CHAPTER 2

LITERATURE REVIEW

2.1 VARIOUS ACCIDENT ANALYSIS TECHNIQUES

2.1.1 Black Spot Identification Methods

Road safety is a major concern in the present situation. There are many steps required to achieve the road safety measures. Mandloi and Gupta (2003) found a method by which the accident – prone locations on roads commonly termed as accident black spots can be identified. In road safety, the determination of road locations that is more dangerous than others (black spots (or) also called sites with promise) can help in better scheduling road safety policies. Brijs et al (2006) proposes a multivariate model to identify and rank site according to their total expected cost to the society using a Markov Chain Monte Carlo approach. In another study Geurts and Wets (2003) developed an overview of the poisson gamma generalized linear model and techniques that are used in Belgium, Denmark, and Australia to analyse black spots. He concluded that the black spot safety work has been effective in reducing the number of causality crashes. So on going evaluation is necessary to help governments determine if the benefits from further treatment of black spot sites justify the treatment cost.

Mandloi and Gupta (2003) developed a model to identify black spots on roads using prioritization and Geographical Information Systems (GIS). The usefulness of GIS and point pattern techniques for describing road-accident black zones within urban agglomerations are defined (Steenberghen et al 2004). Sayer (1994) presented the outline of the steps
needed by investigators to carry out black spot accident investigation. Murthy et al (1991) found that black spot study on selected roads of Bangalore city using the severity factors can be used as a very effective method to quantify and categorise road locations with respect to accidents and he concluded that black spot study done annually can help in establishing priorities for suggested improvement in traffic management.

2.1.2 Clustering Techniques

Fukuda et al (2005) found that Hiyari-Hatto method is a significant alternative method for public participatory enhancement to develop black spot database nationwide. The location of road accidents is based on dynamic segmentation, address geocoding and intersection identification. One-dimensional (line) and two-dimensional (area) clustering techniques for road accidents are compared. The operationality of the techniques is illustrated by showing the impact of traffic-calming measures on the location and type of accidents in one Belgian town (Mechelen).

2.1.3 Sampling Method

Furth (2005) applied methods, which include simple random sampling, ratio estimate with a variety of possible auxiliary variables, stratified sampling, cluster sampling, and combinations of these approaches. The latter technique used on-off data from a sample of trips to estimate the ratio of passenger-miles to potential passenger miles, a newly proposed auxiliary variable. This approach reduced the sampling burden by over 80% compared with both simple random sampling and a sampling method published by the Federal Transit Administration.
2.1.4 Empirical Bayesian Approach

To evaluate safety treatment with the empirical Bayesian (EB) approach the before period crash experience at treated sites is used in conjunction with a negative binomial crash prediction model for untreated reference sites to estimate the expected number of crashes that would have occurred without treatment (Persaud 2010). Persaud contributes the introduction of time varying coefficients into the Full Bayesian (FB) models, which are similar to the safety performance function (SPF) multiplies in EB analysis. The main application is an evaluation of the conversion of road segments from a four-lane to a three-lane cross-section with two-way left-turn lanes (also known as road diets). They summarized the results of an earlier application pertaining to the evaluation of conversion of rural intersections from unsignalized to signalized control.

Lan et al (2009) explore the application of full Bayesian methods for before–after road safety studies. It was then applied to California rural intersection data to evaluate the safety effect of conversion from stop to signalized control. Park (2010) developed a Fully Bayesian (FB) multivariate approach jointly modelling crash counts of different types or severity levels for a before–after evaluation with a comparison group/comparison groups and established a step-by-step procedure for implementing the FB methods for a before–after evaluation with a comparison group/comparison groups.

Persaud et al (2010) evaluated the conversion of road segments from a four-lane to a three-lane cross-section with two-way left-turn lanes (also known as road diets) and they compared the two Bayesian approaches (Empirical Bayes (EB) and Fully Bayesian (FB)) through empirical applications (Ozbay et al 2009) A Fully Bayesian multivariate conditional autoregressive (CAR) models are considered to account for the spatial effect. Markov Chain Monte Carlo (MCMC) was used for computation (Song et al
The fully Bayesian method was applied to California rural intersection data to evaluate the safety effect of conversion from stop to signalized control. The results were then compared with those from the empirical Bayesian method, approach for conducting unbiased before–after evaluations. (Lan et al 2009).

