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Study of Accidents on Highway Under Mix Traffic Conditions in Hilly areas

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***Abstract*- The road accident is a matter of concern in the developing countries and it is increasing with the increase of vehicle. The road accidents increased from 5% to 35% in a decade of which 70% of accidents are due to drunken driving. This is terrifying issue. The accident prone areas are needed to be identified . The accidents are identified and their analysis is done to check the pattern of accidents so proper remedies should be given to overcome hazards.**

***Keywords:*— accidents, terrifying issue, analysis, remedies.**

I. INTRODUCTION

The road transport plays an important role in the development of country economy. It enables the country gross production. The road network is the important mode of communication. India had a poor network at the time of independence. Between 1947 and 1988, India witnessed no new projects, and the roads were poorly maintained. The roads were single lane and mostly unpaved. In 1988, National Highway Authority of India was established and came into existence on 15 June, 1989. Since 1995, the authority has privatised road network development in India, and by December 2016, India had a highway network of 100,087 km of which 22,900 km of highway is paved.

India has less than 0.07 km of highways per thousand people and 3.8 km of roads per 1000 people which include paved and unpaved roads. This is one of the lowest road densities. United State has 21 km of road per 1000 people, while France has 15 km per 1000 people. The first evidence of roads in India dates around 2800 B.C from the cities of Indus Valley Civilisation. The kings of ancient India used to construct roads to connect cities.

II. TRAFFIC COLLISIONS IN HIMACHAL PRADESH

The rate of traffic collision in India is among the countries having highest number of collisions. The number of deaths per year due to traffic collisions in India is about 135,000. The accident rate in nation capital is 40 times higher than the capital of United Kingdom.
In Himachal Pradesh over a last decade 29,555 accidents occurs. In past five years the state witnessed 15,047 accidents of which 5,612 persons are killed and 26,580 injured. According to police data the average accidents taking place are 3,000 in which 1,000 persons are killed and 3,000 injured. The state of Himachal Pradesh witnessed 3,934 accidents in 2011, 4,448 accidents in 2012, 4,862 in 2013, and a big rise after 2013. In 2014 state witnessed 6,764 accidents.

The total number of accidents occurs on HP roads are as:
Overtaking: - 14102493510
Over speeding: - 12642350619
Drunk driving: - 6812826
Defect in motor vehicle: - 10127282
Animal crossing: - 7103
Weather conditions (Poor visibility/ other causes): - 366610
Lack of road infrastructure: - 322
Vehicle park on road shoulders: - 131
Unknown causes: - 4110
Other causes: - 431750150
The accidents severity in Himachal Pradesh is 36.4%. Mostly the road accidents in Himachal Pradesh occur in between
3pm – 9 pm.

