

RESEARCH ARTICLE



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## ACCIDENT INVESTIGATIONS

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### ABSTRACT

India is a developing country and safety of road is still in a premature stage. Accident severity is increasing in increasing order due to increasing in vehicle population. Accident leads to disablement, death, damage to health and property, social suffering and general degradation of environment. The road accident situation in India is alarming. Records show that there is loss of 17 lives on an average every hour in our country. The high accident rate is largely attributed to the inadequacy of the highways and other main roads to meet the traffic demands, road user behavior, vehicle defects, poor road geometrics and visibility. Road accidents inflict heavy economic loss to the country. Road Safety is necessary to reduce accident involving both human and vehicles there by making the road more safe and user friendly to traffic.

NH-16 is one of the major connectivity from Kolkata to Chennai which caters to the need of transportation of light goods to heavy goods and passengers. Study area was undertaken on road NH-16 & NH 65 in and around Vijayawada. The study Stretch is a major connectivity to Airport and many more small scale industries based on automobiles. The no of accidents is rising up every year due to increasing vehicles population. The location in a roadway where the traffic accident often occurs is called a black spot. The accident data is analyzed using accident frequency and severity index method. The safety deficiencies were detected to minimize accidents and save the road users. The deficiencies along with the measures for further improvement have been presented in this article.

keywords: Accidents, injuries, fatalities, blackspots.

### INTRODUCTION

#### 1.1 General

Road crashes take away the right to life of 3,288 people every day. This is a global humanitarian disaster, and it is man-made. (Global Status Report on Road Safety 2015 by WHO)

Road safety is one of the most important problems in our society. Every year 1.2 million of people are killed and between 20 and 50 million people are injured in road accidents. If current trends continue road traffic accidents are predicted

to be third leading contributor to the global burden of Disease and injury by 2020 (Torregrosa et al., 2012)

India had earned the dubious distinction of having more number of fatalities due to road accidents in the world. Road safety is emerging as a major social concern around the world especially in India.

In other words, its ambit spans engineering aspects of both, roads and vehicles on one hand and the provision of health and hospital services for

trauma cases in post-crash scenario. Road accident in India is shown in Table 1.1

**Table 1.1 Road accident in India (2005-2015)**

Year	Number of Accidents		Number of Persons		Accident Severity*
	Total	Fatal	Killed	Injured	
2005	4,39,255	83,491 (19.0)	94,968	465,282	21.6
2006	4,60,920	93,917 (20.4)	105,749	496,481	22.9
2007	4,79,216	1,01,161 (21.1)	114,444	513,340	23.9
2008	4,84,704	1,06,591 (22.0)	119,860	523,193	24.7
2009	4,86,384	1,10,993 (22.8)	125,660	515,458	25.8
2010	4,99,628	1,19,558 (23.9)	134,513	527,512	26.9
2011	4,97,686	1,21,618 (24.4)	1,42,485	5,11,394	28.6
2012	4,90,383	1,23,093 (25.1)	1,38,258	5,09,667	28.2
2013	4,86,476	1,22,589(25.2)	1,37,572	4,94,893	28.3
2014	4,89,400	1,25,828(25.7)	1,39,671	4,93,474	28.5
2015	5,01,423	1,31,726(26.3)	1,46,133	5,00,279	29.1

Causes of accidents and their contribution are as follows by statistics of Road accidents in India (2015)

- Drivers fault- 82%
- Defects in road condition- 1.5%
- Defects in motor vehicle- 2.3%
- Fault of bicyclist- 0.7%
- Fault of pedestrian- 1.5%
- Weather condition- 1.2%
- All other causes- 10.8%

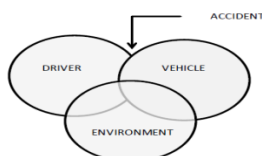
Road safety in India is the poorest in the world. Awareness among road users and safe design of road components is necessary to reduce accident involving both human and vehicles.

### 1.11 Road Safety & Various Causes of Accident

Road traffic safety refers to methods and measures for reducing the risk of a person using the road network being killed or seriously injured. The users of a road include pedestrians, cyclists, motorists, their passengers, and passengers of on-road public transport, mainly buses. Best practice road safety strategies focus upon the prevention of serious injury and death crashes in spite of human fallibility. Safe road design is now about providing a road environment which ensures vehicle speeds will be within the human tolerances for serious injury and death wherever conflict points exist.

