

Effect on Road Safety by Roadway Condition, Traffic and Manmade Features

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Abstract- India is a leading developing country and road safety is still in a premature stage. Accident severity is growing in rapid order due to increasing in vehicle population. Accident leads to disablement, damage to health and property, death of human or animals' social suffering and general degradation of environment. The road accident situation in India is vibrating. Records from year 2014 show that there is one death at every 3.75 minutes because of road accidents. The high accident rate is largely considered to the inadequacy of the highways and other main roads to meet the traffic demands, road user behaviour, vehicular defects, poor road geometrics and inadequate visibility. Road accidents results in heavy wealth loss to the country. Road Safety is necessary to reduce accident involving both human element and vehicles there by developing the road safer and user friendly to traffic.

In Madhya Pradesh state area around our district headquarter Khargone roads has major connectivity and there are not big industries but these road carries large numbers of passengers to industrial area of Indore and Gujarat.

Keywords – ACCIDENT, DRIVER, ROAD SAFETY, TRAFFIC DENSITY, TRAFFIC VOLUME

I. INTRODUCTION

Road accident takes away the life of 3398 peoples every day. This is global humanitarian disaster, and it is man-made (Global Road Safety Partnership Annual Report (GRSPAR-2014)).

Road safety is most important problem in our society. By Year -2014 rate of death in road accident is 2.24 million per year and about 50 million peoples were injured every year. About 50 % of all road death are among pedestrian, cyclist or motorcycle riders. in 2014 Indian roads were at their dead list claiming more than 16 lives every hour on average. Over 1.41 lakh people died in crashes, 3% more than the number of fatalities in 2013.

If the current trends of road accident continue than it is predicted to be third leading contributor to global burden of diseases and injury by 2020.now traffic accident are at 8th position globally. India having more number of fatalities recorded by road accidents in the world had earned the dubious distinction. Road safety is emerging as major social concern around the world especially in India. Accidents are somewhat a drain on the national economy and may lead to disablement, damage to the health and property, death, social suffering and general environmental degradation.

To minimize the number of crashes by any kind and a road safety is the severity expected to takes place on the entity during a specific period. Accidents and the fatalities on road are also the result of reciprocity of a number of factors. Road users in India are heterogeneous in nature, ranging from pedestrians, cycles, rickshaws, animal- driven carts, hand carts ,bullock carts and tractor trolleys, to various categories of two wheelers or three wheelers, cars, buses, trucks, and multi-axle commercial vehicles etc., The vehicle population has been steadily increasing because of changes in lifestyle of society. There are development in vehicle population with limited road space used by a various variety of vehicles has increase the need and urgency for a well thought-out policy on the issue of road safety. In India growth of vehicle population is directly proportional to the rate of accident.

Road accidents are a human tragedy, which is directly related to high human suffering. They impose a huge socio-economic cost in terms of injuries, untimely deaths, and loss of potential income. The ramifications of road accidents can be colossal and negative impact of road accident is felt not only on individuals, their health and welfare, as well as on the economy. Consequently, it has become an issue of national concern. Road Safety is a multi-sectored and multi-dimensional issue. It includes the development as well as management of road infrastructure, provision of safer vehicles, urban land use planning, legislation and law enforcement, provision of health and hospital services, child safety, mobility planning, etc In other words, its having spans engineering aspects

of both, roads and vehicles on one hand and the provision of health and in post-crash scenario hospital services should available for trauma cases