2.1.5 Strategic Approach

This is to investigate the causative factors of traffic accident in Oman (Shahalam et al. 2001) and delineate a strategic approach towards reducing the number of accidents in the country. A number of issues such as causes of accidents, accident locations and characteristics of road users are considered. Abulbasher says from the data and analysis it appears that the following factors namely, speed control, safety belt wearing, training of drivers, awareness of road hazards, driver behaviour and pedestrian crossing, and better intersection and road design need to be carefully considered to bring the traffic accidents and fatalities down.

In a study Chin and Quddus (2003) confirmed like others that traffic volumes are the most important factor, or main effect, predicting crashes. While these studies concluded traffic volume as the primary indicator variables, there are researchers such as Ossenbruggen et al (2001), who examined the effect of land use on road segment crashes, Noland and Quddus (2004), Valverde and Jovanis (2006) investigated the effects of demographic patterns and weather on country – level crashes. Shankar et al (1996) applied a nested logic formulation for estimating accident severity likelihood conditioned on the occurrence of an accident. Which found that there is a greater probability of evident injury or disabling injury/fatality relative to no evident injury if at least one driver did not use a restraint system at the time of the accident.
2.1.6 Models of Accident Risk Index (ARI) and Accident Severity Index (ASI)

Deshpande et al (1987) developed an index which can account for all the factors and provide a proper comparison of actual accident rates and such an index also can identify the factors influencing it. Chand and Alex (2007) computed accident risk index and accident severity index for different states in India. These indices are based on a set of accident indicators, which are combined together to form an index. Values of these two indices have been computed and compared across the states of India. Accident rate in a locality (Bangalore city) is closely related to vehicle movement rather than the population or the number of vehicles. Therefore, accident rates expressed in terms of million vehicle-kilometers is a more reliable approach (Murthy et al (1991).

The level of accident rate differs to a great extent from one state to another state. Different rates of accidents give different pictures. In this way it has been directed towards the computation of Accident Risk Index (ARI) for the states of India. It has been computed through the use of a set of accident ratios which have been combined by assigning to them certain weights (Srinivasan and Chand 1984). ARI is one such indicator which reflects the impact of vehicle, road length, area and population on the number of accidents and identifies the prevailing probability for an accident to take place in the district or state. A severity index was found from the number of accident casualties giving more weightage to the number of persons killed rather than the number of persons injured. The computed value of rank correlation between ARI and severity index is significantly different (Satyakumar et al 1990).
2.1.7 Accident Reduction Factor (ARF) Model

Davis (2000) predicted the change in accident occurrence which a countermeasure can be expected to cause using accident reduction factor. Since ethical and legal obstacles preclude the use of randomized experiments when evaluating traffic safety improvements, empirical support for the causal effectiveness of accident countermeasures comes entirely from observational studies. Al-Masaeid and Sinha (1994) developed a probabilistic procedure to estimate accident reduction factor and its expected ranges and the safety effectiveness of pavement marking of undivided rural roads. They concluded that pavement marking does improve the safety of hazardous sites on rural undivided highways. Persaud (1986) who concludes, that the effectiveness of safety measure is a function of the expected number of accidents and cannot be specified as a single reduction factor which is commonly practised.

2.1.8 Accident Prediction Models

Mustakim et al (2008) identified the factors that contribute to the cause of accident and the development of an accident prediction Model for Federal Route 50 in Malaysia. The significant accident predictive model developed in this study is applicable in road safety improvement. Geedipally and Lord (2007) evaluated the predictive models with fixed and varying dispersion parameters that estimated using data collected in California at 537 3-legged rural unsignalized intersections. They showed that models developed using a varying dispersion parameter usually produce smaller confidence intervals. Hence more precise estimates than models with a fixed dispersion parameter both for the gamma mean and the predicted response.

