

Identification and Improvement of Accident Prone Locations on a Selected Stretch of Nh-1

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ABSTRACT

This experimental work attempts to identify the accident prone locations on selected stretches on NH 1 in the Haryana State. Growing number of road accidents needs to be controlled by identifying the accident prone locations on NH 1. In this paper a study has been carried out on road accident data of a selected stretch of NH-1 (Panipat-Karnal Road). A 50 km road stretch between RD 66 km to 116 km was selected and road accident data of four years (2012-2015) was collected. To identify the accident prone locations the total stretch was divided into smaller sections of 5 km each. Total accidents and accident severity value has been used to rank the accident prone locations. The stretch of the road 66-79 km is found to be the most accident prone followed by the stretch 79-88 km and the stretch 89-98 km. A field study has been conducted to compare the analysis with field results. This thesis contains the data collected from NH-1 highway on the section from Panipat to Karnal in Haryana, their analysis and results are derived. The study is divided in four sections, at each section study is conducted by accidental statistics reports and usage studies which further contains accumulation studies and duration studies.

1. INTRODUCTION

The rapid population growth and increasing economic activities have resulted in the tremendous growth of motor vehicles. This is one of the primary factors responsible for road accidents on National highways in India. The increasing number of road accidents is imposing considerable social and economic burdens on the victims, and various direct and indirect costs. Road accidents are essentially caused by improper interactions between vehicles, between vehicles and other road users and/or roadway features. The situation that leads to improper interactions could be the result of the complex interplay of a number of factors such as pavement characteristics, geometric features, traffic characteristics, road user's behavior, vehicle design, driver's characteristics and environmental aspects. Thus, the whole system of accident occurrence is a complex phenomenon. Many researchers have devoted their work in the area of road accidents and traffic safety aspects. Works have been undertaken on accidents characteristics, accident forecasting and better roadway and vehicular design for the improvement of road safety in different traffic and roadway conditions. A number of studies on road safety have also been carried out in India, in different cities such as Delhi, Mumbai, Chennai and Ernakulum as well as on some highway (Sandip Chakra borthy and Sudip K. Roy). In this dissertation work, an attempt has been made to Identify and Improve Accident Prone Location on a Given Stretch of NH-1.

Total Road Length in India

India has a road network of over 4689842 million kilometers of roadway, making it the 2nd largest road network in the world. At 0.66 km of highway per square kilometer of land the density of India's highway network is higher than that of the United States (0.65) and far higher than that of China's(0.16) or Brazil's (0.20).

India's road network consist of 92,851.05 Km National Highway including 2000 km. of Expressways, 154,522 km of State Highways, 2,577,396 km of Major District Roads and 2,650,577 km of Village and Other Roads. Though the length of NHs is about 2% of the total road length, they carry as high as 40% of the total traffic. About 26% of NHs have single/intermediate lane, 51% of the NHs have double lane and only 23% have four or more lanes. The NHs is thus the most important carrier of passenger and freight traffic in the country.

Table 1. shows the development of Road Length of NH's after independence of India.

Fig. 1. depicts the Map of NHs in India.

Table 1. Development of Road Length of NHs after the Independence of India

| Period | Total Length- National Highways (km) |
|------------|--------------------------------------|
| 1947-69 | 24,000 |
| 1969-90 | 33,612 |
| 1990-97 | 34,298 |
| 1997-03 | 58,112 |
| 2003-05 | 65,569 |
| 2005-13 | 79,116 |
| At Present | 92851.05 |

