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Study on accidental risk analysis and preventive measures for road safety

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ABSTRACT

Through comprehensive road safety plans have been formulated which focus on education, enforcement measures and emergency care, there is a lack of sound and rational engineering measures to improve road safety in our country. This paper aims to analyse, evaluate and identify effective road safety treatment measures for a rural national highway. The study area will be the outer ring road and NH-44 connecting Hingna T Point Bus Stop to Chinch Bhavan Bus Stop. Accident data of past 4 years will be collected for the analysis. The basic aim of this study will be articulate, carry out a complete analysis of crash data, and identify the critical stretch in the national highway which would require immediate safety improvements. The critical sketch is identified. This could aid the highway safety audits in the country for identifying specific regions in national highways depending upon the geometric element which is aimed to improve as part of safety improvement programs.

Keywords— Crash causes, Road safety, Road traffic accidents

1. INTRODUCTION

A Road Traffic Accidents is described as “An incident that is on a road either road to public transport, output in any more people being killed or injured, where at most one moving vehicle is connected. Thus road traffic accidents are a collision between vehicles and pedestrians, between vehicles and animals and geographical or architectural obstacles”. Everyone is a road user in one or the other size. The current transport system has reduced the distance but it has increased life risk. In every road accident, millions of people lost their lives and severe people suffered injuries. There are uncertain roads in the rural areas and the severity of the crowd in urban areas is high.

These are some major problems on any Indian roads. This is a very serious situation and requires proper attention to the use of some statistical methods. In this study, the data is analysed using regression analysis. In our society, Road safety is most important. In road accidents, every year 1.3 million peoples are killed and 30 to 60 million peoples are injured.

The road link in India spread to the 2nd biggest and 3,300,000 km in the world. The most essential roadways linking states crosswise the country are the NH which are established and protected by the India Government.

2. LITERATURE REVIEW

P.Puvanachandra et al. in the year (2011) observed that for Road Traffic Injuries and Data System in Egypt: Addressing the Challenges: In this paper Author recommended to health and transport professionals must work together to prevent RTIs (Road Traffic Injuries) in vulnerable populations. The author suggested to improving standardizing data collection system, educating young drivers and improving road designs as well as offering frequent medial screening.

Myriam Marie Delcasse in the year (2017) observed that for Title Black Spot Study: In this paper author suggested the selection of zone/area for Black Spot Study, Physical and non-physical accidents. Accident prevention program was recommended and comparison of IRC standards within site conditions.

N. Dehury et al. (2013): In their work on National Highway-55 between Angul and Bhushan plant in Orissa divided the total stretch into 4 stretches and plotted annual variation of total fatal, major and minor accidents, monthly and hourly variations. Using the traffic data they developed accident prediction model regressed with density and roadside features. It represents the road collisions increases with an increase in density, no of plantations on shoulder and curves. Roadside clearance, time to time inspection of shoulders, adequate lighting, intersection enhancement and provisions of humps near accident spots were suggested.

Apparao G.P. Malikarjuna Reddy et al. in the year (2013): Observed that for Identification of accident Black Spots for National Highway Using GIS: In this paper author suggested the methodology of identification of the accident-prone location and Ground Control Points (GCP) are collected with help of GPS. The advancement in GIS and GPS can be put to effective use of accident analysis.

3. PROCEDURE

The main data required for the evaluation purpose will be:

3.1 Accident data

The accident data required for the study was collected from the records of police which were collected associated with National Highway Authority of India (NHAI) project with the following particulars:

- Accident Location
- Accident Date and Time
- Nature of Collisions
- Categorization of Crashes
- Reasons for Accident
- Road Features and Road Condition on the Spot
- Weather Condition at the Time of Accident
- Intersection Type and Control
- Number of persons affected as per the injury (Fatal, Grievous, Minor)

4. STUDY STRETCH AND DATA COLLECTION



Fig. 1: Study stretch (Google map)

The study stretch was selected from Hingna T point Bus Stop to Chinch Bhavan Bus Stop Wardha Road Nagpur in Maharashtra state. The accidents data were collected from Rana Pratap Nagar Police Station with prior permission. The Study Stretch is shown in figure 1.

