

ROAD SAFETY AUDIT OF NATIONAL HIGHWAYS IN INDIA AT CONSTRUCTION STAGE

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ABSTRACT

: In most regions of the world, the epidemic of road traffic fatalities is on the upsurge with over 1.2 million people die every year due to road crashes and about 50 million suffer non-fatal injuries. Motor vehicle population has grown at a compound annual growth rate (CAGR) of 10 per cent 2000-2009, fuelled by a rising tide of motorization. Concomitantly, traffic risk and exposure have grown. During the year 2010, there were around 5 lakh road accidents, which resulted in deaths of 134,513 people and injured more than 5 lakh persons in India. These numbers translate into 1 road accident every minute and 1 road accident death every four minutes. 1.5 The loss to the Indian economy due to fatalities and accident injuries estimated at 3% of GDP in 1999-2000 is particularly severe as 53.1% of road accident victims were in the age group of 25 to 65 years in 2010, with pedestrians, bicyclists and two-wheelers, who comprise the most unprotected road users, accounting for around 40% of all fatalities. Considering the above severity of the accidents recently National Highways Authority of India lunched massive Road Safety Audit Programmes to carry out the audit at Design stage, Construction stage as well as Pre-opening stage. The present study focuses on Road Safety Audit at construction stage conducted on NH-202 was discussed. The road safety audit at construction stage recommendations were given further improve the road safety at construction stage.

Keywords: Road Safety Audit 1, Construction stage 2, National Highways Infrared 3

INTRODUCTION

The widening and strengthening of NH-202 under NHDP Phase - III in the State of Andhra Pradesh (AP) for a road length of 35.4 km is undertaken by NHAI (National Highways Authority of India) under DBFO (Design, Built, Finance and Operate) basis handed over to concessionaire. This existing road stretch of two lane undivided carriageway is proposed to be developed as a partially access controlled and widened to four lane divided toll highway. The starting chainage of road stretch of NH-202 for 4-laning is from Km 18.600 (Hyderabad, AP) to Km 54.000 (Yadagiri, AP) on Built-Operate-Transfer (BOT) Toll basis. Total length of the project is 35.4 Km and out of that 15.91 km are bypasses. The location map of the road stretch on NH-202 highlighting the study stretch is shown in Figure 1.1.

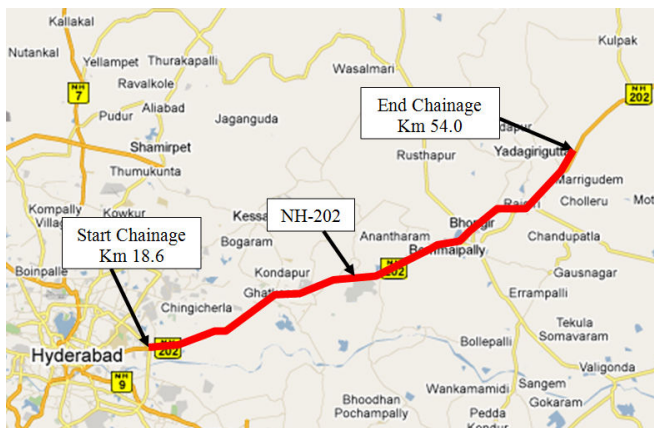


Fig1: Location Map of Study Stretch on NH-202 from Hyderabad (Km. 18.600) to Yadagiri (Km. 54.00)

The Ministry of Road Transport & Highways (MoRTH), Government of India had stipulated that all the BOT toll and BOT Annuity projects of Highways under PPP (Public Private Partnership) basis are to be compulsorily safety audited with qualified safety auditors. Keeping this in view, NHAI has initiated road safety audit of newly awarded highway projects which are under development/ construction stage mainly 4/6-laning of highways under NHDP Phase-III and V. In continuation of that, NHAI has appointed Central Road Research Institute (CRRI), New Delhi as the Safety Auditor for the highway project from Hyderabad to Yadagiri from Km 18.600 to Km 54.000 of NH-202 (Package No. 34 in the list given by NHAI) which is 35.4 Km long as mentioned before.

As part of the safety audit work by CRRI, Road Safety Audit (RSA) during the construction stage has been carried out in the month of October, 2011. The present paper focus on construction stage safety audit findings and subsequent recommendations to improvement the safety of work zone as well as workers was discussed.

An overview about road safety audit and the various stages of road audit has been explained briefly in the next section. In section 3 the methodology followed in conducting the road

safety audit at construction stage has been explained. In section 4 the salient observations emanated out of the construction safety audit and finally conclusions drawn from the present study is presented in Section 5.