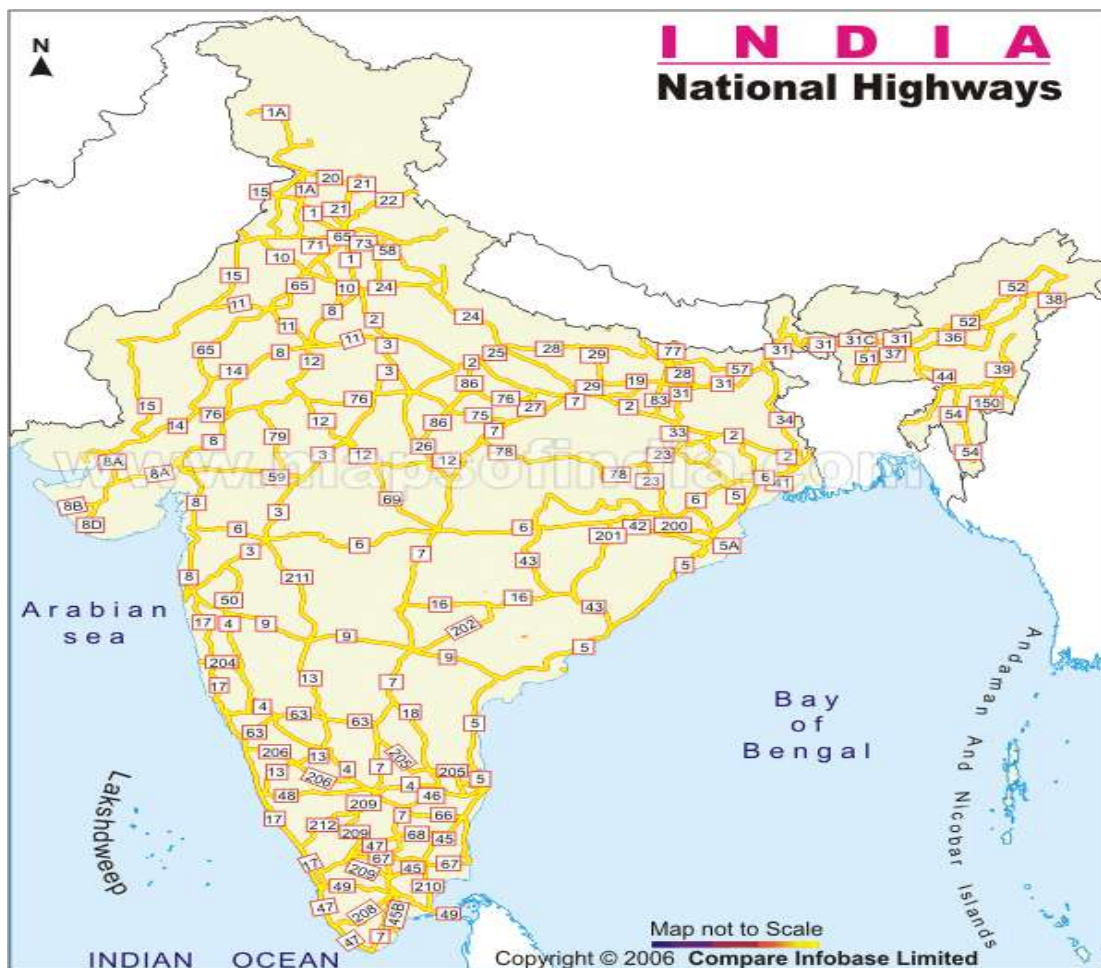


Fig 1. Map of NHs

Dissertation Topic and its importance

The research work is entitled as “Identification and Improvement of Accident Prone locations on a selected stretch of NH-1”. The dissertation topic is selected because safety on roads has become a major area of concern. The number of persons killed in road accidents has increased considerably in the last decade (MORTH). The data has been given in table 2.

Table 2 Numbers of Accidents during 2000-2015 in India

| Year | Number of Accidents | Number of Persons Killed |
|------|---------------------|--------------------------|
| 2001 | 4,05,637 | 80,888 |
| 2002 | 4,07,497 | 84,674 |
| 2003 | 4,06,726 | 85,998 |

| | | |
|------|----------|----------|
| 2004 | 4,29,910 | 92,618 |
| 2005 | 4,39,255 | 94,968 |
| 2006 | 4,60,920 | 1,05,749 |
| 2009 | 4,79,216 | 1,14,444 |
| 2012 | 4,84,704 | 1,19,860 |
| 2015 | 4,86,384 | 1,25,660 |

The sheer magnitude and severity of road accidents requires immediate attention. On Indian Roads about every 4 minutes a person gets killed. This all leads to a great social and economic loss to the people. The social and economic impacts of road accidents include trauma to the accident victims and their families, the loss of jobs and livelihood of the victims and disturbance in the lives of their families, the cost incurred on the treatment of victims and the compensations to be given to the victims and their families. Including the cost of litigations etc, Through the social impacts are difficult to quantify, it is estimated that the nation suffers a loss of about 90000 crores per annum due to road accidents in the country. So, there is a great need to take up such measures that can help improve road safety in the country. As NHs are responsible for causing about 40% of fatalities on Indian roads, the present study has been undertaken to identify and improve the accident prone locations on an selected stretch of National Highway-1 with a view to help improve road safety on the road.

