ATTITUDE OF GREEK DRIVERS TOWARDS ROAD SAFETY AT INTERURBAN ROADS

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Abstract

This survey-based paper aims at investigating driver attitude toward road safety issues at interurban roads. This research is placed within the overall framework of analyzing driver behavior toward road accidents at the interurban network of Greece. A series of important driver behavior characteristics are identified with the use of parametric statistical analysis methods (discriminant, cluster and factor analysis). The findings of this analysis suggest that young male drivers and high vehicle occupancy are factors associated with speed excess, whereas drivers with lower yearly mileage are more inclined to drinking and driving, independently of their age. Finally, despite the almost unanimous belief that enforcement could be an important contributor to road safety improvement, enforcement at the interurban road network is considered far from efficient.

Keywords: road safety, driver attitude and behavior

1. Introduction

1.1. Current situation

Road accidents in Greece have increased by about 60% during the last twenty years, while they have decreased in all other European Union countries by about 18%.[i] This wide discrepancy seriously questions the existence of an integrated and efficient framework for dealing with the complexities of road safety in Greece. Efforts to face the road accident problems are fragmented, on top of fragmented accident causal analysis. The human factor, i.e. driver behavior, is a dominant parameter of road accident causes which has not been sufficiently analyzed in the context of Greek drivers. Furthermore, efforts for analyzing driver behavior at the interurban road network, where accident severity is almost triple that of the urban network, are almost absent.[ii]

In 1993, a survey aiming at the investigation of driver attitude toward speed limits was conducted in Greece.[iii] Using discriminant and factor analysis techniques, the research found that the older the driver the more he/she declares adhering to the speed limits. Furthermore, female drivers declare respecting speed limits more than male drivers. Finally, the results suggest that the higher the annual mileage and the education level, the higher the disrespect of speed limits.

In 1985, a survey was conducted concerning Greek driver attitude toward road safety issues at interurban roads[iv]. This survey used a questionnaire published in daily newspapers. The most important results of this survey, which also provides the basis for the current survey, dealt with the characteristics increasing accident risk and traffic enforcement, as well as actions aiming to improve road safety in Greece. More precisely, from this survey it was shown that drivers consider the human factor as the most important cause of road accidents, whereas they consider that the characteristics increasing accident risk are aggressive driving, irregular passing, wrong perception of traffic conditions, wrong estimation of other driver speed, bad physical condition of the driver, and drinking and driving (DWI). Further, while enforcement at the interurban roads is considered as very beneficial, it is insufficient. Finally, the majority of drivers considers its involvement in a road accident within the next five years as probable or very probable. Results from this survey are compared with those of the present research in the following sections.

Several attempts to analyze driver attitude and behavior were also carried out at the international level. Several surveys were conducted in Great Britain and Australia, whereas two pan-European surveys examining European drivers' attitudes towards road safety have been conducted this decade.

In 1976, a survey conducted in Great Britain aimed at identifying the causes leading an important percentage of drivers to disrespect speed limits.[v] This research used a questionnaire, completed by 1012 drivers, which was analyzed using factor analysis. The analysis showed that the wide majority of the sample (79%) declared that without speed limits no road safety would exist on the roads. It was also observed that young (between 17 and 24) male drivers like speeding. On the other hand, it was observed that drivers which are either afraid or have a negative attitude toward fast driving are mostly women or drivers with an annual mileage of 8,000 km or less.

Another survey was conducted in 1977 in Great Britain also aiming at identifying driver attitude towards road safety.[vi] From this research it was shown that there is a generally pessimistic approach to road accidents, since the majority of the drivers in the sample believes that the

probability of being involved in an accident in the future will be higher, despite the annual decrease of the road accident numbers. According to driver declarations, imprudence is a major contributor to road accidents, while overpassing increases accident risk more than any other maneuver. DWI also plays an important role in road accidents. According to the drivers in the sample, police presence and frequent patrols oblige drivers to a more cautious and safe driving. For the improvement of road safety, drivers stressed the important role of police, and asked for reinforcement of laws for speed excess and DWI.

