

Pre And Post Road Safety Audit Study on Existing Road

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Abstract- In India there is road network of 33 lakh kilometers of which nearly 65% of the cargo activity and 80% of traveler movement is on the road networks. National Highways constitute around 1.7% of the road network but carry about 40% of the aggregate road traffic. Number of vehicles has been increasing at a normal pace of 10.16% for every annum in the course of the most recent five years. Road safety audit is the formal methodology for getting accident potential and safety potential in the development of new road schemes and the schemes for the improvement and maintenance of the existing road facilities. Accident prevention and accident reduction are the two main strategies in the road safety.

In this case study, Strengthening and Widening of 2 lane / 4 lane project highway comprises the section of Vodarevu Narsaraopeta Piduguralla Road of NH167A from Km 8.310 to Km 69.000 in the State of Andhra Pradesh under EPC Mode highway carries considerable amount of traffic throughout the day and it has number of conflict points such as villages, industries.

I. INTRODUCTION

Project Background

Road Safety Audit (RSA) is a formal procedure for assessing collision potential and safety performance in the provision of new roads and schemes for the improvement and maintenance of existing roads. However, its systematic application can also ensure that growing awareness about good road safety principles is achieved throughout highway planning, designing, construction, and maintenance phases. The safety concerns have been narrated supported with pictures captured during the visit and recommendations are made in layout format for easy adoption and implementation.

The Project Road is part of "Strengthening from Km 8/310 to Km 69/000 of AP/TS border to Vodarevu - Narsaraopeta - Piduguralla Road of NH-167 A in the State of Andhra Pradesh on EPC Mode under Annual Plan 2019-20". The entire project road runs through the Guntur district in the State of Andhra Pradesh.

The project road is having single lane, an intermediate lane, a Two-Lane carriageway, and Four-lane Divided Carriageway and the pavement type is flexible. The width of the carriageway about varies from 5.50m to 14.0m. It is stipulated in the CA that the authority shall appoint an experienced and qualified firm or organization as a Road Safety Consultant (RSC) for carrying out a safety audit of the project highway by the safety requirements for the aforesaid phases of a project.

II. OBJECTIVE

The major objective of the safety audit is to ensure safety as a primary operative feature of the section of NH-167 A. The purpose of carrying out this an operation and maintenance safety audit is to:

- ✓ Minimize the likelihood of crashes and severity of accidents on the project road
- ✓ Ensure safety for all categories of road users of the project road
- ✓ Improve the level of awareness of safe design practice by all involved in the planning, design, construction, maintenance, and operation of roads.

III. SCOPE OF WORK

The scope of work for Safety Consultants for operational stage audit is "safety audit to determine conformity of the Project Highway with the safety requirements and Good Industry Practice."

Project Description

The Road Safety problem in India demands a multidimensional approach. Road Safety Audit is only one important component: Subcontracts India is doing ground-breaking work in the following areas:

Feasibility/Concept audit

Feasibility/Concept audits are conducted at an early stage when preliminary design plans may or may not have yet

been generated. At this stage, the advantages, and disadvantages of major elements such as alignments and intersection types are assessed against each other from a safety perspective. Feasibility/Concept audits are normally conducted for medium to large projects only but can be of benefit to smaller projects depending on the nature of the works.

Preliminary/Functional Design audit

Preliminary/Functional Design audits occur at a critical stage in the design process where horizontal/vertical alignments, super-elevation, sightlines, intersection layouts, access locations, and all road user groups are considered. Site inspections are undertaken at this stage to uncover any unknown existing features that may impact the works and to gain a general appreciation of the site conditions of the proposed design.

Detailed Design audit

Detailed Design audits assess the design at a stage when the major conceptual and layout decisions have already been made. They reassess the road design aspects as done in the Preliminary audit but focus on the final details such as barrier terminations, correct type and placement of signs, batter slopes, table drain profiles, pedestrian facilities, drainage, and roadside objects, signals, and so on. Site inspections are also undertaken at this stage if they have not already been undertaken at the preliminary stage.

Pre-Opening audit

Pre-Opening audits are a final check to ensure that the road has been built as designed and to identify any safety issues. The new road is assessed in detail, along with its connections to existing roads during the day and night. At this stage, many of the issues raised can be rectified with only minor modifications.

Post-Opening Audit

When a post-opening audit is commissioned, normally the project is of a magnitude that has also required a pre-opening audit. The post-opening audit checks that issues raised in the pre-opening audit have been adequately addressed and have a particular emphasis on how all road users are coping with the new road facility and whether any significant operational problems are being observed (above and beyond normal teething issues).

