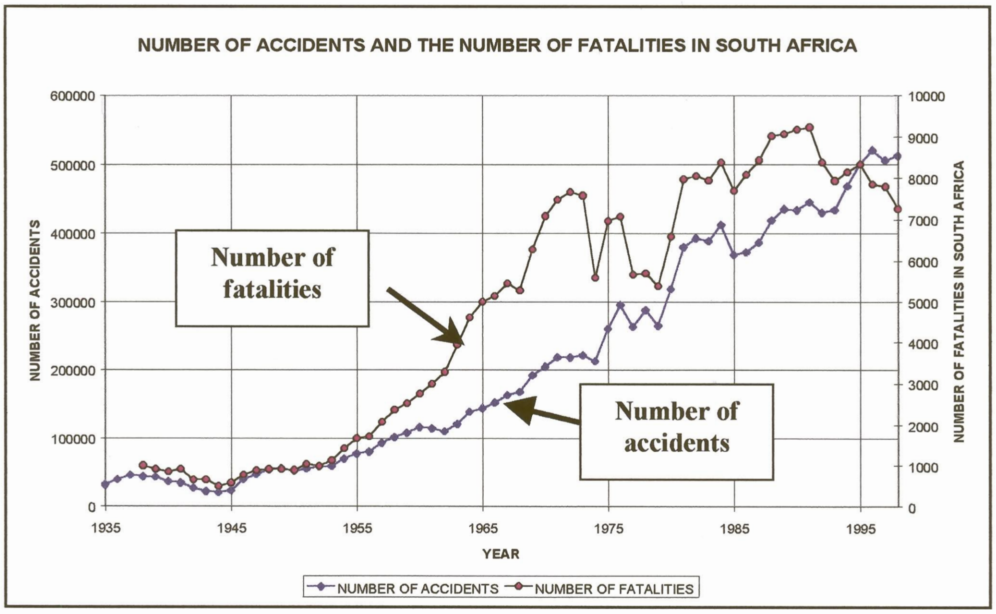
CHAPTER 9: ACCIDENT ANALYSIS USING YEARLY DATA

9.1 INTRODUCTION

The purpose of this chapter is to illustrate the different types of accident data analysis by utilising national annual data from as early as 1935. Difficulties with the different measures as well as relationships are highlighted. The chapter also provides details of attempts to predict the number of accidents by using long-term accident data. Predictions of the null alternative (no road safety improvement intervention) is essential to determine the effect of the road safety improvement.

9.2 ACCIDENT FREQUENCY

The total number of accidents in South Africa from 1935 to 1998 is shown in Graph 9-1.



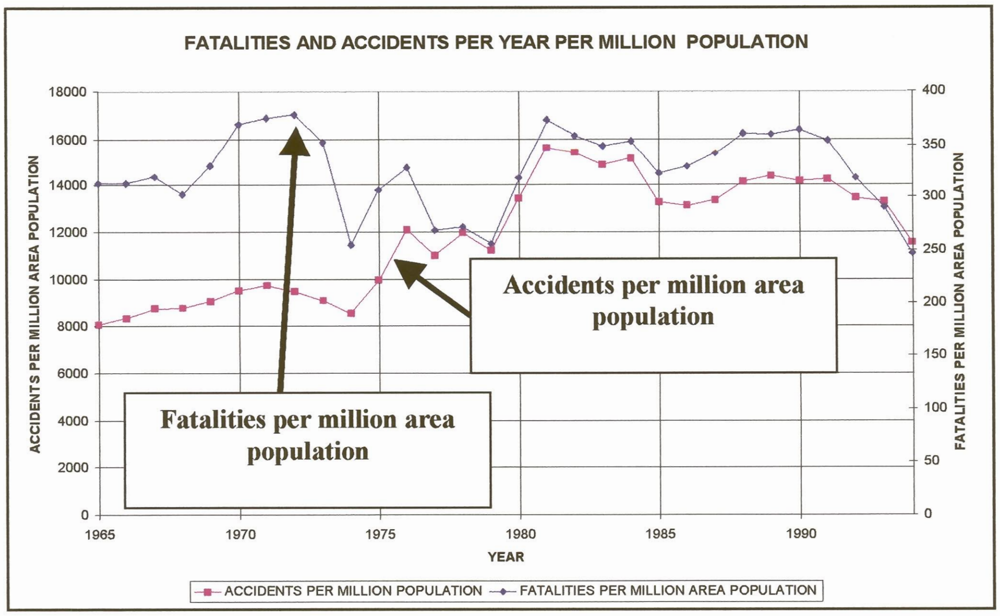
Graph 9-1: The number of accidents and fatalities in South Africa (after CSS 1999).

