ISSN (e): **2250 – 3005** || Volume, 08 || Issue, 5|| May 2018 ||
International Journal of Computational Engineering Research (IJCER)

# Road Accident Prediction Modeling At Intersetcions

Malothu Narasimha[1], Pavankumar N. Shirahatti[2], Debarati Jana[3], S. Ramya[4]
[1,2,3,4]*Assistant Professor, Department of Civil Engineering, MRITS College, Maisammaguda, Dist. Medchal-500010 India*
*Corresponding Author: Malothu Narasimha*

**ABSTRACT**
The road traffic deaths and injuries are predicted to be the third largest contributor to the global burden of preventable death by 2020. Incidentally, India holds the dubious distinction of registering the highest number of road accidents in the world. According to the experts at the National Transportation Planning and Research Centre (NTPRC), the number of road accidents in India is three times higher than that prevailing in developed countries. The number of accidents for 1000 vehicles in India is as high as 35 while the figure ranges from 4 to 10 in developed countries. A brief analysis of the NCRB report points out that Andhra Pradesh is having the highest share of deaths due to road accidents (12%) followed by Maharashtra and Uttar Pradesh (11% each).
To regulate or reduce road accidents, identification of the accident prone locations and the factors to be evaluation is essential. For identification of accident prone zones and factors affecting accidents, the accident prediction models are developed. In the present study, the models at intersections are developed for accident rate with respective to intersection parameters for selected stretches on National Highway-9 and National Highway-7. The factors causing or influencing may be rectified and improvement can be done for prevention or reducing the accidents at intersections in the future improvements.

**Keywords:** Preparation of. Accident Data, Models at Intersections, Study Area Description.

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Date of Submission: 05-05-2018 Date of acceptance: 21-05-2018

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## I. INTRODUCTION

Road accidents have been a major social problem in the developed and developing countries. In developing countries due to development in industrialization and urbanization with increase in the vehicular population there is no escape from accident hazard. Studies on road accident have indicated that accident rate in developing countries are high compared with those in developed countries. Travel is an inherently risk activity, because movement creates kinetic energy, and if there is an accident or collision, the energy exchanges can cause damaging to both human and property.

## II. LITERATURE REVIEW

The development of models relating traffic accidents and volumes has been the subject of numerous studies. Generally, there are two main options for estimating the model parameters: the conventional linear regression approach, which assumes a normal distribution error structure, and the GLIM approach, which assumes a non-normal error structure (usually Poisson or negative binomial).
The GLIM approach used here is based on the work of Hauer et al (1997) and Kulmala(1995). *Y* is assumed as random variable that describes the number of accidents at an intersection in a specific time period, and *y* is the observation of this variable during a period of time. The mean of *Y* is L, which can also be regarded as a random variable. Then for L=l, *Y* is Poisson distributed with parameter l. Because each site has its own regional characteristics with a unique mean accident frequency L, Hauler (1997) et al. Have shown that, for an imaginary group of sites with similar characteristics, L follows a g distribution (with parameters k and k/μ), with a mean and variance of $E(Y) = \mu$; $\text{vary}\ (Y) = \mu + \mu^2 /K$ .
**Model structure:** The model structure used in this study relates accidents to the product of traffic flows entering the intersection. This type of model has been shown to be more suitable to represent the relationships between accidents and traffic flows at intersections. In this model structure, accident frequency is a function of the product of traffic flows raised to a specific power (usually less than 1). That is the estimation of model

parameters is based on a methodology proposed by Bonneson and McCoy (1989). First, the model parameters are estimated based on a Poisson error structure. Second, a dispersion parameter ($\sigma_d$) is calculated:

## III. METHODOLOGY

The intent of this chapter is to explain the procedure which is going to be adopted in this present study. A flow chart involving proposed methodology is shown in Figure 1.

