

Road Safety Audit of NH-3 Section From Rau Circle To Manpur – A Case Study

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Abstract: India with 1,46,133 fatalities per annum, accounts for about 10 percent of total world's road fatalities. The case study focuses on the identification of existing and potential safety hazards to the road users of an existing road NH-3 Section from Rau-Circle to Manpur. The section was chosen for Road Safety Audit (RSA) study as it already existed just like most of the 3.3million km of already existing road networks in India and carries considerable amount of traffic throughout the year. Any kind of changes in geometry and alignment cannot be made easily which could otherwise prove to be very expensive to improve upon. Through this Audit, potential road safety issues were found and suggestions were made to prevent frequent occurrences of accidents or at least reduces their severity, thereby making the journey safer for the road users and its surrounding area. The analysis were made based on the modified checklist made as per the Guidelines of Road Safety Audit Manual IRC:SP:88-2010. The analysis for NH-3 section from Rau-circle to Manpur may not be the same for every other road network in the country as it also depends upon type of terrain, surrounding conditions, their environmental.

The study helped in gaining knowledge about the designing of safety devices and methods through which risk of an accident can be reduced and identifies the conflict point and provide measures to reduce the severity of such accident at these conflict points, as any loss of life or injure to a person is a loss to the economy of a Nation.

Index Terms – National Highway, RSA, PCU, Fatal Accidents, Safety.

I. INTRODUCTION

The undertaking of new highway improvement programs can have a negative impact on road safety. As roads are being improved to allow greater capacity and higher speeds, the safety of the road user can become compromised. National Highways, which constitute less than 2 percent of the total road network, account for 20 percent of total road accidents and 25 percent of total road traffic fatalities occurring on the Indian roads. Further, the severity of road traffic accidents on National Highways is more because of higher speeds as compared to other roads.

Road safety audit is a formal procedure for assessing accident potential and safety performance in the provision of new road schemes and schemes for the improvement and maintenance of existing roads. Since the operational safety of an existing road can change over time, as volumes, types of users or nearby land uses changes. Thereby leading to reviewing these road safety measures at various stages of change.

An audit of existing road helped us to identify features which are potentially hazardous, although they may or may not have contributed to an accident. high and steep embankments, untreated junctions, non standardized speed reducing devices, encroachment of road side have increased the hazards significantly. While efforts should be made to reduce accidents through various systematic accident investigation procedures.

The case study analysis the National Highway 3(Agra- Mumbai) section from Rau-Circle to Manpur. The section passes through Indore city and major industrial centre Pithampur which add up to the heavy traffic on this section. The study section has one toll plaza from where traffic studies were being made. Most of the conflict points had correct road geometry but were not marked or delineated as per the standards which very well indicates the poor awareness amongst the designer, planners and contractors.

II. 2. NEED OF STUDY

The study is carried on NH-3 section from Rau-Circle to Manpur (approx. 38km). The section was chosen for Road Safety Audit (RSA) as it already existed just like most of the 3.3million km of other road networks in India which already exist. Now to these roads changes in geometry and alignment cannot be made easily which could otherwise prove to be very expensive and difficult to improve

upon. The study mainly focused on the identification of existing and potential safety hazards and various types of conflict point on NH-3 Section from Rau-Circle to Manpur and thereby making necessary road safety recommendations.

This Audit estimated the potential road safety issues by undertaking traffic studies, road inventory study and accident data were studied based on which measures to be taken to prevent the frequent occurrences of accidents or at least to reduce their severity, thereby making the journey safer for the road users and its surrounding area.

The analysis of the study section lead to the conclusion that unauthorized median openings and poor visibility at curves, embankments and intersections were the major cause for accident. There is a strong need for enforcement of law and order in-order to remove the encroachments along the Manpur Service road and from Rau-Circle to Mhow- Bypass section. Also there is a greater need for providing a service lane from Rau-Circle junction to Mhow Bypass ROB in order to prevent the heterogeneous traffic movements due to its populated surroundings.

III. 3. OBJECTIVES

The main objective of this study was to identify the safety deficiencies and accident prone spots/ conflict points on NH -3 section from Rau-Circle to Manpur (approx.38km). Based on which recommendations for appropriate safety measures that should be provided at accident prone locations as per the Guidelines for the existing road network as per IRC:SP:88-2010 and various short - term and long -term remedies were suggested.

