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## ROAD SAFETY AUDIT AND DESIGN COMPLIANCE ON HIGHWAY

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### ABSTRACT

This study focuses on assessing the road safety audit (RSA) and design compliance of the Gurugram-Faridabad Highway, highlighting critical flaws and their implications for operational safety. The research identifies the absence of a safety consultant and missed opportunities for RSA as key factors contributing to compromised safety measures. Non-compliance with design norms, including pedestrian facilities and curve radius, further exacerbates the risks faced by road users. The study emphasizes the neglect of vulnerable road users (VRUs) in highway design and construction, emphasizing the need for RSA to address their specific infrastructure needs. Operational safety challenges arising from undeveloped intersections, unauthorized gaps, and uncontrolled cattle movement are identified. Despite road improvements, traffic accidents and fatalities have not significantly decreased. The study concludes by recommending the mandatory implementation of RSA in road development projects and highlights the importance of addressing design non-compliance and conducting future risk assessments based on the research findings. Addressing these issues is crucial to ensuring safer road environments and reducing the impact of accidents on the Gurugram-Faridabad Highway and similar road corridors.

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### 1. INTRODUCTION

**Introduction-** As long-term fixes for all categories of road safety, including low-traffic rural and isolated routes, remain elusive, a hierarchy of control should be imposed, much like the classifications used to enhance workplace safety and health. Preventing collisions that result in severe injury or death over time is the top priority, with sustainability requiring attention to all major outcome areas. The second tier, real-time risk reduction, includes alerting people who are in imminent danger so that they may take preventative measures. Applying the rules and guidelines for road design and enhancing driver behavior and enforcement constitute the third step of lowering the collision risk.

**Road Safety Concern-** Human error in making split-second decisions is the leading cause of traffic accidents, especially among drivers and other vulnerable road users including pedestrians, cyclists, and rickshaw/cart pullers, according to research. It seems that excessive speed is the primary contributor to both types of mistakes. Inadequate road geometry, insufficient setback/sight distance, and overloading are only some of the causes of accidents. Seventy percent of drivers in our nation are at risk. Large numbers of lives are lost every year, and countless buildings are destroyed. It's a shame that India

**Road Safety Audit-** The phrase "Road Safety Audit" (RSA) is used to describe a systematic and formal analysis of a road's safety performance, either in its current state or in its planned future state. It's a great way to ensure the future success of a road project's safety measures. To reduce accidents and save money, you can't beat a road safety audit. The lifesaving potential of RSA has been shown. The purpose of a Road Safety Analysis (RSA) is to reduce risk as much as possible in planned road improvements. The cornerstone of RSA is the integration of crash avoidance and mitigation strategies into the preliminary stages of developing, designing, and building new projects. The result is a list of possible safety problems and recommendations for fixing them. The idea at work here is that auditors who focus only on safety issues should be external to the project's design and planning teams. In addition, the auditors always prioritize safety, regardless of cost. Different countries have different RSA regulations. Safety audits are a mandatory aspect of the project planning and execution processes of the World Bank, the IMF, and the Asian Development Bank. The Indian Road Congress (IRC) is a prominent body in India responsible for establishing standards and specifications for Road Design & Construction, Road Maintenance, and Road Developments. In 2010, the IRC produced Auditing for Traffic Safety: A Manual (IRC:SP:88-2010).

### 2. LITERATURE REVIEW

The cultural and historical context of road safety and development in India is discussed by Reid (2004). Two case studies were reviewed; one focused on the assessment of road safety measures along India's Northern Corridor after substantial road upgrades, and the other examined the societal effect of repairing a 50-kilometer route with a high traffic flow. Drivers account for 49.4 percent of the component ratio in creating accidents on the Northern Corridor, with pedestrians coming in second at 21.7 percent. A large percentage of Northern Corridor incidents end in death

(24%), according to the data. The research also shown that

Homel and Wilson (2007) discuss a common practice in the United States of deploying more law enforcement personnel and vehicles at peak accident periods and locations. Police resources are distributed based on the incidence rate of accidents, as determined by the Safety Council. In contrast, the US National that day or shift takes the view that it is pointless to send any generals to low circulation or low accident hours, irrespective of the location's high accident frequency.

The Department of Transport, as reported by Malik H. (2014), has discovered that truck safety has significantly increased in recent years due to the voluntary installation of load sensing valves in the brakes of articulated trucks. The price of anti-lock braking systems dropped to an affordable level, and they required nothing in the way of maintenance. However, only major corporations were installing comprehensive anti-lock systems on both the tractor and trailer .

Most drivers have not had any formal training or instruction in road safety, claims Francis John Gichaga (2016). Many suggestions for improving many areas of road safety throughout the corridor and beyond were offered in this report as a result of the road safety study. The research also found that high levels of truck composition were associated with a higher accident rate, and that geometric highway features, yearly average daily traffic, truck composition, and chance all had a role in the location of accident hotspots. The vast majority of drivers lacked even rudimentary knowledge or experience in road safety, according to the data collected.