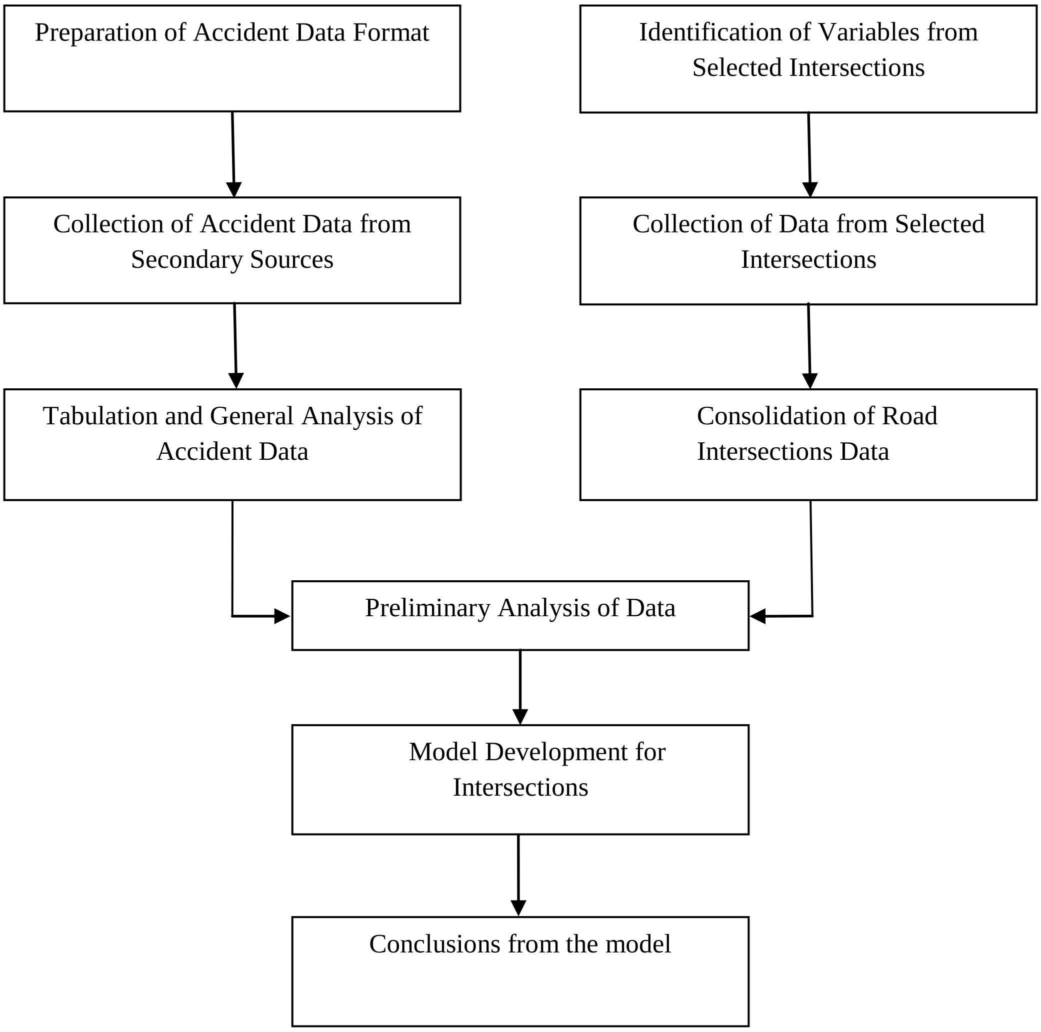
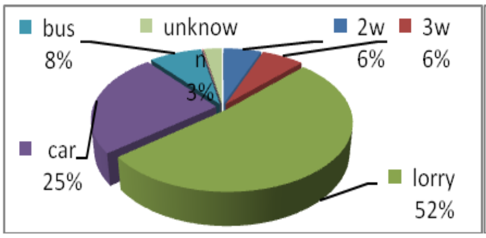



**Figure 1. Flow chart of methodology**

## IV. COLLECTION OF INTERSECTION DATA

**Table 1. Number of Accused and Victim Vehicles Involved In The Accidents**

| Vehicle Type | Accused Vehicle | Victim Vehicle |
|---|---|---|
| 2w | 89 | 377 |
| 3w | 98 | 164 |
| lorry | 782 | 272 |
| car | 372 | 180 |
| bus | 122 | 78 |
| cycle | 0 | 51 |
| ADV | 0 | 7 |
| pedestrian | 3 | 292 |
| unknown | 42 | 67 |



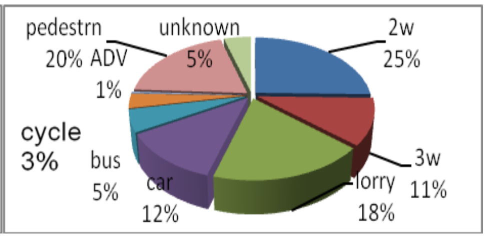




**Figure 2. Composition of Accused vehicles involved in the accident**

**Figure 3. Composition of Victim involved vehicles involved in the accident**

On the selected stretch detailed traffic and pedestrian volume surveys are carried out and intersection parameters include approach width, shoulder width, number of legs, and angle of turn.

