

A REVIEW ON ACCIDENT ANALYSIS IN ROAD TRAFFIC AND PREDICTION MODEL

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Abstract – Road accidents is a matter of serious concern in India. There is tremendous increase in number of people killed per number of road accidents with increase in vehicular population. Road traffic accidents injuries are one of major cause of death and disabilities in the country imposing huge socio-economic costs. Due to road accidents, developing country like India suffers from a huge economic loss .Traffic flow characteristics, traffic analysis is related to traffic control. For this purpose accurate data of road accidents is required to control and suggest safety measures on road traffic accidents. Without accurate data and deep understanding of crash risks the problem of road accidents cannot be solved. This study aims to provide brief information about the studies conducted for the road traffic analysis, current scenario of road accidents and to find the factors responsible for road accidents. After reviewing the whole analysis on road traffic accidents, factors responsible for road accidents are being evaluated and safety measures, recommendations are provided to avoid the damage to precious life of living beings.

Keywords – vehicular population, road traffic accidents, socio-economic, current scenario, safety measures

I. INTRODUCTION

India has the highest number of road deaths across the globe. One in every 10 deaths is reported from India (times of India). Road accidents in India report 2017, reflecting information that total number of registered motor vehicle in country grew at a rate of compound annual growth rate (CAGR) 9.9 percent between 2006 to 2016, while total number of length of road accident increased compound annual growth rate (CAGR) 3.7 percent over period 2006 to 2016, implying a worsening vehicular congestion on road. Most of roads are heavily encroached by parked vehicles. This results in restricting traffic flow. The number of vehicles registered in year 2017 was found to be 2,52,354 thousands. The number of vehicle registered has increased by 22320 thousands as comparing to the previous year. The number of road accidents in 2017 was found to be 4,64,910. The number of road accidents has decreased by 15742, comparing to the previous year. There is significant decrease in number of fatal accidents, number of persons killed, number of persons injured. The number of road accidents has decreased for consecutive two years. But the accident severity of year 2017 was 31.8 which is increased by 0.4 percent. Accident severity is increasing every year. This reflects, that percentage number of people killed as compared to the number of road accidents in year 2017 is more. With decreasing number of road accidents, it is also important to decrease accident severity.

Table 1
Road accidents in India (Current Scenario)

Year	Total Accidents	Number of Vehicles Registered (in thousands)	Fatal Accidents	Number of persons killed	Number of persons injured	Accident severity
2010	4,99,628	1,27,746	1,19,558	1,34,513	5,27,512	26.9
2011	4,97,686	1,41,866	1,21,618	1,42,485	5,11,394	28.6
2012	4,90,383	1,59,491	1,23,093	1,38,258	5,09,667	28.2
2013	4,86,476	1,81,508	1,22,589	1,37,572	4,94,893	28.3
2014	4,89,400	1,90,704	1,25,828	1,39,671	4,93,474	28.5
2015	5,01,423	2,10,023	1,31,726	1,46,133	5,00,279	29.1
2016	4,80,652	2,30,031	1,36,071	1,50,785	4,94,624	31.4
2017	4,64,910	2,52,354	1,34,796	1,47,913	4,70,975	31.8

Source – Road accidents in India 2016, 2017 (Government of India and Ministry of Road Transport and Highway)
Accident Severity: number of peoples killed per 100 accidents

II. LITERATURE REVIEW

A. SANJAY KUMAR SINGH, ASHISH MISHRA “Road accident analysis: A case study of Patna city.” Department of humanities and social sciences IIT Kanpur, Uttar Pradesh, India

In this paper road accident analysis of Patna city is done from year 1996-2000. It provides an overview of road accident scenario in India and also deals with existing transport system in India. Data was collected from police station and Deaths and Suicide in India 1996, 1997, 1998 published by National Crime Record Bureau. It conveyed a detail analysis on rate of road accident deaths, fatality rate, type of accidents, category of fatality, age wise distribution, vehicle responsible, percentage of accidents during day and night, location, black pots in Patna. Vehicular population has increased from 219906 to 294164 from 1996 to 2001 in Patna. He conclude that public transport system i.e. Rail and bus plays a negligible role in urban transport system in Patna. Due to this vehicle population is increasing.

Study concluded:

According to vehicle-wise accident rates, buses are most risky (as per number of accidents by number of buses registered).

From year 2000 onwards, new road bypass (NH-38) is most accident prone location in city. (Contributed 15% of total) 31 to 45 years people are more responsible for accidents.

B. VELURU SAILAJA, DR. S. SIDDI RAJU, "Accident Analysis on NH-18 by using Regression Model and its preventive measures." Deptt of civil engineering, Siddharth institute of Engineering and Technology, Puttur, A.P 517583, India

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. Accident data of 5 years (2008-2012) was collected from near police stations. The data was analyzed using SPSS (statistical package for social sciences) software. The accident model was developed between number of accidents (dependent variable) and width of road, alignment of road, number of side roads and traffic volume (independent variable).