The audit process included inspection of operating conditions so that the RSA team travelled through the entire project corridor and identified several safety-critical components. Notes were taken on the horizontal alignments; available sight distance; layouts of curves and intersections/interchanges; road cross-sections; bridges and culverts; side drains; provision for parked vehicles, slow-moving vehicles (tractors, bullock carts, bicycles), and pedestrians; bus bays; truck parking, etc. In addition to these, the audit team examined appropriate markings and signs, the presence of a clear zone, roadside friction, traffic control devices, lighting requirement, and other interim measures. During the audit, the team gave importance to observing the type of geometry and traffic behavior at a site, which would lead to a certain type of conflict and crash types with the probable severity level. This Road Safety Audit Report is the outcome of the physical inspection on the project road the recommendations/improvements suggested herein are based on the philosophy of obviating road accidents due to wrong judgment of the drivers and protecting the vulnerable road users and workers from meeting with collisions.

IV. CASE STUDY

The Audit Methodology

The audit was conducted with help of checklists prepared for the purpose as given in the Safety manual. Ideally, any road subjected to pre-opening stage RSA should. It was expected all the pending safety issues pointed & RSA, as well as any other, have an under-gone audit starting from Design Stage RSA followed by Pre-Opening Stage new minor safety-related issues have to be addressed by the client. This survey should focus primarily on any of the missing road safety issues, on the Project Corridor.

RSA findings and Analysis

Hazard clearance markers

Hazard clearance markers are required at each corner of a bridge/Culvert when there is an obstruction that could be hit by an oncoming vehicle. Obstructions include bluntends of concrete parapets, old pipe or timber railing, guide rail terminated at the bridge ends parallel to traffic, bridge structure members, culvert headwalls, etc. When standard approach road way guide rail is not attached to the bridge railing directing vehicles across the bridge, hazard clearance markers are usually required.

Narrow bridges

Another safety-critical infrastructure identified by the RSA team was the narrow bridges. In most of the cases, the approach road to a narrow bridge had no warning signs or speed limits mentioned, and the guardrails were broken and covered with dense vegetation (Fig. 4.2). In a few cases, the abutments posed roadside hazards. Due to the sudden decrease in the lane width, maneuvering at such narrow bridges was found to be dangerous, especially at night.

Illegal truck parking was found along long stretches of the highway. Such illegal truck parking resulted in edge drop and poor visibility (Fig.7). Moreover, the effective width of the carriage way decreased. Since a large proportion of heavy vehicles plied through these highways, provision should be made to construct truck lay bays with necessary facilities. Inbuilt-up areas where truck parking is of utmost necessity, paved shoulders should be provided. In addition to that, information signs to notify the drivers of the truck parking and edge rumble to alert drivers if they are driving off should be provided.

Illumination

Most of the intersections and builtup are as were not adequately illuminated. As a result, spotting a pedestrian or NMT at night was a challenging job for the driver. Sudden exposure of pedestrians or NMTs can lead to severe accidents at such locations. High mast street lamps should be provided at such intersections and stretch with a high number of access points. Moreover, speed limits and warning signs should be provided at such locations to alert the drivers to control speed and be prepared for any sudden action.

Pedestrian facility

Although numerous market areas, schools, colleges, offices, and hospitals were noticed along the road sides and a high amount of pedestrian volume was found at these locations the basic pedestrian facilities were missing in most of the locations. Although a few locations were provided with pedestrian sidewalks, none of the intersections had a suitable cross-walk facility, and pedestrians were found crossing the road at any point. In a few places such as near schools or markets, pedestrians were found to occupy almost half of the carriageway. In general, highways are built for higher mobility and lesser accessibility, but in the case of such highways, which run through important towns and have a significant built-up area all along providing adequate access to the highway is a necessity.

Intersections

Most of the intersections along the highways were not signalized and uncontrolled. Several intersections were located on the curve. The approach speed of vehicles from the minor road was high and drivers seldom stopped or reduced their speed before merging with the major road traffic. Moreover, as the opposing traffic was not separated vehicles were found to take wrong turns. During the audit visit, the RSA team found several vehicles taking wrong turns at the intersection, posing a high danger. Further, the approach of such intersections was often not visible due to encroachments; therefore, the drivers were unable to judge the situation ahead, which resulted in the chaotic maneuver. In addition to that, the presence of bus stops and auto stands enhanced the problems at the intersections. Such intersections can result in lateral swipes, head-on or rear-end collisions. In most of the intersections, there were no stop lines or zebra cross markings and appropriate signs were also missing.

Other Vehicle users:

A common observation was made by the audit team that most of the drivers were unaware of the safety aspects of driving. Most of the two-wheeler riders drove impudently along the highway without wearing helmets. Even the drivers of public vehicles were found to overtake slow-moving vehicles recklessly near curves. Moreover, at intersections, several vehicles were taking wrong turns and were overspending.

