

Accidental Analysis and Road Safety Auditing for NH-75

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ABSTRACT

In recent years, the road accident has become a global problem and marked as the ninth prominent cause of death in the world. Due to the massive number of road accidents every year, it has turned out to be a major problem. Consequently, to handle this overwhelmed situation, a precise analysis is required. In India there is a road network of 33 lakh kilometres of which nearly 65% of the cargo activity and 80% of traveller 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 a formal procedure for assessing accident potential and safety performance in the provision of new road schemes, the improvement of existing road and in maintenance of roads. Accident prevention and accident reduction are the two main strategies in the road safety. In this case study we analyse the NH-75 which is the major highway connecting Bangalore and Mangalore. The highway conveys substantial volume of traffic throughout the day and it has number of conflict points such as villages, industries. Detailed analysis of NH-75 will be carried out from the point of view of safety and geometric design aspects will be performed. This paper aims to identify deficiencies, improving design aspects, enhancing credibility of the roads.

Keywords: Accidental Analysis, Road safety, Maintenance of roads, Conflict points, Safety and geometric design aspects

1. Introduction

The problem of accident is very acute in highway transportation due to complex flow pattern of vehicular traffic. Traffic accident leads to loss of life and property. Thus, Traffic engineers have to undertake a big responsibility. There has been a dramatic increase in road accidents across the globe; out of which India ranks among the top with 1 in every 9 deaths due to road accident, is reported in India. It is seen that road accidents are the No. 1 cause of death among children and young adults in the age groups of 5 -29 years. In India more than 150,000 lives are lost in road accident, every day 400 people are injured. Primarily in India, we need to do a lot more to reduce accident-prone locations and to help us understand the ways to improve the road safety scenario.

In India at present there are road safety audits to be undertaken. However, India has also started the importance of road safety audits. It is because of ministry of road transport and highways sponsored the project on "Development of safety Audit methodology for existing roadway section" to Central Road Research Institute in April 2002. In systematic approach for evaluation of existing or new roads by an independent audit team at the stages of planning, design, construction, operation and maintenance to achieve accident free roads and to enhance overall safety performance.

Road accidents are major causes of loss all over the world. They are the cause of over 50 million injuries every year and sum up to over US\$ 65 billion in the developing countries. These deaths are more in number than many other accidents due to different modes put together and the cost to the society is much more than the office aid received by the developing countries all over the world. In India, more than 100,000 lives are lost in road accidents every

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year while 400,000 people are injured. Sweden has set itself a target of vision zero by 2020 it might be difficult to achieve something similar in India in the near future on such a grand scale. Primary aim of any transportation infrastructure is to provide mobility. Accidents pose as threats to the improvement of the system, which need to be controlled in order to achieve the objective. Primarily in India, we need to do a lot more to reduce accident prone locations and to help us understand the ways to improve the road safety scenario.

There may be various reasons for an accident, one such paper from identifies rainfall as one of the reasons, it states road crashes are a complex interaction of different parameters like road, vehicle, environment, human etc. skidding of road vehicles is considered as one of the major cause of road accidents occurring all over the world. Skidding, caused by lack of tire to road friction, is of the most important single causes of traffic accidents. This paper aims to critically analyse the weather and wet road related crashes.

The road accident situation in India is alarming. Records show that there is one death at every 2.75 minutes because of road accidents. The high accidents rate is largely attributed to the inadequacy of the highways and other main roads to meet the traffic demands, road user behaviour, vehicle defects, poor road geometries and visibility. Road accidents cannot be totally prevented but by suitable traffic engineering and management the accident rate can be reduced to certain extant. For this reason, systematic study of traffic accidents is required to be carried out. Proper investigation of the cause of accident will help to propose preventive measures in terms of design and control. The objective of the study is the identification of accident prone area on the road from FIR, to study the effect of roadway geometries and traffic condition on the road stretch and development of statistical relationship between accident rates and various factors causing accidents. The scope of the study is to reduce accidents on road network, reducing severity of accidents and the need for costly remedial work is reduced.