IV. 4. REVIEW OF LITERATURE

Katiyari (2014) studied the road safety analysis of major arterial street of Nagpur city. The location of interest was Wardha road from Morris college square to Airport intersection. The study identifying deficiencies in developing mitigation strategies and calculating the crash rate of each intersection or length of road. The roadway carries considerable amount of traffic and has number of conflict points. The study uses Microsoft visual studio to calculate the crash rate or accident rate of intersection or length of roads. The study showed that the crash rate, crash rate width and percentage (%) difference of intersection sitabuldi, dhantoli and sonogao lead to the conclusion that with increase in width by 2m the crash rate can be decreased.

Mankar (2014) presented that road safety is an important component in transportation planning process. By 2020, road accidents will be the 6th largest cause of death worldwide. Road safety is one of the main driving sources of development of vehicular communication (VC) systems, relies on high-rate safety messaging. This paper presented the road safety audit on the basis of vehicular communication, design, construction, operation, maintenance and analysis of various accidents occur in the road. It was found that road standards have been suddenly raised but other related factors are not brought to this level such as road user prevailing surrounding conditions etc. It was found that slow moving traffics were creating hazards for fast moving traffic as it always occupied the inner most lane of highway.

Ahmed (2011) research was to assess potential safety hazards of Dhaka-Mawa Highway using road safety auditing approach and to recommend possible options for remedial treatment. Attempts were made to assess the safety hazard scenario and to suggest likely remedial measures in view of the construction of proposed Padma Bridge, rapid urbanization and implementation of 4-laning project. Local traffic conditions were critically observed during the whole study. Following the checklists developed in this research work, potential safety hazards along the highway were systematically identified. Presence of 11 highway- adjacent education institutions, 14 filling stations and 15 sites of past crashes shows the high intensity of hazard exist along the highway. Field measurements showed inadequate SSD and OSD at three curves and not curve widening was found on 12 sharp curves of the corridor. Vehicular flow data, pedestrian intensity count as well as associated site specific safety hazards revealed the necessity of overpasses at five locations. As a whole this corridor is assessed as hazardous mainly due to wide range of vehicular speeds, heterogeneous vehicle composition.

Singh (2011) studied Road Safety Audit of a section of four-lane National Highway(NH)58.The study focuses on correlation analysis of collected influential safety parameters. Here, dependent variable is taken as accident rate and independent variables are taken as J, CWC,MWCO, CSPE, RM, CWCh, OWA, CD, ARSR, LU, TV and SS. Derived correlation between dependent and independent variables are found good correlation with TV, CWC, SS, RM, MWCO and OWA. The results showed that trucks parked on highway and unauthorized median openings reduces the effective width of carriageway and creates traffic hazards to high speed moving traffics. Missing road and median markings to be done and speed signs should match with speed. Access and service lanes are also deficient which requires immediate improvement. The most Vulnerable Road User (VRU) i.e. pedestrians and cyclists facilities near habitation are lacking and needs to be facilitated on priority.

Peabody (2011) described the application of spatial crash analysis and road safety investigations that were employed in Massachusetts with a direct focus on the older driver. The study was confined to accidents that were caused by the drivers of age above 65 years. Specifically, the paper outlined an approach for identifying high crash locations for older drivers and presents the results of older driver focused road safety investigations for selected locations. The research approach targeted both intersections and roadway segments and identifying locations where older drivers are overrepresented in crashes.

Kemeh (2008) research aimed at treatment of known accident black spots and other accident prone locations to reduce road traffic crashes (accidents) on Konongo Kumasi highway after two years of its reconstruction. The study ascertain data-wise the effectiveness or otherwise of the measures implemented. Analyzing crash records showed that pedestrian-hit crashes continue to dominate collision types. Post-construction records give 114 pedestrian-hit crashes of which 75 were fatal over the two year period. Resulting in pedestrian-hit deaths reduced from 54% of all deaths during the pre-construction period to 51% during post-construction period. The study shows that HGV category now lead in the involvement in fatal crashes (33%) within the two year post-construction period. In general, the rural Konongo-Ejisu section with an annual traffic growth rate of about 9.8%, showed a 16% reduction in traffic crash rate relative to pre-construction rate. The peri-urban Ejisu-Kumasi section with an annual traffic growth rate of about 4.5%, on the other hand showed an increase of 24%. Spot speed measurements conducted within a typical town and rural section of the highway showed speeds are within posted limits.