The various causes of accidents may be due to three factors shown in fig 1.1

- Driver
- Vehicle
- Environment



**Fig.1.1 Causes of Accident**

### 1.2 Need and Objectives of Study

Expansion in the road network, surge in motorization and a rising population of a country

contribute towards increasing numbers of road accidents, numbers of registered motor vehicles in the country and the country's population have increased at a rapid rate. During the time period 2006-2015, the number of road accidents in the country decreased at a CAGR of 1.3 per cent. But, the number of road accident fatalities and the number of persons injured in road accidents in the country between 2006 and 2015 increased at 4.4 per cent and 0.7 per cent, respectively.

Very little work has been done in India to analyze accidents on two-lane roads.

The major objectives of the present work are listed below

- To study the annual, monthly, daily and hourly variation in accident rate on selected Stretch of urban two-lane road.
- To study the effect of traffic volume, density and capacity on accident rate on urban Two-lane road.
- To study the maintenance of road surface and shoulder on rate of accident.
- To develop an accident prediction model based on AADT, road condition, road side Features.

### 1.3 Outline of the Report

The work has been documented in the following manner. The first chapter gives overall understanding about the present accident scenario at national level. It also includes the importance of the two-lane roads, factors affecting accident and their contribution, and defines objectives of the study. Chapter two is comprised of review of literature. Site selection for data collection, methodology adopted for data collection are discussed in third chapter. Chapter four depicts traffic and surface properties data of Study stretch. Chapter five is comprised of accident investigation and Black Spot analysis. Significant conclusion drawn from study and further work are given in chapter six.

### REVIEW OF LITERATURE

Many factors may exhibit a measurable influence on driving behavior and traffic safety on two-lane highways (Bhuyan, 2003). These include, but are not limited to,

- Human factors such as improper judgment of road ahead and traffic, driving under the influence of alcohol or drugs, driver

education and experience, young driver, age and sex.

- Traffic factors like speed, volume, density, capacity, traffic mix and variation.
- Vehicle deficiencies, such as defective brake, headlight, tyres, steering and vehicle condition
- Road condition like slippery or skidding road surface, ravel, pot hole, ruts etc.
- Road design such as inadequate sight distances, shoulder width, no of lanes, improper curve design, improper lighting and traffic control devices.
- Weather condition like fog, heavy rainfall, dust, snow etc.
- Other causes such as enforcement, incorrect sign and signals, service station, badly located advertisement, stray animals etc.

## 2.1 Driver characteristics

### 2.1.1 Age, Gender and Personality

**Hassan and Aty (2012)** studied 680 young driver behavior involvement in traffic crash in Florida. The result revealed that aggressive violation, in-vehicle distraction and demographic characteristics were the significant factors affecting young drivers involvement in crashes at the age of 16-17. In-vehicle distraction, attitude towards speeding and demographics characteristics were the significant factors effect young drivers crash risk at the age of 18-24.

**Constantinou et al.,(2011)** found that young novice driver(<25 yrs.) are in high risk related to traffic offence. The study was based on gender, sex, age and personality.

**Chandraratna et al.,(2006)** studied licensed driver involvement in a crash. Using logistic regression it was found very young and old male drivers are responsible due to both speeding and non-speeding

### 2.1.2 Perception

**Sagberg and Bjornskau (2006)** conducted a video-based hazard perception test and concluded that male novice driver had relatively longer reaction time and initial risk involved.

**Deery (1999)** studied about hazard and risk perception among young novice driver and concluded that hazard and risk perception are fundamental skill that young drivers need to develop.

### 2.1.3 Alcohol and Drugs

The leading cause of traumatic death is motor vehicle accidents, falling accidents and blunt trauma. The use of drugs such as alcohol or illicit such as opium, cocaine increases the risk of trauma by traffic collision. Other drugs such as benzodiazepines increase the risk of trauma in elderly people.