As a continuation of this survey, a new survey was conducted in 1990 in Great Britain, aiming at identifying the updated driver attitude toward road safety.[vii] Furthermore, it was hoped that this survey would set the basis for the continuation of the survey on an annual basis. The most important findings show that among characteristics increasing accident risk, DWI is rated first. Young male drivers seem to be prone to drinking and driving according to the sample answers. In general, male drivers, with percentages decreasing with age, are those most probable for drinking over the limits and driving. Contrary to this, female drivers are not as prone to drinking and driving. Moreover, the accident prone driver groups are those of young people, motorcycle drivers and holiday drivers.

In 1986, in Australia, a driver attitude survey was conducted using a phone-based questionnaire to 1,000 drivers.[viii] It is was shown that women under 20 years of age declare that they don't drink at all when they have to drive. Additionally, male drivers over 25 years of age declare that when they have to drive they set a limit to alcohol consumption.

In 1991, the SARTRE survey (Social Attitudes to Road Traffic Risk) was conducted in fifteen European countries with the participation of 17,000 drivers. Its aim was not only to describe the behavior of European drivers as a whole, but also to point out the differences between attitudes towards road safety of drivers from different European countries.[ix,x] SARTRE II[xi] is the continuation of the SARTRE project and examines the attitudes and behaviors of European drivers towards road safety, linking them with some general issues such as risk perception, way of life, driving habits, and application of uniform European road safety laws.

According to the findings of these two surveys, more than 40% of the drivers asked considers drinking and driving an important cause of road accident.[xii] Laws forbidding drinking before driving find many supporters in the northern countries (Sweden, Netherlands, Great Britain and Finland), whereas lower alcohol consumption limits find more supporters in the Mediterranean countries (Italy, Spain, France, and Greece). Analysis of SARTRE II results shows that an important percentage of Greek drivers declares consuming important alcohol quantities before driving, that the probability of an alcohol test is very low, but they also ask for lower alcohol consumption levels before driving. As far as seat belt use is concerned, percentage of cars equipped with seat belts to all seats has significantly increased since 1991, whereas the lowest seat belt use percentages in Europe are observed in Greece and Italy.

1.2. Objective of the research

Within the above general framework, this research aims at investigating driver attitudes toward road safety at interurban roads. Its main goal is to fill in the gap in the analysis of Greek driver behavior towards road accidents occurring everyday at the interurban network. With this survey, an attempt is made to understand Greek driver behavior with emphasis on the evolution, over time, of the characteristics of this behavior in relation to road accidents. Special attention is also given to the quantitative identification of these characteristics, allowing for the formation of solid policy proposals for the improvement of road safety at the interurban road network of Greece.

1.3. Methodology

To achieve these objectives a survey was conducted in 1997, equivalent to the one carried out in 1985, thus allowing for the possibility of analyzing changes in driver behavior characteristics over time. The questionnaire used for the survey was based on the questionnaire of the 1985 survey allowing thus the direct comparison of results from the two studies. Small amendments to the 1985 questionnaire were aimed not only at a better formulation and structure of the proposed multiple choice answers, but also at the addition of some new questions considered as necessary for the better identification of driver behavior.

The questionnaire used was finalized after a pilot survey. More precisely, the questionnaire is structured into five parts and contains 31 questions in total. Part A of the questionnaire concerns general driving and vehicle characteristics (5 questions), Part B concerns speed limits (5 questions), Part C refers to issues of road safety (road accident factors, enforcement, measures) (5 questions). Part D concerns specific road safety issues (probability of involvement in an accident, seat belt use, drinking and driving, general driver attitude) (12 questions), and Part E refers to the general user characteristics (sex, education, age, profession) (4 questions).

As with the 1995 survey, the questionnaire was distributed in a random sample of drivers which they had to mail back completed. 251 completed questionnaires were collected, a percentage of about 8,4% of the questionnaires distributed. The sample is composed of 29% women and 71% men drivers, whose ages range from 18 to 76 years as shown in Exhibits 1 and 2.

