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## Road safety in Greece

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### Abstract

The objective of this research is the analysis of road safety in Greece. For that purpose, the SUNflower footprint methodology is used, in which a country's road safety level is analysed hierarchically in relation to all components of the road safety system, from structure and culture elements, to the existing programmes and measures, to the performance indicators reflecting the current road safety operational level, to the number of outcomes (i.e. road accidents and casualties) resulting from this road safety level and to the eventual social costs. A wealth of data is gathered and analysed in this framework, including data from the Hellenic Statistical Authority and other national data sources, as well as from various international data files (CARE, ERSO, Eurostat, IRTAD, etc.) and research projects (e.g. SARTRE). The analysis confirmed that Greece is one of the worst performing countries in the European Union in terms of road safety. The yearly social costs of road accidents are estimated to 4 billion Euros. Moreover, Greece is characterised by increased traffic of motorcycles and pedestrians, which is associated with a considerable proportion of total fatalities, summing up to 42%. Greek drivers present aggressive and risk-taking behavior, as well as low compliance to traffic rules. Nevertheless, fatalities have decreased over time, namely by 37% compared to the century start, due to a significant increase of road safety enforcement, a new and stricter Road Code, as well as a large programme of motorway development during the last decade. Finally, the (until recently) lack of a central authority in charge of road safety results in limited efficiency of the implementation of quite a few road safety programmes and measures foreseen at the national strategic plans of the last decade.

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## 1. Introduction

As Greece is one of the poorest performing countries in Europe as regards road safety, the present research is intended analyse the road safety situation and development over time in Greece, in order to identify possible causes and particularities. For that purpose, the SUNflower footprint methodology is used, in which Greek road safety level is analysed hierarchically in relation to all components of the road safety system, from structure and culture elements, to the existing programmes and measures, to the performance indicators reflecting. This methodology provides a well-specified, complete and concise structure for analyzing and linking the various components of the road safety system in Greece.

The SUNflower pyramid comprises five distinct levels (Figure 1). The road safety performance of Greece is related to structural and cultural characteristics (i.e. policy input) at the bottom level, as well as common practice (i.e. safety measures and programs - policy output), as result at level 2. To link these first two layers to the actual road accident outcomes an intermediate layer specifies the operational level of road safety in the country, containing road safety performance indicators (RSPI) on issues like speeding, drinking and driving, as well as a concise depiction of the road network and the main features of the vehicle fleet. Final outcomes expressed in terms of road casualties are then necessary to understand the scale of the problem. This type of information is found at level 4, and consists of different types of road risk indicators related to the three components of a traffic system (infrastructure, vehicle, road user). The top of the pyramid includes a sound estimate of the total social costs of road crashes in any area (Wegman et al. 2005).

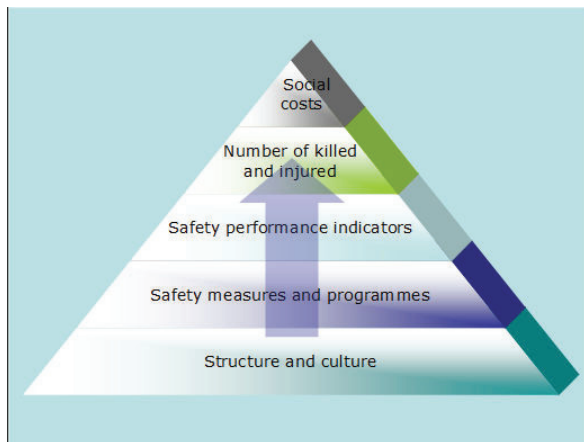


Fig. 1. The SUNflower pyramid.

Consequently, the SUNflower pyramid provides a framework for the analysis of Greek performance, allowing not only to examine all aspects of the road safety problem, but also to link these aspects in the identification of road safety causes and effects.

In the next section, the various levels of the pyramid are further analyzed in terms of data, information and indicators. Data from the Hellenic Statistical Authority and other national data sources, as well as from various international data files (CARE, ERSO, Eurostat, IRTAD, etc.) and research projects (e.g. SARTRE). Particular emphasis is given in the final synthesis of the results, which serves as an integration of the information presented in the five levels, and allows not only for an overall assessment of Greek performance, but also for the identification of specific road safety problems and a series of respective countermeasures.

