



ROAD SAFETY AUDIT FOR THE ROAD STRETCH FROM TALAGATTAPURA TO HOSA GABBADI OF NH-209: A CASE STUDY

Siddaraju B R¹, Manjunatha S²

¹Department of Civil engineering, Sri Krishnarajendra Silver Jubilee Technological Institute, Bengaluru-01

²Departmente of Civil engineering, Sri Krishnarajendra Silver Jubilee Technological Institute, Bengaluru-01

Abstract— For assessing accident potential and safety performance Road Safety Audit (RSA) is conducted. The existing road can be improved by rehabilitation after conducting Road Safety Audit.

By identifying the potential problem of the selected road by inspections and collecting data, the auditor as to provide his advice in the form of recommendations.

The main objective of conducting RSA is to identify the accidents location on the road by studying FIR copies from concerned Police station and studying the road geometric and condition of traffic, the auditor as to develop the statistical relationship between accident rate and other factor causing accidents.

The purpose of conducting RSA is to reduce accidents on road network and to reduce the severity of accidents.

For this study the road selected was Talagattapura to Hosa Gabbadi. The accidents analysis is done by studying the FIR copies of last three years of concerned police stations. By examining all the existing features and conditions of road using IRC-SP-88-2010 checklist, safety measure are recommended for all kind of road users during day and night times as well in dry and wet conditions.

Keywords-component; Road Safety Audit (RSA), Severity of Accident

I. INTRODUCTION

At present, there may not be any formal requirements for safety of roads to be under taken in India. Now a day's India realizing the RSA importance. Hence MORTH sponsored the project related to 'Development of RSA for existing sectors' to CRRI in 2002 (April). The NHAI entrusted CRRI about engineering design for RSA on NH-2. This is having total length of about 900km, it was the longest road project in the world taken for RSA. And the CRRI only has taken the project of RSA in 2000 at Indore bypass. This is the first Road Safety Audit Project in India.

RSA is considered as very formalized procedure for independent assessment for accident potentials and mainly performance of safety with specified design for road traffic, either for new road or for existing road system. The procedure mainly includes accident analysis and related skills of RSA. It should be used for Accidents prevention at old or new roads, the skill usage for reduction in occurrence of accidents on old or existing road by utilizing local safety schemes at most of the cases with economy

II. OBJECTIVE OF THE STUDY

The following are main objectives of the RSA study

- Identify the stretches for which RSA has to be conducted.
- Collect required data for the selected stretch from relevant sources.
- Inventory of Road geometrics and Traffic condition.
- Conduct the statistical analysis for the collected data.
- Suggestion of Remedial Measures based on the inventory and results of analysis.

III. LITERATURE REVIEW

Road accidents, NCRB 2015^[1]: For the year 2015 Traffic accidents throughout India was reported to about 464674. As on time base analysis maximum traffic accidents happened in May (45215), Maximum number of Traffic accidents (80113) is reported during 15.00 hrs to 18.00 hrs of the day. Road accidents victims mainly are two wheeler riders. Buses, cars, trucks, are accounted for 19.4%, 8.3% and 12.4% of accidental deaths respectively. Mainly accidents occurred due to over speeding i.e. of about 43.7% of total road accidents, in that 212815 people are injured & 60969 deaths were recorded.

Zarulazam Eusofe et.al. Assessment of Road Safety Management at Institutional level in Malaysia^[2]

Here the author in his research has investigated the current institutional arrangements in Malaysia for the Management of Road Safety. This paper explains into how the effectiveness and efficiency of the Road Safety Management. Here the key stakeholders of Road Safety Management were allowed to participate in a semi structured interview based exploratory approach. The analysis have shown that the efficiency and effectiveness of Road Safety Management system of Malaysia may be co-related with the funding sources, awareness in public, process of decision making, institutional capacity and the local needs, legislative framework for the Road Safety. It also showcases a systematic analysis for evaluation of Road Safety Management for the countries where limited financial resources are available. It reveals the effect of funding mechanism on effectiveness and efficiency of Road Safety Management.

