

# Road Crash – Analysis and Alleviation Measures

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**Abstract—** Now-a – days there has been a quantum jump in number of vehicles; the road length has been barely doubled. The fatalities and injuries due to road accidents have increased three folds. Fatalities due to road accidents are very much higher in India as compared to all other developed countries. The road accidents constitute the highest percentage, around 22 percent. For minimizing the rate of accidents where the resources are limited, attention has to be given to cost effective mitigation methods. Proper accident analysis is necessary to know the real reasons causing accidents. The location chosen for the study was East coast Road (ECR) from Thiruvanniyur to Pannaiyur covering a length of 11.4 km road. After the thorough study of accident statistics, two accident locations were selected to perform road inventory survey, Traffic Volume survey and spot speed survey for further work. The speed frequency curves were drawn to analyse the variation of speeds of vehicles which causes accidents. From the observations, road safety measures were recommended to reduce the rate of accidents.

**Keyword-**Fatalities, Mitigation, Road Inventory, Traffic Volume, Spot speed, Speed Frequency

## I. INTRODUCTION

Due to growth of economical status of the people and passion to own a vehicle in recent years, there is a tremendous increase in the number of motor vehicles using the road. This Spectacular increase in the number of vehicles on the road had created a major problem of loss of lives and property through accidents. The appalling human misery and the serious economic loss demand the attention to know the real cause of accidents.

India has 1 percent of world's vehicle population but 6 percent of the total reported accidents occurs in the country and the situation is worsening day by day as the vehicle population is increasing. Heavy vehicles are involved in 40-60 percent of road accidents in India and casualties are more in such accidents. National highways and State highways constitute only 9 percent of the total road length are responsible for 69 percent road fatalities occurring in India. The accident rate is a function of number of factors. The factors includes the state of the road network, the density of population, the number of vehicles in service, the climate, type of pavement, the specific nature of the traffic rules and regulations. The value of the relative accident rates objectively reflect the influence of road conditions on ensuring of traffic safety.

The main objective of this study is to identify the major causes of road accidents which create the problem, to minimize risk and severity of accidents and to inculcate the importance of safety in highway design, safety measures on roads are recommended.

## II. LITERATURE REVIEW

The numerous studies were carried out to identify the various parameters influenced for the causes of road crash. Ross Owen Philips (2013), identified that the following factors consistently associated with causes of accidents such as sleepiness of drivers, driving off the road, good road conditions which in turn increases the speed of the vehicles, longer distance driving and less experience in driving. Omar Bagadadi (2013), various measures are used to estimate the severity of a traffic conflict which are limited to estimate the crash risk. The proposed method gives the possibility to compare different conflicts or kind of road users involved with regard to severity. Quang Ngoc Laa (2013), made a accident analysis by interviewing the taxi drivers. Using the regression analysis, the parameters associated with the crash risk were identified. To improve the road safety and to prevent the injury of these commercial drivers, prospective and qualitative studies were recommended to provide detailed crash characteristics as well as behavior and perception of taxi drivers. Wittenberg (2013) provides an alternative to the determination of safety targets by political commitments only, taking the history of road fatalities trends and population into consideration. Mondal (2011), India already accounts for about 9.5 percent of the total 1.2 million fatal accidents in the world. Road crashes are complex interaction of different parameters like road, vehicle, environment, human, etc. Skidding of road vehicles is considered as one of the major causes of road accidents. Mouyid Bin Islam (2008), the visibility, geometry, lane markings, surface condition and street light facilities have a potential influence on the drivers to perceive and react in a dynamic driving condition.

### III. STUDY AREA

The East Coast Road (ECR) starts at Thiruvanniyur, Chennai and ends at Uthandi. From Uthandi, the scenic beach way section starts as a toll road. The speed of the vehicles on this road is restricted to a maximum of 80 km/hr.

### IV. DATA COLLECTION

The various traffic surveys were carried out to know the locations along the stretch, existing road geometry, Traffic volume, the travelling speed of vehicles at the Accident prone zones along the selected stretch of East Coast Road.