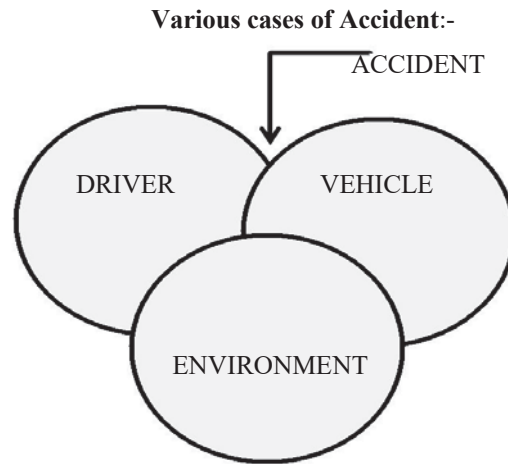


Table 1.0- Various Causes of Road Accident

DRIVER RELATED	
Alcohol & drugs	Sickness
Unsafe speed	Cell phones Use
Drowsing or Fatigue	Distraction
Improper passing or turning	Disregard Traffic controls
Non Use of Restraint	Eye problem
VEHICLE RALATED	
Over Loading	Steering Defect
Brake Defect	Tire Failure
Light Defect	Improper Wheel Alignment
ENVIRONMENT –RELATED	
Road Side Hazard	Vision –Obstruction
Ruts/ Shoulder Defect	Improper Traffic Control
Debris or Garbage on The Road	Improper / Nonworking traffic control
Fixed Object	Glare
Water ponding	Smoke or Fog

Table 2.0 - Types of Accident, Position of Vehicles and Consequences

Type of Accident	Position of Vehicle
Head On	Vehicle From Opposite Direction
Rear End	Vehicle In Same Side
Angle and Turning	Vehicle from Adjacent Direction (Intersection)
Parking or Backing	Overturning
Roll Over	On path
Run-off Road	Off Path
Moped Bike	On Curve Turning

Fixed Object (Trees & Poles)	Off Path Curve
Pedestrian	Any Position
Animal	Any Position
Consequences	
Property Loss	Contusion (Head Injury Without Skin Unbroken)
Spot Death	Fracture
Loss of Consciousness	Freezing
Amputation (Loss of One or More Limb)	Trauma
Head / Neck Injury	Laceration(Injury Involving Cut)
Abrasion	Vision/Speech/Hearing Impairment
Sprain (Ankle/Joint Twist)	Chest Pain/Respiratory Impairment

II. OBJECTIVES OF THE PROPOSED STUDY

Expansion in the road network, growth in motorization and a rising population of a country contribute towards increasing numbers of road accidents, road numbers of registered motor vehicles in the country and the country's population have rising at a compound annual growth rate (CAGR) of 3.4 per cent, 9.9 per cent and 1.6 per cent, respectively, during the decade 2002 to 2011. During the same period, the number of road accidents in the country increased at a CAGR of 2.1 per cent. also the number of road accident fatalities and the number of persons injured in road accidents in the country between 2002 and 2012 increased by 5.8 per cent and 2.4 per cent, respectively. Very little work has been done in India to analyze accidents on two-lane roads.

The main objectives of the study work are:-

- (i) To study the annual, monthly, daily and hourly variation in accident rate on selected Stretch of urban two-lane road
- (ii) To study the effect of traffic volume, traffic density and traffic capacity of roadway on accident rate on urban Two-lane road.
- (iii) To study the maintenance of road surface and cross-sectional element on rate of accident.
- (iv) To develop an accident prediction model based on AADT, road condition, road side Features.

III. LITERATURE REVIEW

Many factors may exhibit a measurable influence on driving behaviour and traffic safety on two-lane highways; these include, but are not limited to

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

A- *Driver Characteristics*

- (i) AGE, GENDER AND PERSONALITY

at Hassan and Aty (2012) studied 680 young driver behaviour 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 demographic 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.

(ii) 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.

(iii) ALCOHOL AND DRUGS

In 2012 Shivkumar and Krishnaraj, Alcohol causes deterioration of driving skills even at low levels and the probability of accidents increases with rising blood alcohol levels. Alcohol needs no digestion and is absorbed rapidly into the blood stream; about 10% to 15% of alcohol users develop alcohol dependence and become alcoholics. After drinking, the judgment power of the driver gets impaired which is a threat to road safety. Due to its effects, driver tends to take more risks, becomes more aggressive and takes a longer reaction time. The relative probability of causing accidents increases with the rising blood alcohol levels keeping road safety at stake.).

(iv) SPEED

Aarts and Schagen (2006) studied relationship between speed and risk of a crash. The conclusion was when speed increases crash increases.

