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# A Perceptual Approach for Performing Road Safety Audit for Highway during Construction Stage

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**ABSTRACT:** An outstanding role for nation's economy and development is played by developing nation's road system. This is because by using roads, users are able to fulfill their essential needs. Many lives are lost and tremendous measure of property harm happens due to mishaps. This research is an Endeavour to break down the activity wellbeing circumstance from College of Engg. & Tech., Akola to Vyalla on Amravati- Shegaon Highway No-194, India. Recognition of counter measures is done for extends in which the aggregate damage brought about by accidents can be significantly and promptly diminished. As a result of conducting Road Safety Audits, it was discovered that median openings at some places are insufficient. Heavy vehicles are halted on the sideways, thereby impeding the proper width of the carriageway and resulting in risks to quick movement of vehicles. Unapproved median openings were discovered which ought to be quickly closed. It is necessary to mark the road and the middle sections and to organize the speed signs. Regulatory and informatory sign boards are not provided at many places. The Vulnerable Road User (VRU) i.e. people on motorcycles do not have proper safety on carriage way at night due to provision of leveled shoulder. For future implementation, the appropriate recommendation was provided for quality improvements taking into account coordinates of the entire study area.

**KEYWORDS:** Road Safety Audit, Road Safety Analysis, Traffic Safety, Construction Stage Audit, Safety Program, Road Accident, Safety of Vulnerable Road User

## I. INTRODUCTION

Road safety is a global socio-economic concern. The accident rate and fatality rates in developing countries are alarmingly high. Every year, many people die and are get injured on roads. States, countries, regions, and municipalities spend a large amount of money each year to reconstruct and improve roads in an effort to reduce accidents. The streets of India are incredibly dangerous. We essentially don't have a decent quantitative comprehension of the nature and degree of wellbeing related issues on the streets. There is extensive under-reporting, poor mishap records, and a lack of information about the severity of the issue that renders it difficult to frame an assessment. Take the following regular perceptions as a categorization: overloaded merchandise and traveler vehicles, unregistered and uncertified vehicles, unlicensed drivers, and a lack of consistency in the enforcement of street rules. Inadequately maintained streets do not fit within basic security-related outline guidelines, such as movement isolation, partitioned carriageways, crossing points, and path markings. Street configuration favours mechanized vehicles to the detriment of defenseless people on foot and cyclists. Additionally, these people tend to be less financially capable and likewise bear an unequal risk of wounds and fatalities. Crisis recovery treatment is rarely assured at mishap locales and is frequently postponed, adding to the prominent reason why so many wounds happen on Indian roadways.

A road safety audit is a simple method by which a design for a road can be assessed for its accident potential and safety performance and can be improved in the near future. Assessing the likely effects of proposed traffic and road schemes is done through a road safety assessment. That has substantial effects on road traffic, upon accident occurrence throughout the road network upon which traffic conditions may be affected by the schemes. Generally, roads are designed with a large number of criteria such a travel time, user comfort and convenience, fuel consumption, construction costs, environmental impact and objectives of urban or regional planning. The assessment of safety is often assumed to be accomplished by adhering to prescribed standards of alignment and layout in each element of the design. Safety audit procedures ensure that independent expertise is used to make explicit the safety implications of an entire design and, doing so, lead to safer design of both new and modified roads.

The scope of RSA is usually confined to a separate road scheme, which may be a new road or modification to an existing road. The foundation for safety audit is the application of safety principles to the design of a new or a modified

road to prevent future accidents occurring or to reduce their severity. As vehicular traffic began to increase, the congestion on the streets began to hamper the safe and efficient movement of traffic. As a result, greater attention must be paid to the operational characteristics of highway transportation, as well as the need for improved geometric design, capacity, intersections, traffic regulations, signals, traffic signs, roadway markings, parking facilities, and street lighting design. Due to the rapid urbanization, the tremendous rise in number of vehicles is variably accompanied by ever increasing volume of traffic and intense traffic congestion on roads.

The peaking phenomenon is particularly noticeable in road traffic due to its proclivity to cause congestion. Because of the seriousness of the congestion problem, a RSA engineer must understand the economic effects of congestion as well as the methods available for its mitigation. The existing street system, which changed over centuries, was never intended to accommodate future development due to rapidly rising population. It has become increasingly difficult to stop the vehicle and get out on one's own. In some areas, finding a safe parking spot is nearly impossible. Congestion causes delays and time loss. The inevitable result of increased traffic has been an increase in road accidents, which have taken a heavy toll on human life.

