

An Empirical Investigation & Analysis of Critical Factors of Road Accidents

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Abstract-India is paying a high socio-economic cost of injuries and fatalities due to road accidents. Effective policies are needed to curb road accidents and save precious lives. The problem is acute on highways due to complex flow pattern of vehicular traffic, presence of mixed traffic along pedestrians. Road users, vehicles, road condition, road design, environmental factors, open level crossing are some major factors behind road accidents. The analysis of road accidents reveals that driver's fault is the single most important factor responsible for accidents, fatalities and injuries.

Keywords-accident, fatalities, accident philosophy, Human factors, Environmental factors

I. INTRODUCTION

What is an Accident?

Accident is an unforeseen event. The whole system of accident occurrence is a complex phenomenon. It can also be expressed as-Unplanned event results in mishap (personal injury or property damage). Accidents are the result of the failure of people, equipment, materials, or environment to react as expected. All accidents have consequences or outcomes. Accidents are caused by an unsafe act, injured person or an unsafe condition, work place.

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 in many metropolitan cities, including Kolkata, India. The increasing number of road accidents is imposing considerable social and economic burdens on the victims, and various direct and indirect costs to individuals and government. 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, drivers characteristics and environmental aspects. Thus, the whole system of accident occurrence is a complex phenomenon. Poor traffic management specially in respect of the reckless driving of buses, minibuses and auto rickshaws, inefficient traffic control at intersections, poor road geometrics, lack of public awareness, road users' indiscipline and inefficient movement, undefined bus stops, etc. are the major causes of road accidents.

Accident costs are an important component of external costs of traffic, a substantial part is related to fatal accidents. The evaluation of fatal accident costs crucially depends on the availability of an estimate for the economic value of a statistical life.

The deaths of persons and serious economic loss caused by road accidents demand a continuous attention in accordance with the spectacular growth in road transportation. Traffic on the Indian City roads has increased tremendously due to the increasing rate of urbanization. Globalizations of the Indian economy and the improvement in economic status of the people have also induced greater impact on the transportation system. The traffic movements on city roads have been compounded by frequent interruptions, resulting in drastic reduction in speed, leading to congestion and accidents. Road accidents cause injury, death, loss of property and damages to vehicles. All these involve a monetary loss to the economy.

A. Purpose of Accident Investigation

- Determine the sequences of events leading to failure.
- Identify the cause of the accident.
- Find methods to prevent accident from recurring.

B. Objectives of Accident Investigation

- Explain the meaning and impact of accidents
- Identify different types of accident causes
- Know the purpose of accident investigation
- Explain how to conduct an accident investigation
- Know how to document accident investigations.

C. Benefits of Accident Investigation

- Prevention of future, losses
- Contribution to the bottom line
- Reduction of human suffering
- Continuous improvement process

D. Factors Responsible For Accident

Accident is an unplanned & uncontrolled event in which action/reaction of an object substance, person or radiation results in personal injury.

Knowledge of factors in the accident sequence guides & consist in selecting a point of attack in prevention work. Factor responsible for accident can be broadly classified as follows:

- Human factor
- Mechanical factor
- Third party factor
- Environmental factor

E. Causes of Road Accident

Accidents are caused directly by:-

- Unsafe act of person
- Exposure to unsafe mechanical condition.
- Unsafe action & condition caused only by faults of person.
- Faults of person are created by environment or acquired by inheritance.

II. PHILOSOPHY OF ACCIDENT PREVENTION

It is based upon following axioms.

1) The occurrence of injury invariably results from a completed sequence of factors- the last one of these being the accident itself.

2) Unsafe act of persons are responsible for a majority of accident.

3) Persons who suffer a disabling injury caused by an unsafe act, in the average case has had over 300 narrow escapes, from series injury as a result committing the very same unsafe act. Likewise, the persons are expose to mechanical hazards 100 times before they suffer injury.

4) Severity is largely preventable.

5) Basic reasons or motives for occurrence of unsafe act provide guide to the selection of appropriate corrective measures.

6) Basic methods are available for preventing accidents-

- a) Engg. revisions.
- b) Persuasion & appeal.
- c) Personal adjustment.
- d) Discipline.