Lee et al.,(2006) developed a real-time crash prediction model by taking total travel time and Crash potential reduction. The study result indicated the variable speed limit could reduce crash potential by 5-17%. Prabhakhar et al.,(2011) analyzed that imparting training among drivers reduces speeding behavior.

Houquani et al.,(2012) investigated hospitalized drivers who were involved in road traffic collision between April 2006 to October 2007 in UAE. A logistic model was fitted using the variables like drivers demographic data, time, date, location, mechanism of collision, speed at collision and sleepiness. The conclusion was sleep is an important factor to road traffic collision. Further they advised to discontinue driving on highways feeling sleepy especially during lunar month of Ramadan. They used speed as dependent variable and distance as function in ANOVA.

(v) FATIGUE

Blower et al.,(1998) observed that 20% of all fatal crash and 10% of all injuries involving truck occurred between 12AM to 6AM, the peak period for driver fatigue.

(vi) CELL PHONES

Tornros and Boiling (2005) conducted an experiment with 48 drivers by covering a distance of 15 Km on a rural two-lane road. They concluded that driving performance reduced by dialling hand held phone and speed decreased with hands free phone. Reaction time to warning sign at road side decrease for hand held phone user

B- VEHICULAR CHARACTERISTICS

Vehicle plays an important role in a crash. This may be due to defective wheel alignment, tyre bursting, brake failure, overloading, one or two head light defect, back light defect, indicator defect, steering defect.

(i) TYRE DEFECT

Tyre defect may be due to under or over inflation, overloading, ageing behavior, external impact due to pothole, debris, nail etc. Tires up to six years from the date of manufacturer should be changed including spare tires (Osueke and Okorie,2012)

(ii) BRAKE FAILURE

Accident imposes high intangible cost (pain, grief and suffering). Vehicle accident can be fatal and constitute a high economic burden. Oduro (2012) surveyed a no of accident and found that 83% brake failure result in accident. Brake ineffectiveness is due to vehicle overloading, uneven tyre pressure, incorrect brake adjustment, air in

braking system, automatic brake adjuster not working, brake fluid on lining .Brake failure is due to broken pipe, low brake fluid level, cracked brake drum, brakes overheating.

(iii) OVERLOADING

One overloaded axle causes damage equivalent to 22 legally loaded axles. Overloaded vehicle increases maintenance cost and hazard (Osama et al., 2012) Overloading truck reduces braking ability of truck, stability of truck, unexpected defect of road and damage of vehicle. Fatal crashes involving overloaded large truck increases by 52% (Chan, 2008)

C- ENVIRONMENT CHARACTERISTICS

(i) ROAD ELEMENTS

Roadway design is one of the most significant factors that affect driving behavior and perceived safety. Bassat and Shinar (2011) studied combined effect of roadway design element such as shoulder width, guardrail and roadway geometry (curvature) by taking objective driving measures (speed and lane position) and subjective measure(perceived safe driving speed and estimated road safety) into account. They found the shoulder width had a significant effect on actual speed and lane position but when a guard rail had a significant effect on perceived safe driving.

Zegeer et al.,(1991) studied the relationship between lane or shoulder widening and accident reduction rate. He concluded that 21% reduction in accident can be achieved by widening the lane 4 feet per side

(ii) SURFACE DISCONTINUITY

Forest et al.,(2009) established a relationship between accident data and surface discontinuities(pavement edge drops, pavement ruts, potholes etc.)

(iii) ROAD SIDE FEATURES

Somchainuek et al., (2013) investigated road side safety on Thai NH. The result showed that speeding vehicles were involved in roadside crashes accounted for about 70% of the total crashes and 30% of road side crashes were due to road side trees. Jinsun and Doohee (2003) established a relationship between accident severity and roadside features.

(iv) 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.

(v) 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.

(vi) 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 an 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, 35.6% 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.

Zhuanglin(2009) fitted a multiple logistic relationship between accident severity and a series of potential factors like-Cross section, pavement type, accident location, traffic environment, traffic environment, lighting. He found that major accident was on expressway as compared to Arterial Street.