## 2. Structure and culture

Greece is a European country with a population of 11.3 million inhabitants in 2010. With a total area of 131.990 km<sup>2</sup>, the terrain of the mainland of Greece is mostly mountainous while its seas are sprinkled with more than 2000 islands and climate and weather conditions are favourable. The road network is consisted of 117.000 km (2008) roads length, and the vehicle fleet in 2009 was 7.9 million vehicles.

Regarding some basic transport characteristics, in 2009 there were 5.1 million registered passenger cars, 1.5 million registered mopeds and 1.45 million registered motorcycles. As for vehicle km travelled by these different vehicle types in 2004, 65.8 billion vehicle km travelled by passenger cars, 1.2 billion vehicle km travelled by mopeds and 3.3 billion vehicle km travelled by motorcycles.

In addition, in 2009, population density was 85.3 inhabitants/km<sup>2</sup> and the level of motorization was 0.702 vehicles per inhabitant. Moreover, a percentage of 52% of adults had a driver license in 2000 and 61% of the total population lived inside urban areas in 2001.

### 2.1. Structure of road safety management

The coordination of all the Ministries involved in road safety (RS) management, is ensured since 2001 by the Inter-Ministerial Committee on road safety chaired by the Minister of Citizen Protection. However, its role remains limited as the corresponding coordination secretariat has never been established. For this reason in Greece a number of key actors are involved in Greek road safety policy making (see Table 1).

Table 1. Key actors involved in road safety policy making in Greece

Key functions	Key actors
1. Formulation of national RS strategy Setting targets Development of the RS programme	Ministry of Infrastructure, Transport and Networks Ministry of Citizen Protection Ministry of Interior  Remarks: Under the coordination of the Inter-Ministerial Committee on road safety
2. Monitoring of the RS development in the country	Ministry of Infrastructure, Transport and Networks Ministry of Citizen Protection Ministry of Interior  Remarks: Under the coordination of the Inter-Ministerial Committee on road safety
3. Improvements in road infrastructure	Ministry of Infrastructure, Transport and Networks: national, interurban and rural roads; Athens metropolitan area main road network. Municipalities: urban roads
4. Vehicle improvement	Ministry of Infrastructure, Transport and Networks: vehicle licensing and technical inspection
5. Improvement in road user education	Ministry of Infrastructure, Transport and Networks: driver training and licensing, development and monitoring of the Road Code Ministry of Education, Life-Long Learning and Religion: traffic and road safety education in high-school.
6. Publicity campaigns	Ministry of Infrastructure, Transport and Networks (national level) Regional and Local Authorities (regional and local level)
7. Enforcement of road traffic laws	Ministry of Citizen Protection, through the Traffic Police: implementation of the Road Code, road safety enforcement Regional police forces

Other Ministries with responsibilities as regards road safety are the Ministry of Health, the Ministry of Education, Life-Long Learning and Religion and the Ministry of the Economy. Moreover, a number of non-governmental organizations are often involved in road safety activities, including the Technical Chamber of Greece, the Hellenic Institute of Transportation Engineers, the Automobile and Touring Club of Greece etc., as well as Universities and Research Institutes.

## 2.2. Attitudes towards risk taking

In Greece most drivers seem to perceive the risk of accident involvement as being extremely low, while at the same time they over-estimate their driving skills. Furthermore, the majority of Greek drivers is positive towards the messages of road safety information and awareness campaigns, but considers that these concern other drivers and not themselves. In Table 2 road safety attitudes and drivers behaviour characteristics are presented concerning 1996 and 2003.

Table 2. Road safety attitudes and behaviour of Greek drivers 1996 and 2003

	1996	2003
Self-reported driving behaviour	% of drivers	
Inappropriate overtaking	9%	15%
Drinking and driving	13%	6%
Exceeding speed limits in interurban areas	28%	23%
Exceeding speed limits in urban areas	7%	6%
Supporting higher penalties	% of drivers	
Supporting higher BAC limits	2%	13%
Perceived risk of apprehension	% of drivers	
Expected probability of speeding control	13%	20%
Expected probability of alcohol control	5%	15%

Table 2 shows that the proportion of drivers who adopt aggressive and risk-taking behaviour has increased between 1996 and 2003, as suggested by the increase in self-reported frequency of inappropriate overtaking. On the other hand, though, the proportions of drivers that reported exceeding the speed limits and driving under the influence of alcohol are significantly reduced, whereas the proportion of drivers in favour of higher and stricter BAC limits has increased. Finally, the perceived probability of being tested for speeding or drinking and driving has increased (SARTRE, 2003).