### 4.1 Nature of Accident Occurred

**Table 2. Nature of accidents occurred**

| Nature of Accident | No. of Accident |
|---|---|
| overturning | 68 |
| Head on collision | 658 |
| Rear end collision | 397 |
| Collision brush | 264 |
| Right angled collision | 7 |
| Skidding | 22 |
| Right turn collision | 5 |
| Hit tree | 28 |
| Hit n run | 85 |

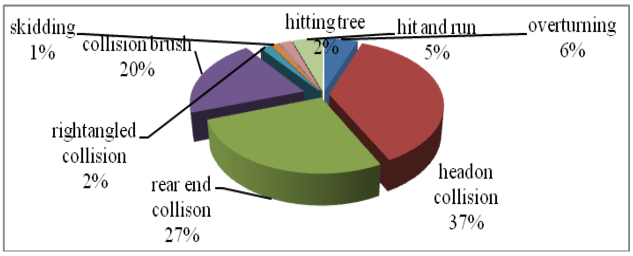



**Figure 4. Nature of Accidents**

The rear end collision and head on collision are more due to misjudgment of speeds between following and opposing vehicles, as show in Table 2 and Figure 4

### 4.2 Time Wise Distribution of Accidents

**Table 3. Time wise distribution of accidents**

| Hours of the day | No of accidents | Hours of the day | No of accidents |
|---|---|---|---|
| 0:00- 1:00 | 22 | 12:00-13:00 | 65 |
| 01:00 - 2:00 | 47 | 13:00-14:00 | 75 |
| 2:00- 3:00 | 36 | 14:00-15:00 | 61 |
| 3:00-4:00 | 55 | 15:00-16:00 | 73 |
| 04:00 - 5:00 | 49 | 16:00-17:00 | 96 |
| 5:00-6:00 | 53 | 17:00-18:00 | 85 |
| 6:00-7:00 | 72 | 18:00-19:00 | 82 |
| 7:00-8:00 | 52 | 19:00-20:00 | 110 |
| 8:00-9:00 | 62 | 20:00-21:00 | 81 |
| 9:00-10:00 | 69 | 21:00-22:00 | 51 |
| 10:00-11:00 | 71 | 22:00:00- 23:00 | 56 |
| 11:00-12:00 | 66 | 23:00-24:00 | 52 |

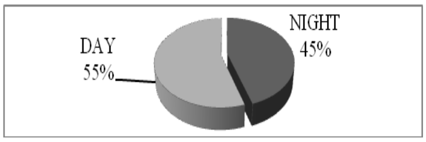



**Figure 5. Time wise distribution of accidents**

The time of occurrence of accidents is categorized into hourly blocks indicating that the accidents are distributed throughout the day. It is seen that the accidents occurred during day and night are in 55% and 45% proportion respectively. From Table 3 it is observed that accidents are occurring during 16:00 to 17:00 and 19:00 to 20:00 hours and presented graphically in Figure 5

**Table 4. Accidents occurred in different places**

| Type of area | 2006 - 2010 |
|---|---|
| near school | 14 |
| near or in side viilage | 996 |
| near a factory | 64 |
| near a religious place | 25 |
| in bazar | 110 |
| near office complex | 40 |
| near hospital | 32 |
| residential area | 24 |
| open area | 35 |
| near bus stop | 125 |
| near petrol pump | 40 |
| effected by encroachments | 8 |
| near recreation place | 21 |

Accidents occurred at different places are categorized as shown in Table 4 most of the accidents occurred near the villages where the highway is passing and graphical presentation is shown in Figure 5

# V. MODEL DEVELOPMENT

## 5.1 General

Some of the factors responsible for accidents at intersections are traffic volume, pedestrian volume, approach width, number of legs, shoulder width, turning radius and turning angle. In this chapter an attempt has been made to relate these factors with number of accidents and obtained relationship.

