

Accident Modeling for SH-8, Gujarat

Parth J. Goswami¹ Srinath Karli² Patel Deep D.³

¹ME Student ²Assistant Professor ³Assistant Project Manager

¹Department of Transportation Engineering ²Department of Civil Engineering

^{1,2}HGCE, Vahelal, Gujarat, India ³Tata Consulting Engineers

Abstract— This study discusses the risk factors which are associated to the cause of road traffic accidents on SH 8 of Gujarat state. The study describes the composition of motor related injuries including non motorized casualties on SH 8. The study assesses different road safety measures taken by the authorities to prevent accidents on SH 8. Interviews with accident victims, government officials were done accordingly. The study has revealed the pattern and trends of motor traffic accidents on SH 8 from 2011 to 2016. It shows that the accident occurrence was increasing every year, passengers and pedestrians are always at highest risk of being injured or killed on the road. Young males are highly prone to motor traffic accidents. Males are more involved in road accidents than females; the risk of dying in an accident during the night was significantly higher than during the day, especially when it was raining.

Key words: Accident Analysis, Accident Modelling

I. INTRODUCTION

Most of the developing countries including India have a serious road accident problem. Death rates (defined as, road accidental deaths per 10,000 vehicles) are quite high in comparison to developed countries. While in Europe and North America the situation is generally improving. According to the World Health Organization, road traffic injuries caused an estimated 1.24 million deaths worldwide in the year 2010, slightly down from 1.26 million in 2000. That is one person is killed every 25 seconds.

Only 28 countries, representing 449 million people (7% of the world's population), have adequate laws that address all five risk factors. (Speed, drink-driving, helmets, seat-belts and child restraints) Over a third of road traffic deaths in low- and middle-income countries are among pedestrians and cyclists.

However, less than 35% of low- and middle-income countries have policies in place to protect these road users. Half of the world's road traffic deaths occur among motorcyclists (23%), pedestrians (22%) and cyclists (5%) – i.e. "vulnerable road users" – with 31% of deaths among car occupants and the remaining 19% among unspecified road users.

Road transport is the basic mode of transportation for good and passengers in India; catering 90% of National freight tonnage and 95% of the transport volume. Despite the fact that the development of road systems and transport is an important factor in social economic development, road accidents account for high death rates in the country and pose a threat to public health and developmental progress.

A. Objectives of the study

- To collect data of accident occurred on selected road stretch
- To generate accident prediction model by regression analysis

- To give remedial measures to prevent the accident

B. Limitations of the study

The data collected are for the years 2011-2016. Data before 2011 was not available. For detailed identification of black spot and develop prediction model detailed data is most important.

C. Need of the study

- Higher rate of accidents
- Higher rate of fatalities
- Improper geometric design on approximate 3 km stretch near Dharmaj
- Intrusion of animals
- High volume of traffic
- Mix traffic which contains more than 35% slow moving vehicles

D. Scope of the study

The data obtained from analyzing of accident can be used in further modeling. Prediction over future accidents can be applied. Remedies given can be kept in mind in newly development of roads. Safety features can be maintained all time.

II. LITERATURE REVIEW

- 1) Ravi Shenker & Arti Chowksey in their research identified that the road safety depends on humans, vehicles, and road conditions and these factors influence the road safety separately or in combination. The main objective of their study was to check the effect of road geometric features on rate of accidents. Along this accident prediction model was also developed by regression analysis by considering dependent and independent variables. From the study it was distinct clear that the effect of road geometry is greater on rate of accidents. Road traffic data was collected from respective departments. Road geometry data was also collected. Require sight distance was calculated from formula. Curve radius was extracted from drawings.
- 2) Alkeshkumar B. Labana & Vaidehi A. Parikh in their study identified that the road transportation increases year by year, but the rate of road crashes also increases with it. India is one of the developing countries, where the rate of road crashes is more than the critical limit. This paper presents road accidents situation in India and literature review related to road accident and safety. In this paper also highlights of the objective of study, methodology and accidental data of a case study on Dahod to Jhalod section of N.H.113 are given.
- 3) G.Udayakumar & S.Chandralekha conducted their study to reduce the risk level during median divider accidents. In transportation sector, the roadway