IV. METHODOLOGY

The following steps are adopted for the present study:

- For conducting RSA for the present work a stretch of 18km from Talagattapura to Hosa Gabbadi is adopted. This stretch comes under the Jurisdiction of 3 Police stations namely, Talagattapura Police station, Kumaraswamy layout Police station and Kaggalipura Police stations. The road accident data from concerned police station to be collected.
- Odometer survey for measuring length and to confirm chain age.
- Dividing the entire stretch into 7 subdivisions for accurate RSA as indicated below

	Stretch (From & To)	Chainage
1.	Talagattapura to Nice road junction	0.000km-1.570km
2.	Nice road junction to Ravishankar guruji aashram	1.570km-3.630km
3.	Ravishankar guruji aashram to Kaggalipura	3.630km-7.269km
4.	Kaggalipura to APS Polytechnic	7.269km-9.916km
5.	APS Polytechnic to Golden twinkle school	9.916km-13.119km
6.	Golden twinkle school to Vaderahalli	13.119km-15.629km
7.	Vaderahalli to Hosa gabbadi	15.629km-18.753km

- FIR copy's or Road accident related data will be collected for past 3 years,i.e For 2015,2016 and 2017.
- Conduction of RSA using Checklist.
- Based on the FIR copy's statistical analysis of accidents in different stretches will be done.
- Conduction of questionnaire survey and analysis.
- Recommendation of remedial measures for faults in the existing road.

V. DATA ANALYSIS

5.1 Checklist Auditing for Stretch-1

Table 1: Checklist for Road Safety Audit Survey in the Stretch of CH: 0.00 km to 1.57 km

Sl. no	Particulars	Observations			Remarks
General					
1	Are the prevailing speed levels within acceptable limits?		No		Speed of vehicles are high
2	Are road users stop in manners that could establish hazards?	Yes			From Ch:0.02 to 0.98km Provision for parking should be done.
3	Is plantations obscure perceivability or notice of sign?		No		In this stretch plantation are not obscure the view of sign.
4	Is the surface and carriage path marking in good condition?		No		Marking is so light it's not visible at night and wet condition
5	Are the medians and islands of sufficient width for the pedestrians?		No		Provided bus bays are not in usable condition
6	Are the bus stops and bus bays securely situated with satisfactory perceivability and clearance to the traffic path?		No		Vehicles are parked on the portion of the road.
7	Is overtaking opportunity for fast moving vehicles?		No		There is no opportunity for vehicles to overtake.
8	Is the road limits free of any activities that are probably going to distract drivers?	Yes			Road side stalls are likely to distract the drivers at ch: 0.002 to 0.77km.
Alignment					
1	Is the proposed speed of the vehicles related to the function of the road, the blend of traffic likely to utilize it, and the road condition?	Yes			Yes, but vehicles speed are more than design speed
2	Provision of adequate sign if speed is not up to the mark of design speed.		No		No cautionary signs are provided
3	Does the alignment give safe overtaking chances?		No		From Ch:0.90 to 1.08km due to 's' shape curve overtaking is not visible
Cross section					
1	Is the widths of the median, carriage way and shoulder is related to standard and satisfactory for capacity of road, volume and the mix of vehicular traffic likely to utilize it?		No		In this stretch No medians, No paved shoulders,
2	Are the bridges having proper footpath and crash barriers?			Na	No bridges in this stretch.
3	Does the given shoulder and slopes as per standard and find any locations with inadequate shoulder.		No		No proper side slopes, water logging during rainfall and no paved earth shoulder.
4	Whether side drains have provided to a safe standard?		No		No safe because, water get stuck during heavy rain fall