## 5.2 Relation Of Accident/Year With Intersection Parameters

**Table 5. Relation between the parameters**

| Variable | Equation | $R^2$ Value |
|---|---|---|
| Major Road Volume | Y = (1E-04)X + 1.727 | 0.159 |
| Minor Road Volume | Y = (1E-05)X + 1.568 | 0.472 |
| Turning Traffic | Y = (8E-05)X+2.474 | 0.103 |
| Pedestrian Volume | Y = (1E-05)X + 1.694 | 0.503 |
| Edge Drop | Y = exp(0.018X) | 0.608 |
| Number of legs | Y = 1.207X-0.930 | 0.158 |
| Turning Radius | Y=exp(-0.01X) | 0.169 |
| Speed | Y=1.77exp(0.004X) | 0.012 |

An attempt has been made to develop the relationship between accidents and different intersection parameters using Microsoft Excel trend line approach. An attempt has been made to develop Poison regression model for accidents to intersection parameters. The trend line results and the relationship between the parameters are shown in Table 5

## 5.3 Development Of The Model Using Ncss Software

For developing model the following intersection parameters are considered as independent variables where accident per year (Y) is taken as dependent variable in the analysis.

1. Major Road Volume (MRV) 2. Minor Road Volume (MRV)
3. Turning Traffic Volume (TTV) 4. Pedestrian Volume (PV)
5. Approach Width (AW) 6. No. of Legs (NL)
7. Paved Shoulder Width (PSW) 8.Earthen Shoulder Width (ESW)
9. Turning Radius (TR) 10.Speed (V) 11. Edge Drop (ED)

**MODEL FORM**

**ACCIDENT rate, Y = 0.3386exp(0.00001*MRV + 0.0001*mrv + 0.00003*TTV + 0.00009*PV + 0.67567*NL + -0.01654*TR)**

Where,

MRV is Major Traffic Volume (veh/day)
mrv is Minor Traffic Volume (veh/day)
TTV is Turning Traffic Volume (veh/day)
PV is Pedestrian Volume (ped/day)
NL is Number of Legs for the intersection
TR is Turning Radius (m)

## VI. CONCLUSIONS

The following conclusions are drawn from the present study

1. Number of legs and turning radius are playing critical role for the accidents at intersections.
2. Major traffic, Minor traffic, Turning traffic and Pedestrian volume are the major factors causing collisions.
3. Approach width is also playing a critical role for intersection accidents.
4. As the number of legs of intersection increases there is a increase in accident rate.
5. As number of intersections or access points increases there is a increase in accident rate.
6. Number of legs, Major, Minor traffic volume, Pedestrian volume and Turning traffic are having positive relation with the accident rate.
7. Approach width and Turning radius are having negative relation with the accident rate.
8. Most accused type of vehicles causing accidents are the heavy vehicles like trucks and the victims are pedestrians and two wheeler riders.
9. Head on, Rear end and sideswipe (collision brush) collisions are observed in more number of accidents.
10. The accidents occurring during day and night are almost equal in proportions.
11. Highest numbers of accidents have occurred near the villages where the National Highway is passing.
12. Highest numbers of accidents have occurred in the month months of January, March, April and May.

## REFERENCES

[1]. Andrew Vogt and Joe Bared (1998), "Accident Models for Two-Lane Rural Segments and Intersections", TRB Paper No.98-0294.
[2]. Andrew P. Tarko (2006), "Calibration of Safety Prediction Models for Planning Transportation Networks", Transportation Research Record 1950, pp. 83-91.
[3]. Arun Chatterjee (2005)," Planning Level Regression Models for Crash Prediction on Interchange and Non-Interchange Segments of Urban Freeways", Southeastern Transportation Center, Center for Transportation Research, The University of Tennessee, Knoxville, TN 37996-4133 August, 2005.
[4]. Charles V Zegeer (1995) "Accident Relationships of Roadway Width on Low-Volume Roads Horizontal curves". TRB.
[5]. Dr.B.N.Nagaraj, M.V.L.R.Anjaneyulu & K.S.Vipin (2002)," Systematic Segmentation Approach for Prediction of accidents at intersections un urban areas", Journal of the Indian Roads Congress, Aug 2002 ,vol63-3, 625-646.
[6]. Dominique Lord and Bhagwant N. Persaud (2003), "Accident Prediction Models With and Without Trend: Application of the Generalized Estimating Equations (GEE) Procedure" , Paper No. 00-0496
[7]. El-Basyouny and Sayed T (2006), "Comparison of Two Negative Binomial Regression Techniques in Developing Accident Prediction Models", Transportation Research Record 1950 pp. 9-16.

Malothu Narasimha "Road Accident Prediction Modeling At Intersetcions." International Journal of Computational Engineering Research (IJCER), vol. 08, no. 05, 2018, pp. 17-21.