5. ACCIDENT DATA

The accident data collected during the last 4 years were plotted with MS Excel. Total number of accidents; fatalities, grievous, injuries, non-injuries are shown in table 1.

Table 1: Classification of accident 2014

Year	2014	2015
Total no of accidents	66	51
Person Killed	10	9
Grievous	26	22
Minor Injury	25	14
Non-injury	5	6

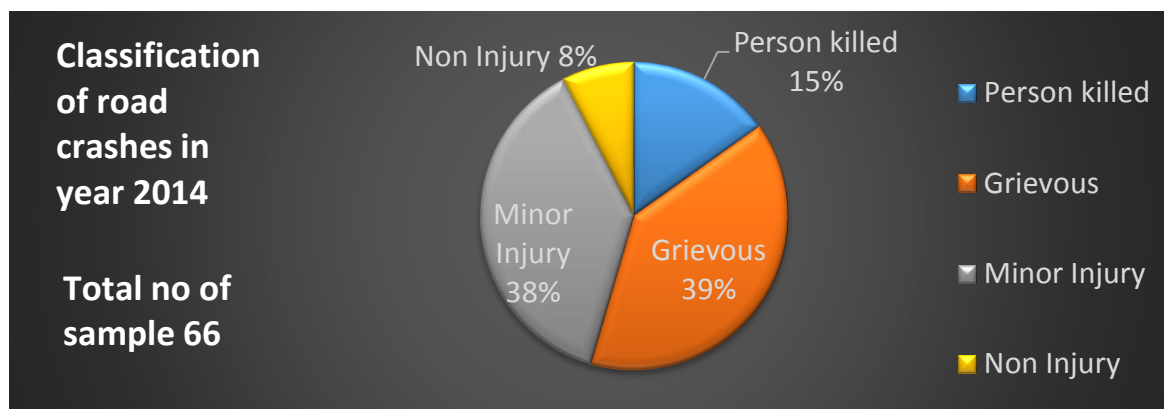


Fig. 2: Classification of accident 2014

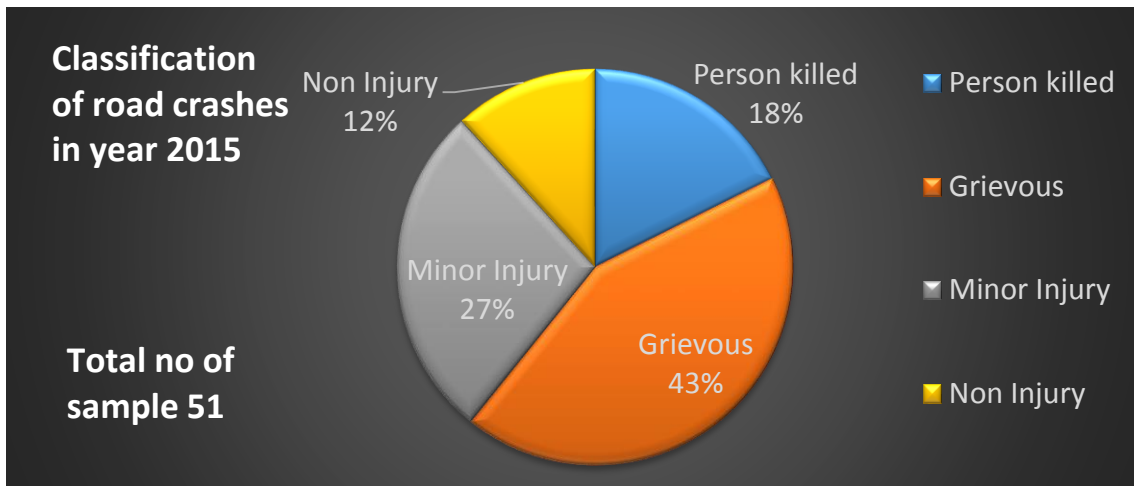


Fig. 3: Classification of accidents in 2015

Total number of accidents; fatalities, grievous, injuries, non-injuries are shown in table 2.