Study Concluded:

Trucks are responsible for most accidents (27%).

Most accidents took place between 9 to 10 and 16 to 17.

From data stimulation, it was found that Road Markings, Conditions, Traffic Volume, Median Opening and Carriageway condition were main parameters for causing accidents.

Suggestions to reduce road accidents like, penalties of fine, check on drivers by police, maximum hour of work for drivers, rules for cyclist, motor cycle riders, uniform road signs was given.

C. MANU.N.NAIR, DR.V. THANGAMANI, "An Analysis of Spatially explicit Scenario of Road Traffic Accidents in Kerala Using GIS." School of Earth and Atmospheric sciences, Madurai Kamaraj University, Madurai, Tamil Nadu, India

The aim of the study is to examine the temporal variation in the patterns of road traffic accidents, to identify the factors leading to road accidents and to formulate suggestions to avoid road traffic accidents. Road accident details were taken from Kerala police (2001-2014), and number of vehicles registered are taken from Motor Vehicle department Kerala and NATPAC. Details were analyzed using GIS.

Study Concluded:

In 2007 and 2010 the most number of accidents are recorded in Ernakulum followed by Thiruvananthapuram the capital city. Also the number of accidents has reduced from 2007 to 2010 to 3.09%.

Most of accidents are due to carelessness of drivers or the pedestrians.

Accidents are decreasing from year 2007 to 2010 but the injuries and deaths rate are increasing in many districts.

D. A.N. DEHURY, A.K. PATNAIK, A.K. DAS, U. CHATTRAJ, P. BHUYAN, M. PANDA, "Accident Analysis and Modelling on NH-55 (India)." Department of civil engineering, National Institute of Technology, Rourkela-769008, Orissa, India

The aim of this study is to study the accident rate on hourly, monthly, annually on selected stretch, to study traffic volume effect, and to develop accident prediction model based on density and road condition. Stretch from chainage km 157/0 to km 159/0 was selected and divided into five equal stretches of 5km each. The data of last ten years from year 2002- 2011 was collected and analyzed. Prediction model given was:

No. of accident = $48.599 * \text{density} + \text{no. of tress on shoulder} * 0.7 + \text{no. of curves} * 4.998 - 8.914 * \text{shoulder condition}$

Study concluded:

Most accidents occur in month of March, April, May between 8 to 9 pm.

Trucks (60%) was responsible for major accidents.

Accidents can be reduced in the selected stretch by road side clearance, proper maintenance of shoulders, lightning and junction improvement.

E. MIAOMIAO LIU, YONGSHENG CHEN, GUANGQUAN LU "The Analysis of serious fatal road traffic accidents in China", Research institute of Highway, Ministry of Transport, 8 Xitucheng road, Haidian district, Beijing 100088

In this paper analysis of Serious Fatal Road Traffic Accident data of year 2004 to 2014 is done using Statistics Software SPSS. Regression analysis between number of serious fatal road traffic accidents (SF-RTA) and various factors including human, vehicle, road, society was done. Decision tree analysis is also performed. Data is collected from Road Accident

Statistics Annual Report of People's Republic of China. Analysis is performed on basis of regional distribution (Eastern, Middle, Western), provinces, hour, week, month, vehicle distribution, type of road, accident type

Study concluded:

From Regression analysis it is concluded that S1, H1 and R4 (denoted gross domestic product, total population and substandard highway mileage) has larger impact on number of SF-RTA than other factors.

Decision tree Analysis also concluded that R4 and H1 are main factors affecting SF-RTA. Results were found similar to Regression analysis.

SF-RTA occurred in western region the most. Timing were found to be 6 to 8 and 12 to 16. Accidents occur on Saturdays are most.

F. RAHUL BADGUJAR, PRIYAM MISHRA, MAYANK CHANDRA, SAYALI SANDBHOR, HUMERA KHANUM “Accident data analysis using statistical methods- case study of Indian highway” Department of civil engg, Symbiosis Institute of Technology, Pune, India

The aim of this study is to study various factors causing road accidents and to use regression technique to predict the occurrence of accidents for certain situation. Data of road accidents for a stretch of 101 kms of NH-9 was collected for past 3 years. From regression analysis an equation was obtained:

$$y = (-0.00357x_1 + 0.016035x_2 - 0.01715x_3 + 0.009262x_4) + 2.460883$$

y = classification of accident, x1 = road feature, x2 = road condition, x3 = intersection type and control, x4 = weather condition

For validation of regression analysis predicted values from regression analysis were compared with available accident data and found that prediction model for classification of accident predicts 66% values.

Study Concluded:

Analysis based on accident location predicts 180- 189 km on right lane and 240-249 km on left lane have highest no. of accidents on study stretch. Safety provisions must be done for these locations.

Analysis based on time predicts 18:00-20:50 hrs have highest no. of accidents on study stretch. Lighting provisions must be improved.