Roozenburg and Turner (2005) have developed a number of Accident Prediction Models (APM) for accidents at signalized intersections. Roozenbing developed the knowledge of accident causing mechanisms in
accidents at traffic signals. It has been shown that the key variables at traffic signals are motor-vehicle, cyclist and pedestrian flows and that there is generally a decrease in the accident rate per vehicle, pedestrian and cyclist with increasing flows.

White and Raeside (2001) showed that children from single parent families or minority ethnic backgrounds were at particular risk and should therefore be groups targeted to improve accident rates. An analysis showed that there is little difference in perceived risk but did find differences in the approach to that risk. There was some evidence of risk compensation in that children from poorer areas undertook more risk oriented behavior in an attempt to enrich their environment, and generally there was less supervision of children on trips to school and during play. Clearly a greater proportion of children of more affluent families are driven to school, while those who walk or cycle are exposed to greater risk.

2.1.9 Parametric and Non-Parametric Bootstrap Methods

Parametric and non-parametric bootstrap methods were investigated to evaluate the conditional assumption using simulated and observed data (Ye and Lord 2009). It is observed data should not be used as a substitute for the variance, even if the entities are assumed to be poisson distributed. Consequently, the estimated variance for the parameters under study in traditional before–after studies is likely to be underestimated.

2.1.10 Smeed’s and Andreassen Models

Accident prediction models are usually used to monitor the effectiveness of various road safety policies that have been introduced to minimize accident occurrences. Over the past 60 years, many models have been developed to estimate traffic accidents all over the world. When
developing his model Smeed (1949) investigated the relationship among death, number of vehicles and population by using the 1938 data gathered from 20 different countries. However, Andreassen (1985, 1991) seriously criticized Smeed’s model since only one year data was utilized in the model development. He also pointed out that Smeed model could not be used for all countries because each country has distinct traffic, economic and social parameters and therefore, the model coefficient and exponent should be different for each country.

Chakraborty and Roy (2005) conducted a study to determine the road safety level in Kolkata city of India. They considered 4 parameters namely accident severity index, accident fatality rate, accident fatality risk and accident risk and created a model based on Smeed’s approach to predict future accidents for Kolkata. Valli (2005) adapted the Smeed and Andreassen models to India and selected metropolitan cities for predicting the number of accidents, injuries and fatalities for the years of 2007 and 2010. Similarly, Akgungor and Dogan (2008a) estimated the number of accidents, injuries and fatalities for Turkey using modified forms of the Smeed and Andreassen models. The authors performed model simulations to estimate number of accidents, injuries and fatalities up to 2020 under 3 various scenarios for the country.

Valli (2004) analyzed the models of the road accident data at all India level as well as for major metropolitan cities. The data for the 25-year period from 1977 to 2001 were analyzed to build models to understand the nature and extent of the causes of accidents using the concept of smeed’s formula and Andresen’s equations. The above models have been used to predict road accidents for the years 2007 and 2010. Valli and Sarkar (1997) identified that, major policy may be evolved to reduce the growth of
2.1.11 Artificial Neural Networks and Genetic Algorithm Models

Lately, Artificial Neural Networks (ANN) has been utilized to develop accident models in road safety studies. Chiou (2006) used an ANN-based expert system for the appraisal of 2 car crash accidents. The author expressed that the most influential variables in accidents are right of-way, location and alcohol usage. Delen et al (2006) carried out a study employing ANN to model the nonlinear relationships between the injury severity levels and crash-related factors. Akgungor and Dogan (2008b) introduced accident prediction models for Turkey using ANN and nonlinear regression approaches to estimate the number of accidents, injuries and deaths. They compared ANN and nonlinear models in terms of various error expressions. Akgungor and Dogan (2009a) showed that ANN model had better results against the nonlinear regression models. The same researchers performed another study employing Artificial Intelligence (AI) for metropolitan city of Istanbul, Turkey. They established ANN and Genetic Algorithm (GA) models for number of accidents, injuries and fatalities separately. The study results showed that the ANN models had minimum errors for training and testing data.