ROAD SAFETY AUDIT

Road safety audit is the systematic checking of the safety aspects of new/existing highway and traffic management schemes, including modifications to existing layouts. The main aim of road safety audit is to ensure that all new road schemes operate as safely as practicable from the beginning and to reduce future problems. This means that safety should be considered throughout the entire cycle of design, construction and pre-opening of any project facility and also during operation & maintenance of the highway. In many our highway projects safety devices are included in the designs, but are simply not constructed on the ground. Frequently, road maintenance is limited to fixing potholes and cleaning drainage facilities, without replacing missing traffic signs, guard-rails, road markings and other safety features essential to create a safe road network.

Safety Audit can be applied on (a) new roads (b) existing roads. On new projects safety audit will lead to avoiding building road crash-prone situations and on existing roads audit will lead to improved roads from the safety point of view. It should be realized that safety audits are a necessary cost, and not an additional expense. As project is audited, it provides further scope to improve/enhance safety. In projects where there is a choice of route or standards, or there are known safety problems, the designer should discuss these with auditors at the initial stage. The safety audit shall be carried out on road and traffic improvement projects. These are the different stages of road safety audits carried out depending upon the stage of progress of the project.

- i) Safety Audit during the Feasibility Study
- ii) Safety Audit during the Preliminary Design
- iii) Safety Audit on Completion of Detailed Design
- iv) Safety Audit at the Construction Stage
- v) Safety Audit on Completion of Construction (Pre-opening)
- vi) Safety Audit on Existing Roads (Monitoring)

First five stages of safety audit are applicable to the new Construction/Widening of existing and last one is applicable to the existing roads. In the present study the road safety audit was conducted at the pre-opening stage before opening to the traffic.

METHODOLOGY ADOPTED

In carrying out the safety audit of the road project following methodology was adopted, the sequence of steps are as shown in Figure 2.

- The Information relating to the design standards adopted for the road project was obtained from NHAI.
- Detailed engineering drawings of the road were requested from the NHAI in form of hard as well as soft copies to get an idea of the project from the point of adequacy in design.

- Field visits were made by driving / walking along the project road to appreciate other physical and environmental features that required special attention from the point of view of safety during day time as well as night time. Some typical aspects studied include pedestrians, roadside developments and sociological aspects which needed special attention focusing on provision of appropriate facilities.

RSA Checklists (IRC-SP-88:2010) was taken to ensure that problems and situations that can affect the road safety at the desired stage of road safety audit have been taken into consideration. These checklists broadly covered the aspects like

- Have all recommendations from the previous stage been followed? If not, why not?

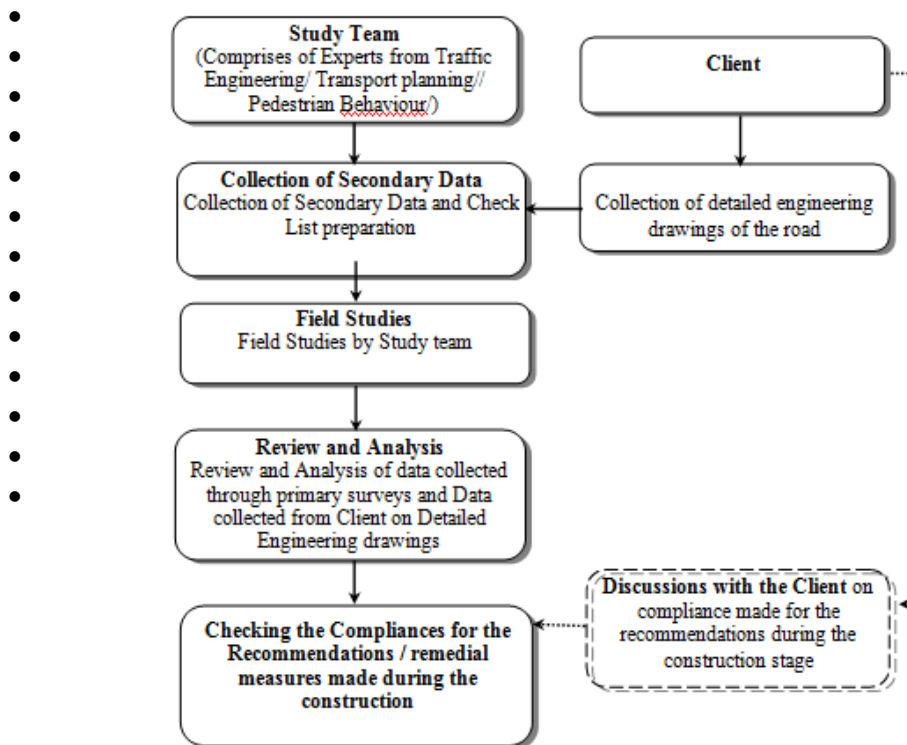


Fig.2: Methodology adopted for Road Safety Audit at Pre-opening stage

Whether information regarding the construction zone approaching has been provided well in advance or not?