Exhibit 1
Sample Distribution by Sex

Sex	**Sample**	**Percentage**
Men	177	71%
Women	74	29%
Total	**251**	**100%**

Exhibit 1
Sample Distribution by Age

Age	**Sample**	**Percentage**
18 - 23	30	12%
24 - 34	78	31%
35 - 44	63	25%
45 - 54	48	19%
55 - 64	22	9%
> 65	10	4%
Total	**251**	**100%**

For the analysis of driver answers use of statistical methods was performed, allowing for the extraction of conclusions which were not directly obvious.[xiii] More precisely, for the comparison of the two surveys, average square deviation and χ^2 checks took place and the related relevance Tables were used. For the specific analysis of the various parts of the questionnaire three parametric statistical analysis methods were used: Discriminant, Factor and Cluster analysis. Special emphasis was given to the major road safety issues, like speed, drinking

and driving, driving risk and the characteristics of accident risk increase. The interpretation of the results of these methods has led to the extraction of a series of conclusions concerning driver behavior characteristics which were the basis for the respective proposals.

2. Changes in driver attitudes: 1985 - 1997

For the identification of driver attitude changes on the basis of the results from the two surveys (1985 and 1997) a check controlling whether there is a statistically significant difference between the answer percentages in each question at the 95% level of significance, by the use of the average square deviation method. Then it was checked whether there was any statistically significant change in all the answers for each question, between the 1985 and 1997 surveys using the χ^2 test and the related relevance Tables.[xiv] [xv]

From Exhibit 3, it is observed that there is a statistically significant difference between answers of the drivers of the 1985 with those of 1997, as far as the major accident causation factor (road user, road environment, vehicle) is concerned. In 1997, none of the drivers put vehicle as the first in importance factor. Furthermore, human factor takes 66% in 1997 instead of 60% in 1985.

Exhibit 3
Driver attitude changes between the 1985 and 1997 surveys (by important factors responsible for road accidents)

Factors responsible for road accidents	1985 survey	1997 survey	Total	χ^2	critical $\chi^2_{.05,2}$	% difference between the two surveys
Road environment	371 (36%)	83 (34%)	454	10,93	5,991	1,50%
Vehicle	42 (4%)	0 (0%)	42			4,00%
Road user	631 (60%)	161 (66%)	792			3,50%
Total	1044	244	1288			

Exhibit 4 addresses answers related to enforcement. It is observed that police presence on the interurban road network is considered very positive but at the same time the present enforcement level is considered insufficient both in 1985 and in 1997. In fact, checks show that there is no statistically significant difference between the 1985 and 1997 answers as far as the contribution of enforcement and its efficiency to the decrease of road accident numbers is concerned.

Exhibit 4
Driver attitude changes between the 1985 and 1997 surveys (by contribution and efficiency of traffic enforcement)

How much can enforcement contribute to accident number decrease?	1985 survey	1997 survey	Total	χ^2	critical $\chi^2_{.05,2}$
much - very much	637 (61%)	163 (65%)	800	1,33	3,84
a little - not at all	403 (39%)	87 (35%)	490		
Total	1040 (100%)	250 (100%)	1290		
How sufficient is traffic enforcement in the Greek roads today?					critical $\chi^2_{.05,1}$
much - very much	115 (11%)	20 (8%)	135	1,95	3,84
a little - not at all	934 (89%)	231 (92%)	1165		
Total	1049	251 (100%)	1300		

	(100%)				

As far as the probability to get involved in a road accident within the next five years is concerned, it is inferred from Exhibit 5 that there is a statistically significant difference between drivers' answers in 1985 and 1997. In 1985, the percentage of drivers declaring that it is probable or very probable to be involved in an accident is greater (75%) than the corresponding percentage of 1997 (64%). It can be argued that the fact that the majority in both surveys considers probable or very much probable to get involved into an accident shows that road users have a negative safety feeling when travelling at the Greek interurban road network.

Exhibit 5
Driver attitude changes between the 1985 and 1997 surveys (by accident involvement probability)

Accident involvement probability within the next five years	1985 survey	1997 survey	Total	χ^2	critical $\chi^2_{.05,2}$	% difference between the two surveys
totally improbable – probable	81 (8%)	38 (15%)	119	17,49	5,990	8%
rather improbable	181 (17%)	52 (21%)	233			4%
probable – very probable	793 (75%)	160 (64%)	953			11%
Total	1055 (100%)	250 (100%)	1305			

3. Analysis of drivers attitudes

3.1. Speed limit respect

For the identification of driver behavior characteristics on the basis of their attitude towards speed limit respect, discriminant analysis was applied.