## 2.3. Road Safety Strategy of Greece

In Greece all three strategic plans (2001-2005, 2006-2010, 2011-2020) put quantitative targets and propose a comprehensive set of road safety programmes and measures. However, a basic priority of the Greek Road Safety Strategy has been the establishment and operation of a Leading Authority for road safety policy making. The new Greek Road Safety Strategy is putting special emphasis on the creation of a 'safety culture' among Greek road users. A 'Safe System Approach' spans the various actions of all three road safety strategic plans.

## 3. Programmes and measures

### *3.1. National Strategic Plans and targets*

The 1st national road safety plan (2001-2005) and its implementation contributed to a significant decrease in the number of road accidents and related casualties in Greece (Yannis et al. 2002). In addition, the 2nd national road safety strategic plan (2006-2010) proposed to achieve the European target of a 50% reduction in fatalities by 2010 (in relation to 2000). A set of 50 priority measures were proposed and some of them were implemented focusing mainly on the intensification of road safety enforcement, a large programme of maintenance interventions on the interurban road network, an important programme of motorway development, and a stricter Road Code already in force since June 2007, targeted road safety education and information campaigns. (Kanellaidis et al. 2005)

The 3rd national road safety strategic for the period 2011-2020 has just been accepted by the Ministry of Infrastructure, Transport and Networks. The European target of a 50% reduction in road fatalities by 2020 (in relation to the 2011 figures) is already adopted, and intermediate targets are also considered (NTUA, 2011).

### *3.2. Road infrastructure*

Regarding road infrastructure, in Greece, speed limit for passenger cars is 130 km/h for motorways (80 km/h for motorbikes smaller than 125cc), 90-110 Km/h for interurban and rural roads (80 km/h for motorbikes smaller than 125cc) and 50 km/h for urban roads. Speed limits for trucks and buses are generally lower. As for the geometric characteristics and the construction process of the interurban road network a series of national guidelines were adopted on 2001 (GDRI, 2003).

Concerning road infrastructure and road environment improvement several actions are included in the 2nd Strategic Plan, however, most of these actions are only partially implemented. On the other hand, a large programme of motorway development is under way, totalling 2,500 kms of motorways (total motorway length on 2008 was 948 kms).

### *3.3. Traffic laws and regulations*

According to the Greek Road Code (2007) seat belt use is compulsory in front seats since 1987 and in rear seats since 2003, while for all motorcycles and moped riders wearing the helmet is compulsory. Regarding the allowed BAC level, only for novice drivers (<2 years experience) the limit is 0.2 gr/lt. For motorcycle and moped riders, drivers of public vehicles, lorries > 3,5 t, buses, school buses and coaches, ambulances, dangerous goods vehicles the limit is 0.5 gr/lt - 0.2 gr/lt. Drugs limits have not yet been defined. Hand-held mobile phone use while driving is prohibited since 1999. Moreover, periodical technical inspections are compulsory for all vehicles (except mopeds and motorcycles), while periodic medical examinations are compulsory as well, for driving license renewal every 3 years for all drivers older than 65 years old, and every 5 years for lorry >3.5 tn, bus and coach drivers older than 65 years old.

### *3.4. Enforcement*

According to Yannis et al. (2008), the intensity of enforcement of driver speeding and drinking-and-driving behaviour increased considerably during the last decade. Moreover, during this period, the number of alcohol controls recorded increased by more than 400%. For the first time on year 2003, an increase in the number of controls resulted in a decrease in the number of violations recorded, whereas the opposite was the case in the previous years (i.e. more controls resulted in more violations recorded), reflecting a change of behaviour of the Greek drivers.