Accidents increased gradually until the 1970's. A decrease in the number of accidents and fatalities is noticeable in 1973 and 1979 that can be attributed to the energy crisis and the consequent reduction in mobility. Accidents increased by 4,1% from 1995 to 1996, decreased by 2,8% from 1996 to 1997 and increased again by 1,3% from 1997 to 1998. Fatalities increased slower than the total number of accidents from 1935 to 1973.

9.3 POPULATION-BASED ACCIDENT RATES

9.3.1 Death or accident characteristic frequency per million area population

Graph 9-2 shows the fatalities and accidents per million area population[1] for South Africa from 1955 to 1998.



Graph 9-2: Fatalities and accidents as a rate per million area population (South Africa) (after CSS 1999)

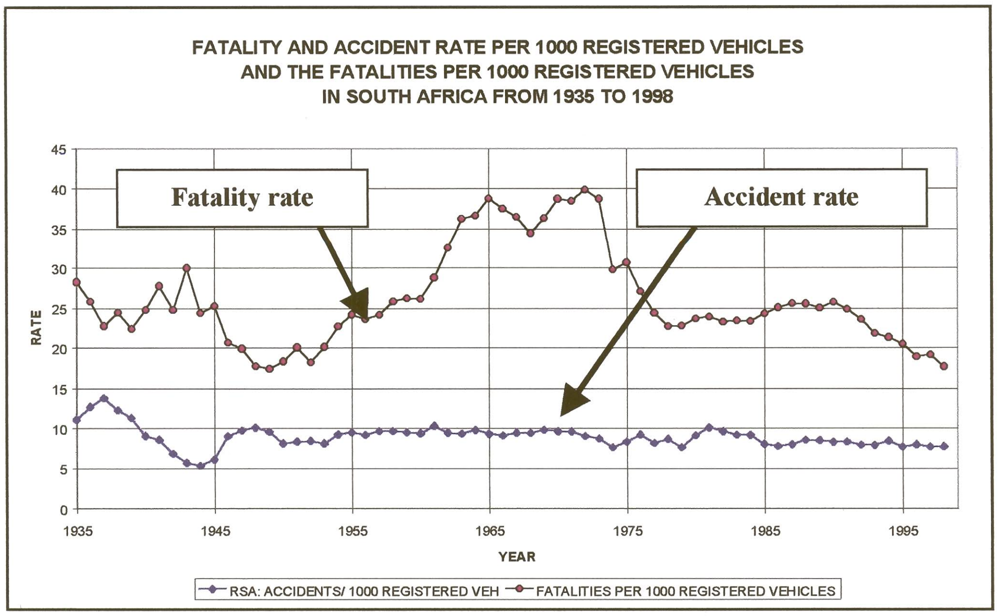
The increase and decrease of the fatality rate per million area population corresponded with increases and decreases in the number of accidents per million area population.

The accident or fatality rate per million area population does not provide a measure for effectiveness as it does not provide a measure for the exposure of the different age groups or for the greater exposure by the economically active portion of the population. It does however provide a measure in terms of public health when compared to deaths due to heart attacks, cancer etc.

[1] The term *per million area population* refers to the number of people in a specific area.

9.3.2 Death or accident characteristic frequency per 1,000 registered vehicles

Graph 9-3 shows the fatalities and accidents per 1000 registered vehicle population. The fatality rate per 1000 registered vehicles reduced from 1996 to 1998.