IV. PROPOSED METHODOLOGY

Selected road for the Study:-

- (i) Khargone To Kasrawad Road (35.6 Km.)
- (ii) Khargone to Sanawad road (58.4 Km.)
- (iii) Khargone to Julwaniya road (48 Km.)
- (iv) Khargone to Bhagwanpura (22.8 Km)
- (v) Khargone to bhikangaon (40.1 Km)

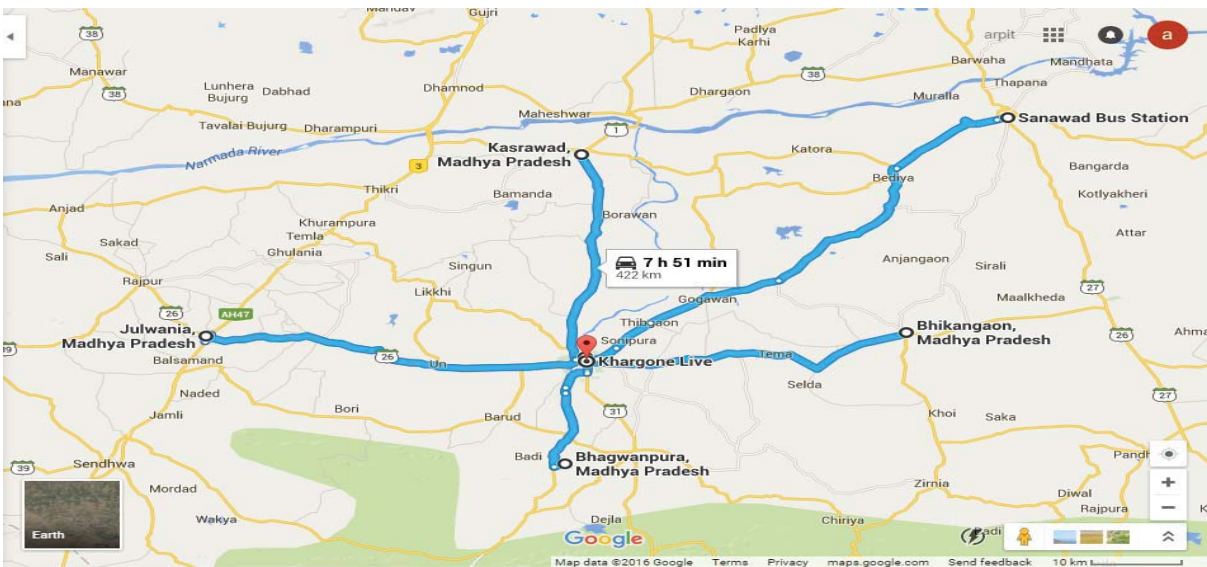


Fig. :- Study Area , Source:- Google Map

A- Collection Of Data From Police Record

The application is given to the S.P. KHARGONE regarding the collection of data of accident from S.P. office Khargone.

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).

Police Station	Area Covered Under The Police Station
Khargone	Near Khargone

Kasrawad	Kasrawad To Maingaon
Gogawan	Jetapur To Rodiya
Bediya	Rodiya To Satajana
Bhagwanpura	Bhagwanpura ToKhargone
Segaon	Khargone To Segaon
Sanawad	Satajna To Sanawad
Maingaon	Khargone Maingaon
Bhikangaon	Khargone To Bhikangaon

B- Collections Of Data From P.W.D. (PUBLIC WORK DEPARTMENT)

Width of carriage way in Mt.	7
Width of formation in Mt.	12
Width of Land in Mt.	45

V. EXPECTED OUTCOME

Following Outcome are expected:-

- (i) Determination of accident rate and frequency of accident
- (ii) Annual variation in accidents.
- (iii) Monthly Variation in Accidents.
- (iv) Hourly variation in accidents.
- (v) Number, Category Of Vehicle Involve In Fatalities.
- (vi) To establish Relation between the traffic volume and accident.
- (vii) Identification of road surface conditions along the black spot.
- (viii) To compare trend of accident, injuries and fatalities. Identification of road side feature involve in accident.

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