#### A. Accident Statistics

The accident data occurring within the jurisdiction of respective police stations for the years from 2010 to 2014 were collected based on types of accidents such as fatal, major injury, minor injury and non-injury accidents for the selected accident locations from Thiruvanniyur to Panaiyur. Fig. 1 shows from the accident data that the minimum number of fatal accidents is 30 and non-fatal accidents is 170 occurring every year in the last 5 year record. The vehicle wise accident data represents that the cars and two wheelers vehicle category.

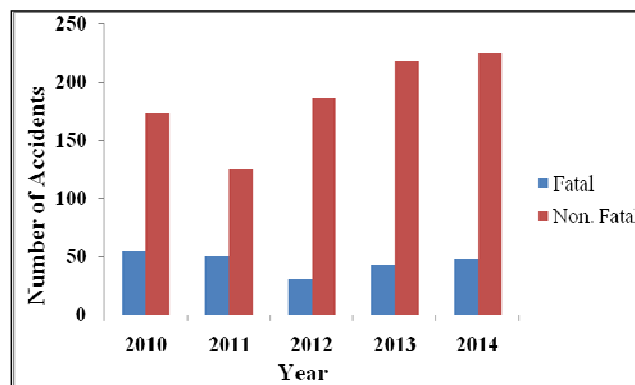


Fig. 1. Accident statistics for years from 2010 to 2014

TABLE I. Vehicle wise Accident Statistics for the years from 2012 to 2014

Type of vehicle	No. of Fatal Accidents			No. of Non – Fatal Accidents		
	2012	2013	2014	2012	2013	2014
Govt. Buses	3	3	3	12	16	15
Private buses	1	1	1	14	5	6
Trucks	0	2	2	3	9	5
Cars	7	12	15	61	90	95
Van	4	2	1	11	7	8
Auto Rickshaw	2	5	3	27	20	23
Two wheeler	8	11	15	38	68	73
Jeep	0	0	0	14	0	0
Others	6	6	7	6	3	5
Total	31	42	47	186	218	225

#### B. Road Inventory Survey

The values of the relative accident rates objectively reflect the influence of road conditions on ensuring of traffic safety. Hence the detailed inventory of existing roads network such as carriageway width, shoulder width, pavement condition, types of objects found nearer to the road edge and their distance from the pavement edge, sight distance, etc were carried out to identify the deficiency in road geometrics at all selected accident locations. It is observed that there is a variation in the carriageway width at the selected locations and encroachments on the sides of roadway.

#### C. Traffic Volume Study

The number of accidents grows approximately in direct proportion to the average daily traffic volume. Hence the traffic volume count was taken from injambakkam towards Panaiyur and also from injambakkam towards Thiruvanniyur to observe the number of vehicles using the road per day. Fig. 2 shows that the two wheelers

using the ECR road in the peak hours are more i.e. around 45 % in the morning and 48 % of total traffic in the evening. Similarly, the second larger numbers of vehicles passing were cars, jeep and vans i.e. 36 % in the morning and 40 % in the evening.

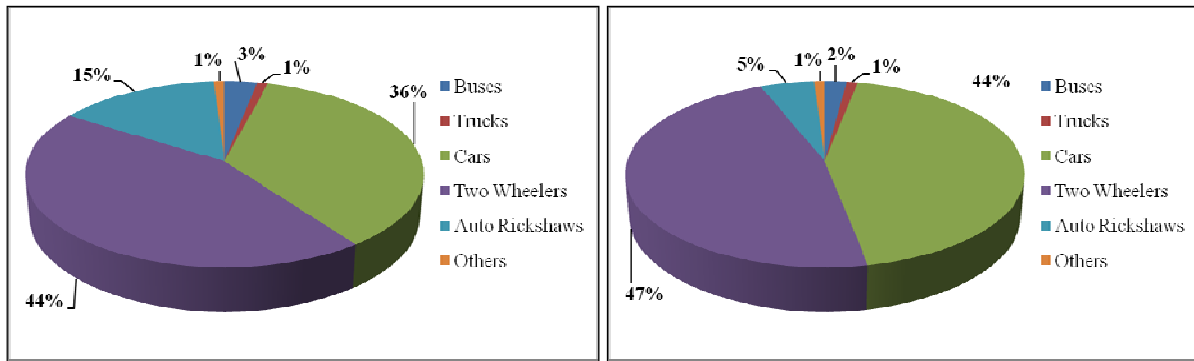


Fig. 2. Percentage of Traffic volume travelling along East Coast Road in the morning and evening hours