LITERATURE REVIEW

In a dubious distinction for the country, the World Health Organization has revealed in its first ever Global Status Report on Road Safety that more people die in road accidents in India than anywhere else in the world, including the more populous China. Calling road fatalities an "epidemic" that will become the world's fifth biggest killer by 2030, the report said while rich nations had been able to lower their death rates, these were sharply on the rise in the third world. It said 90% of deaths on the world's roads occur in low and middle-income countries (21.5 and 19.5 per lakh of population, respectively) though they have just 48% of all registered vehicles.

The statistics for India are chilling. At least 14 people die every hour in road accidents in the country. In 2013, 1.14 lakh people in India lost their lives in road mishaps - that's significantly higher than the 2013 road death figures in China, 81,649 (Morth). Road deaths in India registered a sharp 6.1 % rise between 2011 and 2012. However, road safety experts say the real numbers could be higher since many of these accident cases are not even reported. "There is no estimate of how many injured in road accidents die a few hours or days after the accident", points out Rohit Baluja, member of the UN Road Safety Collaboration and Commission of Global Road Safety representing Asia.

The report, based on 2013 and 2014 statistics collected from 178 participating countries, said globally over 1.2 million people die in road accident" every year and 20-25 million people suffer non-fatal injuries, Baluja said both central and state governments, while pushing for construction of more highways and roads, were doing precious little to make them safe. "We don't have scientific traffic engineering which forms the basis of road safety improvement practices in US and UK since 1930s. This still remains a matter of consultancy in India as we are yet to have our own traffic engineering wings", Baluja adds.

In fact, the report shows while only 3,298 people died in road accidents in UK in 2012 the figure, at 42,642, was much higher in the US. The report pointed to speeding, drinking-driving and low use of helmets, seat belts and child restraints in vehicles as the main contributing factors. In 2004 road accidents were the top ninth cause of death. Speed is the main reason behind accidents. An increase in average speed is directly related to both the likelihood of a crash occurring and to the severity of crash consequences. A 5% increase in average speed leads to an approximately 10% increase in crashes that cause injuries and a 20% increase in fatal crashes. Zones of 30 km/hr can reduce crash risk and injury severity and are recommended in areas where vulnerable road users are particularly at risk.

Only 29% countries had managed to reduce traffic speed in urban areas and 10% have been effective in managing it. The report stated traffic calming measures were lacking in areas with no traffic segregation. A brief analysis of the Rohit Baluja's report points to Andhra Pradesh (11046) having the highest share of deaths due to road accidents followed by Maharashtra(9875) and Uttar Pradesh(9946).

Trucks being one of the major killers on roads, the report show these to be the biggest victims of mishaps as well-23,991 occupants of trucks lost their lives in 2012. This was followed by occupants of two-wheelers. India's record in road deaths has touched a new low, as toll rose to at least 14 deaths per hour in 2011 against 13 the previous year. The total annual deaths due to road accidents are now 1.25 lakh.

While trucks/lorries and two-wheelers were responsible for over 40% deaths, the rush during afternoon and evening hours were the most fatal phases. Traffic experts are alarmed over the shooting trend of fatalities on roads between 2008 and 2015, and progressive states having a significant share of road fatalities. While the toll was only 84,430 in 2009, it crossed 1.18 lakh in 2012, an increase of nearly 40%. Andhra Pradesh, Maharashtra and Tamil Nadu reported 12%, 11% and 10.8% of total road accident deaths in the country respectively.

Traffic accidents have social and economic implications for developing countries and for the families of the casualties. Implications include loss of life, permanent disability, property damage, time and monetary costs. According to World Bank, traffic accidents cost developing countries one to one and half percent of their gross domestic product (GDP), while for developed countries it is two percent. The global costs are estimated to be US\$518 billion per year, while the low-income countries account is US\$65 billion, which is more than they receive in development assistance (World Bank). This is a debilitating situation that has besieged poor countries as the money could be used to fight other social ailments like poverty, HIV/AIDS and lack of development. Many low-income and middle-income countries cannot provide all the health care services that people sustaining road traffic injuries would get in high-income countries.