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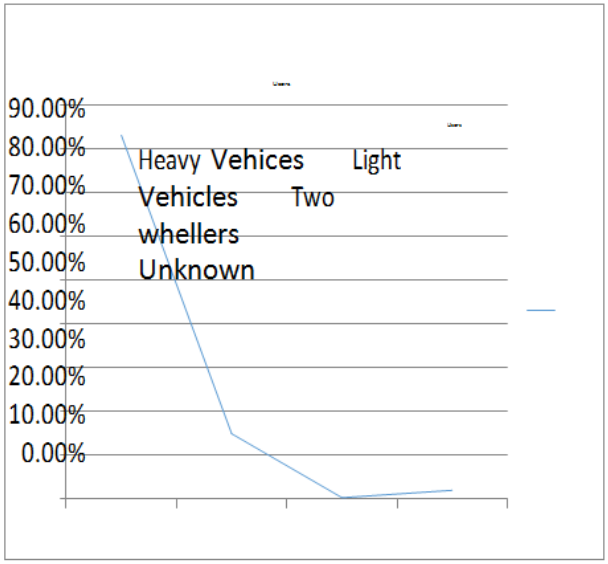
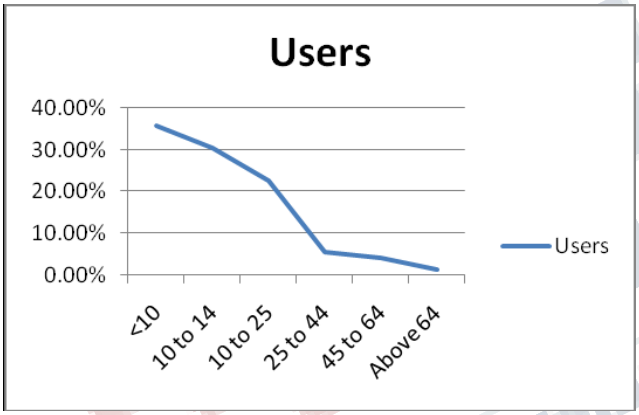
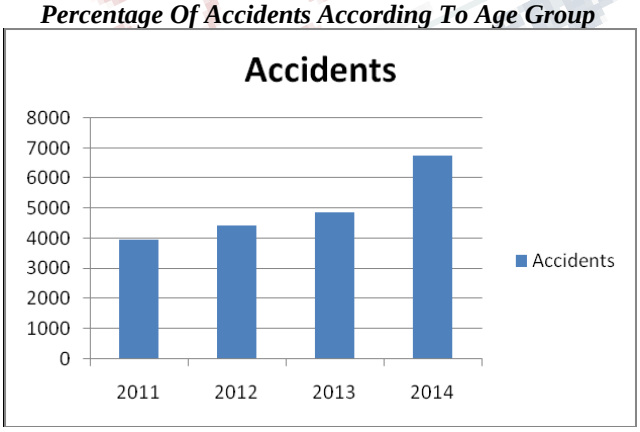


Percentage Of Accidents According To Vehicles



Percentage Of Accidents According To Age Group



Accidents in Himachal Pradesh

III. MAJOR ACCIDENTS IN HIMACHAL PRADESH IN RECENT YEARS

Date	Place Of Accident	Destination	Deaths/Injured	Status
2 September, 2009	Bilaspur	Sundernagar to Mandi	32 deaths, 12 injured	Bus rolled down to George
11 August, 2012	Rajera, 8 km from district headquarter of Chamba	Chamba to Dulera	52 deaths, 46 injured	Driver lost control over the vehicle tyre burst and fell into 250 feet deep George
11 September, 2012	District Kangra	Palampur to Asha Puri	34 deaths, 5 injured	Bus was found torn apart and more than 20 bodies were scattered on steep slippery slopes accessible only through ropes
11 October, 2012	Sholtu, India-Tibet NH	Rekong Peo in tribal Kinnaur to Kaylong via Rampur-Luri, Kinnaur	11 deaths, 27 serious	
11 April, 2013	Beas River 25 km from Manali	Delhi to Manali	1 death, 8 injured	Driver lost control over the vehicle, 1 death on spot
10 May, 2013	Beas River near Kullu		40 deaths	Talking on Phone
16 June, 2014	Sirmaur district	Tourist Bus way to Renuka ji to Paonta Sahib	11 deaths, 45 injured	Met an accident near Madhar Ghat some 15 km from Renuka ji
21 August, 2014	Bus fell into a George on the bank of BaspaRiver in Kinnaur district	Sangla Valley to Kalpa	23 deaths, 20 injured	Skidded off the road and rolled down into the George
23 December, 2014	Near Khadar Ghat Basanthpur region	Shimla to Saver a Khand in Sunni area	20 deaths	Buss fell into a narrow George 400m depth
24 February, 2015	Near Khadar Ghat Basanthpur region	Shimla to Saver a Khand in Sunni area	20 deaths	Buss fell down into a deep George due to continuous rainfall from a week which made the road slippery
25 March, 2015	Taragarh	A Tibetan school children van met accident at Taragarh on Palampur-Baijnath Highway	12 injured	
10 July, 2015	Dalah, Kullu district	Jeory to Shimla	6 deaths, 25 injured	Driver lost control over the vehicle while negotiating a curve
23 July, 2015	Plunged into turbulent Parvati River at Sarsari district Kullu	Private bus from Punjab on its way to Anandpur Sahib to Manikaran	8 deaths, 12 injured, 29 feared to have been washed away	
1 September, 2015	Napatha on India-Tibet NH	Rekong Peo to Rampur	18 deaths, 12 injured	Bus broke into pieces and rescuers struggled to extricate the bodies trapped in the vehicle
4 October, 2015	Shilonbagh	Shilonbagh on the Shimla-Chail Road	14 injured	Skidding
8 May, 2016	Near Jogindernagar	Dharamshala to Rekong Peo	14 deaths, 40 injured	Driver was allowing another vehicle coming from the opposite side to cross
29 August, 2016	Jawalpur	Bus coming from Kullu town	30 injured	Overcrowded, driver appeared to have lost control over the vehicle negotiating a curve
5 November, 2016	Plunged into Beas river Vindravani, Mandi district	Private bus travelling from Mandi to Kullu	18 deaths, 24 injured	Trying to avoid a motorcyclist and fell into Beas