Table 2: Classification of accidents in 2015

Year	2016	2017
Total no of accidents	50	74
Person killed	6	9
Grievous	27	34
Minor Injury	12	21
Non-Injury	5	10

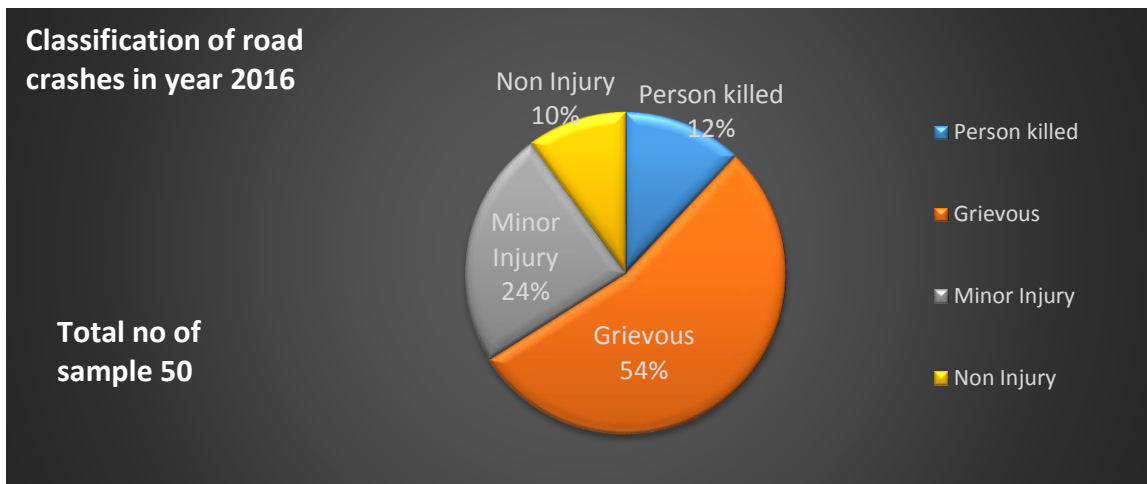


Fig. 4: Classification of accidents in 2016

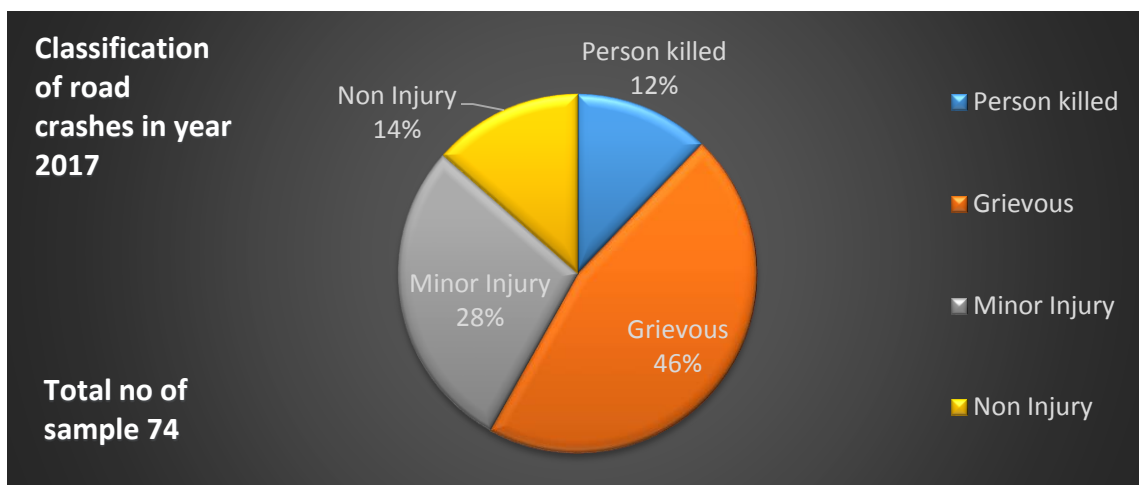


Fig. 5: Classification of accidents in 2017

6. Data Analysis

6.1 Classification of Road Accidents

The classification of road accident has been described earlier, which has been coded in four different categories according to NHAI coding. The amount of fatal road accident is 14.10% of the total road accidents. Classification of road accidents as shown in fig.