transportation rank high in travel and also in reportable accidents. Nowadays, there are various changes in road network and infrastructure developments done in our country. But according to the statistical report “Road Accident in India 2012” released by the Government of India, Ministry of Road Transport and Highways (MORTH) the reportable accidents, injury and fatality rates were in increasing order for the past decade up to 2011 and there is only a slight decline in the year 2012. When compared with other States and Union Territories, Tamilnadu tops two in road accidents and fatalities. In these accidents a considerable amount of accidents are due to vehicle-divider and vehicle-barrier collisions. This paper suggests and devises flexible median divider using suitable polymer material, so as to reduce the risk level during median divider accidents.

III. STUDY AREA & DATA COLLECTION

The SH 8 was conceptualized in Revised Development Plan of 2001 of R & B. However, R & B took up the task of implementing the Road even before the Development Plan was sanctioned. This road was planned with a long-term vision considering the road network and growth structure of Charotar. This highway was planned by considering the view of connecting the charotar region with saurashtra region. A 102 km road was planned around the developing areas of Bagodara to Vasad to strengthen the existing road network within the state. The SH 8 has a right of way of 60m. It is a Four lane divided road with two 7.5m carriage way, 5m central median and 2.5m shoulders for each direction. Further, SH 8 crosses the NH8A at 2 junctions. It meets the state highways and other major roads at 13 locations.

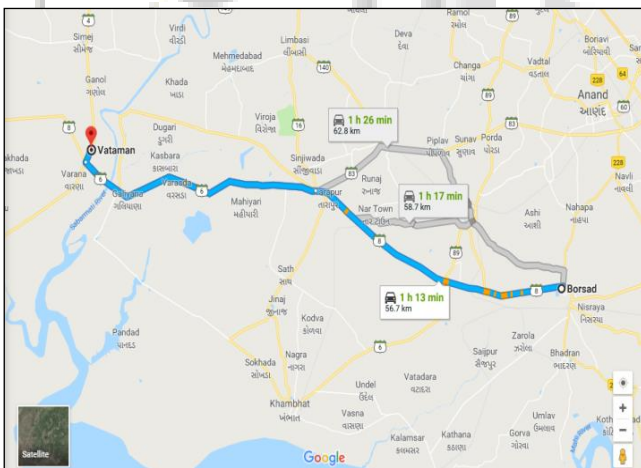


Fig. 1: Study Area Map from Borsad to Vataman

The data to be collected are of year 2011-2016 from the respective police stations. For the convenience of the study the entire study area is divided into four stretches enlisted as below:-

Stretch	Length
Borsad – Dharmaj	12
Dharmaj – Tarapur	17
Tarapur – Varasda	18
Varasda – Vataman	15

Table 1: Details of stretches

Year	Fatal	Major injury	Minor injury
2011	11	57	178
2012	16	62	168
2013	13	72	145
2014	14	68	163
2015	22	81	208
2016	26	98	275

Table 1: Details of Accidents (2011-2016)



Fig. 1: Photograph of actual accident in study area

IV. MODEL FORMULATION

There are two types of models developed by using regression analysis.

- 1) Linear regression
- 2) Multiple regression

When there is only one dependent variable and one independent variable at that time linear regression method is being use.

When there is single dependent variable but multiple independent variable at that time multiple regression method is being use.

The general form of each type of regression is:

Linear Regression: $Y = a + bX + u$

Multiple Regression: $Y = a + b_1X_1 + b_2X_2 + \dots + b_nX_n + u$

Where:

Y= the variable that we are trying to predict

X= the variable that we are using to predict Y

a= the intercept

b= the slope

u= the regression residual

In multiple regression the separate variables are differentiated by using subscripted numbers. Regression takes a group of random variables, thought to be predicting Y, and tries to find a mathematical relationship between them. This relationship is typically in the form of a straight line (linear regression) that best approximates all the individual data points.