2. Literature Review

Arun S Bagi, Dheeraj N Kumar (2012): "Road safety audit" Road safety audit is formal procedure for accessing accident potential and safety performance in the provision of new road schemes, the improvement and rehabilitation of existing road and in maintenance of roads.

Dr. S.S Jain (2011): "Road safety audit for four lane national highway" The study aims to evaluate road safety audit of a section of four lane national highway and will focus on evaluating the benefits of the proposed actions that have emanated from deficiencies identified through the audit process.

Hitesh Kumar, mrs. Monika (2017): "Road safety audit and a case study" The primary role of auditing identifying the potential problems of a highway project by conducting the site inspection and collecting data. The objective of the study in the identification of accident-prone area on the road from FIR, to study the effect of roadway geometries and traffic conditions on the road.

Rakesh Kumar singh and S.K. Suman (2012): Accident analysis and prediction of model on national highways road stretch isNH-77 Hajipur to muzaffarpur. Hinted that accident prone locations can be identified by ranking the parameters based on severity index parameters which causes a maximum number of accident were assign maximum weighted. Accident prediction model developed in the present study show that number of accidents per km-year increase with AADT and decrease with improvement in road /shoulder condition.

Sanjay Kumar Sing (2016): "Road traffic accidents in India issues and challenges" The main aim of this paper is to analyse the road accidents in India at national level, State, and metropolitan city level. Analysis shows that the distribution of road accidental deaths and injuries in India varies according to age, gender, month and time.

3. Scope and Objectives

The spectacular increase in the number of motor vehicles on the road has created a major social problem the loss of lives through road accidents. The appalling human misery and the serious economic loss caused by the road accidents demand the attention of society and call for the solution of the problem. A multi-disciplinary approach is needed in understanding the problem before providing the solutions. The traffic engineer thus concerned features of highway affecting the safety of vehicle and road users. The analysis of accidents statistics provides clues to the many factors that lead to accidents and improvement that may be desired. Based on the statistics the traffic engineer must devise ways to reduce the accidents through better planning, design construction, maintenances and traffic operation. The traffic engineer is also concerned about regulation and management of traffic to ensure safer travel.

Keeping in view an attempt has been made to analyse the impact of different variables on accidents rate by applying causes-effect relationship by regression analysis. In this regard, in the present project work an attempt has been made.

- To identify various traffic and road related factors causing accidents and suggestion of possible improvements.
- To study the cause of accidents and suggest corrective measures at potential location
- To evaluating existing design
- To compute the financial losses incurred
- To support the proposed design and provide economic justification to the improvement suggested by the traffic engineer.
- To carry out before and studies and to demonstrate the improvement in the problem.
- To study the monthly and annual variation in accidents rate on selected stretch.
- To study the effect of traffic volume on accident rate.

The objectives of this study are as follows:

- To help produce designs and roads that reduce the number and severity of cracks

- To ensure that road elements with an increased risk potential are removed at that measured are identified to reduce the like risk
- To reduce likelihoods of accidents
- To minimize the severity and cracks risk of road traffic crashes that may be influenced by the road facility or adjacent environment.
- To minimize the need for remedial measure after the opening of a new road project
- To identify and report on the crash potential and safety problem of a road project

StudyArea

The stretch from National Highway 75 had been selected for analysis. The selected highway stretches have been most important highway in Bangalore to Mangalore. The area is covered by urban land, agriculture, industrial area. This National Highways maintained and operated by National Highway Authority of India (NHAI) under the Ministry of Road Transport and Highways.

4. Road Accident and Black Spot

An accident (collision, overturning or slipping) which occur or originated on a road open to public traffic resulting in either injury or loss of life, or damage to property, in which at least one moving vehicle is involved is known as Road accident. The place where the accident occurs frequently in the given location is called Black Spot.

