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Accident Analysis on NH-18 by Using Regression Model and its Preventive Measures

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Abstract: ***Road accidents are one of the main causes of deaths worldwide. About half a million people are killed in road related crashes every year throughout the world. The probability of an accident occurring is influenced by numerous factors like roadway geometric characteristics, vehicle characteristics, pavement conditions and weather conditions each of these factors contribute its own share towards occurrence of accidents. This paper discusses the influence of various factors on accident caution based on statistical package Regression Analysis collected from the most accident prone stretch, Ayalurmetta to Thammarajupalli (30KM) in Andhra Pradesh on NH18 and from the results of the analysis, it can be concluded that this National Highway section needs improvement from safety point of view. A large number of accidents have been occurring over such a small section of 15 km length. Proper traffic guidance and control system to guide road users ensuring safe movement of vehicles has been recommended and some of the facilities such as pedestrian crossings and median openings, acceleration and deceleration lanes were re-designed in order to improve the safety of the road and minimize the accidents.***

Keywords: Road Accidents, Geometric characteristics, vehicle characteristics, pavement conditions, Regression Analysis, pedestrian crossings,

1. Introduction

In India analysis of previous data indicates that 66% of the accidents occur due to human error and 33% due to road parameters such as road and vehicle interaction, other road user and environmental factors. India has road network of 3.3 million km consisting of National Highway (NH), State Highway (SH), Major District Roads (MDR) and Other District roads (ODR). National Highways constitute 2% of the total road length and carries more than 40% of passenger traffic and 85% of goods traffic has registered more accidents accounting for 20%, as compared to other roads.

The road network in India is the second largest in the world and spans over 3,300,000 km. The most important roadways connecting states across the country are the national highways that are developed and maintained by the Government of India. Although national highways constitute a little over 2% of the road network, it is estimated that they carry around 40% of the road traffic in the country.

The objectives for this accident investigation and data collection project were:

1) To initiate in-depth traffic accident data collection with the support of the police.
2) To establish a methodology and develop a framework for a comprehensive accident database for road accidents.
3) To understand the nature of accidents and identify causes/problems along NH18.

Figure 1.1: shows the key map of the section

2. Methodology of the Study

It is a known fact that the width of the road plays an important role in accident causation. The alignment of the road is also an important parameter which affects the accident rate. Alignment of the road affects sight distance. Adequate sight distance is essential for the safe traffic operations. The alignment is classified into straight alignment, curve alignment. For a straight aligned road there will be adequate sight distance. The sight distance goes on reducing as the degree of curvature increases. Increase in the number of side roads interrupts is an important parameter which affects the accident rate. When side roads increases, accident rate also increases.

3. Test Results and Discussions

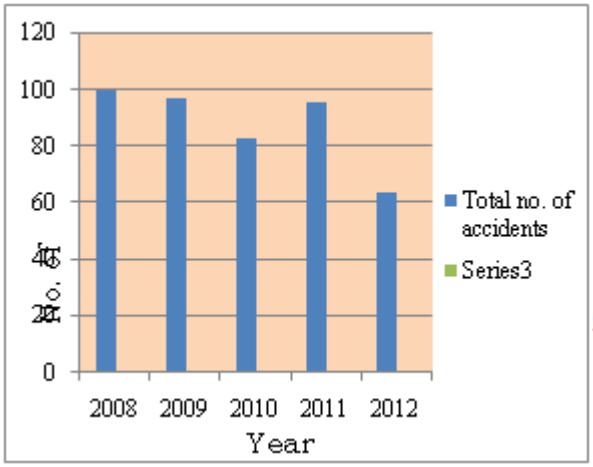
3.1 General

The stretch is taken from Ayalurmitta to Tammarajupalli. By taking the accident data from the near by police stations we conclude that the total no of accidents happened for the 5 years.And we had selected 10 main points where mostly accidents happened. This ten main points is shown in table no 2 .9.and by this a latest technique called Regression statistics we can find the no of accidents to be happened in future days.

Table 3.1: No of accidents held from 2008-2012.

Year	Total No. of Accidents
2008	100
2009	97
2010	83
2011	96
2012	64
Total	440

3.2 Figure Showing Year vs Number of Accidents



3.3 Vehicle Analysis

For this analysis, vehicles involved in all types of accident have been studied. We found that out of all the vehicles involved in crashes reported on the NH18 during the study span, 123 of them were trucks. The total number of vehicles involved in crashes were shown in the Table 3.4

Table 3.4: Vehicle Distribution

Year	Auto	Car	Buses	Trucks	Other Vehicles	Tractor	Two Wheeler
2008	36	16	5	21	1	6	10
2009	18	23	11	26	1	6	12
2010	15	20	6	29	2	9	11
2011	14	26	8	27	0	5	15
2012	16	9	5	20	0	6	7
Total	99	94	35	123	4	32	55