IV. ACCIDENTS DISTRIBUTION

Unsafe Driving

The various reasons of unsafe driving are time pressure, tired, demanding tasks. Most common case seen

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is 'High speed in worst weather'. The safety steps needed to be taken are as

- Trips are planned according to weather and according to road condition.
- Planning should be such that drivers get proper rest time.
- Timely instructions and training required to create awareness.
- Proper load distribution and cargo should be properly tied.

Carrying Dangerous Substances

Often truck drivers carry such substances which are hazardous like chemicals, gases and various other flammable things and have lot of risks in transporting from one place to other.

Road conditions

In hilly areas mountain roads poses challenge for drivers. The major problem is overheating of brakes by continuously use. The preventive measures include

1. Proper training of drivers.
2. Proper maintenance and regular inspection of vehicles.
3. Tight schedules should be avoided.

Weather Conditions

The risk of accident increases while travelling in bad weather conditions. Weather conditions like rain and snow make the road slippery. Fog lowers the visibility. The various factors include rain droplet size, snow, fog, light, high wind etc. Proper attention is required to drive in those conditions.

Vehicle condition

The various defects in tyres, brakes and lights cause lot of accidents. The improper working of safety lights also become cause of accident. Timely inspection and maintenance is required.

Loss of control

Numerous accidents occur in heavy vehicles due to loss of control. The reasons behind loss of control are driving a bend, while turning or while avoiding another vehicle.

Alcohol and drug use

The use of alcohol while driving is the problem of concern. About 70% of the road accidents in India occur due to drunk driving. One of the fact is driver of heavy vehicles such as trucks doesn't have time to consult doctor. They sometimes use medicines which affect their driving capability and some medicines reduce their concentration, alertness and reaction time.

Accident Factors

- ***Traffic Flow***

In India the traffic flow is of mixed type. Various light vehicles, heavy vehicles, two wheelers, autos are running on the roads. With the increase in population, vehicles are also increasing hence increasing traffic density.

- ***Speed***

Speed is one of the major reasons of accident. Design speed is the safe speed at which driver control the vehicle safely. Different highways have different design speed and in hilly roads the design speed of roads is lesser as roads are singled lane not properly paved. Due to the increased speed the driver also gets less reaction time, hence causing the accident.

- ***Segment length***

The segment length of a specific region of highway comes under jurisdiction of their respective police station. Segments have curves and stretches. At curved section the visibility is limited.

- ***Heavy vehicles***

Buses, trucks, lorries comes under heavy vehicles. Due to increase in population the demands also increases and the roads are not properly widened. About 61% of road accident occurs due to heavy vehicles.

- ***Overloading***

About 25% of accidents caused due to overloading of which most involved vehicle are trucks.

