

A study of accident rates in Kuwait

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ABSTRACT

This paper describes a study of the traffic and accident data in Kuwait to assess the general accident situation in the country. The study uses published data over an 11-year period to examine the changes over time in the number of vehicles per person, and of fatal and non-fatal injuries per person and per vehicle. It was found that the fatal and non-fatal injury rates per vehicle were decreasing with time.

A relationship between fatalities, vehicles and population is derived and shows that the tendency found by Smeed for fatalities per vehicle to decrease with increasing car ownership is also evident in Kuwait.

INTRODUCTION

Oil revenues in Kuwait have transformed it into one of the richest countries in the world. Road construction was given an early priority in the development programme and the length of paved roads has increased from 273 km in 1956 to 2110 km in 1975. One particular result of all this has been the rapid growth in the number of vehicles. This, together with increasing urbanisation, has led to traffic congestion and traffic accidents. Road traffic accidents have become an increasing problem over the years as the number of vehicles has continued to grow at a very rapid rate. The study of this problem has been given very little attention and the little work done usually has the form of general reports and is of little academic value. However, over the last couple of years, people have become increasingly aware that road safety is an important problem that deserves attention.

This paper studies the basic road accidents in Kuwait during the period between 1969 and 1979 to determine the nature and extent of the road safety problem in Kuwait. Previous work has shown some general trends of traffic accidents in Kuwait with particular reference to Al-Salmiya urban district (Jadaan 1982).

OBJECTS OF STATISTICAL STUDIES

Statistical studies of road accidents may be divided into two kinds according to the nature of their objectives, although this is by no means a clear-cut division (Johnson & Garwood 1971). The first kind includes those studies which aim at giving a broad factual description of the situation such as the distribution of accidents among various

classes of road. The second kind of statistical studies aims at finding the factors which affect accident frequency. In some cases these studies involve a cost–benefit analysis of the remedial measures.

This study is of the first kind and aims at providing an analytical approach to road safety in Kuwait by describing the nature and scale of the road safety problem. A second part of this programme which will be presented in a separate paper deals with assessing the factors which affect accident frequency.

DATA SOURCES

Improving the road accident situation in any particular country requires that the problem itself be clearly defined. Thus accident data must be collected over a period of time to provide an idea about the characteristics of these accidents. The first thing that strikes any prospective investigator is the lack of accurate, published accident data. Unfortunately accident information collected by the police is not tabulated and analysed and the only data available are the number of fatal, serious and slight personal-injury accidents for any given year.

The analysis undertaken in this paper is based mainly on published government statistics (Ministry of Planning 1979).

TRENDS IN MOTOR VEHICLE OWNERSHIP

Since the discovery of oil Kuwait has been subjected to large-scale rapid development and motor vehicle use in particular has considerably increased. In order to determine the changing pattern in vehicle ownership with time, data on population and the number of vehicles were obtained over the 11-year period between 1969 and 1979. The total number of motor vehicles increased from 136,622 in 1969 to 496,576 in 1979. The pattern of this growth is shown in Fig. 1, which shows that the number of vehicles has increased steadily. The population of Kuwait has also grown over the 11-year period

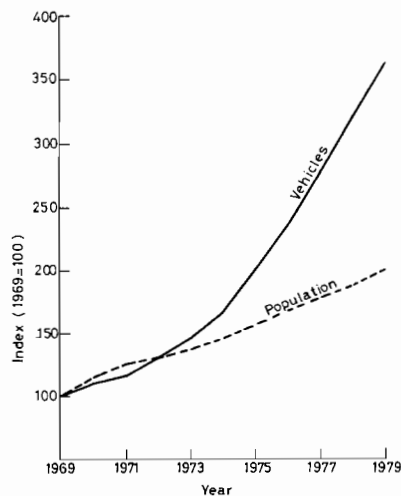


Fig. 1. Relative changes in motor vehicles and population.