5	Are pedestrians having a sufficient foot path width?		No		Foot path is there but not paved no guard rails, light poles are placed in footpath itself & trees on footpath
Junction					
1	The type of intersection (T type, signal controlled junction) appropriate for the functions of two or more roads?	Yes			Junction is good for function of two or more road but marking & signs are not properly provided
2	Is the type of intersection sufficient for all generated vehicular movements and for all kind of vehicles?	Yes			Layout is good
3	Whether provisions of night time light are adequate to standard?		No		Except Ch:0.0to 1.08km , the street lights & roadside lights are not in good condition
4	Are intersections at that stretch having appropriate markings, signs to keep away from accidents?		No		No sign boards are provided at junctions
Road signs					
1	Is the arrangement for road signs (Informatory, Regulatory, Warning signs and Delineators) satisfactory as per the standard?		No		Expect warning sign & informatory sign no other signs are provided.
2	Check for any unapproved traffic signs and use of non standard signs?	Yes			In Talagattapura village unauthorised signs are provided.
3	Check for viability of traffic signs by watching them during the night and identify any lack of reflectivity		No		No lack of reflectivity.
Informatory signs					
1	Is provided all intersections with distance information signs and advanced direction signs?		No		Except curve locations, No signs are installed in junctions.
2	Are these signs effectively situated to empower the required action to be taken by the drivers?	Yes			Signs are not provided in right position.
Road markings					
1	Perceivability of road markings by a driver during night/day time and in dry/wet climate condition?		No		They are not visible during night and wet condition
2	Has proper type of markings been used in different circumstances (path line, edge line)?		No		Except Ch:0.00 to 0.77km, Road edge line is not marked
3	Is zebra crossing markings given at intersections?		No		Zebra crossing marking is not provided at junctions
4	Is situating of stop lines appropriate?	Yes			Position of stop lines are appropriate but Not visible at night time.
5	Are chevron alignment markers are introduced, have correct types of markers been utilized?		No		Not yet installed

Lighting					
1	Find the road locations where lighting pole positions are hazard to traffic?	Yes			In ch:0.02,0.07,0.15,0.67,0.93,0.9 km Lighting columns constitute hazards to traffic.
2	Is the electrical poles are installed in particular location with a minimum clearance from road edge as per standard?	Yes			Light poles are installed, but the minimum clearance is not provided from the road edge
3	Has lighting for signs especially overhead signs been given where important?		No		Signs not visible properly.
4	Are there any electrical poles or utility poles near the edge of the berms which may cause hazards to traffic?	Yes			Yes all the poles in this stretch are on the edge, that cause hazard
5	Is there any lighting pole in the median unprotected by crash barriers?		No		in this stretch median is not there.
Road side Hazards					
1	Are the bridge railing, crash barriers or pedestrian guard rail and end of bridge parapet of a safe design?		No		No bridge in this stretch
2	Is there any presence of street side stall or other road side commercial activities?	Yes			There is side stalls on shoulders
3	Are the median clear of any trees with trunks of circumference more than 30cm? If not, are such areas covered by protective crash barriers?		No		No median
Road side facilities					
1	Is there satisfactory and safe arrangement for pedestrian and non motorized vehicles along the street?		No		Due to inadequate footpath and no footpath in some location and due to no lighting it is not safe for pedestrian to walk during night times
2	Is the bus stop area safe, appropriate and whether the arrangement for buses to stand clear of vehicular movement paths has been made? Additionally is there requirement for lighting at these areas? For the security and safety of road users.		No		In this stretch has no bus stops all bus are stopped at road itself which cause abstraction to other vehicles no bus lanes are provided.