- Whether standard procedure and contract conditions provided for proper management of the construction site and road users are properly and safely accommodated?
- Whether the transitions from the existing road to the road works safe and clearly laid out?
- Whether the width of the lanes is satisfactory for the traffic passing through the works area?
- Whether sight and stopping distances adequate at works and at intersections?
- Whether bus stops appropriately located with adequate clearance from the traffic lane for safety and visibility.
- Whether appropriate street lighting or other delineation provided at the road works to ensure that the site is safe at night? Check the night time visibility of traffic control devices.

- Check for proper education and training programme for site operators and managers, which would assist in creating and maintaining safer environment for construction workers and road users.
- For clear and sufficient information to the road user, advance warning signs installed or not?
- Is there any provision of marked lanes for safe and clearly guiding road users?
- Whether suitable measures provided through construction zones to control driver behaviour?
- Check for the adequacy of traffic control devices (such as signs, markings, cones, drums, delineators, barricades, flashing lights etc.) required for each zone i.e., at advance warning zone, at approach transition zone and at work zone? Check for placement and visibility of these control devices.
- Has permission been taken while changing the standard layouts from safety point of view.
- Whether police and other emergency services been consulted?

Appropriate recommendations / remedial measures for the identified safety deficiencies during the construction stage was provided or not, was checked conforming to IRC-SP-88:2010. However, some of the important safety audit observations at construction stage have been discussed in the subsequent sections in brief.

SALIENT FINDINGS OF ROAD SAFETY AUDIT AT CONSTRUCTION STAGE

Appropriate recommendations / remedial measures for the identified safety deficiencies during the construction stage was provided or not, was checked conforming to IRC-SP-88:2010. However, some of the important safety audit observations at construction stage have been discussed in the subsequent sections in brief.

The present road safety audit at pre-opening stage consisted of a careful and detailed examination of each of the logically delineated sections as per the checklists within the study area. The observations, recommendations made during the construction stage were examined in terms of compliance made at the pre-opening stage. Further considering the length papers some important issues have been discussed below showing the construction stage recommendations and compliance made for the same issues. The Audit findings are briefly listed under the following heads:

- i) Diversion Plans/Traffic Management Plans
- ii) Construction vehicle movements at the work zone
- iii) Use of blinkers and quality reflective tapes
- iv) Pavement Markings
- v) Pedestrians and Cyclists
- vi) Hazard markers on fixed objects and CD works
- vii) End treatment of Crash Barrier and Provision of safety measures at high edge drops
- viii) Dilapidated Sign boards and Missing Signs
- ix) Personnel Protective Equipments (PPE)

The above points are discussed below referencing to the site photos/Figures.

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Diversion Plans/Traffic Management Plans

The Construction is under progress at many places as shown in Fig 3, accordingly the traffic diversion observed in many places. However at most the places the diversions are not properly provided without any proper warning signs speed limits, Blinkers etc,. User shall be given enough time and information before entering in to the diversion zone.



Fig 3. Diversion (RHS) from Hyderabad to Yadagiri use blinker for enhancing the safety at night and adopt diversion as per IRC specifications

Provide the diversion according to plans and type of widening taking place as given in Fig4., along with adequate warnings and its placement on the project highway shall be maintained

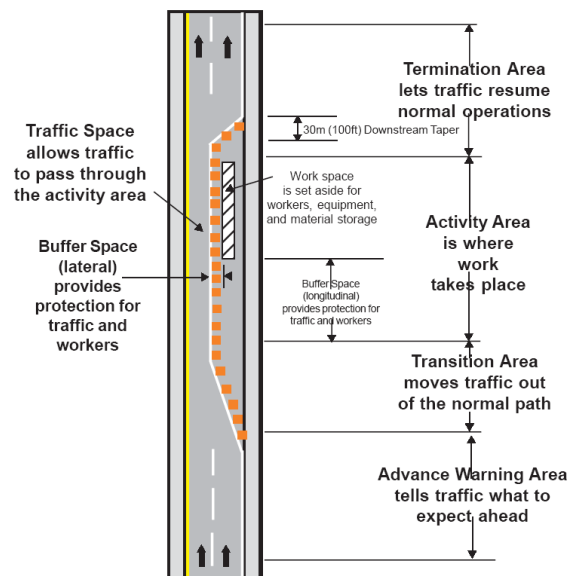


Fig.4: Prepare Work zone components, supplemented with the diversion plan before taking up any construction activity to enhance the safety.