Table 1. Changes in vehicle ownership during the study period

Year	Vehicles	Population (000s)	Vehicles per 10,000 persons
1969	136,622	637	2144
1970	149,150	739	2018
1971	158,446	781	2029
1972	175,526	826	2125
1973	197,777	874	2263
1974	223,788	925	2419
1975	272,232	995	2736
1976	320,656	1065	3011
1977	379,101	1129	3358
1978	439,553	1199	3666
1979	496,576	1242	3998

from 637,244 in 1969 to 1,242,000 in 1979, nearly double. The pattern of this growth is also shown in Fig. 1.

For the 11-year period, the changes in number of vehicles owned per person were obtained. The results are shown in Table 1, which shows a change in vehicle ownership at a rate higher than that of many developed countries (from 0.21 in 1969 to 0.40 in 1979). It can be seen that, as might be expected, there was an increase in the number of vehicles per person over the 11-year period. Experience in the industrialised societies (Europe and North America) indicates that vehicle ownership does not begin to level off until values of approximately 0.45 are reached (Ross & Cornwell 1980). This level has not yet been reached in Kuwait and consequently further increase in the number of vehicles is expected to take place until ownership figures of this order are reached. The large numbers of non-national manual workers in Kuwait who cannot afford (or may not wish) to purchase a private vehicle make the situation slightly different. However,

Table 2. Changes in traffic accidents, fatalities and injuries during the study period

Year	Accidents	Fatalities	Injuries
1969	10,547	182	2341
1970	11,775	144	2465
1971	12,668	233	2718
1972	14,035	253	2869
1973	12,708	231	2902
1974	11,627	304	2944
1975	14,060	367	3168
1976	16,744	307	3545
1977	19,234	321	3702
1978	22,864	361	3588
1979	38,252	414	1798

multi-car-owning households exist amongst the nationals which, to some extent, counterbalance the effect of the non-national workers.

TRENDS IN ROAD ACCIDENTS, FATALITIES AND INJURIES

The increase in car ownership indicates that the number of vehicles has increased at a rate higher than that of the population growth. In consequence, the number of accidents is expected to increase. By 1969, there was already a total of nearly 10,547 traffic accidents but by 1979 this figure had increased almost fourfold to 38,252 accidents.

Table 2 shows that a total of 184,514 traffic accidents were reported during the 10-year period; 3117 persons were killed and 32,030 persons received injuries. Most of the injuries were serious and in many cases would have handicapped the victims for the accidents resulted in 414 deaths and 1798 injuries. These numbers indicate the terrible social and economic waste resulting from traffic accidents in Kuwait.

Table 3. Changes in traffic casualties per 10,000 persons

Year	Fatalities per 10,000 persons	Injuries per 10,000 persons
1969	2.86	36.8
1970	1.95	33.4
1971	2.98	34.8
1972	3.06	34.7
1973	2.64	33.2
1974	3.29	31.8
1975	3.69	31.8
1976	2.88	33.3
1977	2.84	32.8
1978	3.01	29.9
1979	3.33	14.5

Accident statistics are usually converted into accident rates so that useful comparisons can be made by taking into account the degree of exposure to risk that has occurred in the events. Table 3 shows the number of casualties as related to population. It can be seen that the number of fatalities per head of population has reached a peak in 1975 but did not show a significant change during the 3 years 1976, 1977 and 1978. Unlike the death rate, the injury rate has shown some improvement during the study period. The percentage changes in fatalities and injuries do not appear to be closely related to changes in vehicle ownership.

A more useful indication of the accident situation in any country over a period of time is the changes in fatalities and injuries per licensed vehicle. These changes are shown in Table 4 which shows that there is a tendency for both rates to decrease with time. The fatality rate decreased from 13.32 in 1969 to only 8.34 in 1979 and the injury rate also decreased from 171.4 to 36.2 during the same period.