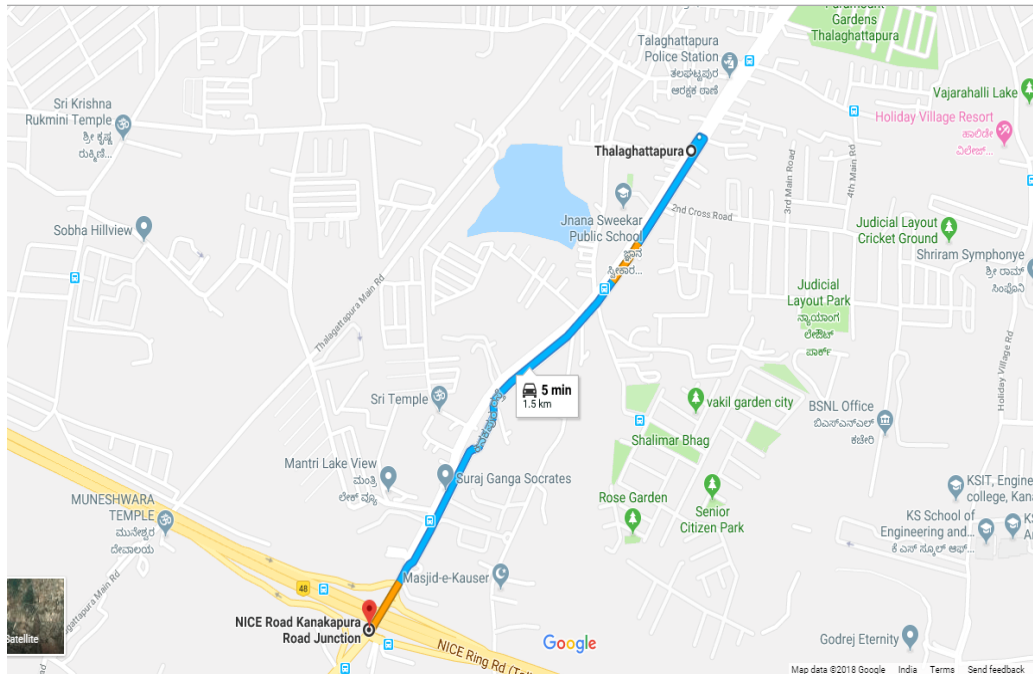


Figure 1 showing the road map of RSA study stretch from Talaghattapura to Nice road junction of chainage 0.000 to 1.570km

By care full study of FIR, the frequency of accidents, severity of accidents are found and based on the frequency and severity the level of Risk were found out. Then suitable remedial measures are suggested. One such analysis for road stretch from Talaghattapura to Nice road junction is given below.

Frequency	Frequent
Severity	Serious
Risk	Intolerable
Measures	Safety concern must be corrected at any cost

Considered stretch no 1 from Talaghattapura to nice road junction with chainage of 0.000 to 1.570km, as per statistical analysis of accident data it is ranked first. In this stretch crashes are occurred frequently with serious crash severity i.e., one or more accidents per month having severity of a death or serious injury. Level of risk of the accidents is intolerable hence the obtained course of action is safety concern must be corrected at any cost.

5.2 QUESTIONNAIRE SURVEY FOR THE HIGH ACCIDENTAL ZONE

The questionnaire survey for the stretch 1 which is classified as High accident zone based on the analysis of FIR data is conducted. The Graphical representation of percentage of accidents for different reasons is given in Figure 2

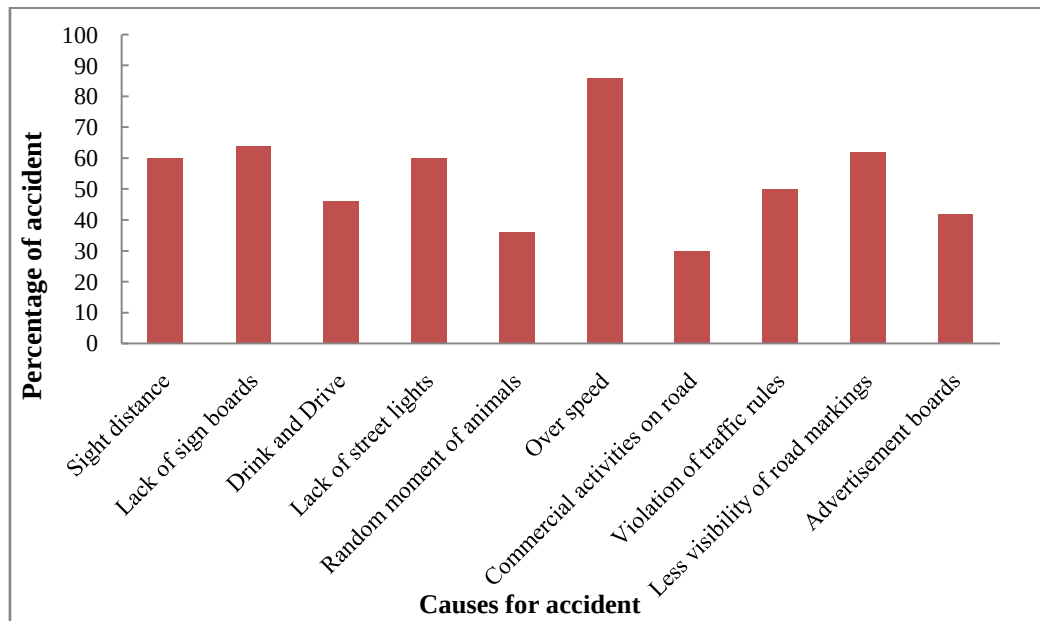


Figure 2 Percentage of accidents in high accident zone at chainage 0.000 to 1.570 km

The careful analysis of the above table 4.3 indicates that the major factor for the accidents is over speed which constitutes about 86%. And the other factors affecting road accidents are inadequate sign boards with 64%, less visibility of road marking factor of about 62%, improper sight distance and improper street lights both constitutes about 60%, and the least affecting factor are Random movements of animals and commercial activities on road sides constitutes about 30% to 40%.