G. ELANGO S, RAMYA AB, RENITA, REVATHY S, RAJAJEYAKUMAR M “An Analysis of Road Traffic Injuries in India from 2013 to 2016: A Review Article.” Department of community medicine, MGR University, India

The aim of this study is to analyze the available data on road traffic accidents from year 2013-2016. Study also aims to access the availability of India to achieve the Brasilia declaration (to reduce accident by 50 percent till 2020). The data is analyzed in SPSS software.

Study concluded:

Most of accidents happen in Tamil Nadu and are caused by age of 18-44 years.

Two wheeler type of vehicle is mostly responsible for this.

Most of accidents are uncontrolled, caused due to fault of driver and occur in month of May.

Current efforts to reduce the number of accidents are not sufficient to achieve the Brasilia declaration.

Recommendation were given to reduce number of road accidents: to increase awareness, to strengthen road safety management and its enforcement, to enforce safer road infrastructure.

H. MUKUL NAMA, MR. NANDESHWAR LATA, DR. BHARAT NAGAR “A statistical data analysis of road traffic accidents in Jaipur city.” Civil Engg. Department, Jagannath University, Chaksu, Jaipur, India

Objective of this study is to analyze the traffic data of Jaipur, to identify the black spots and to suggest safety measure to minimize road accidents. Collected the data from three police stations. Collected road width data and traffic volume in PCU/hour manually of three locations. After analyzing the data road intersection with maximum frequency of accident is identified and found that number of road accidents in Nri circle (77 to 143), Trivani Tiraha (64 to 118), B2 Bye Pass (180 to 224) has increased from year 2006 to 2015.

Study concluded:

Designed a signal for NRI Circle.

In B2 Bye Pass most accidents occur at night. Reason behind the accidents is that road to Mansarovar is having the divider but there is no obstruction so the glazing of vehicle head light is falling on opposite side. For decreasing accidents he suggested proper arrangement in dividents and provocations of cameras and a speed breaker.

In Trivani Tiraha he designed a signal.

I. FSHATSYON BRHANE GEBRETENSAY, JAYESH JUREMALANI “A Road traffic accident analysis and prediction model: A case study of Vadodara city”, dept. of Civil engineering, Parul University, Gujarat, India.

This paper aims to perform a micro level analysis of road traffic accident data of last seven years (2010 to 2016) and to develop an accidental model in Vadodara city. Data is collected from nearest police station and a detailed analysis is done on basis like hour, year, location, type of collision, type of road accident, weather condition, vehicle wise distribution, vehicle ownership. On above analysis an accident prediction model is develop between (a) vehicle-population ratio and number of accidents (b) vehicular composition and total number of accidents using Regression analysis. Model is validated using Chi Square test.

Study concluded:

During last seven years number of killed peoples of city is increasing year to year with increase in population.

Most number of accidents occur in month of May and between time 10:00 to 11:00 am.

Highest cause of accident is fault of driver and two-wheeler (32%) type of vehicle in the city.

J. WEIHONG MA, ZHENZHOU YUAN, “Analysis and comparison of traffic accident regression prediction model.” Moe key laboratory for urban transportation complex systems theory and technology, Beijing Jiaotong University, Beijing 100044, China

This paper aims to compare the goodness of degree parameters of different models (Poison Regression, Negative Binomial (NB) Regression, Zero Inflated Negative Binomial (ZINB) Regression, Random Forest (RF) Regression) and to select one with best fitting degree. Relationship between the expected number of traffic accidents and various influencing factor is find out from various models and then compared.

Study concluded:

For the existing traffic data, ZINB regression model has best goodness of fit, followed by NB, RF and Poison regression.

Poison regression has poor goodness of fit.

III. CONCLUSION

- i. The number of road accidents has decreased for two consecutive years in India i.e. for year 2016 and 2017. But the accident severity has increased by 0.4 percent for year 2017 and the number of vehicles registered has also increased. The number of vehicles are increasing due to increase in population and poor public transportation system.
 - ii. The major cause of accidents are fault of driver, over-speed, carriageway condition, over- loading and pedestrians.
 - iii. Trucks and two wheeler type of vehicles are most responsible for road accidents.
 - iv. Most of accidents occur in between 9:00 to 11:00 am and 5:00 to 8:00 pm.
 - v. The regression model provides a good relationship between the dependent and independent variable.
- As accident severity is increasing year by year so there is alarming need to decrease the number of year killed as compared to number of road accidents.

IV. RECOMMENDATIONS

- i. Public transportation system must be strengthen. GPS based transportation system should be installed.
- ii. Separate ambulance lanes should be made.
- iii. Speed cameras and sensors should be installed in black spots.
- iv. Effective enforcement should be done on over speeders and drunken drivers.
- v. Road infrastructure such as traffic signs and carriage conditions should regularly checked and maintained.
- vi. Road accident data should be collected effectively.

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