MODELING TRAFFIC FLOW ON THE INTERCHANGE AND ACCIDENT ANALYSIS AND DEVELOPMENT OF CRASH PREDICTION MODEL OF HARYANA (FARIDABAD CITY)

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I. CRASH PREDICTION MODELS

Transport is an important factor in achieving economic success in any country's urban and rural areas. Rapidly urbanization, industrial and immigration and other social changes have increased the need for aging groups to travel in all major cities of China. Because the public transport system does not meet the needs of the travelers, because the number of road users utilizes private transport in all major cities of India. It's like most personal vehicles, like two wheels and passenger cars. Road collisions are accidents or accidental losses. Due to traffic accidents on roads, the main part of death rate is increasing.

II. LITERATURE SURVEY

[1] P. Pramada VALLI: Massive scale widely used in India, road-usage patterns are very different from countries developed. In Indian cities, a number of non-motor vehicles are part of the roads. After independence, India's rapid urban population rapidly developed 23 Metropolitan cities according to 2001 census. Although the risk of road traffic accidents has become an important problem in more than 90,000 people's annual losses, a large part of it is from major cities. The purpose of this document is to analyze the data on road traffic accidents, and at every level in major cities in India..

[2]Darçin Akin and Bülent Akba: The Neural Network (NN) models have been developed to offer traffic accidents in the Macomb County of the State of Michigan (MI), USA. Only the deadly injury and loss of property (PDO) occurs at the time: The probability of neural network models is divided by the collision to determine the following types of power. Trained back propaganda algorithm to simulate the type of collision and effects (e.g. time, weather, light and surface conditions) Multi-feed forward nervous network NN for non-linear relationship between car and driver development and testing Methods, features and so on.

[3] Ali Payıdar Akgüngör, and Erdem Dogan: The forecast for traffic accidents is used for research safety research. This study analyzes two analytical models and a artificial neural network (ANN) model to assess the number of traffic accidents in three metropolitan cities in Turkey between 1986 and 2005. The first analysis model is Smeed crash forecasting model, and a compound of the second Andreessen model. In model development, population (p) and number of vehicles (N) are considered free variables. In artificial neural network procedures, S type and pure linear functions are used as integration functions of the forwarding projection algorithms. Comparison between the estimated values and observation values according to the model shows that the ANN model is better than the other two analytical models.

[4] Felipe Ladrón de Guevara, Simon P. Washington, and Jutaek Oh: At least two major transport planning activities have confidence in the forecasting model prediction model. One of these 21st Century Transit Equality Bills Transport Sector and Metro-Planning organizations will need to consider security issues in the process of transport planning clearly. The other reason may be that national agencies need a stimulating plan to reduce loss and save lives. Both of these applications need future security offer. Toxins, Describing the Feelability Level by Planning Arizona Metropolitan Area of Endangered Forecasting model to demonstrate these models. This figure was divided into deadly, injury and property accidents.

[5] Moinul Hossain,Yasunori Muromachi: It is said that near the shield is a dark place on the highway of the city. While maintaining a high speed, the driver requires a high level of academic answers to ensure road safety, reading road signs, reading routes, answering such kindness and other vehicles and other complicated events, which requires a safe distance. Therefore, there may be driving errors caused by any additional trouble due to traffic dynamics.

[6] Hillary Isebrands and Shauna Hallmark: The Roundabout is becoming effective in the American citizen and the suburban environment, but ring on the rural road's color road is a bit more convenient. There is no doubt that roundabouts reduce the speed of all vehicles and reduce the frequency of deadly and injury-related accidents. This study is the first comprehensive survey on fast track in the rural environment. Ninth squares have a wide range of data about data security analysis and analysis.

III. EXPERIMENTAL INVESTIGATION

3.1 Modeling traffic flow on the interchange and Accident analysis and development of crash prediction model of metro city.

3.1.1Purpose of the research:-

The overall goal is to study on the impact of all major road features on the safety of rural roads and to develop powerful collision prediction models with these features. As described below, three-step method or plan is presented to achieve this purpose.

Skipping study for identifying key variables and data

collection and initial sample requirements
Study pilot to examine alternate data collection methods and improve sample size and budget requirements.

3.1.2 The main study, to build the necessary models.
Navy Land Transport Authority NZ (now the NZTA) funded the 2006 skipping study. The main purpose of skipping study is:
• Investigate the current transaction forecasting model to ensure which variables are important.
• Determine that road and traffic related features can be added to predictable models of rural road traffic and determine current (electronic) variables that can be used to keep these features in quantity.