Mekky (1985) investigated the relationship between the ratios of the number of vehicles to the number of accident fatalities in developing countries. The author found that there has been an inverse relationship
between 2 parameters in both developed and developing countries. Mohan and Bawa (1985) studied traffic accidents and deaths in Delhi city of India and found that 80% of accidents were caused by pedestrians and motorcycles. The investigators also indicated that the role of buses and other motorized vehicles in traffic accidents in Delhi was less significant than other industrialized cities across the world.

2.1.12 Bayesian Accident Risk Analysis

Bayesian accident risk analysis framework integrates both accident frequency and its expected consequences in the hotspot identification process. For modelling and estimating the severity levels of each individual involved in an accident, a Bayesian multinomial model is proposed. For modeling accident frequency, use hierarchical poisson models (Moreno et al 2009).

2.1.13 Generalized Linear Mixed Models

Miaou and Song (2005) were to explore some of the issues raised in recent roadway safety studies regarding ranking methodologies in light of the recent statistical development in space–time Generalized Linear Mixed Models (GLMM). First, general ranking approaches are reviewed, which include native or raw crash-risk ranking, scan based ranking, and model based ranking. Through simulations, the limitation of using the native approach in ranking is illustrated. Second, following the model based approach, the choice of decision parameters and consideration of treatability are discussed. Third, several statistical ranking criteria that have been used in biomedical, health, and other scientific studies are presented from a Bayesian perspective.

2.1.14 COM-Poisson Generalized Linear Model

A detailed review of the key issues associated with crash-frequency data as well as the strengths and weaknesses of the various methodological
approaches that researchers used to address the problems (Lord and Mannering 2010). Lord et al 2008 were to evaluate the application of the Conway-Maxwell-Poisson (COM-Poisson) Generalized Linear Model (GLM) for analyzing motor vehicle crashes and compare the results with the traditional Negative Binomial (NB) model. The comparison analysis was carried out using the most common functional forms employed by transportation safety analysts, which link crashes to the entering flows at intersections or on segments.

2.1.15 Road Safety using Statistical Models

An evaluation of the effects on road safety of new urban arterial roads in Oslo, Norway, and a synthesis of evidence from similar studies found the safety effects of new urban arterial roads in other cities. A before-and-after study was made of four urban arterial road projects in Oslo (Amundsen and Elvik 2004). The identification of crash hotspots is the first step of the highway safety management process. Montella (2010) despite the importance of using effective Hotspot Identification (HSID) methods, five year’s of crash data were utilized from the Italian motorway A16.

There has been considerable research conducted over the last 20 years focused on predicting motor vehicle crashes on transportation facilities. The range of statistical models commonly applied includes binomial, Poisson, Poisson-gamma (or negative binomial), Zero-inflated Poisson and Negative Binomial Models (ZIP and ZINB), and multinomial probability models. Given the range of possible modelling approaches and the host of assumptions with each modeling approach, making an intelligent choice for modeling motor vehicle crash data is difficult. Lord et al (2005) compared different statistical modelling approaches, identified which statistical models are most appropriate for modelling crash data, and provided a strong justification from basic crash principles. They concluded, carefully
selecting the time/space scales for analysis, including an improved set of explanatory variables and/or unobserved heterogeneity effects in count regression models, or applying small-area statistical methods (observations with low exposure) represent the most defensible modeling approaches for datasets with a preponderance of zeros.

Wood (2005) described, how confidence intervals (for example, for the true accident rate at given flows) and prediction intervals (for example, for the number of accidents at a new site with given flows) can be produced using spreadsheet technology. Motorcycles are over represented in road traffic crashes and particularly vulnerable at signalized intersections. Haque et al (2010) identified causal factors affecting the motorcycle crashes at both four-legged and T signalized intersections. With the red light camera, motorcycles are less exposed to conflicts because it is observed that they are more disciplined in queuing at the stop line and less likely to jump start at the start of green.

2.1.16 Correlation and Regression Models

Gideon (2010) found a very general method of multiple regression based on the distribution and population values of correlation coefficients. Habibullah et al (2010) analysed and used for determining correlation coefficients and linear and multiple regression equations, expressing the influence of the operation process conditional sojourn times in particular operation states on the ferry operation process total conditional sojourn time and concluded that multiple regressions technique provides an accurate predicting of the ferry total conditional sojourn time.