Apart from the increase in motor vehicle numbers, Vasconcellos points out that most accidents occur in built environments and blames the increase in traffic accidents on the structure of town and cities. The way the city is constructed, and the way the circulation structure is formed, have a direct effect on the nature of traffic conflicts and hence the probability of traffic accidents (Vasconcellos). He observes that cyclists and pedestrians are the most vulnerable because they are involved in more severe accidents. Vasconcellos maintains that streets are usually made to pass through high-density pedestrian. Areas, so that, the coexistence of high-speed motor traffic and low-speed pedestrian traffic makes accidents unavoidable. Roads are designed to increase both speed and safety of motorized vehicles and when used by non-motorized vehicles they become unsafe. When discussing traffic accidents and political environments Vasconcellos notes that decisions about road construction are usually based on economic rationale and are motor vehicle orientated, so that cyclists and pedestrians needs are not taken into account, hence few or no facilities are provided for non-motorized road users.

Road Accidents in other Countries

Vasconcellos gives a short history of the way the industrialized countries have perceived traffic accidents. Initially they considered them as acts of God, and as such, unavoidable. As accidents became more common on the roads of the industrialized countries, there was a realization that they were facing a problem in need of immediate attention. The industrialized countries understood that traffic accidents are a human-made problem and hence preventable. Another change in perception was to look at traffic accidents as a public health problem deserving special attention by the state. A reason why traffic accidents are increasing in developing countries is that there are conflicts in acknowledging the problem by society. People attribute the causes of traffic accidents to several other factors, namely inadequate road supply and quality, often unpaved and in a bad state of repair; unsafe driving behavior, which results from virtually non-existent driver training, extremely lax licensing procedures, and lack of traffic law enforcement; unsafe vehicles; inadequate or non-existent traffic signals and signage and lack of traffic management; almost complete lack of infrastructure for pedestrians and cyclists; forced sharing of narrow, crowded rights of way for motorized and non-motorized vehicles, pedestrians, animals and street vendors; and overcrowding of buses, auto-rickshaws, and even motorcycles.

According to Aworemi, Joshua Resmi, Abdul-Azeez, Ibraheem Adegoke, Olabode, Segun Oluwaseun (2010), the human, vehicle, environmental and roadway characteristics, are the salient factors that are responsible for road traffic crashes in South western states of Nigeria.

In 1996, J Wootton and G D Jacobs presented a broad review of the road safety problems in developing and emerging countries so that an effective improvement strategy can be devised.

In 1991, Downing, Chris J Baguley and Brian L Hills presented a study in which Traffic Safety Issues for the low and middle income countries were discussed.

METHODOLOGY OF STUDY

The study aims at identifying and improving the accident prone locations on a given stretch of NH-1. With this objective in view, the accident data of the selected road stretch for the study, 66km-116km of NH-1, are collected from different sources. After analysis of the data, the results are summarized and accident prone locations are identified using the concept of Accident Severity Value (ASV). The methodology adopted for the present research is diagrammatically represented in Fig. 2.