Discriminant analysis is used when a population sample is already divided in one or more groups on the basis of some variables and members of each group are known. Discriminant analysis allows for the identification of variables playing the most important role for the classification of the sample members into one of the groups and in this way a process can be established for the classification of the other members of the same population into one of the groups. This process concerns the creation of linear discriminant functions the number of which depends on the existing groups. The final capacity of discriminant analysis to classify new members of the same population into existing groups is expressed by the success percentage, e.g. the percentage of properly classified members of the sample used to determine the linear discriminant functions. A percentage greater than 60% is considered as satisfactory.[xvi]

From the application of the discriminant analysis, which presents satisfactory level of success (66%), it is concluded that age, sex and capacity of vehicle most often used at the interurban network are the variables which play the most important role for the identification of driver attitude towards speed limits. The related discriminant function is the following:

$$D1 = -2.935 - 0.412CAP + 1.669SEX + 0.659AGE \quad (1)$$

where:
CAP = vehicle size driven (used as a proxy for vehicle capacity) (1 for less than 1,000 cc, 2 for 1,000-1,399 cc, 3 for 1,400-1,699 cc, 4 for 1,700-2,000 cc, 5 for more than 2,000 cc)
SEX = driver sex (1 for male and 2 for female drivers)
AGE = driver age (1 for 18-23 years old, 2 for 24-34 years old, 3 for 35-44 years old, 4 for 45-54 years old, 5 for 55-64 years old, 6 for 65 or more years old)

From Exhibit 6, combining answers regarding speed limit and driver age, we can observe that the majority of drivers between 18 end 34 years old declare that they never/sometimes respect speed limits, whereas on the contrary drivers of age 35 or more declare respecting speed limits always/most of the times. Furthermore, from the same Exhibit it is derived that women, according to their declarations, respect speed limits in a greater degree than men do. This attitude applies for each age group and for each capacity of vehicle driven by women.

Exhibit 6
Sample distribution by age and by sex by speed limit respect

	Respecting speed limits			
	Always - most of the times		**Sometimes – never**	
Sex	**Answers**	**%**	**Answers**	**%**
Men	83	47%	94	53%
Women	54	74%	19	26%
Total	137	55%	113	45%
Age				
18 - 34	47	44%	61	56%
35 -> 65	90	63%	52	37%
Total	137	55%	113	45%

Moreover, as far as vehicle capacity related to speed limit respect is concerned, it is observed that drivers using vehicles of less than 1,400 cc declare that they respect speed limits most of the times or always, contrary to those driving vehicles of higher capacity (more than 1,400 cc) which declare that they respect speed limit sometimes or never.

To further analyze driver behavior on the basis of attitude towards speed limit, cluster analysis was also used. Cluster analysis allows the distinction among several mutually exclusive groups on the basis of a collection of variables. The data available are the values of the variables for cases whose group membership is unknown and in fact when even the number of groups is often unknown. The goal of cluster analysis is to identify homogeneous groups of clusters as well as the identification of variables that are important for distinguishing among these groups.[xvi] Cluster analysis was carried out using the SPSS statistical package and adopted the square Euclidean distance measure. The square Euclidean distance is the sum of the squared differences over all the variables. On the basis of the matrix of square Euclidean distances between variables of all pairs of cases, the agglomerative hierarchical clustering formed clusters by grouping progressively cases into bigger and bigger clusters until all cases are members of a single cluster. Hierarchical clustering does not allow cases to separate from clusters in which they have been allocated. The criterion used for the agglomerative hierarchical clustering was the average between-groups linkage.

Cluster analysis divided the population into two groups according to their stated attitude towards speed limit as shown below. The first group represents 66% of the sample whereas the second represents 34%. In order to identify the specific attitudes leading to the division of the

population into two groups, discriminant analysis for speed limit was applied. This discriminant analysis showed that in the first group, female drivers prevail whereas in the second group men and young drivers (18-34 years old) prevail.