V. METHODOLOGY

In order to carry out comprehensive road safety audit in line with the objective of the study following methodology was followed:

- Standard Road Safety Audit Guidelines as per IRC:SP:88-2010 was studied and followed.
- Efforts were made to gain and develop sufficient knowledge in road safety from senior engineers and safety experts.
- Standard Code of practices was being followed in this study.
- Collection of design data of NH-3 section Rau-circle to Manpur from NHAI-PIU Indore and reviewing the data.
- Collection of Accident Record of NH -3 section Rau-Circle to Manpur from MTH-Police Station (Traffic) Indore.
- An Audit Check List was prepared for carrying out detailed study on the NH-3 section from Rau-Circle to Manpur.
- Inspection of the site was carried out to identify safety deficiencies as per the check list



Fig. 1 Route Map of Study Section from Rau-Circle to Manpur

VI. CHECKLIST

Checklists are useful to assist the audit team. These checklists describe the performance and situations that can affect the road safety of selected type of project.

The checklist covered road safety audit under following major heads:

- Intersections
- Alignment
- Road Signs

- Road markings
- Traffic signals
- Pavements condition
- Pedestrian facilities
- Delineation
- Service road
- Roadside Barrier
- Roadside Facilities

VII. DATA COLLECTED

Table 1 Classified Traffic Volume Count

PCUs	1	1.5	3	4.5	4.5	
Year 2016	Car	LCV/Mini Bus	Bus/Truck- 2 Axle	Truck- 3 Axle	Earth Equipments & Machinery	Moving Total no. of PCUs
No. of vehicles	92262	31819	40423	148874	583	933816

Table 2 Accident Data Year 2013-2014

Name of Places	Number of people		
	Fatal Accident	Grievous Accident	Minor Accident
Pigdamber	3	8	31
Umariya	1	3	10
Tihi	2	5	11
Banjari	3	8	22
Khandawa	1	3	9
Jamanya	1	4	9
Nanded	1	0	4
Bhicholi	1	7	18
Kankriya	1	0	1
Manpur	4	11	43

Table 3 Accident Data Year 2014-2015

Name of Places	Number of people		
	Fatal Accident	Grievous Accident	Minor Accident
Pigdamber	3	5	13
Umariya	2	0	3
Tihi	0	1	9
Banjari	2	5	8
Khandawa	0	1	5
Jamanya	0	1	2
Nanded	1	0	0
Bhicholi	0	4	7
Kankriya	0	3	2
Manpur	2	2	11

Table 4 Accident Data Year 2015-2016

Name of Places	Number of people		
	Fatal Accident	Grievous Accident	Minor Accident
Pigdamber	0	2	5
Umariya	0	0	2
Tihi	1	1	3
Banjari	0	4	3
Khandawa	1	1	7
Jamanya	0	0	0
Nanded	1	0	1
Bhicholi	1	0	0
Kankriya	1	2	0
Manpur	0	4	7