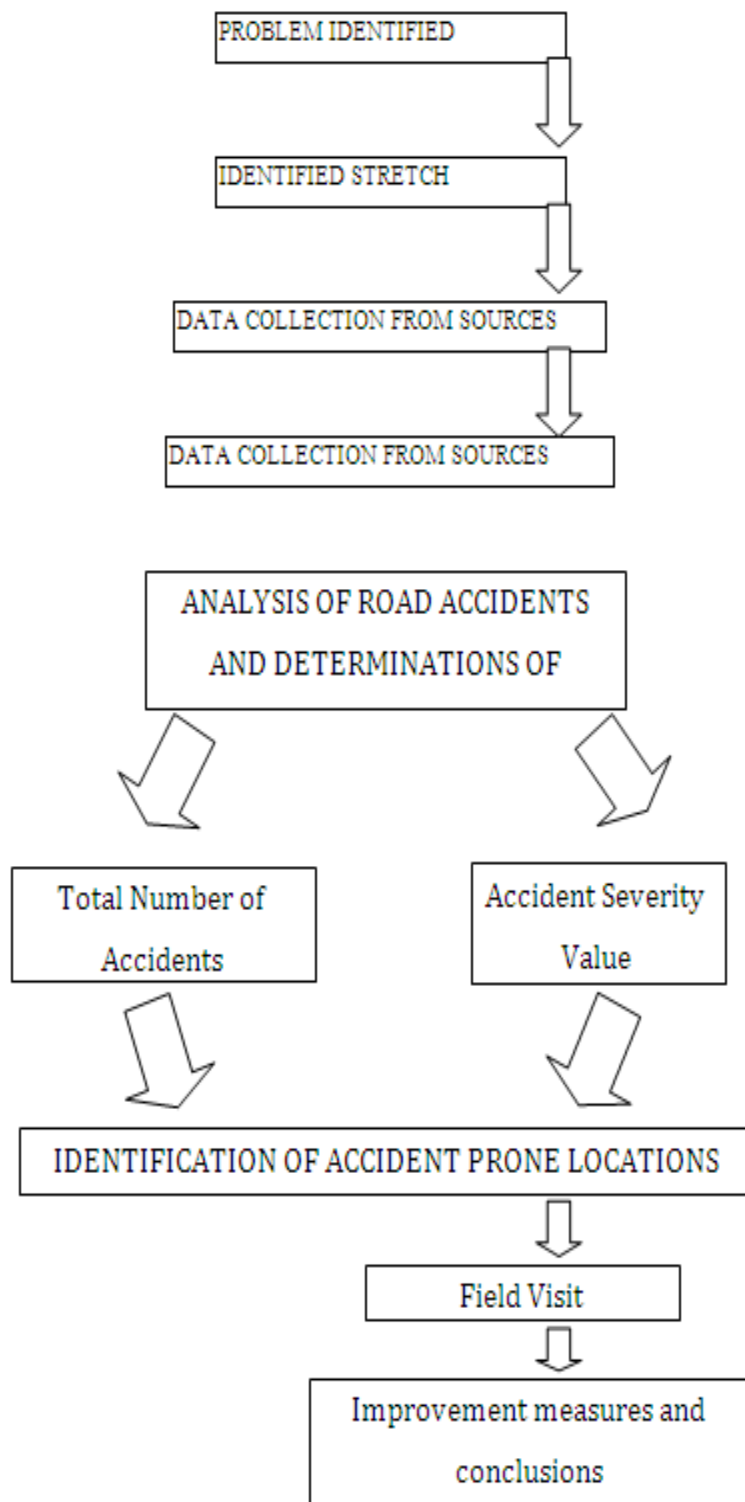


Fig. 2. Methology of the study

Data Collection

The accident data are collected from National Highway Authority of India (NHAI) and SOMA Isolux. NHAI is associated with maintenance and construction of NHs in the country. The SOMA Isolux Construction Company was engaged in widening project of NH-1 from Panipat to Jalandhar. The data collected is for four years from 2012 to 2015. The accident

data contain the information like date, time and location of accidents. The data also include type of accident (fatal/mirror or serious injury), number of persons dead/ injured, vehicles involved in accident, probable cause of accident and the jurisdiction of the police station. As the data collected is of four years duration, it consists of voluminous pages. Some sample tables of the data are given in. The data regarding physical features of the site, wherever required, is collected by conducting field visit to the sites of accidents.

Identification of Accident Prone Locations

For identifying accident prone locations, first Accident Severity Value (ASV) was calculated. ASV is calculated by assigning some values to different types of accidents based on injuries which occur during the road accidents. Generally four types of accidents are classified based on injury type and the values assigned to them in this study are given below-

| | | |
|---------------------------|---|----|
| • Fatal Accident | - | 10 |
| • Serious Injury Accident | - | 05 |
| • Minor Injury Accident | - | 03 |
| • Non Injury Accident | - | 02 |

After that ASV is calculated and a field visit is made to the site and photographs are taken of the locations or points which contribute or due to which accident can take place on the road stretches. The different stretches considered in the study are assigned ranking on the basis of above analysis made,

Improvement Measures

The study presented in the dissertation has been conducted to identify the accident prone locations on the selected stretch (66-116km) of NH-1. On the basis of the characteristics of the accidents and the field visits conducted for the study the improvements are suggested to reduce the accidents on the road.

ANALYSIS OF DATA AND CHARACTERISTICS OF ACCIDENTS

The road accidents can be analyzed on several characteristic. The following characteristics are used in this dissertation work:-

- According to cause of accident
- According to the nature of accident
- According to the type of injury
- According to the type of vehicles involved in accident
- According to time of accident

The analyses of accidents for the stretch of 66.0 km to 116.0 km of NH-1 for the year 2012 to 2015 has been done as per above characteristics in the following sections.