Need for Analyzing Accident at Black Spot

The spectacular increase in the number of motor vehicle on the road has created a major social problem – the loss of lives through road accidents. A multidisciplinary approach is needed in understanding the problem and providing solutions. The features of highway affect the safety of vehicles and road users; it has to be designed properly. The analysis of accident statistics provides clues to the many factors that lead to the accidents and improvements that may be desired. Accident data also supply valuable information to control, to regulate and manage the traffic more efficiently. Hence, based on these studies, the traffic engineer must devise ways to reduce accidents through better planning, design, construction, maintenance, traffic operation with timely regulation and management of traffic to ensure safety for the road users.

Road accident scenario in India

Many development countries including India have a serious road accident problem. Fatality rates defined as, road accidental death per 10,000 vehicles is quite high in comparison to developed countries. While in Europe and North America the situation is generally improving, many developing countries faces a worsening situation. The road accident costs of developing countries are increasing at least 3% of their gross national product and in further expected to increase further. Apart from increased accident cost the number of deaths by road accident is increasing drastically. Also, the proportion of commercial and public service vehicles involved.

Numerous studies have been conducted to investigate the relationships between vehicle accidents and the geometric design of roadways. These studies have indicated that improvements to highway geometric design could significantly reduce the number of vehicular accidents.

Causes for Accidents

There are four basic elements in a traffic accident they are the road users the vehicles the road and its condition and environmental factors traffic weather etc. the road user responsible for the accidents may be the drive of one or more vehicles involved, pedestrians or the passengers. Vehicles involved in the accident may also be defective. The condition of the road surface or other existing geometric features or any of the environmental conditions of the road may not be to the expectation causing an accident. An accident may be caused due to a combination of several reasons and seldom due to one particular reason. Hence it is often not possible to pin point a particular single cause of an accident.

Need for Analyzing Accident at Black Spot

The spectacular increase in the number of motor vehicle on the road has created a major social problem – the loss of lives through road accidents. A multidisciplinary approach is needed in understanding the problem and providing solutions. The features of highway affect the safety of vehicles and road users; it has to be designed properly. The analysis of accident statistics provides clues to the many factors that lead to the accidents and improvements that may be desired. Accident data also supply valuable information to control, to regulate and manage the traffic more efficiently. Hence, based on these studies, the traffic engineer must devise ways to reduce accidents through better planning, design, construction, maintenance, traffic operation with timely regulation and management of traffic to ensure safety for the road users.

5. Methodology

Volume Studies

The traffic volumes at National Highway-48 of Hassan city are to be determined by manual counting method during morning peak, evening peak and off-peak hours. Manual counting method requires simply counting of every vehicle seen to pass a fixed point on a road. In its simplest form the observer record on a specially prepared field sheet, the passage of each vehicle. It is normally done pen or pencil, method of recording and summarizing the traffic volumes at intersections where the volumes of the various turning's movements are required to be recorded.

Equivalent PCU values are to be multiplied to the obtained classified vehicles volume, total PCU during morning peak, evening peak and off-peak hour is to be obtained.

Traffic Volume Study

Classified traffic volume count can be done at a time interval of 15 minutes, 30 minutes or one hour. In the study of traffic volume data collected from NHAI. Classified traffic volume count survey was carried out near RIT collage. The main objective of classified traffic volume count was to assess the traffic characteristics on project road section in terms of hourly traffic variation, peak hour traffic, average daily traffic, traffic composition and directional distribution. Traffic composition were car, Mini Bus, Bus, light commercial vehicle (LVC), Multi Axel Vehicle (MAV), Private Bus (PVT Bus), Trucks – 2 axels, Truck -3 axel, Tractors, Two-wheelers (TW), Auto-Rickshaw and Animal Drawn vehicles (ADV). The survey was carried out by manual vehicle counting and classified the vehicles passing through survey station. The counts were made separately for motorized and non-motorized vehicles.

Accident Studies

The various objective of the accident studies are, to study the causes of accidents and to suggest corrective treatment at potential location, to evaluate existing designs, to support proposed designs, to carry out before and after studies and demonstrate the improvement in the problem, to make computations of financial loss, and to give economic justification for the improvements suggested by the traffic engineer.

