

# ACCIDENT ANALYSIS AND GENERATING ACCIDENT PREDICTION MODEL FOR MADURAI CITY

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**Abstract :** The dramatic increase in the number of vehicles over the past decades lead to increase in the number of accidents. It is inferred from the review of related literatures that though many studies were taken up at national and state level, limited studies were found to be conducted at Madurai and that too covers the Madurai city alone. Contrarily, compared to rural areas, the rate of accidents in the city limits was low. There are lots of factors will cause the accidents such as road user, vehicle, climatic and roadway factors. The present study is indented to examine the accident prone areas in Madurai district and the cause of death would be analyzed from the point of view of Traffic Engineering. The accident prediction model is generated from the available data. After analyzing the data, suitable recommendations would be suggested to make the roads in Madurai district safer.

**IndexTerms - Keywords-** Traffic accident, Accident severity index, prediction model .

## I. INTRODUCTION

The rapid population growth and increasing economic activities have resulted in the tremendous growth of motor vehicles. This is one of the primary factors responsible for road accidents in many metropolitan cities, including Madurai, India. The increasing number of road accidents is imposing considerable social and economic burdens on the victims, and various direct and indirect costs. Road accidents are essentially caused by improper interactions between vehicles, between vehicles and other road users and/or roadway features. The situation that leads to improper interactions could be the result of the complex interplay of a number of factors such as pavement characteristics, geometric features, traffic characteristics, road users' behavior, vehicle design, drivers' characteristics and environmental aspects. Thus, the whole system of accident occurrence is a complex phenomenon. Many researchers have devoted their work in the area of road accidents and traffic safety aspects. Works have been undertaken on accident characteristics, accident forecasting and better roadway and vehicular design for the improvement of road safety in different traffic and roadway condition.

Kannan et.al.(2018) studied Road Accidents and Road Safety Measures in Tamil Nadu" with the view to analyze the growth of the vehicular population in Tamil Nadu. The study inters that the Road user's behavior was found to be the primary reason of accidents in 70% to 90% cases.

Mohammed Fayaz, et.al (2018) studied the "Black Spot Identification Using Accident Severity Index Method" to identify the accident prone zones within Cochin City, using Accident Severity Index Method and to locate the hotspots using Arc GIS software.

Mohammad N. Al-Marafi and Kathirgamalingam Somasundaraswaran (2018) reviewed the Crash Prediction Models and their applicability in Black Spot Identification to improve road safety.

Different researchers have chosen different method of analysis for the accident data. Accident prediction model was developed by fitting models such as linear regression, binomial etc.

## OBJECTIVES

- To identify the accident prone areas in Madurai district
- To analyze the variations of fatal accidents year-wise, gender-wise & age-wise etc.,
- To calculate accident severity index
- To Develop linear regression model with ASI and relationship parameters
- To survey the intersection sight distance and approach sight triangle for the most vulnerable accident hot spots
- To recommend necessary modifications in the existing accident prone spots from the point of view of civil engineering

## II. METHODOLOGY

- Selection of study area
- Collection of accident data
- Data analysis
- Generation of accident prediction model
- Development of linear regulation model of accident severity index & relationship parameter .

## A. Selection of study area

In Madurai traffic accidents occur for various reasons. Poor traffic management specially in respect of the reckless driving of buses, minibuses and auto rickshaws, inefficient traffic control at intersections, poor road geometrics, lack of public awareness, road users' indiscipline and inefficient movement, undefined bus stops, etc. are the major causes of road accidents. In the recent past some measures regarding improvement of traffic operations have been undertaken in the city. Some of these measures are a one-way road system on a number of major arterials, construction of flyovers, improvement of geometrics of the intersections, and greater attention to road markings and signage. As a result there has been some improvement in the average travel speed of vehicles.

## B. Collection of Accident data

An accurate and comprehensive system of collecting and recording accident data is required for studying the traffic accident characteristics in a city. Such data serve to identify the basic causes of accidents and to suggest means for overcoming the deficiencies that lead to such accidents. For the present accident characteristics study in Madurai, the past accident data Data on fatal accidents in Madurai City from 2007 to 2018 was collected from the Crime Record Bureau. The data obtained were analyzed to calculate various indices that indicated the road safety characteristics of the city.

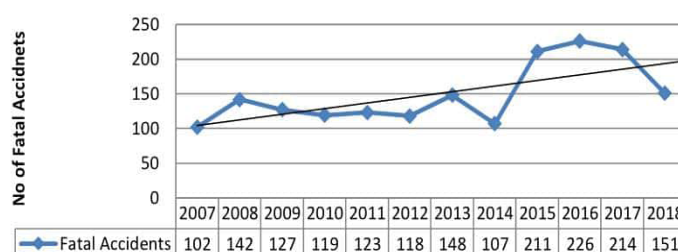
## C. Data Analysis

Accident data were analyzed year wise, gender wise, age wise and the variations were identified. The variation of fatal accidents from 2007 to 2018 is shown in the table I. The accident severity index was generated for consecutive three years as shown in table II. It measures the seriousness of an accident. It is defined as the number of persons killed per 100 accidents. Based on the ASI value major hotspots were identified and geometric data were collected for those areas as shown in table II. The major data collected such as sight distance, parking maneuver, width of carriage way, shoulder width etc. In some of the locations it was identified that sight distance was not adequate as per the standards.