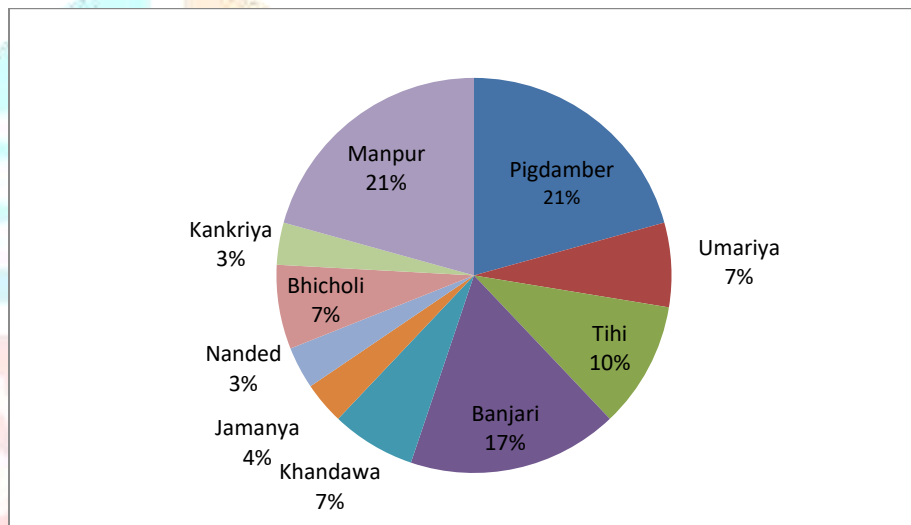


Fig. 2 Fatal Accident Percentage

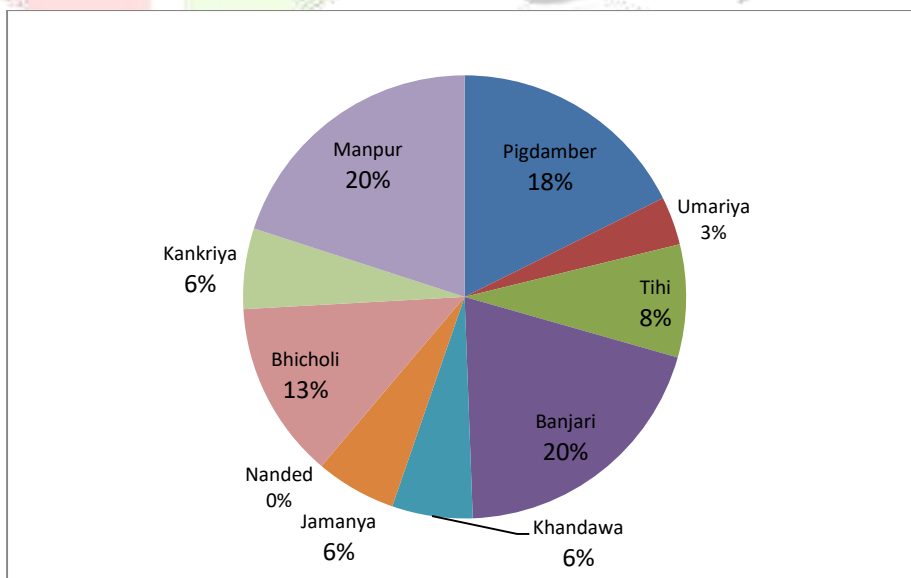


Fig. 3 Grievous Accident Percentage

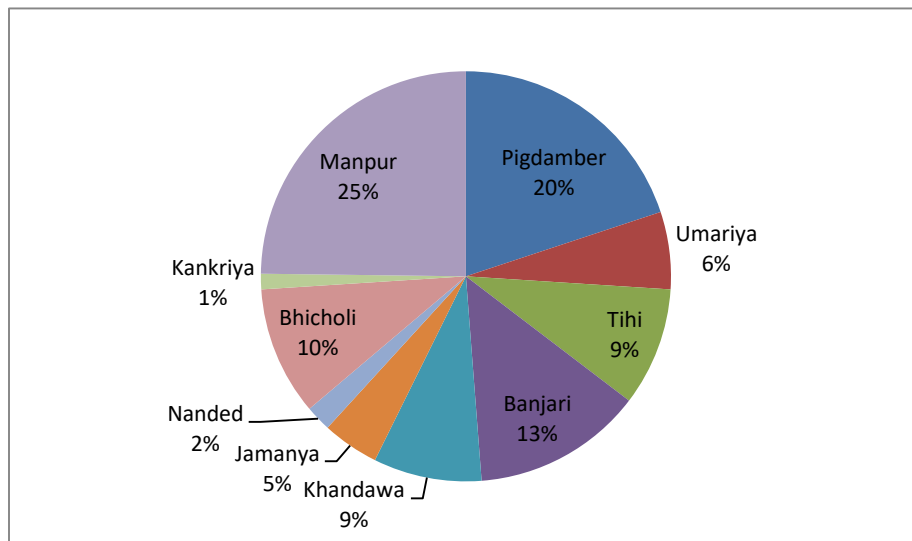


Fig.4 Minor Accidents Percentage

VIII. RESULTS

The accident data of the study section shows that Manpur, Pigdamber and Banjari are the Major conflict points of the study section where most number of accidents (i.e. minor, grievous and fatal accident) have occurred. The causes for these accidents can be observed in the data collected from the checklist observation table and based on which conclusions were made.