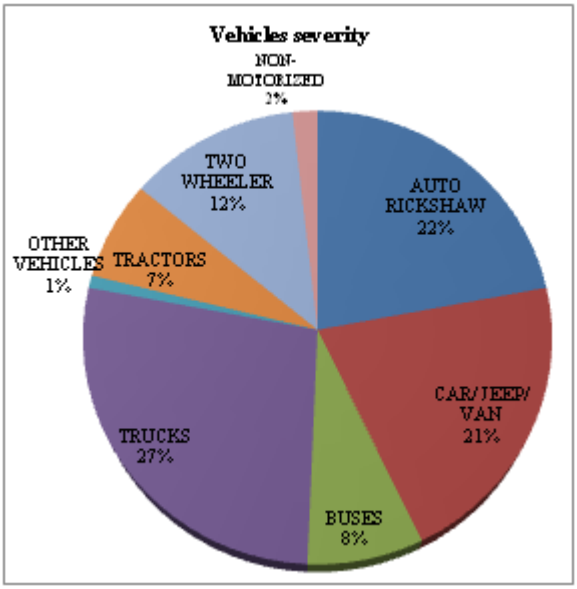


Figure 3.4: Vehicle Distribution

3.5 Accident Distribution by Time

The distribution of accidents by time is show in figure 5.3Maximum number of accident recorded between that is 31 accidents took place between 09:00 to 10:00 AM and 04:00 to 05:00 PM.

Table 3.5: Accident Distribution By Time

S.No.	Time	Total No. of Accidents
1	0-1	2
2	1-2	7
3	2-3	12
4	3-4	9
5	4-5	11
6	5-6	16
7	6-7	12
8	7-8	16
9	8-9	17
10	9-10	31
11	10-11	29
12	11-12	21
13	12-13	19
14	13-14	20
15	14-15	25
16	15-16	21
17	16-17	31
18	17-18	23
19	18-19	27
20	19-20	19
21	20-21	28
22	21-22	19
23	22-23	11
24	23-24	17

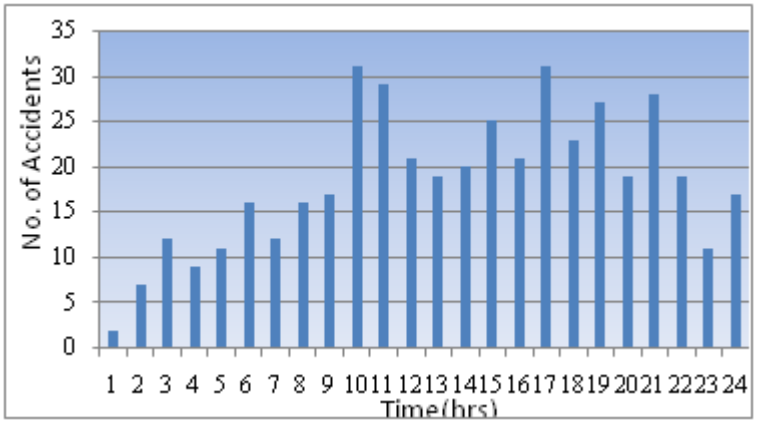


Figure 3.6: Accident Distribution by Time

3.7 Regression Analysis

The technique of predicting the values of one variable (called the dependent variable) from measurements of the other (called the independent variable)is called "REGRESSION ANALYSIS". If the relation between the dependent and independent variables is linear, the analysis is known as "LINEAR REGRESSION". If the independent variables are two (or) more in number, the analysis is known as MULTIPLE LINEAR REGRESSION ANALYSIS. If the independent variable is denoted by Y and the independent variable by X .The linear relationship between the two can be of the following form:

$$Y=a+bX+\epsilon$$

Where a and b are constants and Є it is a term denoting the random error. The random error term Є will be small if the two variables are closely related. Thus the observed values of X and Y are:

$$(x_1,y_1),(x_2,y_2),\ldots\ldots\ldots\ldots(x_n,y_n),\text{then}$$

$$Y_{i=}\, a_i+bx_i+\epsilon$$

The problem is to estimate the values of a and b such that the sum of the ϵ_i's ($\epsilon_1+\epsilon_2+\epsilon_3\ldots\ldots\ldots+\epsilon_n$) is as small as possible and thus minimize the likely error in prediction , this is done by method of least squares, thus a and b are chosen to makea minimum

$$R=\sum_{i=1}^{n}\epsilon_i^2$$

where n is the total number of points observed.

