devices such as signboards, road markings, and warning signs. Another important aspect included in the scope of the project is the identification of accident-prone locations. Certain locations on highways such as intersections, curves, and areas near villages often experience higher accident rates. By studying such locations, it becomes possible to understand the factors contributing to accidents. The project also examines the existing safety measures available on the selected highways. These may include traffic signs, street lighting, pedestrian facilities, speed control devices, and other safety features. Evaluating these measures helps in determining whether they are sufficient or require improvement.

Based on the observations and analysis, suitable recommendations are suggested to improve highway safety. These recommendations are mainly related to engineering improvements and traffic management strategies that

can reduce accident risks. It is important to note that the scope of this project is limited to observation and analysis of existing conditions. The project does not involve detailed design calculations or construction work but focuses on identifying safety issues and proposing practical solutions.

V. ACTION PLAN AND METHODOLOGY

For any engineering project, it is important to follow a systematic method to complete the study effectively. The action plan and methodology describe the steps followed to carry out the project work. These steps help in organizing the study and understanding the safety conditions of highways. In this project, different stages such as topic selection, data collection, field observation, analysis of problems, and preparation of the project report were followed. These steps helped in studying the safety conditions of selected highways and identifying possible improvements.

5.1 Selection of Topic

The first step in the project was selecting a suitable topic related to civil engineering. After discussion with the project guide, the topic related to highway safety was selected because road accidents are increasing and road safety has become an important concern in transportation engineering.

Studying highway safety helps in identifying the causes of accidents and suggesting measures that can improve road safety and traffic management.

5.2 Data Collection

Data collection is an important part of the project work. Information related to highway safety was collected from different sources such as textbooks on transportation engineering, highway engineering books, government reports, and educational websites.

These sources provided useful information about road design, traffic control devices, and safety measures used on highways.

5.3 Field Observation

Field observation was carried out to study the actual traffic conditions on selected highways such as the Pune–Solapur Highway and Pune–Saswad Road. During the observation, factors such as traffic movement, road conditions, and availability of safety facilities were studied.

Photographs were also taken at certain locations to record the existing road conditions and safety issues.

5.4 Analysis of Problems

After collecting the necessary information and conducting field observations, the safety problems observed on the highways were analyzed. Some of the common issues identified include over-speeding vehicles, lack of proper traffic signs, poor road markings, and absence of pedestrian crossings in some areas.

These factors contribute to unsafe traffic conditions and increase the chances of accidents.

5.5 Suggestion of Safety Measures

Based on the analysis of the problems observed, some safety measures were suggested to improve highway safety. These measures include installation of proper traffic signs, improvement of road markings, and provision of pedestrian crossings where necessary.

Speed control measures such as rumble strips and better street lighting can also help in improving safety conditions.



(Fig4. Road Safety and conditions observed during field study.)

VI. CONCLUSION

Highway safety plays a vital role in the development of an efficient and reliable transportation system. With the rapid growth of urbanization and industrial activities in regions such as Pune, the volume of vehicular traffic on highways has increased significantly. This growth has led to a higher risk of road accidents, making highway safety an important area of study in civil engineering. The present project focused on understanding the current safety conditions of highways in Maharashtra, particularly around the Pune region, and identifying the major factors that contribute to road accidents.

From the study, it was observed that several factors influence highway safety. These include improper geometric design of roads, lack of proper traffic signs and road markings, inadequate street lighting, poor maintenance of road infrastructure, and unsafe driving behavior. Field observations conducted on selected highways helped in identifying some of these issues directly. Problems such as damaged or missing traffic signs, insufficient lighting during night time, and high-speed traffic movement were noticed, which may increase the risk of accidents if not addressed properly.

The analysis of available accident data and previous research studies also highlighted certain patterns in highway accidents. Some months and time periods during the day show higher accident rates due to increased traffic flow and driver fatigue. These findings indicate that highway safety should not only focus on road design but also on proper traffic management and enforcement of safety regulations.

Based on the observations and analysis carried out in this project, several safety measures were suggested. These include installation of clear and visible traffic signs, improvement of road markings, better street lighting along highways, construction of pedestrian crossings where required, and implementation of speed control measures such as rumble strips and speed limit enforcement. The use of modern technologies like traffic monitoring systems and improved pavement materials can also contribute to safer highways.

In conclusion, highway safety is a shared responsibility involving civil engineers, government authorities, and road users. Civil engineers play an important role in designing and maintaining safe road infrastructure, while proper planning and implementation of safety measures can significantly reduce accident risks. By studying highway safety conditions

in the Pune region and suggesting practical improvements, this project contributes to the broader goal of creating safer and more efficient transportation networks in Maharashtra and across India.

VII. BIBLIOGRAPHY

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