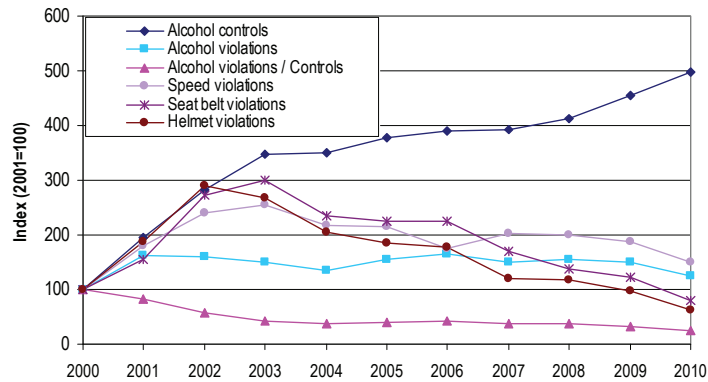


Fig. 2. Trends of road safety enforcement 2000-2010, Source: Ministry of Citizen Protection (adapted by NTUA)

Since the early nineties, a demerit point system is in place in which Points are added in the driver's record for several violations regarding alcohol and traffic rules (e.g. seat-belt or helmet use, red light violation, speeding etc.). The license is suspended when 25 points are gathered. However, the effectiveness of the system is questionable because of several operational shortcomings.

### 3.5. Road user education/training and public campaigns

Driver training in Greece is compulsory for all license types, except mopeds. More specifically, there are requirements for obtaining a driver licence: passing a theoretical exam and a practical exam (20 hourly compulsory lessons are foreseen in the Greek Road Code). Minimum age requirements for drivers are 16 years for the A1 license category (mopeds and motorcycles <125cc), 21 years for lorries >3.5 tn, buses or coaches and 18 years for all other vehicles. Traffic and road safety education is not taught as a compulsory and independent course of high-school education, but is included as part of Civil and Social Education courses.

Regarding public campaigns there are some road safety awareness campaigns at national and/or local level occasionally implemented, mainly concerning speeding, alcohol, seat-belt and helmet wearing. However, emphasis is put on massive exits from urban centres e.g. for holidays.

## 4. Road Safety Performance Indicators

### 4.1. Alcohol and drugs

The percentage of fatalities resulting from accidents involving at least one driver impaired by alcohol for year 2008 was 7.5%. However, more than 50% of drivers' alcohol test results are unknown.

### 4.2. Vehicles

The total number of registered vehicles for year 2009 upon the Hellenic Statistical Authority was 7,910,595, a figure that is likely to include scrapped vehicles not removed from the national register. More specifically, 65% of all vehicles are passenger cars, 18% are motorcycles, 16.5% are trucks and less than 1% are buses or coaches. A very interesting characteristic is that in 12 years (1998 - 2009) the total number of registered vehicles in Greece has doubled and that more than 1,000,000 mopeds are separately

registered in the Ministry of Citizen Protection. Finally, as for vehicle age, around 40% of both passenger cars and motorcycles registered in Greece for year 2009 are older than 10 years.

#### 4.3. Protective systems

Table 3 shows seat belt and helmet wearing rates per area type and position. The overall rate of seat belt use for year 2009 is 77% for drivers, 74% for other front passengers and 23% for rear seats passengers. The percentage of use of seat belt by the driver is 72% in urban areas 78% in rural roads and 95% in motorways (Yannis et al. 2011). Overall helmet wearing rates for year 2009 are 75% for motorcycles/mopeds drivers and 46% for passengers. In addition, the respective helmet wearing rates by the driver are 73% in urban areas, 85% in rural areas and 98% on motorways. This reflects the general poor road safety culture of Greek drivers, resulting in inappropriate behaviour.

Table 3. Seat belt and helmet wearing rates per area type and position

		Seat belt use	Helmet use
Urban area	Driver	72%	73%
	Front passenger	68%	-
	Rear passenger	19%	41%
Outside urban area	Driver	88%	96%
	Front passenger	85%	-
	Rear passenger	28%	91%
Total	Driver	77%	75%
	Front passenger	74%	-
	Rear passenger	23%	46%

## 5. Road Safety Outcomes

### 5.1. Trends and basic figures 1991-2010

Despite the important decrease observed in the last decade, Greece is by far the worst performing country among the older EU Member States, with higher fatality rate than several new Member States (138.5 fatalities per million inhabitants, compared to 67 in the EU) (Figure 3).