5.3 QUESTIONNAIRE SURVEY FOR THE LOW ACCIDENTAL ZONE

The questionnaire survey for the Stretch 3 which is classified as Low accident zone based on the analysis of FIR data is conducted. The Graphical representation of percentage of accidents for different reasons is given in Figure 3

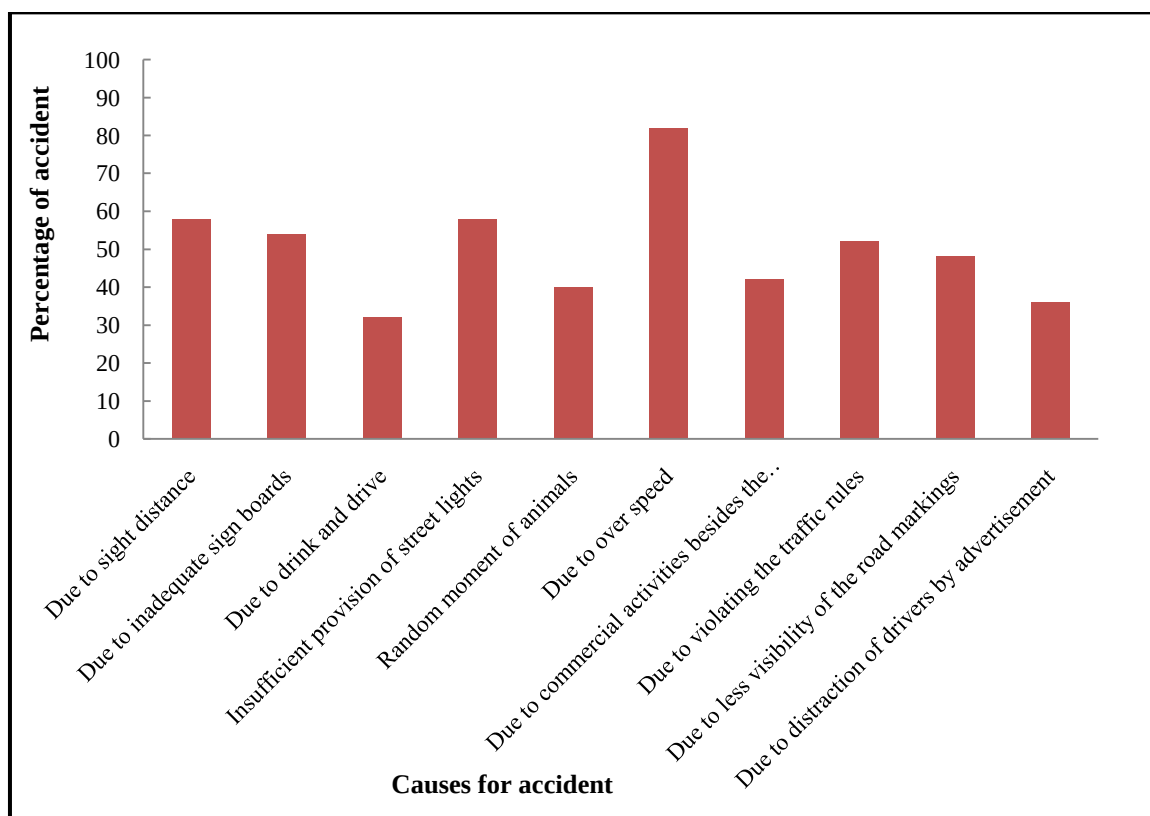


Figure 3 Percentage of accidents in Low accident zone at chainage 3.630 to 7.369km.

