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Review on Road Safety audit based design issues mitigation plan in 4 Laning of Khalghat – MP/ Maharashtra Border Section of NH-52 (Old NH-3)

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ABSTRACT

Road safety audit is formal procedure for assessing potential and safety performance in the provision of new road schemes, the improvement and rehabilitation of existing road and in maintenance of roads. The role of auditor is to provide independent advice in the form of recommendation. The primary role of auditing identifying the potential problems of a highway project by conducting the site inspection and collecting data. The objective review of the study in the identification of accident prone areas on the road from FIR, to study the effect of roadway geometrics and traffic conditions on the road and development of statistical relationship between accident and various factors causing accidents.

Keywords: Accidents, HMDA Roads, Road Safety Audit, Outer ring road, Urban Road.

I. INTRODUCTION

Road safety review is a formal methodology for autonomous appraisal of the accident potential and likely safety execution of a particular outline for a road or traffic plan - whether new development or a change to a current road. Road safety sway appraisal is a formal system for autonomous evaluation of the imaginable impacts of proposed road or traffic plans, or to be sure different plans that effect sly affect road traffic, upon accident event all through the road system whereupon traffic conditions might be influenced by the plans. These two methods empower the abilities of road safety building and accident examination to be utilized for the anticipation of accidents on new or adjusted roads. They hence supplement the utilization of these same aptitudes to lessen the event of accidents on existing roads by method for neighborhood safety plans, as a rule as minimal effort measures (ETSC, 1996). This survey

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expects to depict and show the utilization of safety reviews and safety sway appraisal in outlining and fabricate safe road and traffic plans, and at the arranging stage in picking which plans to advance from among a scope of potential outcomes. For the most part, roads are composed in light of an expansive number of criteria, for example, travel time, client solace and accommodation, fuel utilization, development costs, natural effect and objectives of urban or provincial arranging. Safety is one of the criteria, however is frequently verifiably thought to be accomplished by holding fast to endorsed principles of arrangement and format for every component of the outline.

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."[1] Road safety audits differ from conventional traffic safety studies in two key ways: road safety audits are often pro-active investigations, rather than reactive investigations of sites with histories of complaints or poor safety performance, and the investigation team is independent from the staff that is designing the project or maintains the road. [1]

II. NEED OF ROAD SAFETY

Road Safety Auditing is a specialist process that must be carried out independently of design and construction work. Road Safety Audits are intended to ensure that operational road safety experience is applied during the design and construction process in order that the number and severity of collisions are kept to a minimum. Road Safety Audits fulfil a vital role in checking that roads have been designed and built to the highest safety standards. A well carried out Road Safety Audit adds value to a highway scheme at every level. [6] The main objective of safety audit is to ensure that all highway schemes should operate as safely as possible after opening to traffic and to minimize risks to all road users.

III. LITERATURE REVIEW

Satyajit Mondal et al. [1] Road transportation is considered one of the most essential factors for the growth of a country. Due to the exponential growth in population and fast urbanization, the existing roadway facilities are facing a huge surge in vehicle growth. But this development

is also accompanied by the concerning growth of road crashes. To mitigate road crashes, one needs to identify the potential risk factors involved with them. This requires detailed accident data, which is sometimes difficult to acquire and in addition, there is a high probability of accidents in many places due to various hazardous situations, but there may not be an accident record yet. Road Safety Audit is an alternative approach that can overcome these obstacles. Hence, the present study has attempted to highlight various risk factors involved with road crashes for four different road facilities type, viz. Straight, intersection, curve, and road with culvert and flyovers (RCF) by conducting the Road Safety Audit for 216 black spots. Analytic Hierarchy Process (AHP) was performed on the data collected from the audit process to determine the weightage of involvement of each factor in road crashes and identify the most significant ones.

Xiao Qin et al. [2] A road safety audit (RSA) is a formal safety examination of a future road project or an existing road by an independent, qualified, and multidisciplinary team who reports on the project's crash potential and makes recommendations for safety treatments. The concept of an RSA was developed in the United Kingdom in the 1980s, and it is now widely acknowledged as one of the most cost-effective tools for improving road safety and preventing crashes. RSAs can be applied at every stage during the life cycle of a road project through an eight-step process. RSAs are in accordance with the safe systems approach to road safety management that ensures that human error does not lead to a death or a life-changing injury.