Signboards are Obstructed by vegetation:

Signs should be visible to drivers at all times. Maintenance patrols should be on the lookout for trees and brush that block the view of signs and other traffic control devices. Tree branches or bushes in front of a sign can hide it from the view of motorists. Bush and tree branches in front of them should be cut immediately. A motorist must-see warning and guide signs as well, so blocking vegetation in front of these signs should be done.

Lack of sight distance:

Visibility is a particular concern at highway grade crossings due to the severe crashes that can occur.

Traffic congestion at major junction:

The RSA team observed a Major junction at chilakaluripeta which meets NH-16 & NH- 167A. Traffic congestion at this junction due to improper working of signals especially at peak hours the traffic is blocked due to improper signaling system the movement of flow is characterized by

slower speeds, longer trip times, and increased vehicular queuing. Traffic demand is great enough that the interaction between vehicles slows the speed of the traffic stream, this results in some congestion.

Accident Scenario In Project Road

Major Causes for Road Accidents

The major cause of accidents in developing countries is not only negligent driving or irrational driver behavior. A careful study reveals that the infrastructure provided for the road users is not adequate to cater to their needs. The effect of road conditions and the lack of safety engineering is still underestimated. Based on widespread scientific research involving analysis of road accidents and a study of how vehicles are driven under different road conditions, it is possible for the highway engineer to establish the impact of road conditions on accidents. The main road conditions that contribute to accidents are:

- Road Width
- Width and state of shoulders
- Width of the median
- Grades
- Deficiency in sight distance
- Radii of horizontal curves and deficiency in super elevation at curves etc.
- Inadequate/improper provision of road user information and guidance facilities.
- Lack of protective measures for errant/run-off-road vehicles.
- Absence of traffic segregation measures particularly at the rural-urban interface and lack of access control measures.
- Poor safety management during construction.
- Absence of gore area treatment at approaches to grade-separated structure.

The accidental data was collected from a near by police station at Project Corridor Road, The Fatal & Non-Fatal Accident information shows in blow graphs

Mitigation Measures

The project section is part of an important National Highway corridor. It is the Concessionaire's duty and responsibility to provide a smooth and thoroughfare for the road users by assuring safe and hindrance-free movement for both Traffic and Pedestrians along with urban locations & habitations.

Here are some General Comments are drawn in the light of observations made during our Road Safety Audit.

- ✓ Proper and standard signs should be erected at all necessary locations to caution, guide, control, and help all road users. Completion of all necessary planned Roadway Furniture.
- ✓ Pavement Road Markings should be completed wherever it is absent, thin, or not visible. A good portion of the Project Corridor sections are completed in good shape but the remaining sections there is Work-in-Progress. Pavement markings should be conspicuous during the daytime and should have enough reflectivity at the night.
- ✓ Road Studs (Solar Studs) should be installed at intersections, approaches, curves, and pedestrian crossings to enhance visibility & safety during the dark.
- ✓ Pedestrian Crossings should be highlighted with pavement markings, road studs, signs, etc.
- ✓ Traffic Blinkers (preferably Solar Blinkers) should be installed at Junctions, Median Openings, Bridge (Minor & Major) Locations, etc. for diver alertness and caution during night times.

The following specific recommendations are given below in light of observations made during our Road Safety Audit. They are illustrated under the following categories:

Mitigation Measures at Median Openings, T-Junctions & 4-Legged Junctions

At other Minor Median Openings, Provide Dual Head Solar Blinker at both ends of the Median.

At Median Opening, the following signs of Median Opening Ahead, U-Turn Ahead Sign, U-Turn Sign, Mandatory Movement Sign and Hazard Marker has to be installed. Additionally, the road signs like Junction Ahead, Pedestrian Crossing, Stop Signs and Speed Limit along the road side has to be installed.

Provide four sets of yellow color thermoplastic bar markings of 300 mm wide, 5 mm height at 600 mm apart (one set is of 6 strips) at 50 Metres, 80 Metres, 120 Metres, and 180 Metres from the zebra crossing on all arms of the NH & side roads. (Ref: Fig11.2,Page-75 ofIRC:35-2015)

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At all heavy traffic T-junctions provide; Yellow box marking as a Prohibitory marking to convey that no vehicle shall be stopped in the designated box area. Please see the below figure for illustration as per Figure 9.2 of IRC-35(2015).

Safety Mitigation Measures at Curved Locations

Chevron Signs on sharp bends on both approaches of the Major/Minor Bridges and Curved Locations along with Advanced Warning Signs. (As per IRC: 67-2012)

As a Roadway Safety Consultant, we are of the view that the Work is in progress and is moving in the right direction but needs more time for 100% compliance with the additional Mitigation Measures recommended. Since the Safety Measures are at the place of the Roadway, the present Project Corridor should be acceptable and reliable for Road Users to travel.

Mitigation Measures at Bridge Location

Provide dual-head solar blinker at both ends of the bridges