**D. Spot Speed Survey**

The spot speed measured at any particular location will depend upon a number of factors such as the geometric layout of a road, volume of traffic, the condition of road, environmental influences (rain, fog, etc), the human element associated with the individual drivers and the characteristics of vehicles. Spot speed survey was conducted at selected accidents locations such as Injambakkam and Neelangarai. For the determination of spot speed, direct timing procedure was used. At injambakkam location, the average speed of two wheelers and cars travelling on ECR varies from 54 kmph to 75 kmph and from 45 kmph to 70 kmph respectively. Similarly the average speed of two wheelers and cars travelling varies from 40 kmph to 70 kmph and 40 kmph to 65 kmph respectively.

**V. TRAFFIC FORECASTING**

The likely growth rates of traffic volume under various scenarios for different classes of vehicles have been calculated based on the previous history of traffic volume. Table II gives the peak hour traffic volume will increase to 32,590 by the year 2030 under normal conditions.

TABLE III. Traffic Forecasting of East Coast Road

Year	Growth of traffic volume
2015	6590
2020	13718
2025	21583
2030	32590

**VI. DATA ANALYSIS**

Observations at the characteristics places were taken for the spot speed analysis. For establishing the most frequently repeating speeds, distribution curves were drawn for each of the selected sections. The change in the speed along the length of the road was determined with the help of these curves. For easy computations, the speed data were analysed for different classes of vehicles.