The Road Safety Audit must survey on the basis of street client learning, qualities and aptitudes, day/night, and wet and dry street conditions. Road Safety Audit is simply an investigation of security perspectives, and an inspector may reveal street security issues inherent in plans that conform to our street principles. This is because our street measures are an outflow of a financial harmony between street wellbeing, availability, the environment, and the economy. The goal of street security review is to ensure that all new street ventures - as well as major working and upkeep movement on existing streets - are assessed from the standpoint of street security, so that any parameters of the venture that are unsatisfactory from the standpoint of street security are addressed in time.

## II. LITERATURE REVIEW

**Jain et al.** Audited road safety for four lane NH. They extended from Km 75.00 to Km 130.00, National Highway 58 had been chosen for investigation. This review aims to identify the advantages of proposed activities that have emerged as a result of inadequacies identified through the review procedure. Subsequent to directing RSA, it is found that trucks are stopped on roadway which diminishes the viable width of carriageway and making activity dangers to fast moving traffics. Unapproved middle openings were discovered which ought to be quickly shut. The most Vulnerable Road User (VRU) i.e. walkers and cyclists offices close home is missing and should be encouraged on need.

**Mehara and Agarwal** studied A Systematic Approach for Formulation of A Road Safety Improvement Program in India The review presents essential ideas to build up a mishap record framework for Positioning of Safety dangerous areas, For distinguishing proof of wellbeing change measures, To decide needs of wellbeing measures. It is normal that this review will give an efficient way to deal with advancement of street security change program in India and along these lines make ready for enhancing wellbeing on Indian streets.

**Tripodia et al.** analysed A Decision Support System for Analysis of Vulnerable Road Users Safety Issues: Results of the SAFER.BRAIN Project. A Decision Support System (GIS-based application) is produced to choose wellbeing measures to lessen danger of mishaps of Vulnerable Road Users, acknowledge remedial and preventive investigations and street security reviews. The "restorative module" depends with examinations of VRUs mischance information, distinguishing proof of reasons for mishaps, conceivable countermeasures basing on Cost-Benefit and Cost-Effectiveness Analyses and checking of results. The DSS plans to give assistance to specialists and leaders to do mischance examination or street wellbeing reviews / investigations.

**Weekley et al.** An audit instrument to detect plan standard and security deficiencies on high-risk street segments was developed. The ESReT extend has built up an instrument to bolster the survey of street segments that have been distinguished as 'high hazard' as indicated by system screening forms and having two section. The initial segment is an examination of street properties against outline measures and the second part is a correlation of street qualities against 'security rules'. The device gives a correlation of street properties against outline gauges and against 'security tenets' to distinguish deficiencies and data on potential medicines.

**Oza Dakshesh kumar B. and Damodariya** audited Road Safety for Kapurai - Dabhoi Section of State Highway-11. An author distinguished the causes of street accidents, the number regarding yearly, monthly, and hourly, client type vehicle, age, and frequency of traffic accidents in this review. Additionally dark spots in the review region were recognized and recommendation was given to enhance wellbeing of street clients.

**Jurewicz and Excel** studied Application of a crash-prescient hazard appraisal model to organize street wellbeing interest



in Australia. The author exhibited the key parts of ANRAM and had indicates how it can be utilized to drive street security foundation program advancement. It exhibited ANRAM's experience as an apparatus for recognizable proof and organizing of street areas with high danger of extreme accidents. The paper demonstrated how half and half hazard appraisal and crash expectation system are connected to gauge individual and aggregate serious crash chance.

**Vardaki et al.** audited Road safety audit on a major freeway: implementing safety improvements. In this paper, we describe the method followed in a road safety audit of the Attica Freeway, the findings and recommendations that were presented, the improvements made by the freeway operator to improve safety, and the safety treatment plans which were proposed with a view to broader implementation in the future to mitigate similar problems throughout the United States. Results showed the RSA findings were recorded in the RSA report together with recommendations for implementation.

**Parikr Vakichi Ashokbhai and Dr. A.M. Jain (2014)** estimated the out black spots and to understood the importance of road safety audit in the developed as well as in developing country for reducing vulnerability of accident in the main corridor of urban area. For this research paper they have selected study area corridor of Narol to Naroda national highway-Ahmedabad city of Gujarat state. In the section of national highway no.8 with provision of BRTS corridor from past 5 years data has been collected from zonal police stations for the research purpose. The authors concluded that the black spots are identified based on police record, deficiencies of geometric like Non availability of footpath, service lane, parking lane etc.

**Rejivas .V.A et. al. (2014)** studied road safety audit was done at selected black spots in the study stretch i.e., Kaloor, Palarivattom and Edappally. This construction project is being undertaken by Delhi Metro Rail Limited (DMRL) and is known as Kochi metro. This project taking place at Emakulam city between Aluva and Petta which is currently in progress. Several safety deficiencies were detected in each black spot by the road safety audit. Each safety issue was rated as low, medium, or high severity. RSA on black spots identified the following major safety issues: inefficient street lighting and speed reducing measures, potholes, insufficient warning signs, visibility problems, concrete projections in the road surface, presence of electric posts on the roadside, difficulty pulling rope over barricades, vehicles parked outside of designated parking areas, empty shoulders, unexpected side road access, and improper pavement markings.