3.1.3The next generation of rural road crash prediction models:
• Determine the data needed to be stored in the field to provide the complete set of variables for the model.
• Prepare mapping and data collection methods for each variable.
• Create a sampling framework for pilot study and prepare basic sample framework for basic study.

In July 2006 a skipping report was developed to discuss each objective.
The Land Transport New Zealand Research Fund later funded the 2008-09 project pilot Study (Step 2). The main objective of pilot study is:

• Data of every important street feature described in the report of the Waikato 500 meter × 200 million Rural Highway section was collected. New data (when electronic was not available) was manually submitted to the site.
• Use video data collection technology to collect "new" data samples for samples of rural roads and then determine that this method is mainly enough to change the process of submitting manual database. Is correct
• Prepare initial transaction forecasting models for major types of technologies for key roads.
• Estimate the sample size for the main study to produce national and regional rural road models.
Pilot's study was published in March 2011 (Turner et al 2011) and is the initial model developed at this stage.

3.2Data Collection:-
Crash Prediction Data Analysis
Perform data analysis of crash forecast models. Bowen Ally, Osmania University, Punjagutta, Banjara Hills and Jubilee Hills sites were modeled for the ideal because more accidents occurred during their expansion. Table 3 provides data for deadly, neutral, and total number of accidents. This is the main reason for the crash analysis to consider individual variables. These locations are considered more traffic accidents due to their expansion in the city. The crash forecast model is used for the development.

Collision Type Data Analysis
In order to collect data on the Hyderabad area, it is important to find out what type of collision. According to the type of collision, analyze the data, vehicle type involved in the vehicle, and number of car accidental and non-death accidents.

Data Analysis
Perform the initial analysis of data to understand the variations of variable parameters. The broom can be seen due to driving, more in the context of the road. Table 3.1 provides the description of every variable considered for the crash model development. Time and weather conditions were not considered for analysis because figures were not reflected in other ways.

Table 3.1 road data analysis

Road Data	Road Crash Data	Traffic Data
Inventory Survey Shoulder width Number of curves Number of bus stops Subjective Rating Pavement condition Shoulder condition	Police Records Road crash location Age of driver Type of vehicle involved Number of persons injured or dead Type of collision	Manual Method volume count conducted at midblock sections

IV. OBJECTIVE OF THE STUDY

The three-year road traffic accident data was collected and analyzed. The first part analyzes the use of multiple linear refinements, Poisson regression and legal models. The second part of the analysis is analysis using traffic analysis and traffic data.

The purpose of study is:
a) Determine road traffic accidents and variable effects that determine the mathematical model.
b) Estimate the importance of road accident collision.

V. PROPOSED WORK

Development of Models for Crash Prediction and Collision Estimation- A Case Study for Faridabad City:
Road traffic crash is a cause of unnatural death and occupies fifth position in the world as per WHO records. Road crashes in India are alarming in situation while road safety is professionally lacking and politically missing. Faridabad city, the capital of newly formed Haryana State occupies sixth position in occurrence of road crashes. An attempt is made to understand which model is suitable for road crash prediction and estimation of collision type which is influencing road crashes in the city. A retrospective observational study was conducted in the city of considering factors as roadway geometrics, traffic data and type of collision. Regression models like Multiple Linear Regression, Poisson Regression, Compare-IT-Model Model and Multinomial Logistic Model are considered for arriving

crash prediction models. The suitability of model is based on R2 and chi-square test. It is observed from the analysis through comparison of above model; Compare-IT-Model model has an R2 of 0.997127 and is significant for chi-square test. Shoulder condition is an affecting factor for non-fatal crashes in the city which is ascertained by Compare-IT-Model model. Further analysis is also carried for arriving on type of collision influencing on road crashes. It is observed from the results that sideswipe is more significant for road crashes. Transportation is an important factor for providing an economical success in urban and rural areas of any country. Rapid urbanization, industrialization and migration along with other social changes have resulted in increasing necessity for travel across all age groups in all metropolitan cities of our country. As public transportation systems is not in pace with the demand of commuters, a large portion of road user adopts personal modes of transport across all metropolitan cities in India. This has resulted in increasing volume of more personalized motor vehicles such as two-wheelers and passenger car. A road crash is a damage that happens unexpectedly or by chance. A Major part of death rate is increasing due to road crashes. The Global Burden on Disease Study conducted by World Health Organization (WHO) reveals that every year about 1.24 million people die due to road crashes, mostly young people of age 15-29 year are involved in road crashes. As per the data of National Crime Records Burea(NCRB) it is said that the road crashes occupies ninth position during the year 1990 and will be moved to third position by the year end of 2020. A total of 400517 fatal deaths were reported in the country during the year 2013. There is an increase in 1.4% of fatal crashes from the year 2012-2013. Ministry of Road Transport Highways (MORTH) data exhibits that every hour there are about 56 road crashes, every hour more than 14 deaths and majority is due to the occurrence of road crashes. The crash rate of Andhra Pradesh during the year 2013 was 36.1% (SourceMORTH11.)Most of researchers explained that road crashes are unpredictable because of factors beyond control. Regression models were developed by them for predicting road crashes considering various factors in most of the metropolitan cities. In this paper an attempt is made to develop Crash Prediction Model and to estimate which type of collision is more significance for the cause of road crashes. Four types of regression models are considered: Multiple Linear Regression, Poisson regression and Compare-IT-Model models for prediction of crashes and Logistic Regression was used for estimation of collision significance.