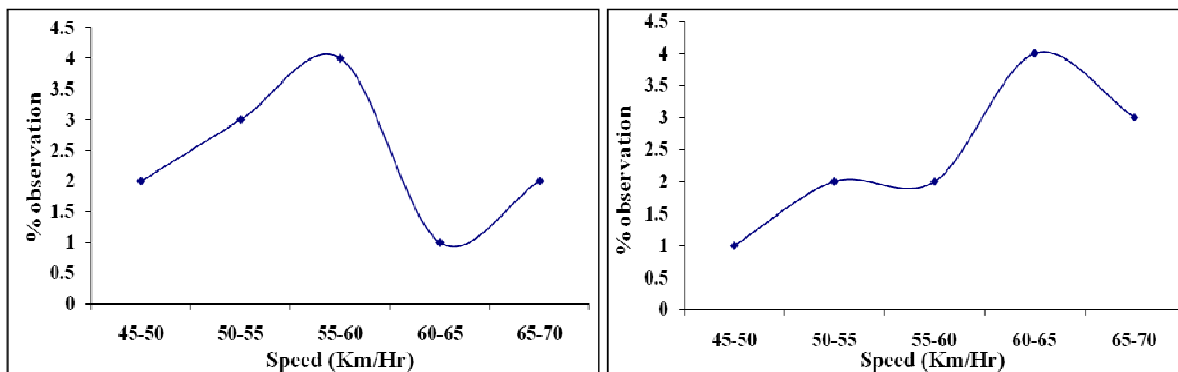


Fig. 3. Speed Frequency curve for Car and Two-wheeler at Injambakkam

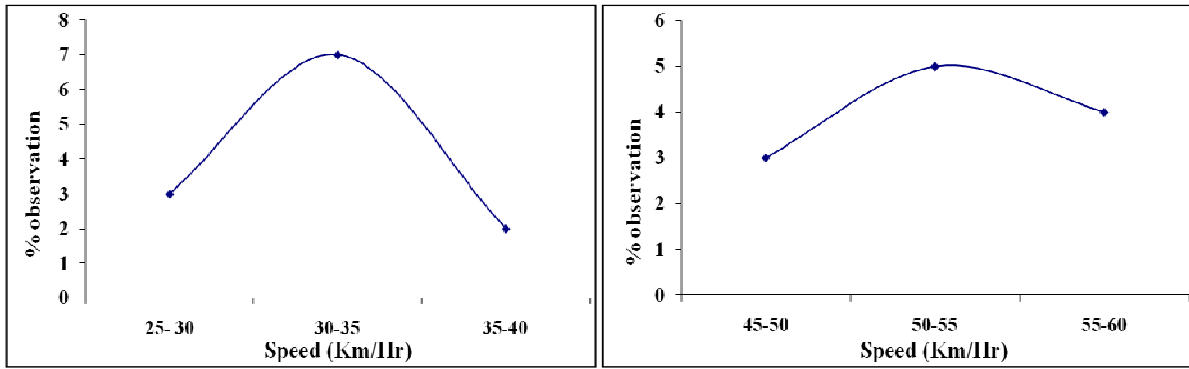


Fig. 4. Speed Frequency curve for Truck and Bus at Injambakkam

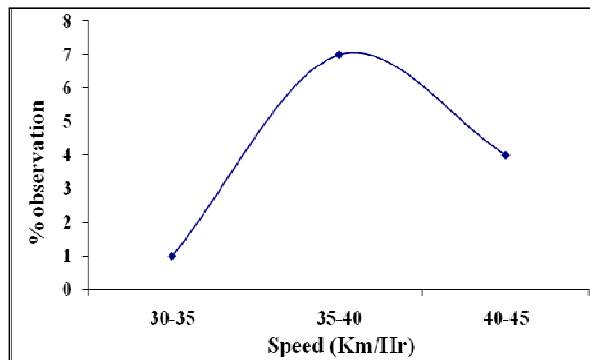


Fig. 5. Speed Frequency curve for Auto Rickshaw at Injambakkam

From the speed frequency curves for the location Injambakkam represented in Fig. 3 to 5 clearly stated that there are variations in the speed of each type of vehicle. For bus, speed varies from 40 kmph to 55 kmph. For trucks, the speed limit changes from 25 kmph to 40 kmph. It is observed that there is wide variation in speed of car, which ranges up to 70 kmph. When the number of accidents is greater, broader is the range of speeds in the traffic stream. The number of accidents is greater which is due to flow of mixed traffic than the homogenous traffic.