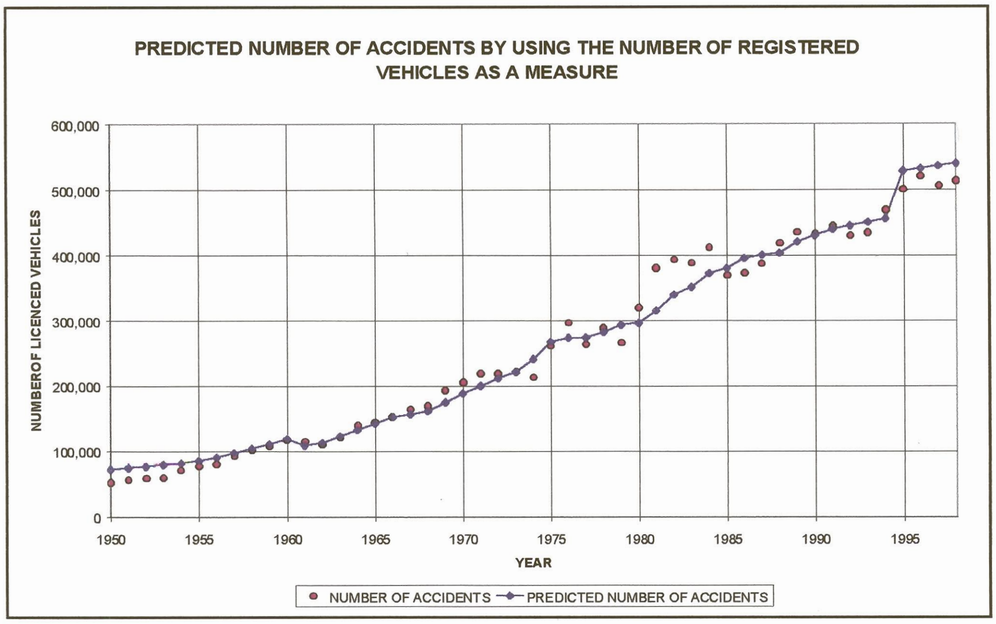


Graph 9-3 : The number of accidents and fatalities per 1000 registered vehicles (Data from CSS 2000).

The fatality rate per 1000 registered vehicle population remained relatively constant. From 1985 to 1998 the fatality rate remained lower than the rest of the curve – this can be attributed to an improvement to vehicle safety. The accident rate per 1000 registered vehicles decreased from the early 1990's.

A regression analysis was prepared for the number of accidents and the number of registered vehicles. The predicted number of accidents, based on the number of registered vehicles, is shown in Graph 9-4.

The regression analysis results are shown in Appendix A. The residuals represents residuals ranging from -5,7% to 20%. The residuals are however not acceptable if targets such as 5% accident reduction are set. This can be explained by the fact that the number of registered vehicles is not an indication of the exposure to accident risk.



Graph 9-4: The predicted number of accidents based on the number of registered vehicle population

9.4 EXPOSURE-BASED ACCIDENT RATES

9.4.1 Introduction

An accident is a direct result of mobility. Exposure-based accident rates take mobility into consideration. There are a number of exposure-based accident rates, namely:

- death or accident characteristic per 1000 000 vehicle kilometres;
- death or accident characteristic per 1000 litre fuel;
- death or accident characteristic per vehicle mode per 1000 000 vehicle kilometres.