7) Management or organization has the best opportunity & ability to initiate the work of prevention, therefore it should assume responsibility

III. APPROACH TOWARDS ACCIDENT PREVENTION

The severity of accident & factors which are responsible for road accidents are categorized and being graded as follows:

HUMAN ERROR OF FIRST PARTY (DRIVER) MISTAKE (X₁):

Sr. No.	Causes	Points
1.	Drunken + Rash Driving	10
2.	Drunken Driving	09
3.	Rash Driving	08
4.	Exceeding Safe Speed Limit	07
5.	Sleep /Fatigue	07
6.	Wrong Overtaking / Wrong Parking /Wrong Side Driving	06
7.	Signal Breaking/Not Following Traffic Rules	05
8.	Sudden Turning/Change of Lane /Crossing	04
9.	Unsafe Distance	03
10.	Driving Overloaded /Damage Vehicle	02
11.	Distracted Driving/Misjudgment	01

HUMAN ERROR OF THIRD PARTY MISTAKE (X₂):

Sr. No.	Causes	Points
1.	Drunken + Rash Driving	10
2.	Drunken Driving	09
3.	Rash Driving	08
4.	Exceeding Safe Speed Limit	07
5.	Sleep /Fatigue	07
6.	Wrong Overtaking / Wrong Parking /Wrong Side	06

	Driving	
7.	Signal Breaking/Not Following Traffic Rules	05
8.	Sudden Turning/Change of Lane /Crossing	04
9.	Unsafe Distance	03
10.	Driving Overloaded /Damage Vehicle	02
11.	Distracted Driving/Misjudgment	01

ENVIRONMENTAL ERROR (X₃):

Sr. No.	Causes	Points
1.	Improper geometrical design, poor alignment, blind intersections, inadequate traffic control devices.	10
2.	Bad weather and obstructed vision.	09
3.	Bad vision due to absence of street lights especially on road intersections.	08
4.	Bad road conditions like patches, bumps	07
5.	Heavy rainfall	06
6.	Road made up of soil and stone	05
7.	Landslide in the hill areas	04
8.	Fallen trees at turning points where it is directly nor visible	04
9.	Thundering, Lightening, fog	03
10.	High speed wind.	02

SEVERITY OF ACCIDENT (Y1) :

Sr. No.	Causes	Minor 2W	Mode r-ate 2x4W	Major 4x4W
1.	Minor damage to vehicle + No Injury to Driver/ Third Party / Passenger / other	1	1	1
2.	Minor damage to vehicle and minor injury to Driver / Third Party / Passenger / other	1	2	3
3.	Minor Damage to	2	3	4

	vehicle and major injury to Driver / Third Party / Passenger / other			
4.	Major Damage to vehicle and minor injury to Driver / Third Party / Passenger / other	3	4	5
5.	Major Damage to vehicle and major injury to Driver / Third Party / Passenger / other	4	5	6
6.	Minor Damage to vehicle and Major Injury + Permanent Disability/ Death of a person	5	6	7
7.	Minor Damage to vehicle and + Death of more than 1 person	6	7	8
8.	Major damage to vehicle and + major injury +Permanent Disability/Death of a person	7	8	9
9.	Major damage to vehicle and + death of more than 1 person	8	9	10

COST OF ACCIDENT (Y2):

Sr. No.	Cost	Points
1.	Above Rs. 4,50,000	10
2.	Between Rs.4,00,000 to 4,49,999	09
3.	Between Rs. 3,50,000 to 3,99,999	08
4.	Between Rs. 3,00,000 to 3,49,999	07
5.	Between Rs. 2,50,000 to 2,99,999	06
6.	Between Rs.2,00,000 to 2,49,999	05
7.	Between Rs. 1,50,000 to 1,99,999	04
8.	Between Rs.1,00,000 to 1,49,999	03
9.	Between Rs.50,000 to 99,999	02
10	Below Rs.50,000	01

IV. DATA COLLECTION

The data is collected from various sources like-

- National insurance co. ltd
- Police station
- United insurance co. ltd
- Newspaper
- Internet

➤ MSRTC

TABULATION OF COLLECTED DATA

The collected data has been tabulated as under & the marks allotted to various factors are entered in respective columns on 10 point scale as detailed in Table 1.

TABLE 1: SCALED EXPERIMENTAL DATA RECORD.

Sr.No.	X1	X2	X3	Y1	Y2
1	10	0	8	6	8
2	8	4	0	1	1
3	8	2	10	8	5
4	2	0	7	5	3
5	8	0	0	7	5

V. ANALYSIS OF DATA

The scaled values of the variables 105 in number was analyzed using a “Statistical mathematical Analysis Tool”. Accidents are classified as major and minor according to the points allotted to the cause i.e. severity of accident (Y1) as follows:

Points	Accident Type
1 to 5	Minor accident
6 to 10	Major accident

After sorting the data, the frequency of Occurrence of various causes & Correlating it with the point scale the results are interpreted graphically by using various bar charts & pie charts for both major and minor accidents.