A study of accident rates in 19 developing countries was carried out by the Transport and Road Research Laboratory, England. Out of the 19 countries studied

Table 4. Changes in traffic casualties per 10,000 vehicles

Year	Fatalities per 10,000 vehicles	Injuries per 10,000 vehicles
1969	13.32	171.4
1970	9.66	165.3
1971	14.71	171.5
1973	11.70	146.7
1974	13.58	131.6
1974	13.58	131.6
1975	13.48	116.4
1976	9.57	110.6
1977	8.47	97.7
1978	8.21	81.6
1979	8.34	36.2

15 showed a decrease in fatalities per vehicle and 14 a decrease in injuries per vehicle (Jacobs & Hutchinson 1973).

RELATIONSHIP BETWEEN FATALITIES, VEHICLES AND POPULATION

The formula that expresses the relationship between the road fatalities, registered vehicles and population is given by

$$F/V = K(V/P)^c$$

where F is the number of fatalities, V is the number of vehicle registrations, P is the population and K , c are constants.

Smeed (1949) used data collected in 1938 from 20 countries, the majority of which were European, to derive the following relationship:

$$F = 0.0003 (VP^2)^{1/3}$$

The derived equation proved to be a good fit on more than one occasion. It was a good fit when applied to data collected from mainly European countries over the period 1957–66 (Smeed 1968) and when applied to data collected from 68 different countries over the period 1960–67 (Smeed & Jeffcoat 1970). Smeed's equation can be rewritten in other forms to give the relationship between car ownership, the fatality rate expressed as fatalities per vehicle, and fatalities per person. The relationship between fatality per person and car ownership is given by

$$F/P = 0.0003 (V/P)^{1/3}$$

and the relationship between fatalities per vehicle and car ownership is given by

$$F/V = 0.0003 (V/P)^{-2/3}$$

where V/P = car ownership, F/V = fatalities per vehicle, F/P = fatalities per person.

This implies that fatalities per person increase and fatalities per vehicle decrease as car ownership increases.

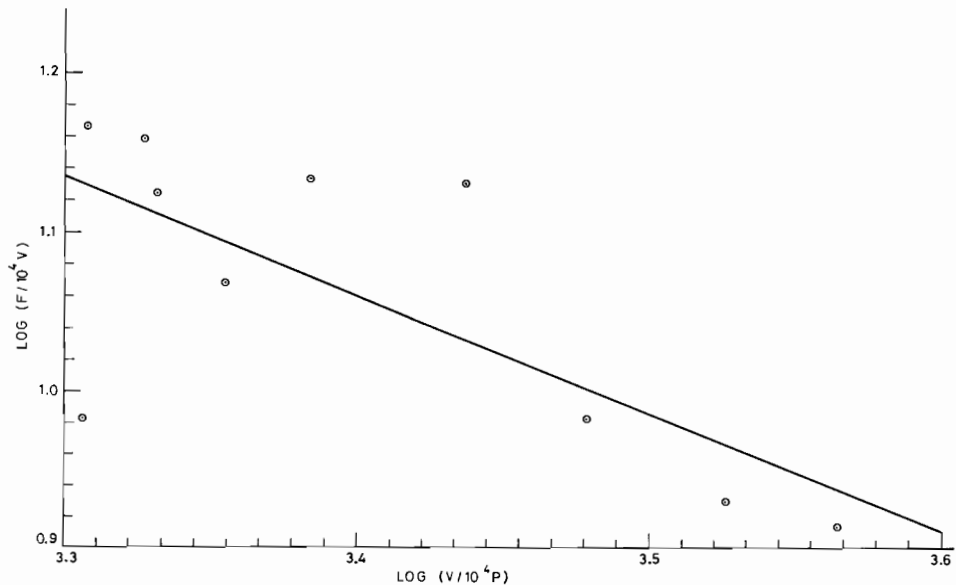
Table 5. Vehicle ownership and fatality rates used in formula derivation

Vehicles per 10,000 persons	Fatalities per 10,000 vehicles
2144	13.3
2021	9.6
2030	14.7
2126	14.4
2264	11.7
2420	13.6
2736	13.5
3010	9.6
3357	8.5
3668	8.2

An attempt was made to derive similar relationships for Kuwait. The data collected on road fatalities, vehicles and population over the study period were used for this purpose. Table 5 shows the change in car ownership expressed as number of vehicles per 10,000 persons and the fatality rate expressed as number of fatalities per 10,000 vehicles over the study period. The data were plotted and used for the derivation of the formula. The plotting is shown in Fig. 2.