**P. V. Arundev et al (2016)** studied the Road Safety Audit on Karamana Kaliyikkavila Road (NH 66). The results of the audit report shows that there are various factors which results in the hazardous condition of the road. From the accident data of the road stretch after the commencement of the construction work it seems that at Kaimanam and Pappanamcode the number of accidents increased by 54% & 33% respectively. Thus the proper implementation of the suggested remedial measures may bring down the accident rates in the remaining areas of the stretch where the construction is yet to begin.

### III. METHODOLOGY

#### A. Road Safety Audit Group

Several street wellbeing engineers with appropriate experience and capabilities conducted the Road Safety Audit for the specific venture. Among their major skills were street plan and development, movement administration, and human factors.

#### B. Field Inspection and Agendas

As asked by the administrator, RSA group put together rules for each particular venture. The way they were designed and fitted depended on an analysis of the important materials. In both dry and wet conditions, the road was inspected in sunlight and by night. All developments from each trade were taken into account. Motorcyclists represented a significant share of accidents, as was obvious from the information gave to the RSA group, while more established drivers showed troubles at specific areas. The RSA group examined challenges regarding recognizability, early cautions, and directions, particularly where drivers make complex choices and execute complex moves. We focused on the street on the basis of the reasonable time available to drivers so that they could make decisions and move, the consistency of street format with driver expectations (any progress/basic move focuses in the street and activity qualities being shown unmistakably and in good time), and the analysis of potential infraction of assumptions associated with the roadway plan. Investigations were booked amid run of the mill or delegate movement conditions, permitting the RSA group to see how normal activity conditions and street client conduct may influence security amid the daytime and around evening time. There were particular areas of the highway where drivers had to pick bearings as well as move in short sequences or within passages, interpreting rather vague signs at high speeds and with significant activity. The road safety auditor records the problems in the RSA report with the suggestion for usage.

#### C. Road Safety Audit Procedure

A road stretch from College of Engg. & Tech., Akola to Vyalla on Amravati- Shegaon State Highway No-194. After taking image, finalization of the parameters of road safety i.e. Inventories, Geometry, Rules and regulation are done. Data collection is started from 5 km stretch per day including all the data. Then data collected is tabulated. Once the data collection process is completed, the entire section of

road is analyzed for safety issues based on a safety analysis of each of the parameters taken from MoRTH and IRC. Construction stage checklist is observed, run the Checklist and then validate the checklist. Further identify problem zone recognized in view of overall scoring of issue area or can be assessed in view of aggregate score of audit.

## VI. SITE SELECTION STUDY AREA

The extension from College of Engg. & Tech., Akola to Vyalla on Amravati- Shegaon State Highway No- 194 had been chosen for the research purpose. The area delineated guide and course guide are appeared in Figure 1 and Figure 2. This highway is being constructed under the vigilance of National Highway Authority of India (NHAI).

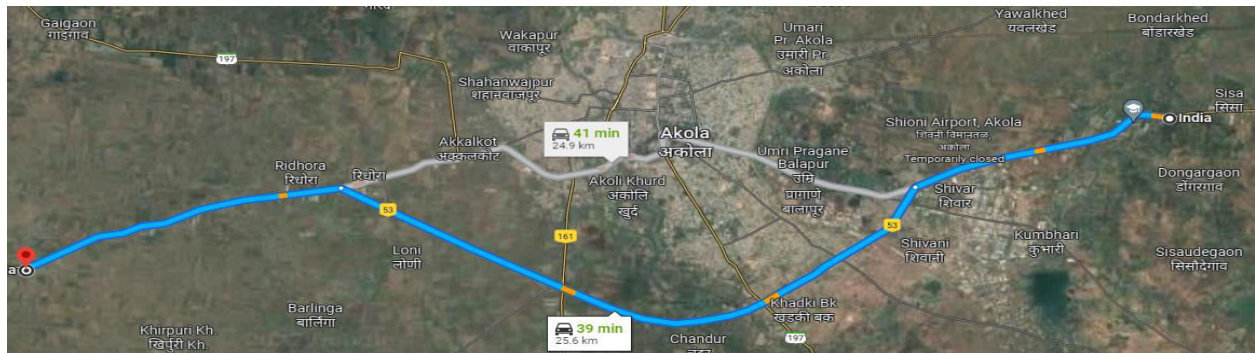


Fig 1: Study Area Terrain Map (Source: Google Maps)



Fig 2: Study Area Route (Source Google Maps)

## V. DISCUSSION AND CONCLUSION

### A. Hazard markers, Sign posts and Road Studs

Speed limit sign and informatory sign boards must be present at consolidation and isolated ways of organization streets, genuine crossing points, petrol pump and specialist's offices. Delineators must be given on the centre and edge of longitudinal curve. Danger markers may be suited divisional and channelizing islands at all genuine crossing points, centre openings, before parapet bridge structures, before crash obstacles, before vertical posts of overhead gantry sign boards laying on shoulders. All signs are reflectorized sort with high power retro -canny boards of typified sort has been given.