2.1.17 Accident Studies Involving Weather Conditions

Edwards (1998) investigated the relationship between the recorded weather and road accidents in England and Wales. Accident severity for
various adverse weather categories of rain, fog, and high winds were compared with non-hazardous fine weather conditions. The results showed that accident severity decreases significantly in rain as opposed to fine weather. Fridstorm et al (1995) carried out a similar study and measured the contribution of randomness, exposure, weather and daylight to the variation in road accident counts.

**2.1.18 Accident Studies Involving Real Time Applications**

The online applications using real time data have become a recent trend in research studies. In a research study, Cheol (2000) focused on the use of real time freeway data and a Bayesian probability concept for potential use in preventing accidents by identifying the traffic conditions, which led to accidents. Also, Wahab and Abdel-Aty (2001) used the concept of negative binomial modeling and the data from the I-4 freeway in Orlando, for identifying the precursory conditions which would lead to accidents. In the study, negative binomial modeling was used to estimate the real-time traffic conditions under which the real time accident likelihood could be estimated. The approach proved definitive in identifying the real time traffic conditions under which an accident could occur. Considering routing issues, Kaysi et al (1993) developed an application to predict congestion and helped route guidance. He suggested that routing decision should be based on forecasting future traffic conditions rather than historical traffic conditions. Thus, the applications and real-time data involvement have been beneficial in understanding the properties of the freeway conditions and accidents.

Lyons et al (2008) showed that trends in serious road traffic casualties differ between various places and health datasets in Great Britain. They proved the results that should help derive the most appropriate matter for surveillance of serious road traffic casualties. Whilst the use of multiple databases has attendant costs from a societal perspective these will be far
lower than the costs associated with potential misinterpretation of trends and consequent policy decisions which could result in lost opportunities to prevent road traffic injuries.

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’ behaviour, vehicle design, drivers’ characteristics and environmental aspects. Thus, the whole system of accident occurrence is a complex phenomenon (Chakraborty and Roy 2005).

The purpose of the statistical testing is to test whether or not there exists a considerable difference in the precursory traffic conditions and accident occurrence condition in terms of traffic measure values. In conclusion an accident occurrence condition might have come into existence due to certain traffic conditions like speed and volume of the vehicular traffic which might have affected driver’s driving abilities, eventually leading to an accident could be assessed. It thus would show a relationship between accident occurrence and the precursory traffic condition (Shaik 2003).

2.2 CAUSATIVE FACTORS OF ROAD ACCIDENTS

2.2.1 Main Causative Factors

In developing countries traffic accidents rates are still quite high. Therefore, the issue of road safety is a major concern in transportation engineering. The most effective way to reduce road accident is to better understand the causative road accidents hence to prevent the occurrence of
road accidents. One important aspect of the road safety problem is the causative factors to road accidents.

The study has considered every aspect of the causative factors leading to traffic accidents, such as the effects of weather, seasonal variation, and road and lighting conditions. In 1970, 73.6% of accidents were due to faults of drivers, a figure which in 1975 increased to 85.0%. Pedestrians were responsible for 8.1% of accidents in 1975. Accidents attributable to road conditions made up 1.9%, while other factors were of minor significance. In the United States accidents were more frequent in rural than in urban areas throughout the period under review, the pattern thus differing from that in Malaysia (Silva 1978).

Considerable past studies were emphasized on identification of black spot. Accidents are rarely caused because of one single factor. Thus, a multi-disciplinary approach is essentially needed in understanding the problems and providing better and appropriate solutions (Soemitro and Bahat 2005). According to the formal tables of the road traffic police the prime causes of road accidents are 89% of accidents are due to illegal driving, 4% of accidents are due to vehicles, 6% of accidents are due to road conditions and 1% of accidents is due to weather conditions and other factors.

More precisely, the main cases concerning illegal driver’s behaviors are over speed, right of way offences, drunken driving, red light offences, traffic in opposite side of the road, distraction and fatigue and illegal overtaking. It is clear enough, that human factors play a determinative role in road accidents, but also distraction and fatigue seem to affect the driving skill and behaviour (Dobbeleer et al 2009).
2.2.2 Studies concerning fatigue as a main cause of accidents

The main causative factors may vary from country to country as below.