Construction vehicle movements at the work zone

At some diversions (Fig 5) there is no control on vehicles entering the work zone as result these locations will forms a death traps during the night time



Fig 5: The traffic diversion was not properly made as result the all the traffic also passing through the construction zone resulting the potential accidents spots during the night time.

All the diversions at the work zone shall be controlled. Except the construction vehicles no vehicles are allowed. Signs shall be placed stating 'Only Construction vehicles are allowed'. Entry to the construction zone for construction vehicles is also manned by manual control to avoid any accidents at these locations.

Use of blinkers and quality reflective tapes

From the night time audit, all the diversions have night visibility very poor, even the ribbons are not reflective as shown in Fig.6.



Fig 6: Reflective ribbons night visibility is very poor. Hence use quality ribbons are recommended to enhance safety at night. Regular replacement of ribbons and barricades are warranted

To enhance the safety during the night time it is recommended that use of blinkers at the start of the construction zone, use quality reflective ribbons and in addition to barricading. As shown in Figure 7.



Fig 7: Solar powered blinkers are recommended to enhance the night visibility for diversions

Pedestrians and Cyclists

During the audit it was observed that there are lot of crossing movements by pedestrians, elderly people and cyclists as shown in Figure 8



Fig 8. Crossing of Pedestrians NMT users

To enhance the safety of pedestrians and NMT users it is recommend that manual operations of traffic or use of signal (temporarily) recommended wherever the urban settlements/ NMT movement is high are high until the construction of project highway finished

Hazard markers on fixed objects and CD works

It was observed that most the fixed objects like trees and electrical poles, Cross Drainage works do not have Hazard markers as shown in Figure 9.



Fig.9: Cross drainage works without hazard markers a potential hazard during the night

To enhance the safety until the permanent measure is done the hazard markers are warranted.

End treatment of Crash Barrier and Provision of safety measures at high edge drops

During the Safety Audit it was found that the crash barrier end treatment was not properly made as shown in Figure 10.



Fig. 10: Crash Barrier end treatment was not proper and High edge drops are potential for accidents.

End treatment of crash barrier shall be properly made to avoid the accidents due to crash brash barrier and proper function of crash barrier, End treatment of crash barrier shall be properly made to avoid the accidents due to crash brash barrier and proper function of crash barrier.

Dilapidated Sign boards and Missing Signs

At most of the locations the sign boards are dilapidated and at diversions most of the locations the traffic margining and bi-directional traffic flow signs are missing as shown in Figures .11 &12.



Fig. 11: Dilapidated sign boards require regular maintenance.



Figure 12: Placement of sign boards is not correct for the traffic playing from Hyderabad to Yadagiri Direction. Further this sign board is missing at most of the locations.

Regular maintenance of sign boards is warranted. Standard sign boards as per IRC:67: 2010 shall be kept.

Personnel Protective Equipments (PPE)

Workers are not wearing Personal Protection Equipment (PPE) as shown in Figure 13.



Fig.13: Workers are without any personnel protective equipment exposed to risk

Consider enforcing the workers to wear PPE while doing construction work. Regular inspection from top management is required. Regular training calendar regarding the safety of personnel and equipment shall be carried out.

ACTION PLAN AND CONCLUSIONS

A site visit was made by CRRI team of scientists to conduct Road Safety Audit during Construction Stage. The action plan devised from this audit has been given below to improve safety :

- Consider enforcing the workers to wear Personal Protection Equipment (PPE) while doing construction work on the project highway as well as site offices.
- Consider keeping appropriate barricades with retro-reflective tapes to segregate the construction activities and zones from the main carriageway.
- Consider implementing diversion plan as explained in at the diversion locations.
- Consider maintaining the existing road in usable condition with all the proper signage's and regular maintenance.
- Consider developing site safety plan (HSE Plan) at site offices and organize the training to the workers on safety issues such as operating fire extinguishers etc regularly by the contractors.
- Most of the places on existing road the hazard markers on fixed objects and CD works parapet walls are missing. Hazard markers shall be fixed to enhance the safety on Project Highway.

Based on the construction stage audit the recommendations given above are further checked in the subsequent visits and gap report will be prepared. This continuous process of the auditing during the construction stage will enhance safety of the road users as well as workers on the site.

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