AN OVERVIEW OF ROAD SAFETY IN GREECE

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ABSTRACT

This paper presents an overview of the road safety issue in Greece. First, road fatalities are investigated, and their characteristics and temporal and other variation are analysed. Then the severity of accidents is presented. It is found that the most serious accident types in Greece do not include head on collisions, as expected, but collisions to fixed object or vehicle, pedestrian accidents and coming off the road. Then, a comparison of road accidents in Greece to the fourteen other EU countries is carried out. The trends show that Greece is in one of the worst positions within the EU. Greece seems also to belong to a group of countries, including South European countries and Ireland, which present road safety characteristics significantly different from those of the other EU countries. The reasons for these differences are explained in detail. Finally, the paper proceeds to a description of the safety measures already implemented in Greece, and concludes with recommendations for improving the road safety in this country.

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1. INTRODUCTION

In 1993, a total of 1822 road users were killed in Greece, and 29,905 injured. The cost to the country of all road accidents (22,161), based on figures supplied by the NSSG (National Statistical Service of Greece 1993) and by various researchers (Sambrakos 1985, Tsohos and Hautopoulos 1994, Mintsis *et al.* 1994) was estimated to be several million U.S. dollars, while the hospital and pharmaceutical treatment and care cost about 28 million U.S. dollars.

When compared with other countries, members of the European Union (EU), Greece has the lowest car ownership per 10,000 persons. In contrast, it occupies one of the first places in the number of accidents per 10,000 vehicles. The actual problem is even greater than the statistics show: while accidents involving deaths are fully reported, other accidents are not; research showed (Yannis 1994) that injuries to car occupants are likely to be underreported by a percentage ranging between 20-40%, corresponding mainly to slight injuries.

This paper considers the main components of accidents in Greece that contribute to the overall number of accidents, compares road safety parameters with other EU countries, and explores strategies to improve safety performance on Greek roads.

2. FATALITY CHARACTERISTICS

The fatality rates (deaths per 10,000 vehicles) in Greece over the years have decreased progressively from 27.0 in 1970 to 9.7 in 1980 and 6.5 in 1993 i.e. there has been a significant decrease over the last 24 years (Fig. 1). However, during the last 8 years the situation seems to have been stabilised.

The conclusions of some further analyses of the 1987-1993 fatal accidents are given below.

Tables 1 and 2 present an overview of the distribution of the number of persons killed by age group, sex and road user type leading to a number of general remarks. Even-though distribution of killed persons among men and women accounts for an overall 77% for men and 23% for women, further breakdown of these percentages by road user type shows that 96% of killed drivers are men, whereas the corresponding percentages for killed passengers and pedestrians are 53% and 62% respectively.

Furthermore it is interesting to note that out of the total number of killed persons 52% are drivers, 24% are passengers and 24% are pedestrians. However, it should be stressed that although these percentages give a broad overview, they do not take into

account exposure, and as a consequence no valid conclusions can be extracted through cross comparisons.

As far as age distribution of killed persons is concerned, different patterns are found in men and women killed. Distribution of men killed by age group present a net high in the age group 20-29 (29%) and as expected very low percentages for the age groups 0-20 and 70+, obviously due to the fact that exposure corresponding to these age groups is limited. On the contrary, distribution of women killed by age group presents a relative peak in the age group 20-29 (19%) but also high percentages for the age groups 60-69 and 70-79 (13% and 14% respectively). Further analysis of this age group distribution by road user type shows significant numbers for elderly pedestrians above 60 years old (56%), young drivers in the age group 20-29 (34%) and young passengers in the age group of 20-29 (31%) killed in road accidents.

The distribution of the number of killed persons per month, day of the week and hour of the day were also calculated. It was found that the months with highest rates are the summer months: July (12% of the total) and August (11%), probably due to the increased number of tourists. On the contrary, the lowest numbers occur in January (6%) and February (5%).

The hourly variation shows that a significant number of fatal accidents occur during the evening (between 6 p.m. and midnight a 30% of the total was recorded). This can attributed to the specific night life habits concerning entertainment in Greece.

Table 1. Number of killed persons by age group, sex and road user type (1987-1993).