For major Accident

TABLE 2.MAJOR ACCIDENT SHEET ON THE BASIS OF POINT SCALE OF VARIOUS CAUSES

Point Scale	x-1	x-2	x-3
10	3	0	9
9	4	0	9
8	35	7	4
7	15	3	19
6	2	8	14
5	0	1	0
4	0	6	9
3	4	8	0
2	8	7	0
1	2	5	0

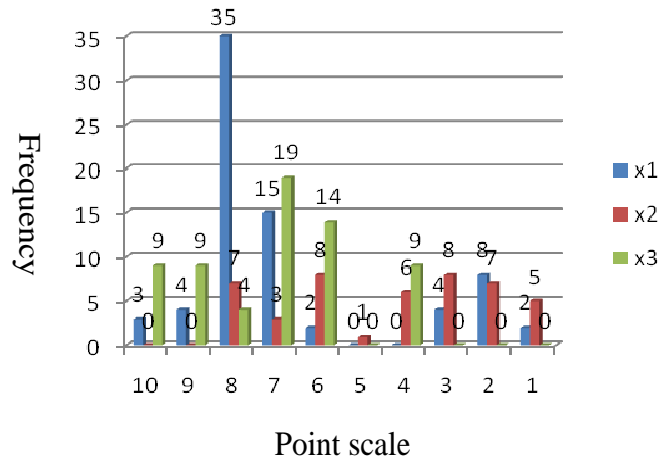


Fig.5.1. Bar chart of Point scale v/s frequency of accidents for major accidents

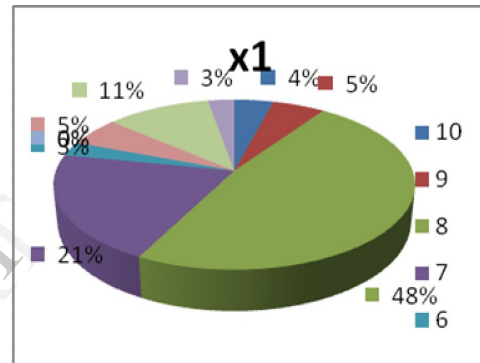


Fig.5.2.Pie chart of Percentage contribution of various causes of accident for human error of first party (x1)

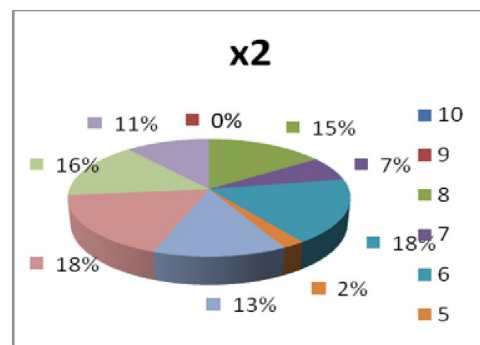


Fig.5.3. Pie Chart of Percentage contribution of various causes of accident for human error of third party (x2)

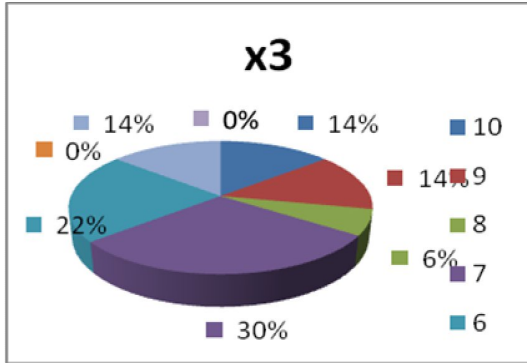


Fig.5.4. Pie Chart of Percentage contribution of various causes of accident for environmental error (x3)

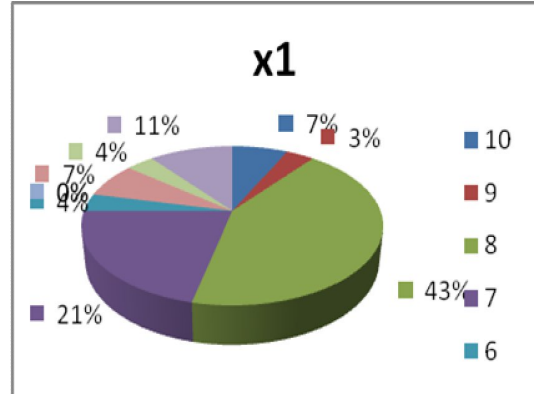


Fig.5.6. Pie Chart of Percentage contribution of various causes of accident of human error of first party (x1)