The careful analysis of the above Table 4.3.2 indicates that the major factor for the accidents is over speed which constitutes about 82%. And the other factors affecting road accidents are inadequate improper sight distance & inadequate provision of street lights with 58%, due inadequate provision of street lights of 54% and the least affecting factor are drink & drive, Random movements of animals and commercial activities on road sides constitutes about 30% to 40%.

5.4 STATISTICAL ANALYSIS OF ACCIDENTS

The ranking is done on the basis of Accident Point Weightage (APW). Typical calculation of APW is as shown below.

The Weightages adopted for the different nature of accidents are as given below.

- Fatal -6
- Major injury-3
- Minor injury-0.6
- Vehicle Damage-0.2

Calculation of APW for stretch 1 is given below.

For chainage 0.000 to 1.570km = $24*6+21*3+11*0.8+105*0.2=236.8$ (APW)

Table 2. APW Values of different stretches.

Sl no	Stretch Name	Fatal	Major injury	Minor injury	Damage	Total	APW	IN APW	Rank
1	Talagattapura to nice road junction ch:(0.00to1.57km)	24	21	11	105	210	236.8	5.46	1
2	Nice road to ravishankar guruji aashrama (1.57to3.63km)	14	2	46	117	234	150	5.37	2
3	Ravishankar guruji aashram to kallipura(3.63to7.26km)	6	-	23	51	102	64.6	4.16	7
4	Kaggalipura to APS Polytechnic (7.26to9.91km)	12	1	28	76	152	112.6	4.72	3
5	APS Polytechnic to Golden twinkle school (9.91to13.11km)	8	1	38	84	108	98.2	4.58	6
6	Golden twinkle school to vaderahalli (13.11to15.62km)	10	-	36	89	144	106.6	4.66	4
7	Vaderahalli to Hosa gabbadi (15.62to18.75km)	13	1	11	44	89	98.6	4.59	5

From the Table 1, we can observe that Stretch-1 Talagattapura to Nice road junction of chainage 0.000 to 1.570 km as ranked first as per statistical analysis. This shows that Stretch-1 contributes more road accidents with more fatal and serious injuries. And the last ranked Stretch is 3. i.e. Ravishankar guruji aashrama to Kaggalipura of chainage 3.630 to 7.269 km. This shows that in this project study area Stretch 3 contributes lesser road accidents with lesser severity. And the remaining stretches are ranked according to the road accidents and its severity.

VI. CONCLUSIONS AND DISCUSSIONS

6.1 Conclusion

- Road safety audit is an excellent strategy for improving safety with respect to road crashes, accident analysis.
- A good audit effective in identify the dangerous hazards elements on the road stretch. And some remedial measures can be given as per IRC Guidelines.
- From the ranking analysis Stretch-1 i.e. Talagattapura to Nice road junction is high accident zone and the stretch Ravishankar Guruji Aashrama to Kaggalipura is low accident zone.
- The road accident data available in FIR of relevant Police stations, and it is a very good source of information for RSA.
- Road safety audit is the finest method for improving safety against the dangerous road hazards and crashes.
- RSA using check list is also an effective and efficient method.

6.2 Discussion

- RSA gives the full idea of improvements required to nullify or minimize the accidents. Hence it is concluded as an RSA is an effective tool
- Stretch 1 is very high vehicular density and lots of construction activity is going on. Many traffic regulators such traffic sign, signal, lane marking are not present.
- Stretch 3 is well kept compared to other stretches. Markings, Road signs, and Median are also present. This contributing to the lesser accidents.

VII. REFERENCES

- [1] Road accident: (NCRB-2015)
- [2] Zarulazam Eusofe et al. Assessment of Road Safety Management at Institutional Level in Malaysia, IATSS Research.
- [3] Francis John Gichaga et al. Road Safety and Road Safety Audit in India: A Review. ISSN:2347-4718
- [4] Arun S Bagietal. Road Safety Audit (IOSRJMCE) ISSN:2278-1684
- [5] Francis John Gichaga, The Impact of Road Improvements on Road Safety and Related Characteristics. IATSS Research (2016), university of Nairobi, Kenya.
- [6] Manual on Road Safety Audit. New Delhi : Indian Road Congress.