UK

- A recent study by the Sleep Research Center (Home and Reyner 2000) indicates that driver fatigue causes up to 20% of accidents on monotonous roads. This suggests that there are several thousand casualties each year in accidents caused drivers falling asleep at the wheel.

- An earlier study (Home and Reyner 1995) of road accidents between 1987-1992 found that sleep related accidents comprised 16% of all road accidents, and 23% of accidents in motorways.

USA

- The National Highway Traffic Safety Administration (NHTSA) estimates that there are 56,000 sleep related road crashes annually in the USA, resulting in 40,000 injuries and 1,550 fatalities (NCSDR/NHTSA 1998).

- One study calculated that 17% (about 1 million) of road accidents are sleep related (Johnson 1998).

- A study of road accidents on two of America’s busiest roads indicated that 50% of fatal accidents on those roads were due to fatigue (Reissman 1996). Another study claims that 30%-40% of accidents involving heavy trucks are caused by driver sleepiness (NTSB 1995).
Australia

- VicRoads (www.vicroads.vic.gov.au/road_safe/index.htm), an Australian road safety organization, estimates that 25% - 35% (and possibly up to 50%) of road crashes are sleep related. A 1994 study (Fell 1994), estimated that driver sleepiness accounts for 6% of road accidents, 15% of fatal accidents and 30% of fatal crashes on rural roads.

Germany

- A study (Hell 1997) of motorway accidents in Bavaria estimated that 35% of fatal motorway crashes were due to reduce vigilance (driver inattention and fatigue).

New Zealand

- Between 1996 and 1998, 114 fatal road crashes (8% of all crashes) and 1,314 injury road crashes (5% of injury accidents) were thought to be fatigue related (Land Transport Safety Authority, 1998). A study (Gander 1998) of 370 heavy vehicle crashes in 1997, found that driver fatigue was listed as a contributing factor in 7% of accidents.

Norway

- A questionnaire survey (Sagberg 1999) of 9,200 accident-involved drivers found that 3.9% of all accidents were sleep related, but almost 20% of nighttime accidents involved driver drowsiness.
Israel

- An assessment of road accidents between 1984 and 1989 (Zomer 1990) found that up to 1% were recorded as sleep related, but the real figure was likely to be much higher as many accidents recorded as other types of driver error were likely to have been related to driver fatigue.

2.3 Scope of Data Collection and Analysis

2.3.1 Collection of Data

Accident data of different types were compiled from the records and files at office of the Traffic Police Department, Tiruchirappalli, Pudukottai, Thanjavur and statistical department (Chennai). The accident statistics cover the whole area under the jurisdiction of commissioner of Police. The length of roads are taken as those covered within this area. For determining the accident rates and pavement marking, 87 (sites) sections of roads with high accident densities and with different geometrics and traffic characteristics were chosen from different localities in the three districts. That is the accident details are obtained from the Traffic Police Department. The road length and the area are got from the statistical department and the traffic volumes are collected in person.

The sample survey of classified traffic volume flow studies were carried out on ten days from October 2006. At each station point, five minutes short count was taken. The five minutes counting was carried out at each station at four different periods in a day viz. morning pre-peak hour, morning peak hour, afternoon pre-peak hour and evening peak hour. Making use of the four representative short counts, the values of the average vehicular flow per day were estimated on the 87 road stretches and the average daily traffic volume is determined from this study. The data collected personally from 87
sites of these three districts (Tiruchirappalii, Pudukottai, Thanjavur) are given in detail.

The collection of data pertaining to the different types of accidents occurring at this junction-like human involvement year wise, month wise accidents, which could give the possibilities of the causes of the accident. The available data of road accidents, population, area, road length and number of motor vehicles of all the 29 districts of Tamilnadu were collected from information recorded by the Directorate of Economics & Statistics, State crime record bureau-Chennai, Transport department, evaluating the cost of road accidents collected from the Institute of road transport and Tamilnadu road sector project, government of Tamil Nadu from 1997 to 2008.