	Drivers		Passengers		Pedestrians		Total	%
Age	M	F	M	F	M	F		
0-9	14	0	79	56	98	56	303	3%
10-19	558	20	279	176	77	52	1162	10%
20-29	1973	96	552	352	115	49	3137	26%
30-39	1023	57	193	200	106	44	1623	14%
40-49	788	41	128	161	100	51	1269	11%
50-59	790	18	149	207	210	120	1494	13%
60-69	525	6	109	132	300	222	1294	11%
70-79	193	4	60	65	393	296	1011	9%
80-89	35	0	20	28	320	153	556	5%
90+	1	0	4	2	24	13	44	0%
Total	5900	242	1573	1379	743	1056	11893	100%
%	96%	4%	53%	47%	62%	38%		

3. ACCIDENT SEVERITY

The consideration of road accidents and related killed persons inside and outside built up areas in Greece (Table 3) reveals that accidents in the interurban network (national and regional roads) are, as expected, more serious, probably due to higher travel speeds. It is worth mentioning that even though 73% of injury accidents occur inside built up areas, only 45% of the total number of killed persons are killed in these accidents. Furthermore, it should be noted that accident severity inside built up areas increases when these areas are crossed by roads of the regional or national network. Only 9% of the total number of accidents occur in national or regional roads crossing a built up area, but the respective percentage of number of killed persons is 24%.

Table 3. Deaths per 100 injured persons by road type.

	Inside Built up areas	Outside Built up areas	Total
National	10	14	13
Regional	7	9	9
Municipal	4	12	4
Total	4	11	6

Table 4 reveals that accidents with the highest severity (14 killed per 100 injured persons) occur in two-way roads of the national road network with markings (1 or 2 traffic lanes per direction), but without central island or median. The most serious accidents in the urban network of Greece occur in two-way roads with central island (5 killed per 100 injured persons). On the contrary, accident severity in the interurban network is lower for the same type of roads (7 and 9 killed per 100 injured persons) as compared to two-way roads without a central island or a median. This is probably due to the fact that this type of roads allows travel speeds which are higher than those that can be compatible with the urban environment activities.

Table 4. Deaths per 100 injured persons by road type.

	National	Regional	Municipal	**Total**
One-way road without markings	N.A.	I.S.	3	**3**
One-way road with markings	N.A.	I.S.	3	**4**
Two-way road without markings	N.A.	9	4	**5**
Two-way road with markings (1 lane)	14	9	3	**8**
Two-way road with markings (2 lanes)	14	10	4	**7**
Two-way with central island	9	7	5	**6**
Total	**13**	**9**	**4**	**6**

N.A.: No accidents - I.S.: Insignificant sample

A parameter found to influence significantly accident severity is the lighting conditions. Table 5 shows that accident severity is much higher during the night, when there is no street lighting (poor, unlit, without). The number of killed per 100 injured persons is more than double in accidents occurring during the night in roads without or with unlit street lighting (12-13 killed persons per 100 injured persons). Accidents occurring during twilight or dawn are also more serious from day time accidents. It should be also noted that accident severity during the night in roads with good street lighting is not higher than accident severity during the day.

Table 5. Deaths per 100 injured persons by lighting conditions.

Day	Dawn Twilight	Night-street lighting				Total
		good	poor	unlit	without	
5	7	5	8	13	12	**6**

Finally, it is worth considering the severity of accidents by accident type. Table 6 shows clearly that the most serious accident types in Greece, for both urban and rural areas, are collisions to fixed object or vehicle, pedestrian accidents and coming off the road. On the contrary, lateral, at angle and rear-end collisions present less important severity. Accident severity varies considerably inside and outside built up areas and presents, as expected, its peak value for pedestrian accidents outside built up areas (32 killed per 100 injured persons). It is worth mentioning that, in contrast to the existing belief, head-on collisions are not the cause for the most serious accidents. This conclusion concerns mainly accidents inside built-up areas, a fact rather expected, probably due to low speeds. As far as head-on collision outside urban areas are concerned, they lead to serious accidents, but other accident types lead to more fatalities per 100 persons injured.

Table 6. Deaths per 100 injured persons by road type.

Accident type	Inside Built up area	Outside Built up area	Total
Head-on collision	3	12	8
At angle collision	2	9	4
Lateral collision	2	4	2
Rear-end collision	4	5	4
Fixed object/vehicle collision	9	12	10
Pedestrian accident	7	32	10
Came off the road	8	10	10
Total	**4**	**11**	**6**

4. COMPARISON WITH EU COUNTRIES

A comparison of road fatalities in Greece to the fourteen other countries of the European Union was carried out, and is presented in Table 7.

Table 7. EU Comparisons 1993 of Vehicle Ownership and Death Rates in Road Accidents.