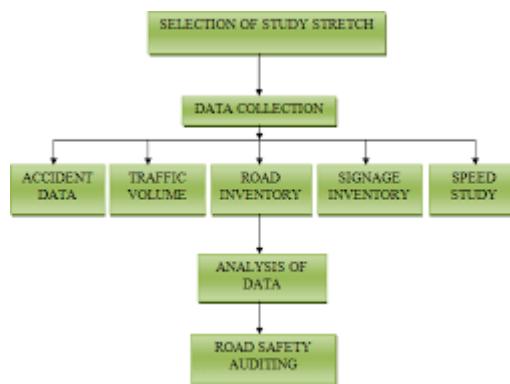


Fig 1: Flow chart of methodology

Accident Investigations

The scientific approach suggested that a mobile laboratory may be kept ready in every city. A bus equipped with essential instruments to measure the alcohol content in the breath, reaction time and other driver characteristics, skid resistance of pavement surface, etc. and a traffic engineer and his assistants may from the proposed mobile laboratory which should reach the accident spot as soon as possible after an accident.

Measurement for the reduction in accident rates

The various measurements to decreases the accident rates may be divided into three groups. These three measures are generally termed “3 -ES”.

Role of Highway Geometries in increasing accident rates

Highway geometries play a major role in occurrence of repeated accidents at a spot. The failure in implementation of required geometries on field makes it an accidents prone region. The characteristics of a road have a greater influence on the causation of accidents. Improvements to the condition of the road can bring measurable change in the accident rate. The highway and the traffic engineer have an important duty in ensuring that the roads are designed to proper standards, built to correct specifications and maintained adequately. It is being increasingly realized that safety can be built into the highways.

Spot speed studies

Spot speed is the instantaneous speed of the vehicle at a specified location. Speed of vehicle fluctuates from time to time along the road and its value as shown on the speedo meter at a particular spot is called the „spot speed”. In these speed-checks at problematic locations (spots), while a trip maker is more interested in total journey time involved in the complete journey speed are maintained on the highway system. For maintaining good journey speeds, the delays or involuntary stop due to road congestion should be minimum and vehicle should be running smoothly. This involves the concept of running speed of vehicle. For speed analysis in each circle by 50m length on the road, at starting point the stop clock is turned ON and when the vehicle reaches 50m length at the time stopping the stop clock. This results in knowing the time taken by each vehicle to pass 50m length. By using this data, the speed approaching lane is obtained.

Road Safety Audit (RSA)

A Road Safety Audit (RSA) is the strict safety performance examination of an existing or future road or intersection by an independent, multidisciplinary team. It qualitatively evaluates and reports on prospective road safety issues and recognizes opportunities for improvements in safety for all road users. A key feature of a road safety audit is the use of a team of professionals with wide-ranging expertise. The team should comprise highway safety engineers, highway design engineers, maintenance personnel, and law enforcement. The team members must not be involved in the design or maintenance of the facility being examined, so that they can have an objective point of view.

The road safety audit may examine general safety conditions, or it may concentrate on specific concerns or users. Walkability audits concentrate on pedestrian safety and accommodation and transit audits emphasis on safety of bus and train users.

6. Results and Discussions

The stretch from National Highway 75 had been selected for analysis. The selected highway stretches have been most important highway in Bangalore to Mangalore. The area is covered by urban land, agriculture, industrial area. This National Highways maintained and operated by National Highway Authority of India (NHAI) under the Ministry of Road Transport and Highways.



Fig 2: Area for Buvanahally



Fig 3: Study Area for RIT Collage

Accident Data

The data was collected from the Annual report of accident data records from the traffic Police station. The below set of data provides rate of fatality, non-fatality and injured at location on Bangalore- Mangalore highway at year 2019-2020 are presented.