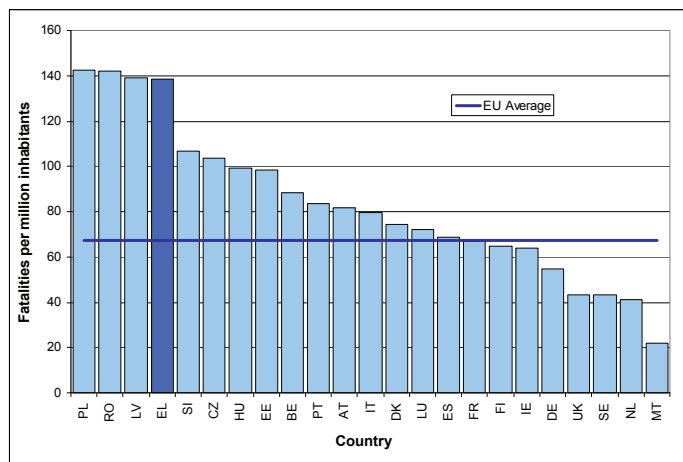


Fig. 3. Fatalities per million inhabitants in the EU countries, 2008 (not including BU, CY, LT, SI), Source: CARE database, Eurostat database (date of queries: May 2010)

In addition, while in EU a continuously decreasing trend of fatality risk was observed during the last two decades, at the same time Greece followed a different pattern. Fatalities and fatality rates (i.e. fatalities per million inhabitants) in Greece presented an increasing trend until 1998 (2182 fatalities). As an exception, an important decrease was noted in the period 1998-2003 (1605 fatalities) and another remarkable decrease took place from 2007 onwards (1258 fatalities on 2010).

### 5.2. Vehicle type and vehicle age

Regarding fatalities per vehicle type, it is estimated that mopeds and motorcycles riders present from 5 to 10 times higher risk than passenger car drivers. Moreover, the fatality risk of moped and motorcycle riders decreases with vehicle age while the fatality risk of passenger cars decreases with age, and further increases for vehicles older than 10 years old (Figure 4-left panel).

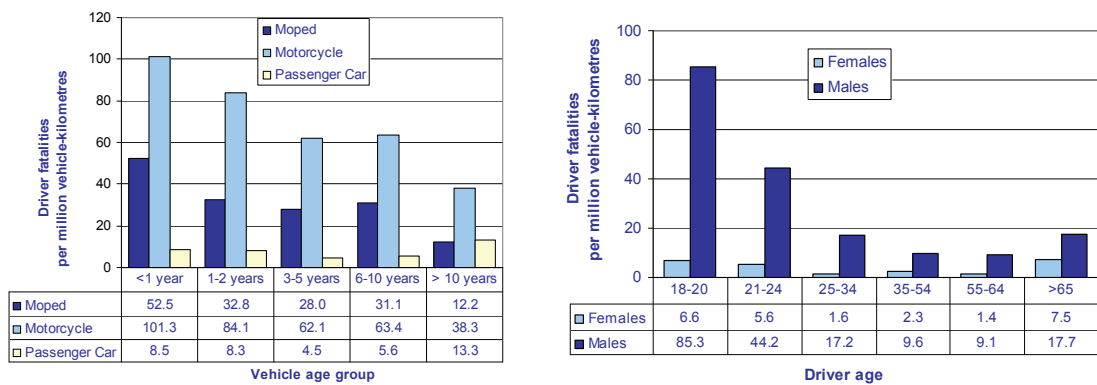


Fig. 4. Driver fatalities per million vehicle-kilometres per vehicle age and type (left panel), per age and gender (right panel) (2004), Source: National Technical University of Athens (2005)

### 5.3. Person class, age, gender, area and road type

Overall, drivers account for around 66%, passengers account for around 20% and pedestrians account for around 14% of fatalities. Moreover, people between 25-55 years old are clearly over-represented in driver fatalities, whereas the elderly (older than 65 years old) are clearly over-represented in pedestrian fatalities.

In terms of accident risk, male drivers present from 2 to 12 times higher fatality risk than female drivers. The young (<35 years old) and the elderly (older than 65 years old) drivers are also at increased fatality risk for both genders. Young males present by far the highest fatality risk compared to older ones, a difference that is much more striking than the one observed between young and older females (see Figure 4, right panel).

Regarding area and road type, it is estimated that about half of all fatalities occur outside urban areas. Nevertheless, accident severity (fatalities per 100 accidents) is from 3 to 5 times higher outside urban areas, especially on interurban roads (non-motorways).