Dillip Kumar Das et al.[3] Occupational health and safety (OHS) challenges persistently plague road construction endeavours. The pivotal role of worker behaviour in influencing these challenges is widely acknowledged. Nevertheless, a comprehensive exploration of how OHS issues manifest in road construction due to worker behaviour has been conspicuously absent. Within the context of India's National Highway expansion project, this study investigates the key factors associated with worker behaviour that contribute to accidents and presents a systemic archetype for ameliorating worker behaviour and, consequently, OHS. Data sourced from surveys and robust statistical analyses form the foundation of this research, with the System Dynamics modelling (SD) framework employed to construct the archetype. Furthermore, the Theory of Planned Behaviour (TPB) serves as the theoretical underpinning for this study. The findings underscore that accidents are often precipitated by a dearth of

knowledge and inadequate training regarding safety codes and practices, which consequently leads to their violation. However, an investment in knowledge dissemination and comprehensive training to heighten awareness, encourage adherence, and facilitate implementation of safety standards and practices could markedly enhance OHS within road construction projects. This study posits that fostering appropriate worker behaviour rooted in knowledge and training, along with promoting the rigorous enforcement of safety codes and practices, stands as a crucial strategy for preventing accidents in road construction. Consequently, it is argued that knowledge acquisition and training should be recognized as pivotal leverage points for enhancing OHS through the prism of worker behaviour in road construction projects.

Yagnik M Bhavsar et al. [4] In the past decade, the number of vehicles in India has increased exponentially; however, road infrastructure has not scaled proportionately. As a result, road traffic problems such as congestion on urban roads, dangerous traffic violations, and road accidents have increased significantly. Due to limited road infrastructure, traffic violations (human errors) have intensified in densely populated urban areas. This paper presents a case study (at a multi-lane urban roundabout in Ahmedabad city, India) and the methodology based on computer vision to investigate road traffic and violations using drone/UAV-based aerial video. You Only Look Once-YOLOv7 is used for vehicle detection, and Simple Online and Real Time Tracking-SORT for tracking vehicles. Our methodology divides the road scene (roundabout) into certain zones. We then formulated the dictionary, which maps the traffic violations under Motor Vehicle Driving Regulations - MVDR/ Motor Vehicle Act - MVA and the movement of the vehicle (zone traversal sequences). Using the zone-based methodology, we could also probe other road traffic data such as the count of vehicles, speed of vehicles, rate of traffic flow, and congestion. Based on our results, we also infer some of the possible causes of traffic violations in terms of problems/limitations of road infrastructure. As per our analysis, around 23.26% of vehicles committed traffic violations. We detected traffic violations related to lane indiscipline, driving against the authorized flow of traffic, parking violations, and over-speeding within the roundabout. Our methodology of investigating road traffic and violations can be used for road infrastructure improvement, law enforcement drives, and policy making, for road traffic safety, in developing and densely populated countries.

Andrea Paliotto et al. [5] The proposed literature review has started considering a web search on Web of Science (WoS). Then, a systematic review of each publication has been carried out using the Bibliometrix software, to identify the main characteristics of the publications within the specific topic. Then, the most relevant and widespread safety analysis procedures have been considered and the following aspects have been analyzed: the type of approach (crash analysis, crash prediction models procedures, based on road safety inspections, etc.), which and how many data are required (crashes, traffic, visual inspections, geometrical data, etc.), which is the effectiveness of the procedure, and which are the segmentation criteria used (fixed length, variable length based on geometry, traffic, etc.).

Debashis Ray Sarkar et al. [6] In recent times, the assessment of unsignalized intersection safety has received significant research attention because of the complex and diverse traffic movements and driving behaviour at such locations. However, priority traffic regulations are not well followed in comparison to the unsignalized junctions, which leads to more conflicts. Additionally, the severity of conflicts increases with continuous traffic manoeuvres, including right-turns and through traffic, combined with different driving behaviours. Several studies have compared crash-based analysis to proactive traffic safety measures. Current research outcomes imply that surrogate safety measures (SSMs) have the potential to elucidate the sequence of events that result in collisions, their underlying causes, and their outcomes. Therefore, to further understand the appropriateness of SSMs, further study is required based on heterogeneity in traffic along with driver behaviour that incorporates turning vehicle factors. This study presents an all-inclusive evaluation of the recent advancements in SSMs and their practical implementation, with a particular emphasis on unsignalized intersections in developing nations. The findings of this investigation would be helpful in identifying the appropriate safety indicators for evaluating traffic safety at unsignalized intersections.