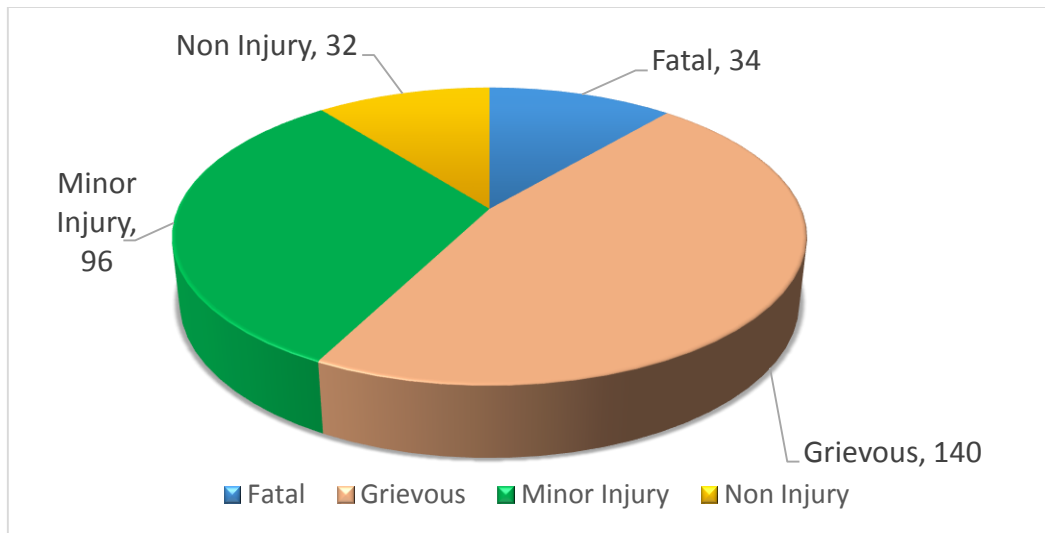


Fig. 6: Data Analysis of fatalities (2014-2017)

6.2 Nature of Road Accidents

The nature of the road accident described earlier has been coded in seven different categories. While analysing the nature of a road accident, it has been found that a single vehicle has contributed to 241 road accidents.

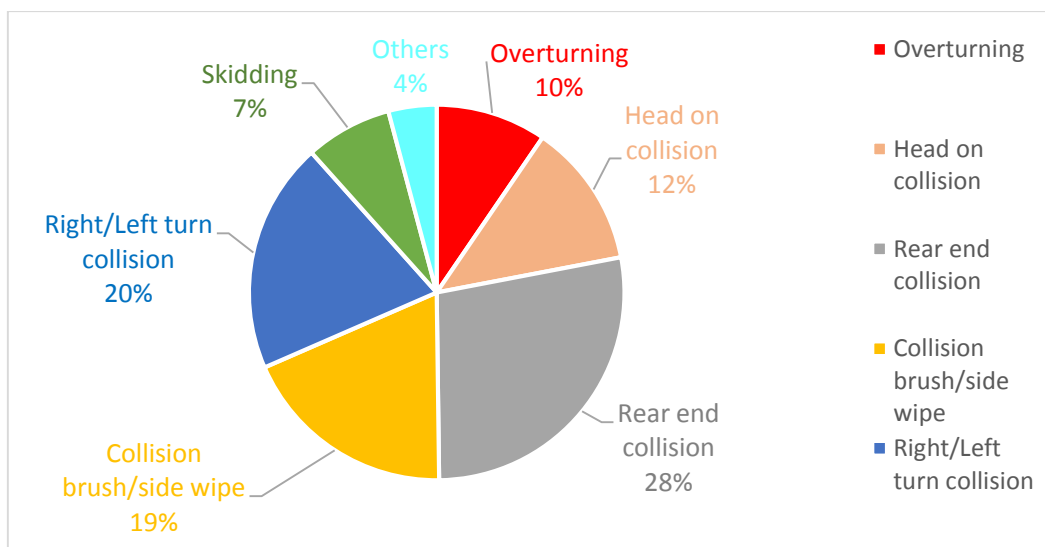


Fig. 7: Nature of accident (2014-2017)