For Minor Accident

TABLE 3 MINOR ACCIDENT SHEET ON THE BASIS OF POINT SCALE OF VARIOUS CAUSES

Point Scale	x-1	X-2	x-3
10	2	1	0
9	1	1	0
8	12	2	7
7	6	1	5
6	1	2	1
5	0	0	2
4	0	4	0
3	2	3	0
2	1	0	0
1	3	2	0

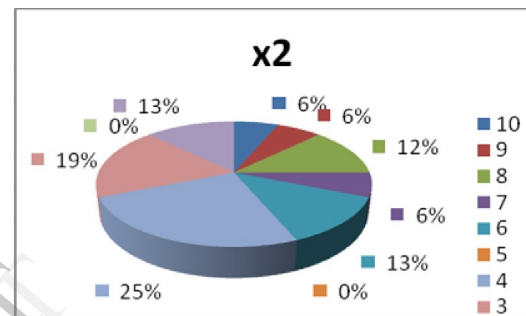


Fig.5.7. Pie Chart of Percentage contribution of various causes of accident For human error of third party (x2)

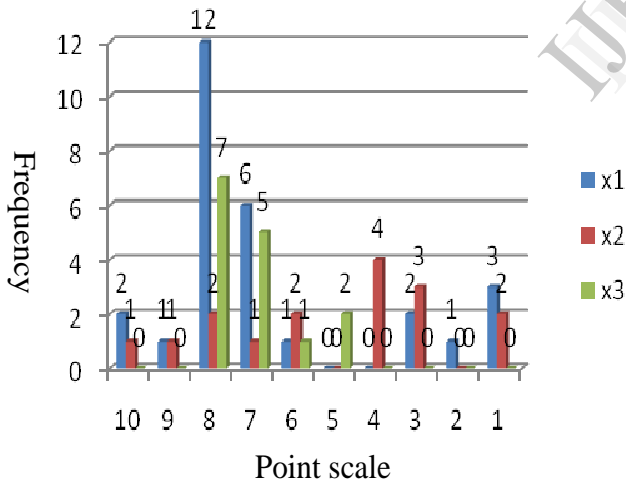


Fig.5.5. Bar chart of Point scale v/s frequency of accidents for minor accidents

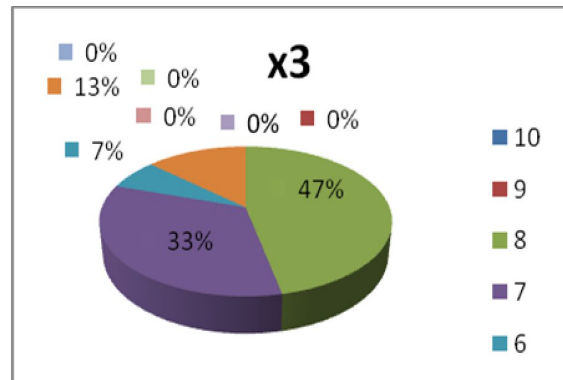


Fig.5.8. Pie Chart of Percentage contribution of various causes of accident For environmental error (x3)

After calculating the various factors the following results were obtained.

		X1 ,X2
CAUSES	POINT	%
Rash Driving	8	51.43
Exceeding Safe Speed Limit	7	20.96
Driving Overloaded /Damage Vehicle	2	5.71
Drunken Driving	9	5.71
Wrong Overtaking / Wrong Parking /Wrong Side Driving	6	5.71
Drunken + Rash Driving	10	4.76
Unsafe Distance	3	3.8
Sudden Turning/Change of Lane /Crossing	4	0.952
Distracted Driving/Misjudgment	1	0.952
Signal Breaking/Not Following Traffic Rules	5	0

VI. CONCLUSION

From the Statistical analysis it is concluded that, accident took place because of so many reasons but some factors play a major role in it. Because of human error more number of accident took place. Rash driving is a major factor resulting into road accident(i.e51.43%),followed by exceeding safe speed limit, driving overloaded vehicle, drunken driving, wrong overtaking, Drunken rash driving, unsafe distance, sudden turn, distracted driving, signal breaking. Thus, this is a serious concern and some effective measures must be taken to curb this problem and save the valuable lives.

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