Faan Chen et al. [7] Road traffic injuries are a leading cause of socio-economic loss in East Asia Summit (EAS) countries. A regular performance rating to monitor progress and calibrate interventions is crucial for road safety improvement, helping to save human lives and reducing economic losses. To this end, we propose a new and easy-to-adapt multi-criteria decision-making method for systematically rating the road safety performance of the EAS countries, the preference selection index with principal component analysis of RIDIT scores (PSI-PRIDIT)

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(scores of a distribution relative to an identified distribution integral transformation). Using the results from other classical methods as a reference, we rank the EAS countries robustly and place them into three groups over the last decade (2009–2019), based on the composite road safety development index. Our findings should be useful for EAS countries to detect underlying problems and identify best practices, as well as provide government officials, policymakers, and practitioners with meaningful guidelines on the adoption of successful road safety measures. Overall, the proposed rating framework should help to strengthen the institutional capacity for road safety management and addresses road safety issues. Laxman Singh Bisht et al. [8] Research has revealed the safety benefits of shoulder improvements on highways are significant. The study aimed to assess the impact of paved shoulder width on the frequency of fatal crashes in case of heterogeneous traffic on a rural four-lane divided highway in India. A matched case-control design was employed to evaluate the safety effectiveness of the paved shoulder width on fatal crashes. The impact of shoulder widths on victims of motorized two-wheelers (MTW) users, slow-moving vehicles and rear-end fatal crashes were also analyzed. The study stretch was divided into segments of 100 m. Each segment was linked to the traffic volume, speed, geometric characteristics, and roadside hazards characteristics. Analysis of the crash data revealed that 39% of the total crashes are due to rear-end collisions, mostly occurring at nighttime. The model results are interpreted concerning segments with no shoulder as the baseline category. Model results suggest that paved shoulder has safety benefits for all road users up to 1.5 m shoulder width. The provision of paved shoulders reduced the risk of all fatal crashes and improved the safety of pedestrians and slow-moving vehicles. However, the safety of MTW users reduced on segments having paved shoulder width more than 2 m. Also, segments with a paved shoulder width of more than 1.5 m have a higher risk of rear-end fatal crashes than no shoulder segments. This study findings have a direct bearing on the geometric standards recommended by the road authorities in India.

Sujata Basu et al. [9] This paper presents an evaluation of risk factors for highway crashes under mixed traffic conditions. The basis of selecting study sites was abutting land use, roadway, and traffic characteristics. Accordingly, the study selected thirteen segments on the existing highway network in the state of West Bengal of India, covering a wide spectrum of

such road attributes. A systematic investigation based on site-specific accident data to capture the highway sections' safety features revealed that the crash rate has steadily increased for years with traffic regardless of roadway category and conditions. A number of risk factors that affect road accidents were identified; they are mid-block access, pavement and shoulder conditions, vehicle involvement, time of day, and road configuration, i.e., two and multi-lane. The empirical observation indicates that the crash rate is relatively lower on multi-lane highways; however, the severity of any crash on such a road is relatively high. Notably, the crash frequencies on such roads are less during daylight hours due to the lane-based unidirectional traffic movement. This is quite the opposite during nighttime when drivers exhibit an inability to meet traffic contingencies, thereby increasing crash risk. The majority of crashes on two-lane highways are, on the other hand, due to unsafe driving manoeuvers. The study also observed that frequent mid-block accesses and poor shoulder conditions reduce scopes to rectify driving errors and increase crash risk as a consequence. The paper subsequently suggests proactive approaches to identify safety deficits at the time of planning and designing.

Kristina Baklanova et al. [10] Road safety audit has been used for a long time all over the world as one of the main tools for organizing safe traffic but in Russia this concept appeared only in 2017 at the legislative level. Thus, the article describes the purpose and essence of road safety audit. For a more detailed review on the road safety audit procedure on highways, a federal road of the Krasnoyarsk region was chosen. After analysis of official statistics and accident reports several priority sections requiring some special attention were identified. The priority area was determined by the greatest social economic damage from the death/injury of people per one accident. These calculations were based on the value of statistical life. After a detailed analysis of the types of accidents and road conditions that affect the risk of accidents the road sections with a high rate of car accidents were determined. After a detailed study of road accidents on these road sections some measures to reduce the accident rate were proposed. The effectiveness of the proposed measures was tested using the PC-Crash (the accident simulation and reconstruction program).

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IV. CONCLUSION

Road Safety Audits should be conducted throughout the planning, design and construction stages of new road projects to ensure that they are safe. The experiences of best practices countries and the significant reduction in their fatality rate, along with the importance of the process on safety. RSA is an important process to reduce incident rates, improving safety and traffic conditions.

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