TABLE I  
Fatal Accidents from 2007 to 2017

Year	No of Fatal Accidents	Percent
2007	102	5.7
2008	142	7.9
2009	127	7.1
2010	119	6.7
2011	123	6.9
2012	118	6.6
2013	148	8.3
2014	107	6.0
2015	211	11.8
2016	226	12.6
2017	214	12.0
2018	151	8.4
Total	1788	100.0

Year-wise No of Fatal Accidents



**TABLE II**  
**Accident Severity Index (ASI)**

Year	No of Accidents	No of Person Killed	Accident Severity Index (col.3*100\col.2)
2016	943	226	23.96
2017	923	214	23.18
2018	962	151	15.69

**TABLE II**  
**Place of Occurrence**

S.No.	Place of Occurrence	No of Fatal Accidents	Percent
1	TPK Road	182	10.2
2	Alagarkovil Road	104	5.8
3	Aruppukkottai road	103	5.8
4	Melur road	91	5.1
5	Dindigul Road	77	4.3

From the above locations major hot spots were identified as shown below.

**TABLE III**  
**Major hotspots**

SI No.	Location
1)	Infront of Fathima college
2)	kannan departmental store
3)	Agrini Apartment Gate 1
4)	Infront of Madura college
5)	chinnaodappu Crossing
6)	keeraithurai Crossing
7)	Mattuthavani Bus Stand In and Out Gate
8)	Flower Market In and Out Gate
9)	Tammukam
10)	Thevar Statue

#### D. GENERATION OF ACCIDENT PREDICTION MODEL

For the measurement of sighting rod and target were made as shown in figure and the following data were measured. A linear regression model was generated using average number of accidents for three consecutive years as Y value and roadway width, sight distance and parking manoeuvre as X variables. The multiple linear regression was formed using Microsoft excel as below.

After measuring the data at the major hotspots accident prediction model was developed as shown below.

TABLE IV  
Geometric data collected at the hotspots

SI.NO	Hotspots	Average No Of Accident	Major Roadway WIDTH (feet)	Minor Roadway WIDTH (feet)	Stopping sight Distance (feet)	S.S.D.Measured (feet)	Parking (No)
1	Infront of Fathima college	8.00	60.20	20.00	70.00	4.00	1.00
2	kannan departmental store	8.00	79.88	15.00	160.00	487.00	2.00
3	Agrini Apartment Gate 1	27.00	59.87	20.00	70.00	5.00	2.00
4	Infront of Madura college	27.00	66.10	15.00	70.00	100.00	0.00
5	chinnaodappu Crossing	20.33	96.78	20.00	90.00	210.00	0.00
6	keeraithurai Crossing	20.33	96.78	30.00	160.00	500.00	1.00
7	Mattuthavani Bus Stand In and Out Gate	11.00	67.25	30.00	160.00	525.00	2.00
8	Flower Market In and Out Gate	11.00	74.14	30.00	160.00	575.00	1.00
9	Tammukam	8.67	76.77	40.00	160.00	275.00	0.00
10	Thevar Statue	8.67	72.50	100.00	160.00	325.00	2.00
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**TABLE II**  
**MESURMENT DATA ANALYSIS**

SUMMARY OUTPUT								
Regression Statistics								
Multiple R	0.723							
R Square	0.523							
Adjusted R Square	0.045							
Standard Error	8.093							
Observations	11.000							
ANOVA								
	df	SS	MS	F	Significance F			
Regression	5.000	358.42	71.68	1.095	0.462			
Residual	5.000	327.45	65.49					
Total	10.00	685.87						
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	25.534	23.531	1.085	0.327	-34.954	86.021	-34.954	86.021
X Variable 1	0.147	0.271	0.541	0.612	-0.550	0.843	-0.550	0.843
X Variable 2	-0.003	0.151	-0.022	0.983	-0.392	0.385	-0.392	0.385
X Variable 3	-0.198	0.189	-1.050	0.342	-0.683	0.287	-0.683	0.287
X Variable 4	0.012	0.037	0.325	0.758	-0.082	0.106	-0.082	0.106
X Variable 5	0.521	3.924	0.133	0.900	-9.566	10.607	-9.566	10.607

### LINEAR REGRESSION EQUATION

Linear regression equation was formulated based on the consideration of following parameters.

Y -Average no of accident

X1-Major roadway width

X2-Minor roadway width

X3-Stopping sight distance as per Standard

X4-S.S.D. Mesured

X5-Parking

$$y=0.147X1-0.003X2-0.198X3+0.012X4+0.521X5+25.53$$

### CONCLUSION

After the data analysis the following conclusions were made.

- By comparing the year wise accident variation is shows that the trend is varying year to year. But in the year 2016 the maximum number of fatal accidents occurred.
- By the accident analysis by gender wise shows that the involvement of male is higher than the female.
- The age wise analysis shows that the people under the age category more than 58 involved in more number of accidents.
- The accident severity index was calculated based on the available data shoes that it is having a decreasing trend.
- The major location were selected based on the accident severity and geometric datas were measured on these locations.
- Accident prediction model was developed using the linear regression analysis.

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