7. RESULT

From regression analysis output we obtain coefficients for parameters and obtained equation is:

$$y = (-0.288625734 \times 1 - 0.215507258 \times 2 + 0.001866447 \times 3 + 0.000339445 \times 4) + 3.805549711$$

Table 3: Summary output

Regression statistics	
Multiple R	0.347253707
R Square	0.120585137
Adjusted R Square	0.062918589
Standard Error	0.797545926
Observations	66

ANOVA					
	df	SS	MS	F	Significance F
Regression	4	5.320362417	1.330090604	2.091076033	0.042887425
Residual	61	38.8008497	0.636079503		
Total	65	44.12121212			

The R² value of 12.00% indicates how much the independent variables has been able to explain the variation in the dependent variable, which is the number of accidents. To explain the statistical significance of the model, we often rely upon the significance F value. Here it can be seen that the significance F value = 0.0428 < 5 which means that the model is sufficiently significance at 95% confidence level.

Table 4: Result of used parameters

Parameters	Coefficients	Standard Error	Lower 95%	Upper 95%
Intercept	3.805549711	0.654421915	2.496952215	5.114147207
Road Features (x1)	-0.288625734	0.151869627	-0.592307822	0.015056353
Road Conditions (x2)	-0.215507258	0.115826963	-0.447117585	0.016103068
Intersection Type and Control (x3)	0.001866447	0.03058914	-0.059300319	0.063033213
Weather Condition (x4)	0.000339445	0.025955407	-0.051561598	0.052240488

Value of a coefficient indicates that for each 1 unit of increase in that parameter, how much would be the relative increase in the dependent variable. Crash prediction models are developed to establish the relationship between the explanatory variables and crash frequency. It can be clearly seen that the model successfully explains the crash variation to an extent of 12.0%.

7.1 Prediction

Using the equation form from regression analysis of accidental data prediction is made for different independent variables along the stretch so as to find the classification of an accident that can occur. Validation of the prediction model is done using available accident data. Error in the respective model is identified and their validity is checked in table 4.

Table 5: Prediction for Classification of Accident

Predicted Value	Classification of Accident (Actual Value)	Difference	Error (%)
2.44	2	0.44	81.97
2.45	2	0.45	81.64
2.81	3	-0.19	93.24
2.44	3	-0.56	77.05
2.45	3	-0.55	77.56
2.45	1	1.45	40.82
3.03	3	0.03	99
2.45	2	0.45	81.64
2.22	3	-0.78	64.87
2.45	1	1.45	40.82

8. PREVENTIVE MEASURES

- (a) To specify age limits for operators.
- (b) To enable police to check the drivers for their drunkenness and to impose suitable penalties.
- (c) To prescribe uniform road signs throughout the country and provide for penalties for the non-observance of the same.
- (d) To introduce penalties of fine, imprisonment, disqualification, or endorsements on licenses for careless driving.
- (e) Provide standard speed breaker along with marking and warning signs.

9. CONCLUSION

Aim of the study was to identify and analyse the various parameters responsible for accidents. Based on the literature review, the main factors responsible for accidents were identified. The study stretch was decided considering some important features such as feasibility for conducting surveys and availability of adequate accident data. A substantial amount of accident data was collected and segregated for further analyses. This paper aimed to analyse, evaluate and identify effective road safety treatment measures for a rural national highway. The study area was defined as the Ring Road and NH-44 connecting Hingna T Point Bus Stop to Chinch Bhavan Bus Stop. Accident data of the last 4 years were collected for the analysis.

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