4. Multiple Linear Regressions

The statistical technique which will be most frequently encountered by a traffic engineer and traffic planner is the multiple linear regression analysis. The problem concerns with the establishment of relationship between a variable which is known to respond to changes in two or more other variables. The variable which is known to respond, Y variable, is commonly called the independent variable, and the other variable influencing it is called the independent variables, i.e X variable. The function will be the following form:

$$Y=a_0+a_1x+a_2x_2+a_3x_3+\ldots+a_mx_m$$

Where Y=true estimate of the dependent variable,y

$x_1,x_2,x_3\ldots\ldots\ldots x_m$=m independent variables

a_0=regression constant

$a_1,a_2,a_3\ldots\ldots a_m$=regression coefficients of the respective m independent variables.

5. Assumptions

The following are some the condition which must be satisfied if a multiple linear regression analysis is to be used:

1) All the independent variables must be independent of each other and there should be no correlation between them.
2) All the variables are normally distributed**.**
3) All the variables are continuous**.**
4) **4**.A linear relationship exists between the dependent variable and the independent variables.
5) The influence of the independent variables is additive, i.e. the inclusion of each variable in the equation contributes a distinct portion in the estimation of the dependent variable and all the variables together contribute additively in the estimation.

6. Model Building

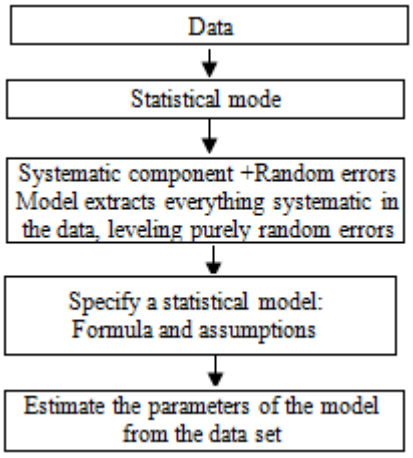


Figure 3.8: Model Building

The collected data were statistically analyzed to evaluate the effect of the selected parameters on accidents. The relationship between the accidents and various factors were also obtained. The data was analyzed using SPSS (Statistical Package for Social Sciences) software. Here the number of accidents was taken as the dependent variable and width of the road, alignment of the road, number of side roads and traffic volume were taken as independent variables. The table shows the ten points which we had taken in the stretch. This ten places shows more no of accidents happened from

the past five years data which we have collected. This accident data is collected form our nearest police stations. And the traffic volume is collected for a week(day and night) The table shows the width and alignment and no of side roads in the ten selected points. The points are mentioned in the below Table 3.9

Name of The Stretch	*Width (M)*	*Alignment*	*No of Side Roads*	*Volume (PCU/ Hr)*
KMC to Thammarajupalli	6.8	Straight	1	818.35
Thammarajupalli to BSNL tower	6.5	Curve	1	896.35
BSNL to Sugalimitta	6.5	Curve	0	893
Sugalimitta to Panyam	7.9	Straight	4	965.52
Panyam to RGM college	8.5	Curve	3	1253
RGM college to Balapanuru	7.9	Straight	2	978.3
Balapanuru to Venkateshwarapuram	7.4	Straight	1	965.73
Venkateshwarapuram to K.C canal	6.9	Straight	3	997
K.C canal to Nandyal Public School	7.5	Curve	2	974.29
Nandyal Public School To Ayalurmetta	7	Curve	2	962.44

7. Methods of Identifying Blackspots

Blackspots on the roads are those places, where accidents often appear to cluster or concrete the techniques used to identify the blackspots may broadly be categorized as a

a) Statistical methods
b) Engineering Methods
c) Bio-medical methods
d) Subjective assessment techniques.

Legislative measures those are possible

A variety of legislative measures are possible and different countries have adopted different measures. Some of them are listed below:

1) To stipulate age limits for drivers.
2) To introduce penalties of fine, imprisonment, disqualification, or endorsements on licenses for careless driving.
3) To enable police to check the drivers for their drunkenness and to impose suitable penalties.
4) To prescribe maximum hours of work for drivers of commercial vehicles and buses to prevent them from fatigue.
5) To prescribe uniform road signs throughout the country and provide for penalties for the non-observance of the same.
6) To lay down rules for pedestrians when crossing streets and to impose penalties for their non-observance.
7) To prescribe rules for cyclist.
8) To prescribe rules for motor-cycle and scooter riders.
9) To prescribe rules for the maximum size and weights (axle loads) of vehicles.
10) To prescribe minimum standards for the design of vehicle.

8. Conclusion

The model developed and calibrated using regression analysis is used to predict the accidents depending upon the factors considered**.** Once the proposed measures are implemented, the number of accidents can be decreased. From data stimulation, it found that Road Markings, Condition, Traffic Volume, Median Opening and Carriageway condition were main parameters for causing accidents. All undeveloped major and minor intersections must be developed with adequate lighting provisions. Pedestrian guardrail should be provided all along the footpath of service road and at bus stops. All the horizontal curves and bridges approaches are to be provided with guardrails so as to guide the drivers through the right path.

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