### Signs and Signals

**Chen et al., (2011)** developed traffic safety model using regression in New York city. The result shows that signal related countermeasure that are designed to reduce conflict are split phase, timing, signal installation, all pedestrian phase and increasing pedestrian crossing reduces crashes. Traffic calming measures including road diets are also found to be significant in safety benefits. Countermeasures that are designed to alert driver cognitive attention such as high visibility crosswalks and posted speed limit reduction signs appear to have lesser effect.

### 2.3.5 Fog and Smoke

**Mohmed et al., (2011)** studied on crash related to visibility obstruction due to fog and smoke in Florida. It was found that fog smoke related crashes are more likely to occur at night without street lighting leading to more severe injuries. Head-on and Rear-end are common crashes in terms of crash risk and severity. These crashes are more prevalent on high speed road, undivided roads, roads with no sidewalks and two lane rural roads.

### 2.3.6 Volume

**Hiselius(2004)** studied the accident frequency and homogeneous flow of vehicle. It was found that the accident rate decreases when the traffic flow is homogenous in nature. For Lorries there was a decrease in no of accident and for car the accident rate was constant.

**Golob et al.,(2004)** made a relation between traffic flow and traffic accident. It was from the study that means volume and median speed affect safety. Lane- change crashes tend to occur when there is the highest variability in speed. While rear end crashes tend to cluster where there is a lower variation in speed. There suggestion was to improve traffic engineering and implementation of ITS

(Intelligent Transportation System) and enhance driver education.

**Kurlaftis and Golias (2002)** studied between road geometric characteristics and accident rate. They found AADT, lane width, Serviceability index, friction, pavement type, access control are the main factor contributing to accidents. Relative importance was 100% for AADT, 72% for lane width, 59% for serviceability, 32% for friction, 30% for pavement type and 14% for rural two-lane road.

Good LOS tends to occur at night when volumes are low. Single vehicle crash rate is higher because more drivers are drowsy or less alert. When traffic volume is heaviest multi-vehicle crashes are likely to occur (Ivan et al., 2004).

**Caliendo et al.,(2006)** fitted a Poisson and negative binomial model using accident as dependent variable and length, curvature, sight distance, side friction coefficient, longitudinal slope, presence of junction as independent variable.

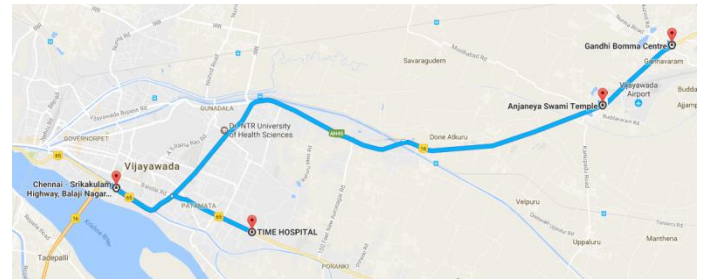
**DATA COLLECTION**

The only information available for accident studies is the FIR (First Information Report) lodged in the police stations. The data from these records of last ten years (2006-2015) were extracted from the FIR record filed under IPCno.279/337/338/304(A). Vehicles those involved in accidents and reported in the F.I.R. The categories of vehicles include tempo, auto, mini-truck, minibus, Tata indica, Tata-407, trecker, motor cycle, tanker, tailor(articulated vehicle), truck and bus.

**3.1 Road selected for study**

Two-lane roads from Gannavaram to Krishnalanka on NH-16 & NH-65 was chosen for this study. The following stretches were selected for data collection. The study area is shown in fig.3.1

- Gandhi Bomma Centre Gannavaram
- AnjaneyaSwamy temple kesarapalli
- Netaji Bridge Centre, Krishnalanka
- Times Hospital, Autonagar



**Fig 3.1 Study area Source: Google Map**

**3.2 Data collected from Police Records**

The accident data was collected on two-lane highways from three police stations. The police stations have their own FIR records of several years. The data from these records of last ten years were extracted from the FIRs filled under IPC NO.279/337/338/304 (A).