Country	Vehicles per 10,000 population	Deaths[(1)] per 10,000 vehicles	Deaths[(1)] per 10,000 population
B	4,507	3.66	1.65
UK	3,735	2.88	1.08
D	4,364	2.82	1.23
GR	2,737	8.01	2.19
E	4,221	3.86	1.63
F	5,095	3.25	1.66
IRL	2,929	4.18	1.22
I	5,555	2.22	1.23
L	5,940	3.29	1.95
NL	4,194	1.92	0.81
A	4,566	3.93	1.80
P	4,627	6.29	2.91
FIN	4,283	2.23	0.95
S	4,439	1.63	0.72
UK	4,424	1.54	0.68

(1) To obtain the absolute numbers of killed persons, the common definition of killed person in a road accident was used, which comprises all persons that died within 30 days from the day of the accident. When for the original data the above common definition is not used, which is the case for Greece, appropriate correction coefficients are taken into consideration (ECMT 1993, Golias and Tzivelou 1992). For this Table, data and correction coefficients contained in the statistics publication of the European Conference of Ministers of Transport (ECMT) have been used.

Greece seems to have the lowest car ownership level in the EU. In contrast, it is by far in the first place as far as deaths per 10,000 vehicles are concerned. It can also be found in the second place as far as deaths per 10,000 population are concerned, after Portugal (Table 7).

Table 8. Percentage change in Vehicle Ownership and fatality rates 1986-1993.

Country	Vehicles/10,000 population	Deaths/10,000 vehicles	Deaths/10,000 population
B	19.2	- 30.0	- 16.2
DK	3.4	- 26.3	- 23.4
D	N.C.*	N.C.	N.C.
GR	35.8	+ 10.6	+ 51.0
E	41.5	- 17.9	+ 16.4
F	13.6	- 26.5	- 16.2
IRL	24.5	- 9.9	+ 11.9
I	22.6	- 18.3	0
L	28.3	- 29.1	- 9.3
NL	13.6	- 32.6	- 22.8
A	6.3	- 21.9	- 6.2
P	87.2	- 21.2	+ 47.8
FIN	15.4	- 33.4	- 23.4
S	6.4	- 32.4	- 28.7
UK	22.3	- 43.8	- 31.3

* N.C. = Non-Comparable, because in the years before 1989 only statistics for W. Germany are available.
SOURCE OF DATA: (National Statistical Service of Greece 1993, EUROSTAT 1991, EUROSTAT 1994, EUROSTAT 1991, Tsohos *et al.* 1992).

The changing pattern in car ownership levels and fatality rates over time was also investigated for the fifteen EU countries. The percentage changes in vehicles per person and in fatality rates over an 8-year period, 1986 to 1993, were calculated, and the results are shown in Table 8. The following remarks can be made:

(i) All countries, as might be expected, showed an increase in vehicle ownership. However, the South European countries, Portugal, Spain and Greece present larger increases. This can be attributed to the economic recovery in these three countries.

(ii) In most EU countries there was a decrease in the number of fatalities per 10,000 persons. Exceptions were Greece (+51.03%), Spain (+16.4%), Portugal (+47.8%) and Ireland (+11.9%) where substantial increases in their number of fatalities per 10,000 people were recorded.

(iii) Finally, only Greece presents an increase in fatality rates per 10,000 vehicles. All other countries present a reduction, while the smallest numbers can be found in countries like Ireland, Spain, Italy and Portugal.

The above analysis indicates that losses because of traffic accidents are comparatively quite heavy in the South European countries, and Ireland i.e. there is a

clear distinction between this group of countries and the other EU countries, as far as road safety is concerned. An attempt for the explanation of these results is given below.

During the last few decades, most EU and other European countries experienced a trend following character in their transport policies. Growth rate in gross domestic product was followed by a rapid increase in car-ownership and vehicle kilometres. However, there has been a difference:

- in the industrialised countries of the north (such as the Netherlands, U.K., Belgium, Denmark, Germany, France) mass motorization took place in the sixties
- in the South European countries (such as Greece, Portugal, Spain) mass motorization started much later, in the eighties (Ireland may be added to this latter group).

As a result, the former countries are confronted with lower than average growth rates, while the latter still present high growth rates. The underlying difference is in fact the time difference in economic development between these two groups of EU countries.

Due to the above, the former countries have been confronted with the consequences of the mass motorization for quite a few years; therefore, their transport policies (Matsoukis and Van Gent 1995) are now clearly focused on the decrease of the negative effects of private car use (e.g. the one-third reduction target for accidents by 2000 in U.K., the reduction of road deaths by 50% and of injuries by 40% up to the year 2010 in the Netherlands etc.). The latter countries are facing the corresponding problem in the current decade, and furthermore some of them seem not to be gaining from the experience of their EU colleagues.