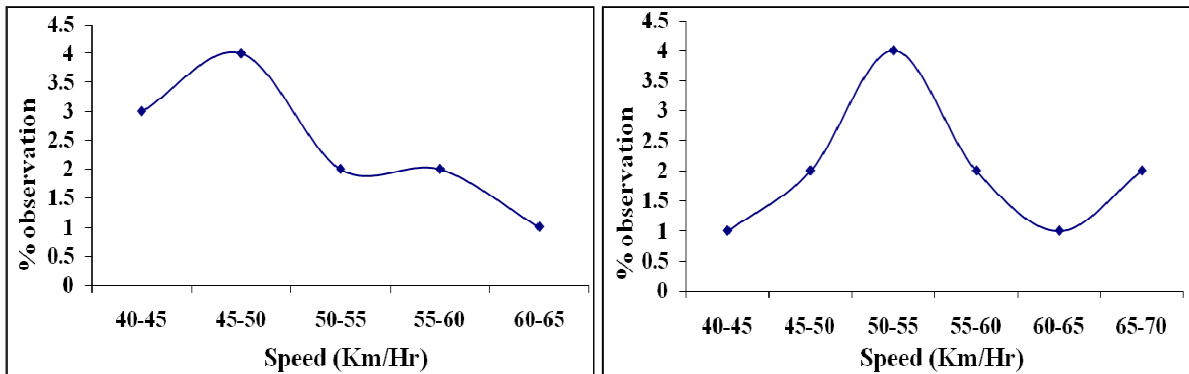


Fig. 6. Speed Frequency curve for Car and Two-wheeler at Neelangerai

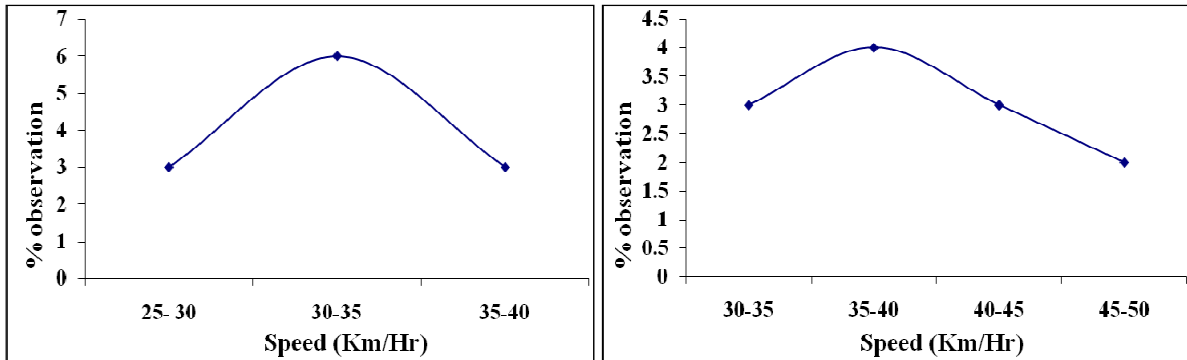


Fig. 7. Speed Frequency curve for Truck and Bus at Neelangarai

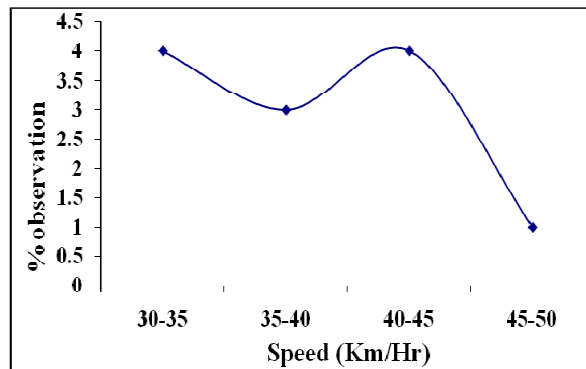


Fig. 8. Speed Frequency curve for Auto Rickshaw at Neelangarai

Similarly the speed frequency curves for the location Neelangarai shown in Fig. 6 to 8 observed that the speed varies from 30 kmph to 50 kmph for buses. For Trucks, the limit of speeds changes from 25 kmph to 40 kmph. The variation in the speed of cars and two wheelers ranges from 40 kmph to 70 kmph creates the possibility of occurrence of accidents in large number.

**VII. FINDINGS**

The speed – frequency curves for total vehicles shows that there is a large fluctuation in speed of vehicles starting from 25 kmph to 70 kmph with larger oscillation in the higher speed class which is the main reason for accident occurrence at the selected locations. This speed variation is due to the inexperienced or risky drivers running at to high speed without awareness of speed limit of the particular stretch.

When travelling over a road at different speeds, the number of objects that gets distracted into a driver’s field of vision during a unit of time is greater. Since the possibilities of a driver to distinguish and grasp all the incoming information are limited and he unconsciously react to the situation in several ways. This circumstance appreciable increases the danger of accidents connected with the unexpected appearance of a pedestrian on the road.

**VIII. CONCLUSION**

Most of the roads accidents occur were due to cars and two wheelers. Accidents may not be fatal but the number of accidents was more when compared to other classes of vehicles. It is observed that the reasons for the accidents are widely due to lack of road geometrical features at Neelankarai and higher speeds of vehicles at Injambakkam. Hence an efficient traffic control system and management measures would reduce the rate of occurrence of accidents.

**IX. RECOMMENDATIONS**

In order to reduce the rate of accidents and also to minimize the economic losses due to road accidents, a proper traffic management measures should be formulated. Transportation System Management (TSM) is a package of short term measures to make the mast productive and cost- effective use of existing transportation facilities, services and modes. Traffic control measures which include provision of traffic signals, restrictions, speed, parking, size of vehicles and so on.

In addition to this, road safety education especially for children propaganda will promote the next generation to the awareness of safe travel and enforcement of traffic rules and regulations deserve the careful consideration in road safety in future.

## X. LIMITATIONS OF THE STUDY

This study was restricted to the stretches of two accident locations only and the variables considered for the study was also limited. This work will be validated with more number of stretches with more number of data for accurate and better results.

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