IX. CONCLUSIONS

1. There were large number of illegal median openings at 11 places in the study section which were found to be a major cause of accident.
2. Traffic at Rau-Circle junction had frequent stopping condition at rotary section due to the encroachment around junction area.
3. Manpur service road encroachment was preventing its usage and was largely being misused which was leading to slower traffic movement and reduced carriageway for the highway traffic.
4. No Lighting was provided at junctions like Medicaps junction, Pigdamber junction, Rau-Pithampur junction, Mhow-Ghatabillod junction, Janapava kutti service road and Manpur service road section which make them accident prone.
5. Illegal hoarding around sign boards and overhead gantry were leading to distraction and confusing among the driver.
6. Most of the curves were found not delineated either with chevron or with solar studs which are helpful in guiding the driver during night.
7. The parking of vehicle on carriage way at manpur service road section was causing slower traffic movement in this area.
8. It was found that at 14 locations the high embankments were not having delineator or crash barrier with hazard marking.
9. Excessive growth of vegetation and animal danger was affecting the traffic movement and also the visibility of the signs.

X. SCOPE FOR FURTHER STUDY

1. The accident data should be analyzed for detailed study as to know how, when, where, with whom etc. the accident had occurred and can be analyzed further for its causes.
2. The traffic data of the pedestrians should be studied to know the requirement for underpasses.
3. The speed study of the vehicles needs to be carried out to know if the vehicles are within the design speed limits and if not then what steps needs to be taken.
4. The economic aspect of RSA needs to be studied at regular intervals, which would help in proving RSA to be beneficial.
5. When should a RSA be renewed for any kind of project stage, also needs to be studied.

REFERENCES

1. Ahmed, N. U. (2011) "Road safety auditing approach in assessing safety hazards of a selected highway section of Bangladesh"

- <lib.buet.ac.bd:8080/xmlui/bitstream/handle/123456789/457/Full%20Thesis.pdf> (Oct. 2011)
2. Hussein, A. E. (2005) "Development of a rural road safety audit expert system (RRSAES)".
<<https://www.iasj.net/iasj?func=fulltext&aid=41779>> (June 2005)
 3. KATIYARI, M. D. (2014) " ROAD SAFETY AUDIT: A CASE STUDY FOR WARDHA ROAD IN NAGPUR CITY", *INTERNATIONAL JOURNAL OF ENGINEERING RESEARCH AND APPLICATIONS*, 4 (11), 27-30.
 4. Kemeh, J. J. (2010), "Road Traffic Crashes on the Konongo – Kumasi Highway – Two years after Reconstruction".
<<https://www.scribd.com/document/233023158/Kemeh-THESIS-Main-Report>> (April 2010)
 5. MANKAR, C. R. (2014) "ROAD SAFETY AND AUDIT : AN ACCIDENT STUDIES OF SELECTED STRETCH ROAD", *INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH AND DEVELOPMENT*, 3(5), 112-117.
 6. Nura, B. (2014) " Road Safety Audit of Typical Two lane Divided Highway in Nigeria" *Noble International Journal of Scientific Research* 1(3), 55-54.
 7. Peabody, D. A.(2011) " An application of spatial crash analyses and road safety investigations to increase older driver safety" *3rd International Conference on Road Safety and Simulation*, Indianapolis, USA.
 8. Shruthi, P. (2013) " Analysis of Fatal Road Traffic Accidents in a Metropolitan Cit of South India" *Indian Academy of Forensic Medicine Journal* 35(4),93-97.
 9. Singh, P.K. (2011) "Road safety audit for four lane national highway", *3rd International Conference on Road Safety and Simulation*, Indianapolis, USA.
 10. Wright, P.V. (1998) " Safety Audit Procedures for Existing Roads".
<<https://www.nzta.govt.nz/assets/resources/safety-audit-procedures-existingroads/docs/safety-audit-procedures-existing-roads.pdf>> (December 1998)
 11. IRC :SP : 88(2010) " Manual on Road Safety Audit" *Indian Road Congress*, New Delhi, India.
 12. National Co-operative Highway Research Program (2004), Road Safety Audit, NCHRP, Synthesis, 336
 13. IRC : Road Development Plan" VISION: 2021", Ministry of Road Transport and Highway, Government of India, November 2001.

