ANALYSIS OF FACTORS INFLUENCING TRAFFIC ACCIDENTS: A CASE STUDY OF TIRUCHIRAPPALLI CITY

Hemanthini Allirani
Centre of Excellence in Transportation Engineering - National Institute of Technology
Department of Civil Engineering, Tiruchirappalli 620015, Tamilnadu, India
Phone: + 91 8807205176 E-mail: hemumalu@gmail.com

Moses Santhakumar S, Department of Civil Engineering, National Institute of Technology, Tiruchirappalli, India; Kavitha Kumar, Department of Civil Engineering, National Institute of Technology, Tiruchirappalli, India

1. INTRODUCTION
Road safety is a major concern in many developing countries including India. Road accidents are responsible for an increase in deaths and disability throughout the world. Road accidents lead to loss of life, property and affect the general welfare of the people and the economy. India accounts for 10% of global road accidents and has the highest death rate in the world (Source: Economic Times Auto, December 28, 2016). In India, traffic fatalities have increased by 4.6% from 2014 to 2015 (Source: Road Accidents in India 2015, Ministry of Road Transport and Highways). The analysis of road accident data reveals that about 57 accidents and 17 deaths take place every hour on an average in Indian roads. Road accidents have been increasing alarmingly in Tamil Nadu, being a major state contributing to total no. of accidents in India. Tamilnadu reported the highest number of road accidents in 2015 sharing about 13.8% of the total accidents in the country. Tamilnadu accounts for about 10.7% and 15.9% of total road fatalities and injury accidents in the entire country. Tamilnadu ranked second highest and first in the country for fatalities and minor injury accidents.

A case study of Tiruchirappalli city is considered for the present study. Tiruchirappalli city is situated at the geographical center of Tamilnadu. Every year, a number of people are killed or injured due to road accidents. In Tiruchirappalli between the year 2010 and 2015, about 924 fatal accidents were reported and 974 people were killed due to road accidents. Hence, it is essential to find solutions to mitigate the problem. Road accidents are influenced by many factors such as traffic flow, geometric design of road sections, horizontal curvature, vertical grade, lane width, and shoulder width etc. Predicting the exact cause for the road accident is complex. Studies were done relating the factors like traffic volume, speed, road characteristics, road geometrics etc., with the road accidents. This study focuses on analysing road accident data and the relationship between various factors influencing road accidents so that suitable accident remedial measures can be suggested to enhance road safety.

2. STUDY AREA AND DATA COLLECTION
Tiruchirappalli city traffic has been categorized into two zones namely North zone and South zone. The North zone includes seven stations and the South zone comprises of five stations. Twenty four roads selected for the present study are the major arterial and sub-arterial roads connecting major commercial areas, government offices, schools and residential areas of Tiruchirappalli city. The accident data for six years from 2010 to 2015 was collected from Tiruchirappalli Police Commissioner’s Office. The distribution of accidents based on number of lanes and divided or
undivided roads revealed that 45% of fatal and non-fatal accidents are observed in 2-lane 2-way undivided roads and 25% of the total accidents are recorded in 4-lane 2-way divided roads. The study highlights that two wheelers are responsible for 42% of total road accidents followed by buses (22%), cars (16%), trucks (13%) and auto Rickshaws (7%). Two wheelers and pedestrians are the victim of more number of accidents accounting for about 48% and 40% of the total road accidents.

The road infrastructure elements like bus stops, speed breakers, number of lanes, presence of median, shoulder, drainage etc., that are likely to influence traffic accidents are identified from literature and field visit. The physical features and traffic controlling measures of the site are collected for all the 24 selected roads by field investigation. Classified volume counts was carried out for 24 roads in Tiruchirappalli city. Traffic volume composition shows that two wheelers share the maximum composition of 60%-70% in almost all the urban road segments followed by cars (11%-15%), auto-rickshaws, buses, cycles and trucks.

3. FACTOR ANALYSIS MODEL
Factor analysis is a method of data or dimension reduction. It is achieved by finding underlying unobservable variables that are reflected in the observed variables. The main scope of this analysis is to achieve simple structure where every variable loads exceptionally onto one and only one factor. Road accidents are influenced by many factors such as road geometric conditions, driver characteristics, vehicle related factors and environmental factors. The factors that influence road accidents interact in obscure ways thus the interaction among the variables are not easily identified. Subsequently, so as to classify observed variables into several groups’ factor analysis is used. In this study, factor analysis is used to analyze the relationship among observed variables in turn to evaluate and to depict the number of fundamental dimensions that underlie the observed data.

The factors are analyzed by maximum likelihood method. Some of the parameters are dropped out since the model gave inconsistent result. In the second step factor analysis was done in 15 parameters. The parameters that show insignificance is removed and finally 9 parameters are included for modeling. The model shows significant with respect to the existence of pattern between the variables. The Bartlett’s Test of Sphericity has the value 0.005 (p < .05) indicates that there exist significant relation among the variables. Four factors with eigen values greater than 1 are extracted from the analysis. Varimax rotation is adopted to maximize the variance of each of the factors, so the total amount of variance accounted for is redistributed over the four extracted factors. The extracted factors account for about 76.248% of the total variance of the variables. Four factors are derived such as Traffic Factor, Shoulder Factor, Median Factor and Access Factor. Factor Scores are determined for each factor.

4. RESULTS AND CONCLUSIONS
Traffic volume, speed and on-street parking have positive influence on accident occurrence and increase the chance of accident by 1.2 times for every unit increase in the variable. Similarly, increase in number of median openings, number of minor intersecting roads and number of bus stops increases the chance for accident occurrence. However, presence of shoulder decreases the frequency of accidents by a factor of 0.8. Some suggestions that can be followed to improve the safety of road network are avoiding bus stops near the intersections, increasing shoulder width to provide buffer space for vehicle or pedestrian movement, providing proper parking facilities on the roadside and regulating access from minor roads, providing speed breakers near intersections to reduce speed of the vehicles and incorporating ITS technologies such as speed management, smart parking and access control for enhancement of road traffic safety.