According To the Cause of Accident

A road accident can occur due to many reasons, it can be due to over speeding, drunken driving, vehicle out of control, fault of driver of motor vehicle/ driver of other vehicle or the accident can take place due to defect in condition of motor vehicle/ road condition. As accident rate can differ in day and night time, different analyses need to be done for day and night. The analysis for accidents according to cause has been presented in the form of pie charts. The accidents according to cause in day and night time are shown in Fig. 3.

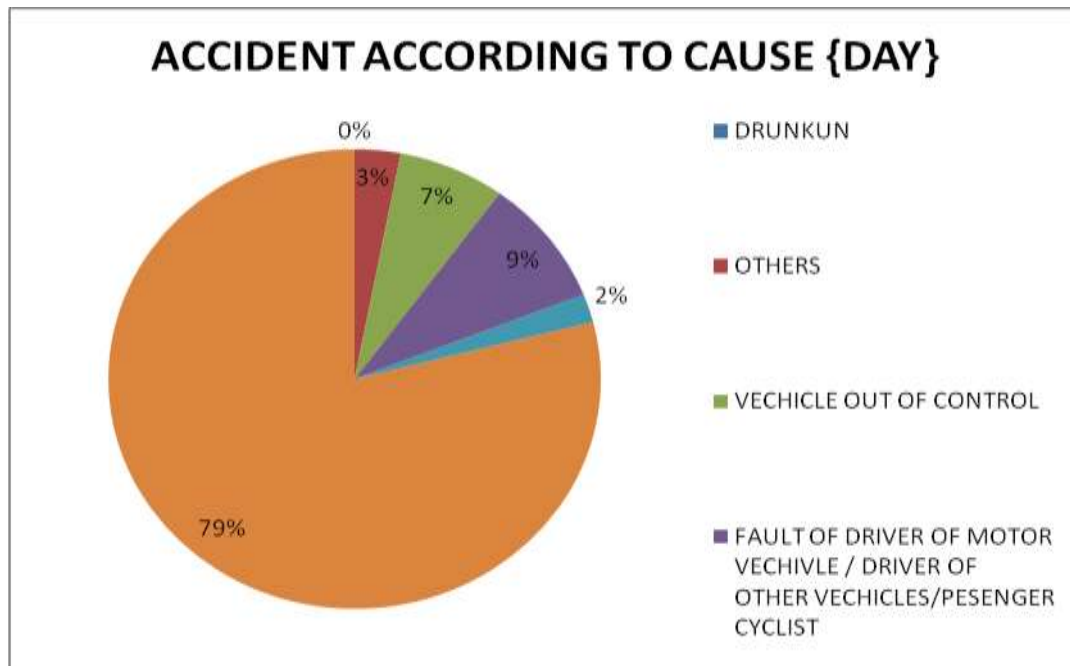


Fig. 3. Accident According to Cause (Day)

CONCLUSIONS

Highways form the main lifeline of a country's economy, trade and commerce. Without highways a nation cannot develop. As the country grows, the traffic and the number of accidents on highways also increase. The road accidents scenario in India is alarming. The study presented in the dissertation has been conducted to identify the accident prone locations on the selected stretch (66-116 km) of NH-1 and suggest the improvements. The following are the main conclusions drawn from the study:-

- The road accident data for the year 2012-15 for the stretch 66-116 km of NH-1 was collected from NHAI and Soma Isolux, the agency involved in widening project of NH-1. The data was analyzed to determine various characteristics of accidents.
- Over speeding/drivers fault (87-88%) is found to be the main cause of road accidents. About 2% of accidents are caused due to defective vehicles/ bad roads, about 6% of accidents are caused due to vehicles going out of control and 3% of accidents are caused due to other reasons which may include bad weather etc. There is no significant difference in the cause of accidents during day and night time.
- The collected data is found to be lacking in respect of making clear distinctions between various causes of accidents specially the drivers fault/over speeding/vehicle going out of control/drunken driving.
- Type of accidents include 46% as head on/rear end collision, 19% as hit and run type and about 14% as overturning type accidents. There is no significant difference in the type of accidents during day and night time.
- Maximum accidents fall in the category of non injury type (49%) followed by serious injury type (29%), minor injury type (17%) and fatal accidents (5%). Serious injury type accidents are found to be more than minor injury accidents. There is no significant difference in the type of injury during day and night time accidents.

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