5.1 Objective of the Study:

Three years road crash data was collected for city and is considered in analysis. First part analysis is carried using Multiple Linear Regression, Poisson regression and Compare-IT-Model models. Second part of analysis is carried using traffic and crash data for collision analysis.

5.2 The objectives of study are:

a) To ascertain which type of mathematical model is suitable for prediction of road crashes and its influencing variables.
b) To estimate type of collision significance on road crashes.

Road safety is emerging as a major social concern in the country. A major part of the death rate is increasing due to road crashes. Many models were developed for Prediction of road accidents. Honget al. developed models considering the characteristics of roadway alignment and traffic characteristics. They developed models that can be used to predict the accident rates on new or improved roads. Desai and Patel focused on the development of accident prediction model based on regression analysis. They made attempt to develop accident model based on linear regression techniques. The model exhibits satisfactory goodness-off it and a good prediction of success rate. Olugbenga and Makinde discussed on regression models developed with dependent variables as number of accident and independent variables as number of people killed in the accident, number of people injured, number of people involved in the accident. The model has provided good coefficient of correlation and coefficient of determination “R2” value. Awe and Mumini developed regression models to capture the interconnectedness among accident related variables in Nigeria. Their study focused on determining the degree of association between those who are killed in road crash. Variables considered are number of vehicles involved, number of accidents recorded, number of injuries and month of the accident occurred.

Table 5.1. Literature review on influence of geometric and traffic variables on crashes

Factor	Factor	Conclusions
Width of Road	Garber and Erhard3	There is no relationship between road width and crashes. Traffic volume and speed are responsible for cause of crashes.
	Hanley et al.4	As shoulder and lane widths increases crash rate decreases.
Width of Shoulder	Hauer5	More number of fatal road crashes occurs due to improper shoulder width.
	Anitha and Anjaneyulu1	More number of fatal and non-fatal crashes is due to reduction of shoulder width.
Condition of Shoulder	Ogden12	Unpaved shoulders play a prominent role for the cause of crashes.
Traffic Volume	Haynes et al.6	Traffic volume is more responsible for the increase of crash rate.

Rao used factors that influences road accidents and has analyzed using Statistical Package for Advance Excel, a mathematical toll for development of regression models. His objective is to review relation between accident per year and intersection.

5.3 Crash Causing Factors:
There are five critical components that interact in a traffic system as
(i) Road users (drivers & pedestrians),
(ii) Vehicle factors,
(iii) Traffic Control Devices,
(iv) Environmental factors and
(v) Streets and Highways.
In the analysis more number of road crashes occurs due to road users.

5.4 Key Concepts in Regression Modeling:
Regression analysis is a statistical process for estimating the relationships among dependent and independent variables. There are many techniques for modeling and analyzing variables correlations. Regression analysis is widely used for predicting road crashes.

5.5 Multiple Linear Regressions:
In this approach modeling is carried between a scalar dependent variable y and one or more explanatory variables (or independent variable) denoted as X, $Y = \beta 0 + \sum \beta i . Xi + e$ where, Xi is explanatory variables and is β i regression coefficients of the respective independent variables and $\beta 0$ regression constant.

5.6 Poisson Regression:
This technique explains random variable Y that exhibits Poisson distribution along with parameter μ. It takes integer values y = 0, 1, 2 etc. with probability. Occurrence of a crash can be considered as the result of a Bernoulli's trial. It can have only two outputs as occurrence or non-occurrence of a crash.

$P(Y=y) = (\exp(-\mu).\mu y)/y$ (1)
Where, μ is mean number of crashes occurring, y is crashes per time period. Above equation is used to predict the number of crashes in a city.