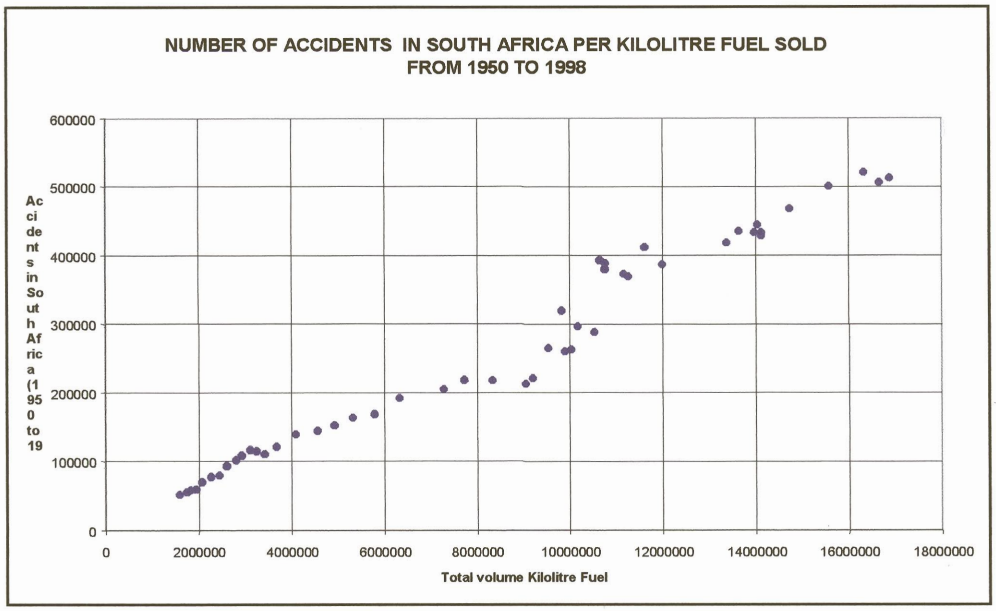
9.4.2 Available data

The amount of vehicle kilometres travelled in South Africa is estimated using certain categories of petrol and diesel sales as made available by the Department of Mineral and Energy Affairs. The categories of petrol and diesel sales are however only available for the period 1 January 1995 to date. Previous information is only grouped into total sales of petrol and diesel. Vehicle kilometres per mode are not available and can therefore not be utilised.

9.4.3 Fuel sales as a measure of exposure

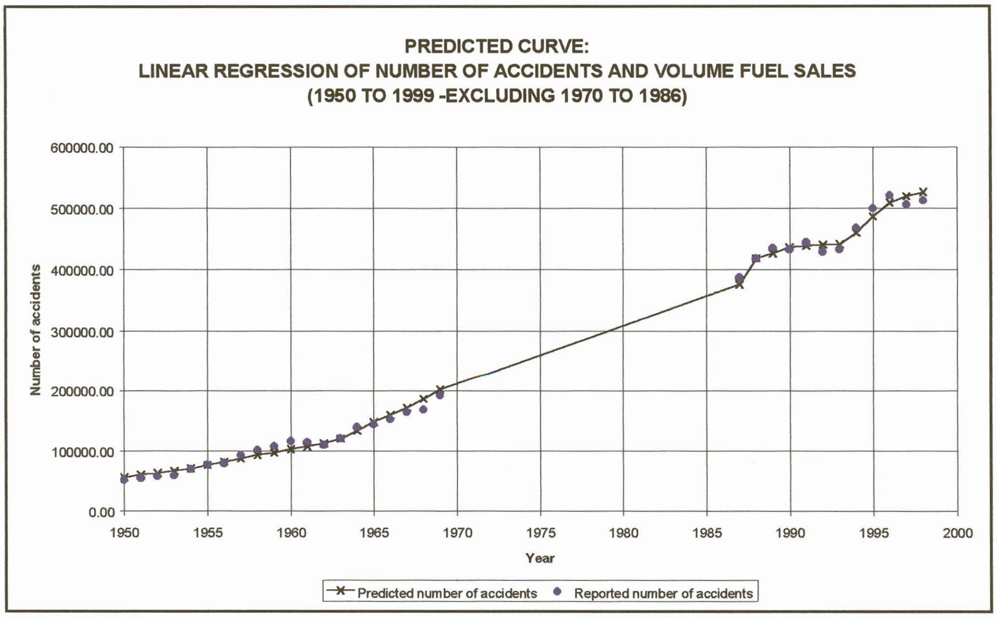
To determine long-term trends to enable the measurement of changes as a result of the Arrive Alive 1 campaign is not possible because the categories petrol and diesel sales prior to 1995 are not available.

Graph 9.5 shows the plot of number of accidents related to the total fuel (petrol and diesel) sales from 1950. Note that the data between 1970 and 1986 shows great variation.



Graph 9.5 : The number of accidents and the fuel (petrol and diesel) sales in South Africa from 1950 to 1998 (Department of Mineral and Energy Affairs, 2000 and data from CSS).

In the period 1970 to 1986, the data shows significant deviations. This can be explained by the fuel that the National Defence Force bought for the Angola war. If the data between 1970 and 1986 is disregarded, a regression line ($R^2 = 0{,}998$) can be fitted as shown in Graph 9.6. The regression analysis is shown in Appendix B.