Accident details during 2006-2015 on this road section are shown in Table 3.2. Accident data were collected year wise from each police station records then sorted out month wise. Average yearly variation of accidents stretch wise during 2006-2015

**Table 3.1 Details of accidents**

Year	Fatal	Major Injury	Minor Injury
2006	15	16	37
2007	11	35	50
2008	16	25	45
2009	20	32	39
2010	21	34	40
2011	18	41	84
2012	4	24	61
2013	13	32	81
2014	18	34	84
2015	11	30	58
<b>Total</b>	<b>147</b>	<b>303</b>	<b>579</b>

**Table 3.2 Details of accident stretch wise**

Year	Fatal	Major	Minor
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	S1	S2	S3	S4	Total	S1	S2	S3	S4	Total	S1	S2	S3	S4	Total
2006	9	3	0	6	15	4	5	1	6	16	15	8	2	12	37
2007	6	3	0	2	11	10	18	1	6	35	10	26	2	12	50
2008	3	1	1	11	16	5	13	0	7	25	11	24	0	10	45
2009	9	4	1	6	20	7	17	2	6	32	10	20	2	7	39
2010	10	3	1	7	21	11	11	2	10	34	14	12	1	13	40
2011	6	4	1	7	18	23	3	2	13	41	33	15	7	29	84
2012	1	2	0	1	4	9	10	1	4	24	14	23	2	22	61
2013	6	2	3	2	13	18	7	3	4	32	22	18	5	36	81
2014	8	3	0	7	18	25		9	0	34	36	18	2	28	84
2015	2	3	1	5	11	10	6	1	13	30	16	16	3	23	58
Total	60	28	8	54	147	122	90	22	69	303	181	180	26	192	579

### 3.3 Data collected from P.W.D Records

P.W.D (Public Works Department) records are the main source of details of road. The proforma used to record these details is shown in Table 3.4

Table 3.3 Proforma for details of road section

Width of Carriage way in Mt	7
Width of Formation in Mt	12
Width of Land in Mt	45

In addition to the above, traffic volume data were also obtained from PWD records. These are shown in Table 3.5

Table 3.4 Traffic volume data

YEAR	ADT	AV PCU PER DAY	PCU/HR
2002	14533	24656.11	1027.338075
2003	12584	21501.46	895.8942667
2004	12679	21655.23	902.301225
2005	10484	18102.4	754.2667667
2006	12700	21689.22	903.7175

## ANALYSIS OF DATA AND DISCUSSION

### 4.1 Accident Rate and Frequency

Accident Rate = M/L Where,

M = Total no of Accidents of a stretch

L = Length of Road

Table 4.1 Accident Rate

Name of Stretch	Length	No of accidents in a year	
		Sum of 10 Years	Accident Rate
Gandhi Bomma Centre, Gannavaram	5 km	228	45.6
AnjaneyaSwamy Temple, Kesarapalli	5 km	208	41.6
Netaji Bridge, Krishna Lanka	5 km	26	5.2
Times Hospital, Autonagar	5 km	239	47.8

Table 4.2 Frequency of Accident

Distance of origin	No of accidents (2006-2015)	Frequency	Total frequency
0-5	228	32.5	32.5
6-10	208	29.6	62.1
11-15	26	3.7	65.8
16-20	239	34.1	100
Total	701	100	

From the Table 4.1 and 4.2 it is observed that frequency and rate of accident is more for stretch-4 followed by stretch-1,2,3 respectively

## Conclusions

- [1]. The available literatures on accident analysis indicate that 82 percent of road accidents in India are caused due to driver's error.
- [2]. Heavy vehicles like truck are involved in maximum no of accident on two-lane roads. It is estimated that fatalities 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 user.
- [3]. Stretch IV has the highest no of accidents which accounts for 34.1% of total accidents .The accident rate can be decreased by road side clearance, proper maintenance of shoulders, lighting, and junction improvement. Speed limit should be brought down by providing humps near accident spots. Sight distance near curves should be obstruction free.
- [4]. Stretch I have the second highest no of accidents accounts for 32.5% of total accident. The Accident rate can be reduced by providing signalized junction, junction improvement, and shoulder Clearance, installation of humps, shifting of poles,

removal of trees near the edge of pavement etc.

- [5]. No of accidents in stretch III accounts for 29.6% of total accidents. The accident rate can be Minimized by clearing-off shoulders, reducing speed limit, junction improvement, providing Signals on the median, shifting structures on the shoulder.
- [6]. Stretch II has minimum no of accidents accounts for 3.7% of total accidents. Speed limit reduction near junction should be reduced to prevent accidents.

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