Using regression analysis, the relationship between fatalities per vehicle and car ownership was found to have the following form

$$F/V = 0.0004079 (V/P)^{-0.746}$$

**Fig. 2.** Variation of fatality rate with vehicle ownership.

and the relationship between fatalities per person and car ownership was

$$F/P = 0.0004079 (V/P)^{0.254}$$

This means that fatalities per person are proportional to vehicles per person raised to the power 0.254, and fatalities per vehicle are inversely proportional to vehicles per person raised to the power 0.746. This implies that doubling vehicle ownership would have 19% more fatalities per person and 40% fewer fatalities per vehicle.

Similar analysis of fatality rates based on Smeed's work was carried out on data collected from 32 developing countries (Jacobs & Hutchinson 1973) and the following relationships were derived:

$$F/V = 0.00077 (V/P)^{-2/5}$$

and

$$F/P = 0.00077 (V/P)^{3/5}$$

The equations derived for the developing countries and Kuwait show that the tendency found by Smeed of fatalities per vehicle to decrease with increasing car ownership also exists in developing countries.

INTERNATIONAL COMPARISON

In order to appreciate the magnitude and relative seriousness of the traffic accident problem in Kuwait, a comparison was made between the accident rates as related to human and vehicle population. The comparison considered the number of traffic fatalities which occurred in a number of selected countries as related to their respective populations and vehicles. Fig. 3 shows the fatalities per 100,000 population and Fig. 4 shows the fatalities per 10,000 vehicles for all the selected countries. Fig. 4 is more

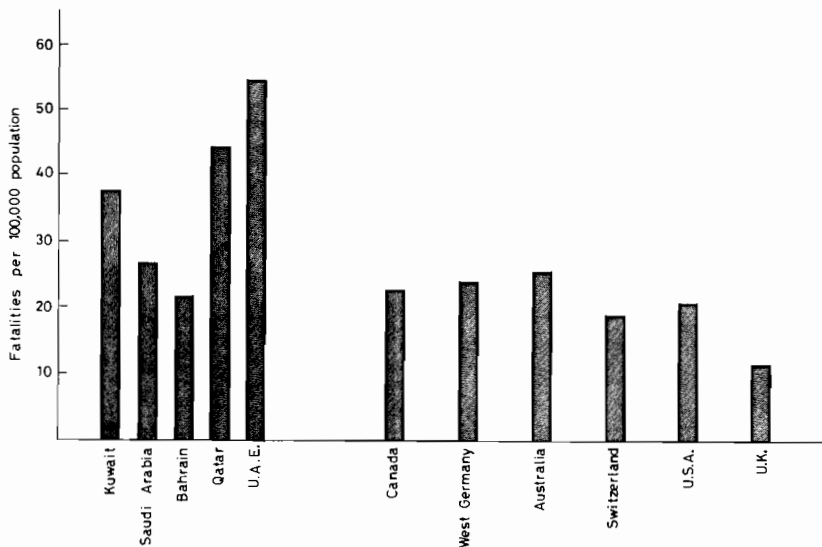


Fig. 3. International comparison in fatalities per 100,000 population, 1976.