2.3.2 Data Analysis

Accident data pertaining to 29 districts of Tamilnadu (except Krishnagiri and Chengalapattu for which data are not available in full shape due to bifurcation of district process) were collected from the authorized sources for a period of 12 years from 1997 to 2008. From the data collected for all the districts of Tamilnadu the road length varies significantly. In Chennai, Kancheepuram, the Nilgiris and Tiruchirappalli, the road length is highly reduced where as in Karur, Namakal, Peambalur, Theni, Thiruvallur, Thiruvarur and Villupuram, it is doubled in comparison with the years 1997 and 2008.

It is very difficult to conduct any national or state wise road safety analysis, as the data available do not permit any scientific analysis of road traffic rashes and the associated risk factors. Except in a few metropolitan cities, no details are available on the types of road users killed, the location of the crash, or the circumstances in which the crash took place. Discrepancies between data – for example, between police and health-related sources, limit
the usefulness of existing data sources. Reliable data are needed to provide a solid foundation for road safety planning and decision making. Therefore, it is essential that steps should be taken to establish road traffic injury surveillance systems that generate reliable data on road traffic crashes and injuries. Some of the essential steps are outlined below.

As a first step in the direction of road safety research, the accident prevalent in the different roads of a state or a region should be studied in detail from accident records. In this thesis, the analysis of accident rates in Tamilnadu has been taken up as a case study. Similar analysis can be carried out in the case of any other city with advantage, before working out various measures to identify and solve the problems in accident-prone locations. Accident rate per million mixed vehicle-kilometers for Tamilnadu as a whole can be found out only after traffic volume counts of the classified vehicles are carried out during peak and off-peak hours on all the roads in Tamilnadu.

Using the accident records maintained by the Traffic Police Department, the accident rates in Tamilnadu based on different factors such as population, number of vehicles, vehicle ownership, mobility and vehicle movements have been worked out. This paper also aims at developing various correlations and checking their validity for Tamilnadu and also comparing the accident situations in the state with respect to few other cities and the general trend of accidents in various developing and developed countries.

Various analysis and investigations are needed at different stages of the investigation. Initially, a broad study of the database is required identifying hazardous sites and locations. This data base should consist minimum of three to five years worth of information. Such a time span allows for sufficient accidents to have been amassed for meaningful analysis, helps reduce fluctuations in the data and should not be too long a time span for traffic flow and engineering changes to have affected results. The initial
analysis of the accident data highlights the hazardous sites that will be subject future to detailed study with a view to introducing low-cost engineering treatment.

2.4 SUMMARY

Many researchers have devoted their work in the area of road accidents and traffic safety aspects. A number of studies on road safety have also been carried out in India, in different cities such as Delhi, Mumbai, Chennai and Ernakulum as well as on some highways (Srinivasan and Prasad 1979, Tuladhar and Justo 1981, Valli and Sarkar 1997, Sing and Misra 2001, Chakraborty and Roy 2005). However, no significant studies have appeared on the accident characteristics of passenger vehicles in the districts of Tamilnadu. In this thesis, an assessment of the current level of road safety in the districts of Tamilnadu has been made. A literature review is concerned with various accident studies, which are presented in this chapter.

Chapter three, deals with black spot study on selected roads of Tiruchirappalli city, in Tamilnadu, giving weightage to the severity factors and accident point. Chapter four deals with the ranking by accident rate, which is calculated accidents per million vehicle kilometres. A probabilistic procedure used to estimate an accident reduction factor due to pavement marking in chapter five. In the sixth chapter, ARI is reliable and dependable tool to identify the accident risk zone. ASI is thus computed by combining four ratios namely population based ratio, area based ratio, surfaced road length based ratio and vehicle based ratio in chapter seven. In the eighth chapter the accident data from 1997 to 2008 were analyzed to build models to understand the nature and extent of the causes of accidents using the concept of regression, multiple regressions, trend analysis by least square method, trend chart and Smeed’s formula. The last chapter summarizes the thesis with the various conclusions arrived from this study.