Graph 9.6: Predicted and recorded number of accidents based on the petrol and diesel sales from 1950 to 1998 (excluding data from 1970 to 1986).

It should, however, be noted that the regression line does not intercept at the origin. This means that the estimation implies that accidents still occur even if fuel sales are zero. This can be explained by the fact that the petrol and diesel prices do not provide information or relationships that include the different transportation modes, their vehicle kilometres or fuel efficiency. The use of monthly data is even more problematic as fuel sales and usage do not necessarily take place during a calender month.

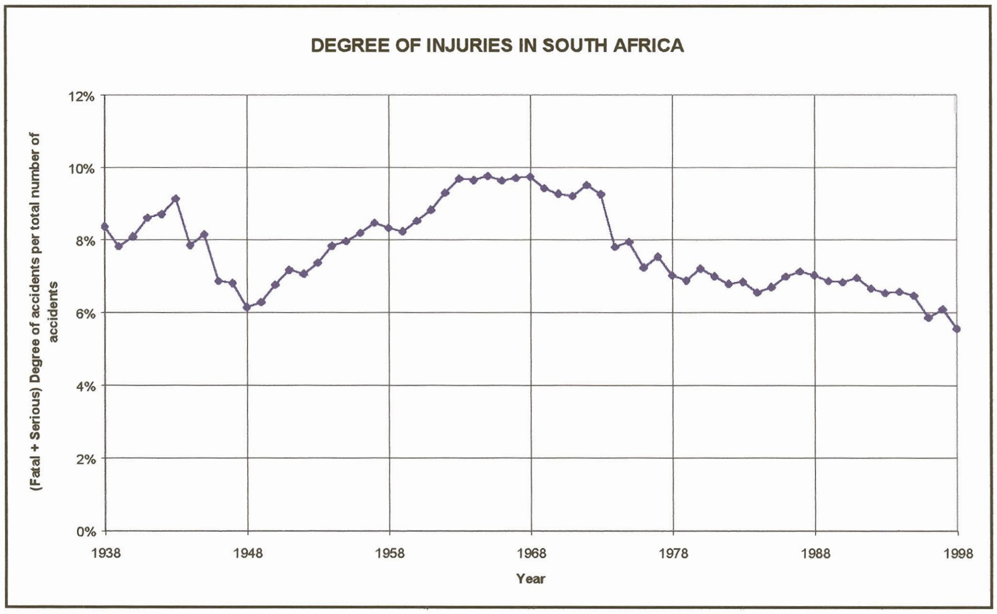
At particular sites or similar sites, vehicle-kilometres are easily estimated for microanalysis by using traffic counts for a particular intersection or route. Sample sizes can, however, reduce the significance of statistical findings. To solve this problem, a cross-sectional analysis can be carried out. Data from similar sites is added to increase the sample size. This is problematic as it increases the difficulty of the identification of all variables influencing the number of accidents at the particular sites.

9.6 CONCLUSIONS

The analysis of the annual accident data indicated that there are a number of factors that show similar trends to the number of accidents, e.g. volume of fuel sales and number of registered vehicles. The analysis shows too great a variation to be utilised as predictors of the number of accidents. The residuals in historic accident data prediction need to be much less than the target set for accident, injury or fatality reduction. There is a need for the development of a model that can predict the number of accidents, fatalities, etc. to evaluate the reduction in accidents and fatalities from the road traffic accident improvement interventions based on exposure.

9.4.4 DEGREE OF INJURY

The Degree of Injury can be defined as the percentage Fatal and Serious degree injury accidents per total number of accidents. Serious injury accidents are included as the difference between a fatality and a serious injury is merely a function of the health of the particular patient and the health or after-care system available. Graph 9.7 shows the degree of injuries in South Africa.



Graph 9.7: The degree of injuries in South Africa from 1938 to 1998 (after CSS).

The degree of injury of accidents reduced during the past few years. Degree of injuries is reduced by, for example, the use of seatbelts, safer car technologies etc.

9.5 TRENDS

The annual accident data and number of fatalities show large fluctuations. See Graphs 9-1, 9-2 and 9-3.