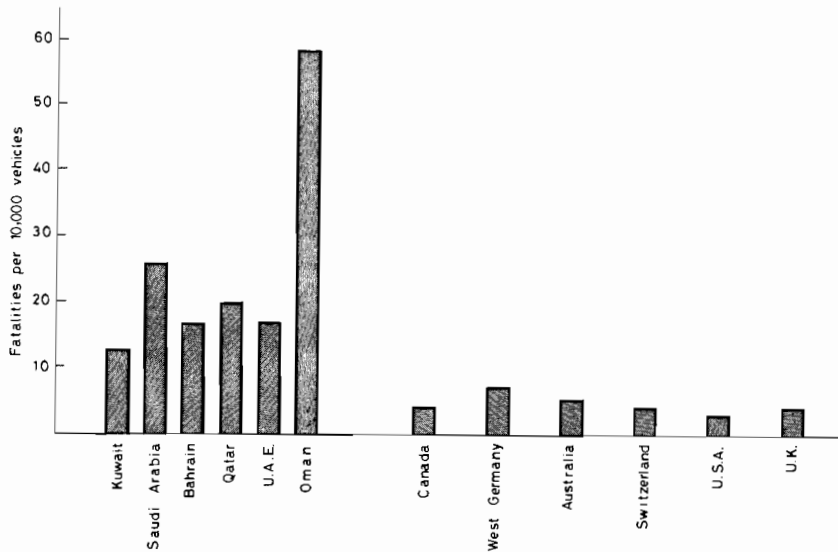


Fig. 4. International comparison in fatalities per 10,000 vehicles, 1976.

meaningful and shows that the rates for Gulf countries are four to six times higher than equivalent rates for most of the industrialised countries included in the comparison. Kuwait has the lowest rate of all the Gulf countries (13.5 fatalities per 10,000 vehicles), but this is still about twice the highest rate of developed countries. Oman has the highest rate of all countries (about 60) which is about eight times as much as the highest rate of developed countries. This indicates the seriousness of the problem in Gulf countries in general and Oman in particular.

REFERENCES

- Jacobs, G.D. & Hutchinson, P. 1973. A study of accident rates in developing countries. RRL Report LR 546. Road Research Laboratory, Crowthorne, Berkshire, England.
- Jadaan, K.S. 1982. Traffic accidents in Kuwait. *Traff. Engn. Control* 23(4): 221-3.
- Johnson, H.D. & Garwood, F. 1971. Notes on road accident statistics. RRL Report LR 394. Road Research Laboratory, Crowthorne, Berkshire, England.
- Ministry of Planning 1979. Annual statistical abstract, Kuwait.
- Ross, A. & Cornwell, P.R. 1980. An analytical approach to road safety. Halcrow Fox and Associates, London, England.
- Smeed, R.J. 1949. Some statistical aspects of road safety research. *J. Roy. Statist. Soc., Series A (General)* 112(1): 1-23.
- Smeed, R.J., 1968. Variations in the pattern of accident rates in different countries and their causes. *Traff. Engn. Control* 10(7): 364-71.
- Smeed, R.J. & Jeffcoat, G.O. 1970. Effects of change in motorisation in various countries on the number of road fatalities. OECD Symposium on the use of statistical methods in the analysis of road accidents, Paris.

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دراسة معدلات الحوادث في الكويت

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خلاصة

يهدف هذا البحث الى دراسة وضع حوادث المرور في دولة الكويت . وقد تم استخدام البيانات لاحدى عشرة سنة (ما بين ١٩٦٩ و ١٩٧٩) لتحديد تغير اعداد المركبات وكذلك الحوادث المميّة وغير المميّة منسوبة لكل شخص من السكان ولكل مركبة تستخدم الطريق . وقد وجد أن معدل الحوادث لكل مركبة يقل مع الزمن . ثم استخدمت هذه البيانات لاشتقاق علاقة بين المركبات والسكان والحوادث المميّة في دولة الكويت ، وقد أثبتت هذه العلاقة أن الاتجاه الذي وجدته سميد من أن معدل الحوادث المميّة لكل مركبة يقل مع زيادة معدل امتلاك السيارات ينطبق أيضا على الكويت .

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