Exhibit 7
Sample clustering according to expressed opinion for speed limits

	Cluster 1 (66%)	**Cluster 2 (34%)**
Speed limits	• Respecting speed limits • Same or lower speed limits than those applied today • Important decrease of road accidents if speed limits were respected • Up to 75% of the drivers does not respect speed limits	• Not respecting speed limits • Higher speed limits than those applied today • Small decrease of road accidents if speed limits were respected • 75% -100% of the drivers does not respect speed limits
Road user characteristics	•75% of women of the sample belongs to cluster 1 • 67% of cluster 1 is men	•57% of cluster 2 belongs to the age group 18 - 34 • 79% of cluster 2 are men

3.2. Drinking and driving

From the application of discriminant analysis, presenting satisfactory level of success (60%), it is derived that yearly mileage at interurban roads as well as sex are variables playing the most important role for the formation of driver attitude towards drinking and driving. The analysis showed that driver age does not determine behavior towards alcohol. The related discriminant function is the following:

D1= - 3.859 + 0.68KM + 1,621SEX

where:
KM = yearly mileage at interurban roads (1 for less than 1,000 km, 2 for 1,000-5,000 km, 3 for 5,000-10,000 km, 4 for 10,000-15,000 km, 5 for 15,000-20,000 km, 6 for more than 20,000 km)
SEX = driver sex (1 for men and 2 for women)

As far as mileage is concerned, drivers with high annual mileage, conceivably the more experienced drivers, tend avoiding driving if they consumed any quantity of alcohol, a habit not found in drivers with low mileage. The threshold separating high and low mileage drivers seems to be at 15,000 kilometers traveled yearly. Finally, women are found to be more careful than men as far drinking and driving is concerned.

3.3. Driving risk according to drivers

From the application of discriminant analysis (success level 73%) it is derived that, as shown in Exhibit 8, variables playing the most important role for the formation of drivers attitude toward driving risk are age and respect (or not) of speed limits. Half of the drivers who consider driving as risky are between 18 and 34 years old, and majority declares respect toward speed limits. On the other hand, drivers of the same age who do not consider driving as risky declare disrespect toward speed limits. Further, older drivers not considering driving as risky declare respecting speed limits. Therefore, a general conclusion could be that drivers considering driving as risky respect speed limits more often than the other drivers do.

Exhibit 8
Attitude concerning driving risk

	Driving according to drivers			
	Risky		Not risky	
Age	**Answers**	**%**	**Answers**	**%**
18 – 34	54	37%	52	51%
35 - >65	90	63%	50	49%

3.4. Characteristics increasing road accident risk

Factor analysis was used to examine driver attitudes concerning characteristics that increase accident risk. Factor analysis is a statistical technique used to identify a relatively small number of factors that can be used to represent relationships among sets of various interrelated variables. More precisely, the n initial variables are expressed as a linear function of n factors. The importance of each factor developed is assessed by the percentage of the total variable variance explained by the factor. Only factors with percentage variance explanation higher than the percentage corresponding to each of the n variables - equal to 100/n for each variable due to the fact that each variable is standardized - are considered. Then, the coefficients of the variables in relation to the factors are checked and a general characterization of the selected factors is possible. The original factors were rotated to provide a better fit. The results from the rotated factors are presented in Exhibit 9.

The variables used during the application of factor analysis are the 13 driving characteristics, which increase accident risk. The objective of this method was the identification of a number of factors, which express the relations, if any, between drivers' attitudes towards driving characteristics increasing accident risk

Exhibit 9
Groups of driving characteristics increasing accident risk in relation to the attitude towards speed limits

Drivers declaring respecting speed limits	**Drivers declaring not respecting speed limits**
not taking into account risk - driving in a bad physical or psychological condition - driving under the influence of alcohol - speed not adapted to the prevailing road conditions	**not taking into account risk** - wrong estimation of other vehicle speed - driving without the necessary concentration - overpassing in hazardous points and in a wrong way - driving in a bad physical or psychological condition
insufficient driving ability - not respecting distance from other vehicles - wrong estimation of other vehicle speed - lack of traffic education and insufficient driving training	**insufficient driving ability** - appearance of unexpected situations - lack of traffic education and insufficient driving training
not respect of traffic rules - not respecting speed limits - underestimation of risk and/or overestimation of driver abilities and vehicle ca-	**aggressive and unsocial driving** - driving under the influence of alcohol - aggressive driving