Accident Data for Buvanahally :

Table1: Year Wise Road Accident Statistics of Buvanahally Stretch

Accident severity year	Fatal	Non-Fatal	Injured	Death	Total
2017	02	05	02	08	17
2018	01	04	01	04	10
2019	-	02	-	02	04
2020	01	02	01	02	06

Accident Data for RIT Collage:

Table 2: Year Wise Road Accident Statistics of RIT Collage

Accident severity year	Fatal	Non-Fatal	Injured	Death	Total
2017	-	04	-	07	11
2018	02	02	02	02	08
2019	01	02	01	02	06
2020	-	-	-	-	-

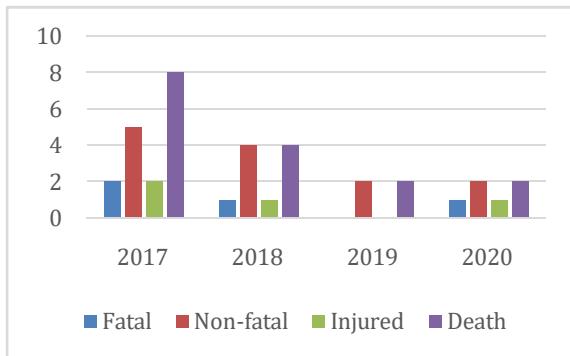


Fig 4: Accident Statistics of Buvanahally Stretch

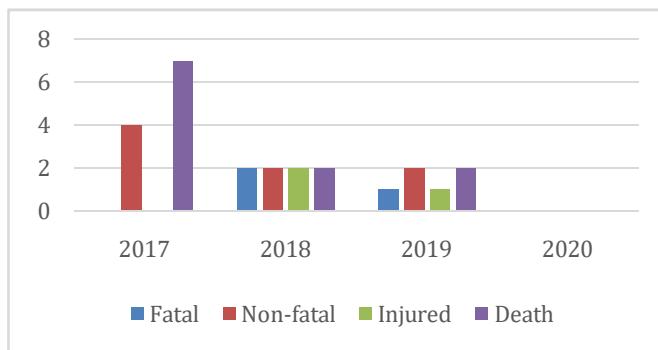


Fig 5: Accident Statistics of RIT Collage Stretch

Traffic volume data

A traffic count is a count of vehicular or pedestrian traffic, which is accompanied along a stretch. Traffic volume study is conducted to find the number, movements, and classification of vehicles at the given section. In this project, volume count is conducted a week. The volume of traffic approaching the location on highway and Rajeev college road for 15 minutes" interval during peak hour is analyzed on selected location. The traffic volume data is collected for 7 X 24 hours in manual method and PCU values are multiplied. The PCU values of vehicles at urban roads are as follows.

Table 3: PCU values of the vehicles

SL.NO	Vehicles class	PCU values of vehicles at urban road
1	Car and Jeep	1.0
2	Bus and Truck	3.0
3	Auto rickshaw	0.5
4	Two-wheeler automobile	0.5
5	Pedal cycle	0.5
6	Bullock cart	8.0
7	Tonga and Hand cart	3.0

Spot Speed Study:

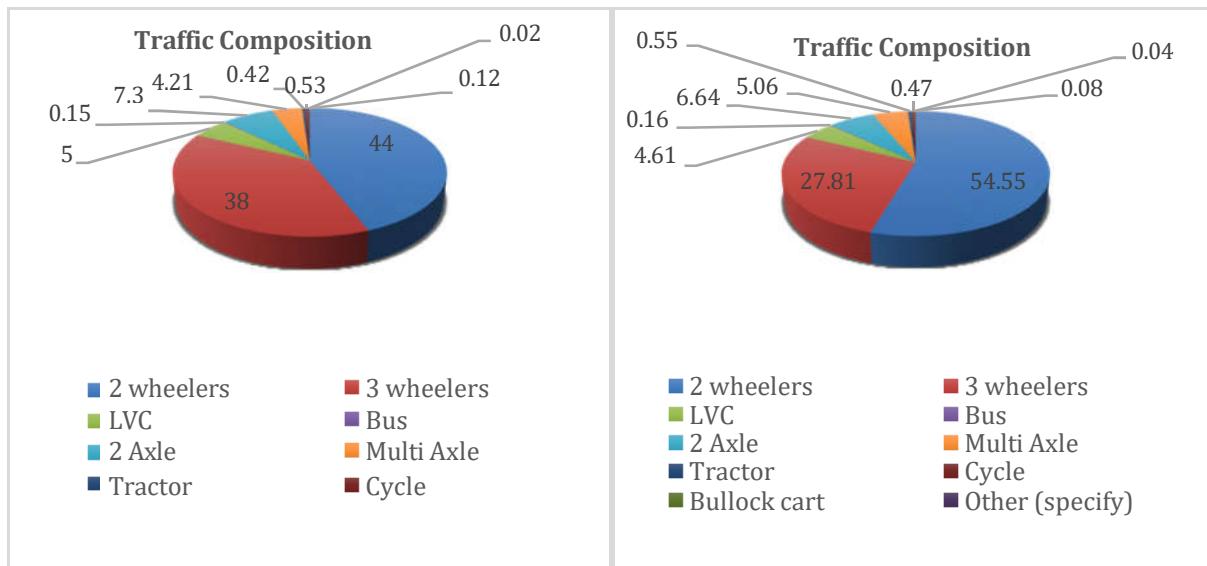
Spot speed study is conducted on both Buvanahally and Rajeev college road for 50meters interval by using stopwatch method for the vehicles which are moving commonly on both roads

Table 4: Spot Speed Study

Spot speed study at 50m interval	On Buvanahally km/hr	On Rajeev college road km/hr
Car, Jeep	55.61	43.02
Bike	48.081	46.29
2 Axle Truck (6 tires)	35.06	32.05
LVC	45.04	35.21
3 Axle Truck (10 tires)	28.01	26.04

Table 5: Total Vehicular Count

Type of vehicles		Average daily traffic in week					
		Total vehicles					
		Towards Bangalore	Towards Mangalore	Towards RIT College	% Composition	Towards highway	% Composition
Fast moving vehicles	2 wheelers	16263	22420	11704	44	11525	54.55
	3 wheelers	26568	19086	10142	38	5876	27.81
	LVC	5036	3712	1185	5	974	4.61
	Bus	1347	1362	41	0.15	35	0.16
	2 Axle	5660	4747	1930	7.3	1403	6.64
	Multi Axle	2475	2925	1114	4.21	1071	5.06
	Tractor	427	777	113	0.42	117	0.55
Slow moving vehicles	Cycle	129	104	140	0.53	100	0.47
	Bullock cart	6	9	6	0.02	9	0.04
	Other (specify)	46	30	31	0.12	17	0.08
	Total vehicles	57957	55172	26406	100	21127	100

**Fig 6:** % of Traffic Composition towards RIT college and Highway

7. Conclusion

Present study gives an insight of how the analysis of traffic accident can be done from the viewpoint to reduce it by designing proper safety measure. Heavy vehicles like truck are involved in maximum number of accidents on two lane roads. It is estimated that facilities caused by truck is 59% followed by other 26% and bike 7% and jeep 5% and bus 3%. Road safety awareness should be raised among road users. The NH-75 design speed is 80 km/h. but from the spot speed study we can observe that the max speed of the vehicles is 105 km/h. From the traffic volume study, it is found that the percentage of

movement of bike is high as the RIT is adjacently located. And the HPCL trucks (2 axels and multi axel) movement is also more HPCL is located there. From the adjacent analysis the number of accidents is growing year to year, so it is suggested as black spot. The present 10.25m wide two-lane NH should be made as one-way road. And another new road should be designed and provide beside it as shown above. Service road and underpass should be designed and provided for the easy movement of vehicles. Bommanayakanahalli road should be extended till HPCL road so that the traffic can be divided. The trucks can be diverted to Bommanayakanahalli road so that the chances of collision between HPCL trucks and college vehicles can be reduced.

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