### 3. METHODOLOGY

With the tragic number of people killed on our roads, it is imperative that all parties involved work together to develop effective solutions. The four pillars of road safety, or the "four E's," may be broken down into.

#### Road Engineering

How drivers act is affected by the road's geometry. Poor horizontal and vertical geometry, blind intersections, small and fragile bridges, a lack of signage and suitable lighting are only some of the geometric design flaws that contribute to an increase in traffic accidents.

Furthermore, geometric criteria become violated due to the physical state of the road, include the road's riding surface, skidding, potholes, ruts, and the space limitations imposed by fixed buildings. Accidents are always a possibility in these high-risk areas if adequate warning signs are not provided.

Physically enhancing the current road network includes identifying all high accident locations using police records to improve geometrics, skid resistance, intersection features, decongestion via the installation of a bypass or grade separator, traffic flow separation, pedestrian over/under bridges, and road lighting, among other things.

When it comes to designing roads, the goal of functional design is to organize the physical features so that they best meet the needs of the user and the vehicle, with an emphasis on providing intrinsic safety and efficiency.

#### Vehicle

Road user behavior and accident rates are affected by factors such as vehicle type, operating parameters (such as acceleration/deceleration rate, braking efficiency, illumination, etc.), and road conditions. Brake failure, steering system failure, tyre rupture, broken axle, etc.[17] are all examples of vehicle flaws that may lead to accidents.

Standard equipment in today's autos includes several different sorts of safety systems to keep passengers and drivers safe in the event of an accident.

#### Enforcement

When it comes to enforcing laws like speed limits, wearing seatbelts, not driving while intoxicated, etc., the traffic police play a crucial role.

In order to limit the number of accidents that occur on the road, the participation of traffic police and administration is crucial. Similarly, pedestrians and drivers must abide by certain regulations that are the responsibility of the traffic police and administration.

#### Drivers

Drivers' negligence is often responsible for a significant number of accidents, with various factors contributing to these incidents.

The primary causes include driving at excessive speeds, engaging in reckless and negligent driving behaviors, disregarding traffic rules and regulations, failing to yield the right of way, inability to perceive or comprehend traffic situations, signs, or signals, experiencing temporary impairments due to fatigue or lack of sleep, succumbing to the intoxicating effects of alcohol, being overage, or having impaired vision.

#### 4. CONCLUSION

With a BOT approach to construction, the Concessionaire was in charge of the detailed design, which would then be reviewed by an independent consultant hired by the project's employer, PWD B&R. Due to the lack of a required clause in the concession agreement, no safety Consultant was hired. Consultant conducted the feasibility study without including a safety check. The Consultant's feasibility report informed the project's progress, and the report's technical criteria were set in stone, so there was limited option for revisions down the line. There were several missed opportunities to perform the RSA.

##### **Compliance to standards and specifications**

This research reveals that some norms, including as design velocity, curve radius, and intersection development, have not been met. There is a lack of pedestrian and VRU (non-motorized vehicle) facilities. Cattle have been free to roam the whole length of the corridor since no fence has been installed to restrict their movement. There is currently no plan in place to divide the road's mixed traffic. The Gurugram–Faridabad Highway winds across undulating terrain, therefore central verge and shoulder delineators are crucial but have been removed by vandals. The road lines have completely faded away and need to be repainted with thermoplastic paint, along with new cat eyes and delineators. To reduce the glare of oncoming headlights, vegetation should be grown in the center median of four-lane sections as soon as possible. The speed breaker has to be rebuilt to meet current IRC specifications. Wild jungle vegetation and puddles cover the shoulders. Cracks in the tarmac should be filled as soon as possible. The audit would have revealed such problems in a timely manner, allowing for appropriate adjustments to be made in order to bring the design parameters up to date so that they conform to standards and specifications. Because of this, operational efficiency and safety had to take a hit from the compromise solutions that were implemented.

##### **Vulnerable road users**

This research lends credence to the idea that VRUs (including pedestrians, cyclists, and motorcyclists) have their demands neglected in highway design and construction while vehicular traffic is given first priority. By drawing attention to the challenges faced by the infrastructure needs for VRUs, RSA may facilitate positive change. Despite the improvements in road capacity, traffic accidents have not decreased much from 2008 to 2023, according to an analysis of this research.

##### **Operational Safety**

Improving operational safety is a primary focus area for RSA. This study demonstrates the importance of RSA by showing how many undeveloped major and minor intersections affect operational efficiency and safety due to ROW constraints, unauthorized gaps in central verge, steep curves with small radius of curves, a lack of road signals and road markings, and the uncontrolled movement of stray cattle. The fact that deaths have decreased only little despite road improvements is evidence of continuing dangers and blind spots.

##### **Need to make RSA mandatory**

This research has helped advance the mission of RSA by highlighting possible risk factors and offering solutions to these problems. Therefore, it is crucial that Road Authorities provide rules and instructions making RSA necessary for road developments.

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