pacity - low probability of offence control and punishment	

The above groupings of driving characteristics show that drivers declaring respecting speed limits consider the non respect of traffic rules as the driving behavior increasing accident risk. Driving characteristics defining this kind of behavior (not respecting speed limits, underestimation of risk and/or overestimation of driver abilities and vehicle capacity, low probability of offence control and punishment) are, according to their opinion, those increasing accident risk. On the contrary, drivers declaring not respecting speed limits consider aggressive and antisocial driving characteristics (driving under the influence of alcohol, aggressive driving) as the driving behavior increasing accident risk.

4. Conclusion - proposals

On the basis of the results from the statistical analysis of the Greek drivers' answers to the survey concerning their attitude towards road safety at interurban roads, a series of useful general conclusions has been extracted. On the basis of these conclusions

4.1. Conclusion

The majority of drivers of both surveys (1985 and 1997) consider that enforcement could contribute much toward the decrease of road accident numbers. This fact could mean that road safety is a general social problem and for its solution drivers tend to believe more in the role of the police. However, police presence and traffic enforcement are considered insufficient in both surveys (1985 and 1997).

As far as driver attitude towards speed limits is concerned, it is observed that the majority of younger drivers (18 - 24 years old) declare not respecting speed limits. On the contrary, older drivers (35 years old or more) declare respecting speed limits in general. Furthermore, it was observed that drivers using higher capacity vehicles declare not respecting speed limits so often, because of their vehicle capability to overcome difficult situations that possibly occur during driving. On the contrary, drivers with lower capacity vehicles (less than 1,400 cc) declare that in general they respect speed limits. It is also noted that women drivers are more conservative than men toward speed limits, independently of their age and the capacity of the vehicle they use. Finally, drivers who consider driving at the interurban road network as risky declare respecting speed limits more often than other drivers. Conclusions concerning driver attitude toward speed limits seem to agree with respective conclusions derived from other research.[iii]

Drinking and driving presents a peculiarity given that various research conducted to date has shown some conflicting results.[vii,viii] This survey, contrary to several others, showed that age is a factor independent to driver attitude toward drinking and driving. Consequently, according to the results of this survey and contrary to common belief, young drivers are not inclined more than other drivers to drinking and driving. Furthermore, women as well as drivers with high mileage (more than 15,000 km per year) tend not to drive after having consumed any quantity of alcohol.

4.2. Policy Recommendations

The results of this survey can be very useful for the efficient implementation of road safety measures given that they indicate which characteristics of driver behavior and which target-groups must be focused by road safety information and driver campaigns as well as by the road safety school education programs.

More precisely, results from this survey show that driver campaigns on speed excess must focus mainly on young men drivers, whereas drinking and driving campaigns should be addressed to drivers of all ages, and especially to those with lower yearly mileage.

Results of this survey concerning drinking and driving do not seem to be in fully accordance with those derived from other surveys.[vii,viii] Consequently, this very important issue requires further research given that the various surveys carried out up to today led very often to conflicting results. The identification of the characteristics of drivers attitude towards drinking and driving can lead to very useful proposals for the confrontation of this very important road safety problem.

In the present survey, an attempt was made to extract conclusions concerning characteristics of drivers presenting a higher frequency of involvement in a road accident. However, such conclusions were not possible on the basis of the questionnaire answers, and therefore another survey aiming at investigating characteristics of drivers presenting a higher frequency of involvement in a road accident, should be very useful.

This survey also showed that there is a need for a specialized investigation of road user attitudes toward vehicle safety equipment (seat belt, airbags, third braking light, etc.). Results from such a specialized survey could be very useful for the success of a plan for their progressive implementation to all vehicles circulating at the road network.

Finally, it is noted that results and conclusions derived from surveys like the one used in this paper have a greater value when driver attitudes and related changes are observed frequently and in a systematic way. Consequently, the continuous monitoring of Greek driver attitudes toward road safety could be very useful, given that it allows for the identification of changes over time of the characteristics.

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