**Fig 3: Hazard Marker Sign and Diversion Sign**

**B. Regulatory sign boards or Speed limit boards**

It is necessary to provide continuous regulatory sign boards on every curve as well as speed limit sign board as it warns the driver to reduce the speed of the vehicle so the vehicle should not topple in other lane and cause major accident.



**Fig4: Regulatory Sign Boards**

**C. Lighting blueprint:**

Adequate lighting game-plan is ahead of time on flyovers and on at level roads close-by cut-off focuses. High post lighting must be given at a couple of regions. Lighting strategy is in like manner required underneath area in vehicular underpasses. All major and minor convergences of the roadway should be empowered with high post lighting strategy for safe advancement of vehicular movement and people by walking.





Fig 5: Informatory Sign Board

#### D. Pedestrian facilities locations:

Separate pathway should be given around the local area and town territory for wellbeing of pedestrian. Pedestrian guardrail might be given at the spots where pedestrian movement is high and on raised pathway in favours of carriageway at transport stops and transport coves for satisfactory length yet at least 10 m on either side for Pedestrian wellbeing.



Fig 6: Footpath absent with barrier



Fig 7: Unraised Pathway

#### E. Median Openings:

Most of the median openings are not provided with proper sign boards. No vegetation must be planted in median (upto 100m) to keep up clear sight separate at median opening areas. Pre warning sign board must be provided on high speed national highways. It is observed that at a few areas of the venture extend, nearby individuals were harming the middle kerbs and utilizing as unapproved middle openings. These might be confined and every single such openings might be shut close.



**Fig 8: Dangerous meridian opening**



**Fig 9: Kerbs missing dangerous at night**

#### **F. On proper size meridian opening is provided**

Median opening must be given large where there is frequent turning of vehicle for specific town / village.”STOP” line and ‘U-turn’ marking must be taken up to manage the drivers legitimately.



**Fig 10: On proper size meridian opening is provided**

#### **G. Railing Missing**

Bridge Railing must be maintained regularly and height of the railing also be increased so as to avoid any future hazard to the road users



**Fig 11: Bridge railing missing**

#### **G. Markings**

The street markings were missing and blurred at specific areas while old markings controlling impermanent activity had not



been expelled viable. New markings are suggested as absence of the marking will confuse and mislead the drivers about their boundaries of lanes. Use of an excellent retro intelligent material compelling in rain and haziness with sufficient slip resistance qualities was prescribed.



**Fig 12: Blurred Marking**



**Fig 13: No Marking**

#### H. Roadside Dangers

The RSA group recognized areas where the roadside barrier (Fig.5.9) was hindered short separation. This would bring about an errant vehicle entering the unprotected zone to be "caught", with no plausibility to hold control and collide with roadside impediments behind the obstructions. The establishment of a solid boundary of suitable stature and length and exceptional treatment of move ranges between the diverse sorts of restriction frameworks was suggested.



**Fig 14: Roadside parked vehicles**

Proper Informatory sign boards, hazard marker as well as storage lane is suggested as this spot of intersection.



**Fig 15: Speed sign board and warning sign board missing**



## VII. RECOMMENDATION

Based on the present investigation of road safety audit for selected national highway, the accompanying conclusions have been drawn:

It is found that Road Markings, Condition of Shoulder, Median Opening and carriageway condition were fundamental parameters for bringing on accident causing situation. It was additionally observed that moderate moving traffics were making activity perils for quick moving movement as it generally occupied the innermost path of highway.

In light of above conclusions following are the recommendations for the selected stretch are given:

- Speed limit sign board and Regulatory sign board should be provided.
- Informatory sign board should be provided where there are arterial roads and old informatory boards should be painted at regular interval.
- Footpath must be provided near village touching highway for ease village people without entering main carriageway.
- Speed breaker must be provided at the entrance of the village to slow the village traffic from immediate entering in main traffic stream.
- Dangerous meridian opening must be provided with crash barrier with appropriate reflective color.
- Kerbs must be completed when work is done on the specific part.
- Proper size of meridian opening should be provided where there is crossing of heavy vehicle.
- Bridge railing must be maintained regularly and should be painted with reflective paint.
- Blurred old marking should be scraped off and new paint should be painted.
- Warning sign should be provided where there is necessity.

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