5.7 Logistic Regression:
Logistic regression, a regression model where the dependent variable is categorical.

$Y= (\exp \sum(\beta 0 + \beta 1.X1)1+(\exp\sum(\beta 0 + \beta 1.X1)$

Where, Y, is dependent variable, X1 is explanatory variables and $\beta 1i$ is regression coefficients.

5.8 Data Collection:
Crash Prediction Data Analysis
Statistical analysis was carried for developing crash prediction model. Few Location of Old Faridabad, New Industrial Township, Railway Colony, and Ram Nagar Locations are selected for model development as more number of crashes are occurred long these stretches. Crash data in terms of fatal, non fatal and total number of crash. The data includes road geometrics, crash data and traffic volume. These locations are considered as more number of road crashes takes along these stretches in the city and is used for development of crash prediction model.
5.9 Collision Type Data Analysis:
Faridabad area data is collected for arriving on which type of collision is more significant. Data was analyzed based on type of collision, type of vehicle involved and number of fatal and non-fatal crashes. Parameters considered for analysis of collision type.

5.10 Data Analysis:
Preliminary analysis of data was performed to understand the relationship of variable parameters. From the analysis it is observed that more number of road crashes takes place due to rash driving. Table provides the description of each variable considered for model development of crash. Time and weather condition was not considered for analysis as data was not reflecting from the secondary source.

5.11 Correlation Analysis:
Correlation analysis gives a quantitative assessment of association between two variables. The correlation can be positive or negative with varying strengths. A positive correlation coefficient means that the value of one variable increases, the value of other variable also increases. As one variable decreases the other also decreases. A negative correlation coefficient indicates that as one variable increases, the other variable decreases. It is observed from result that as pavement condition deteriorates more number of non-fatal crashes is increasing.

VI. RESULTS AND DISCUSSIONS

Three types of regression models were used for developing crash models. The dependent variables are considered as Non-Fatal Crashes, Fatal Crashes and Total Crashes and the variables which are listed in table as shown below are considered as independent variables. The model parameters are provided.

6.1 Model Interpretation for Crash Prediction:
In Table below all the variables are significant for model predication and it can attribute on better suitability of model for crash prediction. Condition of the pavement is also one of the affecting factors for prediction of model development.

Table 5.1 Regression statistics (2012 to 2015)

SUMMARY OUTPUT								
Regression Statistics								
Multiple R	0.998563							
R Square	0.997127							
Adjusted R Square	0.996409							
Standard Error	120.7455							
Observations	6							
ANOVA								
	df	*SS*	*MS*	*F*	*Significance F*			
Regression	1	20242289	20242289	1388.41	3.10E-06			
Residual	4	58317.91	14579.48					
Total	5	20300607						
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-92.2953	61.4472	-1.50203	0.207502	-262.9	78.30943	-262.9	78.30943064
Persons Killed	2.625407	0.070459	37.26137	3.1E-06	2.429781	2.821033	2.429781	2.821033354

6.2 Multiple Linear Regression Model:

Linear Regression Model R2 value and coefficient obtained from model analysis explains that there is relationship between dependent and independent variables. Fatal crashes are less frequent when compared to Non-Fatal crashes which approximates as linear in relation. It is observed that no variable coefficients are zero and is an indication of existence of model. All the t-statistic values are within the limit at 1 degree of freedom for 0.05 level of significance. The developed model of linear regression has lower R2 value (0.997127) and shows poor performance in prediction of crashes. Hence it is not fit for prediction of crashes. The models emphasize that there is influence of pavement condition on non fatal crashes. This value is higher than shoulder condition. Improvement in pavement condition and increase in shoulder width may reduce non-fatal crashes.

VII. CONCLUSIONS

Road crashes have become a major concern to the road users, safety experts and traffic engineers. The main reasons for the cause of crashes are due to human physiological behavior, vehicular defects and road geometrical conditions. Many variables are responsible for the cause of crashes. It is not possible to consider all the variables in conducting studies for development of crash prediction model. This study examines the major influencing factors for the cause of road crashes in Faridabad city. Three regression models were used for development of crash prediction models as Multiple Linear regression, Poisson regression and Compare-IT-Model regression. Among the three Compare-IT-Models model is found to be more suitable for prediction of crashes in the city. The observed regression values are within the limit at 0.05 level of significance. From Compare-IT-Model model analysis it is observed that due to poor pavement and shoulder condition more number of non-fatal crashes is occurred. Proper care shall be taken for improving the pavement condition on regular basis and providing provision for shoulder in urban area. Improving pavement condition and shoulder width may reduce non-fatal crashes in the city. From collision analysis it is observed that side swipe is more significant for non-fatal crashes.

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