Before conducting regression it is quite essential to find the co-relation amongst various variables. For this purpose correlation analysis had been performed using Microsoft Excel 2007.

Number of accident is taken as a dependent variable. Factors identified to be taken as an independent variables are vision, driver’s error, road geometry and vehicular.

The linear regression model is developed, for that total accidents, fatal accidents, major accidents and minor accidents are considered as dependent variable and other factors are considered as independent variable.

Considering the total number of accidents as dependent variable and number of accidents occurred due to vision, driver's error, road geometry, vehicular factor as independent variable we can get the equation as:

$$Y = 9.91 - 3.17X_1 - 1.53X_2 + 6.71 X_3 + 2.39 X_4$$

For this equation regression statistics obtained are tabulated as follow:-

Regression Statistics	
Multiple R	0.796862
R Square	0.817317
Adjusted R Square	0.838471
Standard Error	7.218974
Observations	6

Where,

Y= Total number of accidents

X1= Number of accidents occurred due to vision

X2= Number of accidents occurred due to driver's error

X3= Number of accidents occurred due to road geometry

X4= Number of accidents occurred due to vehicular factor

Thus from the regression analysis performed amongst various parameters it is distinct clear that when we are trying to predict linear regression at that time the scattering is less and for multiple regression scattering is more as compared to linear.

The factors which are having positive value of coefficient is indicates that with the increase in independent variable the dependent variable also increases positively and the factor which is having negative value of coefficient is indicating that with the negative decrease in independent variable the dependent variable will increases negatively.

V. CONCLUSION

The purpose of present study is to analyze the accidents on Borsad – Vataman highway. From the analysis of data following things have been concluded.

The Following findings are drawn from the above study:

- 1) Land-use pattern along the study area is Agricultural, Commercial/Industrial and Residential etc.
- 2) The Vehicle that is most responsible mode for the fatal accident is 4 wheelers.
- 3) Driver's error can cause maximum fatal accidents and visibility error can cause overall maximum accidents.
- 4) Two wheelers and pedestrians are the most vulnerable victim of the accidents on the selected stretch.
- 5) In the month of August, maximum accidents have been occurred.
- 6) Most of accidents occurred in season of rain.
- 7) It is observed that maximum number of accidents occurred during time 2:00-4:00 am.
- 8) In the year 2016 maximum accidents had occurred.
- 9) Among all age groups, 31-40 age groups are mostly responsible in accidents.
- 10) From analysis it is observed that maximum number of accidents occurred on the intersections and curves. So the improvement is needed on the intersections and curves.

- 11) Geometry of the road caused many number of accidents. So improvement is need for the surface of road as well as for the speed breakers of the stretch.

From the vehicle volume data obtained from government it is found that the population and concentration of vehicles in study stretch is increasing year by year. There are most of the drink and drive cases found in heavy vehicle drivers. Along this from the spot speed survey at two black spot on curves it had been found that most of the vehicles are driving at speed greater than permissible speed. Proper remedial measures should must be applied with immediate action to save valuable life of humans and property.

REFERENCES

- [1] Mouyid bin islam , Kunnawee Kanitpong, "Identification of factors in road accidents through in-depth accident analysis" , Science direct , IATSS research, February 2004
- [2] A. N. Dehury, A. K. Patnaik , "Accident Analysis and Modeling on NH-55(India)" International Journal of Engineering Inventions, May 2013
- [3] Dr. NSSR Murthy and R. Srinivasa Rao "Development of model for road accidents based on intersection parameters using regression models", International Journal of Scientific and Research Publications, January 2015
- [4] A.N.Dehury, A.K.Das, "Black Spot Analysis on National Highways", International Journal Of Engineering Research and Applications (IJERA) , May-Jun 2013
- [5] IRC:53-1982- Road Accident Forms A-1 and 4 (First Revision)
- [6] <http://www/NHAI/org>, National Highway Authority of India