#### 5.4. Injury under-reporting

According to a recent study linking Police and Hospital data for the Greek island of Corfu for the period 1996-2003, police data were found to capture 97% of fatalities. On the contrary, hospital data captured 95% of non fatal injuries, whereas police only captured 16% (Petridou et al. 2009).

The results of this study were used in a European pilot study for the development of under-reporting coefficients. Overall, there are actually 5 serious casualties for each serious casualty reported by the Police, slight injuries are more under-reported than serious ones for all road user types. Finally, it appears that the Police misclassify an important number of serious injuries as slight (Broughton et al. 2008).

### 6. Social Cost

The social cost of road accidents in Greece for year 2008 is estimated more than 4 billion Euros. In addition, the cost of a fatal accident is around 1.9 million Euros in 2008 prices, whereas the average cost of an accident in Greece is around 0.180 million Euros (Table 4).

Table 4. Social cost of road accidents and related casualties in Greece, 2008, Source: National Technical University of Athens

Euros 2008	Cost of Accidents with		
	<b>Killed</b>	<b>Seriously Injured</b>	<b>Slightly Injured</b>
Material Damage cost (per unit)	42,203	26,662	20,397
Generalised cost (per unit)	649,076	35,070	10,210
Human cost (per unit - VoSL)	1,191,699	154,921	11,917
<b>Total cost</b>	<b>1,882,978</b>	<b>216,652</b>	<b>42,524</b>
Proportion of casualties	6.5%	11.5%	82.0%
Average accident cost	<b>181,749</b>		

Generalised costs include Police, Fire Brigade, Emergency Services, First Aid and Transportation, hospital and rehabilitation, insurance companies, courts and loss of productive capacity. Human costs (VoSL: value of statistical life) for fatalities are estimated by means of a willingness-to-pay survey, whereas the related values for serious and slight injuries are taken as proportions of the VoSL (13% and 1% respectively, according to recommendations from the literature) (Yannis et al. 2005). It is noted that these are national estimates and should not be compared to those of other EU countries.

### 7. Synthesis

The analysis confirmed that Greece is one of the worst performing countries in the European Union in terms of road safety. The yearly social costs of road accidents are estimated to 4 billion Euros (Yannis et al. 2002). A considerable proportion of total fatalities (48%) is associated with accidents inside urban areas (38% in EU), 24% with motorcycle accidents (14% in the EU) and 37% with single vehicle accidents (31% in the EU). Moreover, 16% of the fatalities is a pedestrian. Young drivers and two-wheeler riders are particular high-risk groups. Moreover, Greece is characterised by increased traffic of motorcycles and unorganised traffic of pedestrians. These factors, together with the inappropriate behaviour of Greek drivers (i.e. speeding, drinking and driving, low levels of seat belt and helmet use) may be considered the critical road safety factors in Greece.

Nevertheless, fatalities have decreased over time, namely by 38% (1.258 in 2010) compared to the century start (2.037 in 2000), due to a significant increase of road safety enforcement, a new and stricter

Road Code, as well as a large programme of motorway development during the last decade. From year 2008 onwards, the recession may have also contributed to the decrease of fatalities, through a decrease in traffic (especially of heavy goods vehicles) and possibly in the mobility of some vulnerable groups (e.g. young people, elderly), but also through an overall change of traffic behaviour (e.g. less aggressive and more economical and environment-friendly driving). In general, the improvement of road safety in Greece during the period 2000-2010 may be attributed to a combination of the authorities' efforts and the continuous improvement of the road safety culture in Greece.

On early 2010, an Inter-Ministry Committee on Road Safety was established and the respective working forces are gradually put in place in order to develop, implement and follow up the national road safety programme and all related measures. In addition, a National Road Safety Council is established, with an active advisory role. The 3rd National Road Safety Strategic Plan for the period 2011 - 2020, prepared by the National Technical University of Athens has just been accepted by the Ministry of Infrastructure, Transport and Networks.

However, the lack of a central authority in charge of road safety, together with some overlap and ambiguity in the responsibilities of several authorities involved, resulted in limited efficiency of the implementation of quite a few road safety programmes and measures foreseen at the national strategic plans of the last decade; dealing with these institutional and administrative weaknesses may be a key factor for the improvement of road safety in Greece.

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