- ***Unbalanced Load***

According to Motor Carrier Safety Administration, each truck have specified load carrying capacity but the driver doesn't follow rules and think their trucks are safely loaded and this unbalanced load proves deadly. To check this some steps are needed to be taken

Modelling of road accidents

1. Models based on geometry

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• Shankar et al (1994) studied various effects of environmental factors and road geometries. They studied and analysis various road factors such as horizontal and vertical alignments, weather affects using negative binomial model. They found out rain plays a significant role in the occurrence of accidents.

• Vogt and Bared (1998) takes the lane width, shoulder width, degree of curve, road sign, average daily traffic and speed limit at intersection. They formulated a model for intersections and two lane road using Poisson and negative binomial model. They found out the accidents at right turn lanes increases.

• Seunglim Kang et al (2005) develop a traffic accident analysis model based on various accident risk factors. The risk factors include curve length, curve radius and super elevation.

Traffic Accident Risk Model

Y=3.368+60163CLR+3.74RR+2.566GR

Where, Y= traffic accident rate, accident/ vehicle-km
CLR= accident risk due to curve radius and curve length (CLR>0)
RR= accident risk due to length of tangent (RR>0)
GR= accident due to vertical grade (GR>0)

• Wong et al (2007) gave negative binomial regression and Poisson model to show the influence of traffic flow, road design, and environmental factors and found out the road factors, degree of curve and stops were the main reasons for the traffic volume and had effect on crash risk.

• Quddus et al (2010) gives the relationship between the severities and traffic congestion by response models. The various factors taken into consideration are crash data, congestion in traffic flow, speed, road geometry

1. Models based on traffic flow and access road

• Girma Berhanu (2004) relates the accident with the traffic flow variables and road geometry by Poisson and negative binomial regression models. They found out 30% of the accidents are caused by the vehicles on parked on street. They also found that the accident rates increases in the areas having undivided highways.

• Mohamadreza Banihashemi et al (2005) studied on a 4.2 km of two lane rural highway. The unit cost associated with improvement is associated. 200m was chosen as a minimum length for which the improvements are maintained and uses the linear identification model.

Ns= (()
Where, Ns= Expected number of crashes for all highway segments

H= number of homogeneous segment
ADTi= ADT for homogenous segment
Li= Length of homogenous segment

F(ADTi, Li)= A function of ADTi and Li taking into account the effect of these two parameters in predicting the expected number of crashes for segment.

a= Number of highway features for which those are AMF in the model

AMFsi= AMF number for homogenous segment i

Si= Index associated the AMFs to the highway features

• Dominique Lord and Bonneson (2006) give the procedure for calculating accident per year. The various variables included are traffic volume, segment length, degree of curve and segment length and all these variables are significant.

• Yi (Grace) Qi et al (2007) using the Analysis Approach i.e., data collected from individual, groups etc and analysis is done. The analysis shows the main factors of traffic accidents are traffic density, weather conditions and geometry.

2. Models bases on speed

• Garber Gadiraju (1998) studied the relationship between speed and accident studies. He analyse design speed, mean speed and operating speed. The results are compared with road geometry.

• Letty Aarts and Ingrid Van Schagen (2006) studied crash records due to speed. Higher the speed higher the crash rate.

IV. CONCLUSION AND RECOMMENDATION

Conclusion

The traffic conditions in hilly areas is of mixed type having light motor vehicles, heavy motor vehicles, two wheelers. The state of Himachal Pradesh witnessed 29,555 accidents in last 10 years of which 3,934 in 2011; 4,418 in 2012; 4,862 in 2013 and 6,764 in 2014. The

accidents severity of the state roads is 36.4% mostly occurs in between 3pm – 9pm. Highway accidents are caused by various factors such as traffic density, population and road environment.

The other factors include alcohol consumption, use of drugs, speed, vehicle condition, safety regulations etc. For modelling various data is taken into consideration. The data needs to be collected from various sources. The data required in modelling are traffic volume, road features like road width, road curvature, number of junctions per km. Modelling show all the factors and these factors requires attention. Recommendation for future research

- Other category of highway, four lane, expressways. .
- To check the accidents using ITS.

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