As secondary reasons for explaining the above difference in road accident trends the different weather conditions, way of life and behavioural characteristics of people in the South European countries can be used. Although the latter reason (driver behaviour) is a parameter which cannot easily be verified, studies have shown that relative indications exist, at least for Greece (Vlahopoulos 1985). Thus, it is possible that - at least for Greece - a good potential for accidents reduction lies in influencing human behaviour. Changing behaviour patterns through persuasion or training, however, may be more difficult than other measures, such as enforcement and engineering measures, which remove hazards or improve vehicles.

The increase in the rates of persons killed in the road accidents in Greece is also explained by the fact that the various road safety measures introduced in Greece during the last years have not been properly implemented. More precisely, during the

last ten years the most important road safety measures introduced in Greece consisted mainly of the following:

1986: Compulsory wearing of helmets by motorcyclists (driver and passenger).
1987: Compulsory fitting of seat belts in the front seats of all passenger cars, which the driver and the front seat passenger must wear.
1990: Compulsory periodical technical control of all vehicles.
1991: Launching of a ten-year plan to upgrade the design elements in all the motorways and the national roads of the country. This is anticipated to be completed by year 2000, and it is a program co-funded by the European Community.
1993: Revision and reformation of the Road Safety Codes of Greece.
1994: Introduction of the alco-test technique to discourage driving after alcohol consumption.

Most of the above measures were not followed by a systematic and persistent enforcement. As a result they became slack a few months after their implementation. This applies particularly to the seat-belt wearing for the driver and the front seat passenger (Trivellas 1994). Furthermore, the improvements in the road infrastructure proceed at very low tempo. For the rest of these measures, cost benefit or other systematic analyses for the quantification of their effects were not carried out. Therefore, there are no indications for their contribution to road safety improvements in Greece.

In general, at the core of the problem of road safety in Greece can be found, not the inability to conceive the appropriate road safety measures and initiatives, but the lack of the necessary public consciousness towards road accidents. This leads to serious difficulties in the persistent application of the various road safety measures, and should be attributed to the limited resources allocated to this objective.

5. RECOMMENDATIONS

Although there has been no road safety strategic planning carried out by the Greek authorities concerned, there is important road safety strategic thinking by the scientific society of Greece. Congresses (ITE 1985, AUTH *et al.* 1994) together with several publications (Kanellaidis and Golias 1994, Frantzeskakis and Yannis 1995, Technical Chamber of Greece 1994) on road safety contributed to the formation of the road safety objectives even-though these are not officially accepted and followed by the relevant Greek organisations. On the basis of the above presented reality for road safety in Greece and the relevant experience, a number of steps are recommended

for the improvement of the existing situation. These recommendations are summarised in the following points.

- There is need for the formation of a national road safety policy aiming at the progressive decrease of road accidents and their victims. The formation of this policy together with its implementation should be co-ordinated by a National road safety body (Ministry of Public Works 1995).
- Road safety should be monitored both in aggregate and disaggregate level allowing reliable and effective analysis. Decisions for improvements should be taken after appropriate studies and the evaluation of the interventions should be ensured by "before" and "after" studies.
- There is need for speeding up the interventions for improving the infrastructure in both the interurban and urban road network. These interventions should concern amongst others, geometric characteristics, pavements, signs, etc. The newly introduced concept of road infrastructure management should be enhanced with the definition of satisfactory road safety standards.
- Information and education campaigns should be carried out periodically focusing on critical road safety issues such as drinking and driving, speed excess, use of seat belts, young drivers, etc.
- The enforcement of a safer traffic behaviour should focus more on the retraining of road users and less on their punishment. The use of advanced technologies can contribute a lot to a more efficient enforcement of safe driving.
- The procedure for acquiring a driving licence should be improved on the basis of higher standards.
- The implementation of an effective road safety policy requires important resources including human work-effort, money and time. A higher level of road safety can be obtained only progressively by continuous and systematic effort.

6. CONCLUSIONS

Road accidents characteristics in Greece have been outlined in this paper leading to the conclusion that inappropriate road infrastructure and lack of persistent implementation of road safety measures, together with the "Mediterranean" behavioural particularities of the Greek driver (Vlahopoulos 1985) led to a low level of road safety in Greece. All accident parameters (road user, road environment, vehicle) require thorough and continuous investigation followed by the implementation of an efficient and long-term programme for road safety improvements.

It should also be added, that, in most of the other European Union countries there have been important long-term road safety programs supported by substantial

budgets, which contributed a lot to a significant decrease of the numbers of road accidents and their casualties (Brisaer 1994). The lack of such a coherent road safety program in Greece is one of the reasons for the low level of road safety in this country. The recent European policy in the field of road safety (legislative decisions and directives for drivers and vehicles together with support of promotion actions), started to affect the way relevant decisions are taken in Greece, but it did not produce yet any spectacular results (Golias and Yannis 1995).

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